HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Photos: Wallace River Hatchery and Reiter Ponds. Source: WDFW Hatchery Staff, Google Maps.

Hatchery Program:	Snohomish/Skykomish River Winter Steelhead Hatchery Program (Segregated)
Species or Hatchery Stock:	Steelhead *(Oncorhynchus mykiss)* Early Winter Stock
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Snohomish Watershed/North Puget Sound
Date Submitted:	July 28, 2014
Date Last Updated:	November 25, 2014

Executive Summary

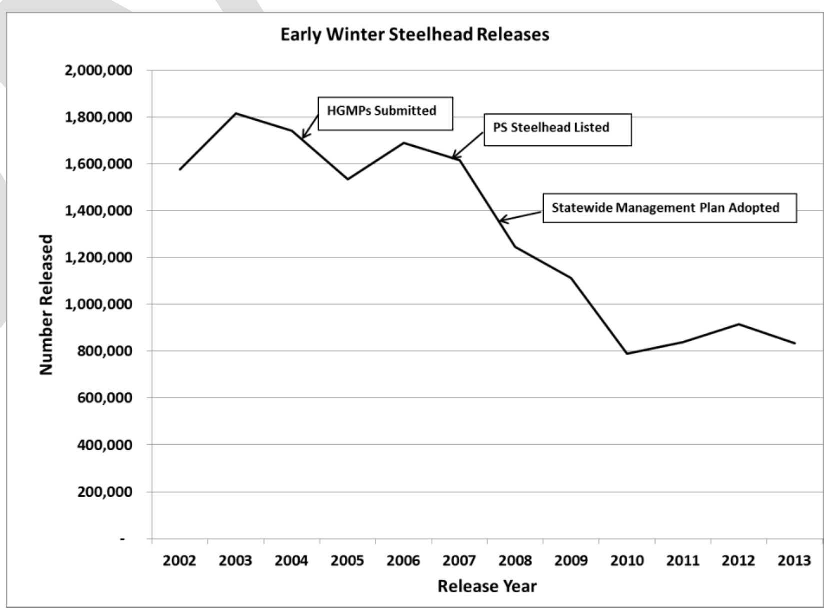
ESA Permit Status:
On March 31, 2004, the Washington Department of Fish and Wildlife (WDFW) submitted a Hatchery Genetic Management Plans (HGMPs) for the Reiter Ponds and Wallace River Hatchery early-winter steelhead programs as part of a joint state/tribal hatchery resource plan for consideration under the 4(d) rule. In a letter from NOAA Fisheries dated August 4, 2004, the co-managers were informed that NOAA Fisheries anticipated completing a draft Environmental Impact Statement (EIS) by the summer of 2005. NOAA noted that “A final EIS may then be completed by winter 2005-2006, after which time NOAA Fisheries will release ESA 4(d) Rule determinations for the hatchery plans.” The letter concluded by stating that “Your work on these hatchery plans is important, and will substantially contribute to on-going salmon recovery efforts within the region.” WDFW provided updated HGMPs to NOAA Fisheries in August 2005.

The co-managers are now re-submitting an HGMP for the Snohomish/Skykomish River hatchery early-winter steelhead program to further update the description of the program and incorporate new information and analyses.

The Puget Sound steelhead Distinct Population Segment (DPS) is listed as “Threatened” under the ESA, however, Snohomish Basin hatchery early-winter steelhead are not included in the ESA-listing. The Puget Sound Technical Recovery Team has preliminarily delineated three Demographically Independent Populations of native winter steelhead (Snohomish/Skykomish River Winter, Pilchuck River Winter, and Snoqualmie River Winter) and two native summer populations (NF Skykomish Summer, Tolt R Summer) in the Snohomish basin.

Early-winter Steelhead - Additional Risk Reduction Measures:
The Co-managers have implemented substantial additional risk reduction measures for early-winter hatchery steelhead programs since the HGMPs were first submitted in 2004. The risk reduction measures were developed around the principles and recommendations of the Co-managers’ Resource Management Plans.

Across the Puget Sound Distinct Population Segment (DPS), these risk reduction measures include:



- >50% reduction in hatchery releases of early-winter steelhead;
- >65% reduction in release locations;
- Elimination of cross-basin transfers, off-station releases, adult recycling, and fry releases into anadromous waters;
- Volitional smolt releases to minimize natural-origin fish interactions;
- Hatchery broodstock collection by January 31 to enhance separation between hatchery and natural-origin fish;
- Establishment of a network of wild stock gene banks; and
- Genetic monitoring of hatchery strays to natural spawning areas.

The developments of new genetic analysis techniques since July 2013 has provided significant new information to evaluate and, as necessary, modify hatchery programs.

Snohomish/Skykomish River Hatchery Early-winter Steelhead Program:
The purpose of the program is to produce early-winter steelhead for sustainable recreational and tribal fisheries. Program fish will be produced at the Reiter Ponds, located on the Skykomish River, and Wallace River Hatchery, located on the Wallace River, a tributary to the Skykomish River. The program will release 256,000 yearling smolts into the Snohomish/Skykomish Rivers nnually (185,000 at Reiter Ponds and 71,000 at Wallace River Hatchery

The early-winter Snohomish/Skykomish River hatchery program is designed to take into account potential risks of artificial propagation on listed species while still providing for some harvest by treaty tribes and recreational fisheries. Efforts to minimize potential risks of artificial propagation are described below. Likewise, to protect against overutilization of natural-origin steelhead whose abundances have declined from historical levels, the NMFS Biological Opinion established a 4.2% harvest limit of the aggregate average harvest rate of natural-origin steelhead in five basins: Skagit River, Snohomish River, Green River, Puyallup River, and Nisqually River. The factors driving the declining abundance of natural-origin steelhead, however, have not been similarly restricted, including: 1) the present and increasing threat of destruction, modification and curtailment of natural-origin steelhead freshwater, estuarine, and marine habitat; 2) predation and potentially disease, and 3) the inadequate existing regulatory mechanisms to protect natural-origin steelhead habitat. The current harvest restriction severely limits the opportunities for both treaty and non-treaty fisheries on natural-origin steelhead. The lack of adequate habitat protection and restoration places an unacceptable disparate burden on hatchery programs, the exercise of the tribes' treaty-secured rights, limits recreational fishing opportunities, and fails to conserve steelhead. The potential risks of this hatchery program are minimal compared to risks of failed steelhead habitat protection and restoration measures.

The program will be operated as a "segregated" program with the intent for the hatchery population to represent a distinct population that is reproductively isolated from naturally-spawning populations. Segregation will be achieved operationally by using only adult hatchery-origin early-winter steelhead (distinguished by an adipose fin-clip) returning primarily to Reiter Ponds and Wallace River Hatchery traps, and by operating the program in a manner to limit gene flow to the natural-origin population. Specific risk-reduction measures that have been implemented since 2004 for this program include:

- > 60% reduction in release locations relative to 2003-2004 (from five to two).
- Hatchery traps now remain open through March 15 (or later as conditions allow) to provide the opportunity for all adult hatchery-origin fish to return to the hatcheries to reduce straying,
- All eggs are taken from hatchery-origin fish returning prior to January 31 to maintain the temporal separation in spawn-timing between hatchery- and natural-origin steelhead, and
- Eggs are primarily collected from broodstock returning to Reiter Ponds and/or Wallace River Hatcheries to promote fidelity of homing to the hatcheries.

The genetic impact from this segregated hatchery program on natural-origin steelhead will be assessed through measures of introgression and the proportion of effective hatchery contribution derived directly from DNA, based on periodic tissue sampling of key demographic/tributary groups, and linked to other harvest and habitat actions in a Total Viability Analysis (TVA) that considers the effects on all viability parameters from "All H" actions. These performance indicators are estimated using genetic samples collected from the natural populations and hatchery-origin fish straying to natural spawning areas. Given the above improvements and more direct measures of introgression and gene flow, the revised hatchery program should result in significant reductions in genetic impacts on natural-origin populations provided other factors affecting productivity remain neutral. Environmental and ecological effects that could contribute to the decline of steelhead viability are being addressed in ongoing monitoring efforts (smolt trapping, estuarine and nearshore marine monitoring done for more than twelve consecutive years) and new monitoring efforts (e.g. Salish Sea Marine Survival Project with the co-managers and fifteen other agencies and entities, Sea Grant juvenile fish monitoring project, new zooplankton monitoring, etc.). Risk control measures are also in place to address other potential hazards including ecological interactions, disease transmission, and facility effects.

An integrated TVA is needed to assess the risks of the proposed hatchery program relative to other risk factors and to develop management actions that are likely to lead to recovery. As noted by the Puget Sound Technical Recovery Team (2003), “Considering the effects of one factor at a time (e.g. harvest, habitat, or hatchery management actions) on salmon population characteristics is more tractable from a technical standpoint, but such estimates of effects are sure to be wrong in most instances. Managers [are asked] to consider suites of habitat, harvest, and hatchery actions together, especially with a view towards how these factors interact...” The WDFW and Treaty tribes are now developing analytical tools to complete this task.

Harvest:
WDFW and Tribal co-managers (Stillaguamish Indian Tribe and the Tulalip Tribes) prepare an annual Fisheries Management Plan for the harvest of Snohomish River winter steelhead produced from this program (WDFW et al. 2008 to present). Returning early-winter steelhead adults provide for limited tribal commercial and subsistence use and provide a localized recreational sport fishery, mostly from November through mid-February each year. Tribal fisheries include net and hook and line fisheries, generally from early-December through late-February. The sport fishery directed at hatchery-origin adults for the 2013-2014 season was open October 16 to January 31, within selected stream reaches and until February 15, within the hatchery terminal areas, with retention of two hatchery-origin steelhead over 20 inches allowed (WDFW Sport Fishing Rules 2013/2014).

Monitoring, Evaluation, and Adaptive Management:
WDFW, the Tulalip Tribes, and Snohomish County PUD conduct annual spawning ground surveys in the Snohomish, Snoqualmie and Skykomish River mainstems and in the Pilchuck, Raging, Sultan, Tolt and Wallace Rivers as well as selected tributaries. Survey data are used to track annual trends in natural population abundance and spatial distribution. WDFW and the Tulalip Tribes are also implementing a genetic monitoring program to measure the proportion effective hatchery contribution and genetic introgression between segregated hatchery steelhead and natural-origin populations in the Puget Sound DPS. These monitoring programs will provide input data to a TVA model that will provide information to adaptively manage the early-winter hatchery programs relative to other “All-H Actions” and viability parameters.

1 SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1 Name of hatchery or program.

Skykomish River Winter Steelhead Program.

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

Snohomish/Skykomish River Winter Steelhead (*Oncorhynchus mykiss*) – Early Winter Hatchery Stock.

Not listed - Early-winter hatchery stock perpetuated at the Snohomish/Skykomish Rivers is not considered part of the Puget Sound Distinct Population Segment (DPS), for Puget Sound. Puget Sound Steelhead (*Oncorhynchus mykiss*)**,** were listed as *Threatened* under the ESA on May 11, 2007 (72FR26722).

1.3 Responsible organization and individuals

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

Co-manager policies are in effect for all Puget Sound hatchery programs. The Tulalip and Stillaguamish Tribes, along with WDFW, prepare an annual fishery management plan for the harvest of Snohomish system summer and winter steelhead released from hatchery programs. All rearing of hatchery fish occurs at WDFW facilities for this program.

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

Program	Funding Sources	Operational Information (for FY 2013)[1]
Wallace River Hatchery	General Fund – State DJ – Federal Puget Sound Recreational Fisheries Enhancement	Full time equivalent staff – 3.48 Annual operating cost (dollars) - $466, 879
Reiter Ponds	Wildlife Fund – State	Full time equivalent staff – 1.53 Annual operating cost (dollars) - $140,655

1 The above information for annual operating cost applies to all species produced at these facilities.

1.5 Location(s) of hatchery and associated facilities.

Table 1.5.1: Location of culturing phases, by facility.

Facility	Culturing Phase	Location
Wallace River Hatchery	Broodstock collection; Adult holding, Incubation, Rearing, Acclimation, Release.	Wallace River (WRIA 07.0940), RM 4 at the confluence with May Creek (WRIA 07.0943); enters Skykomish River (WRIA 07.0012) at RM 36. The Skykomish River continues as Snohomish River at RM 20.51 and drains into Puget Sound (at the juncture of Possession Sound and Port Susan between the Tulalip Indian Reservation and the city of Everett).
Reiter Ponds	Broodstock collection; Adult holding, Rearing, Acclimation, Release.	Skykomish River (WRIA 07.0012) at RM 46, which continues as Snohomish River at RM 20.51.

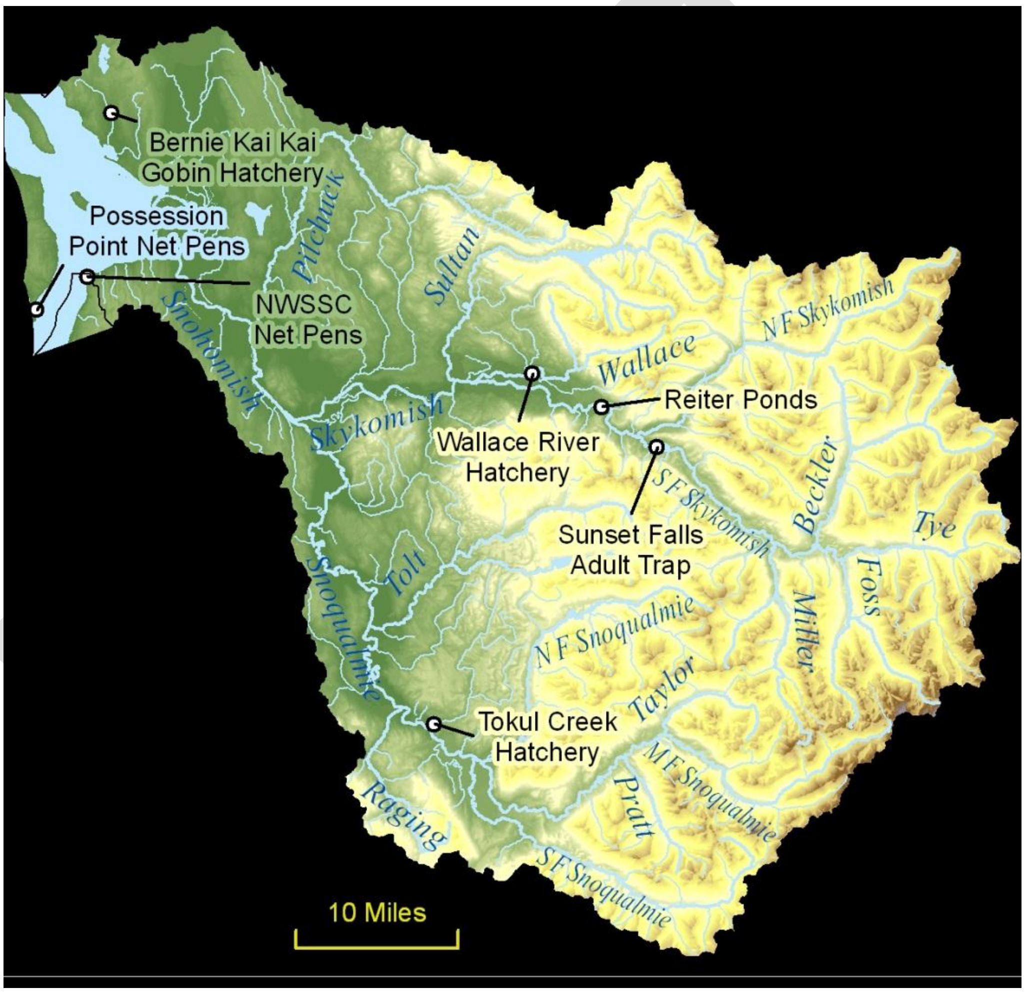

Figure 1.5.1: Map of the Snohomish Basin hatchery and trapping facilities. Source: WDFW GIS Staff.

1.6 Type of program.

Segregated Harvest.

1.7 Purpose (Goal) of program.

Harvest Augmentation.

1.8 Justification for the program.

The purpose of the program is to produce steelhead for sustainable fisheries for harvest in terminal recreational fisheries

To minimize impacts on listed fish from facilities operations: the following Risk Aversions are included in this HGMP (**Table 1.8.1**):

Table 1.8.1: Summary of risk aversion measures for the Snohomish/Skykomish River winter steelhead program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.1, 4.2	*Water rights for Wallace River hatchery and Tokul Ponds are* formalized through Washington Department of Ecology (WDOE) permits (numbers provided in section 4.1). Monitoring and measurement of water usage are reported in monthly NPDES reports.
Intake Screening	4.2	*Wallace River Hatchery*: 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 2011a). *Reiter Ponds:* No listed species of salmonids are present within the water source for Reiter Ponds.
Effluent Discharge	4.2	*Wallace River Hatchery*: Effluent from the Wallace River Hatchery is regulated through NPDES permit# WAG 13-3006. *Reiter Ponds:* Effluent from Reiter Pond is regulated through NPDES permit# WAG 13-3005.
Broodstock Management & Adult Passage	2.2.2, 2.2.3, 7.9	Listed steelhead are not reared through this program, and are not expected to be captured in significant numbers during broodstock collection at Reiter Ponds or Wallace River Hatchery. Bull trout (infrequently, if ever observed) or natural-origin steelhead may also be inadvertently handled and released from trapping facilities. However, operational protocols are in place to return these adults back to stream as quickly as possible when and where they occur. In almost all years, no encounters have been observed.
Disease Transmission	2.2.3, 9.2.7	The *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006), details hatchery practices and operations designed to stop the introduction and/or spread of any diseases.
Competition & Predation	2.2.3, 10.11	Fish are released as smolts between April and May to foster rapid migration to marine waters and to allow juvenile listed fish to grow to a size that reduces the potential for predation. Additional collaborative monitoring efforts include Salish Sea Marine Survival Project, and new Sea Grant study (see HGMP section 11.1.1).

1.9 List of program "Performance Standards".

See HGMP section 1.10.

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

1.10.1 "Performance Indicators" addressing benefits.

Table 1.10.1.1: "Performance Indicators" addressing benefits.

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.1 Program contributes to fulfilling tribal trust responsibility mandate and treaty rights as described in applicable agreements (*U.S. v Washington*).	Contributes to co-manager harvest.	Participate in annual coordination between co-managers to identify and report on issues of interest, coordinate management, and review programs (EBD and FBD processes, annual fisheries management plans).
3.1.2 Program contributes to mitigation requirements.	Number of fish released by program, returning, or caught, applicable to given mitigation requirements.	Annually estimate survival and contribution to fisheries for each brood year released. This program provides mitigation for lost fish production due to development within the Snohomish system and contributes to sport and tribal fisheries.
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP updated and re-submitted to NOAA with significant changes or under permit agreement.
3.2.1 Fish produced for harvest are propagated and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while adequately minimizing by-catch of non-target species.	Annual number of fish produced by program caught in all fisheries, including estimates of fish released.	Annually mass-mark hatchery steelhead releases to differentiate hatchery from natural-origin fish and record estimates of mark rate. The external mark enables mark-selective fisheries, which can reduce directed harvest mortality on natural-origin fish. Agencies monitor harvests and hatchery returns to provide up-to-date information. Estimate survival and contribution to fisheries for each brood year released.
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.	Level of smoltification (size, appearance, behavior, etc.) at release compared to WDFW rearing and release guidelines (Tipping 2001). Release type volitional or direct).	Monitor fish condition in the hatchery throughout all rearing stages. Annually monitor and report size, number, date and type of release.
3.5.6 The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Program is properly sized to meet harvest objectives; program fish are fully utilized in target fisheries.	Monitor harvests and hatchery returns throughout the run.
3.6.1 The hatchery program uses	Apply basic monitoring	Collect annual run timing, age

standard scientific procedures to evaluate various aspects of artificial propagation.	standards in the hatchery: feed conversion rates, growth trajectories, mark/tag rates, weight distributions (CVs).	and sex composition data upon adult return. Annually monitor and report growth rates, mark rate, size at release and release dates.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Contributes to cultural and recreational benefits to the general population. Also contributes cultural, ceremonial and subsistence (C&S), and recreational benefits for PNW Native Americans. Surplus (food-grade quality) fish contribute cultural, ceremonial and subsistence (C&S), and recreational benefits for PNW Native Americans and provide contributions to local charitable organizations. Recreational fishery angler days, length of season, number of licenses purchased.	Assess annual harvest of hatchery fish based on Catch Record Card (CRC) estimates. Annually record and report number of surplus fish donated to local charitable organizations.

1.10.2 <u>“Performance Indicators” addressing risks.</u>

Table 1.10.2.1: “Performance Indicators” addressing risks.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP is updated to reflect any major changes in program and resubmitted to NOAA fisheries. Program risks have been addressed in this HGMP through best available science and hatchery management actions. Monitor juvenile hatchery fish size, number, date of release and mass-mark quality; monitor contribution of hatchery adult fish to fisheries and hatchery 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 by-catch of non-target species.	Annual number of fish produced by this program caught in all fisheries, including estimates of fish released.	Annually mass-mark hatchery steelhead releases (adipose fin-clip) to differentiate hatchery from natural-origin fish and record estimates of mark rate. The external mark enables state agencies to initiate mark-selective fisheries, which can reduce directed harvest mortality on natural-origin fish. Harvest is regulated to meet appropriate biological assessment criteria. Agencies monitor harvests and

		hatchery escapements to provide up-to-date information.
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.	Spawn timing through redd surveys and smolt monitoring.
3.5.1 Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	Within and between populations, genetic structure affected by artificial production.	Conduct genetic monitoring of the hatchery and natural populations (see HGMP section 11.1).
3.5.2 Collection of broodstock does not adversely impact the genetic diversity of the naturally-spawning population.	Total number of natural-origin spawners (if any) reaching the collection facility. Timing of collection compared to overall run timing - broodstock-separated timing of earlier hatchery fish from later natural-origin spawners to minimize potential spawning overlap.	All hatchery production is identifiable by adipose fin clip. Segregated program - only marked hatchery fish are used for broodstock purposes; fish are spawned before January 31. Collect annual run timing, origin, age, and sex composition data. Examine returning fish for the fin-mark at the hatchery. Annually monitor and report numbers of estimated hatchery (marked) and natural (unmarked).
3.5.3 Hatchery-origin adults in natural production areas do not negatively affect the total natural spawning population.	Watershed-specific introgression rates of the natural spawning populations.	Collect tissues for DNA analysis from key demographic/tributary groups in each watershed subbasin sampling and refine DNA analysis to better understand the genetic composition of steelhead DIPs and monitor for signals for hybridization with hatchery fish. Input introgression data to TVA analysis and attempt to scale programs accordingly.
3.5.4 Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Location of release (on-station, acclimation pond, direct plant). Release type (forced, volitional or direct stream release).	Annually monitor and report release information -- including location, method, and age class -- in hatchery data systems (WDFW Hatcheries Headquarters Database).
3.5.5 Juveniles are released at fully-smolted stage.	Level of smoltification at release. Release type (forced, volitional, or direct).	Annually monitor and report size, number, date of release and release type.
3.5.6 The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Program is sized appropriately for harvest goals. Numbers of surplus hatchery returns are calculated annually.	Annually monitor and report adult return and surplus at Wallace River Hatchery and Reiter Ponds.
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests

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

		Fisheries Co-Managers of Washington State (WDFW and WWTIT 1998, updated 2006).
3.7.5 Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal and federal carcass distribution guidelines.	All applicable fish disease policies are followed. See HGMP sections 7.5 and 7.8.	Controls of specific fish pathogens through eggs/fish movements in accordance to the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). Record disposition of carcasses in the WDFW Hatcheries Headquarters Database.
3.7.6 Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally-produced population.	Spatial and temporal spawning distribution of natural populations above and below weir/trap currently compared to historic distribution.	Trap is checked regularly. When natural-origin steelhead are mixed in with hatchery fish, they are safely returned to the river.
3.7.7 Weir/trap operations do not result in significant stress, injury or mortality in natural populations.	Mortality rates in trap. Pre-spawning mortality rates of captured fish in the hatchery and/or after release.	Trap checked regularly. Annually monitor and report abundances and observations of natural-origin and hatchery-origin fish at hatchery facilities.
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.	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. Although these studies are for listed Chinook, all species caught are processed, (see also HGMP section 11.1). Hatchery smolt release size and time are monitored to quantify/minimize predation effects on naturally-produced listed fish (Sharpe et al. 2008, Pflug et al. 2013) (see also HGMP section 2.2.3).
3.8.1 Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries	Total cost of operation.	Compare annual operational cost of program to calculated fishery contribution value (Wegge 2009).

targeting this population.		

1.11 Expected size of program.

1.11.1 <u>Proposed annual broodstock collection level (maximum number of adult fish).</u>

Up to 300 adults collected annually.

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

Table 1.11.2.1: Annual fish release levels.

Life Stage	Release Location	Annual Release Level
Yearlings	Skykomish River (WRIA 07.0012)	185,000
	Wallace River (WRIA 07.0940)	71,000

Source: Future Brood Document 2014.

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

Due to a lack of coded-wire tag (CWT) studies and limitations that not all fish can be accounted for as being harvested or as back-to-rack counts, smolt-to-adult survival rates (SAR) are likely underestimated. Based on the average smolt-to-adult survival for the entire Snohomish Basin of 1.29% for brood years 1998-2009 (see HGMP section 3.3.1), and a programmed release goal of 256,000 yearling smolts, the estimated adult production (goal) level would be 3,302.

Table 1.12.1: Wallace River Hatchery and Reiter Ponds winter steelhead escapement 2001-2013.

Year	Wallace Hatchery	Reiter Ponds
2001/2002	NA	NA
2002/2003	63	65
2003/2004	NA	193
2004/2005	NA	162
2005/2006	NA	119
2006/2007	NA	49
2007/2008	NA	NA
2008/2009	78	123
2009/2010	50	92
2010/2011	71	96
2011/2012	88	577
2012/2013	50	582
2013/2014	82	317
Average	**67**	**206**

Source: WDFW Hatcheries Headquarters Database 2014.

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

Initial winter-run steelhead releases were made in the Snohomish River system in the early-1930s (WDFW Historical Database Records pre 1960-2006). The Reiter Ponds program began with the construction of the ponds in 1974, with the first releases in 1975. Wallace River Hatchery began rearing and releasing winter steelhead into the Wallace River in 1999. Until brood year 2014 broodstock for releases from Tokul Creek and Wallace River hatcheries as well as Reiter Ponds was collected at Tokul Creek. Starting with brood year 2015, the program has been modified and separated into two programs: Skykomish program, that includes Wallace River Hatchery and

Reiter Ponds portion and Snoqualmie program that include Tokul Creek Hatchery portion (see Tokul Creek Winter Steelhead HGMP).

1.14 Expected duration of program.

On-going.

1.15 Watersheds targeted by program.

The Skykomish and Snohomish Rivers (WRIA 07).

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

Alternative 1: Reduce winter steelhead release numbers as a measure to decrease genetic and ecological risks to natural-origin steelhead. The alternative was not pursued because further reductions to the proposed program size would gain negligible ecological benefits while imposing harsh consequences on harvest; this alternative 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 (*U.S. v Washington*) for sustainable fisheries.

Alternative 2: Discontinue the program. The Co-Managers did not pursue this alternative because: 1) program is projected to meet standards; and 2) it would not meet enhancement or harvest objectives for the program and would not meet the goals of either Co-Manager, which include providing recreational, cultural and subsistence, ceremonial, religious, commercial and non-commercial benefits, nor be compatible with Treaty Indian fishing rights (*U.S. v Washington*) for sustainable fisheries.

Alternative 3: Replace segregated program with an integrated program. To meet conditions of the incidental take statement in NOAA's recent Biological Opinion (NMFS 2011b), the average terminal harvest rate for Skagit, Snohomish, Green, Puyallup and Nisqually, should not exceed 4.2%. Changing broodstock strategy from segregated to integrated would place the fishery on top of the peak natural-origin run, and would be expected to exceed allowable impacts.

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

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

The Reiter Ponds and Wallace River winter steelhead HGMPs were previously submitted to NOAA Fisheries in 2005, but were not acted on at that time. This updated HGMP is submitted to NOAA Fisheries for ESA consultation, and determination regarding compliance of the plan with ESA Limit 6 of the 4(d) rule criteria for joint state/tribal hatchery resource management plans affecting listed species.

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

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

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

None directly.

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

Puget Sound Chinook (*Oncorhynchus tshawytscha*): Listed as *Threatened* on March 24, 1999 (64FR14308); *Threatened* status reaffirmed on June 28, 2005 (70FR37160); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448). The Puget Sound Chinook salmon ESU is composed of 31 historically quasi-independent populations, of which 22 are believed to be extant currently. The ESU includes all naturally-spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Strait of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington (Ford 2011), as well as twenty-seven artificial propagation programs (NMFS 2013 78FR38270). In the Snohomish basin, the Technical Recovery Team (TRT) has identified demographically independent populations (DIPs) in the Skykomish and Snoqualmie River sub-basins (Ruckelshaus et al. 2006).

Puget Sound steelhead *(Oncorhynchus mykis*s): Listed as *Threatened* under the ESA on May 11, 2007 (72FR26722); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448). The DPS includes all naturally spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations, below natural migration barriers in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington (Ford 2011). Also includes steelhead from six artificial propagation programs: Green River Natural; White River Winter Steelhead Supplementation; Hood Canal Steelhead Supplementation Off-station Projects in the Dewatto, Skokomish, and Duckabush Rivers; and the Lower Elwha Fish Hatchery Wild Steelhead Recovery (NMFS 2013 78FR38270). This DPS is bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), and also includes the Green River natural and Hood Canal winter-run steelhead hatchery stocks. In the Snohomish Basin, the TRT has preliminarily delineated three DIPs of winter steelhead (Snohomish/Skykomish, Pilchuck, and Snoqualmie) and two DIPs of summer steelhead (Tolt, and NF Skykomish) (PSSTRT 2013).

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

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

Wallace River Hatchery summer Chinook in the Puget Sound Chinook ESU. NMFS (1999) considered this hatchery stock to be part of the ESU, but not essential for recovery. The hatchery population was listed with natural-origin Chinook salmon that are part of the Skykomish population (70 FR 37160 June 28, 2005; NMFS SHIEER 2004). This stock was designated Category 2a. 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 (SSHAG 2003).

Snohomish Chinook in the Puget Sound ESU. Recent escapement levels (2001-2012) have averaged 3,913 for natural spawners in the Skykomish River DIP and 2,000 for the Snoqualmie River DIP. Both populations have shown declining population trends during this same period (SaSI, WDFW 2013).

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).

See Wallace River Summer Chinook HGMP for Chinook viability criteria.

Snohomish winter-run Steelhead in Puget Sound Steelhead DPS. The number of natural-origin winter steelhead has substantially increased in the last five years. From a low point in 2008-2009, the number of spawners in the Snohomish River increased to 1,068 in 2009-2010 to 2,658 in 2012-2013. Ford (2011) used spawner data collected through 2008 and concluded the following: "Steelhead counts in the Snohomish watershed have declined since the 1980s. The estimated probability that this steelhead population would decline to 10% of its current estimated abundance (i.e., to 445 fish) is moderately high—about 50% within 100 years. With an estimated mean population growth rate of −0.024 ($\lambda = 0.976$) and process variance of 0.033, NOAA was highly confident ($P < 0.05$) that a 90% decline in this population will not occur within the next 15 years, and that a 99% decline will not occur within the next 35 years. However, beyond the next 40−50 years NOAA was highly uncertain about the precise level of risk." Based on a preliminary intrinsic potential (IP) estimate by the PSSTRT (2013), the capacity for winter steelhead is between 2,139 and 42,779 adults in the Snohomish/Skykomish DIP, 519 and 10,386 in the Pilchuck River DIP and 1,674 to 33,479 in the Snoqualmie River DIP.

Tolt and North Fork Skykomish summer-run steelhead in the Puget Sound Steelhead DPS. The number of natural-origin summer steelhead has increased in the Tolt River in the last five years. From a low point of 50 spawners in 2006-2007, the number of summer steelhead spawners in the Tolt River increased to 126 in 2012-2013. Ford (2011) used spawner data collected through 2005 and concluded the following: "Steelhead counts in the Tolt River have declined since the late 1990s. The estimated probability that this steelhead population would decline to 10% of its current estimated abundance (i.e., to 6 fish) is high—nearly 80% within 100 years. With an estimated mean population growth rate of −0.040 ($\lambda = 0.961$) and process variance of 0.010, NOAA was highly confident ($P < 0.05$) that a 90% decline in this population will not occur within the next 8−10 years, and that a 99% decline will not occur within the next 15−18 years. However, beyond the next 20 years NOAA was highly uncertain about the precise level of risk." There is no adequate population trend data North Fork Skykomish DPS and as such the status of this population is currently unknown (SaSI, WDFW 2013). Based on an intrinsic potential (IP) estimate by the PSSTRT (2013), the capacity for summer steelhead between 32 and 641 adults in the Tolt River and 66 and 1,325 in the North Fork Skykomish River.

*Puget Sound steelhead: Updated Risk Summary***.** The number of winter steelhead spawners has increased for many populations in Puget Sound since 2009. The number of spawners for 16 Puget Sound winter steelhead populations, relative to the average number of spawners for each population in the four year period up to the listing in 2007, increased from an average of 51% in 2009 to 141% in 2013.

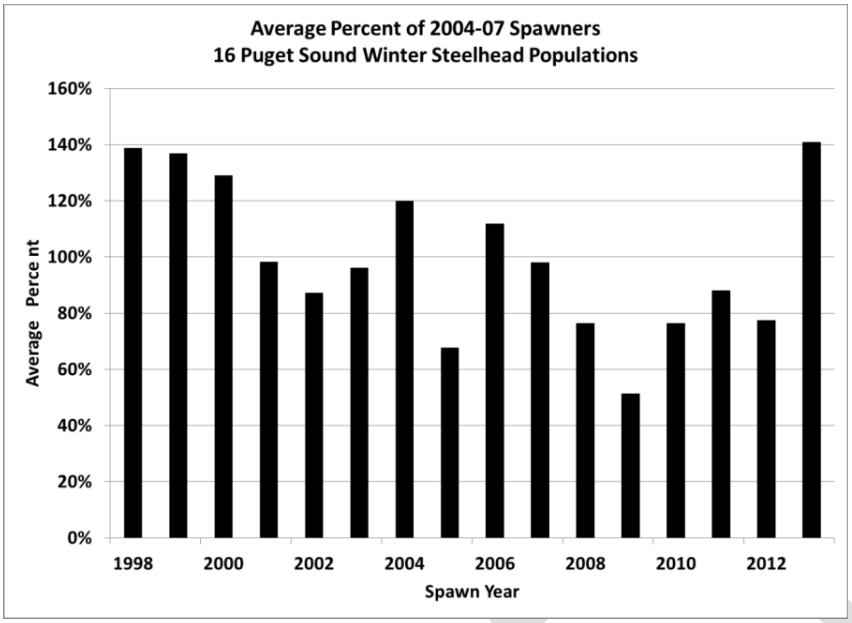

Figure 2.2.2.1: Average percent of 2004-2007 spawners for 16 Puget Sound winter steelhead populations.

These recent, short-term increases in spawners are a positive development, but do not negate the long-term risks facing Puget Sound steelhead DPS. Using spawner data collected through 2008 or 2009, Ford (2011) concluded that the status of the listed Puget Sound steelhead DPS has not changed substantially since the 2007 listing, and that steelhead in the Puget Sound DPS remain at risk of extinction throughout all or a significant portion of their range in the foreseeable future but are not currently in danger of imminent extinction.

Table 2.2.2.1: Interim DIP abundance goals for steelhead in Puget Sound, based on a four-year average. Abundance goals for summer-run fish *(italics)* are still under review. QET, quasi extinction threshold; SAS, smolt to adult survival. Minimum abundance = 100 (Low Abundance), 250 (Viable).

Population Basin				Quasi Extinction Threshold	Low Abundance	Viable	Capacity
Population Name	**Area km^2**	**Mean Elevation (m)**	**Total Stream Length (m)**		**1% SAS**	**5% SAS**	**20% SAS**
Snohomish/ Skykomish R	1,595	420	1,021,690	73	2,139	10,695	42,779
Pilchuck River	356	253	242,383	34	519	2,597	10,386
North Fork Skykomish River	*156*	*1,195*	*117,602*	*25*	*100 (66)*	*331*	*1,325*
Snoqualmie River	1,615	620	1,134,038	58	1,674	8,370	33,479
Tolt River	*182*	*784*	*117,732*	*25*	*100 (32)*	*250 (160)*	*641*
Puget DPS Total				**1,462**	**30,449**	**153,194**	**613,662**

Source: Hard et al. 2014.

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

See Wallace River Summer Chinook HGMP for Chinook productivity data.

Table 2.2.2.2: Steelhead Exp 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. These are based on analyses reported by Ford (2011) that are not necessarily agreed to by WDFW and the Tulalip Tribes.

- 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.

See Wallace River Summer Chinook HGMP for Chinook Escapement Data.

Table 2.2.2.3: Snohomish River basin winter and summer steelhead escapement 2000/01-2012/13.

Year	Snohomish System Winter Steelhead			Snohomish System Summer Steelhead		
	Snoqualmie River	Pilchuck River	Snohomish/ Skykomish River	Tolt River	S.F. Skykomish	N.F. Skykomish
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	1,510	1,518	3,116	42	344	NA
2005	1,060	604	2,746	68	318	NA
2006	1,832	580	2,854	112	498	NA
2007	964	976	NA	50	NA	NA
2008	404	646	NA	52	282	NA
2009	428	342	NA	86	311	NA
2010	662	294	732	116	369	82
2011	732	552	1,150	68	328	14
2012	914	848	876	122	592	22
2013[a]	740	1,036	1,008	126	----	NA
Average	**955**	**679**	**1,683**	**102**	**437**	**NA**

Source: SaSI, WDFW 2013; Peter Verhey WDFW 2013.
[a] Preliminary 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.

See Wallace River Summer Chinook HGMP for Chinook pHOS and pNOS estimates.

Snohomish System steelhead (*Oncorhynchus mykiss*): The early-winter hatchery programs in the Snohomish River basin are designed to take into account potential risks of artificial propagation on listed species while still providing for some harvest by treaty tribes and recreational fisheries. Efforts to minimize potential risks of artificial propagation are described below. Likewise, to protect against overutilization of natural-origin steelhead whose abundances have declined from historical levels, the NMFS Biological Opinion established a 4.2% limit of the aggregate average harvest rate of natural-origin steelhead in five basins: Skagit River, Snohomish River, Green River, Puyallup River, and Nisqually River. The factors driving the declining abundance of natural-origin steelhead, however, have not been similarly restricted, including: 1) the present and increasing threat of destruction, modification and curtailment of natural-origin steelhead freshwater, estuarine, and marine habitat; 2) predation and potentially disease, and 3) the inadequate existing regulatory mechanisms to protect natural-origin steelhead habitat. The current harvest restriction severely limits the opportunities for both treaty and non-treaty fisheries on natural-origin steelhead. The lack of adequate habitat protection and restoration places an unacceptable disparate burden on hatchery programs, the exercise of the tribes' treaty-secured rights, limits recreational fishing opportunities, and fails to conserve steelhead. The potential risks of this hatchery program, therefore, have to be considered in the context of failure to implement steelhead habitat protection and restoration measures commensurate with those measures imposed on steelhead hatchery and harvest programs that result in diminished fishing opportunities.

An integrated Total Viability Analysis (TVA) is needed to assess the risks of the proposed hatchery program relative to other risk factors and to develop management actions that are likely to lead to recovery. As noted by the Puget Sound Technical Recovery Team (2003), "Considering the effects of one factor at a time (e.g. harvest, habitat, or hatchery management actions) on salmon population characteristics is more tractable from a technical standpoint, but such estimates of effects are sure to be wrong in most instances. Managers [are asked] to consider suites of habitat, harvest, and hatchery actions together, especially with a view towards how these factors interact..." Rather than simplistic single sector analysis and management actions, our challenge is to develop a suite of integrated recovery actions that lead to increased production and viability of natural-origin steelhead. The WDFW and Treaty tribes are now developing analytical tools to initiate this task.

Analyses of a single hatchery parameter or application of a universal standard is unlikely to lead to an informed decision regarding the potential risk of a hatchery program or to the identification of appropriate management actions. We used four analyses to evaluate the potential genetic effects of the early-winter steelhead programs on natural-origin steelhead. The analyses are complementary - they use multiple sources of information and address multiple questions.

1) Genetic Introgression. Introgression is the accumulation of hatchery-origin genetic changes in natural-origin populations, and starts with hybridization, here between hatchery and natural-origin individuals. We estimate the relative number of F1 hybrids (i.e. first generation hybrids) as a proxy for genetic introgression to address the question "How have past early-winter hatchery program practices affected the genetic characteristics of natural-origin steelhead?" Since our analysis relies on tissue samples from natural-origin steelhead collected in the Snohomish/Skykomish and Pilchuck Rivers, it provides a direct measure of the identity of the parents of individuals sampled, and depending on what year the individuals were sampled, may represent the effects of the original early-winter hatchery program. However, it may also reflect some practices that have now ended (e.g., off-station plants, recycling of returning adults, larger number of fish released).

2) Projected Genetic Introgression. We developed a simple, heuristic model to project how genetic introgression might change in the future based on the assumptions discussed below and the model structure.

3) Proportion Effective Hatchery Contribution. The proportion effective hatchery contribution (PEHC) is the proportion of natural spawners that are genetically derived from the early-winter hatchery program and includes both hatchery/natural-origin hybrids and pure natural-origin hatchery-lineage fish. We estimated the PEHC from an analysis of the genetic ancestry of tissue samples from natural-origin steelhead in the Snohomish River (Warheit 2014). Since the PEHC includes pure hatchery-lineage fish that have the potential to generate hybrid offspring, it addresses a broader question than would genetic introgression alone: "How may early-winter hatchery program practices affect the potential for genetic introgression, given the limitations to that projection as described below (**Table 2.2.2.4**)?" Like the analysis of introgression, PEHC relies on tissue samples from natural-origin steelhead collected in the Snohomish River, and provides a direct measure of the effects of the early-winter hatchery program.

4) Gene Flow. Whereas genetic introgression is a cumulative state, gene flow is the process that leads to genetic introgression. Gene flow may vary each year in response to hatchery program characteristics such as the number and location of fish released and the number of natural-origin spawners. We asked the question "What was the historical gene flow and what do we anticipate gene flow will be with the new proposed program?" We calculated a potential range of gene flow from the early-winter hatchery program to the natural-origin populations based on the assumptions of hatchery steelhead fitness, the

overlap in spawn timing of hatchery and natural-origin steelhead, and stray rate assumptions for early-winter steelhead (see next section and Hoffmann 2014).

The results are summarized in **Table 2.2.2.4** and discussed in greater detail in the following sections. The estimated PEHC for the proposed program ranged from 0 to 0.05 and gene flow was projected to be less than 2% for most parameter values. Several key assumptions and uncertainties of the analyses are discussed briefly below (see Warheit 2014 and Hoffmann 2014 for a more detailed discussion):

1) Uncertainty in Estimates. Although we report most statistics as point estimates, the estimates have variance associated with sampling the population and measuring biological attributes. Because of variability inherent in natural systems, and our sampling programs, we can expect substantial inter-annual variability in our point estimates, even if the true value is constant.
2) Effects of Variations in Population Abundance. Our projections for the proposed program assume that the abundance of the natural-origin population remains constant relative to when the samples were taken. Increases in population abundance will result in lower values of introgression, PEHC, and gene flow even if the hatchery programs do not change. Conversely, decreases in population abundance will result in higher values of introgression, PEHC, and gene flow than projected.
3) Time Lags. The effects of changes in hatchery programs may not be evident for 2-5 years after the changes have been made. This time lag reflects: a) the multiple years of ocean residence between smolt release and the return of adult fish; b) the multiple ages at return for adult steelhead; and c) the presence of hatchery/natural-origin hybrids from previous generations that can continue to contribute to the genetic characteristics of the population.
4) Neutral Markers. The genetic analysis was based on SNP loci that were presumably neutral to natural selection. These markers were used to categorize fish as pure early-winter hatchery lineage, natural-origin lineage, and hybrid between the hatchery and natural-origin lineages. If a hatchery program is terminated, the amount of time it takes a natural-origin population to purge itself of alleles that categorize a fish as being a hatchery or hybrid fish is a function of the frequency of the alleles and the effective size of the natural-origin population.

Genetic Introgression. We evaluated genetic introgression through F1 hybridization resulting from the early-winter hatchery program through an analysis of tissue samples from steelhead in the Snohomish/Skykomish and Pilchuck Rivers (Warheit 2014).

Table 2.2.2.4: Estimates of F1 hybridization, PEHC, and gene flow from early-winter hatchery programs to steelhead populations in the Snohomish/Skykomish and Pilchuck Rivers for past practices and proposed programs. Ranges in gene flow reflect the minimum and maximum values for parameter values from cases 1-6.

Population	F1 Hybridization	PEHC	Gene Flow
Snohomish/Skykomish River Winter			
Past Practice	0.00%	0.00%	0.08% - 1.06%
Proposed Program		0.00%	0.14% - 1.66%
Pilchuck River Winter			
Past Practice	0.00%	1.43%	0.12% - 1.03%
Proposed Program		1.31%	0.00% - 0.00%
NF Skykomish River Summer			
Past Practice	2.71%	1.35%	-
Proposed Program		1.24%	-

[a] PEHC and gene flow estimates for the proposed program shown were scaled to reflect changes in program size and elimination of off-station releases.

For the Snoqualmie and Tolt Rivers populations see Snoqualmie River Steelhead HGMP

Projected Genetic Introgression. We constructed the heuristic simulation model to develop insights regarding the sensitivity of introgression to variables, the time lag between when actions are taken and when changes in introgression might become evident, and variability in the estimates of introgression that might result. The model is not intended, structured, or parameterized to provide specific predictions on past or future levels of introgression, nor does it address the need for an “All-H” viability analysis as discussed above.

The base parameter values in the model included a 20% stray rate and a 45% overlap in the timing of natural-origin and hatchery-origin (including hybrid) spawners. The numbers of natural-origin spawners and hatchery releases were scaled to result in an introgression rate of approximately 6%. In the model, we initiated a hatchery program at time 0 with both on-station and off-station smolt releases, we eliminated the off-station releases after year 10, and eliminated all hatchery production after year 20. Our preliminary results are summarized below:

1) The model indicates a lag of three to five years may occur between when a hatchery management action is implemented and when the introgression level reaches a new equilibrium (**Figure 2.2.2.2**). In the model, this results from both a) the multiple years of ocean residence between smolt release and returns of adult cohorts and b) the presence of a reservoir of hatchery-natural-origin hybrids from previous generations that continue to contribute to the genetic characteristics of the natural-origin population.
2) With a sample size of 100 fish, estimates of introgression are likely to have substantial uncertainty when the introgression rate is relatively low (**Figure 2.2.2.2**). This is a result of a small sample size and the inherent variability in an estimate of an infrequent event.
3) We conducted a preliminary analysis of the sensitivity of introgression to the abundance of natural-origin steelhead, the stray rate, and the overlap in timing of hatchery and natural-origin spawners (**Table 2.2.2.5**). We increased or decreased the value of each variable by 50% and assessed the effect upon the estimated introgression. Estimates of introgression were most sensitive to the straying rate and changes in the abundance of the natural-origin spawners.

Table 2.2.2.5: Preliminary analysis of the sensitivity of introgression to the abundance of natural-origin spawners, straying rate, and overlap of the spawn timing of hatchery and natural-origin steelhead.

Variable	Estimated Introgression
Abundance of Natural-Origin Spawners	
+50%	0.025
Base	0.034
-50%	0.051
Stray Rate	
10%	0.016
Base (20%)	0.034
30%	0.056
Spawn-Timing Overlap	
22.5%	0.027
Base (45%)	0.034
67.5%	0.038

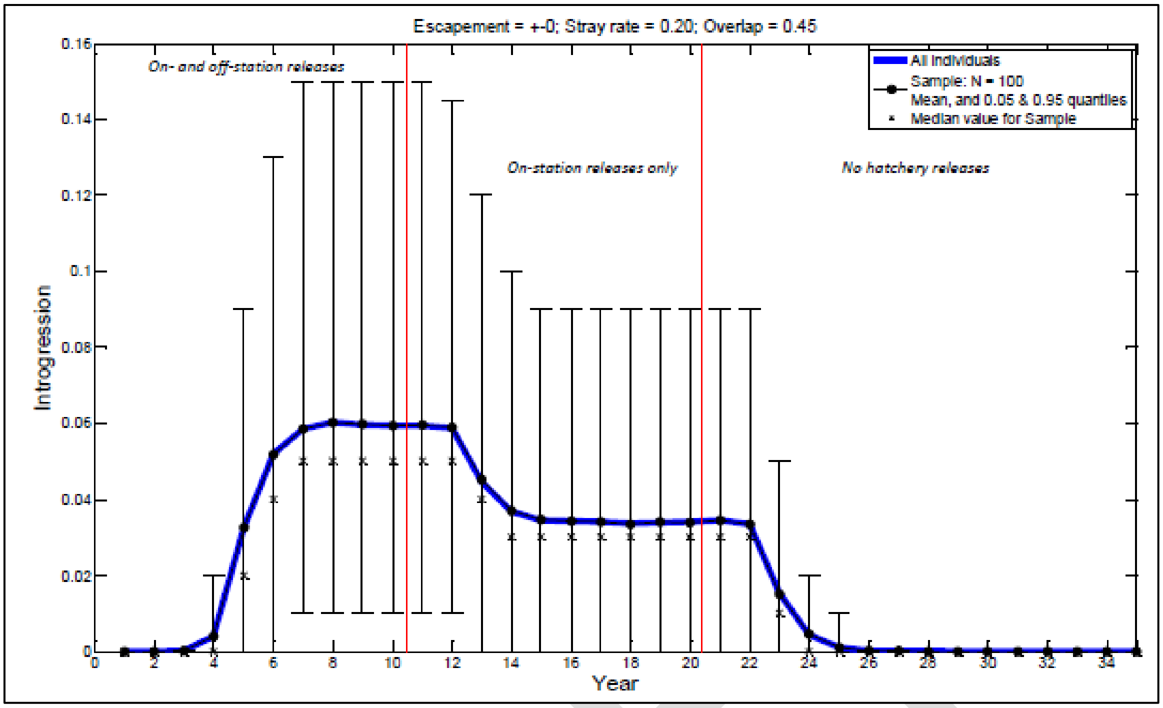

Figure 2.2.2.2. Preliminary simulation analysis of introgression including lag times in response to hatchery actions and uncertainty of estimates.

Proportion Effective Hatchery Contribution. We estimated the PEHC from the early-winter hatchery program from a genetic analysis of juvenile and adult steelhead (Warheit 2014). The estimated PEHC did not exceed 0.01 for the, Snohomish/Skykomish Winter, and Pilchuck Winter populations. More detailed analysis is presented below for the Snohommish/Skykomish and Pilchuk Rivers Winter populations (estimated PEHC of 0.133 with past practices) and North Fork Skykomish Summer (estimated PEHC of 0.017 with historical practices).

North Fork Skykomish River Summer. The PEHC was estimated as 1.35% from an analysis of 89 samples from the North Fork Skykomish River Summer population (Warheit 2014). The genetic samples were taken from juvenile and adult steelhead in 2004, 2012, and 2013. The estimated PEHC reflects the hatchery practices that were in place in the years affecting the juvenile and adult fish in the years when the samples were collected. The average number of juvenile fish released in the years affecting these samples was 224,700 (**Table 2.2.2.7**).

Since the hatchery releases of winter steelhead at the Wallace and Reiter hatcheries of 256,000 is greater than the average production for the release years associated with the genetic samples, we projected a future PEHC (Hoffmann 2014). The increase in hatchery production (from 224,700 to 256,000) in conjunction with the elimination of off-station releases is projected to reduce the PEHC to 1.24%, other factors held constant.

Table 2.2.2.7: Genetic samples and associated hatchery releases of winter steelhead into the Snohomish/Skykomish River.

Sample	Life Stage	Sample Collection Year	Primary Spawn Year	Primary Release Year	Releases
NF Skykomish	Juvenile	2004	2004	2002	212,736
NF Skykomish	Adult	2012	2008	2006	261,598
NF Skykomish	Adult	2013	2009	2007	258,512
NF Skykomish	Juvenile	2013	2013	2011	165,955

Gene Flow. We estimated the gene flow from stray rates for on-station and off-station releases (Hoffmann 2014). The HSRG has generally used stray rates of 0.10 or 0.20 for hatchery programs where juveniles are released on-station and the hatchery has adult collection facilities. We used a stray rate of 100% for off-station releases and stray rates of 20% and 30% for on-station releases.

We assumed that releases in the Snoqualmie River and tributaries would affect the Snoqualmie Winter populations and that releases in the Pilchuck River would affect the Pilchuck Winter population, and that releases in the Skykomish River and tributaries would affect the Snohomish/Skykomish winter population.

We estimated gene flow using the methods of Scott and Gill (2008) with the correction provided by Busack (2014). We used the following sources for parameter estimates:

Spawn Timing of Hatchery-Origin Spawners (o_H). The spawn timing of early-winter hatchery steelhead (Hoffmann 2014) was estimated from: a) the spawn timing at the Tokul Creek Hatchery; and b) entry timing of winter steelhead into the Tokul Creek Hatchery (for the Snoqualmie population analysis) or the Reiter-Wallace Hatchery (for the Snohomish/Skykomish and Pilchuck analyses).

Spawn Timing of Natural-Origin Spawners (o_N). The spawn-timing of natural-origin fish in the Snohomish River populations (Hoffmann 2014) was estimated from: a) the range of values from Scott and Gill (2008) to bracket the likely spawn timing; and b) the spawn-timing observed for natural populations in the Snohomish River.

Relative Fitness of HxH Crosses (k_1). The early-winter hatchery programs are operated with a segregated, nonlocal broodstock that has been domesticated over a period of more than 60 years. Unlike well run integrated hatchery programs, we can anticipate that the relative fitness will be low for fish produced from this type of program. We used a range of values (0.02 to 0.13) for relative fitness drawn from the empirical studies for steelhead programs that use nonlocal broodstock (Araki et al. (2008)). These studies were not conducted with Puget Sound steelhead populations. The co-managers are committed to continuing research and monitoring to refine estimates of fitness and overlap in spawning to better understand gen flow between early-winter steelhead and natural-origin steelhead.

Relative Fitness of HxW Crosses (k_2). We used a value of 0.54 which is halfway between the average value for HxH crosses (0.084) and a relative fitness of 1.0.

Proportion of Total Natural Spawners of Hatchery-Origin (q). We estimated the proportion of hatchery-origin spawners using the assumed stray rate of 100% for off-station releases and 20% or 30% for on-station releases.

Combinations of parameter values used for the six cases analyzed are summarized in **Table 2.2.2.8.**

The estimated gene flow for six cases of alternative parameter values are provided in **Tables 2.2.2.9** through **2.2.2.11**.

Table 2.2.2.8: Parameter values for six alternative cases for estimating PEHC and gene flow.

Parameter	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
o_H	Spawn timing of early-winter steelhead at Tokul Creek Hatchery.	Spawn timing of early-winter steelhead at Tokul Creek Hatchery.	Entry timing of hatchery steelhead at Tokul Creek Hatchery or Reiter/Wallace hatcheries.	Spawn timing of early-winter steelhead at Tokul Creek Hatchery.	Spawn timing of early-winter steelhead at Tokul Creek Hatchery.	Entry timing of hatchery steelhead at Tokul Creek Hatchery or Reiter/Wallace hatcheries.
o_N	Spawn timing of natural-origin steelhead in Snow Creek.	Spawn timing of natural-origin steelhead in Clearwater River.	Spawn timing of natural-origin steelhead for the population analyzed.	Spawn timing of natural-origin steelhead in Snow Creek.	Spawn timing of natural-origin steelhead in Clearwater River.	Spawn timing of natural-origin steelhead for the population analyzed.
Stray Rate	0.20	0.20	0.20	0.30	0.30	0.30
k_1	0.02, 0.13	0.02, 0.13	0.02, 0.13	0.02, 0.13	0.02, 0.13	0.02, 0.13
k_2	0.54	0.54	0.54	0.54	0.54	0.54

Table 2.2.2.10: Estimated gene flow from the early-winter hatchery program for the Pilchuck River Winter steelhead population under six alternative cases.

Spawn Year	**Case 1** Natural: Snow Creek Hatchery: Tokul Creek Stray Rate = 0.20		**Case 2** Natural: Clearwater R. Hatchery: Tokul Creek Stray Rate = 0.20		**Case 3** Natural: Pilchuck Hatchery: Reiter-Wallace Stray Rate = 0.20		**Case 4** Natural: Snow Creek Hatchery: Tokul Creek Stray Rate = 0.30		**Case 5** Natural: Clearwater R. Hatchery: Tokul Creek Stray Rate = 0.30		**Case 6** Natural: Pilchuck Hatchery: Reiter-Wallace Stray Rate = 0.30	
	K_1 = 0.02	K_1 = 0.13	K_1 = 0.02	K_1 = 0.13	K_1 = 0.02	K_1 = 0.13	K_1 = 0.02	K_1 = 0.13	K_1 = 0.02	K_1 = 0.13	K_1 = 0.02	K_1 = 0.13
2001-2002												
2002-2003	0.12%	0.28%	0.06%	0.33%	0.46%	0.67%	0.14%	0.32%	0.07%	0.38%	0.49%	0.74%
2003-2004	0.12%	0.26%	0.06%	0.31%	0.44%	0.63%	0.13%	0.30%	0.07%	0.36%	0.48%	0.70%
2004-2005	0.21%	0.48%	0.11%	0.58%	0.62%	1.02%	0.24%	0.54%	0.12%	0.65%	0.66%	1.12%
2005-2006	0.16%	0.37%	0.08%	0.44%	0.54%	0.83%	0.19%	0.42%	0.10%	0.50%	0.58%	0.92%
2006-2007	0.04%	0.09%	0.02%	0.10%	0.19%	0.25%	0.04%	0.10%	0.02%	0.12%	0.22%	0.28%
2007-2008							0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2008-2009	0.49%	1.14%	0.25%	1.36%	0.89%	1.95%	0.55%	1.29%	0.29%	1.53%	0.93%	2.13%
2009-2010	0.36%	0.83%	0.19%	1.00%	0.79%	1.54%	0.41%	0.94%	0.21%	1.12%	0.83%	1.69%
2010-2011	0.29%	0.67%	0.15%	0.80%	0.72%	1.31%	0.33%	0.76%	0.17%	0.91%	0.76%	1.44%
2011-2012	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Through 2011	0.23%	0.51%	0.12%	0.62%	0.58%	1.03%	0.23%	0.52%	0.12%	0.62%	0.55%	1.00%
All Years	0.20%	0.46%	0.10%	0.55%	0.52%	0.91%	0.20%	0.47%	0.11%	0.56%	0.49%	0.90%
No Offstation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Release 256,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 2.2.2.11: Estimated gene flow from the early-winter hatchery program for the Snohomish/Skykomish River Winter steelhead population under six alternative cases.

Spawn Year		**Case 1** Natural: Snow Creek Hatchery: Tokul Creek Stray Rate = 0.20		**Case 2** Natural: Clearwater R. Hatchery: Tokul Creek Stray Rate = 0.20		**Case 3** Natural: Skykomish Hatchery: Reiter-Wallace Stray Rate = 0.20		**Case 4** Natural: Snow Creek Hatchery: Tokul Creek Stray Rate = 0.30		**Case 5** Natural: Clearwater R. Hatchery: Tokul Creek Stray Rate = 0.30		**Case 6** Natural: Skykomish[1] Hatchery: Reiter-Wallace Stray Rate = 0.30	
		K_1= 0.02	K_1= 0.13	K_1= 0.02	K_1= 0.13	K_1= 0.02	K_1= 0.13	K_1= 0.02	K_1= 0.13	K_1= 0.02	K_1= 0.13	K_1= 0.02	K_1= 0.13
2001-2002		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2002-2003		0.12%	0.28%	0.06%	0.34%	0.47%	0.69%	0.16%	0.37%	0.08%	0.45%	0.56%	0.85%
2003-2004		0.17%	0.38%	0.09%	0.46%	0.57%	0.87%	0.23%	0.52%	0.12%	0.63%	0.68%	1.12%
2004-2005		0.15%	0.33%	0.08%	0.40%	0.52%	0.78%	0.20%	0.46%	0.11%	0.56%	0.64%	1.02%
2005-2006		0.09%	0.20%	0.05%	0.24%	0.37%	0.52%	0.13%	0.28%	0.07%	0.35%	0.48%	0.70%
2006-2007													
2007-2008													
2008-2009													
2009-2010		0.36%	0.82%	0.19%	1.01%	0.86%	1.61%	0.52%	1.20%	0.28%	1.48%	1.02%	2.17%
2010-2011		0.23%	0.53%	0.12%	0.65%	0.69%	1.14%	0.35%	0.80%	0.19%	0.99%	0.85%	1.58%
2011-2012		0.77%	1.81%	0.42%	2.24%	1.21%	3.03%	1.23%	3.01%	0.70%	3.77%	1.54%	4.70%
Through 2011		0.16%	0.36%	0.08%	0.44%	0.50%	0.80%	0.23%	0.52%	0.12%	0.64%	0.60%	1.06%
All Years		0.24%	0.54%	0.13%	0.67%	0.59%	1.08%	0.35%	0.83%	0.19%	1.03%	0.72%	1.52%
No Offstation		0.17%	0.38%	0.09%	0.46%	0.43%	0.77%	0.28%	0.64%	0.15%	0.79%	0.59%	1.19%
Release	256,000	0.25%	0.57%	0.14%	0.69%	0.56%	1.08%	0.40%	0.95%	0.23%	1.16%	0.74%	1.66%

[1] Snohomish/Skykomish Winter population.

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

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

Broodstock Trapping/Holding: Broodstock collection for the Snohomish/Skykomish River early winter program takes place primarily at Reiter Ponds and Wallace River Hatchery. Broodstock collected from these two facilities may be used as a backup source for Snoqualmie early winter steelhead program in the case of a broodstock shortfall at Tokul Creek Hatchery, however the goal will be to manage the Snohomish/Skykomish and Snoqualmie programs separately, by trapping adults, and incubating, rearing and releasing juveniles for facilities within each of the basins to promote higher imprinting rates, reduce straying, and continue to encourage local adaptation. The trapping facility at Reiter Ponds is a hatchery outlet only, with little or no incentive for natural-origin fish to voluntarily enter. The Wallace River Hatchery trapping facilities are located on May Creek and Wallace River. Broodstock collection of winter steelhead takes place between November and January 31; however, the traps are operated until March 15 or later as conditions allow, insuring that any hatchery-origin adults are captured and removed from the system. Listed steelhead, if encountered and identified by presence of an adipose fin, are safely returned back to stream and specifically avoided for use as broodstock.

Broodstock Spawning/Pathology Sampling: Only hatchery-identified steelhead are spawned in thise steelhead program. After spawning, moribund females or fresh pond mortalities may be kidney/spleen sampled for thorough pathogen screening per the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).

Rearing Program: Only hatchery steelhead are reared on-station. Listed fish are not reared in this program.

Residualism: Rearing and release strategies are key components to minimizing risks from hatchery programs on out-migrating salmonids. Ideally, hatchery steelhead are released when fish are smolting to encourage rapid outmigration to minimize the opportunity for predation or residualism risks (Fuss et al. 1999 and Snow et al. 2013) of hatchery fish on natural out-migrants. Studies conducted on predation risks to natural-origin Chinook (Sharpe et al. 2008) and steelhead (Naman and Sharpe 2012; Pflug et al. 2013) have shown predation risks to be minimal. Short out-migrating travel times have also been shown to minimize opportunity for negative interactions (nine days Moore et al. 2013 Puget Sound wide; 16.4 days Goetz et al. 2014, Green River).

Based on 30 years of staff observations and the studies conducted to evaluate predation and residualization risks, the current protocol as described incorporates the following risk aversion factors into best practices to reduce risks to ESA-listed populations while meeting management goals.

- FISH UNIFORMITY: Monitor population uniformity of hatchery steelhead through CVs and condition factors prior to release to ensure release criteria are met (uniform size, condition, etc.).
- FISH SIZE: Release groups will meet the minimum size criteria of 10 fpp established by Tipping 2001.
- RELEASE TIMING: Releases of hatchery smolts will occur on or after April 15 to minimize predation risks on out-migrating natural-origin listed fry in the freshwater system so long as the first two criteria of fish uniformity and fish size (Tynan 2012 analysis-unpublished; Iverson and Missildine 2013 unpublished).

- VOLITIONAL RELEASE: Releases of hatchery smolts will be volitional to minimize residualization risks.
  - Volitional release will begin after April 15 when steelhead display cues of outward physical signs and behaviors of active smoltification, such as loss of parr marks, banding of tail, actively cruising pond edges, inflow, and outflow areas.
  - Hatchery Staff will pull screens to provide the opportunity for steelhead smolts ready to emigrate to leave the pond(s) or raceway(s).
  - Steelhead that have not volitionally left the holding area by the end of the release period (approximately one month (Fuss 1999; Tipping 2001) will be transferred to non-anadromous lakes for angling opportunities.

For more information on predation and competition risks see HGMP section 2.2.3 *Competition/Niche-Displacement* and *Predation* sections below.

Operation of Hatchery Facilities: Potential facility operation impacts on listed fish include; water withdrawal, hatchery effluent, and intake or barrier blockages. Monitoring and maintenance of hatchery facilities is conducted regularly. Effluent at outfall areas is rapidly diluted with main stem flows and operation is within permitted guidelines (see HGMP sections 4.1 and 4.2). All permit requirements are followed in order to minimize the potential indirect 'Take" associated with the operations of these facilities. No direct take of listed steelhead have been reported by staff during the hatchery operations.

Genetic Introgression: Genetic introgression may occur if hatchery adults spawn in the wild. However, both temporal and spatial separation of hatchery- and natural-origin steelhead play a role in the amount of potential impact. Run timing for natural-origin winter steelhead stocks in Puget Sound systems range from November to June, with the current existing peak spawn time in most populations from mid-April through May (SaSI, WDFW 2013). Where native summer steelhead stocks are present, run timing occurs from April to December, with peak spawn time believed to be approximately one month earlier than the winter stock.

Plants to various locations in the system occurred in the past, but have been eliminated and program fish are currently released on-station (100% mass-marked) and with no out of basin transfers. This reduces overlap potential and straying incidences. For the early-winter steelhead stocks in Puget Sound, eggs will not be taken later than January 31, in order to reduce potential overlap of hatchery fish from the existing natural-origin winter steelhead peak spawning time frame in the Snohomish system. The natural-origin winter run steelhead spawning generally occurs from early-March to early-June.

The expected gene flow rate can be much lower than the "stray" rate. In a well-run segregated program, the level of gene flow should be quite low for three reasons: 1) the numbers of hatchery-origin fish that have escaped harvest should be low compared to the number of natural-origin fish present; 2) the reproductive success of the hatchery-origin fish can be expected to be low (Leider et al. 1990; Kostow et al. 2003; McLean et al. 2003; McLean et al. 2004); and 3) spawning overlap may be low (Scott and Gill 2008).

Operational changes were implemented in 2009 to remove hatchery fish, including adults trapped above broodstock needs. These will not be recycled for additional sport opportunities and trapping facilities will continue removing hatchery fish until March 15, or later as conditions allow.

Additional analyses are presented in HGMP section 2.2.2.

Competition/Niche-Displacement: Freshwater carrying capacity may be compromised if hatchery steelhead smolts planted or those produced naturally from hatchery spawners competitively displace or compete with natural-origin fish in their natural rearing habitats. Due to size differences between steelhead smolts and sub-yearlings, competition is probably low with regards to food and spatial preference between species and size. Studies specific to competition or niche displacement in the Snohomish/Skykomish River system and tributaries are not conducted. Smolts from on station releases in large river systems travel rapidly – migration rates of approximately 20 river miles per day have been observed with steelhead smolts released in the Cowlitz River (Harza 1999). Interactions with listed salmonids in the estuarine and nearshore environment are likely to be limited. Telemetry studies indicate that steelhead migrate out of the Puget Sound quickly, with an average travel time of approximately nine days to the Strait of Juan de Fuca (Moore et al. 2013, Moore et al. 2010, Goetz et al. 2008).

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

Predation: Steelhead released from hatchery programs are unlikely to prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, the habitat in which the population occurs, and the characteristics of the hatchery program (e.g., release time, release location, number released, and size of fish released). Based on stomach fullness, most steelhead smolts do not begin to feed extensively until about a week after release (Cannamela 1993). Recent WDFW research (Sharpe et al. 2008) has shown that the predation risk from hatchery steelhead smolt releases are minimal on smaller prey fish. Based on a study in the Skagit basin, Pflug et al. 2013 showed that hatchery steelhead smolts did not prey on natural-origin steelhead juveniles.

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

Listed Chinook have not been collected during winter steelhead trapping. Bull trout or natural-origin steelhead may be inadvertently handled and released from trapping facilities but operational protocols are in place to return these adults back to stream as quickly as possible when and where they occur. With current facilities, listed fish encountered at these trapping sites (Wallace Hatchery and/or Reiter Ponds) and returned back to stream is estimated to be 0-10 fish annually. In most years staff have reported no encounters of listed fish.

- 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 comments above.

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

Any additionally mortality from these activities, above what is anticipated and described above, would be communicated to WDFW Fish Program and NOAA staff for additional guidance.

3 SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

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

This HGMP is part of the Co-manager's plan for implementing hatchery programs in the Snohomish watershed.

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

The Stillaguamish Indian Tribe and Tulalip Tribes along with WDFW prepare an annual fishery management plan for the harvest of Snohomish steelhead produced from this program. Emergency in-season regulations may restrict fishing when hatchery escapement shortfalls are anticipated (WDFW et al. 2008 to present).

WDFW hatcheries operate under *U.S. v Washington* that provides the legal framework for coordinating these programs, defining artificial production objectives, and maintaining treaty-fishing rights through the *Puget Sound Salmon Management Plan* (PSSMP 1985). This co-management process requires that both the State of Washington and the relevant Puget Sound Tribe(s) develop program goals and objectives and agree on the function, purpose and release strategies of all hatchery programs.

Equilibrium and Future Brood Document (EBD and FBD): The PSSMP defines the EBD as the annual expression of the equilibrium brood document as it pertains to the coming year's run of salmon and describes the standard mode of operation for existing facilities/functions, associated with fish culture activities. The FBD provide descriptions of facilities, species propagated, and fishery management, hatchery production, broodstock management, egg-take, rearing, and release goals for each facility. While it does not include all of the requirements of the EBD, the Future Brood Document (FBD) is currently used as a pre-season planning document for EBD fish hatchery production reporting information in Washington State for the upcoming brood stock collection and fish rearing season (July 1 –June 30). The FBD is coordinated between WDFW, Puget Sound and coastal treaty tribes, the Northwest Indian Fisheries Commission (NWIFC), eastern Washington treaty tribes, and Federal fish hatcheries. Hatchery production by volunteers, schools, and Regional Fisheries Enhancement Groups are represented by WDFW.

See also HGMP section 3.1.

3.3 Relationship to harvest objectives.

WDFW general harvest goals are to provide fishing opportunities consistent with the mandate of the agency for restoration and recovery of natural-origin indigenous salmonid runs, the Pacific Salmon Treaty, the *Puget Sound Salmon Management Plan*, the *Statewide Steelhead Management Plan*, annual fisheries management plans, *U.S. v Washington* (1974), and other state, federal, and international legal obligations. The Tulalip and Stillaguamish Tribes along with WDFW prepare an annual fishery management plan for the harvest of Snohomish River system summer and winter steelhead released from hatchery programs.

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.

Harvest targeted on hatchery fish: Snohomish River system programs benefit the in-river recreational fishery and to some extent the Stillaguamish and Tulalip Tribes' commercial and subsistence fisheries. Commercial tribal catch is restricted to marine areas (8A & 8D). Depending on the river basin (Stillaguamish, Skykomish, Snoqualmie Rivers and several other tributaries), the steelhead recreational fishery is open from June 1, to January 31 or February 15 (terminal fishery at the mouth of Tokul Creek), with two hatchery-origin steelhead over 20 inches allowed (WDFW Sport Fishing Rules 2013/2014).

Table 3.3.1.1: Snohomish River Basin hatchery winter steelhead recreational harvest 2001-2012a.

Return Year	Total Released[b]	Sport Harvest[c]	Tribal Harvest[d]	Hatchery Escapement	SAR %
2000/2001	317,091	4,360	34	483	1.54%
2001/2002	506,343	8,642	416	1,148	2.02%
2002/2003	377,345	2,420	0	458	0.76%
2003/2004	408,242	6,845	44	1,362	2.02%
2004/2005	446,708	7,993	265	842	2.04%
2005/2006	419,292	3,943	126	1,116	1.24%
2006/2007	429,560	4,315	10	846	1.20%
2007/2008	442,113	3,944	33	581	1.03%
2008/2009	456,410	1,929	41	588	0.56%
2009/2010	439,326	2,168	31	507	0.62%
2010/2011	380,254	2,659	46	899	0.95%
2011/2012	408,958	4,564	NA	1,515	1.49%
Average	**419,304**	**4,482**	**95**	**862**	**1.29%**

Source: WDFW Catch Record Card (CRC) Database 2013, WDFW Hatcheries Headquarters Database 2013.

[a] Assumes three year old adults and cannot determine repeat spawners.

[b] Release numbers include all winter steelhead releases within the Snohomish watershed. Smolts release two years earlier in the spring.

[c] Sport Harvest based on WDFW Catch Record Card (CRC) data for the Snohomish system (brood years 1999-2009). 2- or 3-salt returns cannot be broken out. Does not include marine catch.

[d] Tribal Harvest is based off of hatchery fish caught in the tribal fishery (WDFW et al. 2011).

Table 3.3.1.2: Snohomish River Basin hatchery winter steelhead harvest 2001-2012.

Year	Pilchuck River	Skykomish/ Snohomish River[a]	NF Skykomish River	SF Skykomish River	Snoqualmie River[b]	Tolt River	Tokul Creek
2000/01	9	2,678	80	35	1,269	60	126
2001/02	310	5,119	145	98	2,175	145	650
2002/03	70	1,495	44	21	627	23	140
2003/04	123	3,517	63	10	2,177	75	880
2004/05	318	4,306	90	22	2,235	86	936
2005/06	101	2,343	22	34	897	24	522
2006/07	84	2,648	78	29	810	34	632
2007/08	106	2,580	42	10	1,003	24	179
2008/09	40	1,043	26	20	583	16	201
2009/10	46	1,199	17	6	674	11	215
2010/11	68	1,679	26	9	571	7	299
2011/12	15	2,706	34	3	1,299	3	504
Average	**116**	**2,609**	**56**	**25**	**1,193**	**42**	**440**

Source: WDFW CRC Database 2013.

[a] Includes catches from Sultan and Wallace rivers, and Woods and Purdy Creek.

[b] Includes catches from Raging River.

Incidental impact on non-targeted natural-origin steelhead*:* Implementation of selective-fishing rules which requires the release of all natural-origin, unmarked steelhead in Puget Sound began in the 1990s. This has reduced natural-origin steelhead harvest statewide to approximately 1% of the catch (Scott and Gill 2008). Cool water temperatures at this time minimize mortality on listed steelhead. Non-targeted natural-origin steelhead may be hooked and released with an unknown impact for most streams and direct studies have not been done in this system. Nelson et al. (2005) showed catch and release mortalities of 1.4% to 5.8% in 1999 and 2000 respectively on steelhead caught in recreational fisheries on the Chilliwack River in British Columbia. A hook and line mortality study conducted in the Samish River on winter-run steelhead also showed similar results, although it indicated that there may be a negative relationship between a fish being caught in a sport fishery and their survival to out-migration as kelts (Ashbrook et al. in press). Taylor and Barnhart (1999) determined that summer steelhead caught and released in the Mad and Trinity Rivers of California had a 9.5% mortality rate, with 83% of the mortalities occurring at water temperatures of 21°C or greater. As the Snohomish Basin sport harvest season ends by February, except near the hatcheries where it ends by mid-February, most of the incidental catch and release may be prior to much of the natural-origin winter run being present.

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 steelhead populations. Habitat protection and restoration strategies are paramount to the recovery of self-sustaining, natural populations. If land use practices have been optimized to allow sufficient habitat protection and restoration, and harvest goals are being met, the hatchery program will be the remaining focus to meet management criteria for population status, genetic brood stock management, ecological benefits and risks, and environment regulations. With habitat and harvest goals being met, the conservation objective will be the primary requirement. The alternative would be evaluated relative to policy goals for the watershed.

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

Lead Entities: The Lead Entity for the Snohomish watershed (Snohomish County) WRIA 7 (see also http://www.rco.wa.gov/salmon_recovery/lead_entities.shtml).

Regional Fisheries Enhancement Groups (*RFEGs*): Several citizen based groups in conjunction with local governments work on habitat actions to benefit both listed and non-listed stock in the system including the Stilly-Snohomish Fisheries Enhancement Task Force and Mid-Sound Fisheries Enhancement Group.

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

State of Our Watersheds: Individual member Tribes have worked with the NWIFC and SSHIAP to create the State of Our Watersheds report. This document examines key indicators of habitat quality and quantity across more than 20 watersheds in western Washington that lie within tribal Usual and Accustomed fishing areas as defined by *U.S. v Washington* (Boldt decision). The Snohomish River habitat section can be found under the Tulalip chapter at http://maps.nwifc.org:8080/sow2012/.

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, WDFW, the Tulalip Tribe, 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.

See HGMP section 11 for new research on impacts.

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

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

Rearing and migrating juveniles and adults originating from the program may also serve as prey for large, mammalian predators in nearshore marine areas, the estuary and in freshwater areas downstream of the hatcheries 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
- Puget Sound 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 salmonids produced by the Snohomish/Skykomish River steelhead program. Juvenile fish of these listed species may serve as prey for newly released hatchery salmon in areas where the species co-occur and if the listed juvenile fish are of a small size, and vulnerable to predation by yearling life stage steelhead. 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/Skykomish Rivers through natural and hatchery production. Juvenile fish of these species may serve as prey items for hatchery-origin steelhead during their downstream migration in freshwater and into the marine area. Decaying carcasses of spawned adult fish may contribute nutrients that increase productivity in the watershed, providing food resources for emigrating salmon. Salmonid adults that return to the Snohomish Basin and any seeding efforts using adult salmon carcasses may provide a source of nutrients and stimulate stream productivity. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003).

(4) *Salmonid and non-salmonid fishes or other species that could be positively impacted by the program.* The steelhead program could positively impact freshwater and marine fish species that prey on juvenile fish. Nutrients provided by decaying steelhead carcasses may also benefit fish in freshwater. These species include:

- Northern pikeminnow
- Cutthroat trout
- Chinook salmon
- Steelhead
- Bull trout
- Coho salmon
- Pacific staghorn sculpin
- Numerous marine pelagic fish species

4 SECTION 4. WATER SOURCE

4.1 Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Table 4.1.1: Water sources available at Wallace River Hatchery and Reiter Ponds

Facility	Water Source	Water Right		Available Water Flow	Water Temp. (Fº)	Usage	Limitations
		Record/Cert. No.	Permit No.				
Wallace River Hatchery	Wallace River (surface)	S1-00108C WRIS	-----	16 cfs	34-66	Broodstock collection, incubation, rearing, acclimation	No limitations
		S1-00109C WRIS	-----	24 cfs			
	May Creek (surface)	S1-*05617C WRIS/ 01899	03525	10 cfs	34-66	Broodstock collection, incubation, rearing	
		S1-23172C WRIS	-----	4 cfs			
Reiter Ponds	Austin Creek (spring fed)	S1-00667C WRIS	16574	10 cfs	35-65	Broodstock collection, rearing, and acclimation	Low flow, flooding
	Hogarty Creek (spring fed)	S1-00313C WRIS	-----	10 cfs	35-65	Broodstock collection, rearing, and acclimation	Low flow, flooding

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

Wallace River Hatchery: 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. They are small streams that are subject to rapid changes in flow, especially during the winter flood months. 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.

Water rights for fish propagation at Wallace River Hatchery are authorized and regulated through the Washington Department of Ecology (WDOE) (**Table 4.1.1**). Surface water rights were obtained by the Washington Game Department in 1970 and 1971 for Wallace River, and in 1941 and 1978 for May Creek.

Reiter Ponds. The primary source of rearing water at Reiter Ponds is a spring- and runoff-fed Austin Creek. Hogarty Creek, also spring- and runoff-fed, is a secondary water source used as a supplement to Austin Creek. Hogarty Creek can serve as a primary source during emergency situations. Water temperatures are similar in both creeks, and typically ranges from 35 to 65°F. Flows fluctuate depending on weather conditions and time of year: Austin Creek ranges from 3,000 to 135,000 gpm, and Hogarty Creek ranges from 600 to 45,000 gpm. During high water periods, gravel and rocks can clog the Austin Creek intake which needs to be cleaned regularly to function properly.

Water rights for fish propagation at Reiter Ponds are authorized and regulated through the Washington Department of Ecology (WDOE) (**Table 4.1.1**). Surface water rights for both creeks were obtained by Washington Game Department in 1970. An additional water right (#R1-20415AWC) to hold 70 acre-feet of water (reservoir) for fish propagation from Hogarty and Austin creeks was formalized in 1972.

NPDES permits:

These facilities operate 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) (**Table 4.1.2**). 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 4.1.2. Record of NPDES permit compliance at Wallace River Hatchery and Reiter Ponds

Facility/ Permit #	Reports Submitted Y/N			Last Inspection Date	Violations Last 5 yrs) (see Table 4.1.5)	Corrective Actions Y/N	Meets Compliance Y/N
	Monthly	Qtrly	Annual				
Wallace R WAG13-3006	Y	Y	Y	8/3/2005	1	N	Y
Reiter Pond WAG13-3005	Y	Y	Y	8/03/2005	0	N	Y

Source: Ann West, WDFW Hatcheries Headquarters Database 2014.

Table 4.1.3: List of NPDES violations at Wallace River Hatchery over the last five years (2009-2013).

Month/ Year	Parameter	Sample Type	Result/ Violation	Permit Limit	Comment	Action
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.	New pond being built in approximately

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

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

Wallace River Hatchery: The facility has two water intake structures -- one on May Creek and one on the Wallace River. Both structures are in compliance with state and federal guidelines (NMFS 1995, 1996), but do not meet the current *Anadromous Salmonid Passage Facility Design* criteria (NMFS 2011a). Chinook are not passed above the May Creek weir; however, they are passed above the Wallace River Hatchery water intake. Hatchery intake screens are in compliance with federal screening criteria (NMFS 1995, 1996), and are designed to minimize the risk of juvenile fish injury and mortality through entrainment. Funding for design and permitting for the retrofit of the existing intake that will allow intake screens to comply with NMFS *Anadromous Salmonid Passage Design* Criteria (NMFS 2011) at the Wallace River Hatchery has been secured. Wallace River Hatchery compliance improvements have been identified as a high priority in the 2016-2017 WDFW capital budget request. Completion of this project will be contingent on securing the necessary capital funding and permits.

Per Hatchery Scientific Review Group (HSRG) recommendations, steps have been undertaken to improve the pollution abatement system. Funding was approved in 2012 to construct the new two-bay pollution abatement pond; the project is currently in the conceptual design phase.

Reiter Ponds. The two water intakes that supply water to the Reiter Ponds facility are in compliance with state and federal guidelines (NMFS 1995, 1996), but do not meet current

Anadromous Salmonid Passage Facility Design criteria (NMFS 2011a). There is an impassable barrier close to the mouth of Austin Creek. Due to its small size and limited flows, Hogarty Creek is not likely utilized by ESA-listed species, so the intake structures should not pose any danger to listed fish.

5 SECTION 5. FACILITIES

5.1 Broodstock collection facilities (or methods).

Wallace River Hatchery. May Creek. An in-stream trap, which measures 70-ft at its widest point and 110-ft in length, is located at the mouth of May Creek (tributary to the Wallace River). Early-winter steelhead broodstock is recruited from adults returning to the trap or reconditioned kelts. 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, and is operated from June through March 15, or later as conditions allow.

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.

Reiter Ponds. Winter steelhead collected at Reiter Ponds are volunteers returning to the Skykomish River hatchery trap or reconditioned kelts. They enter concrete adult holding pond through a ladder, which is open from mid-May through March 15 or later as conditions allow (see Reiter Ponds Summer Steelhead HGMP).

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

Fish can be transported in 1,000 and 1,700-gallon (Wallace to Reiter) tanker trucks equipped with aerators and oxygen tanks.

5.3 Broodstock holding and spawning facilities.

Broodstock for this program will be held at Wallace River Hatchery. Steelhead returning to the Wallace River Hatchery will be held in the adult pond. Broodstock collected at the Reiter Ponds will be transported to the Wallace River Hatchery as often as necessary and held in circular ponds. The ponds are supplied with Wallace River water. A wall and a roof covered area located at the end of the adult ponds is used to conduct spawning.

5.4 Incubation facilities.

Wallace River Hatchery: 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.

Reiter Ponds:

Table 5.4.1: Incubation vessels available at Reiter Ponds.

Type	Number	Size
Shallow troughs	4	16' x 1' x 0.5'
Iso-buckets	80	3-gallon

5.5 Rearing facilities.

Table 5.5.1: Rearing ponds available at Wallace River Hatchery.

Type	Number	Dimensions
Circular Ponds	4	16' x 4.5'
Adult Ponds	3	15' x 100' x 5'
Raceways	6	10' x 100' x 36"
Standard ponds	4	20' x 80' x 20"
Klubes pond	1	8' x 27' x 28"
“Green Monster”	1	3' x 14' x 24"
Rearing Channels[a]	3	28' x 1,000' x 37"

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

Table 5.5.2: Designation and dimensions of the sectioned-off portions of the raceways available at Wallace River Hatchery.

Designation	Dimensions
1A	22.75' x 704' x 32"
1B	24.5' x 282' x 43"
2A	22' x 167' x 27"
2B	23' x 523' x 32"
2C	26' x 323' x 43"
3A	24' x 307' x 3"
3B	25' x 485' x 40"
3C	27' x 208' x 46"

Wallace River Hatchery: Winter steelhead reared in two 100-ft x 10-ft x 3-ft raceways supplied with mix of Wallace River/May Creek water. In January, the yearling steelhead (10 fpp) are moved to adult ponds supplied with Wallace River water, where they remain until release in May.

Table 5.5.3: Rearing ponds available at Reiter Ponds.

Type	Number	Dimensions
Adult Pond	1	120' x 8' x 10'
Dirt bottom pond	2	1,400' x 90' x 8'
Circular pond	3	2' x 6' diameter

Reiter Ponds. Early-rearing takes place at Wallace River Hatchery. Steelhead parr (25 fpp) are transferred to Reiter Ponds in September/October. The fish are reared in a 1,400' x 90' x 8' dirt bottom pond, supplied with mix of surface water from Austin and Hogarty creeks, where they remain until release in May.

5.6 Acclimation/release facilities.

Wallace River Hatchery: Fish are reared and acclimated on May Creek and/or Wallace River water.

Reiter Ponds: Fish are reared and acclimated on mix of Austin/Hogarty creeks surface water, and are released from the dirt bottom pond directly into Skykomish River.

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.

Listed fish are not targeted or collected for hatchery broodstock at this facility. Trapping methods do not pose lethal risks to the fish and if trapped natural-origin fish will be returned unharmed to the river. Unmarked steelhead have not been trapped at this facility in recent years.

A hatchery employee is on stand-by at the facility at all times to monitor hatchery operations and respond to any unexpected events. The hatchery 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* (WDFW and WWTIT 1998, updated 2006). Adherence to artificial propagation, sanitation and disease control practices defined in the policy should reduce the risk of fish disease pathogen transfers.

6 SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

6.1 Source.

Adult hatchery (distinguished by an adipose fin-clip) winter steelhead returning to Wallace River Hatchery and/or Reiter Ponds, before January 31, are the source of broodstock for Snohomish/Skykomish River program. This is an early winter stock that is not ESA-listed.
In the event of an egg-take shortfall at Wallace River Hatchery and Reiter Ponds, eggs collected at Tokul Creek Hatchery may be utilized for Snohomish/Skykomish River program, however the intention is to keep Snohomish/Skykomish and Snoqualmie programs as separate as possible.

6.2 Supporting information.

6.2.1 History.

Initially, Department of Game (WDG) winter-run steelhead releases were made in the Snohomish River system in the early-1930s (WDFW Historical Database Records pre 1960-2006). The Snohomish basin programs started adult collection in the early-1960s. From the late-1970s to the late-1990s, hatchery stock has been propagated from adults returning to Tokul Creek Hatchery and (if needed) from Whitehorse Ponds (Stillaguamish River). Prior to the merger of the WDG and the Department of Fisheries (WDF) in 1994, eggs collected at Tokul Creek were incubated to the eyed stage on-site. They were then transferred to Lakewood Hatchery (then known as South Tacoma Hatchery), which served as the state bank for the early-winter stock. Further incubation, rearing and mass-marking took place at Lakewood Hatchery, before program fish were transferred back to Tokul Creek for final rearing and release. After the merger, the entire culturing process was moved to Tokul Creek Hatchery.

The Snohomish Basin hatchery winter steelhead programs utilize fish derived from the early-winter stock, which was established in 1945 from a winter run steelhead population collected at South Tacoma Hatchery (now Lakewood Hatchery -WRIA 12) (Scott and Gill 2008). Warmer water available at this location was used to accelerate spawning time and encourage growing smolts as a one-year age product rather than two-years, (Crawford 1979). Hatchery stock used at Reiter Ponds and Wallace River Hatchery has been maintained from adult returns to Tokul hatchery since the late-1970s.

The current goal is to manage the Skykomish (Wallace and Reiter) and Snoqualmie (Tokul) programs separately, by trapping adults or reconditioning kelts, incubating, rearing and releasing juveniles within each of the programs to promote higher imprint rates, reduce straying, and continue to encourage local adaptation. Starting with brood year 2015, broodstock for the Snohommish/Skykomihs River programs will be maintained primarily with adults returning to the Wallace River Hatchery and Reiter Ponds.

Snohomish Basin programs have been significantly changed in the past 10 years (see HGMP section 10.11).

6.2.2 <u>Annual size.</u>

Up to 300 adults may be collected to meet program broodstock goals. No natural-origin fish are included.

6.2.3 <u>Past and proposed level of natural fish in broodstock.</u>

Prior to the implementation of mass-marking of steelhead by WDG in 1981, any level of mixing natural fish in the broodstock in the past could not be identified (B. Crawford pers. comm. 2006). As most steelhead programs had volunteer collection sites on small tributary streams in the past, natural-origin spawners may not have had a strong incentive to enter those trapping sites.

This winter steelhead production is currently managed as segregated program. This means that hatchery broodstock is reproductively segregated from naturally-spawning populations, and is composed entirely of returning hatchery-origin adults identified by a missing adipose fin.

6.2.4 <u>Genetic or ecological differences.</u>

Early-winter hatchery steelhead stocks typically return from late-November through early-February, while their natural-origin counterparts return from November through June. Peak hatchery spawning occurs in January, while peak natural-origin spawning occurs mid-April to May. Hatchery steelhead are released as age 1+ smolts, whereas natural-origin steelhead are predominately age 2+ smolts. Out-migration timing for both life history types is similar but is slightly earlier for hatchery component (Fuss et al. 1998).

Steelhead collected for Snohomish/Skykomish River program are of locally-adapted early-winter stock, and are segregated from the natural-origin population both spatially and temporally.

Recent genetic analysis has been performed and detailed results can be found in HGMP section 2.2.2, Warheit, 2014 unpublished report and addendum to this HGMP.

DNA collections and analysis will be conducted to update genetic makeup of endemic and non-local steelhead stocks in Puget Sound (see HGMP section 2.2.2 for current results).

See also "*Genetic Introgression*" in HGMP section 2.2.3.

6.2.5 <u>Reasons for choosing.</u>

The early-winter steelhead stock was selected for its early arrival and spawn timing (as compared to natural-origin steelhead), availability, and the ability to release one-year smolts (Crawford 1979). This stock has been used statewide to provide fish for recreational and/or tribal harvest with minimal overlap in time and space with natural-origin steelhead.

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.

Fish collected for this hatchery program are from the early-winter hatchery stock. Priority is given to keeping hatchery returns to Snoqualmie facility (Tokul Creek) and the Skykomish facilities (Wallace River and Reiter Ponds) within each respective river basin in an effort to promote local adaptation and reduce straying. No natural-origin fish are included in the broodstock. No eggs are collected after January 31 (change implemented with the 2008 broodstock collection). A target of 100% mass marking allows exclusion of natural-origin fish from the hatchery broodstock and selection for earlier-maturing fish deepens temporal separation, keeping the hatchery and naturally-spawning fish genetically different and increasing divergence of the populations.

This production is managed as a segregated program with the intent to separate hatchery- and natural-origin stocks and excludes utilization of natural-origin (adipose present) steelhead. The separation was achieved by producing fish that spawn earlier than natural-origin fish. Early-winter stock hatchery fish typically return from late-November through early-February, while their wild counterparts return from November through June. Peak hatchery spawning takes place in January, while the peak spawn timing for natural-origin winter steelhead is from late-April through early May (Hoffmann 2014). To further accentuate and minimize spawning overlap with known natural-origin winter steelhead present in the system, adipose clipped hatchery broodstock collection period was further limited to fish maturing before January 31, from the previously accepted date of February 28.

The proposed rules for listing Puget Sound steelhead (71FR15666; March 29, 2006) stated "Several BRT members noted that anecdotal historical accounts discuss significant early runs of wild steelhead, but expressed concern that these early wild spawners have apparently disappeared from several river systems." While we acknowledge that significant uncertainty exists in our understanding of the historical run and spawn timing of steelhead, we believed that it was important to evaluate the risk that the proposed early-winter hatchery programs could suppress re-expression of this potential component of the population. This could occur, for example, if the early-spawning natural-origin steelhead spawned with hatchery-origin steelhead, and if the resulting hybrids had a lower chance of survival than natural-origin by natural-origin crosses.

One important piece of information to evaluate this risk is the historical spawn timing of steelhead in Puget Sound rivers. The PSSTRT (2013) compiled historical records from a wide variety of sources to help define the historical populations of steelhead in the Puget Sound DPS. We have summarized this information in **Table 6.3.1**. The limited information available from these sources is consistent with our current observations for the spawn timing of Puget Sound natural-origin winter steelhead (Hoffmann 2014).

Table 6.3.1: Summary of historical information regarding the spawn timing of steelhead in the Puget Sound DPS.

River Basin	Timing	Comments/Sources
Baker	March 8 – May 9	Collection of adults in 1900 for Baker Lake Hatchery. May include summer-run. Ravenal (1900) cited in PSSTRT (2013).
Sauk	Early February through June 15	Collection of steelhead spawn in 1906. Riseland (1907) as cited in PSSTRT (2013).
Sultan	April 8 – June 4	Spawning at the Sultan River Hatchery in 1920s. Leach (1923) as cited in PSSTRT (2013).
Quilcene	February 27 – June 7	Spawning at the Quilcene National Fishery Hatchery in 1922. USBF (1923) as cited in PSSTRT (2013)
Hood Canal West Side Tributaries	March 24 – May 1	Spawning of ripe fish in 1926. Leach (1927) as cited in PSSTRT (2013).

The PSSTRT (2013) also reviewed records of steelhead spawning at Washington Department of Game hatchery facilities in the 1930s. The PSSTRT cautioned that the timing of egg collection "may not be fully representative of natural spawn timing"; however, little if any spawning occurred at the Nooksack, Samish, Skykomish, or Dungeness hatcheries prior to March 1. In some years, spawning did occur earlier at the Puyallup Hatchery (as early as early February in two of six years analyzed) and the Green Hatchery (as early as early-February), but there is no evidence that these early spawning fish comprised a significant component of the return, A third source of information is Snow Creek, a small lowland tributary to the Strait of Juan de Fuca. The Department has conducted extensive research on Snow Creek for more than 30 years. Fishing has been prohibited since 1977, and no releases of hatchery-origin steelhead have occurred that would affect the timing of spawners. The initial redds in this stream can be constructed as early as February or March. For example, the date of first redd construction was the week of March 1 in 1979, and February 4 in 1980. The average date of spawning in these years was March 28, and 95% of the spawning occurs after the end of February (Hoffmann 2014).

The PSSTRT (2013) concluded that "steelhead spawn earlier in small lowland streams where water temperatures are generally warmer than in larger rivers with higher elevation headwaters." Our analysis of historical information and current data support this conclusion and suggest that natural-origin steelhead spawn from early-March through mid-June in rivers originating in the Cascades or Olympics. As evident from Snow Creek, initial spawning in small lowland streams can be earlier: early-February to early-March.

This information, and the substantial modification of early-winter steelhead programs that have occurred since 2008, suggest that interbreeding of early-winter hatchery-origin and natural-origin steelhead is unlikely to suppress re-expression of a potential early-spawning component of a natural-origin steelhead population. In the larger rivers with higher elevation headwaters, the hatchery-origin early-winter steelhead spawn well before the natural-origin steelhead. In small lowland streams like Snow Creek, the potential for genetic interaction between hatchery-origin early-winter steelhead and natural-origin steelhead is greater, but remains small. Even in this case, Hoffmann (2014) estimated that only 7.4% of Snow Creek natural-origin steelhead would spawn during the same time period as early-winter steelhead from the Tokul Creek Hatchery. Even more importantly, the elimination of all off-station releases and the cessation of releasing steelhead in small streams (e.g., Samish River, Pilchuck Creek, Pilchuck River, Raging River, Tolt River, Sultan River, east side Hood Canal rivers) provided additional risk control measures.

7 SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2 Collection or sampling design.

Broodstock for the Snohomish/Skykomish River early steelhead program are collected from volunteers that are returning to the Wallace River Hatchery and/or Reiter Ponds traps (see section 5.1. for traps descriptions), or from reconditioned kelts. Broodstock is collected until January 31 to minimize potential time overlap with natural origin spawning fish; volunteers returning after this date are removed from the system. The run usually ends by mid-February, but traps remain open through the mid-April. Although it is possible that summer steelhead can enter the holding pond, summer run fish are not utilized for winter program broodstock and only winter origin fish are released through this program.

If the number of adults returning to Wallace River, and Reiter Ponds will not meet broodstock needs, eggs collected at Tokul Creek Hatchery may be transferred and used to meet spawning goals.

7.3 Identity.

All fish released through this hatchery program have been consistently 100% mass-marked (adipose fin-clipped) since the 1984 releases (brood year 1983).

7.4 Proposed number to be collected:

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

Up to 300 adults may be collected annually to meet program broodstock goal.

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

Until brood year 2014, Tokul Creek Hatchery provided the majority of eggs for releases from the Wallace River Hatchery and Reiter Ponds programs. See Tokul Winter Steelhead HGMP for broodstock levels prior to brood year 2015.

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

Fish collected in surplus of broodstock needs are removed from the system; no recycling occurs. Removed fish may be donated to Tulalip Tribes, approved charitable organizations, or used for nutrient enhancement if not suitable for human consumption.

Table 7.5.1: Disposition of hatchery stock adult winter steelhead returning to Wallace River Hatchery, 2009-2013.

Return Year	Transferred[a]	Trap/Holding Mortality	Surplus	Total
2008/2009	78	---	---	78
2009/2010	---	2	48	50
2010/2011	---	0	71	71
2011/2012	---	11	77	88
2012/2013	---	8	42	50
Average	---	**6**	**60**	**67**

[a] Adults shipped to Tokul Creek Hatchery for broodstock.

Table 7.5.2. Disposition of hatchery stock adult winter steelhead returning to Reiter Ponds, 2009-2013.

Return Year	Transferred[a]	Trap/Holding Mortality	Surplus	Total
2008/2009	31	5	92	128
2009/2010	40	12	40	92
2010/2011	----	44	52	96
2011/2012	----	20	557	577
2012/2013	----	9	573	582
Average	----	**18**	**263**	**295**

[a] Adults shipped to Tokul Creek Hatchery for broodstock.

7.6 Fish transportation and holding methods.

Adults for broodstock will be transferred to Wallace River hatcher from Reiter Ponds using a 1,000 gallon tanker truck, equipped with aerators and oxygen tanks, weekly or as needed during broodstock collection time (November, December and January). Transportation between facilities is approximately 15 minutes.

7.7 Describe fish health maintenance and sanitation procedures applied.

The program adheres to standard fish health protocols, as defined in the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).

7.8 Disposition of carcasses.

Food-grade quality carcasses may be distributed to approved charitable organizations and Tulalip Tribes for ceremonial and subsistence purposes. Nonfood-grade carcasses are used in local streams for nutrient enhancement if approved by the Fish Health Specialist.

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.

This program is managed as segregated with the intent to separate hatchery- and natural-origin stocks and as such listed steelhead are not targeted in the hatchery broodstock.

In the past, eggs for this program were collected through February. A policy introduced in 2008 eliminated egg-takes after January 31. Early-winter stock hatchery fish typically return from late-November through early-February, while their natural-origin counterparts return from November through June. Peak hatchery spawning takes place in January, while peak natural-origin spawning occurs in late-April. The revised collection period takes place earlier than much of the natural-origin winter steelhead escapement observed in the system, and may further accentuate and minimize overlap with current known natural-origin winter steelhead spawn timing. This collection timeframe also mostly, if not totally, avoids listed Chinook during the trapping season. Any natural-origin steelhead or bull trout encountered at these site are immediately returned back to the stream.

8 SECTION 8. MATING

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

Broodstock spawning for this program takes place at Wallace River Hatchery.

8.1 Selection method.

Spawners are chosen based on ripeness once a week until January 31. All fish are selected and spawned randomly on a given spawn date.

8.2 Males.

All males collected, including jacks, are considered for spawning and are selected randomly on spawn days.

Steelhead males are often live-spawned to ensure that enough males are available for mating. Live-spawned males are separated in the pond and reused only when necessary.

Steelhead jacks are rare at this facility. Few or no jacks are seen in most Puget Sound hatchery winter steelhead programs.

8.3 Fertilization.

Eggs from five females are collected into one bucket and milt form each male is collected separately. Eggs from one bucket are spread equally into five buckets, and each batch is fertilized separately with milt from one male and maximizes the effective size of the spawning population. After fertilization, eggs are placed in troughs and water-hardened for one hour in a 100 ppm iodophor solution.

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.

No listed steelhead are use as part of the mating scheme in the broodstock.

9 SECTION 9. INCUBATION AND REARING -

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

9.1 Incubation:

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

Prior to brood year 2015, all eggs for the Snohomish Basin programs were collected and incubated at Tokul Creek Hatchery. See Tokul Winter Steelhead HGMP for previous egg-to-ponding survival rates. Survival data for the Snohomish/Skykomish River program will be provided when they become available.

9.1.2 Cause for, and disposition of surplus egg takes.

Additional eggs are taken to buffer for elevated mortality that may occur due to Cold Water Disease (CWD). Losses occur shortly after fertilization and during rearing. The disease can be identified within few days of fertilization; infected eggs are destroyed and replaced with healthy eggs collected during the next spawning event.

9.1.3 Loading densities applied during incubation.

Fertilized eggs are placed in vertical incubators at the amount of approximately 10,000 per tray. Once they reach the eyed stage, the eggs are shocked, mortalities are removed and the eggs are reloaded at the amount of approximately 9,000-10,000 per tray.

9.1.4 Incubation conditions.

All eggs are incubated in trays supplied with May Creek water at the rate 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.

Fish are ponded into raceways when approximately 95% buttoned-up.

9.1.6 Fish health maintenance and monitoring.

All fertilized eggs are water-hardened in an iodophor solution. Fungus in troughs is controlled by a formalin drip (15-minutes every other day drip, at a target dose of 1,667-ppm) throughout incubation, until just prior to hatching. Once eyed, the eggs are shocked and mortalities are removed. Fry loss is picked daily.

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

Listed fish are not incubated for this program.

9.2 Rearing:

9.2.1 <u>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.</u>

Table 9.2.1.1: Fry-to-sub-yearling and sub-yearling-to-smolt survival of winter steelhead at Wallace River hatchery and Reiter Ponds 2002-2013.

Brood Year	Fry-to-Sub-yearling	Sub-yearling-to-Smolt	
	Wallace	Wallace	Reiter
2002	91.7	77.6	76.0
2003	93.2	79.6	73.7
2004	76.6	28.1	85.4
2005	97.3	89.8	82.1
2006	97.9	61.3	80.6
2007	91.2	85.0	76.3
2008	95.8	99.9	75.3
2009	83.1	49.4	86.2
2010	89.5	91.6	78.5
2011	95.0	90.0	77.0
2012	93.8	86.6	86.4
2013	90.5		81.2
Average	**91.4**	**76.3**	**80.2**

Source: WDFW Hatchery Records 2014.

9.2.2 <u>Density and loading criteria (goals and actual levels).</u>

Loading and density levels at WDFW hatcheries conform to standards and guidelines set forth in *Fish Hatchery Management* (Piper et al. 1982) and the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). Fish rearing densities are maintained at maximum less than 3 lbs of fish /gpm at release and under 0.35 lbs/ft^3.

9.2.3 <u>Fish rearing conditions.</u>

Wallace River Hatchery: Initial rearing takes place at Wallace River Hatchery, where fish are reared in raceways supplied with mix of Wallace River/May Creek water. Fish are mass marked (ad clipped), when approximately the size of 150-200fpp (July). In September/October, when approximately the size of 25fpp., 225,000 juveniles are transferred to Reiter Ponds for final rearing until release in May. In January, the yearling steelhead (10 fpp) remaining at the Wallace River Hatchery are moved to rearing channel supplied with Wallace River water, where they remain until release in May.

Reiter Ponds: Juveniles transferred from Wallace River Hatchery are reared in a dirt bottom pond, supplied with mix of surface water from Austin and Hogarty creeks, where they remain until release in May.

Table 9.2.3.1: Average surface water temperature (°F), by month, at Wallace River Hatchery and Reiter Ponds.

Month	Average Water Temperature (ºF)	
	May Creek (Wallace)	Austin Creek (Reiter)
January	42	38
February	44	38
March	45	41
April	46	45
May	48	48
June	51	51
July	57	55
August	59	60
September	55	65
October	52	51
November	45	48
December	43	41

Source: WDFW Hatchery Records 2012.

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

Table 9.2.4.1: Average size (fpp), by month, of winter steelhead yearlings reared at Wallace River Hatchery and Reiter Ponds.

Month	Average Size (fpp)	
	Wallace	Reiter
August	55	
September	28	
October	24	25
November	11	18
December	11	10
January	10	10
February	9	9
March	8	8
April	7	7
May	6	6

Source: WDFW Hatchery Records 2012.

Until 2014 (including) initial rearing took place at Tokul Creek Hatchery. See Tokul Creek steelhead HGMP for fish growth information before transfer.

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

See **Table 9.2.4.1** and Tokul Creek steelhead HGMP for growth information. No energy reserve data is 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).

Steelhead are fed a variety of diet formulations including starter, crumbles and pellets; feed brand may vary, depending on cost and vendor contacts.

Wallace River Hatchery: Feeding frequencies vary depending on the fish size and water temperature and usually begin at 8 feedings/7 days a week and end at 2-3 feedings/5 days a week. Feed rates vary from 1.25% to 2.75% B.W./day. The overall season feed conversion ratio has averaged approximately 0.9-1:1

Reiter Ponds: Steelhead at Reiter Ponds are fed pellets using on-demand feeders. The food brand used may vary, depending on cost and vendor contacts. Feed rates varies from 1.25% to 2.75% B.W./day. The overall season feed conversion ratio has averaged approximately 0.9-1:1

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

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

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

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

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

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

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

This program is managed as segregated. Listed steelhead are not included in the hatchery broodstock and are not reared in this program.

The goal is to manage the Skykomish and Snoqualmie programs separately, by trapping adults, incubating, rearing and releasing juveniles independently within their sub-basins to promote higher imprinting rates, reduce straying, and continue to encourage local adaptation.

Hatchery fish are reared to meet *Statewide Steelhead Rearing and Release Guidelines* (Tipping 2001) to achieve a size and condition factor at the time of releases that optimize post-release survival. Rearing fish to a yearling smolt stage is mandatory in order to foster out-migration and subsequent survival when the fish vacate the system. Fry or sub-yearlings will not be reared and released from this program in order to eliminate or minimize interactions with listed fish rearing in the system.

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

10 SECTION 10. RELEASE

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

10.1 Proposed fish release levels.

Table 10.1.1: Proposed release levels by age, number, size, release date and location.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Yearling	256,000	6.0	April/May	Skykomish River

Source: WDFW Future Brood Document 2013

Note: 5.0 fpp = 210 mm fork length (fl), 6.0 fpp = 198 mm fork length

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

Stream, river, or watercourse:	Wallace River (WRIA 07.0940)	Skykomish River (WRIA 07.0012)
Release point:	RM 4.0 (Wallace River Hatchery)	RM 46.0 (Reiter Ponds)
Major watershed:	Snohomish River	
Basin or Region:	Puget Sound	

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

Based on genetic sampling results (see HGMP section 2.2.2) , in 2014, release goals at Wallace River Hatchery and Reiter Ponds facilities were increased to 71,000 and 186,000, respectively.

Table 10.3.1: Actual numbers and sizes of winter steelhead released at Wallace River Hatchery.

Release Year	Smolt Release	Avg. Size (fpp)	CV	Date(s)
2002	20,000	8.0	8.81	5/3
2003	19,700	7.0	6.30	5/1
2004	18,500	7.5	7.07	5/3
2005	22,000	5.3	8.80	5/1-13
2006	22,000	6.7	8.16	5/1
2007	21,000	6.3	6.88	5/1
2008	21,705	7.2	7.52	5/1-3
2009	19,998	7.1	6.70	5/6
2010	18,000	6.2	6.72	5/1-3
2011	20,000	6.5	7.70	5/1-2
2012	17,500	6.5	6.46	5/1
2013	20,000	6.7	7.45	5.1
Average	**20,034**	**6.8**	**7.38**	

Source: WDFW Hatcheries Headquarters Database 2013 (2012-13 data preliminary).

Note: 5 fpp = 210 mm fork length (fl); 6 fpp = ~198 mm; 7 fpp = 188 mm fl.

Table 10.3.2: Actual numbers and size of on-station and off-station releases, Reiter Ponds winter steelhead program 2000-2013.

Release Year	On-Station	Off-Station[a]	Avg. size (fpp)	CV	Date(s)
2002	133,366	59,370	6.0	5.30	4/29-30, 5/14-24
2003	148,534	66,500	5.0	4.03	4/22-5/8
2004	173,500	62,644	7.3	7.34	5/1-18
2005	160,025	58,962	5.9	6.36	4/12-5/15
2006	184,324	55,274	5.8	5.28	5/1-15
2007	181,536	55,976	5.8	6.47	5/1-15
2008	150,740	50,328	6.2	6.34	5/13-15
2009	148,196	46,875	6.4	5.68	5/1-13
2010	153,900	Discontinued	5.4	5.79	4/27-5/4
2011	145,955		6.5	5.72	5/1-10
2012	142,500		6.4	NA	5/1-5/8
2013	147,308		5.6	6.10	5/1-10
Average	**155,824**	**56,991**	**6.0**	**5.86**	

Source: WDFW Hatcheries Headquarters Database 2013.
Note: 5 fpp = 210 mm fork length (fl); 6 fpp = 198 mm; 7 fpp = 188 mm fl.
[a] Includes releases into NF Skykomish, Sultan, Pilchuck, Tolt and Wallace rivers and Barr, Howard, and Index Creeks.

10.4 Actual dates of release and description of release protocols.

Volitional releases would occur no earlier than April 15 (under same criteria as stated in HGMP section 2.2.3 – *Residualism*). Fish that do not volitionally out-migrate will be placed into landlocked lakes.

Wallace River Hatchery: Currently at this facility the screens will be open for up to three weeks, or less if all the fish out-migrate, due to constraints on available high quality water and rearing space needed for the next year's on-station fry. See **Table 10.3.1** for actual release dates.

Reiter Ponds: Screens will be open for up to one month, or less if all the fish leave. See **Table 10.3.2** for actual release dates.

10.5 Fish transportation procedures, if applicable.

Wallace River Hatchery. Juvenile fish are not transported for the Wallace winter steelhead program.

Reiter Ponds. Parr (25 fpp) transferred from Wallace Hatchery to Reiter Ponds are transported in a 1700-gallon tanker truck equipped with aerators and oxygen tanks. Transport time is 10-15 minutes.

10.6 Acclimation procedures.

Wallace River Hatchery: Winter steelhead are reared on a mix of Wallace River/May Creek water from August through January, and on Wallace River water from January through release in May.

Reiter Ponds: Winter steelhead are reared on mix of surface water from Austin and Hogarty creeks from October through their release in May.

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

Table 10.7.1: Number released, by age and mark type, Reiter Ponds winter steelhead.

Brood Year	Yearlings	Mark Type
2014	256,000	AD-only

Source: Future Brood Document 2014

Hatchery steelhead are intended to be released 100% adipose fin-clipped (AD). Due to regeneration of a partially-clipped adipose fin or a missed fin-clip, some hatchery adults may return with an intact adipose fin. WDFW monitors the clip rate during the marking process, and partial or missed clips are recorded as a bad fin-clip.

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

The egg-take is carefully managed to minimize the likelihood of collecting surplus eggs or raising surplus fry. Annual fluctuations in survival may result in production levels above the release goal, and actual releases of up to 10% above the release goal is acceptable. If fish are available for release in excess of 10% of the acceptable level, regional staff and NOAA Fisheries will be informed and consulted for proper action to be taken.

Surplus fish above the release goal have been released into various King County lakes for use in non-anadromous programs (see Tokul Winter Steelhead HGMP), per the direction of WDFW Fish Management and Co-manager agreement. Surplus fish will be planted into lakes that are functionally isolated from anadromous accessible freshwater and in compliance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).

10.9 Fish health certification procedures applied pre-release.

Standard Fish Health Procedures performed at the facility:

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

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

In the case of a catastrophic event, such as water failure, conditions critical to the fish health would be monitored and if necessary to prevent loss, the fish may be released prematurely.

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

WDFW has taken following actions to minimize adverse genetic and ecological effects to listed species resulting from hatchery releases:

- Eliminated transfers of eggs and juveniles between watersheds.
- Eliminated egg-takes after January 31, to keep hatchery and natural populations temporally segregated.
- Eliminated off-station releases where no trapping facilities are available.
- Eliminated recycling fish back into the river for sport fishing opportunities.
- Eliminated fry and sub-yearling releases, and mandatory rearing; release only yearling smolts, which are in migratory condition. This promotes rapid out-migration and thus minimizes the time spent in the river, in order to minimize or eliminate interactions with natural-origin salmonids rearing in the system (*Statewide Steelhead Rearing and Release Guidelines*; Tipping 2001).
- Manage the Skykomish and Snoqualmie programs separately, by trapping adults, and incubating, rearing and releasing juveniles for facilities within each of the basins to promote higher imprinting rates, reduce straying, and continue to encourage local adaptation.
- Leave trapping facilities open during the entire return time for adults of the segregated stock.
- Promoted volitional releases to foster rapid seaward migration and limit residualism and freshwater interactions with listed Chinook and steelhead juveniles, bull trout and other naturally-produced salmonids.
- Mass-mark all releases for harvest selection and removal from the system.
- Release fish no earlier than April 15, to allow listed stocks to emigrate out of the system, and/or provide time for additional growth to minimize potential predation.
- Continue monitoring, research and reporting of hatchery smolt migration performance behavior, and interactions with natural-origin fish to assess and adjust, if necessary, hatchery production and release strategies to minimize effects on natural-origin fish.

Hatchery steelhead releases have been 100% mass-marked since the 1980s to enable identification during selective harvest, broodstock selection and, most recently, removal from the system.

WDFW continues monitoring, research and reporting of hatchery smolt migration performance behavior, and interactions with natural-origin fish to assess and adjust, if necessary, hatchery production and release strategies to minimize effects on natural-origin fish, (see HGMP section 11). WDFW is conducting research on the effects of volitional releases in Upper Columbia basin. This study is not yet fully completed, but preliminary results suggest faster fish migration, and lower rates of residualism when the fish are released volitionally (Snow et al. 2013).

With changes already being implemented, WDFW continues monitoring its hatchery programs and the affected watersheds to observe the effects on the populations at the hatcheries and natural spawning grounds.

See also HGMP section 2.2.3.

11 SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

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

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 co-managers conduct numerous ongoing monitoring programs, including catch, escapement, marking, tagging, fish health testing and an extensive post-release juvenile monitoring program.

The Tulalip Tribes have initiated extensive monitoring and biological sampling focused on juvenile salmonids operating smolt traps in the Skykomish and Snoqualmie Rivers annually since 2000 and 2001, respectively, have partnered with NOAA Fisheries in an extensive juvenile salmonid sampling effort in the Snohomish estuary since 2001, and have monitored nearshore marine areas, pocket estuaries and coastal streams in collaboration with NOAA Fisheries since 2004. Tulalip, WDFW, NOAA Fisheries, and the University of Washington are starting up additional juvenile fish and plankton monitoring programs in offshore marine areas from the Snohomish estuary beginning in 2014 and beyond.

The new offshore marine indicators monitoring will be coordinated with these other ongoing monitoring programs to track program fish to examine their post-release growth patterns during the key early marine entry period along with other co-occurring fish to determine presence/length of time that any overlap might occur by monitoring the origins, relative co-occurrences, abundances size, growth indices (scales, otoliths and size observed spatially and temporally), and tends in the quantity and quality of habitat used by both natural and hatchery salmonid production. We will intensively employ methodical collection of timing, abundance/size structure, and collect biological samples at multiple juvenile life stages using a common set of procedures for sample processing and data analysis.

These efforts will be coordinated with other efforts across Puget Sound and the Salish Sea that includes efforts of numerous other Tribes, NWIFC, USGS, DOE, DFO Canada, EPA, and King County, facilitated by Long Live the Kings under Salish Sea Marine Survival Project. Juvenile salmonid performance and the associated community of prey, competitors and predators will be intensely studies, including zooplankton and other potential lower trophic level, biotic and abiotic metrics (e.g., water quality parameters, physical, chemical and oceanographic indicators). The particular focus will be on stage-specific growth rate indicators at early marine entry and during the following critical months of early marine growth hypothesized to affect marine survival. The goal is to develop a more mechanistic understanding of the complex factors that affect juvenile salmonid marine survival in Puget Sound. This is critical information required for successful implementation of habitat, harvest, and hatchery actions integrated with the goals of the Puget Sound Chinook ESU-wide recovery strategy and regional recovery plans and this HGMP. Information on body size and condition (weight, length, condition factors) will be collected to study size-at-age as the fish move offshore.

Stomach contents will be collected to determine diet composition related to growth history indicators (growth rate increments on scales and otolith, otolith microchemistry and stable isotopes) along with energy and lipid content of diet. This will be done concurrently with studies of invertebrate densities and edible ichthyoplankton and zooplankton, chlorophyll, and other measures of potential lower trophic level and abiotic metrics. These same parties are starting up a long-term new zooplankton core pray field and ecosystem indicators program in 2014. A total of at least 12 zooplankton monitoring locations representative of salmon and steelhead distribution in the main geographical basins of Puget Sound will be samples biweekly beginning in 2014 under this study.

Additional research, monitoring and evaluation in the Snohomish watershed: Table 11.1.1.1 should be considered preliminary as this framework is still under development and subject to change.

Table 11.1.1.1: Snohomish Basin steelhead monitoring.

Project	Description
HGMP Monitoring	Co-manager activities include oversight and implementation of regional hatcheries, spawning ground surveys, weir operations, and . in-season management of broodstock collection activities Deliverables include: development of hatchery management plans that will contribute to HGMP updates; estimation of performance metrics for WDFW hatchery programs includes adult run timing, spawn timing, broodstock mortality (including handling and pathology), fecundity, egg mortality rate, sex ratios, and stage-specific juvenile survival and marking protocols).
Monitoring of Populations of Winter Steelhead	This project will continue to conduct spawning ground (redd) surveys in the Snohomish River and its tributaries that support populations of winter steelhead. *Snohomish / Skykomish DIP*: Streams surveyed include: sections of the Snohomish River mainstem and South Fork Skykomish River (WRIA 07.0012) from RM 16.0 to 51.5, RM and selected tributaries (Proctor, Elwell/Young's Creeks, East and West fork of Woods Creek, Olney, Lewis and Salmon creeks); the Wallace River (WRIA 07.0940) (RM 0.0 to 15.0); and the Sultan River (WRIA 07.0881) (RM 0.0 to 5.8 conducted by Snohomish PUD). *Pilchuck River DIP*: Streams surveyed include: the Pilchuck River mainstem (WRIA 07.0125) from RM 0.0 to 15.3 (counts from RM 0.0 to 7.5 are peak counts) and selected tributaries (Worthy, Dubuque and Little Pilchuck creeks). *Snoqualmie River DIP*: Streams surveyed include: sections of the Snoqualmie River mainstem (WRIA 07.0219) (RM 0.0 to 3.0, RM 20.5 to 24.9 and RM 32.9 to 38.6) and selected tributaries (Peoples, Cherry, Harris, Griffin, Patterson, Canyon, Skunk and Tokul creeks); the Tolt River (WRIA 07.0291) and tributaries; and the Raging River (WRIA 07.0384) including Deep Creek (WRIA 07.0396). Surveys will provide data regarding abundance, which is a key VSP parameter.
Monitoring Summer Steelhead Populations	This project will monitor the summer steelhead population in the North Fork Skykomish and Tolt Rivers, as well as numbers of summer steelhead passed above Sunset Falls on the South Fork of the Skykomish River. Counts of HOR fish surplused and NOR fish passed at Sunset Falls will be collected annually. *North Fork Skykomish DIP*: The study design for this project is to continue to conduct spawning ground (redd) surveys in the North Fork Skykomish River (WRIA 07.0302) when flow conditions allow. *Tolt River DIP*: The study design for this project is to continue to conduct spawning ground (redd) surveys in the South Fork Tolt River (WRIA 07.0302) from RM 3.3 to 7.8. Data can be used to track annual trends in abundance, which is a key VSP parameter.

Monitoring of Introgression from Hatchery Steelhead Populations to Natural-origin Steelhead Populations	The Co-managers are implementing a genetic monitoring program to measure introgression between segregated hatchery steelhead programs and natural-origin populations in the Puget Sound DPS (Warheit, 2014). See Appendix for additional details.

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

See HGMP section 11.1.1

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

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

12 SECTION 12. RESEARCH

12.1 Objective or purpose.

Research specific to Snohomish Watershed early-winter hatchery steelhead is not currently conducted.

12.2 Cooperating and funding agencies.

Not applicable.

12.3 Principle investigator or project supervisor and staff.

Not applicable.

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

Not applicable.

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

Not applicable.

12.6 Dates or time period in which research activity occurs.

Not applicable.

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

Not applicable.

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

Not applicable.

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

Not applicable.

12.10 Alternative methods to achieve project objectives.

Not applicable.

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

Not applicable.

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

Not applicable.

13 SECTION 13. ATTACHMENTS AND CITATIONS

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14 SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the 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:_____________

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

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

The WDFW and the USFWS have a Cooperative Agreement pursuant to section 6(c) of the Endangered Species Act that covers 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 indicate 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). Resident native char typically occupy 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 rivers as well as in the Upper North Fork Skykomish River and tributaries. The current status of the Snohomish/Skykomish bull trout 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 table of core area rankings for population abundance, distribution, trend, threat, and final rank.

Core Area Population	Abundance Category (individuals)	Distribution Range Rank (stream length miles)	Short-term Trend Rank	Threat Rank	Final Rank
Snohomish & Skykomish Rivers	1000-2500	620-3000	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 2012).

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
2012	83	55
Average	**223**	**78**

Source: WDFW SaSI 2013

Habitat-- Many of the key spawning and rearing habitats of local 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. As with most major river systems within the Puget Sound Management Unit, habitat complexity has been significantly reduced in the mainstem rivers 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 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-1990s have helped allow the population to increase in abundance from the low levels of the late-1980s. Recent returns strongly indicate that this population has likely rebounded near or to recovered levels of abundance. (USFWS 2004).

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

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

Marbled murrelet (*Brachyramphus marmoratus*) -Threatened
Canada Lynx (*Lynx canadensis*) –Threatened
Gray Wolf (*Canis lupus*) –Threatened
Grizzly bear (*Ursus arctos horribilis*) –Threatened
Northern Spotted owl (*Strix occidentalis caurina*) –Threatened
*G*olden Paintbrush (*Castilleja levisecta*) [historic]

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*)

15.3 Analyze effects.

Hatchery activities, including in-river broodstock collection, hatchery trap, 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. No encounters of bull trout have been reported at Tokul Creek Hatchery or Reiter Ponds (D. Hatfield, WDFW, pers. comm.

2012). Capture, handling, and release of bull trout will not pose a significant risk to the population or the individual fish. Information collected through the trapping operation may benefit scientific understanding of population status, migration behavior, and population structure of bull trout in the Puget Sound region.

15.4 Actions taken to minimize potential effects.

Trap is checked at least daily. Any bull trout encountered at the trap are immediately returned to the stream. Bull trout may be encountered in other hatchery programs during broodstock collection activities (Chinook or coho) that would directly impact or create potential effects on bull trout in this system based on the current understanding of the status of these fish.

15.5 References.

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"Take" Tables

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

Listed species affected: Steelhead *(Oncorhynchus mykiss)*	**ESU/Population:** Snohomish River/ Puget Sound Steelhead		**Activity:** Skykomish Basin Winter Steelhead Program	
Location of hatchery activity: Wallace River Hatchery: Wallace River (WRIA 07.0940) at RM 4 Reiter Ponds: Skykomish River (WRIA 07.0012) at RM 46	**Dates of activity:** December-June		**Hatchery program operator:** WDFW	
Type of Take	**Annual Take of Listed Fish By Life Stage** *(**Number of Fish**)*			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass a)	-	-	-	-
Collect for transport b)	-	-	-	-
Capture, handle, and release c)	-	-	0-30*	-
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-		-
Unintentional lethal take g)	-	-	0-3*	-
Other Take (specify) h)	-	-	-	-

*Natural-origin steelhead have not been seen in the hatchery traps for the last 12 years, but with the existing possibility of the encounter we estimate that up to 30 fish may be encountered in a single year in the future during broodstock collections with up to 3 unintentional mortality based on current facilities.

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

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

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

Listed species affected: Chinook *(Oncorhynchus tshawytscha)*	**ESU/Population:** Snohomish River/ Puget Sound Chinook	**Activity:** Skykomish Basin Winter Steelhead Program
Location of hatchery activity: Wallace River Hatchery: Wallace River (WRIA 07.0940) at RM 4 Reiter Ponds: Skykomish River (WRIA 07.0012) at RM 46	**Dates of activity:** December-June	**Hatchery program operator:** WDFW

Type of Take	**Annual Take of Listed Fish By Life Stage** (***Number of Fish***)			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass a)	-	-	-	-
Collect for transport b)	-	-	-	-
Capture, handle, and release c)	-	-	17	-
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	-	-
Unintentional lethal take g)	-	-	-	-
Other Take (specify) h)	-	-	-	-

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