HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Photo: Courtesy of hatchery staff

Hatchery Program:	Whitehorse Ponds (Stillaguamish River) Winter Steelhead Hatchery Program (Segregated)
Species or Hatchery Stock:	Winter Steelhead (*Oncorhynchus mykiss*) Early Winter Stock
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Stillaguamish/Puget Sound
Date Submitted:	July 28, 2014
Date Last Updated:	July 26, 2014

Executive Summary

ESA Permit Status:
On March 31, 2004, the Washington Department of Fish and Wildlife (WDFW) submitted a Hatchery Genetic Management Plan (HGMP) for the Whitehorse Ponds Hatchery early winter steelhead program 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." The WDFW provided updated HGMPs to NOAA Fisheries in August 2005.

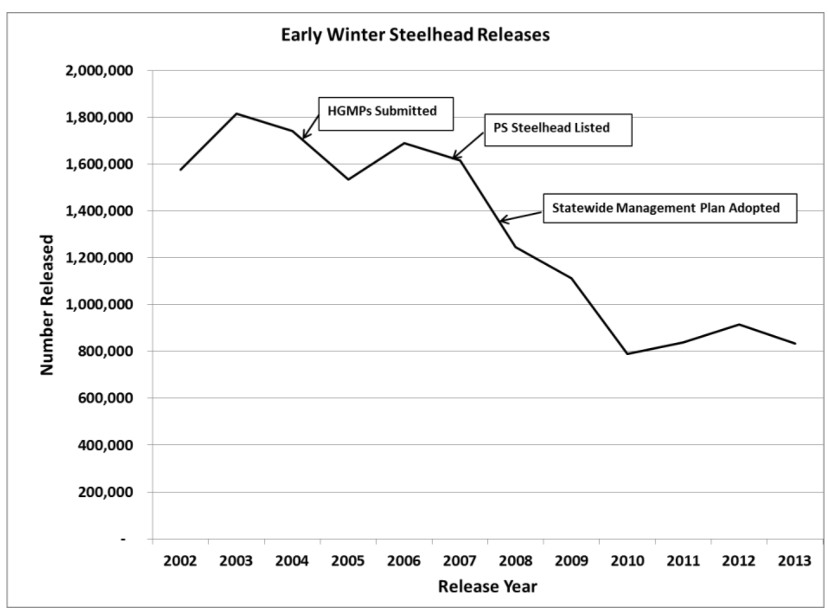
The co-managers are now re-submitting an HGMP for the Stillaguamish River basin hatchery early winter steelhead program to further update the description of the program and incorporate new information and analyses.

The Puget Sound steelhead Distinct Population Segment (DPS) is listed as "Threatened" under the ESA, however, Stillaguamish basin hatchery early winter steelhead are not included in the ESA-listing. The Puget Sound Technical Recovery Team has preliminarily delineated one Demographically Independent Populations of native winter steelhead (Stillaguamish River Winter) and two native summer populations (Deer Creek Summer and Canyon Creek Summer) in the Stillaguamish River 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 31st 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.

Stillaguamish Basin Hatchery Early Winter Steelhead Program:
The purpose of the program is to produce Stillaguamish basin early winter steelhead for sustainable recreational and tribal fisheries. Program fish will be produced at the Whitehorse Ponds Hatchery, located on Whitehorse Spring Creek, a tributary to the North Fork Stillaguamish River. The program will release 130,000 yearling smolts into the Stillaguamish basin annually.

The early winter hatchery program in the Stillaguamish 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% 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 the 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 to the Whitehorse Hatchery trap, 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:

- > 75% reduction in release locations relative to 2003-2004 (from four to one),
- 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 only collected from broodstock returning to Whitehorse Ponds Hatchery 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 12 consecutive years) and new monitoring efforts (e.g. Salish Sea Marine Survival Project with the co-managers and 15 other agencies and entities, SeaGrant 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 Stillaguamish 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 2013-14 season was open October 16 to January 31, within selected stream reaches and until February 15 within the hatchery terminal area, 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 Stillaguamish Tribe conduct annual spawning ground surveys in the North Fork Stillaguamish River mainstem and 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.

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Whitehorse Pond (Stillaguamish River) Winter Steelhead Program.

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

Stillaguamish River (Early Winter stock) winter steelhead (*Oncorhynchus mykiss*).

Not listed - Early winter hatchery stock is not considered part of the Puget Sound Distinct Population Segment (DPS) for Puget Sound Steelhead listed as *Threatened* under the ESA (National Marine Fisheries Service, May 11, 2007).

1.3) Responsible organization and individuals

Hatchery Operations Staff Lead Contact

Name (and title):	Edward Eleazer, Region 4-North Operations and Hatchery Reform Manager
Agency or Tribe:	Washington Department of Fish and Wildlife
Address:	16018 Mill Creek Boulevard, Mill Creek WA 98012
Telephone:	(425) 775-1311 ext. 109
Fax:	(425) 338-1066
Email:	Edward.Eleazer@dfw.wa.gov

Fish Management Staff Lead Contact

Name (and title):	Jennifer Whitney, District Fish Biologist
Agency or Tribe:	Washington Department of Fish and Wildlife
Address:	16018 Mill Creek Boulevard, Mill Creek WA 98012
Telephone:	425-775-1311 Ext 107
Fax:	425-338-1066
Email:	Jennifer.Whitney@dfw.wa.gov

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/Stillaguamish River system summer and winter steelhead released from hatchery programs. All rearing of hatchery fish occurs at WDFW facilities for this program. In the past, the Stillaguamish Tribe's Harvey Creek Hatchery – located 2 miles upstream from the mouth of Harvey/Armstrong Creek (05.0126), a tributary to the Stillaguamish River (05.0001) at RM 15.3 – provided some rearing support for this program; this was discontinued in 2007.

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

Funding Sources	**Operational Information (FY 2013)**
Wildlife Fund – State	FTEs = 2.12
	Annual operating cost (dollars) $195,626

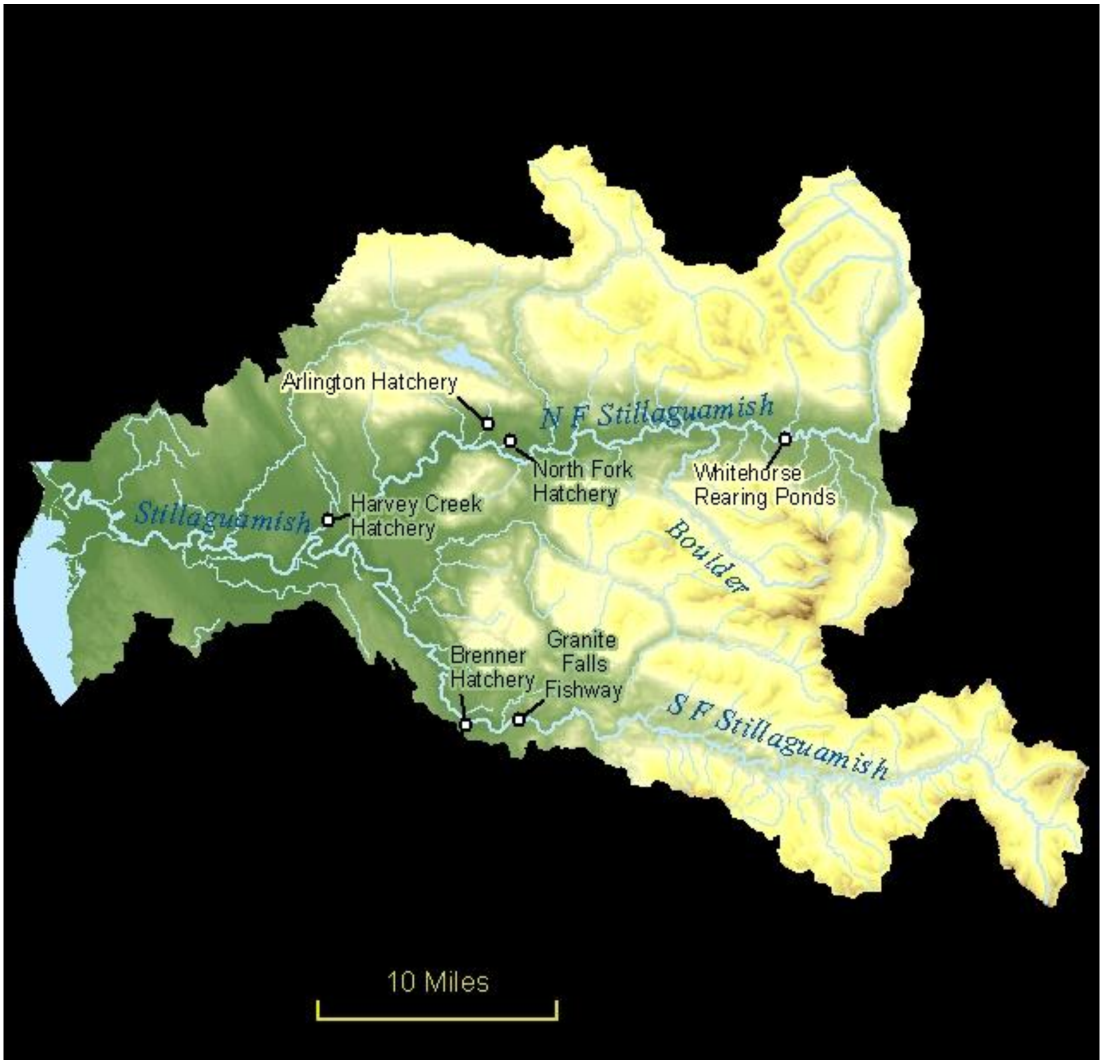
The annual operating cost applies to all species produced at this facility and cannot be broken out specifically by program. WDFW uses a figure of $3.50 to produce a pound of steelhead smolts (6.0 fish per lb.) applied to segregated steelhead programs in Puget Sound (pers. comm. J. Kerwin, 2007).

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

Broodstock Collection; Adult Holding; Spawning; Incubation; and Rearing Location:

Whitehorse Ponds: Located at RM 1.5 of Whitehorse Springs Creek (WRIA 05.0254A), tributary to the NF Stillaguamish River (WRIA 05.0135) at RM 28, Puget Sound, Washington.

Figure 1.5.1: Map of the Stillaguamish Basin hatchery 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 further sections of this HGMP (**Table 1.8.1**):

Table 1.8.1: Summary of risk aversion measures for the Whitehorse Rearing Pond winter steelhead program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Water for Whitehorse Pond is obtained from springs and a well that is formalized through water right permit #s S1-00825 and G1-28153P and routed back to the Stillaguamish River. No listed species are present in any of the water sources.
Intake Screening	4.2	No listed species of salmonids are present in any of the water sources used for this program.
Effluent Discharge	4.2	Effluent from the Whitehorse Pond is regulated through NPDES permit # WAG 13-3008.
Broodstock Management & Adult Passage	2.2.2, 2.2.3, 7.9	Winter steelhead voluntarily enter an off-channel pond in a time period (December through March) when summer Chinook, bull trout and listed steelhead are not typically present. Operational protocols are in place to return natural-origin fish back to stream as quickly as possible when and where the encounters inadvertently occur. In almost all years, no encounters have been observed.
Disease Transmission	9.2.7	The *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006), details hatchery practices and operations designed to stop the introduction and/or spread of any diseases.
Competition & Predation	2.2.3, 10.11	Fish are released 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 SeaGrant study, (see section 11.1.1).

1.9) List of program "Performance Standards".

See HGMP section 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,	Annually estimate survival and contribution to fisheries for each

	applicable to given mitigation requirements.	brood year released. This program provides mitigation for lost fish production due to development within the Stillaguamish 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 monitor and report 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 (forced, 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 standard scientific procedures to evaluate various aspects of artificial propagation.	Apply basic monitoring standards in the hatchery: food conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV).	Collect annual run timing, age and sex composition data upon adult return. Annually monitor and report growth rates, mark rate and size at release and release dates.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	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 provides contributions to local	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.

	charitable organizations. Recreational fishery angler days, length of season, number of licenses purchased.	

1.10.2) "Performance Indicators" addressing risks.

Table 1.10.2.1: "Performance Indicators" addressing risks.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP is updated to reflect any major changes in program and resubmitted to NOAA fisheries. Program risks have been addressed in this HGMP through best available science 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 is not significantly 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	All hatchery production is identifiable by adipose fin clip. Segregated program - only marked hatchery fish are used for broodstock purposes; fish are

	earlier hatchery fish from later natural-origin spawners to minimize potential spawning overlap.	spawned before Jan 31. Collect annual run timing, origin, and 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 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 numbers of adults returning to the hatchery, broodstock collected, and surplus returns.
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006), INAD, MDFWP).	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level of compliance with applicable standards and criteria.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed. The program is operated consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
3.7.2 Effluent from hatchery facility will not detrimentally affect natural populations.	Discharge water quality compared to applicable water quality standards by NPDES permit. WDOE water right permit compliance.	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 infectious fish 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 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). Report disposition of carcasses in the WDFW Hatcheries Headquarters Database
3.7.6 Adult broodstock collection	Spatial and temporal spawning	Trap is checked regularly. When

operation does not significantly alter spatial and temporal distribution of any naturally-produced population.	distribution of natural populations above and below weir/trap currently compared to historic distribution.	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- 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.	Hatchery smolt release size and time are monitored to quantify/minimize predation effects on naturally-produced Chinook (Sharpe et al. 2008, Pflug et al. 2013) (see also HGMP section 2.2.3). No predation data available for the watershed.
3.8.1 Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population.	Total cost of operation.	Compare annual operational cost of program to calculated fishery contribution value (Wegge 2009).

1.10) Expected size of program.

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

Up to 120 adults collected annually.

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

Table 1.11.2.1: Annual release levels.

Life Stage	Release Location	Annual Release Level
Yearling	Whitehorse Spring Creek (WRIA 05.0254A)	130,000

Source: Future Brood Document 2014

1.11) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels.

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 of 0.61% for brood years 1998-2009, and a program release goal of 130,000 yearlings, the estimated adult production (goal) level would be 793 (see HGMP section 3.3.1).

Table 1.12.1: Whitehorse Ponds hatchery winter steelhead escapement 2001-2012.

Year	Hatchery Escapement
2000/2001	91
2001/2002	410
2002/2003	65
2003/2004	188
2004/2005	300
2005/2006	373
2006/2007	140
2007/2008	133
2008/2009	67
2009/2010	164
2010/2011	166
2011/2012	227
2012/2013	172
Average	**192**

Source: WDFW Hatcheries Headquarters Database 2013.

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

The current program released from Whitehorse Ponds has been ongoing since 1964. Whitehorse Ponds was built in 1955. Earlier plants began in the 1950s and originated from Arlington Hatchery (built in 1939), or from Tokul Creek Hatchery (WRIA 7).

1.14) Expected duration of program.

Ongoing.

1.15) Watersheds targeted by program.

Stillaguamish River (WRIA 05.0135).

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 enhancement or harvest objectives for the program and would not meet the goals of either Co-Manager, including providing recreational, cultural and subsistence, ceremonial, religious, commercial and non-commercial benefits, nor be compatible with Treaty Indian fishing rights (*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, 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 fisheries measures and harvest impacts are not to exceed those implemented in the recent seasons. 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 impacts from recent years.

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

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

The Whitehorse winter steelhead HGMP was previously submitted to NOAA Fisheries in 2004. This HGMP is submitted to NOAA Fisheries for ESA consultation, and determination regarding compliance of the plan with ESA section 4(d) rule criteria for joint state/tribal hatchery resource management plans affecting listed 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) Description of NMFS ESA-listed salmonid population(s) affected by the program.

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

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 Stillaguamish basin, the Technical Recovery Team (TRT) has identified demographically independent populations (DIPs) in the North Fork Stillaguamish and South Fork Stillaguamish River (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.).This DPS is bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive) (Ford 2011). Also includes steelhead from six artificial propagation programs: Green River Natural; White River Winter Steelhead Supplementation; Hood Canal Steelhead Supplementation Off-station Projects in the Dewatto, Skokomish, and Duckabush Rivers; and the Lower Elwha Fish Hatchery Wild Steelhead Recovery (NMFS 2013 78FR38270. In the Stillaguamish Basin, the TRT has preliminarily delineated one DIP of winter steelhead (Stillaguamish River) and two DIPs of summer steelhead (Deer and Canyon creeks) (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

Whitehorse Ponds hatchery summer Chinook in the Puget Sound Chinook ESU. NMFS (1999) considered this stock to be part of the ESU and essential for recovery. The population was designated Category 1a. This broodstock was founded recently from the natural population inhabiting the basin in which it is released. There has been ongoing exchange between the hatchery and natural components since the time of founding (SSHAG 2003).

Stillaguamish Chinook in the Puget Sound Chinook ESU. Recent escapement levels (2001-2012) have averaged 1,043 for natural spawners in the North Fork Stillaguamish River DIP and 155 for the South Fork Stillaguamish River DIP. Both populations have shown slight declining population trends during this same period (SaSI, WDFW 2013).

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

Table 2.2.2.1: Stillaguamish Chinook MU, minimum viability spawning abundance and abundance at equilibrium or replacement, and spawning A/P at MSY for a recovered state as determined by EDT analyses of properly functioning conditions and expressed as a Beverton-Holt function. The TRT minimum viability abundance was the equilibrium abundance or 17,000, whichever was less.

Region and population	TRT minimum viability abundance	Under properly functioning conditions (PFC)			NMFS Escapement Thresholds	
		Equilibrium abundance	Spawners at MSY	Productivity at MSY	Critical[a]	Rebuilding[b]
NF Stillaguamish	17,000	18,000	4,000	3.4	300	552
SF Stillaguamish	15,000	15,000	3,600	3.3	200[c]	300
ESU	**261,300**	**307,500**	**70,948**	**3.2**	**3,875**	**2,785**

Source: Ford 2011; NMFS 2011b.

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

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

[c] Based on generic VSP guidance (McElhaney et al. 2000; NMFS 2000a).

Stillaguamish River winter-run steelhead in the Puget Sound steelhead DPS. The number of natural-origin winter steelhead has increased in the last five years. From a low point in 2008-2009 of 487 fish, the number of spawners for the Stillaguamish River winter population increased to 2,085 in 2012-2013. Ford (2011) used spawner data collected through 2008 and concluded the following: "Steelhead counts in the Stillaguamish River have declined steadily since the 1980s. The estimated probability that this steelhead population would decline to 10% of its current estimated abundance (i.e., to 37 fish) is high—about 90% within 60 years. With an estimated mean population growth rate of −0.071 ($\lambda = 0.931$) and process variance of 0.016, 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 30 years. However, a 50% decline is highly likely within 100 years. Beyond the next 30−40 years, NOAA was highly uncertain about the precise level of risk." Based on a preliminary intrinsic potential (IP) estimate by the PSSTRT (2013a), the capacity for winter steelhead in this system ranged from 1,912 to 38,236 adults (Table 2.2.2.2).

Deer Creek and Canyon Creek summer-run steelhead in the Puget Sound steelhead DPS. Very little data is available on the status of summer-run steelhead in Deer and Canyon Creeks. Based on low juvenile densities, the Deer Creek population was considered to be depressed in 2002, while the status of the Canyon Creek population is currently unknown (SaSI, WDFW 2013). Based on a preliminary IP by the PSSTRT (2013), the capacity for summer steelhead ranged from 157 to 3,144 adults in Deer Creek and from 12 to 243 in Canyon Creek.

*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.

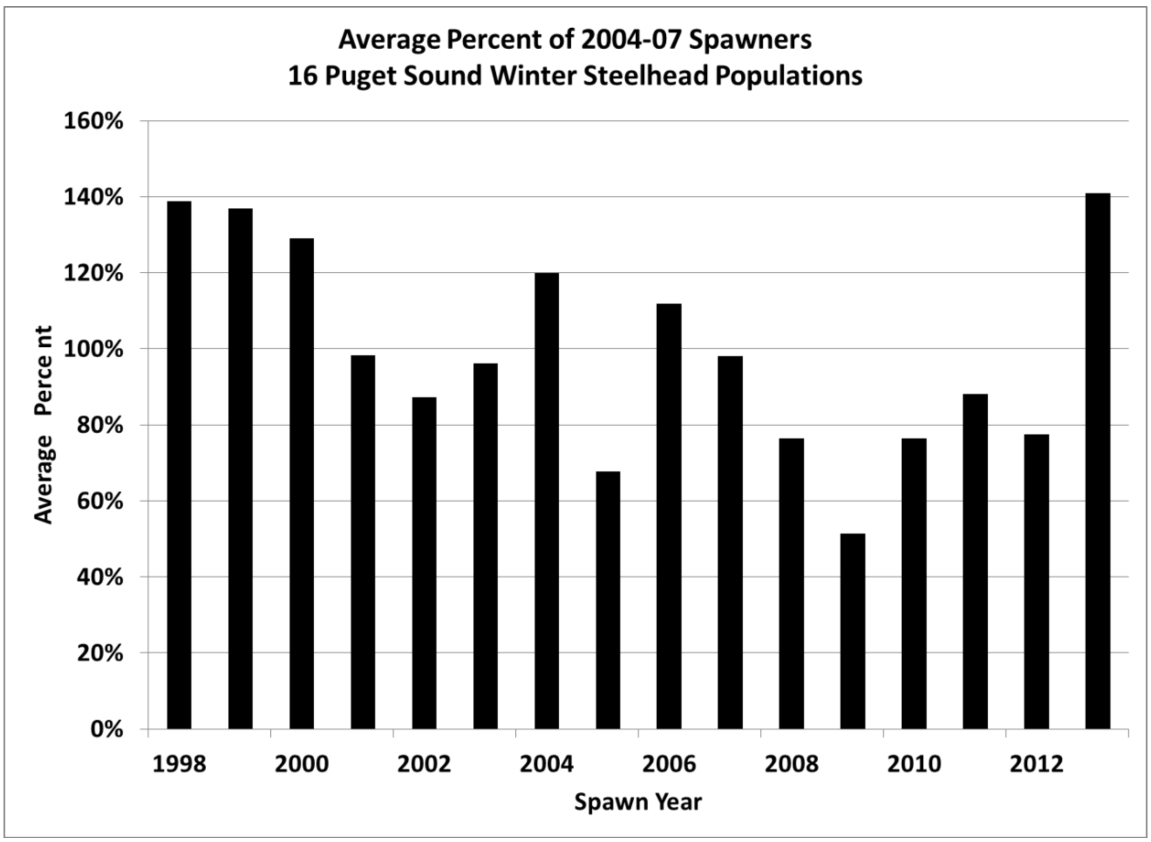


Figure 2.2.2.1. Average percent of 2004-2007 spawners for 16 Puget Sound winter steelhead populations.

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 2.2.2.2: 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
Stillaguamish R	1,230	398	927,234	67	1,912	9,559	38,236
Deer Creek	180	761	105,313	31	157	786	3,144
Canyon Creek	100	864	47,716	24	100 (12)	250 (60)	243
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.

Stillaguamish Chinook (*Oncorhynchus tshawytscha*): Smolt monitoring activity occurs in this system. Most downstream migrants caught are sub-yearlings, although some yearlings are caught each year. Between 2005 and 2011 freshwater production has averaged of 211,151 migrants per year (2006 data is inaccurate and was not used in the average).

Table 2.2.2.3: Stillaguamish River smolt trap catches and total out-migrant estimate.

Year	Natural origin Chinook[a]	Hatchery Chinook[a]	Egg to Migrant Survival (Natural origin Chinook)	Natural origin Steelhead[b]	Hatchery Steelhead[b]
2011	617 (27,013)	2,696 (113,496)	1.5%	416	427
2010	2,498 (305,784)	2,500 (233,258)	14.5%	395	321
2009	1,524 (92,871)	2,027 (108,645)	3.2%	436	836
2008	643 (186,115)	926 (277,019)	13.9%	248	268
2007	1,194 (319,692)	713 (122,755)	11.1%	247	30
2006[e]	3,500 (1,031,922)[e]	3,180 (765,714)[e]	9.7%	378	370
2005	2,504 (335,429)	602 (75,980)	10.7%	NA[d]	NA[d]

Source: Stillaguamish Tribe 2006-2012 (Griffith et al. 2006-2012)

[a] The number caught in the trap plus the estimated total number of migrants to pass the trap location

[b] Steelhead numbers are total season catches on the Stillaguamish Tribe's Smolt Trap. No production estimate for Steelhead was made, nor can it be assumed that efficiencies for hatchery and natural origin smolts are the same.

[c] [d] Prior to 2006, Trapping operations did not separate natural origin and hatchery steelhead.

[e] Equation underestimated trap efficiency and over estimated production (only 208,737 Chinook smolts were released from Whitehorse Ponds)

Table 2.2.2.4: Puget Sound Chinook population average productivity for five-year intervals measured as recruits per spawner (R/S) and spawners per spawner (S/S). Trend over the intervals is also given.

Brood Years	1982-1986		1987-1991		1992-1996		1997-2001		2002-2006		Trend	
Populations	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**
North Fork Stillaguamish	*14.68*	*1.67*	*2.98*	*0.78*	*1.88*	*1.01*	*1.51*	*0.67*	*0.9*	*0.51*	*-2.9*	*-0.24*
South Fork Stillaguamish	*20.44*	*2.48*	*4.16*	*1.26*	*1.7*	*0.96*	*1.46*	*0.81*	*1.2*	*0.7*	*-4.12*	*-0.4*
ESU	***9.57***	***2.19***	***5.05***	***0.96***	***3.01***	***1.24***	***2.70***	***1.19***	***1.67***	***0.67***	***-1.81***	***-0.28***

Source: This is copied from analyses reported by Ford (2011). These analyses incorporate assumptions for years where escapements were not sampled for hatchery: natural-origin ratios that are not necessarily agreed to by WDFW and the Tribes. Trend over the intervals is also given.

Table 2.2.2.5: Short and long term population trend and growth rate estimates for the Puget Sound Chinook ESU populations.

Regions and Populations	Years	Trend Natural Spawners w/Cl	Hatchery Fish Success = 0 Lambda w/Cl	p>1	Hatchery Fish Success = 1 Lambda w/Cl	p>1
North Fork Stillaguamish River Fall Run	1995-2009	0.987 (0.928 - 1.05)	0.996 (0.59 - 1.681)	0.47	0.886 (0.596 - 1.317)	0.08
	1974-2009	0.985 (0.971 - 1.0)	0.976 (0.898 - 1.062)	0.26	0.922 (0.852 - 0.998)	0.02
South Fork Stillaguamish River Fall Run	1995-2009	0.915 (0.85 - 0.986)	0.958 (0.542 - 1.692)	0.26	0.958 (0.542 - 1.692)	0.26
	1974-2009	0.991 (0.972 - 1.009)	0.983 (0.889 - 1.086)	0.34	0.983 (0.889 - 1.086)	0.34

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

Stillaguamish System steelhead (*Oncorhynchus mykiss*): Current Co-manager smolt monitoring for Chinook, Coho or Chum productivity incidentally captures some natural origin steelhead smolts, but due to the evasive ability of steelhead smolts in large systems, no methodology has been developed to estimate total productivity (see HGMP Table 2.2.2.2). Productivity for Deer Creek summer run stock has been estimated from juvenile estimates per 100 sq. meters from six index areas in Deer Creek. From 1981 – 2001, these estimates ranged from 4 – 20 juvenile fish per m^2 (SaSI**,** WDFW 2002). No productivity measures are available for the Canyon Creek summer steelhead stock.

Table 2.2.2.6: Exp. Steelhead Population Trend ln(nat. spawners) (95% CI).

Population	1985-2009	1995-2009
Stillaguamish River winter-run	0.910 (0.887 - 0.934)	0.879 (0.820 - 0.943)

Source: Ford 2011. These are based on analyses reported by Ford (2011) that are not necessarily agreed to by WDFW and the 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.

Stillaguamish Chinook (*Oncorhynchus tshawytscha*): For the Stillaguamish River basin total escapement estimates are based on redd counts for the entire South Fork & North Fork Stillaguamish Rivers.

Table 2.2.2.7: Stillaguamish River Chinook escapement 2001-2012.

Year	N.F. Stillaguamish	S.F. Stillaguamish
2001	1,029	283
2002	1,301	335
2003	962	105
2004	1,358	168
2005	885	78
2006	1,035	219
2007	567	40
2008	1,393	278
2009	958	43
2010	763	20
2011	914	103
2012	1,345	189
Average	**1,043**	**155**

Source: SaSI (WDFW 2013).

Table 2.2.2.8: Stillaguamish River natural origin winter steelhead escapement 2001-2012.

Year	Index Escapement	Total Escapement
2001	630	2,556
2002	354	1,436
2003	660	2,678
2004	740	3,002
2005	462	1,874
2006	676	2,743
2007	NA	NA
2008	306	1,241
2009	120	487
2010	372	1,509
2011	362	1,469
2012	340	1,379
Average	**457**	**1,852**

Source: SaSI (WDFW 2013)

Deer Creek and Canyon Creek Summer Steelhead (*Oncorhynchus mykiss*): Escapement data is not available for the Deer or Canyon Creek summer steelhead populations.

- 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.

Stillaguamish Chinook (*Oncorhynchus tshawytscha*):

Table 2.2.2.9: North Fork Stillaguamish River Chinook escapement, natural origin and hatchery-origin 2000-2011.

Return Year	% Natural Spawners	Natural origin	Hatchery
2001	61.26	653	413
2002	59.70	748	505
2003	45.36	401	483

2004	52.31	701	639
2005	46.88	444	503
2006	44.15	457	578
2007	54.66	311	258
2008	60.23	839	554
2009	44.99	431	527
2010	53.08	405	358
2011	50.77	464	450
2012	53.05	714	632
Average	**52.20**	**547**	**492**

Source: *Comprehensive Management Plan for Puget Sound Chinook* (2010) and SaSI (WDFW 2013)

Table 2.2.2.10: Puget Sound Chinook average natural (natural-origin and hatchery) and natural-origin only spawners and percent hatchery contributions for five year intervals. Spawning abundance averages are geometric means and hatchery contribution averages are arithmetic.

Return Years	1990-1994			1995-1999			2000-2004			2005-2009		
Populations	**Nat**	**%**	**NOR**	**Nat**	**%**	**NOR**	**Nat**	**%**	**NOR**	**Nat**	**%**	**NOR**
North Fork Stillaguamish	679	26%	500	904	37%	564	1,173	30%	809	943	46%	478
South Fork Stillaguamish	298	0%	298	240	0%	240	210	0%	210	99	1%	98
ESU	**23,938**	**75%**	**17,905**	**27,392**	**63%**	**17,245**	**43,192**	**72%**	**31,294**	**34,486**	**69%**	**23,938**

Source: Ford 2011. These are based on analyses reported by Ford (2011) that are not necessarily agreed to by WDFW and the Tribes.

Stillaguamish System steelhead (*Oncorhynchus mykiss*):

The early winter hatchery programs in the Stillaguamish 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 Stillaguamish River, 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 from the Stillaguamish 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 Stillaguamish 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 2.2.2.11 and discussed in greater detail in the following sections. Introgression from the early winter steelhead program was not evident in samples from the Deer Creek Summer population, the Canyon Creek Summer population, or from the smolt trap in the Stillaguamish River. The estimated PEHC for the proposed programs ranged from 0 to 0.003 and gene flow was projected to be less than 2%. 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 categorized 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 Stillaguamish River basin (Warheit 2014).

Table 2.2.2.11. Estimates of F1 hybridization, PEHC, and gene flow from early winter hatchery programs to steelhead populations in the Stillaguamish River basin 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
Stillaguamish River Winter			
Past Practice	0.00%	0.00%	0.11% - 1.14%
Proposed Program [1/]		0.00%	0.09% - 1.03%
Deer Creek Summer			
Past Practice	0.00%	0.00%	-
Proposed Program		0.00%	-
Canyon Creek Summer			
Past Practice	0.00%	0.00%	-
Proposed Program		0.00%	-

[1/] PEHC and gene flow estimates for the proposed program shown were scaled to reflect changes in program size and elimination of off-station releases. The PEHC values are based on an grouped collection of natural origin smolts that included natural origin winter and natural origin summer fish.

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 3-5 years may occur between when a hatchery management action is implemented and when the introgression level reaches a new equilibrium (Fig. 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 (Fig. 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 2.2.2.12). 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 2.2.2.12. 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

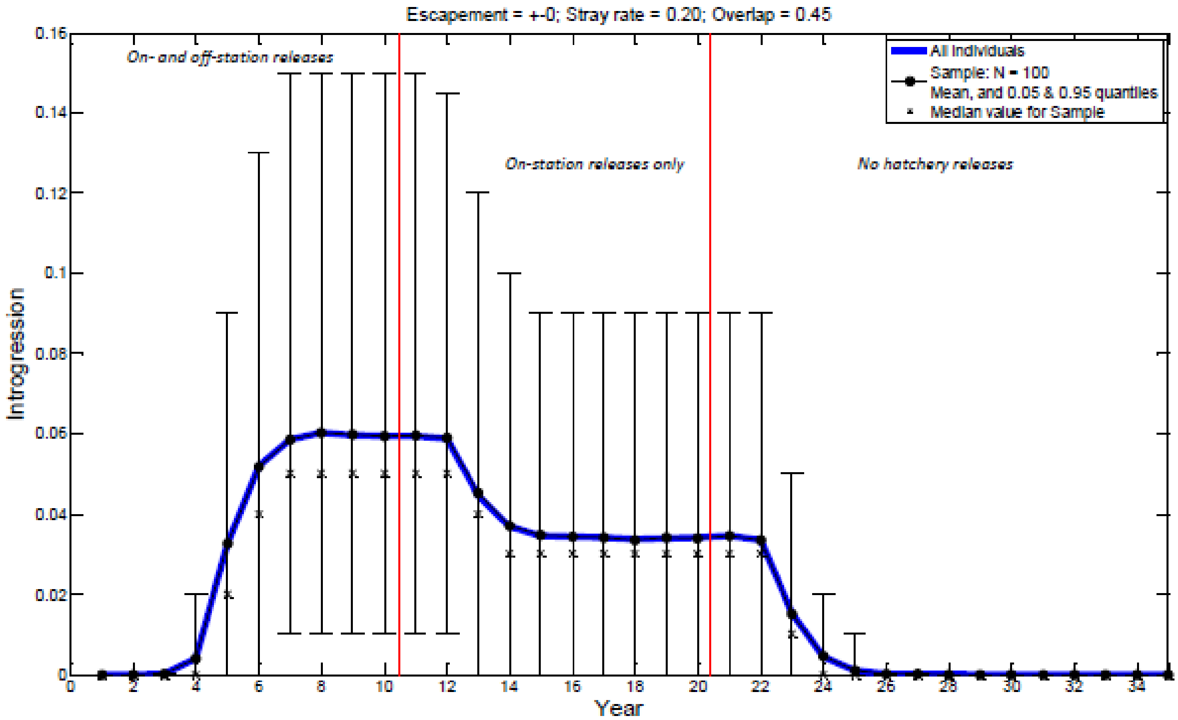


Figure 2.2.2.2. Preliminary simulation analysis of introgression including lag times in response to hatchery actions and uncertainty of estimates.

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 Deer Creek Summer population, Canyon Creek Summer population, or samples from the Stillaguamish River smolt trap. More detailed analysis is presented below for the Stillaguamish Winter population (estimated PEHC of 0.003 with past practices).

<u>Stillaguamish River Winter</u>. The PEHC was estimated as 0.000 from an analysis of 62 samples from a smolt trap in the Stillaguamish River in 2006 (Warheit 2014). This sample may include both winter and summer steelhead produced from the winter and two summer populations in the Stillaguamish River. The estimated PEHC reflects the previous hatchery practices that affected the juvenile and adult fish in the years when the samples were collected. Assuming that most of the natural origin smolted sampled were age 2, and that the primary age of hatchery adults was age 4, then the estimated PEHC primarily reflects juvenile hatchery released in 2002. The number of hatchery early winter steelhead released in 2002 was 138,616 (Table 2.2.2.13) and, with a proposed release of 130,000 early winter smolts, the future PHEC (Hoffmann 2014) is expected to remain at 0.000.

Table 2.2.2.12. Genetic samples and associated hatchery releases of winter steelhead into the Stillaguamish River.

Sample	Life Stage	Sample Collection Year	Primary Spawn Year	Primary Release Year	Releases
Stillaguamish River Smolt Trap	Juvenile	2006	2004	2002	138,616

Gene Flow. We estimated the gene flow from stray rates for on-station and off-station releases (Hoffmann 2014). We used a stray rate of 100% for off-station releases and stray rates of 20% and 30% for on-station releases.

We estimated gene flow using the methods of Scott and Gill (2008) and 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 Whitehorse Hatchery.

Spawn Timing of Natural-Origin Spawners (o_N). The spawn-timing of natural-origin fish in the Stillaguamish 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 winter steelhead in the Stillaguamish 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 2.2.2.13.

The estimated PEHC and gene flow for six cases of alternative parameter values are provided in Table 2.2.2.14.

Table 2.2.2.13. 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 Whitehorse Hatchery.	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 Whitehorse Hatchery.
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

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Table 2.2.2.14. Estimated PEHC and gene flow for the Stillaguamish 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: Stillaguamish Hatchery: Whitehorse 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: Stillaguamish Hatchery: Whitehorse 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		0.63%	1.47%	0.34%	1.82%	0.75%	2.28%	0.86%	2.05%	0.47%	2.54%	0.92%	3.08%
2002-2003		0.04%	0.09%	0.02%	0.11%	0.09%	0.17%	0.06%	0.14%	0.03%	0.17%	0.13%	0.26%
2003-2004		0.13%	0.29%	0.07%	0.35%	0.25%	0.53%	0.19%	0.42%	0.10%	0.51%	0.33%	0.74%
2004-2005		0.41%	0.95%	0.22%	1.16%	0.57%	1.53%	0.56%	1.29%	0.30%	1.59%	0.69%	2.03%
2005-2006		0.20%	0.46%	0.11%	0.56%	0.35%	0.79%	0.31%	0.71%	0.16%	0.87%	0.48%	1.18%
2006-2007		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2007-2008		0.16%	0.36%	0.08%	0.44%	0.30%	0.64%	0.25%	0.56%	0.13%	0.69%	0.41%	0.96%
2008-2009		0.20%	0.46%	0.11%	0.56%	0.35%	0.80%	0.31%	0.72%	0.17%	0.88%	0.48%	1.19%
2009-2010		0.16%	0.36%	0.08%	0.44%	0.30%	0.65%	0.25%	0.57%	0.13%	0.69%	0.41%	0.97%
2010-2011		0.18%	0.40%	0.09%	0.49%	0.32%	0.71%	0.27%	0.62%	0.14%	0.76%	0.43%	1.04%
2011-2012		0.18%	0.41%	0.09%	0.50%	0.33%	0.72%	0.31%	0.69%	0.16%	0.85%	0.47%	1.16%
Through 2011		0.21%	0.48%	0.11%	0.59%	0.33%	0.81%	0.31%	0.71%	0.16%	0.87%	0.43%	1.14%
All Years		0.21%	0.48%	0.11%	0.59%	0.33%	0.80%	0.31%	0.71%	0.16%	0.87%	0.43%	1.15%
No Offstation		0.14%	0.31%	0.07%	0.38%	0.26%	0.56%	0.24%	0.53%	0.13%	0.65%	0.38%	0.90%
Release	130,000	0.17%	0.37%	0.09%	0.44%	0.29%	0.64%	0.28%	0.62%	0.15%	0.75%	0.41%	1.03%

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 Collection: The trapping facility at Whitehorse Ponds is a temporary structure located in a side channel where the pond outlet enters. During summer low flow periods, most fish will remain in the N.F. Stillaguamish River although some hatchery adults may be attracted to the trap as they have been imprinted and released from this location. There is little incentive for natural origin Chinook (runs have terminated by this time), listed steelhead or bull trout to voluntarily enter the trap. If any listed fish would be encountered they are safely returned back to stream. Broodstock collection of winter steelhead takes place between November and January 31; however the trap is operated until March 15 or later as conditions allow, to insure that any hatchery-origin adults are captured and removed from the system. Natural origin steelhead components, if encountered, would be identified by presence of an adipose fin and are returned back to stream and are not considered for broodstock use.

Broodstock Spawning/Pathology Sampling: Only hatchery identified winter run steelhead are spawned at Whitehorse Ponds. After spawning, all broodstock (up to 60 total), moribund females or even fresh pond mortality may be kidney/spleen sampled for thorough pathogen screening per the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State Policy*, (WDFW and WWTIT 1998 and updated 2006). This protocol does not take listed fish.

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 outmigrating 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 outmigrants. 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 outmigrating travel times have also been shown to minimize opportunity for negative interactions (9 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 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 compliance. 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 take of listed fish are reported by staff during the normal operation of the hatchery.

Genetic Introgression: Genetic introgression may occur if hatchery adults spawn in the wild, with both temporal and spatial separation of hatchery and natural origin steelhead playing 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 (SaSI, WDFW 2013).

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 Stillaguamish 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 at facilities would not be re-cycled for additional sport opportunities while trapping facilities would continue removing hatchery fish until March 15 or later as conditions allow.

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).

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 Stillaguamish River system 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). Telemetry studies indicate that steelhead migrate out of the Puget Sound quickly, with an average travel time of approximately 9 days to the Strait of Juan de Fuca (Moore et al. 2013, Moore et al. 2010, Goetz et al. 2008).

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 risks 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. Inadvertent mortality on all listed fish encountered at these trapping sites and returned back to stream is estimated to be 0-1 fish yearly. In most years staff has reported none.

- 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 listed 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.

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 plan for implementing hatchery programs in the Stillaguamish 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 Tulalip Tribe and Stillaguamish Tribe along with WDFW prepare an annual Fisheries Management Plan for the harvest of Stillaguamish River system winter steelhead produced from this program (WDFW et al. 2008 to present). Emergency in-season regulations may restrict fishing when hatchery escapement shortfalls are anticipated.

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 EBD provide descriptions of facilities, species propagated, and fishery management, hatchery production, broodstock management, eggtake, 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 Stillaguamish 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: Stillaguamish River system programs benefit the in-river recreational fishery and to some extent the Stillaguamish and Tulalips Tribes commercial and subsistence fisheries. Commercial tribal catch is restricted to marine areas (8A & 8D). Depending on tributary (Stillaguamish, Skykomish, Snoqualmie Rivers and several other tributaries), the generic steelhead season is open from June 1, to January 31 or February 15, with two hatchery-origin steelhead over 20 inches allowed (WDFW Sport Fishing Rules 2013/2014).

Table 3.3.1.1: Whitehorse Ponds hatchery winter recreational steelhead harvest, 2001 – 2012.

Return Year[a]	Smolt Release[a]	Freshwater Sport[b]	Tribal Harvest[c]	Hatchery Return	Smolt-to-Adult Contribution
2000/2001	107,390	1,070	14	91	1.09
2001/2002	108,776	1,404	50	410	1.71
2002/2003	123,606	536	0	65	0.49
2003/2004	138,616	512	15	188	0.52
2004/2005	171,957	733	1	300	0.60
2005/2006	155,025	625	22	373	0.66
2006/2007	152,427	852	30	140	0.67
2007/2008	148,760	521	2	133	0.44
2008/2009	153,937	116	1	67	0.12
2009/2010	154,734	108	0	164	0.18
2010/2011	125,165	105	1	166	0.22
2011/2012	76,605	282	NA	227	0.66
Average	**134,750**	**572**	**12**	**194**	**0.61**

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

[a] Smolt release two years earlier in the spring; includes on-station and Pilchuck Creek releases.

[b] 2 or 3 salt returns cannot be broken out. Steelhead catches are cumulative to the Stillaguamish River system and not broken out by tributary plants.

[c] Tribe harvest totals cannot be broken out to natural origin or hatchery catch, and therefore not included as part of the hatchery contribution %.

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 Stillaguamish River 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 too 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 Stillaguamish Tribe and Snohomish County co-lead the Stillaguamish lead entity. The Tribe and County are working on a long-term strategy to ensure the protection and restoration of healthy salmon populations. The local Watershed Recovery Plan developed will "rollup" into the regional salmon recovery plan (Shared Strategy for Salmon Recovery) (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 Sound Salmon Solutions (RFEG).

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. vs. Washington* (Boldt decision). The Stillaguamish River habitat section can be found under the Stillaguamish Tribe chapter at http://maps.nwifc.org:8080/sow2012/.

3.5) Ecological interactions.

(1) *Salmonid and non-salmonid fishes or other species that could negatively impact the program.* Negative impacts by fishes and other species on the Whitehorse Ponds hatchery steelhead program could occur directly through predation on program fish, or indirectly through food resource competition, genetic effects, or other ecological interactions. In particular, fishes and other species could negatively impact steelhead survival rates through predation on newly released, emigrating juvenile fish in the freshwater and marine areas. Certain avian and mammalian species may also prey on juvenile steelhead while the fish are rearing at the hatchery site, if these species are not excluded from the rearing areas. Species that could negatively impact juvenile steelhead 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 adult steelhead originating through the program may also serve as prey for large, mammalian predators in marine areas, nearshore marine areas and in the Stillaguamish River to the detriment of population abundance and the program's success in harvest augmentation. 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

(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 trout and other salmonid species present in the Stillaguamish River watershed through natural production. Juvenile fish of these species may serve as prey items for the 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 the emigrating steelhead. Salmonid adults that return to the watershed 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 program could positively impact freshwater and marine fish species that prey on juvenile fish. Nutrients provided by decaying steelhead carcasses might also benefit fish in freshwater. These species include*:*

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

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 Whitehorse Ponds.

Water Source	Available Water Flow (gpm)	Temp. (ºF)	Usage	Limitations
Whitehorse Spring Creek	500-2,500	47-48	Broodstock collection, incubation, rearing, and acclimation	Low flow during summer and fall
Well	500	47-48	Broodstock collecting (attracting water), incubation water supplementation	No limitation

Whitehorse Ponds: Is supplied with water from the spring-fed Whitehorse Spring Creek, which initiates 200 yards above the facility. Flows are seasonal and range from 90 gpm during low-flow months (summer) to 2,800gpm during peak-flow months (spring). Dissolved oxygen (DO) levels range from 9 ppm to 10.5 ppm. The facility's water is supplied directly from the source of the stream and as such water temperatures remain constant throughout the year. Flooding has not been an issue as the spring water source is very stable.

Surface and well water right permits are #S1-00825and #G1-28153P, respectively.

The Hatchery Scientific Review Group (HSRG 2002) recommended developing an additional water source to increase available water flows. In response, one underground well, independent of Whitehorse Springs Creek, was added in 2004. This helped to increase water flows for the incubation room but did not increase the attraction water levels.

Table 4.2.2. Record of NPDES permit compliance at Whitehorse Ponds.

Facility/ Permit #	Reports Submitted Y/N			Last Inspection Date	Violations Last 5 yrs.	Corrective Actions Y/N	Meets Compliance Y/N
	Monthly	Qtrly	Annual				
Whitehorse Pd WAG13-3008	Y	Y	Y	5/19/2005	0	N	Y

Source: Ann West, WDFW Hatcheries Headquarters Database 2013.

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

The water intake structure is in compliance with state and federal guidelines (NMFS 1995, 1996), but does not meet the current Anadromous Salmonid Passage Facility Design criteria (NMFS 2011a).

This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE), WAG 13-3008. 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.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Winter steelhead broodstock is recruited from volunteers returning to the hatchery trap, which is located in the release channel adjacent to the most-westerly dirt-bottom pond, reconditioned kelts, or captive brood, at Whitehorse. The trap is operated from June through March 15 or later as conditions allow, to accommodate summer and winter-run broodstock collection and the removal of hatchery-origin fish from the system.

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

A 1,500-gallon tanker truck equipped with aerators and oxygen tanks is available on-station for fish transportation. A 350-gallon tanker truck can be borrowed from the Arlington Hatchery when needed. Adults are moved from the trap, using 100-gallon cattle watering trough and a pickup truck.

5.3) Broodstock holding and spawning facilities.

Broodstock is held in the 100’ x 10' x 10'concrete raceway supplied with creek water. During low flow months well water can be used as a supplementing source. Spawning takes place in the in the shed directly adjacent to the pond. Ripe adults not selected for kelt reconditioning are killed and spawned. The adults selected for kelt reconditioning will be live spawned, rehabilitated and reared.

5.4) Incubation facilities.

A portion of the progeny from 2014 brood ye A portion of the progeny from 2014 or years with significantly low eggtake, will be reared to begin a captive brood program, which along with kelt reconditioning will be a backup source for eggs in the future if sufficient volitionally returning adults are not available.

Table 5.4.1: Incubation vessels available at Whitehorse Ponds.

Type	Number	Size
Vertical stack incubators	56 trays	24" x 25" x 3"
Deep troughs	3	16' x 3' x 2'

5.5) Rearing facilities.

Table 5.5.1: Rearing ponds available at Whitehorse Ponds.

Type	Number	Dimensions
Concrete raceways	3	100’ x 10' x 10'
Dirt bottom ponds	1	360' x 204' x 6'
	1	195’ x 66’ x 6’
	1	280’ x 220’ x 6’

All rearing ponds are covered with bird netting. All dirt bottom ponds have concrete release channels adjacent to them.

5.6) Acclimation/release facilities.

Fish are reared on a well or well/Whitehorse Springs Creek mix, depending on availability and needs, through their entire time at the hatchery. Fish are released through channels adjacent to each dirt bottom pond. Two channels are similar in size and measure approximately 45' x 7' x 3'; one is bigger and measures 55' x 7' x 5'. The latter is also used as a trap for returning fish.

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

There have been no operational difficulties which have led to significant fish loss. However, Cold Water Disease, which may occur between the ponding and fry development phase, has been documented. Predation problems may cause elevated fish losses.

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

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

Fish rearing is conducted in compliance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006) to minimize the likelihood for the take of listed natural fish that may result from disease transmission. Adherence to artificial propagation, sanitation and disease prevention, diagnosis, treatment and control practices defined in the policy prevent or reduce the incidence and intensity of disease during hatchery spawning, incubation and rearing. This also controls the transmission of infectious pathogens between hatchery fish and the potential to infect natural-origin salmonids from hatchery effluent or directly by preventing or reducing releases of infected hatchery fish.

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 natural origin fish of the same species/population.

6.1) Source.

Broodstock is collected from adult hatchery (distinguished by an adipose fin-clip) winter steelhead returning to the Whitehorse Ponds trap through January 31. The early winter stock fish used for this hatchery program are not ESA-listed.

6.2) Supporting information.

6.2.1) History.

The Whitehorse Ponds hatchery winter steelhead program utilizes fish derived from the early winter hatchery stock established in 1945 from a winter-run steelhead population collected at South Tacoma Hatchery, (now Lakewood Hatchery -WRIA 12) (Scott and Gill 2008). The warmer water available at the location was used to accelerate spawning time and encourage growing of smolts as a one-year age product rather than two, thereby significantly reducing cost of rearing in freshwater (Crawford 1979). The early winter stock, as a part of the Regional Egg Source, was utilized in the Puget Sound by several hatcheries and transferred to and between several river systems including the Skykomish, Snoqualmie, Skagit, Stillaguamish and Bogachiel Rivers.

When the program was initiated, hatchery-origin adults returning to Whitehorse Ponds spawned and the eggs were shipped to South Tacoma Hatchery for incubation, early rearing and mass-marking, before they were returned to Whitehorse Ponds for acclimation and release. Previously, egg support came from adults collected at Tokul Creek Hatchery located on the Snoqualmie River (WRIA 07.0219).

6.2.2) Annual size.

Up to 120 adults are collected for broodstock. No natural-origin fish are included.

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

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

This winter steelhead production is currently managed as a segregated program, which means that the 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) Genetic or ecological differences.

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 occurs in January, while peak natural-origin winter spawning occurs in 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 at Whitehorse Ponds 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) Reasons for choosing.

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 and priority is given to keeping hatchery returns to Snoqualmie facilities (Tokul Creek) and the Skykomish facilities (Wallace and Reiter) 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). 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 31st, from the previously accepted date of February 28.

The proposed rules for listing Puget Sound steelhead (71 FR15666; 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
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 hatcheries 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 28th, 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 offstation 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.

SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2) Collection or sampling design.

Winter steelhead broodstock is recruited from volunteers returning to the hatchery trap, which is located in the release channel adjacent to the most westerly dirt bottom pond, reconditioned kelts, or captive brood. The trap is operated from June through the end of March to accommodate summer and winter steelhead broodstock collection and the removal of hatchery-origin fish from the system. Winter steelhead returns peak in December and January. Fish for broodstock are collected until January 31, and volunteers returning after that date are removed from the system.

The trap is checked daily and collected adults are transferred to concrete raceways for holding.

In years when the egg-take goal was not achieved, eggs were transferred from Tokul Creek Hatchery (WRIA 7). Eggs transfers between watersheds were eliminated and since brood year 2011 broodstock is selected exclusively from fish returning to the hatchery trap.

7.3) Identity.

All fish released through this hatchery program has been consistently 100% mass-marked (adipose fin-clipped), since brood year 1983 (1984 releases). Early winter broodstock is differentiated from early summer broodstock by condition of fish and timing of capture. Leaner morphology and presence of copepods are indicative of early summer run steelhead. Fish that are questionable are not used for either program.

7.4) Proposed number to be collected:

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

Up to 120 adults collected annually.

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

Table 7.4.2.1: Sex composition of winter steelhead broodstock spawned at Whitehorse Ponds.

Brood Year	Females	Males
2002	87	24 + 65
2003	31	+31
2004	70	30 + 44
2005	69	45 + 26
2006	78	78
2007	69	40 + 30
2008	65	45 + 20
2009	26	22 + 6
2010	53	53
2011	60	60
2012	61	59
2013	45	45
Average	**60**	**60**

Source: WDFW Hatcheries Headquarters Database 2013 (2012 data preliminary).
Note: "+ number" indicates live spawned males.

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

Fish collected above broodstock needs (surplus) are removed from the system; no recycling occurs. If available, food-grade surplus fish may be donated to approved charitable organizations and local tribes for ceremonial and subsistence purposes. Nonfood-grade carcasses are used in local streams for nutrient enhancement if approved by the Fish Health Specialist.

7.6) Fish transportation and holding methods.

Adults are moved from the trap, using 100-gallon cattle watering trough and a pickup truck, to the 100' x 10' x 10' concrete raceway where they are held until spawning. The raceway is supplied with creek water, but can be supplemented with well water during low-flow months.

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 local 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 production is managed as segregated program with the intent to separate hatchery and natural origin stocks. As such, listed steelhead are not targeted for hatchery broodstock.

In previous years, 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 spawning by natural origin fish occurs in late-April. The new collection period takes place earlier than most of the natural origin winter steelhead escapement seen in the system (SaSI, WDFW 2013), and may further accentuate and minimize overlap with natural origin winter steelhead present in the system. This collection timeframe also mostly, if not totally, avoids listed Chinook during the trapping season. Natural-origin Chinook encountered at the trap site will be transported in a tote and released directly and released into the N.F. Stillaguamish River; transportation time is approximately 5 minutes.

SECTION 8. MATING

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

8.1) Selection method.

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

8.2) Males.

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

Steelhead males are live spawned in low male return years to ensure enough males are available for mating. Live spawned males are operculum punch marked and reused only when necessary.

Steelhead jacks are not seen at this facility.

8.3) Fertilization.

Eggs from 5 females are collected into one bucket and milt from each male is collected separately. Eggs from one bucket are spread equally into five buckets and each batch is fertilized separately with the milt from one primary male. Then a backup male (primary male used for the previous batch) is used (modified matrix spawning).

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.

Listed steelhead broodstock are not a part of the mating scheme.

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

The current egg-take goal (FBD 2013) for the Whitehorse Ponds winter steelhead program is 200,000.

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

Table 9.1.1.1: Survival rates from egg-take to ponding, Whitehorse Ponds winter steelhead, 2005-2012.

Brood Year	Eggs Collected	Survival Rates (%)	
		Green-to-Eyed Up	Eyed-Up-to-Ponding
2005	261,684	93.4	87.0
2006	273,000	90.3	89.0
2007	238,000	87.4	88.0
2008	227,500	93.3	88.0
2009	98,800	90.2	90.0
2010	185,500	90.4	90.0
2011	210,000	94.4	84.0
2012	206,500	90.1	90.4
Average	**212,623**	**91.2**	**88.3**

Source: WDFW Hatchery Records 2012.

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

Extra eggs may be collected for this program, to allow for a larger effective gene pool and to offset losses to predation and disease. When additional eggs are taken, the surplus is typically culled at picking or after initial swim up. If losses are too high, production goals are not met.

9.1.3) Loading densities applied during incubation.

Fertilized eggs are placed in vertical incubators at around 10,000 per tray. Eyed-eggs are reloaded and placed at approximately 8,000 per tray.

9.1.4) Incubation conditions.

All eggs are incubated in vertical trays supplied with well water at the rate of 2.5 gpm. The temperature of the in-flowing water is a constant 47-48ºF. Dissolved oxygen is checked when needed and Vexar™ layers are placed in the trays to provide substrate.

9.1.5) Ponding.

When completely buttoned up and ready for initial feeding (April and May), a portion of the alevins are ponded into deep troughs supplied with well water. The rest are ponded directly into the concrete raceways supplied with creek water. In May and June, when all fish are approximately the same size (~1,000 fpp), fry are moved from the troughs into a single raceway.

9.1.6) Fish health maintenance and monitoring.

All fertilized eggs are water-hardened for one hour in a 100 ppm iodophor solution. Opportunistic fungus that grows on dead eggs in the incubators is controlled by daily formalin flush treatments (8 ounces of formalin per stack) throughout incubation until just prior to hatching. Once eyed, eggs are shocked and dead eggs are removed. Eyed-egg to ponded fry loss is picked at the time of ponding. Fry mortalities are culled from the ponds on a daily basis.

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

Table 9.2.1.1: Survival rates from fry to sub-yearlings and sub-yearlings to smolts, Whitehorse Ponds winter steelhead, 2005-2012.

Brood Year	Survival Rates (%)	
	Fry-to-Sub-yearling	Sub-yearling-to-Smolt
2005	90.0	77.7
2006	90.0	78.0
2007	88.0	80.1
2008	88.0	78.6
2009	89.0	76.8
2010	89.0	82.2
2011	94.5	84.3
2012	80.2	79.6
Average	**88.6**	**79.7**

Source: Hatchery Records 2012.

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

Loading and density levels at WDFW hatcheries conform to standards and guidelines set forth in *Fish Hatchery Management* (Piper et al. 1982) and 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.

The maximum flow index goal is 2.1 or lower. Actual flow index can reach 2.25 with a density index of 0.01.

9.2.3) Fish rearing conditions.

Fish are initially reared in troughs and raceways. Fish ponded into troughs are moved with fish ponded into the raceway in June, when they are a similar size (around 1,000 fpp). Mass-marking takes place from the end of June through August, when the fish are 50-80 fpp. In September, the fish are moved to one of the dirt bottom ponds where they stay until the May release. The dirt pond is supplied with water from Whitehorse Springs Creek.

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 juvenile winter steelhead reared at Whitehorse Ponds.

Month	Average Size (fpp)
March	3,000
April	2,500
May	1,700
June	400
July	200
August	85
September	52
October	29
November	21
December	15
January	12
February	10
March	8
April	7
May	6

Source: WDFW Hatchery Records 2012.

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

See **Table 9.2.4.1** 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; the food brand used may vary, depending on cost and vendor contacts. Feeding frequencies vary depending on the fish size and water temperature and usually begin at 7 feedings/7 days a week. After they are moved to the earthen pond, winter steelhead are fed using on-demand feeders. Feed rates vary from 1% to 4% B.W./day. The overall season feed conversion ratio has averaged approximately 1.1-1.5:1.

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

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.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

Table 10.1.1: Proposed release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Yearling	130,000	6.0	April 15/May	Stillaguamish River

Source: WDFW Future Brood Document 2013
Note: 6.0 fpp = 198 mm fork length (fl).

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

Stream, river, or watercourse: Whitehorse Spring Creek (WRIA 05.0254A)

Release point: Whitehorse Spring Creek RM 1.5

Major watershed: Stillaguamish River (05)

Basin or Region: Puget Sound

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

Surplus fish above the new release goal were released into various King and Snohomish County lakes for use in non-anadromous programs (**Table 10.3.2**). 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).

Table 10.3.1: Numbers, size and date of release, by location, Whitehorse Ponds winter steelhead.

Release Year	Stillaguamish River				Pilchuck Creek			
	Yearling	Avg. size (fpp)	Avg. CV	Date(s)	Yearling	Avg. size (fpp)	Avg. CV	Date(s)
2002	118,245	5.8	NA	5/2-18	10,569	5.9	NA	5/2, 14
2003[a]	161,662	5.8	NA	4/30-5/20	10,295	5.8	NA	4/30
2004	144,801	5.1	NA	5/1-31	10,224	5.1	NA	5/10, 11
2005	142,427	6.2	NA	5/1-18	10,000	6.2	NA	5/10-12
2006	138,756	5.6	NA	5/1-31	10,004	5.6	NA	5/22, 24
2007	143,919	5.3	NA	5/1-31	10,018	5.3	NA	5/25, 29
2008	144,654	6.8	NA	5/1-31	10,080	6.8	NA	5/21
2009	115,120	6.2	8.4	5/13-27	10,045	6.2	8.4	5/12, 20
2010	76,605	5.9	6.6	5/5-31	**Discontinued**			
2011	128,066	6.6	7.2	5/9-15				
2012	152,599	6.1	9.1	5/4-5/10				
2013	86,725	7.0	7.7	5/6-20				
Average	**129,465**	**6.0**	**7.8**		**10,154**	**5.9**	**8.4**	

Source: WDFW Hatcheries Headquarters Database 2013 (2011-12 data preliminary).
Note: 5.0 fpp = 210 mm fork length (fl); 7.0 = 188 mm fl.
[a] 15,225 smolts (6fpp) were released into Canyon Creek on April 29 and 30, 2003.

Trucking and planting fish off-station was discontinued. The last off-station release took place in 2009.

Table 10.3.2: Numbers, stage, size and dates of out-of-basin and lake releases, by location, Whitehorse Ponds winter steelhead.

Release Location	Release Year	Stage	Number Released	Avg. size (fpp)	Date(s)	Avg. CV
Lake Releases						
Lake Cassidy	2006	Fed Fry	25,020	417	5/27	NA
Lake Roesiger	2006	Fed Fry	25,000	423	5/30	NA
Lake Tye	2006	Fed Fry	8,000	423	5/30	NA
Martha Lake	2006	Fed Fry	15,000	425	6/4	NA
Lake Shoecraft	2006	Fed Fry	5,000	425	6/4	NA
Green Lake	2012	Sub-yearling	28,250	48	10/25	NA
Out of Basin Releases						
Pilchuck River WRIA 7	2001	Yearling	15,315	6.0	5/2-4	NA
	2002		10,376	5.9	5/4,10	NA
Sauk River WRIA 3	2001	Yearling	21,780	6.0	5/2-3	NA
	2002		21,203	5.8	5/1	NA

Source: WDFW Hatcheries Headquarters Database 2013.
Note: 5.5 fpp = 205 mm fork length (fl); 6.0 fpp = 198 mm; 48 fpp = 99 mm fl; 423 fpp = 48 mm fl.

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

Whitehorse Rearing Ponds: Volitional releases would occur no earlier than April 15th (under same criteria as stated in **HGMP Section 2.2.3 - Residualism**. Screens will be open for up to one month, or less if all the fish out-migrate. Fish that do not volitionally out-migrate will be placed into landlocked lakes.

10.5) Fish transportation procedures, if applicable.

Not applicable, fish are released on-station.

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

All winter steelhead are reared and acclimated to Whitehorse Springs Creek water. Well water can be used to supplement flow during summer low-flow months.

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

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

Brood Year	Yearlings	Mark Type
2013-14	130,000	AD-only

Source: WDFW Future Brood Document 2013

Hatchery steelhead are intended to be released 100% adipose fin-clipped. Due to regeneration of a partially-clipped or unclipped adipose fin (missed clip), some hatchery adults may return with an intact adipose fin. WDFW monitors clip rates during the marking process; partial or missed clips are recorded as a bad 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. In the past, fish available over the 10% limit were planted, according to the direction of WDFW Fish Management, into lakes for use in non-anadromous programs (see **Table 10.3.2**).

10.9) Fish health certification procedures applied pre-release.

Standard Fish Health Procedures performed at the facility:

- *All fish health monitoring is conducted by a qualified WDFW Fish Health Specialist.*
- *Juvenile fish examinations are conducted at least monthly and more often if necessary*. A representative sample (at the discretion of the fish health specialist) of healthy and moribund fish from each lot is examined.
- *Abnormal levels of fish loss are investigated when they occur*.
- *Fish health status determined prior to release or transfer to another facility*. The exam may occur during the regular monthly monitoring visit, i.e. within 1 month of release or transfer.
- *Appropriate actions, including drug or chemical treatments recommendation 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's 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.

Fish at Whitehorse Ponds are reared exclusively on spring or well water. There have been no emergency releases.

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).
- 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 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. 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 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 Section 2.2.3.

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. Stillaguamish 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, and fish health testing.

The Stillaguamish Tribe initiated extensive monitoring and biological sampling focused on juvenile salmonids in the Stillaguamish River and nearshore marine areas. The tribe has operated a smolt trap in the Stillaguamish Rivers annually since 2001. Other projects include redd mapping, adult carcass surveys, adult and juvenile snorkel surveys, estuary mapping, and research into the effects of scour and fine sediment on survival to emergence.

Additional research, monitoring and evaluation in the Stillaguamish 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: WDFW Stillaguamish 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 North Fork Stillaguamish River and its tributaries upstream of Deer Creek that support populations of winter steelhead. The river turbid conditions of Deer Creek preclude redd visibility and as such are not currently surveyed. *Stillaguamish River DIP*: Streams surveyed as an index of escapement include: The North Fork Stillaguamish River from the mouth of Deer Creek at river mile 14.3 to the bridge at river mile 34.4 (WRIA 05.0135), and Grant (05.0156), Frye (05.0213), Brooks (05.0215), French (05.0246), Segelsen (05.0255), Squire (05.0260), and Brown (05.0265) creeks and the Boulder River (05.0229). Supplemental surveys are conducted on Pilchuck Creek (05.0062) and on the South Fork tributaries Jim (05.0322) and Riley (05.0338) creeks. Surveys will provide data regarding abundance, which is a key VSP parameter.
Monitoring Summer Steelhead Populations	This project will continue to conduct spawning ground (redd) surveys in the South Fork Stillaguamish River that support populations of summer steelhead. Surveys are conducted on the Upper South Fork tributaries of Heather (05.0398), Benson (05.0399), and Hemple

	(05.0401) creeks.
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.

SECTION 12. RESEARCH

12.1) Objective or purpose.

Research specific to Whitehorse Ponds and hatchery steelhead program 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.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

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

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

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

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

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

Stillaguamish Bull Trout *(Salvelinus confluentus):* Bull trout were listed as a threatened species in the Coastal-Puget Sound Distinct Population Segment on November 1, 1999 (64 FR 58910). The USFSW identified the Stillaguamish River as a core area with four local populations; Deer Creek, the North Fork Stillaguamish River, Canyon Creek and the South Fork Stillaguamish River (USFWS 2004). Bull trout in the Stillaguamish River system exhibit anadromous, fluvial and resident life history forms and in many cases these life history forms overlap (WDFW Bull Trout SaSI 2004). Spawning habitat in this core area is believed to be a limiting factor in the watershed due to a lack of accessible upper elevation stream habitat. Foraging and overwintering habitat in the basin is found throughout the anadromous reaches of the mainstem, North and South Forks and the estuary of the Stillaguamish. The status of this stock is unknown and most bull trout observations have been anecdotal or occurred during monitoring efforts for other species (WDFW Bull Trout SaSI 2004)The recovered abundance level for bull trout in the Stillaguamish Core Area has been set at 1,000 adult spawners, based on current habitat capacity (USFWS 2004).

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

Core Area Population	Abundance Category (individuals)	Distribution Range Rank (stream length miles)	Short-term Trend Rank	Threat Rank	Final Rank
Stillaguamish River	250-1000	620-3000	Unknown	Moderate, imminent	At Risk

Source: USFWS 2008

Habitat - Past forest practices and related road networks and mass wasting have had some of the most significant impacts to bull trout habitat within this core area. These have resulted in the degradation of a number of spawning and rearing areas within local populations, as well as foraging, migration, and overwintering habitats. Ongoing mass wasting delivers significant amounts of sediment to this system, resulting in the loss of deep pools and elevated water temperatures. Like most major river systems within the Puget Sound Management Unit, habitat complexity has been significantly reduced in the mainstem and intertidal habitats have been largely eliminated 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. Past fisheries on bull trout, up until the early 1990s, likely resulted in a significant reduction of the overall core population. Given the low abundance of migratory adults, current legal and illegal fisheries within the Stillaguamish core area may significantly limit the ability of the population to recover. The absence of established spawner index areas or other repeatable means of monitoring bull trout population abundance and distribution within the core area continues to hinder the identification, conservation, and restoration of remaining spawning and rearing reaches within the core area. (USFWS 2004).

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

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

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

Candidate Species
Fisher *(Martes pennanti)* – West Coast DPS
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.

There are no activities associated with this hatchery program that would directly impact the Stillaguamish bull trout population. There is the possibility for indirect "take" associated with hatchery program operations—up to and including unintentional lethal take. Any observations of bull trout encountered during any hatchery activity, up to and including lethal take associated with hatchery activities, are reported annually by WDFW to USFWS under the ESA section 6 operating agreement. See HGMP section 15.1.

15.4) Actions taken to minimize potential effects.

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

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

15.5) References

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

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

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

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

Listed species affected: Steelhead *(Oncorhynchus mykiss)*		**DPS/Population:** Puget Sound / Stillaguamish Steelhead		**Activity:** Whitehorse Ponds Winter Steelhead Program
Location of hatchery activity: Whitehorse Ponds (N.F Stillaguamish)		**Dates of activity:** December- May		**Hatchery program operator:** WDFW
Type of Take	**Annual Take of Listed Fish By Life Stage (*Number of Fish*)**			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass a)	-	-	-	-
Collect for transport b)	-	-	-	-
Capture, handle, and release c)	-	-	5*	-
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-		-
Unintentional lethal take g)	-	-	1*	-
Other Take (specify) h)	-	-	-	-

*Natural origin steelhead have not been seen in the hatchery traps for last 12 years, but with the existing possibility of the encounter we estimate that up to 5 fish may be encountered in a single year in the future during broodstock collections.

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

Listed species affected: Chinook *(Oncorhynchus tshawytscha)*	**ESU/Population:** Puget Sound/ Stillaguamish Chinook		**Activity:** Whitehorse Ponds Winter Steelhead Program	
Location of hatchery activity: Whitehorse Ponds (N.F Stillaguamish)	**Dates of activity:** December- May		**Hatchery program operator:** WDFW	
Type of Take	**Annual Take of Listed Fish By Life Stage (*Number of Fish*)**			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass a)	-	-	-	-
Collect for transport b)	-	-	-	-
Capture, handle, and release c)	-	-	0	-
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	-	-
Unintentional lethal take g)	-	-	-	-
Other Take (specify) h)	-	-	-	-

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