# HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

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| **Hatchery Program:** | Soos Creek Fall Chinook Hatchery Program (Integrated) |
| **Species or Hatchery Stock:** | Green River Fall Chinook (*Oncorhynchus tshawytscha*) |
| **Agency/Operator:** | Washington Department of Fish & Wildlife |
| **Watershed and Region:** | Green River (Duwamish) / Puget Sound |
| **Date Submitted:** | April 3, 2013 |
| **Date Last Updated:** | April 3, 2013 |

# SECTION 1. GENERAL PROGRAM DESCRIPTION

## 1.1) Name of hatchery or program.

Soos Creek Fall Chinook Program.

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

Green River Fall Chinook (*Oncorhynchus tshawytscha*) – Re-affirmed threatened by five-year status review, completed August 15, 2011 (76FR50448).

## 1.3) Responsible organization and individuals

*Hatchery Operations Staff Lead Contact*

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

The Muckleshoot Indian Tribe has co-management authority for the Green River system. Under contract with WDFW, the Muckleshoot Tribe operates the Palmer Ponds facility.

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

| Facility | Funding Sources | Operational Information (FY 2011) |
|---|---|---|
| Soos Creek Hatchery | Puget Sound Recreational Enhancement Fund (PSRE)<br>Wildlife Fund – State<br>DJ-Federal<br>Local | FTEs = 4.33<br>Annual operating cost (dollars) = $411,152 |
| Icy Creek Hatchery | PSRE fund | Full time equivalent staff – 1.25<br>Annual operating cost (dollars) = $88,000 |
| Palmer Ponds | MIT | Annual operating cost (dollars) = $175,000 (in 2013) |

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

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

**Broodstock Collection; Incubation; Rearing Locations:**

Soos Creek Hatchery: Located on Big Soos Creek (WRIA 09.0072) at RM .6, tributary to the Green River (WRIA 09.0001) at RM 33.6.

**Acclimation and Release Locations:**
Soos Creek Hatchery

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| Icy Creek Hatchery: | Located at the mouth of Icy Creek (WRIA 09.0125), L.B. tributary to the Green River (WRIA 09.0001) at RM 48.3. |
| Palmer Rearing Ponds: | Located on unnamed stream (WRIA 09.0147) at RM 0.2, tributary to Green River (WRIA 09.0001) at RM 56.1. |

## 1.6) Type of program.

Integrated harvest.

## 1.7) Purpose (Goal) of program.

Harvest Augmentation

## 1.8) Justification for the program.

The purpose of the program is to produce Green River stock Chinook for sustainable fisheries (Magnuson/Stevens Act), for harvest in Puget Sound recreational fisheries and to fulfill Treaty Indian fishing right entitlements (*US v Washington*). The Soos Creek Hatchery fall Chinook sub-yearling program is used as PST Indicator Stock, and a Double-Index Tag (DIT) group. The DIT group serves as an index group for wild fall sub-yearling Chinook as well as provides data on catch contributions, run timing, total survival, migration patterns and straying into other watersheds. With the exception of the DIT group, all releases are consistently mass-marked (see HGMP section 10.7).

To minimize impacts on listed fish by WDFW facilities operation and the Soos Creek, Icy Creek, and Palmer Ponds hatchery Chinook programs, the following Risk Aversions are included in this HGMP:

**Table 1.8.1:** Summary of risk aversion measures for the Soos Creek fall Chinook program.

| Potential Hazard | HGMP Reference | Risk Aversion Measures |
|---|---|---|
| Water Withdrawal | 4.1, 4.2 | Surface water rights are formalized through trust water right #S1-21122 (Soos) and # S1-00317 (Icy). Spring water rights at Soos are formalized though trust water right #S1-000382CL.<br>Water Rights for Palmer are covered under permits R-1 20920C; S1-20296C' S120928C; and S121324C.<br>Monitoring and measurement of water usage is reported in monthly NPDES reports. |
| Intake Screening | 4.2 | Intake screens at Soos Creek are in compliance with state and federal guidelines (NMFS 1995, 1996), but do not meet the current Anadromous Salmonid Passage Facility Design criteria (NMFS 2011a) intended to minimize the risk of entrainment of juvenile natural-origin fish. |
| Effluent Discharge | 4.2 | This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System administered by the Washington Department of Ecology (DOE) - WAG 13 – 3014 (Soos) and WAG 13 – 3013 (Icy). (Soos); WAG 13 – 3013 (Icy); and WAG 13-3002 for Palmer. |
| Broodstock Collection & Adult Passage | 2.2.3, 7.9 | The majority of broodstock is collected at the Soos Creek Hatchery. Natural-origin fish are trapped at Soos Creek and the Tacoma Public Utilities (TPU) |

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| | | trap to incorporate into the broodstock at the Soos Creek Hatchery. No broodstock is currently collected at either Icy Creek Hatchery or Palmer Ponds. In 2003, a trap was installed in Icy Creek to trap and remove marked hatchery-origin Chinook as a measure to reduce straying of Icy Creek Hatchery-origin Chinook to natural spawning areas. In future years, returning Palmer-reared hatchery returns may be collected for broodstock at either of these facilities and/or at the TPU trap. The TPU trap is used currently for collection of NORs for broodstock incorporation.<br>The current upstream passage goal for Chinook above the Soos Creek weir is up to 1,200 adults. An additional management intent is to utilize Soos Creek surplus adults to support natural spawning levels sufficient to meet the escapement goal (5,800) in the Green River. The fish resulting from these integrated broodstock management actions will have different release strategies dependent on the number of natural-origin spawners observed in the Green River during the most recent three-year period. If an average of 900 natural-origin spawners are observed in a three-year period (mainstem and Newaukum combined), then 3.2-million sub-yearlings will be released at Soos Creek, and 1.0 sub-yearlings at Palmer. Preference to release the fish that are integrated at the highest rate will go to Palmer Ponds; with the intent that returns from this highly-integrated release will seed the upper watershed with natural spawning fish.<br>If an average of 1,500 natural-origin spawners are observed in the mainstem and Newaukum over the last three years a different release strategy is triggered. 2.2-million sub-yearlings will be released from Soos Creek which have a lower integration rate, as well as 1.0-million sub-yearlings which have the highest integration rate. An additional 1.0-million limited integration fish will be released from Palmer. This strategy will rely on the release of the fish with the highest integration rate to return to Soos Creek to provide broodstock. |
| Disease Transmission | 9.2.7 | The Co-Managers Fish Disease Policy details hatchery practices and operations designed to stop the introduction and/or spread of any diseases. |
| Competition & Predation | 2.2.3, 10.11 | Fish are released at a time, size, and life-history stage (smolts) to foster rapid migration to marine waters. |

## 1.9) List of program "Performance Standards".

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

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

### 1.10.1) "Performance Indicators" addressing benefits.

**Table 1.10.1.1:** "Performance Indicators" addressing benefits.

| Benefits | | |
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| **Performance Standard** | **Performance Indicator** | **Monitoring & Evaluation** |
| *3.1.1* Program contributes to fulfilling tribal trust responsibility mandate and treaty rights as described in *US v WA*. | Contributes to co-manager harvest. | Participate in annual coordination between co-managers to identify and report on issues of interest, coordinate management, and review programs (FBD process, North of Falcon). |
| *3.1.2*- Program contributes to mitigation requirements. | This program provides mitigation for lost fish production due to development within the Green River Basin and contributes to sport, tribal and commercial fisheries. | Survival and contribution to fisheries will be estimated for each brood year released. |
| *3.1.3* Program addresses ESA responsibilities. | Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions. | HGMP 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 bycatch of non-target species. | Externally-marked hatchery fish differentiate hatchery from natural-origin fish and enable mark-selective fisheries, which can reduce directed harvest mortality on wild fish. | Harvests and hatchery returns are monitored by agencies to provide up-to-date information. |
| *3.3.2* Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population. | Percentage of total hatchery releases are identifiable as hatchery-origin fish. Mass-mark (fin-clips, otoliths, tags, etc.) production fish to allow for their differentiation from naturally-produced fish. | Green River fall Chinook have been Coded Wire Tagged as a Pacific Salmon Treaty (PST) Indicator Stock since the 1974 brood (Scott et al. 1992).<br>Annual estimates of mass-mark rate (ad-clip, Ad/CWT, CWT-only) of all hatchery releases.<br>Returning fish encountered are examined for the fin-mark upon hatchery return and on the spawning ground. Numbers of estimated hatchery (marked and/or tagged) and natural (unmarked and untagged) are recorded annually.<br>The double index tag (DIT) group (CWT-only) provides data on estimated wild fall Chinook catch contributions, run timing, total survival, migration patterns and straying into other watersheds. |

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| *3.4.1* Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken. | Collection of broodstock is done randomly throughout the entire return period.<br>Adhere to WDFW spawning guidelines. (Seidel 1983, HSRG 2004). | Annual run timing, age and sex composition and spawning escapement timing data are collected. |
| *3.5.5* Juveniles are released at fully-smolted stage to benefit juvenile to adult survival rates, and reduce the likelihood for residualism and negative ecological interactions with natural-origin fish. | Smoltification status (size fpp/mass CV and condition factor) and behavior are monitored in the hatchery (80 fpp Chinook sub-yearling; 10 fpp at Icy and 70 fpp at Palmer). | Monitor size, number and date of release. |
| *3.5.6* The number of adults returning to the hatchery that exceeds broodstock needs is declining. | Program is properly sized to meet harvest objectives; program fish are fully utilized in target fisheries. | Harvests and hatchery returns are monitored throughout the run. |
| *3.6.1* The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation. | Adhere to HSRG (2004) and WDFW spawning guidelines (Seidel 1983).<br>Apply minimal monitoring standards in the hatchery: food conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV). | Annual run timing, age and sex composition and return timing data are collected. |
| *3.8.3* Non-monetary societal benefits for which the program is designed are achieved. | Contributes to the cultural benefit that fishing provides.<br>Recreational fishery angler days, length of season, number of licenses purchased<br>Fish available for tribal ceremonial use | Annual harvest of hatchery fish based on CWT recovery estimates and creel surveys. |

## 1.10.2) "Performance Indicators" addressing risks.

**Table 1.10.2.1:** "Performance Indicators" addressing risks.

| **Risks** | | |
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| **Performance Standard** | **Performance Indicator** | **Monitoring & Evaluation** |
| *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 | Harvest is regulated to meet appropriate biological assessment criteria. Mass-mark juvenile hatchery fish prior to release to differentiate hatchery- from natural-origin fish and enable state agencies to implement selective fisheries. | Harvests and escapements are monitored by agencies to provide up-to-date information. |
| 3.2.2 Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries. | Percentage of total hatchery releases are identifiable as hatchery-origin fish. Mass-mark (adipose-fin clip, CWT, otolith-mark, etc., depending on species) produced fish to allow for their differentiation from naturally produced fish for selective | 100% mass-marking as of 2000 release year. Annual harvest of mass-marked hatchery fish assessed based on CWT recovery estimates and creel surveys. (Palmer releases will be differentially marked - |

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| | fisheries. | otolith mark and/or CWT).<br>DIT groups (CWT-only) provide data on catch contributions, run timing, total survival, migration patterns, straying, in-stream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds. |
| *3.3.1* Hatchery program contributes to an increasing number of spawners returning to natural spawning areas. | Total number of spawners, categorized by origin, are monitored (pHOS, spawner-recruit ratios). | Annual natural spawning based on redd counts in the mainstem Green and in Newaukum Creek (SaSI). Fish origin determined from expanded mark/tag recovery estimates. |
| *3.3.2* Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production and to evaluate effects of the program on the local natural population. | All hatchery production is identifiable in some manner (fin-marks, tags, otolith, etc.) consistent with information needs Palmer releases will be differentially marked. | 100% mass-marking as of the 2000 release. Annual estimates of mass-mark rate (ad-clip, Ad/CWT, CWT-only) of all hatchery releases.<br>Returning fish encountered are examined for the fin-mark upon hatchery return and on the spawning ground. Numbers of estimated hatchery (marked and/or tagged) and natural (unmarked and untagged) are recorded annually. |
| *3.4.1* Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken. | Collection of broodstock is done randomly throughout the entire return period. | Annual run timing, age and sex composition and return timing data are collected. |
| *3.4.2* Broodstock management does not significantly reduce potential juvenile production in natural rearing areas. | Collection of NOB does not significantly reduce potential juvenile production in the system. | Transfers to the Green River and upper Soos Creek are proportional to the total adult return timing to the trap (see HGMP section 7.5). |
| *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. | WDFW monitors salmon escapement to the natural spawning areas above and below the hatchery release sites to estimate the number of tagged, untagged, and marked fish escaping each year.<br>Some smolt emigration rates post-release, timing of emigration and predation assessment are evaluated via smolt trapping in the mainstem Green River for WDFW wild juvenile salmon production monitoring. |

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| *3.5.1* Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production. | Within and between populations, genetic structure is not affected by artificial production. | Currently not monitored. |
| *3.5.2* Collection of broodstock does not adversely impact the genetic diversity of the naturally-spawning population. | Collection of broodstock is done randomly throughout the entire return period. | Annual run timing, age and sex composition and return timing data are collected.<br>DIT groups allow evaluation of straying, in-stream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds. |
| *3.5.3* Hatchery-origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning population. | The ratio of observed and/or estimated total numbers of artificially-produced fish on natural spawning grounds, to total number of naturally-produced fish (pHOS). | Not applicable (see Genetic Effects in HGMP section 2.2.3). |
| *3.5.4* Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations. | Fish are released in lower river locations after acclimation. | Release information, including location (on-station, acclimation), method (Soos = forced; Icy = volitional) and age class (Soos sub-yearlings, Icy yearlings) are recorded annually in hatchery data systems. |
| *3.5.5* Juveniles are released at fully-smolted stage. | Level of smoltification at release. Forced release type. | Monitor size, number, date of release. |
| *3.5.6* The number of adults returning to the hatchery that exceeds broodstock needs is declining. | Program is sized appropriately for harvest goals.<br>Numbers of surplus hatchery returns are calculated annually. | Numbers of adults returning to the hatchery, broodstock collected, and surplus returns are recorded annually. |
| *3.7.1* Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (IHOT, PNFHPC, WDFW Fish Health Policy, INAD, MDFWP). | Annual reports indicating levels of compliance with applicable standards and criteria.<br>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. |
| *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.<br>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. |

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| *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 Co-managers Fish Health Disease Policy (WDFW and WWTIT 1998, revised 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. | 1 to 6 weeks prior to transfer or release, fish are examined in accordance with the Co-managers Fish Health Policy |
| | Inspection of adult broodstock for pathogens and parasites. | At spawning, lots of 60 adult broodstock are examined for pathogens |
| | Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites. | Controls of specific fish pathogens through eggs/fish movements are conducted in accordance to Co-managers Fish Health Disease Policy. |
| *3.7.5* Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal and federal carcass distribution guidelines. | All applicable fish disease policies are followed.<br>See HGMP sections 7.5 and 7.8. | Controls of specific fish pathogens through eggs/fish movements are conducted in accordance to Co-managers Fish Health Disease Policy<br>Disposition of carcasses are recorded in the WDFW Hatchery Adult Data |
| *3.7.6* Adult broodstock management does not significantly alter spatial and temporal distribution of any naturally-produced population. | Spatial and temporal spawning distribution of natural populations above and below weir/trap currently compared to historic distribution. | Annual run timing, age, and sex composition and return timing data are collected.<br>Goal is to transfer surplus Chinook from Soos Creek Hatchery to the Green River proportional to the total adult return timing to the trap (see HGMP section 7.5). |
| *3.7.7* Weir/trap operations do not result in significant stress, injury or mortality in natural populations. | All observations of natural-origin fish at hatchery facilities are recorded and reported annually. | The Soos Creek trap is checked daily. Natural- and hatchery-origin fish abundances recorded and reported annually. |
| *3.7.8* Predation by artificially | Hatchery juveniles are raised to | Hatchery smolt release size |

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| produced fish on naturally – produced fish does not significantly reduce numbers of natural fish. | smolt-size and released from the hatchery at a time that fosters rapid migration downstream. | and time are monitored to quantify/minimize predation effects on naturally produced Chinook (Seiler et al. 2000, 2002). |
| *3.8.1* Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population. | Total cost of operation. | Annual operational cost of program compared to calculated fishery contribution value (Wegge 2009). |
| *3.8.3* Non-monetary societal benefits for which the program is designed are achieved. | Contributes to the cultural benefit that fishing provides.<br>Recreational fishery angler days, length of season, number of licenses purchased.<br>Fish available for tribal ceremonial use. | Agencies and tribes to provide up-to-date information needed to monitor harvests. |

## 1.11) Expected size of program.

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

Up to 2,922 adults collected annually for Soos Creek, Icy Creek and Palmer Ponds program releases.

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

**Table 1.11.1:** Proposed annual fish releases.

| Life Stage | Release Location | Annual Release Level |
|---|---|---|
| **Sub-yearling** | Big Soos Creek (WRIA 09.0072) | 3,200,000 |
| **Sub-yearling** | Palmer Ponds (WRIA 09.0147) | 1,000,000 |
| **Yearling** | Icy Creek (WRIA 09.0125) | 300,000 |

Data Source: WDFW, Future Brood Document 2011.

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

For brood years 2000 through 2004, the average smolt-to-adult survival rate was 0.43% for sub-yearlings, and 0.68% for yearlings (RMIS 2012). Based on the average smolt-to-adult survival rates and the program release goal of 3,200,000 sub-yearlings and 300,000 yearlings, the estimated adult production would be 15,820 (See HGMP section 3.3.1).

**Table 1.12.1:** Soos Creek Hatchery fall Chinook escapement (adults returning to the hatchery), 2000-2011.

| Year | HOR | NOR | Total Escapement |
|---|---|---|---|
| **2000** | NA | NA | 5,967 |
| **2001** | NA | NA | 11,751 |
| **2002** | NA | NA | 10,461 |
| **2003** | 4,410 | 2,164 | 6,574 |
| **2004** | 3,945 | 722 | 4,667 |
| **2005** | 7,188, | 922 | 8,110 |
| **2006** | 10,145 | 1,074 | 11,219 |

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|---|---|---|---|
| **2007** | 12,284 | 1,152 | 13,436 |
| **2008** | 7,816 | 600 | 8,416 |
| **2009** | 10,866 | 337 | 11,203 |
| **2010** | 11,022 | 398 | 11,420 |
| **2011** | 8,475 | 152 | 8,627 |
| **Average** | **8,620** | **836** | **9,321** |

Source: WDFW Hatchery Headquarters Database 2012.

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

The Soos Creek fall Chinook program began in 1901. Yearlings have been released at Icy Creek since 1983. Sub-yearlings have been released at Palmer Ponds since 2011.

### 1.14) Expected duration of program.

On-going

### 1.15) Watersheds targeted by program.

Soos (WRIA 09.0072), Icy (WRIA 09.0125) and unnamed (WRIA 09.0147) creeks are tributaries to the Duwamish/Green River (WRIA 09.0001).

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

The Puget Sound Salmon Management Plan (PSSMP 1985), a federal court order, describes the co-management responsibilities of WDFW and the tribes with regard to fishery management and artificial production. The PSSMP (1985) explicitly states that "no change may be made to the Equilibrium Brood Document (program production goals) without prior agreement of the affected parties." In the Green River/Duwamish River watershed any changes in the production at the Soos Creek Hatchery must be reviewed and approved by the Co-managers.

*Alternative 1: Reduce sub-yearling fall Chinook release numbers at Soos Creek Hatchery.* This measure would decrease ecological risks to natural-origin Chinook salmon and reduce listed Chinook salmon adult removal levels required each year for broodstock collection at the hatchery rack. WDFW has not pursued this alternative because it does not meet fisheries enhancement objectives for the program, including treaty Indian fishing right entitlements (*US v Washington*) and the Magnuson/Stevens Act for sustainable fisheries.

*Alternative 2: Eliminate the release of yearlings from Icy Creek Hatchery as a measure to reduce predation on rearing natural-origin Chinook, and to reduce potential increased domestication effects and rate of adult hatchery fish straying into the upper Green River watershed*. WDFW did not pursue this alternative because of the higher juvenile to adult survival rate for yearlings relative to sub-yearlings of 0.68% to 0.43%, respectively, and the higher contribution rate to Puget Sound sport fisheries from Chinook yearlings compared to sub-yearlings. Additionally, this program is implemented in accordance with the legislatively mandated Puget Sound Recreational Enhancement Program.

*Alternative 3: Convert yearling production to sub-yearling production for WDFW's Green River hatchery programs.* WDFW did not pursue this alternative because of the higher juvenile to adult survival rate for yearlings relative to sub-yearlings, of 0.68% to 0.43%, respectively. Additionally, the fishery contribution rates from sub-yearlings and yearlings to the Puget Sound winter sport fisheries demonstrate a higher catch contribution from Icy Creek yearlings over the Soos Creek sub-yearlings at 7.65% and 0.84%, respectively over the broodyears 2000-2005 collectively (PS Salmon Management Data-Steve Thiesfield 2012).

*Alternative 4: Change the release location of yearlings from Icy Creek to the Elliott Bay Net Pens:* WDFW did not pursue this alternative due to concerns of straying to neighboring

watersheds. The majority of net pen Chinook programs were eliminated from Puget Sound in the 2000s.

## 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.

None currently. This HGMP is submitted to the NOAA Fisheries for ESA consultation, and determination regarding compliance of the plan with ESA section 4(d) rule criteria for joint state/tribal hatchery resource management plans affecting listed Chinook salmon and steelhead.

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

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

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

**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, as well as twenty-six artificial propagation programs (Ford 2011). In the Duwamish/ Green River basin, the Technical Recovery Team (TRT) has identified one demographically independent population (DIP) (Duwamish/ Green River Chinook) (Ruckelshaus et al. 2006).

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

**Puget Sound steelhead** *(Oncorhynchus mykiss*): Were listed as *Threatened* under the ESA on May 11, 2007 (72FR26722); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448). The DPS includes all naturally spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations, below natural migration barriers in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington (Ford 2011). This DPS is bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), and also includes the Green River natural and Hood Canal winter-run steelhead hatchery stocks. In the Duwamish/ Green River basin, the TRT has preliminarily delineated one demographically independent population (DIP) of winter steelhead; (Green River), no summer run populations were identified in the basin (PSSTRT 2011).

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

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

**Soos Creek (Green/Duwamish) fall Chinook in the Puget Sound Chinook ESU**. NMFS (1999) considered this stock to be in the ESU, but not essential for recovery. The stock was designated Category 2a, as the hatchery population is derived from a native, local population (SSHAG 2003). The NMFS subsequently listed hatchery production in the Green because these

hatchery stocks are not significantly divergent from naturally-spawning fish in the watershed (70 FR 37160. June 28, 2005; NMFS SHIEER 2004, NMFS 2005).

**Green/ Duwamish fall Chinook in the Puget Sound Chinook ESU.** Recent escapement levels (2003-2011) have averaged 1,860 for natural spawners in the Green/Duwamish DIP. During this same time period, the population has shown declining trend (SaSI, WDFW 2012).

*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.

**Table 2.2.2.1:** Green/Duwamish Chinook (Central/South Puget Sound), 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] |
| *Green-Duwamish* | 17,000 | 22,000 | 4,900 | 3.2 | 835 | 5,523 |
| **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).

**Green River steelhead in the Puget Sound steelhead DPS.** Steelhead counts in the Green River have declined steadily since the 1980s and most sharply since 2005. The estimated probability that this steelhead population would decline to 10% of its current estimated abundance (i.e., to 45 fish) is high—about 90% within 80 years. With an estimated mean population growth rate of -0.042 ($\lambda = 0.959$) and process variance of 0.001, we can be highly confident ($P < 0.05$) that a 90% decline in this population will not occur within the next 20 years, and that a 99% decline will not occur within the next 45 years. However, beyond the next 50 years we are highly uncertain about the precise level of risk (Ford 2011). Based on a preliminary analysis by the PSSTRT (2011), the estimated historical capacity for winter steelhead in this system was 15,809 adults.

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

portion of their range in the foreseeable future, but are not currently in danger of imminent extinction (Ford 2011) .

**- 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.**

**Green/Duwamish River summer-fall Chinook** (*Oncorhynchus tshawytscha*): WDFW smolt monitoring activities occur on this system and sampling is conducted with five-foot screw trap located at river mile 34.5 (upstream of Soos Creek). Additionally the Muckleshoot Indian Tribe (MIT) operates a smolt trap on Soos Creek just upstream of the hatchery at RM 1.

**Table 2.2.2.2:** Relative abundance of two life history strategies for sub-yearling natural-origin Chinook in the Green River. Data are abundance of fry and parr migrants above the Green River trap site, brood year 1999 to 2009.

| Trap Year | Fry Migrants | | | Parr Migrants | | |
|---|---|---|---|---|---|---|
| | Migration Interval | Abundance | % of Migration | Migration Interval | Abundance | % of Migration |
| **2000** | 1-1-4/29 | 266,481 | 56.10% | 3/11-7/31 | 208,726 | 43.90% |
| **2001** | 1/1-5/20 | 379,174 | 46.80% | 3/8-7/31 | 430,442 | 53.20% |
| **2002** | 1/1-5/23 | 357,602 | 61.20% | 3/3-7/31 | 226,550 | 38.80% |
| **2003** | 1/1-5/27 | 413,358 | 91.90% | 2/16-7/13 | 36,598 | 8.10% |
| **2004** | 1/1-4/29 | 136,144 | 57.50% | 3/21-7/31 | 100,506 | 42.50% |
| **2005** | 1/1-4/26 | 391,274 | 83.20% | 2/20-7/31 | 79,061 | 16.80% |
| **2006** | 1/1-5/1 | 29,946 | 30.00% | 2/18-7/31 | 69,850 | 70.00% |
| **2007** | 1/1-5/7 | 88,439 | 69.40% | 3/21-7/31 | 39,053 | 30.60% |
| **2008** | 1/1-6/8 | 251,815 | 62.80% | 3/15-7/31 | 148,948 | 37.20% |
| **2009** | 1/1-5/13 | 119,406 | 60.90% | 2/6-7/31 | 76,709 | 39.10% |
| **2010** | 1/1-4/20 | 5,559 | 10.00% | 2/11-7/31 | 49,988 | 90.00% |
| **Average** | | **221,745** | **57.25%** | | **133,312** | **42.75%** |

Source Data: Topping and Zimmerman 2011.

**Table 2.2.2.3:** Puget Sound Chinook population average productivity for five-year intervals measured as recruits per spawner (R/S) and spawners per spawner (S/S). 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** |
| Green/Duwamish | *4.69* | *1.18* | *1.34* | *0.23* | *3.1* | *0.53* | *3.58* | *0.73* | *3.12* | *0.29* | *-0.09* | *-0.13* |
| **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 Data: Ford 2011

**Table 2.2.2.4:** 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 |
|---|---|---|---|---|---|---|
| Green River Fall Run | 1995-2009 | 0.952 (0.851 - 1.065) | 1.003 (0.274 - 3.67) | 0.51 | 0.835 (0.3 - 2.324) | 0.13 |
| | 1968-2009 | 1.01 (0.981 - 1.039) | 0.994 (0.892 - 1.108) | 0.45 | 0.799 (0.716 - 0.89) | 0.00 |

Source Data: Ford 2011.

**Green River steelhead** (*Oncorhynchus mykiss*): WDFW natural-origin smolt monitoring activity occurs on this system.

**Table 2.2.2.5:** Abundance estimates, 95% confidence intervals, and coefficient of variation (CV) for natural-origin steelhead smolts rearing above the Green River juvenile trap, migration years 2000-2010.

| Trap Year | Abundance | 95% C.I. | | CV |
|---|---|---|---|---|
| | | Lower | Upper | |
| **2000** | 14,529 | ----- | ----- | ----- |
| **2001** | 53,077 | ----- | ----- | ----- |
| **2002** | 12,612 | ----- | ----- | ----- |
| **2003** | n/a | ----- | ----- | ----- |
| **2004** | n/a | ----- | ----- | ----- |
| **2005** | n/a | ----- | ----- | ----- |
| **2006** | 16,748 | ----- | ----- | ----- |
| **2007** | 2,285 | ----- | ----- | ----- |
| **2008** | n/a | ----- | ----- | ----- |
| **2009** | 26,174 | 10,151 | 42,198 | 19.4% |
| **2010** | 71,710 | 49,317 | 94,103 | 15.9% |

Source: (Topping and Zimmerman 2011).

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

| Population | 1985-2009 | 1995-2009 |
|---|---|---|
| Green River winter-run | 0.992 (0.969 - 1.016) | 0.953 (0.892 - 1.019) |

Source Data: Ford 2011.

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

**Duwamish/Green River/Summer-Fall Chinook:**

**Table 2.2.2.7:** Mainstem Green River summer/fall Chinook total natural spawners [a], 2000-2012.

| Year | NOS | HOS | Total Natural Spawners |
|---|---|---|---|
| **2000** | NA | NA | 6,170 |
| **2001** | NA | NA | 7,975 |
| **2002** | NA | NA | 13,950 |
| **2003** | NA | NA | 5,864 |
| **2004** | NA | NA | 7,947 |
| **2005**[b] | 1,109 | 1,414 | 2,523 |
| **2006**[b] | 2,516 | 3,274 | 5,790 |
| **2007**[b] | 1,832 | 2,469 | 4,301 |
| **2008**[b] | 3,825 | 2,146 | 5,971 |
| **2009**[b] | 164 | 524 | 688 |
| **2010**[b] | 839 | 1,253 | 2,092 |
| **2011**[b] | 459 | 534 | 993 |
| **2012** | 1,629 | 1,462 | 3,091 |

Source: Aaron Bosworth WDFW 2013 and SaSI 2013.

[a] Escapement estimates listed here include all HOR and NOR fish spawning naturally in the mainstem Green River and Newaukum Creek. These estimates do not include fish spawning naturally in Soos Creek, either upstream or downstream of the hatchery rack. Prior to 1997, mainstem escapement estimates were based largely on redd counts estimated from fixed wing aircraft coupled with cumulative redd counts in one or two short reaches of the river. In 1997 helicopter surveys, more robust boat surveys, and multiple cumulative season redd counting areas were initiated. Spawner surveys consist of weekly

boat surveys through most of the mainstem, at least one flight during the peak of spawning, and select reaches where individual redds are marked in order to get a cumulative season total. The aerial counts are primarily used to estimate redd counts in largely inaccessible Green River Gorge. The cumulative redd estimates are extrapolated to non-cumulative areas using the relative peak counts. Historically this has been stratified into areas thought to have different redd life, the upper river from the headworks dam at RM 61.0 to RM 42.6 and the lower river from RM 42.6 to RM 25.4. Starting in 2003, the breakpoint was moved to RM 47.0. In recent years (2009 - present) the number of redds has been low enough that the redd survey is basically a census count (except for those redds in the Gorge). Newaukum Creek is a census redd count by foot.

[b] Estimates from 2005 to 2011 are calculated proportions of HORs spawning naturally in the Green River system, and are based on annual sample data from carcass recovery surveys. Brood Year 2000 is the first year of full mass marking (99 was partial). So 2005 is first year with all ages of mass marking returning and estimates from prior to 2005 are not included here. These estimates do not include natural Chinook spawning in Soos Creek.

**Table 2.2.2.8:** Green (Duwamish) River wild winter steelhead spawning escapement 2000-2012.

| Return Year | Escapement |
|---|---|
| **1999/2000** | 1,705 |
| **2000/2001** | 1,402 |
| **2001/2002** | 1,068 |
| **2002/2003** | 1,615 |
| **2003/2004** | 2,359 |
| **2004/2005** | 1,298 |
| **2005/2006** | 1,955 |
| **2006/2007** | 1,452 |
| **2007/2008** | 833 |
| **2008/2009** | 304 |
| **2009/2010** | 423 |
| **2010/2011** | 855 |
| **2011/2012** | 392 |

Source: Aaron Bosworth, District Biologist, 2013. Data are total escapement estimates based on cumulative redd counts in all mainstem spawning areas and in index reaches in Soos and Newaukum creeks totaling 12 miles. Does not include wild brood collected for hatchery program.

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

**Table 2.2.2.9:** 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** |
| Green/Duwamish | 5,239 | 56% | 2,214 | 6,792 | 68% | 2,007 | 6,335 | 37% | 3,921 | 3,077 | 56% | 1,288 |
| **ESU** | **23,938** | **75%** | **17,905** | **27,392** | **63%** | **17,245** | **43,192** | **72%** | **31,294** | **34,486** | **69%** | **23,938** |

Data Source: Ford 2011.

**Green River (Duwamish) steelhead** (*Oncorhynchus mykiss*): The level of hatchery winter run steelhead spawners in the Green River is unknown. Due to timing differences between early Chambers winter stock and Skamania summer stock steelhead and a majority of the existing wild winter stocks (being later February – June), interaction on the spawning grounds is unclear.

### 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 Program**: See also HGMP section 5.5.1.

*Broodstock Collection*: **Duwamish/Green River/Summer-Fall Chinook:**

*Broodstock removal effects:* Prior to consistent mass-marking in release year 2000, the proportion of natural-origin Chinook adults used in broodstock was unknown. Returning adult hatchery fish as of 2004 could therefore be distinguished from natural-origin Chinook during broodstock collection activities so that listed Chinook take levels may be determined. Under the 4(d) Rule for listed Puget Sound Chinook salmon, hatchery-origin Chinook salmon that are marked with an adipose fin clip are not subject to ESA section 9 take prohibitions (70 FR 37160. June 28, 2005), and no take limits apply to such fish. See "Take Tables" at the end of this document for direct take.

*Capture, handle and release effects:* The Soos Creek Hatchery adult weir is capable of trapping 100% of the adult Chinook returning to Soos Creek at RM 0.8. Intent is to allow fish not needed for broodstock to spawn naturally in the Green River Basin up to levels sufficient to meet the escapement goal (5,800). The collection and handling of these fish may result in takes of listed fish through migration delay, injury during holding or through handling and incidental mortality through trapping or handling.

No broodstock is collected at the Icy Creek facility, although a trap was installed in 2003 to trap and remove marked hatchery-origin Chinook to reduce straying of yearling hatchery-origin Chinook to natural spawning areas. The Icy Creek trap, along with traps at the TPU facility and Palmer, may be used in the future to collect returning adults that were initially reared at the Palmer facility.

**Rearing Program:**
*Operation of Hatchery Facilities*: Potential impacts from facility operations at Soos Creek include water withdrawal, hatchery effluent, and intake compliance. Monitoring and maintenance are conducted along with staff observations.

*Entrainment effects:* Upstream of the Soos Creek Hatchery weir is the hatchery pump intake that may cause a very low take risk to adults passing the intake dam. The pump intake screens are believed to pose a low level risk to juvenile migrants due to the small screen size and the high volume of bypass water associated with the structure. The weir and hatchery intake has been identified for improvements in the WDFW capital budget process.

No anadromous fish exist above the intake screens at Icy Creek and Palmer facilities, so there is no risk of entrainment of salmonids on the intake screen.

**Release:**
*Predation/Competition:* The release date of juvenile fish for the program can influence the likelihood that listed species are encountered or are of a size that is small enough to be consumed. The most extensive studies of the migration timing of naturally produced juvenile Chinook salmon in the Puget Sound ESU have been conducted in the Skagit River, Bear Creek, Cedar River, and the Green River (Seiler et al., 1998-2002). Although distinct differences are evident in the timing of migration between watersheds, several general patterns are beginning to emerge:

1) Emigration occurs over a prolonged period, beginning soon after enough emergence (typically January) and continuing at least until July;

2) Two broad peaks in migration are often present during the January through July time period; an early season peak (typically in March) comprised of relatively small Chinook salmon (40-45 mm), and a second peak in mid-May to June comprised of larger Chinook salmon;

The risk of Icy Creek yearling Chinook predation on listed natural-origin Chinook salmon in freshwater after their release into the Green River is unknown. Yearlings are released through the program in April at an average individual size of 10 fpp or ~ 155 mm fork length (fl). Seiler et al. (2002) reported none of the yearling Chinook sampled for stomach contents at the Green River smolt trap in 2000 had consumed juvenile Chinook salmon. WDFW trapping data indicates that the yearlings exit upper river reaches used by rearing natural-origin juveniles quite rapidly, peaking in abundance at the RM 34 trap location one week after the commencement of volitional release at RM 48 (Seiler et al. 2000).

Fish from the Soos Creek facilities, including Palmer Ponds, are released at a similar size and after most of their wild counterparts have left (88%) the system (Seiler et al. 2002), therefore the potential for predation/competition with natural-origin listed fish is assumed to be low. The June release timing for the hatchery fish reduces the likelihood for interaction with the majority of natural-origin juvenile Chinook rearing and emigrating each year. Food resource competition risks to listed Chinook juveniles in the Green River are reduced by delaying release of the hatchery-origin Chinook until June.

*Disease Effects:* The risk of disease transmission to wild Chinook in the area (Puget Sound) is low. Transmission of hatchery-origin diseases from the hatchery to wild fish in areas where they co-occur is an unlikely event. Although hatchery populations can be considered to be reservoirs for disease pathogens because of their elevated exposure to high rearing densities and stress, there is little evidence to suggest that diseases are routinely transmitted from hatchery to wild fish (Steward and Bjornn 1990). These impacts are addressed by rearing the Chinook at lower densities, within widely recognized guidelines, continuing well-developed monitoring, diagnostic, and treatment programs already in place (Co-manager's Fish Health Policy, WDFW and WWTIT 1998, updated 2006).

*Genetic Effects:* A Chinook hatchery has been present in the Green River System since 1901. There appears to be a high level of exchange between the Soos Creek Hatchery stock and the Green River natural population (SSHAG 2003). Hatchery fall-run Chinook salmon are genetically similar to naturally spawning Chinook salmon in Newaukum Creek, a tributary to the Green River (Marshall et al. 1995). The Chinook program at Soos Creek Hatchery is integrated, and incorporates natural-origin fish for use as broodstock (See HGMP section 6.2.3). At Soos Creek Hatchery, the intent is to allow fish not needed for broodstock to spawn naturally in the Green River Basin up to levels sufficient to meet the escapement goal (5,800).

Natural-origin fish are trapped at Soos Creek, Icy Creek, and the TPU trap to incorporate into the broodstock at the Green River Hatchery Complex. The fish resulting from these integrated broodstock management actions will have different release strategies dependent on the number of natural-origin spawners observed in the Green River during the most recent three year period. If an average of 900 natural-origin spawners are observed in a three year period, then 3.2-million sub-yearlings will be released at Soos Creek, and 1.0 sub-yearlings at Palmer. Preference to release the fish that are integrated at the highest rate will go to Palmer Ponds; with the intent that returns from this highly-integrated release will supplement the upper watershed with naturally spawning fish.

If an average of 1500 natural-origin spawners are observed in the mainstem over the last three years a different release strategy is triggered. 2.2-million sub-yearlings will be released from Soos Creek that are integrated one generation out, and 1.0-million sub-yearlings will have the highest integration rate of fish spawned that brood year. An additional 1.0-million limited integration fish

will be released from Palmer. This strategy will rely on the release of the fish with the highest integration rate to return to Soos Creek to provide future broodstock for the program.

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

With a permanent rack in place, all returning adults can be captured. The first 100% mass marked group (2000 releases) returned in 2004. Since that time the facility staff has been able to differentiate between hatchery and natural-origin returning Chinook.

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

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

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

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

## SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

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

WDFW hatchery programs in Puget Sound operate under and adhere to *U.S. v Washington* (1974), which provides the legal framework for coordinating these programs, defining artificial production.

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

*Hatchery Reform- Principles and Recommendations of the Hatchery Scientific Review Group.* WDFW programs have incorporated the suggestions this report provided, in a detailed description of the HSRG's scientific framework, tools and resources developed for evaluating hatchery programs, the processes used to apply these tools, and the resulting principles, system-wide recommendations, and program-specific recommendations to reform (HSRG 2004). See also HGMP section 6.2.3.

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

This hatchery program, and all other WDFW anadromous salmon hatchery programs within the Puget Sound Chinook ESU, operates under *U.S v Washington* (1974) and the *Puget Sound Salmon Management Plan* (PSSMP 1985) which provides the legal framework for coordinating these programs, defining artificial production objectives, and maintaining treaty-fishing rights through the court-ordered Puget Sound Salmon Management Plan (PSSMP 1985).

The program is implemented in accordance with the legislatively-mandated Puget Sound Recreational Enhancement Program.

WDFW signed an agreement (2000) with the Muckleshoot Tribe (see citations) linking mass marking with production goals. Production and marking goals shall be agreed to annually between the Co-managers.

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

See also HGMP section 3.1.

### 3.3) Relationship to harvest objectives.

Adult Chinook salmon produced through the Soos Creek Hatchery Chinook program are managed for harvest in fisheries in accordance with the co-managers' *Puget Sound Comprehensive Chinook Management Plan: Harvest Management Component* that was submitted for ESA review and authorization by NOAA Fisheries in 2010 (NMFS 2011b). The "recovery exploitation rate" applied as a harvest impact limit on listed Green River natural-origin Chinook salmon that are commingled with hatchery-origin Chinook salmon in pre-terminal southern U.S. fishing areas is 15%. Marine and freshwater terminal area fisheries are managed to achieve an escapement goal to naturally spawning areas in the Green River of 5,800 natural and hatchery-origin Chinook salmon.

WDFW general harvest goals are to provide fishing opportunities consistent with the mandate of the agency for restoration and recovery of wild indigenous salmonid runs, the Pacific Salmon Treaty, the Puget Sound Salmon Management Plan, the Pacific Fishery Management Council (PFMC) a North of Falcon (NoF) annual fisheries management planning process, *US v. Washington*, and other state, federal, and international legal obligations.

#### 3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

**Table 3.3.1.1:** Soos Creek Hatchery Fall Chinook Fishery Contributions.

| Brood Years: 2000-2004 (Sub-yearling) and 2002-2004 (Yearling)<br>Fishery Years: 2004-2008 (Sub-yearling) and 2006-2008 (Yearling) | | | |
|---|---|---|---|
| | **Average SAR%[a]** | **0.43** | **0.68** |
| ***Agency*** | ***Non-WA Fishery*** | ***% of total Survival*** | |
| | | ***Soos Cr Sub-yearlings*** | ***Icy Creek Yearlings*** |
| CDFO | All | *17.8* | *5.0* |
| NMFS | All | *0.6* | *0.2* |
| ODFW | All | *0.8* | *0.6* |

| | | | |
|---|---|---|---|
| Unk | All | *0.1* | *0.3* |
| ***Agency*** | ***WA Fishery*** | ***Soos Creek Sub-yearlings*** | ***Icy Creek Yearlings*** |
| WDFW | 10- Ocean Troll | *1.2* | *0.4* |
| MAKA | 15- Treaty Troll | *0.1* | --- |
| WDFW | 15- Treaty Troll | *3.4* | *1.3* |
| WDFW | 23- PS Net | *27.4* | *25.3* |
| WDFW | 41- Ocean Sport- Charter | *0.2* | *0.1* |
| WDFW | 42- Ocean Sport- Private | *0.5* | *0.2* |
| WDFW | 45- PS Sport - May to September | *8.3* | *16.8* |
| WDFW | 45- PS Sport - Winter Blackmouth[b] | *1.1* | *8.8* |
| WDFW | 46- Freshwater Sport[c] | *0.4* | *0.5* |
| Unk | 50- Hatchery Escapement | *0.1* | *0.8* |
| WDFW | 50- Hatchery Escapement | *33.7* | *13.1* |
| Unk | 54- Spawning ground | *0.2* | --- |
| WDFW | 54- Spawning ground | *4.1* | *26.9* |
| WDFW | 62- Test Fishery Seine | --- | *0.1* |
| | ***Total*** | ***100.0*** | ***100.0*** |

Source: RMIS 2012.

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

[b] Winter Blackmouth fishery occurs between October and April

[c] Freshwater Sport based on WDFW Catch Record Card (CRC) data: no CRC data for BY 2000-2002

## 3.4) Relationship to habitat protection and recovery strategies.

*Salmon Recovery Funding Board (SRFB).* 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). SRFB has helped finance over 500 projects. The Board supports salmon recovery by funding habitat protection and restoration projects. It also supports related programs and activities that produce sustainable and measurable benefits for fish and their habitat.

*Lead Entities.* The Lead Entity for the Green River/Duwamish River watershed is King County (WRIA 9). A Recovery Plan (2005) has been drafted http://www.govlink.org/watersheds/9/plan-implementation/HabitatPlan.aspx. As part of this recovery plan, a number of habitat actions have been implement, with addition improvements identified to be considered in the future. Howard Hanson Dam, an impassable barrier to fish migration, prevents natural production of salmonids into 106 lineal miles of stream habitat of the Upper Green River. The lower portion of the Green River basin is highly developed, channelized, diked and industrialized. These factors have degraded or eliminated habitat important for Chinook and coho salmon, adversely affecting the survival and productivity of the natural population in the watershed. (See also http://www.rco.wa.gov/salmon_recovery/lead_entities.shtml).

*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 Mid Puget Sound Regional Enhancement Group (RFEG).

*Shared Strategy Plan*. An ESU-wide recovery planning effort was undertaken by Shared Salmon Strategy for Puget Sound, a collaborative group dedicated to restoring salmon throughout Puget Sound (online at http://www.sharedsalmonstrategy.org).

*State of Our Watershed*. 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* (1974). The Green River habitat section can be found under the Muckleshoot 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 Soos Creek Hatchery sub-yearling Chinook program could occur directly through predation on program fish, or indirectly through food resource competition, genetic effects, or other ecological interactions. In particular, fishes and other species could negatively impact Chinook survival rates through predation on newly released, emigrating juvenile fish in the freshwater and marine areas. Certain avian and mammalian species may also prey on juvenile Chinook while the fish are rearing at the hatchery site, if these species are not excluded from the rearing areas. Species that could negatively impact juvenile Chinook through predation include the following:

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

Rearing and migrating adult Chinook originating through the program may also serve as prey for large, mammalian predators in marine areas, nearshore marine areas and in the Green River and Soos Creek 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
- 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 Green River watershed through natural production. Juvenile fish of these species may serve as prey items for the Chinook during their downstream migration in freshwater and into the marine area. Decaying carcasses of spawned adult fish may contribute nutrients that increase productivity in the watershed, providing food resources for the emigrating Chinook. Salmonid adults that return to the creek 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). With adult Chinook having been passed upstream of the hatchery on Soos Creek, 2-3,000 adult

Chinook carcasses could contribute, assuming average size of adult Chinook is 15 pounds, approximately 30,000-45,000 pounds of marine derived nutrients to organisms in the creek.

(4) *Salmonid and non-salmonid fishes or other species that could be positively impacted by the program.* The Chinook program could positively impact freshwater and marine fish species that prey on adult and juvenile fish. Nutrients provided by decaying Chinook carcasses might also benefit fish in freshwater. These species include:
- Southern Resident Killer Whale
- Northern pikeminnow
- Cutthroat trout
- Bull trout
- Steelhead
- Coho 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 Soos Creek and Icy Creek Hatcheries, and Palmer Ponds.

| Facility | Water Source | Available Water Flow (gpm) | Temp. (ºF) | Usage | Limitations |
|---|---|---|---|---|---|
| **Soos Creek Hatchery** | Spring | 50 | 47 | Adult holding, incubation, rearing | Available in small volume |
| | Big Soos Creek (surface) | Up to 13,000 | 32-70 | Adult holding, incubation, rearing | No limitation |
| **Icy Creek Hatchery** | Spring | Up to 4,000 | 45-48 | Rearing, acclimation | No limitations |
| **Palmer Pond** | Spring | 400-8000 | 46-48 | Rearing | No limitations |

*Soos Creek Hatchery* is supplied by surface water from Soos Creek. Water is withdrawn via four pumps at the hatchery site. Pumps produce 13,500 gallons per minute (gpm). In addition, a small spring water supply (50 gpm) can be utilized in the incubation building. Soos Creek responds quickly to heavy rainfall and is prone to rapid fluctuations. Heavy bed loads and winter floods are becoming an increasingly common occurrence (Perry 2005). In 2012, the Legislature passed a jobs creation bill that provided WDFW with funding for hatchery capital improvements in addition to our capital budget request. These projects include replacing the water distribution tower and main supply lines to the tower (see also Table 5.8.1.).

The facility is supplied with surface water from Soos Creek. Water rights are regulated through permit # S1-21122. Spring water withdrawal is regulated through permit #S1-00382CL.

*Icy Creek Hatchery* is an earthen, gravity-fed with spring water pond. Spring water quality is excellent but varies with the season from a low of 2.2cfs in the late fall to 13cfs in the late spring. Water usage is regulated under permit #S1-22710.

*Palmer Ponds* is a series of two earthen ponds that are gravity fed with spring water. The water right is for 16 cfs and flow availability is seasonal ranging from 0.89 cfs in late-fall to 21.2 cfs in winter/spring. There is also capability to pump river water into the ponds. Surface water usage is regulated under permit #S1-20296.

**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.**

*Soos Creek Hatchery.* The hatchery water intake is not in compliance with NOAA 2004 screening passage requirements. The 2012 budget provided WDFW with funding to replace/renovate the existing intake to meet current fish passage and screening requirements.

Monitoring and reporting of effluent discharge results have been in compliance with NPDES permit number WAG 13-3014 (see Table 4.2.1). The 2012 Legislature provided WDFW with funding to build a new two-bay pollution abatement pond system.

*Icy Creek Hatchery*. Due to its extremely steep stream gradient, no natural-origin anadromous salmonid population has used the watershed upstream of the Icy Creek Hatchery water intake. A trap was installed in 2003 at the mouth of Icy Creek to trap and remove marked hatchery-origin Chinook, and to release any stray unmarked, presumably natural-origin Chinook salmon back into the Green River. Icy Creek Hatchery is operated to ensure that hatchery effluent is not detrimental to downstream aquatic life by meeting or exceeding applicable NPDES Permit standards (see Table 4.2.1).

*Palmer Ponds.* The facility is supplied with spring water; no anadromous fish are present above the intake structure.

These facilities operate under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE), WAG 13-3002. Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE.

Discharges from the cleaning treatment system are monitored as follows:

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

**Table 4.2.1.** Record of NPDES permit compliance at Soos Creek and Icy Creek Hatcheries, and Palmer Ponds.

| Facility/ Permit # | Reports Submitted Y/N | | | Last Inspection Date | Violations Last 5 yrs (see Table 4.2.2) | Corrective Actions Y/N | Meets Compliance Y/N |
|---|---|---|---|---|---|---|---|
| | Monthly | Qtrly | Annual | | | | |
| Soos Creek WAG13-3014 | Y | Y | Y | 1/10/2012 | 3 | N | Y |
| Icy Creek WAG13-3013 | Y | Y | Y | 1/10/2012 | 2 | N | Y |
| Palmer Ponds WAG13-3002 | Y | Y | Y | 1/10/2012 | 2 | N | Y |

Source: Ann West, WDFW Hatchery Data Unit

**Table 4.2.2.** List of NPDES violations at Soos Creek and Icy Creek Hatcheries, and Palmer Ponds, over the last five years (2008-2012).

| Facility | Monitoring Month | Parameter | Sample Type | Result/ Violation | Permit Limit | Comment | Action |
|---|---|---|---|---|---|---|---|
| Soos Creek Hatchery | September 2008 | TSS | Avg Net Composite | 21.6 mg/L | 5.0 mg/L | River mixing with effluent sample and possible salmon in discharge pipe. | None |
| | | TSS | Max Net Composite | 29.0 mg/L | 15.0 mg/L | | |
| | January 2009 | TSS | Avg Net Composite | 13.0 mg/L | 15.0 mg/L | Due to flooding. | |
| Icy Creek Hatchery | April 2009 | SS | Avg Net Composite | Unreported | 0.1 ml/L | Unreported sample. Sampler retired and records could not be located. | None |
| | May 2009 | SS | Avg Net Composite | Unreported | 0.1 ml/L | | |
| Palmer Ponds | April 2009 | SS | Avg Net Composite | Unreported | 0.1 ml/L | Unreported sample. Sampler retired and records could not be located. | None |
| | May 2009 | SS | Avg Net Composite | Unreported | 0.1 ml/L | | |

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

# SECTION 5. FACILITIES

## 5.1) Broodstock collection facilities (or methods).

1. *Soos Creek Hatchery*. Broodstock is collected from Soos Creek adjacent to Soos Creek Hatchery. Upstream migrating fall Chinook adults are trapped in an in-stream, run-of-the-river pond framed by two semi-temporary weirs, with a "V"-entry into the lower weir.
2. *The TPU Trap*. Since 2008, additional natural-origin adult Chinook have been trapped at the new TPU Fish Collection Facilities (FCF) and transported to Soos Creek Hatchery for integration into the hatchery broodstock.
3. *Icy Creek.* A new permanent trap built on Icy Creek will begin operation in fall 2012. It will replace the temporary trap at the mouth of Icy Creek, built in 2003 to collect and remove marked hatchery-origin adults homing to the hatchery release site. This trap can also potentially collect unmarked fish for the broodstock.

Adult collection at Palmer Ponds currently does not occur because the existing adult collection facilities do not function during the time period that Chinook are normally present due to low flows which inhibit adult entry into the trapping structure.

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

Adults trapped at the TPU trap are transported to Soos Creek Hatchery in 1,500 gallon tanker truck, equipped with aerators and oxygen tanks (owned and operated by Tacoma Public Utilities).

## 5.3) Broodstock holding and spawning facilities.

Broodstock returning to Soos Creek are trapped and held in an in-stream, run-of-the-river pond. It is the natural stream channel framed by a two semi-temporary weirs, with a "V"-entry at the lower one. The pond created by the weirs measures approximately 150-ft x200-ft.

Adults selected for broodstock at Soos Creek are seined, sorted, killed and spawned at pond-side.

Adults transported from the TPU trap are kept separately in 16' circular pond.

Funding has been provided in 2012 to construct new adult handling facilities and ponds (see HGMP section 5.8).

## 5.4) Incubation facilities.

*Soos Creek Hatchery.* There are 160 shallow and 24 deep troughs used for incubation. Deep troughs are used exclusively for Chinook. Funding has been provided in 2012 to construct a new hatchery/incubation building outside the 100-year flood plain (see HGMP section 5.8).

*Icy Creek Hatchery.* There are no incubation facilities at Icy Creek.

*Palmer Ponds* There are currently no incubation facilities at Palmer Ponds.

## 5.5) Rearing facilities.

**Table 5.5.1:** Rearing facilities available at Soos Creek and Icy Creek hatcheries, and Palmer Ponds.

| Facility | Type | Number | Size |
|---|---|---|---|
| Soos Creek Hatchery | Asphalt lined rearing ponds | 3 | 0.14 acre |
| | Standard concrete raceways | 8 | 10'x80' |
| | Concrete rearing ponds | 8 | 17.5'x95' |
| | Fiberglass raceways | 12 | 16'x4' |
| | Fiberglass circular ponds | 2 | 16-ft diameter |
| | Fiberglass circular ponds | 6 | 6-ft diameter |
| | Shallow troughs | 160 | 15'x1'x5' |
| | Deep troughs | 24 | 15'x1.5'x1' |
| Icy Creek Hatchery | Earthen rearing pond | 1 (can be split into 2) | 0.5 acre |
| Palmer Ponds | Earthen pond | 1 | 1 acre |
| | Earthen pond | 1 | 0.4 acre |
| | Circular ponds | 4 | 20-ft diameter |

Chinook are reared in standard raceways and asphalt pond.

See also Table 5.8.1 for planned pond renovations/upgrades.

## 5.6) Acclimation/release facilities.

Chinook for on-station release are acclimated on Soos Creek water and released from individual ponds directly into the creek.

Fish transferred to Icy Creek Hatchery are reared for approximately 12 months, acclimated on Icy Creek water, and released directly into Icy Creek.

Fish released from Palmer Ponds can be acclimated on either spring water or Green River surface water prior to release.

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

Soos Creek Hatchery is subject to flooding during high flow events, which causes the pump intake screens to become plugged frequently with heavy debris loads. In addition, flood risks

limit the use of eight low-lying, standard (17.5'x95') raceways. Flood waters inundate the lower raceways, which allow the premature release of the fish; they are therefore unusable between November and March. Funding has been provided in 2012 to replace/renovate the existing intake and also construct new ponds necessary for the hatchery to operate properly and in compliance with current requirements (see HGMP section 5.8).

**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.**

*Soos Creek Hatchery* A crew member is on stand-by at all times to monitor hatchery operations and respond to any unexpected events. Facility is equipped with low water alarms and a back-up generator in case of power loss.

*Icy Creek Hatchery* is a satellite facility. An employee is present when needed (feeding times). Water is gravity fed to the pond and there is no need for back-up generator. Facility is equipped with low water alarms.

*Palmer Ponds* are fed by gravity flow spring water.

Fish rearing at all facilities is conducted in compliance with the co-managers Fish Health Policy (WDFW and WWTIT 1998, updated 2006). Adherence to artificial propagation, sanitation and disease control practices defined in the policy should reduce the risk of fish disease pathogen transfers.

The 2012, the Legislature passed a jobs creation bill that provided WDFW with funding for hatchery capital improvements in addition to our capital budget request. At Soos Creek Hatchery, this allowed for the following improvements (see also HGMP section 4).

**Table 5.8.1:** Hatcheries capital improvement projects funded under the "Jobs Now Act" (2012).

| **Project** |
|---|
| Renovate or replace existing intake to meet current fish passage and screening requirements. |
| Construct new hatchery/ incubation building outside the 100 year flood plain. |
| Construct six new 120' X 20" ponds. |
| Demolish north side ponds and current adult handling facilities. |
| Construct new adult handling facilities and ponds. |
| Construct a new incubation settling pond. |
| Construct new two bay pollution abatement ponds. |
| Replace water distribution tower. |
| Replace main supply line to distribution tower. |

# SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

## 6.1) Source.

Adult Chinook salmon collected at Soos Creek, the TPU trap, and potentially Icy Creek and Palmer Ponds traps, representing the extant, Duwamish/Green River native population delineated by the Puget Sound TRT (Ruckelshaus et al. 2006). The intent is to allow hatchery adults surplus to broodstock needs to spawn naturally up to levels sufficient to meet the escapement goal (5,800).

## 6.2) Supporting information.

### 6.2.1) History.

Soos Creek Hatchery Chinook originated from broodstock collected from the main-stem Green River from 1901 through 1924 (Becker 1967). After 1924, sufficient adult returns to the hatchery release site had been established to create a self-sustaining program (SSHAG 2003). Some additional stocks were occasionally imported in the early days of the hatchery operation (e.g., Columbia river-origin Chinook in the 1920s), but genetic analyses (Marshall et al. 1995) indicate that the contribution of these transferred, out-of-basin stocks was not significant.

### 6.2.2) Annual size.

Up to 2,922 adults collected annually for Soos Creek, Icy Creek and Palmer Ponds program releases.

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

Chinook were not consistently mass-marked until 2000. Prior to consistent mass-marking the level of natural-origin fish incorporated into the hatchery brood stock was unknown.

The fall Chinook production at Soos Creek Hatchery is currently managed as an integrated program, which requires annual inclusion of natural-origin fish into hatchery broodstock (see Table 7.4.2). Natural-origin fish are trapped at Soos Creek, Icy Creek, and the TPU trap to incorporate into the broodstock at the Soos Creek Hatchery. Fish resulting from these integrated broodstock management actions will have different release strategies dependent on the number of natural-origin spawners observed in the Green River during the most recent three year period. If an average of 900 or less natural-origin spawners is observed in the mainstem in the three year period, then 3.2-million sub-yearlings will be released at Soos Creek, and 1.0-million sub-yearlings at Palmer Ponds. Preference to release the highly integrated fish will go to Palmer Ponds. If an average of 1,500 or more natural-origin spawners is observed in the mainstem over the last three years, 2.2-million limited integration sub-yearlings will be released from Soos Creek, 1.0-million highly-integrated from Soos Creek, and 1.0-million limited integration released from Palmer Ponds.

**Table 6.2.3.1:** Fall Chinook integration results at Soos Creek Hatchery 2008-2012.

| Year | pNOB | pHOS | PNI |
|---|---|---|---|
| **2008** | 0.07 | 0.35 | 0.17 |
| **2009** | 0.20 | 0.76 | 0.20 |
| **2010** | 0.15 | 0.60 | 0.20 |
| **2011** | 0.08 | 0.54 | 0.13 |
| **2012** | 0.13 | 0.47 | 0.21 |
| **Average** | **0.12** | **0.54** | **0.19** |

Data Source: Hatchery Evaluation and Assessment Team Broodstock Tracking Tables 2013. All pHOS estimates provided by WDFW District 12 Biologist, Aaron Bosworth. 2013.

### 6.2.4) Genetic or ecological differences.

Soos Creek Hatchery fall-run Chinook salmon are genetically similar to naturally spawning Chinook salmon in Newaukum Creek, a tributary to the Green River (Marshall et al. 1995). There appears to be a high level of exchange between the Soos Creek Hatchery stock and the Green River natural population (SSHAG 2003).

### 6.2.5) Reasons for choosing.

The stock was chosen because it is the native Green River stock.

### 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.

Broodstock is selected randomly from adult returns to the trapping sites. All WDFW releases are managed as an integrated program and natural-origin adults are included in the broodstock to keep the hatchery and naturally-produced fish genetically similar, reducing the risk of divergence of the populations.

## SECTION 7. BROODSTOCK COLLECTION

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

Adults

### 7.2) Collection or sampling design.

Broodstock at Soos Creek Hatchery is collected from adults returning to Soos Creek trap throughout entire run. Peak adult returns to the trapping site occur between early-September and mid-October, with the total return extending from August to late-October.

Fish at the TPU trap are collected throughout the duration of the run timing. It is anticipated Palmer Ponds- released fish will return may be collected for broodstock in the future with the goal of supplementing the broodstock taken from the Soos Creek trap.

### 7.3) Identity.

Releases from Soos Creek and Icy Creek facilities have been consistently marked since release year 2000, allowing identification of hatchery-origin fish. Fish that receive a coded-wire tag (CWT) prior to release can be identified by origin and release site. The primary emphasis of the Palmer Ponds Program is to release highly-integrated fish for the purpose of augmenting natural production in the mainstem Green River. These fish will be identifiable with different marks/tags then the Soos Creek or Icy Creek releases.

### 7.4) Proposed number to be collected:

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

Up to 2,922 adults collected annually for Soos Creek, Icy Creek and Palmer Ponds program releases.

#### 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:** Fall Chinook broodstock spawned at Soos Creek Hatchery, by age, sex and origin.

| Year | Adults | | | | Jacks | |
|---|---|---|---|---|---|---|
| | Females | | Males | | | |
| | Hatchery | Natural | Hatchery | Natural | Hatchery | Natural |
| **2000** | 105 | 780 | 103 | 849 | 4 | 3 |
| **2001** | 314 | 646 | 326 | 694 | 0 | 0 |
| **2002** | 191 | 686 | 347 | 526 | 1 | 0 |
| **2003** | 923 | 231 | 747 | 197 | 1 | 0 |
| **2004** | 1,009 | 55 | 979 | 148 | 0 | 0 |
| **2005** | 1,095 | 76 | 1,126 | 193 | 1 | 0 |
| **2006** | 1,150 | 75 | 990 | 180 | 47 | 0 |
| **2007** | 885 | 73 | 811 | 176 | 42 | 10 |
| **2008** | 1,018 | 53 | 912 | 91 | 68 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **2009** | 757 | 106 | 611 | 238 | 57 | 3 |
| **2010** | 1,012 | 112 | 964 | 160 | 26 | 0 |
| **2011** | 1,096 | 58 | 1,053 | 125 | 51 | 10 |
| **Average** | **796** | **246** | **747** | **298** | **25** | **2** |

Source: WDFW Hatchery Headquarters Database 2011. 2011 data is preliminary.

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

The preferred use of surplus adult fish collected at the hatchery are to seed upstream spawning habitat in both upper Soos Creek (up to 1,200 adults) and the mainstem Green River (up to escapement goal of 5,800). Additional surplus adults are then donated to a local food bank, sold to the carcass buyer or used for nutrient enhancement.

### 7.6) Fish transportation and holding methods.

Adults trapped at the TPU trap are transported to Soos Creek Hatchery in a 1,500 gallon tanker truck, equipped with aerators and oxygen tanks (owned and operated by operated by Tacoma Public Utilities). Transportation takes one hour. Transferred adults are kept in 13' circular, covered pond. Surplus fish transferred to the mainstem Green River are transported via tanker truck.

### 7.7) Describe fish health maintenance and sanitation procedures applied.

Standard fish health protocols, as defined in the Co-manager Fish Health Policy (1998, updated 2006) are adhered to. No antibiotics or formalin treatment is applied since fish are held in and in-river trap. The only maintenance is the removal of mortalities.

### 7.8) Disposition of carcasses.

Spawned carcasses are utilized for nutrient enhancement or sold to a carcass buyer. Adults not spawned are either donated to local food banks or sold to the carcass buyer. Live adult surplus to broodstock needs will be allowed to spawn naturally. Pond mortalities are utilized for nutrient enhancement.

### 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.

Fall Chinook released from Soos Creek Hatchery are managed as an integrated program; natural-origin fish are trapped and removed for broodstock. Trapping methods do not generally pose lethal risks to the fish health and trapped natural-origin fish in excess of broodstock needs will be returned to the river.

Due to its extremely steep stream gradient, no anadromous natural-origin salmonid populations have used the watershed upstream of the Icy Creek Hatchery water intake. A temporary trap was installed in 2003 at the mouth of Icy Creek to trap and remove marked hatchery-origin Chinook, returning to the release site. This trap was replaced by a permanent one, which will start operating fall 2012. Eventually this trap may be used to collect Palmer Ponds-reared returning adults for Soos Creek Hatchery broodstock.

## SECTION 8. MATING

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

### 8.1) Selection method.

Chinook for broodstock are selected randomly as they ripen across the entire maturation time frame. All available unmarked fish are spawned when ripe.

Depending upon the magnitude of the returns, the goal is to spawn enough ripe females each spawn day to secure an adequate egg take for the program. If the egg-take goal for the program is met, but later-spawning females are available, eggs will be collected to represent the later portion of the run; these will replace the portion of the eggs collected at the earlier timing. Eggs from natural-origin fish, or fertilized with milt from natural-origin males are not culled.

**8.2) Males.**

All males collected are considered for utilization in the broodstock. Jacks may represent up to 2% of the males used. Males used for spawning are selected randomly from the available spawners.

**8.3) Fertilization.**

Eggs from each female are collected in a separate container and mixed with milt from one male (pairwise spawning). If the male used is not ripe or has very little milt, another male is used to assure fertilization. Eggs mixed with milt are allowed 30-60 seconds for fertilization and then moved to 5-gallon buckets for transportation to the incubation room. There, eggs are moved to the baskets, placed in shallow troughs and water hardened for 1-hour in an iodophor solution of 100 ppm.

**8.4) Cryopreserved gametes.**

Cryopreserved gametes are not used.

**8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.**

Adults are chosen randomly from the available gene pool. Every attempt is made to ensure that the egg-take is representative of the entire fall Chinook run. Both hatchery- and natural-origin fish are included in the broodstock.

In an effort to minimize directed, artificial selection of traits that could negatively affect this listed population, a pair-wise spawning protocol is implemented to maximize the representation of each individual adult into the entire brood.

The effective breeding population size ($N_e$) for the Soos Creek Hatchery program is 9,688, (2,422 adults spawned each year times a generation length of 4 years for Chinook salmon). The genetic diversity and long-term adaptive potential of hatchery salmon populations may be conserved when the Ne is maintained above 200 to 500 individuals (FAO - UN, 1981; Allendorf and Ryman, 1987; Nelson and Soule 1987). Waples (1990) suggested that 100 effective breeders per year (for Chinook salmon with a four year generation length, and Ne of approximately 400 fish). At the Soos Creek facility, the number of effective breeders is much higher than suggested for keeping the genetic diversity and conserve long-term adaptive potential of this hatchery salmon population.

## 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:**

Current egg-take goal (FBD 2012) for the program is 4,100,000. All eggs are collected and incubated at Soos Creek Hatchery. Additional 1,000,000 eggs may be collected for Palmer Ponds program contingent upon Co-manager agreement.

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

**Table 9.1.1.1:** Survival from egg take to ponding, Soos Creek fall Chinook, 2000-2011.

| Brood Year | Eggs Collected | Survival Rates (%) | |
|---|---|---|---|
| | | Green-to-Eyed Up | Eyed-Up-to-Ponding |
| **2000** | 4,664,800 | 95.6 | 95.0 |
| **2001** | 4,722,000 | 89.0 | 95.0 |
| **2002** | 4,554,000 | NA | NA |
| **2003** | 5,147,000 | 91.7 | 95.0 |
| **2004** | 4,805,000 | 93.4 | 95.0 |
| **2005** | 4,624,260 | 95.2 | 95.0 |
| **2006** | 4,616,000 | 94.4 | 95.0 |
| **2007** | 4,040,000 | 93.4 | 95.0 |
| **2008** | 4,107,000 | 95.0 | 95.0 |
| **2009** | 4,040,000 | 94.5 | 95.0 |
| **2010** | 4,992,500 | 93.9 | 95.0 |
| **2011** | 5,149,040 | 94.3 | 96.0 |
| **Average** | **4,621,800** | **93.7** | **95.1** |

Source Data: Hatchery Records, 2012.

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

If enough eggs for the program needs are secured before the end of the run time and later-spawning females are available, eggs are collected to represent late-run, and replace portion of the eggs collected at the earlier time. Otherwise no surplus eggs are collected.

### 9.1.3) Loading densities applied during incubation.

Fertilized eggs are placed in baskets and in shallow troughs at 20,000 to 25,000 per basket. Once eyed (600 TU) egg are moved to the trays at 6,000 per tray and placed in deep troughs at about 26,000 per section.

### 9.1.4) Incubation conditions.

All eggs are incubated at Soos Creek Hatchery using surface water (Soos Creek); flow in shallow troughs is 10 gpm, and 12 gpm in deep troughs. Water temperature ranges from 32-50ºF. Baskets are periodically flushed to remove accumulated silt since Soos Creek water is subject of heavy silt loads.

### 9.1.5) Ponding.

Ponding occurs when the fry are 95%+ buttoned-up (late January, February). Fish are moved from troughs into 10'x80'x4' raceways and reared on surface water.

### 9.1.6) Fish health maintenance and monitoring.

All eggs are fertilized and water hardened in an iodophor solution. Fungus in troughs is controlled by formalin drip, (15-minute injection per day at a target dose of 1,667-ppm formalin), throughout incubation to just prior to hatch. At approximately 600 TU's eggs are shocked and dead eggs removed prior to laying eggs down to hatch. Fry loss is picked at the time of ponding and then as needed.

### 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.

Water temperatures are monitored. Silt deposit is monitored and removed as needed.

All incubation systems are alarmed with 24-hr/day monitoring and an emergency backup generator to prevent egg and fish loss caused by disruptions in water flow.

## 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:** Fry-to-sub-yearling/yearling survival rates of Soos Creek fall Chinook 2000-2011.

| Brood Years | Fry-to-Sub-yearling Soos Creek Hatchery | Sub-yearling-to-Smolt | |
|---|---|---|---|
| | | Icy Creek Hatchery | Palmer Ponds |
| **2000** | 93.0 | 96.0 | NA |
| **2001** | 92.0 | 95.0 | NA |
| **2002** | NA | 87.0 | NA |
| **2003** | 96.0 | 87.0 | NA |
| **2004** | 96.0 | 68.0 | NA |
| **2005** | 98.0 | 95.0 | NA |
| **2006** | 97.0 | 92.0 | NA |
| **2007** | 96.0 | 98.0 | NA |
| **2008** | 97.0 | 95.0 | NA |
| **2009** | 96.0 | 99.0 | NA |
| **2010** | 75.0 | NA | 99.0 |
| **2011** | 86.0 | NA | 92.5 |
| **Average** | **92.9** | **91.2** | **95.7** |

Data Source: Hatchery Records 2012; Muckleshoot Tribe / HatPro data base 2012.

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

Guidelines for rearing procedures (Piper et al. 1982), and fish health maintenance (Co-managers Fish Health Policy 1998, updated 2006), are followed.

Fish rearing densities are maintained at maximum of 3.3lbs/gpm to split and 5lbs/gpm at release.

### 9.2.3) Fish rearing conditions

Chinook are initially reared in 10'x80'x4' raceways. When about 225 fpp (usually in March), fish are marked and divided into two release groups. Fish to be released at Icy Creek are kept separately in the same raceways till transfer in late April- mid-May (180 fpp). They stay at an Icy Creek rearing pond (surface water) for approximately 12 months, until the following year release.

Fish to be released at Soos Creek are moved to 1/3 acre asphalt pond where they are kept till release in June (creek water). Oxygen levels are monitored and range between 8-10ppm at the outflow.

Fish collected for the Palmer Ponds program, are marked, transported to Palmer in April and May, and reared in an earthen pond.

**Table 9.2.3.1:** Average monthly surface water temperature (°F) at Soos Creek, Icy Creek and Palmer Ponds.

| Month | Soos Creek (ºF) | Icy Creek (ºF) | Palmer Ponds (ºF) |
|---|---|---|---|
| **January** | 41 | 47 | 47 |
| **February** | 41 | 47 | 47 |
| **March** | 45 | 48 | 47 |
| **April** | 49 | 48 | 47 |

| | | | |
|---|---|---|---|
| **May** | 51 | 48 | 47 |
| **June** | 56 | 49 | 47 |
| **July** | 58 | 49 | 47 |
| **August** | 58 | 49 | 47 |
| **September** | 56 | 49 | 47 |
| **October** | 50 | 49 | 47 |
| **November** | 43 | 48 | 47 |
| **December** | 41 | 48 | 47 |

Source: Hatchery Records 2012.

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

**Table 9.2.4.1:** Average size (fpp), by month, of juvenile fall Chinook reared at Soos Creek and Icy Creek Hatcheries, and Palmer Ponds.

| Month | Average Size (fpp) | |
|---|---|---|
| | Sub-yearlings | Yearlings |
| **January** | 1,200 | 1,200 |
| **February** | 500 | 500 |
| **March** | 250 | 250 |
| **April** | 100 | 100 |
| **May** | 80 | 125 |
| **June** | 70 | 65 |
| **July** | ---- | 45 |
| **August** | ---- | 30 |
| **September** | ---- | 25 |
| **October** | ---- | 22 |
| **November** | ---- | 19 |
| **December** | ---- | 17 |
| **January** | ---- | 16 |
| **February** | ---- | 14 |
| **March** | ---- | 12 |
| **April** | ---- | 10 |

Source: Hatchery Records 2012.

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

Not available.

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

Feed type is a salmon formulation of dry crumbles or pellets. Feed brand varies with the contract price. Initially, fish are fed at a rate approximating 2% BW/day. Final feed rates average $\leq$1% BW/day. The maximum feed rate goal is approximately 0.1lb feed/gpm inflow. Feed conversions depend upon the diet and formulation but range between 0.8 - 1.1:1.

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

Fish health is monitored on a daily basis by hatchery staff and at least monthly by a state Fish Health Specialist. At the Palmer Ponds, a Tribal Fish Health pathologist monitors fish health. Hatchery personnel carry out treatments prescribed by the FHS. Procedures are consistent with the Co-Manager's Fish Health Policy (1998, updated 2006).

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

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

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

No "NATURES" type rearing methods are applied through the program. The fish reared at Palmer Ponds receive semi-natural rearing via residing in earthen ponds with vegetation.

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

All reasonable and prudent measures are employed to minimize rearing and incubation losses. These include the use of high quality feeds for rearing, rearing densities and loadings that conform to best management practices and frequent fish health inspections.

## SECTION 10. RELEASE

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

### 10.1) Proposed fish release levels.

**Table 10.1.1:** Proposed number and size at release, Soos Creek fall Chinook.

| Age Class | Maximum Number | Size (fpp) | Release Date | Location |
|---|---|---|---|---|
| **Sub-yearling** | 4,200,000 | 80 | June | Green River |
| **Yearling** | 300,000 | 10 | April* | |

WDFW, Future Brood Document 2012.
Note: 10 fpp ~ 155 mm fork length

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

| | | | |
|---|---|---|---|
| **Stream, river, or watercourse:** | Big Soos Creek (09.0072) | Unnamed Tributary (09.0147) | Icy Creek (09.010) |
| **Release point:** | Big Soos Creek, RM .8 | Palmer Ponds, RM 56.1 | Icy Creek at RM 48.3 |
| **Major watershed:** | Green River | | |
| **Basin or Region:** | Puget Sound | | |

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

**Table 10.3.1:** Actual number and size at release, Soos Creek fall Chinook, 2000-2011.

| Release Year | Soos Creek | | | Icy Creek | | | Palmer Ponds | | |
|---|---|---|---|---|---|---|---|---|---|
| | Sub-yearlings | Avg. size (fpp) | CV | Yearlings | Avg. size (fpp) | CV | Sub-yearlings | Avg. size (fpp) | CV |
| **2000** | 3.096,413 | 77 | NA | 146,610 | 9 | NA | ----- | ----- | |
| **2001** | 3,395,665 | 77 | 7.9 | 241,300 | 8 | 9.3 | ----- | ----- | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **2002** | 3,502,054 | 76 | 6.5 | 309,000 | 9 | 11.1 | ----- | ----- | |
| **2003** | 3,036,900 | 81 | 8.2 | 324,000 | 10 | 11.8 | ----- | ----- | |
| **2004** | 3,292,700 | 80 | 7.8 | 280,000 | 10 | 11.8 | ----- | ----- | |
| **2005** | 3,423,279 | 74 | 8.6 | 280,663 | 10 | 10.3 | ----- | ----- | |
| **2006** | 3,568,000 | 78 | 6.2 | 219,978 | 6 | 12.1 | ----- | ----- | |
| **2007** | 3,397,000 | 76 | 8.4 | 330,000 | 12 | 9.1 | ----- | ----- | |
| **2008** | 3,230,306 | 80 | 6.2 | 297,425 | 7 | 8.2 | ----- | ----- | |
| **2009** | 3,456,867 | 77 | 7.5 | 316,400 | 12 | 10.9 | ----- | ----- | |
| **2010** | 3,220,642 | 83 | 8.2 | 327,400 | 10 | 7.3 | 980,000 | 53 | NA |
| **2011** | 2,889,713 | 86 | 9.7 | 299,928 | 9 | NA | 925,000 | 45 | NA |

Source: WDFW Hatchery Plants Database and Hatchery Headquarters Database 2012; Muckleshoot Tribe / HatPro Database 2012.

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

Screens are pulled and sub-yearlings are forced-released directly into the Soos Creek in early June. Any attempts to release later have been met by higher water temperatures and low flows, which have accentuated the problem with *Furunculosis.*

Icy Creek yearlings are allowed to volitionally migrate from the pond through the removal of pond screens starting in April (see HGMP sections 1.8 or 2.2.3 for April release information). After two weeks, any fish remaining in the pond will be "force-released" using a seine in order to make pond space for the next year's group of fish.

The fish reared at Palmer Ponds are volitionally released by slowly lowering the pond depth over a week period.

**Table 10.4.1:** Number and size at release, Soos Creek fall Chinook, 2000-2011.

| Release Year | Sub-yearlings (Soos) | | Yearlings (Icy) | | Sub-yearlings (Palmer) | |
|---|---|---|---|---|---|---|
| | **Release Range** | **Release Type** | **Release Range** | **Release Type** | **Release Range** | **Release Type** |
| **2000** | 5/9-5/31 | Forced | 4/24-4/30 | Volitional | ----- | ----- |
| **2001** | 5/18-6/11 | Forced | 5/1-5/4 | Volitional | ----- | ----- |
| **2002** | 5/23-6/7 | Forced | 5/21 | Volitional | ----- | ----- |
| **2003** | 5/22-5/29 | Forced | 5/1-5/2 | Volitional | ----- | ----- |
| **2004** | 5/13-5/31 | Forced | 5/1-5/3 | Volitional | ----- | ----- |
| **2005** | 5/2-5/31 | Forced | 5/3-5/13 | Volitional | ----- | ----- |
| **2006** | 5/5-5/30 | Forced | 4/18-4/30 | Volitional | ----- | ----- |
| **2007** | 5/22-6/6 | Forced | 5/1 | Volitional | ----- | ----- |
| **2008** | 5/24-6/10 | Forced | 4/21 | Volitional | ----- | ----- |
| **2009** | 5/24-6/12 | Forced | 4/15-5/1 | Volitional | ----- | ----- |
| **2010** | 5/7-6/11 | Forced | 4/15-4/23 | Volitional | 7/1-7/15 | Volitional |
| **2011** | 5/16-5/23 | Forced | 5/6 | Forced | 7/1-7/15 | Volitional |

Source: WDFW Hatchery Plants Database and Hatchery Headquarters Database 2011; Muckleshoot Tribe / HatPro Database 2011.

## 10.5) Fish transportation procedures, if applicable.

Fish are transferred to the Icy Creek Hatchery in a 1,500-gallon truck equipped aerators and oxygen tanks. The loadings are no more than 0.5 pound of fish per gallon of water. The transportation time is about 30 minutes. Fish are transferred to the Palmer Ponds in a 1,000 gallon truck equipped with aerators. The loadings are no more than 0.5 pound of fish per gallon of water. The transportation time is about 45 minutes.

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

Sub-yearlings released from Soos Creek Hatchery are reared till release entirely on Soos Creek water. Fish transferred to Icy Creek are reared till release (approximately 12 months) on Icy Creek water. Fish transferred to Palmer are reared to release (approximately 3 months) on Palmer Ponds water.

## 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/location, Soos Creek fall Chinook program.

| Brood Year/ Escapement level | Mark Type | Releases | | |
|---|---|---|---|---|
| | | Sub-yearlings (Soos) | Yearlings (Icy) | Sub-yearlings (Palmer) |
| 2011 | AD only | 2,800,000 | 300,000 | 950,000 |
| | AD+CWT | 200,000 | ----- | 50,000 |
| | CWT only | 200,000 | ----- | ----- |
| If 3-year average of natural origin spawners drops below 900 | AD only | 2,800,000 | 300,000 | ----- |
| | AD+CWT | 200,000 | ----- | ----- |
| | Otolith marked | ----- | ----- | 1,000,000 |
| | CWT only | 200,000 | ----- | ----- |
| If 3-year average of natural origin spawners rises above 1,500 | AD only | 2,200,000 | 300,000 | 1,000,000 |
| | AD+CWT | 200,000 | ----- | ----- |
| | CWT only | 200,000 | ----- | ----- |
| | BWT only | 600,000 | ----- | ----- |

Source: WDFW Future Brood Document 2012.

The Soos Creek Hatchery fall Chinook sub-yearling program is used as a Double-Index Tag (DIT) group. Of the 3,200,000 released, 2,800,000 are mass marked (adipose-fin clip only), 200,000 adipose-fin clip/coded-wire tagged (Ad + CWT) and 200,000 CWT-only. Sampling of mass-marked adult returns can provide NOR/HOR ratios on the spawning grounds in the Green River watershed. The DIT group can serve as an index group for wild sub-yearling fall Chinook as well as providing data on catch contributions, run timing, total survival, migration patterns and straying into other watersheds.

Yearling releases from Icy Creek are currently 100% mass-marked with an adipose fin-clip.

The 2010 brood from Palmer Ponds were ad-marked only, but starting in 2011 a percentage will have CWTs.

Beginning with the 2012 Brood year, a new management strategy will begin, based on observed numbers of natural-origin spawners. If an average of 900 or less natural-origin spawners is observed in the three year period, then 3.2-million sub-yearlings will be released at Soos Creek Hatchery, and 1.0-million sub-yearlings at Palmer Ponds. Preference to release the highly-integrated fish will go to Palmer Ponds. If an average of 1,500 or more natural-origin spawners is observed in the mainstem over the last three years, 2.2-million limited integration sub-yearlings will be released from Soos Creek, 1.0-million highly-integrated from Soos Creek, and 1.0-million limited integration released from Palmer Ponds.

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

Egg take is carefully managed to minimize the likelihood of surplus eggs or fry.

In the past, significant numbers of surplus fish were planted as fry.

### 10.9) Fish health certification procedures applied pre-release.

Prior to Soos and Icy release, fish health is monitored and the fish health status of the population is certified by a WDFW Fish Health Specialist. Fish reared at Palmer Ponds receive a fish health certification prior to release by a NW Indian Fish Commission pathologist.

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

*Soos Creek Hatchery*. During severe flood events the screens are generally not pulled because floodwaters rise to the point where they breach the ponds. Past experience has shown that the fish tend to lie on the bottom of the pond during flooding events and only those that are inadvertently swept out are able to leave.

*Icy Creek Hatchery*. Flooding is not a problem at this facility, and no emergency procedures have been developed. During severe drought conditions, fish may be moved to Soos Creek if water and space are available.

*Palmer Ponds.* Flooding has not historically caused fish loss at this facility. Palmer Ponds is supplied with gravity-fed spring water, however fish may be released early to prevent loss.

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

The production and release of only smolts through fish culture and volitional release practices fosters rapid seaward migration with minimal delay in the rivers, limiting interactions with listed Chinook. To minimize the risk of residualization and impact upon natural fish, sub-yearlings are released in June (80 fpp) and yearling are released in April (10 fpp), which coincides in time with before and after the peak of natural fish migration.

Fish are visually monitored for smolting activity to ensure that they are released fully smolted in order to actively migrate downstream. In addition, a coefficient of variation (CV) for length at release of 10.0% or less is desired in order to increase the likelihood that most of the fish are ready to migrate (Fuss and Ashbrook 1995). The average CV was 8.0% for sub-yearlings for release years 2007-2011, and 9.5% for yearlings for release years 2006-2010.

Chinook salmon reared to the yearling life stage have a higher likelihood for domestication effects relative to fry, sub-yearling (zero-age) release groups. The collection of broodstock to sustain the Icy Creek program at Soos Creek reduces the risk of genetic diversity and fitness loss in the hatchery population that might occur through continued propagation of yearling-origin adults. The recently initiated selective removal of returning adult hatchery-origin fish at Icy Creek will help reduce the risk of interbreeding, and genetic diversity and fitness reduction effects to the Green River natural-origin Chinook population.

## SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

Elements of the annual Monitoring and Evaluation plan for this program are identified in HGMP section 1.10. The monitoring program is designed to determine whether the hatchery is providing the benefits intended, while also minimizing or eliminating the risks inherent in the program. A key tool in any monitoring program is having a mechanism to identify each hatchery production group.

Each production group is identified with distinct otolith marks, adipose fin-clips, coded-wire tags, blank wire tags or other identification methods as they become available, to allow for evaluation of each particular rearing and/or release strategy. This will allow for selective harvest on hatchery

stocks when appropriate, monitoring of interactions of hatchery and wild fish wherever they co-mingle in riverine, estuarine and marine habitats and assessment of the status of the target population. WDFW shall monitor annual salmon escapement to hatchery release sites within the watershed and in natural spawning areas to estimate the number and proportions of tagged, un-tagged and marked fish escaping each year. WDFW will also monitor straying of hatchery salmon to other Puget Sound watersheds through mark recovery programs conducted during routine spawning ground surveys and sampling at other Puget Sound hatcheries.

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

1. WDFW mass marks (adipose fin-clip) 100% of the sub-yearling release from the Soos Creek Hatchery, of which 6.25% are double-index tagged (see HGMP section 10.7). This allows monitoring and evaluation of Chinook escapement to the Green River, which enables WDFW to assess the NOR/HOR spawning ground ratios and assessment of the status of the target population.
2. WDFW monitors salmon escapement to the natural spawning areas above and below the hatchery release sites to estimate the number of tagged, untagged, and marked fish escaping each year. This will allow for assessment of the status of the target population and the success of the program in achieving restoration objectives. Also, WDFW will continue to monitor smolt emigration rate post-release, timing of emigration and predation assessment via smolt trapping (Seiler et al. 2002).
3. The Co-managers sample annually and monitor adult salmon and steelhead in fisheries, in hatchery returns, and on the spawning grounds. Sampling includes collection of data on fish size (length and/or weight), age (scales and/or otoliths), hatchery vs. natural-origin (scales, otoliths, fin clips and/or coded wire tags), and stock origin (DNA samples). Monitoring includes catch and both hatchery and spawning ground escapement estimation (live fish counts, carcass counts and/or redd sampling/monitoring).
4. WDFW's Wild Salmon Production/Evaluation Unit (WSPE) operates a juvenile out-migrant trap at in the Green River mainstem at (RM 33) RKm 55, above the confluence with Soos Creek. This trap enumerates Chinook, coho, chum, pink, and steelhead, as well as facilitates the collection of biological data on age, size and timing. This juvenile trap can encounter hatchery fish during the spring outmigration. WSPE publishes their results annually.

   For one year (2000), WSPE operated a second trap in Soos Creek, just upstream of the Soos Creek Hatchery. This location provided wild juvenile production monitoring while reducing encounters with hatchery releases. In 2012, the Muckleshoot Tribe began operating a juvenile out-migrant trap in Soos Creek, upstream of the hatchery, as the first year of a three-year monitoring program.

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

Funding is currently available to mass mark and coded-wire tag (see HGMP section 10.7) the entire program.

Biological staff continues to monitor the spawning grounds to determine natural spawning escapement and its composition. Additional funding will be required to expand assessment efforts and biological collections.

WSPE juvenile production monitoring receives local funding for their trap operations.

**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.**

Not applicable

**12.2) Cooperating and funding agencies.**

Not applicable

**12.3) Principle investigator or project supervisor and staff.**

Not applicable

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

Not applicable

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

Not applicable

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

Not applicable

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

Not applicable

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

Not applicable

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

Not applicable

**12.10) Alternative methods to achieve project objectives.**

Not applicable

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

Not applicable

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

Not applicable

## SECTION 13. ATTACHMENTS AND CITATIONS


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## SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

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

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

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

> "The department is authorized by the USFWS for certain activities that may result in 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.

**Green (Duwamish) 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 Green River is considered critical habitat for bull trout and is thought to serve rearing, migration and overwintering purposes (USFWS 2004). Bull trout have been document in the Green River as far upstream as RM 41 in recent years and are consistently reported in the lower Duwamish River. It is unclear whether these fish represent a local spawning population or transients from other systems as there is no information on timing or distribution of spawning in the basin if any occurs (SaSI 2004).

**Habitat**--The Green River watershed has been heavily impacted by human activities, which include logging, road construction, flood control and municipal water supply diversion dams, agricultural development, river channelization, intensive industrial and residential development, and estuarine dredging and filling. Historically the contribution of the White and Black Rivers which accounted for two-thirds of the flow of the Duwamish would have greatly increased the amount of favorable bull trout habitat in the system. It is unknown if the current habitat can support bull trout, but suitable habitat may still be available in the upper watershed above Howard Hanson Dam. It is not known if bull trout occupied the upper watershed in the past; they do not appear to be present now (Watson and Toth 1994).

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

**Listed or candidate species:**
*"No effect" for the following species:*
Marbled murrelet (*Brachyramphus marmoratus*) –Threatened [critical habitat designated]
Canada Lynx (*Lynx canadensis*) –Threatened [critical habitat designated]
Gray Wolf (*Canis lupus*) –Threatened
Grizzly bear (*Ursus arctos horribilis*) –Threatened
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.

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

### 15.4 Actions taken to minimize potential effects.

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

### 15.5 References

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

| **Listed species affected:** Spring Chinook *(Oncorhynchus tshawytscha)* | **ESU/Population:** Puget Sound / Green Fall Chinook | | **Activity:** Soos Creek Fall Chinook Program |
|---|---|---|---|
| **Location of hatchery activity:** Soos Creek Hatchery RM 1.0 Big Soos Creek (09.0072) | **Dates of activity:** August- June | | **Hatchery program operator:** WDFW |
| **Type of Take** | **Annual Take of Listed Fish By Life Stage *(Number of Fish)*** | | | |
| | **Egg/Fry** | **Juvenile/Smolt** | **Adult** | **Carcass** |
| **Observe or harass a)** | - | - | Up to 2,164 | - |
| **Collect for transport b)** | - | - | Up to 795 | - |
| **Capture, handle, and release c)** | - | - | Up to 580 | |
| **Capture, handle, tag/mark/tissue sample, and release d)** | - | - | - | - |
| **Removal (e.g. broodstock) e)** | - | - | Up to 2,164 | - |
| **Intentional lethal take f)** | - | - | Up to 1,948 | - |
| **Unintentional lethal take g)** | 450,000 | 570,000 | Up to 216 | - |
| **Other Take (specify) h)** | - | - | | - |

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

***Instructions:***

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

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

| **Listed species affected:** Steelhead *(Oncorhynchus mykiss)* | **ESU/Population:** Puget Sound/ Green River Steelhead | | **Activity:** Soos Creek Fall Chinook Sub-yearling Program |
|---|---|---|---|
| **Location of hatchery activity:** Soos Creek Hatchery RM 1.0 Big Soos Creek (09.0072) | **Dates of activity:** August- June | | **Hatchery program operator:** WDFW |

| **Type of Take** | **Annual Take of Listed Fish By Life Stage *(Number of Fish)*** | | | |
|---|---|---|---|---|
| | **Egg/Fry** | **Juvenile/Smolt** | **Adult** | **Carcass** |
| **Observe or harass a)** | - | - | - | - |
| **Collect for transport b)** | - | - | - | - |
| **Capture, handle, and release c)** | - | - | | - |
| **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)** | - | - | - | - |

*See summer, winter and late winter Soos Creek HGMP's take tables.

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.

## Attachment 1. Definition of terms referenced in the HGMP template.

Augmentation - The use of artificial production to increase harvestable numbers of fish in areas where the natural freshwater production capacity is limited, but the capacity of other salmonid habitat areas will support increased production. Also referred to as "fishery enhancement".

Critical population threshold - An abundance level for an independent Pacific salmonid population below which: depensatory processes are likely to reduce it below replacement; short-term effects of inbreeding depression or loss of rare alleles cannot be avoided; and productivity variation due to demographic stochasticity becomes a substantial source of risk.

Direct take - The intentional take of a listed species. Direct takes may be authorized under the ESA for the purpose of propagation to enhance the species or research.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the Endangered Species Act). A population will be/is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery population - A population that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility.

Hazard - Hazards are undesirable events that a hatchery program is attempting to avoid.

Incidental take - The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

Integrated harvest program - Project in which artificially propagated fish produced primarily for harvest are intended to spawn in the wild and are fully reproductively integrated with a particular natural population.

Integrated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), and fish produced are intended to spawn in the wild or be genetically integrated with the targeted natural population(s). Sometimes referred to as "supplementation".

Isolated harvest program - Project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Isolated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), but the fish produced are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Mitigation - The use of artificial propagation to produce fish to replace or compensate for loss of fish or fish production capacity resulting from the permanent blockage or alteration of habitat by human activities.

Natural fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with *natural origin recruit (NOR).*

Natural origin recruit (NOR) - See *natural fish* .

Natural population - A population that is sustained by natural spawning and rearing in the natural habitat.

Population - A group of historically interbreeding salmonids of the same species of hatchery, natural, or unknown parentage that have developed a unique gene pool, that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics. This term is synonymous with stock.

Preservation (Conservation) - The use of artificial propagation to conserve genetic resources of a fish population at extremely low population abundance, and potential for extinction, using methods such as captive propagation and cryopreservation.

Research - The study of critical uncertainties regarding the application and effectiveness of artificial propagation for augmentation, mitigation, conservation, and restoration purposes, and identification of how to effectively use artificial propagation to address those purposes.

Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored.

Stock - (see “Population”).

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Viable population threshold - An abundance level above which an independent Pacific salmonid population has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

## Attachment 2. Age class designations by fish size and species for salmonids released from hatchery facilities.

**(Generally from Washington Department of Fish and Wildlife, November, 1999).**

| | SPECIES/AGE CLASS | Number of fish/pound | SIZE/CRITERIA Grams/fish |
|---|---|---|---|
| X | Chinook Yearling | <=20 | >=23 |
| X | Chinook (Zero) Sub-Yearling | >20 to 150 | 3 to <23 |
| X | Chinook Fry | >150 to 900 | 0.5 to <3 |
| X | Chinook Unfed Fry | >900 | <0.5 |
| X | Coho Yearling 1/ | <20 | >=23 |
| X | Coho Sub-yearling | >20 to 200 | 2.3 to <23 |
| X | Coho Fry | >200 to 900 | 0.5 to <2.3 |
| X | Coho Unfed Fry | >900 | <0.5 |
| X | Chum Fry | <=1000 | >=0.45 |
| X | Chum Unfed Fry | >1000 | <0.45 |
| X | Sockeye Yearling 2/ | <=20 | >=23 |
| X | Sockeye Sub-yearling | >20 to 8000 | 0.6 to <23 |
| X | Sockeye Fall Releases | >150 | >2.9 |
| X | Sockeye Fry | >800 to 1500 | 0.3 to <0.6 |
| X | Sockeye Unfed Fry | >1500 | <0.3 |
| X | Pink Fry | <=1000 | >=0.45 |
| X | Pink Unfed Fry | >1000 | <0.45 |
| X | Steelhead Smolt | <=10 | >=0.45 |
| X | Steelhead Yearling | <=20 | >=23 |
| X | Steelhead Fry | >20 to 150 | 3 to <23 |
| X | Steelhead Unfed Fry | >150 | <3 |
| X | Cutthroat Yearling | <=20 | >=23 |
| X | Cutthroat Sub-yearling | >20 to 150 | 3 to <23 |
| X | Cutthroat Fry | >150 | <3 |
| X | Trout Legals | <=10 | >=0.45 |
| X | Trout Fry | >10 | <0.45 |

1/ Coho yearlings defined as meeting size criteria and 1 year old at release, and released prior to June 1st.
2/ Sockeye yearlings defined as meeting size criteria and 1 year old.