HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Hamma Hamma Fall Chinook Supplementation Program
Species or Hatchery Stock:	Hamma Hamma Fall Chinook (*Oncorhynchus tshawytscha*) George Adams Hatchery Fall Chinook
Agency/Operator:	Long Live the Kings Hood Canal Salmon Enhancement Group Washington Department of Fish and Wildlife
Watershed and Region:	Hood Canal / Puget Sound
Date Submitted:	
Date Last Updated:	January 16, 2013

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SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Hamma Hamma Fall Chinook Restoration.

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

Hamma Hamma fall Chinook (*Oncorhynchus tshawytscha*) – Re-affirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448).

George Adams (Purdy Creek) fall Chinook (*Oncorhynchus tshawytscha*) – Re-affirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448).

1.3) Responsible organization and individuals

Program,Contact

Name (and title): Michael Schmidt, Director of Fish Programs
Agency or Tribe: Long Live the Kings (LLTK)
Address: 1326 5th Ave. Ste. 450, Seattle, WA 98101
Telephone: 206-382-9555 x27
Fax: (206) 382-9913
Email: mschmidt@lltk.org

WDFW Hatchery Operations Staff Lead Contact

Name (and title): Randy Aho, Region 6 Hatchery Operations Manager
Address: 48 Devonshire Road, Montesano, WA 98563
Telephone: (360) 249-4628
Fax: (360) 249-1229
Email: Randy.Aho@dfw.wa.gov

WDFW Fish Management Staff Lead Contact

Name (and title): Mark Downen, District 15 Biologist
Agency or Tribe: Washington Department of Fish and Wildlife
Address: 600 Capitol Way North, Olympia, WA 98501-1091
Telephone: (360) 202-7005
Fax: (360) 427-2107
Email: Mark.Downen@dfw.wa.gov

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

The *U.S. Fish and Wildlife Service* (*USFWS*) provides funding, project planning and overview.

The *Point No Point Treaty Council* (*PTPTC*) includes the *Port Gamble S'Klallam* and *Jamestown S'Klallam tribes*, and provides project planning and overview, data collection and staff;

The *Skokomish Tribe* provides project planning, data collection and staff.

The Hood Canal Salmon Enhancement Group periodically provides staff support and participates in planning discussions; and the Hood Canal Coordinating Committee participates in planning discussions.

Long Live The Kings (*LLTK*) operates the projects juvenile out-migration trap on the Hamma Hamma River.

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

Funding Sources	Operational Information
LLTK: USFWS, LLTK Private Donations	Full time equivalent staff – 2.0 Annual operating cost (dollars) - $172,000

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

Broodstock Collection; Adult holding; Spawning

George Adams Hatchery: Located on Purdy Creek (WRIA 16.0005) at RM 1.0; tributary to the lower Skokomish River (WRIA16.0001), which flows into Hood Canal in southwestern Puget Sound near Union, Washington.

John Creek Conservancy Site: Located at RM 2.0 on John Creek (WRIA 16.0253), tributary to the Hamma Hamma River at R.M. 1.4

Incubation; Early Rearing: George Adams Hatchery

Rearing; Acclimation and Release Site: John Creek Conservancy Site

1.6) Type of program.

Integrated recovery.

1.7) Purpose (Goal) of program.

Restoration. The goal of this program is to restore a healthy, natural, self-sustaining population of fall Chinook to the Hamma Hamma River (SSHAG 2003).

1.8) Justification for the program.

Spawning escapement of Chinook in the Hamma Hamma River has been low for a relatively long period of time. Restoration through the conservancy site began in 1995. The intent is that this program will be of short duration (12 years maximum) and would be conducted in a manner that does not jeopardize the restoration of ESA-listed Chinook in Hood Canal. In July 2009 it was determined by the Chinook Technical Working Group that the program would be extended through brood year 2012, at which time there would be enough data available to evaluate the program's effectiveness and decide how to proceed (see **Attachment 4**).

Objective 1: Restore and maintain population comprised of naturally spawning Chinook on the Hamma Hamma River.

Objective 2: Boost the numbers of naturally-produced Chinook in the Hamma Hamma River using Chinook adults returning to the Hamma Hamma River and George Adams Hatchery as the donor stocks. Foster the recovery and development of the Chinook stock adapting to the Hamma Hamma River by reducing the use of George Adams Hatchery Chinook and transitioning to the use of Hamma Hamma Chinook as broodstock. Produce sub-yearlings for release into the Hamma Hamma River (with fry from each of the Hamma Hamma and/or George Adams donor stocks, as appropriate – see HGMP section 6.0).

Objective 3: Monitor and evaluate the effectiveness of the restoration program (see HGMP section 1.10). Report the results of the program each year.

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

Table 1.8.1: Summary of risk aversion measures for the Hamma Hamma Chinook program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.1	The water source at John Creek is several groundwater springs and is specific pathogen-free; the water quality is consistent in temperature and amount with year around temperature ranging from 46 - 50 degrees.
Intake Screening	4.2	All intakes are screened.

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Effluent Discharge	4.2	The John Creek facility will produce a relatively small amount of fish each year, and well under the 20,000 pounds per year criteria set by WDOE as the limit for concern regarding hatchery effluent discharge effects and for the requirement for an NPDES permit.
Broodstock Collection & Adult Passage	2.2.3,7.2, 7.9	Up to 30 pairs of listed Chinook are collected for broodstock. Protocols and guidelines set forth by WDFW and the tribes shall be followed to ensure minimal harm to listed fish; fish not used as broodstock, returned to the Hamma Hamma River.
Disease Transmission	2.2.3, 9.2.7	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, life-history stage (smolts), and location to foster rapid downstream migration to marine waters.

Note: For Broodstock collection and facilities info see: George Adams Fall Chinook HGMP, Long Live the Kings- Lilliwaup Summer Chum HGMP, and **Attachments 1, 4 and 5**.

1.9) List of program "Performance Standards".

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

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

Table 1.10.1: "Performance Indicators" addressing benefits.

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP updated and re-submitted to NOAA with significant changes or under permit agreement.
3.3.1 Hatchery program contributes to an increasing number of spawners returning to natural spawning areas.	Increasing total annual abundance of spawners.	Annual natural spawning based on redd counts. Fish origin determined from expanded mark/CWT tag recovery estimates. and otolith analysis
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.	100% CWT releases as of BY 2008. Annual estimates of mass-mark rate otolith-marking.
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in	Collection of broodstock is done randomly throughout the entire	Annual run timing, age and sex composition and spawning escapement timing data are

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proportions approximating the timing and age distribution of population from which broodstock is taken.	return period. Adhere to WDFW spawning guidelines. (Seidel 1983; Schroder and Ames 2004).	collected.
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; Schroder and Ames 2004).	Apply minimal monitoring standards in the hatchery: food conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV).
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Program is designed to help achieve the end goal of conserving and stabilizing natural salmon populations.	Annual estimates of total stock abundance and productivity monitored towards recovery objective. An overall program review is performed by program operators.

Table 1.10.2) "<u>Performance Indicators" addressing risks.</u>

Risks		
Performance Standard	**Performance Indicator**	**Monitoring and Evaluation**
3.1.3 Program addresses ESA responsibilities.	Approved (pending) HGMP.	HGMP is updated to reflect any major changes in program and resubmitted to NOAA fisheries.
3.2.2 Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	All hatchery production is identifiable in some manner (otolith, fin-marks, CWT, etc.) consistent with information needs.	Differentially mark all hatchery-origin fall Chinook fry using otolith (thermal) marking (with unique marks for the progeny of returns to the Hamma vs. George Adams Hatchery) and 100% CWT to allow for distinction from natural-origin fish upon return as adults on the spawning grounds.
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.	Monitor operation of adult collecting operations, ensuring compliance with established broodstock collection protocols for each station. Monitor timing, duration, composition, and magnitude of each run at each adult collection site. Maintain daily records of collection operation and maintenance (e.g. time of collection), number and condition of fish caught, and environmental conditions (e.g. river stage, tide, water temperature). Summarize results for presentation in annual reports. Provide recommendations on means to improve broodstock collection, and refine protocols if

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		needed for application in subsequent seasons.
3.4.2 Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.	Maximum natural-origin broodstock level determined by co-managers (Schroder and Ames 2004-**Attachment 4).** Adhere to HSRG (2004) and WDFW spawning guidelines (Seidel 1983).	Differentially mark all hatchery-origin fall Chinook fry using otolith (thermal) marking (with unique marks for the progeny of returns to the Hamma vs. George Adams Hatchery) and CWT or another permanent, effective method determined by the Co-Managers, to allow for distinction from natural-origin fish upon return as adults on the spawning grounds.
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.	LLTK operates juvenile out-migration trap and WDFW generates annual estimates of juvenile production, including biological data (size, scale samples). Otolith and scales are collected from adults upon return.
3.5.1 Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	Within and between populations, genetic structure is not significantly affected by artificial production.	Collect age, sex, length, average egg size, and fecundity data from a representative sample of broodstock used in each restoration program for use as baseline data to document any phenotypic changes in the populations.
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 (Schroder and Ames 2004-**Attachment 4).**	Collection date and location is recorded annually. Otolith analysis is done post-spawning.
3.5.3 Hatchery-origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning population.	Annual level of pHOS is estimated and compared to population-dependent pHOS objectives.	Conduct spawning ground surveys throughout the fall Chinook return to enumerate spawners, and to collect information regarding fish origin (via random sampling of fish heads for otoliths, marks, and CWTs), and age class composition through scale sampling. Estimate the number of naturally spawning hatchery-origin fall Chinook contributing to each restoration population's annual escapement.
3.5.4 Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return	Location of release (on-station, acclimation pond, direct plant). Release type (forced,	Annual information regarding release type (on-station, acclimation pond, direct plant) and type of release are recorded

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locations.	volitional or direct stream release).	in hatchery data systems (WDFW *FishBooks*).
3.5.5 Juveniles are released at fully-smolted stage.	Level of smoltification at release. Release type (forced, volitional or direct).	Juveniles are reared to appropriate size and release stage, and visually monitored for active smoltification at the facility.
3.5.6 The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Program is sized appropriately for conservation goals.	No surplus hatchery adults are collected.
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (IHOT, PNFHPC, WDFW Fish Health Policy, INAD, MDFWP).	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level of compliance with applicable standards and criteria.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed.
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. WDFW water right permit compliance.	Flow and discharge reported in monthly NPDES reports.
3.7.3 Water withdrawals and in-stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Water withdrawals compared to NMFS, USFWS and WDFW applicable passage and screening criteria for juveniles and adults.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
3.7.4 Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens.	Certification of fish health during rearing and immediately prior to release, including pathogens presence and virulence.	WDFW Fish Health Section inspect adult broodstock yearly for pathogens and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
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.	No surplus hatchery adults are collected. Post-spawn adult carcasses are disposed in an approved manner. Collect biological information on collection-related mortalities, if any. Determine causes of mortality, and use carcasses for stock profile sampling, if

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		possible.
3.7.6 Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally-produced population.	Spatial and temporal spawning distribution of natural populations above and below weir/trap currently compared to historic distribution.	Collection date and location is recorded annually. Otolith analysis is done post-spawning. Monitor escapements of non-restoration populations to determine the level of straying of restoration program-origin fish to other drainages, linked to a broader effort addressing Hood Canal hatchery Chinook straying.
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.	All fish captured are utilized for broodstock.
3.7.8 Predation by artificially produced fish on naturally – produced fish does not significantly reduce numbers of natural fish.	Hatchery juveniles are raised to smolt-size and released from the hatchery at a time that fosters rapid migration downstream.	Annual release dates, type of release and location are recorded annually.
3.8.2 Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	Artificial production was chosen as the preferred alternative for habitat and population recovery objective.	Annual operating costs reported.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Program is designed to help achieve the end goal of conserving and stabilizing natural salmon populations.	Annual estimates of total stock abundance and productivity monitored towards recovery objective.

1.11) Expected size of program.

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

Up to 60 adults collected annually (see **Attachments 1 &5**).

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

Proposed fish release levels are currently based on the available flows (gpm) and volumes (ft^3) at the rearing sites on John Creek and the estimated production capacities for Chinook at the sites.

Table 1.11.2.1: Annual release levels.

Life Stage	Release Location	Annual Release Level
Sub-yearling	John Creek (WRIA 16.0253)	47,500 (Hamma Hamma) 47,500 (George Adams/Purdy)

WDFW, Future Brood Document 2012.

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

Recent CWT-based survival estimates for brood year 2004 to 2006 show that Hamma Hamma River fall Chinook had a SAR of 0.27% (RMIS 2012; brood year 2006 data is preliminary and provides a minimum estimate of survival). Based on the programmed release goal of 40,000 sub-yearlings, the estimated adult production (goal) level would be 108 fish (see HGMP section 3.3.1).

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Additionally, program fish contribute to total spawning ground abundance. For annual pHOS estimates (see HGMP section 2.2.2).

Table 1.12.1: Hamma Hamma Hatchery fall Chinook escapement 2000-2012.

Year	Total Escapement
2000	381
2001	248
2002	32
2003	95
2004	49
2005	33
2006	16
2007	60
2008	255
2009	98
2010	67
2011	271
2012[a]	403
Average	154

Source: SaSI, WDFW 2012.
[a] 2012 data is preliminary from Hood Canal co-manager agreed run reconstruction files.

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

Restoration through the Hamma Hamma conservancy site began in 1995. LLTK and the Hood Canal Salmon Enhancement Group (HCSEG) initiated six Hood Canal programs to determine the feasibility of re-colonizing a river with hatchery salmon, relying on their natural adaptability to re-establish a self-sustaining run.

When Puget Sound Chinook and Hood Canal summer chum were listed as threatened under the Endangered Species Act in 1999, LLTK, HCSEG, and the fishery co-managers terminated three of the conservancy sites in eastern Hood Canal rivers to protect summer chum. LLTK discontinued two other sites because their effects (pro or con) on native Chinook could not be determined. Only the Hamma Hamma Chinook Conservancy Project remains.

1.14) Expected duration of program.

This program was originally scheduled to run 12 years maximum. In July 2009, it was determined by the Chinook Technical Working Group that the program would be extended through brood year 2012, at which time there would be enough data available to evaluate the program's effectiveness and decide how to proceed (see **Attachment 4**). This evaluation has not yet been completed.

1.15) Watersheds targeted by program.

Hamma Hamma River (WRIA 16.0251), Hood Canal.

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

The Puget Sound Salmon Management Plan (PSSMP 1985) and the Hood Canal Salmon Management Plan (HCSMP) are federal court orders that currently control both the harvest management rules and production schedules for salmon in Hood Canal under the *U.S. v Washington* (1974) management framework. The parties to the conservation hatchery program

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recognize that the PSSMP explicitly states that, "no change may be made to the Equilibrium Brood Document (production goals) without prior agreement of the affected parties." This program operates within the overview of a technical workgroup comprised of representatives of NMFS, WDFW, USFWS, Point-No-Point Treaty Council, Skokomish Tribe, HCSEG, and LLTK.

The Hatchery Scientific Review Group (2004) recommended that a plan be executed to replace the program's George Adams eggs with eggs from natural-origin returns, including a specific end point for the use of George Adams eggs. As a result of low smolt-to-adult returns and the small program size, too few natural-origin adults have been returning to the system. This, combined with difficulties in collecting broodstock using seining and having no adult trap/weir, prevents a sufficient egg take for this small program. With the low number of adults returning to the Hamma Hamma, LLTK has expressed concern about the Ryman-Laikre effect (Ryman and Laikre 1991; Ryman et al. 1995) as currently managed, if the use of George Adams hatchery-origin fish were discontinued. The size of the program cannot be increased significantly due to space limitations and, therefore, may not be a viable option to overriding this problem. Because of this, the Technical Working Group decided that the current program should continue as operated with continued evaluation of the performance of George Adams vs. Hamma Hamma origin fish.

LLTK has recommended that a broader evaluation of the mid-Hood Canal Chinook population and associated population recovery actions - including this conservation hatchery program - occur and a revised conservation hatchery plan be produced for recovering mid-Hood Canal Chinook due to concerns about the performance of this program, and whether the George Adams stock is an appropriate stock. A proposal, supported by the co-managers, to perform this work was submitted to the Pacific Salmon Commission in 2011 but not funded. The proposal is attached (see **Attachment 6**).

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 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 Hood Canal region, the Technical Recovery Team (TRT) has identified two demographically independent populations (DIPs); the Skokomish

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and Mid-Hood Canal Rivers (Dosewalips, Duckabush and Hamma Hamma) (Ruckelshaus et al. 2006).

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

Hood Canal summer chum (*Oncorhynchus keta***):** Listed as *Threatened* on Mar. 25, 1999 (64FR14507); *Threatened* status reaffirmed on June 28, 2005 (70FR37160); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448). Final designation for Critical Habitat was published Sept. 2, 2005 (70FR52630), with effective date of Jan. 2, 2006. The ESU includes all naturally spawned populations of summer-run chum in Hood Canal and its tributaries, populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington, and eight artificial propagation programs: Quilcene NFH, John Creek Conservancy site, Lilliwaup Creek Fish Hatchery, Union River/Tahuya, Big Beef Creek Fish Hatchery, Salmon Creek Fish Hatchery, Chimacum Creek Fish Hatchery, and the Jimmycomelately Creek Fish Hatchery summer-run chum programs (Ford 2011).

Puget Sound steelhead (*Oncorhynchus mykiss*): 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, Elwha natural, White River natural and Hood Canal winter-run steelhead hatchery stocks. In the Hood Canal region, the TRT has preliminarily delineated four Demographically Independent Populations (DIPs) of winter steelhead; (East Hood Canal, South Hood Canal, Skokomish and Olympic West Hood Canal), no summer run populations were identified in the region (PSSTRT 2011).

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

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

Hamma Hamma fall Chinook in the Puget Sound Chinook ESU: The hatchery population was listed with natural-origin Chinook salmon that are part of the Mid-Hood Canal population (70 FR 37160. June 28, 2005; NMFS SHIEER 2004). The stock was designated Category 2b or 3c. Broodstock sources are from within the ESU but because of the frequent exchange of George Adams Hatchery and Finch Creek (Green River origin) fall-run broodstocks, the George Adams stock is unlikely to be representative of any of the native Hood Canal fall-run Chinook salmon populations. This categorization could be revised as more information on the genetic and demographic relationship between the hatchery and natural populations becomes available. Pending a final determination on whether any elements of the native fall-run exists, the precautionary position would be to manage for the protection of a native population and consider this stock as a 3c (SSHAG 2003).

Mid-Hood Canal fall Chinook in the Puget Sound Chinook ESU: Recent escapement levels (2000-2011) have averaged 175 for spawners in the Mid-Hood Canal DIP and have shown declining population trend during this same period (SaSI, WDFW 2012).

George Adams fall Chinook in the Puget Sound Chinook ESU: NMFS (1999b) considered this stock to be part of the ESU but not essential for recovery. This stock is a category 2b or 3c. Broodstock sources are from within the ESU, but because of the frequent exchange between George Adams Hatchery and Finch Creek (Green River origin) fall Chinook salmon broodstocks, the George Adams stock is unlikely to be closely related to any native Hood Canal fall Chinook salmon populations. This categorization could be revised as more information on the genetic and

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demographic relationship between the hatchery and natural populations becomes available. (SSHAG 2003).

Skokomish fall Chinook in the Puget Sound Chinook ESU: Recent escapement levels (2000-2011) have averaged 558 for natural spawners in the Skokomish River and have shown declining population trend during this same period (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 (Ford 2011).

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

Region and population	TRT minimum viability abundance	Under properly functioning conditions (PFC)			NMFS Escapement Thresholds	
		Equilibrium abundance	Spawners at MSY	Productivity at MSY	Critical[a]	Rebuilding[b]
Mid Hood Canal[c]	11,000	11,000	2,500	3.2	200[d]	1,250
ESU	**261,300**	**307,500**	**70,948**	**3.2**	**3,875**	**2,785**

Source: Ford 2011; NMFS 2011.

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

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

[c]The mid Hood Canal population consists of spawning aggregations from Dosewallips, Duckabush, and Hamma Hamma rivers. Only the Dosewallips was listed in the TRT viability report.

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

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

Hood Canal summer chum salmon - Updated Risk Summary: The spawning abundance of this ESU has clearly increased since the time of listing, although the recent abundance is down from the previous five years. While spawning abundances have remained relatively high compared to the low levels in the early 1990s, productivity has decreased significantly for the last five brood years, being lower for brood years 2002-2006 than any previous 5-year average since 1971. This is a concern for future production. Since abundance is increasing and productivity is decreasing, this suggests that improvements in habitat and ecosystem function are needed. Diversity is increasing from the low values seen in the 1990s due both to the reintroduction of spawning aggregates and the more uniform relative abundance between populations; this is a good sign for

viability in terms of spatial structure and diversity (Ford 2011). Spawning survey data shows that the spawning distribution within most streams has been extended further upstream as abundance has increased (WDFW and PNPTC 2007). Overall, the new information considered does not indicate a change in the biological risk category since the time of the last BRT status review (Ford 2011).

Skokomish winter-run steelhead in the Puget Sound steelhead DPS - Population trends for Skokomish River winter-run steelhead. The counts have been especially low since the late 1990s. The estimated probability that this steelhead population would decline to 10% of its current estimated abundance (i.e., to 35 fish) is high—about 80% within 80 years. With an estimated mean population growth rate of −0.037 (λ = 0.964) and process variance of 0.019, we can be highly confident ($P < 0.05$) that a 90% decline in this population will not occur within the next 20 years and that a 99% decline will not occur within the next 40 years. However, beyond the next 30−40 years we are uncertain about the precise level of risk (Ford 2011). Based on a preliminary intrinsic potential (IP) estimate by the PSSTRT (2011), the capacity for winter steelhead in this DIP is 8,275 adults.

East Hood Canal winter-run steelhead in the Puget Sound steelhead DPS - Population trends for east Hood Canal winter-run steelhead. Steelhead counts in east Hood Canal show no clear trend over the time series. The estimated probability that this steelhead population would decline to 10% of its current estimated abundance (i.e., to 22 fish) is relatively low—about 30% within 100 years. With an estimated mean population growth rate of −0.002 (λ = 0.998) and process variance of 0.052, we can be highly confident ($P < 0.05$) that a 90% decline in this population will not occur within the next 10 years, and that a 99% decline will not occur within 30 years. However, beyond about 30 years we are highly uncertain about the precise level of risk (Ford 2011). Based on a preliminary intrinsic potential (IP) estimate by the PSSTRT (2011), the capacity for winter steelhead in this DIP is 4,175 adults.

West Hood Canal winter-run steelhead in the Puget Sound steelhead DPS - Population trends for west Hood Canal winter-run steelhead. Steelhead counts in west Hood Canal have shown an increasing trend since the mid 1990s. The estimated probability that this steelhead population would decline to 10% of its current estimated abundance (i.e., to 31 fish) is low—near zero within 100 years. With an estimated mean population growth rate of 0.093 (λ = 1.097) and process variance of 0.017, we can be highly confident ($P < 0.05$) that a 50% or greater decline in this population will not occur within the next 100 years (Ford 2011). Based on a preliminary intrinsic potential (IP) estimate by the PSSTRT (2011), the capacity for winter steelhead in this DIP is 4,148 adults.

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

Table 2.2.2.2: Status of Hood Canal winter steelhead populations.

Population	Run timing	2000-2005 escapement	2006-2011 escapement	Percent change	Escapement Goal[b]	Status
Dewatto	Winter	25	42	64.5%	138	Depressed
Tahuya	Winter	122	112	-8.6%	236	Depressed
Skokomish[c]	Winter	214	388	81.6%	1,400	Depressed

Hamma Hamma[a]	Winter	125	112	-10.8%	91	Depressed
Duckabush	Winter	19	36	92.9%	44	Depressed
Dosewallips[d]	Winter	79	29	-62.8%	318	Depressed

Source: SaSI, WDFW 2012.
[a]Hamma Hamma River steelhead supplementation program ran from 1998 to 2008.
[b]Escapement Goal is for index areas and was derived WDFW methodology (Gibbons et al. 1985). However the state and Treaty Tribes have not agreed to the goal or the method used to derive it.
[c] Escapement methodologies have changed since 2007 when weekly foot surveys were instituted in lieu of periodic helicopter flights
[d] Recent escapements are not considered comprehensive estimates but minimum levels

- 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.

Mid-Hood Canal Chinook: Natural and Hatchery smolt monitoring activities occur in the Hamma Hamma basin.

Table 2.2.2.3: Hamma Hamma smolt trap numbers, production estimates and CVs 2002 to 2011.

Year	Wild 0+	Hatchery 0+	Production	CV
2002	592	1,420	18,047	12.19%
2003[a]	113	854	---	-
2004	210	-	5,852	18.97%
2005	215	7,801	7,442	21.88%
2006[a]	36	7,797	-	-
2007	48	4,249	1,279	16.25%
2008	43	607	1,021	15.03%
2009	142	12,023	408	6.49%
2010[b]	277	2,587	1,841	8.61%
2011	1,610	1,468	10,644	15.90%
Average	**329**	**4,312**	**5,817**	**14.42%**

Source Data: Weinheimer et al. 2011 and WDFW 2012.
[a] Unable to calculate production estimate due to large trap outages.
[b] Production estimate is bias low due to trap being installed during the middle of the migration.

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

Brood Years	**1982-1986**		**1987-1991**		**1992-1996**		**1997-2001**		**2002-2006**		**Trend**	
Populations	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**
Skokomish	*12.84*	*1.84*	*2.7*	*0.45*	*0.84*	*0.51*	*1.86*	*0.57*	*0.93*	*0.33*	*-2.47*	*-0.29*
Mid Hood Canal	*1.9*	*0.18*	*13.57*	*2.4*	*7.02*	*3.39*	*1.88*	*0.62*	*2*	*0.68*	*-1.15*	*-0.08*
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.

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

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
Mid-Hood Canal Fall Run	1995-2009	0.911 (0.818 - 1.016)	0.921 (0.224 - 3.787)	0.30	0.859 (0.209 - 3.532)	0.20
	1968-2009	0.952 (0.93 - 0.974)	0.934 (0.781 - 1.118)	0.20	0.871 (0.724 - 1.047)	**0.06**
Skokomish River Fall Run	1995-2009	1.019 (0.936 - 1.108)	0.995 (0.408 - 2.424)	0.48	0.76 (0.345 - 1.674)	0.07
	1968-2009	0.994 (0.976 - 1.013)	0.982 (0.861 - 1.12)	0.37	0.784 (0.692 - 0.888)	0.00

Source Data: Ford 2011.

Table 2.2.2.6: Short and long term population trend and growth rate estimates for the Hood Canal Summer Chum ESU populations.

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

Source Data: Ford 2011.

Hood Canal Steelhead: Natural and hatchery smolt monitoring activities occurs on the streams in the Hood Canal basin.

Table 2.2.2.7: Hood Canal steelhead parr and smolt counts, 2007-2011.

Population	2007	2008	2009	2010	2011
Big Beef	189	164	206	135	--
Dewatto	213	282	168	95	--
Duckabush	54	30	59	3	27
Hamma Hamma	23	79	189	109	27
Little Quilcene	--	--	226	233	--
SF Skokomish	563	358	230	93	--
Tahuya	208	325	275	545	--

Source Data: Barry Berejikian NOAA 2012, Weinheimer et al. 2011 and WDFW 2012.

Table 2.2.2.8: Steelhead Population Exp. Trend ln(nat. spawners) (95% CI).

Population	1985-2009	1995-2009
East Hood Canal winter-run	1.022 (0.997 - 1.048)	1.033 (0.976 - 1.092)
Skokomish River winter-run	0.956 (0.932 - 0.979)	1.006 (0.958 - 1.057)
West Hood Canal winter-run	1.101 (1.046 - 1.160)	1.101 (1.046 - 1.160)

Source Data: Ford 2011.

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

Table 2.2.2.9: Hood Canal fall Chinook, Hood Canal summer chum and Hood Canal winter steelhead spawner abundance data 2000-2012.

Year	Summer Chum[a]	Winter Steelhead	Fall Chinook[b]
2000	8,649	675	20,881
2001	12,044	644	30,389
2002	11,454	693	34,436
2003	35,696	506	38,797
2004	69,995	608	36,893
2005	16,378	685	59,356
2006	26,753	799	46,986
2007	10,781	960	39,323
2008	15,403	838	40,899
2009	7,423	834	44,044
2010	12,741	659	43,748
2011	6,958	935	59,842
2012	30,121	898	Unavailable
Average	**19,523**	**736**	

Source: Chinook data are from co-manager Chinook terminal run reconstruction. Summer chum data are from WDFW and PNPTT (2003) and co-manager run reconstruction. Winter steelhead are from WDFW SaSI (2012) run reconstruction.

[a]Includes wild broodstock used in supplementation program.

[b]2008 through 2011 should be considered preliminary and are subject to revision. These are terminal run numbers directly from last year's Pre-season Forecast files, per Mark Downen WDFW District 15 Biologist. 2012.

Table 2.2.2.10: Chinook salmon spawner escapements in the Hamma Hamma, Duckabush and Dosewalips Rivers 2000-2012.

Year	Hamma Hamma	Duckabush	Dosewalips	Mid Hood Canal Total
2000	381	28	29	438
2001	248	29	45	322
2002	32	20	43	95
2003	95	12	87	194
2004	49	0	80	129
2005	33	2	10	45
2006	16	1	13	30
2007	60	4	9	73
2008	255	0	18	273
2009	98	9	23	130
2010	67	0	15	82
2011	273	5	11	289
2012	403	6	7	416

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Average	**134**	**9**	**32**	**175**

Source: SaSI, WDFW 2012 and Co-manager agreed run reconstruction files.

Table 2.2.2.11: Hood Canal natural summer chum escapement from 2000 to 2011.

Year	Tahuya[a]	Union[b]	Liliwaup[c]	Hamma Hamma[d]	Duckabush[e]	Dosewallips[f]	Quilcene[g]
2000	2	744	22	229	464	1,260	5,898
2001	0	1,491	92	1,227	942	990	6,373
2002	0	872	858	2,328	530	1,627	4,487
2003	0	11,916	353	854	1,869	7,066	12,733
2004	8	5,976	1,017	2,691	8,637	11,549	38,153
2005	4	1,987	1,049	1,411	821	2,658	6,758
2006	749	2,837	1,615	3,065	3,135	2,577	11,876
2007	623	1,967	529	1,489	1,294	1,468	2,526
2008	700	1,130	636	1,627	2,668	3,930	3,861
2009	380	611	246	663	2,659	1,127	1,492
2010	1,153	897	238	1,471	4,110	2,521	2,073
2011	325	296	111	772	1,529	1,130	1,550
Average	**329**	**2,560**	**564**	**1,486**	**2,388**	**3,159**	**8,282**

Source: WDFW SaSI 2012 and Thom Johnson PNPTC 2012

[a] Data are total escapement estimates based on live spawner counts from RM 0.0 to 2.6.

[b] Data are total escapement estimates based on rack counts and live spawner counts from RM 0.3 to 2.1.

[c] Data are total escapement estimates based on live spawner counts from RM 0.0 to 0.7 or counts of adult summer chum at a temporary trap.

[d] Data are total escapement estimates based on live spawner counts from RM 0.3 to 1.8 in the Hamma Hamma River and in John Creek, a tributary.

[e] Data are total escapement estimates based on live spawner counts from RM 0.0 to 2.3.

[f] Data are total escapement estimates based on live spawner counts from RM 0.0 to 2.3 on the Dosewallips.

g Data are total escapement estimates based on Quilcene National Fish Hatchery rack counts, live spawner counts from RM 0.0 to 2.8 on the Big Quilcene River, and on Little Quilcene River live spawner counts from RM 0.0 to 1.8.

Table 2.2.2.12: Spawner abundance estimates for Hood Canal steelhead populations based on redd surveys, 2000-2012.

Year	Dosewalips[a]	Duckabush	Hamma Hamma	Skokomish[a]	Tahuya	Dewatto	Big Beef Creek[a]
2000	78	36	19	261	191	23	--
2001	89	13	3	286	133	19	--
2002	52	16	260[2]	156	97	30	--
2003	96	8	133	132	53	18	--
2004	--	29	214	233	168	39	--
2005	--	10	123	--	91	23	--
2006	--	21	73+	231	183	53	--
2007	15	16	193	405	175	28	--
2008	42	18	198	285	144	49	--
2009	--	12	81	567	53	15	--
2010	--	29	42	361	68	13	--
2011	31	120[2]	45	478	47	92[b]	--
2012	11	104	49	564	78	55	
Average	**52**	**116**	**309**	**330**	**114**	**30**	**--**

Source: SaSI Database (WDFW 2012).

[a] Years with -- indicate insufficient data to estimate run size.

[b] Fish from supplementation program start returning.

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Beginning in 1993, escapements from the Hamma Hamma been based solely on data collected in-river.

- 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.

It is unknown whether hatchery-origin Chinook returned to the Hamma Hamma watershed from 1967-1997. Beginning with brood year 1995, the otoliths of Chinook salmon embryos produced in the restoration program were thermally mass-marked (otolith-marked) prior to the release of sub-yearlings. Examination of otoliths recovered from spawned adults provides a method to separate the number of restoration (hatchery) fish from the number of naturally spawning (wild) fish. Based on otolith analysis of Chinook adults collected on the spawning grounds during 1998, it is estimated that 46% of the age 3 Chinook returning to the Hamma Hamma were of hatchery origin (memo from Jeff Grimm, WDFW, to HCSEG, dated May 17, 1999). During 1999, it is estimated that about 77% of age-3 Chinook and 97% of age-4 Chinook were otolith-marked; overall, 83% of the Chinook returning were otolith-marked and of hatchery origin (Thom H. Johnson, WDFW, personal comm., based on Jeff Grimm memo dated May 26, 2000 and age composition data from scales).

Table 2.2.2.13: 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**
Mid Hood Canal	110	21%	86	176	16%	148	202	21%	158	81	39%	44
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.

Table 2.2.2.14: Natural and hatchery-origin summer chum spawning escapement in the Hood Canal watershed 2000-2011.

Year	Natural Origin Returns	Hatchery Origin Returns	Total
2000	5,866	2,783	8,649
2001	7,202	4,839	12,041
2002	6,862	4,592	11,454
2003	27,319	8,377	35,696
2004	60,303	9,667	69,970
2005	11,368	4,467	15,835
2006	21,377	5,369	26,746
2007	9,385	1,374	10,759
2008	13,499	1,810	15,309
2009	6,536	846	7,382
2010	11,538	1,077	12,615
2011	6,442	409	6,851
Average	**15,641**	**3,801**	**19,442**

Source: Data provide by Thom Johnson PNPTC.

Hood Canal steelhead: Plants of Chambers stock winter steelhead were terminated in 2003 in the Hood Canal basin. Prior to the start of the supplementation program, the number of hatchery-reared steelhead on the spawning grounds of Hood Canal streams was unknown, but the proportion is believed to be low based on the very poor marine survival of hatchery-origin fish

(indicated by low catch numbers), temporal divisions in spawn timing, and genetic analyses. Current pHOS levels in the Hood Canal are unknown.

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

- 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.

Listed Chinook salmon adults will be collected, spawned and released from August through October and result in a take. In the Hamma Hamma, other listed Chinook adults would be handled and passed upstream during brood stocking and may lead to injury to listed fish through delayed migration and spawning, or delayed mortality as a result of injury or increased susceptibility to predation.

Incubation and rearing of Chinook from September through April has a high potential to take listed Chinook due to natural mortality causes and due to fish culture activities and conditions which affect fish health and development including handling procedures, fertilization procedures, water temperature, water quality, water flow, feeding success, and transport and/or transition from fresh to saltwater environments. Risk aversion measures minimize the likelihood for the take of listed Chinook (see HGMP section 5.8). No take of other listed salmonids due to these activities is anticipated.

Physical harm of reared Chinook at release (March through May) due to de-scaling or increased susceptibility to predation at release has a potential to take listed Chinook, but protocols will be observed to minimize take. No take of other listed salmonids is anticipated.

The contact with Chinook during spawner escapement surveys (August through October), carcass recovery programs (September and October), and other monitoring and evaluation programs have a potential to take listed Chinook, but care is taken not to harm, harass or otherwise disturb Chinook spawners.

Summer Chum. The SCSCI (WDFW and PNPTT 2000) provides an assessment of risks to summer chum juveniles and adults posed by the production of Hamma Hamma fall Chinook risk-averse measures to implement, and monitoring and evaluation measures to be applied to minimize any risks.

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

None

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

For listed Chinook salmon, projected annual take levels are may be as high as (1) approximately 12,000 eggs and fry mortality during incubation, rearing, and release (based on 10% mortality from green egg to release as fed fry). (2) Approximately 30 pairs of Hamma Hamma River adults and/or George Adams Hatchery Chinook adults collected for broodstock spawning; (3) unintentional lethal take of 1 adult during collection, holding prior to spawning (based on 2% loss of 60 adults collected); (4) 18 adults affected by trapping operation where fish are captured, handled and released upstream (based on 100 adults collected minus broodstock and unintentional lethal take); (5) 200 adults affected by contact with listed fish during spawner surveys and carcass and mark recovery projects (based on multiple events and average of 1 occurrence/spawner for one-third of 600 spawners); and (6) 200 carcasses sampled for otoliths, scales, genetic stock identification, and other biological information

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during spawner surveys, brood stocking, and routine monitoring and evaluation activities (based on target sample size of 200).

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

Hatchery activities that may lead to the take of listed summer chum salmon are described in a separate HGMP for the Hamma Hamma summer chum restoration program.

- 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.

The take of Chinook will be limited since the number of broodstock collected will be consistent with guidelines and protocols based on those developed in the SCSCI and the number of carcasses collected will be consistent with monitoring and evaluation objectives provided by the co-managers. Methods to prevent catastrophic loss of Chinook during incubation, rearing, and release are in compliance with program operations and protocols in the SCSCI (which includes measures to cull surplus production) and will limit take.

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.

The program will be consistent with the understandings (1) presented in letters from: LLTK and HCSEG (dated September 26, 2001), NMFS (dated October 19, 1999 and November 16, 2000), WDFW (dated September 18, 2000), and the broodstock benefit/risk analysis and recommendations developed by NMFS, WDFW and PNPTC (dated September 15, 2000); and (2) with updated understandings of the program technical workgroup, including NOAA Fisheries.

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; objectives *Comprehensive Management Plan for Puget Sound Chinook* (2004); and the Hatchery Action Implementation Plan (HAIP) for the watershed (see HGMP section 3.4).

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

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

This hatchery program, and all other WDFW anadromous salmon hatchery programs within the Puget Sound Chinook ESU, operates under *U.S v Washington* (1974) and the *Puget Sound Salmon Management Plan* (PSSMP 1985) and the *Hood Canal Salmon Management Plan* (HCSMP1986) which provides the legal framework for coordinating these programs, defining artificial production objectives, and maintaining treaty-fishing.

Hatchery salmon and steelhead production levels are detailed in the annual Future Brood Document. The Future Brood Document (FBD) is a pre-season planning document for fish

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

See also HGMP section 3.1.

3.3) Relationship to harvest objectives.

Tribal and non-Tribal fisheries directed at Chinook and other species produced through WDFW hatchery releases will be managed to minimize incidental effects to listed Chinook salmon. There is no directed harvest on the Mid-Hood Chinook salmon population in the terminal area; however, there is a restricted sport fishery in mixed stock areas.

The upper management threshold (UMT) is set at 750, which is the best available estimate of MSH escapement for the Mid Hood Canal population. If escapement is projected to be less than 750 pre-terminal fisheries in southern U.S. (SUS) areas will be managed to not exceed an exploitation rate of 15%, as estimated by the FRAM model. The extreme terminal areas for this management unit, which include the Hamma Hamma, Dosewallips, and Duckabush rivers, will be closed if escapement is not projected to exceed 750. A low abundance threshold of 400 Chinook spawners has been established for the Mid-Hood Canal MU. This value is approximately 50% of the current MSY goal for the Mid-Hood Canal sub-populations. If escapement is projected to fall below this threshold, conservation measures will be implemented in pre-terminal SUS fisheries to further reduce mortality, such that that the projected pre-terminal Southern U.S. (PTSUS) exploitation rate does not exceed 12.0% (WDFW PSTT 2010).

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, *US v. Washington (1974)*, and other state, federal, and international legal obligations.

Each year, state, federal and tribal fishery managers plan the Northwest's recreational and commercial salmon fisheries. This pre-season planning process is generally known as the North of Falcon process, which involves a series of public meetings between federal, state, tribal and industry representatives and other concerned citizens. The North of Falcon planning process coincides with meetings of the Pacific Fishery Management Council, which sets the ocean salmon seasons at these meetings.

Compliance with the fisheries management strategy defined in the Summer Chum Salmon Conservation Initiative (SCSCI) (WDFW and PNPTT 2000) will lead to fisheries on WDFW hatchery-origin stocks that are not likely to adversely affect listed Chinook or listed summer chum.

3.3.1) <u>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.</u>

Although there is no directed commercial harvest in the terminal area, there are fisheries (below) that benefit from the program. The long-term objective of the program is to recover the stock to the extent that sustainable tribal and non-Indian fisheries harvesting Mid-Hood Chinook salmon can occur. The current fisheries management objective is to minimize the impact of incidental harvest to a level that does not impede recovery. The FRAM model is used to provide both pre-season and post-season estimates of exploitation rates for the Mid-Hood Canal Chinook. Post-season FRAM estimates of the total annual exploitation rate for Mid-Hood Canal Chinook show a dramatic decrease in the average rate of 63% for the period of 1983 – 1997, to an average of 26% for the period of 1998-2008. The exploitation rate on Hood Canal

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Chinook in northern fisheries (Alaska and Canada) has not shown this same dramatic decrease, with the recent year average (16% since 1998) only 5% less than the average for the earlier period (21% for 1983 – 1997). Southern U.S. exploitation rates declined from an average rate of 41% for the period 1983 – 1997, to just 10% for the period 1998 – 2008. Terminal area exploitation rates have been very small since 1998, averaging less than 1%. FRAM estimates of fishing impacts on Mid-Hood Canal Chinook utilize recoveries of George Adams Hatchery tags in the model base period. The co-managers are currently re-examining those assumptions for Mid-Hood Canal Chinook in Hood Canal and other Puget Sound fisheries (WDFW and PSTT 2010).

There are no targeted fisheries on this stock at this time and only low levels of incidental harvest are permitted in southern U.S. fisheries. The tables below represent CWT Recovery estimates from all North Pacific fisheries.

Table 3.3.1.1: Hamma Hamma River Hatchery sub-yearling fall Chinook fishery contributions.

Brood Year: 2004 - 2006[a] Fishery Year: 2008 - 2010		
	Average SAR%[b]	**0.27**
Agency	***Non-WA Fishery***	***% of total Survival***
ADFG	All	*0.0*
CDFO	All	*17.5*
ODFW	All	*1.4*
Agency	***WA Fishery***	***% of total Survival***
WDFW	10- Ocean Troll	*1.7*
WDFW	15- Treaty Troll	*3.4*
WDFW	23- PS Net	*19.9*
WDFW	42- Ocean Sport -Private	*0.9*
WDFW	45- PS Sport	*13.7*
WDFW	50- Hatchery Escapement	*9.5*
WDFW	54- Spawning ground	*32.1*
	Total	***100.0***

Source: RMIS 2012.
[a]Brood year 2006 data is preliminary and provides a minimum estimate of survival and contribution.
[b]Average SAR% = (tags recovered/tags released).

3.4) Relationship to habitat protection and recovery strategies.

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

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been lost (WDFW and WWTIT 1994). Gravel aggradation and removal have been problems in the lower Big Quilcene.

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

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

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

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

RFEGs: Several citizen based groups in conjunction with local governments work on habitat actions to benefit both listed and non-listed stock in the system including the Hood Canal Salmon Enhancement Group (HCSEG).

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

3.5) Ecological interactions.

(1) *Salmonid and non-salmonid fishes or other species that could negatively impact the program.* Negative impacts by fishes and other species on the Chinook program could occur directly through predation on program fish, or indirectly through food resource competition, genetic effects, or other ecological interactions. In particular, fishes and other species could negatively impact Chinook survival rates through predation on newly released, emigrating juvenile fish in freshwater, estuarine and marine areas. Certain avian and mammalian species

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may also prey on juvenile Chinook while the fish are rearing at the hatchery site, if these species are not excluded from the rearing areas. Species that could potentially negatively impact juvenile Chinook through predation include the following:

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

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

- Orcas
- Sea lions
- Harbor seals
- River otters

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

- Puget Sound Chinook
- Puget Sound steelhead

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

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

- Southern Resident Killer Whale
- Northern pikeminnow
- Cutthroat trout
- Steelhead
- Coho salmon
- Pacific staghorn sculpin
- Numerous marine pelagic fish species

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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.

John Creek Conservancy Site: The water source at the John Creek facility is several groundwater springs. The water is specific pathogen-free, the water quality is consistent in temperature and amount with year around temperature ranging from 46-50°F and available flow of approximately 1 cfs.

George Adams Hatchery – see George Adams Fall Chinook HGMP.

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.

John Creek Conservancy Site: There is no chance of natural-origin fish being affected by the hatchery water withdrawal because the water sources are fish-free. The intake structures are supplied by infiltration and are adequately screened to minimize risk to any possible listed fish. The Johns Creek facility will produce a relatively small amount of fish each year and well under the 20,000 pounds per year criteria set by WDOE as the limit for concern regarding hatchery effluent discharge effects and for the requirement for an NPDES permit. These will likely lead to no adverse effects on water quality from the program on listed fish. In addition, there are multiple small springs that supply the incubators and the pond. The loss of any one of these spring supplies would not jeopardize the entire program.

George Adams Hatchery – see George Adams Fall Chinook HGMP.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Hamma Hamma River: Broodstock are collected by using a hook-&-line method and a block seine method or other methods determined by the Co-Managers (see ***Attachment 1***). To assure that broodstock collected are representative of the entire run, a capture schedule was developed by the Co-Managers with weekly target goals. Adult Chinook are collected randomly according to the schedule (see section 7.2) and are placed in PVC fish tubes in the river until ready for spawning. Fish are spawned directly adjacent to the Hamma Hamma River. Spawning is accomplished as needed beneath a temporary awning to protect the eggs and milt collected from the fish from rain.

George Adams Hatchery – Adult broodstock collection occurs in a 71' x 157' x 27" trap/holding pond located in Purdy Creek. The trap begins operation August 1 for Chinook and remains open through the end of the chum run in early December. See also George Adams Fall Chinook HGMP.

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

Hamma Hamma River: Green broodstock are transported in a 50 gallon transport tank with supplemental oxygen stone to the John Creek Conservancy site.

George Adams Hatchery – not applicable for adults.

5.3) Broodstock holding and spawning facilities.

John Creek Conservancy Site: All of the broodstock are held in covered 16' x 42" x 42" raceways until they are ripe and stripped of their eggs and milt.

George Adams Hatchery: Adult broodstock are held in the trap/holding pond until they are spawned. Spawning facilities are located adjacent to the trap/holding pond.

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5.4) Incubation facilities.

As of the 2011 brood, green eggs and milt are shipped in chilled containers to George Adams Hatchery where they are fertilized, incubated and otolith-marked. The transport time between the John Creek facility and George Adams Hatchery is approximately 30 minutes.

There are two Ham Remote Site Incubators (RSIs) and three Vertical Stack Incubators at the John Creek facility. None are currently used for Chinook, since (as of 2011 brood) green eggs and milt are transferred to George Adams Hatchery for incubation and otolith-marking.

George Adams Hatchery. Chinook eggs are incubated to eyed-egg stage in Simms deep troughs which can be loaded with 450 pounds of eggs (approximately 900,000 Chinook eggs) (see also George Adams fall Chinook HGMP).

5.5) Rearing facilities.

John Creek Conservancy Site. Two earthen ponds or five 16’ x 3’ x 3’ fiberglass raceways.

George Adams Hatchery. After hatching, Chinook eggs are moved from the incubators into three 20' x 77' x 31" raceways for initial rearing. A total of 2.4 million fish are then transferred from the raceways to a 61' x 167' x 55" gravel-bottomed rearing/release pond (Pond 9) with a maximum density of 1.26 lbs/cu.ft. at release and 1.4 million fish are transferred from the raceways to a 48' x 240' x 33" gravel-bottomed rearing/release pond (Pond 7) with a maximum density of 1.29 lbs/cu.ft at release.

5.6) Acclimation/release facilities.

John Creek Conservancy Site. Two earthen ponds and five 16’ x 3’ x 3’ fiberglass raceways.

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

John Creek Conservancy Site. Prior to 2011, eggs were incubated on-site in RSIs before transport to George Adams Hatchery for otolith-marking. Remote sites have failed in the past during catastrophic flooding events and broken equipment (e.g., pipes). Full time staff will check the sites daily and be on-site during inclement weather. As well, routine maintenance will prevent equipment failures. As of 2011, per WDFW district biologist recommendation, all eggs are incubated at George Adams; this procedure has improved fish survival.

George Adams Hatchery. Severe flooding at George Adams Hatchery in 1997 led to the early release of 1,949,600 Chinook fry. Some of these died, but the number is not known.

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.

John Creek Conservancy Site. The John Creek facility is supplied by water that is gravity-fed from an adjacent pond. Incubators and starter raceways are each fed by independent springs and therefore will not be affected by power failures. Full time staff will check the sites daily and be on-site during inclement weather. The fish for this program are from adults who have been screened for reportable pathogens, and the resulting fry will be monitored for evidence of fish health problems.

George Adams Hatchery. see George Adams Fall Chinook HGMP.

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.

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6.1) Source.

Between 1995-1999, broodstock for this program came from fall-run Chinook adults returning to George Adams Hatchery. Currently, around half of the broodstock is collected from adult Chinook returning to the Hamma Hamma River and half of the egg-take is provided by George Adams Hatchery **(see Attachments 1, 4&5).**

6.2) Supporting information.

6.2.1) History.

Restoration through the conservancy site began in 1995, and eyed-eggs supplied from George Adams Hatchery have been used as a broodstock source (see also George Adams HGMP for stock history). Currently the approximately half of the broodstock collected is from adult Chinook returning to the Hamma Hamma River and half of the egg-take is provided by George Adams Hatchery.

6.2.2) Annual size.

Up to 60 adults collected annually (see **Attachments 1, 4&5).**

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

See HGMP sections 6.1 and 6.2.2.

6.2.4) Genetic or ecological differences.

Genetic characterization of Hamma Hamma River Chinook, to date, suggest that returns to the Hamma Hamma River are not genetically distinct from recent George Adams and Hoodsport hatchery broodstock (Marshall 2000). Available genetic and tagging information indicates that the existing Hamma Hamma natural population is derived from introduced hatchery stocks and do not represent the historically present local population. NOAA Fisheries determined that George Adams Hatchery and Hamma Hamma hatchery Chinook are included and listed as part of the Puget Sound Chinook ESU.

6.2.5) Reasons for choosing.

See HGMP section 6.2.4. The intent is to increase the abundance of the Chinook population currently adapted and adapting to the Hamma Hamma River.

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.

See HGMP sections 6.2.4 and 6.2.5.

SECTION 7. BROODSTOCK COLLECTION

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

Chinook adults.

7.2) Collection or sampling design.

Hamma Hamma River: Hamma Hamma Chinook used for broodstock should reflect the naturally-spawning population with respect to run timing, size, age, and any other traits identified as important for long-term fitness. Collection of pairs will be based on the average weekly run timing developed by WDFW from brood years 1998 and 1999 during the period from August 27 through November 24. To provide flexibility and to allow for early/late run timing, the number of pairs collected will represent the normal timing and run distribution during each of three two-week periods: from September 10-23, from September 24 to October 7, and from October 8-21. Fish are collected and held in covered raceways at the John Creek Conservancy Site until ripe and

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ready to be spawned. Fish not retained for broodstock will be released unharmed into the river to spawn naturally. Egg-take goal is 53,300 for a release of 45,000 sub-yearlings (see **Attachments 1&5**).

George Adams Hatchery. Ripe pairs of fall Chinook returning to George Adams Hatchery (Purdy Creek) will be selected to coincide with the collection and spawn timing of ripe Hamma Hamma fish. Eggs will be collected in approximately 15,000, 30,000 and 15,000 egg lots per each two week intervals: September 10-23, September 24-October 7, and October 8-21. To broaden the genetic base of the egg takes, partial lots of green eggs (i.e. 1,300 to 2,500 eggs per female) from two or more females will be combined and then used as "one" female in the factorial crosses (see HGMP section 8 and Attachment 3). A total of 51,200 eggs are used for a release goal of 45,000 sub-yearlings (see **Attachments 1&5**).

7.3) Identity.

From brood year 1999 through 2008 all hatchery fish released were marked with an adipose-clip to enable identification from natural-origin fish. Since the 2008 brood year 100% of the hatchery fish are released coded-wire tagged.

Both the Hamma Hamma-origin and the George Adams-origin fish will be reared in common lots but will be differentially otolith marked during the eyed-egg stage. Unique thermal otolith marks are applied to assess any difference in survival-to-return between the two release groups (see section 10.7).

7.4) Proposed number to be collected:

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

Up to 60 adults collected annually.

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

Table 7.4.2.1: Fall Chinook broodstock collected at the Long Live the Kings John Creek facility (tributary to the Hamma Hamma River), 2001-2011.

Brood Year	Hatchery			Unknown		
	Male	Female	Jack	Male	Female	Jack
2001	----	----	----	15	14	----
2002	----	----	----	3	2	----
2003	----	----	----	13	13	----
2004	----	----	----	1	1	----
2005	----	----	----	12	1	----
2006	----	----	----	2	2	----
2007	----	----	----	----	----	----
2008	----	2	----	11	7	----
2009	----	----	----	1	8	----
2010	----	5	----	11	5	----
2011	2	2	----	8	8	----
Average	**2**	**3**	**0**	**7**	**5**	**0**

Source: Long Live the Kings hatchery records, 2011.

See also George Adams Fall Chinook HGMP.

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

The production of surplus eggs or fish is avoided to the extent feasible by limiting the number of adult Chinook secured through broodstock collection operations. Any surplus production will be treated in accordance with protocols provided by the Co-managers.

7.6) Fish transportation and holding methods.

Adults collected for broodstock in the Hamma Hamma River are transported to covered raceways where they will be held until they are ripe and ready to spawn. All methods employed will be consistent with the guidelines provided by the Co-Managers (Schroder and Ames 2004). Eggs and milt are transported chilled in containers by truck from the John Creek Conservancy Site to George Adams Hatchery.

7.7) Describe fish health maintenance and sanitation procedures applied.

At all sites, fish health monitoring associated with adult fish used in the program is conducted through the WDFW Fish Health Division. The incidence of viral pathogens in Chinook broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State (NWIFC and WDFW 1998, updated 2006). Ovarian fluid, kidney, and spleen samples are collected from all fish spawned for evaluation by WDFW Fish Health Division staff for disease certification purposes. Sanitation measures will be in accordance with WDFW Fish Health recommendations.

7.8) Disposition of carcasses.

John Creek Conservancy Site: Length data, weight data, scales, DNA and/or allozyme tissue samples, and otoliths will be collected from all broodstock carcasses from fish collected at the Hamma Hamma River, disposition will be back into the stream for nutrient supplementation.

George Adams Hatchery: The disposition of Chinook carcasses at George Adams depends upon the condition of the carcasses and whether the fish had been treated with drugs. Drug-treated fish are buried on station or in a local landfill. Carcasses of untreated fish, both spawned and un-spawned, may be sold to a contracted buyer, donated to a food bank, tribe or used as part of an approved nutrient enhancement program.

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

The multi-trait distribution of the broodstock closely matches the multi-trait distribution of the target population (similar spawn timing, size, appearance, age structure, etc.).

SECTION 8. MATING

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

8.1) Selection method.

Hamma Hamma River: Fall Chinook are collected at random from the Hamma Hamma River by the hook-&-line method or the block seine method, or as advised by the Co-Managers, on a weekly basis. The collection schedule is determined by the Co-Managers, proportional to the timing, weekly abundance and duration of the total return to the river (see HGMP section 7.2).

George Adams Hatchery: Ripe pairs will be selected to coincide with the collection and spawning of ripe Hamma Hamma River pairs (see also HGMP section 7.2).

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8.2) Males.

Use of backup males is not an integral part of the program, but may occur as a precautionary measure. Jacks will be used proportional to their abundance in the total return to the creek. Milt will not be pooled.

8.3) Fertilization.

Hamma Hamma River: Fall Chinook eggs and milt will be transported and chilled from the Johns Creek Conservancy Site to George Adams Hatchery for fertilization and incubation.

George Adams Hatchery: Partial lots of green eggs from two or more George Adams Hatchery females will be combined and then used as one female in factorial crosses using at least a 1:1 spawning ratio. Sanitation protocols are done in accordance with the Co-managers Fish Health (Disease Control) Policy.

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.

One to one (1:1) individual matings or a factorial mating scheme will be applied to reduce the risk of loss of within population genetic diversity for the Chinook salmon population that is the subject of this restoration program.

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

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

Table 9.1.1.1: Hamma Hamma fall Chinook egg-to-fry survival rates at John Creek facility, 2003-2011.

Brood Year	Eggs Collected	Survival Rates (%)	
		Green-to-Eyed Up	Eyed-Up-to-Ponding
2003	59,786	NA	88.6
2004	45,965	95.7	NA
2005	49,641	85.2	NA
2006	10,868	NA	87.6
2007	NA	NA	NA
2008	45,462	NA	81.3
2009	35,282	71.4	55.5
2010	40,565	NA	81.2
2011	52,726	NA	NA
Average	**42,537**	**84.1**	**78.8**

Source: WDFW hatchery records (George Adams Hatchery), 2011.

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Approximately 45,000 eggs are collected from Chinook returning to the Hamma Hamma River and/or 43,000 eggs from George Adams Hatchery (Purdy Creek) fish (see George Adams fall Chinook HGMP).

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

None anticipated. Any surplus production will be handled consistent with protocols provided by the co-managers.

9.1.3) Loading densities applied during incubation.

John Creek Conservancy Site: Prior to 2011, eggs were incubated on-site in RSIs before transport as eyed eggs to George Adams Hatchery for otolith-marking. As of the 2011 brood, green eggs are shipped to George Adams for fertilization, eyeing and incubation.

See also George Adams Hatchery Fall Chinook HGMP.

9.1.4) Incubation conditions.

None at this site. See also George Adams Hatchery Fall Chinook HGMP.

9.1.5) Ponding.

See also George Adams Hatchery Fall Chinook HGMP.

9.1.6) Fish health maintenance and monitoring.

WDFW fish pathologist examines fish prior to release and responds to any requests or concerns expressed about fish health by the program operators.

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

Eggs will be incubated using high quality water to minimize the risk of catastrophic loss due to siltation. Family will be distributed into at least three or more different incubation units, each with a separate spring water supply, to spread the risk and prevent catastrophic loss (see HGMP section 5.8). All Chinook are incubated under the guidance of fish health personnel from WDFW and in accordance with the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State (WDFW and WWTIT, 1998, updated 2006) (see also HGMP section 9.1.6).

9.2) Rearing:

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

Table 9.2.1.1: Hamma Hamma fall Chinook fry survival-to-release (as sub-yearlings), 2003-2010.

Brood Year	Fry-to-Sub-yearling/Release (%)
2003	95.2
2004	NA
2005	76.9
2006	99.2
2007	NA
2008	94.8
2009	99.8
2010	99.8
Average	**94.3**

Source: Hatchery Records, 2011.

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

Hatchery rearing densities will be those that yield the highest expected survivals.

Table 9.2.2.1: Conservative "standard" and "maximum" pond loading densities applied in restoration programs to promote the release of healthy, viable fish.

Size	Pounds fish/gpm inflow		Pounds fish/ft3 rearing volume	
	Standard	Max	Standard	Max
Swim-up	<1.0	1.5	0.5	0.75
1300-600/lb	1	2.5	1	2
600-90/lb	1.5	3	1	2

Actual loading rates at the John Creek facility, LLTK Lilliwaup Hatchery or George Adams Hatchery will be consistent with these guidelines.

9.2.3) Fish rearing conditions

John Creek Conservancy Site: Fish are reared in earthen ponds or 16' x 3' x 3' fiberglass raceways on spring water, with underwater feeding or hand feeding and are protected by bird netting.

George Adams Hatchery: The fish are reared in ambient surface water from Purdy Creek.

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

Fish are not reared in typical hatchery ponds, and are not sampled at the same level of frequency since they are in systems that mimic the natural environment. They are transported from George Adams Hatchery to the John Creek Conservancy Site at 75 to 85 fpp, and released at 60 to 75 fpp between mid-May and mid-June.

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*).

John Creek Conservancy Site: Fish are fed Bio-Diet Grower to a maximum of 2% body weight per day. They also utilize the available natural food. Maximum loading is 3 lbs fish /gpm.

George Adams Hatchery: Fish are reared in a diet of Bio Oregon Bio-Diet Starter and Bio-Diet Grower feed at rates between 1.7 and 2.5% B.W./day.

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

Fish checked routinely by a WDFW fish pathologist as per the Co-managers Fish Health Policy (NWIFC and WDFW 1998, updated 2006).

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

Gill ATPase activity is not monitored.

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

John Creek Conservancy Site: The fish are reared in natural, earthen ponds and 16' x 3' x 3' fiberglass raceways. They are released from the earthen ponds and raceways starting at a size of about 75 fpp and/or are transported to the Hamma Hamma for release.

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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.

John Creek Conservancy Site: Sites are supplied with water that is gravity-fed from multiple natural springs. Fry will therefore not be affected by power failures. A water supply to the incubators and ponds is redundant and the loss of any one of them will minimize loss. Full time staff at least one time daily will check the facility and staff will be on-site during extreme rain events or extreme cold weather events. Uniform rearing methods will be applied across egg take groups.

See also George Adams Fall Chinook HGMP.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

Table 10.1.1: Proposed number and size at release.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Sub-yearlings	23,750 (Hamma Hamma) 23,750 (George Adams)	75	Mid-May to mid-June	Hamma Hamma Rive r
	23,750 (Hamma Hamma) 23,750 (George Adams)	60		

WDFW, Future Brood Document 2012.
Note: 75fpp ~ 82 mm fork length.

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

Stream, river, or watercourse: John Creek, WRIA 16.0253
Release point: John Creek RM 2.0
Major watershed: Hamma Hamma River
Basin or Region: Hood Canal/ Puget Sound

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

Table 10.3.1: Actual number and size at release, 2000-2011.

Release Year	Sub-yearling	Avg. size (fpp)	Date(s)
2000	70,000	80	NA
2001	55,400	70	NA
2002	53,000	80	7/15
2003	48,225	80	7/1
2004	55,000	80	7/7
2005	70,354	89	6/28
2006	69,832	73	5/3-6/14
2007	84,375	79	4/14-6/26
2008	86,051	86	6/7-16
2009[a]	80,745	66	5/4-6/16
2010	81,174	67	5/17-6/11
2011	84,807	67	5/16-6/16
Average	**69,914**	**76**	

Source: WDFW Hatchery Plants database, 2011.
Notes: Releases are George Adams (Purdy Creek) and Hamma Hamma stocks, combined.
[a]The size at release was reduced as determined by the Chinook Technical Work Group; as of the 2009 brood the program was changed to acclimate and release fry in two different groups (see **Attachment 5**).

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

Fish are volitionally released starting late-May and continues into June.

10.5) Fish transportation procedures, if applicable.

John Creek Conservancy Site: If it should become necessary, fry may be transported in ambient temperature freshwater to the Hamma Hamma River in a 4' x 4' x 2.5' plastic tote aerated with regulated oxygen via air stone or in a WDFW supplied fish transport truck; transport takes less than 20 minutes.

George Adams Hatchery: Fish will be transported to the John Creek facility in April/May using a fish transport truck with regulated oxygen.

Fed fry are transported from the George Adams Hatchery by WDFW staff via a planting truck to the John Creek Conservancy Site for acclimation and release (see also George Adams Fall Chinook HGMP).

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

Fish are reared at George Adams Hatchery and transported to acclimate on spring water on a tributary (John Creek) of the Hamma Hamma river.

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

Table 10.7.1: Juvenile fall Chinook releases from Hoodsport Hatchery.

Release Year	Sub-yearlings	Marking
2011	42,400 (Hamma Hamma) 42,400 (George Adams)	CWT+Otolith

WDFW, Future Brood Document 2012.

One hundred percent of the hatchery fish will be released with a CWT; program releases have not be adipose fin-clipped since the 2008 brood. Both the Hamma Hamma-origin and the George Adams-origin fish will be reared in common lots but will be differentially otolith marked during the eyed-egg stage. Unique thermal otolith marks are applied to assess any difference in survival-to-return between the two release groups.

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

We do not anticipate any excess fish as egg takes will be regulated to avoid this possibility. Any surplus production will be handled consistent with protocols provided by the Co-Managers.

10.9) Fish health certification procedures applied pre-release.

WDFW fish pathologist will examine the fish prior to release.

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

Fish will be allowed to migrate with floodwaters in response to complete water failure. This is highly unlikely at the conservancy site due to redundant water supplies from multiple springs.

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.

John Creek Conservancy Site: Hamma Hamma Chinook smolts are released at a size of about 60-75 mm between mid-May and early-June, when wild smolts are expected to be about 60 to 80 mm long (see **Attachment 5**).

The restoration program will result in an increase in the number of Chinook salmon carcasses in freshwater areas and provide a source of nutrients that will benefit other salmonids and non-salmonids.

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Releases of George Adams fall Chinook from the John Creek Conservancy Site in the Hamma Hamma River are more problematic. There are wild listed summer chum in these streams. Chinook sub-yearling smolts are scheduled for release between mid-May and early-June. Wild summer chum should have cleared the area around the mouth of the Hamma Hamma well before May, so Chinook should pose a low risk to summer chum juveniles.

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 purpose of a monitoring program is to identify and evaluate the benefits and risks that may derive from the hatchery program. The monitoring program is designed to answer questions of whether the hatchery is providing the benefits intended, while also minimizing or eliminating the risks inherent in the program. A key tool in any monitoring program is having a mechanism to identify each hatchery production group.

Each production group shall be identified with distinct otolith marks, adipose 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.

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

These fish are 100% marked with coded-wire tags and otolith-marks. Fish will not be adipose fin-clipped will occur, which would allow for selective fisheries (harvest opportunity) in mixed stock areas. This will minimize impacts on the stock, distinguishing it from the hatchery fall Chinook production in fisheries and during the NOR/HOR spawning ground ratios.

WDFW staff and PNPTC/tribal staff communicate if production changes are proposed. Production changes involving the Regional Fish Enhancement Group (RFEG) or volunteer co-op groups are communicated through the WDFW's Region 6 office. The changes in goals and production levels that result from these discussions are reflected in WDFW's Future Brood Document.

WDFW and NOAA Fisheries are engaged in discussions of hatchery Chinook production and release in Hood Canal to ensure that agency hatchery programs are consistent with recovery requirements. WDFW staff assigned to implement the policy will review aspects of hatchery physical plant and operations that may conflict with the Wild Salmonid Policy.

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, staffing, and support are available and committed for Monitoring and Evaluation at the current level as described in HGMP section 11.1, above and as detailed in the Resource Management Plan for Puget Sound Chinook Salmon Hatcheries (WDFW and PSTT 2002). Additional funds are needed to support expanded monitoring and evaluation, including data collection and compilation and support for allozyme, DNA and otolith collections and analyses.

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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.

It is anticipated that adherence to monitoring and evaluation protocols provided by the Co-Managers will not elevate risk to listed Chinook salmon.

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

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SECTION 13. ATTACHMENTS AND CITATIONS

Attachment 1: Broodstock Collection Protocols, Hamma Hamma Chinook Project, Brood Year 1999.

Attachment 2: Chinook Broodstock Benefit/Risk Analysis and Recommendations.

Attachment 3: Letters from NMFS dated October 19, 1999 and November 16, 2000;
Letter from WDFW dated September 18, 2000.

Attachment 4: Hamma Hamma River Chinook Salmon Supplementation Program, Brood Year 2000 & Hamma Hamma Fall Chinook Composite Strategy Evaluation Study.

Attachment 5: Hamma Hamma Fall Chinook Program Reference Document – BY 2011. Dated August 30, 2011.

Attachment 6: Southern Boundary Restoration and Enhancement Fund Detailed Proposal Form 2012.

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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:_____

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

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

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

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

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

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

Although there are anecdotal and historical observations of bull trout in Hood Canal tributaries (e.g. Hamma Hamma, Dosewallips, Duckabush Rivers), there are no current records of bull trout in independent tributaries to Hood Canal (USFWS 2004).

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

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

Source Data: USFWS 2008

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

Year	North Fork Skokomish Bull Trout
1999	90
2000	93
2001	87
2002	93
2003	89

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2004	109
2005	150
2006	71
2007	243
2008	202
2009	74
2010	NA
Average	**118**

Data Source: SaSI (WDFW 2012)

Habitat. There is no bull trout population or habitat in the Hamma Hamma River watershed.

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

Cushman Dams 1 and 2 on the North Fork Skokomish River were constructed without fish passage and have eliminated connectivity of fish upstream from the dams with habitat and fish in the lower North Fork Skokomish River, the mainstem Skokomish River, the South Fork Skokomish River, and Hood Canal. Lack of, or greatly reduced, flows in the North Fork Skokomish River resulting from diversion of water to a power canal have reduced sediment transport capabilities, resulting in further aggradation of the river. Channelizing and diking for agriculture and residential development have further contributed to sediment accumulation. Incidental mortality to migrating bull trout from Tribal gill-net fisheries has been documented in the DPS (Brenkman 2005) and incidental mortality from other targeted fisheries (both recreational and Tribal) likely also pose a threat to bull trout in the Skokomish River due to the low numbers of adult fish observed over the past several years (USFWS 2004).

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

Marbled murrelet (*Brachyramphus marmoratus*) –Threatened
Northern Spotted owl (*Strix occidentalis caurina*) –Threatened

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

15.3) Analyze effects.

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

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15.4 Actions taken to minimize potential effects.

There are no activities associated with this hatchery program 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 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chinook *(Oncorhynchus tshawytscha)*	**ESU/Population:** Puget Sound/ Hood Canal Chinook	**Activity:** Hamma Hamma Chinook Program
Location of hatchery activity: John Creek, RM 2.0, WRIA 16.0253	**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 to100	-
Collect for transport b)	-	-	-	-
Capture, handle, and release c)	-	-	Up to18	-
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-		-
Intentional lethal take f)	-	-	Up to 80	-
Unintentional lethal take g)	Up to 3,500	Up to 2,500	Up to 1	-
Other Take (specify) h)	-		-	-

Note: The above numbers assume 100% natural origin adults collected from the Hamma Hamma. Supplementation with fish from George Adams hatchery has been and will be used until total broodstock can be attained through returns to the Hamma Hamma River.

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.*

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Attachment 1: Broodstock Collection Protocols

Hamma Hamma Chinook Project Brood Year 1999

Have developed the following procedures to be applied for the collection of broodstock in the Hamma Hamma River he following procedures to be applied for the collection of broodstock in the Hamma Hamma River have been developed by the Kings staff, with technical support from the Washington Department of Fish and Wildlife and Point No Point Treaty Council. All of these techniques were utilized last year with summer chum without any resulting mortality, (other than the expected mortality associated with spawning and extended holding of males in a freshwater environment.)

Capture Techniques

Two capture techniques will be utilized: the hook-and-line capture method, and with a block seine. Two snorkelers will float down the river from the blue hole (river mile 2) to a block seine erected at river mile 1. The snorkelers will either capture fish using the hook-and-line method (the preferred and primary method for collecting broodstock) or they will drive fish downstream into the seine (the secondary, back-up collection method). Regardless of the method used, care will be taken to avoid capture and displacement of Chinook in the act of spawning to allow completion of redds.

The Hook-and Line Capture Method

Primarily the snorkelers will use this method. The capture apparatus is a large barbless fishhook, fitted to a metal cap and a heavy-duty line. The cap is attached to the shank of the hook with the opening facing toward the eye. A thin wooden stick is fitted into the cap, creating a gaff hook with a disengaging staff. The diver holds the stick and the line, keeping pressure on the hook, until a fish is engaged. The diver uses the stick to hook the fish on the dorsal half of the caudal peduncle, anterior to or even with the adipose fin. The diver then releases the stick and retrieves the fish with the line.

The Block Seine Capture Method

The block seine will be manned with at least three people. LLTK and WDFW staff in proper fish handling techniques will train the seine operators. All non-targeted fish will be captured by hand from the seine and gently passed downstream Any Chinook encountered will be retained up to the weekly broodstock collection goal. Care will be taken to avoid walking on summer chum & Chinook redds during operation of the seine. If large numbers of pinks are collecting in the seine, the operators will lift the lead line to allow the fish to escape downstream, rather than handling individual fish.

Number of Fish to be Collected

A weekly target number of fish to be collected has been established based on the expected escapement and early, average, and late run timing curves (see below). A table will be provided by the Co-Managers, based upon these curves, indicates the weekly proportions of the total return that should be collected. These numbers will be reviewed mid-way through the run to accommodate any in season variations in run size or timing. The number of fish to be collected each week will be either the target number or half of the weekly escapement, whichever is lower.

Timing and Duration

Broodstock will be collected during the normal Chinook upstream migration. Collection will occur on Monday, Wednesday and Friday of each week, or on Tuesday and Thursday on those

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weeks that the workweek begins on Tuesday. Collection will last only until the weekly collection goal has been reached, and then discontinued until the following week.

Broodstock Holding

Adults will be segregated by sex and held in PVC tubes. The tubes are approximately 4' long and 10" in diameter, and have large holes drilled in them throughout their length to allow the free exchange of water. These tubes are large enough to accommodate up to three fish each for short periods. However, for this program, only one female will be held per tube, while males may be held up to three per tube. For holding periods greater than 12 hours, loading rates for both sexes will be one fish per tube. The tubes holding fish will be placed in the river in backwater areas and secured to a fixed object on the bank with rope.

Fish will be held in the tubes until spawned. Females will be checked for ripeness upon capture and twice per week thereafter, and will spawned as soon as possible. Males will be live-spawned and returned to the tubes until they either spawn with three or more females or until they expire.

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Attachment 2: Chinook Broodstock Benefit/Risk Analysis and Recommendations

Developed by Dr. Jim Myers, NMFS Northwest Fisheries Science Center; Dr. Craig Busack Washington Department of Fish and Wildlife, and Chris Weller, Point No Point Treaty Council

September 15, 2000

1 Hamma Hamma Supplementation Program

Review of the program was done in two phases. First, genetic risks (loss or dilution of native or locally-adapted genetic resources) and demographic risks (risks related to small population abundance or due to over escapement) were evaluated separately. Second, the risks were discussed in the context of other factors (watershed history, etc.).

It was generally agreed that allowing the return adults to spawn naturally without any supplementation offered the least potential for genetic risk and the maximum rate of local adaptation. Using adults returning to the Hamma Hamma River as broodstock for the supplementation program was considered the second best option. There were concerns that this option did not provide the maximum rate of local adaptation. The Hybrid option was viewed as inferior to the all-Hamma Hamma broodstock because of the continued influence of George Adams fish. The George Adams transfer was considered the least desirable.

Two demographic scenarios were considered. If the existing population was under the freshwater habitat-based carrying capacity, then any supplementation would have minimal risk and would be of benefit to the target population (as long as the supplementation did not result in over escapement). The hybrid and all-George Adams options were considered equally beneficial, given that there would be no reduction in the reproductive capacity of the returning adults. The use of both males and females returning to the Hamma Hamma would result in some decrease in natural production, but would contribute supplementation fish to the system (it was assumed the egg to adult survival of hatchery reared eggs was substantially higher than that for naturally-deposited eggs). Lastly, the cessation of supplementation altogether would produce a minimum demographic benefit.

If the existing population (approximately 600 naturally spawning adults), were near or over the existing carrying capacity of the Hamma Hamma River the continuation of the supplementation program would be of little benefit and may be deleterious to the population (depending on the validity of the Beverton Holt or Ricker models). Under these conditions the No Supplementation option would be preferred.

Likely to Have Lower Genetic Risks:

1st. D. No supplementation
2nd. B Returning Hamma Hamma Fish
3rd. C. Hybrid
4th. A. George Adams

Likely to Have Lower Demographic Risks (w/o genetic risks considered):

A. Under carrying capacity
1st. Hybrid

1st. George Adams
2nd. Returning Hamma Hamma Fish
3rd. No supplementation

B. Over carrying capacity
1st. No supplementation
2nd. Supplementation Fish
2nd. Hybrid
2nd. George Adams

Discussion:

It was difficult to evaluate the overall potential for the continued existence of some remnant of the native Hamma Hamma River Chinook salmon population. Foremost, was the absence of information on the reproductive success of George Adams fish in the Hamma Hamma River. If supplementation program fish are nearly as successful as native fish, it would be unlikely that a native population remnant could persist. Alternatively, if the supplementation program fish do not successfully reproduce, then NOR adults may still be representative of the native population. Analysis of allozyme data suggests that little difference exists between Hamma Hamma and Skokomish River Chinook salmon; however, the sample was taken during one year (1999) and only from adults. Given the small size of the watershed and limited suitable spawning habitat it is unlikely (but not impossible) for native fish to have remained reproductively isolated to any significant degree. However, the locally adapted NORs and what native genetic characteristics they retain are an important resource for recovery.

There was some concern that the current return of adults (NORs and HORs) to the Hamma Hamma River may be sufficiently large to sustain the population without further supplementation. Furthermore, if escapement exceeds carrying capacity further supplementation may be deleterious. Ideally, if further supplementation is required, then the most locally-adapted source available should be utilized.

Ultimately, the success of the program will depend on the sustainability of the population without supplementation. If the population is not sustainable:

a. Limiting habitat factors may need to be corrected
b. The stock may not be suited to the watershed
c. The supplementation stock may not have become locally-adapted
d. Other limiting factors may need to be identified.

Recommendations:

1) Any future releases of supplementation fish should be externally marked (preferably also with a distinctive mark to distinguish them from fish released into other basins –otolith mark, CWT, etc.).
2) Genetic samples should be taken from naturally spawning adults and juveniles out-migrating the following spring.
3) Habitat carrying capacity (present and historical) should be estimated.
4) A clear set of program termination criteria should be developed.
   a) If escapement goals are met for a designated number of years – the program may no longer be necessary.
   b) If the contribution of supplementation fish (adult returns or smolt production) does

not exceed a certain level – the program may not provide sufficient benefits to justify its continuation.

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Attachment 3: Letters from NMFS dated October 19, 1999, November 16, 2000 & Letter from WDFW dated September 18, 2000.

October 19, 1999

Mr. Tim Flint, Fish Program Manager
Washington Department of Fish and Wildlife, Region 6
48 Devonshire Road
Montesano, Washington 98563

RE: Decisions on Chinook Hatcheries in Hood Canal

Dear Mr. Flint:

The disposition of Chinook hatcheries in Hood Canal has been discussed at several meetings in recent months between the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), the co-managers, and private hatchery enhancement groups. This memo summarizes conclusions reached by NMFS based on discussions at these meetings, and provides a reference for current hatchery planning under Sections 7 and 4(d) of the Endangered Species Act (ESA).

NMFS recognizes the management authority and responsibility of the state and the tribes for hatchery production. We also appreciate the sincere intent, commitment to wild fish recovery, and substantial production of the private enhancement groups over the last five years. Their field accomplishments are particularly note worthy for innovation.

The conclusions in this memo reflect NMFS's first priority under the ESA to conserve and protect listed species of naturally produced summer chums and Chinook in Hood Canal. If you have any questions or comments on this memo, please feel free to call Derek Poon of my staff at (206) 526-6550.

EASTERN HOOD CANAL:

As proposed by the co-managers, the three private "wild conservancy sites" at Tahuya, Union, and Dewatto, which reared and released George Adams hatchery Chinook for 5 years, are to be discontinued. Returning Chinook will continue to spawn naturally and will be monitored; they are not expected to produce a sustainable natural population.

The co-managers proposed closing these facilities for a number of reasons. Bill Waknitz of NMFS conducted an independent analysis of historic data and verified the co-manager's conclusions. Our findings are as follows. 1) These are summer chum streams and not Chinook rivers. 2) Redd superimposition by Chinook on chum salmon has occurred and is expected to continue. Thus, there is a risk that George Adams hatchery Chinook will dig up summer chum redds resulting in a take as defined under the ESA. 3) Long term Chinook production in non-Chinook rivers is not expected to produce self sustaining natural Chinook populations. 4) A

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moot point for these streams and rivers, but not for western Hood Canal rivers: George Adams Chinook should not be continuously released off site, confounding the process of local adaptation at release sites. This last point is a topic for future discussions.

BIG BEEF CREEK:

The Chinook releases at Big Beef Creek appear to pose little risks to chum salmon and can continue as long as redd superimposition with summer chums can be avoided by operation of the weir and other means, and harvest can be managed to avoid adverse impacts on wild Chinook. The weir can be operated for its research value in monitoring the reintroduced summer chums and other research projects. The long-term status of the weir, however, should be addressed in the recovery planning process.

WESTERN HOOD CANAL:

The three private "conservancy sites" at Hamma Hamma, Skokomish, and Duckabush, all Chinook rivers, can continue rearing and releasing Chinook, on this their 5th year of operation. While NMFS prefers to stop importing George Adams eggs to these rivers, we agree with the co-managers that there isn't time to plan for and justify an on-site egg take this year. Therefore, the egg source, and for brood year 1999 only, can be George Adams hatchery. All released fish are to be externally marked.

Efforts are being made over the next several years to determine if native Chinook populations exist on these rivers. If native populations exist, brood stocks will be transitioned over to them. If native populations do not exist, brood stocks will be switched to returning F1 hatchery adults, or to other brood stock to be determined by the co-managers and NMFS based on proximity, similarity of habitat, and other characteristics. We anticipate that George Adams fish will not be used for brood year 2000.

OTHER PRIVATE REARING AND RELEASE SITES:

There are a number of other private projects (mostly southern and eastern Hood Canal), which rear and release a variable number of George Adams hatchery Chinook, up to several thousand and more, on streams that are not Chinook rivers. These are not federally funded. Many, but not all, of these projects are affiliated with schools.

In general, these projects are unlikely to contribute to the recovery of the wild populations, and may confound harvest and genetic management goals. NMFS concluded that all projects not affiliated with schools and not part of the ESU-wide hatchery plan should be discontinued.

Technically, these school projects are not consistent with native stock recovery and should also be terminated. The students should learn that hatcheries need to produce the right fish in the right way to benefit wild fish recovery. On the other hand, rearing salmon in the classroom has important educational values. To reconcile these opposing needs, NMFS concluded that production in school projects should continue but reduced to a level that will not have significant adverse impacts.

Accordingly, it is our understanding that all school projects will have production limits of up to five hundred eggs, to reduce adult returns to an insignificant level. In addition, all fish released

at three grams or less need not be externally marked. All fish released at greater than three grams should be adipose clipped, with coded-wire nose tags as optional.

Sincerely,

Stephen H. Smith, Chief
Hatcheries and Inland Fisheries Branch

cc: Al Adams
Hood Canal Salmon Enhancement Group
Barbara Cairns
Long Live the King

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16 November 2000

Dr. Jeff P. Koenings, Director
Washington Department of Fish and Wildlife
600 Capitol Way N
Olympia, WA 98501-1091

Dear Dr. Koenings:

Thank you for your September 18, 2000 letter seeking National Marine Fisheries Service (NMFS) concurrence with Washington Department of Fish and Wildlife's (WDFW) brood year 2000 broodstock protocols, for the Long Live The Kings (LLTK) and Hood Canal Salmon Enhancement Group (HCSEG) Chinook hatcheries at Hamma Hamma and Duckabush Rivers in Hood Canal. Derek Poon of my staff has conveyed our concurrence verbally to Assistant WDFW Director Lew Atkins, and this letter conveys NMFS concurrence with your proposal.

Your letter attached protocols to hybridize George Adams hatchery eggs with F1 Hamma Hamma milt for the Hamma Hamma hatchery, and you proposed to use George Adams eyed eggs for the Duckabush hatchery.

NMFS has taken a position on broodstocks at these hatcheries in an October 19, 1999 letter from Steve Smith to the Co-managers, with copies to LLTK and HCSEG. In this letter, NMFS indicated that F1 hatchery returns should be used for broodstock and transplant of George Adams eggs should stop. We continue to stand by this position, which was vetted with the Co-managers, LLTK and HCSEG, and followed Co-managers recommendations. Nonetheless, your proposal for the 2000 brood year, developed collaboratively between all affected parties, is an acceptable one-year solution.

I understand that the Skokomish Tribe did not concur initially with the use of George Adams eyed eggs at Duckabush, and wanted to stay with conditions outlined in the October 19, 1999 NMFS letter. I appreciate the discussion between David Herrera of the Tribe and Lew Atkins that led to a recent agreement to use George Adams eggs for this year only.

In developing the broodstock protocols in the Hatchery and Genetic Management Plans for the LLTK and HCSEG hatcheries, please use as source documents this letter; your September 18, 2000 letter; our October 19, 1999 letter; and the September 15, 2000 broodstock benefit/risk analysis and recommendations developed by Dr. Jim Myers of the NMFS Northwest Fisheries Science Center, Dr. Craig Busack of your staff, and Chris Weller of the Point No Point Treaty Council.

Thanks for the WDFW leadership in finding solutions to this broodstock issue. If you have any further questions on the NMFS position, please call Derek Poon at 206-526-6550.

Sincerely,

William L. Robinson

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Assistant Regional Administrator
for Sustainable Fisheries

cc: Donna Darm, NMFS
Dr. Robin Waples, NMFS
Gerry Jackson, USFWS
David Herrera, Skokomish Tribe
Chris Weller, PNPTC
Barbara Cairns, LLTK
Dr. Al Adams, HCSEG

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September 18, 2000

Mr. Derek Poon
National Marine Fisheries Service
7600 Sandpoint Way N.E., Building 3
Seattle, Washington 98115-6349

Dear Mr. Poon:

The enclosed information is a synopsis of the protocols required for implementation of the "Hamma Hamma F1 Milt/George Adams Chinook Eggs" option for year 2000 only. This option was discussed at length at our joint meeting September 6, 2000 at Washington Department of Fish and Wildlife (WDFW) and in subsequent discussions, e-mails, and telephone calls between the involved parties.

Based on our joint discussions regarding the various options presented by the group, an internal science review and risk assessment by WDFW, joint review by NMFS and WDFW science staff regarding the benefits associated with this option, as well as consideration of time constraints we face in implementing a plan for this season, WDFW believes the F1 Milt option for the Hamma Hamma is the right decision for this year.

This option provides:

1) Direct benefits to the resource;
2) Movement toward locally adapted stocks;
3) Maximum protection for the spawning F1 adults as the males will be live-spawned and all F1 females will be allowed to spawn in the wild;
4) Integrity of the project goals Long Live the Kings and the Hood Canal Salmon Enhancement Group have for the Hamma Hamma; and
5) The opportunity to implement an option that is sensitive to all of our needs and the time constraints we manage under.

We are approximately 25 percent into the Chinook adult return to the Hamma Hamma for this year. As you see in the attached protocols, full utilization of the various components of the run is essential. This requires that we begin collecting milt no later than next week, the week of September 18, 2000, and implement this option.

Despite our efforts to come to an understanding of the issues on the Duckabush, considerable uncertainty remains regarding the appropriate steps to take in 2000. Though similar to the recovery program on the Hamma Hamma, the program initiated on the Duckabush has apparently failed to result in a similar level of escapement. The lack of escapement increases the risk of immediately implementing the use of locally adapted stocks. In contrast, providing George Adams eyed eggs for one more year and working together to identify and remedy limitations to the success of the Duckabush program appears to present limited risk to the stock and may provide additional options for recovery actions in subsequent years. Because of our

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desire to balance the risks to the stock of our program in the Duckabush, this year, WDFW will provide George Adams eggs for one additional year unless absent any NMFS analysis that indicates this approach will result in a taking of listed fish.

WDFW is committed to working with our partners, and with NMFS, to plan and implement a long-term recovery strategy for both systems before the fall of 2001. We believe that by working through such issues and resolving them with our partners is the best way to recover salmon. Thus, planning for next year would begin immediately to ensure agreement on an approach and readiness to implement that approach next fall.

We appreciate your earliest response regarding this issue. Again, we anticipate needing to implement this option the week of September 18 if we are to be successful. Your timely comments are appreciated.

Sincerely,

Jeff P. Koenings, Ph.D.
Director

JK:dr

cc: Lew Atkins, Assistant Director
Jo Wadsworth, Deputy Assistant Director
Phil Anderson, Intergovernmental Policy
Jim Scott, Fish Chief Scientist
Tim Flint, Regional Fish Program Manager
Thom Johnson, District Manager

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Attachment 4: Hamma Hamma River Chinook Salmon Supplementation Program, Brood Year 2000

Synopsis of Protocols for the "Hamma Hamma F1 Milt x George Adams Hatchery Eggs" Option

September 2000

Production level: 70,000-sub-yearling release from John Creek facility on Hamma Hamma River.

Egg take goal: 78,000 green eggs; based on 90% survival from green egg to release.

Number of female Chinook needed: Based on an average of 3500 eggs per female, could be accomplished with about 22 females. However, recommend that partial (approximately half) lots of eggs from each of 50 females be used to achieve egg take goal of 78,000 green eggs. Estimates of the cumulative number of green eggs will be made after each egg take and the number of female Chinook needed may be adjusted to reach, but not exceed, the egg take goal of 78,000 green eggs.

Number of male Chinook needed: a minimum of 25 males

Broodstock selection:

Hamma Hamma males: Males from Hamma Hamma used for broodstock will represent the naturally spawning donor population with respect to run timing, size, age, and any other traits identified as important for long-term fitness. Collection of males will be based on the average weekly run timing developed by WDFW from brood years 1998 and 1999 during the period from August 27 through November 24. In practice, to provide flexibility and to allow for early/late run timing during 2000, the number of males collected during 2000 will represent the timing during each of three two-week periods: 6 males during September 10-23, 13 males during September 24-October 7, and 6 males during October 8-21. Males will be collected, held in PVC tubes in the Hamma Hamma River until ripe, and live spawned. Males will not be sampled for virology.

George Adams Hatchery females: Ripe females will be selected to coincide with the collection and spawning of ripe Hamma Hamma males. Females will be spawned at George Adams Hatchery and all fish health protocols followed. Samples will be transported to WDFW virology lab in Olympia and preliminary results will be available in about one week. Partial lots of green eggs from two or more females will be combined and then used as "one" female in the factorial crosses (see mating).

Mating: Spawning protocols are done in accordance with the co-managers fish health policy. Mating protocols and data collection developed by Steve Schroder of WDFW Science Division which are currently in use for the summer chum supplementation program on the Hamma Hamma will be used for Hamma Hamma Chinook. Green eggs will be transported to John Creek and fertilized there. Eggs will be fertilized factorially (2x2 or 3x3) or using at least a 1:1 spawning ratio. Back-up males will be used as a precautionary measure when available.

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Incubation and rearing : All incubation and rearing will take place at John Creek facility on the Hamma Hamma River. All eggs will be water hardened in iodophor and placed in remote site incubators at John Creek facility. Each day's egg take will be maintained in a single incubator and each female will be numbered and tracked. Although it is anticipated that it is a low likelihood, the entire day's egg take will be destroyed if virology testing proves positive. Eyed eggs will be marked with a unique otolith mark at John Creek facility. Fish will volitionally migrate from incubators to raceways for initial rearing. All fish will be marked with an adipose fin clip prior to ponding in natural ponds. Fish are released volitionally into spring water sources on John Creek, a Hamma Hamma River tributary. Production goal is a release of 70,000 Chinook during April-May at a size of 80 fish per pound. WDFW fish pathologist routinely checks fish health during incubation, rearing and prior to release.

Hood Canal Salmon Enhancement Group and Long Live the Kings staff, with technical support from the Washington Department of Fish and Wildlife and Point No Point Treaty Council. All of these techniques were utilized last year with summer chum without any resulting mortality, (other than the expected mortality associated with spawning and extended holding of males in a freshwater environment.)

Capture Techniques

Two capture techniques will be utilized: the hook-and-line capture method, and with a block seine. Two snorkelers will float down the river from the blue hole (river mile 2) to a block seine erected at river mile 1. The snorkelers will either capture fish using the hook-and-line method (the preferred and primary method for collecting broodstock) or they will drive fish downstream into the seine (the secondary, back-up collection method). Regardless of the method used, care will be taken to avoid capture and displacement of Chinook in the act of spawning to allow completion of redds.

The Hood-and Line Capture Method

This method will be used primarily by the snorkelers. The capture apparatus is a large barbless fish hook, fitted to a metal cap and a heavy duty line. The cap is attached to the shank of the hook with the opening facing toward the eye. A thin wooden stick is fitted into the cap, creating a gaff hook with a disengaging staff. The diver holds the stick and the line, keeping pressure on the hook, until a fish is engaged. The diver uses the stick to hook the fish on the dorsal half of the caudal peduncle, anterior to or even with the adipose fin. The diver then releases the stick and retrieves the fish with the line.

The Block Seine Capture Method

The block seine will be manned with at least three people. The seine operators will be trained by LLTK and WDFW staff in proper fish handling techniques. All non-targeted fish will be captured by hand from the seine and gently passed downstream Any Chinook encountered will be retained up to the weekly broodstock collection goal. Care will be taken to avoid walking on summer chum & Chinook redds during operation of the seine. If large numbers of pinks are collecting in the seine, the operators will lift the lead line to allow the fish to escape downstream, rather than handling individual fish.

Number of Fish to be Collected

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A weekly target number of fish to be collected has been established based on the expected escapement and "early", average, and "late" run timing curves (see below). The table will be provided by the Co-Managers, based upon these curves, indicates the weekly proportions of the total return that should be collected. These numbers will be reviewed mid-way through the run to accommodate any in season variations in run size or timing. The number of fish to be collected each week will be either the target number or half of the weekly escapement, whichever is lower.

Timing and Duration

Broodstock will be collected during the normal Chinook upstream migration. Collection will occur on Monday, Wednesday and Friday of each week, or on Tuesday and Thursday on those weeks that the work week begins on Tuesday. Collection will last only until the weekly collection goal has been reached, and then discontinued until the following week.

Broodstock Holding

Adults will be segregated by sex and held in PVC tubes. The tubes are approximately 4= long and 10" in diameter, and have large holes drilled in them throughout their length to allow the free exchange of water. These tubes are large enough to accommodate up to three fish each for short periods. However, for this program, only one female will be held per tube, while males may be held up to three per tube. For holding periods greater than 12 hours, loading rates for both sexes will be one fish per tube. The tubes holding fish will be placed in the river in backwater areas and secured to a fixed object on the bank with rope.

Fish will be held in the tubes until spawned. Females will be checked for ripeness upon capture and twice per week thereafter, and will spawned as soon as possible. Males will be live-spawned and returned to the tubes until they either spawn with three or more females or until they expire.

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HAMMA HAMMA FALL CHINOOK COMPOSITE STRATEGY EVALUATION STUDY

Abstract

Overall goal: To simultaneously access the fry-to-adult survival of fall Chinook originating from Hatchery x Hatchery, Acclimatized x Acclimatized, and Natural origin recruits. Null Hypothesis: Parental origin has no effect on the fry-to-adult survival of fall Chinook salmon

Provisional Approach:

1) Capture fall Chinook returning to the Hamma Hamma River, artificially mate the fish in a factorial fashion, incubate, thermally mark, rear in conservancy ponds, and release. The offspring of these fish will be used to create the Acclimatized x Acclimatized treatment group. They represent fish that have at least demonstrated a competency to return to the Hamma Hamma, and may be one or more generations removed from hatchery selection pressures.
2) Import eyed eggs from George Adams, thermally mark the eggs, rear in conservancy ponds, and release. These eggs will be used to create the Hatchery x Hatchery treatment group. They have originated from parental fish that have been exposed to hatchery selection pressures for multiple generations.
3) Natural origin fry will be produced by fall Chinook allowed to reproduce naturally in the Hamma Hamma River. They will originate from parental fish that will have been removed from hatchery life for varying periods of time, from none (a hatchery fish returning to spawn) to one or more generations

Procedural Steps for the creation and monitoring of these populations:

1) All adults used to create the Acclimatized x Acclimatized and Hatchery x Hatchery populations will have extensive biological information collected on them and the survival of their offspring. For example, age, weight, length, egg size, reproductive effort, DNA, pathology samples, egg-to-eyed egg survival, eyed egg to fry survival, and occurrence of monstrosities will be recorded
2) Distinct thermal codes will be induced into the otoliths of the fry representing each type of cross. Marking will occur at the eyed stage. After marking, the fish will be placed into RSIs that empty into conservancy ponds. The number of eyed eggs representing each cross will be calculated by using standard gravimetric methods. Several RSI options exist. In one case, a known number of eyed eggs from each treatment can be placed into the same RSI and incubated. Conversely, eggs from each treatment can be placed into separate RSIs, two per conservancy pond. The use of separate RSIs would be very helpful, since at the end of the incubation period, the number of dead eggs, alevins, and monstrosities remaining in each RSI could be counted and subtracted from the total number of eyed eggs placed into the RSI. This would then give us a good initial number of fry representing each treatment that entered the conservancy pond. If fry from both treatments were incubated in the same RSI, we could calculate the number of fry entering the pond but would be uncertain of their precise origin.

3) To help alleviate any pond effects, it is important that fish representing each of these two treatments rear in the same conservancy ponds. Multiple conservancy ponds could be used.
4) The standard practice is to stop feeding the fish after a set rearing period and let them volitionally exit their rearing ponds. This would be continued, with two modifications. First, we would want to serially sample the fish as they exited the ponds to determine the proportions of Hatchery and Acclimatized fry leaving over the course of the out-migration period. Second, the number of fish leaving a pond would be determined on a daily basis. Probably the best way to accomplish both of these objectives would be establish a net pen, or a circular tank lined with a net at the outlet of the conservancy exit pipe. This container would be checked daily, the fry could be counted gravimetrically or by hand, or by an automatic counter. A random sample of fish would then be removed, lengths and weights would be taken on them and their otoliths would be decoded to determine their treatment origin. The remaining fish would be released that night. The automatic fish counter would be the preferred option, as it would reduce stress caused by handling. The overall goals of the above work are to:
    a) Determine the total number of fry entering the Hamma Hamma River that have originated from the two treatment groups
    b) Ascertain whether the out-migration timing of fish originating from the two treatments differ
    c) Evaluate if any size differences exist in fish representing each treatment
    d) Determine if any differential survival occurred during the rearing phase, that is while the fish were held in the conservancy ponds
5) A screw trap will be established in the Hamma Hamma River to calculate the number of Natural-Origin Recruits leaving the system. In addition, it will also be used to assess the number of Hatchery and Acclimated conservancy fish exiting the basin. The trap will be installed above the influence of high tides to prevent fish passing by the trap multiple times. Trap efficiency will be routinely assessed by: 1) staining some of the captured fall Chinook with Bismarck Brown, 2) releasing them far enough above the trap so that can redistribute themselves in the river, 3) counting the number of marked fall Chinook recaptured, and 4) determining a trapping rate by simply dividing the number of recovered marks by the number released. If possible a stream gauge should be set up so that a relationship between stream flow and capture rate can be established. The screw trap should begin fishing in mid-January and sampling should continue through mid July or longer depending upon catch rates. Routine fish size measurements will be taken on a sample of the captured fish. All fall Chinook captured prior to the first liberation of conservancy fish will be regarded as NORs (Natural Origin Recruits). Once conservancy fish have been liberated into the Hamma Hamma then random samples of captured fry will have to be retained and examined to determine their origin (i.e. their otoliths will have to be decoded). Lengths and weights will be taken on the sampled fish. The overall goals of the trapping work are to:
    a) Characterize the number, size, timing, and type of fall Chinook leaving the Hamma Hamma River (We will therefore know the number of fall Chinook originating from each treatment that left the Hamma Hamma River. We will also have an idea of their size, and when they left the system.
    b) Compare the survival of Hatchery and Acclimatized conservancy fish from

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release to the Hamma Hamma trap

c) Compare the residency time of Hatchery and Acclimatized conservancy fish in the Hamma Hamma River.

6) Perform stream surveys in the Hamma Hamma River. Otoliths will be collected from adult fish returning the Hamma Hamma River to determine if NORs, Hatchery or Acclimatized fish survive at the same or different rates to the adult stage. The null hypothesis is that there is no difference in survival among the three groups from the fry stage to adulthood. If the study can be repeated for an entire brood cycle (minimum of three years maximum of five years) data could be pooled across brood years to increase power. It may also be possible to investigate whether any interactions have occurred among survival of treatment groups and treatment types. Recovered otoliths would be decoded and analyzed to provide this information.
7) It is recommended that managers and operators of this program meet at least once a year, prior to brood stock capture, to assess the results of the previous year and to identify needed changes to this program.

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Attachment 5: HAMMA HAMMA FALL CHINOOK

PROGRAM REFERENCE DOCUMENT – BY 2011
Version – August 30th, 2011

Prepared by Michael W. Schmidt, Long Live the Kings
Originated from the July 20th 2005, Technical Workgroup Meeting
Last modifications made were based on the August 19th, 2010 Technical Workgroup Meeting

The goal of this hatchery program, a cooperative effort between LLTK, HCSEG and the co-managers, is to restore a healthy, natural, self-sustaining population of fall chinook to the Hamma Hamma River. The current objectives are to:

1) develop and maintain, in the long term, a population comprised of naturally spawning Chinook on the Hamma Hamma River;
2) boost the numbers of naturally spawning Chinook in the Hamma Hamma River using Chinook adults returning to the Hamma and George Adams Hatchery as donor stocks, producing a maximum of 95,000 fed fry each year (~47,500 George Adams and ~47,500 Hamma);
3) monitor, evaluate and report on the effectiveness of the restoration program.

---Taken from the Mid-Hood Canal Chinook recovery section of the Puget Sound Salmon Recovery Plan, Shared Strategy 2005, http://www.sharedsalmonstrategy.org/plan/index.htm

Based on EDT estimates of the productive capacity of the Hamma Hamma River, the recovery goal is around 1,000 Chinook returning to the Hamma annually (if productivity is one adult recruit per spawner). Even at its maximum production level of 95,000 fed fry per year, given the current level of natural production, the Hamma Chinook supplementation program should not exceed the natural capacity of the watershed. However, NOAA is finding that the EDT model, used to establish current productivity/capacity estimates and recovery targets for many Puget Sound streams, in many cases may have overestimated these values (pers. comm. S. Bishop. NOAA. August 19, 2010 TWG meeting).

The original duration of the program was from brood year 1995-2006. In August 2007, the Technical Workgroup decided it would be of value to continue the program for a minimum of two more years. Rearing protocols improved the quality of fish released beginning with brood year 2004. Subsequently, an increased number of Chinook returned in 2007 and 2008, indicating that fish culture modifications may be improving smolt-to-adult survival. In July 2009, the Technical Workgroup decided that the program should continue as described in this document, subject to annual review, through brood year 2012, at which time enough data should be available to evaluate the program's effectiveness and decide how to proceed. After the supplementation portion of the program is complete, monitoring and evaluation will continue for an additional three to four years to determine whether the program contributed to the rehabilitation of a self-sustaining Hamma Chinook population.

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Program Protocol

The following is a list of protocol for the Hamma Hamma Fall Chinook program. The parties responsible for each action are in brackets.

1. Broodstock Collection and Spawning

The egg take goal for BY 2011 is 104,500; this is an increase of 16,500 eggs compared to BY 2009. In 2010, the intent was to collect a higher proportion of the total eggs from Hamma chinook, but it was not possible. In 2011, a goal of ~50% of the eggs will again be targeted from each of the Hamma and George Adams chinook stocks. George Adams eggs will be used to backfill egg take goals, if needed.

- ~50% of the 2011 broodstock are any Chinook returning to the Hamma, including hatchery and natural, adipose and non-adipose clipped fish (53,300 eggs), and ~50% of the 2011 broodstock are from George Adams (51,200 eggs). Mortality is assumed to be slightly higher for the Hamma stock (~10%) compared to the George Adams stock (~7%). [LLTK, WDFW]
- Spawn the Hamma and George Adams fish separately using 1:1 individual or factorial mating. [LLTK, WDFW]
- Take Chinook throughout each run and incorporate jacks to ensure genetic diversity. [LLTK, WDFW]
- The general Hamma and George Adams collection schedule is as follows; [LLTK, WDFW, HCSEG, Skokomish Tribe]

Period	Hamma Hamma Broodstock	Hamma Hamma Egg take goal	George Adams Egg take goal
Sept. 10-23	3 pair	12,300 green eggs	11,815 green eggs
Sept. 24- Oct. 7	7 pair	28,700 green eggs	27,570 green eggs
Oct. 8 – 21	3 pair	12,300 green eggs	11,815 green eggs
Totals	13 pair	53,300 green eggs	51,200 green eggs

However, if the run manifests itself differently for a particular brood year, the co-managers should be contacted (per the Program Change Protocol, below) to decide whether the broodstock collectors may adjust the schedule accordingly.

- Select pairs at George Adams to coincide with the collection and spawn timing of Hamma fish [WDFW]. Regular communication with George Adams staff is needed re: the actual dates and numbers of Hamma Hamma Chinook spawned [LLTK].
- Organize volunteers for observation, collection and spawning activities. Create a phone tree of on-call volunteers for immediate support to address Chinook found ripe. [LLTK, HCSEG, Skokomish Tribe]
- Collect Chinook via seine net and hook and line at the Hamma [LLTK, HCSEG, Skokomish Tribe, Port Gamble S'Klallam Tribe].
- At the Hamma, adults will be collected and held in in-stream net pens or a covered raceway at the Johns Creek conservancy site until the fish are ripe. [LLTK, HCSEG, Skokomish Tribe, Port Gamble S'Klallam Tribe].
- Spawn the Chinook following summer chum protocols and take kidney and spleen samples. Notify WDFW Virology Lab in Olympia and send them the samples within 24 hours of

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spawning. Virology Lab does not accept samples after 11am on Fridays; therefore, spawning generally should not occur on Fridays and definitely not on Saturdays. If necessary, ripe fish captured can be spawned earlier than scheduled days. LLTK will notify WDFW if they are planning to spawn before coordinated spawn dates. [LLTK, HCSEG, Skokomish Tribe, WDFW]

2. Rearing

- Hamma: Incubate eggs until eyed in vertically stacked trays at Johns Creek. Possibly use ½ stacks, placed in the raceways to protect the eggs (In 2005, a bear knocked over a few stacks of trays). [LLTK]
- George Adams: Incubate eggs until eyed using standard procedures for the hatchery. [WDFW]
- Use summer chum protocol for inventorying eyed eggs. [LLTK, WDFW]
- Transfer eyed Hamma eggs to George Adams. [LLTK, WDFW]
- Otolith mark eyed eggs using different marks for the Hamma and George Adams egg groups. [WDFW]
- Hatch eggs and rear fish. George Adams and Hamma-origin fish can be pooled together during rearing. [WDFW]
- Adipose fin marking and coded-wire tagging is decided annually. Marking and/or tagging would occur at ~400 fpp prior to transferring the Chinook to the Johns Creek site in April and May. [WDFW] {BYs 2005 thru 2007 = 100% Ad-fin clip and coded-wire tag; BYs 2008 thru 2010 = 100% coded-wire tag only}
- In early March, check flows and pond sizes to determine stocking densities for ponds and raceways at Johns Creek prior to transfer.
- Transfer half of the fish in April and half of the fish in May to the Johns Creek site to condition/imprint. [WDFW]
- Rear fish at the Johns Creek site until they are ready for release. A rearing strategy will be determined based upon the number of fish on hand and the two-stage release strategy (see below). [WDFW, LLTK]
- Cover raceways with screens and use predator fencing at the Johns Creek site to reduce predation. [LLTK]
- Feed per WDFW guidelines. [LLTK, WDFW]
- If needed, have Chinook checked by a fish pathologist. At a minimum, fish health should be checked two weeks after tagging, prior to transfer, and one week prior to release. [LLTK, WDFW]

3. Release

- The release goal is 95,000 for BY 2011; this is an increase of ~15,000 compared to BY 2009.
- Use a two-stage release strategy. Release all fish transferred in April (first group) at ~75 fpp by May 15th. Release all fish transferred in May (second group) at ~65 fpp no later than June

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7th or at a time that mimics the outmigrant timing of natural-origin Hamma Chinook smolts. Releases should still be somewhat dictated by fish behavior.

- In early May, begin checking for fish behavior indicating that the Chinook are ready for release (e.g. fish crammed against the screens). [LLTK]
- Force release the Chinook from the ponds and raceways. Count all the fish gravimetrically. Use buckets to weigh and then release fish into Johns Creek. [LLTK]
- Collect length and weight data on fish released, volitionally or forced. [LLTK]
- Calibrate smolt trap efficiency from the Johns Creek conservancy site and the Hamma mainstem in order to get an accurate read on out-migrating juveniles. Be sure to weigh each test group for fpp. [LLTK]

4. Data Collection and Evaluation

- Use the Hamma smolt trap to determine number of out-migrating juveniles, wild and hatchery origin. [LLTK, Port Gamble S'Klallam Tribe]
- Count and sample all adult carcasses. Determine length, sex, hatchery/wild (presence of adipose-fin clip), and otoliths and remove snouts for potential coded-wire tags. WDFW carcass tags and scale cards should be completed for each carcass. [WDFW and LLTK]
- Collect:
    - broodstock information per the summer chum recovery program biological data sheet: gender, length, weight, number of eggs per female [LLTK, WDFW]
    - egg mortality information at eyed egg stage [LLTK, WDFW]
    - fish release data: fish release dates, number released, length and weight [LLTK]
    - kidney and spleen samples of broodstock [LLTK, WDFW]
    - <u>Check for coded-wire tags and collect snouts from all chinook, including broodstock</u> [LLTK, WDFW]
- Compare George Adams-origin hatchery, Hamma-origin hatchery and natural-origin groups.
- Address data confidence, recognize program constraints and note observations in the evaluation.
- Distribute a brief annual program progress report to the Technical Workgroup [WDFW]

5. Emergency Protocol

For the Hamma conservancy site [LLTK]:

- In inclement weather check the Hamma conservancy site often. If needed, notify a member of the Robbins family for support.
- In a worst-case-scenario situation it is ultimately up to the operator to make the on-the-ground decision as to how to deal with a problem at the conservancy site. If this occurs, the operator should immediately notify the co-managers of their actions after the incident.
- If a failure should occur, the operator should:
    a. Resort to the backup system to keep the fish healthy
    b. If needed, contact local hatchery staff (at George Adams or Hoodsport, etc) for support with fix.
    c. Notify the co-managers/technical workgroup of the incident and the actions taken to resolve the issue.

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d. In the case of a large loss, options on how to address the loss should be discussed by the technical workgroup, including NOAA-Fisheries.

- For George Adams [WDFW]: Notify the co-managers/technical workgroup of the incident and the actions taken to resolve the issue.

6. Program Change Protocol

- If a change to the program is needed, the co-managers should be notified. The co-managers can then decide whether the change warrants a meeting to discuss the issue or whether they can come to an agreement through communication via email or over the phone.
- If a change does occur, the program reference document will be updated and re-distributed. If the change is such that other documents (FBD, HGMP) must be updated, the Co-managers will do so.

7. Technical Workgroup and Support Contact List

Cindy Gray, Skokomish Tribe, cgray@skokomish.org
Jed Moore, LLTK, jmoore@lltk.org
Jonathon Wolf, Skokomish Tribe, jwolf@skokomish.org
Joy Lee, LLTK, jlee@lltk.org
Mark Downen, WDFW, Mark.Downen@dfw.wa.gov
Matthew Kowalski, Skokomish Tribe, mkowalski@skokomish.org
Michael Schmidt, LLTK, mschmidt@lltk.org
Neil Werner, HCSEG, neil@hcseg.org
Randy Aho, WDFW, randy.aho@dfw.wa.gov
Rick Endicott, LLTK, rendicott@lltk.org
Teresa Sjostrom, HCSEG, teresa@hcseg.org
Thom Johnson, PNPTC, tjohnson@pnptc.org
Tim Tynan, NOAA Fisheries, tim.tynan@noaa.gov
Susan Bishop, NOAA Fisheries, susan.bishop@noaa.gov
Paul McCollum, Port Gamble S'Klallam Tribe, paulm@pgst.nsn.us
Hans Daubenberger, Port Gamble S'Klallam Tribe, hans@pgst.nsn.us
Richard Brocksmith, HCCC, rbrocksmith@hccc.wa.gov

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Attachment 6:

Southern Boundary Restoration and Enhancement Fund
Detailed Proposal Form 2012

Project Title: Conservation hatchery plan to support Mid-Hood Canal Chinook salmon recovery

Proponents name: Michael Schmidt, Dir. of Fish Programs; Barry Berejikian, Research Fishery Biologist

Affiliation: Long Live the Kings; NOAA Fisheries

E-mail address: mschmidt@lltk.org **Phone:** 206-382-9555 x27

Identify the one Goal and its applicable Objective that best describes the main intent of the proposal.		**Dollar amount requested (specify currency)**
Goal:	Objective:	
1. Improve management of stocks & fisheries	1, 2, 3, 4,	**$ 92,205 USD**
2. **Address priority stocks of interest**	5, 6, 7,	
3. Improved collaboration	8,	
4. Ecosystem based management	9.	

Project Location:	**Is this proposal a continuation of a project previously funded by the Southern Fund? N**
Dosewallips, Duckabush and Hamma Hamma Rivers, Hood Canal, Washington	**This is Year # NA of NA years.**

Start Date: 1/3/2012 **End Date:** 31/12/2012

1. **Overview:** We propose to develop a conservation hatchery plan for rebuilding the mid-Hood Canal Chinook population (Hamma Hamma, Duckabush and Dosewallips rivers) that incorporates existing genetic, habitat, and freshwater and marine survival data; is integrated as a component of mid-Hood Canal Chinook recovery (original plan - WDFW and PNPTT 2005), and is consistent with other Chinook recovery actions throughout the Hood Canal basin. The plan will identify the most appropriate genetic stock to rebuild the extant mid-Hood Canal Chinook salmon population. In the Hamma Hamma River, naturally spawning hatchery Chinook salmon from a non-local, domesticated broodstock (Green River origin) have yielded egg-to-migrant survival rates (see Weinheimer et al. 2011) insufficient to support a viable natural population. Juvenile Chinook salmon samples will be collected from the Dosewallips River and analyzed as the final step to determining whether a genetic legacy of the indigenous stock still exists.[1] If not, the plan will identify stocks from other basins with habitat, flow, and temperature conditions similar to and compatible with the conditions of each of the three rivers. Regardless of the most appropriate founder stock for rebuilding, we will utilize the most current guidelines for conservation hatcheries to develop a stock-specific approach for the culture-based rebuilding program. Key components of the plan will be derived from an analysis of the existing Hamma Hamma Chinook salmon supplementation program, evaluating the efficacy of that and other culture-based Chinook programs (e.g., White River, Dungeness River), and successful approaches and practices associated with those programs. The Hood Canal Technical Working Group, whose represented parties have an excellent track record for developing, implementing, and monitoring rebuilding programs for ESA-listed salmon

[1] *The Duckabush juvenile Chinook samples collected in 2011 were analyzed by WDFW in late summer, after the project concept form was submitted to the PSC. They were closely associated with the George Adams Hatchery / Green River origin stock (pers. comm. K. Warheit, WDFW, Sept.2011).*

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(summer chum) and steelhead in Hood Canal, will review and provide input on the plan. Long Live the Kings, as a nonprofit, will be able to raise public and private funds to implement the new enhancement approach once the plan is finalized and approved by the federal, state, and tribal managers.

2. **Stock:** Mid-Hood Canal Chinook, Puget Sound Chinook ESU

3. **Conservation:** The Mid-Hood Canal Chinook population is of **High** conservation concern. It is part of the Puget Sound Chinook ESU, listed as threatened under the ESA. It is one of the two populations of Chinook in the Hood Canal bioregion identified by NOAA's Puget Sound Technical Recovery Team that must be recovered to self-sustainable levels in order for the ESU to be delisted. Despite relatively good freshwater habitat and promising habitat recovery efforts, reduced exploitation rates (from 60% in mid-90s to 30%), and ongoing enhancement activities in the Hamma River, mid-Hood Canal Chinook average 99, 3, and 16 fish escaping to the Hamma Hamma, Duckabush, and Dosewallips rivers, respectively (yrs. 2006-2010 – WDFW Escapement Reports, Salmonscape). Recovery benchmarks are 250, 325, and 750 at 3.0 recruits per spawner, respectively (Mid-HC Recovery Plan, Submitted to Shared Strategy May 2005 by WDFW and the Point No Point Treaty Council).

3. **Bilateral Fishery Relevance:** As an ESA-listed population required for delisting and with consistently low returns, this stock has a **High to Medium** level of impact or constraint on fisheries in Canada. The total expected exploitation rate is approximately 30%, of which approximately 10% is attributed to southern U.S. fisheries and about 20% to Canada (there is no projected Alaskan harvest) (2004-2008 FRAM Post Season Eval.– S. Bishop, NOAA, 2010). Overall, harvest primarily occurs in mixed-stock ocean and terminal net and sport fisheries directed at other species and stocks. Canadian harvest impacts primarily occur in the WCVI troll fishery.

5. **Fishery Benefits:** Improving the status of the mid-Hood Canal Chinook population has **High** benefits by way of reducing existing constraints on other fisheries, currently in place to protect this population. Improved status will likely have **Low** to **Medium** direct benefits to fisheries by way of harvestable fish (overall habitat capacity est. at 1,325 adults at 3.0 recruits per spawner – 2005 Recovery Plan). However, the rivers are within the U&A's of the Point No Point Treaty Tribes, and they have significant interest in future fishery potential.

6. **Context:** The 2005 Recovery Plan for Puget Sound Chinook salmon identifies enhancement as one of the tools for rebuilding mid-Hood Canal Chinook salmon (see cite in 3, above). This project seeks to improve upon existing enhancement efforts, which have received continued support from tribal, state and federal managers represented on the Hood Canal Technical Working Group. This project is a high priority project because: 1) The TRT indicated that mid-Hood Canal watersheds ranked in the highest 1/3 of Puget Sound Chinook watersheds for ecological integrity (TRT 2006), suggesting other limiting factors may exist. 2) We'll test the assumption that existing stock is likely comprised of summer/fall run Green River strays (Dosewallips and Duckabush), the same stock currently released into the Hamma Hamma River. The TRT (2006) presumed the indigenous population had spring adult run timing and considers it to now be extinct (TRT 2006 Independent Populations of PS Chinook – Table 1). 3) Strays from nearby net pens (Green River stock) into all three mid-Hood Canal Rivers in the mid 1990s produced modest increases in adult abundance that disappeared when the releases were terminated, suggesting they were poorly adapted to these rivers (K. Adicks. WDFW – Feb. 2010 memo).

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For help completing the following sections please see the accompanying Guidelines to the Stage Two Detailed Proposal Form in the Strategic Plan (page 24).

Part 2. TECHNICAL IMPLEMENTATION DETAILS

ADDITIONAL CONTEXT[2]

Mid-Hood Canal Chinook recovery includes habitat, hatchery and harvest actions. In the 2005 Mid-Hood Canal Chinook Recovery Plan, habitat recovery actions were developed using a qualitative model (Ecosystem Diagnosis and Treatment Model) that describes the fish status relative to current habitat conditions and fish population response to particular habitat restoration actions (WDFW and PNPTT 2005). Based on this model-based analysis, the region's co-managers concluded that attributes related to habitat diversity, channel stability, key habitat quantities, flow, and sediment load emerged as the most important habitat factors limiting recovery, with the greatest impact in the lower rivers and estuaries (Shared Strategy 2007). The plan reflects the harvest strategy established via a Puget Sound Chinook harvest management plan and international harvest management mechanisms, which has reduced the overall exploitation rate to approximately 30% (with 10% attributed to southern US fisheries) [3]. Finally, the hatchery component describes both harvest and conservation directed programs, indicating actions taken or proposed to reduce risks and improve their performance. The Hamma Hamma Chinook conservation hatchery program, which began in 1995 and was modified in 2001 to what it is today,[4] preceded the development of the Chinook recovery plan, and, upon review of the recovery plan, the TRT did not believe that this program was grounded in a well-defined recovery hypothesis (Puget Sound TRT 2005). They indicated that support for the recovery hypothesis lacked watershed specific data, and suggested that the hypothesis be improved to more strongly consider the status and function of the habitat and to use the most recent data available on population status (abundance, productivity, contribution of hatchery fish to natural spawning, etc). They also suggested data from other watersheds be used to increase the analytical support for the project, and recommended that more be done to show how the hatchery recovery actions are integrated with habitat recovery and harvest management.

Habitat restoration remains a top priority for mid-Hood Canal Chinook recovery. However, the concerns that have arisen in response to the recovery plan's conservation hatchery strategy (described above), the questionable performance of the current hatchery program located in the Hamma Hamma River, and, largely, ongoing questions regarding whether the Chinook present in mid-Hood Canal is the appropriate stock for its habitat warrant a an assessment of the situation and a revised hatchery plan that is carefully designed to contribute to recovery.

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[2] *Additional contextual information not covered in the 2-page concept form was added at the request of the regional co-managers.*

[3] *Reference is on page 2, section 3.*

[4] *See section IV, Analysis of the Hamma Hamma supplementation project, for more information about that project.*

7. Approach: Describe in detail the techniques and methods to be employed.

PROJECT PROCESS

This proposal is to create a plan that describes alternatives and a recommended approach for a fish-culture component to mid-Hood Canal Chinook recovery, integrated with habitat recovery and harvest management efforts and recovery planning for the other primary Chinook population in the Hood Canal bioregion (Skokomish River): an All-H, regionally-based approach. Genetic, habitat (including flow and temperature regimes), historical information, and data regarding the performance of the existing Hamma Hamma Chinook supplementation program/population will be used as a foundation for determining the most appropriate stock for the three mid-Hood Canal rivers. The methods and findings of the recently drafted Skokomish River Chinook Recovery Plan (Skokomish Tribal Nation, DRAFT 2010) will provide guidance to this effort, where it was determined that spring Chinook represent the appropriate life-history for Chinook recovery in the watershed based upon historical information, including information about habitat condition, flow and temperature regimes. The most current guidelines will be used for conservation hatcheries to develop a stock-specific approach for a culture-based component for mid-Hood Canal Chinook recovery. Key parts of the plan will be derived from an analysis of the existing Hamma Hamma Chinook salmon supplementation program, evaluating the efficacy of that and other culture-based Chinook programs (e.g., White River, Dungeness River), and successful approaches and practices associated with those programs.

Similar to the Salmon Recovery Funding Board project planning process (SRFB 2011), alternatives will be developed regarding how a conservation hatchery program could be implemented. Alternatives may vary based upon scope (e.g., # of rivers), scale (number of fish produced), stock (e.g., if a late-fall or early-spring run ultimately fits the Duckabush habitat/flow regime), timing of implementation[5], etc. The alternatives will be evaluated based on feasibility (e.g., availability of donor stock, cost, access to the appropriate sections of the river, infrastructure needs, etc.), the extent to which they integrate well with habitat recovery and harvest management actions in the basin, their potential risk to other species of salmonids (esp. those that are ESA-listed) in the watersheds, and how well they synchronize with the recovery efforts in the Skokomish River. A preferred approach will be designated, and a detailed plan for the conservation hatchery program will be developed.

The plan will be developed in collaboration with state and tribal co-managers, federal agencies and other salmon recovery entities in Hood Canal. Throughout the course of the planning process, meetings will be held with them to discuss the technical data, evaluate alternative strategies for recovery, choose the preferred approach for rebuilding the mid-Hood Canal Chinook population, and review the detailed rebuilding plan. The Hood Canal Chinook Technical Working Group[6], established in 2000, will be the primary body for plan

[5] *One alternative may include a "wait and see" approach where a rebuilding plan is delayed until the Skokomish River spring Chinook recovery effort is underway, to determine whether strays from the Skokomish River will re-seed the mid-Hood Canal rivers with Chinook that are productive enough to recolonize.*

[6] *The Technical Working Group includes representatives from the Skokomish Tribal Nation, WDFW, NOAA, Port Gamble S'Klallam Tribe, Point No Point Treaty Council, the Hood Canal Coordinating Council, Hood Canal Salmon Enhancement Group, and LLTK. See section 11, below, for more information.*

development discussions. Regional managers representing the Point No Point Treaty Tribes[7], the Washington Department of Fish and Wildlife (WDFW), and NOAA Fisheries will be the primary decision makers when choosing the preferred rebuilding approach.

ASSESSMENT TECHNICAL DETAILS

If the genetic, life-history and migratory characteristics of the current Chinook stock do not align with their environment, the intrinsic productivity of that stock may not be sufficient to respond to culture-based and other recovery measures. Therefore, one of the primary challenges is assessing options for the most appropriate broodstock for rebuilding the population, which may include the extant population, or translocation of a non-local population possessing genetic, life history, and behavioral characteristics to support a high level of fitness in Mid-Hood Canal Rivers. To determine the appropriate broodstock, as referenced above, we will incorporate genetic information, assess the habitat (flow and temperature regimes) and the life-history attributes they can support, review available historical information, and further evaluate the current Hamma Hamma Chinook program. The Hamma Hamma Chinook evaluation will also provide additional information to help assess limiting factors for Chinook salmon recovery in the Hamma Hamma River and help guide future alternatives. The following describes the techniques that will be used for data gathering and analysis. The parties carrying out each assessment are indicated in parentheses.

I. Genetic information (WDFW and Port Gamble S'Klallam Tribe w/ LLTK and NOAA support)

Selecting the appropriate broodstock for a rebuilding program requires an understanding of the genetic composition of the extant population. There is substantial evidence that two of the three Mid-Hood Canal Chinook populations (Hamma Hamma and Duckabush) are genetically very similar to the primary hatchery population (George Adams Hatchery) stocked into Hood Canal over several decades. The George Adams Hatchery population was derived from Soos Creek Hatchery (Green River, Puget Sound) broodstock and has been released into the Skokomish and other rivers for several decades. The Hamma Hamma supplementation program has received direct releases of George Adams Hatchery Chinook salmon since 1995. Allozyme and DNA microsatellite analyses of Hamma Hamma River Chinook salmon have indicated that this population is more closely linked to the George Adams Hatchery population than any other population in Hood Canal or Puget Sound (Marshall et al. 2000, Warheit et al. 2011). Subsequent analyses of juvenile outmigrants collected by WDFW from the Duckabush River have shown essentially the same level of association with the George Adams Hatchery population (pers. comm. K. Warheit, WDFW, September 2011). Therefore, there is no evidence of a genetic legacy of the endemic Chinook salmon populations in samples collected from either of these rivers.

Genetic data are not yet available from Chinook salmon in the Dosewallips River. The Port Gamble S'Klallam Tribe will be installing and operating a trap on the Dosewallips River in the spring of 2012. Tribal biologists will sample outmigrant Chinook salmon and preserve tissue

[7] *From here forward, Point No Point Treaty Tribes refers to the Skokomish, Port Gamble S'Klallam, Lower Elwha Klallam, and Jamestown S'Klallam tribes. The Point No Point Treaty Council (PNPTC) is also referred to in this document. The PNPTC currently represents the Port Gamble S'Klallam and Jamestown S'Klallam tribes.*

samples for DNA extraction and analysis. Genetic samples will be analyzed by WDFW geneticist, Todd Kassler, and compared against the GAPS microsatellite baseline for Puget Sound Chinook salmon and the new SNP baseline that is currently being developed (described by Warheit et al. 2011). The results of the Dosewallips genetic analysis and the published information from the other two rivers will be assessed by the working group to help guide decisions regarding the most appropriate broodstock for the rebuilding plan.

Genetic methods will be used to estimate the population-of-origin for Chinook collected from the Dosewallips River. These methods are based on a procedure described by Rannala and Mountain (1997) that uses a partial Bayesian procedure and the expectation-maximization (EM) algorithm to calculate the stock-source probabilities (posterior probabilities) for each sample. The probability of the multilocus genotype (i.e., a genetic fingerprint from an individual fish) is determined for an individual stock in the genetic baseline (one probability for each stock in the baseline). Others have used the basic methods developed by Rannala and Mountain (1997) to provide population-of-origin assignments of unknown individuals (Hauser et al. 2006, Taylor and Costello 2006, and Waples and Gaggiotti 2006). The Chinook coastwide microsatellite DNA baseline v3.0 was developed by the Genetic Analysis of Pacific Salmonids (GAPS) consortium (including nine laboratories from the Western United States) to standardize protocols for the collection and reporting of microsatellite data.

II. Hydrologic and temperature regimes support different life history types (NOAA and LLTK)

Evaluating other potential broodstock sources will be a critical component of the rebuilding plan, especially if the genetic data from the Dosewallips river confirm results from the Hamma Hamma and Duckabush populations (i.e., George Adams Hatchery stock), and if further evaluation of the Hamma Hamma Chinook program confirms that it is not a viable alternative for rebuilding (see section IV, below). The hatchery component of the Skokomish River Chinook Salmon Recovery Plan (Skokomish Tribal Nation, DRAFT 2010) selected its broodstock based upon historical information about the fish in the Skokomish River Basin and the past hydrologic and temperature regimes there. This historical information confirmed the appropriate life-history characteristics to recover and how to improve the habitat and manage the dams on the Skokomish River so that hydrologic and temperature regimes are consistent with those life-history characteristics. The development of the proposed plan for Mid-Hood Canal Chinook will proceed under a similar hypothesis, which is that potential broodstock sources should express demographic, behavioural and life history characteristics that will provide for a high level of fitness under the hydrologic and temperature conditions of the Mid Hood Canal Rivers.

Currently, very little information is available regarding important phenotypic characteristics (migration and spawn timing, age-at-smoltification, size and age-at-maturity) of the endemic Mid-Hood Canal Chinook salmon population. The Recovery Plan for Puget Sound Chinook indicates that the historic run timing of Mid Hood Canal Chinook was earlier than the current summer/fall run timing evident in spawner surveys and monitoring data for the supplemented Hamma Hamma River (WDFW and PNPTT 2005). Similar to the approach taken in the Skokomish River Recovery Plan, the proposed project will evaluate the current and historic hydrologic and temperature profiles of the mid-Hood Canal rivers. The profiles will be compared to other Puget Sound rivers supporting Chinook salmon populations and their

behavioural, demographic and life history traits. Thermal regime clearly plays a critical role in determining life history traits and is an important driver in determining spawn timing, incubation and emergence timing, and age-at-smoltification (Brannon et al. 2004). Beechie et al. (2006) summarized hydrologic conditions throughout Puget Sound, including Hood Canal, and clustered populations based on hydrologic regime and phenotypic traits (spawn timing and age-at-smoltification). The relative contributions of phenotypic plasticity and local adaptation to phenotypic expression among these populations remain somewhat unclear. However, consistent dramatic differences in run timing in other regions, evidence for artificial selection for run timing in hatchery populations, and rapid evolution of run and spawn timing differences (Quinn et al. 2000) clearly point to a genetic role for these traits. As part of the plan development, we will update the hydrologic information compiled by Beechie et al. (2006) from the same sources (USGS), and obtain additional sources of information (Washington State Department of Ecology) and data available from the Hood Canal Steelhead Project.

Cluster analyses based on pairwise correlations between rivers for temperature and streamflow will be performed to determine the degree of similarity in conditions among the three Mid-Hood Canal Rivers and other rivers in Puget Sound from which broodstock may be available. The results of the analysis will be considered by the working group along with the results of the existing and new (Dosewallips) genetic analysis to provide a ranked set of potential donor broodstocks.

III. Historical Information (LLTK and NOAA)

Some information was collected regarding the history of Chinook salmon in mid-Hood Canal in the development of the Mid-Hood Canal Chinook Recovery Plan (WDFW and PNPTT 2005) and NOAA's ―Independent Populations of Chinook Salmon in Puget Sound‖ (NOAA 2006). However, the information was limited. We will review this information, but also make an additional attempt to recover more information on both the salmon population and historic habitat conditions that may shed light on the historic run timing and life history of Chinook in mid-Hood Canal. Additional information sources to be reviewed include news articles, old records from an early 1900s hatchery located on the Duckabush River, interviews with tribal members, cannery records, maps/T-sheets, etc.

IV. Analysis of the Hamma Hamma supplementation project (WDFW, NOAA, LLTK)

The recovery goal for the Hamma Hamma River population based on EDT analyses used in the Puget Sound Recovery Plan is around 1,000 Chinook returning annually (at productivity = 1 R/S). The Hamma Hamma Chinook salmon supplementation program began in 1995 with the goal of aiding in recovery of naturally spawning Chinook in the Hamma Hamma River. The program was initiated with George Adams Hatchery broodstock in 1995. Since 2001, the hatchery broodstock has come from hatchery-origin adults returning to the Hamma Hamma River and hatchery-origin adults from the George Adams Hatchery. The goal has been to produce a maximum of 80,000 fed fry each year (40,000 from each donor stock). In 2001, the project collaborators established a monitoring plan that included: i) otolith thermal marking of embryos to identify the origin of returning adults (i.e., George Adams hatchery broodstock, Hamma Hamma hatchery broodstock, or, if mark absent, presumed natural-origin) collected on the spawning grounds, ii) the number of redds constructed, iii) potential egg deposition (number of redds x estimated fecundity), iv) natural egg-to-migrant survival rates, and v)

marine survival rates (migrant to adult).

We propose to conduct two primary analyses to inform the process of determining whether the approach taken in the Hamma Hamma River should continue to be included as a viable alternative for rebuilding of Mid-Hood Canal Chinook populations. For the first analysis, marine survival rates (migrant-to-adult) will be compared between hatchery-reared juveniles from George Adams Hatchery broodstock and those from Hamma Hamma River hatchery broodstock. This analysis will provide an indication as to whether adult Chinook salmon that had been released from and returned to the Hamma Hamma River confer any survival advantage to their offspring compared to offspring of George Adams Hatchery broodstock. This analysis will compare the release-to-adult return proportions and will be based on numbers of juveniles released and thermal codes on otoliths recovered from the spawning grounds (return years 2003, 2004, 2005, 2006, 2008, 2009, 2010, 2011). Scale age-data will be used to assign each adult to its respective brood year. The second analysis will be conducted to provide information on the freshwater productivity of (mostly) returning hatchery-origin adults. The analysis will involve updating freshwater survival rates (egg-to-migrant) reported in Weinheimer and Zimmerman (2011). They derived survival rates from estimates for egg deposition and juvenile migrant abundance estimates (outmigration years 2002 through 2010). Abundance of naturally produced Chinook outmigrants was calculated using a single partial-capture trap study design. Additional migrant data were collected in 2011 and will be collected again in 2012 via smolt trap operations on the Duckabush (WDFW) and Hamma Hamma (LLTK) rivers. The analysis will be updated to provide a total of 8 years of egg-to-migrant survival data (estimates could not be made for outmigration years 2003, 2006 or 2010). The freshwater survival data will be considered by the working group in the context of marine survival estimates to help assess limiting factors for Chinook salmon recovery in the Hamma Hamma River and help guide future alternatives.

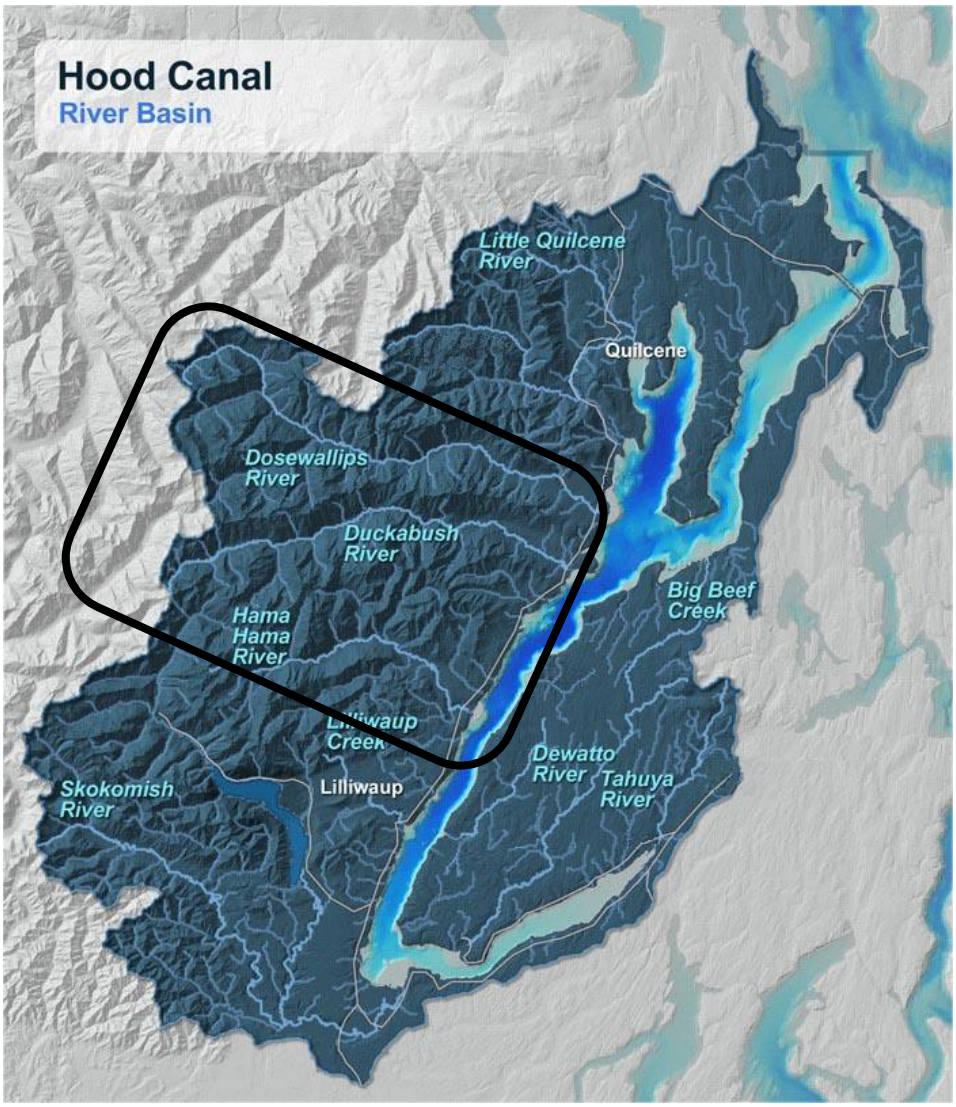

Figure 1. Project study area

PLAN DEVELOPMENT

Per the description in the ―Approach Process‖ section above, alternatives will be developed and evaluated. Information will be collected from the tribal and state co-managers, NOAA and the Hood Canal Coordinating Council regarding feasibility (e.g., availability of donor stock, cost, access to the appropriate sections of the river, infrastructure needs, etc), the extent to which the alternatives integrate well with habitat recovery and harvest management actions in the basin, their potential risk to other species of salmonids (esp. those that are ESA-listed) in the watersheds, and how well they synchronize with the recovery efforts in the Skokomish River.

From there, an alternative will be chosen by the regional co-managers and a detailed plan developed. Both the alternatives and plan will rely on information that has recently been published regarding best practices for conservation and rebuilding programs using artificial propagation. We will incorporate the guidance from these publications on: i) factors to

consider when initiating a conservation hatchery program (HSRG 2005), ii) broodstock management (e.g., Mobrand et al. 2005, Kozfkay et al. 2008), iii) innovative rearing methodologies to promote natural timing of life history transitions (e.g., Swanson et al. 2011), and iv) optimized release strategies to maintain adaptive traits (Berejikian et al. 2004). Captive broodstock programs can provide for quick population amplification and can be started from a much smaller number of gametes than a conventional hatchery program, but come with their own set of genetic risks (Waples and Do 1994, Fraser 2008) and safeguards (Flagg and Mahnken 2004). We will compile pertinent information from current and past Chinook captive broodstock programs (e.g., Marlowe et al. 2001, Hoffnagle et al. 2011) to assess whether this strategy should be considered as part of the rebuilding plan. This includes evaluating local culture-based rebuilding programs such as those employed on the Dungeness River and White River. The Dungeness program is of particular interest because of its close proximity to Hood Canal and the Dungeness River has a hydrologic regime that is more similar to the Dosewallips River than to other Puget Sound rivers.

The complete plan will include information from the assessment, the alternatives process, and a detailed approach for developing a conservation hatchery program. The plan will describe: i) broodstock source and collection methods, ii) culture methods (including water supply, facilities), iii) disease management, iv) breeding strategies, v) incubation and rearing strategies, vii) release strategies, and viii) all associated monitoring. Key components of the plan will include which of the three Mid-Hood Canal rivers to supplement, broodstock source, natural spawner abundance targets, release abundance targets, and monitoring approaches. The plan will be sufficient enough to provide a basis for a future Hatchery and Genetic Management Plan (HGMP). The Hatchery and Genetic Management Plans (HGMP) are used in Washington, Oregon, and Idaho to provide a single, comprehensive source of information regarding anadromous salmonid hatchery programs. The National Marine Fisheries Service (NMFS) uses the information in its Endangered Species Act (ESA) processes to assess impacts on listed anadromous fish.

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8. Schedule: Provide a timetable of key activities for the project culminating in the delivery of a Final Report.

ID	Task Name	Duration	Start	Finish
1	**Meeting to discuss/confirm data collection and evaluation activities and timeline**	1 day	Mon 3/5/12	Mon 3/5/12
2	**Collect data**	**72 days?**	**Tue 3/6/12**	**Wed 6/13/12**
3	Hydrologic and temperature regime	25 days?	Tue 3/6/12	Mon 4/9/12
4	Historical information	20 days	Tue 3/6/12	Mon 4/2/12
5	Outmigrant Trapping, including genetic samples	66 days?	Wed 3/14/12	Wed 6/13/12
6	**Perform Analyses**	**72 days?**	**Tue 4/3/12**	**Wed 7/11/12**
7	Analyze hydrologic and temperature regimes relative to life-history types	20 days?	Tue 4/10/12	Mon 5/7/12
8	Review historical information and summarize	15 days?	Tue 4/3/12	Mon 4/23/12
9	Genetic analysis of Dosewallips outmigrants	18 days?	Thu 6/14/12	Mon 7/9/12
10	Evaluate the Hamma Hamma Chinook supplementation program	48 days?	Mon 5/7/12	Wed 7/11/12
11	**Meeting to discuss results of analyses and begin developing alternatives**	1 day	Tue 7/17/12	Tue 7/17/12
12	**Draft alternatives for rebuilding plan**	**42 days?**	**Wed 7/18/12**	**Thu 9/13/12**
13	Develop broodstock & program scale, scope, timing, etc. options	21 days?	Wed 7/18/12	Wed 8/15/12
14	Evaluate feasibility of alternatives; how well they integrate with habitat recovery, harvest management, and Hood Canal wide recovery actions; etc.	21 days?	Thu 8/16/12	Thu 9/13/12
15	**Meeting to discuss alternatives and determine recommended approach for rebuilding plan**	1 day	Tue 9/18/12	Tue 9/18/12
16	**Draft operational details of the rebuilding plan**	40 days?	Wed 9/19/12	Tue 11/13/12
17	**Meeting to review and finalize plan**	1 day	Wed 11/14/12	Wed 11/14/12
18	**Rebuilding plan is finalized. A copy of the rebuilding plan and a final project report is submitted to the Pacific Salmon Commission by 12/19/2012**	25 days?	Thu 11/15/12	Wed 12/19/12

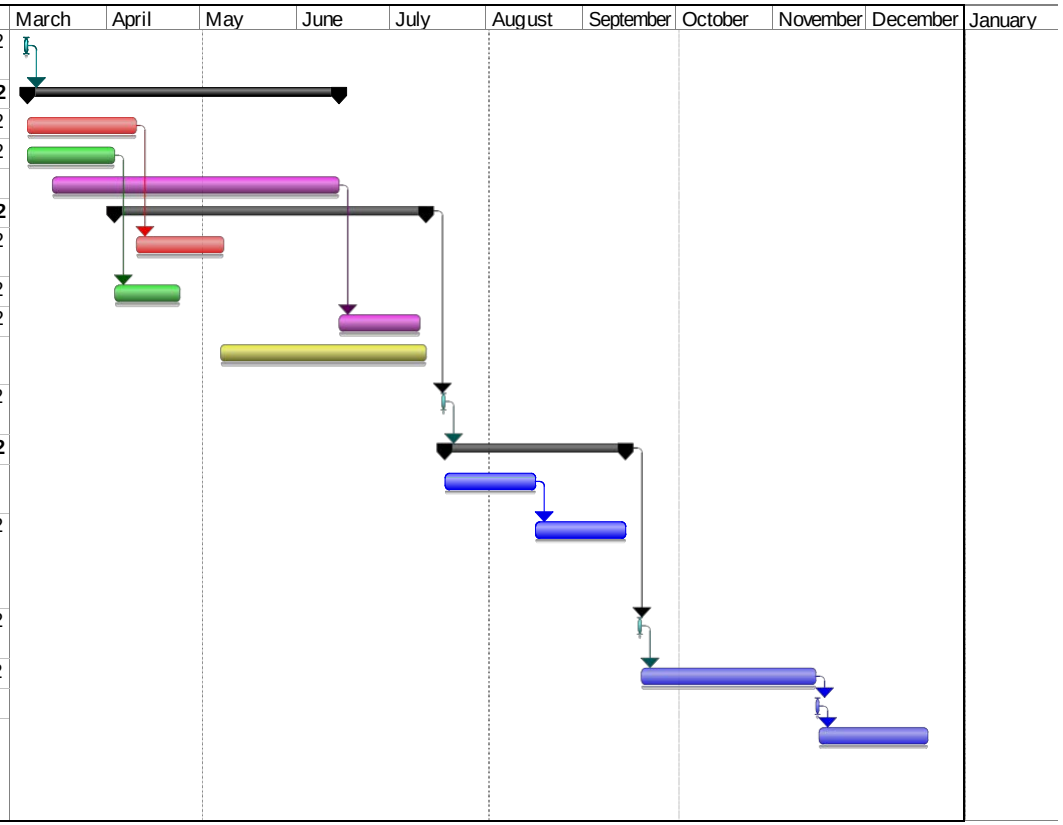

Figure 2. Mid-Hood Canal Chinook rebuilding plan schedule

9. Assumptions and Risks: Describe any assumptions or risks which must be taken into account that might affect the timeline, budget, leadership or the ultimate success of your proposal. Describe your contingency plan for potential problems.

Process Assumption and Risk: We assume that co-managers within the Hood Canal Watershed will engage cooperatively to develop an approach for rebuilding mid-Hood Canal Chinook salmon. The co-managers (and other key stakeholders) in this watershed have worked together successfully to date to make ongoing management decisions for the existing Chinook program on the Hamma Hamma River, to develop and implement a recovery plan for summer chum salmon, and they have collaborated on a 16-year conservation hatchery implementation and monitoring project for ESA-listed steelhead. Therefore, we are confident that components of this proposal requiring engagement from the co-managers and consensus decision making will be successful.

Technical Risk: One technical risk is if no or too few Chinook are collected in the temporary trap on the Dosewallips River in 2012, and, thusly, no genetic analysis occurs to determine whether the Dosewallips Chinook differ from George Adams/Green River-origin Chinook (i.e., evidence to help determine whether a remnant native population remains in the Dosewallips). If this occurs, we will plan on trying to collect genetic information from adult returns (carcasses) during spawning surveys or from outmigrants in subsequent years but, in the interim, use existing information to make a determination regarding whether there remains a native population (presence/absence of adipose fin on adult carcasses, escapement estimates and associated fluctuations relative to proximate hatchery returns, run time, etc; current conclusions of the TRT and co-managers, etc).

Part 3. CAPACITY TO DELIVER

10. Key Personnel: Identify key project personnel. If any component of the proposal will be provided by others, identify these persons, the nature of their involvement, and their relevant qualifications. *Note: submission of full-length detailed resumes is not required.*

Michael Schmidt, Director of Fish Programs, Long Live the Kings, mschmidt@lltk.org

Project Role - *Project Leader:* Michael will be the lead developer of the mid-Hood Canal Chinook rebuilding plan. He will facilitate the assembly of the background/assessment information needed, including coordinating the activities of the other project participants listed below, and lead this project team in the development of a recommended rebuilding approach. He will write, compile and/or edit several sections of the plan. Michael will also coordinate the meetings between the project team and the Hood Canal Technical Working Group and relevant co-managers who will be reviewing and providing input on the plan at various stages during its development.

Education: Master of Marine Affairs, University of Washington, 2004. Bachelor of Arts, Marine Affairs, University of Miami, 1997.

Professional Experience: Over 10 years of experience managing, coordinating and/or facilitating salmon research, recovery, fisheries enhancement, and management reform

programs for LLTK (2001-present), including: Director, overseeing all eleven LLTK salmon and steelhead research, recovery and fisheries enhancement programs, including the LLTK's role in the Hood Canal Steelhead Project (2006-present); Facilitator – USFWS Pacific Region Federal Hatchery Review (2006-2010); Project Assistant - Puget Sound and Coastal Washington Hatchery Reform Project (2001-2005). In-depth knowledge of hatchery reform related concepts, including contemporary conservation hatchery practices and genetics-based broodstock management.

Service: Member of the Puget Sound Hatchery Action Advisory Committee for Washington State (June 2011-present).

List of publications available upon request.

Barry Berejikian, Research Fishery Biologist, Behavioral Ecology Team Leader, NOAA Manchester Research Station, barry.berejikian@noaa.gov

Project Role – *Project Oversight*: Barry will oversee the development of the mid-Hood Canal Chinook rebuilding plan and provide technical and scientific guidance. He will perform the data analysis and reporting of results for the hydrologic and temperature regime assessment and will provide input on the other analyses where appropriate. Barry will also provide technical expertise on artificial propagation approaches for developing a rebuilding plan (i.e., broodstock practices, rearing and release strategies, ecological interactions, etc), and will review results and ensure that the assessments and resulting rebuilding plan are technically sound.

Education: Ph.D., University of Washington, 1995; Master of Science, University of Washington, 1992. Bachelor of Science, California Polytechnic State University, San Luis Obispo, 1990.

Professional Experience: Over 20 years of experience conducting applied research on behaviour, ecology and life history of anadromous salmonids, including 40 peer-reviewed scientific publications; Currently team leader of the Behavioural Ecology Team at the Northwest Fisheries Science Center, Manchester Research Station; Primary research areas include ecological interactions between hatchery- and natural-origin anadromous salmonids, mechanisms causing domestication selection on hatchery steelhead, scientific evaluations of artificial propagation programs for anadromous salmonids and other marine species; Currently the Principal Investigator for the Hood Canal Steelhead Project, which is a before-after-control-impact field experiment testing the effects of supplementation on natural population abundance, genetics and life history diversity.

Service: Current member of Columbia River Basin captive broodstock technical oversight committees, Northwest Fisheries Science Center research planning team, Columbia River Hatchery Effects Evaluation Teams, Member of the Science Consortium for Ocean Replenishment and Enhancement, and several other technical working groups.

List of publications available upon request.

Joy Lee Waltermire, Fish Biologist, Long Live the Kings' Lilliwaup Hatchery, jlee@lltk.org

Project Role – *Research Assistant: data collection, analyses, and reporting:* To collect the data needed for developing the Mid-Hood Canal Chinook rebuilding plan, Joy will continue to lead the operation of the Hamma Hamma smolt trap, work with WDFW staff to help operate the Duckabush River smolt trap, and will coordinate with Port Gamble S'Klallam staff who will be temporarily installing a juvenile trap on the Dosewallips River to ensure that the genetic samples are collected and transferred to WDFW. She will work with WDFW to compile and analyze both juvenile outmigrant and adult return information. She will also work with Rick Endicott (LLTK) to collect and analyze any available historical information regarding Chinook in the mid-Hood Canal watershed. Joy will then help draft the relevant analyses sections of the rebuilding plan.

Education: Bachelor of Arts, Environmental Science, Evergreen State College, 2001.

Professional Experience: Fish Biologist, LLTK (2001-Present). Responsible for monitoring, data collection, management, reporting and analysis, including: redd surveys—by foot and snorkelling; smolt outmigrant trapping; adult and juvenile hook-and-line genetic sampling; and periodic sampling at the hatchery. Also perform broodstock collection and spawning (chum, Chinook) and direct egg collection (steelhead), and provide general hatchery/fish rearing support. Current research/recovery projects include (ESA status in parenthesis): Hood Canal Steelhead (threatened), Hood Canal Summer Chum (threatened), and Hamma Hamma Chinook (threatened).

Service: Member of the Hood Canal Technical Advisory Group, experts who assist in the development of salmon recovery strategies and review and help prioritize recovery projects for the region.

List of publications available upon request.

Rick Endicott, Facility Manager, Long Live the Kings' Lilliwaup Hatchery, rendicott@lltk.org

Project Role – *Fish culture guidance and data gathering*: Rick will contribute his fish culture expertise and extensive local knowledge to the development of the rebuilding plan. He will also work with Joy to collect field data (i.e., smolt trap operation) and any available historical information regarding Chinook in the mid-Hood Canal watersheds.

Education: Bachelor of Arts, Environmental Science, Evergreen State College, 2001.

Professional Experience: Lilliwaup Facility Manager, LLTK (1993-Present). Responsible for day-to-day fish culture activities (broodstock collection, spawning, rearing, release), developing and refining fish culture protocol for LLTK affiliated programs, maintaining the hatchery facility, and performing data collection activities with LLTK's Fish Biologist, Joy Lee, in the field and at the hatchery. Current research/recovery projects include (ESA status in parenthesis): Hood Canal Steelhead (threatened), Hood Canal Summer Chum (threatened), and Hamma Hamma Chinook (threatened). Hatchery Technician, Washington Department of Fish and Wildlife (1977-1993).

List of publications available upon request.

(Consultant) Mara Zimmerman, Research Scientist, Washington Department of Fish and Wildlife, mara.zimmerman@dfw.wa.gov

Project Role – *Evaluate Hamma Hamma Chinook supplementation program*: Mara will compile, analyze and report on the existing juvenile and adult datasets for Hamma Hamma Chinook, evaluating the freshwater survival rates of natural production and comparing the marine survival rates of the progeny of George Adams and Hamma Hamma broodstocks.

Education: Ph.D., Biology, University of Michigan, 2004; B.A. Biology and Psychology (double major) Bowdoin College, 1995.

Professional Experience: Seventeen years of field experience as an aquatic ecologist and fish biologist. Statistical expertise includes multivariate statistics, mark-recapture abundance estimators, and spawner-recruit analyses. Currently lead the Wild Salmonid Production Evaluation Unit (WSPE) and coordinate juvenile and adult monitoring of ESA-listed species in western Washington. The goals of the WSPE unit are to understand variables that influence the abundance, survival, and life history of wild salmon, steelhead, and char in Washington State and to make these results available for the purpose of species conservation and management. Current research focuses on survival and life history diversity of Puget Sound salmonid populations, responses of juvenile coho and steelhead to freshwater habitat restoration, forecasting methods for wild coho salmon, and study designs for mark-recapture abundance estimation.

List of publications available upon request.

(Consultant) Todd W. Kassler, Biologist, Washington Department of Fish and Wildlife, Todd.Kassler@dfw.wa.gov

Project Role - *Geneticist*: Conduct genetic analysis of Chinook salmon collected in the Dosewallips River to determine if they are a genetically unique population or similar to the Green River source fall Chinook that have been stocked throughout Hood Canal and Puget Sound.

Education: M.S., University of Illinois, Urbana/Champaign, Natural Resources Ecology and Conservation Biology-NRECB, 1997; B.S., University of Illinois, Urbana/Champaign, Biology, 1992

Professional Experience: Twenty years of experience as a fisheries geneticist conducting statistical analyses to determine population stock structure of fish populations and analyses to determine parentage for reproductive success studies. Currently I work as the WDFW Molecular Genetics Laboratory manager to oversee the coordination of all projects that are being processed. The Molecular Genetics Laboratory is involved in the analysis of fish populations to assess genetic differentiation of hatchery and natural-origin collections as well as population of origin analyses of unknown samples. The laboratory also participates in wildlife projects and in the analysis of forensics samples to support the WDFW Enforcement program.

List of publications available upon request.

11. Consultation and Partnerships: Describe the steps taken during project planning to collaborate and consult with others where appropriate and to gain their support where needed.

History of Organizations Involved:

Long Live the Kings (LLTK): The mission of LLTK is to restore wild salmon and steelhead to the waters of the Pacific Northwest while supporting sustainable fisheries. Since our founding in 1986, we have helped create and implement research, recovery, fisheries enhancement, and resource management reform projects designed to meet the specific conservation and fisheries challenges of Puget Sound, the Washington coast, and Columbia River basin salmon and steelhead populations. Significant accomplishments include: substantially increasing the number of natural-origin chum (~100 in the 1990s to an average of 1,775 (2004-2010)) and steelhead (less than 10 in the late 90's to over 70 today) in the Hamma Hamma River (Hood Canal) via temporary conservation hatchery programs that have ended; facilitating hatchery reform for a decade (2000-2010), leading to significant changes in the way hatcheries are managed throughout the northwest; and helping the Washington Department of Fish and Wildlife improve their decision-making via a framework that is goal-oriented, provides increased transparency, and integrates decisions about hatcheries, harvest and habitat (2005-2009).

In Hood Canal, LLTK currently works with NOAA Fisheries, the WDFW, US Fish and Wildlife Service, US Forest Service, the Skokomish Tribe, the Port Gamble S'Klallam Tribe, the Point no Point Treaty Council and the Hood Canal Salmon Enhancement Group on a 16-year (2007-2022), over 16-million dollar project to assess the effects and effectiveness of innovative conservation hatchery techniques for recovering depleted steelhead populations in the Duckabush, Dewatto, and South Fork Skokomish rivers, with the added potential to directly assist in that recovery. The Hood Canal Steelhead Project's Principal Investigator is Barry Berejikian (NOAA). LLTK is also working to restore Lilliwaup Creek summer chum via both habitat restoration and an ongoing conservation program and operates the current mid-Hood Canal Chinook conservation hatchery program in the Hamma Hamma River with WDFW.

NOAA Northwest Fisheries Science Center's Manchester Research Station: The Northwest Fisheries Science Center's Manchester Research Station is at the forefront of research on captive rearing, disease control, hatchery technology, fish genetics and fish identification for both Pacific salmon and marine groundfish. NMFS's Manchester Research Station, on Clam Bay in Western Puget Sound, provides scientific leadership in the development of environmentally sound aquaculture technologies and conservation of salmon and marine fish stocks. The Manchester Research Station is a leader in state-of-the-art salmonid culture technologies. Under the NWFSC's Resource Enhancement & Utilization Technologies (REUT) Division, and collaborating with other Divisions such as Fish Ecology (FE) and Conservation Biology (CB), Manchester scientists provide an array of research support to NOAA Fisheries' efforts to conserve at-risk and endangered populations of Pacific salmon – research that is conducted in cooperation with many federal, state and local agencies, Tribal groups and universities, among others.

Project Background and Partnerships:

In 1995, Long Live the Kings, with the Hood Canal Salmon Enhancement Group, initiated a project to reintroduce Chinook in the Hamma Hamma River using Chinook from George Adams hatchery. After Puget Sound Chinook were listed in 1999, WDFW, the treaty tribes and NOAA Fisheries worked with LLTK to redesign the hatchery program so that it used returns to the Hamma Hamma River for 50% of the broodstock instead of exclusively using returns to George Adams. This was done due to concerns about the ramifications of the continued use of 100% George Adams hatchery broodstock (restricting local adaptation), and to evaluate the performance of progeny derived from each broodstock by determining whether parental origin affects smolt-to-adult survival. The Hood Canal Chinook Technical Working Group[8] was established via these discussions and since then has been meeting annually to discuss project performance, issues, operational needs, etc. In 2004-05, the Working Group made significant improvements to the fish culture component of the project; however, too few fish continue to return as adults. This is likely due to the small size of the fish culture program (80k release), poor adult to outmigrant survival in the wild (Weinheimer et al. 2011), and potentially low smolt-to-adult survival rates (which will be investigated as part of this project).

In June 2010, LLTK convened a broad group of constituents, including the members of the Technical Working Group and NOAA's Technical Recovery Team, to discuss the information that exists about the mid-Hood Canal Chinook population, including the existing recovery plan, and potential next steps for recovery. There was an emphasis on artificial propagation as a recovery tool, discussing potential limitations of current activities on the Hamma Hamma River and considerations for a broader artificial propagation approach, inclusive of the Duckabush and Dosewallips rivers, if one were chosen for mid-Hood canal. The group also discussed the propagation program recently proposed for Chinook population recovery in the Skokomish River, which looked to historical information and habitat indicators such as flow regime to determine which Chinook life-history profile is best suited for recovery (since the historic population is considered extirpated). The group concluded that this type of information can help provide the basis for developing and evaluating alternative strategies for recovery.[9]

The proposed rebuilding plan will continue the 2010 discussion, performing the analyses necessary and providing a forum for continued discussions with the Technical Working Group and the parties they represent (including managers from the Point No Point Treaty Tribes, WDFW, and NOAA), to determine alternative strategies for recovery and ensure that the mid-Hood Canal Chinook rebuilding plan is developed in an All-H context (aligning with harvest management and proposed habitat recovery actions) and with a regional perspective (aligning with the new recovery plan for spring Chinook on the Skokomish River). Since the June 2010

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[8] *See footnote 6 for list of Working Group participants.*

[9] *Meeting notes are available upon request from mschmidt@lltk.org. Meeting attendees included: Barry Berejikian (NOAA), Ken Currens (NWIFC/Puget Sound Partnership/ex-NOAA Technical Recovery Team member), Cindy Gray (Skokomish Tribe), Larry Lestelle (Private Consultant who helped develop the Skokomish River Chinook Recovery Plan), Dave Zajac (USFWS), Ed Jouper (WDFW), Hans Daubenberger (Port Gamble S'Klallam Tribe), Jacques White (LLTK), John Meyer (Puget Sound Partnership), Joy Lee (LLTK), , Marc McHenry (USFS), Michael Schmidt (LLTK), Neil Werner (HCSEG), Randy Harder (Point No Point Treaty Council), Richard Brocksmith (HCCC), Rick Endicott (LLTK), Scott Bass (Point No Point Treaty Council), Teresa Sjostrom (HCSEG), and Thom Johnson (WDFW, now Point No Point Treaty Council).*

meeting, there have been a few discussions among the parties actively involved in Chinook culture and monitoring projects within mid-Hood Canal (LLTK, WDFW, and the Port Gamble S'Klallam Tribe) about existing monitoring and evaluation activities and data needed to develop recovery alternatives with an artificial propagation component. These discussions helped form the technical aspects of this proposal.

As this proposal is to support a plan development process, as stated above, we will continue to work closely with the Technical Working Group and associated co-managing bodies throughout the course of the proposed project, discussing assessment activities, reviewing assessment results, developing and evaluating alternatives and developing the detailed rebuilding plan. This includes working with the Skokomish Tribe to ensure that the end product aligns with their recovery activities on the Skokomish River and takes a Hood Canal region-wide approach. For data collection, analysis and reporting, LLTK and NOAA staff will work with the WDFW and Port Gamble S'Klallam Tribe. WDFW staff plan to continue to operate the Duckabush River smolt trap and perform the Hamma Chinook freshwater and marine survival rate data evaluation (pers. comm. M. Zimmerman, Wild Salmonid Production Evaluation Unit Leader, WDFW, October 2011). WDFW staff will perform the genetic analyses for any samples taken from juvenile Chinook (pers. comm. M. Zimmerman, WDFW, October 2011). The Port Gamble S'Klallam Tribe has agreed to collect samples for DNA analysis when they test a juvenile trap on the Dosewallips in 2012 (pers. comm. P. McCollum, Natural Resources Director, Port Gamble S'Klallam Tribe, October 2011). See section 7 –Approach‖, above for more information.

Letters of support for this project from the Port Gamble S'Klallam Tribe, the Point No Point Treaty Council, the Hood Canal Coordinating Council, and the Hood Canal Salmon Enhancement Group are attached. The Skokomish Tribe has reviewed this proposal. We have incorporated their suggested changes and they have agreed to participate in the project. The WDFW letter that verifies their operational commitment to this project is also attached.

12. Approvals: Describe applicable regulatory requirements and how these will be addressed.

4(d) coverage for the potential take of ESA listed salmon via the operation of the Duckabush and Hamma Hamma smolt traps has been and will continue to be authorized annually via request by the WDFW as a component of their ongoing research programs. As the smolt traps are an ongoing operation, HPA, etc. permits for operating the traps have already been obtained. 4(d) coverage for obtaining samples for genetic analysis from the juvenile trap on the Dosewallips River will be requested by the Port Gamble S'Klallam Tribe this fall.

How this project coordinates with and has the approval of the appropriate fishery management agencies is described in section 11, above.

Part 4. COST EFFECTIVENESS

13. Costs: From the PSC Project Budget Form, justify the need for the main budget items listed that the Southern Fund grant will cover.

The total request to the Pacific Salmon Commission is $92,205. The bulk of the request ($71,792) is for labour. Time, and, thusly, wage estimates for project staff and consultants were developed by those charged with completing each assessment section. Time committed by each staff member (including the bulk of the project leader's time) to the Project Process and Plan Development components of this proposal was estimated by LLTK based upon past experience facilitating projects and developing resulting materials. $797 of the request is for site/project costs, all of which is to cover travel to meetings, to collect historical information, and to help cover LLTK travel to mid-Hood Canal Rivers to collect smolt outmigrant data. Details regarding travel expenses are provided in the budget. $1,434 is for administrative costs, including rent for NOAA office space and office supplies, telephone and printing costs incurred by LLTK. Finally, $18,182, or 19.72% of the PSC request is going to indirect costs, below the 20% mark requiring back-up documentation justifying the expense (however, documentation is available upon request).

14. Cost sharing: Name the contributors of any additional sources of funding or in-kind contributions and specify whether their support is confirmed or just anticipated.

$177, 357, or 67% of the project budget is covered through shared costs, largely as a result of activities planned by collaborators in the mid-Hood Canal watersheds. WDFW and LLTK operate smolt traps in the Duckabush and Hamma Hamma Rivers, respectively. The cost of those traps, $50,000 (Duckabush) and $20,000 (Hamma Hamma) was previously incurred by each respective party. WDFW is covering the cost of operating the Duckabush smolt trap and performing additional analyses of juvenile outmigrants ($30,500 + $32,500 + $14,692 indirect = $77,692) as part of their ongoing effort to estimate the abundance and survival of Puget Sound salmonids.[10] The Port Gamble S'Klallam Tribe is covering the cost of deploying an outmigrant trap in the Dosewallips River and collecting samples from juvenile Chinook for genetic analysis as part of their planned trap testing exercise ($7,560). The several members of the Chinook Technical Working Group (including WDFW, Skokomish Tribe, Point No Point Treaty Council, Port Gamble S'Klallam Tribe, NOAA, the Hood Canal Coordinating Council, and the Hood Canal Salmon Enhancement Group) will be meeting at least 4 times over the course of the project. Regional managers, in additional to the technical staff on the Working Group, will participate in the third meeting when decisions are being made regarding the recommended approach for moving forward. This contribution from the Technical Working Group and regional managers is estimated at $11,220 (wages and employer costs). This is conservative given the number of people involved and the amount of discussion that will likely occur regarding mid-

[10] *Go to http://wdfw.wa.gov/conservation/research/projects/puget_sound_salmonids/ for more information about this WDFW program.*

Hood Canal Chinook as the proposed process gets underway[11]. Finally, WDFW and LLTK staff will cover the cost of their field gear (field notebooks, waders, rain gear), approximately $895.

15. Cost effectiveness: Explain how project benefits compare to the overall cost of the project.

The project benefits are significant. Developing a revised conservation hatchery plan that is integrated with habitat recovery and harvest management efforts and recovery planning for the other primary Chinook population in the Hood Canal bio-region (Skokomish River) will help managers prioritize actions for mid-Hood Canal Chinook recovery, leading to more cost effective decisions regarding how to move forward. Also, LLTK, as a nonprofit, will be able to raise both public and private funds for the new rebuilding approach once a plan is finalized and approved by the federal, state, and tribal managers. LLTK has invested over $4.5 million dollars in fish-culture based recovery projects in Hood Canal since opening Lilliwaup Hatchery in 1993.

Detailed Proposal forms must be in electronic format and must be received by e-mail, at the following address:

southfund@psc.org

by midnight on Monday October 31st, 2011.

[11] *It is highly likely that regional managers will have additional discussions regarding the strategy for moving forward with mid-Hood Canal Chinook; however, the formal point of convening the managers in the proposed process is the third meeting.*