HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Marblemount Yearling Spring Chinook Program
Species or Hatchery Stock	Spring Chinook (Oncorhynchus tshawytscha) Skagit River
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Skagit River, Puget Sound
Date Submitted	August 04, 2005
Date Last Updated	July 27, 2005

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Marblemount Yearling Spring Chinook Program

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

Skagit River Spring Chinook (*Oncorhynchus tshawytscha*) - listed as "threatened" June 2005

1.3) Responsible organization and individuals

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

Tulalip Tribe: spring chinook program suspended beginning with 2000 brood, could be re-instated in the future.

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

Operational Information	Number
Annual operating cost (dollars)	$351,149
The above information for annual operating cost applies cumulatively to the Marblemount Hatchery Fish Programs and cannot be broken out specifically by program. Funding sources are General Fund – State, General Fund - Federal & Wildlife State – Local (Seattle City Light).	

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

Broodstock Collection; Incubation; Rearing and Release:

Marblemount Hatchery: Located on Clark Creek (04.1421) at RM0.5, which is a tributary to the Cascade River (04.1411). The Cascade River is a tributary to the Skagit River (03.0176) at RM 78.

1.6) Type of program.

Isolated harvest. The proposed isolated strategy for this program is based on WDFW's assessment of the genetic characteristics of the hatchery stock and local natural populations, the current and anticipated productivity of the habitat used by the populations, the potential for successfully implementing programs as integrated, and NOAA's final listing determinations (64 FR 14308, June 28, 2005). Modification of the proposed strategy may occur as additional information is collected and analyzed.

1.7) Purpose (Goal) of program.

The primary goal of the Marblemount Hatchery spring chinook program is to release 150,000 yearlings to serve as an index stock for spring chinook in the Skagit River.

The secondary goal of the program is to provide conservation "back-up" for natural spring chinook in the Suiattle River. This stock also makes an important contribution to tribal ceremonial and subsistence fisheries.

1.8) Justification for the program.

This program will be operated to provide scientific information regarding fishery contribution rates for Skagit River wild spring chinook populations with yearling smolt life history trajectories. The program will also be operated to provide for harvest opportunity while minimizing adverse effects on the listed fish. These objectives will be accomplished in the following manner:

1. Hatchery-origin fish will be released as actively migrating smolts to minimize emigration time to saltwater thereby minimizing or eliminating adverse interactions with natural-origin listed fish.

2. Hatchery-origin fish will be double-indexed tagged to distinguish them from natural-origin listed fish as well as reflecting what the naturally produced fish are doing in the system.

3. Only progeny of adult spring chinook identified as originating from Marblemount Hatchery will be propagated.

4. Hatchery fish will be propagated using appropriate fish culture methods and consistent with the Co-Managers Fish Health Policy, spawning and genetic guidelines and state and federal water quality standards.

To minimize impacts on listed fish by WDFW facilities operation and the Marblemount spring chinook yearling program, the following Risk Aversions are included in this HGMP:

Table 1. Summary of risk aversion measures for the Marblemount spring chinook year- ling program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	All water sources are permitted through trust water right permit # S1-20241. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.2	At Marblemount, all intake screens are 1" x .125" mesh and are in compliance with state and federal guidelines (NMFS 1995,1996). However, they do not meet the current NOAA intake criteria. No chinook are passed above Clark Creek. Jordan Creek is utilized only from May through September.
Effluent Discharge	4.2	This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System administered by the Washington Department of Ecology (DOE) - WAG 13-3015.
Broodstock Collection & Adult Passage	6.2.3, 7.9, 2.2.3	Only hatchery-origin spring chinook entering the holding pond will be collected between late April and September. No rack exists on Cascade River. Hatchery fish can by-pass hatchery and spawn naturally. No chinook are passed above Clark Creek. Jordan Creek is utilized only from May through September. But, having a very steep and unstable gradient, the potential utilization by chinook in Jordan Creek is limited.
Disease Transmission	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	See sections 2.2.3 & 10.11

1.9) List of program Performance Standards.

See below

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

Benefits:

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Assure that hatchery operations support Puget Sound Salmon Management Plan (*US v Washington*), the Shared Strategy for Salmon Recovery, production and harvest objectives.	Contribute to a meaningful harvest for tribal and commercial fisheries. Achieve a 10-year average of .52% smolt-to-adult survival that includes harvest plus escapement.	As an indicator stock, contribution to fisheries and escapement will be estimated for wild fish each brood year released. Work with co-managers to manage adult fish returning in excess of broodstock need.
Maintain outreach to enhance public understanding, participation and support of WDFW hatchery programs.	Provide information about agency programs to internal and external audiences. For example, local schools and special interest groups tour the facility to better understand hatchery operations. Off-station efforts may include festivals, classroom participation, stream adoptions and fairs.	Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program. Record on-station organized education and outreach events.
Program contributes to fulfilling tribal trust responsibility mandates and treaty rights.	Follow pertinent laws, agreements, policies and executive and judicial orders on consultation and coordination with Native American tribal governments.	Participate in annual coordination between co-managers to identify and report on issues of interest, coordinate management, and review programs (FBD process).
Implement measures for broodstock management to maintain integrity and genetic diversity. Maintain effective population size.	A minimum of 500 adults are collected throughout the spawning run in proportion to timing, age and sex composition of return.	Annual run timing, age and sex composition and return timing data are collected. Adhere to HSRG (2004) and WDFW spawning guidelines (WDFW 1983).
Region-wide, groups are marked in a manner consistent with information needs and protocols to estimate impacts on natural and hatchery-origin fish.	The spring chinook yearling program is used as a Double-Index Tag (DIT) group. Half (75,000) are adipose-fin clip/coded-wire tagged (Ad + CWT) and half (75,000) coded-wire tagged only. DIT groups provide selective harvest estimates for fish management. The 75,000 yearlings that are Ad + CWT also serve as an index group for natural-origin yearling spring chinook (Cascade, Sauk and Suiattle rivers).	Returning fish are sampled throughout their return for length, sex, and CWTs.
Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens. Follow Co-managers Fish Health Disease Policy (1998).	Necropsies of fish to assess health, nutritional status and culture conditions.	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. As necessary, WDFW's Fish Health Section recommends

		remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites.	1 to 6 weeks prior to transfer or release, fish are examined in accordance with the Co-managers Fish Health Policy.
	Inspection of adult brood-stock for pathogens and parasites.	At spawning, lots of 60 adult broodstock are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	Control of specific fish pathogens through eggs/fish movements is conducted in accordance to Co-managers Fish Health Disease Policy.

Risks:

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Minimize impacts and/or interactions to ESA listed fish	Hatchery operations comply with all state and federal regulations. Hatchery juveniles are raised to smolt size (10 fish/lb) and released at a time that fosters rapid migration downstream	Monitor size, number, date of release and mass mark quality. Additional WDFW projects: straying, instream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds, fish health documented.
Artificial production facilities are operated in compliance with all applicable fish health guidelines, facility operation standards and protocols including HOPPS, Co-managers Fish Health Policy and drug usage mandates from the Federal Food and Drug Administration.	Hatchery goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks and to produce healthy smolts that will contribute to the goals of this facility.	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.
Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring.	NPDES permit compliance WDFW water right permit compliance	Flow and discharge reported in monthly NPDES reports.
Water withdrawals and in-stream water diversion structures for hatchery facility will not affect spawning behavior of natural populations or impact juveniles.	Hatchery intake structures meet state and federal guidelines where located in fish bearing streams.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
Hatchery operations comply with ESA responsibilities	WDFW completes an HGMP and is issued a federal and state permit when applicable.	Identified in HGMP and Biological Opinion for hatchery operations.
Harvest of hatchery-produced fish minimizes impact to wild populations.	Harvest is regulated to meet appropriate biological assessment criteria.	Agencies and tribes to provide up-to-date information needed to monitor harvests.

1.11) Expected size of program.

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

500 adults (to meet fingerling and yearling program; and to accommodate re-instatement of Tulalip tribal net pen program needs).

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

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	Clark Creek (WRIA 04.1421)	150,000

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

Collective (natural) escapement goal (Upper Cascade, Sauk and Suiattle) is 3,000. The natural escapement levels for brood years 1995 through 2003 were 855, 1,051, 1,041, 1,086, 471, 1,021, 1,856, 1,065 and 2,337, respectively.

For broodyears 1990, 1993 through 1998 the smolt-to-adult survival rate average was 0.52% (yearling program).

Escapement levels back to the hatchery rack for brood years 1995 through 2003 were 1,080, 960, 1,138, 1,126, 3,159, 1,102, 1,567, 1,663 and 1,558, respectively.

Based on the average smolt-to-adult survival rate of 0.52% and the programmed release goal of 150,000, the estimated adult production (goal) level would be 780 for the yearling release.

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

1978

1.14) Expected duration of program.

Ongoing.

1.15) Watersheds targeted by program.

Skagit River (03.0176)

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

To eliminate the program, it would not allow WDFW to monitor and evaluate the natural-origin spring chinook populations in the Skagit River watershed. Also, WDFW and the Skagit Coop each year enter into an agreement, which is identified as the Skagit Memorandum of Understanding. The principle purpose of the memorandum is to set forth mutually agreed upon steps and conditions under which all Washington fisheries affecting Skagit stocks will be managed for that particular year, with the primary management objective of providing consistent and equitable management of inside and outside treaty (*US v Washington*) and non-treaty fisheries. A second objective is to outline steps to plan for and attain cooperative, joint management of Skagit System fisheries in future years.

This process follows the Puget Sound Salmon Management Plan (PSSMP), a federal court order, which describes the co-management responsibilities of WDFW and the tribes (Skagit Coop) with regard to fishery management and artificial production. The PSSMP explicitly states that "no change may be made to the Equilibrium Brood Document (program production goals) without prior agreement of the affected parties."

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

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

During 2004-05, WDFW is writing an HGMP to cover the stock/program of chinook produced at the Marblemount facility for authorization under the 4(d) rule of the ESA.

Harvest management of chinook populations within Puget Sound is implemented through the draft Puget Sound Comprehensive Chinook Management Plan (PSCCMP) - Harvest Management Component (Puget Sound Indian Tribes and WDFW, March 2004).

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

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

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

Upper Cascade Chinook

There are three stocks of native spring chinook in the Skagit River: Upper Sauk, Suiattle and Upper Cascade. The Upper Sauk was considered healthy (SASSI, 1992). However, in recent years a downward trend has been observed. The Suiattle stock remains depressed. The Upper Cascade is identified as unknown. Both the Suiattle and Cascade stocks have stabilized at low levels. Collectively, the escapement goal for Skagit spring chinook is 3,000 spawners. Actual escapement has been 1,000 or less in recent years. Suiattle spring chinook spawn in the Suiattle mainstem in the proximity of various tributaries including: Big, Tenas, Buck, Straight, Lime, Downey, and Sulphur Creeks. Spawning in the glacial mainstem has been observed and while not quantified because of poor visibility, appears to be limited. Suiattle spring chinook are the earliest spawners in the Skagit basin, and perhaps the earliest chinook spawners in Puget Sound. Spawning begins in mid-July, peaks in the second week of August, and ends by mid-September. The two other spring chinook stocks, the Upper Sauk and Upper Cascade, have a similar spawn timing which begins in early August, peaks around the last week of August to first week of September and is completed by the end of September. Upper Sauk spring chinook spawn in the mainstem Sauk from river mile 31.9 to 41.2; in the South Fork Sauk up to river mile 4; and in the Whitechuck River up to river mile 10.4. Upper Cascade spring chinook spawn in the Cascade River from river mile 7.8-18.6 and in Found and Kindy Creeks. The spring populations have significant yearling life history components as well as some zero-age life history strategies that vary in proportion form year to year.

Escapement of Skagit Spring Chinook

Year	Upper Cascade	Suiattle	Upper Sauk	Total
1988	133	740	870	1,743
1989	218	514	668	1,400
1990	269	685	557	1,511
1991	135	354	747	1,236
1992	205	201	580	986
1993	168	292	323	783
1994	173	167	130	470
1995	225	440	190	855
1996	208	435	408	1,051
1997	308	428	305	1,041
1998	323	473	290	1,086
1999	83	208	180	471
2000	273	360	388	1,021
2001	625	688	543	1,856
2002	340	265	460	1,065
2003	298	353	193	844

Source: WDFW data

-Identify the ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

Chinook

Lower Skagit/MS Trib Chinook, Upper Skagit/MS Trib Chinook, Lower Sauk Chinook.

There are three stocks of summer chinook: Upper Skagit, which is considered healthy, and Lower Sauk and Lower Skagit (mainstem and tributaries), which are depressed. Escapement goal for the combined runs is 14,900, which has not been met since 1990. In 1998, however, the escapement was 14,600, nearly meeting the goal. The Lower Sauk summer chinook are slightly earlier than the Upper Skagit chinook. Spawning in the Lower Sauk occurs from river mile 0.0-21.2 and in Dan Creek. Spawning begins in mid-August, peaks in mid-September, and is completed by early October. The summer chinook in the Upper Skagit comprises the largest population of chinook in the Skagit basin. The spawning range is from RM 67.2 to 93 in the mainstem, and in Illabot, Diobsud, Bacon, Goodell, and Falls creeks. Spawning begins in late August, peaks in late September and continues well into October. It is assumed that the summer chinook populations are predominately comprised of zero-age life history strategies.

See above for information on Suiattle, Upper Sauk and Upper Cascade spring chinook.

Bull Trout/Dolly Varden *(Salvelinus confluentus)*

Lower Skagit bull trout have been identified as a distinct stock based on their geographic distribution. The Skagit River, below Gorge Dam (excluding the Baker River), is composed of several major tributaries (Sauk, Cascade, Suiattle, and Whitechuck rivers) and numerous "minor" tributaries, which range in size and length from small rivers to small creeks. Bull trout populations as utilize much of this extensive area spawning and rearing areas. These populations are apparently composed of anadromous, fluvial, and resident life history forms.

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

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

Chinook
Preliminary critical and viable population thresholds under ESA have been determined by the Co-manager's (Puget Sound) Technical Review Team (PSTRT) to be at 576 and 3,000, respectively for Skagit spring chinook (PSTRT 2003). For Skagit fall chinook, preliminary critical and viable population thresholds under ESA have been determined by the PSTRT to be at 4,800 and 14,900, respectively. And finally, the preliminary critical population threshold has been determined by the PSTRT to be at 2,200 for the Upper Skagit, 900 for the Upper Sauk and 400 for the Lower Skagit summer/fall chinook. No viable population thresholds have been determined. The SaSI report (draft 2002) determined the populations of Upper Skagit, Upper Sauk, Upper Cascade and Lower Sauk stocks as "depressed", the Suiattle chinook stock as "healthy" and the lower Skagit mainstem chinook stock to be "depressed".

Bull trout
This stock is classified as Healthy. Part of the difficulty in assessing the status of this stock is due to the size of the Skagit system, the remoteness of the upper watershed, the extensive geographic overlap among life history forms, and the overlap between bull trout and salmon spawning areas. (WDFW 1997)

- 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. Indicate the source of these data.

See table below.

- 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.

SKAGIT CHINOOK

Brood Year	Est. Females	Potential Eggs* (Millions)	Total Smolts	Survival to Migration
1989	3274	14.7	963,930	6.5%
1990	8468	38.1	233,603	0.6%
1991	2923	13.2	1,777,330	13.5%
1992	3598	16.2	2,142,078	13.2%
1993	2793	12.6	1,436,530	11.4%
1994	2847	12.8	1,310,448	10.2%
1995	3465	15.6	414,691	2.7%

* at 4,500/female

Range of Natural Origin Recruit per Spawner (1992 to 1999) = .356 to 2.619: 1. Average is 1.132 spawner / recruit.

Source: WDFW trapping data

Ratio of naturally produced smolts to hatchery-reared smolts for 1995 is 1.7:1 (refer to Table 10.3 for number of hatchery-reared smolts for 1995).

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

Adult strays (carcass recoveries) from Skagit spring chinook indicator groups of 0-age and yearling releases from the Marblemount facility have been localized to one-mile radius of hatchery outlet. Preliminary data shows 5% of fish on spawning grounds in the Upper Cascade River are of hatchery-origin (J. Scott, WDFW, pers. comm. 2002).

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

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

Broodstock Collection:

Wild adult chinook (unclipped) may on occasion volunteer into the off-channel hatchery trap. They are wanded to detect a tag. If no tag is detected, they are netted and transported, by tank truck, to the Cascade River where they are released. The take risk is deemed low due to the small numbers expected, usually only a few fish (2 in 2003 and zero in 2002).

Having no temporary or permanent weir on the Cascade River allows potential movement of hatchery fish into natural spawning areas. Preliminary data shows 5% of fish on spawning grounds are of hatchery-origin (J. Scott, WDFW, pers. comm. 2002).

The Jordan Creek Intake, one of four water supplies for the hatchery, may pose a low to moderate risk of take to listed fish by seasonally delaying passage or restricting access to Jordan Creek. But, having a very steep and unstable gradient, the potential utilization by chinook in Jordan Creek is limited. The intake is not in operation from October through April and salmonids have upstream passage during that time. Adult salmonids are not passed upstream into Clarks Creek, an additional hatchery water supply.

Predation/Competition:

The potential for predation is limited by the relative body size of fish released from the program and the size of prey. Generally, salmonid predators are thought to prey on fish approximately 1/3 or less their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length (Pearsons et al. 1998). The lengths of juvenile migrant chinook salmon originating from natural production have been monitored in the Skagit River (Seiler et al, 1997-2001). The average size of migrant chinook salmon is typically 40mm or less in February and March, but increases in the period from April through June as emergence is completed and growth commences (Table 2). Assuming that the prey item can be no greater than 1/3 the length of the predator, Table 2 can be used to determine the length of predator required to consume a chinook salmon of average length in each time period. The increasing length of natural origin juvenile chinook salmon from April through June indicates that delaying the release of hatchery smolts of a fixed size will reduce the risks associated with predation. Yearlings at Marblemount are volitional released over a three-week period in April as smolts (150-155 mm fl) where the size of the wild chinook ranges from 43 to 51 mm fl. According to the table below and the 1/3rd rule, the wild chinook at this stage are unlikely to be consumed by the yearlings. In recent literature review of chinook salmon food habits and feeding ecology in Pacific Northwest marine waters, Buckley (1999) concluded that cannibalism and intra-generic predation by chinook salmon are rare events.

Table 2. Average length by statistical week of natural origin juvenile chinook salmon migrants captured in traps in the Skagit River watershed. The minimum predator length corresponding to the average length of chinook salmon migrants, assuming that the prey can be no greater than 1/3 the length of the predator, are provided in the last row of the table.

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit [1] 1997-2001	43.2	48.3	50.6	51.7	56.1	59.0	58.0	60.3	61.7	66.5	68.0
Minimum Predator Length	153	169	176	187	195	205	210	221	232	239	250

Sources: [1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001).

Food resource competition may also be a risk factor to listed natural-origin juvenile chinook in freshwater and estuarine areas where the two groups interact. However, food item preferences may be different for the two groups in freshwater and the estuarine areas due to the large size of the yearling fish relative to natural-origin juvenile chinook that may be encountered after the hatchery fish are released (Steward and Bjornn 1990).

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

In 2002, all fish returning to the hatchery were marked. In 2003, only 2 unmarked adults (1 male: 1 female) returned to the facility and were released back to the Cascade River.

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

See "take" table at end of HGMP.

- 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 program is operated as a segregated (isolated) program so any non-marked adults that return voluntarily to the Clark Creek trap will be returned to the Cascade River. Out of all the adult returns in 2002 and 2003 only 2 unmarked adults returned voluntarily to the trap on Clark Creek.

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 Marblemount Hatchery yearling spring chinook salmon HGMP is included as one of 29 WDFW-managed plans under the co-managers' Resource Management Plan (RMP) for Puget Sound region chinook salmon hatcheries. This HGMP is in alignment with the RMP, which serves as the overarching comprehensive plan for state and tribal chinook salmon hatchery operations in the region.

As affirmed in the co-managers' RMP, WDFW hatchery programs in Puget Sound must adhere to a number of guidelines, policies and permit requirements in order to operate. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. Following is a list of guidelines, policies and permit requirements that govern WDFW hatchery operations:

Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington. These guidelines define practices that promote maintenance of genetic variability in propagated salmon (Hershberger and Iwamoto 1981).

Spawning Guidelines for Washington Department of Fisheries Hatcheries. Assembled to complement the above genetics manual, these guidelines define spawning criteria to be use to maintain genetic variability within the hatchery populations (Seidel 1983).

Hatchery Reform- Principles and Recommendations of the Hatchery Scientific Review Group. This report provides 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)

Stock Transfer Guidelines. This document provides guidance in determining allowable stocks for release for each hatchery. It is designed to foster development of locally adapted broodstock and to minimize changes in stock characteristics brought on by transfer of non-local salmonids (WDF 1991).

Fish Health Policy of the Co-managers of Washington State. This policy designates zones limiting the spread of fish pathogens between watersheds, thereby further limiting the transfer of eggs and fish in Puget Sound that are not indigenous to the regions (WDFW, NWIFC, USFWS 1998).

National pollutant Discharge Elimination System Permit Requirements This permit sets forth allowable discharge criteria for hatchery effluent and defines acceptable practices for

hatchery operations to ensure that the quality of receiving waters and ecosystems associated with those waters are not impaired.

In 1999, several PS and coastal stocks were listed as threatened under the federal Endangered Species Act (ESA). State, tribal and federal managers need to ensure that their hatcheries do not present a risk to listed species. Through this HGMP and hatchery reform efforts, the Co-managers have sought to go beyond merely complying with ESA directives. The new approach is to reform hatchery programs to provide benefits to wild salmon recovery and sustainable fisheries. Hatchery management decisions will be based on system-wide, scientific recommendations, providing an important model that can be replicated in other areas.

In addition, the Legislature, in 1999, created the Salmon Recovery Funding Board (SRFB) and the Shared Strategy for Salmon Recovery. Both are collaborative efforts to protect and restore salmon runs across Puget Sound. They bring together the experience and viewpoints of citizens, major state and federal natural resource agencies, local governments, non-government organizations and Puget Sound Tribes. The SRFB provides grant funds to protect or restore salmon habitat and assist related activities that produce sustainable and measurable benefits for fish and their habitat. The Shared Strategy process helps identify what is needed in each watershed to recover salmon habitat through a watershed recovery plan (see section 3.4 for more details).

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

Although not directly related to hatchery programs, the North of Cape Falcon Fishery Planning process should be mentioned as an avenue for developing harvest regulations. This is an annual process that involves co-managers and stakeholders, and a process that is conducted in concert with the Pacific Fisheries Management Council. The primary focus is to develop salmon fishing regulations for commercial and recreational fisheries in marine and freshwater areas. As a result, WDFW and the Skagit Coop each year enter into an agreement, which is identified as the Skagit Memorandum of Understanding. The principle purpose of the memorandum is to set forth mutually agreed upon steps and conditions under which all Washington fisheries affecting Skagit stocks will be managed for that particular year, with the primary management objective of providing consistent and equitable management of inside and outside treaty and non-treaty fisheries. A second objective is to outline steps to plan for and attain cooperative, joint management of Skagit System fisheries in future years.

This hatchery program, and all other WDFW anadromous salmon hatchery programs within the Puget Sound Chinook ESU, operates under *U.S v Washington* and the Puget Sound Salmon Management Plan (PSSMP) (1985). The salmon resource co-management process affirmed through these court orders, and under the court approved plan, requires that both the State of Washington and the relevant Puget Sound Tribe(s) develop *Equilibrium Broodstock Programs*. Two documents are completed each year, describing agreed hatchery fish production levels for each brood year. The "Future Brood Document" is a detailed listing of

agreed annual juvenile fish production goals. This document is reviewed and updated each spring, and finalized in July. The "Current Brood Document" presents actual juvenile fish production levels relative to the annual production goals. This second document is developed in the spring after eggs spawned that year have been enumerated and actual resultant juvenile fish production levels can be estimated. Through this process, the co-managers document their agreement on the function, purpose and release strategies for all Puget Sound region hatchery programs.

3.3) Relationship to harvest objectives.

WDFW general harvest goals are to provide fishing opportunities consistent with the mandate of the agency for restoration and recovery of wild indigenous salmonid runs, the Pacific Salmon Treaty, the Puget Sound Salmon Management Plan, *US v. Washington*, and other state, federal, and international legal obligations. Besides ocean fisheries, specific harvest objectives will vary depending on the phase of reintroduction and recovery program.

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

Although there is no directed harvest in the terminal area, there are fisheries that benefit from the program. The table (table 3) below shows the fisheries contributions of the Marblemount yearling spring chinook program.

Table 3. Marblemount Spring Chinook Yearlings Broodyear 1990-1999 Fisheries Contributions.

Brood Year	Program Release #	# of Fish Program Contributed to Catch	Proportion (%) of Total Catch								
			AK Ocean Troll	Can. Ocean Troll	Can Estuarine Comm	WA Treaty Troll	WDFW Test	PS Comm. (Treaty and Non Treaty)	Can. Ocean Sport	PS Sport	Misc. Fishery Contri. (<1% each)
1990	284,523	1,434	0.0	15.1	17.5	2.9	0.0	4.3	34.4	24.0	1.7
1991*	-	-	-	-	-	-	-	-	-	-	-
1992*	-	-	-	-	-	-	-	-	-	-	-
1993	241,084	383	0.0	4.2	0.0	0.0	1.5	3.1	41.4	49.2	0.6
1994	231,253	370	3.9	4.8	4.1	0.0	0.0	2.1	49.6	34.4	1.1
1995	249,718	966	1.0	5.7	0.0	0.0	0.0	5.6	49.1	37.9	0.8
1996	115,465	70	0.0	17.0	0.0	0.0	0.0	1.9	37.0	44.1	0.0
1997	142,380	208	1.6	8.8	0.0	3.9	0.0	5.3	41.0	39.5	0.0
1998	135,300	56	0.0	10.9	0.0	0.0	0.0	3.7	42.8	42.6	0.0
1999	147,393	1,078	0.0	64.1	0.0	0.0	0.0	1.5	19.7	13.6	1.2
Avg	**193,390**	**571**	**0.8**	**16.3**	**2.7**	**0.9**	**0.2**	**3.4**	**39.4**	**35.7**	**0.7**

* No data available for broodyears 1991 and 1992.

3.4) Relationship to habitat protection and recovery strategies.

All chinook stocks in the Skagit River basin have been adversely affected by estuarine habitat loss. The Skagit estuary has been reduced by almost two-thirds over the last two hundred years, mainly as a result of diking (WDNR, 1998). Biologists believe the Skagit River estuary is a limiting factor for all chinook production in the basin (from Hatchery Scientific Review Group's Skagit Briefing Book, 2002).

The Legislature, in 1999, created the Salmon Recovery Funding Board (SRFB) and, as indicated earlier, the Shared Strategy for Salmon Recovery. Both are collaborative efforts to protect and restore salmon runs across Puget Sound. They bring together the experience and viewpoints of citizens, major state and federal natural resource agencies, local governments, non-government organizations and Puget Sound Tribes. The SRFB provides grant funds to protect or restore salmon habitat and assist related activities that produce sustainable and measurable benefits for fish and their habitat. The Shared Strategy process helps identify what is needed in each watershed to recover salmon habitat through a watershed recovery plan.

Shared Strategy

The Shared Strategy is based on the conviction that:
1) People in Puget Sound have the creativity, knowledge, and motivation to find lasting solutions to complex ecological, economic, and cultural challenges;
2) Watershed groups that represent diverse communities are essential to the success of salmon recovery;
3) Effective stewardship occurs only when all levels of government coordinate their efforts;
4) The health and vitality of Puget Sound depends on timely planning for ecosystem health and strong local and regional economies; and
5) The health of salmon are an indicator of the health of our region salmon recovery will benefit both human and natural communities.
The 5-Step Shared Strategy
1) Identify what should be in a recovery plan and assess how current efforts can support the plan.
2) Set recovery targets and ranges for each watershed.
3) Identify actions needed at the watershed level to meet targets.
4) Determine if identified actions add up to recovery. If not, identify needed adjustments.
5) Finalize the plan and actions and commitment necessary for successful implementation.

Salmon Recovery Funding Board

Composed of five citizens appointed by the Governor and five state agency directors, the Board provides grant funds to protect or restore salmon habitat and assist related activities. It works closely with local watershed groups known as lead entities (see below). SRFB has helped finance over 500 projects. The Board supports salmon recovery by funding habitat protection and restoration projects. It also supports

related programs and activities that produce sustainable and measurable benefits for fish and their habitat.

Lead Entities

Lead entities are voluntary organizations under contract with the Washington State Department of Fish and Wildlife (WDFW). Lead entities define their geographic scope and are encouraged to largely match watershed boundaries. Lead entities are essential in ensuring the best projects are proposed to the Board for funding in its annual grant process.

All lead entities have a set of technical experts that assist in development of strategies, and identification and prioritization of projects. The lead entity citizen committee is responsible under state law for developing the final prioritized project list and submitting it to the SRFB for funding consideration. Lead entity technical experts and citizen committees perform important unique and complementary roles. Local technical experts are often the most knowledgeable about watershed, habitat and fish conditions. Their expertise is invaluable to ensure priorities and projects are based on ecological conditions and processes. They also can be the best judges of the technical merits and certainty of project technical success. Citizen committees are critical to ensure that priorities and projects have the necessary community support for success. They are often the best judges of current levels of community interests in salmon recovery and how to increase community support over time with the implementation of habitat projects. The complementary roles of both lead entity technical experts and citizen committees is essential to ensure the best projects are proposed for salmon recovery and that the projects will increase the technical and community support for an expanded and ever increasing effectiveness of lead entities at the local and regional level. (http://www.iac.wa.gov/srfb/leadentities.htm).

The Skagit Watershed Council is the Lead Entity for the Skagit basin that includes the lower and upper Skagit River (WRIAs 3 & 4). It is the largest watershed in Puget Sound. The land use in the lower portion is 64% forestry, 22% agriculture, 5% urban, 4% range and 5% other. In the uplands, land use is 73% forestry, 12% range and 15% other.

One of the projects that were ten years in the making (Deepwater Slough) removed two main dikes on state land. This allowed the mainstem and six tributary channels to re-connect and return to their historic paths and restored 200 acres of estuary habitat (see above). This project is expected to produce an additional 1,000 to 2,000 adult chinook and continues to support important migratory waterfowl and shorebird habitat.

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 Marblemount Hatchery yearling spring chinook program could occur directly through predation on program fish, or indirectly through food resource competition, genetic effects, or other ecological interactions. In particular, fishes and other species could negatively impact chinook survival rates through predation on newly released, emigrating juvenile fish in the freshwater and marine areas. Certain avian and mammalian species may also prey on juvenile chinook while the fish are rearing at the hatchery site, if these species are not excluded from the rearing areas. Species that could negatively impact juvenile chinook through predation include the following:

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

Rearing and migrating adult chinook originating through the program may also serve as prey for large, mammalian predators in marine areas, nearshore marine areas and in the Skagit River to the detriment of population abundance and the program's success in monitoring and evaluating the wild stock and harvest augmentation. Species that may negatively impact program fish through predation may include:

- Orcas
- Sea lions
- Harbor seals
- River otters

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

- Chinook
- Bull trout

(3) Salmonid and non-salmonid fishes or other species that could positively impact the program.

Fish species that could positively impact the program may include other salmonid species and trout present in the Skagit River 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. Many watersheds in the Pacific

Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003). With integrated spawning and any carcass seeding efforts, 3,000 adult chinook carcasses (escapement goal) could contribute, assuming average size of adult chinook is 18 pounds, approximately 54,000 pounds of marine derived nutrients to organisms in the river.

(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 fish. Nutrients provided by decaying chinook carcasses may also benefit fish in freshwater. These species include:

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

SECTION 4. WATER SOURCE

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

Marblemount Hatchery has four water sources available most of the year. Well water provided by five wells produces about 1,000 gallons per minute (gpm) per pump. This water is used for the hatchery and up to six 10' X 100' ponds. Clark Creek, which is spring fed and provides up to 2,500 gpm, is used for starting fish because of its quality and water temperature (40-55 degrees Fahrenheit). Clark Creek also flows through the adult pond and is used to attract and acclimate all fish released and coming back to the hatchery. The bulk of the water is supplied from the Cascade River. Four pumps receive water from a settling pond. Each pumps 2,500 gpm. Jordan Creek is the fourth water source that is used for only about five months out the year. High winter flows force this intake to be shut down. Jordan Creek can provide about 8,000 gpm. Temperatures can range from a low of 38 degrees Fahrenheit to a high of 65.

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.

At Marblemount, all intake screens are 1" x .125" mesh and are in compliance with state and federal guidelines (NMFS 1995,1996). However the water intakes do not meet current NOAA water intake standards. No chinook are passed above Clark Creek. Jordan Creek is utilized only from May through September. All discharge meets or exceeds NPDES requirements as per the permit # WAG13-3015. All water sources at the Marblemount Hatchery are accessed under one water right permit # S1-20241 (for further information on water rights contact the Department of Ecology).

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Adult fish return to the Clark Creek trap where they enter through a four-step ladder and a V trap. From there, they are held in 10' X 200' holding section.

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

A 300-gallon fish tank on a flatbed truck is used (15 fish per load). Fish are carried from the adult pond to the transport truck in rubber tubes. Fish are then transported to holding ponds (500 feet) until spawning.

5.3) Broodstock holding and spawning facilities.

Adults are held and spawned in one of three 10' X 100' X 3' concrete raceways.

5.4) Incubation facilities.

Eggs are incubated in isolation buckets one female per bucket. Once eyed, the eggs are put into vertical incubators @5000 eggs per tray and 3.5 gpm using well water.

5.5) Rearing facilities.

Fish are reared in 10' X 100' X 3' raceways on well water and/or surface water.

5.6) Acclimation/release facilities.

All fish released on station are acclimated on Clark Creek water prior to release.

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

None

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.

At least one hatchery crewmember is at the facility and on stand-by status at all times. All rearing vessels have low water flow alarms. All tools are disinfected prior to use on each pond to prevent disease transmission.

All returning adults are 100% electronically sampled to allow separation during spawning of spring, summer and fall chinook as well as natural-origin spring chinook.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

6.1) Source.

The source of broodstock for the Marblemount Hatchery spring chinook program is adults of indigenous Skagit River stock returning to the Marblemount Hatchery.

6.2) Supporting information.

6.2.1) History.

Marblemount Hatchery spring chinook stock appears to have originated from local Skagit stock. References to Skagit spring chinook were found in planting records in 1952. These fish may have originated from the Cascade River. Plants of spring chinook were discontinued until the 1974 brood when Buck Creek stock was introduced. From 1976-1986 other tributaries of the Suiattle were trapped and broodstock collected for the hatchery. In 1981, the first returns of Buck Creek stock returned to the hatchery. These progeny, along with the other tributary broods were combined and released.

6.2.2) Annual size.

500 adults (total for fingerling and yearling programs and for suspended Tulalip tribal program).

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

Currently use only hatchery-origin broodstock. Any non-adipose fin clipped fish encountered during trapping are "wanded" to detect the presence of a coded-wire tag (CWT). Use of natural-origin broodstock would necessitate going out in river to collect wild fish. Removals of natural-origin spawners associated with this practice, if applied, might present a higher risk to the listed Cascade River spring chinook population than continuing to use only hatchery-origin broodstock. As recommended by the co-managers, this will be a segregated program and will not necessitate removing wild fish from the spawning grounds.

6.2.4) Genetic or ecological differences.

There are no known genetic or ecological differences between the hatchery-origin fish and the con-specific Cascade River spring chinook population.

6.2.5) Reasons for choosing.

Indigenous stock.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

Hatchery fish are double-index tagged; 75,000 are adipose fin-clipped/ coded-wire tagged and 75,000 are coded-wire tagged only. All fish returning are wanded for CWT's. Only hatchery-origin fish are used for spawning at this facility at this time (see section 6.2.3).

SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2) Collection or sampling design.

WDFW shall collect broodstock from adults returning to the Marblemount Hatchery prior to August 15. Only coded-wire tagged adults originating from the Marblemount Hatchery Spring Chinook program shall be used for broodstock. Marked adults entering the trap in excess of broodstock requirements shall be transported and released into Baker Lake where they may spawn in its' tributaries. Unmarked adults shall be returned to the Cascade River.

7.3) Identity.

Hatchery fish are double-index tagged; 75 K are adipose fin-clipped/ coded-wire tagged and 75 K are coded-wire tagged only. All fish returning are wanded for CWT's. Only hatchery-origin fish are used for spawning at this facility at this time. Unclipped fish not bearing a coded-wire tag are assumed to be wild and transported upstream (Cascade River) to spawn naturally.

7.4) Proposed number to be collected:

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

A minimum of 500 adults.

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

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
1992	98	110	4	379,000	
1993	400	1,174	14	1,549,000	
1994	239	250	10	843,000	
1995	196	203	5	844,500	
1996	232	235	3	1,037,989	
1997	170	193		798,800	
1998	145	142	1	563,400	
1999	227	227		1,013,340	

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
2000	166	172		774,000	
2001	132	132		607,300	
2002	165	171		699,530	
2003	138	134		585,700	

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

Marked adults entering the trap in excess of broodstock requirements shall be transported and released into Baker Lake where the fish may spawn naturally in the upper Baker River watershed. Unmarked adults shall be returned to the Cascade River.

7.6) Fish transportation and holding methods.

Adults for spawning are transported from trap to holding pond (500 feet) in a 300-gallon tank. At time of transfer fish receive an injection of erythromycin at 20 mg/kg of fish. Fish are injected again after 3 weeks. Fish are loaded about 15 fish per load and are in the tank for about 20 minutes. Adults are held in well water treated with formalin every other day at 1:10,000. Well water is used to hold adults. Two-thirds of the pond (10' X 100' X 3') is covered with a tarp.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adults are treated with a formalin drip at 1:10,000 every other day in the holding pond. All tools are disinfected between each use to reduce the incidence of Bacterial Kidney Disease (BKD) . Females receive an injection of erythromycin at 20 mg/kg of fish. Fish are re-injected after 3 weeks. Any loss is removed daily and buried on station. No treated fish will be used for anything but spawning. All spawned fish will be buried on station.

7.8) Disposition of carcasses.

Carcasses, not treated for BKD, are used for nutrient enhancement or buried on station. All spawned fish will be buried on station.

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

Coded-wire tagged/adipose-fin clipped adults and adults containing just a CWT will be used for the broodstock program at this time (see Section 6.2.3). All returning adults are 100% electronically sampled to allow separation during spawning of spring, summer and fall chinook as well as natural-origin spring chinook.

SECTION 8. MATING

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

8.1) Selection method.

All fish are selected and spawned randomly throughout the entire run.

8.2) Males.

A primary and secondary male (to one female) are used in the mating scheme. Jacks return in such low numbers that none are utilized in the mating scheme.

8.3) Fertilization.

Primary male sperm is mixed with eggs (from one female) and allowed to set for 30-60 seconds. The secondary male is added and also given 30-60 seconds. Water is added to activate sperm. Eggs are then poured into a colander and drained. The colander is then dipped and drained twice in a iodophor solution of 100 ppm. Eggs are then placed into an incubator and water hardened for 1 hour in an iodophor solution of 100 ppm.

8.4) Cryopreserved gametes.

NA

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.

Only hatchery-origin fish (marked), randomly selected throughout the entire run, are used for broodstock.

SECTION 9. INCUBATION AND REARING

9.1) Incubation:

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

The egg take to meet the yearling program needs is 150,000. The eggs are sorted by level of BKD (ELISA test) in the parent fish. Only eggs from parents exhibiting the lowest BKD levels are retained. All others are destroyed. The survival rates to eyed egg averages 93% with a high of 96% and a low 86%. Average loss from eyed egg to swim-up fry is 4%.

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

Eggs in excess of need are taken to allow for BKD losses. Eggs detected with high BKD levels are destroyed at the eyed-egg stage.

9.1.3) Loading densities applied during incubation.

Eggs from one female are loaded into an isolation bucket with a flow of 1.5 gpm. After eyeing up, dead eggs are removed and the remaining eggs are incubated in vertical Heath Trays at 5,000 per tray with a flow of 3.5 gpm.

9.1.4) Incubation conditions.

All eggs and fry are incubated on well water at 47 degrees. After fry hatch, the dissolved oxygen levels (DO's) are12 ppm coming in and 9.5 ppm going out.

9.1.5) Ponding.

Fry ponding is based on appearance of the fry and the KD. Fry are 95%-100% buttoned up and swimming up with a KD of 1.75-1.97. Mean length of 40.325 mm mean weight of .498g/f.. Fry are ponded into starter troughs in the hatchery building with all fry from that egg take date put together.

9.1.6) Fish health maintenance and monitoring.

Eggs are picked prior to hatching at a strong-eyed stage. Eggs are treated every other day with formalin at 1,667 ppm until just prior to hatching. Fry loss is picked at time of ponding. Loss is picked daily. Fish pathologist checks Fry every 3 weeks.

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.

All eggs will be incubated on well water. Fish pathologist checks Fry every 3 weeks. All fish are from marked hatchery-origin adults.

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.

The average survival from fingerling to yearling smolt for the 2001 broodyear was 97%.

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

Maximum loadings for this stock are 3 lbs/gpm with a density index of 0.20. Actual levels reached are 2.3 lbs/gpm and a density index of 0.13.

9.2.3) Fish rearing conditions

All fish are started in the hatchery building on well water at 47 degrees and held indoors as long as possible. When fish are about 400-800 fish per pound (fpp), they are moved to outside rearing ponds (10' X 100' X 3'). Temperatures range between 40-55 degrees Fahrenheit and the DO's range from 8 ppm - 12 ppm.

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.

Condition factor ranges from 1.101 to 1.202

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*).

This stock is started on BIO-STARTER up to 400 fish per pound (fpp). At this size they are switched to BIO-MOIST FEED. Fish are fed every day, 2-8 times per day. The % of feed to be fed will range from .75 % to 3.5 % B.W./day. Percent body weight fed will vary so that all fish will reach 200 fpp by late April. Overall conversion 1.4:1

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

All tools are disinfected between uses. All ponds are disinfected between uses. All loss is removed daily. Fish pathologist checks fish every 3 weeks. Treatments are made as prescribed by fish pathologist and the Co-managers Fish Health Policy (1998).

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

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

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

None.

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

All fish under propagation are hatchery-origin fish. Rearing fish in well water maximizes survival. The Area Fish Health Specialist monitors fish health on a routine basis during rearing. If needed, treatment plans are prescribed in accordance with the Co-managers Fish Health Policy (1998).

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	150,000	10	April	Clark Cr.

Note: 10 fpp ~ 155 mm fork length

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

Stream, river, or watercourse: Clark Creek (WRIA 04.1421)
Release point: Pond outlet 100 yards above mouth of Clark Creek.
Major watershed: Skagit River
Basin or Region: Puget Sound

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

Release	Eggs/ Unfed	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1994							326,500	15
1995							241,084	12
1996							231,253	11
1997							249,718	9
1998							115,465	10
1999							142,380	10
2000							135,300	11
2001							147,393	11
2002							148,450	16
2003							150,728	13
Average							188,827	12

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

All fish released from the hatchery are imprinted on Clark Creek water for three weeks prior to release. All fish are volitionally released. This can take up to 20 days. Presently, a fish counter is used during release time. After most of the fish have left the pond, it is drawn down to allow more to migrate out.

10.5) Fish transportation procedures, if applicable.

NA

10.6) Acclimation procedures

All fish are acclimated on Clark Creek water for three weeks prior to release.

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

The Skagit spring chinook yearlings are tagged as a double-index group; 75,000 adipose-fin clip/coded-wire tagged (Ad + CWT) and 75,000 coded-wire tagged only (CWT). All returning adults are 100% electronically sampled to allow separation during spawning of spring, summer and fall chinook as well as natural-origin spring chinook.

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

NA

10.9) Fish health certification procedures applied pre-release.

All fish are checked by a fish pathologist prior to release (Co-managers Fish Health Policy 1998).

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

In the case of a catastrophic event (drought or flooding) critical to the fish's survival, the fish would be released early to prevent their loss in the ponds.

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.

All fish released from the hatchery are imprinted on Clark Creek water for three weeks prior to release. This is done to ensure a strong homing to the hatchery thus reducing straying. Also, they are released as smolts to foster rapid seaward emigration and reduce the potential impacts of predation/competition with natural-origin chinook (see section 2.2.3)

In addition, a rearing parameter of the yearling program is to attain a coefficient of variation (CV) for length of 10.0% or less in order to increase the likelihood that most of the fish are ready to migrate (Fuss and Ashbrook 1995). The average CV for release years' 1995-2002 was 8.56%.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of APerformance Indicators@ presented in Section 1.10.

Elements of the annual Monitoring and Evaluation plan for this program are identified in 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 is identified (see section 10.7) 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. WDFW will attempt to monitor the chinook salmon escapement into the target and non-target chinook populations to estimate the number of tagged, un-tagged and marked fish escaping into the river each year and the stray rates of hatchery chinook into the rivers.

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

WDFW will tag all spring chinook yearling releases from the hatchery each year to allow monitoring and evaluation of juvenile out-migrants (Seiler et al., 1998-2002) and adult returns. Also, to maintain separation during hatchery spawning between springs, summer and fall chinook stocks.

WDF&W will also monitor chinook escapement (see Section 11.1.2 below) to the Marblemount Hatchery and the Skagit River natural spawning areas to estimate the number of tagged, untagged and marked fish escaping to the river each year. This monitoring will allow for assessment of the status of the target population and the success of the program in achieving restoration objectives. Also smolt trapping and estuarine surveys allow for more assessment of the status of the target population (work being done by WDFW (D. Seiler), UW/NOAA Fisheries and Skagit System Coop).

WDFW and the tribes shall review the results from the spring, summer and fall exploitation rate indicator stock programs to determine if all programs are required.

Also, the above monitoring and research will be regularly evaluated by the co-managers with the intent of adjusting as appropriate the HGMPs consistent with stock recovery and fishing objectives.

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

Staffing hours to conduct spawning grounds surveys and biological assessment is limited by funding. Funding and resources are currently committed to monitor and evaluate this program as detailed in the Resource Management Plan for Puget Sound Chinook Salmon Hatcheries (Washington Department of Fish and Wildlife and Puget Sound Treaty Tribes, August 23, 2002). Commitments to M&E are listed in section 11.1.1

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

Spawning ground surveys and biological sampling occurring during the recovery will employ measures to ensure that effects on the survival of the listed chinook salmon population are insignificant. Salmon redds and live spawning fish will not be disturbed during surveys and sampling.

SECTION 12. RESEARCH

The Skagit Tribe, WDFW and UW/NOAA Fisheries are conducting juvenile out-migrant and estuarine studies.

12.1) Objective or purpose.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

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

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

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

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

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

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 Atake table@ (Table 1).

12.10) Alternative methods to achieve project objectives.

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

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.

SECTION 13. ATTACHMENTS AND CITATIONS

Bilby, R.E., B.R. Fransen, and P.A. Bisson. 1996. Incorporation of nitrogen and carbon from spawning coho salmon into the trophic system of small streams: evidence from stable isotopes. Can. J. Fish. Aquatic Sci. 53: pp 164-173.

Buckley, R. 1999. Incidence of Cannibalism and Intra-generic Predation by Chinook Salmon in Puget Sound, Washington. Progress Report for Washington Department of Fish and Wildlife, Resource Assessment Division, RAD 99-04. Olympia, WA.

Fuss, H. and C. Ashbrook. 1995. Hatchery Operation Plan and Performance Summaries (HOPPS). Washington Department of Fish and Wildlife. Olympia, WA.

Gregory, S.V., G.A. Lamberti, D.C. Erman, K.V. Koski, M.L. Murphy, and J.R. Sedell. 1987. Influence of forest practices on aquatic production. *In* E.O. Salo and T.W. Cundy (editors), Streamside management: forestry and fishery interactions. Institute of Forest Resources, University of Washington, Seattle, Washington.

Hatchery Scientific Review Group (HSRG), Skagit Briefing Book. 2002. Long Live the Kings, 1305 Fourth Avenue, Suite 810, Seattle WA.

Hatchery Scientific Review Group. 2004. Hatchery Reform; Principles and Recommendations of the Hatchery Scientific Review Group. Long Live the Kings, 1305 Fourth Avenue, Suite 810, Seattle WA.

Hershberger, W.K., and R.N. Iwamoto. 1981. Genetics Manual and Guidelines for the Pacific Salmon Hatcheries of Washington. Univ. of Wash. College of Fisheries. Seattle, WA. 83 pp.

Kline, T.C., J.J. Goring, Q.A. Mathisen, and P.H. Poe. 1997. Recycling of elements transported upstream by runs of Pacific salmon: I _ ^{15}N and _ ^{13}C evidence in Sashin Creek, southeastern Alaska. Can. J. Fish. Aquatic Sci. 47: pp136-144.

Levy, S. 1997. Pacific salmon bring it all back home. BioScience 47: pp 657-660.

Mathisen, O.A., P.L. Parker, J.J. Goering, T.C. Kline, P.H. Poe, and R.S. Scalan. 1988. Recycling of marine elements transported into freshwater systems by anadromous salmon. Verh. Int. Ver. Limnol. 23: pp 2249-2258.

NMFS (National Marine Fisheries Service). 1995. Juvenile fish screen criteria for pump intakes. Available at *http://www.nwr.noaa.gov/1hydrop/nmfscrit1.htm.*

NMFS (National Marine Fisheries Service). 1996. Juvenile fish screen criteria for pump intakes. Available at *http://www.nwr.noaa.gov/1hydrop/pumpcrit1.htm.*

Piper, R et al. 1982. Fish Hatchery Management; United States Dept of Interior, Fish and Wildlife Service, Washington, DC.

Puget Sound Technical Recovery Team (PS TRT). 2003. (Draft) Independent populations of chinook salmon in Puget Sound - Puget Sound TRT public review draft (May 18, 2004 version). Northwest Fisheries Science Center. National Marine Fisheries Service. 92p.

Salmon and Steelhead Inventory (SaSI). 2002. Salmon and steelhead inventory - 2002. Introduction, Summary Tables, and North Puget Sound, South Puget Sound, Hood Canal and Strait of Juan de Fuca volumes. Fish Program, Science Division. Washington Department of Fish and Wildlife. Olympia, WA.

Seidel, Paul. 1983. Spawning Guidelines for Washington Department of Fish and Wildlife Hatcheries. Washington Department of Fish and Wildlife. Olympia, Wa.

Seiler, D., L. Kishimoto, and S. Neuhauser. 1998. 1997 Skagit River wild 0+ chinook production evaluation. Contract report to Seattle City Light. Washington Department of Fish and Wildlife, Olympia, Washington.

Seiler, D., L. Kishimoto, and S. Neuhauser. 1999. 1998 Skagit River wild 0+ chinook production evaluation. Contract report to Seattle City Light. Washington Department of Fish and Wildlife, Olympia, Washington.

Seiler, D., L. Kishimoto, and S. Neuhauser. 2000. 1999 Skagit River wild 0+ chinook production evaluation. Contract report to Seattle City Light. Washington Department of Fish and Wildlife, Olympia, Washington.

Seiler, D., S. Neuhauser, and L. Kishimoto. 2001. 2000 Skagit River wild 0+ chinook production evaluation. Annual Project Report. Science Division, Washington Department of Fish and Wildlife. Olympia, WA. 45 p.

Seiler, D., L. Kishimoto, and S. Neuhauser. 2002. 2001 Skagit River wild 0+ chinook production evaluation. Contract report to Seattle City Light. Report FPA 02-11. Washington Department of Fish and Wildlife, Olympia, Washington.

Slaney, P.A., B.R. Ward. 1993. Experimental fertilization of nutrient deficient streams in British Columbia. *In* G. Schooner and S. Asselin (editors), Le developpmente du saumon Atlantique au Quebec: connaitre les regles du jeu pour reussir. Colloque international e la Federation quebecoise pour le saumon atlantique, p. 128-141. Quebec, decembre 1992. Collection *Salmo salar* n°1.

Slaney, P.A., B.R. Ward, and J.C. Wightman. 2003. Experimental nutrient addition to the Keogh River and application to the Salmon River in coastal British Columbia. *In* J.G. Stockner,(editor), Nutrients in salmonid ecosystems: sustaining production and biodiversity, p. 111-126. American Fisheries Society, Symposium 34, Bethesda, Maryland.

Steward, C. and T.C. Bjornn. 1990. Supplementation of salmon and steelhead stocks with hatchery fish; a synthesis of published literature. Tech. Rpt. 90-1. Idaho Cooperative Fish and Wildlife Research Unit. University of Idaho, Moscow, ID.

U.S. District court of Western Washington. 1976. United States v. Washington, 384 F, Supp. 312.

United States v. Washington, No. 9213 Phase 1 (sub no. 85-2) Order Adopting Puget Sound Management Plan, 1985

USFWS (U.S. Fish and Wildlife Service). 1994. Biological assessment for operation of U.S. Fish and Wildlife Service operated or funded hatcheries in the Columbia River Basin in 1995-1998. Submitted to National Marine Fisheries Service (NMFS) under cover letter, dated August 2, 1994, from William F. Shake, Acting USFWS Regional Director, to Brian Brown, NMFS.

Ward, B.R., D.J.F. McCubbing, and P.A. Slaney. 2003. Evaluation of the addition of inorganic nutrients and stream habitat structures in the Keogh River watershed for steelhead trout and coho salmon. . *In* J.G. Stockner,(editor), Nutrients in salmonid ecosystems: sustaining production and biodiversity, p. 127-147. American Fisheries Society, Symposium 34, Bethesda, Maryland.

Washington Department of Fisheries. 1991. Stock Transfer Guidelines. Hatcheries Program. Washington Department of Fisheries. Olympia, WA.

Washington Department of Fisheries, Washington Department of Wildlife and Western Washington Treaty Indian Tribes. 1992. Washington State Salmon and Steelhead Stock Inventory. Olympia, WA.

Washington Department of Fish and Wildlife. 1996. Fish Health Manual. Hatcheries Program, Fish Health Division, Washington Department of Fish and Wildlife. Olympia, WA.

Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes. 1998. Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Olympia, WA.

Washington Department of Natural Resources (WDNR). 1998. Our changing nature - natural resource trends in Washington State. Washington Department of Natural Resources. Olympia, Washington. 75p.

Washington Department of Fish and Wildlife and Puget Sound Treaty Tribes, 2002, A Puget Sound Chinook Salmon Hatcheries, Resource Management Plan@, a component of Comprehensive Chinook Salmon Management Plan, August 23, 2002. 103 pages.

Wipfli, M.S., J. Hudson, and J. Caouette. 1998. Influence of salmon carcasses on stream productivity: response of biofilm and benthic macroinvertebrates in southeastern Alaska, U.S.A. Can J. Fish. Aquatic Sci. 55: pp 1503-1511.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

AI hereby certify that the foregoing information 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:_____

Take Table. Estimated listed salmonid take levels by hatchery activity.

Chinook

ESU/Population	Puget Sound Chinook *(Oncorhynchus tshawytscha)*- Lower Skagit River
Activity	Marblemount Spring Chinook Program
Location of hatchery activity	Marblemount Hatchery, RM 0.5 Cascade River (04.1411).
Dates of activity	Fingerlings- July-June Yearlings- June-April
Hatchery Program Operator	WDFW

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)	-	-	-	-
Collect for transport (b)	-	-	-	-
Capture, handle, and release (c)	-	-	2*	-
Capture, handle, tag/mark/tissue sample, and release (d)	-	-	-	-
Removal (e.g., broodstock (e)	-	-	-	-
Intentional lethal take (f)	-	-	0	-
Unintentional lethal take (g)	-	-	-	-
Other take (indirect, unintentional) (h)	-	Unknown	-	-

*Number of natural origin fish removed and released from hatchery in 2003.

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.