HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Voights Creek Winter S teelhead Program
Species or Hatchery Stock:	Steelhead (*Onchorynchus mykiss*) Voights Creek (Puyallup River)
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Puyallup River Puget Sound
Date Submitted:	March 17, 2003
Date Last Updated:	March 19, 2003

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Voights Creek "Winter" Steelhead Program

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

Voights Creek (Puyallup River) Steelhead (*Onchorynchus mykiss*) - not listed

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:

The Puyallup Tribe of Indians shares co-management of the winter steelhead program.

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

The program is funded through the State Wildlife Fund. The staff at Voights Creek consists of 3 full time employees.

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

Voights Creek Hatchery:	Located at RM 0.5 on Voights Creek (10.0414), a tributary of the Carbon River (10.0413). Voights Creek enters the Carbon River at RM 4. The Carbon River is a tributary to the Puyallup River (10.0021) and joins it at RM 17.8.
Puyallup Hatchery:	Clarks Creek, (10.0027)

1.6) Type of program.

Isolated harvest

1.7) Purpose (Goal) of program.

Augmentation.

The goal of this program is to provide adult fish for sport and treaty harvest opportunity.

1.8) Justification for the program.

This program will be operated to provide fish for harvest while minimizing adverse effects on listed fish. This will be accomplished in the following manner:

1. Release steelhead as smolts with expected brief freshwater residence.

2. Attempt time of release not to coincide with out-migration of listed fish.

3. Only appropriate stock will be propagated.

4. Mark all reared fish.

5. Hatchery fish will be propagated using appropriate fish culture methods and consistent with Co-Managers Fish Health Policy and state and federal water quality standards; e.g. NPDES criteria.

1.9) List of program Performance Standards .

See below

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

Performance Standards and Indicators for Puget Sound **Isolated Harvest** Steelhead programs.

Performance Standard	Performance Indicator	Monitoring and Evaluation Plan
Produce adult fish for harvest	Survival and contribution rates	Monitor catch
Meet hatchery production goals	Number of juvenile fish released - ***200,000 (see section 1.11.2)**	Future Brood Document (FBD) and hatchery records
Manage for adequate escapement where applicable	Hatchery return rates	Hatchery return records

Minimize interactions with listed fish through proper broodstock management and mass marking. Maximize hatchery adult capture effectiveness. Use only hatchery fish	Number of broodstock collected - **250 (see section 1.11.1)**	Rack counts Spawning guidelines
	Stray Rates	
	Sex ratios	Hatchery records
	Age structure	
	Timing of adult collection/spawning - **late November to mid-February**	Spawning guidelines Hatchery records
	Adherence to spawning guidelines - **see section 8.3**	
	Total number of wild adults passed upstream - **only hatchery steelhead are broodstocked, wilds' released**	
Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	FBD and hatchery records
	Out-migration timing of listed fish / hatchery fish - **mid-May /late April-May**	FBD and historic natural outmigration times
	Size and time of release - **9 fpp /late April-May release**	FBD and hatchery records
	Hatchery stray rates	Hatchery records (marked vs unmarked)
Maintain stock integrity and genetic diversity	Effective population size	Spawning guidelines
	Hatchery-Origin Recruit spawners	

Maximize in-hatchery survival of broodstock and their progeny; and Limit the impact of pathogens associated with hatchery stocks, on listed fish	Fish pathologists will monitor the health of hatchery stocks on a monthly basis and recommend preventative actions / strategies to maintain fish health	Co-Managers Disease Policy Fish Health Monitoring Records
	Fish pathologists will diagnose fish health problems and minimize their impact	
	Vaccines will be administered when appropriate to protect fish health	
	A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings	
	Fish health staff will present workshops on fish health issues to provide continuing education to hatchery staff.	
Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring	NPDES compliance	Monthly NPDES records

1.11) Expected size of program.

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

Broodstock is collected at Voights and Puyallup hatcheries as well as the tribal hatchery on the lower Puyallup at Diru Creek. 250 adults are needed for the program, 125 of each sex.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	Voights Creek	*200,000

* - Beginning in release year 2003, all 20,000 fish destined for planting into the White River from the Puyallup Hatchery will be released from Voight's Creek facility. Total release will be 200,000 steelhead.

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

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

Traditionally fish were released into the mainstem Puyallup with a minor component released off station into the Carbon River. Beginning in the early 90's, the majority of the steelhead program was acclimated and released from the Voights Creek Hatchery to facilitate broodstock recovery and reduce adult straying.

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.

Puyallup River watershed (10.0021)

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

The wild steelhead population in the Puyallup River system is unable to sustain the high sport and tribal harvest rate that hatchery stocks can sustain.

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

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

None.

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.

None

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

Puyallup River Fall Chinook.

Adults spawn in the mainstem Puyallup River from approximately RM 10.4 upstream to the anadromous barrier at Puget Sound Energy's Electron diversion facility (RM 41.7). Sexually mature fish begin arriving back at the river mouth in late July and continue to enter the river until mid-October. The upstream migration peaks in late August to mid-September. Spawning begins in early September, peaks in early October and is generally complete by November. Fall chinook spawning habitat is available in the Carbon River from its mouth up into Mt. Rainier National Park. Tributary spawning takes place in Clarks Creek, Fennel Creek, Canyon Falls Creek, South Prairie Creek, Wilkeson Creek and Kapowsin Creek.

Most naturally produced Puyallup River chinook migrate to salt water as zero age smolts after spending only a few months in freshwater (Out-migration timing was not currently well defined but a study initiated in 2000 by the Puyallup Tribe, to determine juvenile production levels and migration timing, has indicated that the peak of out-migration occurs in mid-May. Size of the chinook out-migrants at the peak was 80-90 mm). After a few weeks of estuarine acclimation, most juveniles begin moving to nearshore feeding grounds in Puget Sound and the Pacific Ocean.

White River Spring Chinook.

Adults spawn in the mainstem White River from the Puget Sound Energy project tailrace at Dieringer (river mile 3.5) up to the Puget Sound Energy diversion dam at river mile 24.3. Sexually mature fish begin arriving back at the river mouth in May and enter the river through mid-September. Collection and passage (upstream 12 miles) at the Buckley trap commences in late May or early June and ends in early October. Spawning takes

place from early September through mid-October. Tributary spawning takes place in Boise Creek, below the diversion dam, and in the Greenwater River, Clearwater River, Huckleberry Creek and the West Fork White River, all above Mud Mountain Dam.

Like the Puyallup fall chinook, the White River spring chinook juveniles are predominantly zero age outmigrants.

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** (*see definitions in Attachment 1").*

Critical and viable population threshholds under ESA have not been determined, however, the SASSI report (WDFW) determined both the Puyallup River Fall Chinook and the White River Summer/Fall Chinook populations status to be "unknown". The report determined that the White River Spring Chinook population status was "critical".

- 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.

There is no stock-specific data available to estimate survival or productivity of the natural Puyallup River fall chinook.

Washington run size is not estimated for White River spring chinook and coded-wire-tagging results have not yet provided the stock-specific harvest rate data necessary to calculate adult production rates.

- 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.

Estimates of Puyallup River fall chinook spawning naturally in the South Prairie Creek sub-basin[1]

1994	798
1995	1335
1996	1225
1997	622
1998	1028
1999	1422

[1.] Note that the historic Puyallup River fall chinook escapement estimates listed in Run Reconstruction are not considered accurate by the co-managers and are not relative to estimates made by a new method, beginning in 1999. The South Prairie Creek sub-basin has been chosen as an indicator of Puyallup River escapement, with a local spawning objective of 500 adults.

Numbers of adult White River spring chinook passed above Mud Mountain Dam[1] (From Army Corps of Engineers trucking records):

1988	127
1989	83
1990	275
1991	194
1992	406
1993	409
1994	392
1995	605
1996	628
1997	402
1998	320
1999	553

[1.] Note that there are currently no estimates made of spring chinook spawning below the Puget Sound Energy diversion dam at Buckley.

- 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.

Puyallup River fall chinook - Unknown. There has been no identification of hatchery-origin fish in this basin until the 1997 brood. Ratios will be developed when these fish mature and return to spawn.

White River spring chinook - Unknown, although only unmarked, untagged fish are trucked above Mud Mountain Dam. This precludes identified hatchery-origin adults from being passed upstream, but unidentified hatchery-origin fish may be in the upper river natural spawning population. 1999 coded-wire-tag recoveries at the Buckley trap/White River Hatchery showed contributions of Skagit River spring chinook (released into Tulalip Bay), Fox Island Net Pen fall chinook, Voights Creek fall chinook, South Sound Net Pen fall chinook, Elliott Bay Net Pen fall chinook, Diru Creek fall chinook and Hoodsport Hatchery fall chinook. All of these strays were removed from the spawning population, however, unmarked elements of these production units (and others) may have been incorporated into the local broodstock, both above and below the barrier.

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 *(see Attachment 1" for definition 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.

The release of fish as described in this HGMP could potentially result in ecological interactions with listed species. These potential ecological interactions are discussed in Section 3.5, and risk control measures are discussed in Section 10.11. Implementation of the program modifications provided in this HGMP, and the actions previously taken by the comanagers, are anticipated to contribute to the continued improvement in the abundance of listed salmonids.

The operation of the hatchery gravity intake is not compliant with current intake standards. USFWS has provided funding to WDFW to identify facility modifications to bring the intake into compliance.

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

Unknown

- **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).**
*Complete the appended take table (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or worst case scenarios.*

See "take" table

- 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.

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.

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

Puyallup Basin hatchery winter steelhead production levels are specified to be a minimum of 200,000 smolts per year by agreement between the Puyallup Tribe and WDFW.

3.3) Relationship to harvest objectives.

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

The following catches and harvest rates for Puyallup Basin hatchery winter steelhead include fish from both the Voights Creek program and the Puyallup Hatchery program which cannot be distinguished from one another:

Year	Sport Catch	Treaty Catch	Harvest Rate
1988	528	676	92.9%
1989	804	862	92.3%
1990	587	332	92.3%
1991	720	261	92.3%
1992	693	824	92.3%
1993	310	190	92.3%
1994	560	431	92.3%
1995	456	335	92.3%
1996	316	45	64.5%
1997	154	10	61.7%
1998	404	85	70.7%
1999	339	24	62.2%

3.4) Relationship to habitat protection and recovery strategies.

The comanagers resource management plans for artificial production in Puget Sound are expected to be one component of a recovery plan for Puget Sound chinook under development through the Shared Strategy process. Several important analyses have been completed, including the identification of populations of Puget Sound chinook, but further development of the plan may result in an improved understanding of the habitat, harvest, and hatchery actions required for recovery of Puget Sound chinook.

Identified habitat management needs within the Puyallup basin include:

Pursue to completion the fish passage facility at Puget Sound Energy's Electron Dam. Monitor instream flows in the upper Puyallup River to assure that minimum levels are met or exceeded.

Increase the amount of large woody debris in the watershed, maintain wooded riparian zones and enhance vegetation in damaged riparian areas.

Reduce channelization of the Puyallup River and pursue opportunities to develop levee setback projects and reconnect historic meander channels. This would include minimizing "infilling" of floodways and critical habitat with residential development in order to preserve future opportunities.

Reduce the number of logging roads in the watershed and replace culverts that currently block fish passage.

Further limit gravel removal operations in the Puyallup River.

3.5) Ecological interactions.

The program described in this HGMP interacts with the biotic and abiotic components of the freshwater, estuarine, and marine salmonid ecosystem through a complex web of short and longterm processes. The complexity of this web means that secondary or tertiary interactions (both positive and negative) with listed species could occur in multiple time periods, and that evaluation of the net effect can be difficult. WDFW is not aware of any studies that have directly evaluated the ecological effects of this program. Alternatively, we provide in this section a brief summary of empirical information and theoretical analyses of three types of ecological interactions, nutrient enhancement, predation, and competition, that may be relevant to this program. Recent reviews by Fresh (1997), Flagg et al. (2000), and Stockner (2003) can be consulted for additional information; NMFS (2002) provides an extensive review and application to ESA permitting of artificial production programs.

Nutrient Enhancement

Adults originating from this program that return to natural spawning areas may provide a source of nutrients in oligotrohic coastal river systems 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).

Predation Freshwater Environment

Coho and steelhead released from hatchery programs may prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, the habitat in which the population occurs, and the characteristics of the hatchery program (e.g., release time, release location, number released, and size of fish released). The site specific nature of predation, and the limited number of empirical studies that have been conducted, make it difficult to predict the predation effects of any specific hatchery program. WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP.

In the absence of site-specific empirical information, the identification of risk factors can be a useful tool for reviewing hatchery programs while monitoring and research programs are developed and implemented. Risk factors for evaluating the potential for significant predation include the following:

Environmental Characteristics. Water clarity and temperature, channel size and configuration, and river flow are among the environmental characteristics that can influence the likelihood that predation will occur (see SWIG (1984) for a review). The SIWG (1984) concluded that the potential for predation is greatest in small streams with flow and turbidity conditions conducive to high visibility.

Relative Body Size. 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 numerous watersheds throughout Puget Sound, including the Skagit River , Stillaguamish River, Bear Creek, Cedar River, Green River, Puyallup River, and Dungeness River. 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 3.5.1). Assuming that the prey item can be no greater than 1/3 the length of the predator, Table 3.5.1 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 March through June indicates that delaying the release hatchery smolts of a fixed size will reduce the risks associated with predation.

Table 3.5.1. Average length by statistical week of natural origin juvenile chinook salmon migrants captured in traps in Puget Sound watersheds. 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 final row of the table. (NS: not sampled.)

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
Stillaguamish [2] 2001-2002	51.4	53.5	55.7	57.8	60.0	62.1	64.2	66.4	68.5	70.6	72.8
Cedar [3] 1998-2000	54.9	64.2	66.5	70.2	75.3	77.5	80.7	85.5	89.7	99.0	113
Green [4] 2000	52.1	57.2	59.6	63.1	68.1	69.5	NS	79.0	82.4	79.4	76.3
Puyallup [5] 2002	NS	NS	NS	66.2	62.0	70.3	73.7	72.7	78.7	80.0	82.3
Dungeness [6] 1996-1997	NS	NS	NS	NS	NS	NS	NS	NS	77.9	78.8	81.8
All Systems Average Length	50.4	55.8	58.1	61.8	64.3	67.7	69.2	72.8	76.5	79.0	82.4
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), and Seiler et al. (2002)..

[2] Data are from regression models presented in Griffith et al. (2001) and Griffith et al. (2003).

[3] Data are from Seiler et al. (2003).

[4] Data are from Seiler et. (2002).

[5] Data are from Samarin and Sebastian (2002).

[6] Data are from Marlowe et al. (2001).

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

1) Emigration occurs over a prolonged period, beginning soon after enough emergence (typically January) and continuing at least until July;
2) Two broad peaks in migration are often present during the January through July time period; an early season peak (typically in March) comprised of relatively small chinook salmon (40-45mm), and a second peak in mid-May to June comprised of larger chinook salmon;
3) On average, over 80% of the juvenile chinook have migrated past the trapping locations after statistical week 23 (usually occurring in the first week of June).

Table 3.5.2. Average cumulative proportion of the total number of natural origin juvenile chinook salmon migrants estimated to have migrated past traps in Puget Sound watersheds.

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit [1] 1997-2001	0.61	0.64	0.68	0.73	0.76	0.78	0.83	0.86	0.90	0.92	0.94
Bear [2] 1999-2000	0.26	0.27	0.28	0.32	0.41	0.52	0.73	0.84	0.92	0.96	0.97
Cedar [2] 1999-2000	0.76	0.76	.0.76	0.77	0.79	0.80	0.82	0.84	0.87	0.88	0.90
Green [3] 2000	0.63	0.63	0.64	0.69	0.77	0.79	0.84	0.86	0.88	0.98	1.00
All Systems Average	0.56	0.58	0.59	0.63	0.68	0.72	0.80	0.85	0.89	0.94	0.95

Sources:

[1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002)..

[2] Data are from Seiler et al. (2003).

[3] Data are from Seiler et. (2002).

Release Location and Release Type. The likelihood of predation may also be affected by the location and type of release. Other factors being equal, the risk of predation may increase with the length of time the fish released from the artificial production program

are commingled with the listed species. In the freshwater environment, this is likely to be affected by distribution of the listed species in the watershed, the location of the release, and the speed at which fish released from the program migrate from the watershed.

Coho salmon and steelhead released from western Washington artificial production programs as smolts have typically been found to migrate rapidly downstream. Data from Seiler et al. (1997; 2000) indicate that coho smolts released from the Marblemount Hatchery on the Skagit River migrate approximately 11.2 river miles day. Steelhead smolts released onstation may travel even more rapidly migration rates of approximately 20 river miles per day have been observed in the Cowlitz River (Harza 1998). However, trucking fish to offstation release sites, particularly release sites located outside of the watershed in which the fish have been reared, may slow migrations speeds (Table 3.5.3).

Table 3.5.3. Summary of travel speeds for steelhead smolts for several types of release strategies.

Location	Release Type	Migration Speed (river miles per day)	Source
Cowlitz River	Smolts, onstation	21.3	Harza (1998)
Kalama River	Trucked from facility located within watershed in which fish were released.	4.4	Hulett (pers. comm.)
Bingham Creek	Trucked from facility located outside of watershed in which fish were released.	0.6	Seiler et. al. (1997)
Stevens Creek	Trucked from facility located outside of watershed in which fish were released.	0.5	Seiler et. al. (1997)
Snow Creek	Trucked from facility located outside of watershed in which fish were released.	0.4	Seiler et. al. (1997)

Number Released. Increasing the number of fish released from an artificial production program may increase the risk of predation, although competition between predators for prey may eventually limit the total consumption (Peterman and Gatto 1978).

Predation Marine Environment

WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP. NMFS (2002) reviewed existing information on the risks of predation in the marine environment posed by artificial production programs and concluded:

1) Predation by hatchery fish on natural-origin smolts or sub-adults is less likely to occur than predation on fry. Coho and chinook salmon, after entering the marine environment, generally prey upon fish one-half their length or less and consume, on average, fish prey that is less than one-fifth of their length (Brodeur 1991). During early marine life, predation on natural origin chinook, coho, and steelhead will likely be highest in situations where large, yearling-sized hatchery fish encounter sub-yearling fish or fry (SIWG 1984).

2) However, extensive stomach content analysis of coho salmon smolts collected through several studies in marine waters of Puget Sound, Washington do not substantiate any indication of significant predation upon juvenile salmonids (Simenstad and Kinney 1978).

3) Likely reasons for apparent low predation rates on salmon juveniles, including chinook, by larger chinook and other marine predators are described by Cardwell and Fresh (1979). These reasons included: 1) due to rapid growth, fry are better able to elude predators and are accessible to a smaller proportion of predators due to size alone; 2) because fry have dispersed, they are present in low densities relative to other fish and invertebrate prey; and 3) there has either been learning or selection for some predator avoidance.

Competition

WDFW is unaware of any studies that have empirically estimated the competition risks to listed species posed by the program described in this HGMP. Studies conducted in other areas indicate that this program is likely to pose a minimal risk of competition:

1) As discussed above, coho salmon and steelhead released from hatchery programs as smolts typically migrate rapidly downstream. The SIWG (1984) concluded that migrant fish will likely be present for too short a period to compete with resident salmonids.

2) NMFS (2002) noted that ..where interspecific populations have evolved sympatrically, chinook salmon and steelhead have evolved slight differences in habitat use patterns that minimize their interactions with coho salmon (Nilsson 1967; Lister and Genoe 1970; Taylor 1991). Along with the habitat differences exhibited by coho and steelhead, they also show differences in foraging behavior. Peterson (1966) and Johnston (1967) reported that juvenile coho are surface oriented and feed primarily on drifting and flying insects, while steelhead are bottom oriented and feed largely on benthic invertebrates.

3) Flagg et al. (2000) concluded, By definition, hatchery and wild salmonids will not compete unless they require the same limiting resource. Thus, the modern enhancement strategy of releasing salmon and steelhead trout as smolts markedly reduces the potential for hatchery and wild fish to compete for resources in the freshwater rearing environment. Miller (1953), Hochachka (1961), and Reimers (1963), among others, have noted that this potential for competition is further reduced by the fact that many hatchery salmonids have developed different habitat and dietary behavior than wild salmonids. Flagg et al (2000) also stated It is

unclear whether or not hatchery and wild chinook salmon utilize similar or different resources in the estuarine environment.
4) Fresh (1997) noted that Few studies have clearly established the role of competition and predation in anadromous population declines, especially in marine habitats. A major reason for the uncertainty in the available data is the complexity and dynamic nature of competition and predation; a small change in one variable (e.g., prey size) significantly changes outcomes of competition and predation. In addition, large data gaps exist in our understanding of these interactions. For instance, evaluating the impact of introduced fishes is impossible because we do not know which nonnative fishes occur in many salmon-producing watersheds. Most available information is circumstantial. While such information can identify where inter- or intra specific relationships may occur, it does not test mechanisms explaining why observed relations exist. Thus, competition and predation are usually one of several plausible hypotheses explaining observed results.

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.

Voights Creek hatchery is supplied by surface water from Voights Creek. Water is withdrawn from a gravity intake approximately ½ mile upstream from the hatchery. Gravity water is supplemented with water pumped at the hatchery site. The gravity intake supplies 2000 gallons per minute (gpm). The (three) pumps deliver 1,500 gpm each. Voights Creek responds quickly to heavy rainfall and is prone to rapid fluctuations. Heavy bed loads are due to landslides, timber harvest and watershed development. Winter floods are becoming a common occurrence. Late summer low flows with elevated temperatures into the high 60's have been the norm for several decades. Water withdrawals from the gravity intake divert a significant portion of the creek water from the area immediately below the intake. The screen box bypass channel and a tributary creek rejoin the creek several hundred yards below the intake. The fish ladder is accessible and operational even with the low flows. Natural salmon production is blocked, above RM 4, due to a series of impassable waterfalls.

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.

Gravity intake screens are not in compliance with code requirements for mesh size but are identified for replacement. Chinook have access to the habitat above the gravity intake in years of high flow during the time period when adult chinook are returning to Voights Creek. The pump intake is fitted with 3.5" x .125" "wedge-wire" screening. Hatchery effluent shall meet or exceed NPDES permit standards for discharge of pond cleaning waste or pond drawdown.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock are collected in an off-line trap situated alongside Voights Creek. The trap pond is earthen and measures approximately 30' X 250' The pond doubles as a rearing pond in the spring. Prior to 1996, adults were diverted into the trap pond by a permanent rack in Voights Creek. Since 1996, the rack has been inoperative due to gravel deposition. Returning adults enter the trap pond volitionally at this time.

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

Fish hauls utilize fish tanker trucks of 500 to 2,000 gallon capacity equipped with water pumps and oxygen tanks.

5.3) Broodstock holding and spawning facilities.

Broodstock are held in a large earthen pond. Adults are seined, sorted, killed and spawned at pondside.

5.4) Incubation facilities.

Incubation utilizes 68 vertical Heath Techna incubators with the eyeing capacity of 11 million eggs and the hatching capacity of 5.5 million salmon.

5.5) Rearing facilities.

The facility utilizes 9 "standard" concrete rearing ponds, two 1/4 acre asphalt ponds and one large earthen pond (also used to trap adults).

5.6) Acclimation/release facilities.

There is the potential to release smolts from three different ponds, a 30' X 250' earthen rearing pond or two 1/3 acre oval asphalt ponds.

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

In the past 12 years:

1. Heavy debris loads cause the gravity intake screens to become plugged frequently. This, coupled with a faulty alarm unit, caused the loss of 100,000 yearling coho in November, 1999.

2. Flood conditions in February 1996 caused the suffocation loss of several hundred thousand coho sac-fry yet in the incubators. The same flood caused the premature release of an unknown number (>50K) of yearling coho.

3. Occasionally, water orifices which supply individual vertical incubators will plug with debris causing the loss of complete vertical stacks of eggs or fry.

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.

The hatchery is equipped with a backup generator and adequate fuel supply in the event of a power outage. Two on-site personnel are on rotating standby status year around in the event of a problem. An upgraded alarm system is designed to detect changes in flow and power status. The risk of disease transmission shall be limited by using effective theraputents, as prescribed and in a timely manner.

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.

Prior to 1996, adults were diverted into the trap pond by a permanent rack at the Voights Creek Hatchery. Since 1996, the rack has been inoperative due to gravel deposition. Returning adults enter the trap pond volitionally at this time.

6.2) Supporting information.

6.2.1) History.

The stock of steelhead utilized at Voights Creek is considered Chambers Creek stock. However, in recent years the emphasis is to utilize as many locally adapted fish as possible for the program. In years when egg take goals cannot be met with locally adapted fish, stocks from both the Bogachiel Hatchery and Tokul Creek Hatchery are utilized to secure an egg take. Both Bogachiel stock and Tokul Creek stock are considered Chambers Creek derivatives.

6.2.2) Annual size.

The rack return to Voights Creek hatchery has ranged from 50 to 400 fish since the program inception (with 250 (125:125) needed for egg take). See section 1.11.1.

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

No naturally produced fish are used for the program. Only adipose-fin clipped adults are collected for spawning purposes.

6.2.4) Genetic or ecological differences.

There are genetic differences between native Puyallup River system steelhead and Voights Creek Hatchery steelhead. They also exhibit separate spawning times and juvenile rearing times.

6.2.5) Reasons for choosing.

This stock was selected because it produces an early returning adult, typically between December and January. This minimizes the amount of spawning overlap with native steelhead in the Puyallup system.

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.

NA

SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2) Collection or sampling design.

Returning adults are trapped, volitionally, in an off-creek trap. An instream weir has been in-operative since 1996. It will eventually be replaced. With a weir, trap efficiency is 98%. Without a weir, trap efficiency is 80-90%.

7.3) Identity.

All steelhead returning to facility are mass marked (adipose-fin clipped).

7.4) Proposed number to be collected:

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

250 (125:125). See section 1.11.1.

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

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995					
1996					
1997	56	64		164,000	
1998	10	10		21,000	
1999	51	51		176,822	
2000	5	2		18,000	
2001	20	21		84,000	

Data source: Voight's Cr. hatchery records

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

Surplus hatchery steelhead are recycled for additional sport fishing opportunity if they are in good condition. Fish that are in spawning condition are killed and donated to a food bank.

7.6) Fish transportation and holding methods.

All adults are trapped and held on site.

7.7) Describe fish health maintenance and sanitation procedures applied.

Standard fish culture techniques and sanitation procedures are applied during spawning procedures. Eggs are water hardened in iodophor solution to minimize the chance of disease transmission.

7.8) Disposition of carcasses.

Carcasses are disposed of after being spawned. If unspawned and surplussed they are donated to a food bank.

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.

NA

SECTION 8. MATING

8.1) Selection method.

Typically all returning fish are spawned when ripe. The pond is sorted on a weekly basis between December and mid-February. Both males and females are typically kill and spawned. Unless there is a shortage of viable males they are live spawned.

8.2) Males.

Fish are spawned on a 1:1 basis with the use of a backup male. Jacks are used if available, however, steelhead jacks are rare at this facility.

8.3) Fertilization.

1:1 individual mating with the use of a backup male which is added a minute after the initial fertilization attempt.

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.

NA

SECTION 9. INCUBATION AND REARING -

9.1) Incubation:

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

Egg take has ranged from 50,000 to 250,000. Survival rates from green egg to eye-up vary from 65 to over 90%.

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

Has never occurred.

9.1.3) Loading densities applied during incubation.

Steelhead eggs are typically about 2800 per pound. They are loaded in vertical trays at 12,000 per tray, 20,000 per shallow trough section for hatchout. All green eggs are transferred to Puyallup Hatchery prior to fertilization and incubation and early rearing occur there.

9.1.4) Incubation conditions.

Eggs are treated with a 100 parts per million (ppm) formalin drip daily until hatchout. Head boxes are alarmed to notify staff of water flow fluctuations. Vertical trays are checked frequently and rodded of excess silt to prohibit egg/fry suffocation.

9.1.5) Ponding.

Fish are ponded when they are visibly 95% buttoned up. Ponding is forced.

9.1.6) Fish health maintenance and monitoring.

Fungus is controlled during incubation with a 100 ppm formalin drip. Fish Health Specialists make regular visits to insure fish health. Eggs are shocked and picked at 600 Temperature Unit's (TU's).

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.

NA

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..

Survival from fingerling to smolt is typically between 75 to 90%.

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

Loading and density goals follow those described in Fish Hatchery Management (Piper, 1982).

9.2.3) Fish rearing conditions

All ponds receive ambient water from Voights Creek. Incoming oxygen levels are saturated, but are not normally monitored. Due to heavy silt loads the ponds are vacuumed frequently (weekly or as-needed).

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.

Not available.

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

Fish are fed more aggressively during spring and early summer to maximize growth. Growth and feeding rates are decreased during late fall and winter due to cold surface water temperatures and lack of aggressive feeding.

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*).

Fish are fed a dry pelleted diet. Fish are fed several times a day, depending on fish activity. Steelhead are highly variable feeders and feed rates often vary widely from day to day. Typically range between 1 and 4% B.W./day. Conversion rates are generally 1:1. Higher conversions such as 1.2:1 or 1.3:1 have been achieved recently with some of the newer, higher protein foods.

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

Ponds are vacuumed weekly or as-needed. Fish Health Specialists make scheduled visits to check on fish health. Medications or alternate management plans derive from these checks. When emptied, all ponds are cleaned, air dried and sun-sanitized, if possible.

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

NA

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

NA

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.

NA

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	*200,000	9	lateApril/May	Voights Creek

*- Beginning in release year 2003, all 20,000 fish destined for planting into the White River from the Puyallup Hatchery will be released from Voight's Creek facility. Total release will be 200,000 steelhead.

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

Stream, river, or watercourse: Puyallup River (10.0021)
Release point: Voights Creek (10.0414; RM 0.5)
Major watershed: Puyallup River (10.0021)
Basin or Region: Puget Sound

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

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995							42,262	5
1996							49,550	9
1997							56,500	7
1998							179,100	6
1999							180,000	9
2000							178,600	8
2001							176,300	9
Average							123,187	8

Data source: Voights Cr. hatchery records

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

Release dates have varied from late April to early May. Fish are released based on observed behaviors such as working the pond edges and screens, as well as fish size. Releases generally begin as volitional and last several days to a couple weeks. It ends as a forced release.

10.5) Fish transportation procedures, if applicable.

NA

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

Fish are reared and acclimated on the surface water at Voights Creek Hatchery.

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

All steelhead are 100% identified with an adipose-fin clip (mass marked).

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

Has not occurred at Voights Creek Hatchery (surface water source). Surplus steelhead produced at the Puyallup Hatchery (spring water source) have been planted in lowland lakes with no outlet to bolster the sport fishery.

10.9) Fish health certification procedures applied pre-release.

Fish are examined by a WDFW Fish Health Specialist prior to release or transfer in accordance with the Co-Managers Salmonid Disease Policy.

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

Screens can be pulled to release fish early in case of flooding or water system failure.

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.

To minimize the risk of residualization and impact upon natural fish, hatchery yearlings are released in late April/May as smolts and only in the Puyallup River watershed. All fish released are mass marked. The turbidity of the Puyallup River is likely to reduce the risks of predation posed by this program..

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

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

The comanagers conduct numerous ongoing monitor programs, including catch, escapement, marking, tagging, and fish health testing. The focus of enhanced monitoring and evaluation programs will be on the risks posed by ecological interactions with listed species. WDFW is proceeding on four tracks:

1) An ongoing research program conducted by Duffy et al. (2002) is assessing the nearshore distribution, size structure, and trophic interactions of juvenile salmon, and potential predators and competitors, in northern and southern Puget Sound. Funding is provided through the federal Hatchery Scientific Review Group.

2) A three year study of the estuarine and early marine use of Sinclair Inlet by juvenile salmonids is nearing completion. The project has four objectives:

a) Assess the spatial and temporal use of littoral habitats by juvenile chinook throughout the time these fish are available in the inlet;

b) Assess the use of offshore (i.e., non-littoral) habitats by juvenile chinook;

c) Determine how long cohorts of juvenile chinook salmon are present in Sinclair inlet;

d) Examine the trophic ecology of juvenile chinook in Sinclair Inlet. This will consist of evaluating the diets of wild chinook salmon and some of their potential predators and competitors. Funding is provided by the USDD-Navy.

3) WDFW is developing the design for a research project to assess the risks of predation on listed species by coho salmon and steelhead released from artificial production programs. Questions which this project will address include:

a) How does trucking and the source of fish (within watershed or out of watershed) affect the migration rate of juvenile steelhead?

b) How many juvenile chinook salmon of natural origin do coho salmon and steelhead consume?

c) What is the rate of residualism of steelhead in Puget Sound rivers?

Funding needs have not yet been quanitifed, but would likely be met through a combination of federal and state sources.

4) WDFW is assisting the Hatchery Scientific Review Group in the development of a template for a regional monitoring plan. The template will provide an integrated

assessment of hatchery and wild populations.

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

See Section 11.1.1.

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

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

SECTION 12. RESEARCH

12.1) Objective or purpose.

There is currently no research being conducted utilizing Voights Creek Winter Steelhead.

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 take 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.

(*e.g. Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.).*

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

I 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:_____

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

Listed species affected: Chinook ESU/Population: Puget Sound Activity: Hatchery Operations				
Location of hatchery activity: Voights Creek Dates of activity: December-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)				
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)	Unknown	Unknown		
Other Take (specify) h)				

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

Instructions:

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