HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**Big Creek Hatchery Tule Fall Chinook**
Species or Hatchery Stock:	**Fall Chinook (Big Creek Stock-13)**
Agency/Operator:	**Oregon Department of Fish and Wildlife**
Watershed and Region:	**Lower Columbia River and Estuary**
Draft Submitted: **Updated Draft Submitted:**	**October 24, 2005** **May 10, 2016**
Date Last Updated:	**March 14, 2016**

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of Program.

Big Creek Hatchery Tule Fall Chinook Salmon Program

1.2) Population (or stock) and species.

The Big Creek Hatchery fall Chinook program utilizes Columbia River fall Chinook Salmon *Oncorhynchus tshawytscha*, tule stock 13. Wild and hatchery populations of fall Chinook in the lower Columbia River are part of the Lower Columbia River Chinook Evolutionarily Significant Unit (ESU). This ESU contains both fall and spring Chinook Salmon, and was listed as threatened under the Federal Endangered Species Act (ESA) in 1999 (Federal Register Notice 1999). This hatchery population was included as part of the Lower Columbia River Chinook ESU (Federal Register Notice 2005).

1.3) Responsible organization and individuals.

Lead Contacts:

Name (and title):	Scott Patterson, Fish Propagation Program Manager
Organization:	Oregon Department of Fish and Wildlife
Address:	4034 Fairview Industrial Drive SE, Salem, OR 97302
Telephone:	(503) 947-6218
Fax:	(503) 947-6202
Email:	Scott.D.Patterson@state.or.us

Name (and title):	John North, Columbia River Fisheries Management Manager
Agency or Tribe:	Oregon Department of Fish and Wildlife
Address:	17330 SE Evelyn Street, OR 97015
Telephone:	(971) 673-6081
Fax:	(971) 673-6070
Email:	john.a.north@state.or.us

Hatchery Contacts:

Name (and title):	Rob Dietrichs, Big Creek Hatchery Manager
Organization:	Oregon Department of Fish and Wildlife
Address:	92892 Ritter Rd, Astoria, OR 97103
Telephone:	(503) 458-6512
Fax:	(503) 458-6529
Email:	BigCreek.Hatchery@state.or.us

Name (and title):	Vacant, Fish and Wildlife Supervisor, Klaskanine Hatchery
Organization:	Oregon Department of Fish and Wildlife
Address:	82635-202 Hatchery Road, Astoria, OR 97103
Telephone:	(503) 325-3653
Fax:	(503) 325-2426

Email: Klaskanine.Hatchery@state.or.us

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

NOAA: 100% funding through Mitchell Act.
WDFW: Co-manager for fish harvest under the Columbia River Compact.

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

Big Creek Hatchery:
Funding Sources: NMFS (70%) and ODFW (30%)
Annual hatchery budget (FY 2015-16): $987,322
Estimated annual cost for tule fall Chinook program: $493,661
Staffing level: 6 FTE

Klaskanine Hatchery:
Hatchery Funding Sources: BPA (100%)
Annual hatchery budget (FY 2015-16): $158,308
Estimated annual cost for tule fall Chinook program: Staff time only, as tule production cost is covered by Big Creek hatchery budget.
Staffing level: 3 FTE

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

Big Creek Hatchery:
Big Creek Hatchery is located on Big Creek, 16 miles east of Astoria, at RM 3.3 which is approximately 3 miles upstream from Big Creeks' confluence with the Columbia River, Clatsop County, Oregon. The site is at elevation of approximately 75 feet above sea level, at latitude 46° 08' 46" N (46.1460) and longitude 123° 34' 45" W (123.5806). The regional mark processing code for Big Creek Hatchery is 5F33202 H2 21.

Fall Chinook program activities at Big Creek Hatchery include:
Broodstock Collection
Adult Holding
Spawning
Egg Incubation
Juvenile Rearing
Marking, and
Smolts Release

Klaskanine Hatchery:
Klaskanine Hatchery is located along the North Fork Klaskanine River approximately 12 miles southeast of Astoria, Oregon, on Highway 202. The site elevation is about 25 feet above sea level, at latitude 46° 05' 21" N (46.0890) and longitude 123° 42' 57" W (123.7174). The regional mark processing code for Klaskanine Hatchery is 5F33214

H14 21. Activities at Klaskanine Hatchery are acclimation and release of smolts into N. Fork Klaskanine River.

Classroom Incubators:
Within the Salmon and Trout Enhancement Program (STEP), 30,000 eyed tule fall Chinook eggs are transferred from Big Creek Hatchery to classroom incubators at Astoria High School (Clatsop County) for educational purposes and later stocked in Youngs Bay as smolts (45 fish/lb). Additional eyed tule fall Chinook eggs are incubated by the STEP program for distribution to other Clatsop County high schools, e.g., Warrenton High School (20,000 eyed eggs and released as smolts at 30 fish/lb into Skipanon River), and Lewis and Clark School (1,200 eyed eggs and released as unfed fry into Skipanon River). Seaside High School has not received STEP eggs in the past, but may be interested in receiving eggs in the future.

1.6) Type of program.

Isolated harvest program.

1.7) Purpose (Goal) of program.

The primary goal of the Big Creek tule fall Chinook hatchery program is to produce adult Chinook Salmon for commercial and recreational harvests by releasing ~5.2 million sub-yearling smolts each year, to supplement harvest in commercial and recreational fisheries. And the harvest goal is ~0.5% of the returned adults with minimal harvest impacts to listed natural salmon migrating through the harvest area. This tule fall Chinook program contributes significantly to the ocean and Columbia River commercial and recreational fisheries. In the ocean, hatchery-origin tule fall Chinook of Big Creek are important to the west coast commercial troll fishery and the northern Oregon and southern Washington recreational fisheries. Big Creek tule fall Chinook also contribute to the Buoy 10 recreational fishery in the Columbia River estuary, as well as lower Columbia River mainstem and Select Area commercial fisheries.

The program is managed to maintain the tule fall Chinook broodstock and genetic integrity of the population. It also aims to minimize the adverse impacts to naturally produced fall Chinook. The Big Creek tule fall Chinook production program also provides eyed-eggs to local schools for educational purposes. The eggs are incubated in classroom incubators provided through the STEP and students are responsible for rearing the fish and monitoring growth. In November, 30,000 eyed-eggs are transported to Astoria High School. The resulting fish are 100% adipose fin-clipped and released as smolts into Youngs Bay in June (45 fish/lb). An additional 20,000 eyed eggs are given to Warrenton High School and released as smolts (30 fish/lb, 100% ad-clip) into the Skipanon River. Lewis and Clark High School receives 1,200 eyed eggs for incubation and later releases the unfed fry into the Skipanon River.

1.8) Justification for the program.

The production of tule fall Chinook (stock 13) at Big Creek Hatchery is mandated by the U.S. - Canada Pacific Salmon Treaty. Big Creek Hatchery tule fall Chinook program is designed to supplement harvest in a variety of commercial and recreational fisheries with minimal harvest impacts to listed natural fish. This program provides fish in adequate numbers to meet the harvest goals (as defined by location, time, gear and fishing method) that are intended to benefit the diverse fisher groups. The Oregon commercial and recreational fisheries which target Columbia River hatchery-produced fall Chinook, including Big Creek fall Chinook, are managed to not exceed impact levels to ESA-listed salmon and steelhead authorized by federal NMFS and state agencies. Although tule fall Chinook smolts are produced at Big Creek Hatchery they are released from two different hatchery locations i.e., Big Creek Hatchery (3.1 million) and Klaskanine Hatchery (2.1 million), to expand the commercial and recreational fishing areas. All sub-yearling smolts are mass marked with adipose fin clip to facilitate selective harvests; and a proportion of the smolts is marked with ad-clip + CWT, for program performance evaluation (determine survival rates and straying to other tributaries) (see below Figure 1). And, fisheries targeting the lower Columbia River hatchery-produced fall Chinook are managed by quotas, time, area, and gear types to assure that federal and state ESA harvest limits are not exceeded.

Fishing effort for Big Creek hatchery-origin fall Chinook is concentrated prior to the arrival of most naturally produced chum and late stock coho that may return to the local tributary streams. Management of Chinook harvest in the ocean and freshwater fisheries is designed to maximize harvest of hatchery-origin Chinook by mass marking with minimal harvest impacts to listed Chinook. Maximizing harvest of hatchery fish both improves program performance (providing fish for harvest) and reduces the number of hatchery-produced Chinook that escape to potentially spawn in Big Creek, Youngs Bay drainages and other lower Columbia River tributaries.

Specific release strategies, including smolt size at release, release locations and time of release, are practiced to minimize potential adverse biological and ecological effects to naturally produced juvenile salmonids residing within the tributaries or out-migrating through the lower Columbia River and estuary. Juveniles are reared to the smolt stage when they are ready to migrate. The sub-yearling smolts are released from Big Creek and Klaskanine hatcheries in May at size of 80 fish/lb that accelerate their emigration to the estuary and minimize interactions with listed natural fish. On-site releases of smolts from two hatcheries may also reduce the potentials for straying, as most of the escaped fish shall return to hatchery traps. This program also contributes to educational projects for high school students, with the aim to make the students knowledgeable in salmon biology, life cycle, and habitat requirements. See Figure 1 for Big Creek Hatchery tule fall Chinook program size, release area, and marking.

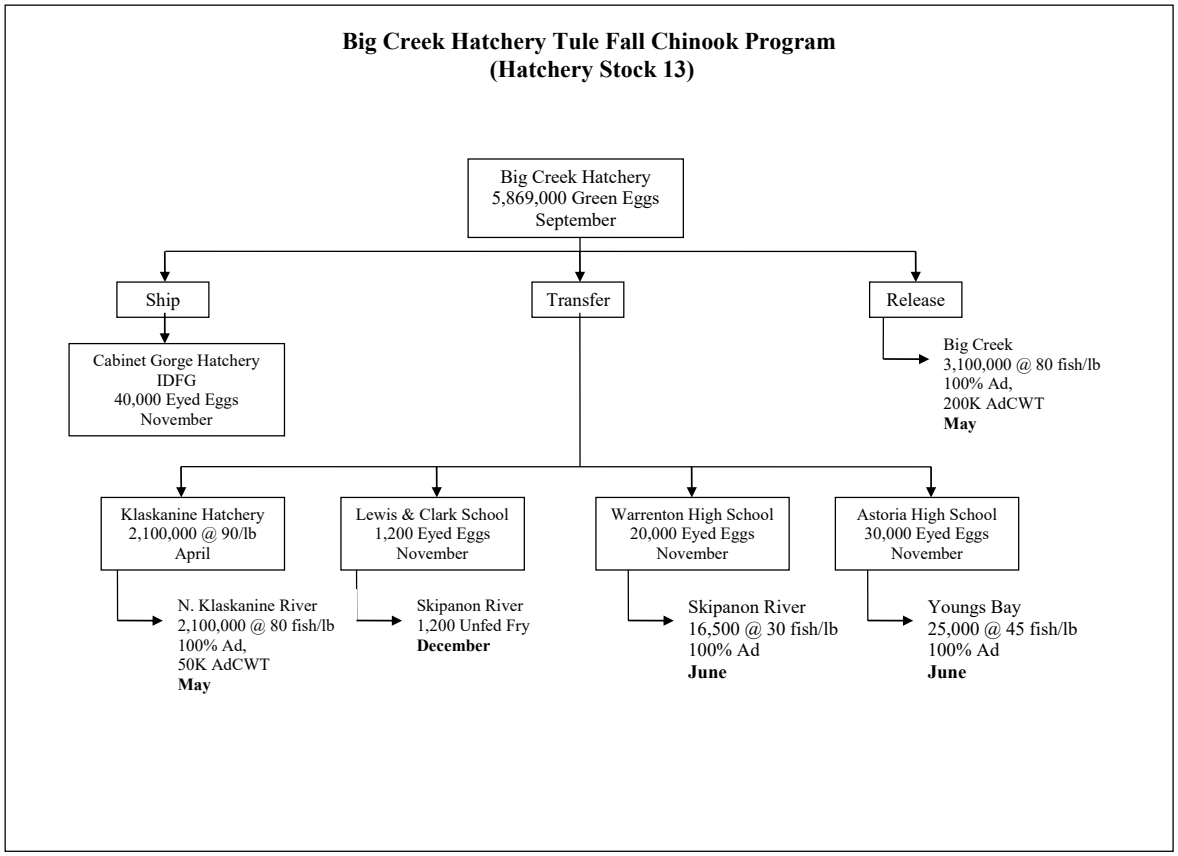

Figure 1. Flow chart of Big Creek Hatchery tule fall Chinook Salmon program.

1.9) Performance Standards.

See Section 1.10.

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

1.10.1) "Performance Indicators" addressing benefits.

BENEFITS Performance Standards	Performance Indicators	Monitoring & Evaluation
Produce hatchery fish to meet production goals.	On-station releases of 3,100,000 sub-yearling smolts into Big Creek and 2,100,000 sub-yearling smolts into N. Klaskanine River, at 80 fpp.	Pre-release sampling for fish size and estimated release numbers and data reporting.
Maintain a broodstock of Big Creek tule fall Chinook with adequate genetic diversity.	Number of males and females spawned, a minimum of 1,300 females and 1,300 males (preferred ratio 1:1, female to male ratio could be up to 3:1, if situation warrants). Broodstock collection represents entire run. Meet fish health standards.	Annually record number of females, males and jacks retained as broodstock and spawned. Timing of run and fish retained for broodstock, sex ratios. Broodstock survival rate, and results of fish health checks.

BENEFITS Performance Standards	Performance Indicators	Monitoring & Evaluation
Contribution of hatchery tule fall Chinook to fisheries.	Number of program adults harvested in target fisheries. Angler success rates (catch per angler trip).	Fish buyer monitoring, recreational fishery sampling, and recovery of Coded-Wire Tagged (CWT) fish from sampling programs.
Adaptive management to improve program performance.	Projects are identified, reviewed, and implemented that aim to increase survival of program fish.	Research and monitoring programs are incorporated into project designs. Examples of projects include: rearing/release studies and feeding studies.
Release groups are mass marked and adequately CWT tagged to track survival and distribution.	Number of program fish adipose fin-clipped and coded-wire-tagged. Current goal is to mark all smolts released from the two hatcheries.	Pre-release mark quality checks. Recording of releases data into ODFW and PSMFC databases.
Hatchery will be operated in compliance with established fish health guidelines.	Number of broodstock sampled and pathogens observed. Rearing survival rates, egg to fry, and fry to smolt. Number of juveniles sampled and pathogens observed during rearing and immediately prior to release.	Juvenile fish health is monitored on at least a monthly basis at the rearing hatchery, and at pre-release.
Contribution to ecosystem function (e.g. through nutrient enhancement, food web effects, etc.)	Stream enrichment program, use of hatchery carcasses complies with existing management guidelines.	The existing MOA calls for documenting project activities, and establishes monitoring and evaluation of the program.

1.10.2) "Performance Indicators" addressing risks.

RISKS Performance Standards	Performance Indicators	Monitoring & Evaluation
Fisheries conducted to harvest hatchery produced tule fall Chinook are consistent with conservation requirements.	Fishery impacts to ESA listed salmon and steelhead do not exceed federal and state ESA requirements.	In-season monitoring of catch by species is conducted in the ocean, and catch and stock composition in the Columbia River. Post-season analysis of fisheries estimates impacts to listed fish based on sampling of the landed catch (sport and commercial) for species and CWTs.
Juvenile hatchery releases minimize interactions with naturally produced fish species.	Release timing, location, condition of juveniles, and emigration patterns.	Standard hatchery pre-release sampling and data reporting.
Minimize disease risk to naturally produced fish.	Program complies with all state and federal health monitoring, transfer, and release guidelines. Only health certified fish are released.	Juvenile fish health is monitored regularly on a monthly basis and prior to release.

RISKS Performance Standards	Performance Indicators	Monitoring & Evaluation
Minimize straying of hatchery fish to other lower Columbia River tributaries.	Recovery of program fish in tributaries other than Big Creek and Klaskanine River. ODFW's Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead targets stock-specific hatchery stray rates of 10-90% for Youngs Bay and Big Creek populations but generally 10% for Scappoose and Clatskanie (ODFW 2010; Table 8-6)	Spawning surveys and fish trap counts. Document marked fish and recovery of CWTs.
Natural spawning of program fish is accounted for to enable enumeration of naturally produced fall Chinook spawning.	Ability to estimate the number of hatchery and naturally produced tule fall Chinook spawning in lower Columbia River tributaries	Spawning ground surveys. Recover CWT fish, document timing and spatial distribution.

1.11) Expected size of program.

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

Mortality of adult tule fall Chinook is high. Therefore, the current annual broodstock collection goal is 3,000 adults (including mortalities) with a green egg take goal of 6,500,000 ± 10%. To meet this egg take goal the proposed annual broodstock collection level would be approximately 1,300 female and 1,300 male Chinook (preferred spawning ratio is 1:1; female to male ratio could be up to 3:1, if situation warrants). Actual number of males and females spawned since 1990 is reported in Table 7.4.2, Section 7.4.2. Differences between actual numbers of fish spawned and the broodstock collection goal are largely due to mortality losses.

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

Life Stage	Release Location	Annual Release Level (size)
Eyed Eggs	None	None
Unfed Fry	Skipanon River (STEP)	1,200
Fry	None	None
Sub-yearling smolts	Big Creek	3,100,000 (~80 fish/lb)
	N.F. Klaskanine River	2,100,000 (~80 fish/lb)
	Youngs Bay (STEP)	25,000 (~45 fish/lb)
	Skipanon River (STEP)	16,500 (~30 fish/lb)

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

The purpose of this hatchery program is to provide fish for harvest. Performance is measured by total adult harvests, hatchery returns and smolt-to-adult survival. The total hatchery returns of this stock are provided in Table 1.12a. Smolt-to-adult survival rates are provided in Table 1.12b. See Section 3.3 for harvest information.

Table 1.12a. Total returns to Big Creek Hatchery and natural spawner escapement (in Big Creek) of Big Creek Hatchery tule fall Chinook, 1992-2011.

Return Year	Big Creek Hatchery Returns	Big Creek Spawner Escapement[a]	Klaskanine Hatchery Returns[b]	Klaskanine Spawner Escapement[a]
1992	4,622	NA	8	
1993	3,478	NA	35	
1994	7,918	NA	12	
1995	6,173	NA	8	
1996	7,987	NA	0	
1997	5,028	NA	0	
1998	3,991	461	0	
1999	6,467	725	17	na
2000	2,363	1,197	12	2
2001	16,596	7,227	7	0
2002	20,278	11,677	0	0
2003	16,785	19,308	10	0
2004	8,578	5,970	6	0
2005	5,262	4,220	129	71
2006	2,125	153	0	0
2007	3,392	304	0	0
2008	8,792	4,772	0	0
2009	5,392	2,028	0	101
2010	8,141	6,574	0[b]	0
2011	8,031	2,682	137	185
2012	5,621	?	0	?
2013	2,810	?	167	?
2014	6,627	?	0	?
2015	5,556	?	0	?

[a] Prior to 1998, estimates of natural spawner escapements were not made. Escapement estimates are primarily comprised of hatchery fish, but may include some naturally produced fish, including jacks (source: WDFW Big Sheets). Klaskanine includes both North and South Forks.

[b]2010 was the first release of tule fall Chinook from Klaskanine Hatchery. Chinook that returned to Klaskanine Hatchery during 1992-2010 may have been stray fish of either natural- or hatchery-origin fish or combination of both (source: ODFW HMIS).

Table 1.12b. Big Creek Hatchery tule fall Chinook smolt-to-adult survival rates and estimated total adult production, brood years 1986-2008.

Brood Year	Number Released[a]	Smolt to Adult Survival (%)[b]	Total Adult Production
1986	7,383,158	0.16	12,013
1987	8,851,920	0.05	4,028
1988	10,576,010	0.14	15,304
1989	9,746,836	0.09	9,180
1990	9,399,319	0.08	7,092
1991	10,972,552	0.18	19,593
1992	7,901,061	0.06	4,957
1993	7,025,715	0.22	15,282
1994	11,188,784	0.06	7,157
1995	9,470,792	0.03	2,598
1996	5,961,118	0.20	11,956
1997	5,867,783	0.08	4,442
1998	5,804,921	0.60	34,575
1999	5,821,235	0.98	57,339
2000	4,537,448	1.07	48,620
2001	5,765,933	0.30	17,459
2002	5,764,833	0.08	4,503
2003	5,887,836	0.03	1,971
2004	5,865,175	0.04	2,436
2005	5,850,219	0.21	12,542
2006	4,243,134	0.16	6,994
2007	4,057,770	0.66	26,924
2008	5,666,218	0.21	11,999

[a] Does not include Klaskanine Hatchery releases, because Klaskanine releases began in 2010 (2009 brood year) and first adult return is expected in 2012 (three year old fish).

[b] Calculated using only AD+CWT release numbers and AD+CWT recoveries.

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

The first year of operation for this program at Big Creek Hatchery was 1941, with an expansion in the early 1950's. The first release of tule fall Chinook from Klaskanine Hatchery was in 2010.

1.14) Expected duration of program.

The program is on-going with no planned termination.

1.15) Watersheds targeted by program.

Columbia River Estuary, Big Creek and N.F. Klaskanine River.

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

1.16.1) Brief Overview of Key Issues.

Issue 1. Maintain "tule" fall Chinook production at Big Creek Hatchery.

Tule fall Chinook return at an advanced stage of maturation, with flesh quality deteriorating upon entry into the Columbia River and generally poor in the tributaries. Because of this inferior flesh quality, and low commercial value, the benefit of this stock had been questioned in the past. However, this stock does contribute substantially to the Buoy 10 sport fishery at the mouth of the Columbia River and to ocean sport and commercial fisheries. These fisheries include those under the jurisdiction of the Pacific Salmon Commission.

The tule fall Chinook program at Big Creek Hatchery is funded with Mitchell Act and State funds. In the past decade, Mitchell Act funding to the states has declined significantly, which has resulted in elimination of tule fall Chinook programs in the Willamette River Basin. The main concern is that, in recent years, proposed cuts in Mitchell Act funding have typically put at risk of this on-going tule fall Chinook program at Big Creek Hatchery. The advantage is that the tule fall Chinook program has a low unit cost compared to some hatchery programs for other species (e.g. steelhead or coho) due to short rearing times and smaller size at release, which allows for greater production for harvest; however, survival rates have also been low at times partly due to release of smaller size fish (Table 1.12b).

Issue 2: Passage of fall Chinook above Big Creek Hatchery.

Quality habitat exists in the Big Creek watershed above the site of Big Creek Hatchery, especially for coho, chum salmon and winter steelhead. However, low water level in Big Creek during tule adult return is a major concern as to whether unmarked tules shall be passed or out-planted above the hatchery barrier. Tule Chinook usually return to Big Creek Hatchery trap at an advanced maturation stage during late August to early September when the water level in Big Creek is usually at the lowest level, which is less than ideal for tule upstream migration, survival and successful spawning. Previous experimental out-planting of tule above hatchery barrier resulted in the death of all fish before spawning, probably due to very low level of water in Big Creek. Therefore, tule Chinook shall not be passed upstream above the hatchery barrier and shall be returned to Big Creek with a punched opercle to give them opportunity to migrate to their natal stream; and if the punched tules reenter the hatchery trap these fish would be considered

mismarked hatchery-origin fish and be incorporated into broodstock. However, the late arriving unmarked tules may be passed above the hatchery barrier, if flow in Big Creek seems to be high enough for their survival and spawning. Habitat above Big Creek Hatchery may be suited for coho, chum and winter steelhead because they return later when water level in Big Creek is higher due to rainfall. Therefore, passage of significant numbers of anadromous salmonids (coho, chum, steelhead, and possibly some fall Chinook) above the hatchery intake weir would require modifications to the hatchery facilities, including adult hauling facility. Facility improvements would focus on treating the water source for potential pathogens, screening the hatchery intake was completed in June 2012 to meet NOAA Fisheries requirements, and improving adult fish handling facilities. Additionally, sampling of downstream migrants would be valuable to evaluate effectiveness of providing access to spawning and rearing areas above the hatchery.

Adults returning to Big Creek Hatchery are trapped and sorted by hand. Since the 2001-2002 return-year, all unmarked adult coho, chum, and steelhead have been passed upstream of the hatchery weir to utilize the habitat in upper Big Creek. The current sorting facility does not allow direct return of unmarked fish back to the stream; therefore, unmarked adults are loaded into a portable tank and truck and transported upstream for release back into Big Creek.

1.16.2) Potential Alternatives to the Current Program.

The following alternatives are ideas only and not necessarily all endorsed by the agency.

ISSUE 1: Maintain tule fall Chinook production at Big Creek Hatchery.

Alternative 1: Maintain current Mitchell Act funding for tule fall Chinook production at Big Creek Hatchery. The current tule fall Chinook program at Big Creek Hatchery supports important ocean and freshwater fisheries. Releases of this stock are mandated by the U.S.- Canada Pacific Salmon Treaty. Adult returns provide a significant contribution to Columbia River and Select Area commercial fisheries occurring during the months of August and September. Additionally, production from this program is used for educational activities in local public schools. The Big Creek tule fall Chinook program is funded entirely through the Mitchell Act funding. Previous reviews of Mitchell Act funded programs have placed a low priority on the Big Creek tule fall Chinook program. Because of this low priority and Mitchell Act funding constraints, the program's future is uncertain.

Alternative 2: Develop alternate funding for tule fall Chinook program at Big Creek Hatchery. Tule fall Chinook provide significant contributions to ocean and freshwater fisheries. Tule stock fall Chinook are included as production accounted for in the Pacific Salmon Treaty and are especially valuable to ocean fisheries in Canada and along the Washington coastline. Additionally, tule fall Chinook support the Buoy 10 sport fishery and August and September commercial fisheries in the lower Columbia River. Current funding through the Mitchell Act has been jeopardized in recent years. Previous reviews of Mitchell Act funded programs have placed a low priority on the Big Creek tule fall

Chinook program. Currently, no alternative sources of funding have been identified; however, should Mitchell Act funding be eliminated for Big Creek fall Chinook, the ODFW would review its fish production priorities and make a decision on whether or not to continue to seek funding for this program.

Alternative 3: Replace tule fall Chinook production at Big Creek Hatchery with an alternative stock. This alternative has been frequently suggested by commercial fishermen in the lower Columbia River as a way to increase the value of production from Big Creek Hatchery. This suggestion is not unexpected since the value of this stock to local fisheries is low (about $0.70/pound in 2011) due to poor flesh quality at the time of harvest. However, this stock does contribute significantly to other regional fisheries. Due to seasonal water shortages at the hatchery, very few alternative Chinook stocks exist. One potential alternative would be to replace some of the tule fall Chinook production with select area bright (SAB) stock fall Chinook. Releases of this stock were conducted at Big Creek Hatchery from 1983-1996 but were discontinued due to excessive straying. Since SAB smolts are released at a larger size than "tules", fewer fish could be raised on site. This option would require additional funding to purchase net pens for final rearing in Youngs Bay or Knappa Slough, in addition to increased feed and personnel costs. Another consideration is that SAB fall Chinook migrate south in the Pacific Ocean while "tule" fall Chinook migrate north. Therefore, international management agreements may not support this alternative. During the last decade, upriver bright (URB) fall Chinook have been released periodically at the Tongue Point Select Area Fishery Evaluation (SAFE) site. However, use of this stock is not anticipated in the future. The use of URB fall Chinook would require considerable discussion in the U.S. v. Oregon forum and would likely not be supported by the treaty tribes. Further discussion among many parties may be required to determine if this alternative merits any consideration.

Alternative 4: Discontinue releases of tule fall Chinook from Big Creek and Klaskanine hatcheries. This alternative would result in lost harvest opportunity for ocean sport and commercial fisheries north of Cape Falcon and in the mainstem Columbia River, especially the "Buoy 10" fishery. Releases of this stock are still mandated by the U.S.-Canada Pacific Salmon Treaty. Because tule fall Chinook can be released as sub-yearling smolts, they are relatively inexpensive to rear. This also matches the water supply profile at Big Creek Hatchery, which has in-stream flow issues during summer months. Due to the significant contribution of this program to various regional fisheries and the relatively low unit cost of production, this alternative is not supported by ODFW.

ISSUE 2: 100% mass marking of hatchery fall Chinook.

Alternative 1: Maintain current mass marking of hatchery-origin tule fall Chinook. The 100% mass marking of hatchery-origin fish is the best alternative as they are produced for harvest by commercial and recreational fisheries. Although mark-selective regulations are not currently required for either recreational of commercial fisheries in the Columbia River, the potential exists and is likely to be utilized in the future. Under the current mass marking program, only a representative number of fish are marked with

either Ad+CWT marking and all the remaining fish are marked with external adipose fin-clipping. External fin clipping facilitates selective harvests of these fish; and Ad+CWT marking may be used to determine survival rates and straying of these fish to other tributaries. The current Ad+CWT marking program is adequate for fishery management under the ESA, stock status monitoring and freshwater distribution analyses. Data currently collected through the CWT marking and recovery programs is used to reconstruct major Columbia River fall Chinook runs, including Lower River Hatchery tules produced by this program. The current database allows for development of annual stock-specific abundance estimates, forecasts of future stock-specific abundance estimates, detection of fish straying to escapement areas other than Big Creek Hatchery, harvest in Columbia River sport and commercial fisheries, and harvest in ocean fisheries, including Canadian and Alaskan fisheries.

ISSUE 3: Passage of fall Chinook above Big Creek Hatchery.

Alternative 1: Maintain the status quo where fall Chinook are not passed above Big Creek Hatchery barrier. Currently, unmarked non-cwt tule fall Chinook (possibly stray or mismarked hatchery fish) are not passed above Big Creek Hatchery, primarily, due to very low level of water in Big Creek during the month of September when fully ripe tule Chinook enter the Big Creek Hatchery trap. Experimental out-planting of tule above hatchery barrier in the recent year resulted in death of all fish before spawning. It was, therefore, jointly decided by NOAA and ODFW staff that the unmarked non-cwt tules that enter the hatchery trap shall be opercle punched and then released below the weir to give them opportunity to migrate to their natal stream. This approach will give those unmarked tule fall Chinook salmon that have strayed into Big Creek the opportunity to continue their migration to their native stream. Those that do reenter into Big Creek Hatchery trap can be used for broodstock because they are very likely to be mis-marked Big Creek Hatchery origin tule fall Chinook. It was also suggested by ODFW staff that the late arriving unmarked tules may be passed above the hatchery barrier, if the water level in Big Creek appears high enough for tule survival and successful spawning.

Alternative 2: Begin passing fall Chinook above Big Creek Hatchery using existing facilities and methods. Currently, a relatively small number of unmarked coho, chum and winter steelhead are manually sorted at the adult fish trap, loaded into a fish transportation vehicle, and driven to a release site upstream of the hatchery intake. Fish are released back to the stream via transport tank and aluminum tube. This method of trapping, transport, and release is labor intensive and requires substantial handling of adult fish. With existing facilities, this would be the only method available for passing adult fall Chinook above the hatchery. But, in recent experimental passage of unmarked non-cwt tule fall Chinook above hatchery barrier resulted in the death of all fish, possibly due to low level of water in Big Creek for tule survival. The Conservation and Recovery team of ODFW suggested that the late returning unmarked tules may be passed above hatchery barrier, if water level in Big Creek is high enough for their survival.

Passage of significant numbers of anadromous salmonids (fall Chinook, coho, chum, and steelhead) above the hatchery would require certain facility improvements. First and

foremost, the hatchery intake weir was upgraded in June of 2012 with screens to meet standards set forth by NOAA Fisheries. In conjunction with upgraded screens, the access road to the intake weir would require construction of a retaining wall. Additionally, the water supply for Big Creek Hatchery would require treatments to eliminate pathogens. Water supply modifications would include new pump stations and a settling pond plus filtration, ultra violet light, aeration, and ozone treatments of the water prior to its use for incubation and early rearing.

Alternative 3: Improve facilities and methods to begin passing adult fall Chinook to spawning areas above Big Creek Hatchery. The current passage method for unmarked coho, chum, and steelhead requires significant handling of returning adults and could be improved considerably by allowing adults to continue their upstream migration with minimal handling and no transportation. Improved passage would still require fish to be manually handled and sorted at the existing Big Creek adult fish trap. However, modifications to the trapping facility would increase efficiency and reduce handling. Fish would be returned to the stream via a release pipe that would deliver adult fish back into the stream above the adult trap. Fish would continue their migration upstream to the hatchery intake where the fish would move past the intake through a newly constructed fishway.

Passage of significant numbers of anadromous salmonids (fall Chinook, coho, chum, and steelhead) under this alternative would require all the improvements listed under Alternative 2, plus additional improvements to the adult trap and the hatchery intake structure. The adult trap would require adding a hoist to sort and load fish, platforms, tighter net pens, and a pipe to transport adults back to the stream. Improvements to the hatchery intake would require construction of a pool and a 6-step fishway to allow passage over the intake structure. Additionally, a pump station would be required to pump water from the adult trap to the hatchery intake for the purpose of maintaining adequate flows through the stream between the hatchery intake and the adult trap to allow fish passage through this stretch of Big Creek. It should be noted that the topography of the adult trapping facility makes it difficult for adult fish to be returned to the stream via a gravity fed pipe (insufficient slope from trap to stream). Therefore, although a pipe would be the simplest and least expensive method, another method of transport from trap to stream may need to be developed to get around this obstacle. In addition, as with Alternative 2, this alternative is contingent upon the ability to reliably identify naturally produced fall Chinook for passage.

Alternative 4: Establish an out-migrant juvenile counting facility at the hatchery intake weir. This alternative could be developed in conjunction with either Alternative 1 or 2 or 3. The effectiveness of providing adult passage to upstream spawning areas would best be evaluated by measuring corresponding smolt production. Screening improvements mentioned in Alternatives 2 and 3 would allow smolts to pass the hatchery intake and adult trap structures without harm. However, the number of fall Chinook smolts produced in upstream areas could not be documented without additional facilities. Smolt enumeration would require a collection device that could either be associated with the hatchery intake screening modifications or independent of the intake structure (i.e. a

screw trap). Either option would provide a count of out-migrant production. A trap associated with the intake structure would likely document total out-migration while a screw trap would provide index counts of out-migration (although with additional effort, expansion factors could be calculated to also estimate total outmigration). Either method would be adequate for determining relative annual juvenile production. A project to enumerate juvenile outmigrant coho and steelhead with a mobile screw trap was recently implemented as part of a project funded by ODFW's Restoration and Enhancement Program.

1.16.3) Potential Reforms and Investments.

Reform/Investment 1: Establish an alternate source of eggs or broodstock for this stock of tule Chinook in case sufficient adults fail to return to Big Creek Hatchery. Recently, a back-up egg or broodstock source for the Big Creek Hatchery fall Chinook stock is being developed by acclimating and releasing 2.1 million sub-yearling smolts from the neighboring N. Klaskanine Hatchery. There would be no additional cost to acclimate the smolts in Klakanine Hatchery, except the staff time. However, these fish are exposed to extremely high harvest rates in the Youngs Bay Select Area commercial fishery which, by design, limits hatchery escapement. In addition, Klaskanine Hatchery is not currently staffed at a level to conduct significantly large spawning operation.

Reform/Investment 2: Identify an alternative funding source for the tule fall Chinook program at Big Creek Hatchery in the event that Mitchell Act funding were lost. Although annual tule program costs are moderately low (2012 FY $561,000), because tule fall Chinook are reared for a relatively short period of time before being released as sub-yearlings, the unit cost of releasing nearly 5.2 million smolts is fairly modest. This would maintain the last facility in Oregon that rears and releases tule stock fall Chinook. This would also continue the previous commitment to provide fish for sport and commercial fisheries as mitigation for the Columbia River hydropower system, as well as meet obligations to the U.S. – Canada Pacific Salmon Treaty.

Reform/Investment 3: Funding for modifications to the current hatchery facility, including the intake structure, that are required due to the presence of listed anadromous salmonids (coho, steelhead, and fall Chinook (if passage implemented for this species)) upstream of the hatchery. Modifications would include screening of intake structure to meet NMFS requirements, and treatment of water supply to eliminate pathogens (see Issue 3, Alternative 2). Costs of these modifications would likely not exceed $1 million.

Reform/Investment 4: Funding for modifications to the current adult trap and intake structure to allow anadromous salmonids (fall Chinook, coho, chum, or steelhead) to pass upstream of Big Creek Hatchery with minimal handling required. Modifications would include improved trapping equipment, an adult passage ladder at the hatchery intake structure, and a pump station to maintain adequate flows from the intake structure to the adult trap. Total cost associated is likely to be $1 million.

Reform/Investment 5: Funding for a method of enumerating anadromous salmonid (fall Chinook, coho, or steelhead) out-migrants. Collection method could be included as part of the required juvenile screening modifications or with a screw trap operated just downstream of the intake structure. The cost of purchasing a screw trap would be approximately $14,000 with annual operating expenses (personnel, supplies, etc.) for a three month monitoring season ranging from $1,000 to $18,000, depending on whether or not hatchery personnel were available to monitor and maintain the trap.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS (USFWS ESA-listed salmonid species and non-salmonid species are addressed in Section 17).

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

The propagation of tule fall Chinook stock-13 at Big Creek Hatchery is mandated by the U.S. - Canada Pacific Salmon Treaty. HGMP for this program was submitted to NMFS on October 24, 2005, as coverage for the take of ESA-listed fish. This is an updated version of the previously submitted HGMP.

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

All Columbia River anadromous salmonids that successfully return to spawn must migrate through the lower Columbia River and estuary twice during their life cycle. Thus, hatchery programs in the lower Columbia have the potential to affect the 13 listed ESUs in the Columbia basin. However, the program may have a greater impact on those ESA listed natural salmonid populations that occur in the subbasin where the program fish are collected and released, including:

The lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*) ESU is federally listed as threatened under the Endangered Species Act, effective May 24, 1999.

The Columbia River chum salmon (*Oncorhynchus keta*) ESU is federally listed as threatened, effective May 24, 1999.

The lower Columbia River coho salmon ESU is federally-listed as threatened under the ESA, effective June 28, 2005. It is also listed as endangered by the State of Oregon.

The Lower Columbia River steelhead (*Oncorhynchus mykiss*) ESU is federally listed as threatened under the ESA.

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

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

The fall component of the Lower Columbia River Chinook ESU is comprised of two groups: 'tules' and 'brights'. Native fall Chinook in Oregon tributaries of the lower Columbia River are almost all tule fall Chinook, with the exception of bright fall Chinook in the Sandy River. Small scattered naturally spawning tule fall Chinook populations are still observed in other Oregon tributaries (Big, Plympton, Scapoose, and Gnat creeks and the Clatskanie River). Tule fall Chinook generally arrive at the mouth of the Columbia River beginning in August, with peak migration generally in early September. Bright fall Chinook return timing generally is slightly later than tules. Tule fall Chinook are sexually mature upon river entry and spawn soon after arrival to the spawning grounds. Bright fall Chinook are sexually immature and may hold in freshwater for months prior to spawning. Populations in the lower Columbia have short migrations, which are more characteristic of coastal populations than upper Columbia populations. Depending on spawn timing and water temperature, tule fall Chinook juveniles in the lower Columbia River generally emerge beginning in March-April. After emergence they follow an ocean-type life history, emigrating in spring/early summer of their first year as sub-yearlings. Bright fall Chinook juveniles in the lower Columbia River generally emerge from March-June and emigrate to the ocean in early/late summer. Ocean distribution of lower Columbia fall Chinook extends from the coast of Washington to Southeast Alaska; bright fall Chinook salmon are generally more northerly distributed.

The Lower Columbia River Chinook and Coho ESU's are the two listed populations that would be directly affected by this hatchery program, primarily through collection of returning adults for the hatchery broodstock. This program primarily uses broodstock that return to the Big Creek Hatchery (also listed as threatened), which historically originated from natural returns of tule fall Chinook to Big Creek (see Section 6.0). In times of shortfalls, additional broodstock may be transferred from other tule fall Chinook hatcheries in the lower Columbia or collected from Plympton Creek (Columbia River RM 43), although neither option has been utilized in recent years. The naturally produced tule fall Chinook that may be trapped during broodstock collection are part of the Lower Columbia River Chinook ESU, and are considered related to the Lower River Hatchery stock (LRH) for fishery management purposes because they are believed to have originated from the hatchery stock. The LRH stock escapement is currently accounted for in natural spawning and hatchery returns. Since the naturally produced Chinook in Big Creek are largely thought to be the progeny of Big Creek Hatchery stock, there is little chance that Lower River Wild (LRW) fall Chinook are present in the hatchery returns. In addition, the LRW stock is a bright stock and the only bright fall Chinook occasionally observed in Big Creek are Select Area Bright (SAB) hatchery fish from SAFE areas. The SABs can easily be identified because they are mass marked with a left ventral fin clip.

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

Columbia River chum salmon are occasionally observed in the Klaskanine River and Big Creek, but chum salmon in the lower Columbia generally arrive at the mouth of the Columbia River beginning in late October, with peak migration generally in November, and thus are less likely to be affected by the tule hatchery program. However, released tule Chinook smolts may interact or incidentally affect the out-migrating chum fry in the lower Columbia and estuary. Chum salmon are sexually mature upon river entry and spawn soon after arrival to the spawning grounds. Depending on spawn timing and water temperature, chum fry begin emerging in early spring (March) and emigrate shortly after emergence; peak emigration is usually late April. Current chum salmon ocean distribution is not well documented but is expected to extend along the coast from Washington to Alaska.

Lower Columbia River coho salmon are present in numerous Oregon tributaries to the lower Columbia. Spawning survey results indicate that both hatchery and wild coho spawn in these tributaries, with hatchery-wild ratios varying from tributary to tributary (Brown et al. 2003). Lower Columbia River hatchery coho are categorized as either Type S or Type N, based on their general ocean distribution either south or north of the Columbia River. Managers also refer to Type S as early stock coho and Type N as late stock. Early stock coho salmon in the lower Columbia generally enter the Columbia River beginning in August, with peak spawn timing generally in late October-early November. Late stock coho salmon in the lower Columbia generally enter the Columbia River beginning in September, with peak spawn timing generally in late November and December. Depending on spawn timing and water temperature, coho fry begin emerging in the spring and rear for a year in freshwater. Migration to the ocean begins the following spring.

Listed populations that may be incidentally affected by the Big Creek tule fall Chinook salmon program include species utilizing habitat in Big Creek and the Columbia River and estuary downstream of Big Creek. All NMFS ESA-listed salmonids use the lower Columbia River as a migratory route, although effects of the Big Creek tule fall Chinook salmon program are expected to be minimal. Impacts associated with the Big Creek tule fall Chinook program are most applicable to threatened Chinook, coho, and chum salmon that spawn in Big Creek. The abundance of LRH tule fall Chinook in Big Creek has increased in recent years (Table 2.2.2a) while other Columbia River Chinook stocks (e.g. LRW) have not been observed spawning in Big Creek. Select Area Bright stock Chinook are occasionally found in Big Creek as a result of straying from the SAFE fall Chinook program in Youngs Bay. In nearby Plympton Creek, tule fall Chinook abundance has increased in recent years, and many fish are thought to be strays from Big Creek. Chinook in Plympton Creek are comprised almost entirely of LRH stock (Table 2.2.2a). Chum salmon can be observed in the Big Creek Hatchery trap, although abundance is quite low (Table 2.2.2b). Estimates of total escapement have not been quantified for coho salmon; however, fish per mile estimates have been made for Big Creek (Table 2.2.2b).

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

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

The NOAA Fisheries and ODFW have both assessed the current viability status of salmon and steelhead populations in the lower Columbia and Willamette ESUs. Both assessments used the same persistence probability criteria to estimate extinction risk for each population. To estimate the extinction risk, four key attributes were evaluated: 1) abundance and productivity; 2) diversity; 3) spatial structure; and 4) habitat. The populations were ranked from 0-4, with category 0 representing a 0-40% chance of persistence in the next 100 years and category 4 representing a 99 percent chance of persistence in the next 100 years. A population was considered viable with a category 3, or higher, score. The status assessment includes fall chinook, coho, and chum populations in Youngs Bay tributaries, Big Creek, Scappoose Creek, and the Clatskanie River. The persistence probability scores of both the WLC-TRT and ODFW are reflected as a range (Figure 1). The scores for fall chinook are generally low ranging from 1-2, for chum very low at less than 1, and for coho low from 1 to 2. Based on these scores, the status of the natural populations of Chinook, chum and coho in the Lower Columbia would be considered critical.

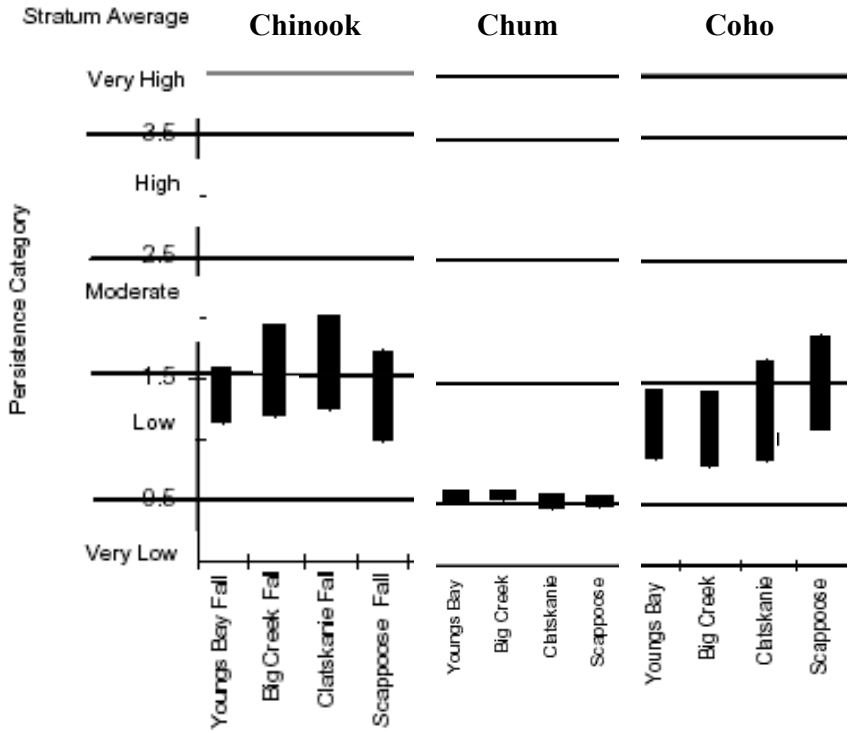

Figure 1. Current viability status of fall Chinook, chum and coho salmon populations in Youngs Bay, Big Creek, Clatskanie River, and Scappoose Creek. Figure adapted from McElhany et al. (2004).

- 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.

These data for listed natural populations are not available.

- 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. (Include estimates of juvenile habitat seeding relative to capacity or natural fish densities, if available).

Most recent available spawning escapement estimates are shown in Table 2.2.2a and Table 2.2.2b.

Table 2.2.2a. Fall Chinook aggregate natural spawning escapement estimates for select lower Columbia River subbasins (1990-2003), as well as Plympton Creek and Big Creek (1998-2011).

Run Year	Lower Columbia Tributaries [a]	Plympton Creek			Big Creek	
		LRH [b]	BUB [c]		LRH [b]	SAB[d]
1990	2,545	na	na		na	na
1991	1,712	na	na		na	na
1992	2,230	na	na		na	na
1993	2,225	na	na		na	na
1994	5,189	na	na		na	na
1995	3,906	na	na		na	na
1996	2,307	na	na		na	na
1997	2,175	na	na		na	na
1998	1,206	545	0		461	8
1999	2,057	1,085	44		725	6
2000	2,843	1,158	0		1,197	61
2001	11,651	3,908	0		7,227	7
2002	22,685	10,071	0		11,677	0
2003	30,036	9,393	0		19,308	0
2004	12,225	5,060	0		5,970	0
2005	7,464	2,620	0		4,220	0
2006	1,140	391	0		153	0
2007	1,341	451	0		304	0
2008	6,593	1,108	0		4,772	0
2009	5,326	2,118	0		2,028	0
2010	10,895	3,430	0		6,574	87
2011	8,090	3,289	0		2,682	0

[a] Expanded spawning ground surveys for nine Oregon lower Columbia River tributaries; South Fork Klaskanine, North Fork Klaskanine, Lewis and Clark River, Youngs River, Bear Creek, Big Creek, Plympton Creek, Gnat Creek, and Clatskanie River. From WDFW Fall Chinook Big Sheets. Includes jacks.
[b] LRH = Lower River Hatchery stock.
[c] BUB = Bonneville Upriver Bright stock.
[d] SAB = Select Area Bright stock.

Table 2.2.2b. Chum and coho salmon escapement estimates in Big Creek, 1990-2011.

Run Year	Chum Big Creek Hatchery Trap	Coho Big Creek[a] (fish/mile)
1990	10	0.0
1991	3	0.0
1992	2	0.7
1993	1	0.7
1994	6	1.4
1995	0	0.0
1996	0	0.0
1997	3	0.0
1998	3	0.0
1999	0	0.0
2000	0	0.0
2001	4	0.0
2002	0	10.0
2003	27	1.4
2004	24	0.0
2005	9	Not available
2006	192	4.3
2007	1	0.0
2008	3	0.0
2009	22	0.0
2010	23	0.0
2011	4	Not available

[a]Escapement estimates represent standard survey fish per mile peak counts; estimates from 2002-2011 represent primarily wild fish (some unmarked hatchery fish included) while pre-2000 estimates include both hatchery and wild fish, of which, many are hatchery fish.

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

These data are not available for chum because of a lack of chum salmon hatchery programs in the region. However, a few hatchery chum salmon are expected to be present in Oregon tributaries of the lower Columbia as strays from Washington State hatchery chum programs. Natural Chinook spawning escapements in Oregon tributaries of the lower Columbia River have been separated by stock components since 1998. No LRW fall Chinook have been observed in Big Creek during that time. The primary stock components in Big Creek are LRH (includes hatchery and naturally produced tule stock fall Chinook). The proportions of hatchery and naturally produced LRH stock are not known with certainty, but have been estimated in the Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead (2010) to be approximately 90% hatchery fish.

Available information on hatchery coho proportions in naturally spawning populations are summarized below (Table 2.2.2c). It is assumed that the coho naturally-produced in the Youngs Bay drainage and Big Creek are very similar to the hatchery-produced fish. Naturally spawning unmarked coho are thought to be primarily of hatchery origin due to the long history of extensive hatchery releases and out-plantings in lower Columbia River tributaries, as well as the lack of genetic distinction between hatchery and naturally produced coho (NMFS 1991).

Table 2.2.2c. Estimated percent of hatchery coho in the natural spawning escapement for select Oregon lower Columbia tributaries.

Year	Youngs River	Big Creek	Clatskanie River	Scappoose River
1999				7%
2000	49%	49%		9%
2001	99%	92%	17%	20%
2002	86%	90%	55%	0%
2003	86%	40%	0%	10%
2004	86%	70%	0%	8%
2005	75%	36%	1%	0%
2006	84%	0%	10%	5%
2007	40%	50%	48%	0%
2008	22%	15%	0%	0%
2009	92%	54%	15%	0%
2010	61%	30%	9%	0%
2011	66%	52%	3%	0%

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

Incidental take of lower Columbia River Chinook, Columbia River chum, or lower Columbia River coho may occur through activities associated with adult broodstock collection for the Big Creek and Klaskanine fall Chinook salmon programs. Tule fall Chinook are also being released at Klaskanine Hatchery, and adult returns started in the fall of 2012. Broodstock collection at this facility targets Select Area Bright (SAB) fall Chinook but other fish may be encountered. There are no plans currently to collect tule fall Chinook eggs at Klaskanine Hatchery, but adults returned to Klaskanine may be used as backup broodstock if sufficient broods are not found at Big Creek Hatchery. At both facilities, broodstock are collected via a volitional return of adults to the fish trap. All tule fall Chinook adults returned to Klaskanine Hatchery trap shall be collected and be sold through competitive bid process. Listed fish may enter the trap while the trap is open. The number of naturally produced tule fall Chinook entering the hatchery trap is

expected to be minimal at both facilities and the unmarked naturally-produced fish would presumably be fish of hatchery origins and/or mismarked hatchery-origin fish. Unmarked naturally produced coho and steelhead are released upstream of the hatcheries to spawn naturally. In the past, chum salmon collected at Big Creek Hatchery have been transported to Little or Bear creeks and released to spawn naturally. Currently, adult chum returning to Big Creek Hatchery are passed upstream of the hatchery. ODFW's chum salmon recovery program started releasing hatchery-produced chum fingerlings (Grays River origin) into Big Creek with the 2011 release year, and these fingerlings may be incidentally affected through competitive interactions with the smolts of tule fall Chinook program during outmigration. Very few chum return to Klaskanine Hatchery.

Incidental take of juvenile lower Columbia River Chinook, Columbia River chum, or lower Columbia River coho is not expected to occur through activities associated with rearing and release at either Big Creek Hatchery or Klaskanine Hatchery. There may be competition between hatchery released smolts and naturally-produced smolts in Big Creek and the Klaskanine/Youngs Bay systems, but these effects are minimized by release strategies (size at release and release time), which promote rapid emigration. Disease, predation, and habitat carrying capacity issues are additional sources of potential impacts to listed juvenile salmon and steelhead in the ocean and Columbia River main-stem.

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

Past takes of listed chum associated with returns to Big Creek Hatchery have ranged from 0 to 192 during 1990-2011. However, few chum are taken during the time period in which fall Chinook are collected. The hatchery rack does remain open past the fall Chinook collection period to collect coho broodstock, and to pass late returning wild coho upstream of the hatchery. Chum migration into Big Creek is generally later than the fall Chinook collection period. Chum salmon are counted and have been transported to Little Creek or Bear Creek to spawn naturally in the past, but are currently passed above the hatchery weir or transported and released in Perkins Creek. They were previously released in lower Big Creek, but tended to return to the hatchery trap. Wild coho are also transported and released back into Big Creek upstream of the hatchery. The wild coho hatchery passage number has ranged from 17 to 515 during 2000-2011. The number of unmarked tule fall Chinook collected in the broodstock is estimated to be ~1% of the total brood stock collected. Because tule Chinook releases have only recently been reinstated at Klaskanine Hatchery (and adult broodstock collection is not planned), take estimates are not available. Because trap operation at this facility is associated with the SAB program, take estimates are provided in the Select Area SAB HGMP.

- 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).

Projected annual take estimates are provided in Table 2.2.3.

Table 2.2.3. Estimated annual take of listed fish from lower Columbia River salmonid ESUs collected at Big Creek Hatchery.

Action	Lower Columbia Chinook		Lower Columbia Chum		Lower Columbia Coho		L. Columbia Steelhead	
	Life stage[a]	Estimated Annual take	Life stage[a]	Estimated Annual take	Life stage[a]	Estimated Annual take	Life stage[a]	Est. annual take
Observe or harass	A	0	A	0	A	0		
Collect for transport	A	0	A	0	A	0		
Capture, handle, and release	A	200	A	35[b]	A	400	A	200
Capture, handle, tag/mark/tissue sample, and release	A	200	A	0	A	0		
Capture and remove (e.g., broodstock)	A	3,000[c]	A	0	A	0		
Intentional lethal take	A	0	A	0	A	0		
Unintentional lethal take	A, J	0	A, J	0	A, J	0		
Other take (specify)	A, J	0	A, J	0	A, J	0		

[a] A = Adult, J = Juvenile.
[b] Take of chum is more appropriately associated with coho production/adult collection at Big Creek but is included here also.
[c] Listed hatchery-origin fish. No information of how many natural fish are taken for broodstock because not all hatchery fish were marked prior to 2007.

- 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.

Big Creek Hatchery fall Chinook have been mass marked since 2007 with an adipose fin clip and a sub-component fitted with CWTs so returning fall Chinook adults can be individually identified as hatchery or naturally produced fish. Marked fish have just started returning to Big Creek Hatchery trap from brood year 2009, and therefore, sufficient data are not yet available.

Chum salmon enter Big Creek after fall Chinook broodstock collection is over. The numbers of chum salmon encountered in the hatchery trap are relatively low and by transporting upstream of the weir, they are placed in a suitable habitat while significantly decreasing the likelihood of recapturing those fish in the trap. The ODFW's chum salmon recovery program in the Oregon side of the lower Columbia tributaries has started releasing Gray's River Hatchery origin fingerlings into Big Creek since the 2011 release year. A contingency plan shall be developed for situations where take of listed chum may occur due to tule fall Chinook program. The handling of naturally produced coho during fall Chinook broodstock collection may be addressed by modifying collection and handling procedures if take levels are greater than projected. The modifications necessary to address incidental take are identified in Issue 3 (passage upstream of Big Creek hatchery) and detailed in Alternatives 2 and 3 (See Section 1.16).

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 Big Creek tule fall Chinook program operates in accordance with the Fish Hatchery Management Policy (ODFW 2003), the Northwest Power and Planning Council Annual Production Review Report (NPPC document 99-15), the Lower Columbia Salmon and Steelhead Recovery and Subbasin Plan (LCFRB 2004), and the Lower Columbia River and Estuary Bi-State Subbasin Plan (LCREP 2004).

The Oregon Fish and Wildlife Commission (OFWC) adopted the Native Fish Conservation Policy (NFCP) in 2002. Conservation plans will provide guidance for hatchery programs for species within the associated Species Management Unit (SMU).

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

Mitchell Act
US v. Oregon
Oregon Division of State Lands submerged land lease(s)
The Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead

Oregon Plan for Salmon and Watersheds (Executive Order 99-01). The Oregon Plan for Salmon and Watersheds is a prescriptive set of measures for recovering threatened

and endangered salmon and steelhead, and meeting federal water quality standards established by Executive Order of the Governor of Oregon. The Oregon Plan includes measures linked to the hatchery production of fall Chinook in Big Creek including nutrient enrichment, acclimation, and other separations of hatchery and wild production, terminal fisheries that reduce harvest impacts on listed salmon, and monitoring of hatchery and wild runs.

The HGMP is consistent with these plans and commitments.

3.3) Relationship to harvest objectives.

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.

This program is managed to provide fall Chinook salmon production to supplement harvest in ocean and Columbia River commercial and sport fisheries. Big Creek tule fall Chinook are an important contributor to the West Coast ocean fisheries and lower Columbia River sport and commercial fisheries. Recovery of coded wire tagged fish indicate that the contribution of Big Creek tule fall Chinook to fisheries is highest in British Columbia and Washington ocean commercial fisheries and, since 2008, Oregon commercial fisheries (Table 3.3.1a).

Total fishery harvest estimates (combined ocean and freshwater) are not available for Big Creek Hatchery fall Chinook. However, analysis of CWT recoveries for the 1976-2007 brood years indicates that about 57% of adult Big Creek Hatchery fall Chinook are harvested in ocean and freshwater fisheries. The Big Creek Hatchery fall Chinook harvest in the Columbia River is estimated as part of an aggregate LRH stock harvest estimate based on CWT recoveries, and total catch estimates. In order to estimate the Big Creek fall Chinook contribution to lower Columbia River fisheries, the Big Creek percentage of total LRH escapement was applied to the aggregate LRH catch estimate. Big Creek fall Chinook returns comprised 5%-29% of all LRH returns during 1990-2011. The total LRH fall Chinook catch in the mainstem Columbia River fisheries has ranged from 0 - 20,100 fish, and the minimum Big Creek fall Chinook portion of that catch is estimated to range from 0 - 4,800 fish (Table 3.3.1b).

Table 3.3.1a. Percentages of Big Creek Tule Fall Chinook recovered by Fishery and Run Year, 1978-2011.

	Fishery Contributions (% of annual harvest) by run year[a]											
	Ocean Harvest									Freshwater Harvest		
	Commercial					Sport				Commercial		Sport
Run Year	AK	BC	WA	OR	CA	BC	WA	OR	CA	WA	OR	OR
1978	0.0	75.8	0.0	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1979	0.0	42.0	24.0	0.0	0.0	0.0	31.5	0.0	0.0	0.0	2.5	0.0
1980	0.0	55.0	20.0	0.0	0.0	2.6	13.0	0.0	0.0	1.3	8.2	0.0
1981	0.0	51.0	20.3	3.6	0.0	9.3	7.1	0.3	0.0	8.3	0.2	0.0

1982	0.0	47.9	13.9	0.4	1.1	1.8	5.8	0.0	0.0	0.0	29.0	0.0
1983	0.0	56.2	9.3	0.0	6.1	9.8	0.0	0.0	0.0	0.0	18.6	0.0
1984	0.0	72.0	2.8	1.5	1.2	2.0	4.5	1.9	0.0	0.0	11.0	3.0
1985	0.0	43.8	12.6	0.0	0.0	0.0	5.1	0.0	0.0	0.0	38.5	0.0
1986	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
1988	0.0	4.6	71.3	0.0	0.0	0.0	12.6	0.0	0.0	0.0	11.6	0.0
1989	0.0	34.4	33.9	17.3	2.7	0.0	6.5	1.9	0.0	0.0	3.2	0.0
1990	0.0	35.2	25.3	5.9	0.0	0.0	33.7	0.0	0.0	0.0	0.0	0.0
1991	0.0	32.8	30.5	5.5	0.0	4.1	14.4	1.2	0.0	0.0	9.6	2.0
1992	0.0	26.7	35.1	6.4	0.0	7.6	13.0	0.0	0.0	0.0	7.0	4.2
1993	2.7	45.1	9.6	0.0	0.0	20.3	20.7	0.0	0.0	0.0	1.6	0.0
1994	3.9	64.6	1.8	24.1	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0
1995	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	2.8	0.0	23.1	6.7	0.0	11.8	2.2	0.0	0.0	0.0	46.2	7.3
1997	5.6	57.4	3.9	0.0	3.8	1.4	11.4	0.0	0.0	0.0	16.5	0.0
1998	0.0	22.7	0.0	0.0	0.0	15.8	28.5	0.0	0.0	0.0	3.5	29.5
1999	0.0	28.0	9.8	7.1	0.0	23.0	2.3	3.3	3.5	0.0	8.2	14.8
2000	0.0	16.7	7.4	0.0	0.0	51.4	10.8	0.0	0.0	0.0	9.3	4.5
2001	0.0	18.7	18.2	31.0	0.0	6.6	9.2	6.2	0.0	0.0	3.3	6.8
2002	0.6	21.8	23.6	14.7	0.0	5.7	13.9	3.1	0.0	0.0	14.1	2.4
2003	0.0	32.2	20.2	7.4	0.0	10.8	16.4	0.9	0.0	0.0	11.5	0.7
2004	0.8	33.9	6.4	7.7	0.0	15.7	6.1	1.1	0.0	0.0	26.8	1.5
2005	0.0	44.3	9.1	3.4	0.0	12.2	4.0	0.0	0.0	0.0	26.7	0.3
2006	0.0	48.1	3.4	0.0	0.0	28.6	0.0	0.0	0.0	0.0	17.7	2.2
2007	1.4	36.0	22.8	0.0	0.0	0.0	11.3	0.0	0.0	0.0	19.5	8.9
2008	0.0	21.4	5.7	1.5	0.0	15.7	12.0	1.3	0.0	0.0	38.2	4.1
2009	0.0	5.6	6.0	0.0	0.0	19.3	19.3	0.0	0.0	0.0	47.6	2.2
2010	0.2	10.7	14.8	9.2	0.0	11.7	10.2	0.2	0.0	0.0	40.2	2.7
2011	0.0	16.0	11.6	4.3	0.0	13.4	14.9	1.4	0.0	0.0	33.5	5.0
Average	2.3	38.7	17.1	9.6	3.0	12.8	12.6	1.9	3.5	4.8	20.8	5.7
Geometric Mean	1.5	32.0	12.6	6.2	2.4	9.1	10.2	1.3	3.5	3.2	12.1	3.4

[a] Freshwater Escapement (e.g. hatchery return, fish in spawning grounds and traps) is not included in this table.

Table 3.3.1b. Estimated contribution of Big Creek tule fall Chinook to Columbia River fisheries, 1990-2011 (numbers in thousands of adult fish).

Year	Lower Col. R. LRH Harvest			Proportion Big Creek [cd]	Index of Total Big Creek Harvest
	Comm. [ac]	Sport [bc]	Total		
1990	4.4	2.7	7.1	0.13	0.9
1991	6.9	6.1	13.0	0.15	2.0
1992	2.7	5.7	8.4	0.11	0.9
1993	4.0	3.5	7.5	0.12	0.9
1994	0.0	0.0	0.0	0.19	0.0
1995	0.0	1.5	1.5	0.18	0.3
1996	3.9	3.3	7.2	0.14	1.0
1997	2.2	5.3	7.5	0.15	1.0
1998	0.9	4.4	5.3	0.11	0.6
1999	2.2	3.7	5.9	0.23	1.4
2000	0.8	2.8	3.6	0.05	0.24
2001	4.4	4.8	9.2	0.29	2.7
2002	9.9	10.2	20.1	0.24	4.8
2003	5.9	6.0	11.9	0.19	2.3
2004	5.5	5.3	10.8	0.17	1.8
2005	5.0	5.0	10.0	0.16	1.6
2006	5.0	4.9	9.9	0.05	0.5
2007	1.3	3.6	4.9	0.10	0.5
2008	3.1	3.0	6.1	0.27	1.6
2009	7.3	3.7	11.0	0.12	1.3
2010	3.8	5.1	8.9	0.18	1.6
2011	8.1	7.7	15.6	0.13	2.0

[a] Includes mainstem and Select Area non-Indian commercial harvest.

[b] Buoy 10 and mainstem only.

[C] From WDFW Fall Chinook Big Sheets

d The Big Creek proportion represents the Big Creek tule fall Chinook component of the total Lower River Hatchery (LRH) run. This proportion was calculated as the adult fall Chinook returns to Big Creek (hatchery returns plus natural escapement) divided by the total LRH hatchery returns and natural escapement for each given year.

3.4) Relationship to habitat protection and recovery strategies.

Natural production in Big Creek is likely limited by factors such as; water quantity, water quality, sedimentation, stream substrate, cover, and barriers to fish passage, etc. No single entity is responsible for habitat protection and recovery strategies in the Columbia River estuary region. The Oregon Department of Fish and Wildlife, Oregon Department of Forestry, Lower Columbia River Estuary Partnership, Hampton Affiliates, the Nicolai-Wickiup Watershed Council, and numerous regional, state, and local organizations have interest in habitat protection in the region. Habitat conditions in Big Creek are considered to be fair to good.

Habitat protection and recovery strategies were recently developed in the draft Lower Columbia River and Estuary Bi-State Subbasin Plan (LCREP 2004). The Big Creek tule fall Chinook program is consistent with these habitat protection and recovery strategies.

3.5) Ecological interactions.

(1) Species that could negatively impact the program include:

- Avian predators, such as great blue herons, Caspian terns, cormorants, and gulls,
- Mammalian predators such as river otters, harbor seals, or sea lions,
- Introduced fish species such as American Shad, Walleye, Smallmouth Bass, and Channel Catfish,
- Northern Pikeminnow,
- Out-of-basin hatchery salmonid releases,
- Known or unknown aquatic non-indigenous animals and plants.

The majority of the preceding species list can be characterized as predators of juvenile salmonids, which may negatively impact Big Creek tule fall Chinook juvenile survival after release. In recent years, Caspian terns (*Sterna caspia*) and Double-crested cormorants (*Phalacrocorax auritus*) have colonized the Columbia River estuary. Both colonies represent the largest of their kind in North America. Recent estimates of annual predation on salmonid smolts by these avian species are approximately 15-20 (Oregon Cooperative Fish and Wildlife Research Unit and Bird Research Northwest), and may have been as high as 25 million (Roby et al. 1998). Caspian tern predation is highest on large smolts, such as steelhead or coho that spend 1-2 years rearing in freshwater. Predation is lower on ocean-type salmonids such as fall chinook and chum salmon that emigrate as sub-yearlings. Northern Pikeminnow (*Ptychocheilus oregonensis*) have been estimated to annually consume millions of juvenile salmonids in the lower Columbia River (Ward et al. 1995). Most northern pikeminnow predation is thought to occur downstream of dams. Pikeminnow abundance in the Columbia River estuary is likely low; therefore, pikeminnow effects are expected to be minimal. Walleye (*Sander vitreus*), Smallmouth Bass (*Micropterus dolomeiui*), and Channel Catfish (*Ictalurus punctatus*) have been estimated to consume substantial numbers of emigrating juvenile salmonids (Zimmerman 1999). Effects of these species is thought to be highest around dams and throughout impounded reaches of the Columbia River (Zimmerman and Parker 1995. Like Pikeminnow, their abundance in the Columbia River estuary is thought to be low. Thus, their predation effects in the lower Columbia River and the estuary should be minimal.

River otters (*Lutra canadensis*) are present in the lower Columbia region and may represent a substantial predation source on juvenile salmonids. Harbor seals (*Phoca vitulina*), Steller sea lions (*Eumetopias jubatus*), and California sea lions (*Zalophus californianus*) are commonly observed in the Columbia River estuary. Seals and sea lions reportedly prey on adult salmonids, although diet studies indicate that other fish species generally comprise the majority of their food (NMFS 1999). These mammals are often attracted to concentrated fishing effort and can be troublesome to both sport and commercial fishers by taking hooked or net-caught fish before they can be landed.

American Shad (*Alosa sapidissima*) and large out-of-basin hatchery salmonid releases represent potential competitors of juvenile Big Creek tule fall Chinook and may decrease juvenile survival through density dependent competition effects. In the Columbia River estuary, juvenile American shad were described as year-round residents in all areas of the estuary (Bottom et al. 1984). Multiple studies have found overlap in both habitat use and diet items in juvenile American shad and both sub-yearling and yearling salmonids (McCabe et al. 1983, Bottom et al. 1984), suggesting competition for food and space. Additionally, other hatchery fish may be a source of competition for Big Creek tule fall Chinook. The potential exists for large-scale hatchery releases of fry and fingerling ocean-type Chinook salmon to overwhelm the production capacity of estuaries (Lichatowich and McIntyre 1987). Estuaries may be "overgrazed" when large numbers of ocean-type juveniles enter the estuary en masse (Reimers 1973, Healey 1991). Food availability may be negatively affected by the temporal and spatial overlap of juvenile salmonids from different locations. Competition for prey may develop when large releases of hatchery salmonids enter the estuary (Bisbal and McConnaha 1998), although this issue remains unresolved (Williams et al. 1998).

Aquatic non-indigenous species introductions in the lower Columbia River represent permanent alterations of the biological integrity of the ecosystem for numerous reasons. Impacts of introduced species are unpredictable, introduced species alter food web dynamics, and introduced species are a conduit for diseases and parasites (Waldeck et al. 2003). Significant changes in estuary faunal and floral communities have occurred through species introductions, but, for the most part, the effects of these species introductions have not been assessed. Several nonnative invertebrate species have expanded their populations dramatically since introduction, particularly the Asian bivalve, *Corbicula fluminea.* Additionally, ecosystem effects of non-indigenous aquatic plants are a concern for many resource managers. Of particular interest in the Columbia River estuary and lower mainstem are four plants considered noxious weeds: purple loosestrife (*Lythrum salicaria*), Eurasian water milfoil (*Myriophyllum spicatum*), parrot feather (*Myriophyllum aquaticum*), and Brazilian elodea (*Egeria densa*). Effects of these non-indigenous species on Big Creek tule fall Chinook are unknown.

(2) Species that could be negatively impacted by the program include:

- Lower Columbia River Chinook Salmon,
- Columbia River Chum Salmon,
- Lower Columbia River Coho Salmon,
- Lower Columbia River steelhead,
- Out-of-basin wild salmonids using the Columbia River estuary.

Wild juvenile salmonids using the Columbia River estuary may be affected by releases of Big Creek tule fall Chinook through competitive interactions. Although Big Creek tule fall Chinook are released as full-term sub-yearling smolts and are believed to emigrate from Big Creek and the Columbia River estuary fairly rapidly, the potential exists for some released fish to rear in the estuary for a period of time. Therefore, some of these fish could compete with naturally produced juvenile ocean-type Chinook in the estuary.

The relatively large size of the hatchery Chinook may give them a competitive advantage over their naturally produced counterparts. The influence of these hatchery juveniles on predator behavior in the lower Columbia is unknown. Some researchers purport that releases of hatchery juveniles in large numbers may attract predators, thereby increasing predation on wild juvenile salmonids (Bayer 1986, Collis et al. 1995). Other researchers maintain that releases of hatchery fish may overwhelm predators, thereby providing a competitive advantage to wild juvenile salmonids that have better predator avoidance capability than hatchery fish (Petersen and De Angelis 1992).

As adults, Big Creek tule fall Chinook return at a time of year when adult chum are not present but overlap to some extent the run timing of other lower Columbia River fall Chinook and coho salmon. Although the abundance of naturally produced fall Chinook, chum, and coho in Big Creek is thought to be low, the potential impacts of large numbers of naturally spawning hatchery fish on relatively small populations is not well known at this time. There is also a potential for genetic interactions with naturally produced fall Chinook because of the high number of hatchery fall Chinook that spawn below the hatchery. However, as previously mentioned, the naturally produced fall Chinook in Big Creek are believed to be descendents of the hatchery stock, and so would be genetically similar.

(3) Species that could positively impact the program include: Species that could positively impact the program include any hatchery or wild fish that die or are deposited within the subbasin for the purposes of stream enrichment. Decaying carcasses of salmonid species may contribute nutrients that increase productivity in the subbasin.

(4) Species that may be positively impacted through the program include: Species that may be positively impacted through the program include any freshwater or marine species that depend on salmonids as a nutrient or food base. Pacific salmon carcasses are important for nutrient input back to freshwater streams (Cederholm et al. 1999). Many species are known to utilize juvenile and adult salmon as a nutrient food base (Groot and Margolis 1991; McNeil and Himsworth 1980). Declines in wild salmonid populations during the last few decades could reduce overall ecosystem productivity. Hatchery production, passage of unmarked fish above hatcheries, and carcass placement in the upper watershed areas of other regional area streams without hatcheries has the potential for maintaining the population dynamics of predator-prey relationships and community ecology during low productivity and shifting climatic cycles when natural returns are reduced. This program likely provides a moderate net gain in nutrient load to Select Area streams due to fishery escapement.

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.

Big Creek Hatchery:
The water at Big Creek Hatchery comes from Big Creek, Mill Creek, and an upper and lower natural spring. Water rights are held on each, with an average annual use of 257 cfs for all sources combined. The water qualities meet or exceed the recommended Integrated Hatchery Operations Team (IHOT) criteria for temperature, ammonia, carbon dioxide, chlorine, pH, copper, dissolved oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zinc. The water supply is protected by flow alarms at the intake(s) and the head box. At Big Creek Hatchery, seasonal flows limit production during July-September.

Klaskanine Hatchery:
Water for Klaskanine Hatchery is supplied by gravity flow from three intakes located on the North Fork Klaskanine River and North Fork of the North Fork Klaskanine River. The current water right is for 22,442 gpm (50 cfs) although the maximum water usage is only 11,000 gpm. Summer/fall water flows are a limiting factor and the hatchery utilizes the entire flow available from the river during this period (~1,000 gpm). The water delivery system limits the amount of water that can be supplied during high flows.

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.

Big Creek and Klaskanine hatcheries are operated under some environmental limitations and conditions established in the National Pollutant Discharge Elimination System (NPDES) general permit 300-J, which is implemented by the Oregon Department of Environmental Quality. The hatcheries are in compliance with the requirements of the permits. Water intake screens at Big Creek are in compliance with NOAA fisheries screening criteria while Klaskanine hatchery screens at intake # 1 and #2 are not in compliance with NOAA Fisheries screening criteria, although intake #3 at Klaskanine Hatchery is in compliance. However, the required criteria will be met once funding becomes available. As mentioned in Section 4.1, flows in Big Creek and Klaskanine River during the summer can get very low and there is about a one month period in late July-early August when in-stream flows between the hatcheries intake and outflow are insufficient for rearing of naturally produced fish. The overall reduction in stream flow during this period also limits hatchery production at both facilities.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

All adult tule fall Chinook for brood are collected using a trap at Big Creek Hatchery, located at RM 3.3 on Big Creek, where fish enter volitionally. The adult holding area consists of a large upper pond and a lower pond divided into 7 sections with a total capacity of about 10,000 fish, depending on the species.

If sufficient brood fish are not available in Big Creek Hatchery trap then adult fish of stock 13 tule fall Chinook returned to Klaskanine Hatchery could be taken as backup broodstock. Klaskanine Hatchery facilities for broodstock collection consist of a trap which is designed with 6 holding pens of about 10' L X 13' W. These pens cover the upper part of the trap. The trap can hold up to 1,500 to 2,000 adults depending on species.

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

Big Creek:
The transfer of fish on-station is done using a distribution box, irrigation pipe and a gas powered pump. All off-station transfers are done with the use of a large liberation truck. Additional information is provided in Table 5.2.

Table 5.2. Fish transportation facilities used at Big Creek Hatchery.

Equipment type	Capacity (gallons)	Supplemental Oxygen (y/n)	Normal transit time	Chemicals used
Tank	250-1000	Y	Varied	None

Klaskanine Hatchery:

Klaskanine Hatchery handles adults in a similar manner as Big Creek Hatchery. Adults collected at Klaskanine Hatchery may be used as a backup source of broodstock for the program and shall be held in the hatchery trap facility, if needed. Juvenile fish are transported in a large fish transportation tank from Big Creek Hatchery to Klaskanine facility for acclimation and release.

5.3) Broodstock holding and spawning facilities.

Big Creek Hatchery:
The adult holding area consists of a large upper pond and a lower pond that is divided into 7 sections with a total capacity of about 10,000 fish, depending on the species. The dimensions of the lower pond are 80' x 29.5' x 3', with a working volume of 6,301 cubic feet. The dimensions of the upper pond are 95' x 36.5' x 5', with a working volume of 15,881 cubic feet. Flow through both ponds is 15-20 cfs. Spawning at Big Creek Hatchery is conducted inside a covered, three-sided metal building.

Klaskanine Hatchery:
Klaskanine Hatchery has a large adult holding pond with a dimension of 158' X 16' X 3'.

The pond can hold up to ~4,000 adult fish depending on species. Spawning at Klaskanine Hatchery is conducted in large, covered wooden shed.

5.4) Incubation facilities.

Incubation of all tule fall Chinook eggs takes place at Big Creek Hatchery, which is done in 7-9 deep troughs to the eyed stage, and in 44 shallow troughs to hatching. Additional information is provided in Table 5.4. At Big Creek Hatchery, incubation water can be heated or chilled to maintain temperatures at desirable levels. Temperature is checked daily with a digital thermometer and held constant at 47° F to the eyed stage. Dissolved oxygen is periodically checked and usually remains between 7-10 ppm. Incubation flow is usually 10-12 gpm.

Table 5.4. Incubation facilities for tule fall Chinook at Big Creek Hatchery.

Incubator Type	Units (number)	Flow (gpm)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Deep Troughs	7-9	10/12	100,000 eggs/section 10 sections/trough	NA (shallows used for hatching)
Shallow Troughs	44	12	NA (deeps used for hatching)	23,000 eggs/section 6 sections/trough

5.5) Rearing facilities.

For Big Creek Hatchery tule fall Chinook, all rearing is conducted in 18 of the 30 available concrete raceways. Additional information is provided in Table 5.5.

Table 5.5. Rearing facilities for tule fall Chinook at Big Creek Hatchery.

Number of ponds	Pond type	Volume (cu. ft)	Length (ft)	Width (ft)	Depth (ft)	Max flow index	Max density index
30	Concrete Raceways	4,800	80	20	3	400-750 gpm	316,667 fish/raceway

5.6) Acclimation/release facilities.

Acclimation facilities at Big Creek Hatchery are the same as those used for rearing, as described in section 5.5. Fish are released directly from the rearing ponds into Big Creek.

Klaskanine Hatchery has 5 raceways of size 150’ x 16’ x 2.5’ and 16 raceways of size 80’ x 20’ x 3’, and some of those may be used for tule fall Chinook juvenile acclimation. Acclimated fish are directly released into N.F. Klaskanine River.

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

No incidences of this nature have occurred in the past 15 years.

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 stock reared at Big Creek and Klaskanine hatcheries is part of the listed Lower Columbia River Chinook ESU. No listed natural fish are reared at these facilities. Both facilities are located in suitable sites to minimize the risk of catastrophic fish loss from flooding. To prevent the transmission of diseases, adult fish, eggs and fry are treated as per prescriptions written by ODFW pathologists. Dead fry are frozen and disposed of in a manner that prevents transmission of disease to the receiving watershed. To prevent the loss of fish due to equipment or water system malfunctions, alarms are installed in all functions critical to the operations. The alarm systems notify the staff of any emergency situations at the facilities. Also, the Big Creek facility is staffed full-time to assure the security of fish stocks within the hatchery facilities. Klaskanine Hatchery uses an on-call/pager system linked to the alarm for notification of water–supply issues on nights/weekends.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

6.1) Source.

All broodstock for the Big Creek Hatchery tule fall Chinook program are collected from adult returns trapped at Big Creek Hatchery. Adult tules of the same Big Creek stock returned to Klaskanine Hatchery may be used as backup, if sufficient broodstock do not return to Big Creek Hatchery and enough return to Klaskanine. In the past, however, adults, eggs and fry from other lower Columbia River tule fall Chinook hatchery broodstocks have been included in the production when adult returns at Big Creek Hatchery were insufficient (Table 6.2.1). Adult broodstock have also been collected at Plympton Creek, a tributary of Westport Slough. Westport Slough enters the Columbia River at about RM 43.

6.2) Supporting information.

6.2.1) History.

The original broodstock for Big Creek Hatchery tule fall Chinook production is thought to have come from other lower Columbia River hatcheries (e.g. Toutle River Hatchery in Washington). After a hatchery tule fall Chinook run was established in Big Creek, broodstock collection was primarily focused on adults returning to Big Creek Hatchery. In most years, sufficient numbers of adults return to the hatchery meeting the egg take goals. However, in years when returns did not produce enough fish to meet program goals, adults have been collected at other sites and/or eggs and fish from other tule stocks have been included in the production. These external sources of adults, eggs and fry of

the past productions are documented in Table 6.2.1. Since the brood year 1998 only Big Creek Hatchery origin adults (stock 13) had been used as broodstock.

Table 6.2.1. Fall Chinook adults, eggs, and fish not collected at Big Creek Hatchery but used in the Big Creek Hatchery tule fall Chinook program.

Brood Year	Stock Source	Stock Number	Number	Life Stage
1990	Carson NFH	072	977,911	Fry
	Grays R Hatchery	116	1,441,908	Fry
	Elochoman Hatchery	117	342,076	Fry
	Klaskanine Hatchery	015	10	Adults
	Plympton Creek	013	563	Adults
1991	Bonneville Hatchery	014	1,531,663	Fry
	Klaskanine Hatchery	015	121,599	Fry
	Plympton Creek	013	155	Adults
1992	Kalama Hatchery	114	886,471	Smolts
1994	Plympton Creek	013	930	Adults
1998	Bonneville Hatchery	014	1,603,909	Fry
2000	Elochoman Hatchery	117	463,950	Eggs
	Grays River Hatchery	116	16,683	Eggs
	Bonneville Hatchery	014	91,076	Eggs
2006	Bonneville Hatchery	014	139,072	Eggs
2013	Bonneville Hatchery	014	912,317	Eggs
	Klaskanine Hatchery	013	605,000	Eggs

6.2.2) Annual size.

The estimated annual broodstock for spawning would be 2,600 (1,300 females and 1,300 males) although a total of 3,000 adults shall be collected due to higher mortality of tule adults. The program has no intention to use adults from the natural population. The annual size of the past Big Creek tule fall Chinook broodstock collection and production data are shown in Table 7.4.2.

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

In the past, naturally produced fish might have been used as broodstock unintentionally due to lack of identifiable marks in hatchery-produced fish, and thus the number of wild fish that were taken in the past is unknown. Mass marking of the tule fall Chinook program at Big Creek Hatchery began in 2007. Currently, the program has no intention to use naturally-produced fish as broodstock.

6.2.4) Genetic or ecological differences.

Genetic differences between this hatchery stock and naturally produced tule fall Chinook in Big Creek are assumed to be minimal due to establishment of hatchery-origin stock from the naturally produced fish. Ecological differences are assumed to exist due to the differences between hatchery and natural rearing environments.

6.2.5) Reasons for choosing.

This broodstock was selected because it had characteristics, primarily an ocean distribution that was desirable for target fisheries. Historically, this broodstock was based on hatchery stocks from other lower Columbia River tributaries.

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.

It is presumed that the naturally-produced tule fall Chinook in Big Creek are genetically similar to hatchery stock because of their hatchery origins and long-term interbreeding practices with Big Creek Hatchery fall Chinook. Yet, the risks of genetic diversity loss or ecological effects to listed natural fish is addressed by; 1) collecting broodstock only from returning tule fall Chinook to Big Creek Hatchery, 2) collecting broodstock in a manner that reflects the overall run of fall Chinook at Big Creek Hatchery, 3) use of the same stock of tule as broodstock that will return to Klaskanine Hatchery as backup, 4) not to recycle hatchery-origin adults for additional harvest opportunity, and 4) not to pass hatchery-origin adults upstream of the hatchery barrier for natural spawning. Eggs from sources other than Big Creek Hatchery have not been used for Big Creek fall Chinook production since 1998. If the backup source at Klaskanine Hatchery also fails to provide broodstock then naturally-produced tule in Big Creek may be incorporated into broodstock or eggs might have to be obtained from Bonneville Hatchery or other hatcheries in Washington, in which case, approval of ODFW's Fish Division will be sought. The practices of mass marking, on-station rearing and release, and targeted harvests management shall help to minimize straying of hatchery fish to areas other than Big Creek.

SECTION 7. BROODSTOCK COLLECTION

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

Returning adults and jacks are collected for broodstock.

7.2) Collection or sampling design.

All adults that enter the trap volitionally at Big Creek Hatchery are collected. Unmarked non-CWT adults (possibly mismarked hatchery fish or strays from other streams) that will volitionally enter the hatchery trap shall be opercle punched and returned to Big Creek, to give them opportunity for migration to their natal stream(s). If they reenter the hatchery trap, they will be considered mismarked hatchery fish and shall be incorporated into brood stock. Adult fall Chinook are selected randomly from the available fish for the broodstock. Broodstock are collected during the course of the run to obtain a representative cross-section of returning adults. Jacks are incorporated into the broodstock as available (no more than 5%). The data of actual collection and spawning

beginning and ending dates for the program fish are presented in Table 7.2.

Table 7.2. Adult collection and spawning dates of Big Creek Hatchery tule fall Chinook program, 1990-2015.

Run Year	Collection		Spawning	
	Beginning	Ending	Beginning	Ending
1990	29-Aug	15-Oct	17-Sep	29-Oct
1991	3-Sep	12-Nov	17-Sep	17-Oct
1992	4-Sep	16-Nov	17-Sep	30-Oct
1993	3-Sep	8-Nov	17-Sep	17-Nov
1994	30-Aug	1-Nov	16-Sep	19-Oct
1995	18-Aug	18-Oct	18-Sep	27-Oct
1996	3-Sep	14-Nov	17-Sep	18-Oct
1997	29-Aug	28-Oct	18-Sep	14-Oct
1998	28-Aug	23-Nov	17-Sep	13-Oct
1999	30-Aug	24-Nov	17-Sep	11-Oct
2000	14-Aug	29-Nov	18-Sep	16-Oct
2001	28-Aug	06-Nov	17-Sep	03-Oct
2002	30-Aug	28-Oct	17-Sep	03-Oct
2003	05-Sep	16-Oct	17-Sep	07-Oct
2004	03-Sep	04-Nov	17-Sep	04-Oct
2005	09-Sep	20-Oct	16-Sep	07-Oct
2006	07-Sep	18-Oct	18-Sep	16-Oct
2007	06-Sep	22-Oct	21-Sep	08-Oct
2008	03-Sep	07-Oct	19-Sep	24-Sep
2009	03-Sep	28-Sep	15-Sep	28-Sep
2010	02-Sep	04-Oct	14-Sep	28-Sep
2011	02-Sep	04-Oct	15-Sep	27-Oct
2012	04-Sep	23-Oct	13-Sep	23-Oct
2013	04-Sep	14-Oct	12-Sep	14-Oct
2014	08-Sep	17-Oct	15-Sep	17-Oct
2015	03-Sep	14-Oct	08-Sep	14-Oct

The future brood collection and spawn timing would be similar to the past (Table 7.2) although there may be little variation due to environmental factors that may affect adult maturation and return timing.

7.3) Identity.

The Big Creek Hatchery tule fall Chinook program began mass marking in 2007, and therefore, all fish are identifiable as to whether the returned adults are of hatchery- or natural-origin. The identifying marks are:

Big Creek Hatchery: Total smolt release number is 3,100,000. All 3,100,000 smolts shall have adipose fin clip, and 200,000 Ad-CWT.

Klaskanine Hatchery: Total release from Klaskanine is 2,100,000 smolts. All 2,100,000 smolts shall have ad-clip, and 50,000 shall have Ad-CWT marking.

7.4) Proposed number to be collected.

7.4.1) Program goal.

The current annual broodstock collection goal is 3,000 adults with a green egg take goal of 6,500,000 ± 10%. To meet this egg take goal it would require spawning approximately 1,300 female and 1,300 male Chinook (preferred female to male 1:1, and it could be up to 3:1 if situation warrants). Differences between the actual numbers of fish spawned and the broodstock collection goal are largely due to mortality losses.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for the most recent years available.

Table 7.4.2. Tule fall Chinook annual broodstock collection levels at Big Creek Hatchery, 1992-2015.

Year	Adults			Eggs (x1,000)	Juveniles[b] (x1,000)
	Females	Males	Jacks[a]		
1992	1,965	NA	NA	11,279	7,106
1993	1,532	592	NA	7,673	7,061
1994	3,509	1,106	NA	17,287	12,077
1995	2,272	764	NA	11,730	9,563
1996	1,820	667	NA	8,669	6,018
1997	1,331	372	NA	6,329	5,695
1998	1,006	326	NA	4,848	4,265
1999	1,458	406	NA	7,117	5,895
2000	826	220	NA	4,899	4,015
2001	1,367	407	NA	6,891	5,842
2002	1,466	469	NA	7,364	5,847
2003	1,965	660	NA	11,279	7,106
2004	4,265	4,233	80	7,367	5,945
2005	3,096	2,145	21	6,550	5,897
2006	1,070	922	133	4,925	4,583
2007	1,062	1,417	913	4,589	4,172
2008	2,944	5,682	166	6,661	5,820
2009	2,790	2,144	458	6,816	5,888
2010	3,769	3,886	486	6,401	5,407
2011	4,188	3,211	632	6,330	5,750
2012	2,836	2,580	205	6,568	5,191
2013	1,092	928	790	4,332	3,972
2014	2,673	3,207	747	5,966	5,448
2015	2,807	2,400	349	5,221	4,848

[a] Included in count of adult males. [b] Fry ponded.

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

At both facilities, tule Chinook in excess of what is needed for broodstock are sold through competitive bid process, if quality is good for human consumption. Some quality fish will also be donated food bank to feed the needy people with quality protein. Those fish not suitable for these programs will be used for stream enrichment or may be hauled to local landfill or buried. All hatchery Chinook carcasses used for enrichment of spawning streams are marked to prevent confusion with naturally spawned fish, during spawning ground survey. Specific criteria and guidelines for operation of the stream enrichment program are identified in an MOU between ODFW and DEQ. All carcasses surplus to needs described above are transported to the Clatsop County landfill for disposal.

7.6) Fish transportation and holding methods.

Fish holding facilities used at Big Creek and Klaskanine hatcheries are described in section 5.2. The IHOT guidelines for transportation are followed in this program. Transportation of adults is not necessary as brood collection, egg incubation and fry rearing take place at Big Creek Hatchery. Juveniles for acclimation at Klaskanine Hatchery are transported from Big Creek to Klaskanine Hatchery in large fish liberation truck with aeration or oxygenation facility. If adults collected at Klaskanine Hatchery are used as a backup source of broodstock for the program, then these fish may either be spawned at Klaskanine Hatchery or transported to Big Creek Hatchery in a large fish liberation truck. If spawned at Klaskanine Hatchery then only fertilized eggs shall be transported to Big Creek Hatchery.

7.7) Describe fish health maintenance and sanitation procedures applied.

ODFW's Fish Health Management Policy, Integrated Hatchery Operations Team, Pacific Northwest Fish Health Protection Committee (PNFHPC), state or tribal guidelines are followed for broodstock fish health inspection, transfer of eggs or adults and broodstock holding and disposal of carcasses.

7.8) Disposition of carcasses.

At both facilities, tule Chinook in excess of broodstock needs are sold through competitive bid process and some will be given Oregon Food Bank if suitable for human consumption. Those fish not suitable for these programs will be used for stream enrichment or may be hauled to landfill. All hatchery Chinook carcasses used for enrichment of spawning streams are marked to prevent confusion with naturally spawned fish. Specific criteria and guidelines for operation of the stream enrichment program are identified in an MOU between ODFW and DEQ. All carcasses surplus to needs described above are transported to the Clatsop County landfill for disposal.

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.

Any fall Chinook of SAB stock returns are identified by a left ventral (LV) fin-clip and are not included in the broodstock for the SAFE/SAB fall Chinook program. The juveniles of tule fall Chinook program are mass marked and a proportion with CWT, and thus, the returned adults are easily identifiable. Only hatchery-origin tules of Big Creek stock shall be used as brood. Some unmarked or naturally-produced adults or stray fish from other streams may volitionally enter the hatchery trap. These fish shall be opercle punched and returned to Big Creek to give them opportunity to migrate to their natal streams. If they reenter the hatchery trap, they would be considered mismarked hatchery-origin fish and shall be incorporated into broodstock. However, the late returning unmarked tules may be passed upstream above the hatchery weir, if there are sufficient water levels in Big Creek for tule survival and successful spawning.

SECTION 8. MATING

8.1) Selection method.

Since 1999 only adults of tule stock returning to Big Creek are intentionally used for spawning. Males and females that are ripe on a given day are randomly selected for mating, without any bias for particular traits or characteristics.

8.2) Males.

The preferred spawning ratio for this program is 1 male for every 1 female. This ratio could be up to 1:3, if situation warrants. Jacks are often included at a low percentage.

8.3) Fertilization.

The plan is to pool eggs from three females and use the milt from three males for fertilization. To prevent transmission of diseases, fertilized eggs are disinfected with 1:100 parts of Argentine for 10 minutes prior to incubation.

8.4) Cryopreserved gametes.

Cryopreserved gametes are not used in this program.

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.

This is an isolated harvest program of hatchery stock, and therefore, it is unlikely that the

mating scheme will have any direct adverse genetic or ecological impacts on listed natural fish. Since the hatchery stock (stock-13) is also an ESA-listed population, returning broodstock are collected throughout the entire run period, mixed and randomly selected for spawning to maintain within-hatchery population genetic diversity. Pairs of males and females are mated randomly to avoid any bias due to size or other external characteristics. This random mating, coupled with broodstock collection over the duration of the run, is presumed to help maintain the genetic diversity and quality within the hatchery-produced population.

SECTION 9. INCUBATION AND REARING

9.1) Incubation.

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

Data of annual egg takes, egg to fry, and fry to smolt survivals since 1990 to 2015 are provided in Table 9.1.1.

Table 9.1.1. Annual egg take and survival rates to fry and smolt stages of tule fall Chinook at Big Creek Hatchery, 1990-2015.

Brood Year	Egg Take (x1,000)	Egg to fry survival (%)	Fry to smolt survival (%)
1990	13,049	76.0	98.5
1991	12,282	89.0	98.6
1992	11,279	90.0	98.2
1993	7,673	93.6	98.9
1994	17,287	90.3	98.7
1995	11,730	93.1	97.3
1996	8,669	92.9	99.0
1997	6,329	94.8	99.2
1998	4,848	92.6	98.6
1999	7,117	95.2	98.9
2000	4,899	94.4	98.5
2001	6,891	90.1	98.4
2002	7,364	91.3	98.3
2003	11,279	91.3	98.1
2004	7,367	80.9	98.5
2005	6,550	90.4	98.6
2006	4,925	93.1	99.2
2007	4,589	90.9	97.5
2008	6,661	88.1	98.4
2009	6,816	87.7	97.4
2010	6,401	86.0	98.2

Brood Year	Egg Take (x1,000)	Egg to fry survival (%)	Fry to smolt survival (%)
2011	6,330	92.3	96.9
2012	6,568	81.1	95.2
2013	4,332	92.1	91.7
2014	5,966	93.0	94.9
2015	5,221	93.8	--

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

If eggs are found to be in excess of production goals, the surplus eggs are destroyed, frozen and disposed of in a manner compliant with the Fish Health Management Policy and IHOT guidelines.

9.1.3) Loading densities applied during incubation.

Loading densities during egg incubation are reported in Table 5.4. The IHOT species-specific incubation recommendations are followed for water quality, flows and temperature. Eggs are incubated under conditions that allow for equal growth and development for all segments of the population to reach a common ponding date.

9.1.4) Incubation conditions.

Incubation conditions are described in section 5.4. Eggs are incubated in natal or home stream water. The IHOT species-specific incubation recommendations are followed for water quality, flows and temperature. Eggs are monitored as needed to determine fertilization efficiency and embryonic development. Eggs are incubated under conditions that allow for equal development of all segments of the population to ponding. Families are not incubated individually, but rather may be mixed with other families from the same spawn group. Families among spawning groups are mixed randomly at ponding so that any unintentional rearing differences affect all families equally.

Disinfection procedures are implemented during incubation to prevent pathogen transmission between stocks of fish on site and to the receiving stream. Following the eye-up stage, eggs are inventoried, and dead or undeveloped eggs removed and disposed of as per ODFW's Fish Health Management Policy.

9.1.5) Ponding.

Rearing facilities are described in section 5.5. Prior to ponding, family groups are mixed so that rearing protocols affect all families equally. The procedures used for determining when fry are ponded include visual inspection of the amount of yolk remaining, and reaching a specified number of accumulated temperature units. At Big Creek Hatchery ponding of tule fall Chinook is forced.

9.1.6) Fish health maintenance and monitoring.

Disinfection procedures are implemented during incubation to prevent pathogen transmission between stocks of fish. Fertilized eggs are disinfected in iodine solution to prevent disease or viral contamination. Developing eggs receive regular treatments with formalin or hydrogen peroxide to prevent/control fungus (*Saprolegnia parasitica*) outbreaks. Eggs are monitored to determine fertilization efficiency and embryonic development. Following the eyed-up stage, eggs are inventoried and dead or undeveloped eggs are removed and disposed of as described in the disease control guidelines. Dead or culled eggs are discarded in a manner that prevents transmission of pathogens to the receiving watershed. Juveniles are treated, if necessary, with medicated feed or chemicals as directed by ODFW fish health staff. Fish health is monitored on a regular basis, at least once in each month. The ODFW's Fish Health Management Policy, IHOT, Pacific Northwest Fish Health Protection Committee, state or tribal guidelines are followed for fish health inspections.

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.

The Big Creek Hatchery tule fall Chinook component of the listed Lower Columbia River Chinook ESU is involved in the incubation process of this program. Disinfection procedures are implemented to prevent disease transfer between stocks. Dead eggs are discarded in a manner that prevents transmission of diseases to the receiving watershed. Fish health is regularly monitored (Section 9.1.6) to prevent disease outbreak and spread of diseases. To prevent loss of fish due to equipment or water system malfunctions, alarms are installed in all functions critical to the operations. The alarm system will notify the staff of any emergency situations at the facility. Also, the facility is staffed full-time to assure the safety and security of fish stocks within the hatchery facilities.

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 (1990-2001), or for years dependable data are available.

Egg to fry and fry to smolt survival rates (1990-2015) of Big Creek Hatchery fall Chinook are presented in Table 9.1.1.

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

The juvenile rearing density and loading guidelines used at the facility are based on: standardized agency guidelines, life stage-specific survival studies conducted at other facilities, staff experience (e.g. trial and error) and other criteria. The IHOT standards are followed for: water quality, alarm systems, predator control measures to provide the necessary security for the cultured stock, loading and density. Eggs are incubated in 7 to 9 deep troughs up to the eyed stage, and 44 (6 sections per trough) shallow troughs until

hatching. See Section 5.5 for specific information regarding loading densities.

9.2.3) Fish rearing conditions.

At Big Creek Hatchery, rearing temperatures are monitored daily via thermograph. Temperatures follow the natural thermograph and range from 33-70 degrees F. Dissolved oxygen is not actively monitored, but is generally between 7-10 ppm based on periodic checks. Water flow through the rearing ponds is 15-20 cfs. Settleable solids, unused feed and feces are removed weekly to ensure proper cleanliness of rearing containers. Ponds are visually inspected, and fish mortalities removed daily. The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines, life stage-specific survival studies conducted at other facilities, staff experience (e.g. trial and error) and other criteria (See sections 5.5 and 9.2.2).

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.

Feeding rates are regulated so that fish size is within 10% of the program goal each year. Hatchery personnel conduct periodic feed quality analysis. Feed is stored under proper conditions as described by IHOT guidelines. The available data on fish growth information is provided below in Table 9.2.4.

Table 9.2.4. Fish growth (fish/lb) information for Big Creek tule fall Chinook.

Rearing Period	Weight (fpp)
Dec	1,200
Jan	639
Feb	317
Mar	178
Apr	94
May	80

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

Monthly growth data (fpp) is provided in Table 9.2.4. Energy reserve data are 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).

Feeding rates are regulated so that fish size is within 10% of the program goal each year. Hatchery personnel conduct periodic feed quality checking. Feed is stored under proper conditions as described by IHOT guidelines. The optimum quantity and type of food is

provided to achieve the targeted growth rate for the species and life stages being reared. The type of food, feeding protocols, and food conversion efficiencies are provided in Table 9.2.6.

Table 9.2.6. Fish food, feeding protocol, and food conversion for tule fall Chinook at Big Creek Hatchery.

Rearing period	Food type	Application schedule (no. feedings/day)	Food Conversion
1/11	BVS #0, #1	8	0.65
2/11	BVS #0, #1	8	0.77
3/11	BVS #1, #2	Demand	0.69
4/11	BVS #2, BCF 1.2	Demand	0.73
5/11	BCF 1.2, 1.5	Demand	0.51

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

ODFW's Fish Health Management Policy and IHOT fish health guidelines are followed to prevent transmission of diseases between lots of fish on-site or transmission to the watershed. Vaccines are avoided, whenever possible, to minimize the use of antimicrobial compounds. The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines, life stage-specific survival studies conducted at other facilities, staff experience (e.g. trial and error) and other criteria. Settleable solids, unused feed, and feces are removed from rearing containers weekly to ensure proper cleanliness. Mortalities are removed daily. All equipment is properly disinfected with iodine. Fish health is monitored on a regular basis by ODFW fish pathologists, and if required, fish are treated as per prescriptions written by pathologists.

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

The migratory state of smolts is determined by age, size, behavior, physical appearance, condition factor, and other criteria. No ATPase activity studies are conducted.

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

Natural rearing methods are not used in this program. However, the fish are reared on the local water source (Big Creek) and the temperature regime for rearing follows the natural thermograph.

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.

The Big Creek Hatchery fall Chinook component of the listed Lower Columbia River Chinook ESU is under propagation at this facility. Measures are taken to collect broodstock over the course of the run to get a broad cross-section of adults, and fish are randomly selected for spawning to avoid artificial selection for certain characteristics

(e.g. size). These measures help to ensure that the stock maintains sufficient genetic diversity for long-term sustainability. ODFW's Fish Health Management is strictly followed to prevent diseases and transmission of disease agents.

SECTION 10. RELEASE

10.1) Proposed fish release levels. (Use standardized life stage definitions by species presented in Attachment 2. "Location" is watershed planted (e.g. "Elwha River").)

Table 10.1. Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eyed Eggs	None			
Unfed Fry (STEP)	1,200		December	Skipanon River
Fry	None			
Sub-yearling smolts	3,100,000	~80 fpp	May	Big Creek
,,	2,100,000	~80 fpp	May	N.F. Klaskanine River
STEP smolts	25,000	~45 fpp	June	Youngs Bay
STEP smolts	16,500	~30 fpp	June	Skipanon River

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse: Big Creek
Release point: Big Creek Hatchery (RM 3.3)
Major watershed: Columbia River/Estuary
Basin or Region: Lower Columbia River

Specific location(s) of proposed release(s).
Stream, river, or watercourse: NF Klaskanine River
Release point: Klaskanine Hatchery (RM 2)
Major watershed: Columbia River/Estuary
Basin or Region: Lower Columbia River

Specific location(s) of proposed release(s).
Stream, river, or watercourse: Youngs Bay
Release point: Near Astoria High School
Major watershed: Columbia Estuary
Basin or Region: Lower Columbia River

Specific location(s) of proposed release(s).
Stream, river, or watercourse: Skipanon River
Release point: Near Warrenton High School
Major watershed: Columbia Estuary
Basin or Region: Lower Columbia River

Specific location(s) of proposed release(s).
Stream, river, or watercourse: Skipanon River
Release point: Near Lewis and Clark High School
Major watershed: Columbia Estuary
Basin or Region: Lower Columbia River

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

The actual numbers of program's tule fall Chinook released into Big Creek and NF Klaskanine River are presented in Tables 10.3a and 10.3b, respectively.

Table 10.3a. Past releases of tule fall Chinook salmon from Big Creek Hatchery, 1990-2015.

Release year	Release dates	Sub-yearling smolts	Avg. size (fpp)[a]
1990[b]	4/20 - 5/31	9,746,836	78
1991[b]	3/27 - 5/31	10,830,215	75
1992[c]	3/26 - 5/08	9,804,926	72
1993[c]	4/30 - 5/18	7,901,061	75
1994[c]	4/15 - 5/16	7,025,715	74
1995[c]	3/27 - 5/22	11,913,861	78
1996	3/28 - 5/10	9,470,792	76
1997	5/05 - 5/15	5,961,118	73
1998	4/29 - 5/07	5,867,783	76
1999	5/24	5,804,921	71
2000	5/05 - 5/12	5,821,235	75
2001	5/05 - 5/31	4,537,449	74
2002	5/05 - 5/20	5,765,933	76
2003	5/01 - 5/19	5,764,833	72
2004	5/10 - 5/19	5,887,835	72
2005	5/05 - 5/16	5,865,175	73
2006	5/02 - 5/12	5,850,209	78
2007	5/01 - 5/07	4,467,015	74
2008	5/14 - 5/19	4,286,153	76
2009	5/11 - 5/20	5,666,218	76
2010	4/30 - 5/13	3,948,579	70
2011	5/16	3,255,120	80
2012	5/07	3,614,747	82
2013	5/15	2,956,068	81
2014	5/16	2,837,900	74
2015	5/11	3,120,712	78

Average		6,075,862	75

[a] Based on release target size of 80 fpp.
[b] Additional release schemes employed during these years where fish were also released at 100 fpp and 150 fpp (not included in average size).
[c] Additional release scheme employed during these years where fish were also released at 150 fpp (not included in average size).

Table 10.3b. Past releases of tule fall Chinook salmon from Klaskanine Hatchery, 2010-2015.

Release year	Release dates	Sub-yearling smolts	Avg. size (fpp)[a]
2010	5/3	2,093,575	78
2011	5/16	1,932,616	81
2012	5/1	1,954,568	77
2013	4/29	1,986,471	77
2014	4/26	1,644,974	80
2015	5/1	2,047,136	83
Average		1,943,223	79

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

Tule fall Chinook are forced released from both Big Creek and Klaskanine hatcheries during the month of May. Actual release dates are shown in Tables 10.3a and 10.3b. Releases usually occur at night to minimize encounters with predators.

10.5) Fish transportation procedures, if applicable.

No transportation is required for tule fall Chinook that are released into Big Creek from the Big Creek Hatchery facility. Fish for the Klaskanine Hatchery release, sub-yearling smolts (90 fish/lb) are transported in March from Big Creek Hatchery to Klaskanine Hatchery in a large fish liberation truck with aeration/oxygenation facility.

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

Fish released from Klaskanine Hatchery are shipped in early April (90 fish/lb) from Big Creek Hatchery to Klaskanine Hatchery for acclimation in raceways and imprinting to NF Klaskanine River water prior to release in May (80 fish/lb). No additional acclimation for Big Creek Hatchery releases are followed other than rearing in natural surface water of Big Creek.

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

Big Creek Hatchery tule fall Chinook program began mass marking since the release year 2007, and therefore, all fish are now identifiable as to whether the returned adults are of hatchery- or natural-origin fish. The identifying marks are:

Big Creek Hatchery: Total release number is 3,100,000 smolts. Out of these smolts 2,900,000 shall have adipose fin clip; 200,000 Ad-CWT.

Klaskanine Hatchery: Total release from Klaskanine is 2,100,000 smolts. Out of these, 2,050,000 are ad-clipped, and the remaining 50,000 smolts shall have Ad-CWT marking.

Astoria High School: Total release 25,000 smolts into Youngs Bay at size 45 fpp. All smolts (100%) are marked with ad-clip.

Warrenton High School: Total release16,500 smolts into Skipanon River at size 30 fpp. All smolts (100%) are marked with ad-clip.

Lewis and Clark School: Unfed fry release (1,200 fry) into Skipanon River with no marking.

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

No culling occurs in this program.

10.9) Fish health certification procedures applied pre-release.

As per ODFW's Fish Health Management Policy, fish health is inspected prior to all releases and only health certified fish are released.

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

In any emergency situation, hatchery staff will contact the Watershed District Fish Biologist and fish will be released per suggestion.

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.

Tule fall Chinook are forced released from both facilities at a time (during dark) and size appropriate for smolts of this stock for safe and quick outmigration to the estuary. The release sites are relatively low in the Big Creek and Klaskanine watersheds with short migration distance to the estuary/ocean. It is anticipated that these release locations and strategy should result in a prompt out-migration, and thus minimize interactions with any listed natural fish within the basins or corridor. Fish health protocols are followed to prevent the spread or amplification of disease in the hatchery and wild populations.

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.

Many policies within the hatchery program are already in place to minimize and avoid risks to ESA listed species. Thus, much of the monitoring and evaluation of the Big Creek Hatchery program are incorporated into routine ODFW operations within the Hatchery, Fish Pathology, and Fish Management programs. See Section 1.10 for a listing of monitoring and evaluation efforts associated with each of the performance indicators for the Big Creek Hatchery tule fall Chinook program.

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

Funding and staffing are adequately provided to allow implementation of the monitoring and evaluation program.

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.

The monitoring and evaluation program is not anticipated to require any additional risk aversion measures, besides those already discussed in previous sections of this report.

SECTION 12. RESEARCH

Research is not currently being conducted at Big Creek Hatchery with regard to this program. Therefore, all the following sections are not applicable to this HGMP.

12.1) Objective or purpose. N/A

12.2) Cooperating and funding agencies. N/A

12.3) Principle investigator or project supervisor and staff. N/A

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. N/A

12.6) Dates or time periods in which research activity occurs. N/A

12.7) Expected type and effects of take and potential for injury or mortality. N/A

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

12.9) Alternative methods to achieve project objects. N/A

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

12.11) 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. N/A

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name and Title of Applicant: Scott Patterson, Fish Propagation Program Manager, ODFW

Signature: _____ **Date:** _____

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

Listed species affected: Chum____ ESU/Population: Lower Columbia River Activity: Hatchery trap operation___				
Location of hatchery activity: Big Creek Dates of activity: November-January Hatchery Operator: Rob Dietrichs				
	Annual Take of Listed Fish By Life Stage (Number of Fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			35	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category.

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

Listed species affected: Chinook ESU/Population: Lower Columbia River Activity: Hatchery trap operation				
Location of hatchery activity: Big Creek Dates of activity: August-January Hatchery Operator: Rob Dietrichs				
	Annual Take of Listed Fish By Life Stage (Number of Fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			200	
Capture, handle, tag/mark/tissue sample, and release d)			200	
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category.

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

Listed species affected: __Coho____ ESU/Population:___Lower Columbia River_____ Activity:___Hatchery trap___				
Location of hatchery activity: Big Creek Dates of activity: August-January Hatchery Operator: Rob Dietrichs				
	Annual Take of Listed Fish By Life Stage (Number of Fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			400	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category.

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

Listed species affected: Steelhead__ ESU/Population:_Lower Columbia River_____Activity:_Hatchery trap operation___				
Location of hatchery activity: Big Creek Dates of activity: August-January Hatchery Operator: Rob Dietrichs				
	Annual Take of Listed Fish By Life Stage (Number of Fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			200	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category.

ATTACHMENT 1. DEFINITION OF TERMS REFERENCED IN THE HGMP TEMPLATE.

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

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

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

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

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

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

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

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

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

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

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

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

natural population.

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

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

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

Natural origin recruit (NOR) - See natural fish.

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

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

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

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

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

Stock - (see “Population”).

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

ATTACHMENT 2. AGE CLASS DESIGNATIONS BY FISH SIZE AND SPECIES FOR SALMONIDS RELEASED FROM HATCHERY FACILITIES.

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

SPECIES/AGE CLASS	SIZE CRITERIA Number of fish/pound	Grams/fish
Chinook Yearling	<=20	>=23
Chinook (Zero) Fingerling	>20 to 150	3 to <23
Chinook Fry	>150 to 900	0.5 to <3
Chinook Unfed Fry	>900	<0.5
Coho Yearling [1/]	<20	>=23
Coho Fingerling	>20 to 200	2.3 to <23
Coho Fry	>200 to 900	0.5 to <2.3
Coho Unfed Fry	>900	<0.5
Chum Fed Fry	<=1000	>=0.45
Chum Unfed Fry	>1000	<0.45
Sockeye Yearling [2/]	<=20	>=23
Sockeye Fingerling	>20 to 800	0.6 to <23
Sockeye Fall Releases	<150	>2.9
Sockeye Fry	> 800 to 1500	0.3 to <0.6
Sockeye Unfed Fry	>1500	<0.3
Pink Fed Fry	<=1000	>=0.45
Pink Unfed Fry	>1000	<0.45
Steelhead Smolt	<=10	>=45
Steelhead Yearling	<=20	>=23
Steelhead Fingerling	>20 to 150	3 to <23
Steelhead Fry	>150	<3
Cutthroat Trout Yearling	<=20	>=23
Cutthroat Trout Fingerling	>20 to 150	3 to <23
Cutthroat Trout Fry	>150	<3
Trout Legals	<=10	>=45
Trout Fry	>10	<45

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

2/ Sockeye yearlings defined as meeting size criteria and 1 year old.