HATCHERY AND GENETIC MANAGEMENT PLAN

(HGMP)

Hatchery Program:	Clackamas Hatchery Spring Chinook Program
Species or Hatchery Stock:	Spring Chinook Salmon (ODFW Stock 19)
Agency/Operator:	Oregon Department of Fish and Wildlife
Watershed and Region:	Clackamas River (Willamette River Basin) and Eagle Creek (Clackamas R. Sub-basin)
Date Submitted:	October 15, 2004 May 10, 2016 May 6, 2020
Date Last Updated:	May 6, 2020

EXECUTIVE SUMMARY

The Clackamas Hatchery, operated by the Oregon Department of Fish and Wildlife (ODFW), produces spring Chinook salmon to support commercial and recreational fisheries in Oregon rivers and the coastal Pacific Ocean. The broodstock used at this facility was founded from upper Willamette River spring Chinook salmon in 1976, and has been managed as a segregated stock since that time. In recent years, the number of adult hatchery-origin spring Chinook salmon returning to the Clackamas River (i.e. smolt-to-adult returns; SARs) has declined precipitously, despite relatively constant production and release of juveniles. In fact, the number of adult hatchery salmon returning to the Clackamas River was so low in 2018 and 2019, that hatchery managers were unable to meet broodstock needs, and fewer than ten fish were harvested in the local sport fishery.

The dire situation of the Clackamas Hatchery's spring Chinook salmon program has prompted managers to consider a variety of alternative actions, including transition to an integrated broodstock (see Attachment 5). This transition, favored by managers, would require take of wild ESA-listed Clackamas spring Chinook salmon, particularly during the first three "rebuilding" years for a new broostock development. Fortunately, the abundance of wild spring Chinook salmon has remained relatively stable in the Clackamas River, with a mean 2,331 (SE ±250) returning to the North Fork Dam each year (2010-2019), suggesting that prudent collection of wild fish for broodstock would not significantly impact the population's viability.

The Hatchery and Genetic Management Plan (HGMP) describes management of the Clackamas Hatchery Spring Chinook Program as an integrated program after three "rebuilding" years. Under this integrated plan, take of wild Clackamas spring Chinook salmon will occur in accordance with a "sliding scale" (Table 7.2) that determines the integration rate as a function of the number of wild spring Chinook returning to the Clackamas River. The number of wild spring Chinook returning to the Clackamas River will be determined by passage counts (June 15th 25% passage, July 10th 50% passage) at Portland General Electric's (PGE) North Fork adult collection facility. The primary collection point for adult natural origin spring Chinook will be PGE's North Fork adult collection facility. Once collected, adult fish will be spawned in the fall. Hatchery-origin fish will be crossed with other hatchery-origin spawners and, similarly wild brood will be spawned only with other wild brood. The program will be managed with a target of less than 10% hatchery origin spawners (pHOS) on natural spawning grounds of the Clackamas River. Most hatchery spring Chinook released in the Clackamas program will be marked by the removal of their adipose fin (ad-clip), the exception being 60,000 fry which are designated for release at various locations as part of the Salmon Trout Enhancement Program. In addition to mass making (ad-clip), all smolts of Clackamas Hatchery (665,000), Clear Creek (140,000), and Eagle Creek (240,000), will be routed through the fish marking trailers for CWT markings, as needed. All Chinook smolts from Clackamas Hatchery will be released directly into Clackamas River, and the releases from Clear Creek and Eagle Creek will be acclimated prior to release.

ODFW plans to rear most of its Clackamas spring Chinook at the Clackamas Hatchery. However, *Ceratonova shasta* is common in Clackamas River waters that may impact juvenile spring Chinook survival at Clackamas Hatchery. Infrastructure development which moves the hatchery water supply to a location above/upstream of Rivermill Dam will take effect in the summer of 2020, and that may allow onsite rearing with minimal adverse effects of *C. shasta*. Studies conducted prior to construction have shown significantly lower levels of *C. shasta* in

waters above the Dam, though additional monitoring will be needed to ensure fish health. If pathogen levels do not meet ODFW standards, juvenile spring Chinook will be reared at other Willamette Valley hatcheries during summer months.

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Clackamas Hatchery Spring Chinook Program

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

Spring Chinook (*Oncorhynchus tshawytscha*) of Clackamas River (stock 19). In March 1999, the Upper Willamette River Spring Chinook ESU was listed as Threatened under the Federal ESA (Federal Register Notice 1999). This is also a sensitive species under the Oregon's Sensitive Species Rule (OAR 635-100-0040). The Clackamas Hatchery stock of spring Chinook (ODFW stock 19) is also part of the Upper Willamette River Spring Chinook ESU and was listed on March 07, 2006.

1.3) Responsible organization and individuals.

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Other agencies, co-operators, or organizations involved:

The National Marine Fisheries Service (NMFS) provides funding for the program through the Mitchell Act. Portland General Electric (PGE) and the City of Portland are also involved by providing funding for the program. Also, some funding is provided for by the Oregon Department of Fish and Wildlife.

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

The funding sources, staffing level and total operating costs for the hatchery facilities involved in the production of spring Chinook for the Clackamas Hatchery spring Chinook program (stock 19) are summarized in Table 1.4. The annual budget for Clackamas Hatchery is dedicated largely to the production of spring Chinook salmon.

Table 1.4. Funding sources, staffing levels, total hatchery operational costs and proportion of total budget spent for the Clackamas River Spring Chinook (stock 19) program.

Facility	Funding Source	Staffing	Total Hatchery Budget*	% of Budget spent for ChS
Clackamas Hatchery	NOAA Fisheries – 66% City of Portland – 25.7% PGE – 8.3%	4.5 FTE	$586,398	~58%
Eagle Creek	Operates with Clackamas Hatchery staff & budgets	1 FTE	$90,754	~44%

*Annual budget is the total operating cost for the hatchery for FY 2019.
FTE = full-time equivalent staff

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

The locations of the operational facilities for spring Chinook program (stock 19) are shown in Table 1.5. The acclimation and release sites in the Clackamas River are all in the lower river and are subject to change to other points between river miles 0 and 30.

Table 1.5 Locations of rearing and acclimation facilities for Clackamas Hatchery spring Chinook (stock 19) program.

Facility	Stream	River Mile	Sub-Basin	Notes
Clackamas H.	Clackamas	22.6	Willamette	Within Milo McIver State Park, 5 mi west of Estacada, OR
Eagle Creek H.	Eagle Creek	9.94	Clackamas R	At RM 9.9 on Eagle Creek, Clackamas River watershed, Estacada, OR
Willamette Valley Hatcheries (tbd).	tbd		Willamette	Within the Willamette basin
*North Fork Dam	Clackamas	30	Willamette	PGE owned/operated facility off Hwy 224, Estacada, OR
Foster Creek Acclimation	Clackamas	11.0	Willamette	Mouth of Foster Creek at Clackamas River
Clear Creek Acclimation	Clackamas	8.1	Willamette	Mouth of Clear Creek at Clackamas River
Classrooms Incubators	Clackamas	Multiple Schools	Willamette	60-180 schools, operating through STEP

STEP = Salmon & Trout Enhancement Program *Adult fish sorting facility.

Figure 1 Flow diagram showing details of the Clackamas Hatchery spring Chinook program (stock 19) distributions are shown below

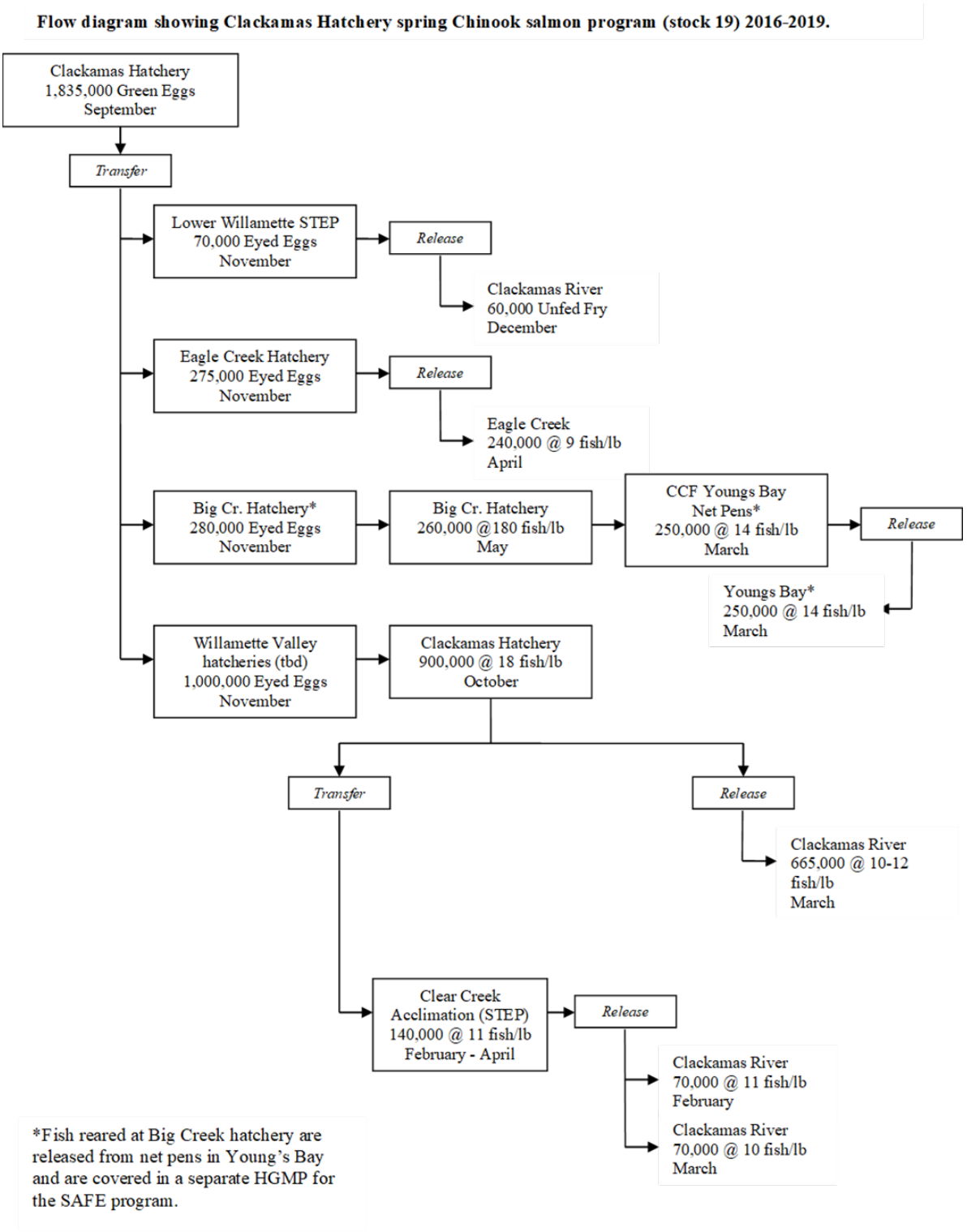
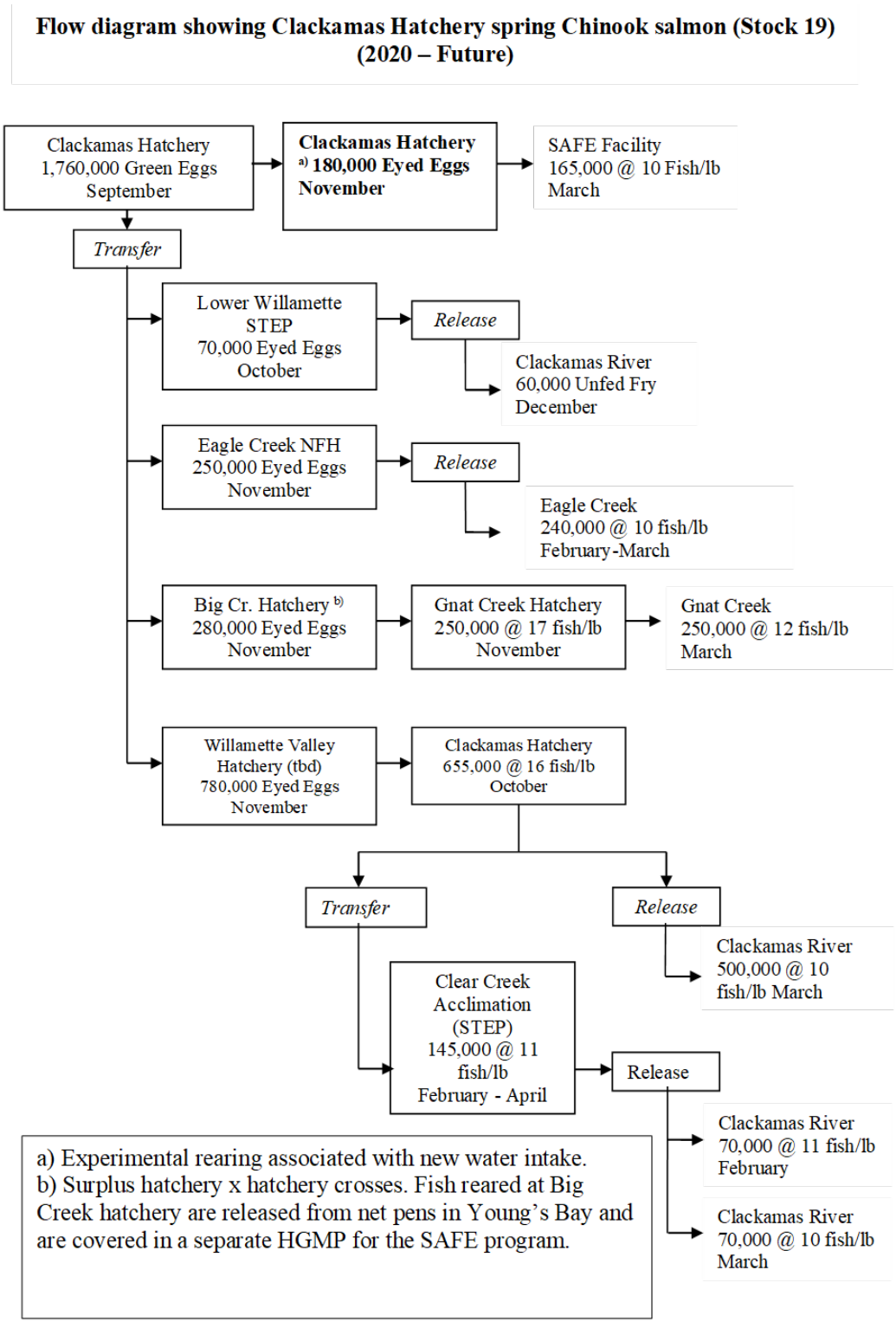


Figure 1 Flow diagram showing Clackamas Hatchery spring Chinook salmon distribution post broodyear 2020



1.6) Type of program.

The purpose of the Clackamas spring Chinook program is mitigation and harvest augmentation. The program is managed to supplement harvest to compensate for a portion of the sport and commercial salmon fisheries that were impacted when natural salmon production was decreased due to loss or degradation of fish habitats and passages in the Columbia River Basin. The Clackamas spring Chinook program is an integrated program founded on Clackamas River stock spring Chinook to reduce genetic drift and reduce domestication risks.

1.7) Purpose (Goal) of program.

Harvest Augmentation – The primary objective of this program is to augment sport and commercial salmon fisheries in the Clackamas, Eagle Creek, Willamette, and Columbia rivers, estuary and the Pacific Ocean.

Mitigation – This program also provides mitigation pursuant to agreements with the Federal Energy Regulatory Commission (FERC) and NOAA Fisheries for loss of habitat quantity and quality as a result of the construction and operation of PGE and USACOE hydropower dams on the Clackamas River and Columbia River, respectively.

Education – Around 70,000 eyed eggs are given to various schools through the STEP program, which are incubated in classroom incubators in the Portland metropolitan area to help educating the students on biology and life cycle of salmon and to make them familiar with critical issues the salmonids are facing. These fish are released as unfed fry. This effort is conducted under, and coordinated through the ODFW's Salmon and Trout Enhancement Program (STEP). This program will be maintained via collection of eggs from hatchery origin parents and no eggs from wild parents (integrated stock) will be used.

1.8) Justification for the program.

The Clackamas River spring Chinook program is managed to augment regionally important fisheries for spring Chinook while minimizing potential risks to wild spring Chinook populations. The following is a summary of primary harvest and hatchery management practices, and measures being implemented to minimize potential risks to wild spring Chinook.

Harvest

The Clackamas River spring Chinook program is managed to supplement harvest in salmon fisheries impacted by the construction and operation of hydropower dams in the Clackamas and Columbia River basins. Specifically, the program is managed to produce spring Chinook salmon to sustain ocean fisheries and selective Columbia River and Willamette River terminal sport and commercial fisheries. The Willamette and Clackamas rivers are well-regarded for recreational spring Chinook angling. These fisheries receive a great deal of angler effort because of the close proximity to the Portland metropolitan area and generate substantial economic benefits to the region. This

hatchery program also contributes significantly to Columbia River sport and commercial spring Chinook fisheries, which also provide a high economic value to the region.

Harvest activities are managed to reduce impacts to wild spring Chinook populations. Current recreational angling regulations in the Upper Willamette River ESU require that *all* unmarked adult spring Chinook be released back to the stream unharmed. Only hatchery-origin adult spring Chinook with an adipose fin-clip may be retained in sport fisheries. Commercial fisheries are also actively investigating different techniques to enable the safe release of unmarked fish. The Fisheries Management and Evaluation Plan (FMEP) for the Upper Willamette River spring Chinook in Freshwater Fisheries of the Willamette Basin and Lower Columbia River Mainstem (ODFW 2001) outlines the future management of fisheries (recreational and commercial) potentially affecting listed upper Willamette River spring Chinook.

- Hatchery fish are produced in sufficient numbers to meet the release and harvest objectives for fisheries intended to benefit from the program.

- Hatchery fish are differentially marked (adipose fin clipped) to enable selective harvest fisheries.

- Angling regulations require that all unmarked spring Chinook be released unharmed.

- Angling regulations restrict angling for adult spring Chinook upstream of North Fork Dam providing refuge for wild spawners year-round in the primary natural spawning habitat for wild spring Chinook.

Hatchery Practices

The Clackamas River spring Chinook program has been managed as a segregated hatchery program since the broodstock was founded in 1976 from upper Willamette River spring Chinook salmon. The program used only hatchery fish returning to Clackamas Hatchery. ODFW has identified that a majority (≥90%) of natural spawning habitat for spring Chinook in the Clackamas basin exists above the North Fork Dam, and only wild fish are allowed to pass upstream of the dam to these primary spawning areas. In 2020, the hatchery transitioned from a segregated to an integrated broodstock program, whereby natural-origin spring Chinook salmon will be spawned at the hatchery to bolster the genetic diversity of the broodstock, and reduce genetic and phenotypic divergence from the wild stock. Given the ongoing sorting efforts at North Fork Dam, the potential for overlap between wild and hatchery Chinook on natural spawning grounds is low, but the potential for domestication selection on the hatchery stock warrants integration of wild fish to further reduce risk from the program. The following is a summary of key hatchery practices and management features that are in place to minimize the risk of potential adverse impacts to listed natural spring Chinook salmon within the basin.

- Adult spring Chinook salmon trapped at the Clackamas Hatchery or North Fork Dam are used as broodstock for the hatchery program. No adult fish are taken from outside the Clackamas Basin for inclusion in the broodstock.
- Wild spring Chinook will be incorporated into the hatchery broodstock at a rate so that the viability and continued existence of wild population is not affected by the hatchery program. Integration of wild fish into the hatchery broodstock will be guided by a "sliding scale" that sets annual integration rates as a function of the number of wild spring Chinook returning to the Clackamas River and past integration rates. The number of wild spring Chinook returning to the Clackamas River will be estimated from passage counts at Portland General Electric's (PGE) North Fork adult collection and sorting facility. The sliding scale has been designed to integrate at higher rates during years of high wild Chinook abundance and at lower rates during low-abundance years, so as to limit long-term genetic and short-term demographic risks.
- Once collected, adult fish are spawned in the fall. Hatchery-origin (adipose fin-clipped) fish will be crossed with other hatchery-origin brood and, similarly, natural-origin (unmarked) brood will be spawned only with other unmarked brood. All portions of the run and all age classes will be incorporated into the broodstock to maintain genetic diversity within the hatchery population.
- Smolts are released in a physical condition, and at times and locations that promote rapid outmigration to reduce potential interactions with wild salmonid populations. A fall-release of sub-yearling migrants may be released to better represent the suite of juvenile life histories expressed by wild spring Chinook in the Clackamas River.
- All spring Chinook smolt releases through the Clackamas Hatchery program will be marked by removal of their adipose fin (ad-clip). This practice facilitates mark-selective fisheries and sorting at North Fork Dam. All smolts released from Clear Creek (165,000) shall have ad-clip and, of this total, 50,000 will have CWTs; releases from Eagle Creek Hatchery (240,000 smolts) shall have 100% ad-clip with 50,000 of these smolts having CWTs.
- Hatchery adults returning to North Fork Dam are selectively sorted out and unclipped Chinook salmon are passed above the North Fork Dam for natural spawning above the barrier. The intent is to maintain a spawning population of spring Chinook above the dam comprised of ≥90% natural-origin fish. While no hatchery-origin fish are intentionally passed, some may reach upper basin spawning areas due to errors in sorting operations. Since May, 2013, errors are greatly reduced due to the construction and operation of a new sorting facility at PGE's North Fork Dam. The practice has been in place since 1998 (though returns were not fully marked until about 2001).
- This program complies with ODFW's Fish Health Management Policy and IHOT standards for egg incubation, fry rearing, fish transfer, and prevention and treatment of fish diseases.
- This program complies with other applicable IHOT standards.

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

Legal Mandates:

Performance Standard (1): Contribute to requirements of mitigation agreements between NOAA Fisheries and the State of Oregon. **Benefit.**

Indicator (1)(a): Production goals are met. **Benefit.**

Performance Standard (2): Program complies with Oregon Native Fish Conservation Policy, the Clackamas River Basin Plan, and the Upper Willamette Chinook Fisheries Management Evaluation Plan (FMEP) and conservation and recovery plans for salmon and steelhead in the Lower Columbia and Willamette Rivers. **Benefit.**

Indicator (2)(a): Reviews identify that hatchery program management decisions and practices are implemented consistent with the policies and plans. **Benefit.**

Harvest:

Performance Standard (3): Hatchery spring Chinook produced for the Clackamas River sport fishery, Lower Willamette River sport fishery, Lower Columbia River sport fishery, and Lower Columbia gillnet fishery are produced and released in a manner that enables effective harvest while minimizing harvest-related impacts on wild spring Chinook (as described in the Upper Willamette FMEP). **Benefit.**

Indicator (3)(a): Number of adult hatchery-origin spring Chinook produced, and the number of adult hatchery-produced spring Chinook harvested in the Clackamas River sport fishery, Lower Willamette River sport fishery, Lower Columbia River sport fishery, and Lower Columbia gillnet fishery. **Benefit.**

Indicator (3)(b): Number of wild spring Chinook handled and released during selective fisheries, estimated mortality rates, and estimated impact to the wild spring Chinook population. **Risk.**

Performance Standard (4): All hatchery release groups are marked to enable selective fisheries and release of wild spring Chinook. **Benefit.**

Indicator (4)(a): Verify that mark rate at release is 95% to 100% for all release groups. **Benefit.**

Indicator (4)(b): Sport fisheries in the Lower Columbia, Willamette, and Clackamas Rivers require all unmarked fish to be released unharmed (as per the Upper Willamette Chinook FMEP). **Risk.**

Life History Characteristics:

Performance Standard (5): Adults collected for broodstock are taken throughout the run in proportions approximating the historic run-timing of the natural spawning population. The hatchery will be operated as an integrated program with the Clackamas wild stock. **Risk.**

Indicator (5)(a): Run timing of hatchery spring Chinook returning to Clackamas Hatchery. **Risk.**

Indicator (5)(b): Run timing of wild spring Chinook returning to North Fork Dam. **Risk.**

Indicator (5)(c): Origin of fish used in broodstock as indicated by fin clips or coded wire tags. **Risk.**

Performance Standard (6): Life history characteristics and age composition of hatchery broodstock do not significantly diverge from characteristics of hatchery spring Chinook returning to the Clackamas River basin. Broodstock life history characteristics shall match hatchery-reared adult return characteristics. **Risk.**

Indicator (6)(a): Run timing, body size (length and weight), sex composition, fecundity (egg number and size), adult:jack ratio, and age distribution. **Risk.**

Conservation of Wild Fish Population:

Performance Standard (7): Broodstock collection will be conducted to have minimal adverse impact on the naturally spawning population of wild spring Chinook. **Risk.**

Indicator (7)(a): All fish without fin clips or coded-wire tags (CWTs) returning to Clackamas Hatchery will be returned to the river with minimum physical stress. If integration is approved under this HGMP, some unmarked fish (maximum of 5% of estimated wild run) returning to the hatchery may be integrated into the broodstock. **Risk.**

Indicator (7)(b): *)*: Up to 5% of the unmarked fish returning to North Fork Dam in a given year may be integrated into the hatchery broodstock, in accordance with a prescriptive "sliding scale". Notwithstanding this collection for the integrated broodstock, all other fish without fin clips or coded wire tags returning to North Fork Dam will be passed above the adult trap with minimum physical stresses. **Risk.**

Performance Standard (8): Juvenile release strategies will minimize impacts to naturally-produced spring Chinook populations. **Risk.**

Indicator (8)(a): Hatchery spring Chinook release locations will be in the lower Clackamas River (below river mile 30; including tributaries). **Risk.**

Indicator (8)(b): Hatchery spring Chinook juveniles will be released as smolt sized fish to encourage rapid migration and minimize residualism. A fall-release of sub-yearling migrants may be released to better represent the suite of juvenile life histories expressed by wild spring Chinook in the Clackamas River. **Risk.**

Indicator (8)(c): Hatchery spring Chinook juveniles will be released at times and locations to reduce impacts to local habitat carrying capacity. **Risk.**

Performance Standard (9): The proportion of hatchery-reared spring Chinook adults in spawning areas in the upper Clackamas River basin will not exceed 10%. ODFW places a high priority on maintaining the upper basin sanctuary above the North Fork Dam for wild population. **Risk.**

Indicator (9)(a): The proportion of hatchery spring Chinook observed on spawning areas above North Fork Dam. **Risk.**

Performance Standard (10): Distribution of hatchery adult carcasses, to provide nutrient enrichment benefits in natural salmon spawning streams, will be accomplished in compliance with Oregon Department of Environmental Quality (DEQ) and ODFW guidelines for disease control and water quality. **Benefit.**

Indicator 10(a): Number, timing, and spatial distribution of hatchery carcasses placed for nutrient enrichment will mimic that of historic wild fish. **Benefit.**
Indicator 10(b): Hatchery carcasses placed for nutrient enrichment will comply with ODFW disease guidelines. **Risk.**

Indicator 10(c): All permits required by DEQ will be obtained, and activities will comply with all permit conditions. **Risk.**

Operation of Artificial Production Facilities:

Performance Standard (11): Clackamas, Bonneville and Eagle Creek hatcheries will be operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (i.e., IHOT, PNFHPC, and the ODFW Fish Health Management and Hatchery Management policies). **Risk.**

Indicator (11)(a): Number of broodstock sampled and pathogens observed are within specified guidelines at Clackamas Hatchery. **Risk.**

Indicator (11)(b): Rearing survival rates (egg-to-fry and fry-to-smolt) at all three facilities. **Risk.**

Indicator (11)(c): Number of juveniles sampled and pathogens observed during rearing and immediately prior to release are within guidelines. **Risk.**

Performance Standard (12): Hatchery water discharges will comply with prescribed NPDES permits required by the Oregon Department of Environmental Quality. **Risk.**

Indicator (12)(a): Water sample collection and reporting records. **Risk.**

Performance Standard (13): Surface water withdrawals for hatchery operations will be screened to minimize mortality to juvenile salmonids. The new gravity fed intake that will be the primary water source for Clackamas Hatchery meets current NOAA fish screen criteria. The existing pump fed intake will be the backup water source for Clackamas Hatchery and currently does not meet current NOAA fish screen criteria. Acclimation pond intakes meet current NOAA fish screen criteria. **Risk**.

Indicator (13)(a): Inspections of screens for compliance with ODFW and NOAA fish screen criteria. **Risk.**

Performance Standard (14): Weir/trap operation at the North Fork Dam ladder and Clackamas Hatchery will be conducted in a manner that minimizes stress, injury, or mortality to wild spring Chinook salmon trapped, handled and released at these locations. **Risk.**

Indicator (14)(a): Number of annual injuries and mortalities of wild spring Chinook captured in adult collection traps will be tracked. **Risk.**

Indicator (14)(b): Number of wild spring Chinook captured, dates, and frequency of adult collection trap operations will be tracked. **Risk.**

Socio-Economic Effectiveness:

Performance Standard (15): Sport and commercial fishery benefits for which the program is designed are achieved. **Benefit.**

Indicator (15)(a): Punch card information, creel surveys, and commercial catch data will be evaluated to determine fishery benefits of the hatchery program. **Benefit.**

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish to be collected for hatchery production of juvenile spring Chinook salmon).

The Clackamas stock of spring Chinook salmon was originally founded from multiple upper Willamette River populations, but has used only broodstock returning to Clackamas Hatchery since 1988. The hatchery population has been managed as a segregated stock, but transitioned to become an integrated stock in 2020. A maximum of 600 adult spring Chinook may be collected to meet production goals as stated below.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location are shown in Table 1.11.2 below.

Table 1.11.2

Age Class	Size (fpp)	Release Location	Annual Release Level and Marking	Release Date
Eyed Eggs	X	X	X	
Unfed Fry	≥900	*Various locations through STEP	60,000 (unmarked)	December
Fry	X	X	X	
Fingerling	X	X	X	
Yearling Smolts	10-12 f/lb 9-11 f/lb 9 f/lb	Clackamas River Clear Creek (STEP) Eagle Creek	665,000 (100% Ad-clip; 50K CWT) 140,000 (100% Ad-clip; 50K CWT) 240,000 (100% Ad-clip; 50K CWT)	Feb-April Feb–April Feb-April

NOTE: In the Clackamas River, all release locations will remain below river mile 30. Unfed fry releases in the Willamette, Columbia, Sandy, and Molalla rivers occur in the mainstem and only in areas with hatchery fish influence. Total numbers released will remain constant and not exceed 1.2 million smolts. Also, see the flow diagram on page #6 and 7 for release details.

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 number of adult spring Chinook salmon returning to the Clackamas Hatchery trap since 1990 is presented in Table 1.12(a). Smolt to adult survival rates, based on coded-wire tagged (CWT) fish from this program, are presented in Table 1.12(b). Total harvest of spring Chinook in freshwater fisheries that this program contributes to are reported in Table 1.12(c).

Table 1.12 (a). Summary of spring Chinook salmon returning to the Clackamas Hatchery trap (2004-2019) and N. Fork Dam (2004-2019). Jacks included in total count.

		North Fork Dam	
Return Year	Clackamas H.[a/]	Hatchery	Wild
2004	6265	7978	5308
2005	4547	2937	2958
2006	7287	1092	1113
2007	3799	2854	1699
2008	3540	1896	1821
2009	1839	1311	941
2010	5509	3570	1432
2011	1778	3165	1833
2012	1521	2156	1909
2013	2098	1286	2306
2014	2973	1347	1088
2015	3573	1647	2574
2016	1028	1009	3601

Return Year	Clackamas H.[a/]	North Fork Dam	
		Hatchery	Wild
2017	503	212	3699
2018	106	95	2430
2019	177	58	2435

Sources: Clackamas Hatchery, HMS. Garth Wyatt (PGE)

Table 1.12 (b). Clackamas River and Eagle Creek releases. Smolt to Adult Returns (SARs) based on percentage of CWTs recovered.

Brood Year	AD+CWT	Total Released	SAR %
2005	134,000	1,432,487	0.34
2006	136,603	1,600,717	1.50
2007	124,915	942,146	0.99
2008	126,600	947,858	0.55
2009	139,649	1,193,805	0.38
2010	282,057	1,183,174	0.41
2011	239,706	974,015	0.65
2012	139,484	774,082	0.15
2013	184,986	636,525	0.04*
2014	159,267	737,634	0.02*

*incomplete

Source: Regional Mark Information System Database [online database]. Continuously since 1977. Portland (OR): Regional Mark Processing Center, Pacific States Marine Fisheries Commission. 11/01/2018:<http://www.rmpc.org

Table 1.12(c). Harvest of adult spring Chinook in the target fisheries for this program (1990-2019). The size of the run entering the Clackamas is also given (ODFW unpublished data).

Year	Sport				Commercial	TOTAL	Run Entering
	L Columbia	L Willamette	Clackamas	TOTAL	L Columbia	HARVEST	Clackamas
1990	8,699	22,658	4,334	35,691	15,494	51,185	11,128
1991	3,474	29,949	3,704	37,127	11,183	48,310	11,557
1992	3,088	12,994	2,665	18,747	3,858	22,605	11,354
1993	958	19,581	2,571	23,110	1,037	24,147	10,503
1994	1,261	11,366	1,483	14,110	1,100	15,210	7,417
1995	0	14,211	1,476	15,687	14	15,701	6,437
1996	0	6,020	1,809	7,829	124	7,953	5,771
1997	0	1,886	1,673	3,559	272	3,831	5,706
1998	47	2,770	1,232	4,049	129	4,178	7,169
1999	0	5,452	1,862	7,314	260	7,574	7,346
2000	201	8,938	1,148	10,287	1,124	11,411	7,514
2001	3,828	7,480	701	12,009	3,519	15,528	10,429
2002	5,161	10,720	2,624	18,505	7,319	25,824	14,094
2003	6,964	13,316	1,239	21,519	1,823	23,342	14,475
2004	5,895	11,885	1,346	19,126	7,243	26,369	21,611
2005	2,826	5,668	1,278	9,772	2,323	12,095	12,502
2006	2,013	7,168	411	9,592	2,674	12,266	10,345
2007	1,602	5,623	208	7,433	1,269	8,702	8,469
2008	203	4,531	209	4,943	96	5,039	7,415
2009	1,327	4,110	191	5,628	323	5,951	3,548
2010	5,352	21,981	711	28,044	3,247	31,291	10,737
2011	2,019	21,016	503	23,538	2,236	25,774	6,516
2012	3,075	15,406	565	19,046	2,290	21,336	5,637
2013	1,679	7,082	384	9,145	1,767	10,912	5,779
2014	2,268	7,972	312	10,552	1,259	11,811	5,380
2015	3,442	13,461	418	17,321	2,542	19,863	8,129
2016	1,404	5,889	45	7,338	946	8,284	5,565
2017	1,252	7,244	103	8,599	1,289	9,888	4,366
2018	1,253	6,153	8	7,414	457	7,871	2,528
2019	208	4,607	1	4,816	325	5,141	2,489

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

Willamette stock spring Chinook (fry, pre-smolts, smolts, and adults) have been released from Eagle Creek National Fish Hatchery (ECNFH) into Eagle Creek, a Clackamas River tributary, and throughout the basin since 1959. All releases of Willamette stock spring Chinook from ECNFH were discontinued after 1987. ODFW started direct releasing spring Chinook smolts into Eagle Creek in 2005, then began acclimating smolts at Eagle Fern Park in 2010. The direct release of 240,000 smolts reared full-term at Eagle Creek Hatchery began in 2015.

The Clackamas River spring Chinook stock was developed from other Willamette Basin hatchery spring Chinook smolts released at Dog Creek (site of Clackamas Hatchery) beginning in 1976 (ODFW 1992). Clackamas Hatchery began operation in 1979 and the first releases of spring Chinook at Clackamas Hatchery were in November 1979 (1978 brood). The last release of smolts at Clackamas Hatchery from adults not collected at Clackamas Hatchery was in 1989 (1987 brood). Since 1988, the Clackamas Hatchery spring Chinook broodstock has been composed entirely of returns to Clackamas Hatchery.

1.14) Expected duration of program.

The project is ongoing, with no planned end date.

1.15) Watersheds targeted by program.

Targeted watersheds include the lower Clackamas River (below North Fork Dam; smolts release, migration, harvest, adult return), Eagle Creek (smolts release, harvest, adult return), lower Willamette River (migration, harvest), Columbia River (below Sandy River confluence; migration, harvest), and the Pacific Ocean (migration, harvest).

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: Regular integration of natural-origin fish into the broodstock to promote genetic characteristics of the locally adapted population has not occurred for decades.

The Clackamas River spring Chinook program has been managed as a segregated broodstock program, using only hatchery-origin adult returns to the Clackamas system (Clackamas stock). The broodstock was founded from Willamette stock spring Chinook. The purpose of this program is to provide harvest opportunities and to mitigate for the loss of habitat resulting from development of hydroelectric dams in the watershed. Returns from the current segregated program are poor and have shifted to a later return timing. Natural-origin fish, for many years, were below the Clackamas spring Chinook delisting goal (100 yr. avg.), as stated in the Upper Willamette River Recovery Plan. Currently, the 3-year average is 2,700 natural-origin fish, which is above the stated delisting goal of 2,314 adults. Integration of natural-origin fish is planned to begin in 2020, with continued integration to promote genetic diversity and minimize inbreeding depression in hatchery population, slow possible domestication selection, and reduce genetic risk from the program.

Issue 2: Water quality limitations (pathogen problems due to high temperatures) in the Clackamas River affect production at the hatchery and result in a need to rear all of the production for this program at other facilities for a portion of their freshwater rearing cycle. *(NOTE: Clackamas Hatchery is scheduled, spring 2020, to switch from a pump intake below Rivermill Dam to a gravity fed intake located upstream in Estacada Lake where water quality testing has shown that pathogen load appears to be much lower.*

This change will also allow for Clackamas Hatchery to utilize their full water right throughout the year).

Issue 3: Acclimating and/or releasing a portion of the Clackamas Hatchery production in Eagle Creek could potentially increase harvest of returning hatchery fish (*NOTE: direct release into Eagle Creek started in 2005, acclimation started in 2010, and full term rearing started in 2015. Evaluation of this program is still ongoing and future changes may be needed to satisfy angler demand for this historically popular fishery*).

Harvest rates of spring Chinook in the Clackamas River appear to have declined after smolt releases from Eagle Creek Hatchery were terminated. Acclimation and/or release of some smolts at a location within Eagle Creek would likely cause returning adults to delay migration in the vicinity of Eagle Creek making them more susceptible to harvest in several popular fishing areas. Fish that migrate into Eagle Creek would also be available for harvest. Minor program changes in this regard could potentially improve the contribution of these fish to anglers, and decrease the workload associated with handling surplus hatchery fish at Clackamas Hatchery and the North Fork Dam sorting facility.

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

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

NMFS 2008 BiOp provided coverage for the impacts of artificial propagation of spring Chinook programs in the Willamette Basin. Biological Opinion on the impacts from the collection, rearing, and release of listed and non-listed salmonids associated with artificial propagation programs in the Upper Willamette spring chinook and winter steelhead evolutionarily significant units, Portland, OR.

- Upper Willamette River Chinook FMEP.
- Incidental Take Permits for the operation of North Fork Dam ladder sorting facility.
- The HGMP for Clackamas spring Chinook program was submitted to NMFS on 05/2016.
- Coverage is provided in the 2017 NMFS BiOP, Evaluation of Hatchery spring
- Chinook, summer steelhead, and rainbow trout in the Upper Willamette basin.
- NMFS Consultation Number: WCR-2018-9781. Signed May, 2019.
- The current (this) version was revised in 2020, and describes several program reforms, including integration of wild brood. Additional coverage is neededthrough this HGMP to allow direct take of natural-origin adults into the broodstock.

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

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

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

The Clackamas River hatchery-origin spring Chinook are a component of the Upper Willamette River Chinook ESU, and are listed under the United States ESA. The listed hatchery-origin fish will be directly taken for broodstock. Harvest is also allowed for hatchery-origin spring Chinook. Beginning in 2020, ESA-listed natural-origin spring Chinook are to be collected to support an integrated broodstock at Clackamas Hatchery. Following establishment of the integrated stock, the numbers of natural-origin fish collected each year shall comply with the "sliding scale" presented in this HGMP (Table 7.2), which has been developed to limit take for brood to an estimated 2.25% of the upper Clackamas River run during years of high abundance (>2,500 escapement), and eliminate take during years of low wild abundance (<1,000 escapement).

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

All listed species occupying habitats in the lower Clackamas River, the lower Willamette River, and the lower Columbia River migration corridor(s) may be indirectly impacted by the Clackamas Hatchery spring Chinook program. It is not definitively known which, if any, of these populations will be affected, but it is believed that incidental impact is minimal, based upon risk aversion measures identified in this HGMP. These listed species include:

- **Upper Willamette River Chinook (spring)**
  The Upper Willamette River Chinook ESU (listed as threatened under the Federal ESA on March 24, 1999), includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River, and upstream of Willamette Falls. Natural populations include spring Chinook in the North Santiam, the McKenzie, the Middle Fork Willamette, and the Clackamas Basins. Wild spring Chinook are commingled with those released at hatcheries located on the Clackamas, North Fork Santiam, South Fork Santiam, McKenzie, and Middle Fork Willamette rivers. Under the draft hatchery policy, NOAA Fisheries has proposed that these five hatchery stocks be designated as part of the ESU, and thus listed. Migrating adults enter Clackamas Hatchery from May through October, with spawning occurring in September and October. Run timing is influenced by weather and fall rains. Spring Chinook salmon upstream migration at North Fork Dam occurs from May through November, with peaks in July and October (ODFW 1992). Peak spawning in the Clackamas Basin above North Fork Dam occurs from late September to early October, although an August spawning component has been documented (Lindsay et al. 1998). Spawning surveys in 1998 in the lower Clackamas Basin (mouth to River Mill Dam) documented spawning of both spring and fall Chinook (Lindsay et al. 1998). Redd density in the lower basin was lower than in the upper basin for the 1998 spawning year (2.1 redds/mi vs. 6.0 redds/mi; Lindsay et al. 1998).
- **Lower Columbia River Chinook (fall)**
  The lower Columbia River Chinook salmon ESU was listed as threatened under the ESA on March 24, 1999. This ESU includes all naturally spawned Chinook populations residing below impassable natural barriers (e.g., long-standing, natural waterfalls) from the mouth of the Columbia River to the crest of the Cascade Range just east of the Hood River in Oregon and the White Salmon River in Washington.

This ESU excludes populations above Willamette Falls. Within this ESU, there are historic runs of three different Chinook salmon populations: spring-run, tule, and late-fall "bright" Chinook salmon.

- **Columbia River Bull Trout**
  The Fish and Wildlife Service issued a final rule listing the Columbia River population of bull trout as a threatened species on June 10, 1998. The Willamette River Recovery Unit forms part of the range of the Columbia River population. The Willamette Recovery Unit encompasses the Willamette River Basin, a major tributary to the Columbia River.
- **Lower Columbia River Steelhead**
  The Lower Columbia River steelhead ESU was listed as threatened under the ESA on March 19, 1998. This ESU occupies tributaries to the Columbia River between the Cowlitz and Wind Rivers Washington, inclusive, and the Willamette and Hood Rivers in Oregon, inclusive. Excluded are steelhead in the upper Willamette River Basin above Willamette Falls, and steelhead from the Little and Big White Salmon Rivers in Washington.
- **Lower Columbia River Chum**
  The Lower Columbia River chum salmon were listed as a threatened species on March 25, 1999. The ESU includes all naturally-produced and hatchery-produced populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon.
- ***Lower Columbia River Coho**
  The Lower Columbia River coho salmon were listed as a threatened species under the ESA in July, 1999. The Lower Columbia coho ESU includes all naturally spawned populations of coho salmon from Columbia River tributaries up to the Big White Salmon River on the Washington side and the Hood River on the Oregon side (including the Willamette River and tributaries as far upriver as Willamette Falls). A hatchery population was included within the ESU if NOAA determined that the hatchery fish were no more than moderately genetically divergent from a natural population included in the ESU. Eagle Creek National Fish Hatchery coho meet NOAA criteria. Coho salmon in the LCR ESU display one of two major life history types. Early returning, or Type S, coho salmon return to freshwater from August to October and spawn from October to November. The other major life history type, late returning or Type N coho salmon, return to freshwater from October through November or December and spawn primarily from November through January. Oregon coho populations consist almost entirely of early run stocks although a late run occurs in the Clackamas River.

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

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

The Willamette/Lower Columbia Technical Recovery Team (WLC-TRT) determined minimum abundance thresholds (MATs) for the Oregon Lower Columbia fall/spring Chinook, winter/summer steelhead and coho populations. (McElhany et al. 2007). The WLC-TRT established MAT values for both "critical" (very high risk of extinction) and "viable" (low risk

of extinction) status. Thresholds for chum salmon were identified, but there was insufficient data to assess the status of chum populations in the Columbia River ESU, so they are not presented here. The MAT values for "critical" status for the Clackamas populations of Chinook, coho and steelhead were 400, 1,800, and 425 respectively. The "viable" abundance levels defined for Chinook, coho and steelhead are 800, 3,300 and 750 respectively.

Current population status and de-listing scenarios identified in existing/current recovery plans

The *Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead* (LCRCRP, ODFW 2010), which is part of the larger NOAA Lower Columbia River Salmon and Steelhead Recovery Plan, adopts the biological criteria for achieving delisting that were established by the WLC-TRT (McElhany et al. 2007). The WLC-TRT criteria use a scoring system that is based on each population's 100-year probability of extinction, as categorized into "extinction risk classes." The criteria do not require each population to be "viable" (i.e., having a low extinction risk), but do require a specific number of viable populations and an aggregate level of extinction risks for all populations within strata and across ESUs that are intended to assure the ESU exists into the future.

Population assessments were completed, using the best available data and scientific inference, to determine current status, in terms of extinction risk class, and improvements necessary to lower extinction risk (i.e., "gaps" to other risk classes). Consistent with NMFS guidance, this extinction risk assessment took into account a number of biological population parameters related to salmonid viability, including abundance, productivity, spatial structure, and diversity. A sophisticated quantitative model was used to assess population abundance and productivity parameters relative to extinction risk. Assessments were done for all Oregon LCR populations, excluding chum, which are considered functionally extirpated (i.e., locally extinct) from the Oregon portion of the ESU.

In light of the current status assessments and based on delisting criteria, the delisting desired status (in terms of extinction risk class) of each population was determined in an iterative process with ODFW, the LCRCRP Stakeholder Team (Stakeholder Team), and State of Washington recovery planners, with input from NMFS and the LCRCRP Planning Team (Planning Team). Once the desired status for each population was determined, ODFW and the Stakeholder Team, with input from the Planning Team on feasibility, determined the threat reduction scenario for each population (excluding chum) utilizing the current status and gap results from the population assessments.

The threat reduction scenario shows how each population will get from its current status to the desired status through the reduction of anthropogenic impacts within a threat category. The scenario also shows the level and relative priority of actions necessary to address each threat in a population. The threat categories represent areas where current anthropogenic mortality rates were able to be estimated and actions can be applied to reduce impacts. These categories include: tributary habitat, estuary habitat, hydropower, harvest, hatchery fish, and predation. An Expert Panel approach, followed by refinement with the Planning Team and threat-specific managers, was used to determine the limiting factors and threats for each life stage and for different life cycle locations for each population. This was used to identify much more specific impacts within each threat category, as well as to guide and structure specific strategies and actions for each threat reduction.

Figure 2.2.2(a). Summary of percent improvement required for each threat category in order to achieve the desired delisting status for Oregon populations of the LCR Chinook Salmon ESU. Shared populations with Washington are indicated by an asterisk

		% Improvement of Threats (Delisting Scenario)						
Species / Stratum (Run)	Population	Tributary Habitat	Estuary Habitat	Hydro	Harvest	Hatchery	Predation	Cumulative
CHINOOK								
Coast (Fall)								
	Youngs Bay	0.00%	19.25%	---	6.67%	0.00%	28.57%	0.85%
	Big Creek	27.54%	19.25%	---	7.69%	0.00%	28.57%	4.21%
	Clatskanie	20.26%	19.25%	---	41.67%	88.89%	23.08%	8.86%
	Scappoose	2.64%	19.25%	---	41.67%	88.89%	23.08%	7.12%
Cascade (Fall)								
	Clackamas	0.00%	19.25%	---	41.67%	66.67%	17.81%	4.51%
	Sandy	31.15%	19.25%	100.00%	41.67%	66.67%	17.81%	14.55%
Gorge (Fall)								
	*Lower Gorge**	28.08%	19.25%	---	41.67%	33.33%	17.81%	10.76%
	*Upper Gorge**	27.43%	19.25%	0.00%	38.46%	33.33%	23.08%	8.63%
	Hood	100.00%	100.00%	43.85%	100.00%	100.00%	100.00%	89.24%
Cascade (Late Fall)								
	Sandy	27.86%	15.86%	100.00%	40.00%	80.00%	17.81%	25.15%
Cascade (Spring)								
	Clackamas	34.73%	15.79%	76.47%	0.00%	84.62%	42.15%	26.64%
	Sandy	0.94%	15.79%	100.00%	0.00%	81.48%	42.15%	1.97%
Gorge (Spring)								
	Hood	8.84%	15.79%	65.62%	0.00%	88.89%	55.13%	7.92%

Provide the most recent 12 year (e.g. 2002-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.

Basin-wide data for productivity do not exist for listed spring Chinook in the Clackamas basin. Counts of adult salmon at North Fork Dam are provided in Table 1.12(a).

Provide the most recent 12 year (e.g. 2002-2019) 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).*

Adult Clackamas spring Chinook are counted at the North Fork Dam by PGE Table 1.12(a). All hatchery spring Chinook salmon in the Willamette Basin, beginning with the 1997 brood, were marked with adipose fin clips. Although intentions were to mark all hatchery Chinook, less than 100% of the returning adults had an external mark for several reasons. First, a percentage of hatchery releases did not receive a clip because fin-clipping personnel failed to successfully clip the adipose fin or clipped only a portion of the fin, which then regenerated. For example, about 3% of hatchery fish were released without a clip in a sample of 76 release groups from the 1996–1999 broods. Second, fry and pre-smolts without fin clips had been released in the basin. Finally, some fish were only marked with a CWT only for research purposes.

Peak spawning activity of wild spring Chinook generally occurs during the last week of September or the first week of October (Schroeder et al. 2002, Whitman et al. 2018). In

the upper Clackamas River, the majority of redds are found upstream of the Collawash River (Whitman et al. 2018). Redd densities upstream of Pinhead Creek have increased in recent years, with some areas supporting extremely high densities of redds. In addition, 50 or more redds are now found in Oak Grove Fork. Redd densities have shifted farther upstream in the upper Clackamas River, likely the result of improved passage at North Fork Dam. The percentage of hatchery origin spawners (pHOS) has been less than 5% in the upper Clackamas in recent years, as only unclipped adults are passed upstream at North Fork Dam. Prespawn mortality remains very low in the upper Clackamas River, typically less than 5%. The majority of spawners in the upper Clackamas migrated to ocean as yearling smolts and return as age-5 adults. Spawning activity of spring Chinook salmon in the lower Clackamas has decreased in recent years. Most of these redds are found between upper and lower McIver boat ramps, where pre-spawn mortality is higher and pHOS is typically greater than 50%. Higher densities of redds are found in the lower Clackamas in late October and early November, when fall Chinook begin spawning. Tables and the information in this paragraph are from Schroeder et al. (2002) and Whitman et al (2018).

Table 2.2.2. Escapement estimates for Clackamas Spring Chinook in the lower and upper Clackamas Basin 2002-2019.

Year	Upper Clackamas River				Lower Clackamas River [a/]			
	Hatchery ChS[a/]	Wild ChS [b/]	Total ChS	% Hatchery [c/]	Hatchery ChS	Wild ChS	Total ChS	% Hatchery [c/]
2002	666	1,505	2,171	30.7%	107	58	165	64.7%
2003	731	2,633	3,364	21.7%	230	63	293	78.3%
2004	1,125	4,051	5,176	21.7%	NA	NA	NA	NA
2005	1,092	1,790	2,882	37.9%	148	47	195	75.7%
2006	251	798	1,049	23.9%	330	93	423	78.0%
2007	477	1,178	1,655	28.8%	151	57	208	72.3%
2008	146	1,626	1,772	8.2%	176	164	340	51.9%
2009	64	754	818	7.8%	48	27	75	63.9%
2010	90	1,251	1,341	6.7%	110	13	123	89.2%
2011	177	1,588	1,765	10.0%	147	88	235	62.6%
2012	99	1,729	1,830	5.5%	95	40	135	70.7%
2013	101	2,136	2,238	4.5%	17	93	110	15.8%
2014	24	960	984	2.4%	22	43	65	34.4%
2015	94	2,371	2,466	3.8%	23	52	75	31.1%
2016	90	3,390	3,480	2.6%	27	68	95	28.6%
2017	50	3,537	3,586	1.4%	NA	NA	NA	NA
2018	69	2,243	2,313	3.0%[d]	36	204	240	14.8%
2019	68	2,210	2,279	3.0%[d]	35	113	148	23.5%

[a/] Escapement estimates from spawning surveys.

[b/] Escapement estimate based on passage data from North Fork Dam provided by PGE

[c/] Unclipped hatchery fish are identified by thermally induced marks from the incubation period in the otoliths. Some are unintentionally passed at North Fork Dam each year. Estimate from 2002-2007 includes presence of double index (non-adipose fin clipped) fish in the spawning population.

[d/] Used average % hatchery (adj from otoliths results) 2013-2017. Fish are no longer thermally marked.

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

A twelve year estimate of the annual proportions of hatchery and wild fish on spawning grounds is provided in Table 2.2.2. No hatchery-origin fish have been intentionally passed above NF Dam since 2001. Only unmarked fish are allowed to migrate upstream of the North Fork Dam to the primary spring Chinook spawning grounds in the Clackamas basin. However, there is a potential that some unmarked hatchery fish could be unintentionally passed upstream. Unmarked hatchery fish can exist due to errors in the fin clipping process, or as unmarked coded-wire tagged fish (double index tag-DIT). A significant number of hatchery origin fish from 2002-2007 were unintentionally passed due the lack of an adipose fin-clip on DIT hatchery smolts released from Clackamas Hatchery. PGE staff that operated the trap at the time did not have the ability to effectively sort out these non-externally marked hatchery adults so they passed into the upper basin. The DIT program was discontinued in 2004 due to the challenges it caused with effectively removing hatchery fish from the natural spawning population.

A limited amount of quantified data exists for the percent of hatchery fish spawning naturally below North Fork Dam, though ODFW has observed that it does occur and the percentage of hatchery-origin fish is relatively high. ODFW does not believe that significant natural spring Chinook production originates from this lower portion of the basin. The amount of natural spawning habitat for spring Chinook is thought to be less than 10% of that available in the Clackamas Basin. The habitat that is available is compromised by habitat degradation and water quality problems leading to little to no natural production below the dams.

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

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

Broodstock collection and handling at Clackamas Hatchery and the North Fork Dam trap/sort facility are hatchery activities that might lead to take of listed fish. Brood are primarily collected at Clackamas Hatchery (swim-in trap), although there is the potential (in an emergency during poor return years) to also collect brood at North Fork Dam (ladder trap). Few wild (unmarked) fish swim into the Clackamas Hatchery trap, so there is only a low probability of listed-fish take. Wild fish that swim into the hatchery-trap may be incorporated into the natural-origin portion of the broodstock but are generally transported back to the mainstem Clackamas River and released.

The trap at the North Fork Dam is owned and operated by PGE, with supervision from ODFW, and serves multiple functions: sorting hatchery-origin fish from upstream migrants, monitoring of the wild population, collection of hatchery fish for brood, and downstream recycling of hatchery-origin fish. This facility is the primary collection

point for Clackamas Hatchery's natural-origin spring Chinook brood. All trapping, handling devices, and transport carry potential to stress and injure listed fish, though measures are taken to avoid such impacts.

See attached take estimate table (Attachment 4).

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

Clackamas Hatchery - Total number of fish that swam into the hatchery trap. All wild/unclipped fish were returned to the river. Note that 2002 was the first year that all returning hatchery adults were marked.

Table 2.2.3(a). Spring Chinook adult collections at Clackamas Hatchery 2004-2019.

Return Year	Adults Collected			Mortality Wild/Unclipped
	Hatchery	From North Fork	Wild/Unclipped	
2004	6,247	4,984	78	0
2005	4,544	2,248	43	0
2006	7,287	72	126	0
2007	3,799	2,307	54	0
2008	3,540	1,514	90	0
2009	1,884	1,013	43	0
2010	5,509	2,810	69	0
2011	1,774	2,131	0	0
2012	1,515	1,439	6	0
2013	2,098	861	9	0
2014	2,973	1,164	12	0
2015	3,573	1,791	2	0
2016	1028	668	1	0
2017	503	181	0	0
2018	106	55	0	0
2019	177	52	8	0

Source: Clackamas Hatchery, HMS.

***North Fork Dam**
Counts include both adults and jacks. No mortalities of wild/unclipped fish were reported. No wild/unclipped (or hatchery unclipped) fish were taken to Clackamas Hatchery for broodstock. Note that 2002 was the first year that all returning hatchery adults were marked. Marked (fin clipped or coded-wire tagged) fish have not been passed above North Fork Dam since 1998.

Table 2.2.3(b). Adult spring Chinook counted at North Fork Dam 2002-2019

Year	Wild ChS	Hatchery ChS[a/]	Total ChS
2002	2171	3558	5729
2003	3364	6115	9479
2004	5176	7854 [b/]	13030
2005	2882	2904 [b/]	5786
2006	1049	1088 [b/]	2137
2007	1655	2805 [b/]	4460
2008	1772	1886	3658
2009	818	1048	1866
2010	1341	3503	4844
2011	1765	3100	4865
2012	1830	2137	3967
2013	2238	1199	3437
2014	984	1301	2285
2015	2466	1618	4084
2016	3479	983	4462
2017	3586	205	3791
2018	2313	92	2405
2019	2279	56	2335

[a/] Starting with 1997 brood year, 100% of hatchery release was adipose fin clipped (2002 would be first complete return year through age 5)
[b/] Hatchery portion includes double index fish

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

See Attachment 4 for annual take levels of listed fish. At the North Fork Dam, take will occur independent of this hatchery program in order to pass and maintain the wild fish management area above the Dam barrier. Hatchery fish are sorted and recycled downstream or provided to Clackamas Hatchery as brood. Natural–origin fish collected, in close coordination with Clackamas Hatchery staff, at the North Fork Dam trap will be provided to Clackamas Hatchery for integration with the hatchery broodstock, at rates that limit genetic and demographic risks to the wild population (Table 7.2).

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.

ODFW will consult with the NOAA Fisheries if projected take levels may be exceeded. However, given the brood collection locations, there are limited options with respect to take. Some unmarked fish returning to the hatchery may be integrated into the broodstock, but take for this purpose will not exceed 5% of the forecast wild run. In addition, trap operations at the North Fork Dam are integral to maintaining a wild fish

sanctuary above the dam, so this operation would also likely not cease. If trapping did cease, further impacts from hatchery fish on wild fish would likely result. Overall, take in the basin might also be reduced by eliminating research projects with identified take.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan or other regionally accepted policies . Explain any proposed deviations from the plan or policies.

Clackamas Hatchery spring Chinook program is consistent with the following ESU-wide plans and policies:

a) Upper Willamette River Conservation and Recovery Plan for Chinook salmon and steelhead (OAR 635-500-6600):

In August 2011, ODFW adopted the Recovery Plan for the Upper Willamette River Chinook salmon ESU and steelhead DPS, which includes the Clackamas River spring Chinook salmon population. The plan suggested to implement actions that may reduce the effects of hatchery fish on the productivity and diversity of the wild population, principally by reducing the proportion of hatchery fish on the spawning grounds. The suggested actions are:

- Maintain a wild fish management zone in the principle spawning areas above PGE hydropower facilities.
- Evaluate/implement additional actions within the hatchery program.
- Mark all hatchery fish.

b) The Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead (LCRCRP, ODFW 2010).

The Lower Columbia River Recovery Plan adopts the biological criteria for achieving delisting that were established by the WLC-TRT (McElhany et al. 2007). The WLC-TRT criteria use a scoring system that is based on each population's 100-year probability of extinction, as categorized into "extinction risk classes." Population assessments were completed, using the best available data and scientific inference, to determine current status, in terms of extinction risk class, and improvements necessary to lower extinction risk (i.e., "gaps" to other risk classes). Consistent with NMFS guidance, this extinction risk assessment took into account a number of biological population parameters related to salmonid viability, including abundance, productivity, spatial structure, and diversity.

c) NMFS' Willamette Project Biological Opinion 2008.

The Willamette Project Biological Opinion (Chapter 5.8.5 Hatcheries) of NMFS suggested, the proposed action includes no hatchery programs in the Clackamas subbasin, but adult salmon and steelhead of hatchery origin from USACE programs upstream of Willamette Falls may stray into the natural spawning area of the UWR Chinook salmon and LCR steelhead populations in the subbasin. And to the degree that this occurs and that the stray spawners are successful at spawning in the wild, such straying would likely

have a small, adverse effect on the abundance and productivity of the affected ESA-listed populations (NMFS 2008).

d) ***NMFS' Upper Willamette Biological Opinion 2018.***

From the 2018 Upper Willamette BiOP, NMFS wrote in their conclusion, "… it is NMFS' biological Opinion that the proposed action is not likely to jeopardize the continued existence of Upper Willamette River spring Chinook salmon and winter steelhead, Lower Columbia River Chinook salmon, coho salmon and steelhead, Columbia River chum salmon, and Snake River spring/summer Chinook salmon in the action area, or destroy or adversely modify any designated critical habitat for these species." The 2018 BiOp also stated that, " ESA-listed salmon and steelhead produced in the Middle Columbia, Upper Columbia, and Snake Basin may be present in the lower Columbia River (below the mouth of the Willamette River) when UWR hatchery fish are also present. However, the co-occurrence of these species and UWR hatchery fish is extremely unlikely."

e) Fisheries Management and Evaluation Plan-Upper Willamette River Spring Chinook in Freshwater Fisheries of the Willamette Basin and Lower Columbia River Mainstem (ODFW 2001).

This document outlines the plans for selective fisheries for hatchery chinook in the Willamette and lower Columbia rivers, and plans for evaluation of the effectiveness of the fishery regulations in protecting natural spawning populations. The Fishery Management and Evaluation Plan (FMEP) calls for a comprehensive monitoring and evaluation program assessing the catch of wild fish, the abundance of wild and hatchery fish, and angler compliance throughout the basin. The results of the monitoring program are to be assessed annually. Review of the FMEP will occur in 2004 after three years of the selective fishery (which began in 2002), and every five years thereafter.

f) ***Willamette Basin Fish Management Plan- Spring Chinook Chapters (ODFW 1998)***.
This document provides direction for the management of spring chinook populations to protect and enhance naturally spawning populations of spring chinook in each of the sub-basins of the Willamette River Basin by identifying and addressing factors that impact those populations. The plan also restricts fisheries on spring chinook adults in ways consistent with rebuilding wild populations. The measures outlined in the plan are designed to maintain viable populations of spring chinook in the Willamette River.

g) ***Native Fish Conservation Policy (OAR 635-007-0502 through 0509)***

h) ***Fish Hatchery Management Policy*** **(OAR 635-007-0542 through 0548)**

These policies further refine the objectives of conservation of native fish stocks and limiting the impacts of hatchery produced fish on those native stocks. The Native Fish Conservation Policy (NFCP) defines ODFW's principle obligation for fish management as the conservation of naturally produced native fish in the geographic areas to which they are indigenous. The policy is based on the concept that locally adapted populations provide the best foundation for maintaining and restoring sustainable naturally-produced

fish. The NFCP requires a conservation plan for each native stock within a given Species Management Unit (SMU). Generally, an SMU is equivalent to an ESU. The NFCP conservation plans will contain an assessment of the status of each native stock, and a description of the desired biological status relative to measurable biological attributes, a description of short and long term management strategies to address the primary limiting factors, short and long term monitoring and research needs and a description of measurable "trigger" criteria which would indicate a change in status or a need to modify or expand recovery efforts.

The Fish Hatchery Management Policy (FHMP) compliments the NFCP in providing direction for the application of hatcheries as a fisheries management tool. The FHMP promotes the use of best management practices to ensure conservation of both naturally-produced native fish and hatchery-produced fish in Oregon. The policy requires a hatchery management plan for each program, and requires effective coordination planning be done cooperatively with other state, federal and tribal management partners, university programs, and the public. The policy also provides general fish culture and facility guidelines and measures to maintain the genetic resources of native fish populations spawned or reared in captivity.

i) *Fish Health Management Policy* (OAR 635-007-0960 to 635-007-1000).

This was developed to "minimize the impact of fish diseases on the state's fish resources." The policy applies to all forms of fish hatchery operations, including Salmon and Trout Enhancement (STEP) projects, and to all importation, transportation, release and rearing of non-aquaria species within the state of Oregon. The goal is to inspect and detect disease agents in order to contain and treat them and thus curtail potential impacts on existing fish populations.

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

- Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead
- *Clackamas River Subbasin Plan (1992)
- US vs. Canada Treaty
- The Mitchell Act's Mitigation Agreement
- Hydro Re-Licensing Agreements with PGE (FERC)
- Mitigation Agreement with City of Portland (FERC)
- NPDES permit for hatchery operations

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, if available.

The Clackamas River spring Chinook stocks are part of the basin-wide hatchery release program in the Columbia River, and all hatchery releases are adipose fin marked for

selective harvests. These stocks support sport and/or commercial fisheries in the lower Clackamas River, lower Willamette River, and lower Columbia River.

The most recent (2005-20012) average smolt-to-adult survival rate for Clackamas Hatchery spring Chinook is 0.62%. Harvests of these spring Chinook occur during the spring and summer in the Pacific Ocean, estuary, lower mainstem Columbia River, mainstem Willamette River and in the Clackamas River. See Section 1.12 for detailed information if survival rates, adult returns at Clackamas Hatchery, Eagle Creek National Hatchery, and NF Dam traps. The Fisheries Management and Evaluation Plan (FMEP) for the Upper Willamette River Spring Chinook in Freshwater Fisheries of the Willamette Basin and Lower Columbia River Mainstem (ODFW 2001) provides guidance for the management of the fisheries (recreational and commercial) to minimize harmful effects upon the survival and recovery of listed spring Chinook salmon in the Upper Willamette River Evolutionarily Significant Unit (ESU). To that end, beginning in 2002, angling regulations require the release of all unmarked spring Chinook. Only adipose fin-clipped hatchery fish may be harvested. In addition, hatchery releases are reduced to sites where straying into areas of natural production is minimized and opportunities for harvest are maximized.

In-season regulation of the fishery is based on pre-season estimates of abundance. The goal is to limit fishery impacts on wild fish to levels which ensure the survival and rebuilding of these populations. The FMEP estimates that under the current regulation strategy, a 15% exploitation rate will achieve this goal even under the most pessimistic assumptions.

3.4) Relationship to habitat protection and recovery strategies.

Clackamas Hatchery spring Chinook program supports the *Upper Willamette River Conservation and Recovery Plan for Chinook salmon and steelhead (OAR 635-500-6600)* by:

- Maintaining a wild fish sanctuary zone in areas above the North Fork Dam for natural spawning by removing all hatchery-origin fish from the trap;

- Marking all hatchery-origin fish for easy identification, sorting, and selective harvest.

Also, policies defined in the *Clackamas River Subbasin Plan* describe the position of ODFW on habitat protection and recovery strategies and priorities:

Policy 1. The Oregon Department of Fish and Wildlife shall actively pursue and promote habitat protection and improvement necessary to achieve the objectives for management of the Subbasin's fish resources.

Policy 2. ODFW shall coordinate with and advise agencies that manage the land and water resources of the Willamette basin.

Policy 3. Habitat protection shall be emphasized over habitat rehabilitation and enhancement.

Policy 4. Potential losses of fish production from habitat alteration shall be prevented or reduced to the extent possible.

Refer to the Clackamas River Subbasin Plan (ODFW 1992) for details regarding these policies as they apply to state, federal and local agencies, dams and hydropower projects, and water diversion and water withdrawals. Fishery managers recognize that habitat alteration, degradation and loss are a serious threat to the continued existence of self-sustaining populations of salmonids within the basin. Enforcing local, state, and federal laws protecting fish habitat is essential to sustaining a vital habitat base. Consequently, ODFW promotes the protection and proper management of fish habitat through coordination with local, state, and federal agencies regarding their habitat protection and management programs. ODFW also provides technical advice regarding regulatory agencies' permits, recommends actions to minimize impacts from various land and water uses that may conflict with fishery interests, and works with agencies and private landowners to complete on-the-ground habitat improvement projects.

3.5) Ecological interactions.

Hatchery fish from this program may overlap in space and time with other species of fish when they are juveniles, smolts, and adults. The program is managed to minimize adverse ecological interactions between hatchery and wild fish. Potential negative interactions which may occur are (a) genetic introgression, (b) competition, (c) disease transmission, and (d) predation. For this program specifically, these interactions have not been quantified. Although risks associated with this program are not completely known, a brief summary of the potential risks and preventive measures taken to minimize the risks are described below.

Genetic Introgression:

Genetic introgression may occur if hatchery adults spawn in the wild. This risk is managed through the following actions:

- All hatchery fish are marked with adipose fin-clip so that returning adults can be easily identified, sorted out and removed from the upstream migrant population of wild salmon at PGE's North Fork Dam on the Clackamas River. Additional markings (e.g. coded wire tags, ventral fin-clip, etc.) also apply to identify strays, and estimate survival rates of hatchery-origin fish. Hatchery adults are recycled downstream throughout the Clackamas River sport fishery areas, or delivered to Clackamas Hatchery for spawning or other disposition. Marked hatchery fish are not intentionally passed above the North Fork Dam into the upper basin, and this management limits genetic introgression from the hatchery population.

- Spring Chinook returning to Clackamas Hatchery are used as broodstock, which originated from the Willamette River spring Chinook population. Hatchery broodstock are collected throughout the adult return period, in order to limit selection on run timing. Natural origin fish will be collected from July 31 – September 15, primarily from North Fork Dam, and integrated with the hatchery population. Late-summer and

fall collection of natural-origin brood improves the accuracy of sex determination based on secondary characteristics, which are often undeveloped during the spring and early summer. Late-summer collection will also allow for confident estimation of the wild run size from passage occurring prior to July 31st, informing the appropriate collection rate to be used during August-October, per the program's sliding scale (Table 7.2).

- North Fork Dam trap was designed to expedite the upstream migration of wild fish above the North Fork Dam. Adults volitionally enter a fish ladder, are trapped and encouraged to enter a false weir where they are visually identified then shunted over to their final disposition without being handled. Final disposition is defined for naturally produced fish as continuing upstream. Hatchery fish or naturally produced fish identified for inclusion into the brood are shunted to a holding tank and transported via 2,000 gallon fish liberation trucks to Clackamas Hatchery where they are held until spawning.

Competition:

Carrying capacity is a function of both a population and its environment, and can be defined as the "upper limit of the steady-state population size that an environment can support" (Brannon et al. 1999). If freshwater carrying capacity is limited, it is possible that hatchery spring Chinook could competitively displace wild fish from their natural rearing habitats. For example, wild juveniles could be displaced as a result of residing hatchery fish. This could result in the wild fish experiencing premature emigration, competition for food and space, or increased vulnerability to predators if they are displaced from preferred habitats to less desirable or to more exposed areas. Although there are little data to substantiate whether competitive interactions are occurring in the Clackamas basin, there is a risk that it may occur in lower river reaches, below River Mill Dam. The following are several strategies ODFW uses to avoid (or minimize) risks associated with hatchery and wild spring Chinook competitive interactions and carrying capacity concerns:

- Spring Chinook smolts are released at a size (~10 fish/lb) indicative of swift emigration and little residualization. This should minimize spatial and temporal overlap, thereby reducing competition with wild juveniles for food and cover and minimizing any density-dependent effects.

- All smolts are released from Clackamas Hatchery or in lower basin locations downstream of the hatchery. These releases occur downstream of the primary wild fish production and rearing areas above North Fork Dam. Some of the hatchery releases (240,000 smolts) have been shifted to Eagle Creek Hatchery for release into Eagle Creek, to expand the fishing area, which will minimize return of adults to North Fork Dam in congregation with wild fish.

- The number of hatchery spring Chinook released from this program is considered "moderate in magnitude relative to other Columbia River production programs and is

not expected to cause serious density dependent effects in the Clackamas Basin or lower Columbia River reaches" (NMFS 1999).

- All hatchery adult fish are removed from the upstream migrating population at North Fork Dam. Thus, hatchery fish will not compete with wild fish during spawning in the upper basin where the majority of spring Chinook spawning habitat exists in the Clackamas basin. Adult hatchery fish and wild fish may compete in the lower basin, which is not considered as a major spawning habitat.

Disease Transmission:

Disease transmission results from multiple environmental factors and interacting causes. Establishing definitive cause and effect relationships for transmission between fish groups is difficult (McIvar 1997). However, because hatchery spring Chinook are reared, acclimated, released and return to the Clackamas River basin, they are potentially a source of pathogen and disease transmission to wild fish populations. ODFW recognizes the importance and magnitude of fish disease and health, and hatchery spring Chinook are managed to minimize disease transmission to wild populations. ODFW's intent, after testing the new water supply, is to rear spring Chinook on station reducing the potential for pathogen and disease transmission to wild fish populations.

Fish health goals are meant to maximize survival at all life stages using disease control and disease prevention techniques. To prevent introduction, spread or amplification of fish pathogens, all activities are conducted in accordance with guidelines developed under the ODFW Fish Health Management Policy, Pacific Northwest Fish Health Protection Committee and according to protocols outlined by the Integrated Hatchery Operations Team (IHOT 1996). Further, ODFW Fish Pathologists, along with hatchery staff, regularly monitor fish health and conduct fish disease examinations. Monitoring efforts include virus sampling, abnormal fish loss investigations, and pre-transfer and pre-liberation inspections.

Predation:

Hatchery spring Chinook released into nursery habitats may residualize within the subbasin and directly prey on naturally producing salmon and steelhead fry. Due to their location, size and time of emergence, newly emerged Chinook salmon fry and fingerling are likely to be the most vulnerable to predation by hatchery released fish (NMFS 1999). Salmonids are believed to prey on fish less than or equal to 1/3 their body length. However, direct predation by hatchery fish on naturally produced fish in migration corridors is believed to be low (NMFS 1999). In addition to direct predation, large groups of hatchery fish may attract alternate predators in rearing habitats and migration corridors, such as pinnipeds, birds, and other fish species. Indirect mortality resulting from the presence of hatchery fish has not been quantitatively demonstrated to-date. This impact on wild fish is minimized through many of the efforts listed above under "(b) Competition".

The risk management practices listed above may further separate the wild population from the hatchery population. All are conscious management decisions, intended to both

reduce risks to the wild population and optimize sport fishery opportunities, which is the primary purpose of the program. Direct benefits of the hatchery program to wild fish include adding nutrients to the system through placement of hatchery carcasses.

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.

Clackamas Hatchery:

- Chinook are incubated and reared in 52°F well-water or with Clackamas River water that is treated with ultraviolet light (UV). Either water source may be chilled during early incubation to even-up stages of egg development. After all groups of eggs are at equal developmental stages, fish are reared in natural-temperature river water.

*ODFW invested in a new gravity intake, scheduled to come online in the summer of 2020, which is upriver approximately 1 mile from Clackamas Hatchery in Rivermill Reservoir at a depth of 30'. There are 2 self-cleaning rotating drums, each with a diameter of 54" and a width of 80". The screening around each drum is stainless wedge wire with an opening of 1.75mm (0.069"), which is compliant with all NOAA criteria. The existing pumped river water intake is 100% screened with 3/16" mesh. These fish screens were inspected on October 18, 2000 and deemed non-compliant to NOAA fish screening criteria. The new gravity fed system will be the primary water supply and this system will be used as an emergency backup.

- River water withdrawal is covered under Oregon water permit number S49433 and S42105. Well water is withdrawn under permit number G8257.

- Discharge water is currently covered under NPDES individual permit number 102663.

- Clackamas River water is limited by water quality (pathogens) during summer months. This means that exposing eggs, fry, and fingerlings to untreated river water may be a disease transmission concern. To avoid these problems, eyed-eggs are shipped to Willamette Valley hatcheries for final incubation and rearing. All fish are returned to Clackamas Hatchery for rearing to smolt size and release. Beginning with 2020, however, hatchery supply water will be taken from upstream of the NF Dam, and that demonstrated lower pathogen levels in a preliminary study.

Table 4.1. Summary of water temperature and water usage (averages):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GPM	5,550	3,750	450	1,400	3,200	4,100	9,200	4,100	4,100	9,350	5,550	5,550
Temp.	36	37	38	40	46	50	55	56	52	44	40	38

- Other characteristics of Clackamas Hatchery include:

    - In the past, the major water source was by pumping from the Clackamas River.

- Beginning with the year 2020, river water will be taken by gravity flow from upstream of the NF Dam.
- The water source is accessible to anadromous fish.
- Water is from the natal stream for the cultured stock.
- The water used results in natural water temperature profiles that provide optimum maturation and gamete development.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality guidelines for temperature.
- The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) water quality guidelines for 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).
- The water supply is protected by flow alarms at the head box.
- The water supply is protected by flow and/or pond level alarms at the holding pond(s).
- The water supply is protected by back-up power generation.

Eagle Creek Hatchery:

The existing water rights for the Eagle Creek Hatchery total 110.02 cfs. This includes 0.02 cfs from one spring for incubating eggs for winter steelhead, two fish ladder passage ways at 27 cfs each located downstream of the hatchery in Eagle Creek, and 56 cfs for fish culture use derived from the hatchery intake structure located one quarter mile upstream of the hatchery in Eagle Creek. The water for raceway fish production is serial use. There are three upper banks of twelve raceways and three lower banks of thirteen raceways. During low creek flows water is serial used through all six banks of raceways. In 2001 the water line to the upper raceways was replaced with a larger size that increased the potential for 25% more water flow. Water use for production ranges from 5,785 gpm to 12,380 gpm. All water for the raceways comes via gravity flow from an intake on Eagle Creek. Summer flows in Eagle Creek limit water usage to 4000 gpm. Low flows in the summer months limit flow for each pond to 400 gpm. The hatchery monitors water discharges and is in compliance with the current NPDES permit.

Clear Creek Acclimation Pond:

The acclimation pond is operated as part of ODFW's Salmon and Trout Enhancement Program (STEP) program. No water right certificate or permit is required for the use of the surface waters of this state if the water is to be used for a salmon and trout enhancement project certified by the State Department of Fish and Wildlife under ORS 496.430 to 496.460. The associated intake is compliant with all NOAA criteria.

Willamette Valley hatcheries (tbd)*:*

Any hatchery within the Willamette Valley that may be used for Clackamas spring Chinook fry rearing must meet or exceed the recommended IHOT water quality guidelines for temperature, ammonia, carbon dioxide, chlorine, pH, copper, dissolved

oxygen, hydrogen sulfide, dissolved nitrogen, iron, and zinc. To ensure uninterrupted water supply to the hatchery, water intakes should have flow alarms which may alert hatchery staff to respond to emergency situations. Also, continued water supply must be ensured by back-up power generation. Facilities are operated under NPDES permits.

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.

Clackamas Hatchery*:* ODFW invested in a new gravity intake, scheduled to come online in the summer of 2020, which is upriver approximately 1 mile from Clackamas Hatchery in Rivermill Reservoir at a depth of 30'. There are 2 self-cleaning rotating drums, each with a diameter of 54" and a width of 80". The screening around each drum is stainless wedge wire with an opening of 1.75mm (0.069"), which is compliant with all NOAA criteria. The existing pumped river water intake is 100% screened with 3/16" mesh.The pumped river intake system, which will transition to the backup system during the summer of 2020, is 100% screened with 3/16th-inch wire mesh, rotating screens. The intake was inspected on 10-18-00 and was considered non-compliant to pre-1995 NOAA Fisheries fish screening criteria. Effluent is discharged through the pollution abatement pond during pond cleaning and chemical treatment events, to settle-out solid wastes and adequate chemical dilution, respectively, prior to discharging into the Clackamas.

Eagle Creek Hatchery*:* Hatchery intake screens currently conform with NOAA Fisheries screening guidelines. Additionally, no wild or hatchery anadromous fish are found upstream of the hatchery intake structure because the natural falls is a barrier to upstream migration.

Clear Creek Acclimation Pond*:* The intake screen currently conforms with NOAA Fisheries screening criteria.

Willamette Valley hatcheries: Water intake screens will be in compliance with NOAA Fisheries screening criteria. The hatchery facilities operate within limitations established in their National Pollutant Discharge Elimination System (NPDES) permits, to comply with the federal Clean Water Act and Oregon water quality standards.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Clackamas Hatchery and the North Fork Dam's traps are utilized to trap spring Chinook. Adult returns from Eagle Creek Hatchery releases may also be used as broodstock, if necessary. At Clackamas Hatchery, adults that swim up Dog Creek are trapped in a 60' x 10' x 3.5' adult trap. From there all adults are anesthetized and individually handled, with a portion of them being held for broodstock. Detailed broodstock collection methods and protocols are described in Section 7.

At North Fork Dam trap, adults volitionally enter a fish ladder, are trapped and encouraged to enter a false weir where they are visually identified then shunted over to

their final disposition without being handled. Final disposition is defined for naturally produced fish as continuing upstream. Hatchery fish or naturally produced fish identified for inclusion into the brood are shunted to a holding tank and transported via 2,000 gallon fish liberation trucks to Clackamas Hatchery where they are held until spawning.

At Eagle Creek Hatchery, fish enter the spawning facility volitionally via a fish ladder below an electric weir. Fish are trapped in the collection pond, which is 80 ft. x 120 ft. x 5 ft. with sloping sides.

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

- Egg Transportation - Eyed eggs shall be transported to Bonneville and Eagle Creek hatcheries and to STEP facilities in nylon bags covered with burlap. In a similar way eyed eggs shall be transported to Willamette Hatchery for the CCF Net Pens project.

- Smolt Transportation **-** Smolts and fingerlings be transported back to Clackamas Hatchery for acclimation in 1000, 2000, or 3000 gallon insulated and oxygenated liberation trucks.

- Adult Transportation - Adult spring Chinook returning to Clackamas Hatchery are trapped and used for broodstock at the hatchery. Adult spring Chinook trapped at North Fork Dam are transported via a 2,000 gallon insulated fish liberation truck equipped with oxygen and aeration to Clackamas Hatchery.

5.3) Broodstock holding and spawning facilities.

***Clackamas Hatchery*:** All spring Chinook broodstock are held at Clackamas Hatchery in two 10'x 60' concrete holding ponds with an average depth of 51". All adults are kept separate from other stocks and are spawned under a covered platform.

Eagle Creek Hatchery: If necessary, Eagle Creek Hatchery may be used for brood collection, holding, and spawning. Brood holding facilities include the collection pond and a 10 ft. x 120 ft. x 3 ft. holding channel. Fish are moved from the collection pond using a mechanical crowder, crowding fish into a water lift. Then fish slide down a tube into the holding channel. A mechanical crowder moves fish into a brail lift that transfers fish into the carbon dioxide anesthetic tank where fish are sorted. Fish not ready to spawn are returned to the holding channel. Ripe fish are handled on aluminum spawning racks.

5.4) Incubation facilities.

Clackamas Hatchery*:* Eggs are incubated in vertical, Heath-style incubator trays. There are 182 trays allowing for the incubation of 1.82 million Clackamas stock spring Chinook eggs. Water is pumped to a head tank and then distributed through the incubation trays via gravity flow.

Eagle Creek Hatchery*:* Incubation is done in the nursery building. There are 38 vertical 16-tray incubators with flow set initially to 3 gpm and raised to 4 gpm after hatching. Water use is primarily from Eagle Creek. It is screened and filtered by a gravel bed before incubation.

Willamette Valley hatcheries (tbd): Incubation facilities will have incubating trays. Approximately 725,000 eyed of spring Chinook are shipped from Clackamas Hatchery to Willamette Valley hatcheries in November for incubation and rearing. Water temperature will be monitored and recorded. Eggs are incubated in trays at lower densities so that low D.O. conditions do not arise. Incubation trays are equipped with low flow alarms, and there are also flow alarms on head boxes to alert personnel immediately in case of any water supply disruptions.

STEP Classroom Incubators*:* Up to 70,000 eyed eggs are incubated in small aquaria in classrooms throughout the Greater Portland Metropolitan area. Each classroom aquarium is supplied with 500-1,000 eggs. Fish are held only to the unfed fry stage and then released. These fish are not intended for production purposes, though ownership and responsibility by students is fostered to assure they receive adequate care and to provide awareness of watershed needs for these fish.

5.5) Rearing facilities.

Clackamas Hatchery*:* All spring Chinook fry coming back to Clackamas from Bonneville Hatchery in October are reared in two 100' x 300' asphalt rearing ponds supplied with 4,500 gpm of river water.

Eagle Creek Hatchery*:* Pond dimensions are 8' x 80' x 2'. There are 75 raceways for fish rearing, which are divided into an upper battery of 36 raceways with flow-through ponds (3 banks of 12) and a lower battery of 39 ponds (3 banks of 13). Dimension of each pond/raceway is 80' x 8' x 2'. The outermost ponds for each battery are not used for fish rearing, and so, there are 63 usable ponds.

Willamette Valley Hatcheries (tbd): The number of ponds/raceways, size, volume, and flows will be adequate to raise spring Chinook.

5.6) Acclimation/release facilities.

Clackamas and Eagle Creek Hatcheries*:* Spring Chinook releases from Clackamas Hatchery (665,000 smolts) and Eagle Creek Hatchery (240,000 smolts) are released directly into river/creek without additional acclimation.

Clear Creek Acclimation Pond*:* The pond at Clear Creek (Carver Park) is an above ground acclimation pond. The pond size is 80' x 17' x 4.5'. The flow in the pond is ~750 GPM unless there is lower fish density for one reason or another. Spring Chinook releases from Clear Creek Acclimation pond will be 140,000 smolts. The target acclimation period is three weeks for all groups of fish. However, the actual number of days varies depending on fish condition and in-river flow conditions that promote rapid emigration from the basin.

Eagle Creek Acclimation Pond*:* The pond at Eagle Creek (Eagle Fern Park) is an above ground acclimation pond. The pond size is 80' x 20' x 4.5'. The flow in the pond is ~750 GPM unless there is lower fish density for one reason or another. The target acclimation period is three weeks for all groups of fish. However, the actual number of days varies

depending on fish condition and in-river flow conditions that promote rapid emigration from the basin.

No fish of this program shall be released from other Willamette Valley hatcheries

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

Clackamas Hatchery*:* There were no reports of any significant fish loss in the last several years at Clackamas hatchery. However, the hatchery experiences bird predation from October through March.

Eagle Creek Hatchery*:* There have been no operational difficulties or disasters at Eagle Creek Hatchery that led to significant mortalities.

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.

Clackamas Hatchery*:* The hatchery is using well water and/or water filtration along with UV treatment to maintain proper fish health standards during incubation. Hatchery staff are on-call 24 hrs/day to address emergency (or unexpected) events. All ponds and head tanks are alarmed for low water levels to notify hatchery staff if an equipment failure occurs. Both water sources are hooked-up to back-up generators to ensure water supply for to the hatchery. River water is treated with UV light during incubation and to minimize disease transmission to hatchery reared fish. Monthly fish health monitoring is conducted by a fish health specialist to detect disease early and provide prevention and control measures. Eyed eggs are and shall be transferred to Willamette Valley hatcheries prior the summer months to avoid exposure to pathogens and viruses present in the Clackamas River. The adult holding pond is locked off at night and protected by a property guard to minimize disturbance to brood fish.

Eagle Creek Hatchery*:* The hatchery has low water alarm probes positioned in three strategic locations to prevent fish losses due to water flow failures. The alarm system is linked with a 24hr./ 7day security operator. Operators telephone hatchery staff and identify the trouble zone. Also the alarm sounds on station to alert staff. Fish health and disease prevention is managed in accordance with the ODFW Fish Health Management Policy and IHOT Policy and Procedures for Columbia Basin Anadromous Salmonid Hatcheries and protocols of Oregon (IHOT 1995). Any health problems are managed promptly by fish health personnel to limit mortality and reduce disease transmission. No offspring from virus-positive brood stock are allowed on station. Monthly fish health monitoring shall be is conducted by a fish health specialist to detect disease at a very early stage and provide prevention and control measures.

Willamette Valley hatcheries (tbd)*:* To avoid fish losses due to water system failure, each hatchery has a centralized monitoring and alarm system with low flow and water level alarms located throughout the system. Alarm systems are connected to a hardwired and

radio notifications system. During fish rearing season, an "on-call" schedule ensures that someone is monitoring the alarm system at all times.

Fish health and disease transmission issues are addressed as per ODFW Fish Health Management Policy, and following Policy and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1995). Fish health condition is inspected at least once in every month, and all measures are taken as per suggestion/prescription of a fish health specialist, to prevent outbreak and/or transmission of diseases.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

6.1) Source.

Historically, the Clackamas River was considered to be one of the largest producers of spring Chinook in the Pacific Northwest. Contemporary run timing, genetic diversity, and abundance were influenced by overharvest, intermittent passage at dams, and hatchery operations. Habitat alteration from industrial development began to adversely affect the Clackamas River prior to the early 1900s. These factors led to Clackamas River spring Chinook being listed as threatened under the federal ESA in 1999.

Current spring Chinook spawn timing on the Clackamas River is substantially altered from historic timing, based on egg take records in the Clackamas subbasin (ODF, 1903). "Very early" spawning spring Chinook (ODF, 1903) that once spawned in the upper river from July to late August disappeared from the population, likely a result of the construction of Cazadero Dam. Due to the dam, few to no spawners reached the upper Clackamas subbasin from 1907-1939 (Wallis 1960). The population of natural spawners above the dam was re-established after 1939 primarily from upper Willamette basin stray adults, and now mirrors the spawn timing of upper Willamette fish. Most natural production occurs above North Fork Dam. Surveys conducted in the late 1960s indicated few Chinook redds above the dam. Surveys after 1982 showed a substantial increase in redds, coinciding with increased escapement of hatchery returns and releases of adults in the upper basin.

The Clackamas River was fished intensively and has a long history of hatchery operations. The salmon hatchery built on the Clackamas River in 1876 was the first in the Northwest. The broodstock for Clackamas Hatchery spring Chinook (stock 19) program was developed beginning in 1976 from other Willamette Basin hatchery spring Chinook stock released at Dog Creek (site of Clackamas Hatchery; ODFW 1992). Clackamas Hatchery began operation in 1979 and the first release of spring Chinook from Clackamas Hatchery was in November 1979 (1978 brood). Since 1988, the Clackamas Hatchery spring Chinook broodstock have been composed entirely of returns to Clackamas Hatchery.

Hatchery reforms have been enacted to help natural origin fish rebound. Integration of natural-origin fish is planned to begin in 2020, with continued integration to promote

genetic diversity and minimize inbreeding depression in hatchery population, slow possible domestication selection, and reduce genetic risk from the program. PGE's North Fork Dam adult collection facility is the primary collection point for Clackamas Hatchery's natural-origin spring Chinook brood.

6.2) Supporting information.

6.2.1) History.

Willamette River stock of spring Chinook (fry, pre-smolts, smolts, and adults) have been released from Eagle Creek National Fish Hatchery (ECNFH) into Eagle Creek (a Clackamas River tributary) and throughout the basin since 1959. All releases of Willamette stock spring Chinook from ECNFH were discontinued after 1989.

The Clackamas River hatchery spring Chinook stock was developed from other Willamette Basin hatchery spring Chinook stock smolts released at Dog Creek (site of Clackamas Hatchery) beginning in 1976 (ODFW 1992). Clackamas Hatchery began operation in 1979 and the first releases of spring Chinook at Clackamas Hatchery were in November 1979 (1978 brood). The last release of smolts at Clackamas Hatchery from adults not collected at Clackamas Hatchery was in 1989 (1987 brood). Since 1988, the Clackamas Hatchery spring Chinook broodstock has been composed entirely of returns to Clackamas Hatchery (and North Fork Dam to a much smaller extent).

Clackamas Hatchery spring Chinook broodstock shall be used for the release of 240,000 smolts annually from Eagle Creek Hatchery. This release from Eagle Creek Hatchery began in 2015. Future adult returns to Eagle Creek Hatchery may also be used for broodstock, if necessary.

6.2.3) Annual size.

The annual broodstock collection goal is 600 adults; the majority of these fish being comprised of hatchery-origin adults that volitionally swim into the trap at Clackamas Hatchery or trapped at North Fork Dam. A relatively smaller number of natural-origin fish, also collected at North Fork Dam, are to be integrated into the brood at Clackamas Hatchery. See Table 7.2 for numbers of natural-origin fish to be integrated each year. If Clackamas Hatchery has surplus hatchery-origin adults, they may be spawned as a segregated stock to support SAFE production.

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

During the establishment of the Clackamas Hatchery broodstock it was difficult to differentiate between wild- and hatchery-origin fish, because not all juvenile hatchery fish were marked at that time. Comprehensive marking began with the 1997 brood year, such that as of 2002 all fish used for broodstock were of confirmed hatchery origin, conforming to a segregated broodstock management approach.

Beginning in 2020, broodstock management transitioned to an integrated approach, with inclusion of natural-origin spawners at rates that vary each year in accordance with the

abundance of wild spring Chinook salmon returning to the Clackamas River. The sliding scale provided in this HGMP (Table 7.2) provides guidance for wild brood integration rates that are designed to range from 0% to over 8%, (pNOB) annually, in function of wild fish abundance estimated at North Fork Dam.

6.2.5) Genetic or ecological differences.

The spring Chinook salmon broodstock at Clackamas Hatchery was founded from a mixed stock that represented several upper Willamette River populations (Willamette stock). Although the program was founded from a composite stock and managed as a segregated program, Johnson & Friesen (2014) found spring Chinook produced by the Clackamas Hatchery were more similar to natural-origin Clackamas spring Chinook than any other population examined, including those from upper Willamette River tributaries. Johnson & Friesen (2014) also found that, unlike other hatchery populations examined, Clackamas Hatchery Chinook presented lower allelic richness (i.e. genetic diversity) than the local wild population.

6.2.6) Reasons for choosing.

Given documented genetic similarity between hatchery- and natural-origin spring Chinook salmon from the Clackamas River, and greater allelic richness of the latter, integration of local, wild spring Chinook into the hatchery population is a natural choice that will preserve existing hatchery-wild genetic relationships, while boosting diversity within the hatchery population. Integration of wild fish into the hatchery brood will serve to mitigate genetic risk from the program and may improve the performance (i.e. survivorship to adulthood) of Clackamas Hatchery spring Chinook salmon.

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.

The Clackamas Hatchery Chinook salmon broodstock will be managed as an integrated population that may receive gene flow from the wild population on a regular basis. This management approach will slow down the rate of genetic divergence between the wild and hatchery populations that could result from domestication selection, and thereby will mitigate genetic risk from the program. Furthermore, sorting of hatchery- and natural-origin Chinook at North Fork Dam will afford spatial isolation to natural-origin fish while spawning in the upper Clackamas River. This practice will limit potential for genetic introgression and ecological impacts from the hatchery program on natural-origin spawners and their offspring. See Section 3.5, for additional risk aversion measures.

SECTION 7. BROODSTOCK COLLECTION

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

Returning adult salmon (including jacks) will be collected and spawned at Clackamas Hatchery.

7.2) Collection or sampling design.

Beginning in 2020, the Clackamas Hatchery will transition from using a segregated broodstock to integration of wild spring Chinook salmon. The first three years of integration will use more wild fish as spawners than in subsequent years (see Attachment 5, Genetic Rescue Research Proposal). Following these initial broodstock development or "founding" years, integration of wild fish will follow the sliding scale provided below (Table 7.2). Hatchery- and natural-origin adults will be collected at the Clackamas Hatchery trap throughout the duration of the run. Hatchery-origin adults will also be collected from the North Fork Dam trap throughout the duration of the run. However, natural-origin adults will be collected from the North Fork Dam trap, in accordance with sliding scale guidelines, only after July 31st. All natural-origin adults will be provided upstream passage above the North Fork Dam prior to this date.

Delayed collection of natural-origin adults at North Fork Dam will satisfy several important management objectives. First, it will reduce the average holding time of natural-origin brood, thereby limiting prespawn mortality and increasing mean fitness of wild fish used as brood. Second, late-summer and fall collection of brood will improve the accuracy of sex determination based on secondary characteristics, which are often undeveloped during the spring and early summer. Accurate sex determination is important, given the 2:1 mating scheme usually used during hatchery spawning. Finally, delayed collection will allow for confident estimation of the wild run size from passage occurring prior to July 31st, informing the appropriate collection rate to be used during August-October, per the sliding scale (Table 7.2).

Table 7.2. Sliding scale guidelines for collection of natural-origin (NOR) spring Chinook salmon. The cumulative count of NOR adults at North Fork Dam by July 31st will be used to forecast total run size and determine the number of NOR brood to be collected during August-October

		NOR to collect for brood		
NOR Count on 31 July	Estimated NOR run size	Males	Females	Total
<1000	<1000	0	0	0
1000-2000	1000-2500	7	14	21
>2000	>2500	15	30	45

7.3) Identity.

Natural-origin fish are identified by the presence of a fully developed adipose fin, and all hatchery-produced fish shall be adipose fin clipped. Additional marking or tagging of hatchery fish will also be used to determine survival and stray rates. However, due to marking error, up to 3% of unmarked fish may be of hatchery-origin that were poorly marked.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:2 sex ratio [male:female] for adults):

The Clackamas Hatchery maintains a broodstock collection goal of approximately 600 adult spring Chinook salmon for spawning, to meet the production goal. Natural-origin spawners may comprise of a portion of this total, depending on the strength of the wild run estimated on July 31st and in accordance with the sliding scale presented in Table 7.2. Both natural- and hatchery-origin brood will be spawned at 1:2 (male:female) ratios.

7.4.2) Broodstock collection levels for the last twelve years (2008-2019), or for most recent years available:

Table 7.4.2. Number of hatchery spring Chinook collected at Clackamas Hatchery and PGE's N. Fk. Adult Collection facility, 2008-2019.

Year	Clackamas Hatchery	N. Fk. Adult Collection[a/]	Total
2008	3540	1514	5054
2009	1884	1013	2897
2010	5509	2810	8319
2011	1774	2131	3905
2012	1515	1439	2954
2013	2098	861	2959
2014	2973	1164	4137
2015	3573	1791	5364
2016	1028	668	1696
2017	503	181	684
2018	106	55	161
2019	177	52	229

Source: Clackamas Hatchery, HMS.
a/Transported to Clackamas Hatchery.

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

Hatchery-origin adults returning to Clackamas Hatchery are allocated in accordance with the ODFW Fish Hatchery Management Policy (FHMP) to meet these priority uses:

1. Provide fish for tribal ceremonial and substance use;
2. Provide for experimental, scientific or educational uses identified in conservation plans, management plans, or other Department agreements;
3. Release downstream (recycling) to provide additional fishing opportunity;
4. As a segregated broodstock to support fish production for ODFW's lower Columbia River SAFE program;
5. For sale to generate revenue for hatchery operations, as authorized through the FHMP;

6. Nutrient supplementation in natural spawning and rearing areas to enhance ecosystem productivity, consistent with ODEQ requirements, management plans and pathology constraints;
7. Provide fish to charitable food share programs benefiting under-served Oregonians;
8. Provide fish for animal feed to animal rehabilitation shelters, zoos, or other such operations; and
9. Discard to landfill or at a rendering plant.

The ODFW Fish Division may approve additional uses or deviations from the stated order of preference to satisfy agreements with management partners, respond to unique situations or respond to unforeseen circumstances.

7.6) Fish transportation and holding methods.

The adult fish kept for brood are held in two 10' x 60' x 51" holding ponds at Clackamas Hatchery. Adult spring Chinook trapped at North Fork Dam are transported via a 1,000 gallon fish liberation truck equipped with oxygen and aeration to Clackamas Hatchery. Live fish transported by Clackamas Hatchery personnel for recycling downstream to expand fishing opportunities will be hauled in a 2,000 gal oxygenated and insulated liberation truck.

7.7) Describe fish health maintenance and sanitation procedures applied.

- ODFW Fish Health Management Policy and recommendation of IHOT Pacific Northwest Fish Health Protection committee (PNFHPC) are followed.

- Adult Chinook salmon are treated with formalin or hydrogen peroxide solution, three to five times a week, to control and minimize fungus infections.

- Adults are injected with erythromycin and/or oxytetracycline prior to holding.

- Adult mortalities (if any) are removed daily.
- Necropsies are performed on pre-spawner mortalities to determine the cause of death.

- All equipment is disinfected with Iodophore between uses. Fish transport tanks are disinfected between the hauling of different fish lots.

- High water quality standard is maintained in broodstock holding pond.

If fish are being processed for transport to food share, then adults are handled with carbon dioxide.

7.8) Disposition of carcasses.

All spawned carcasses will be rendered or used for stream enrichment purposes. All prespawn mortality will be sent to a landfill.

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

The risks of disease in broodstock will be minimized by measures described above in sections 7.7 and 3.5. Relevant fish management policies will be strictly followed to minimize disease impacts. Broodstock will be collected from the entire run period to maintain genetic diversity within the hatchery-produced population.

SECTION 8. MATING

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

8.1) Selection method.

Fish from all portions of the run will be used in the broodstock, except the natural-origin fish that will be collected after July 31st. Fish will be held at Clackamas Hatchery in their holding ponds where they will be mixed and randomly selected for spawning when they are ripe. Natural origin fish will be held separately in an adjacent pond and selected for spawning when they are ripe.

See section 7.2 for details regarding broodstock collection procedures.

8.2) Males.

Hatchery males are spawned at a 1:2 ratio with females. This ratio is used because of the size of the gene pool in the hatchery population. Precocious males (jacks) may be used in the broodstock. Back-up males are not used in the spawning protocol. All ripe adults are killed prior to spawning. Milt is placed into a cup prior to egg fertilization.

Natural-origin males and females will be randomly selected from available broodstock. The typical sex ratio for the program will be a 1:2 male-to-female spawning ratio. No backup males will be used. Precocious males (jacks) may be used in the broodstock. Milt will be placed into a cup prior to egg fertilization.

8.3) Fertilization.

Hatchery-origin broodstock will be humanely euthanized and bled prior to spawning. Hatchery eggs and sperm are fertilized according to a 1 x 2 spawning matrix. Gametes are pooled prior to fertilization. IHOT, PNFHPC, and state guidelines are followed. Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning.

Natural-origin broodstock will be humanely euthanized and bled prior to spawning. Eggs from two females will be fertilized with sperm from one male. Males will not be re-used. Fertilized eggs will be subjected to a 10 minute iodophor bath for disinfection. Trays and egg batches will be individually marked so eggs can be discarded if BKD tests are positive. If the hatchery reduces the number of eggs retained below the amount of green eggs taken, a proportional amount of each male/female cross will be culled so that the gene pool of the brood becomes representative of the parental stock. Exceptions may occur if there is a high degree of disease or epidemics associated with certain parents. If this occurs, offspring of the diseased parents may be culled to maximize the long-term survival of hatchery population without inherited disease. IHOT, PNFHPC, and state guidelines will be followed.

8.4) Cryopreserved gametes.

Not applicable to 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.

- A factorial-mating scheme (as described in Section 8.3) will be used to reduce the risk of loss of within-population genetic diversity.
- Hatchery fish will be selected and spawned randomly (while maintaining a 1:2 male-to-female spawning ratio) from the broodstock population.
- All females will be sampled for BKD during spawning. Eggs from females that test positive will be destroyed. Ovarian fluid and tissues from 60 females will be sampled for IHN, with additional sub-sampling of ovarian fluids will be done if determined necessary by ODFW Pathology. If there is no IHN present, incubation will continue without culling. If IHN is detected, eggs and fingerlings will be monitored to see if they contract the virus, and the fate of infected eggs and fingerlings will be determined by ODFW's Aquatic Veterinarian
- Green eggs are water-hardened in Iodophor solution. Shipped eyed eggs are disinfected at the receiving station.

*Natural origin fish integrated into the brood at Clackamas Hatchery will use a random spawning selection and a 1:2 male-to-female spawning ratio to avoid intentional selection of physical characteristics such as run timing, age or size etc., to maintain genetic diversity in the hatchery population. Sanitation and other preventative measures will be taken to maintain fish health and prevent transmission of diseases during mating.

SECTION 9. INCUBATION AND REARING

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

9.1) Incubation:

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

Table 9.1.1 indicates the number of eggs taken, eyed eggs inventoried, and percent survival at different stages from 2004-2019.

Table 9.1.1. Clackamas hatchery spring Chinook egg takes and survival rates, 2004-2019

Brood Year	Egg Take Green Eggs	Eyed Egg Numbers[a/]	Green Egg to Eyed Egg Survival (%)[b/]	Eyed Egg to Ponding Survival (%)[c/]	Ponding to Release (%)
2004	1,572,056	1,482,594	94.3	92.0	81.5
2005	1,731,216	1,576,250	91.0	86.2	88.5
2006	1,601,680	1,509,632	94.3	94.9	88.6
2007	1,714,764	1,615,000	94.2	78.3	77.2
2008	1,711,976	1,657,880	96.8	82.7	82.1
2009	1,831,516	1,708,444	93.3	80.6	89.9
2010	1,628,364	1,569,750	96.4	93.0	92.5
2011	1,585,552	1,505,760	95.0	88.7	83.6
2012	1,511,372	1,438,000	95.2	96.0	75.7
2013	1,229,708	1,149,900	95.0	87.5	62.5[d/]
2014	1,131,434	1,103,250	92.4	98.0	67.8 [d/]
2015	1,450,703	1,304,950	90.0	97.8	90.3
2016	1,698,176	1,539,777	92.7	86.9	76.3
2017	614,922	567,000	92.2	98.0	83.9
2018	221,965	209,750	94.5	96.6	----
2019	261,694	236,938	90.5	----	----

Source: HMIS database.

[a/] Eyed egg inventory number.

[b/] Green to eyed egg survival represents egg losses due to BKD culling. .

[c/] Eyed egg to ponding survival represents losses due to program excess, BKD culling, and shock loss.

[d/] Rearing losses due to water conditions and disease.

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

- Measures are taken to only collect the number of eggs necessary to attain annual egg take and smolt production goals. If additional eggs are taken, it is anticipated that this would not exceed 10% more than the total needed for production (IHOT 1996).

- Extra eggs are taken to compensate for the potential loss attributed to BKD culling. Excess eggs are frozen and disposed of in the landfill.

- Eggs are not culled randomly over all segments of egg-take.

- Eggs are culled at Clackamas Hatchery once for BKD and a second time if numbers exceed program goals.
- Eggs are culled based on a positive reading for BKD using ELISA.
- Juveniles are normally not culled.
- Families are not culled to minimize family size variation.
- Families are initially incubated individually at Clackamas Hatchery to allow for BKD culling. After eye-up and shocking, eggs are mixed together for shipment to other hatcheries.
- At Willamette Valley hatcheries, it is likely that culling would include only a portion of the latest egg take.

9.1.3) Loading densities applied during incubation.

- Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations are followed for water quality, flows and incubator capacities.
- Eggs are incubated under conditions that result in generally equal survival of all segments of the population to ponding. Survival is equal because the incubation equipment and methods are the same for all segments.

Table 9.1.3. Loading density, egg size, and incubator flows.

Hatchery	Egg Size (#/oz)	Loading (#/Tray)	Standard Incubator Flows (gpm/stack)
Clackamas	~97-116	8-10,000	5

9.1.4) Incubation conditions.

Clackamas Hatchery:

- Water temperatures are recorded daily. Well water averages 52ºF. River water ranges from 45-56ºF. Temperatures may be reduced by 8ºF to even-up separate lots of eggs, during early incubation.
- DO is monitored weekly, and generally falls within 9-10 ppm.

At Willamette Valley hatcheries, similar egg loading densities and flows shall be maintained.

9.1.5) Ponding.

Ponding of fry for Clackamas spring Chinook program shall occur at Willamette Valley Hatcheries.

Typical ponding scenario:

- Fry are removed from incubation units when 80-90% yolk-sac material is utilized and the remaining contained within the body cavity ("button-up").
- Fry are ponded based on visual inspection of the amount of yolk remaining.
- Fry are typically ponded in late December at about 1,600 T.U., with an average size of 1,400 fish/lb.
- Fry are not allowed to volitionally pond but are forcibly ponded.

9.1.6) Fish health maintenance and monitoring.

Clackamas Hatchery: Eggs are treated with formalin (to prevent fungus) from green egg through eyed-egg development. Treatments are administered every other day at 1,666 ppm, for 15 minutes. After eye development (~550 T.U.), eggs are "shocked", picked, and enumerated, and shall be shipped Willamette Valley hatcheries.

Eagle Creek Hatchery: Eyed eggs received from Clackamas Hatchery shall be disinfected upon arrival at Eagle Creek Hatchery. Fish health shall be monitored daily by both hatcheries' staff and on monthly basis by ODFW fish health specialists. If any problems arise, appropriate actions, including drug or chemical treatments, shall be applied.

Willamette Valley Hatcheries: Eyed eggs received from Clackamas Hatchery shall be disinfected upon arrival at Willamette Valley hatcheries. Fish health shall be monitored daily by both hatcheries' staff and on monthly basis by ODFW fish health specialists. If any problems arise, appropriate actions, including drug or chemical treatments, shall be applied.

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.

- ODFW hatcheries are operated in compliance with ODFW's Fish Health Management Policy and the Integrated Hatchery Operations Team (IHOT) fish health guidelines.
- Eggs are incubated on well water or treated river water to prevent exposure to disease.
- Eggs are kept isolated by family group.
- Water supplies and the power supply are alarmed to notify hatchery personnel if a failure occurs. Water supplies are hooked to a back-up generator, in case of a power failure.
- Hatchery staff are available 24 hr/day for immediate response to any emergency situation.

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 (2004-2015), or for years dependable data are available.

See Table 9.1.1 survival data at different life strategies.

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

- Density and loading levels differ by size of fish, size of pond, and time of year (water temperature).
- Fingerling loading criteria are generally below 2.5 lbs/gpm in raceways. Smolt loading criteria can go up to 4.4 lbs/gpm. Actual loading rarely reaches these levels.
- The juvenile rearing density and loading guidelines used at ODFW facilities are based on standardized agency guidelines, life-stage specific survival studies conducted at other facilities, and staff experience (e.g. trial and error).
- IHOT standards are followed for water quality, predator control measures, loading, and density.

9.2.3) Fish rearing conditions.

Clackamas Hatchery: ODFW plans to rear most of Clackamas spring Chinook at Clackamas Hatchery. Rearing conditions and strategies will be evaluated as the new water source comes online. Pond monitoring shall be conducted daily, to observe any sign of stress, disease, water quality and general fish health and behavior. Fish mortalities will be picked and recorded daily.

If fish are unable to be reared at Clackamas, fingerlings returned from Willamette Valley hatcheries (18 fish/lb) shall be reared to 10-12 fish/lb at Clackamas Hatchery for release from February-April into Clackamas River. All 665,000 fingerlings will be reared on river water with temperatures ranging between 45-65ºF. During highest fish rearing densities, D.O. levels will be monitored weekly and maintained at 6 ppm or greater Fish will be reared in 100' x 300' asphalt rearing ponds with 4,500 gpm average flow.

Eagle Creek Hatchery: All 240,000 fingerlings will be reared on river water with temperatures ranging between 35-65F. During highest fish rearing densities, D.O. levels will be monitored weekly and maintained at 6ppm or greater. Fish are reared in 8' x 80' concrete raceways with 300-800 gpm average flow. Release will occur from February-April into Eagle Creek when fish are 10-18 fish/lb.

Willamette Valley Hatcheries: Pond monitoring shall be conducted daily, to observe any sign of stress, disease, water quality and general fish health and behavior. Fish mortalities are picked and recorded daily.

At all facilities:

- Water quality shall be monitored and recorded regularly, as per requirement of the NPDES permits.

- Rearing ponds shall be maintained in a clean and healthy condition. Settleable solids, unused feed, feces, and mortalities shall be removed regularly to ensure proper cleanliness of rearing containers.

- ODFW Fish Health Management Policy and IHOT standards for fish rearing shall be followed.

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

Fish size or growth is measured monthly as number of fish per pound at all facilities. Data are recorded onto monthly ponded fish reports and entered into the ODFW Hatchery Management Information System (HMIS) database. Fish feeding schedules are regulated based upon fish size data in order to achieve desired size at release. Length frequency data are only collected at the time of release. Typical fish growth observed for Clackamas Hatchery spring Chinook at Willamette Hatchery is presented at Table 9.2.4.

Table 9.2.4. Fish growth (number of fish/lb) of Clackamas Hatchery spring Chinook observed at Willamette Hatchery.

Month	Number of Fish/lb (Spring Release)	Life Stage
January	1,275	Fry
February	900	Fry
March	500	Fry
April	250	Fry
May	100	Fry
June	75	Fingerling
July	40	Fingerling
August	20	Fingerling/Smolt
September	14	Smolt
October	11.5	Smolt
November	10.5	Smolt
December	10	Smolt
January	9.5	Smolt
February	9	Smolt
March	9	Smolt

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

See Table 9.2.4 above for fish growth. No energy reserve data is 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*).

Usually BioVita and BioClark's feed are used for Clackamas spring Chinook rearing program (Table 9.2.6).

Table 9.2.6. Food type, size of food particle, and food conversion efficiency for Clackamas Hatchery spring Chinook rearing.

Feed Type	Fish Size Range (fish/lb)	Average Food Conversion Ratio
BioVita Starter #0	Swimup - 570	0.73
BioVita Starter #1	570 - 300	0.71
BioVita Starter #2	300 - 150	0.86
BioClark's Fry 1.2mm	150 - 90	0.89
BioClark's Fry 1.5mm	90 - 50	0.92
BioClark's Fry 2.0mm	50 - 20	0.92
BioClark's Fry 2.5mm	20 - 10	1.15
BioVita Fry 2.5mm	20 - 10	1.10
BioClark's Fry 3.0mm	10 - 6	1.19

All fish are fed starting with the BioVita starter. Feed particle size increases with the increase in fish size. Fish are fed on a demand basis 6 to 10 times a day. At 500 fish/lb, they are put on a feeding schedule and fed a set amount per day. Fish are fed daily and potentially multiple times per day if needed to get their daily amount.

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

Fish health is monitored daily by hatchery staff and on a monthly basis by ODFW fish health specialist. Appropriate actions including use of medicated feed or chemical treatments are applied, if fish health problem arises. 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 or amplification to or within the watershed.

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

The migratory state of the release population is determined by age, size, behavior, physical appearance, and other criteria. Prior to release, length frequency data are measured. No gill ATPase activity is measured.

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

Some of the yearling smolts shall be released directly from Clackamas Hatchery (665,000 smolts) and Eagle Creek Hatchery (240,000), where fish are reared using natural river/stream waters. Other releases from Eagle Creek and Clear Creek acclimation ponds are acclimated for a period of up to three weeks, using natural waters and released

volitionally. Acclimated release (versus direct release of large groups of fish) is believed to reduce the impact of density-dependent effects - fish leave voluntarily while experiencing on-site environmental cues and conditions such as, flow, temperature, light, and weather conditions. In addition, these basin specific environmental cues, along with pre-migration imprinting are believed to encourage adult homing to release areas. Fish are forced out of the pond at the end of the acclimation period.

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.

Risk aversion measures are described in this section above, in Section 3.5, in other parts of this document, in the FMEP, and in other relevant policies. ODFW's Fish Health Management Policy, PNFHCP, and IHOT fish health guidelines are followed to prevent transmission of diseases between lots of fish on site or transmission or amplification to or within the watershed. Rearing ponds are cleaned on weekly basis or as necessary through visual observation of solid wastes on pond bottom. Effluent water quality is monitored as per NPDES permit requirements and data are reported to Oregon Department of Environmental Quality. During fish rearing, feeding schedule and daily feed application rates are adjusted so that no uneaten feed is left on pond bottom, to prevent the rearing ponds and effluent receiving stream from water fouling and undesirable bacterial growth.

Fish are released at a size and during a high flow event whenever possible to encourage rapid downstream migration and thereby minimize interactions with natural origin fis

SECTION 10. RELEASE

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

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 releases of Clackamas Hatchery spring Chinook.

Age Class	Size (fpp)	Release Location	Annual Release Level and Marking	Release Date
Eyed Eggs	X	X	X	
Unfed Fry	≥900	*Various locations through STEP	60,000 (unmarked)	December
Fry	X	X	X	
Fingerling	X	X	X	
Yearling Smolts	10-15 f/lb 10-15 f/lb 10-15 f/lb	Clackamas River Clear Creek (STEP) Eagle Creek	665,000 (100% Ad-clip; 50K CWT) 140,000 (100% Ad-clip; 50K CWT) 240,000 (100% Ad-clip; 50K CWT)	Feb-April Feb–April Feb-April

NOTE: In the Clackamas River, all release locations will remain below river mile 30. Unfed fry releases in the Willamette, Columbia, Sandy, and Molalla rivers occur in the mainstem and only in areas with hatchery fish influence. Total numbers released will remain constant and not exceed 1.2 million smolts. Also, see the flow diagram on page #5 for release details.

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

In the Clackamas River, all release locations will remain between river mile 30 and 0. Numbers of fish released at different locations in this area may vary. Below are listed the historic release sites, though others may be incorporated for management purposes. Unfed fry releases in the Willamette, Columbia, Sandy, and Molalla Rivers occur in the main stem portions of these rivers only. These locations all have hatchery influence and individual sites are dictated by the teacher for each classroom, most likely based upon proximity to the school and ease of access.

Stream, river, or watercourse: Clackamas River (waterbody code = 0300200000)
Release point: RM 22.6 (Clackamas Hatchery)
Major watershed: Clackamas
Basin or Region: Willamette

Stream, river, or watercourse: Eagle Creek (waterbody code = 0200700000)
Release point: RM to be determined
Major watershed: Clackamas
Basin or Region: Willamette

Stream, river, or watercourse: Clackamas River (waterbody code = 0300200000)
Release point: Any Mainstem Site below RM 30
Major watershed: Clackamas
Basin or Region: Willamette

Stream, river, or watercourse: Willamette River (waterbody code = 0300120000)
Release point: Any Mainstem Site (STEP Classrooms)
Major watershed: Willamette
Basin or Region: Columbia

Stream, river, or watercourse: Columbia River (waterbody code = 0300000000)
Release point: Any Mainstem Site (STEP Classrooms)
Major watershed: Columbia
Basin or Region: Columbia

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

Table 10.3. Actual release numbers, locations, and size of fish released in the past from Clackamas Hatchery spring Chinook program, 2003-2019.

Release Date	Brood Year	Release Location	Number Released	Fish per Pound
07/16/03*	2002	Clackamas Hatchery	286,998	17.0
03/16/04	2002	Cassidy Pond	50,752	12.8
03/18/04	2002	Clackamas Hatchery	571,085	10.7
03/23/04	2002	Clackamette Cove Net Pens	87,417	9.9
03/23/04	2002	Clackamas River	133,944	8.6
03/24/04	2002	Clackamas River	15,885	9.0
07/13/04	2003	Clackamas Hatchery	303,620	17.9
02/18/05	2003	Clackamas Hatchery	21,000	10.5
03/10/05	2003	Clackamas River	76,856	10.4
03/11/05	2003	Clackamas Hatchery	210,287	10.5
03/11/05	2003	Clackamas River	79,568	10.3
03/14/05	2003	Cassidy Pond	50,490	10.1
03/16/05	2003	Clackamas Hatchery	268,364	9.9
03/18/05	2003	Clackamette Cove Net Pens	79,024	10.1
03/21/05	2003	Eagle Creek	54,912	11.2
07/16/05	2004	Clackamas Hatchery	205,435	23.2
03/13/06	2004	Eagle Creek	62,043	12.0
03/16/06	2004	Cassidy Pond	51,856	11.7
03/17/06	2004	Clackamas Hatchery	227,101	10.9
03/20/06	2004	Clackamas River	148,496	10.0
03/21/06	2004	Clackamas River	24,701	9.5
03/21/06	2004	Clackamette Cove Net Pens	79,676	9.9
03/30/06	2004	Clackamas Hatchery	270,565	10.6
07/12/06	2005	Clackamas Hatchery	322,437	20.9
03/12/07	2005	Clackamas Hatchery	62,014	11.0
03/12/07	2005	Delph Creek	47,800	12.0
03/12/07	2005	Eagle Creek	107,310	10.7
03/13/07	2005	Foster Creek Acclimation	42,900	10.8
03/14/07	2005	Cassidy Pond	49,872	11.6
03/20/07	2005	Clackamas River	111,119	10.9
03/20/07	2005	Clackamette Cove Net Pens	81,756	11.4
03/21/07	2005	Clackamas River	52,698	10.9

Release Date	Brood Year	Release Location	Number Released	Fish per Pound
03/23/07	2005	Clackamas Hatchery	278,878	10.3
10/08/07	2006	Clackamas Hatchery	321,337	10.6
11/27/07	2006	Clackamas Hatchery	90,847	11.7
03/10/08	2006	Cassidy Pond	48,543	11.7
03/10/08	2006	Foster Creek Acclimation	47,005	11.4
03/11/08	2006	Clackamas Hatchery	45,177	10.9
03/11/08	2006	Eagle Creek	149,996	10.9
03/17/08	2006	Clackamas River	78,709	7.9
03/17/08	2006	Clackamette Cove Net Pens	83,044	9.2
03/18/08	2006	Clackamas River	58,191	8.2
03/19/08	2006	Clackamas River	5,621	7.7
03/27/08	2006	Clackamas Hatchery	289,264	12.6
10/09/08	2007	Clackamas Hatchery	220,876	10.6
03/16/09	2007	Clackamas Hatchery	12,240	13.6
03/16/09	2007	Eagle Creek	164,356	13.6
03/24/09	2007	Cassidy Pond	49,470	14.9
03/24/09	2007	Foster Creek Acclimation	54,077	12.3
03/25/09	2007	Clackamas Hatchery	300,858	14.6
03/31/09	2007	Clear Creek Acclimation	59,388	13.4
04/23/09	2007	Clear Creek Acclimation	80,881	9.9
10/12/09	2008	Clackamas Hatchery	200,037	16.2
03/10/10	2008	Clackamas Hatchery	356,169	12.0
03/25/10	2008	Foster Creek Acclimation	42,915	7.5
03/30/10	2008	Cassidy Pond	60,340	7.9
04/14/10	2008	Eagle Creek Acclimation	86,307	11.5
04/14/10	2008	Clear Creek Acclimation	58,034	8.4
04/26/10	2008	Youngs Bay	130,571	10.3
05/03/10	2008	Clear Creek Acclimation	50,828	7.4
05/18/10	2008	Eagle Creek Acclimation	93,228	9.7
10/06/10	2009	Clackamas Hatchery	319,008	17.7
03/06/11	2009	Foster Creek Acclimation	41,098	9.2
03/10/11	2009	Clackamas Hatchery	382,580	11.0
03/14/11	2009	Eagle Creek Acclimation	84,212	16.9
03/14/11	2009	Clear Creek Acclimation	49,029	8.1
03/22/11	2009	Cassidy Pond	50,583	8.6
04/05/11	2009	Clear Creek Acclimation	50,894	8.6
04/06/11	2009	Eagle Creek Acclimation	84,145	15.5

Release Date	Brood Year	Release Location	Number Released	Fish per Pound
04/26/11	2009	Clear Creek Acclimation	50,802	9.0
04/30/11	2009	Eagle Creek Acclimation	81,454	14.7
09/29/11	2010	Clackamas Hatchery	293,293	16.0
03/12/12	2010	Eagle Creek Acclimation	81,071	13.4
03/12/12	2010	Clear Creek Acclimation	42,436	9.2
03/14/12	2010	Clackamas Hatchery	51,378	10.1
03/15/12	2010	Clackamas Hatchery	405,492	12.5
03/19/12	2010	Foster Creek Acclimation	52,790	9.8
04/02/12	2010	Eagle Creek Acclimation	82,176	12.6
04/02/12	2010	Clear Creek Acclimation	53,119	9.9
04/24/12	2010	Eagle Creek Acclimation	71,401	12.6
04/30/12	2010	Clear Creek Acclimation	50,018	8.6
03/07/13	2011	Clackamas Hatchery	319,500	13.5
03/11/13	2011	Clackamas Hatchery	373,285	10.8
03/14/13	2011	Foster Creek Acclimation	49,900	12.5
03/15/13	2011	Eagle Creek Acclimation	74,535	11.0
03/22/13	2011	Clear Creek Acclimation	45,748	11.3
04/08/13	2011	Tongue Point	101,260	11.8
04/10/13	2011	Eagle Creek Acclimation	68,442	10.7
04/11/13	2011	North Fork Reservoir	4,455	9.0
05/03/13	2011	Eagle Creek Acclimation	37,300	9.0
03/07/14	2012	Clear Creek Acclimation	50,838	11.5
03/11/14	2012	Clackamas Hatchery	343,735	11.5
03/14/14	2012	Young's Bay	187,395	11
03/20/14	2012	Clackamas Hatchery	40,163	10.5
03/25/14	2012	Eagle Creek Acclimation	37,571	9.8
03/28/14	2012	Clear Creek Acclimation	56,944	10.5
04/25/14	2012	Clear Creek Acclimation	60,385	10.9
05/02/14	2012	Eagle Creek Acclimation	77,896	9.8
03/05/15	2013	Clackamas Hatchery	409,991	9
03/09/15	2013	Eagle Creek Hatchery	104,445	10.7
03/15/15	2013	Clear Creek Acclimation	30,050	10
03/26/15	2013	Clackamas Hatchery	38,001	10
02/22/16	2014	Young's Bay	260,386	11.8
03/02/16	2014	Eagle Creek Hatchery	205,282	15.3
03/04/16	2014	Clackamas Hatchery	410,729	11.8

Release Date	Brood Year	Release Location	Number Released	Fish per Pound
03/10/16	2014	Clackamas Hatchery	15,300	10.2
03/02/17	2015	Young's Bay	219,874	13.4
03/06/17	2015	Clackamas Hatchery	301,053	10.8
03/20/17	2015	Clackamas Hatchery	127,108	10.3
01/10/17	2015	Eagle Creek Hatchery	216,217	13.0
03/20/17	2015	Clear Creek Acclimation	68,245	11.7
04/07/17	2015	Clear Creek Acclimation	62,403	10.3
02/28/18	2016	Young's Bay	249,544	11.7
02/28/18	2016	Clear Creek Acclimation	71,088	13.1
03/06/18	2016	Clackamas Hatchery	7,778	11.8
03/08/18	2016	Clackamas Hatchery	398,433	12.0
03/20/18	2016	Eagle Creek Hatchery	242,027	15.8
03/28/18	2016	Clear Creek Acclimation	48,888	12.4
02/04/19	2017	Clackamas Hatchery	199,992	14.8
03/19/19	2017	Clackamas Hatchery	266,192	12.8

*Partial release data for RY 2003.

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

Exact release dates vary based on fish status (primarily weight), river flow conditions, onset of water quality problems (pre-smolt summer release), transfer scheduling, and logistical constraints for rearing other stocks. However, releases occur in the months indicated in the Table 10.1. See Table 10.3 for actual dates of release.

Hatchery smolts and pre-smolts are normally forcibly released (crowded out) into the Clackamas River from Clackamas Hatchery via Dog Creek (the hatchery outlet). Smolts released from Clear Creek and Eagle Creek are from acclimation facilities and are forcibly released (crowded out). Releases from STEP classroom incubators are directly into the river. Releases from Eagle Creek Hatchery shall be forced release into Eagle Creek.

10.5) Fish transportation procedures, if applicable.

IHOT guidelines for transportation are followed. All smolts are transported in 1000, 2000, or 3000 gallon liberation trucks equipped with insulation, aeration, and oxygenation facilities.

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

Two groups of fish are acclimated for 2-3 weeks at the Clear Creek and Eagle Creek acclimation facilities. The first groups are released from February – March and the

second groups are released March - April. The above ground construction of these ponds is not conducive to volitional releases so fish are forcibly released (crowded out). Additional acclimation sites are under review.

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

All smolts of Clackamas Hatchery spring Chinook program are fin marked (adipose fin clip) to differentiate between natural- and hatchery-origin fish, and to facilitate mark selective fishery and adult sorting at North Fork Dam. In addition to adipose fin-clip, all smolts of Clackamas Hatchery spring Chinook program will be routed through fin marking trailers and may receive CWTs (Table 1.11.2). Also, a portion of 240,000 smolts release from Eagle Creek and 140,000 release from Clear Creek acclimation sites shall have CWTs. Additional fin clips may be used periodically for specific monitoring and evaluation projects, if necessary.

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

ODFW does not anticipate surplus production; however, if surplus is identified, NMFS will be notified. Surplus hatchery x hatchery crossed sub yearlings will be released in the lower Clackamas River, such as Dog Creek, or SAFE areas. Broodstock collection and egg-take protocols are reviewed and adjusted annually.

10.9) Fish health certification procedures applied pre-release.

ODFW Fish Pathology staff perform fish health inspections prior to smolt release. Results are reported on the ODFW fish health forms. All groups of fish are sampled to examine for the presence of "reportable pathogens" as defined in the PNFHPC disease control guidelines, within 3 weeks prior to release. Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guidelines and ODFW Fish Health Management Policy. Fish are also inspected prior to each transfer from one facility to the next.

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

Contingency plans are in place to deal with chemical spills or water system failures. In the event of a complete water system failure, all fish shall be released in the same river for which the release program was designed, after consultation and approval of the Regional or Manager. Any fish not programmed for release into the hatchery's basin would be transported to another facility if feasible or allowed to die in the ponds. In the event of a partial water system failure or a chemical spill upstream, fish would be saved according to the following priorities:

1. Broodstock
2. Eggs and fry
3. Fingerlings
4. Smolts

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.

- Most fish are acclimated for a three-week period to promote adult homing to the lower Clackamas River, Eagle Creek, Clear Creek, and to Clackamas Hatchery.

- All smolts shall be released in the spring to promote swift outmigration, which may reduce the retention time during emigration and minimize potential ecological interactions with native wild fish. ODFW does not anticipate surplus production however, surplus hatchery x hatchery sub yearling crosses will be released in the lower Clackamas River, such as Dog Creek, or SAFE areas. A fall-release of sub-yearling migrants may be released to better represent the suite of juvenile life histories expressed by wild spring Chinook in the Clackamas River.

- Smolts are released at sizes larger than natural fish, but at the same life history stage. This is to decrease the time period the hatchery fish spend in the river. Willamette Basin survival studies have shown smaller fish tend to spend more time in the river before passing Willamette Falls on their way to the ocean, increasing the potential for interactions with wild fish.

- All smolts are released downstream of the wild fish sanctuary area (above North Fork Dam) and not allowed to enter this area upon return as adults.

- Mark quality checks are performed (to identify the percentage of unmarked smolts released) prior to smolt acclimation and release.

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.

ODFW Hatchery staff will collect and record data concerning all aspects of the fish propagation program, including water quality, hatchery returns, spawners, eggs, rearing, and release. Data pertaining to fish numbers will be entered into ODFW's HMIS database. Water quality information will be reported to DEQ and kept on hand. Information about hatchery practices will also be collected and kept on hand. ODFW hatchery staff and Pathology Section staff will test, treat if needed, and record information related to fish disease. Indicators which will be covered under these on-going and standard ODFW practices are:

- *Indicator (1)(a):* Production goals are met.

- *Indicator (4)(a)*: Verify that mark rate at release is 95% to 100% for all release groups.

- *Indicator (5)(a):* Run timing of hatchery spring Chinook returning to Clackamas Hatchery.

- *Indicator (5)(b):* Run timing of hatchery spring Chinook used in broodstock.

- *Indicator (5)(d):* Origin of fish used in broodstock as indicated by fin clips or coded-wire tags.

- *Indicator (6)(a)*: Run timing, body size (length and weight), sex composition, fecundity (egg number and egg size), adult:jack ratio, and age distribution.

- *Indicator (7)(a)*: Inclusion of natural origin fish into the broodstock will occur.

- *Indicator (7)(b)*: All fish without fin clips or coded-wire tags (CWTs) returning to Clackamas Hatchery will be returned to the river with minimum physical stress. Some unmarked fish (maximum of 5% of forecast wild run) returning to the hatchery may be considered for integration into the broodstock.

- *Indicator (8)(b)*: Hatchery spring Chinook juveniles will be released as smolt sized fish to encourage rapid migration and minimize residualism. A fall-release of sub-yearling migrants may be released to better represent the suite of juvenile life histories expressed by wild spring Chinook in the Clackamas River.
- *Indicator (11)(a)*: Number of broodstock sampled and pathogens observed are within specified guidelines.• *Indicator (11)(b)*: Rearing survival rates (egg-to-fry and fry-to-smolt) are within guidelines.
- *Indicator (11)(c)*: Number of juveniles sampled and pathogens observed during rearing and immediately prior to release are within guidelines.

- *Indicator (12)(a)*: Water sample collection and reporting records.

- *Indicator (14)(a)*: Number of annual injuries and mortalities of wild spring Chinook captured in adult collection traps will be tracked.

- *Indicator (14)(b)*: Number of wild spring Chinook captured, dates, and frequency of adult collection trap operations will be tracked.

ODFW North Willamette Fish District and ODFW Fish Division staff will ensure that the program details and direction are consistent with pertinent policies and native fish objectives. Indicators which will be covered under these on-going and standard ODFW efforts are:

- *Indicator (2)(a)*: Reviews identify that hatchery program management decisions and practices are implemented consistent with the policies and plans.

- *Indicator (4)(b)*: Sport fisheries in the Lower Columbia, Willamette, Clackamas Rivers and Eagle Creek require all unmarked fish to be released unharmed (as per the Upper Willamette Chinook FMEP).

- *Indicator (8)(a)*: Hatchery spring Chinook release locations will be in the lower Clackamas River (below river mile 30; including tributaries) and in Eagle Creek.

- *Indicator (8)(c)*: Hatchery spring Chinook juveniles will be released at times and locations to reduce impacts to local habitat carrying capacity.

- *Indicator 9(a)*: The proportion of hatchery spring Chinook observed on spawning areas above North Fork Dam.

- *Indicator (13)(a)*: Inspections of screens for compliance with ODFW and NOAA fish screen criteria.

ODFW North Willamette Fish District and/or ODFW Columbia River Management Program staff will conduct harvest management studies (i.e., creel studies) and complete carcass placement (stream nutrient enrichment) projects. Specific creel studies currently exist for the Lower Willamette and Clackamas Rivers, as well as for Columbia River sport and commercial fisheries (overseen by the Columbia River Management Program). The Columbia River Management Program also analyzes CWT returns. The North Willamette Fish District also coordinates and reports on carcass placement projects in the Clackamas Basin. Indicators which will be covered under these on-going and standard ODFW efforts are:

- *Indicator (3)(a)*: Number of adult hatchery spring Chinook produced, and the number of adult hatchery spring Chinook harvested in the Clackamas River sport fishery, Lower Willamette River sport fishery, Lower Columbia River sport fishery, and Lower Columbia gillnet fishery.

- *Indicator (3)(b)*: Number of wild spring Chinook handled and released during selective fisheries, estimated mortality rates, and estimated impact to the wild spring Chinook population.

- *Indicator (4)(b)*: Sport fisheries in the Lower Columbia, Willamette, and Clackamas Rivers require all unmarked fish to be released unharmed (as per the Upper Willamette Chinook FMEP).

- *Indicator 10(a)*: Number, timing, and spatial distribution of hatchery carcasses placed for nutrient enrichment will mimic that of historic wild fish.

- *Indicator 10(b)*: Hatchery carcasses placed for nutrient enrichment will comply with ODFW disease guidelines.

- *Indicator 10(c)*: All permits required by DEQ will be obtained, and activities will comply with all permit conditions.

- *Indicator (15)(a)*: Punch card information, creel surveys, and commercial catch data will be evaluated to determine fishery benefits of the hatchery program.

PGE maintains the fish ladder and adult collection facilities on the North Fork Dam. This structure allows the upper Clackamas River basin to be managed with an emphasis on wild fish production. ODFW and PGE coordinate on ladder and collection facility operation. Indicators which will be covered under these on-going and standard ODFW and PGE efforts are:

- *Indicator 5(c)*: Run timing of wild spring Chinook returning to North Fork Dam.

- *Indicator (7)(c)*: All fish without fin clips or coded-wire tags returning to North Fork Dam will be passed above the adult trap with minimum physical stresses.

- *Indicator 9(a)*: The proportion of hatchery spring Chinook observed on spawning areas above North Fork Dam.

- *Indicator (14)(a)*: Number of annual injuries and mortalities of wild spring Chinook captured in adult collection traps will be tracked.

- *Indicator (14)(b)*: Number of wild spring Chinook captured, dates, and frequency of adult collection trap operations will be tracked.

Finally, other on-going monitoring of fish populations occurs through ODFW's Corvallis Research Lab (Environmental Monitoring and Assessment Program [E-MAP], spawning surveys, habitat surveys, focused research such as Firman et.al. 2002 and Lindsay et.al. 2002), PGE (smolt emigration at North Fork Dam, focused research), the USFS (juvenile surveys, smolt trapping), and other entities. These monitoring efforts do not address any specific indicator, but information collected by these activities will be used by ODFW to evaluate and guide the overall hatchery 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.

Currently, funding and logistics are in place for almost all of the indicators described above. This funding is in the form of base budgets, project-specific grants, agreements with other entities, or direct work conducted by other entities. All of this funding, through the various sources, is subject to change or not be renewed. Continuation of the hatchery program and monitoring depends on the continued commitment and support of co-managers, funding entities, and state budget decision-makers.

Additionally, the Department has identified monitoring and evaluation projects that would be conducted if funding and staff were available. Projects are listed in priority order. Also see Sections 1.16.2 and 1.16.3.

- Assess incidental impacts to wild spring Chinook during lower Clackamas River sport fishery.

- Enumerate adult escapement of wild spring Chinook in habitats overlapping sport fishery areas.

- Compare genetic composition of naturally-produced adults to hatchery adults over time.

- Compare age composition of broodstock collected and natural spawners.

- Quantify stray rates to out-of-basin areas.

- Evaluate annual release numbers from all programs in the basin and sub-basin, including size and life-stage at release, and length or acclimation by program and relate to carrying capacity (i.e., smolt production potential) and spring Chinook production areas within the Clackamas River drainage.

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.

There are no additional risk aversion measures, beyond those identified earlier in this document, applied specifically because of monitoring activities.

SECTION 12. RESEARCH

As the Clackamas Hatchery transitions from using a segregated broodstock to an integrated program, parentage-based (genetic) tagging will be used to investigate the relative contribution of wild brood to subsequent adult returns. This research is briefly described in this Section, and additional details are provided in Attachment 5.

12.1) Objective or purpose.

ODFW-led research will compare the productivity of wild- and hatchery-origin spring Chinook salmon brood, as measured through adult returns to Clackamas Hatchery.

12.2) Cooperating and funding agencies.

This research will be conducted by ODFW, and with collaboration from the Oregon Hatchery Research Center (OHRC) and the State Fisheries Genomics Laboratory.

12.3) Principle investigator or project supervisor and staff.

Research will be led by Dr. Marc A. Johnson (ODFW), with participation from ODFW District Fish Biologist, Ben Walczak, and other ODFW staff.

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

Same as Section 2.

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

Natural-origin spring Chinook salmon will be collected primarily at North Fork Dam of the Clackamas River and held at the Clackamas Hatchery. Genetic (fin tissue) samples will be collected from these adult fish, prior to or at time of spawning. Standard ODFW procedures, including any necessary administration of antibiotics, will be followed to safeguard the health of all brood used for this research. Genetic samples collected from brood will serve as parental-based tags of offspring produced at Clackamas Hatchery.

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

Samples will be collected from brood spawned in 2020-2022, and their putative adult offspring that return to the Clackamas Hatchery in 2025-2028. Analyses of samples will be completed in 2029.

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

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

This research involves the direct take of natural-origin spring Chinook for use as brood at the Clackamas Hatchery. As described in Attachment 5, approximately 120 natural-origin adult spring Chinook will be collected at North Fork Dam in 2020, 2021 and 2022. Adult fish will be water-to-water transferred from the trap to a transport truck for delivery to the hatchery. Standard ODFW broodstock holding procedures will be used to minimize potential for injury or mortality to brood.

12.9) Level of take of listed fish:

Number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1). A total 120 natural-origin spring Chinook (40 males, 80 females) will be collected, spawned and killed each year of 2020, 2021, 2022 for this research.

12.10) Alternative methods to achieve project objectives.

No alternative methods have been identified.

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

N/A

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

research activities.

This research is designed to evaluate the adult-to-adult productivity of natural- and hatchery-origin spring Chinook salmon spawned at Clackamas Hatchery. Measures will be taken to minimize the holding time of listed fish, so as to limit pre-spawn mortality. Standard ODFW procedures will be used to further ensure the health of brood prior to spawning.

SECTION 13. ATTACHMENTS AND CITATIONS

Attachment 1 Citations

Chilcote, M.W. 2003. Relationship between natural productivity and the frequency of wild fish in mixed spawning populations of wild and hatchery steelhead (*Oncorhynchus mykiss*). Can. J. Fish. Aquat. Sci. 60: 1057-1067.

Cramer, S.P., C.F. Willis, D. Cramer, M. Smith, T. Downey and R. Montagne. 1996. Status of Willamette River spring Chinook salmon in regards to the federal Endangered Species Act, Part 2. Report of S.P. Cramer and Associates submitted to National Marine Fisheries Service on behalf of Portland General Electric Company and Eugene Water and Electric Board.

Federal Register Notice. 1999. Endangered and Threatened Species; Threatened status for three chinook salmon Evolutionarily Significant Units (ESUs) in Washington and Oregon, and Endangered status for one chinook salmon ESU in Washington. Vol. 64, No 56, pp 14308-14328.

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IHOT (Integrated Hatchery Operations Team). 1996. Operation Plans for Anadromous Fish Production Facilities in the Columbia River Basin. Volume II-Oregon. Annual Report 1995. Portland, OR. Project Number 92-043, Contract Number DE-BJ79-91BP60629.

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Lewis, M., C. Mallette, W.M. Murrary, J. Thoming, and S. Brzycki. 1999. Annual coded wire tag program, Oregon missing production groups. 1998 Annual Report. Oregon Department of Fish and Wildlife, Project number 89-069, Contract Number DE-BI79-89BP01610, Portland, OR.

Lewis, M.A., C. Mallette, W.M. Murrary, and J. Thoming. 2003. Annual stock assessment – coded wire tag program (ODFW). 2002 Annual Report. Project Number: 82-013-02. Portland, OR.

Lindsay, R.B., Schroeder, R.K., Kenaston, K.R. 1998. Spring Chinook in the Willamette and Sandy Rivers. Annual Progress Report. Oregon Department of Fish and Wildlife. Project Number F-163-R-03. Portland, Oregon.

Lindsay, R.B., R.K. Schroeder, K.R. Kenaston, R. Toman, and M.A. Buckman. 2004. Hooking Mortality by Anatomical Location and its Use in Estimating Mortality of Spring Chinook Salmon Caught and Released in a River Sport Fishery. North American Journal of Fisheries Management 24:367-378.

NMFS (National Marine Fisheries Service). 1999. Biological Opinion on artificial propagation in the Columbia River Basin: incidental take of listed salmon and steelhead from Federal and Non-Federal hatchery programs that collect, rear and release unlisted fish species. Portland, OR.

NMFS (National Marine Fisheries Service). 2000. Biological Opinion on the impacts from the collection, rearing, and release of listed and non-listed salmonids associated with artificial propagation programs in the Upper Willamette spring Chinook and winter steelhead evolutionarily significant units. Portland, OR.

NMFS (National Marine Fisheries Service). 2008. Willamette Project Biological Opinion (Clackamas Effects), July 11, 2008.

ODF (Oregon Department of Fish [ODF]). 1898, 1902, and 1903. Annual reports of the Master Fish Warden.

ODFW (Oregon Department of Fish and Wildlife). 1992. Clackamas River Subbasin Fish Management Plan. Portland, OR.

ODFW (Oregon Department of Fish and Wildlife). 1998. Spring Chinook Chapters, Willamette Basin Fish Management Plan. Oregon Department of Fish and Wildlife, Portland, OR.

ODFW (Oregon Department of Fish and Wildlife). 2001. Fisheries Management and Evaluation Plan - Upper Willamette Spring Chinook in Freshwater Fisheries of the Willamette Basin and the Lower Columbia Mainstem. Oregon Department of Fish and Wildlife, Salem, Oregon.

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Schroeder, R.K., K.R. Kenaston, and R.B. Lindsay. 2002. Spring Chinook Salmon in the Willamette and Sandy Rivers. Annual Progress Report. Oregon Department of Fish and Wildlife. Project Number F-163-R-07. Portland, OR.

Unpublished report. 1950. From U.S. Fish and Wildlife Service. Clackamas River subbasin report. Vancouver, Washington.

Attachment 2 Legal considerations binding the Clackamas River Subbasin Plan
Federal Laws:

Conservation Programs on Public Land Act of 1960: Federal and state agencies cooperatively plan, develop, and maintain programs designed to conserve, rehabilitate, and protect fish, wildlife, and threatened and endangered species.

Endangered Species Act of 1973 – P. L. 93-205, reauthorized 1988: Provides protection for habitat of endangered and threatened species and provides for status review of candidates for listing. Currently, the bull trout (*Salvelinus confluentus*) is listed as a candidate (Category 2) species. More information is needed on its distribution before it can be classified as either rare or endangered. Based on recent research conducted by Oregon State University, the Oregon chub (*Oregonichthys crameri*) may be nominated for consideration for threatened or endangered species status.

Federal Aid in Wildlife Restoration Act of 1937: Provides funding for wildlife programs such as land acquisition, habitat improvement, research and education.

Federal Aid in Sport Fish Restoration Act of 1950, expanded in 1984 (Wallop-Breaux Act) and amended in 1988: Provides funding for sport fish restoration and fish programs such as land acquisition, habitat improvement, research and education.

Federal Land Policy and Management Act of 1976 – P. L. 94-579: Allows Congress to withdraw or designate federal lands for specified purposes.

Federal Water Pollution Control Act, amended by the Clean Water Act of 1977: Establishes as an objective the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters. Sections of the act provide authorization for regulations regarding the discharge of pollutants (Section 402) and the disposal of dredged or fill material (Section 404).

Fish and Wildlife Coordination Act of 1934: States that fish and wildlife conservation shall receive equal consideration with water resources development programs.

Flood Control Act of 1936: Legislative mandate authorizing the Corps to study, plan, and construct major flood control works.

Floodplain Management, 1977 – Executive Order 11988: Designed to avoid adverse impacts associated with destruction or modification of floodplains and to mitigate impacts when avoidance cannot be achieved.

Flood Security Act of 1985: Designed to reduce erosion and sedimentation in watersheds.

Forest and Rangeland Renewable Resources Planning Act of 1974: Directs management planning process for units of the National Forest System.

Land and Water Conservation Fund Act of 1965 – P. L. 88-578: Provides federal assistance to states for planning, acquisition and development of land and water recreation resources.

Magnuson Fishery Conservation and Management Act: Establishes forum for recommendations to the Pacific Fishery Management Council for establishing harvest rates and for conservation, restoration, and enhancement of habitat of anadromous salmonids.

Mitchell Act of 1938, amended in 1946: Authorized the establishment of hatcheries and fishways for anadromous fish in the Columbia River watershed of Idaho, Washington, and Oregon and annually provides operation and maintenance funding.

Multiple Use – Sustained Yield Act: Authorizes and directs the administration and development of the renewable surface resources of the national forests.

National Environmental Policy Act of 1969: Requires that any federal agency proposing an action that significantly affects the human environment must prepare an environmental impact statement.

National Forest Management Act of 1976: Provides for multiple use and sustained yield of the products and services of National Forest System land; includes legislation for protection of riparian vegetation.

Northwest Power Act of 1980: Creates an interstate policy making and planning body for electrical power and fish and wildlife in the Columbia River Basin.

Oregon & California Railroad Act: Principle legal mandate for BLM and USFS management of O&C lands.

Rivers and Harbors Act of 1899: Authorizes the U.S. Army Corps of Engineers to issue permits for any types of activities in navigable waters of the United States.

Sikes Act: Provides for state and federal cooperative management of fisheries resources.

United States – Canada Reciprocal Fisheries Agreement: Governs the harvest of fish stocks of mutual concern.

Water Bank Act of 1970 – P. L. 91-559: Authorizes the Secretary of Agriculture, after coordination with the Secretary of the Interior, to enter into 10-year contracts with landowners to preserve wetlands and retire adjoining agricultural lands. Annual payments to landowners and sharing in the costs of conservation measures are included.

Water Pollution Control Act of 1972 – P. L. 92-500: Precursor to the Clean Water act. Authorized issuance of permit to discharge fill or dredged material into navigable waters at specified disposal sites.

Water Resources planning Act of 1965 – P. L. 89-80: Established the Water Resources council, which issues the "Principles and Standards and Procedures for Federal Participation in

Water and Related Land Resources Planning and Development". The act also authorized establishment of State-Federal River Basin Commissions.

Water Use Act of 1940: Provides domestic, mining, milling and irrigation uses of waters within national forests.

Watershed Protection and Flood Prevention Act of 1954: Assures cooperation of the federal government with state and local agencies in preventing damage from floodwater, erosion and sediments.

Wild and Scenic Rivers Act of 1968, revised 1988: Designates selected rivers for protection under the National Wild and Scenic Rivers System, which preserves scenic, recreational and fish and wildlife characteristics.

Wilderness Act of 1964: Preserves selected units of land for their wilderness characteristics.

State Laws:

The Oregon Forest Practices Act (Forest Practices Act) (ORS 527.610 to 527.730) was adopted in 1972. Commercial timber operations on state and private land are regulated by the act, which is administered by the Oregon Department of Forestry. The Forest Practices Act contains provisions for protection of aquatic habitat. Forest management activities on U.S. Forest Service and BLM land are designed to comply with Forest Practices Act rules and state water quality standards. The Forest Practices Act does not apply within the urban growth boundary of towns and cities. Cities and towns may or may not have regulations for stream protection.

The Oregon Fill-and-Removal Law (ORS 541.605-541.990) requires a permit for the removal or filling of 50 cubic yards or more of material in rural waterways. The Division of State Lands oversees the program, reviews applications and issues permits, and enforces the law. ODFW has the opportunity to comment on permit requests.

Attachment 3 Five year disease history (2015-2019) of spring chinook at Clackamas Hatchery

Disease/Organism	Species/Stock (ChS 19)
IHNV	No
EIBS	Yes
CAD	No
Fl. Psychrophilum	Yes
Fl. Columnare	Yes
Aeromonas salmonicida	Yes
Aeromonas/Pseudomonas	Yes
Yersinia ruckeri	No
R. salmoninarum	Yes
Internal mycosis	No
External mycosis	Yes
Ichthyobodo	Yes
Gyrodactylus	No
Ichthyophthirius	Yes
Gill Amoeba	No
Myxobolus cerebralis	No
Ceratonova Shasta	Yes
Trichodinids	Yes
Proliferative Kidney Disease	No

"Yes" indicates detection of the pathogen, but in many cases no disease or fish loss was associated with presence of the pathogen.
"No" indicates the pathogen has not been detected in that stock.

Treatments for disease at Clackamas Hatchery include: green eggs are routinely water hardened in diluted buffered iodophor; flush treatments of 1:600 formalin for 15 minutes given three to five times per week for fungi prevention on eggs; treating juvenile fish for external parasites using formalin 1:6,000 to 1:40,000 depending on species treated and water temperature. *Ichthyophthirius* may be treated with a prolonged formalin drip, 1:25,000 for 8 hours). On rare occasions it is necessary to treat a group of fish for bacterial pathogens and medicated food containing oxytetracycline or Romet is used. The spring chinook adults are given antibiotic injections of erythromycin and oxytetracycline under a veterinary prescription to prevent bacterial infections such as furunculosis and bacterial kidney disease. They are also treated with formalin flush treatments at 1:4,000-1:8,000 for one hour three to five times per week as needed for external fungi infections.

ODFW's fish health monitoring plan is identical to that developed by the Integrated Hatchery Operations Team for the Columbia Basin anadromous salmonid hatcheries (see Policies and Procedures for the Columbia Basin Anadromous Salmonid Hatcheries, Annual Report 1994. Bonneville Power Administration). Some specifics include:

- All fish health monitoring will be conducted by a qualified fish health specialist.
- Annually examine brood stock for the presence of viral reportable pathogens. Number of individuals examined, usually 60 fish, will be great enough to assure a 95% chance of detection of a pathogen present in the population at the 5% level. American Fisheries Society "Fish Health Blue Book" procedures will be followed. With wild adult steelhead stocks generally all fish are sampled for viruses at spawning.
- Annually screen each salmon brood stock for the presence of *R. salmoninarum* (R.s). Methodology and effort will be at the discretion of the fish health specialist.
- Conduct examinations of juvenile fish at least monthly and more often as necessary. A representative sample of healthy and moribund fish from each lot of fish will be examined. The number of fish examined will be at the discretion of the fish health specialist.
- Investigate abnormal levels of fish loss when they occur.
- Determine fish health status prior to release or transfer to another facility. The exam may occur during the regular monthly monitoring visit, i.e. within 1 month of release.
- Appropriate actions including drug or chemical treatments will be recommended as necessary. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile will be generated when possible.
- Findings and results of fish health monitoring will be recorded on a standard fish health reporting form and maintained in a fish health database.
- Fish culture practices will be reviewed as necessary with facility personnel. Where and when pertinent, nutrition, water flow and chemistry, loading and density indices, handling, disinfecting procedures, and treatments will be discussed.

Attachment 4 Estimated listed salmonid take levels by hatchery activity

Listed species affected: Spring Chinook Salmon ESU/Population: Upper Willamette **Activity: Hatchery Trap**					
Location of hatchery activity: Clackamas River mile 22.6; Dates of activity: May – October; **Hatchery program operator: ODFW**					
	Annual Take of Listed Fish By Life Stage *(Number of Fish)*				
Type of Take	Egg/Fry	Juvenile/Smolt	Adult		Carcass
			Hatchery	Wild	
Observe or harass a)					
Collect for transport b)			350		
Capture, handle, and release c)					
Capture, handle, tag/mark/tissue sample, and release d)					
Removal (e.g. broodstock) e)			Up to 4,000	0-120	
Intentional lethal take f)			Up to 1,000	0-120	
Unintentional lethal take g)			≤10%	≤5%	
Other Take (angler caught for inclusion into brood) h)					

Attachment 4 (Continued).

Listed species affected: Spring Chinook Salmon ESU/Population: Upper Willamette **Activity: North Fork Dam Trap Operation**					
Location of hatchery activity: Clackamas River mile 30 Dates of activity: May – October **Trap operator: PGE**					
	Annual Take of Listed Fish By Life Stage *(Number of Fish)*				
Type of Take	Egg/Fry	Juvenile/Smolt	Adult		Carcass
			Hatchery	Wild	
Observe or harass a)					
Collect for transport b)			350		
Capture, handle, and release c)			2,500	7,500	
Capture, handle, tag/mark/tissue sample, and release d)					
Removal (e.g. broodstock) e)			300	0-120	
Intentional lethal take f)					
Unintentional lethal take g)			5	5	

Listed species affected: Spring Chinook Salmon ESU/Population: Upper Willamette Activity: North Fork Dam Trap Operation					
Location of hatchery activity: Clackamas River mile 30 Dates of activity: May – October Trap operator: PGE					
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 (assumes up to 5% integration).
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

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

Attachment 5. Research proposal

Genetic rescue of a hatchery population: Can wild fish improve smolt-to-adult survivorship of hatchery spring Chinook salmon in the Clackamas River?

Marc A. Johnson[1], Ben Walczak[2], Chris Lorion[1], Kathleen O'Malley[3]

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[3] State Fisheries Genomics Laboratory; Hatfield Marine Science Center; Oregon State University; 2030 Marine Science Drive; Newport, OR 97365

Background

Salmon hatcheries are widely used throughout the Pacific Northwest to augment fisheries and, to a lesser extent, support conservation and recovery efforts. Some hatchery programs spawn only adult hatchery-origin fish (i.e. segregated broodstocks), whereas others include natural-origin fish among those used to produce the next generation (i.e. integrated broodstocks) (see Trushenski et al. 2015). Although a segregated broodstock approach imposes no immediate demographic impact to would-be donor populations of wild salmon, inadvertent domestication selection is thought to be accelerated in segregated hatchery programs (Waters et al., 2018), such that salmon produced by segregated hatchery programs may pose greater genetic risk to wild populations (Paquet et al., 2011).

Over time, domestication selection should and typically does generate salmon stocks that perform well in hatchery environments, but which experience lower fitness in natural settings (Thompson and Blouin, 2015). However, the evolutionary force of drift can randomly "fix" deleterious alleles within populations (particularly small ones), potentially eroding intrinsic population productivity. Under such circumstances, restoration of genetic diversity may be necessary to improve fitness and productivity of otherwise inviable populations. "Genetic rescue", as this management practice is known (Whiteley et al., 2015), has assisted the recovery of myriad species faced with extinction, but is seldom explicitly applied to the management of hatchery salmon.

The Clackamas Hatchery, operated by the Oregon Department of Fish and Wildlife (ODFW), produces spring Chinook salmon to support commercial and recreational fisheries in Oregon and coastal Pacific waters. The broodstock used at this facility was founded from upper Willamette River spring Chinook salmon in 1976, and has effectively been managed as a segregated stock since that time, although some intermittent integration of wild fish occurred up until 2012. The Clackamas Hatchery, operated by the Oregon Department of Fish and Wildlife (ODFW), produces spring Chinook salmon to support commercial and recreational fisheries in Oregon and coastal Pacific waters. The broodstock used at this facility was founded from upper Willamette River spring Chinook salmon in 1976, and has effectively been managed as a segregated stock

since that time, although some intermittent integration of wild fish occurred up until 2012. Spring Chinook salmon produced by Clackamas Hatchery are genetically most similar to local (Clackamas River) wild fish, but present lower allelic richness than wild counterparts (Johnson and Friesen, 2014). In recent years, the number of adult hatchery-origin spring Chinook salmon returning to the Clackamas River (i.e. smolt-to-adult returns; SARS) has declined precipitously, despite relatively constant production and release of juveniles (see Clackamas Hatchery HGMP). In fact, the number of adult hatchery salmon returning to the Clackamas River was so low in 2018 and 2019, that hatchery managers were unable to meet broodstock needs, and fewer than ten fish were harvested in the local sport fishery.

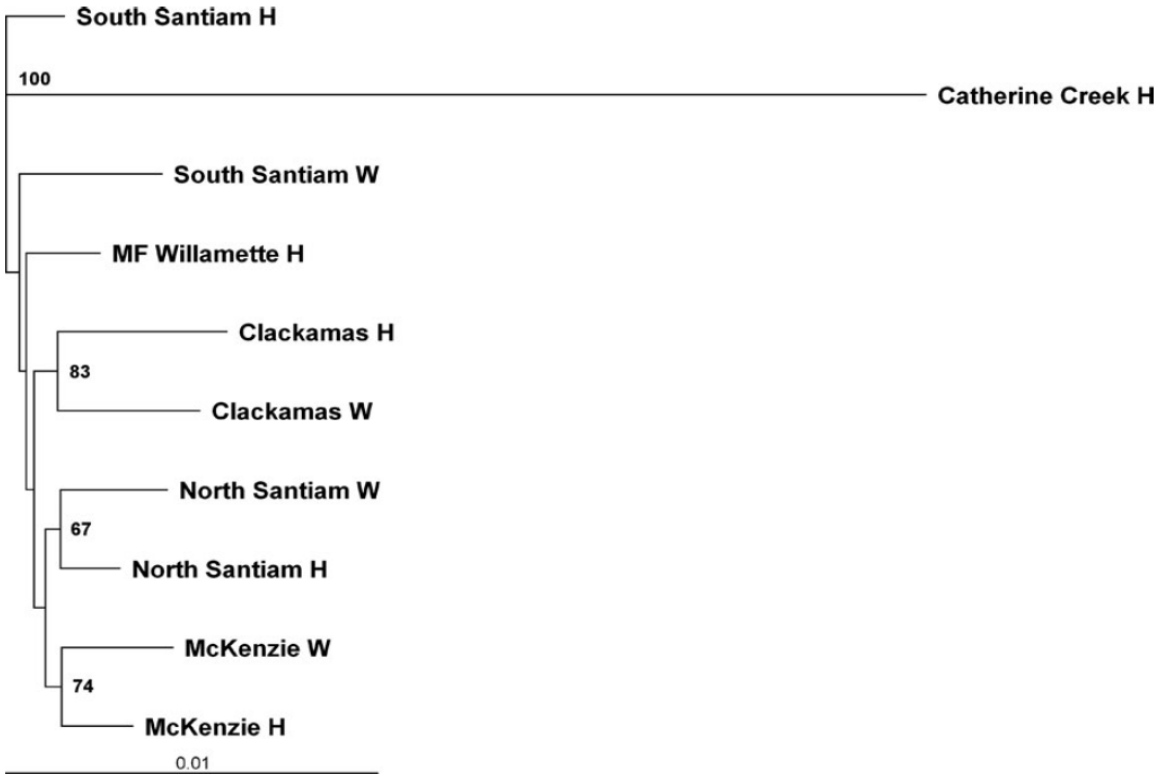

Figure 1. Genetic relationships among upper Willamette spring Chinook salmon populations, illustrating similarity between hatchery (H) and wild (W) populations of the Clackamas River. From Johnson & Friesen (2014).

The dire situation of the Clackamas Hatchery's spring Chinook salmon program has prompted managers to consider a variety of alternative actions, including transition to an integrated broodstock. This transition, favored by managers, would require take of wild Clackamas spring Chinook salmon, particularly during the first three "rebuilding" years. Fortunately, the abundance of wild spring Chinook salmon has remained relatively stable in the Clackamas River, with a mean 2,331 (SE ±250) returning to the North Fork Dam each year (2010-2019), suggesting that prudent collection of wild fish for broodstock would not significantly impact the population's viability (Figure 2).

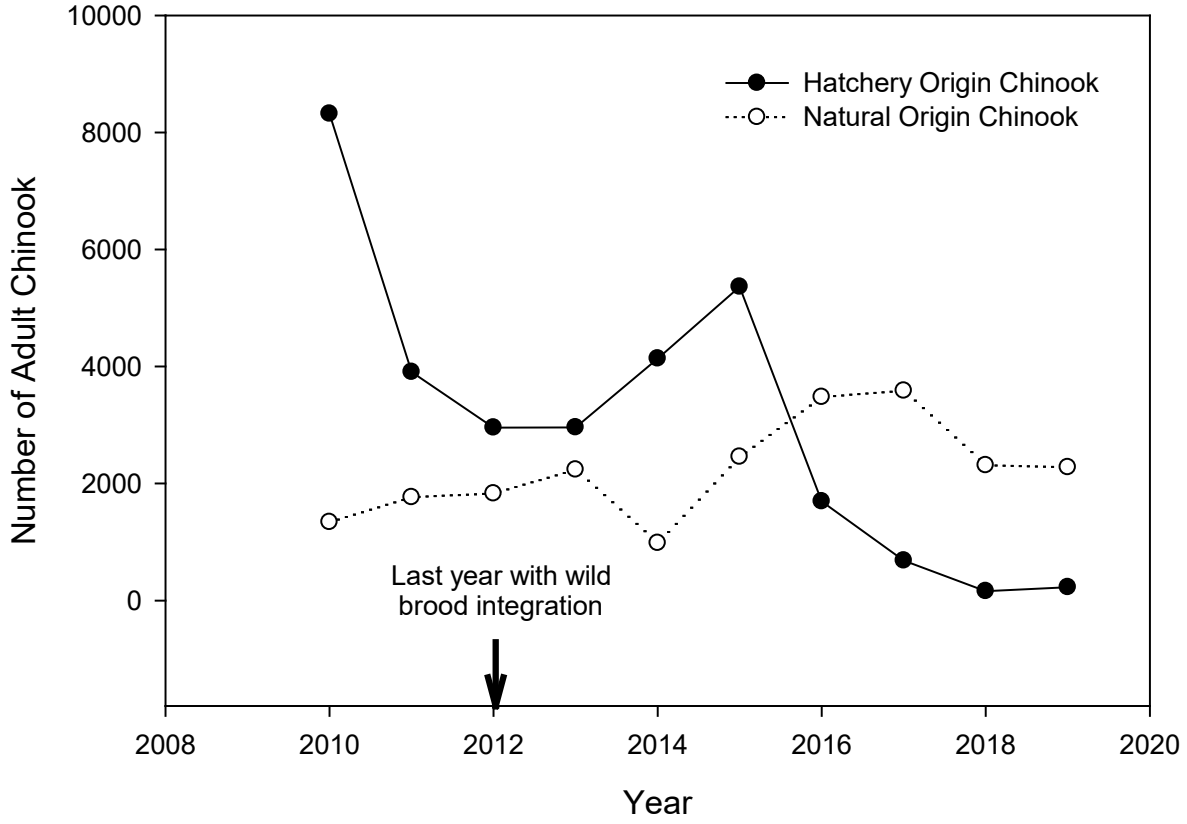

Figure 2. Number of adult hatchery-origin (collected; data ODFW) and natural-origin (counted at North Fork Dam; data PGE) spring Chinook salmon returning to the Clackamas River (2010-2019).

Integration of wild fish into the Clackamas Hatchery's broodstock offers an opportunity to evaluate the efficacy of "genetic rescue" in context of recovering the performance of a hatchery program. Here, we propose to use parental-based genetic tags to track the contribution of wild fish spawned at Clackamas Hatchery to returning adults in subsequent years. Production of returning adults from wild brood will be compared to that produced with the existing hatchery stock over the course of three brood years (i.e. cohorts). Over that period, we will track the genetic diversity of hatchery and wild fish that contribute to hatchery production, and test for relationships between diversity and productivity of Clackamas spring Chinook salmon.

Broodstock collection

The broodstock goal for Clackamas Hatchery is 600 adult spring Chinook salmon, comprised of 400 females and 200 males (all hatchery origin), whereby each male is spawned with two females. For the purposes of our research, we propose to annually collect 120 wild spring Chinook salmon from the Clackamas Hatchery and North Fork Dam traps in 2020, 2021 and 2022. Each year, these wild brood will include 80 females and 40 males, to be spawned in the same 2:1 manner as hatchery-origin brood. Half of the wild broodstock (40 females, 20 males) will be collected during the month of July, when the majority of adult returns arrive at North Fork Dam, and the remaining half will be collected after that date. If fewer than 1,000 wild

spring Chinook arrive at North Fork Dam by July 31st (including those collected for brood), no additional wild Chinook will be collected for that year.

The annual collection of 120 wild spring Chinook salmon, as here proposed, would remove an estimated 5% of the wild spawning population above North Fork Dam during these three years, followed by a reduction of wild brood stock collection in subsequent years, in accordance with HGMP "sliding scale" guidelines.

Spawning and sampling

Fin tissue will be collected from all wild- and hatchery-origin spring Chinook salmon spawned at Clackamas Hatchery in 2020-2022, and stored in individually labeled vials containing 95% denatured ethanol. The sex and forklength (nearest cm) of each spawner will also be recorded and related to vial labels. Eggs from wild-origin females will be fertilized only with milt from wild-origin males and, similarly, hatchery-origin females will be spawned only with hatchery-origin males. In both cases, each male will be used to fertilize eggs from two females. Fertilized eggs will be incubated and hatched according to standard ODFW procedures, and juvenile fish from both groups will be reared together and released from the same location(s) in near equal numbers.

Beginning in 2025, the first year of age-4 adult returns from this study, marked spring Chinook returning to the Clackamas Hatchery, and possibly other locations, will be (tissue) sampled. As before, the forklength of fish will be recorded and tissue will be stored in labeled vials filled with ethanol. Sampling will be repeated each year until 2028, to include age-4 and age-5 adults from each of the three cohorts. We expect to sample from 100 to 300 returning adult spring Chinook salmon each year, depending upon run size and availability of resources for analyses. Sample sizes in this range should provide sufficient data to detect effect sizes of 20–30% difference between SARS for fish produced with hatchery- v. wild-origin brood (Figure 2)[1].

Genotyping and parentage assignment

Whole genomic DNA will be extracted from all brood spawned for this study and putative adult offspring sampled in 2025-2028. Samples will be genotyped at the Oregon State Fisheries Genomics Laboratory[2], which offers unparalleled capacity and expertise with genetic analyses of Pacific salmon. Parentage assignment software, such as COLONY (Jones and Wang, 2010) will be used to probabilistically assign parents to putative offspring, and the proportion of returning adult offspring produced with wild-origin brood will be compared to that from hatchery-origin brood using standard statistical approaches (e.g. goodness-of-fit tests).

Allelic richness of Clackamas Hatchery spring Chinook salmon has been shown to be lower than that of the local, wild population (Johnson and Friesen 2014). Using the data collected through our study, we will monitor the genetic diversity of hatchery and wild brood, as well as that of their returning adult offspring. We predict that increased in genetic diversity of the hatchery population, attained through integration, will result in improved survivorship to adulthood, consistent with a genetic rescue hypothesis.

[1] Assuming equal brood group sizes, $\alpha = 0.05$ and $\beta(\text{power}) = 0.80$

[2] https://agsci.oregonstate.edu/state-fisheries-genomics-lab

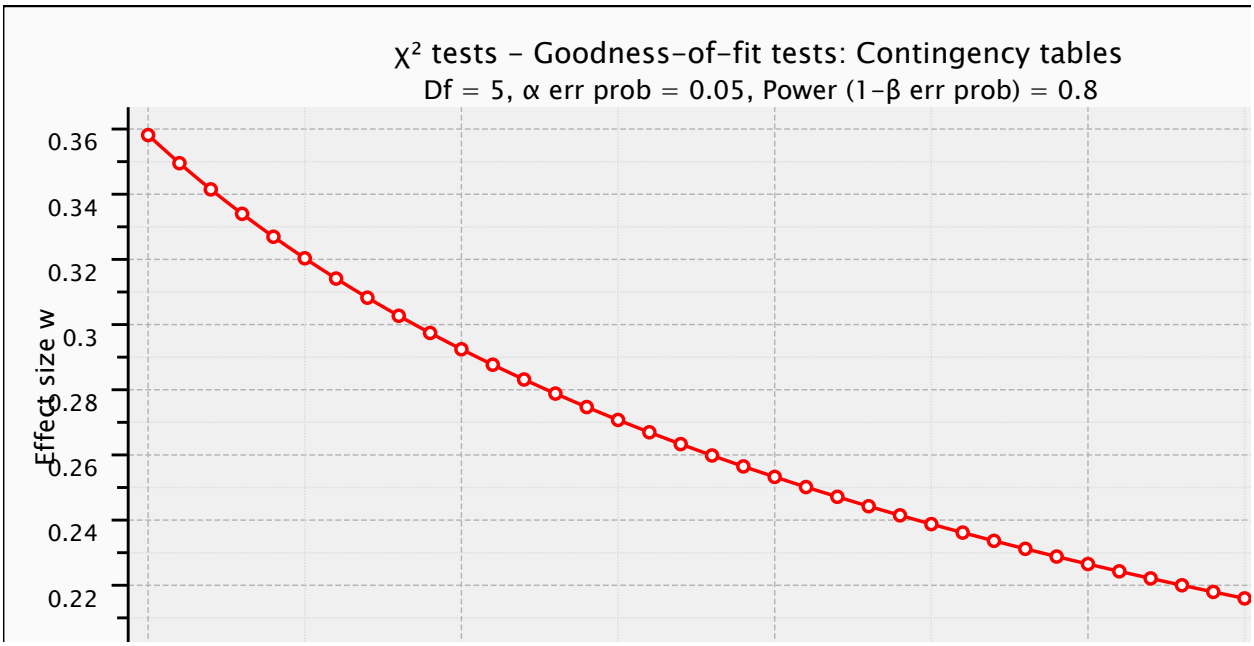

Figure 3. Estimated effect size (w) that could be detected through a χ^2 test with 80% power and $\alpha = 0.05$. Figure and estimates constructed with G*power (Faul et al., 2007).

Expected Results and Implications

This study will directly compare the productivity of wild- and hatchery-origin spring Chinook salmon brood, as measured through adult returns to Clackamas Hatchery. While serving to meet recently unattainable brood collection goals through integration of wild spawners, this operational research will also provide valuable new guidance toward the applicability of "genetic rescue" approaches for underperforming hatchery program

SECTION 14. Certification Language and Signature of Responsible Party

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name and Title of Applicant: Jeff Boechler, Watershed District Manager

Signature: _____ Date: May 6, 2020

Certified by: Scott Patterson, Fish Propagation Program Manager

Signature: _____ Date: 5/6/2020

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