

# Infrastructure and Operations Audit of the Lyons Ferry Fish Hatchery 2023



## Lyons Ferry Fish Hatchery Lower Snake River Compensation Plan

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## Executive Summary

On February 22, 2023, Chris Starr, Facility Coordinator LSRCP, Nathan Wiese, Program Coordinator LSRCP, Derek Gloyn, Lyons Ferry Hatchery Manager, Ace Trump, Lyons Ferry Hatchery Complex Operations Manager, conducted a high-level half-day infrastructure and operations assessment of the Lyons Ferry Fish Hatchery (LFH).

The purpose of this document is to provide the Lower Snake River Compensation Plan (LSRCP) and other stakeholders ample conceptual-level information of the current infrastructure challenges at LFH. The goal is to incorporate audit findings into a 10-year strategic plan for LSRCP that will maximize in-house and external improvement opportunities by developing solutions that fit resources, budgets, and supportive programs in a logical sequence. These efforts are intended to significantly improve water quality, program capacity, efficiency, and flexibility at LFH and ultimately increase opportunities for LSRCP to meet adult mitigation targets for all species.

This audit is a kick-off effort to assess all spring/summer Chinook rearing facilities within the LSRCP program following the 10-year spring/summer Chinook Program Review for the Independent Scientific Review Panel (ISRP) in December 2022. With this review, the LSRCP intends to identify strategies toward improving performance of achieving project area goals of 58,700 spring/summer Chinook salmon adult returns. From 2004-2017, the LSRCP averaged 29,115 spring/summer Chinook salmon adult returns and failed to achieve the project area goal on any year during the period.

The Lyons Ferry audit resulted in several options for increasing spring Chinook capacity.

Construction of three new rearing lakes would improve rearing conditions for several current production group and provide rearing potential for an additional 500,000 spring Chinook smolt program. Total cost is estimated at \$11M

Replacing the dilapidated captive brood tanks would cost about \$1.2 M and could provide rearing opportunities for 500,000 spring Chinook smolts at an annual operation cost of approximately \$75,000.

Experimental Age-0 spring Chinook production to 30-50 fpp releases in late May to early June would be possible with Lyons Ferry rearing temperatures (52 F). This differs from traditional parr programs (September releases at 60-100 fpp) in size and timing. Potential across LSRCP programs is large (10-22M Age-0 smolts) if capacity at multiple facilities is considered. Experimental groups would displace current sub-yearling fall-Chinook at 100,000 per raceway.

Converting Lyons Ferry rearing lakes to all steelhead (400,000 each or 1.2 M total) by moving production withing LSRCP facilities. That movement potentially frees space for up to an additional 2.75 – 3.5M spring Chinook. Total costs are \$600,000 in infrastructure/equipment and \$948,000 annually.

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## 1 Scope

On February 22, 2023, Chris Starr, Facility Coordinator LSRCP, Nathan Wiese, Program Coordinator LSRCP, Derek Gloyn, Lyons Ferry Hatchery Manager, Ace Trump, Lyons Ferry Hatchery Complex Operations Manager, conducted a high-level half-day infrastructure and operations assessment of the Lyons Ferry Fish Hatchery (LFH).

The purpose of this document is to provide the Lower Snake River Compensation Plan (LSRCP) and other stakeholders ample conceptual-level information of the current infrastructure challenges. The goal is to incorporate audit findings into a 10-year strategic plan for LSRCP that will maximize in-house and external improvement opportunities by developing solutions that fit resources, budgets, and supportive programs in a logical sequence. These efforts are intended to significantly improve water quality, program capacity, efficiency, and flexibility at LFH and ultimately increase opportunities for LSRCP to meet adult mitigation targets for all species.

This audit is a kick-off effort to assess all spring/summer Chinook rearing facilities within the LSRCP program following the 10-year spring/summer Chinook Program Review for the Independent Scientific Review Panel (ISRP) in December 2022. With this review, the LSRCP intends to identify strategies toward improving performance of achieving project area goals of 58,700 spring/summer Chinook salmon adult returns. From 2004-2017, the LSRCP averaged 29,115 spring/summer Chinook salmon adult returns and failed to achieve the project area goal on any year during the period.

## 2 Background

Lyons Ferry Fish Hatchery (LFH) is one of many hatchery facilities under the LSRCP. The LSRCP has a project area goal of 58,700 spring/summer Chinook salmon adult returns to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams. However, from 2004-2017, the program failed to reach that goal and averaged 29,115 adult returns (USFWS 2020).

LSRCP funded fish production in Washington began in 1983, with the construction of trout and steelhead rearing facilities at LFH. Construction of salmon hatchery facilities and steelhead acclimation sites followed and were completed in 1985. Production at LFH and Tucannon Fish Hatchery (FH) has been directed toward meeting established hatchery adult return goals of 18,300 fall Chinook, 1,152 spring Chinook, 4,656 summer steelhead; plus providing 67,500 angler days of fishing opportunity from 79,000 pounds of rainbow trout production (currently planted at 2.5 fish per pound (fpp)). In addition to these LSRCP adult return goals to mitigate for expected hydro system losses (approximately 48% of total desired population returns), the LSRCP hatchery program has contributed to conservation efforts to maintain and restore native populations of salmon and steelhead. Additional hatchery production of jumbo-sized (1.5 pounds each) rainbow trout at LFH that historically was state funded is now funded by the Tri-State Steelheaders (non-profit organization).

LFH is located along the Snake River at river mile (RM) 59.1, directly below the confluence of the Palouse River in Franklin County, Washington (Figure 1). Initially it was operated as two separate facilities. Washington Department of Wildlife (WDW) operated the north-side hatchery, producing steelhead and rainbow trout. Washington Department of Fisheries (WDF) operated the south-side hatchery, rearing spring and fall Chinook. A merger of the two agencies in 1994 led to a merging of the two facilities and has since been operated by the Washington Department of Fish and Wildlife (WDFW) through LSRCP funding as LFH.

LFH facilities include two incubation buildings with office space and feed storage, plus adult fish trapping, holding and spawning structures. A visitor center provides interpretive information for guests of the hatchery. There are eight residences on-site for staff to fulfill security and emergency response needs.

The LFH rearing facilities include twenty-eight raceways at 10 ft x 100 ft x 2.8 ft and nineteen raceways at 10 ft x 88.5 ft x 3.5 ft. The raceways rear all species produced at LFH (spring and fall Chinook, summer steelhead, and rainbow trout). These raceways are covered in 2" square mesh netting. There are three large rearing lakes (643,500 cubic feet (ft<sup>3</sup>) of water each; 1,100 ft x 90 ft x 6.5 ft dimensions) which are also covered in 2" netting. Netting has significantly reduced predation since being installed in 2006-08. The steelhead and spring Chinook adult holding facilities include three 83 ft x 10 ft x 5 ft adult raceways with an enclosed spawning building incorporated over the center of these ponds. There are four 8.5 ft x 150 ft x 4.3 ft and four 10 ft x 150 ft x 4.3 ft adult fall Chinook salmon holding ponds, which also accommodate fall Chinook subyearling rearing in the spring months. The incubation facilities include 112 full



Heath Tray stacks (2 units of 8 trays each) of vertical incubators in the south-side hatching building, and 88 shallow eyeing/hatching troughs and four 3.75 ft x 27.5 ft x 2 ft intermediate rearing troughs in the north-side hatching building.

## **Fall Chinook**

The Snake River fall Chinook program at LFH is the cornerstone of a highly coordinated and integrated artificial production program, implemented through the LSRCP, the Idaho Power Company (IPC) Hells Canyon Settlement Agreement, and the Nez Perce Tribal Hatchery (NPTH) with funding through BPA. Broodstock for the program at LFH are primarily collected at Lower Granite Dam (LGR) but may be collected at LFH and NPTH if trapping at LGR is limited (generally because of high water temperatures and ESA handling restrictions from that). The *US v OR* 2018-2027 Management Agreement Table B4 shows priority production by release location and marking/tagging schemes for Snake River fall Chinook production at LFH and Irrigon FH.

NOAA's National Marine Fisheries Service (NMFS) first listed Snake River fall-run Chinook salmon, an evolutionarily significant unit (ESU) Chinook salmon (*Oncorhynchus tshawytscha*), as a "threatened species" under the ESA on April 22, 1992 (57 FR 14653) – NOAA Fisheries 2017a.

LFH was initially designed to release 9.16 million Snake River fall Chinook subyearlings at around 90 fpp. The 2022 production release at LFH will be 700,000 subyearlings at about 50 fpp and 450,000 yearlings at about 10 fpp. LFH will transfer another 1,900,000 subyearlings to the Fall Chinook Acclimation Program (FCAP) facilities, with size at transfer about 65 - 75 fpp. Size at release goal for the FCAP facilities are 50 fpp. In addition, approximately 1,310,000 eyed eggs will be transferred to and reared at the Oregon Department of Fish and Wildlife's (ODFW) Irrigon FH for the LSRCP and IPC programs. The size at release for the subyearlings at Irrigon FH are also 50 fpp. The IPC program at Irrigon FH will release 1,000,000 subyearlings into the Salmon River near Hammer Creek. Another 200,000 subyearlings will be released into the Grande Ronde River near Cougar Creek as part of LSRCP production.

The LSRCP co-managers have discussed and agreed upon a proposal to discontinue the 450,000 fall Chinook yearling program released onsite at LFH. That proposal is being reviewed and will be up for approval by the U.S. v Oregon Policy Committee at the next meeting in May 2023. Following Policy level approval, the National Oceanic and Atmospheric Administration (NOAA) will have to re-initiate consultation in 2023 for Endangered Species Act (ESA) coverage. The outcome of these two processes may result in implementation as soon as Brood Year 2023. The main changes described in the proposal are summarized as:

- Conversion of all yearling production (450,000) to an additional 1,400,000 subyearling production (950,000 more than current production levels).
- increase subyearling releases at LFH from 700,000 to 1,200,000.
- increase the 2nd release of subyearlings at Big Canyon Acclimation Facility (AF, FCAP Site) from 200,000 to 400,000.

- reinitiate a direct stream release of subyearlings at Couse Creek (Snake River) with a release of 400,000.
- increase the Grande Ronde release from 200,000 to 500,000 and change the release strategy from a direct stream release at Cougar Creek to an acclimated release from Big Canyon AF in Oregon (ODFW).

## **Spring Chinook**

Tucannon spring Chinook: The Tucannon River Spring Chinook Hatchery production began in 1985 using endemic broodstock. Currently, both natural origin and hatchery supplementation fish are collected for broodstock. Returning adults are collected at the Tucannon FH Rainbow Lake Intake and transported to LFH for holding, spawning, hatching and initial rearing. The release goal is 225,000 yearling smolts at 12 fpp. WDFW has begun an evaluation of different release strategies within the Tucannon/Snake basin and continues discussions with co-managers and NOAA Fisheries on potential releases outside the Snake River basin, along with a concept to reinitiate a captive broodstock program in the near future to help preserve this stock.

The Tucannon River spring Chinook Salmon is in the Snake River Spring/Summer Chinook Salmon ESU, which was listed as threatened under the Endangered Species Act in 1992 (57 FR 14,653; April 22, 1992) – NOAA Fisheries 2017b.

Touchet spring Chinook: In January 2018, WDFW brought forth a proposal to the Production Advisory Committee (PAC) to initiate a harvest mitigation program for spring Chinook in the Touchet River. This proposal was agreed to in PAC, passed on and accepted through the *US vs OR* Policy Committee. The HGMP for this program was submitted and approved by NOAA Fisheries in 2017. Since then, WDFW has received ~275,000 eyed Carson stock eggs annually from either the USFWS Little White Salmon or Carson hatcheries. All hatching and rearing has taken place at LFH, with the first releases occurring in 2020. A sub-sample of smolts (~15,000) are PIT tagged annually before they are moved to the Dayton AF. Smolts are released from the Dayton AF in mid to late-March, with a release size goal of 12 fpp. Natural runs of Spring Chinook in the Walla Walla basin are believed to have been extirpated in the 1950's. As such, ESA impacts from this program area only related to ESA-listed summer steelhead and bull trout in the Walla Walla Basin.

## **Summer Steelhead**

The LFH currently uses two stocks of steelhead in the Snake River basin, (Tucannon and Wallowa) and two stocks in the Walla Walla basin (Touchet and Wallowa). The Wallowa stock is a non-endemic stock and was originally collected by ODFW from Lower Snake River dams (likely comprised of both A- and B-run fish from Washington, Oregon, and Idaho), and then released in the Wallowa River in the Grande Ronde Basin. For WDFW, Wallowa stock production steelhead are released in the Grand Ronde and Touchet rivers, and on-station at LFH into the Snake River.



The Middle Columbia River steelhead distinct population segment (DPS) was listed as “threatened” under the Endangered Species Act of 1973 (ESA) on January 5, 2006 (71 FR 834) – NOAA Fisheries 2009. The Snake River Basin steelhead DPS were listed as a “threatened” species under the ESA on August 18, 1997 (62 FR 43937) – NOAA Fisheries 2017b. Based on those listings, the National Marine Fisheries Service (NMFS) 1999 Biological Opinion ruled that continued use of Lyons Ferry and Wallowa summer steelhead stocks were causing jeopardy to listed ESA-listed steelhead populations in the Snake and mid-Columbia rivers. It was recommended by NMFS to convert to endemic stock populations where possible (developing new broodstocks from natural origin returns). The Touchet and Tucannon endemic broodstock programs began with BY2000.

Additional changes to the steelhead program are likely in response to results from evaluation of fish stock performance and ESA related concerns regarding the ongoing releases of Wallowa stock steelhead into the Snake, Touchet and Grande Ronde rivers. Such changes may require a departure from the general mitigation approach used for steelhead so far, but also will need careful planning to ensure that the change can be implemented within the limits of the hatchery facilities now or as planned to exist soon.

The Touchet River summer steelhead program is considered an endemic program. The adults for this program are collected at the Dayton Adult Trap (DAT) on the Touchet River, with captured adults shipped to LFH for spawning, incubation and rearing up to the smolt stage. The current goal of this program is to produce 50,000 smolts annually released at ~4.5 to 6 fish/lb from the Dayton AF. Should this program ever be expanded to replace the Wallowa stock program in the Touchet River, the production goal would likely increase to 100,000-150,000 smolts annually, depending on co-manager agreement.

The Tucannon River summer steelhead program is also considered an endemic program, meaning all original production was derived from natural parentage, and in later years, from 1<sup>st</sup> generation hatchery reared endemic stock fish as well. The adults for this program are collected at Tucannon FH and their progeny planted in the Tucannon River as yearlings. Current release goal is 150,000 smolts at 4.5 to 6 fpp, with 50,000 smolts being released for the conservation portion of the program (unclipped) and 100,000 smolts being released for the mitigation portion (ad-clipped) of the program. According to the Tucannon Steelhead Program broodstock sliding scale, the 50,000 smolts for the conservation portion will come from natural-origin returns (NORs) and unclipped endemic hatchery returns (conservation group). The 100,000 smolts for the mitigation portion will come from endemic hatchery returns and consist of ad-clipped/cwt or cwt-only adults, with no NOR’s at lower NOR return levels.

The Wallowa stock program was originally initiated to provide a fishery for summer steelhead in the Grande Ronde River (for both Oregon and Washington anglers) and contribute to both tribal and sport fisheries in the mainstem Columbia and Snake rivers. The overall production of this stock was increased in December 2012, following elimination of the LFH stock steelhead program. WDFW Wallowa stock steelhead are currently in the Touchet River from the Dayton AF (100,000), Grande Ronde River from the Cottonwood AF (225,000) and into the Snake River at LFH (60,000).

A recent Reciprocal Study (Release Years 2015-2018) comparing Wallowa stock steelhead reared at Irrigon FH at normal densities (DI = 0.15) compared to rearing at LFH rearing lakes in a semi-natural environment (DI = 0.01) has been completed. Data from the study demonstrates a 2:1 Smolt-to-Adult Return (SAR) for Wallowa stock steelhead reared in the LFH rearing lakes compared to those reared at Irrigon FH.

In general steelhead returns are very high from LFH Rearing lakes within the Lower Snake River Compensation Plan (USFWS 2020):

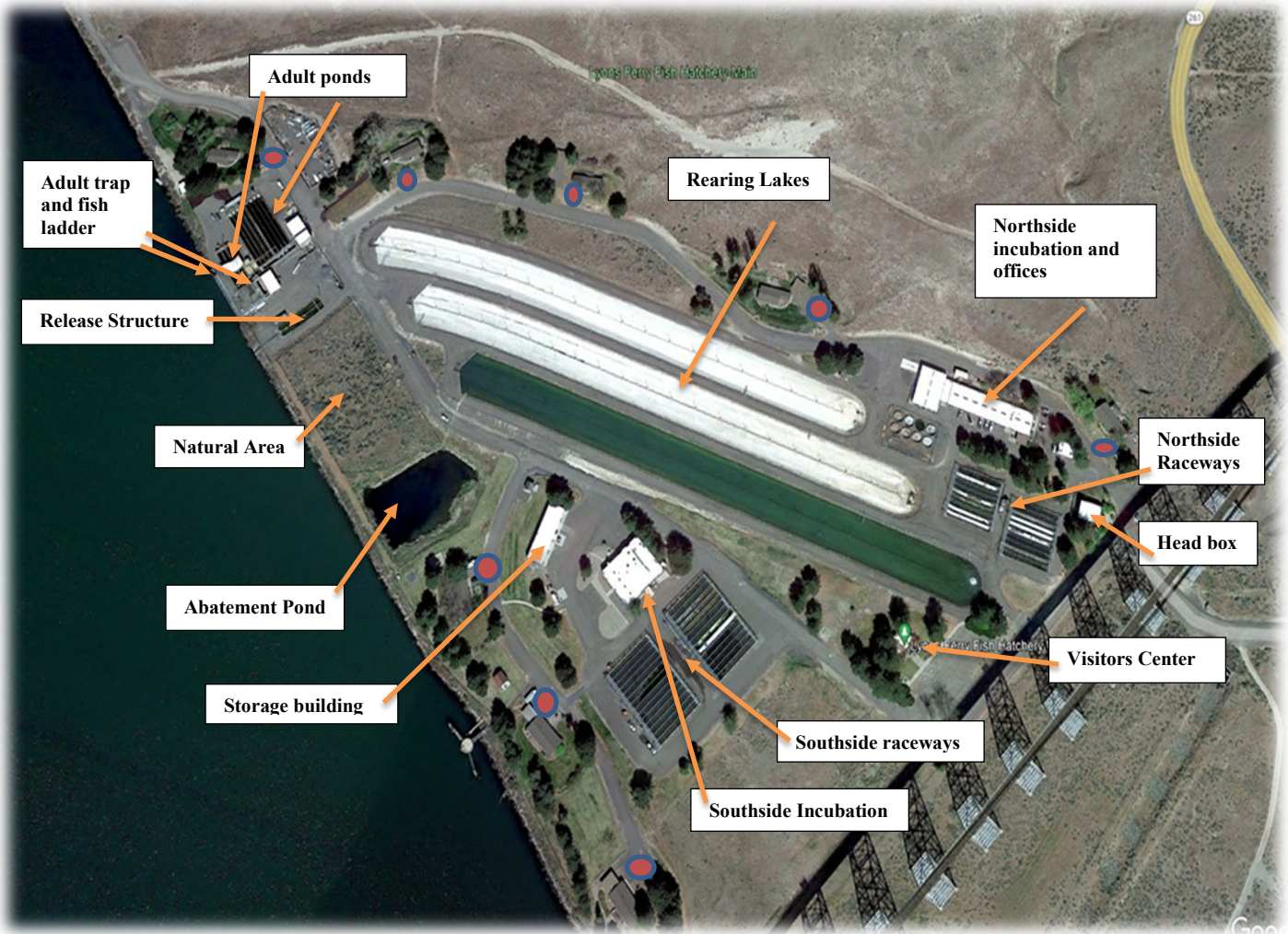
Steelhead Smolt to Adult Survivals (SAS) by basin, Brood Year 2000-2012


Clearwater FH	Hagerman NFH	Magic Valley FH	Imnaha – Irrigon FH	Grande Ronde – Irrigon/Lyons Ferry FH	SE WA – Lyons Ferry FH
1.37%	1.32%	1.03%	1.63%	1.78%	2.16%

## Rainbow Trout

Rainbow trout are reared and planted in both southeast Washington and northwest Idaho to meet LSRCP mitigation goals in both states for lost fishing opportunities because of construction and operation of the lower Snake River dams. The original LSRCP goal was 93,000 lbs at 2.5 fpp (Herrig 1990). However, the WDW determined that in stream habitat improvements, equivalent to the cost of producing 7,000 lbs. annually of hatchery trout, was a reasonable exchange, and that was implemented in 1983, which reduced the annual production goal to 86,000 lbs. for the Snake River Basin. The SE Washington production goal is 79,000 lbs. and the NW Idaho production goal is 7,000 lbs. LFH rears 74,000 rainbows to 2.5 fpp (29,300 lbs), 48,500 to 3.0fpp (16,167) and 1,000 (1,490 lbs) toward this goal and the remainder are reared at Tucannon FH (~94,000 fish). A small, privately funded program (Tri-State Steelheaders, TSS) at the LFH rears 2,500 rainbow to 1.5 lbs. each, providing a unique fishing opportunity in local lakes. A similar program rears 1,600 rainbow to 1.5 lbs each as well for Nez Perce Tribe.

# Lyons Ferry Fish Hatchery



There are eight residences around the perimeter of the facility. 

Smolt-to-Adult Survival (Total SAS) – WDFW Steelhead, spring Chinook, and Fall Chinook programs from Lyons Ferry/Tucannon Complex.

Species	Spring Chinook	Fall Chinook			Summer Steelhead				
	Tucannon	Snake	Snake	Snake	Tucannon	Touchet	LFH / Wallowa	LFH / Wallowa	LFH / Wallowa
Stock	Tucannon	Snake	Snake	Snake	Tucannon	Touchet	LFH / Wallowa	LFH / Wallowa	LFH / Wallowa
Smolt Age	1+	1+	0	0	1+	1+	1+	1+	1+
Release Location	Tucannon	Snake @LFH	Snake @LFH	Grande Ronde	Tucannon	Touchet	Grande Ronde	Snake @LFH	Touchet
Brood Year									
<b>2000</b>	0.15	2.06	0.15	---	---	---	2.34	1.68	1.20
<b>2001</b>	0.09	2.04	0.30	---	---	---	1.94	1.85	1.78
<b>2002</b>	0.10	0.50	0.15	---	---	---	1.92	2.25	2.00
<b>2003</b>	0.10	1.65	0.11	---	0.57	0.44	2.36	1.63	2.01
<b>2004</b>	0.18	2.16	0.08	0.08	0.80	0.28	1.34	1.93	1.62
<b>2005</b>	0.46	1.51	1.67	0.37	1.91	0.43	3.50	2.56	2.71
<b>2006</b>	1.09	7.24	0.24	---	1.95	0.98	3.35	2.59	3.38
<b>2007</b>	0.23	3.25	3.13	0.52	4.61	1.10	7.85	6.59	5.96
<b>2008</b>	0.37	3.64	0.46	0.35	---	0.37	2.13	3.37	2.49
<b>2009</b>	0.13	2.77	1.71	1.50	1.28	0.88	3.47	3.94	3.10
<b>2010</b>	0.10	4.06	2.16	0.39	0.97	0.26	1.02	1.70	0.95
<b>2011</b>	0.28	3.06	0.78	1.01	1.25	0.46	2.42	2.67	2.47
<b>2012</b>	0.25	1.89	1.49	0.57	0.56	0.40	2.98	3.36	2.42
<b>2013</b>	0.18	1.29	0.68	0.35	0.97	1.40	3.09	1.90	1.22
<b>2014</b>	0.21	1.66	0.70	0.68	0.21	0.18	0.58	1.19	0.65
<b>2015</b>	0.09	0.63	0.20	0.02	0.64	0.65	2.26	1.46	1.25
<b>2016</b>	0.01	0.31	0.28	0.36	0.31	0.48	0.83	0.62	0.82
<b>2017</b>		0.30	0.31	0.54	0.48	0.37	1.36	1.85	1.04
<b>2018</b>			0.61	0.74	0.10	0.07	0.67	0.75	0.59
<b>2019</b>					0.70	0.14	2.84	1.80	2.64
<i><b>Average</b></i>	<b>0.24</b>	<b>2.22</b>	<b>0.80</b>	<b>0.53</b>	<b>1.08</b>	<b>0.52</b>	<b>2.41</b>	<b>2.28</b>	<b>2.02</b>
<i><b>Geomean</b></i>	<b>0.16</b>	<b>1.65</b>	<b>0.47</b>	<b>0.36</b>	<b>0.75</b>	<b>0.41</b>	<b>2.01</b>	<b>1.99</b>	<b>1.71</b>

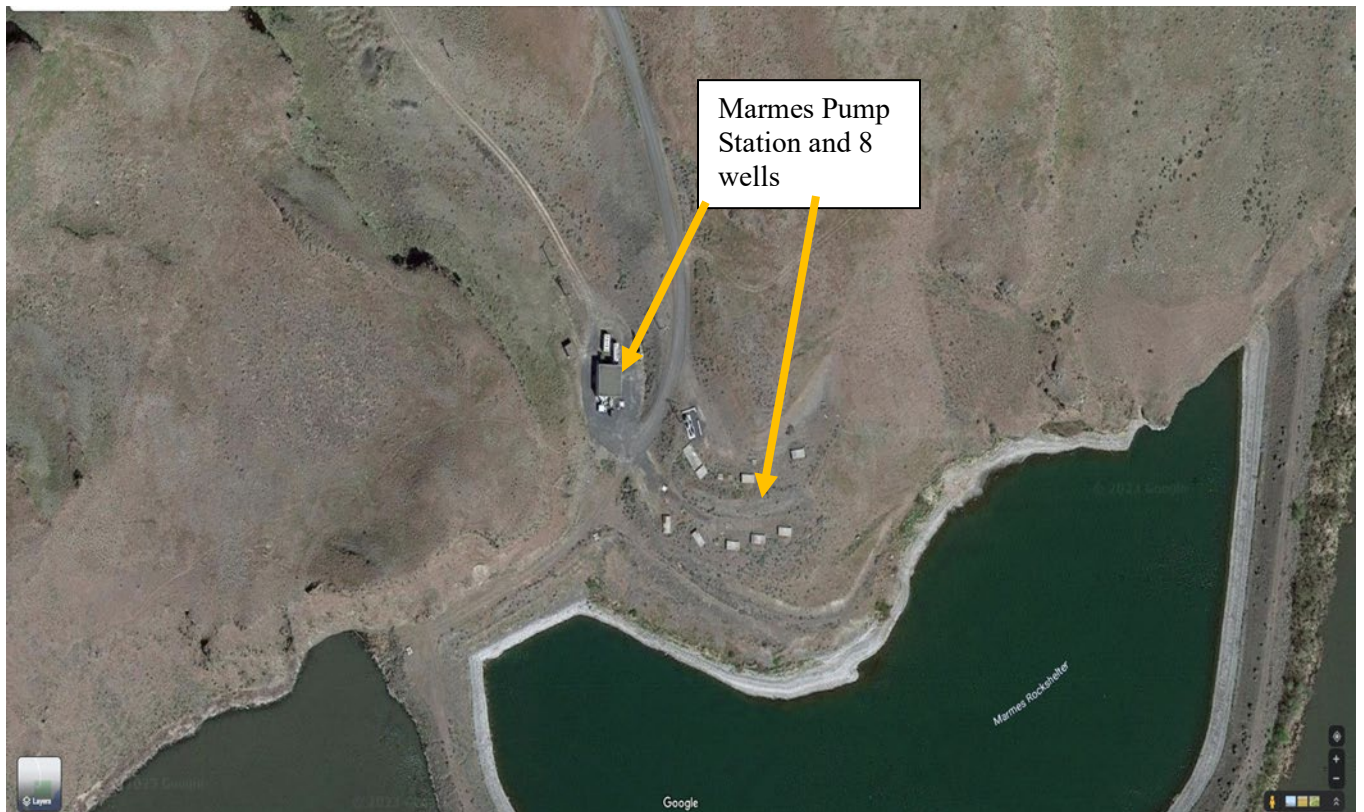


## 2.1 Infrastructure

### 2.1.1 Hatchery Water Supply

The Hatchery receives water through an underground/underwater 60-inch gravity line from the Marmes Pumping station and associated surge tank. There are three 300hp pumps, four 200hp pumps and one 75hp pump. 119 CFS (53,000 gpm) is the water right and what the eight pumps can put out. The water temperature is fairly constant at ~52 degrees F.

Annual maintenance involves one pump being pulled and refurbished.



## 2.1.2 Broodstock Collection

### Fall Chinook

Broodstock are primarily collected at the LGR adult trap. Trapping begins on August 18<sup>th</sup> each year. If water temperatures are too high for collection guidelines, broodstock can be collected at LFH and NPTH as well. Adults are trucked daily during the first few weeks of collection and then as water temperatures decrease and the run slows down, they are hauled less frequently. Currently the adult target is ~2,600 adults. This provides enough females and males to make programs and allows adults with coded wire tags to be collected for run reconstruction purposes. All adults are treated with Parasite -S every other day at 1:6,000 to prevent fungus growth and mortalities.

Approximately 4.6 million green eggs are taken each year. Approximately 1.31 million eyed eggs are shipped to ODFW's Irrigon FH. Of those, ~1 million subyearling smolts are destined for the Salmon River in Idaho for the IPC component of the Snake River fall Chinook program. Another 200,000 subyearling smolts are destined for the Grande Ronde River as part of the WDFW component of the Snake River fall Chinook program. LFH ships ~1.9 million subyearling smolts to the Nez Perce Tribes FCAP program annually. These subyearlings go to Pittsburgh Landing AF, Captain John Rapids AF and the Big Canyon AF for final rearing and release. LFH releases 450,000 yearling smolts and 700,000 subyearling smolts.

After fertilization, all eggs are disinfected for one hour in a 1:100 iodine solution prior to water hardening.

All females spawned will be tested for *R. salmoninarum* using ELISA. This allows for culling of females with moderate to high indexes and all juveniles and eggs shipped or transferred out of Washington must be from females with below-low and low optical indexes.

WDFW categorizes BKD-ELISA optical densities as follows:

- Below low = < 0.099,
- Low = 0.099 to 0.198,
- Moderate = 0.199 to 0.448,
- High = > 0.448

### Spring Chinook

Tucannon spring Chinook are collected at the Tucannon FH Rainbow Lake adult trap and immediately transferred to LFH for holding and spawning. Adults start showing up at the trap from mid-May through early July. LFH has colder water than the Tucannon FH resulting in a lower pre-spawn mortality rate on adults. All adults are treated with Parasite -S every other day at 1:6,000 to prevent fungus growth and mortalities. Up to 170 adults are collected for broodstock and to provide enough eggs to provide 225,000 yearling smolts.

After fertilization, all eggs are disinfected for one hour in a 1:100 iodine solution prior to water hardening.

Touchet spring Chinook are collected at the DAT. The first return of adults occurred in 2022, with 24 adults (hatchery and natural origin) being collected at the trap. A large number of fish bypassed the DAT dam due to high water and could not be collected but continued on upriver and spawned naturally in the upper Touchet River basin. This program began in 2018 and eyed eggs were received from either the USFWS Little White Salmon Hatchery or Carson Hatchery. It is the goal of the program to collect enough broodstock for program needs and not receive eggs from either USFWS facility in the near future. All adults are treated with Parasite -S every other day at 1:600 to prevent fungus growth and mortalities.

After fertilization, all eggs are disinfected for one hour in a 1:100 iodine solution prior to water hardening. All females spawned will be tested for *R. salmoninarum* using ELISA. This allows for segregating eggs and juveniles of females with moderate to high optical indexes.

WDFW categorizes BKD-ELISA optical densities as follows:

- Below low = < 0.099,
- Low = 0.099 to 0.198,
- Moderate = 0.199 to 0.448,
- High = > 0.448

## **Summer Steelhead**

Touchet summer steelhead are collected at the DAT. Adults are transferred to LFH upon collection. Approximately 24 adults are needed to make the release goal of 50,000 smolts. This is a conservation program. All adults are treated with Parasite -S every other day at 1:6,000 to prevent fungus growth and mortalities.

After fertilization, all eggs are disinfected for one hour in a 1:100 iodine solution prior to water hardening.

Tucannon summer steelhead are collected at the Tucannon FH Rainbow Lake adult trap and immediately transferred to LFH for holding and spawning. Approximately 80 adults are needed to make the release goal of 150,000 smolts. This is a conservation and mitigation program. All adults are treated with Parasite -S every other day at 1:600 to prevent fungus growth and mortalities. After fertilization, all eggs are disinfected for one hour in a 1:100 iodine solution prior to water hardening.

Wallowa summer steelhead are collected at the Cottonwood Acclimation Facility (AF) adult trap. Adults are spawned at the adult trap and the gametes are brought back to LFH for fertilization and incubation. After fertilization, all eggs are disinfected for one hour in a 1:100 iodine solution prior to water hardening.



## **Rainbow Trout**

Rainbow trout eggs are received eyed from the WDFW Spokane Hatchery. Eggs are laid out to hatched out in shallow trough baskets. Upon arrival at LFH, the eggs are disinfected in a 1:100 iodine solution for 15 minutes.

### **2.1.3 Incubation**

#### **Fall Chinook**

All females are incubated individually in heath stacks, maintaining their spawning number until eye up and picking. Eggs are treated with Parasite -S daily at 1:600 for 15 minutes until eye up and picking. After picking, eggs are mixed together and weighed down at 5,000 eggs per tray and treatments stop.

At picking, any females with moderate or greater optical indexes are culled. Also, at this time any eggs from known stray females are culled from the program and not kept for production.

At swim up, the fry are transferred from the heath stacks to outside rearing vessels and feed is introduced the day after.

#### **Spring Chinook**

Tucannon spring Chinook are incubated individually in heath stacks, maintaining their spawning number until eye up and picking. Eggs are treated with Parasite -S daily at 1:600 for 15 minutes until eye up and picking. After picking, eggs are mixed together and weighed down at 5,000 eggs per tray and treatments stop. At swim up, the fry are transferred from the heath stacks to outside rearing vessels and feed is introduced the following day.

All females spawned will be tested for *R. salmoninarum* using ELISA. Eggs and juveniles from females with moderate or high optical densities will be segregated and reared separately throughout the rearing term.

Touchet spring Chinook are incubated individually in heath stacks, maintaining their spawning number until eye up and picking. Eggs are treated with Parasite -S daily at 1:600 for 15 minutes daily until eye up and picking. After picking, eggs are mixed together and weighed down at 5,000 eggs per tray and treatments stop. At swim up, the fry are transferred from the heath stacks to outside rearing vessels and feed is introduced the following day.

All females spawned will be tested for *R. salmoninarum* using ELISA. Eggs from females with moderate or high optical densities will be culled.

#### **Summer Steelhead**

Touchet summer steelhead have been incubated separately in down well isolation buckets in the past. The hatchery will continue incubating separately but will be switching to heath stacks for

incubation. Eggs are treated with Parasite -S daily at 1:600 for 15 minutes daily until eye up and picking. After picking, eggs are mixed together and weighed back down into heath trays and treatments stop. At swim up the fry will be transferred to shallow troughs and feed will be introduced the following day.

Tucannon summer steelhead have been incubated separately in down-well isolation buckets in the past. The hatchery will continue incubating separately but will be switching to heath stacks for incubation. Eggs are treated with Parasite-S daily at 1:600 for 15 minutes until eye up and picking. After picking, eggs are mixed together and weighed back down into heath trays and treatments stop. At swim up the fry will be transferred to shallow troughs and feed will be introduced the following day.

Wallowa summer steelhead have been incubated separately in down-well isolation buckets in the past. The hatchery will continue incubating separately but will be switching to heath stacks for incubation. Eggs are treated with Parasite -S daily at 1:600 for 15 minutes daily until eye up and picking. After picking, eggs are mixed together and weighed back down into heath trays and treatments stop. At swim up the fry will be transferred to shallow troughs and feed will be introduced the following day.

#### **2.1.4 Nursery Rearing**

LFH has 88 shallow eyeing/hatching troughs and four 3.75 ft x 27.5 ft x 2 ft intermediate rearing troughs in the north-side hatching building.

Shallow troughs are used primarily for starting feed on summer steelhead rainbow trout and possibly small groups of spring Chinook. Chinook only stay in long enough to be the same size as a larger group and are then mixed together in outside raceways. Fish are generally no larger than 400fpp when moved outside. Touchet and Tucannon steelhead start feed in the shallow troughs and are then moved to the intermediate tanks when DI and FI are met. From the intermediate tanks they are moved to outside raceways, anywhere from 150-500fpp. Rainbow trout are hatched and feed is started in the shallow troughs. They then move to the intermediate tanks and to outside raceways shortly thereafter.

#### **2.1.5 Outdoor Rearing**

The LFH rearing facilities include twenty-eight Southside raceways at 10 ft x 100 ft x 2.8 ft and nineteen Northside raceways at 10 ft x 88.5 ft x 3.5 ft. The raceways rear all species produced at LFH (spring and fall Chinook, summer steelhead, and rainbow trout). These raceways are covered in 2" square mesh netting. There are three large rearing lakes (675,000 cubic feet (ft<sup>3</sup>) of water each; 1,100 ft x 90 ft x 6.5 ft dimensions; 2.25 surface acres each) which are also covered in 2" netting. Netting has significantly reduced predation since being installed in 2006-08. The steelhead and spring Chinook adult holding facilities include three 83 ft x 10 ft x 5 ft adult raceways with an enclosed spawning building incorporated over the center of these ponds. There

are four 8.5 ft x 150 ft x 4.3 ft and four 10 ft x 150 ft x 4.3 ft adult fall Chinook salmon holding ponds, which also accommodate fall Chinook subyearling rearing in the spring months.

Rearing Unit	Total Number	CuFt Each	Flow Each (gpm)
Southside Raceways	28	2,640	500-750
Northside Raceways	19	2,880	500-1,000
Rearing Lakes	3	675,000	3,000-6,000
Adult Ponds (1,2,7,8)	4	5,483	500-1,000
Adult Ponds (3-6)	4	6,450	500-1,000
Adult Ponds (9-11)	3	4,150	300-700

Fall Chinook – 0.09 DI until marking, 0.16 DI until splitting or at release  
 Spring Chinook – 0.09 DI until marking, 0.16 DI until splitting or at release  
 Summer Steelhead – 0.09 DI until marking, 0.25 DI until splitting or at release  
 Rainbow – 0.09 DI until ~100fpp, 0.25 DI until splitting or release

### **Fall Chinook**

Fall Chinook are reared in approximately 19 raceways and eight adult ponds. Sub-yearlings are transferred to FCAP in April and May from raceways and adult ponds between 65 and 75 fpp. On station sub-yearlings are moved to a rearing lake after the yearling program is released directly into the Snake River and released in late May/early June at 50 fpp. Yearling fall Chinook are reared in raceways and then put directly into one of the rearing lakes at marking. They are released in late March/early April directly into the Snake River at 10 fpp.

### **Spring Chinook**

Tucannon spring Chinook are reared in up to five raceways. At marking they are split out to not exceed 0.16 DI prior to transfer to the Tucannon FH in October.

Touchet spring Chinook are reared in up to five raceways. At marking they are split out not to exceed 0.16 DI. Typically, in June they are moved from the raceways to a rearing lake at approximately 65 fpp. In late January/early February, they are transferred to the Dayton AF for acclimation before they are released in mid-March.

### **Summer Steelhead**

Touchet summer steelhead are moved to two outside raceways in July through early August. In September they are marked and tagged and split out into three raceways for the remainder of the rearing cycle.

Tucannon summer steelhead are moved to three to five outside raceways in July through August. In September they are marked and tagged and split out into six raceways for the remainder of the rearing cycle. In March the 50,000 smolts (conservation piece of the program) are transferred to the Curl Lake AF. In April, volitional release begins at Curl Lake AF.

## **Wallowa Steelhead**

Wallowa summer steelhead are moved to five outside raceways in June. In September they are marked and tagged and go directly into one of the rearing lakes. In early February, 225,000 fish are transferred to the Cottonwood AF and then released in April. In late March, 100,000 fish are transferred to the Dayton AF and then released in April. After transfer to Dayton AF, the remaining 60,000 smolts are direct released into the Snake River at LFH at 4.5 fpp in April.

### **2.1.6 Release**

#### **Fall Chinook**

450,000 yearling Chinook are released from a rearing lake at 10 fpp in late March/early April directly into the Snake River at LFH.

In late May/early June 700,000 subyearling Chinook are released from a rearing lake at 50 fpp directly into the Snake River at LFH.

#### **Spring Chinook**

Tucannon spring Chinook are transferred to the Tucannon FH in October and released from there. Currently there are three release strategies being used. Approximately 20,000 smolts are being released into the lower Tucannon River, approximately .25 miles upstream of the mouth. Another~20,000 fish are being trucked back to LFH from Tucannon FH where they will be put on a barge and taken below Bonneville Dam and released. The remainder are being direct released into the Tucannon River at Tucannon FH. All smolts are released at 12 fpp.

Touchet spring Chinook are transferred to the Dayton AF in late January/early February and released from there directly into the Touchet River in March at 12 fpp.

#### **Summer Steelhead**

Touchet summer steelhead are transferred to the Dayton AF in April, just a week or two prior to volitional release. They are released directly into the Touchet River between 4.5 and 6 fpp.

Tucannon summer steelhead are transferred and directly released into the Tucannon River. The transferred group is 50,000 smolts that are taken to the Curl Lake AF approximately five miles upstream from the Tucannon FH. Volitional release begins in April. This is the conservation portion of the program. The mitigation portion is 100,000 smolts that are trucked and direct stream released into the Tucannon River. Approximately 75,000 smolts are to be released at the Marengo Bridge and 25,000 are released up by the Tucannon FH. Due to low broodstock numbers, we have only met the 150,000 smolt release target once since increasing the program from 100,000 smolts to 150,000 smolts in 2017. All smolts are released between 4.5 and 6 fpp.

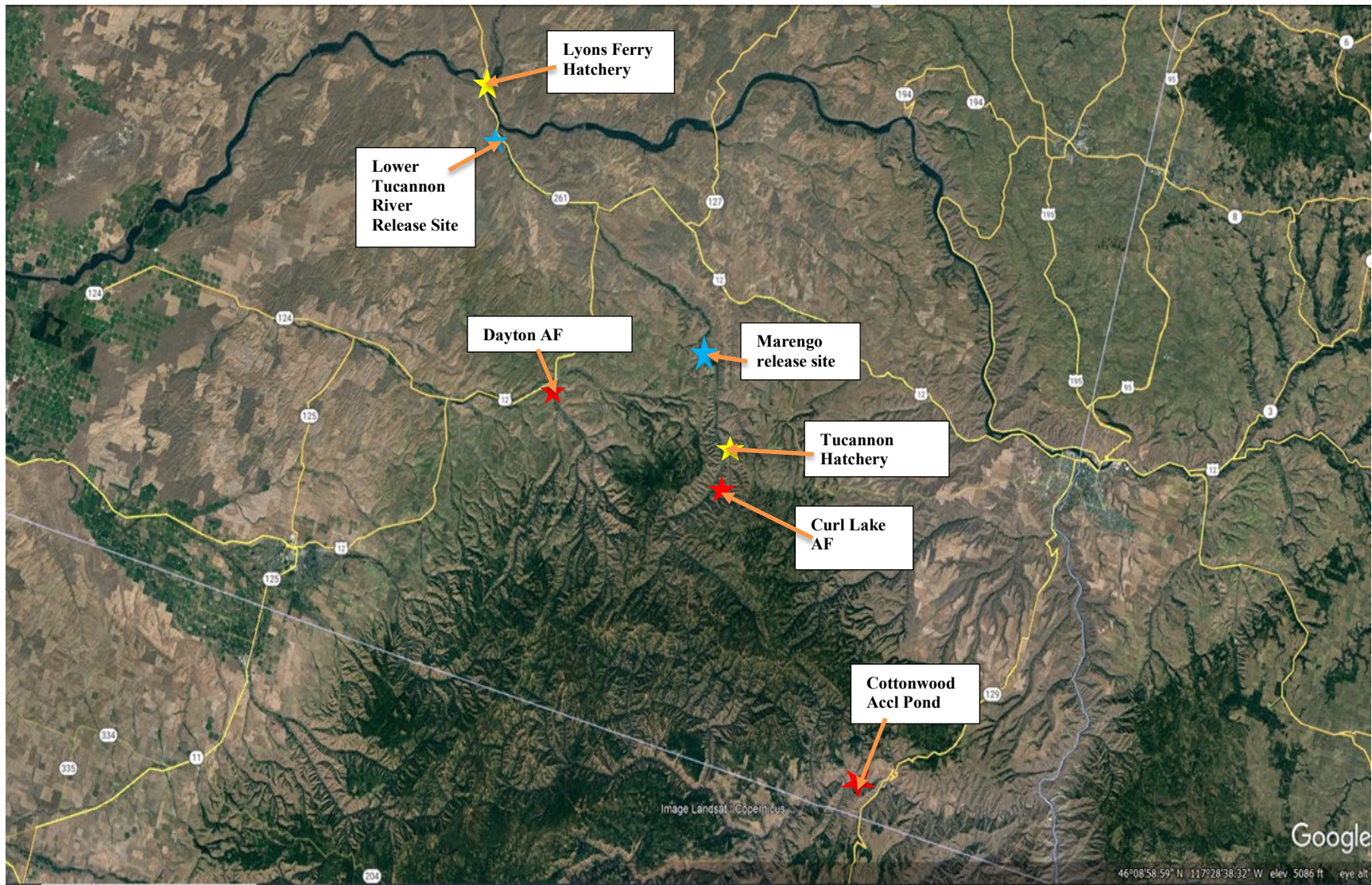
## **Wallowa Steelhead**

Wallowa steelhead go to three locations. In February, ~225,000 smolts are transferred to the Cottonwood AF and volitional release begins in April. In late March, 100,000 smolts are transferred to the Dayton AF and volitional release begins in April. The remaining 60,000 smolts are direct released from LFH into the Snake River in April. All smolts are released at 4.5 fpp.

## **Rainbow Trout**

Rainbow trout are planted into local lowland lakes. Planting begins in late February and continues through Aril. Fish are also transferred to the Nez Perce Tribe in April and May and hauled by the Nez Perce Tribe. Then fish are planted again in October in lowland lakes. Also in October, Idaho Department of Fish and Game transfer 16,000 (3.0 fpp) fish to Idaho.





### 2.1.7 Settling Pond

LFH has an offline settling pond, meaning that only water from rearing vessels when being cleaned goes into it. Water does not pass out of it but rather is absorbed into the ground. Production water from fish rearing goes directly out into the Snake River and is sampled per NPDES permit.

### 2.1.8 NPDES

The facility has always stayed within NPDES permit parameters. The current permit maximum poundage for a single month is 173,000 lbs.

## 3 Operations

### 3.1.1 Marking and PIT tagging

#### **Fall Chinook**

Marking of subyearling production for LFH and FCAP begins in mid-March. There are seven different release groups that are marked and tagged with each group receiving ~200,000 coded wire tags (CWT) and adipose fin clips. Prior to transfer or release, all groups receive Passive Integrated Transponder (PIT) tags. The number of PIT tags per group varies.

Yearling fall Chinook are marked and tagged in July. All 450,000 juveniles are adipose fin clipped and CWT. Smolts receive PIT tags at release.

#### **Spring Chinook**

Tucannon spring Chinook are tagged in March. All 225,000 fish receive a CWT. Smolts receive PIT tags just prior to release.

Touchet spring Chinook are marked and tagged in March. Approximately 85,000 juveniles receive a CWT and all 250,000 are adipose fin clipped. Smolts receive PIT tags prior to transfer to Dayton AF.



## **Summer Steelhead**

Touchet summer steelhead are CWT in August/September. Smolts receive PIT tags prior to transfer to Dayton AF.

Tucannon summer steelhead are marked and tagged in September. Approximately 50,000 juveniles receive a CWT only, ~25,000 are CWT and adipose fin clipped, and 75,000 are adipose fin clipped only. Smolts receive PIT tags prior to transfer or release out of LFH.

Wallowa summer steelhead are marked and tagged in July/August. All 385,000 fish are adipose fin clipped and 40,000 receive a CWT. At transfer or prior to direct release, the smolts receive a PIT tag.

## **Rainbow Trout**

No fish are marked or tagged.

# **4 Operational Changes for Program Efficiency**

## **4.1.1 Build new rearing lakes at LFH**

Three new rearing lakes for LFH have previously been designed and engineered. The approximate cost at the time of engineering was around \$5.5 million without additional water to operate them. At today's costs, program and water usage changes since that time, and those anticipated in the near future (fall Chinook yearling to subyearling conversion) and adding in the needed water component for these lakes, WDFW believes that the total cost could be double of the previous estimate. Based on the size of the lakes, and anticipated stocks that will go into them, two 250hp pumps would be needed, one for operating the lakes and one for backup. For these three additional lakes WDFW would prioritize the rearing of the following programs: Touchet spring Chinook program of 250,000 smolts, the Tucannon spring Chinook program of 225,000 smolts, and the Tucannon steelhead program of 150,000 smolts. For the Tucannon steelhead program, further discussions with co-managers and NOAA Fisheries will have to occur to agree to the mixing of the conservation and mitigation fish together and allow them all to be outplanted upstream of the TFH Weir (50,000 smolts for conservation and 100,000 smolts for mitigation).

These three additional rearing lakes will open up one of the larger rearing lakes due to moving of the 250K Touchet River spring Chinook group. Also, raceways currently used by Tucannon River spring Chinook and Tucannon River steelhead will open up for additional rearing options.

For the approximate cost of \$11M, WDFW would initially propose an additional 500,000 spring Chinook program that would be released in the Clearwater or Salmon River basins. Other

additional programs may also come to light, but will again depend on multiple factors that can influence production capabilities.

#### **4.1.2 Refurbish captive brood tanks from the 90's or replace**

The captive broodstock tanks from the BPA funded Tucannon spring Chinook program from the late 1990's, could be refurbished or replaced. Alone, these tanks would provide enough room to rear ~150,000 additional spring Chinook. However, to make a more efficient use of these circular tanks that would free up additional rearing space would involve moving the rainbow trout production into these circulars. With that change, five raceways would be freed up that could produce ~500,000 more spring Chinook. Midway through rearing, these spring Chinook would then be put into one of the existing large rearing lakes (currently occupied by the yearling fall Chinook program). This new spring Chinook program would have to be released or transferred in late-March/early April prior to subyearling fall Chinook going into the lake the first of April annually.

As part of the refurbishing of the tanks, water needs will have to be addressed either with 1) some kind of reuse system, 2) plumbing in reuse water from the nearest bank of north-side raceways, or 3) a new well. New circular rearing tanks were investigated back in 2014-15 and the design and engineering are already completed, with the approximate cost at that time around \$1.2 million.

LFH is currently going through the process to convert the yearling fall Chinook program to subyearling fall Chinook. This change will increase the demand for rearing space from January to May on the facility (450,000 subs to 1,200,000 onsite and increased production for FCAP). Peak fish loading and water demand occurs in January through May annually prior to shipments to FCAP acclimation locations. At that point, all 119 cfs (53,000 gpm) of the current water right is allocated.

For the ~\$1.2M Cost, WDFW would propose an additional 500,000 spring Chinook program that would be released in the Clearwater or Salmon River basins. Operation costs of \$75,000 annually (500,000 \* \$0.15/smolt).

#### **4.1.3 Experimental Age-0 Spring Chinook Production**

Currently (2022), fall Chinook salmon are reared between 10 fpp as yearlings released in March and 50 fpp as sub-yearlings and released in late May/early June. In the last decade, fall Chinook salmon sub-yearlings have survived much better than what originally occurred in the 1980s and 1990's (Bugert et al, 1997, Rosenberger et al 2017, Bumgarner et al 2022). Only, a small component (15%) of fall Chinook salmon sub-yearlings "holdover" in the Lower Snake reservoir pools created by the hydrosystem. However, these "holdover" subyearlings can account for a

significant (25%+) component of the returning adult fall Chinook salmon (NOAA 2018 pg. 80). Anecdotally, these “holdover” sub-yearlings grow very quickly in the summer and fall months in the productive reaches of the Snake River reservoirs and can surpass the 10 fpp release size of comparable yearlings (Darren Ogden pers comm). However, the reservoir rearing environment has been constantly changing/fluctuating in recent years with additional predator biomass, temperature increases, etc.

Spring/summer Chinook salmon are commonly reared between 12 to 25 fpp within the LSRCF between temperatures of 36 to 55 F as yearlings and 100 fpp as sub-yearlings. At Lyons Ferry, 52 F water temperatures offer an opportunity to rear spring Chinook following a fall Chinook sub-yearling life history. Previous work with spring/summer Chinook sub-yearlings have released 100 fpp parr in the Fall (September). These releases have produced very poor adult return rates (<0.1%). Accelerating growth to target late May/early June releases at 30-50 fpp would match fall Chinook salmon releases and potentially capture the reservoir reared benefit of some smolts “holding-over” in the Lower Snake River reservoirs.

Currently, no space exists for Age-0 spring Chinook smolts at LFH. However, test programs could be explored in multiples of 100,000 per Northside raceway if alternative rearing facilities were identified for existing programs. Across the LSRCF portfolio, several facilities have water temperature profiles that have spring-released Age-0 spring Chinook potential:

Facility	Temperature
Lyons Ferry Fish Hatchery	52 F
Irrigon Fish Hatchery	55 F
Hagerman National Fish Hatchery	59 F
Magic Valley Fish Hatchery	59 F

Replacing steelhead or multi-species rearing with steelhead – i.e., moving steelhead to acclimation facilities mid-winter, has the potential of 10 to 22M additional Age-0 spring Chinook at LFH, Irrigon FH, Hagerman, and Magic Valley Hatcheries.

A test program of Age 0 spring Chinook reared at LFH would need to consider multiple factors and would also need a subsequent control group of yearlings that could be compared to. Current LFH yearling spring Chinook stocks are released mid-hydro projects and would likely not be as conducive to success.

Total costs – Unknown. Potential Age-0 smolts across program: 10 – 22M smolts.

#### 4.1.4 Utilize Rearing Lakes for Steelhead

A recent Reciprocal Study (Release Years 2015-2018) comparing Wallowa stock steelhead reared at Irrigon FH at normal densities (DI = 0.15) compared to rearing in LFH rearing lakes in a semi-natural environment (DI = 0.01) is complete. Data from this study suggests a 2:1 Smolt-to-Adult Return (SAR) for Wallowa stock steelhead reared in the LFH rearing lakes, regardless of release location in the Grande Ronde Basin. This study was implemented because the mean SAR from LFH rearing lake steelhead averaged 2.9% compared to 1.1% at Irrigon raceway-reared steelhead from BY97-2008. During the same timeframe, the remaining LSRCP steelhead facilities also averaged in the 1% to 1.5% range.

Generally, 225,000 steelhead are transferred to acclimation in February each year and 160,000 steelhead are kept until release (April) in Lake Three. With this approach, water demands are decreased from approximately 6000 gpm in lake 3 to about 3000 gpm in lake 3.

With the fall Chinook yearling to subyearling conversion, Lake One will be utilized for final rearing (April – May) of sub-yearlings. Lake Two will be used for Touchet spring Chinook (July – January) and final fall Chinook subyearling rearing (April – May).

If water supplies were maintained at 6,000 gpm each, the rearing lakes could provide steelhead rearing of approximately 400,000 smolts (4.5 fpp) each to April release for a total of 1.2 M smolts in all three rearing lakes. To gain additional water supplies, approximately 12 Southside raceways (750 gpm) rearing capacity would need alternative rearing locations.

Multiple options of “Reciprocal Study Implementation” were examined by the co-managers in 2020 and 2021. From those discussions, the first step was conversion of the fall Chinook yearlings to subyearlings, which is currently in the process of getting approved. Additional species swaps and conversion have a maximum potential of 2.75M to 3.5M spring Chinook yearlings at 20 fpp assuming additional LFH rearing of 800,000 steelhead (2 rearing lakes) to 4.5 fpp.

Costs are \$360,000 for 800,000 steelhead increase at LFH (\$0.45/smolt) for fish food, marking, etc. Additional costs would include in-pond aeration (\$300,000), transport tanker at LFH (\$300,000), and transportation (TBD). Additional spring Chinook up to 3.5M would cost \$533,000 annually at other facilities.

Chinook costs for an additional 2.75 M spring Chinook and 900,000 sub-yearling fall Chinook are approximately \$547,500 annually for fish food, marking, etc. at \$0.15/smolt. Transportation of Touchet spring Chinook would be backhauled on the steelhead transportation costs.

Movement of 800,000 steelhead smolts to LFH could provide an additional 8,000 steelhead annually (1.0% delta SAR on 800,000 smolts). The additional 3.5M spring Chinook smolts

could provide an additional 11,900 adults (0.34% SAR on 3.5M smolts) depending on release location.

Total implementation = \$948,000 annually and \$600,000 additional transport tanker and supplemental aeration.

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# 6 Appendix A – Production Planning

## Lyons Ferry Hatchery

Chin FI=1.6 DI=.09 until marking or splitting, .14 to release as smolts or transfer as smolts. Sthd FI=1.6 DI=.09 until marking, .2 until release or transfer as smolts  
 Rb FI=1.6 DI=.25

1.9 mill FCAP, 700k LFH

	2022/23	Fall CK Subs 2.6 mil 26,667 LBS.	Fall CK yrings 450,000 45,000 LBS.	Tuc Spring CK 225k 9,000 LBS.	Tuca Sthd 150k 33,333 LBS.	Touchet Sthd 50k 11,111 LBS.	Touchet Spring CK 250K 20,833 LBS.	Wallowa Sthd 385 K 89,000 LBS.	RB Trout 122K 47,995 LBS.			
<b>Pond use schematic - by stock</b>	<b>2022/23</b>											
Pond	January	February	March	April	May	June	July	August	September	October	November	December
SS INC												
SS INC												
SS INC												
SS INC												
NS INC												
NS INC												
Tank 6												
Tank 7												
Tank 8												
Tank 9												
N1	NPT/LFH jumbos			NPT/LFH jumbos								
N2							Wallowa sthd					
N3							Wallowa sthd			Tucannon sthd		
N4							Wallowa sthd			Tucannon sthd		
N5							Wallowa sthd			Tucannon sthd		
N6							Wallowa sthd			Tucannon sthd		
N7							Tucannon sthd					
N8							Tucannon sthd					
N9							Touchet sthd					
N10							Touchet sthd					
N11		LFH subs				LFH 1+						
N12		LFH subs				LFH 1+						
N13		LFH Subs				LFH 1+						
N14		LFH Subs				LFH 1+						
N15						LFH 1+		RBT				
N16	RBT											
N17	RBT											
N18	RBT											
N19	RBT											
Lake 1	LFH 1+				LFH Subs, 700k		LFH 1+					
Lake 2	Touchet springs						Touchet springs					
Lake 3	Wallowa Sthd						Wallowa sthd					
S 1	Tou Spr											Tou Spr
S 2	Tou Spr											Tou Spr
S 3	Tou Spr											Tou Spr
S 4	Tou Spr											Tou Spr
S 5	Tou Spr											Tou Spr
S 6												
S 7												
S 8												
S 9												
S 10	Tuc Spr											Tuc Spr
S 11	Tuc Spr											Tuc Spr
S 12	Tuc Spr											Tuc Spr
S 13	Tuc Spr											Tuc Spr
S 14	Tuc Spr											Tuc Spr
S 15	BC Subs											
S 16	CJ Subs											
S 17	Pitts subs											
S 18	Pitts 2 subs											
S 19	Pitts 2 subs											
S 20	BC 2 subs											
S 21	BC 2 subs											
S 22	CJ 2 Subs											
S 23	CJ 2 Subs											
S 24	LFH 1+											
S 25	LFH 1+											
S 26	LFH 1+											
S 27	LFH 1+											
S 28	LFH 1+											
AP 1	BC Subs							Adults				
AP 2	BC Subs							Adults				
AP 3	CJ Subs							Adults				
AP 4	CJ Subs							Adults				
AP 5	LFH Subs											
AP 6	LFH Subs											
AP 7	Pitts Subs							Adults?				
AP 8	Pitts Subs							Adults?				
AP 9			Adults									
AP 10			Adults									
AP 11			Adults									

1,2,7 & 8 are smaller




Lyons Ferry Hatchery

1.9 mill FCAP, 700k LFH

													Fall CK Subs			Fall CK yrings			Tuc Spring CK			Tuca Sthd			Touchet Sthd			Touchet Spring CK 250K			Wallowa Sthd			RB Trout		
													2.6 mil			450,000			225K			150k			50k			20,833 LBS.			385 K			122K		
													26,667 LBS.			45,000 LBS.			9,000 LBS.			33,333 LBS.			11,111 LBS.			89,000 LBS.			47,995 LBS.					
Pond flows by stock and month													2022/23																							
Pond	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December												
SS INC																																				
SS INC																																				
SS INC																																				
SS INC																																				
NS INC																																				
NS INC																																				
Tank 6																																				
Tank 7																																				
Tank 8																																				
Tank 9																																				
N1	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
N2													500	500	500	1,000	1,000	1,000																		
N3	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000		500	500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
N4	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000		500	500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
N5	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000		500	500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
N6	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000		500	500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
N7	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000		500	500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
N8	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000		500	500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
N9	1,000	1,000	1,000	1,000	1,000	1,000							500	500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
N10	1,000	1,000	1,000	1,000	1,000	1,000							500	500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
N11			500	500	500	1,000	1,000						1,000	1,000	1,000	1,000	1,000	1,000																		
N12			500	500	500	1,000	1,000						1,000	1,000	1,000	1,000																				
N13			500	500	500	1,000	1,000						1,000	1,000	1,000	1,000																				
N14			500	500	500	1,000	1,000						1,000	1,000	1,000	1,000																				
N15													1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000															
N16	1,000	1,000	1,000	1,000		500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
N17	1,000	1,000	1,000	1,000	1,000		500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
N18	1,000	1,000	1,000	1,000	1,000		500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
N19	1,000	1,000	1,000	1,000	1,000	1,000		500	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000												
Lake 1	4,500	4,500	4,500	4,500	4,500		6,000	6,000	6,000	6,000							4,000	4,000	4,000	4,000	4,000	4,000	4,500	4,500												
Lake 2	4,000	4,000											4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000												
Lake 3	6,000	6,000	3,000	3,000	3,000	3,000	3,000																													
S 1	750	750	750	750	750	750	750	750	750	750	750													500												
S 2	750	750	750	750	750	750	750	750	750	750	750													500												
S 3	750	750	750	750	750	750	750	750	750	750	750													500												
S 4	750	750	750	750	750	750	750	750	750	750	750													500												
S 5	750	750	750	750	750	750	750	750	750	750	750													500												
S 6																																				
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S 9																																				
S 10	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750			500												
S 11	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750			500												
S 12	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750			500												
S 13	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750			500												
S 14	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750			500												
S 15		500	500	750	750	750	750																													
S 16		500	500	750	750	750	750																													
S 17		500	500	750	750	750	750																													
S 18		500	500	750	750	750	750	750	750																											
S 19		500	500	750	750	750	750	750	750																											
S 20		500	500	750	750	750	750	750	750																											
S 21		500	500	750	750	750	750	750	750																											
S 22		500	500	750	750	750	750	750	750																											
S 23		500	500	750	750	750	750	750	750																											
S 24			500	500	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750															
S 25			500	500	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750															
S 26			500	500	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750															
S 27			500	500	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750															
S 28			500	500	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750															
AP 1		500	500	1,000	1,000	1,000	1,000						750	750	750	750	750	750	750	750	750	750	750	750												
AP 2		500	500	1,000	1,000	1,000	1,000						750	750	750	750	750	750	750	750	750	750	750	750												
AP 3		500	500	1,000	1,000	1,000	1,000						750	750	750	750	750	750	750	750	750	750	750	750												
AP 4		500	500	1,000	1,000	1,000	1,000	1,000					750	750	750	750	750	750	750	750	750	750	750	750												
AP 5		500	500	1,000	1,000	1,000	1,000	1,000																												
AP 6		500	500	1,000	1,000	1,000	1,000	1,000																												
AP 7		500	500	1,000	1,000	1,000	1,000	1,000					750	750	750	750	750	750	750	750	750	750	750	750												
AP 8		500	500	1,000	1,000	1,000	1,000	1,000					750	750	750	750	750	750	750	750	750	750	750	750												
AP 9				350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350															
AP 10																																				

## 7 Appendix B – Water Quality

		<b>Water Analysis Report</b> Soil, Water and Forage Testing Laboratory Department of Soil and Crop Sciences 2610 F&B Road, 2478 TAMU College Station, TX 77843-2478 979-845-4816				
Report generated for: Kelly Britt WDFW Lyons Ferry Hatchery 2927 W Waikiki Rd SPOKANE, WA 99208		Laboratory #: 35045346 Customer Sample ID: Head Trough - 12/8/2021 Date Processed: 1/10/2022 Sample from Franklin, WA County Water Source =Well		Visit our website: <a href="http://soiltesting.tamu.edu">http://soiltesting.tamu.edu</a>  Format based on publication SCS-2002-12		
		Water Use =Aquaculture				
Parameter analyzed	Results	Units	Method	V. Limiting	Limiting	Acceptable
Calcium (Ca)	21	ppm	ICP	<b>Publications on aquatic and pond water quality can be downloaded at: <a href="http://soiltesting.tamu.edu/webpages/publications.html">soiltesting.tamu.edu/webpages/publications.html</a></b>		
Magnesium (Mg)	14	ppm	ICP			
Sodium (Na)	20	ppm	ICP			
Potassium (K)	5	ppm	ICP			
Boron (B)	0.02	ppm	ICP			
Carbonate (CO <sub>3</sub> )	13	ppm	Tit.			
Bicarbonate (HCO <sub>3</sub> )	145	ppm	Tit.			
Sulfate (SO <sub>4</sub> <small>calculated from total S</small> )	16	ppm	ICP			
Chloride (Cl <sup>-</sup> )	12	ppm	Tit.			
Nitrate-N (NO <sub>3</sub> -N)	0.09	ppm	Cd-red.			
Phosphorus (P)	0.04	ppm	ICP			
pH	10.41		ISE			
Conductivity	219	umhos/cm	Cond.			
Hardness	6	grains CaCO3/gallon	Calc.			
Hardness	108	ppm CaCO3	Calc.			
Alkalinity	140	ppm CaCO3	Calc.			
Total Dissolved Salts (TDS)	246	ppm	Calc.			
SAR	0.8		Calc.			
Iron (Fe)	0.05	ppm	ICP			
Zinc (Zn)	0.03	ppm	ICP			
Copper (Cu)	< 0.01	ppm	ICP			
Manganese (Mn)	0.03	ppm	ICP			
Arsenic (As)	< 0.030	ppm	ICP			
Barium (Ba)	0.024	ppm	ICP			
Nickel (Ni)	< 0.005	ppm	ICP			
Cadmium (Cd)	< 0.003	ppm	ICP			
Lead (Pb)	< 0.004	ppm	ICP			
Chromium (Cr)	< 0.007	ppm	ICP			
Fluoride (F)	0.33	ppm	ICP			
Charge Balance (cation/anion*100)	90		Calc.			
ppm=parts per million-milligrams per liter N/A, not applicable for this water use /2021 Descriptions of each water parameter, potential use issues and target levels are provided in publication SCS-2002-10, Description of Water Analysis Parameters. ICP, Inductively coupled plasma; Tit., titration; ISE, Ion selective electrode; Cd-red., cadmium reduction; cond., conductivity; calc., calculated						