

# Infrastructure and Operations Audit of the Irrigon Fish Hatchery 2022



**Irrigon Fish Hatchery**  
**Lower Snake River Compensation Plan**

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## Executive Summary

On November 2, 2022, Chris Starr, Facility Coordinator LSRCP, Nathan Wiese, Program Coordinator LSRCP, Andrew Gibbs, East Region Hatchery Coordinator ODFW, Terry Blessing, Irrigon Hatchery Manager ODFW, and Keenan Schmidt, Hatchery Supervisor ODFW, conducted a high-level one-day infrastructure and operations assessment of the Irrigon Fish Hatchery.

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 the facility and ultimately increase opportunities for LSRCP to meet adult mitigation targets.

This audit is a kick-off effort to assess all spring/summer Chinook rearing facilities within the LSRCP program prior to 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.

To maximize the production capacity and efficiency of Irrigon Fish Hatchery three items have been identified. Low Head Oxygen Supplementation, investing in partial reuse, and production modification.

Low Head Oxygen Supplementation would cost approximately \$520,000 and \$50,000 annually.

Partially moving rainbow trout production will free space for 900,000 additional sub-yearling fall Chinook as part of the Lyons Ferry yearling to sub-yearling conversion. Those sub-yearlings will cost an additional \$90,000 annually.

Moving 400,000 Wallowa steelhead smolts could free 10 additional raceways for production of 800,000 (Age 1+) to 2,000,000 (Age 0+) fall or spring Chinook smolts. Costs for implementation include \$750,000 for water chiller systems and \$160,000 to \$200,000 annually.

Movement of remaining rainbow trout production could free up to 6 raceways for production of 480,000 (Age 1+) to 1,200,000 (Age 0+) fall or spring Chinook smolts. Costs for implementation include \$750,000 for water chiller systems and \$90,000 to \$120,000 annually.

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## 1 Scope

On June 23, 2022, Chris Starr, Facility Coordinator LSRCP, Nathan Wiese, Program Coordinator LSRCP, Terry Blessing, Irrigon Hatchery Manager ODFW, and Keenan Schmidt, Irrigon Hatchery Supervisor ODFW, conducted a high-level one-day infrastructure and operations assessment of the Irrigon Fish Hatchery.

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 the facility and ultimately increase opportunities for LSRCP to meet adult mitigation targets.

This audit is a kick-off effort to assess all spring/summer Chinook rearing facilities within the LSRCP program prior to 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

Irrigon Hatchery is located along the Columbia River above John Day Dam 3 miles west of Irrigon, Oregon. The facility is at an elevation of 277 feet above sea level, at latitude 45.9092 and longitude -119.5442. The area of the site is 33 acres, owned by the USFWS.

The facility began operation in 1984 as part of the Lower Snake River Compensation Plan (LSRCP). The LSRCP was enacted to mitigate for the decline in salmon and steelhead abundance resulting from the construction of the four lower Snake River dams. Irrigon Hatchery serves as the rearing site for summer steelhead smolts for the Grande Ronde and Imnaha River basins. Summer steelhead smolts are transferred to three acclimation sites operated by Wallowa Hatchery: Big Canyon Acclimation, Wallowa Acclimation, and Little Sheep Acclimation.

The Wallowa River summer steelhead program is an isolated program used for harvest mitigation and was designed to escape 9,184 adult steelhead back to the project area. Current smolt production goal for the Wallowa River is 800,000 smolts. The Little Sheep Creek (Imnaha River) steelhead hatchery program is an integrated harvest program with a goal to increase both harvest and supplementation. Current smolt production goal for Little Sheep Creek is 215,000 smolts. The Little Sheep Creek summer steelhead hatchery program was designed to escape 2,000 adults to above Ice Harbor Dam. (HGMP 2011)

The Oregon Department of Fish and Wildlife (ODFW) and Confederated Tribes of the Umatilla Indian Reservation (CTUIR) utilizes the facility to incubate 620,000 Umatilla River coho salmon eggs from green to eyed stage for transfer to Cascade Hatchery for rearing.

Irrigon Hatchery is also used by the Oregon Department of Fish and Wildlife as a rearing site to produce 97,280 legal and 15,900 trophy sized rainbow trout for distribution to northeast Oregon waters.

Additional LSRCP production has been added to occupy infrastructure that does not interfere with the summer steelhead programs. Space was identified to rear fall Chinook subyearlings received as eyed eggs from Lyons Ferry Hatchery. 1,000,000 subyearling smolts are currently being produced through a contract with the Idaho Power Company for release into the Salmon River at Hammer Creek. 200,000 subyearlings are being produced for direct stream release into the lower Grande Ronde River. These programs represent priorities 9 and 10 in the US v OR 2018-2027 Management Agreement Table B4, respectively. Beginning as early as Brood Year 2023 additional fall Chinook smolts are slated to be produced at Irrigon Hatchery to accommodate the conversion of Lyons Ferry Hatchery yearling production to subyearling. The Grande Ronde River production is proposed to increase by 300,000 smolts and be acclimated at ODFW's Big Canyon facility on the Wallowa River. 600,000 subyearling smolts would also be produced and direct stream released at Couse Creek on the Snake River.

No adults are trapped, held, or spawned onsite for LSRCP related production. Adults are collected and spawned by Wallowa Hatchery for the Wallowa and Imnaha stock summer steelhead programs. Fall Chinook adults are collected and spawned by Lyons Ferry Hatchery for

the Grande Ronde River and Salmon River production. Irrigon Hatchery staff spawns Umatilla River Coho, which are collected and held by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) at the Three Mile Falls Dam collection facility.

Irrigon Hatchery’s average 5-year eyed to smolt survival is 94.2% for the summer Steelhead and 95.4% for fall Chinook.

**Table 1. LSRCP Summer Steelhead Production Summary**

<b>Program</b>	<b>Stock</b>	<b>Release Site</b>	<b>Transfer Date</b>	<b>Production Goal</b>	<b>Target F/lb.</b>	<b>Production Pounds</b>
LSRCP/ODFW	Wallowa River	Wallowa Acclimation	November	400,000	10.0	40,000
LSRCP/ODFW	Wallowa River	Wallowa Acclimation	April	160,000	5.5	29,091
<b>Total</b>				<b>560,000</b>		
LSRCP/ODFW	Wallowa River	Big Canyon Acclimation	March	240,000	5.5	43,636
<b>Total</b>				<b>240,000</b>		
LSRCP/ODFW	Imnaha River	Little Sheep Acclimation	February	215,000	5.0	43,000
<b>Total</b>				<b>215,000</b>		
<b>Grand Total</b>				<b>1,015,000</b>		<b>155,727</b>

**Table 2. LSRCP Fall Chinook Production Summary**

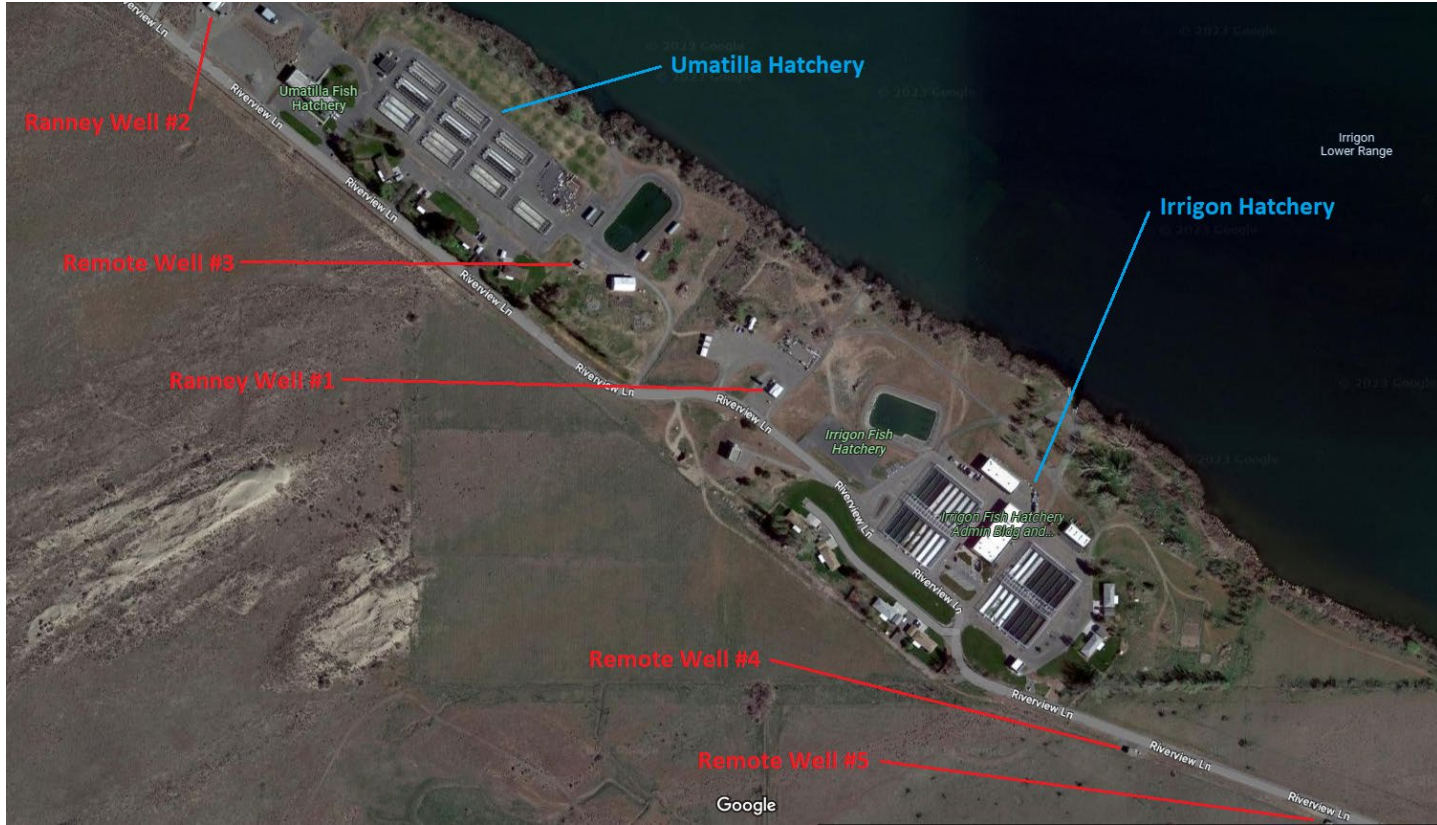
<b>Program</b>	<b>Stock</b>	<b>Release Site</b>	<b>Transfer Date</b>	<b>Production Goal</b>	<b>Target F/lb.</b>	<b>Production Pounds</b>
LSRCP/ODFW	Snake River	Salmon River Direct Stream	May	1,000,000	50.0	20,000
LSRCP/ODFW	Snake River	Big Canyon Acclimation	May	500,000*	50.0	10,000
LSRCP/ODFW	Snake River	Couse Creek Direct Stream	May	600,000*	50.0	12,000
<b>Grand Total</b>				<b>2,100,000</b>		<b>42,000</b>

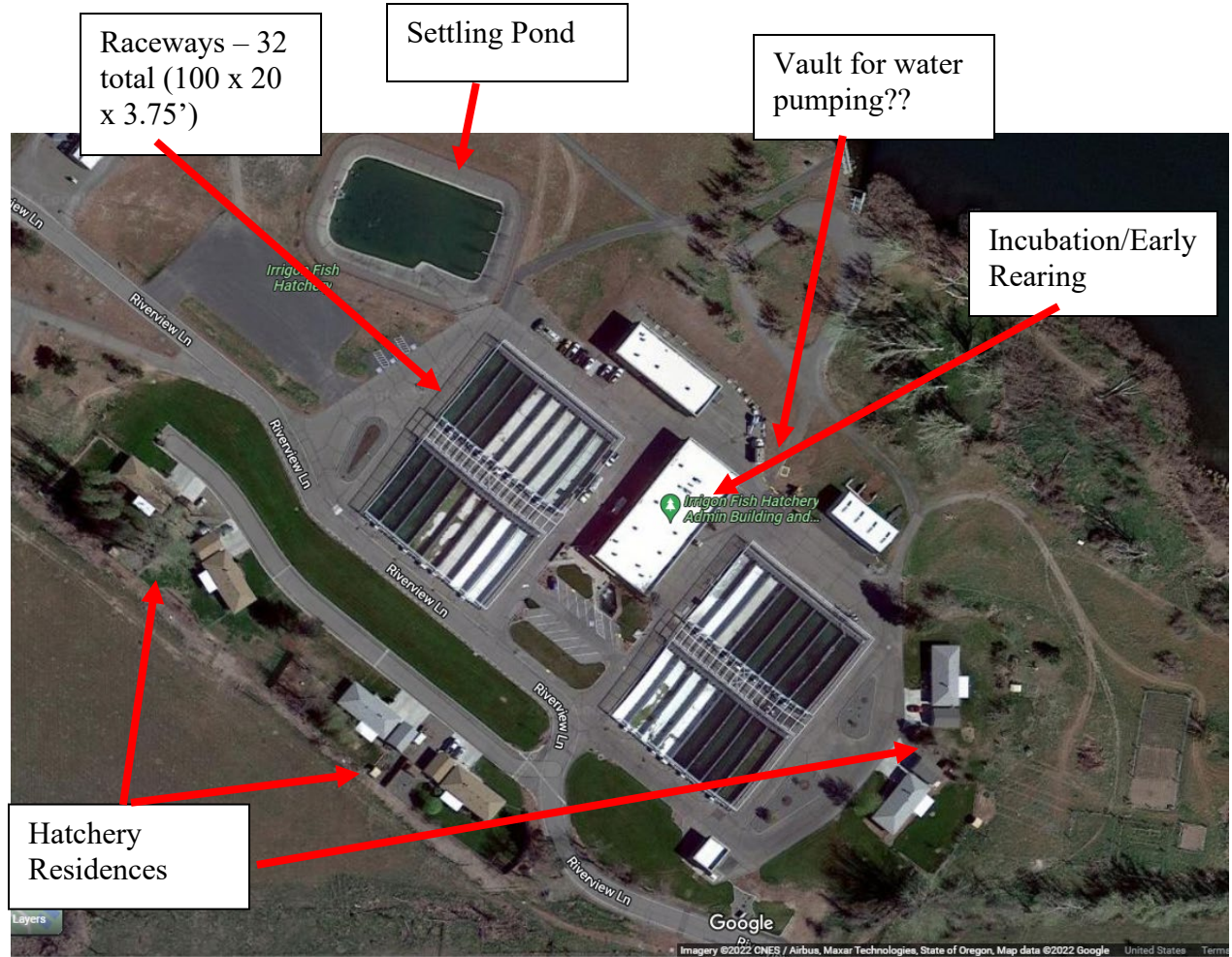
\*Includes proposed additional production beginning as early as Brood Year 2023.

**Table 3. ODFW/OTHER Production Summary**

<b>Program</b>	<b>Stock</b>	<b>Release Site</b>	<b>Transfer Date</b>	<b>Production Goal</b>	<b>Target F/lb.</b>	<b>Production Pounds</b>
ODFW	Rainbow Trout	NE Oregon Waters	March-July	97,280	3.0	32,427
ODFW	Rainbow Trout	NE Oregon Waters	March-July	15,900	0.66	24,091
	<b>Grand Total</b>			<b>113,180</b>		<b>56,518</b>
ODFW/CTUIR Eyed Program	Umatilla Coho	Umatilla River	December Cascade FH	620,000	Eyed Egg	-







## 2.1 Infrastructure and Operation

### 2.1.1 Hatchery Water Supply

The hatchery water supply is provided from 5 wells. At sustainable operating levels, these wells produce a total of 14,000 gpm. Facility water rights, and original design capacity is 25,000 gpm. The 14,000 gpm is available year-round with actual low water use occurring in June when only 9,600 gpm is needed. Supply water temperatures range from 54 to 61 degrees Fahrenheit, peaking in early winter. (HPMP)

Maintenance of the hatchery water supply is much different with a pump station than a surface water facility. Pumps and motors are pulled for service on a rotating annual basis. Pumps and generators are exercised monthly. Physical well checks are performed daily, and wells are sloped weekly. Proper preventative maintenance and investment in replacing pumps and motors in scheduled intervals are crucial to ensuring the reliability of the facilities water supply.

### 2.1.2 Incubation

Maximum summer steelhead incubation tray densities are 10,000 eggs per tray at 5 gpm. Fall Chinook salmon are incubated at densities of 6,000 to 7,000 eggs per tray at 5 gpm. Irrigon Fish Hatchery incubation infrastructure consists of 20 twelve-tray and 16 sixteen-tray vertical incubation stacks (Heath-type). An additional incubation unit consists of 12 four-tray stacks for use with small egg takes.

Eggs of all species are treated with formalin at 1600 ppm (1:600) for 15 min three days per week in addition to a buffered Iodophor flush two days per week (200 ppm or 250 ml buffered Argentyne in the top and middle stack) to prevent soft shell.

Egg development is tracked using Accumulated Temperature Units in Fahrenheit (ATU's). When eggs have reached the eyed stage, they are shocked, picked, and inventoried. Eggs from females with ELISA values >0.200 OD units are culled prior to eye-up and egg enumeration; In trays with multiple females, the entire tray will be culled.

Fry development is monitored visually to determine ponding. Fry are transferred to indoor circulars or outdoor raceways, dependent on species, for early rearing.

### 2.1.3 Indoor Early Rearing

Indoor early rearing infrastructure consists of 64 6ft diameter 68ft<sup>3</sup> fiberglass circular tanks. The summer steelhead program is the only production that utilizes the circular tanks for initial rearing.

Fry are ponded at approximately 40,000 fish per circular tank. Flows are initially set at 15gpm and increased as needed, finishing at 35 gallons per minute, to maintain adequate dissolved oxygen levels. No spin is added for the first week following ponding. Spin speed, or current, is steadily increased as the fish grow. General practice is to ensure that the fish are swimming stationary at no less than one body length per second.

Both behavior and physical observations are made to determine the time to introduce feed. Generally, initial feeding begins 24 to 48 hours after being ponded. Fry are fed by hand on an hourly basis throughout the workday. BioVita and BioPro formula, produced by Skretting/BioOregon, is used for all starter feeds. Feed size transitions occur consistent with Skretting/BioOregon guidelines.

When fry reach 350 fish/lb. ensuring that they are large enough for 1/8" screen plate, they are transitioned to outdoor rearing and into designated pre-mark raceways. Density (DI) and flow (FI) indices in the circular tanks finish at  $DI < 0.79$  and  $FI < 1.54$ .

#### **2.1.4 Outdoor Rearing**

Outdoor rearing infrastructure includes 32 concrete Oregon raceways measuring 20ft by 100ft, averaging 3.75 feet in depth (7500 ft<sup>3</sup>). The water introduced into the 16 upper raceways is reused in the lower 16 raceway under normal operations. A series of valves between the upper and lower bank allows for the lower raceways to be placed on reuse or fresh water. The lower raceways have a header box that is filled with plastic random packing rings to assist in rehabilitating the used water.

Fall Chinook salmon fry are ponded directly into outdoor rearing. Up to 500,000 fry may be ponded in a single raceway. Marking occurs between 100 and 150 fish/lb. During marking and tagging operations, fish are moved to final rearing raceways. Final rearing target is 200,000 sub-yearling smolts averaging 50 fish/lb. per raceway.

Summer steelhead are moved outdoors to pre-mark raceways from the indoor circular tanks at 350 fish/lb. Pre-mark raceways consist of no more than 300,000 fish. Marking occurs around 150 fish/lb. Fish are distributed to final rearing raceways during marking operations. Final rearing target is 40,000 smolts averaging 10.0 fish/lb. per raceway for smolts transferred in November and 5.5 fish/lb. per raceway for smolts transferred February through April.

During outdoor rearing, raceways are cleaned weekly or as needed. Mortality is removed daily.



**Table 4. Final Rearing Densities**

Species	Fish/Raceway	Size	Lbs.	Ft3	Flow (gpm)	Density Index	Flow Index	Lbs./gpm
StS Wallowa	40,000	5.5	7,273	7,500	1,200	0.12	0.75	6.06
StS Imnaha	35,883	5.0	7,167	7,500	1,200	0.12	0.72	5.97
ChF	200,000	50.0	4,000	7,500	1,200	0.13	0.82	3.33
Rb Legal	24,320	2.7	9,007	7,500	1,200	0.12	0.77	7.51
Rb Trophy	5,300	0.66	8030	7,500	1,200	0.08	0.48	6.69

### 2.1.5 Release

No smolts are released directly from Irrigon Hatchery.

Summer steelhead smolts are transferred to acclimation sites managed by Wallowa Hatchery. Transportation is carried out by ODFW East Region Liberation staff and one on station CDL driver. Transport times range from 3 to 4 hours depending on the site. Loading guidelines are 1 lb. of fish per gallon of water but vary by tank design and the size of the fish. The sites used for acclimating the Wallowa stock are Wallowa Acclimation near Enterprise Oregon on Spring Creek and Big Canyon Acclimation located upstream of Minam Oregon on Deer Creek. Both creeks are tributaries of the Wallowa River in the Grande Ronde River basin. The Imnaha stock is acclimated at Little Sheep Acclimation located east of Joseph Oregon on Little Sheep Creek, a tributary of the Imnaha River.

Fall Chinook smolts for the Salmon River are direct stream released into the Salmon River at Hammer Creek and transported by Idaho Power Company. Transport time is approximately 8 hours. The Grande Ronde fall Chinook smolts are hauled by ODFW East Region Liberation staff and direct stream released into the lower Grande Ronde River. Transport takes approximately 3 hours. Loading densities range from 0.70 to 0.80 lbs. of fish per gallon of water. Loading density is adjusted based on the size of the smolts and the length of time they will be in transport. The additional production proposed for Brood Year 2023 would be transported by ODFW East Region Liberation following the same guidelines.

### 2.1.6 Settling Pond

Irrigon Hatchery has a pollution abatement pond. All pond cleaning waste waters are diverted into the pollution abatement pond before being discharged into the Columbia River.

## 2.1.7 NPDES

Irrigon Fish Hatchery is operated under the National Pollutant Discharge Elimination System (NPDES) permit (300-J General Permit #64478). The facility has two outfalls and three sampling locations, the intake and two outfall discharges.

Sampling and water quality monitoring is conducted during the highest production month in each calendar quarter at both outfalls for the required parameters, e.g., flows, total suspended solids (TSS), settleable solids (SS), and pH for both normal operations and active cleaning operations. Irrigon Hatchery samples the months of February, April, September, and December to capture the highest production month in each calendar quarter.

## 2.1.8 Marking and Tagging

Summer steelhead mass marking begins in mid-August and takes approximately 4 weeks to complete. PIT tagging occurs in late September.

Fall Chinook mass marking takes place during the last week of March. PIT tagging is done in Late April or early May prior to transfer.

**Table 5. Fish Marking and Tagging**

Species	Release Site	Stock	Rearing Goals by Mark Type				PIT Tags
			Total	Mark Type			Total
				AD	AD CWT	NO MARK	
StS	Wallowa Acc. 1st Release	Wallowa	400,000	300,000	100,000	0	7,200
StS	Wallowa Acc. 2nd Release	Wallowa	160,000	110,000	50,000	0	3,600
StS	Big Canyon Acc. Release	Wallowa	240,000	140,000	100,000	0	6,800
StS	Little Sheep Acc. Release	Imnaha	215,000	190,000	25,000	0	15,000
ChF	Salmon River Direct	Snake R.	1,000,000	800,000	200,000	800,000	4,500
ChF	Grande Ronde River Direct	Snake R.	*500,000	0	200,000	*300,000	4,500
ChF	Couse Creek Direct	Snake R.	*600,000	0	*200,000	*400,000	4,500

\*Proposed production beginning as early as Brood Year 2023.

## **3 Operational/Infrastructure Changes for Program Efficiency**

### **3.1.1 Low Head Oxygen Supplementation**

Currently, Irrigon Hatchery operates the lower bank raceways on reuse water whenever possible. The water leaving the sump of the upper bank raceways flows through a head box hanging from the lower raceway water supply manifold. The head boxes are filled with plastic random packing rings to help rehabilitate the water by maximizing its contact with air and promoting the exchange of gasses.

To improve carrying capacity and allow for higher density rearing without increased flow, Low Head Oxygen Supplementation (LHOS) would be a viable solution. Pumping water is expensive and LHOS would help promote water conservation throughout the rearing process.

Irrigon Hatchery has liquid oxygen supplementation infrastructure at the aeration tower. The system is used to supersaturate incoming water to the upper raceways during peak production months. It would be much more efficient to invest in supplementation infrastructure to serve individual raceways rather than treating the entire water supply system.

Cost estimate for this project is \$10,000 per LHO or \$320,000, \$200,000 for an additional oxygen tank purchase or piping from existing tank, and \$50,000 annually.

### **3.1.2 Partial Reuse**

Effluent water from the raceways could be collected by installing a pump in an existing vault prior to being discharged into the Columbia River. The water could be pumped back to the aeration tower where it would mix with the fresh water coming from the wells before being gravity fed to the facility. The water would be spilled through existing contact columns to allow for further rehabilitation of the water. Cleaning effluent is diverted through a separate drain to a settling basin leaving this source considerably clean. This water could be utilized to reduce the amount of fresh water needing to be pumped throughout the year. This would result in minimizing stress on current well infrastructure as well as increasing the facilities water supply capacity.

### **3.1.3 Production Modification**

Production at Irrigon Hatchery is currently restrained by a bottleneck in available pond space in February when fall Chinook fry are be ponded, summer steelhead smolts are beginning to be transferred to acclimation sites, and rainbow trout are being received. Modifications to existing programs would need to be made to open space for other production opportunities. Eliminating

or reducing rainbow trout or summer steelhead production would provide opportunities for rearing additional fall Chinook (ChF +0), yearling spring Chinook salmon (ChS +1), and experimental parr spring Chinook salmon (ChS +0).

**Chinook Production Gained For Every Rb or StS RW removed**

	# Fish	Size	Lbs.	D.I.	Lbs/ft3
ChS +0	200,000	50	4,000	0.13	0.53
ChF +0	200,000	50	4,000	0.13	0.53
ChS +1	80,000	14	5,714	0.12	0.76

**3.1.3.1 Adding 900,000 Sub-Yearling fall Chinook**

A production change is in negotiation to convert the remaining sub-yearling Fall Chinook at Lyons Ferry Fish hatchery to sub-yearlings. As part of this conversion, Irrigon took on an additional 900,000 sub-yearling fall Chinook by reducing the rainbow trout program from 121,600 legal (2.7 fpp) and 21,200 trophies (0.66 fpp) to 96,650 legal and 15,810 trophies. This change is proposed for Brood Year 2023 and is expected to be reviewed by the Policy Advisory Committee (PAC) for U.S. v Oregon in May 2023.

Additional cost is \$90,000 annually for sub-yearling fall Chinook (\$0.10/sub-yearling).

**3.1.3.2 Move 400,000 Wallowa steelhead**

If alternative rearing was identified for 400,000 Wallowa steelhead an additional 10 raceways could be made available for other programs. Removing the current “November” transferred Wallowa steelhead does not gain any space because those raceways are already backfilled with sub-yearling fall Chinook.

**400,000 WA StS Removed (BI March and WO April Release)**

	# Fish	Size	Lbs.
ChS +0	2,000,000	50	40,000
ChF +0	2,000,000	50	40,000
ChS +1	800,000	14	57,143

An additional chiller unit and redundancy would be needed to for yearling spring Chinook production.

Total costs are estimated at \$750,000 for additional chiller unit and \$160,000 to \$200,000 for annual operation costs for 800,000 (\$0.20/smolt) to 2,000,000 (\$0.10/smolt) additional production.



### 3.1.3.3 Move 97K legal and 16K trophy trout

Moving the remaining rainbow trout program to an alternate location would make an additional 6 raceways available.

#### **97,000 legal and 16,000 Trophy Trout Removed**

	# Fish	Size	Lbs.
ChS +0	1,200,000	50	24,000
ChF +0	1,200,000	50	24,000
ChS +1	480,000	14	34,286

Total costs are estimated at \$750,000 for additional chiller unit and \$96,000 to \$120,000 for annual operation costs for 480,000 (\$0.20/smolt) to 1,200,000 (\$0.10/smolt) additional production.

## 4 References

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## 5 Appendix A. Monthly Production Strategy – Irrigon Fish Hatchery

### 5.1.1 January

#### Incubation

Species	Stock	Number	#/Tray	Temp (F)
ChF	97H	1,000,000	6,000	48 - 52
ChF	97H	500,000	6,000	48 - 52
ChF	97H	600,000	6,000	48 - 52

#### Indoor Circular

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp

#### Outdoor Raceways

	R-1	R-3	R-5	R-7	R-9	R-11	R-13	R-15	R-13	R-15
Species	Rb									
Stock	53T									
Number	27,000									
Fish/lb.	6									
Lbs.	4,500									
Flow	800									
DI	0.08									
FI	0.76									

	R-2	R-4	R-6	R-8	R-10	R-12	R-14	R-16	R-14	R-16
Species	Rb	Rb	Rb							
Stock	53T	53T	53T							
Number	5,000	5,000	5,000							
Fish/lb.	3	3	3							
Lbs.	1,667	1,667	1,667							
Flow	700	700	700							
DI	0.02	0.02	0.02							
FI	0.25	0.25	0.25							

	R-17	R-19	R-21	R-23	R-25	R-27	R-29	R-31
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	7	7	7	12	12	12	12	12
Lbs.	5,143	5,143	5,143	3,333	3,333	3,333	3,333	3,333
Flow	900	900	900	900	900	900	900	900
DI	0.09	0.09	0.09	0.07	0.07	0.07	0.07	0.07
FI	0.77	0.77	0.77	0.60	0.60	0.60	0.60	0.60

	R-18	R-20	R-22	R-24	R-26	R-28	R-30	R-32
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	7	7	7	12	12	12	12	12
Lbs.	5,143	5,143	5,143	3,333	3,333	3,333	3,333	3,333
Flow	900	900	900	900	900	900	900	900
DI	0.09	0.09	0.09	0.07	0.07	0.07	0.07	0.07
FI	0.77	0.77	0.77	0.60	0.60	0.60	0.60	0.60

### 5.1.2 February

#### Incubation

Species	Stock	Number	#/Tray	Temp (F)

#### Indoor Circulars

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp

## Outdoor Rearing

	R-1	R-3	R-5	R-7	R-9	R-11	R-13	R-15
Species	Rb	Rb		ChF	ChF	ChF	ChF	ChF
Stock	53T	53T		97H	97H	97H	97H	97H
Number	27,000	27,000		500,000	500,000	500,000	500,000	500,000
Fish/lb.	4	6		570	570	570	570	570
Lbs.	6,750	4,500		877	877	877	877	877
Flow	900	800		500	500	500	500	500
DI	0.11	0.08		0.06	0.06	0.06	0.06	0.06
FI	0.88	0.76		0.97	0.97	0.97	0.97	0.97

	R-2	R-4	R-6	R-8	R-10	R-12	R-14	R-16
Species	Rb	Rb	Rb	Rb	Rb			
Stock	53T	53T	53T	53T	53T			
Number	5,000	5,000	5,000	27,000	27,000			
Fish/lb.	1.0	1.5	3	10	8			
Lbs.	5,000	3,333	1,667	2,700	3,375			
Flow	800	700	700	600	700			
DI	0.05	0.04	0.02	0.06	0.07			
FI	0.48	0.43	0.25	0.71	0.72			

	R-17	R-19	R-21	R-23	R-25	R-27	R-29	R-31
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	5.5	5.5	5.5	9	9	9	9	9
Lbs.	6,545	6,545	6,545	4,444	4,444	4,444	4,444	4,444
Flow	1000	1000	1000	1000	1000	1000	1000	1000
DI	0.11	0.11	0.11	0.09	0.09	0.09	0.09	0.09
FI	0.81	0.81	0.81	0.65	0.65	0.65	0.65	0.65

	R-18	R-20	R-22	R-24	R-26	R-28	R-30	R-32
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	5.5	5.5	5.5	9	9	9	9	9
Lbs.	6,545	6,545	6,545	4,444	4,444	4,444	4,444	4,444
Flow	1000	1000	1000	1000	1000	1000	1000	1000
DI	0.11	0.11	0.11	0.09	0.09	0.09	0.09	0.09
FI	0.81	0.81	0.81	0.65	0.65	0.65	0.65	0.65

### 5.1.3 March

#### Incubation

Species	Stock	Number	#/Tray	Temp (F)

#### Indoor Vats

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp

#### Outdoor Rearing

	R-1	R-3	R-5	R-7	R-9	R-11	R-13	R-15
Species	Rb	Rb		ChF	ChF	ChF	ChF	ChF
Stock	53T	53T		97H	97H	97H	97H	97H
Number	27,000	27,000		500,000	500,000	500,000	500,000	500,000
Fish/lb.	2.7	4		160	160	160	160	160
Lbs.	10,000	6,750		3,125	3,125	3,125	3,125	3,125
Flow	1000	900		900	900	900	900	900
DI	0.14	0.11		0.15	0.15	0.15	0.15	0.15
FI	1.03	0.88		1.25	1.25	1.25	1.25	1.25

	R-2	R-4	R-6	R-8	R-10	R-12	R-14	R-16
Species	Rb	Rb	Rb	Rb	Rb			
Stock	53T	53T	53T	53T	53T			
Number	5,000	5,000	5,000	27,000	27,000			
Fish/lb.	0.8	1.0	1.5	8	6			
Lbs.	6,250	5,000	3,333	3,375	4,500			
Flow	900	800	700	700	800			
DI	0.06	0.05	0.04	0.07	0.08			
FI	0.50	0.48	0.43	0.72	0.76			

	R-17	R-19	R-21	R-23	R-25	R-27	R-29	R-31
Species				StS	StS	StS	StS	StS
Stock				56H	56H	56H	56H	56H
Number				40,000	40,000	40,000	40,000	40,000
Fish/lb.				5.5	5.5	5.5	5.5	5.5
Lbs.				7,273	7,273	7,273	7,273	7,273
Flow				1000	1000	1000	1000	1000
DI				0.12	0.12	0.12	0.12	0.12
FI				0.90	0.90	0.90	0.90	0.90

	R-18	R-20	R-22	R-24	R-26	R-28	R-30	R-32
Species				StS	StS	StS	StS	StS
Stock				56H	56H	56H	56H	56H
Number				40,000	40,000	40,000	40,000	40,000
Fish/lb.				5.5	5.5	5.5	5.5	5.5
Lbs.				7,273	7,273	7,273	7,273	7,273
Flow				1000	1000	1000	1000	1000
DI				0.12	0.12	0.12	0.12	0.12
FI				0.90	0.90	0.90	0.90	0.90

### 5.1.4 April

#### Incubation

Species	Stock	Number	#/Tray	Temp (F)
StS	56H	908,000	10,000	42 - 46
StS	29H	248,000	10,000	42 - 46

#### Indoor Vats

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp

## Outdoor Rearing

	R-1	R-3	R-5	R-7	R-9	R-11	R-13	R-15
Species	Rb	Rb				ChF	ChF	ChF
Stock	53T	53T				97H	97H	97H
Number	27,000	27,000				200,000	200,000	200,000
Fish/lb.	2.7	2.7				60	60	60
Lbs.	10,000	10,000				3,333	3,333	3,333
Flow	1000	1000				800	800	800
DI	0.14	0.14				0.12	0.12	0.12
FI	1.03	1.03				1.10	1.10	1.10

	R-2	R-4	R-6	R-8	R-10	R-12	R-14	R-16
Species	Rb	Rb	Rb	Rb	Rb	ChF	ChF	ChF
Stock	53T	53T	53T	53T	53T	97H	97H	97H
Number	5,000	5,000	5,000	27,000	27,000	200,000	200,000	200,000
Fish/lb.	0.7	0.8	1.0	6	4	60	60	60
Lbs.	7,143	6,250	5,000	4,500	6,750	3,333	3,333	3,333
Flow	1000	900	800	800	900	800	800	800
DI	0.06	0.06	0.05	0.08	0.11	0.12	0.12	0.12
FI	0.48	0.50	0.48	0.76	0.88	1.10	1.10	1.10

	R-17	R-19	R-21	R-23	R-25	R-27	R-29	R-31
Species	ChF	ChF	ChF				StS	StS
Stock	97H	97H	97H				56H	56H
Number	200,000	200,000	200,000				40,000	40,000
Fish/lb.	60	60	60				5.5	5.5
Lbs.	3,333	3,333	3,333				7,273	7,273
Flow	800	800	800				1000	1000
DI	0.12	0.12	0.12				0.12	0.12
FI	1.10	1.10	1.10				0.90	0.90

	R-18	R-20	R-22	R-24	R-26	R-28	R-30	R-32
Species	ChF	ChF					StS	StS
Stock	97H	97H					56H	56H
Number	200,000	200,000					40,000	40,000
Fish/lb.	60	60					5.5	5.5
Lbs.	3,333	3,333					7,273	7,273
Flow	800	800					1000	1000
DI	0.12	0.12					0.12	0.12
FI	1.10	1.10					0.90	0.90



### 5.1.5 May

#### Incubation

Species	Stock	Number	#/Tray	Temp (F)
StS	56H	908,000	10,000	42 - 46
StS	29H	248,000	10,000	42 - 46

#### Indoor Vats

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp

#### Outdoor Rearing

	R-1	R-3	R-5	R-7	R-9	R-11	R-13	R-15
Species		Rb				ChF	ChF	ChF
Stock		53T				97H	97H	97H
Number		27,000				200,000	200,000	200,000
Fish/lb.		2.7				50	50	50
Lbs.		10,000				4,000	4,000	4,000
Flow		1000				1000	1000	1000
DI		0.14				0.13	0.13	0.13
FI		1.03				0.99	0.99	0.99

	R-2	R-4	R-6	R-8	R-10	R-12	R-14	R-16
Species		Rb	Rb	Rb	Rb	ChF	ChF	ChF
Stock		53T	53T	53T	53T	97H	97H	97H
Number		5,000	5,000	27,000	27,000	200,000	200,000	200,000
Fish/lb.		0.66	0.8	4	2.7	50	50	50
Lbs.		7,576	6,250	6,750	10,000	4,000	4,000	4,000
Flow		1000	900	900	1000	1000	1000	1000
DI		0.06	0.06	0.11	0.14	0.13	0.13	0.13
FI		0.47	0.50	0.88	1.03	0.99	0.99	0.99

	R-17	R-19	R-21	R-23	R-25	R-27	R-29	R-31
Species	ChF	ChF	ChF					
Stock	97H	97H	97H					
Number	200,000	200,000	200,000					
Fish/lb.	50	50	50					
Lbs.	4,000	4,000	4,000					
Flow	1000	1000	1000					
DI	0.13	0.13	0.13					
FI	0.99	0.99	0.99					

	R-18	R-20	R-22	R-24	R-26	R-28	R-30	R-32
Species	ChF	ChF						
Stock	97H	97H						
Number	200,000	200,000						
Fish/lb.	50	50						
Lbs.	4,000	4,000						
Flow	1000	1000						
DI	0.13	0.13						
FI	0.99	0.99						

### 5.1.6 June

#### Incubation

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp

#### Indoor Vats

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp
StS	56H	900,000	1,000	900	40,000	35	0.41	0.81	54
StS	29H	240,000	1,000	240	36,000	35	0.37	0.72	54

## Outdoor Rearing

	R-1	R-3	R-5	R-7	R-9	R-11	R-13	R-15
Species								
Stock								
Number								
Fish/lb.								
Lbs.								
Flow								
DI								
FI								

	R-2	R-4	R-6	R-8	R-10	R-12	R-14	R-16
Species			Rb	Rb				
Stock			53T	53T				
Number			5,000	27,000				
Fish/lb.			0.66	2.7				
Lbs.			7,576	10,000				
Flow			1000	1000				
DI			0.06	0.14				
FI			0.47	1.03				

	R-17	R-19	R-21	R-23	R-25	R-27	R-29	R-31
Species								
Stock								
Number								
Fish/lb.								
Lbs.								
Flow								
DI								
FI								

	R-18	R-20	R-22	R-24	R-26	R-28	R-30	R-32
Species								
Stock								
Number								
Fish/lb.								
Lbs.								
Flow								
DI								
FI								

### 5.1.7 July

#### Incubation

Species	Stock	Number	#/Tray	Temp (F)

#### Indoor Vats

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp

#### Outdoor Rearing

	R-1	R-3	R-5	R-7	R-9	R-11	R-13	R-15
Species	Rb		StS	StS	StS	StS	StS	
Stock	53T		56H	56H	56H	56H	29H	
Number	50,000		200,000	200,000	240,000	160,000	215,000	
Fish/lb.	80		250	250	250	250	250	
Lbs.	625		800	800	960	640	860	
Flow	500		600	600	600	600	600	
DI	0.03		0.05	0.05	0.05	0.05	0.05	
FI	0.40		0.59	0.59	0.59	0.59	0.59	

	R-2	R-4	R-6	R-8	R-10	R-12	R-14	R-16
Species			RB	Rb				
Stock			53T	53T				
Number			5,000	27,000				
Fish/lb.			0.66	3				
Lbs.			7,576	10,000				
Flow			1000	1000				
DI			0.06	0.14				
FI			0.47	1.03				

	R-17	R-19	R-21	R-23	R-25	R-27	R-29	R-31
Species								
Stock								
Number								
Fish/lb.								
Lbs.								
Flow								
DI								
FI								

	R-18	R-20	R-22	R-24	R-26	R-28	R-30	R-32
Species								
Stock								
Number								
Fish/lb.								
Lbs.								
Flow								
DI								
FI								

### 5.1.8 August

#### Incubation

Species	Stock	Number	#/Tray	Temp (F)

#### Indoor Vats

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp

## Outdoor Rearing

	R-1	R-3	R-5	R-7	R-9	R-11	R-13	R-15
Species	Rb			StS	StS	StS	StS	StS
Stock	53T			56H	56H	56H	56H	56H
Number	50,000			40,000	40,000	40,000	40,000	40,000
Fish/lb.	45			100	100	100	100	100
Lbs.	1,111			400	400	400	400	400
Flow	500			500	500	500	500	500
DI	0.04			0.02	0.02	0.02	0.02	0.02
FI	0.58			0.26	0.26	0.26	0.26	0.26

	R-2	R-4	R-6	R-8	R-10	R-12	R-14	R-16
Species				StS	StS	StS	StS	StS
Stock				56H	56H	56H	56H	56H
Number				40,000	40,000	40,000	40,000	40,000
Fish/lb.				100	100	100	100	100
Lbs.				400	400	400	400	400
Flow				500	500	500	500	500
DI				0.02	0.02	0.02	0.02	0.02
FI				0.26	0.26	0.26	0.26	0.26

	R-17	R-19	R-21	R-23	R-25	R-27	R-29	R-31
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	170	170	170	170	170	170		
Lbs.	212	212	212	235	235	235	#DIV/0!	#DIV/0!
Flow	500	500	500	500	500	500		
DI	0.01	0.01	0.01	0.01	0.01	0.01		
FI	0.17	0.17	0.17	0.18	0.18	0.18		

	R-18	R-20	R-22	R-24	R-26	R-28	R-30	R-32
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	170	170	170	170	170	170		
Lbs.	212	212	212	235	235	235	#DIV/0!	#DIV/0!
Flow	500	500	500	500	500	500		
DI	0.01	0.01	0.01	0.01	0.01	0.01		
FI	0.17	0.17	0.17	0.18	0.18	0.18		

## 5.1.9 September

### Incubation

Species	Stock	Number	#/Tray	Temp (F)

### Indoor Vats

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp

### Outdoor Rearing

	R-1	R-3	R-5	R-7	R-9	R-11	R-13	R-15
Species	Rb			StS	StS	StS	StS	StS
Stock	53T			56H	56H	56H	56H	56H
Number	27,000			40,000	40,000	40,000	40,000	40,000
Fish/lb.	23			30	30	30	30	30
Lbs.	1,174			1,333	1,333	1,333	1,333	1,333
Flow	600			550	550	550	550	550
DI	0.03			0.04	0.04	0.04	0.04	0.04
FI	0.41			0.53	0.53	0.53	0.53	0.53

	R-2	R-4	R-6	R-8	R-10	R-12	R-14	R-16
Species	Rb			StS	StS	StS	StS	StS
Stock	53T			56H	56H	56H	56H	56H
Number	25,000			40,000	40,000	40,000	40,000	40,000
Fish/lb.	22			30	30	30	30	30
Lbs.	1,136			1,333	1,333	1,333	1,333	1,333
Flow	600			550	550	550	550	550
DI	0.03			0.04	0.04	0.04	0.04	0.04
FI	0.39			0.53	0.53	0.53	0.53	0.53

	R-17	R-19	R-21	R-23	R-25	R-27	R-29	R-31
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	55	55	55	75	75	75	75	75
Lbs.	655	655	655	533	533	533	533	533
Flow	550	550	550	550	550	550	550	550
DI	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
FI	0.32	0.32	0.32	0.29	0.29	0.29	0.29	0.29

	R-18	R-20	R-22	R-24	R-26	R-28	R-30	R-32
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	55	55	55	75	75	75	75	75
Lbs.	655	655	655	533	533	533	533	533
Flow	550	550	550	550	550	550	550	550
DI	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
FI	0.32	0.32	0.32	0.29	0.29	0.29	0.29	0.29

### 5.1.10 October

#### Incubation

Species	Stock	Number	#/Tray	Temp (F)

#### Indoor Vats

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp



## Outdoor Rearing

	R-1	R-3	R-5	R-7	R-9	R-11	R-13	R-15
Species	Rb			StS	StS	StS	StS	StS
Stock	53T			56H	56H	56H	56H	56H
Number	27,000			40,000	40,000	40,000	40,000	40,000
Fish/lb.	14			12	12	12	12	12
Lbs.	1,929			3,333	3,333	3,333	3,333	3,333
Flow	600			600	600	600	600	600
DI	0.05			0.07	0.07	0.07	0.07	0.07
FI	0.57			0.90	0.90	0.90	0.90	0.90

	R-2	R-4	R-6	R-8	R-10	R-12	R-14	R-16
Species	Rb			StS	StS	StS	StS	StS
Stock	53T			56H	56H	56H	56H	56H
Number	25,000			40,000	40,000	40,000	40,000	40,000
Fish/lb.	15			12	12	12	12	12
Lbs.	1,667			3,333	3,333	3,333	3,333	3,333
Flow	600			600	600	600	600	600
DI	0.04			0.07	0.07	0.07	0.07	0.07
FI	0.5			0.90	0.90	0.90	0.90	0.90

	R-17	R-19	R-21	R-23	R-25	R-27	R-29	R-31
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	30	30	30	50	50	50	50	50
Lbs.	1,200	1,200	1,200	800	800	800	800	800
Flow	600	600	600	600	600	600	600	600
DI	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
FI	0.44	0.44	0.44	0.35	0.35	0.35	0.35	0.35

	R-18	R-20	R-22	R-24	R-26	R-28	R-30	R-32
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	30	30	30	50	50	50	50	50
Lbs.	1,200	1,200	1,200	800	800	800	800	800
Flow	600	600	600	600	600	600	600	600
DI	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
FI	0.44	0.44	0.44	0.35	0.35	0.35	0.35	0.35

## 5.1.11 November

### Incubation

Species	Stock	Number	#/Tray	Temp (F)
Co	91H	620,000	9,000	42 - 46

### Indoor Vats

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp

### Outdoor Rearing

	R-1	R-3	R-5	R-7	R-9	R-11	R-13	R-15
Species	Rb			StS	StS	StS	StS	StS
Stock	53T			56H	56H	56H	56H	56H
Number	27,000			40,000	40,000	40,000	40,000	40,000
Fish/lb.	10			10	10	10	10	10
Lbs.	2,700			4,000	4,000	4,000	4,000	4,000
Flow	600			700	700	700	700	700
DI	0.06			0.08	0.08	0.08	0.08	0.08
FI	0.71			0.87	0.87	0.87	0.87	0.87

	R-2	R-4	R-6	R-8	R-10	R-12	R-14	R-16
Species	Rb			StS	StS	StS	StS	StS
Stock	53T			56H	56H	56H	56H	56H
Number	25,000			40,000	40,000	40,000	40,000	40,000
Fish/lb.	10			10	10	10	10	10
Lbs.	2,500			4,000	4,000	4,000	4,000	4,000
Flow	700			700	700	700	700	700
DI	0.05			0.08	0.08	0.08	0.08	0.08
FI	0.57			0.87	0.87	0.87	0.87	0.87

	R-17	R-19	R-21	R-23	R-25	R-27	R-29	R-31
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	16	16	16	31	31	31	31	31
Lbs.	2,250	2,250	2,250	1,290	1,290	1,290	1,290	1,290
Flow	700	700	700	700	700	700	700	700
DI	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04
FI	0.57	0.57	0.57	0.41	0.41	0.41	0.41	0.41

	R-18	R-20	R-22	R-24	R-26	R-28	R-30	R-32
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	16	16	16	31	31	31	31	31
Lbs.	2,250	2,250	2,250	1,290	1,290	1,290	1,290	1,290
Flow	700	700	700	700	700	700	700	700
DI	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04
FI	0.57	0.57	0.57	0.41	0.41	0.41	0.41	0.41

## 5.1.12 December

### Incubation

Species	Stock	Number	#/Tray	Temp (F)
ChF	97H	1,000,000	6,000	48 - 52
ChF	97H	500,000	6,000	48 - 52
ChF	97H	600,000	6,000	48 - 52
Co	91H	620,000	9,000	42 - 46

### Indoor Vats

Species	Stock	Number	F/lb.	Lbs.	#/Tank	Flow	DI	FI	Temp

## Outdoor Rearing

	R-1	R-3	R-5	R-7	R-9	R-11	R-13	R-15
Species	Rb							
Stock	53T							
Number	27,000							
Fish/lb.	8							
Lbs.	3,375							
Flow	700							
DI	0.07							
FI	0.72							

	R-2	R-4	R-6	R-8	R-10	R-12	R-14	R-16
Species	Rb	Rb	Rb					
Stock	53T	53T	53T					
Number	5,000	5,000	5,000					
Fish/lb.	7	7	7					
Lbs.	714	714	714					
Flow	500	500	500					
DI	0.01	0.01	0.01					
FI	0.20	0.20	0.20					

	R-17	R-19	R-21	R-23	R-25	R-27	R-29	R-31
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	10	10	10	20	20	20	20	20
Lbs.	3,600	3,600	3,600	2,000	2,000	2,000	2,000	2,000
Flow	800	800	800	800	800	800	800	800
DI	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05
FI	0.68	0.68	0.68	0.48	0.48	0.48	0.48	0.48

	R-18	R-20	R-22	R-24	R-26	R-28	R-30	R-32
Species	StS	StS	StS	StS	StS	StS	StS	StS
Stock	29H	29H	29H	56H	56H	56H	56H	56H
Number	36,000	36,000	36,000	40,000	40,000	40,000	40,000	40,000
Fish/lb.	10	10	10	20	20	20	20	20
Lbs.	3,600	3,600	3,600	2,000	2,000	2,000	2,000	2,000
Flow	800	800	800	800	800	800	800	800
DI	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.05
FI	0.68	0.68	0.68	0.48	0.48	0.48	0.48	0.48

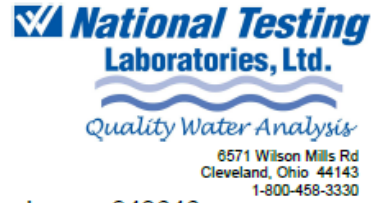
## 6 Appendix B. Water Quality Report

### Informational Water Quality Report

#### WaterCheck Lite

<b>Client:</b>






<b>Ordered By:</b>
Schmidt, Keenan 74135 Riverview Lane Irigoien, OR 97844 ATTN: Keenan Schmidt











Sample Number: 943646

Location: Aeration Tower  
Type of Water: Well Water  
Collection Date and Time: 12/7/2022 11:13 AM  
Received Date and Time: 12/12/2022 9:59 AM  
Date Completed: 1/9/2023

#### Definition and Legend

This informational water quality report compares the actual test result to national standards as defined in the EPA's Primary and Secondary Drinking Water Regulations.	
<b>Primary Standards:</b>	Are expressed as the maximum contaminant level (MCL) which is the highest level of contaminant that is allowed in drinking water. MCLs are enforceable standards.
<b>Secondary standards:</b>	Are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. Individual states may choose to adopt them as enforceable standards.
<b>Action levels:</b>	Are defined in treatment techniques which are required processes intended to reduce the level of a contaminant in drinking water.
<b>mg/L (ppm):</b>	Unless otherwise indicated, results and standards are expressed as an amount in milligrams per liter or parts per million.
<b>Minimum Detection Level (MDL):</b>	The lowest level that the laboratory can detect a contaminant.
<b>ND:</b>	The contaminant was not detected above the minimum detection level.
<b>NA:</b>	The contaminant was not analyzed.
	The contaminant was not detected in the sample above the minimum detection level.
	The contaminant was detected at or above the minimum detection level, but not above the referenced standard.
	The contaminant was detected above the standard, which is not an EPA enforceable MCL.
	The contaminant was detected above the EPA enforceable MCL.
	These results may be invalid.

Status	Contaminant	Results	Units	National Standards	Min. Detection Level
Inorganic Analytes - Metals					
✓	Aluminum	ND	mg/L	0.2 EPA Secondary	0.1
✓	Arsenic	ND	mg/L	0.010 EPA Primary	0.005
✓	Barium	ND	mg/L	2 EPA Primary	0.30
✓	Cadmium	ND	mg/L	0.005 EPA Primary	0.002
●	Calcium	67.0	mg/L	–	2.0
✓	Chromium	ND	mg/L	0.1 EPA Primary	0.010
✓	Copper	ND	mg/L	1.3 EPA Action Level	0.004
✓	Iron	ND	mg/L	0.3 EPA Secondary	0.020
✓	Lead	ND	mg/L	0.015 EPA Action Level	0.002
●	Lithium	0.004	mg/L	–	0.001
●	Magnesium	17.24	mg/L	–	0.10
✓	Manganese	ND	mg/L	0.05 EPA Secondary	0.004
✓	Mercury	ND	mg/L	0.002 EPA Primary	0.001
✓	Nickel	ND	mg/L	–	0.020
●	Potassium	5.1	mg/L	–	1.0
✓	Selenium	ND	mg/L	0.05 EPA Primary	0.020
●	Silica	26.0	mg/L	–	0.1
✓	Silver	ND	mg/L	0.100 EPA Secondary	0.002
●	Sodium	23	mg/L	–	1
●	Strontium	0.317	mg/L	–	0.001
●	Uranium	0.006	mg/L	0.030 EPA Primary	0.001
✓	Zinc	ND	mg/L	5 EPA Secondary	0.004
Physical Factors					
●	Alkalinity (Total as CaCO3)	140	mg/L	–	20
▲	Hardness	240	mg/L	100 NTL Internal	10
✓	pH	7.4	pH Units	6.5 to 8.5 EPA Secondary	
●	Total Dissolved Solids	300	mg/L	500 EPA Secondary	20
Page 2	of 3	1/9/2023 8:20:50 AM		Product: WaterCheck Lite	Sample: 943646

Status	Contaminant	Results	Units	National Standards	Min. Detection Level
	Turbidity	0.1	NTU	1.0	EPA Action Level 0.1
Inorganic Analytes - Other					
	Bromide	ND	mg/L	–	0.5
	Chloride	27.0	mg/L	250	EPA Secondary 5.0
	Fluoride	ND	mg/L	4.0	EPA Primary 0.5
	Nitrate as N	10.0	mg/L	10	EPA Primary 0.5
	Nitrite as N	ND	mg/L	1	EPA Primary 0.5
	Ortho Phosphate	ND	mg/L	–	2.0
	Sulfate	43.0	mg/L	250	EPA Secondary 5.0

*We certify that the analyses performed for this report are accurate, and that the laboratory tests were conducted by methods approved by the U.S. Environmental Protection Agency or variations of these EPA methods.*

*These test results are intended to be used for informational purposes only and may not be used for regulatory compliance.*

***National Testing Laboratories, Ltd.***

556 South Mansfield Street • Ypsilanti • Michigan •