Infrastructure and Operations Audit: Irrigon Fish Hatchery 2024

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. This document was updated in 2024 in anticipation of the Independent Scientific Review Panel steelhead review in January 2025. A secondary facility assessment addressing steelhead trout (*Oncorhynchus mykiss*) production at Irrigon was completed on September 13, 2024, by Shawn Sanders – LSRCP/FWS Fish Biologist and Keenan Schmidt – Hatchery Supervisor ODFW.

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.

- Water restoration to the Hatchery would cost $950,000

- Shade structures to improve fish health/performance are $5.9M.

Table of Contents

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.

This document provides the LSRCP and stakeholders appropriate conceptual-level information and documentation to address the infrastructure challenges at this facility. The Audit findings are subsequently incorporated into the 10-year strategic plan for LSRCP. The audit results provide the documentation to develop solutions which logically and methodically allocate resources, budgets, and supportive programs to meet program goals, improved long-term fish escapement to all program facilities.

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.

Historically, LSRCP adult spring/summer steelhead escapement (returns) goals were met, specifically, between 2006 and 2013, however between 2014 and present escapement has precipitously dropped. From 2004-2017, the LSRCP averaged 70,319 spring/summer steelhead adult returns. During the period of 2014 to present, steelhead escapement (returns) did not meet the annual 55,100 mitigation target. The average LSRCP escapement for 2006-2017 was 65,777, however average escapement/return between 2014-2021 was 26,418, respectively. The follow-up review intends to identify strategies towards optimizing performance to achieve project area goals of 55,100 steelhead adult returns.

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 mean sea level, at latitude 45.9092 and longitude -119.5442. The site area is 33 acres and 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. The current 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 was added without affecting the summer steelhead programs. Fall Chinook are received as eyed eggs from Lyons Ferry Hatchery and reared to sub-yearling smolts (1,000,000), through a contract with the Idaho Power Company for release into the Salmon River at Hammer Creek. An additional 200,000 fall Chinook sub-yearlings 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. In Brood Year 2024 additional fall Chinook smolts were produced at Irrigon Hatchery to accommodate the conversion of Lyons Ferry Hatchery yearling production to sub-yearling. The Grande Ronde River production increased by 300,000 smolts and will be acclimated at ODFW's Big Canyon facility on the Wallowa River. An additional 600,000 sub-yearling smolts will

be produced starting in BY 2024 and direct stream released at Couse Creek on the Snake River (Table 1).

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 (Table 2) and 95.4% for fall Chinook (Table 3).

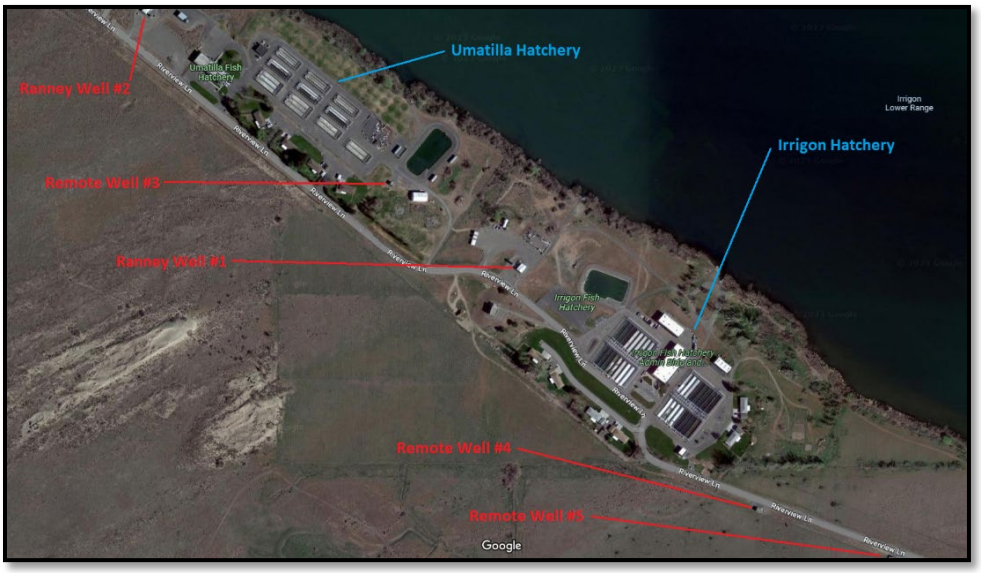

Figure 1. Aerial view of Irrigon FH and Umatilla FH including buildings and well sites.

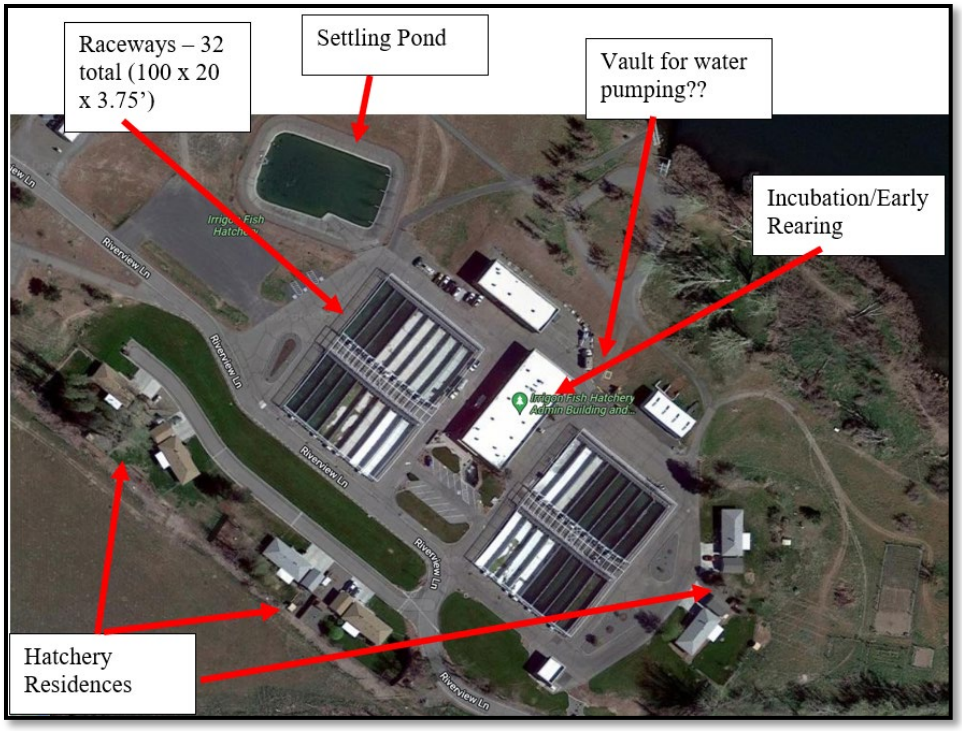

Figure 2. Aerial View of Irrigon FH, including rearing sites, buildings, and residence delineation.

2.1 Infrastructure and Operation

2.1.1 Hatchery Water Supply

The hatchery water supply is provided from five wells. When operating wells within a sustainable protocol, approximately 14,000 gpm is available for fish culture operations. The facility was designed and has rights for 25,000 gpm of water. The 14,000 gpm is available year-round with actual low water use occurring in June when only 9,600 gpm is required for fish production. Supply water temperatures range from 54 to 61 °F, 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 with a flow through Heath stacks at approximately 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 are utilized 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 °F (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. If infected eggs are stored in trays containing multiple females, the entire tray will be culled.

Development is monitored visually to determine when fry are transferred to ponds, raceways, or tanks. Depending on fish species, fry are transferred to either indoor circulars or outdoor raceways.

2.1.3 Indoor Early Rearing

Indoor early rearing infrastructure consists of 64, 6' diameter 68ft^3 fiberglass circular tanks. The summer steelhead program is the only production (within LSRCP) program 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, 8 feedings. BioVita formula, produced by Skretting/BioOregon, is used for all starter feeds. Feed size transitions occur consistent with Skretting/BioOregon guidelines.

Fry are reared to 350 fpp and transitioned to outdoor rearing and into designated pre-mark (prior to adipose fin clip and CWT operations) raceways. Fry at that size are reared to be large enough to ensure that a 1/8" screen plate is acceptable and similarly

that both density (DI) and flow (FI) indices in the circular tanks meet rearing criteria, DI < 0.79 and FI <1.54.

2.1.4 Outdoor Rearing

Outdoor rearing infrastructure includes 32 concrete Oregon raceways measuring 20' by 100', averaging 3.75' in depth (7500 ft^3). The water introduced into the 16 upper raceways is reused in the lower 16 raceways under normal operations. A series of valves between the upper and lower bank(s) 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 packing rings to assist in "rehabilitating" the used water.

Fall Chinook salmon fry are ponded directly into outdoor rearing units. Up to 500,000 fry may be ponded within a single raceway. Marking occurs between 100 and 150 fpp. During marking and tagging operations, fish are moved to final rearing raceways. The final rearing target per raceway is 200,000 sub-yearling smolts which average 50 fpp at transfer.

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

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

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 prior to discharge 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 (Table 5).

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).

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 available rearing (pond) space in February when fall Chinook fry are be ponded and summer steelhead smolts are beginning to be transferred to acclimation sites, while rainbow trout eggs are being received. Modifications to existing programs would need to be made to open space for other production opportunities (Table 6). 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).

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 rearing strategy, Irrigon took on an additional 900,000 sub-yearling fall Chinook by reducing the rainbow trout program from 121,600 legals (2.7 fpp) and 21,200 trophies (0.66 fpp) to 96,650 legals 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 estimated at $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 would be 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 (Table 7). An additional chiller unit and redundancy would be needed to for yearling spring Chinook production.

Total costs are estimated at $750,000 for an additional chiller unit and $160,000 - $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 (Table 8).

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.

3.1.4 Water Restoration Program

Irrigon has an existing pump system at the tail end of the raceways (Figure 3) that was originally installed for wildlife habitat water on the adjacent National Wildlife Refuge. Anecdotally, when this system was used, well production rates increased due to infiltration of the water stored in wetlands on the Refuge property. A privately owned property (Tidewater Terminal Co/Tidewater Barge) exists between the Hatchery and the National Wildlife Refuge that could be purchased to benefit both the Refuge and provide an area for water restoration to the Hatchery (Figure 4). Existing pumps and piping could be used or upgraded for this project. Land Acquisition is estimated at $600,000 for 89.88 acres and pump upgrades are expected to cost $150,000. Wetland pond construction is estimated at $200,000.

Total project cost: $950,000.

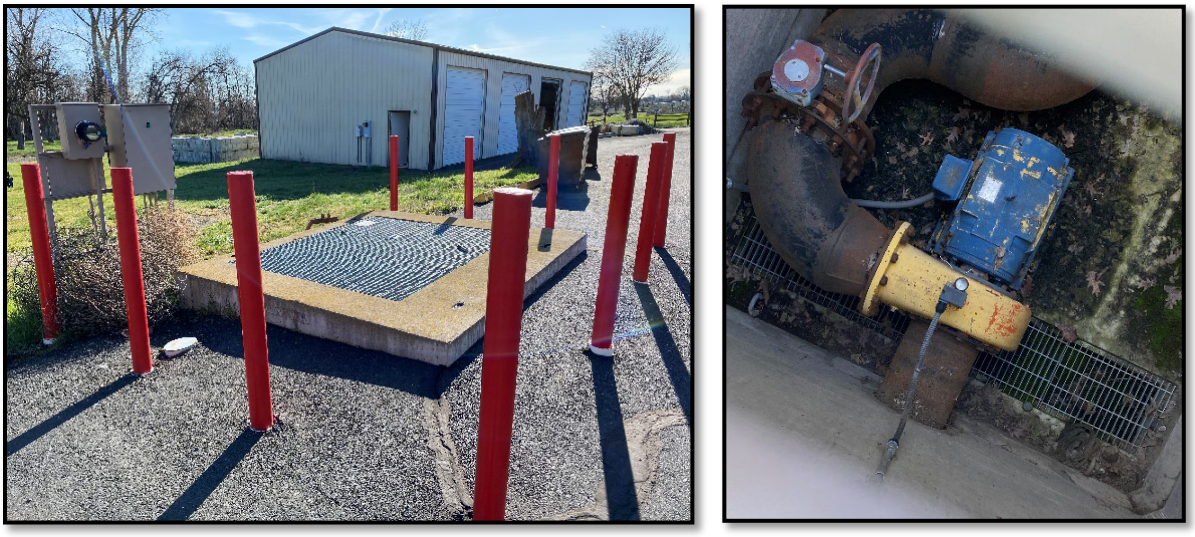

Figure 3. Pump Vault (Left) and existing Pump and valves at Irrigon FH.

Figure 4. Property between hatchery and National Wildlife Refuge for infiltration Pond

3.1.5 Shade Cover

A SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis was completed on a Irrigon Shade structure in April 2024:

Strengths

- Shading benefits smolt growth (Pickering 1987 - https://www.sciencedirect.com/science/article/abs/pii/0044848687902262)
- Identified by Hatchery Review Team in 2011 to reduce stress and improve post release survival.
- Aquatic Invasive Species/Disease contamination and spreading by predators from raceway to raceway.
- Baffles could be used because sunlight is eliminated resulting in less staff for cleaning efforts and reduced fish disturbance.
- Less overhead disturbance to fish from birds and less staff interaction by reduction of cleaning and feeding activities which reduces fish stress, which in turn reduces susceptibility to fish pathogens and increased survival.
- Replaces existing bird netting, which must be replaced periodically.
- Improves working conditions for staff by cooling the work area significantly.
- Improves safety by reducing staff sun exposure during summer months, and slip/fall risk during snow or ice accumulations during winter months.
- Significantly reduces algae growth on pond walls and floors. Less algae means:
    - Reduced labor costs to remove it.
    - Reduced trapped fish waste and uneaten feed (which gets caught in algae filaments) which significantly improves the fish's rearing environment.

Weaknesses

- Cost potential of $5.9M with solar installation
- Reduces resources available for other infrastructure and program needs.
- Labor for install/removal/cleaning of baffles for marking and release (if used)

Opportunities

- Opportunity to increase adult returns.
- Improve rearing conditions for spring Chinook, steelhead, rainbow trout, and fall Chinook.
- Solar PV systems could offset electrical pumping costs ($200K annually)
- Solar PV shade structure only could be an option to reduce installation costs.

Threats

- Catastrophic failure potential (Carson NFH rain on snow event example)
- Increased incidence of *Gyrodactylus* has been anecdotally noted at covered facilities.

There are 8 raceways per bank (32 raceways total). Each raceway is approximately 20’ x 100’. Each bank is approximately 110’ x 170’. Permanent shade structures over the raceways would help improve fish health, algae control in the ponds, and the environmental working conditions for employees. The first step in this process is the design of a shade structure. Engineering should consider the amount of wind this location experiences. Solar panels should also be an considered as this location receives abundant sunshine. Staff are concerned about losing catwalk access to the raceways if a shade structure is built.

Figure 5. Aerial view of four banks of raceways at Irrigon FH.

Project cost: $5.9M

4 References

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5 Tables

Table 1. LSRCP Fall Chinook Salmon Production Summary, BY 2023 – 2024, including site/location, stock, and total production by Brood Year (BY).

Program	Stock	BY 2023	BY 2024
Irrrigon – Salmon River (IPC)	FRCS	1,000,000	1,000,000
Irrigon – Grand Ronde	FRCS	200,000	500,000
Irrigon – Couse Creek Direct	FRCS	0	600,000
Lyons Ferry FH – Age 1	FRCS	450,000	0
Lyons Ferry FH	FRCS	700,000	1,200,000
Big Canyon	FRCS	850,000	850,000
Salmon River (Russel Bar)	FRCS	0	600,000
Pittsburgh Landing	FRCS	600,000	0
GRAND TOTAL (ANNUAL)		4,250,000	5,400,000

Table 2. LSRCP Summer Steelhead Production Summary at Irrigon FH including stock/strain, final rearing/release site, transfer date(s), and production target information.

Program	Stock	Release Site	Transfer Date	Production Goal	Target F/lb.	Production Pounds
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
Total				**560,000**		
LSRCP/ODFW	Wallowa River	Big Canyon Acclimation	March	240,000	5.5	43,636
Total				**240,000**		
LSRCP/ODFW	Imnaha River	Little Sheep Acclimation	February	215,000	5.0	43,000
Total				**215,000**		
	Grand Total			**1,015,000**		**155,727**

Table 3. LSRCP Fall Chinook Production Summary at Irrigon FH including final rearing/release site, transfer date(s), and target production information.

Program	Stock	Release Site	Transfer Date	Production Goal	Target F/lb.	Production Pounds
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
	Grand Total			**2,100,000**		**42,000**

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

Table 4. ODFW/OTHER Production Summary at Irrigon FH including stock/strain/species, release site, transfer date(s), and production goals.

Program	Stock	Release Site	Transfer Date	Production Goal (#)	Target size (f/lb)	Production Wt. (lbs)
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
	Grand Total			**113,180**		**56,518**
ODFW/CTUIR Eyed Program	Umatilla Coho	Umatilla River	December Cascade FH	620,000	Eyed Egg	-

Table 5. Final Rearing Summary for Irrigon FH production by species/strain including all parameters (1. Total Fish/rearing unit, 2. Size (fish per lb), 3. Total WT (lbs) per rearing unit, 4. Area (cubic feet) per rearing unit, 5. Flow (gallons per minute), 6. Pounds of fish in each rearing unit per gpm) required to calculate pre-release Density (DI) and Flow (FI) Indices.

Species	Total fish/Unit	Size (fish/lb)	Total WT (lbs)	Area (Ft^3)	Flow (gpm)	lbs./gpm	Density Index	Flow Index
StS Wallowa	40,000	5.5	7,273	7,500	1,200	6.06	0.12	0.75
StS Imnaha	35,883	5.0	7,167	7,500	1,200	5.97	0.12	0.72
ChF	200,000	50.0	4,000	7,500	1,200	3.33	0.13	0.82
Rb Legal	24,320	2.7	9,007	7,500	1,200	7.51	0.12	0.77
Rb Trophy	5,300	0.66	8,030	7,500	1,200	6.69	0.08	0.48

Table 6. Fish Marking and Tagging Summary including species, final rearing/release site, stock/strain, and total fish marked by mark, clip, or tag at Irrigon FH.

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

TABLE 7. Chinook Production Gained for Every Rainbow Trout (Rb) or Steelhead Trout (StS) rearing unit removed from current production protocols, including strain (ChS=Spring Chinook, ChF=Fall Chinook with 0/1 referencing age at release, respectively), total fish, size (fish per lb), total production weight (lbs), Density Index, and production weight per rearing unit area.

Species/Age	Total Fish/Unit	Size (fpp)	Total WT (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

Table 8. 400,000 WA StS Removed (BI March and WO April Release)

Species/Age	# 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

Table 9. 97,000 legal and 16,000 Trophy Trout Removed

Species/Age	# 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

6 Appendix A. Monthly Production Strategy – Irrigon Fish Hatchery

6.1.1 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									
Fpp	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							
Fpp	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
Fpp	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
Fpp	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

6.1.2 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
Fpp	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			
Fpp	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
Fpp	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
Fpp	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

6.1.3 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
Fpp	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			
Fpp	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
Fpp				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
Fpp				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

6.1.4 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
Fpp	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
Fpp	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
Fpp	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
Fpp	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

6.1.5 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
Fpp		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
Fpp		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					
Fpp	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						
Fpp	50	50						
Lbs.	4,000	4,000						
Flow	1000	1000						
DI	0.13	0.13						
FI	0.99	0.99						

6.1.6 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								
Fpp								
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				
Fpp			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								
Fpp								
Lbs.								
Flow								
DI								
FI								

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

6.1.7 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	
Fpp	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				
Fpp			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								
Fpp								
Lbs.								
Flow								
DI								
FI								

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

6.1.8 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
Fpp	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
Fpp				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
Fpp	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
Fpp	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		

6.1.9 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
Fpp	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
Fpp	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
Fpp	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
Fpp	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

6.1.10 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
Fpp	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
Fpp	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
Fpp	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
Fpp	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

6.1.11 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
Fpp	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
Fpp	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
Fpp	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
Fpp	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

6.1.12 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							
Fpp	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					
Fpp	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
Fpp	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
Fpp	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

7 Appendix B. Water Quality Report

Informational Water Quality Report

WaterCheck Lite

Client:

Ordered By:
Schmidt, Keenan 74135 Riverview Lane Irrigon , OR 97844 ATTN: Keenan Schmidt

National Testing Laboratories, Ltd.
Quality Water Analysis

6571 Wilson Mills Rd
Cleveland, Ohio 44143
1-800-458-3330

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.

Primary Standards:	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.
Secondary standards:	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.
Action levels:	Are defined in treatment techniques which are required processes intended to reduce the level of a contaminant in drinking water.
mg/L (ppm):	Unless otherwise indicated, results and standards are expressed as an amount in milligrams per liter or parts per million.
Minimum Detection Level (MDL):	The lowest level that the laboratory can detect a contaminant.
ND:	The contaminant was not detected above the minimum detection level.
NA:	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

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 •