US Army Corps
of Engineers
Portland District

SYSTEM OPERATION AND MAINTENANCE MANUAL

MINTO FISH COLLECTION FACILITY REBUILD
WILLAMETTE RIVER BASIN
NORTH SANTIAM RIVER, OREGON

MINTO FISH COLLECTION FACILITY REBUILD

FINAL **Sept 2016**

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Abbreviations and Acronyms

ATS	Automatic Transfer Switch
AWS	Auxiliary Water Supply
cfs	cubic feet per second
FCF	Fish Collection Facility
fpm	feet per minute
FWS	Facility Water Supply
GAC	Granular Activated Carbon
HIM	Human Interface Module
IPS	Intake and Pump Structure
kW	kilowatt
LIT or LT	Level Transmitter
NOAA	National Oceanic and Atmospheric Administration
O&M	Operation and Maintenance
ODFW	Oregon Department of Fish and Wildlife
PLC	Programmable Logic Controller
PM	Preventative Maintenance
SCADA	Supervisory Control and Data Acquisition
SOMM	System Operation and Maintenance Manual
VFD	Variable Frequency Drive

Chapter 1 – General Information

1.1. Purpose and Scope

ODFW and the Willamette Project will be responsible for the operation and maintenance of the rebuilt Minto Fish Collection Facility. The new facility is a complex system with many interacting mechanical, electrical, and structural components. In addition, the hydraulic performance must be carefully controlled so that the system operation meets NOAA Fisheries criteria and provides effective fish passage. The System Operation and Maintenance manual provides the necessary guidance in the general system operation and describes the specific operation and maintenance of each component in the system.

1.2. Parts of the Manual

There are seven chapters in this manual including:

1. General Information
2. System Description
3. Theory of Operation
4. Operations
5. Preventative Maintenance
6. Trouble Analysis
7. Corrective Maintenance and Checkout Procedures

Appendices include:

A. As-Built Drawings

B. Equipment O&M Manuals

C. Site Map

D. Commissioning Checklists

E. Minto Auxiliary Water Supply (AWS) PLC Operation

F. Minto Facility Water Supply (FWS) Pumps PLC Operation

G. Minto Area Locator Map

H. Minto Control System User Guide

I. Fish Transfer Procedure

1.3. Project Description

The Minto Fish Collection Facility is located 4 miles downstream of the Big Cliff Reregulating Dam and 7 miles downstream of the Detroit Dam on the North Santiam River. The Minto Fish facility site is located at 44°45’27”N, 122°21’38”W on the boundary between Marion and Linn Counties, Oregon.

The Minto Fish Collection Facility includes the following major features:

a. Fish ladder system including:

   i. Pools separated by weirs and orifices

   ii. Diffusers in lower pools supplied by gravity AWS System

   iii. Fish ladder entrance with two entrance gates

b. Pre-sort pool including:

   i. Crowder, finger weir and false weir

c. Sort Facility including:

   i. Facility office, visitor room, mechanical/electrical room, and storage

d. Post-sort pools including:

   i. 8 post-sort pools

   ii. Sort channel with crowders and hopper pit

   iii. Juvenile return pipe and sort channel drain system

e. Intake and pump structure including:

   i. Pumped Facility Water Supply (FWS) System

   ii. Gravity Auxiliary Water Supply (AWS) System

   iii. Intake screens, porosity plates, bulkheads

f. Fish sorting equipment including:

   i. Fish sorting flumes, anesthetic tank, recovery tank, sort table, adult return to river pipe

g. Fish transfer and loading equipment including:

   i. Hopper crane

   ii. Hopper loading structure

iii. 2 Hoppers

iv. Fish truck

h. East Retaining Wall Structure

i. West Retaining Wall Structure with AWS conduit

j. Abatement Pond

k. Ancillary buildings including:

l. Maintenance building, emergency generator building, site host, 2 shade structures, and 2 IPS stairwell access structures

m. Barrier Dam with flashboards

n. Minto North including sanitary drainfield

Chapter 2: System Description

2.1. SITE MAP

A site map is included in Appendix C.

2.2. FISH LADDER

The fish ladder guides fish from the barrier dam tailrace to the fish collection facility presort pool. This fish ladder is constructed of reinforced concrete, consisting of 52 pools separated by 51 weirs. The ladder channel is 6-feet wide. The ladder is approximately 421-feet long and starting from Pool 1 invert 958.25 feet, the invert is sloped at 1 on 10 feet to rise 38-feet from pool 1 to the presort pool. Discharge down the ladder originates from the presort pool and steps down from pool 52 to pool 1, releasing through the entrance into the tailrace. The FWS pumps supply the presort pool, post-sort pools and upper ladder flow (about 17 cfs). The gravity AWS system provides 80 – 220 cfs to the lower ladder diffuser system to augment the entrance attraction flow.

2.2.1. Fish Ladder Entrance

The fish ladder has two entrances, one for adult and one for juvenile fish, located adjacent to the north end of the barrier dam. A fish barrier screen is located behind (or upstream of) the adult fish entrance gate. The gates close from the top downward. A work platform is located over the fish ladder entrance area allowing workers access to the fish ladder entrance gates and the fish screen gate.

2.2.1.1. Adult and Juvenile Fish Entrance Gates

Figure 2-1

The two entrance gates include a 4-foot wide main adult entrance gate and a 12-inch wide juvenile entrance opening. The gates are 10 feet high and close to invert elevation 958.25 feet. The entrance gates are stainless steel slide plates that are moved by a jack screw and actuator. The juvenile entrance gate leads to a separate channel which has an additional head drop so that the head drop across the juvenile entrance is approximately one half of the entrance head at the main adult entrance. While both gates have separate actuators that can be operated independently, the current plan is to operate them in tandem and monitor the performance. A programmable logic controller (PLC) automatically positions both gates based upon water depth and a differential of the head at the main entrance.

2.2.1.2. Fish Barrier Screen and Support Structure

Figure 2-2

The fish screen gate is used to prevent fish from entering the ladder during commissioning, start up, and shut down operations. The 6-foot wide x 14-foot tall gate is fabricated from stainless steel grating and framed by a hollow structural section. This gate is raised and lowered by a manually-operated electric hoist mounted on the lifting frame.

2.2.2. AWS Diffusion Basins

The AWS system includes 13 diffusion basins and 14 diffuser gates. The entrance pool (pool #1) has 3 diffusers while the remaining diffusers are located in pools 2-11 (Pools 4 and 8 are currently blocked). This water is sourced by gravity from the upstream side of the barrier structure.

2.2.2.1. AWS Diffuser Slide Gates

Figure 2-3

A vertical slide gate is installed at each of the 14 AWS diffuser chamber water inlets. Each gate has an electric actuator that may be automatically positioned by the PLC. Depending upon the tailwater level the gates are either fully open or closed. . The diffuser gates will open one at a time, starting at the ladder entrance and moving up the ladder as tailwater rises. Diffuser gate 7 (pool 4) and diffuser gate 11 (pool 8) are not operated due to the inlets being blocked.

Diffuser gates 13 and 1 are also not operated, and are blocked from automatic operation after an evaluation of hydraulic instability (October 2013) under high total ladder flows. The maximum number of operating diffuser gates is 10. If one of the lower operational diffuser gates becomes disabled, the next higher diffuser gate may replace it in a manual operation sequence. Diffuser Gate 13 or 14 can be operated in the very high tailwater condition when 10 diffuser gates are called upon.

2.2.2.2. Diffuser Screens, Porosity Plate, and Bubbler Beams

The system of baffle blocks, bubbler beams, and porosity plates located between the AWS gates and diffuser screens were designed to dissipate approximately 8 feet of head. The baffle blocks are constructed of reinforced concrete while the bubbler beams, porosity plate, and diffuser screens are constructed of stainless steel.

The AWS diffuser screens are located flush along the ladder wall and are intended to prevent fish from entering the AWS diffusion basins as well as provide a uniform discharge of auxiliary water into the ladder system. Each diffuser screen has a porosity plate behind it. This plate provides a uniform discharge through the diffuser screens by creating most of the hydraulic resistance and head drop between the diffusion basin and the adjacent fish ladder pool.

2.2.3. Ladder Weirs and Orifices

Each ladder weir is constructed of reinforced concrete and has a 4-foot long non-overflow weir as well as a 2-foot long overflow weir located between each fishway pool. A 12-inch wide by 15-inch tall orifice is located on the floor beneath the 2-foot overflow section. The orifice opening is rounded to assist lamprey passage. The crest of the overflow weir is 5-feet above the invert and the non-overflow crest is 2-feet above the overflow crest. The weirs are spaced at 7.5-foot on center from pool to pool and the ladder invert is sloped at 1 vertical to 10 horizontal. The elevation difference between the crest of the weirs up the ladder is 0.75-feet. The FWS pumps must discharge 17-cfs to maintain this 0.75-foot ladder head per design criteria.

2.2.4. Pool 52 – Ladder Head Control with Level Sensor

There are parallel redundant level sensors (LIT-006A/LIT-006B) installed in Pool 52 for monitoring the water level. Adequate ladder flow requires a 9-inch differential between the top of Weir 51 and water elevation in Pool 52. With the FWS system pressure at 12PSI, presort valve 1 is normally preset at 45% open while valve 2 is preset at 100% open. When crowding fish, valve 1 may be set to 100% open while reducing valve 2 to 45% open.

Figure 2-4

2.3. PRE-SORT POOL

Fish jump from the fish ladder, over a finger weir, into the pre-sort pool. The 68-foot long, 13-foot wide, 14-foot tall pre-sort pool is constructed of reinforced concrete. The pre-sort pool is sized to hold a maximum of 750 adult fish. Water is supplied to the pre-sort pool through two floor diffusers. During normal operation, the water is 6-feet deep. If water supply is disrupted, the pre-sort pool will maintain 5-feet of depth.

2.3.1. Finger Weir

Figure 2-5

A finger weir is provided at the transition between the fish ladder and the pre-sort pool. This prevents fish from dropping out of the pre-sort pool back into the fish ladder. The finger weir can be adjusted to match any changes to the pre-sort pool level; typically the pre-sort pool water elevation does not change and the finger weir will not need adjustment once the pre-sort pool water level has been set.

2.3.2. False Weir

The false weir is located at the end of the pre-sort pool and provides a falling water stream that plunges into the pool, stimulating the fish to jump. Under normal conditions the fish will swim over the false weir without the need for a crowder. The false weir's water stream can be changed in two ways; the water supply can be diverted from the floor diffusers in the pre-sort pool, or the total volume of water in the pipe can be changed prior to the diversion valve. These modifications can be done independently or simultaneously. Typically, the operators will adjust these until the fish are swimming into the flume and no further changes are necessary.

2.3.3. Crowder

The crowder is located in the pre-sort pool. If the fish do not respond to the false weir, the crowder is used to move the fish in this direction. The crowder is operated from either the control panel, located on the northeast wall of the pre-sort pool, or the control console, located on the work platform at the east end of the pre-sort pool. During operation the crowder moves along the length of the pre-sort pool forcing the fish to be concentrated next to the false weir. The crowder lower edge can then be moved vertically to push fish into the entrance area of the false weir as necessary to encourage fish to move through the weir.

Figure 2-6

2.3.4. Closure Gate

Figure 2-7

The closure gate is a perforated aluminum slide gate that will allow water to partially pass through when closed. In the event that fish cannot be processed down the flume the gate can be lowered to keep them from jumping into the false weir water stream. The diversion valve actuation is very slow; the closure gate provides a temporary flow disturbance that keeps the fish from entering the flume.

2.3.5. Pre-sort Pool Piping

The pre-sort pool has two 16” diameter stainless steel pipe spools that supply the pool and subsequently the ladder.

Figure 2-8

There are two 8” diameter stainless steel pipe spools embedded in each diffuser pit that allow the pre-sort poll to drain.

2.3.6. False Weir Drain

The False weir has one false weir drain. The drain is a 6 inch butterfly valve located on the left side of the false weir below the platform. The drain valve is manually operated by handle. The drain is used to fine tune the amount of water entering the flume at the backside of the false weir.

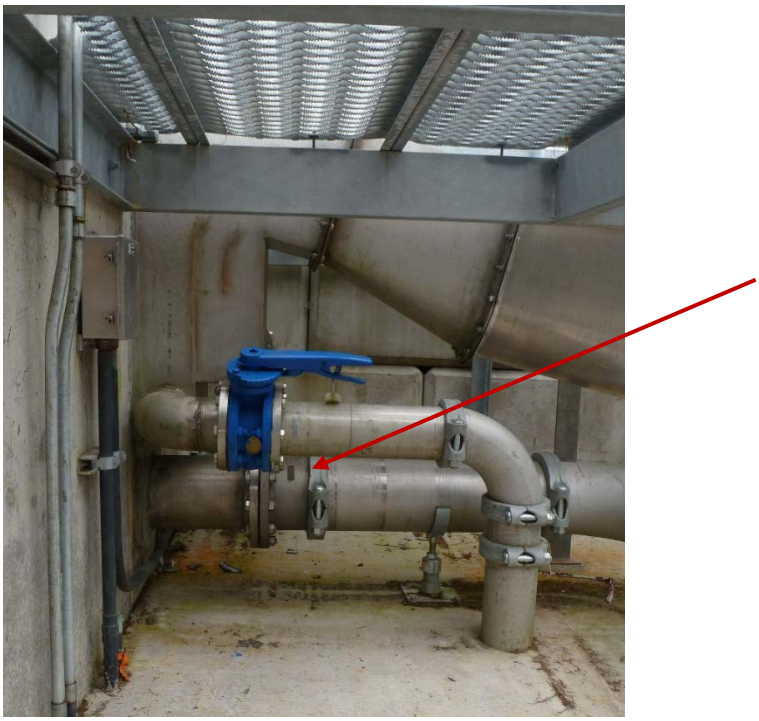


Figure 2-9

2.3.7. Valves

Each 16” supply pipe has an electrically actuated butterfly valve that can be positioned through the HMI for different operations. The valves are within exposed vaults located on the river side of the pre-sort pool.

The pre-sort drain valve is an 8” butterfly valve located in most upstream manhole on the river side.

The false weir pump isolation valve is a 10” butterfly valve and is located in the most upstream vault with the 16” supply valve.

2.3.8. Diffusers

The pre-sort pool diffusers are approximately 2 ft deep and are located at the ends of the pre-sort pool floor. A perforated plate and diffuser grating are located in each diffuser. The perforation plates and diffuser screens are constructed of stainless steel and are 6-ft by 5-ft. The porosity of each perforated plates is about 51 percent. The diffusers are supplied by the FWS pumps and provide hydraulic resistance to flow in order to reduce any jetting flow that may occur near the outlet of a water pipe.

2.4. SORT FACILITY

After jumping out of the pre-sort pool, over the false weir, fish enter a flume to the sort facility. The sort facility is constructed of reinforced concrete and contains a fabricated metal building. The ground level of the structure consists of three rooms, including a mechanical/electrical room and two storage rooms. The fish sorting equipment is also located on the ground floor of the sort structure.

2.4.1. Mechanical/Electrical Room

This room houses the lighting transformer and panelboard for the sort structure electrical loads. Also located here are the communications cabinet, potable water well pump controller, remote I/O cabinet, autodialer, intrusion detection panel, air compressor, potable water tank and the GAC filter. The room also has general and emergency egress lighting plus 120VAC receptacles.

2.4.1.1. Compressed Air and Oxygen

Figures 2-10 and 2-11

The compressed air system is comprised of a Champion VR10-12 compressor with a 120 gallon receiver. The compressor is rated to provide 34.8 CFM @ 175PSI. Compressed air pipe is copper type K. There are two connections; one at the anesthetic tank and one at the service building.

The oxygen pipe is also copper type K pipe cleaned for oxygen service. This pipe services the post sort pools and the anesthetic tank. There are 3 valves at each pool with Schrader connections that will act as

quick disconnects for aquarium stones. The oxygen cabinet is located near the crane beneath the platform access stairs. The oxygen system is designed to operate from 20 to 60 PSI. A flow meter is located in the cabinet to adjust oxygen infusion rates; the operator must manually regulate flow as the system will not self-adjust based on oxygen concentration.

2.4.1.2. GAC Filter

Figure 2-12

The GAC filter uses activated charcoal to remove contaminates from the anesthetic water. An operator using the anesthetic tank will choose where to drain the tank based on the anesthetic being used. The GAC filter should only be used when MS-222 (Tricaine Methanesulfonate) is utilized to anesthetize fish. Operators need to log the amount of fluid that passes through the filter as its media has a limited life span. Occasionally the filter will need to be back flushed; see operation section for additional details. The GAC filter is located in the mechanical room; Siemens PG500.

2.4.2. General Storage and Fish Food Rooms

Figure 2-13

A general storage room and fish food storage room are located on the lower floor of the sort structure. The general storage room is for equipment and supplies for operation of the facility to be stored near the work areas. The fish food room is for storage of fish food used during juvenile acclimation. Normal lighting (plus an emergency egress light) and 120VAC receptacles are provided in each room.

2.4.3. Office and Conference Room

An office and a conference room are located on the upper floor of the sort structure.

2.4.4. Plumbing

Piping is soldered copper pipe. Fixtures are composed of corrosion and vandal resistant materials such as stainless steel or vitreous china. Fixtures are designed to have reduced flow to conserve water. For each fixture, refer to the manufacturer's operation manual for care and maintenance.

2.4.5. HVAC

Occupied areas are thermostatically controlled spaces. Spaces that house temperature and humidity sensitive equipment are also thermostatically controlled. Refer to equipment specific operations manual for additional information.

2.5. POST-SORT POOLS, SORTING CHANNEL, AND HOPPER PIT

The post-sort pools, sort channel, and hopper pit are constructed of reinforced concrete. There are 8 post-sort holding pools that are 10-foot wide by 75-foot long. Water enters and exits the post-sort pools through floor diffusers. The post-sort pools are sized to hold a maximum of 350 adult fish per pool

and 87,500 juvenile fish per pool. There is a 6-foot wide by 139-foot long sort channel located on the south end of the post-sort pools. A hopper pit is located on the east end of the sort channel. Fish are crowded from the post-sort pools to the sort channel and then to the hopper for truck loading.

Figure 2-14

2.5.1. Post-Sort Pool Crowders

Figure 2-15

Two fish crowders are provided for the eight post-sort pools. The post-sort pool crowders are used to move fish from the post-sort pools to the sorting channel. During operation the crowder moves along the length of the post-sort pools, forcing fish to exit the pool and enter the sorting channel. The crowders are "ride-on" and are operated by a console on the crowder. Crowders are powered by DC (batteries), which are charged from 120VAC receptacles on each pool. One crowder is intended for Pools 1-4 and the other for Pools 5-8, even though it is possible to use either crowder on any of the Pools. The crowders can be moved between pools with the crowder trolley. The trolley can hold one crowder at a time and is operated using the controls located on the trolley.

2.5.2. Sorting Channel Crowder

Figure 2-16

A single crowder is provided for the sorting channel. It is used to move adult fish from the sorting channel to the fish hopper. During operation the crowder moves along the length of the crowding channel and forces fish into the fish hopper. During hopper operations, the crowder screen acts as the fourth wall of the hopper pit. The sorting channel crowder is "ride-on" and operated by a console on the crowder.

2.5.3. FWS Piping

The facility water supply piping provides water to the presort pool, sorting area, hopper loading area. The water is pumped and the supply piping is maintained at 12 PSI.

2.5.4. Diffusers

There is one post-sort pool floor diffuser per pool. The diffuser openings are 6-foot wide by 12-foot long. The diffuser opening is covered by grating and a perforation plate is located under the grating, both constructed of stainless steel.

2.5.5. Removable Fish Screens and Overflow Stoplogs

Figures 2-17 and 2-18

There are 8 removable screens at the end of the post sort pools and 2 removable screens in the juvenile release conduit area. The removable screens are constructed of an aluminum frame and expanded aluminum mesh. The porosity of the removable screens is 70%. Timbers are used to regulate the water surface elevation in the pools.

2.5.6. Juvenile Fish Return Pipe

Juvenile fish are released from the sort channel through the juvenile fish return pipe. The juvenile fish return pipe is made from 30-inch diameter HDPE pipe. The pipe connects the west end of the sort channel to the juvenile fish outfall near the fish ladder entrance. The pipe alignment is show on drawing C-015. There is an 18” schedule 40 PVC pipe that supplies water to the lower half of the juvenile return pipe. This is used as the drain when juvenile fish to be evacuated from the Sort Channel by operators.

2.5.7. Sort Channel Drain System

The sort channel is drained to the tailrace of the river and discharge near the ladder entrance. There are two main outlets to the Sort Channel located at the west end of the sort channel (see sheet SC745):

- Upper outlet to 30-inch Juvenile Return Pipe on north side, crest invert 983 feet

- Lower outlet to 18-inch juvenile drain pipe on south side, crest invert 979 feet (I.E. of sort channel). The 18-inch pipe drains to the 30-inch pipe to discharge to the tailrace.

  The upper outlet is used for normal drainage and volitional juvenile passage to the tailrace. The lower outlet is used for draining removing juveniles from the sort channel.

2.6. INTAKE AND PUMP STRUCTURE (IPS)

IPS Road Deck Load Rating: All members & slabs are designed to meet 2010 AASHTO HL-93 Design Vehicle Loads. For any crane that exceeds a gross vehicle weight (GVW) of 72,000 lbs or an axial weight of 32,000 lbs the structure must be checked by CENWP-EC-DS for capacity.

2.6.1. FWS Pump System

Figure 2-19

There are 5, 125 HP FWS pumps and each is controlled by a variable frequency drive (VFD) with a minimum speed setting of 1425 RPM. Four FWS pumps are considered essential for normal operation, while the remaining is a backup or standby unit. During automatic FWS Pump System control the VFD's operate in unison as required to maintain adequate water elevation in ladder pool #52. If a VFD is switched to manual, then starting, stopping, and speed control must be performed by a local operator. Automatic FWS Pump System control is not permitted when any VFD is running in manual mode.

2.6.2. FWS Piping

The FWS piping reducers within the Intake and Pump Structure (IPS) increases in diameter as the piping progresses along the FWS pump system. At FWS Pump No. 1, the pipe diameter is 18" schedule 40 steel pipe. The piping increases to 24" diameter pipe at Pump No. 2, and increases again to 36" diameter

schedule 80 pipe at Pump No. 3. Steel are provided at pipe transitions. The piping remains at 36” diameter along the remaining pumps and a manual drain is provided between FWS pumps No. 4 and No. 5.The FWS flowmeter and air valve are located along the piping inside the IPS before mating up to Sorting Pool Piping.

2.6.3. FWS Flowmeter

A flowmeter (FIT-001) provides flow monitoring of the FWS header pipe. The flow signal connects to the PLC, but is only used for monitoring and hydraulic calculation checks.

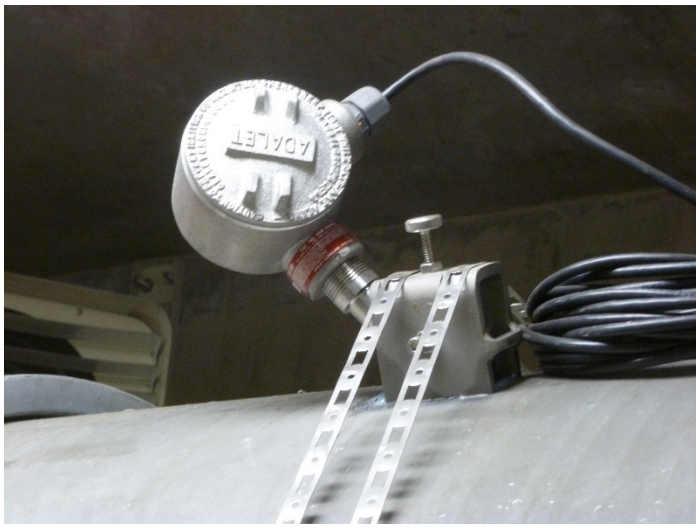


Figure 2-20

2.6.4. AWS Valve and Sump Pump System

The AWS Valve is a gate valve that allows and disallows water to flow into the AWS diffuser basins. The gate valve is a fabricated steel plate with frame. The gate valve is lifted by a dual-rod lifting system driven by an electric drive or manually operated. A slide gate is located at the upstream end of the AWS channel, inside the intake and pump structure. The slide gate closes the AWS supply for times when the fish ladder is not in operation. The gate vertical actuating stem penetrates the floor through a packing gland and has a pedestal-mounted electric actuator with integral local controls for gate operation.

Figure 2-21

Figure 2-22

The Sump Pump System has two submersible pumps. The pumps operate in al lead/lag configuration. Normally only one pump is required unless it cannot keep up with sump level. The pumps operate to remove water from the sump by pumping it into the tailrace to the tailrace. The sump is subject to drainage from the air burst system receivers, structural drainage via trench drain, and is the low point for any other unexpected sources of water infiltration.

2.6.5. Washdown Pipe System

Figure 2-23

A pump control panel is provided to allow automatic operation of the washdown water pump motor based upon water level in the hydropneumatic tank.

2.6.6. Intake Screens

The purpose of the intake screens is to prevent the entrainment of juvenile salmon and other small resident fish into the sump, pumps and discharge pipe system. The intake screens also prevent debris from entering the intake structure that may damage the pumps or other equipment in the system. There are 15 FWS pump intake screens and they are fabricated from stainless steel vertical profile bars. The gaps between the bars are 1.75 mm, sized for juvenile fish per NOAA Fisheries Criteria. Each screen is 6 ft wide, framed with hollow structural sections, and with structural supports between sections.

Figure 2-24

2.6.7. Porosity Plates

There are 15 porosity plates, fabricated from stainless steel, located directly upstream of each intake screen. The purpose of the porosity plates is to cause the flow to pass through the screens more uniformly and prevent the occurrence of velocity hot-spots on the fish screen that could endanger juvenile fish. This is accomplished by having the porosity plate create much more hydraulic resistance than the fish screens. The perforated plates have a porosity of 12.8% in Intake Screens 1-7 (1 starting at upstream or east end) and 10% in Intake Screens 8-15 (downstream or west screens). The porosity is lower at the downstream screens because of higher head differential due to the drawdown of the water surface inside the IPS towards the downstream direction. (See Drawings SO102 for Screen locations & SO525 for Porosity Plate details).

2.6.8. Dewatering Bulkheads

There are 15 bulkheads that can be used to dewater the FWS and AWS systems that are fabricated from stainless steel. When not in use, the bulkheads will be stored in the vertical position. The bulkheads have permanent rigging attached and are raised and lowered using a 5-ton boom truck. A rental 5-ton boom truck can be used to lower and lift the bulkheads.

Figure 2-25

2.6.9. Airburst System

There are total of fifteen (15) airburst screens, each screen is subdivided into four zones. Zone 1 is the lowest in the water while zone 4 is the highest. Each screen has four solenoid valves, one for each zone within each vertical screen. The cleaning cycle shall blow one screen at a time, starting at upstream end, from Zone 1 to Zone 4 and sequence shall be timed so that the debris is carried downstream by the nominal system flow and does not re-impinge on the screens. The system startup will be automatically initiated by a timer or preset pressure differential that would be measured across the screens. Automated control is provided by the PLC, and manual control is performed through the HMI.

2.7. FISH SORTING EQUIPMENT

2.7.1. Fish Transport Flume

Figure 2-26

The transport flume provides fish passage from the pre-sort false weir to the first downstream switch gate. It is fabricated using aluminum and has a U profile. Square bottom to U bottom transitions are provided for the false weir and downstream switch gates.

2.7.2. Switch Gates

Figure 2-27

The switchgates are downstream from the fish transport flume. They are fabricated using aluminum and have Composite bushings at hinge points and a single pneumatic cylinder for actuation. There are three switchgates that allow the operator to choose where a fish is deposited; anesthetic tank, return-to-river pipe, and post-sort pool 8. All switchgates can be operated from a pushbutton pendant located on the pre-sort platform. As well, the return-to-river switchgate can be operated from the control console located on the pre-sort platform.

2.7.3. Anesthetic Tank

Figure 2-28

The anesthetic tank is a 3’ by 8’ stainless steel tank used to anesthetize fish prior to sorting/spawning. A fish brail forms a false bottom in the anesthetic tank and can be actuated up to lift anesthetized fish out of the water for processing. The fish transport flume and the hopper return flume both run through a dewatering screen before connecting to the anesthetic tank. Another flume also connects the anesthetic tank with the spawning table.

The anesthetic tank has a 2” fill pipe and a 3” drain pipe. The drain pipe has a three way valve used to route the effluent to the appropriate discharge area. Drainage from the tank can be routed through the GAC filter to a holding (septic) tank or to the abatement pond. If drained through the GAC filter a pump must be used to move the fluid through the media.

2.7.4. Sort Table

Figure 2-29

The sort table is a large, V-shaped table used for sorting anesthetized fish. The sort table is connected to all 8 of the post sort pools through watered fish pipes coming through the back wall of the table. One end of the sort table also connects to the recovery tank. 2-inch table supply valves feed water to the surface of the table through two perforated plate diffusers. This table water is controlled by ball valves located beneath the table, directly beneath each plate diffuser. Each of the 8 fish types have a dedicated 5-inch water supply line which is controlled by a 5-inch butterfly valve directly beneath each fish pipe opening on the table.

2.7.5. Recovery Tank

Figure 2-30

The recovery tank's purpose is to provide a place for fish to recuperate from their anesthetized state before being returned to the river. The tank is stainless steel with an aluminum fish brail located inside. Fish can volitionally exit the recovery tank by way of the false weir, or can be brailed out of the tank together. The aluminum brail is actuated using an electric motor on a worm gear box, attached to a wire rope drum. Wire ropes attach to the drum and the four corners of the brail, lifting it vertically out of the water.

2.7.6. Recovery Tank False Weir

Figure 2-31

The recovery tank has a false weir mounted to the front end to provide volitional exit for the fish, and recirculation water for the recovering fish. The false weir takes water from the recovery tank, and uses a centrifugal pump run by a variable frequency drive (VFD) to provide the attraction flow and recirculation water. A separate supply line on the flume side of the false weir provides flume water to the return to river fish pipe. A drain box between the two supplies is controlled by a 6” butterfly valve and can be used to fine tune the attraction and flume flow. A control panel is provided for operation of the brail and false weir pump motor.

2.7.7. Spawning Table

Figure 2-32

The spawning table is a 3-foot by 5-foot stainless steel table used for spawning fish. A short-walled fish flume connects the spawning table to the anesthetic tank and sort table. The spawning table has a 2-inch drain located in the middle of the table.

2.8. FISH TRANSFER AND LOADING EQUIPMENT

2.8.1. Hopper Hoists

Figure 2-33

The hopper crane is a pendant controlled class 2, monorail hoist rated for 7.5 TONS. The hoist has been set up with multiple limits; upper over travel, upper stop, upper slow down, and lower stop. The hoist will travel the length of the beam with bump stops at either end to stop the hoist. The hoist will traverse at 65 fpm and will hoist at 12.2/2.1 fpm. A second hoist identical hoist is installed for hopper 2.

2.8.2. Hopper Loading Structure

The hopper loading structure is fabricated using A992 structural steel shapes and A572 Grade 50 for fabricated brackets and bracing. Stainless steel wire ropes with adjustable turnbuckles are used to shore up the structural bracing. A325 structural bolts used in combination with load sensing washers are used for the structural component assembly.

2.8.3. Hopper 1 – Fish Truck

Figure 2-34

Hopper 1 is primarily used to transport ESA fish from the sorting channel to the truck by "water to water" transfer. The Hopper is primarily fabricated from 6061-T6 aluminum. The hopper footprint is 5-foot by 10-inch square with a height of 15-feet-7½-inch. A storage frame is located at the river side of the crane when hopper 2 is being used. General use of the hopper is as follows:

- The hopper is lowered into the sorting channel hopper pit
- Fish are crowded into the hopper
- The hopper is lifted out of the pit and lowered onto the truck
- Hopper valve is opened to equalize pressure across the hopper door
- Hopper door actuation lever is pulled down, opening the hopper door located at the bottom of the hopper
- Drain valve on the truck is opened until proper water level in the truck is reached

2.8.4. Hopper 2 – Spawning (Return to Anesthetic Tank)

Figure 2-35

This Hopper is used exclusively to process broodstock. It's fabricated using 6061-T6 aluminum and its footprint is the same as hopper 1 and its height is 15-feet-7-inches. This hopper has an interior brail and screen that is actuated by pneumatic cylinders. The bottom of the hopper has a bell receptacle with a check valve so that water from the inside of the hopper can be pumped from the bottom of the hopper through the false weir and back into the hopper. General use of the hopper is as follows:

- The hopper is removed from the pedestal and placed into the sorting channel hopper pit
- Broodstock are crowded into the hopper
- The hopper is moved back to the pedestal
- The false weir is turned on; water begins to flow into the hopper through the screen
- Screen is lifted to allow volitional passage into the false weir
- In the event the fish do not self-pass, the brail is lifted forcing fish into the false weir
- Broodstock enter the anesthetic tank return pipe

2.8.5. Hopper False Weir

Figure 2-36

Hopper 2 interfaces with the hopper false weir when it is placed on the hopper 2 pedestal. The hopper false weir is primarily ¼-inch aluminum plate. The false weir attraction water is taken from the base of hopper 2, sent through a centrifugal pump powered by a variable frequency drive, and returned to hopper 2. A facility water supply line is used to supply the return to anesthetic tank fish pipe. A drain box between the two supplies is controlled by a 6-inch butterfly valve and can be used to fine tune the attraction flow and flume flow. A control panel is provided for operation of the false weir pump motor.

2.8.6. Fish Truck

Figure 2-37

The transport truck is a Freightliner FF3789, 33,000 lb GVW rated tank truck. The wheel base is 208 inches, with 138 inches from back of cab to rear wheel centerline (CA=138 inches). The tank is a West-Mark 1500 gallon stainless steel tank, mounted on the truck. The tank has external sight gauges, oxygen sensors, aerators, a top loading port to match the transfer valve system, and a rear release valve. The tank has an anti-siphon overflow pipe and vents.

2.9. EAST RETAINING WALL STRUCTURE

The east retaining wall is constructed from reinforced concrete and spans between the intake and pump structure and gravity block wall on the east side of the facility.

2.10. WEST RETAINING WALL STRUCTURE

The west retaining wall is constructed from reinforced concrete and spans between the intake and pump structure and the fish ladder entrance. An AWS conduit is attached to the north side of the retaining wall.

2.10.1. AWS Conduit

The AWS conduit is fabricated from reinforced concrete. The conduit is 10-foot high by 5-foot wide and is attached to the north side of the west retaining wall. The conduit starts at the west side of the intake and pump structure and ends at the fish ladder entrance diffusion chambers.

2.11. ABATEMENT POND

Figure 2-38

The facility includes an abatement pond. A 12-inch diameter pipe will be used to convey the drainage into an underwater gravel bed about 200 feet downstream of the facility.

The abatement pond will accept inflow from two main sources: the eight post-sort pools and storm water runoff from Catch Basin #2.

2.12. ANCILLARY STRUCTURES

2.12.1. EMERGENCY GENERATOR STRUCTURE

Figure 2-39

A prefabricated metal structure houses the diesel generator and automatic transfer switch. Fuel storage is adjacent to the structure.

2.12.1.1. Diesel Generator

The Emergency Generator by MTU Onsite Energy is rated at 600 KW. The engine portion, manufactured by MTD Detroit Diesel, is Model DS600D6SRA. The Generator Portion, manufactured by Marathon, is Model 572RSL4031. The total oil system capacity is 19.3 Gal.

2.12.1.2. Fuel Storage System

Fuel tank is a 3,000 gallon, double walled precast concrete tank manufactured by Oldcastle Precast. This tank is equipped with leak detection monitoring as well as with a kidney loop filtering system, manufactured by Fuel Technologies International. The purpose of this system is to filter the fuel through a 2 micron filter to remove any contaminates, including water prior to the fuel being needed for the generator.

2.12.1.3. Automatic Transfer Switch (ATS)

An ATS automatically transfers power between the normal (Pacific Power) and emergency (diesel generator) sources.

Figure 2-40

2.12.2. MAINTENANCE BUILDING

The maintenance building is a prefabricated metal structure and a reinforced concrete slab on grade. Normal lighting plus an emergency egress light are provided. Welding receptacles (240VAC) and convenience/maintenance (120VAC) receptacles are provided.

2.12.3. SITE HOST STRUCTURE

The site host structure includes a prefabricated metal structure and a reinforced concrete slab on grade.

Figure 2-41

2.12.3.1. Power Pedestal

The power pedestal provides receptacles for RV usage.

2.12.3.2. Potable Water

Potable water is provided at the site host structure. A hose bib is provided as part of the power pedestal.

2.12.4. IPS STAIRWELL ACCESS STRUCTURES

2.12.4.1. East Access Stairwell Enclosure

The east access stairwell enclosure is a prefabricated metal cover structure. The enclosure is provided to prevent rainwater and debris from entering the intake and pump structure. There is a set of galvanized metal stairs to the lower level of the intake and pump structure. Normal and emergency egress lighting are provided.

Figure 2-42

2.12.4.2. West Access Stairwell Enclosure

The west access stairwell enclosure is a prefabricated metal cover structure. The enclosure is provided to prevent rainwater and debris from entering the intake and pump structure. There is a set of galvanized metal stairs to the lower level of the intake and pump structure. Normal and emergency egress lighting are provided.

Figure 2-43

2.12.5. POST-SORT SHADE STRUCTURES

Figure 2-44

There are two prefabricated metal shade structures covering the post-sort pools. The purpose of the shade structure is to provide a shaded area for the fish in pools.

2.13. STORM WATER ABSORPTION SWALE

The majority of the storm water runoff generated from the East side of the site (East side of post-sort pools) will discharge to the storm water absorption swale, including runoff from the asphalt access road

and the paved parking area. The pond functions as an infiltration swale with approximately 1 ac-ft of storage capacity. The pond has an overflow culvert which discharges to the abatement pond. The pond has adequate capacity for the 10-year 24-hour event.

Figure 2-45

2.14. KAYAK PORTAGE PATH

A kayak take-out landing, portage trail, and put-in was constructed to facilitate safe kayak portage around the barrier dam. The take-out is located on the North shore of the North Santiam River approximately 400 feet upstream of the barrier dam. The take-out consists of a cleared area along the bank. The portage traverses the perimeter of the project directly along the outside of the security fencing from the take out, up to the railroad grade and then back down to the river on the downstream side of the facility. A steel staircase descends the final step portion of the hillside to the put-in landing.

Signage alerting the public to the dangers of the barrier dam and the availability of the portage trail includes one floating sign, two buoys located mid-stream and two signs along the northern bank. The buoys and the embankment signs are directly upstream of the take-out platform. The floating sign is located closer to the North bank than the buoys and is slightly downstream of the take-out platform.

2.15. SANITARY SEWER SYSTEM

2.15.1. Septic Tank

The septic tank is located near the sort structure. A pressurized system pumps the sewage to a drain field located across State Highway 22 at Minto North.

Figure 2-46

2.15.2. Pressure Sewer Line and Pumps

The pressure sewer system is comprised of a 1500 gallon holding tank, pump, distribution pipe and drain field. Waste from the sorting facility office and anesthetic tank is directed to the holding tank. The holding tank houses 2 effluent pumps that are triggered by float switches.

2.15.3. Controls

A control panel provides automatic duplex pump operation through float switches located in the tank. Pumps can also be operated manually if necessary for maintenance purposes. The control panel provides alarms for high tank level and pump failure. The control panel is located on the exterior wall (southeast corner) of the sort structure.

Figure 2-47

2.16. POTABLE WATER SYSTEM

2.16.1. Water Well

A new pump, hydro-pneumatic tank, and pump control panel were added to the existing water well.

Figure 2-48

2.16.2. Hydro-pneumatic Tank

The hydro-pneumatic tank capacity is 317 gallons and is pressurized to provide a service water pressure up to 125 PSI. The system pressure is maintained at 60 PSI.

Figure 2-49

2.16.3. Valves and Piping

Valves and piping are designed for potable water use. Refer to manufacture's operation and maintenance manual for specific material composition and care instructions.

2.16.4. Controls

A control panel provides automatic pump operation based upon system pressure. The control panel also provides alarms for numerous system malfunctions and is located in the sort structure mechanical/electrical room.

2.17. FACILITY ENTRANCE GATES

Vehicle access to the facility is restricted by two gates (bar gate and security gate). Each gate is operated by a motor operator. Motor operators are controlled either through a wireless remote control or keypads for both entry and exit. Facility personnel are able to open the gates with remote controllers without leaving their vehicles. Others are required to leave their vehicle and enter a code on the keypads to gain entry and to exit. The outer most gate (bar gate) has the capability to remain open during operation hours and then shut for afterhours security.

2.18. POWER

2.18.1. Primary Metering Cabinet

Electrical service is provided to the facility from PacifiCorp's 3-phase 20.8kV aerial distribution line to the Primary Metering Cabinet. The service conductors between the pole and the Primary Metering Cabinet will be owned and maintained by PacifiCorp. The Primary Metering Cabinet will be operated and maintained by PacifiCorp. The service conductors provide between the Primary Metering Cabinet and transformer FTQ1 will be operated and maintained by USACE.

A MV disconnect switch was added in a follow on contract.

2.18.2. Transformer FTQ1

The facility transformer is rated 750KVA, 20.8KV-480V, and is fed from the Primary Metering Cabinet. FTQ1 provides the "normal" source of power to the ATS in the Generator Building. The access doors to the primary/secondary compartments will be padlocked and accessible by authorized maintenance personnel.

2.18.3. Backup Power System

The stationary diesel generator provides backup power in the event normal power from the utility (PacifiCorp) is interrupted. The generator is rated 600KW, 480V, 3-phase. It has the capacity for full operation of the facility. Upon loss of normal power, the ATS commands the generator to start, then connects facility power to the generator. Following restoration of normal power the generator will re-transfer facility power back to the utility feed, following a preset time-delay.

Since the ATS is an open transfer type, all operating loads will momentarily lose power when switching between normal and emergency sources. Indirect monitoring of the facility power by the PLC is accomplished through a digital power meter. Since this monitoring is dependent on an Ethernet network and slow to reconnect following power transfers, it is recommended a 3-phase voltage relay be added for PLC monitoring of facility power within the IPS structure for automated FWS pump restarting.

2.18.4. Metering, Protection, and Grounding

Electrical system parameters (voltage, current, power factor, etc.) are processed by a digital power meter and displayed on the touchscreen displays. Arc-flash protection labeling is provided on all electrical equipment operating at 480V plus 208V panelboards. All exposed metal on the site is bonded to the ground system.

2.19. SCADA

2.19.1. Touchscreens

The touchscreens are used to control and monitor various devices and systems of the fish collection system.

2.19.2. Water Level Sensors

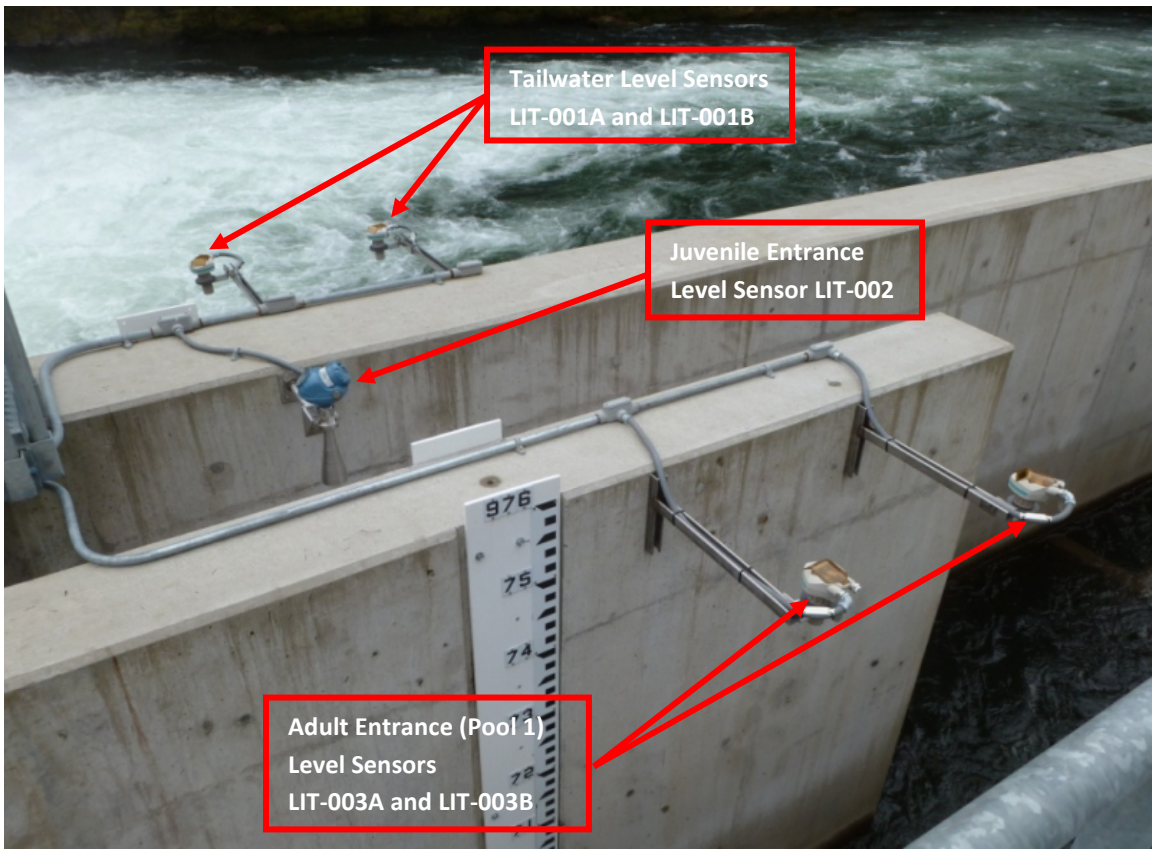


Figure 2-50

Level sensors are provided for both monitoring and/or control. There are a total of 6 submersible level sensors in the IPS. LT-008 and LT-012 measure river level at the downstream and upstream boundaries of the IPS. LT-009 and LT-011 measure level on the backside of the intake screens (Screen 15 and Screen 1, respectively). These sensors are used to calculate the differential across the intake screens for automated operation of the air burst (screen cleaning) system. LT-007 and LT-010 measure level in the IPS AWS chamber and are used only for monitoring/calibration purposes.

There are a total of 7 level sensors at the ladder entrance. Five of the sensors are ultrasonic (LIT-001A, LIT-001B, LIT-003A, LIT-003B and LIT-004) and one is radar (LIT-002). One sensor (LT-005) is a submersible. LT-005 measures pressure/level in the AWS conduit and is only used for hydraulic calculation checks. LIT-001A and 001B are redundant sensors used to measure river level at the ladder entrance. LIT-002 measures the level in the Juvenile Fish entrance. LIT-003A and 003B are redundant sensors used to measure the level in the Adult Fish entrance (Pool 1). LIT-004 is measures the level in diffuser chamber 1. LIT-001A, 001B, 002, 003A and 003B are used for control of the ladder entrance gates. LT-005 measures level (pressure) in the AWS conduit and is used only for monitoring/calibration purposes. Due to the narrow width of the Juvenile entrance, ultrasonic type sensors would not operate properly so a radar type was used (LIT-002).

There are 2 (redundant) ultrasonic level sensors (LIT-006A and LIT-006B) at the Pre-Sort Pool. These sensors measure the level in ladder Pool 5

ANALOG SENSORS CONNECTED TO CONTROLLER

SENSOR ID	TYPE	MFR	DESCRIPTION
FIT.001	Magnetic Flow	Rosemount	FWS Pump Out (CFS)
LIT.001A	Ultrasonic Level	Rosemount	Tailrace (Ft)
LIT.001B	Ultrasonic Level	Rosemount	Tailrace (Ft)
LIT.002	Radar Level	Siemens	Juvenile Chnl (Ft)
LIT.003A	Ultrasonic Level	Siemens	Ladder Pool 1 (Ft)
LIT.003B	Ultrasonic Level	Siemens	Ladder Pool 1 Sensor Data (Ft)
LIT.004	Ultrasonic Level	Siemens	Diffusion Chamber (Ft)
LIT.006A	Ultrasonic Level	Siemens	Ladder Pool 52 (Ft)
LIT.006B	Ultrasonic Level	Siemens	Ladder Pool 52 (Ft)
LIT.008	Ultrasonic Level	Siemens	W.Forebay (El.)
LIT.012	Ultrasonic Level	Siemens	E.Forebay (El.)
LIT.099	Unknown	Unknown	Diesel Fuel Level
LT.005	Submersible Level	GE (Druck)	AWS Conduit (PSI)
LT.007	Submersible Level	GE (Druck)	W.Intake Conduit (El.)
LT.009	Submersible Level	GE (Druck)	W.IntakeScreen (El.)
LT.010	Submersible Level	GE (Druck)	E.Intake Conduit (El.)
LT.011	Submersible Level	GE (Druck)	E.IntakeScreen (El.)
LT.013	Submersible Level	GE (Druck)	Raceway 1 (Ft)
LT.014	Submersible Level	GE (Druck)	Raceway 2 (Ft)
LT.015	Submersible Level	GE (Druck)	Raceway 3 (Ft)
LT.016	Submersible Level	GE (Druck)	Raceway 4 (Ft)
LT.017	Submersible Level	GE (Druck)	Raceway 5 (Ft)
LT.018	Submersible Level	GE (Druck)	Raceway 6 (Ft)
LT.019	Submersible Level	GE (Druck)	Raceway 7 (Ft)
LT.020	Submersible Level	GE (Druck)	Raceway 8 (Ft)
PIT.001A	Pressure	Rosemount	FWS Pump Outlet PSI
PIT.001B	Pressure	Rosemount	FWS Pump Outlet PSI
PIT.020A	Pressure	Rosemount	Air Tank1 (PSI)
PIT.020B	Pressure	Rosemount	Air Tank2 (PSI)
PIT.020C	Pressure	Rosemount	Air Tank3 (PSI)

2.19.3. Other Instrumentation and Sensors

ANALOG SENSORS - STANDALONE

SENSOR ID	TYPE	MFR	DESCRIPTION
FIT.001	Magnetic Flow	Rosemount 3051SF	Post Sort Pool 1
FIT.002	Magnetic Flow	Rosemount 3051SF	Post Sort Pool 2
FIT.003	Magnetic Flow	Rosemount 3051SF	Post Sort Pool 3
FIT.004	Magnetic Flow	Rosemount 3051SF	Post Sort Pool 4
FIT.005	Magnetic Flow	Rosemount 3051SF	Post Sort Pool 5
FIT.006	Magnetic Flow	Rosemount 3051SF	Post Sort Pool 6
FIT.007	Magnetic Flow	Rosemount 3051SF	Post Sort Pool 7
FIT.008	Magnetic Flow	Rosemount 3051SF	Post Sort Pool 8
FIT.009	Magnetic Flow	Rosemount 3051SF	Hopper Area
FIT.010	Magnetic Flow	Rosemount 3051SF	Upstream Bypass
FIT.011	Magnetic Flow	Rosemount 3051SF	Presort Pool

Chapter 3: Theory of Operation

See the Minto Fish Collection Facility Rebuild Design Documentation Report No. 1 for a detailed design discussion.

The fish barrier across the river prevents upstream migration of fish past the Minto fish ladder. The upstream migrating fish are guided into the fishladder entrances by means of attraction flow discharge through the two entrance gates. The fish progress up the fish ladder through ladder orifices or over ladder weirs that rise in increments of 0.75 feet. At uppermost ladder pool 52, the fish must pass over a finger weir into the Pre-sort Pool. The finger weir discourages fish from returning to the ladder downstream.

When operators are ready, the false weir pump is activated to entice fish to exit the Pre-sort Pool at the opposite end of the pool from the Finger Weir. If needed, the Presort Crowder is activated to compel the fish to exit the pre-sort pool. As the fish pass over the false weir, they land in the main transportation flume. Once a fish is sent down the flume, the operator may choose to select one of 4 destinations by application of switch gates. Switch gate 1 leads to Post Sort Pool 8, Switch gate 2 leads to the hopper pit, Switch gate 3 leads to the Return to River flume. During the return of ESA Winter Steelhead, the Return-to-River switchgate can be left open so these fish can directly return to the river for spawning (without being handled). The default setting (no Switch gates open) is the final destination: the Anesthesia Tank. Anesthetized fish are handled at the Sort Table and sent via Sort Flumes to designated Post-sort Ponds (8 total) or to the recovery flume, which leads to the Return to River flume. The Return–to-River Flume discharges to river upstream of the barrier, and is used for a volitional Winter Steelhead Bypass over the barrier during winter months.

Fish directly sent to the Hopper can be loaded into the holding tank of a Fish Truck by raising the hopper via crane, connection to the top of the truck tank and then water-to water transfer into the truck tank from the hopper (by slowly draining the truck tank). When time for transport, the fish in holding ponds are crowded from a Post-Sort Pond to the Sort Channel. Once in the sort Channel, the fish will be crowded again toward the Hopper for truck transport. The Truck will deliver fish (depending on species) upriver above Detroit Dam, to Marion Fork Hatchery, or ‘recycled‘ downriver for sports fishing.

The Minto Adult Fish Collection system is made possible by the strategic management of water that is directed to specific locations of different elevations. All facility water supply is withdrawn from the river upstream of the fish barrier through fish screens (sized to omit juvenile fish) at the IPS structure. Five FWS pumps are available to draw from the IPS sump inside the structure through pressure pipes to deliver up to 52 cfs to the higher elevated Pre-sort Pool, Flumes, Anesthesia tank, Recovery tank, 8 Post-sort Pools, and other miscellaneous uses. Discharge (17 cfs) sent to the Presort-pool discharges over the Finger Weir to establish the ladder flow down to the entrances. The ladder head is operated at 0.75 feet (± 0.08 feet) over the crest at Weir 52.

In the lower ladder section, the ladder flow is augmented by auxiliary water (AWS) through wall diffusers. The AWS flow is discharged via gravity flow from the IPS sump. The AWS discharge is controlled by the number of open Diffuser gates (between 3 - 10 operational gates, 14 total), which are in turn open or closed as a function of the tailwater elevation in the river. The entrance gates are adjusted as a function of entrance head (1.1 -1.4 feet), the difference between Pool 1 (upstream of the gates) and tailwater elevation. The purpose of the smaller juvenile entrance is to provide approximately half the entrance head applied at the larger adult entrance.

Flow from the FWS pumps is piped into the holding ponds to maintain fish health. The post-sort pool flow ultimately discharges over weirs to the Sort Channel. Flow in the Sort Chanel is drained through the 30-inch diameter Juvenile Fish Return Flume to the Tailrace. The Juvenile Fish Return Flume is used to release acclimated juvenile fish to the river.

Chapter 4: Operations

4.1. System Operations

4.1.1. General

This section describes general policies applicable to all areas. Efficient operation of the facility requires that all areas be kept neat, clean, and organized. Typical housekeeping tasks are listed below:

- Clean debris from fish screens and porosity plates.
- Mechanically clean debris from intake pump structure screens annually.
- Keep the cooling surfaces of electric motors clean.
- Replace failed lamps.
- Keep general area clean and free of obstacles.
- Clean and touch up paint.
- Keep all grating, access covers, and safety shields in place.
- Keep all water hoses and power cords rolled up and properly stored.

4.1.2. Facility Startup

To startup the Minto Fish Collection Facility, follow the procedures in the Automatic Startup section. When automatic startup is not possible or desirable, the Minto Fish Collection Facility startup can be done manually.

4.1.2.1. Manual Startup

Manual operation pertains to either the use of the HMI touch screen or local gate or valves actuators or pump controls. If HMI is unavailable, water level measurements need to be taken from staff gages. (Note: Automatic Startup should be used when possible.)

1. Ensure the fish screen gate is down.
2. Record tailwater level from HMI touch screen or the staff gage. Determine target diffuser gate settings (see Table 4, Table 5 and/or Figure 1 in section 4.1.3.1).
3. Place both adult and juvenile entrance gate actuators into manual using HMI touch screen or switching actuator into local.
4. Open both entrance gates to the setting shown in Table 1 for the given tailwater elevation.

Table 1 – Expected Entrance Gate Opening Versus Tailwater Elevation (feet)

TABLE OF EXPECTED ENTRANCE GATE OPENING VERSUS TAILWATER ELEVATION											
TW Tailwater Elevation (ft)	Qaws AWS Discharge (cfs)	DH Target Entr Head (ft)	Qent Entrance Discharge (cfs)	GO Gate Opening (ft)	% of Max GO		TW Tailwater Elevation (ft)	Qaws AWS Discharge (cfs)	DH Target Entr Head (ft)	Qent Entrance Discharge (cfs)	GO Gate Opening (ft)	% of Max GO
963.0	80	1.25	97	3.1	31%		966.3	138	1.25	155	4.9	49%
963.1	80	1.25	97	3.1	31%		966.4	138	1.25	155	4.9	49%
963.2	80	1.25	97	3.1	31%		966.5	157	1.25	174	5.5	55%
963.3	80	1.25	97	3.1	31%		966.6	157	1.25	174	5.5	55%
963.4	80	1.25	97	3.1	31%		966.7	157	1.25	174	5.5	55%
963.5	80	1.25	97	3.1	31%		966.8	157	1.25	174	5.5	55%
963.6	80	1.25	97	3.1	31%		966.9	157	1.25	174	5.5	55%
963.7	100	1.25	117	3.7	37%		967.0	157	1.25	174	5.5	55%
963.8	100	1.25	117	3.7	37%		967.1	157	1.25	174	5.5	55%
963.9	100	1.25	117	3.7	37%		967.2	157	1.25	174	5.5	55%
964.0	100	1.25	117	3.7	37%		967.3	157	1.25	174	5.5	55%
964.1	100	1.25	117	3.7	37%		967.4	157	1.25	174	5.5	55%
964.2	100	1.25	117	3.7	37%		967.5	157	1.25	174	5.5	55%
964.3	100	1.25	117	3.7	37%		967.6	157	1.25	174	5.5	55%
964.4	100	1.25	117	3.7	37%		967.7	176	1.25	193	6.1	61%
964.5	100	1.25	117	3.7	37%		967.8	176	1.25	193	6.1	61%
964.6	100	1.25	117	3.7	37%		967.9	176	1.25	193	6.1	61%
964.7	100	1.25	117	3.7	37%		968.0	176	1.25	193	6.1	61%
964.8	119	1.25	136	4.3	43%		968.1	176	1.25	193	6.1	61%
964.9	119	1.25	136	4.3	43%		968.2	176	1.25	193	6.1	61%
965.0	119	1.25	136	4.3	43%		968.3	176	1.25	193	6.1	61%
965.1	119	1.25	136	4.3	43%		968.4	195	1.25	212	6.7	67%
965.2	119	1.25	136	4.3	43%		968.5	195	1.25	212	6.7	67%
965.3	119	1.25	136	4.3	43%		968.6	195	1.25	212	6.7	67%
965.4	138	1.25	155	4.9	49%		968.7	195	1.25	212	6.7	67%
965.5	138	1.25	155	4.9	49%		968.8	195	1.25	212	6.7	67%
965.6	138	1.25	155	4.9	49%		968.9	195	1.25	212	6.7	67%
965.7	138	1.25	155	4.9	49%		969.0	195	1.25	212	6.7	67%
965.8	138	1.25	155	4.9	49%		969.1	195	1.25	212	6.7	67%
965.9	138	1.25	155	4.9	49%		969.2	195	1.25	212	6.7	67%
966.0	138	1.25	155	4.9	49%		969.3	214	1.25	231	7.3	73%
966.1	138	1.25	155	4.9	49%		969.4	214	1.25	231	7.3	73%
966.2	138	1.25	155	4.9	49%		969.5	214	1.25	231	7.3	73%

5. Open diffuser gates using HMI or local actuators to settings for given tailwater elevation) as listed in Table 4, Table 5 and/or Figure 1.

6. Determine expected total flow demand on FWS Pumps
    a. Determine which ponds and flumes will be operating
    b. Compute total expected demand of FWS system (See Table 2 for methodology and final equation at bottom)

Table 2 – Estimated FWS Flow Demands

		Number of Ponds			
	Presort and Ladder	Purpose 1 Juvenile Acclimation	Purpose 2 Adult holding	Bypass Flume to River	Misc. Uses
Number	1	J	A	1	
unit rate	17*	2.5	1.5	1.5 or 8**	2 or 8 ***
Total Q	17	J X 2.5	A x 1.5	1.5 or 8	1.5 or 8
* Assumed design flow for Presort Pool and Ladder is 17 cfs, actual rate may be as high as 20 cfs ** 8 cfs for winter steelhead bypass, 1.5cfs for normal *** 8 cfs if holding adults, 2 cfs if winter steelhead bypass only **** Sum of bypass + misc. uses ≈ 9.5 cfs regardless of adult or winter operation					
TOTAL FWS DEMAND = 17* + J x 2.5 + A x 1.5 + 9.5****					

7. Activate FWS Pumps (see section 4.2.5.1 on how to operate the pumps). Determine required number of pumps for start-up based on the estimated FWS Flow requirement determined. To determine the number of pumps: See Table 3. (The initial number of pumps is based on a goal of setting the operation as near as possible to midway between minimum and maximum pump speeds)

Table 3 – Number of Pumps at Startup versus Estimated FWS Flow Demand

FWS Demand (cfs)		Number of pumps
minimum	Maximum	
8.0	13.0	1
16.0	25.0	2
25.1	36.0	3
36.1	52.0	4

8. Use Pump Startup Addendum to get the system charged and purged of air. This will be using ONE pump in manual mode to get the whole network filled and ready for system startup.

9. Start-up selected number of FWS pumps (one at a time) at least 5% lower than max RPM.
    a. After two FWS pumps come on line, open all valves for ponds and flumes that were selected for operation in step 8 above.

10. Allow at least 15 minutes to fill the ladder system.

11. Begin recording ladder head (LDH) from the HMI or weir 52 staff gage if HMI is unavailable.

a. If ladder head < 0.67 feet: increase pump rpm. If rpm is at maximum for the current number of pumps, then start an additional pump. If pump capacity is at a maximum with the number of available pumps, then increase one or both Pre-sort Valve openings.

b. If ladder head >0.83 feet: decrease pump rpm. If rpm is at minimum for the current number of pumps, then shut off one of the pumps. If pump capacity is at a minimum with the number of available pumps, then decrease one or both Pre-sort Valve openings.

12. Check or adjust Entrance Head
    a. Adjust both adult and juvenile Entrance gates based on entrance head (DH) readings
        1. DH = LT-003 – LT-001 from HMI OR
        2. DH = Pool 1 staff gage – Tailrace staff gage
    b. The target entrance head (DH) is the maximum of the following two values:
        - 1.25 feet ± 0.15 feet (typically governs)
        - 958.0+ 5.0 – LT-001
    c. NO Change if the following conditions hold:
        i. Pool 1 water depth at least 5 feet deep (30 minutes)
        ii. Entrance head (DH) between 1.1 feet - 1.4 feet (30 minutes)
    d. Opening both gates will reduce entrance head or pool 1 level for a given flow rate
    e. Closing both gates will increase entrance head or Pool 1 level for a given flow rate
    f. Use Table 6 for manual both entrance gate adjustments.

13. Open fish screen at entrance once the ladder is operating in criteria.

14. After 60 minutes: check ladder head, tailwater elevation, and entrance head.
    a. If no change from previous readings or measured conditions, then no action is required with FWS pumps, diffuser gates, or entrance gate otherwise go back to step 13.

4.1.2.2. Automatic Startup

Follow the procedures below to start up the Minto Fish Collection Facility automatically.

1. Ensure the fish screen gate is down.
2. Using the HMI touch screen start the pumps

4.1.3. Normal Facility Operation

4.1.3.1. Normal Operating Criteria

The following information details operational criteria for operation of the facility. Any deviation observed should be reported to the Portland District Design Branch, CENWP-EC-D.

LADDER

- Ladder entrance head is 1.25 ft (between 1.0 – 1.5 feet)
  - Entrance head is difference between water surface elevations in Pool 1 (LT-003) and Tailwater (LT-001): DH = entrance head = LT-003 – LT-001
  - Operational entrance head (DH) is between 1.1 – 1.4 feet (average 1.25 feet)
- Entrance Gate Opening Limits
  - Minimum Gate Opening (GO) with FWS only = 0.75 feet = 7.5% GO
  - Minimum GO with AWS + FWS = 1.5 feet = 15% GO (Fisheries criteria)
  - Maximum GO = 10 feet = 100% GO (Physical limits)
- Minimum Pool 1 depth = 5 ft
  - Pool 1 depth = LT-003 – 958.0 feet
- Ladder pool differential at Pool 52 = 0.75 ft (or 9 inches) between 0.67 – 0.83 feet
  - Pool 52 ladder head (LT-006a) is between 0.67 – 0.83 feet
  - Pool 52 depth = 5.75 ft +/- 0.08 ft

- AWS Diffuser Gates open and close as function of tailwater elevation as shown in Table 4 and Figure 1.

Table 4 – Tailwater Elevation (LT-001a) Setpoints for Opening or Closure of Diffuser Gates

Gate No.	OPEN above TW (ft)	Total Open	Gate No.	OPEN above TW (ft)	Total Open
Diffuser 1	ALWAYS OPEN	1	Diffuser 8	966.4	7
Diffuser 2	ALWAYS OPEN	2	Diffuser 9	967.7	8
Diffuser 3	ALWAYS OPEN	3	Diffuser 10	968.3	9
Diffuser 4	963.7	4	Diffuser 11	*ALWAYS BLOCKED*	9
Diffuser 5	964.7	5	Diffuser 12	969.3	10
Diffuser 6	965.4	6	Diffuser 13	*ALWAYS BLOCKED*	10
Diffuser 7	*ALWAYS BLOCKED*	6	Diffuser 14	*ALWAYS BLOCKED*	10

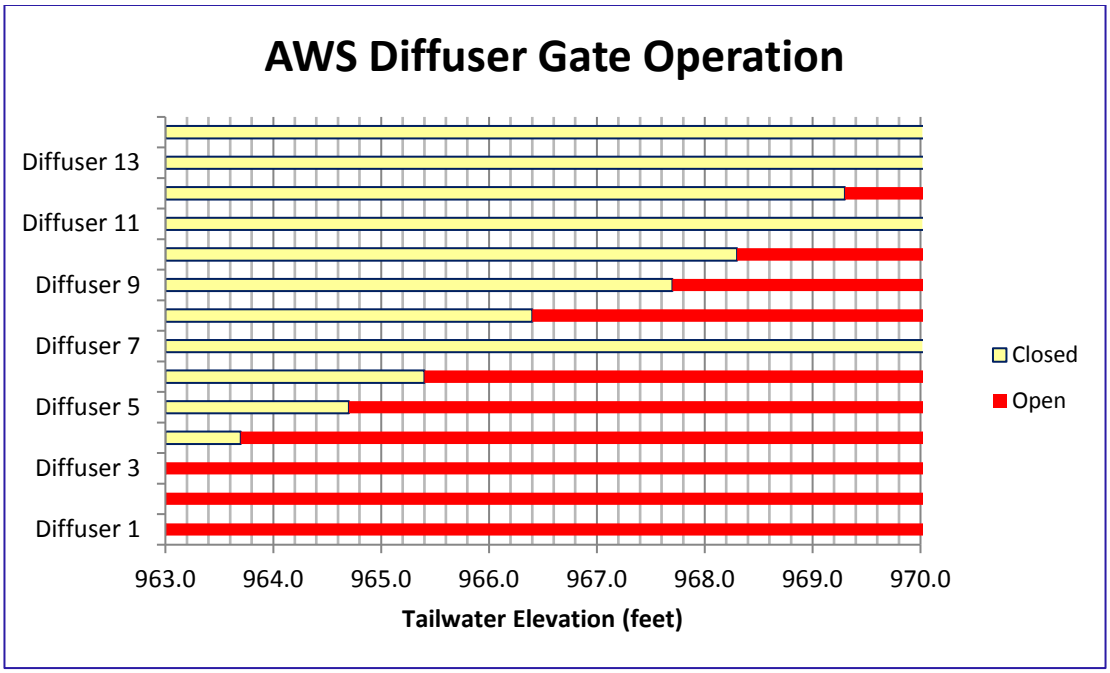


Figure 1 – AWS Diffuser Gates Open versus Tailwater Elevation

- Note: if screen differentials exceed 3.0 feet at the IPS, the PLC will start closing AWS diffuser gates if the AWS system is running in automatic mode. If operating in manual under the same conditions, start closing AWS diffuser gates from the top (or upstream) end until the screen differential is less than 1 foot.

The combined operation of the AWS diffuser gates and estimated AWS discharge rates as a function of tailwater level is further illustrated in Table 5. This table can be used for quick reference in a manual operation.

Table 5 – Combined Table of AWS Discharge and Maximum Open Diffuser Gate versus Tailwater Elevation

COMBINED TABLE FOR AWS DISCHARGE AND GATE SETTING VERSUS TAILWATER ELEVATION								
Tailwater Elevation (ft)	AWS Discharge (cfs)	Maximum Diffuser Gate Open	Number of Diff Open		Tailwater Elevation (ft)	AWS Discharge (cfs)	Maximum Diffuser Gate Open	Number of Diff Open
963.5	80	3	3		966.5	157	8	7
963.6	80	3	3		966.6	157	8	7
963.7	100	4	4		966.7	157	8	7
963.8	100	4	4		966.8	157	8	7
963.9	100	4	4		966.9	157	8	7
964.0	100	4	4		967.0	157	8	7
964.1	100	4	4		967.1	157	8	7
964.2	100	4	4		967.2	157	8	7
964.3	100	4	4		967.3	157	8	7
964.4	100	4	4		967.4	157	8	7
964.5	100	4	4		967.5	157	8	7
964.6	100	4	4		967.6	157	8	7
964.7	100	4	4		967.7	176	9	8
964.8	119	5	5		967.8	176	9	8
964.9	119	5	5		967.9	176	9	8
965.0	119	5	5		968.0	176	9	8
965.1	119	5	5		968.1	176	9	8
965.2	119	5	5		968.2	176	9	8
965.3	119	5	5		968.3	176	9	8
965.4	138	6	6		968.4	195	10	9
965.5	138	6	6		968.5	195	10	9
965.6	138	6	6		968.6	195	10	9
965.7	138	6	6		968.7	195	10	9
965.8	138	6	6		968.8	195	10	9
965.9	138	6	6		968.9	195	10	9
966.0	138	6	6		969.0	195	10	9
966.1	138	6	6		969.1	195	10	9
966.2	138	6	6		969.2	195	10	9
966.3	138	6	6		969.3	214	12	10
966.4	138	6	6		969.4	214	12	10

4.1.3.2. Manual Normal Operation

When automatic operation is not possible or desirable, Minto Fish Collection Facility operation can be done manually. To operate the Minto Fish Collection Facility manually, follow the procedures below.

(Note: Automatic Normal Operation should be used when possible.) For the facility to operate satisfactorily, the normal operating criteria in section 4.1.3.1 must be met.

In the event the PLC is unable to control the pumps for automatic operations, there are a number of staff gauges for manual verification of water levels. Operations personnel will need to verify the facility is running within ESA fish criteria during this time.

4.1.3.2.1 FWS Pumps

Each VFD permits manual or automatic control of an FWS pump by setting the Hand-Off-Auto selector switch. The normal or default setting is "Auto".

OFF: When the selector switch is set to "Off" the VFD is disabled.

HAND: When the selector switch is set to "Hand" a pump may be operated manually by pressing the green run button on the digital human interface module "HIM". The unit may be stopped by pressing the red button on the digital human interface module. The pump speed may also be controlled through the HIM by pressing the up or down arrows. If the *FWS Pump System* is running in automatic from the main HMI touch screen and a VFD is manually started, the *FWS Pump System* will switch to manual mode and automatic control will cease.

Pump Speed (RPM) Control via IPS Main Header Discharge:

The FWS pump discharge rates are a function of pump speed and pump head (the head at the pump minus the sump level in the IPS required to deliver the flow to all points in the system including head losses from the pipeline system). So even if there is no change in the operation over a period, there is still a possible need to adjust pump speed due to changes in pump head caused by changes in forebay elevation or changing losses at the intake screen. For a given constant pump speed, the pump discharge will rise with reduced pump head and drop with increased pump head. For a given constant pump head, the discharge is proportional to the ratio of the squares of the pump speeds. The pump speeds are governed by a variable frequency drive (VFD).

The system controller (PLC), maintains the FWS discharge pressure between 11.0 – 11.5 psi at pressure transmitter FWSP-007 on the main 36-inch FWS pipe in the IPS when operating in automatic mode. (This pressure range was established through multiple tests covering a range of system demands during a PDT site visit on Oct 15, 2014. The tests confirmed the ladder head at pool 52 would stay within criteria if the FWS pressures were maintained between 11.0 -11.5 psi and the presort valves were left fully open.) The PLC automatically determines the number of pumps to operate and their speed.

Pump Speed Adjustments for Pressure Discharge

The FWS pumps will controlled by the selected discharge pressure based on the as-built system. The pressure discharge required is a result of the demand on the system, and will fluctuate depending on the amount of flow traveling through the pipe. As a valve downstream is opened, the pressure at the node will decrease, causing the pumps to speed up. This will increase the discharge head and flow rate to meet whatever the flow through said valve needs to be. Alternatively, when a valve is closed, the

pressure at the node will increase and the pumps will slow down. After the change in pump number, the pumps speed will need to be adjusted to avoid excessive flow changes.

The location of demand will also have influence on the amount of pressure change seen by the node. For example, opening a valve at the pools to receive an additional 2.5 cfs of flow will have a different effect than turning on 2.5 cfs worth of flumes at the sort structure due to the differing frictional losses through each of those respective pathways. Also, turning on pool 8 when 7 pools are already running will have a different effect than turning on pool 2 when only one other pool is running, even though they will be passing the same flow rate through each pathway. For this reason, it will be prohibitively difficult to design set speeds for every different flow scenario. Instead, the required pressure at maximum flow will be used as the baseline. This won't be perfectly efficient but it will simplify operations greatly.

Number of Pumps Control:

Total system flow requirements have been estimated to vary between 24.5 – 58 cfs depending on the month, number of ponds, and other uses. Therefore the number of operating pumps will vary between 2 to 4. The need to add or remove a pump from operation should only occur when there is a significant change in system flow demand, such as a change in one or two ponds under operation. The pumps will have minimum and maximum RPM settings based on the factory tests shown in Figure 2 with a small safety factor. As a result, the pumps will be allowed to operate between 1425 and 1785 RPM. When the system flow demand changes such that the pump speed will need to go outside the allowable range, the number of operating pumps will also change. Note*: It is important to note that the system should never be manually overridden to operate with the presort valves above 85% open as the pumps will runout to their maximum speed with other flows being insufficient for fish survival.*

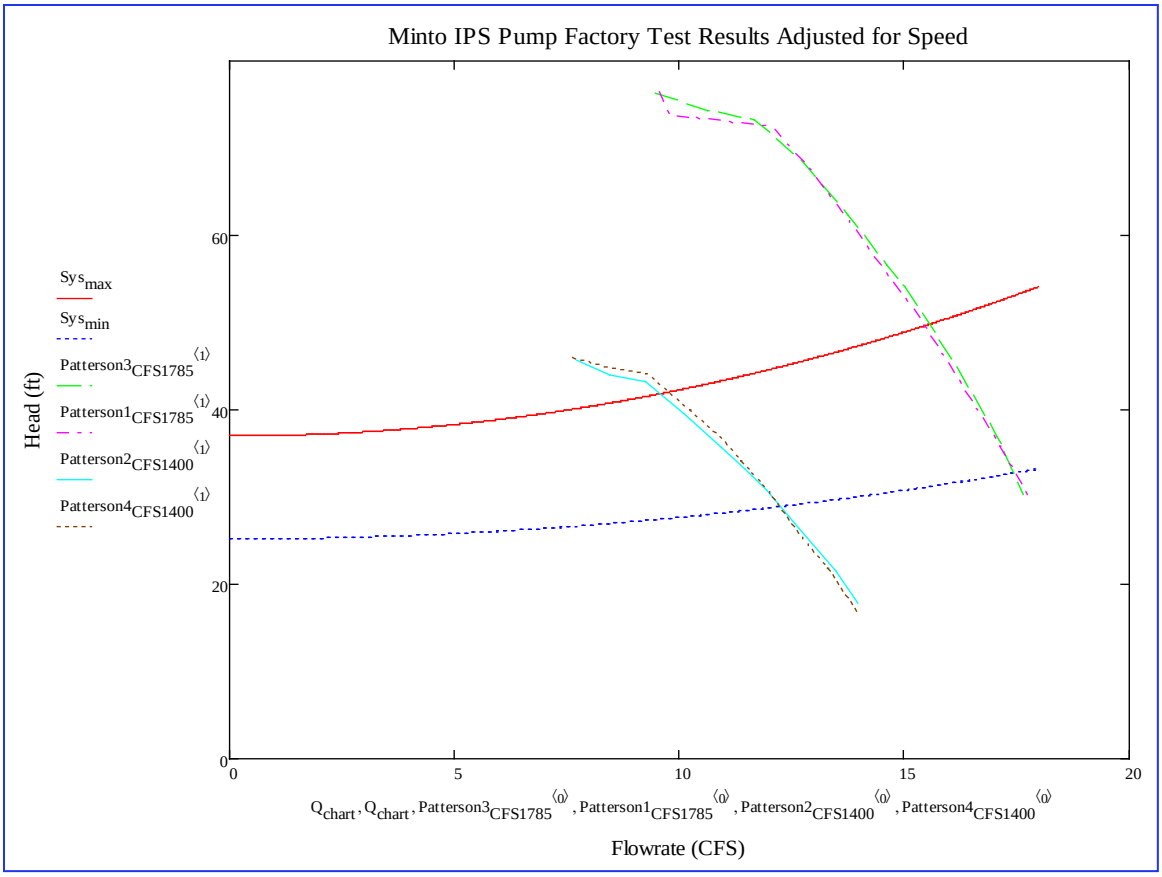


Figure 2 - Minto IPS Pump Factory Test Bracketing

If the FWS system is operating in automatic mode via the HMI touch screen, the PLC will attempt to maintain the FWS supply pressure between 11.0 -11.5 psi.

- If the PLC command to each VFD remains at the upper limit (100.0% speed) for 30 seconds, then additional pumps are started until the system speed is decreased and the setpoint pressure is attained.

If the PLC command to each VFD remains at the lower limit (80.0% speed) for 15 seconds, then one or more pumps are stopped until the system speed is increased and the setpoint pressure is attained. Since two pumps always operate in automatic mode, there may be times when the system operates at pressure higher than the setpoint.

4.1.3.2.2 Ladder Head Control

The ladder head should be monitored at Weir 52 (just downstream of Pre-sort Pool) to assure it is meeting the criteria in section 4.1.3.1. The water level at Weir 52 should be maintained at 0.75Ft +/- 0.08 feet (between 0.67 – 0.83 feet). The HMI touch screen or staff gage at Weir 52 or can be used to verify compliance.

Both pre-sort valves are permanently set in fully open position and are not meant to be changed, so that system power requirements can be kept to a minimum.

West Valve (MTF-FWS-PRE01) 86% Open
East Valve (MTF-FWS-PRE02) 100% Open

In situations where system demands are low and the pump capacity exceeds the ladder level requirements (such as a 2 pump operation), then either activate an additional pond or temporarily throttle Pre-sort valves. However once normal operating conditions have resumed, the pre-sort valves must be set back to 100% open.

If the Weir 52 water level is beyond normal operating conditions or outside of criteria then:

If the water level at weir 52 is low, incrementally increase Pumps RPM.
If the RPM is at maximum, add an additional operating pump.

If the water level at weir 52 is high, incrementally decrease Pumps RPM.
If the RPM is at minimum, remove an operating pump.

Check again after about 2 -5 minutes after adjusting, and adjust further if needed.

4.1.3.2.3 AWS Diffuser Gates

The AWS diffuser gates can be operated in manual through the HMI touch screen or locally if needed. Unless there are high screen differentials recorded at the IPS, Table 4 , Figure 1 and/or Table 5 should be applied to determine the number of open diffuser gates as a function of tailwater elevation. If the tailwater level sensors LT-001a or b are not available, check the tailwater staff gage for tailwater levels.

4.1.3.2.4 Entrance Gates

If the entrance gates need to be operated in manual through the HMI touch screen or locally, Table 6 can be used as a guideline to meet entrance criteria. The goal is to operate with an entrance head between 1.1 – 1.4 feet. If either sets of Level sensors (LT-001, LT-003) are not available, use staff gages in Pool 1 and Tailwater to estimate the entrance head as needed.

Entrance head = LT-003a - LT-001a = Pool 1 Staff gage - Tailwater Staff gage (if needed)

Table 6 – Manual Adjustments for Entrance Gate Operation

Manual Adjustments for Entrance Gate Operation								
DH = Entrance head = LT-003 - LT-001								
Change Condition:					Action	Change in GO	
IF DH ≤	0.5	ft			Reduce gate opening	-1.9	feet
IF DH is between	0.5	ft and	0.8	ft	Reduce gate opening	-0.8	feet
IF DH is between	0.8	ft and	1.0	ft	Reduce gate opening	-0.5	feet
IF DH is between	1.0	ft and	1.1	ft	Reduce gate opening	-0.2	feet
IF DH is between	1.1	ft and	1.4	ft	no change		
IF DH is between	1.4	ft and	1.5	ft	Increase gate opening	0.2	feet
IF DH is between	1.5	ft and	1.7	ft	Increase gate opening	0.3	feet
IF DH is between	1.7	ft and	2.0	ft	Increase gate opening	0.4	feet
IF DH ≥	2.0	ft			Increase gate opening	0.5	feet
NOTES:							
* Minimum Allowable GO = 1.5 feet; Maximum Allowable Go = 10.0 feet.							
Y = Pool 1 Depth = LT-003a - Invert Elevation 958.0 feet							
Change Condition:					Action	Change in GO	
IF Y ≤	4.5	ft			Reduce gate opening	15%	
IF Y is between	4.5	ft and	4.8	ft	Reduce gate opening	10%	
IF Y is between	4.8	ft and	5.0	ft	Reduce gate opening	5%	

4.1.3.3. Automatic Normal Operation

To operate the Minto Fish Collection Facility, follow the procedures below. For the facility to operate satisfactorily, the normal operating criteria in section 4.1.3.1 must be met.

4.1.3.3.1 FWS Pumps

-SITE MAP AREA F3, F4-

Each VFD permits manual or automatic control of an FWS pump by setting the Hand-Off-Auto selector switch. The normal or default setting is “Auto”.

OFF: When the selector switch is set to “Off” the VFD is disabled.

AUTO: When the selector switch is set to “Auto” the VFD digital human interface module (HIM) is locked out, except for the stop button. A VFD/pump may start, stop, or change speed at any time while the FWS Pump System is in automatic mode, as configured through an HMI touch screen.

VFD HIM OPERATION: Reference the full O&M manual for complete instructions.

Figure 3 Fish Pump VFD

AUTO EXERCISE: Each pump should be operated for at least 30 minutes every 30 days. Automatic exercising is achieved by swapping a standby pump with a running pump. Automatic pump swapping will occur under normal operating conditions while the FWS Pump System is in automatic mode. Note that automatic exercising is based on computed standby time and not run-time hours as reported by the VFD. If a VFD is placed in "Manual" or "Off" it is not in standby and excluded from auto exercise tracking. The VFD standby counter is reset after the pump is operated.

STATUS

- RUN LIGHT (RED): Indicates VFD is supplying electrical power to the pump motor.
- POWER LIGHT (GREEN): Indicates 120VAC control power at VFD is available.
- HIM STATUS: Reference the full O&M manual for viewing VFD data.

4.1.4. Normal Facility Shutdown

To shut down the Minto Fish Collection Facility AWS system, follow the procedures in section 4.1.4.1 AWS System Shutdown. The dewatering procedure is described in section 4.1.4.2 Dewatering Procedure.

4.1.4.1. AWS System Shutdown

To shut down the Minto Fish Collection Facility AWS system, follow the procedures below.

1. Place the AWS gate system in manual control from a touch screen.
2. Close all diffuser gates from the touch screen or locally at each actuator.
3. Close the AWS gate in the IPS.

4.1.4.2. Dewatering Procedure

After completing the Facility Shutdown procedures follow the procedures below to dewater the Minto Fish Collection Facility.

1. Shut off the AWS system 24 to 48 hours prior to facility dewatering and raise the entrance gates located at the fishway entrance out of the water.
2. When ready to dewater the facility, drop the fish screen gates at the fishway entrance to prevent any additional fish from entering the fishway. Continue to operate the fishway, if necessary, long enough to allow fish in transit to reach and enter the per-sort pool. Laser counting devices at the fishway entrance and at the per-sort pool finger weir can be used to monitor fish presence in the fishway.
3. Place pumps in local control and initiate drawdown of the fishway flow from 17 cfs to a level allowing visual inspection for fish presence and fish recovery (approximately 6 to 10 cfs in the ladder). The operation should be reduced to a single pump operation to achieve 8 -13 cfs.
4. Recover any remaining fish as necessary. Flow level in the fishway can be adjusted by changing the output of pumps (down to approximately 6 cfs—which will provide about a foot of flow depth at the orifice openings) and by diverting flow from the pre-sort pool through an overflow line leading to the diffuser chambers. These procedures will also permit control of the water level in the pre-sort pool while retaining function of other fish handling facility features.
5. Process any fish in the pre-sort pool or recovered from the fishway. Processed fish may be released above the barrier dam via the return flume or moved to the holding ponds.
    a. Load fish retained in the holding ponds for transport to a release site.
    b. Drain the pre-sort pool and the holding ponds. Wash down and clean the entire fish handling facility.

4.1.4.3. Winterization

Winterization of the facility will protect specific systems from freezing temperatures. Winterization occurs after the facility has been dewatered (See section 4.1.4.3. for dewatering procedure).

WARNING: The pre-sort valves are equipped with flap gate valves that prevent the pre-sort pool from completely dewatering. The diffuser pit drains will be the only way to dewater the pre-sort pool.

Figure 4 Diffuser Pit Flap Gate Valve

1. Verify the appropriate lock-out/tag-out procedures are in place.
2. Open one sorting table supply valve. Partially open pre-sort flap valve; this will allow water to drain down to the pump supply header pipe in the Intake Pump Structure.
3. Locate the low point drain on the IPS header pipe; attach a Garden hose to the valve and open the valve. CAUTION: Ensure hose outlet is <u>secured</u> so that flow is directed into the facility drainage sump. Note the locations of the high point vacuum breaker/air release valves.

Figure 5 IPS Low Point Drain Valve

As the level of water moves below the elevation of each valve, air should begin to enter the piping through the valve. Air entering the header pipe will likely be audible in the IPS. Air entering the piping can be used to track the rate and general elevation of water leaving the piping. This process may take up to 5 hrs.

4. Each pump check valve will need to be opened to drain the remaining water from the pump riser pipes. CAUTION: Do not open the pump check valves until verifying that the pressure is equalized in the piping.

5. The facility has a number of low point drains that allow the piping to fully drain. Once the header has been drained, open the low point drains to verify that the remaining water has left the system.

CAUTION: Prior to facility restart verify plugs are installed and each valve is in the operation position.

CAUTION: During winter facility operation, when freezing temperatures are expected, it is required that water supply valves are cracked open allowing water movement through the piping.

4.1.5. Emergency Operations

4.1.5.1. Power Outage

-SITE MAP AREA F2, G2-

The emergency diesel generator will automatically start following the loss of utility company power. , and stop after a cool down period following the restoration of utility power. Generator fuel consumption is listed by the manufacturer as the following:

- 100% load - 40 Gallons per hour
- 75% load - 30.2 Gallons per hour
- 50% load - 21.2 Gallons per hour

Fuel storage capacity is 3000 Gallons this amount of fuel will provide 3 days of continuous use. Due to intermittent power outages operators should check the fuel level every two weeks.

Figure 6 Diesel Fuel Tank

4.2. Equipment Operations

4.2.1. Fish Ladder

-SITE MAP AREA B4, A4, A3, B3, C3, C2-

4.2.1.1. Fish Ladder Entrance

-SITE MAP AREA B4-

4.2.1.1.1. Adult and Juvenile Fish Entrance Gates

The adult and juvenile fish entrance gates at the fish ladder entrance are operated by their own lift motor, see Figure3. The motors can be operated locally or remotely by setting the local/remote/off switch to the desired mode. When local operation is selected, each gate can be opened and closed using the open/close switch. Remote operation is controlled through a touch screen as shown in Figure 8.

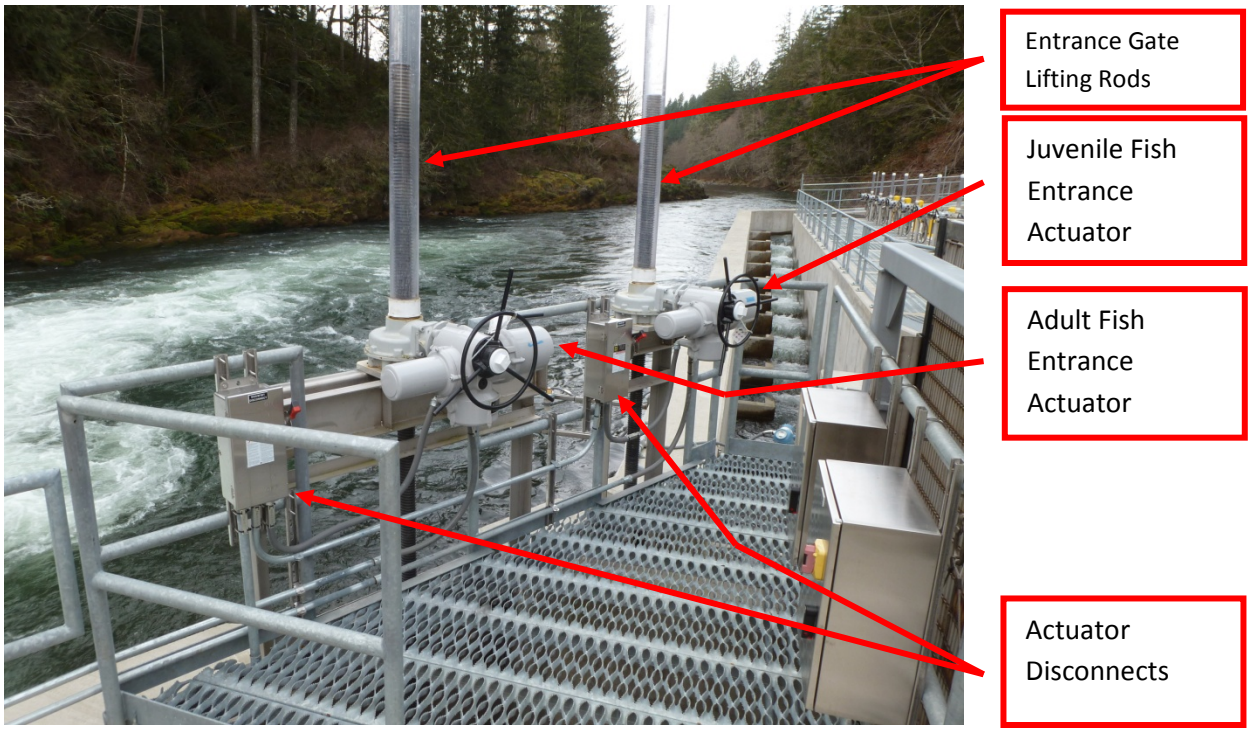


Figure 7 - Fish Ladder Entrance Gates

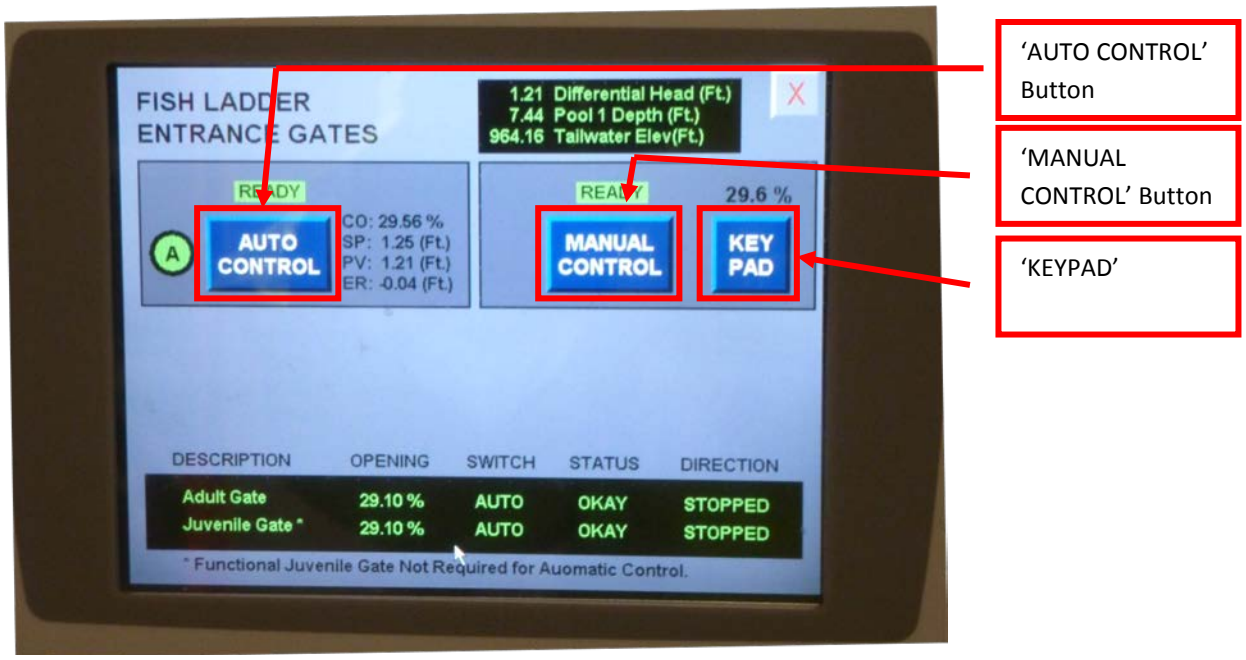


Figure 8 - Touch Screen, Fish Ladder Entrance Gates

Reference the Contractor provided O&M manual Volume 2 for complete operating instructions

4.2.1.1.2. Fish Barrier Screen and Support Structure

The fish barrier is used to keep fish from entering the ladder while the ladder is running. Typically the screen will be used during initial start-up and shut-down operations. The screen is operated by hoist pendant control.

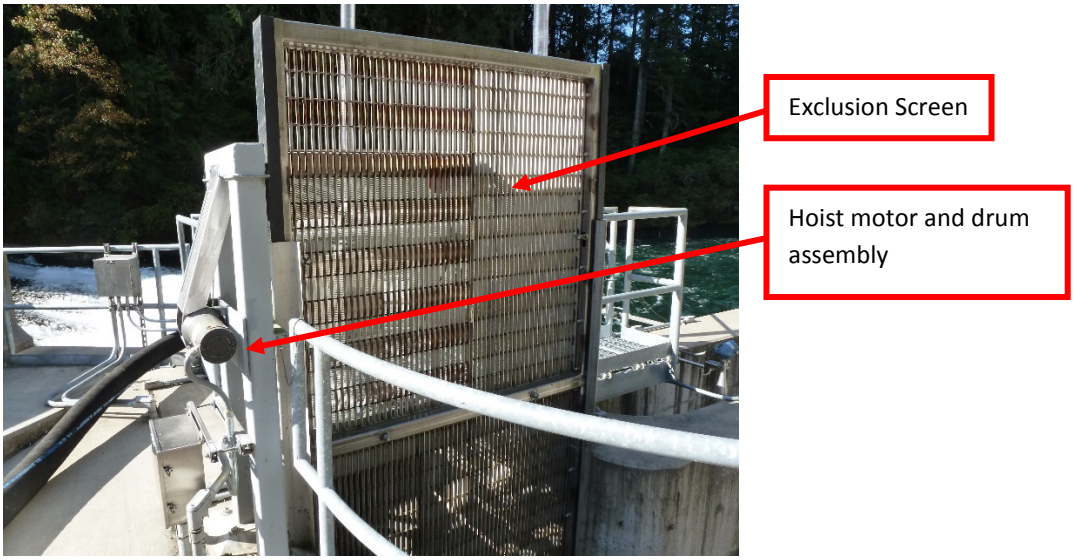


Figure 9 – Fish Barrier screen

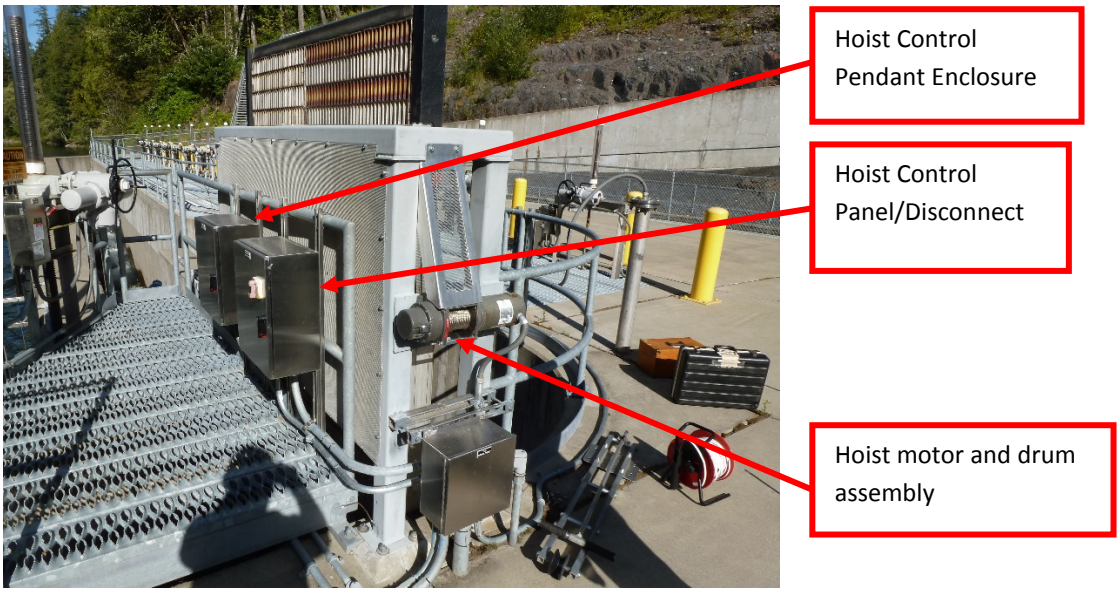


Figure 10 – Fish Barrier screen disconnects

Reference the Contractor Provided O&M manual Volume 2 for complete operating instructions

4.2.1.2. AWS Diffusion Basins

-SITE MAP AREA A4, B4-

4.2.1.2.1. AWS Diffuser Slide Gates

The AWS Diffuser Slide Gates may be manually operated or automatically positioned by the PLC. For automatic positioning each unit's selector switch must be set to "remote" and the HMI AWS Diffuser Gate screen set to "Auto Control". Under automatic operation, the gates will be opened and closed according to Figure 1-AWS Diffuser Gate Operation. Water level transmitters are shown in Figure 5.

Each AWS Diffuser Slide Gate can be operated manually using the actuator's open/close switch or remotely using the Touch Screen, shown in Figure 14. See Contractor provided Operation and Maintenance manual for instructions regarding hand wheel operation.

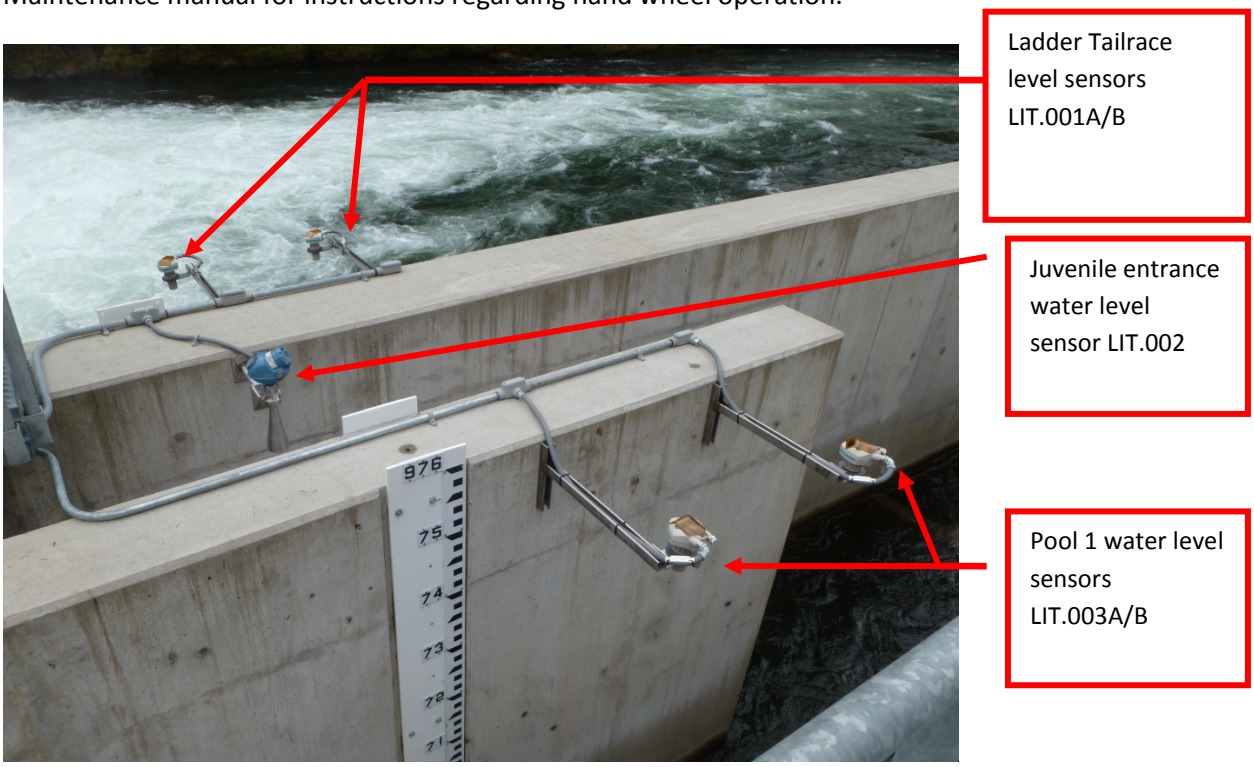


Figure 11 – Entrance level Sensors

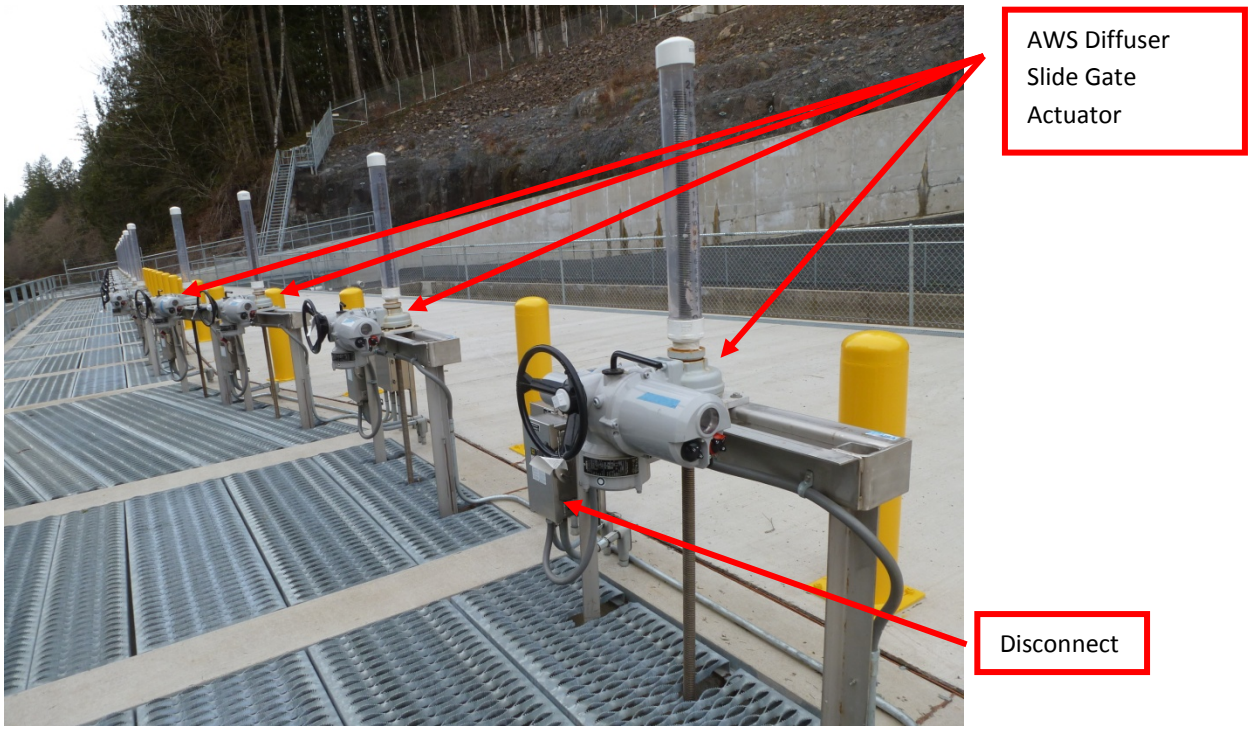


Figure 12 - AWS Diffuser Slide Gate Motors

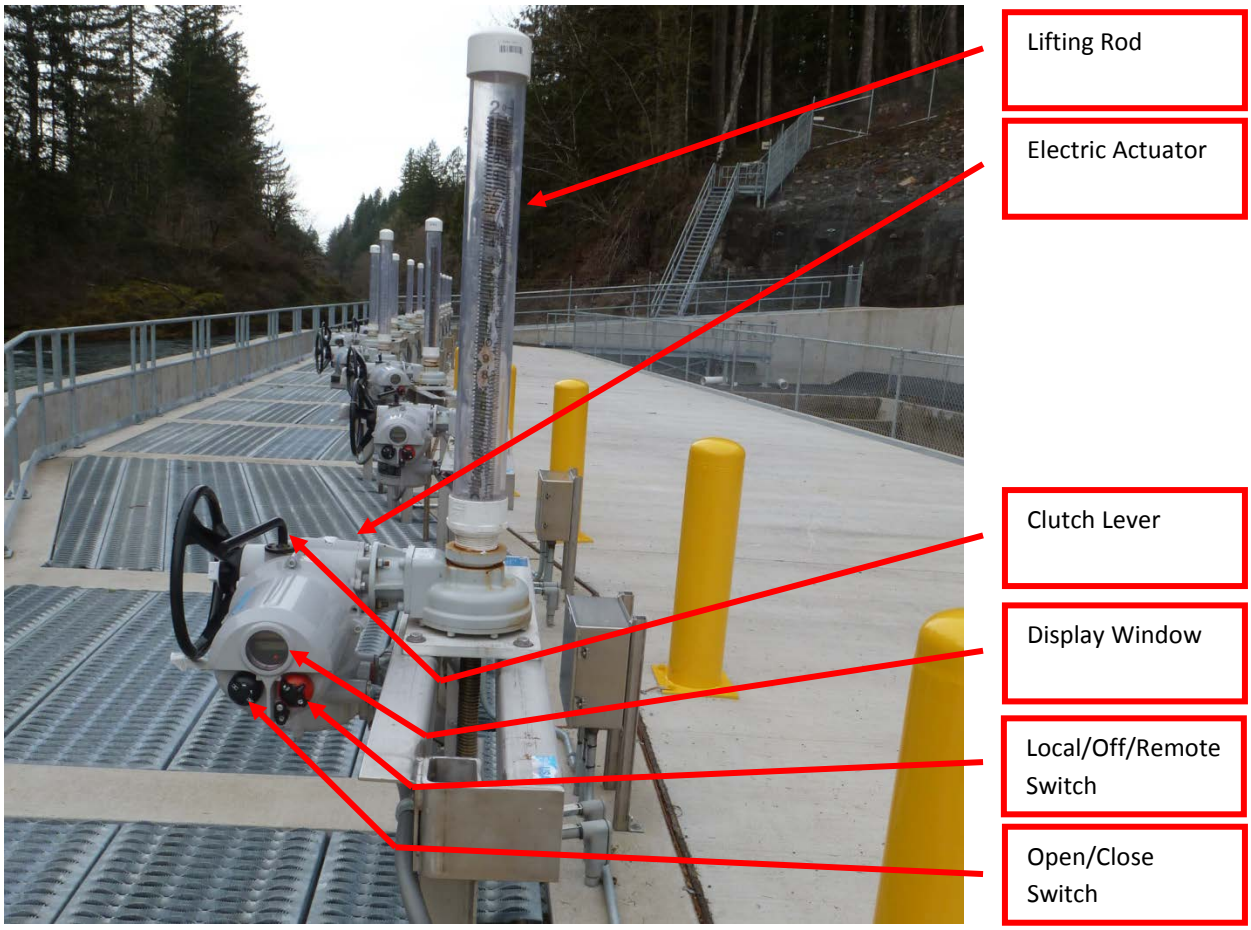


Figure 13 - AWS Diffuser Gate Motor

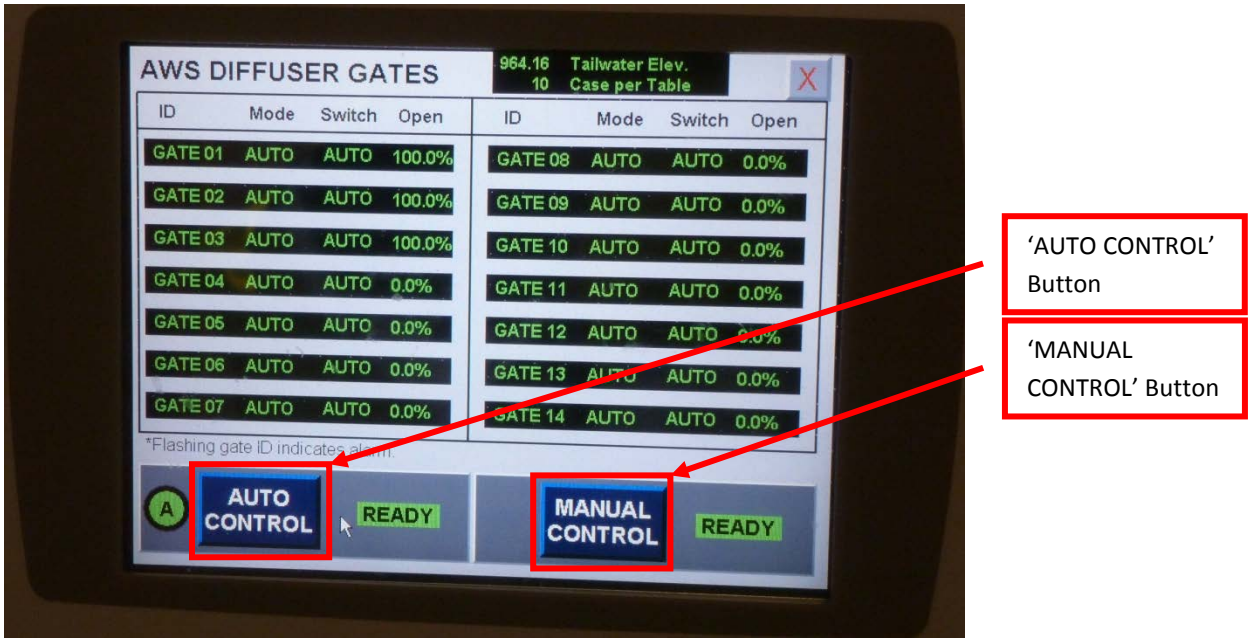


Figure 14 - Touch Screen, AWS Diffuser Gate

Reference the Contractor Provided O&M manual Volume 2 for complete operating instructions

4.2.1.3. Pool 52 – Ladder Head Control with Level Sensors

-SITE MAP AREA C2-

Redundant sensors LIT-006A/B transmit the water level in pool 52 to the PLC. The pool level should be maintained at 0.75' +/- 0.08', and a process alarm provides notification if the pool level remains out of criteria for a preset period of time. If a level sensor fails an alarm is also activated, and the PLC will use the backup sensor if available.

Reference the Contractor Provided O&M manual Volume 6 for complete operating instructions for level sensors

4.2.2. Pre-Sort Pool

-SITE MAP AREA C2, D2-

4.2.2.1. Pre-Sort Pool Control Console

This is the holding pool where fish are stored for future processing. The control console and panel are located on the east side of the pre-sort pool.

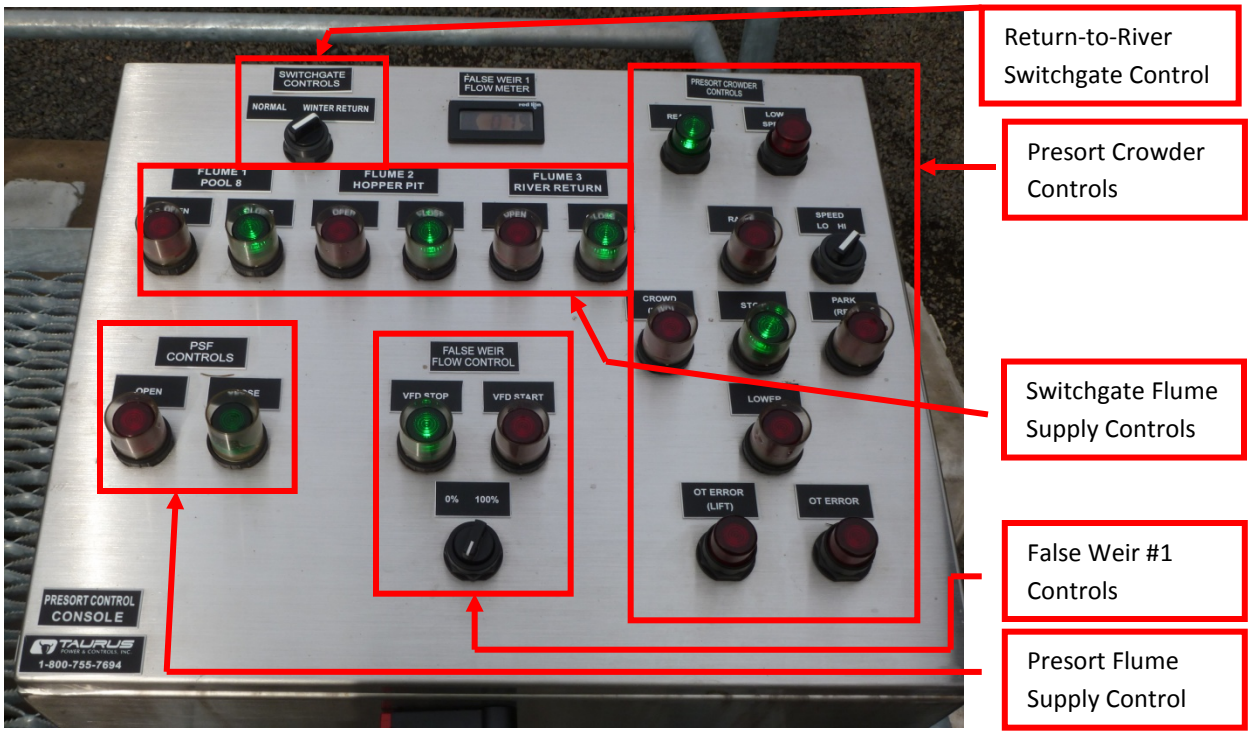


Figure 15 – Presort Control Console

4.2.2.2. Finger Weir

The finger weir (Figure 16) is raised and lowered based upon pre-sort pool water level to prevent fish from re-entering the fish ladder. The finger weir can be operated by a winch, shown in Figure 17.

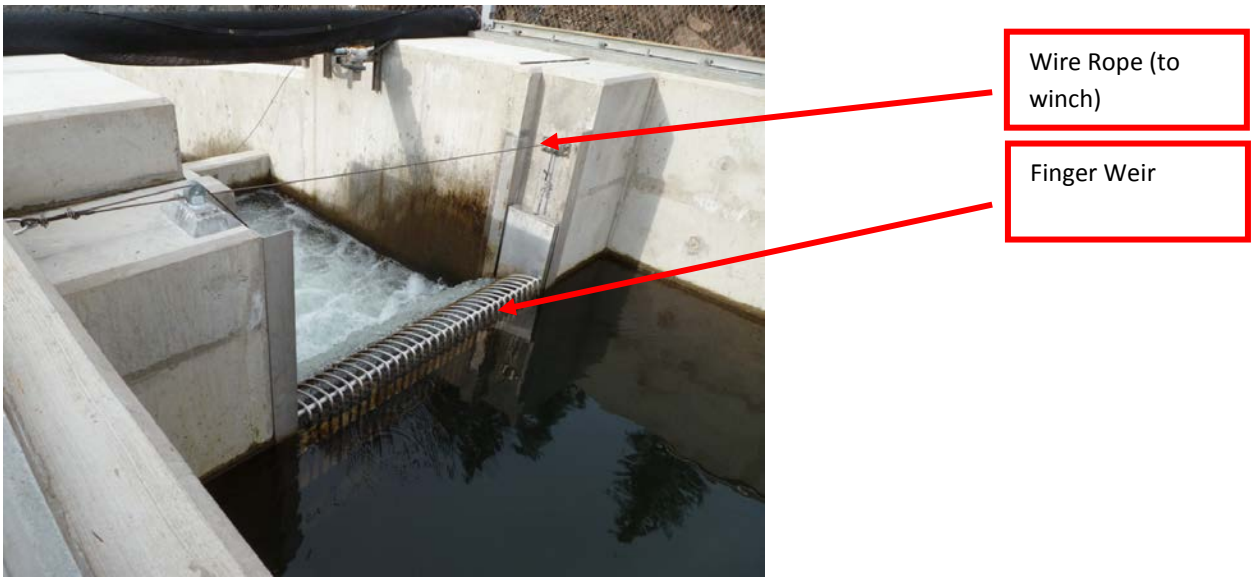


Figure 16 - Finger Weir

Figure 17 - Finger Weir Winch

4.2.2.3. Pre-Sort Crowder

The pre-sort crowder can be operated at the either the Presort Control Console or the Presort Crowder Control Cabinet, shown in Figure 18. A description of each button function is provided below:

SPEED: Select between two crowder speeds, 'Lo' and 'Hi'.

RAISE: Raises crowder screen.

LOWER: Lowers crowder screen.

CROWD (FWD): Moves crowder forward toward false weir (east).

PARK (REV): Reverses crowder away from false weir (west).

STOP: Stops all crowder operation.

ENABLE: This button must be pressed in the event and E-STOP button is actuated.

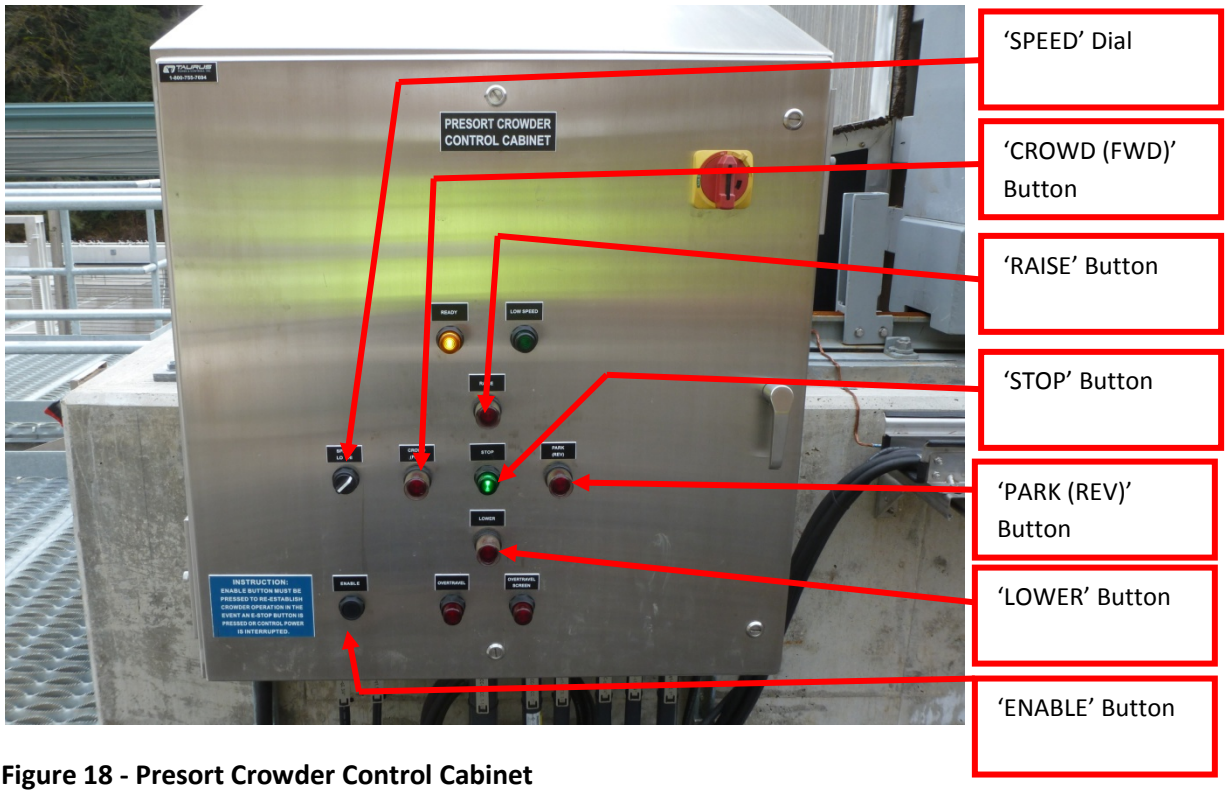


Figure 18 - Presort Crowder Control Cabinet

4.2.2.4. False Weir

The false weir attraction flow is supplied by pump. Operate the false weir at the Presort Control Console (Figure 15). The false weir controls are shown in more detail in Figure 19. To turn the false weir on, push

the 'VFD START' button. Flow can be regulated using the turn dial, set dial to 0% for minimum flow and 100% for maximum flow. To turn the false weir off and stop flow, push the 'VFD STOP' button.

Figure 19– False Weir Flow Control

4.2.2.5. False Weir Drain

This is a 6" drain pipe and is regulated by a lever operated butterfly valve. This drain prevents excess water from spilling into the transport flume. Normally this valve is adjusted in concert with the false weir attraction flow and the transport flume water supply to establish ideal fish passage conditions.

Figure 20 – False Weir Drain Control

4.2.2.6. Transport Flume Water Supply

This is a 6" diameter water supply pipe sourced from the FWS. A 6" actuated valve regulates the water traveling down the transport flume. Up to 1.25 CFS can be supplied for passage operation.

Figure 21 False weir supply pipe

4.2.2.7. Closure Gate

The Closure Gate prevents the fish from entering the false weir and flume when processing is temporarily suspended. The closure gate is operated by a winch with an automatic brake. The winch is located adjacent to the gate and is operated manually to open and close the gate. The winch can be seen in Figure 22 below.

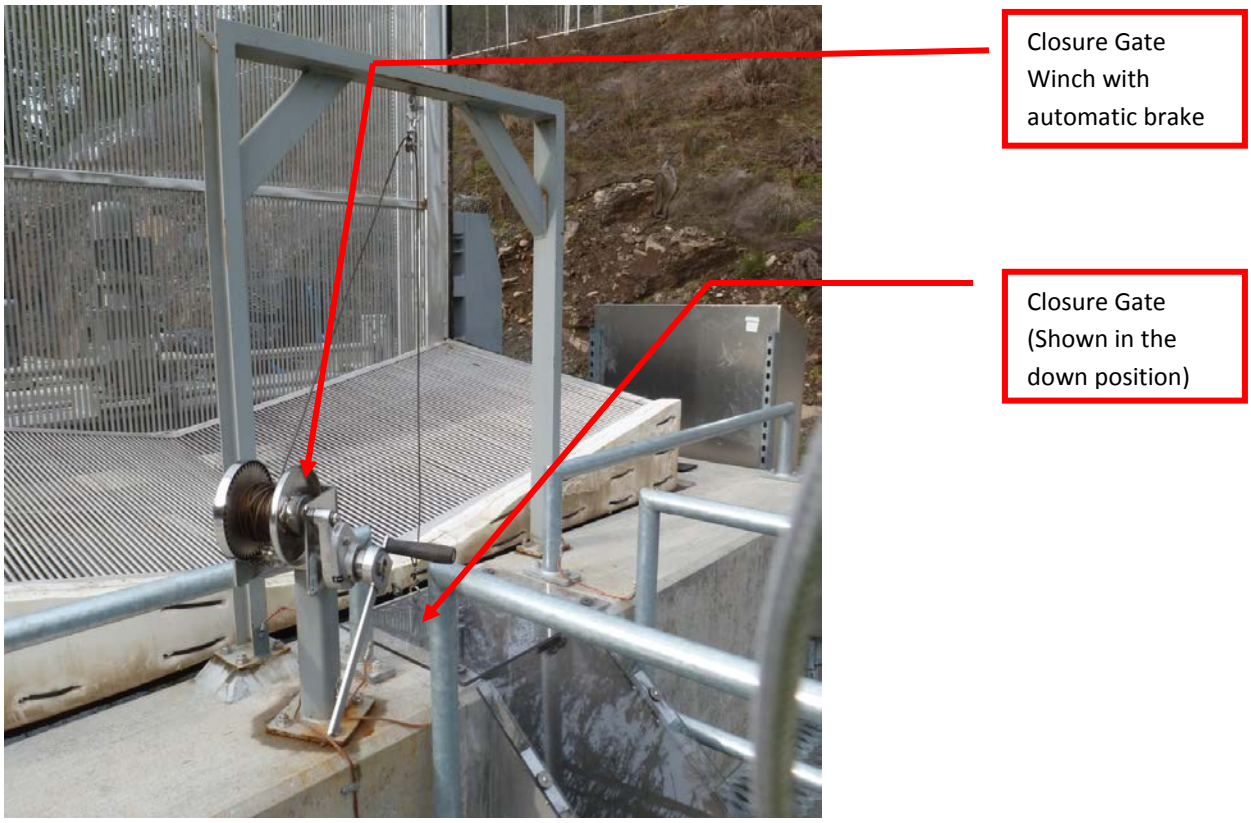


Figure 22 - False Weir 1 Closure Gate

4.2.2.8. Pre-sort Pool Piping

The primary portions of this pipe are buried or embedded. The pipe material is schedule 40/80 PVC and the pipe embedded in concrete is stainless steel. System pressure is 12 PSI.

4.2.2.9. Valves

Process valves in the Pre-sort area are butterfly valves operated by lever or electric actuator.

Figure 23 Pre-sort Pool Valve Vaults

4.2.2.10. Diffusers

There are two Pre-sort diffusers. Each diffuser is supplied by 16” diameter pipe as part of the FWS piping system. The FWS supply pressure is 11 -11.5 PSI. Diffusers require bi-annual maintenance. Occasionally the river conditions will allow abnormally high amounts of sediment to inundate the facility. The screen for each pool should be removed and pressure washed to remove debris. Remove the porosity plates located below the diffuser grating and pressure wash them to remove debris. Sediment and debris should also be removed from the pit area below the porosity plate. The pit drain can be used to divert sediment to the abatement pond however, it is recommended that the majority of the debris is removed and disposed of in accordance with local laws and regulations.

4.2.3. Sort Facility

-SITE MAP AREA E2, F2-

4.2.3.1. Mechanical/Electrical Room

4.2.3.1.1. Granular Activated Carbon (GAC) Filter

The GAC filter and piping are shown in Figure 124 and Figure 25, respectively. The GAC filter is used to filter MS222 prior to discharge to septic tank system. MS222 is not currently used, Aqui-S is the preferred anesthetic.

Figure 24 GAC Filter Tank

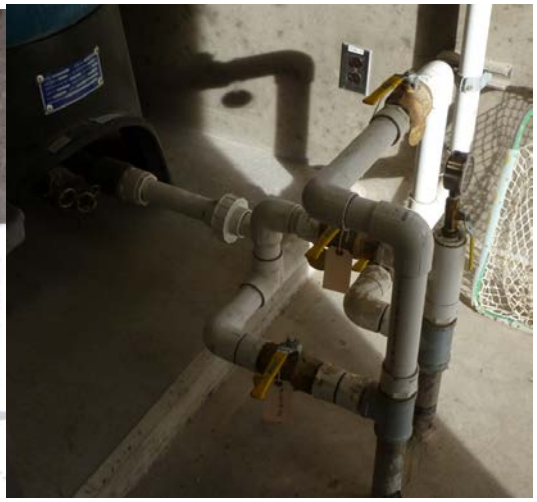


Figure 25 GAC Filter Piping

4.2.3.1.2. Facility Compressed Air

The compressed air system will control air pressure by pressure switch. Each air access point should see a pressure between 90 and 110 PSI.

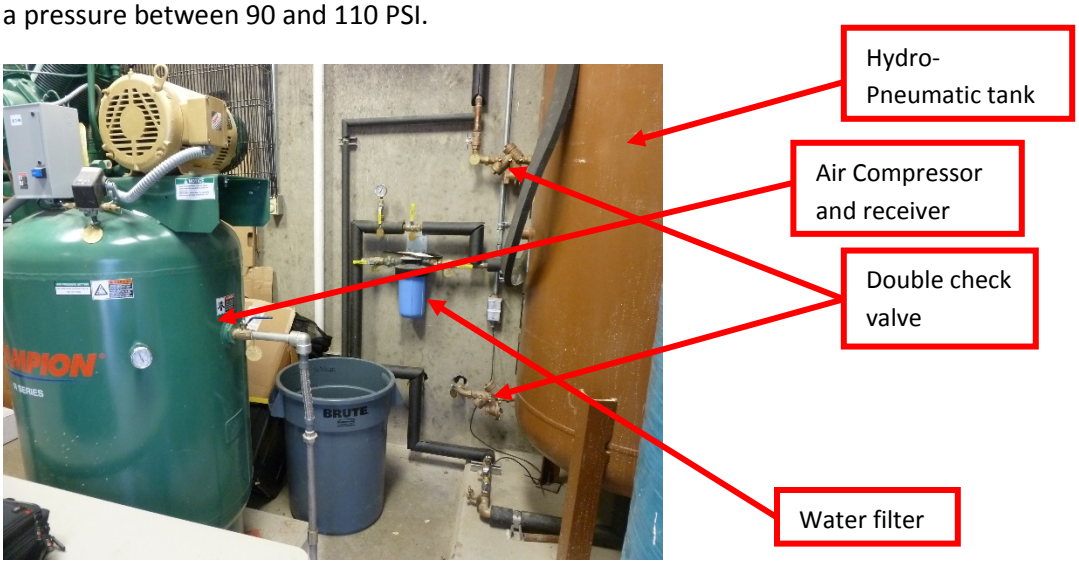


Figure 26 Mechanical Room

4.2.3.1.3. Hydro-Pneumatic Tank

Potable water tank should not require maintenance however there are two double check valves that may require periodic testing. Testing should occur per county requirements. The hydro-pneumatic tank capacity is 317 gallons and is pressurized to provide a service water pressure up to 125 PSI. The system pressure is maintained at 60 PSI.

4.2.4. Post-Sort Pools, Sorting Channel, and Hopper Pit

-SITE MAP AREA E3, F3-

4.2.4.1. Post-sort Pool Crowders

There are two post-sort pool crowders that are operated with individual control consoles. A trolley is provided to move a single crowder from pool to pool; only one crowder can be moved by the trolley at a time. The trolley must be aligned with the pool rails using the hand alignment-brake illustrated in Figure 27.

Trolley: The Trolley is operated with the Trolley Control Console. The trolley is controlled by the speed throttle switch. The trolley will move at the speed and direction as indicated on the console. An indicator light will also illuminate corresponding to the current operation of the trolley.

Crowder: The crowder is controlled by the speed throttle switch. The crowder will move at the speed and direction as indicated on the console. An indicator light will also illuminate corresponding to the current operation of the crowder.

'START': Key switch to allow operation of crowder

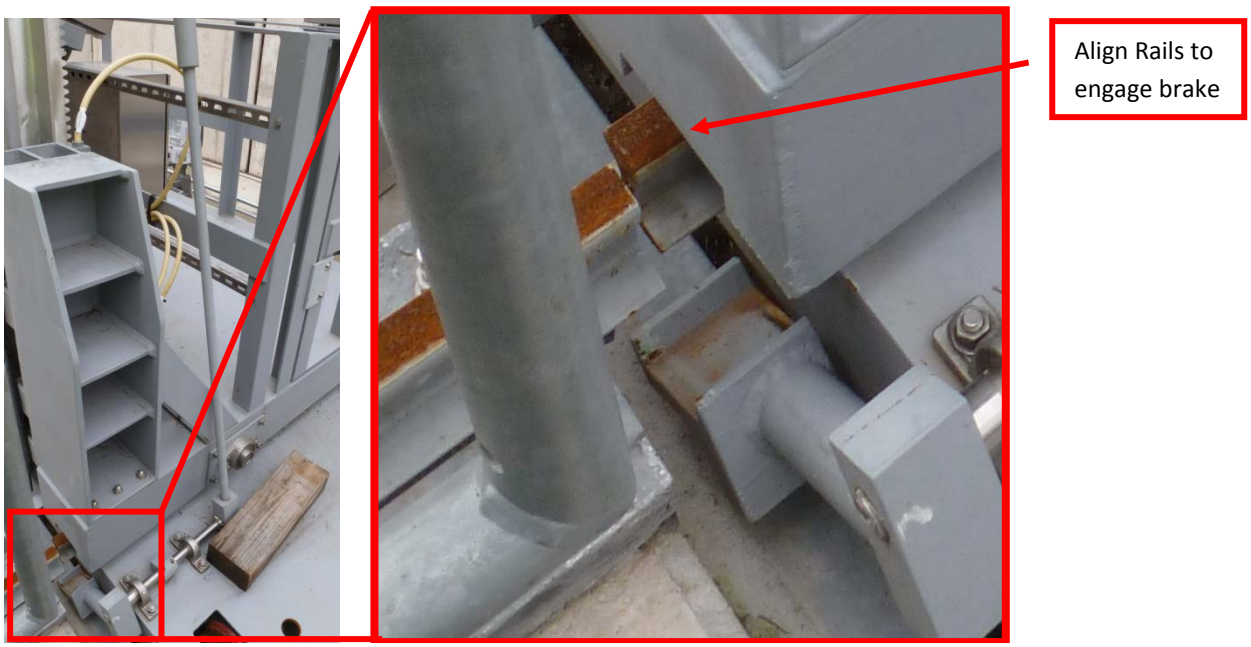
'REVERSE OVERRIDE': Allows travel onto trolley once crowder reaches upstream wall.

'E-STOP': Emergency stop button. Stops all crowder operations.

'RAISE': Raises the crowder screen.

'LOWER': Lowers the crowder screen.

'STOP': Stops crowder screen operation.



(a) **(b)**

Figure 27 – (a) Post-sort Trolley Hand Brake; (b) Rail Alignment

Figure 28 – Post-sort Crowder Platform

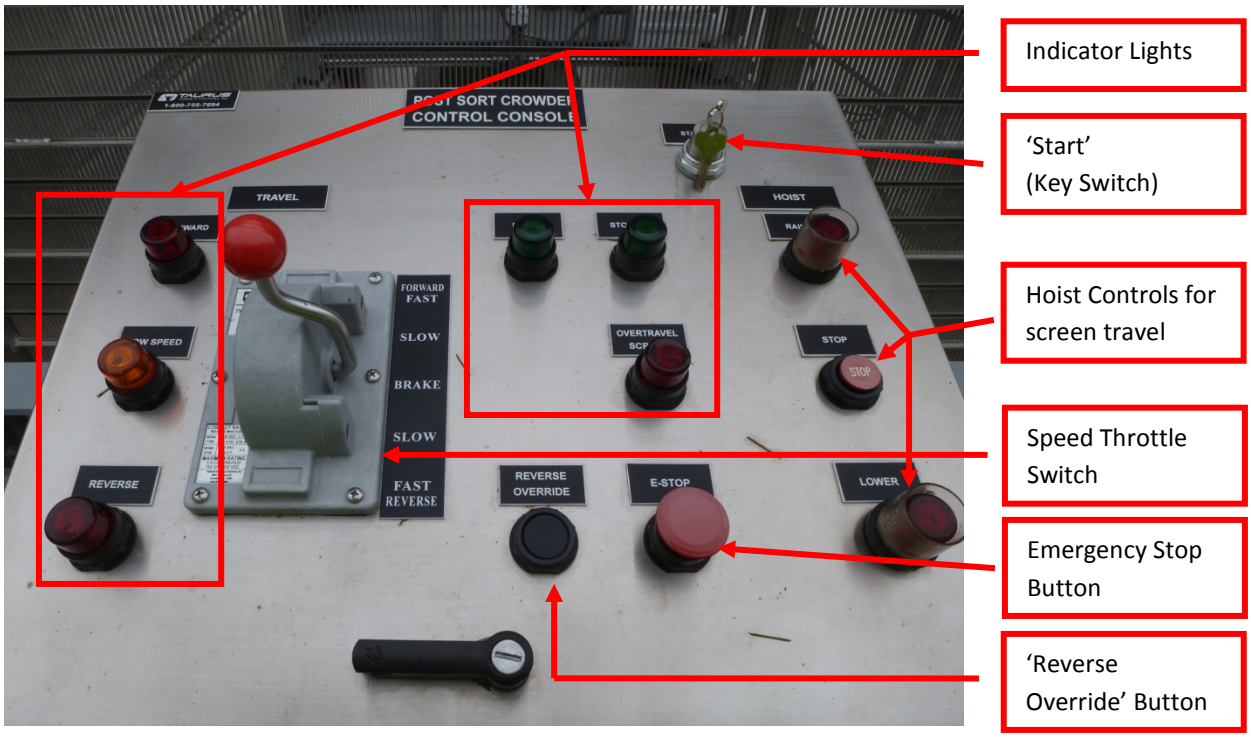


Figure 29 – Post-sort Crowder Control Console

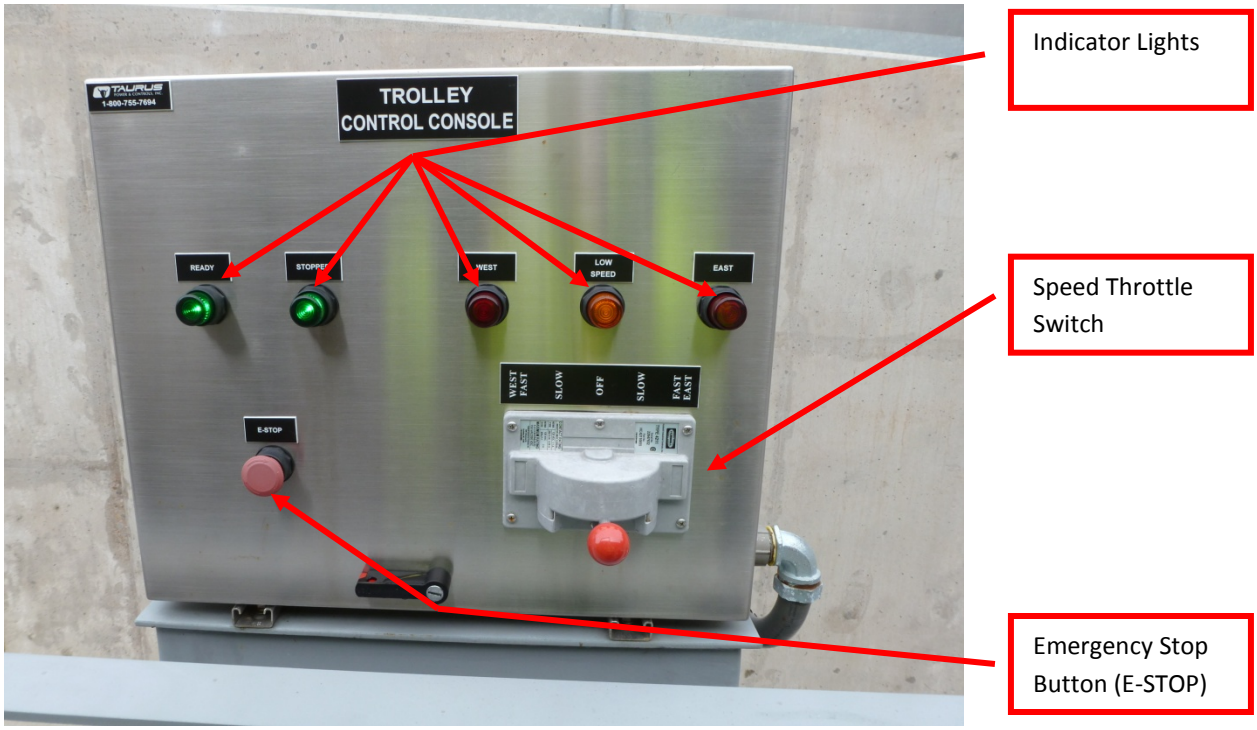


Figure 30 - Trolley Control Console

4.2.4.2. Sorting Channel Crowder

The Sorting Channel Crowder is operated from the Sorting Channel Crowder Control Console, Figure 31, located on the crowder platform. The crowder is operated similarly to that of the post-sort crowder. The crowder is controlled by the speed throttle switch. The crowder will move at the speed and in the

direction as indicated on the console. Indicator lights will also illuminate corresponding to the current operation of the crowder. The button functions are summarized below.

‘RAISE’: Raises crowder screen.

‘STOP’: Stops crowder screen operation.

‘LOWER’: Lowers crowder screen.

‘E-STOP’: Emergency stop. Stops all crowder operations.

In addition to the Sorting Channel Crowder, the sorting channel is equipped with a bridge, see Figure 23. The sorting channel bridge is manually operated and a bridge step is provided to allow for access to the fish barrier screens. The bridge step can be removed using the handles provided to gain access to the weir boards (overflow stoplogs).

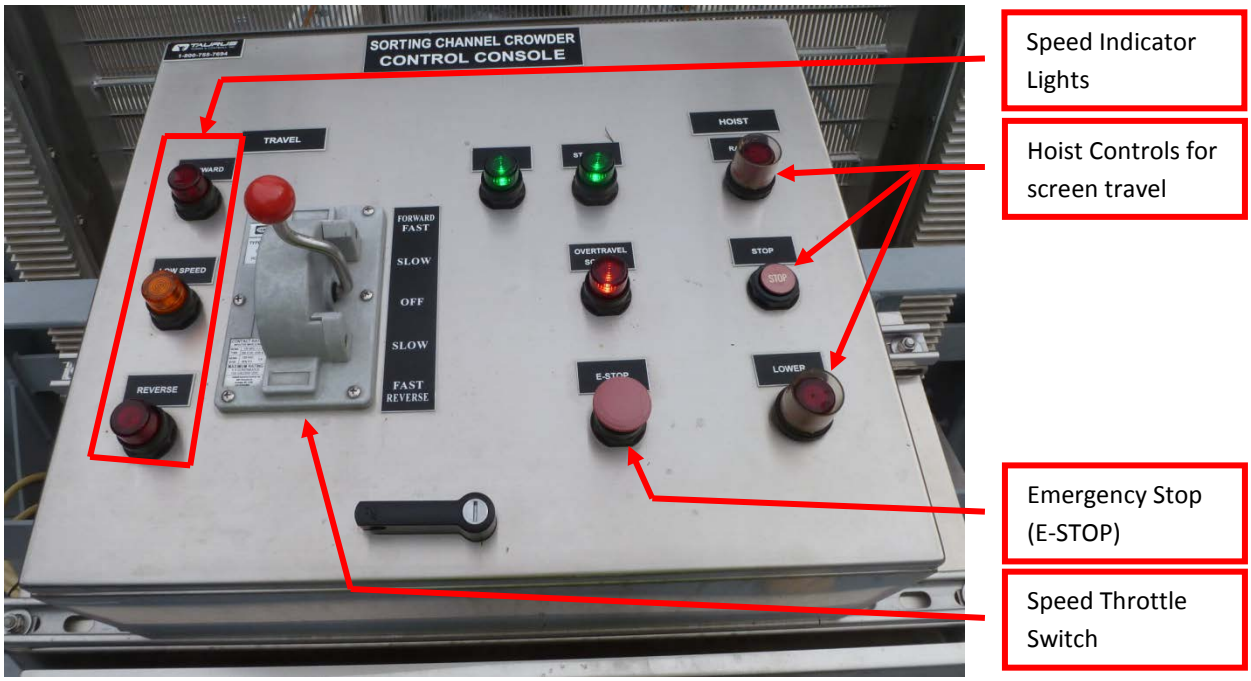


Figure 31 - Sorting Channel Crowder Control Console

Figure 32 - Sorting Channel Bridge

4.2.4.3. Post-Sort Pool Spray Nozzles

Each wall of the post sort pool has multiple spray nozzles that act to calm fish by disturbing the surface of the water. Activation for each pool is done by valve hand wheel. Periodic nozzle maintenance may be necessary remove and clean as needed.

Figure 33 Post sort sprayers

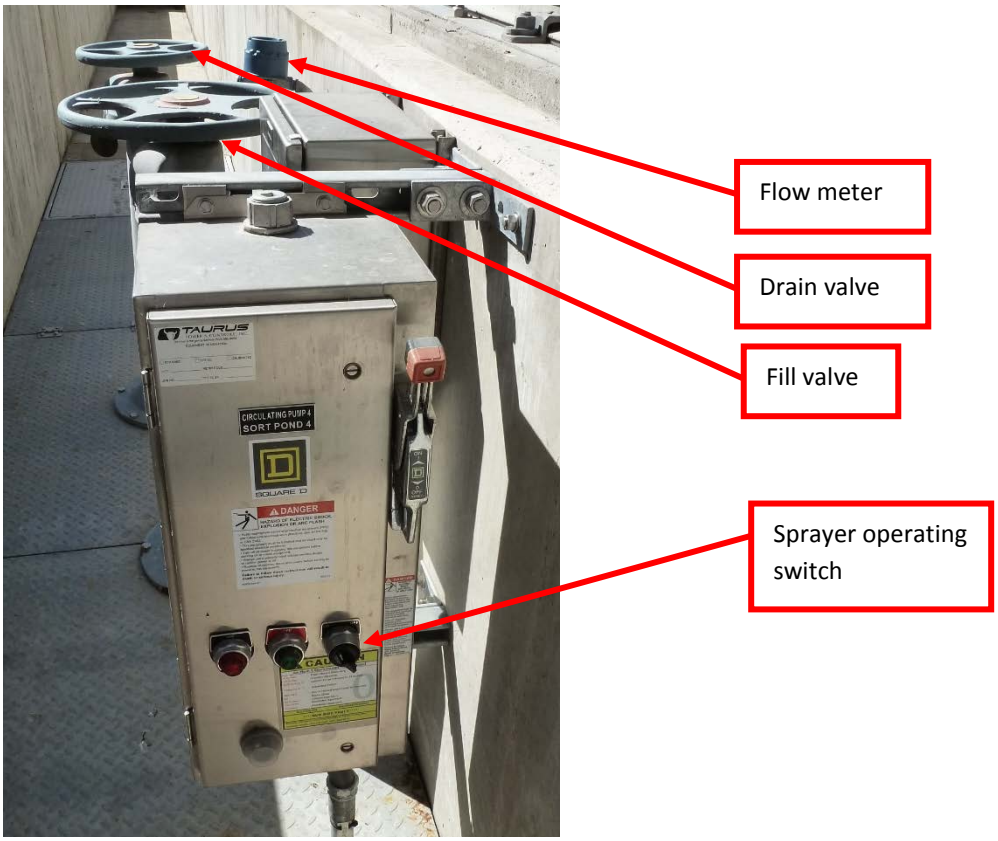


Figure 34 Circulation Pump Control

4.2.4.4. Post-Sort Pool Oxygen System

The oxygen system is designed to be used when pools lose circulating flow. Its design allows for a system pressure of 20-60 PSI. Oxygen used by the fish must be monitored and matched to the oxygen inflow.

Figure 35 – Oxygen Cabinet Location

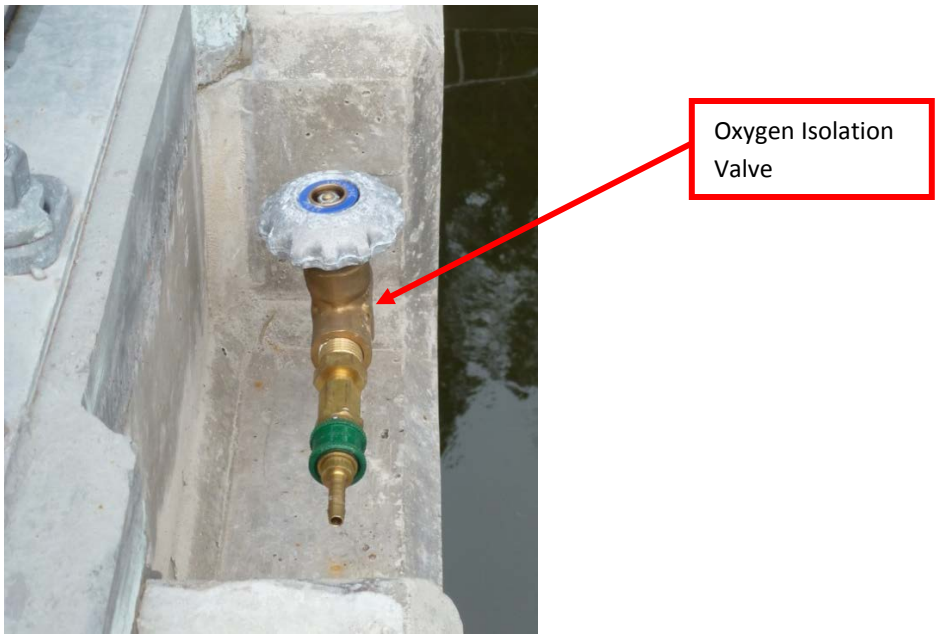


Figure 36 - Post-sort Pool Oxygen Connection

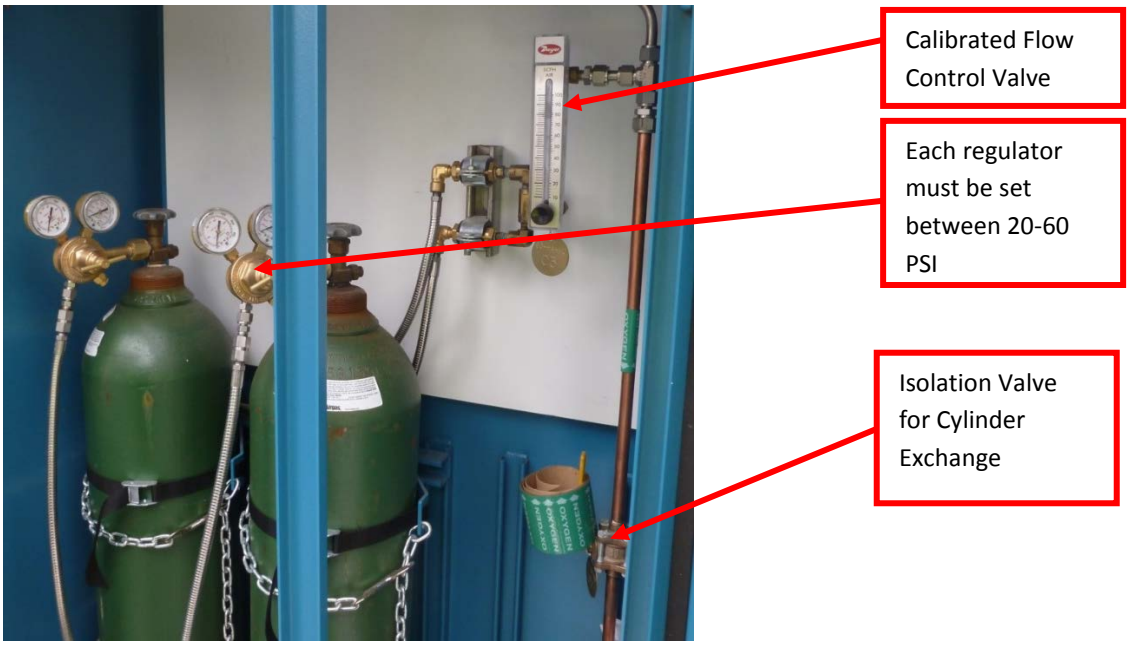


Figure 37 – Oxygen Cabinet Details

4.2.4.5. Post-Sort Pool Recirculation System

When juvenile fish are cared for in the facility; periodically they require medication to avoid large die-offs. While medicating the fish pool inflow and outflow ceases and recirculation pumps are used to maintain medication concentration and dissolved oxygen.

CAUTION: Medication may be atomized and dispersed via sprayers. Use appropriate protective gear if medicating fish.

4.2.4.6. FWS Piping

Exposed FWS piping is primarily composed of galvanized steel with stainless steel spools used for piping that must pass through concrete.

4.2.4.7. Diffusers

Diffusers require maintenance at six month intervals. The screen for each pool should be removed and pressure washed to remove debris. Remove the porosity plates located below the diffuser grating and pressure wash them to remove debris. Sediment and debris should also be removed from the pit area below the porosity plate. The pit drain can be used to divert sediment to the abatement pond however, it is recommended that the debris is removed and disposed of in accordance with local laws and regulations.

Figure 38 Diffuser Pit

4.2.4.8. Removable Fish Screens and Overflow Stoplogs

Figure 39 – Post-sort Exit to Sorting Channel

4.2.4.9. Juvenile Return Pipe

The entrance to the pipe is at the western end of the sorting channel. Juvenile fish that are ready for introduction to the river system are moved from the holding pool to the sorting channel. In the sorting channel they are moved down to the western end of the sorting channel. A fish screen is removed providing access to the pipe.

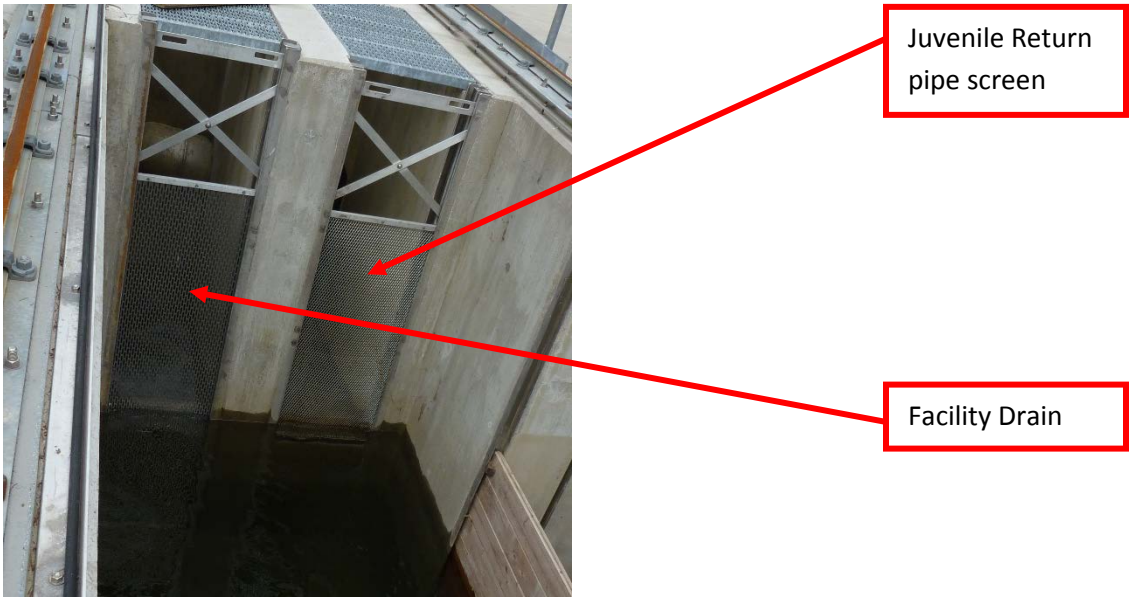


Figure 40 Sorting Channel Drain Screens

4.2.4.10. Sort Channel Drain System

There are two main outlets to the Sort Channel located at the west end of the sort channel (see sheet SC745):

- Upper outlet to 30-inch Juvenile Return Pipe on north side, crest invert 983 feet
- Lower outlet to 18-inch juvenile drain pipe on south side, crest invert 979 feet (I.E. of sort channel)

  Both outlets have guides. The upper outlet can have a picket lead or stop logs (to raise the water level in the sort channel if the pond discharge is low.) Stop logs or weirs are placed in the guides for lower outlet, normally to block the flow into the lower outlet. However, the stop logs are incrementally removed during a fish removal operation.

Normally the Sort Channel discharges back to the tailrace through upper intake at the downstream end of the channel and down the 30-inch diameter juvenile return flume. When juvenile fish are not being released, a picket lead is placed upstream of the upper outlet for the juvenile return pipe so that the pipe continues to release the post-sort pool discharges. Otherwise the picket lead is removed and fish are allowed to leave the sort channel volitionally. The juvenile return pipe discharges into the tailrace near the entrance to the fish ladder.

When the sort channel is to be drained with juvenile fish in the channel, the lower outlet to the 18-inch juvenile drain pipe is opened and the water level in the sort channel is lowered incrementally by means of weirs. The 18-inch juvenile drain pipe connects to the main 30-inch juvenile return pipe to discharge to the tailrace. The 18-inch flushing valve (MTF-FWS-JDS76) for the upper outlet must opened to flush

fish that may have been stranded in the upper juvenile return pipe after the lower outlet was opened. As the last weirs are removed and the sort channel is nearly drained, the 12-inch flushing valve (MTF-FWS-JDS77) for the lower outlet needs to be opened to flush the remaining fish down the 18-inch drain pipe.

When the sort channel needs to be drained and there are no juvenile fish, then the sort channel drain pipe to the abatement pond should be used.

4.2.5. Intake and Pump Structure (IPS)

-SITE MAP AREA E3, F3, E4, F4

4.2.5.1. FWS Pump System

Each FWS pump is controlled by its own VFD; the VFD interface is shown in Figure 42. The mode (H-O-A) selector switch should be placed in 'A' for automatic operations. To select manual operation, place the switch in 'H', and to turn the pump off, place the switch in 'O'. The PLC controls the pump speed only in automatic mode. To operate the pumps, login from the main screen (Figure 43) then navigate to 'FWS Pumps'. Figure 44 shows the operator interface for the FWS pump system. The operator can control the FWS Pump System, and the following information can be found: pump speed (percentage of max); pump power (kilowatts); pump motor current (amps); time on standby (hours); total lifetime runtime (hours). Information for all five pumps is displayed; when pump name is red, the pump is currently running, when the pump name is green, the pump is currently on standby.

Under normal conditions, the FWS Pump System should be operated in automatic mode. This is done by selecting 'AUTO CONTROL' from the touch screen. This feature can only be selected when no VFDs are switched to manual and at least 2 VFDs are switched to automatic. If any of the five VFDs are switched to manual the PLC will not adjust pump speeds or start/stop pumps and the FWS system must be operated manually.

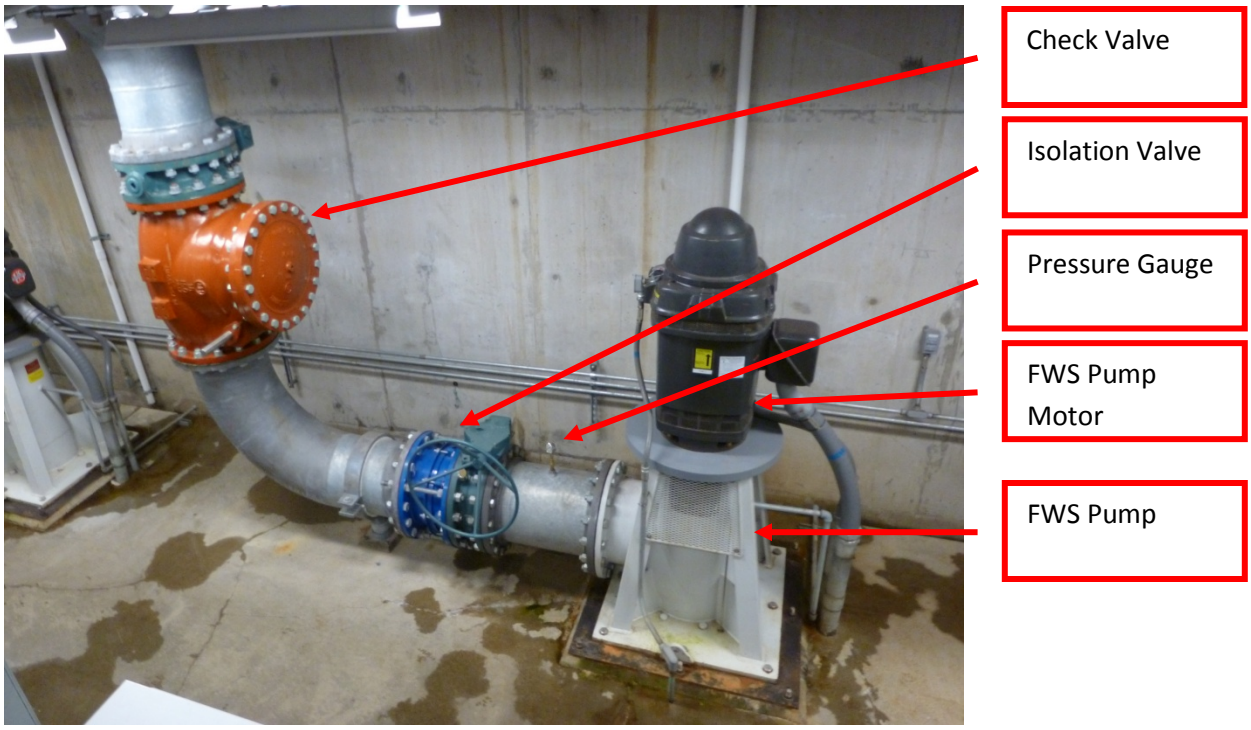


Figure 41 - FWS Pump

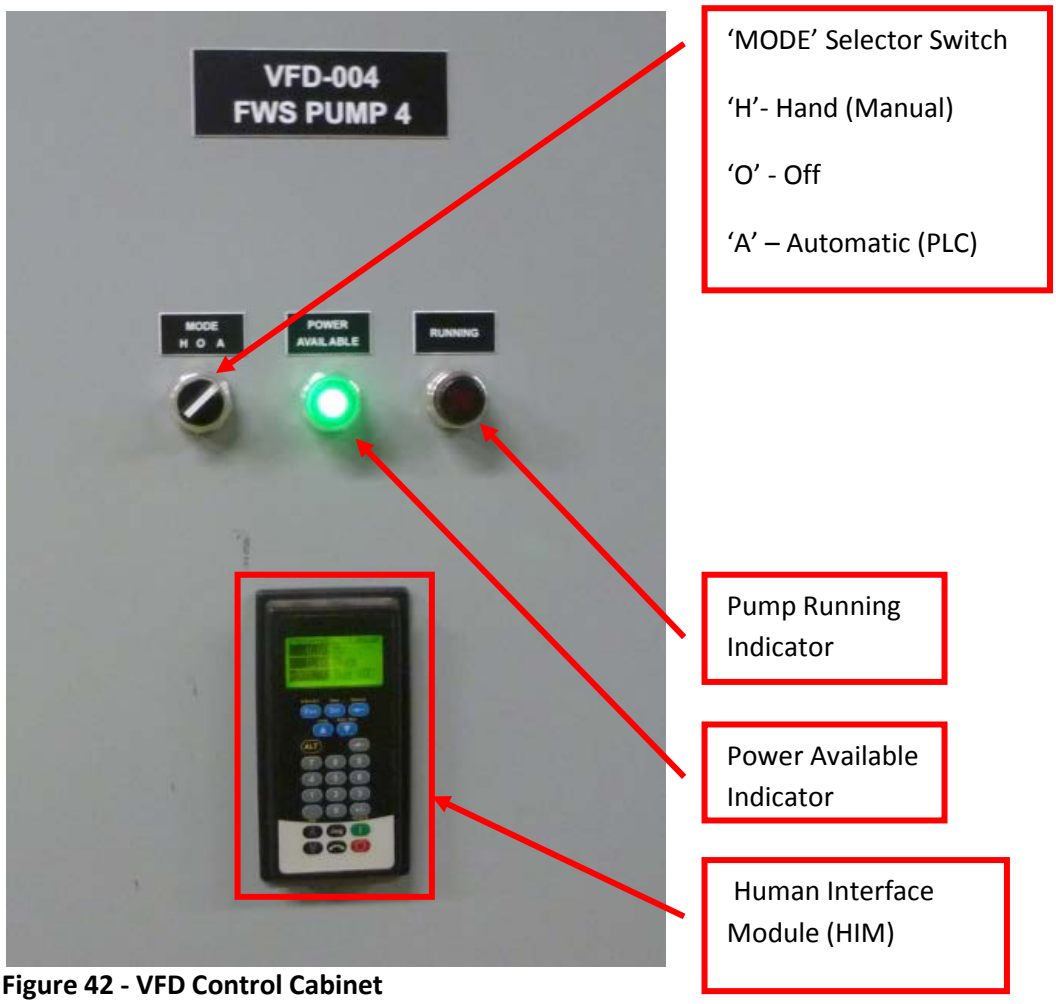


Figure 42 - VFD Control Cabinet

Figure 3 - Touch Screen, Main Screen

Figure 44 – Touch Screen, FWS Pumps

4.2.5.2. IPS Intake Screen Differential

When the intake and pump structure (IPS) screen becomes plugged on the upstream (river) face of the screens with debris, there is a corresponding increase in head differential across the screen from forebay to pump sump inside the IPS. Six level sensors are positioned around and inside the IPS structure to monitor the water surface elevations in the forebay (LT-008 and LT-012), between screens and porosity plates (LT-009 and LT-011), and general pump sump (LT-007 and LT-010). The screen differential at each end of the IPS is determined by the following differences in recorded levels:

LT-009 – LT-008 (west end of IPS)
LT- 012 – LT-011 (east end of IPS)

The pump sump level will be the lowest level in the IPS since the intake flow must pass through the porosity plates downstream of the IPS screens before reaching the sump.

Large screen differentials represent potential impingement and injury threats to passing juvenile fish and place the operating FWS pumps at risk. As the FWS represent the critical water supply of the fish ladder and ponds, AWS diffuser gates are systematically closed as the screen differential becomes higher.

<u>PLC rules for IPS screen differential:</u>

The programmable logic control (PLC) has the following rules governing the operation of the AWS system:

1. IF: Screen Differential > 3 feet; THEN: Close all AWS Diffuser Gates
    a. The PLC will automatically close all AWS diffuser gates.

2. Alarms (both horn and dialer) are sent out if the following conditions are detected by the PLC:
    a. If screen differential > 1 foot for at least 5 continuous minutes
    b. If screen differential > 2 feet for at least 5 continuous seconds
    c. If screen differential > 3 feet for 30 continuous seconds, alarm will signal the automatic shutdown of the AWS diffuser gates

FWS Pump Operations under Low River Flow Conditions

For safe operation of the FWS pumps, the water level in the pump sump (inside the IPS) should not drop below elevation 972 feet. Based on the rating curve for the river levels outside the IPS and accounting for headlosses through the porosity plates, the following screen differentials should not be exceeded as a function of river flow rate:

Table 7 – Maximum Allowable IPS Screen Differential during Low River Flow Conditions

Forebay Elevation feet	Approximate River Discharge cfs	Maximum Allowable Screen Differential (feet)
975.6	2500	3.0
974.5	1500	2.2
974.0	1000	1.7
973.6	750	1.3
973.3	500	1.1
973.0	350	0.8
962.0	300	0.5

The above conditions must be monitored and addressed by the facility operators as the PLC will not take action, except where screen differential alarms are triggered.

4.2.5.3. FWS Piping

The facility water flows through the header pipe and is monitored and regulated by a pair of pressure transmitters. A flow meter is included on the western end of the pump header pipe to verify the facility flow demands. The header pipe is equipped with a manual drain and air release valve.

Figure 45 - FWS Header Pipe Manual Drain

Figure 4 - FWS Header Pipe Air Release/Vacuum Breaker Valve

4.2.5.4. FWS Flowmeter

A General Electric (GE) *DigitalFlow™ DF868* ultrasonic flowmeter (FIT-001) is provided to monitor flow in the FWS header pipe. The flow signal is input into the PLC for monitoring only. See Volume 6 Contractor's O&M Manual for manufacturer's O&M data.

Figure 5 - FWS Header Pipe Flowmeter

4.2.5.5. Sump Pump System

The Sump Pump System is controlled at the Sump Pump Control Panel shown in Figure 48. Normal Operation should set the 'HOA' selector switch to 'A' for automatic operation. When operating automatically, a single pump will run with the other pump as a backup (lead/lag), unless the inflow exceeds the capacity of the single pump, in which case both pumps will run simultaneously. When the 'Run' indicator light is illuminated on the control panel, the corresponding pump is currently operating. Controls provide an alternator circuit so a different (lead) pump is started each time there is demand.

CAUTION: The sump pump discharges to the river. Any amount of hazardous liquid within the IPS that may enter the sump should be remediated immediately.

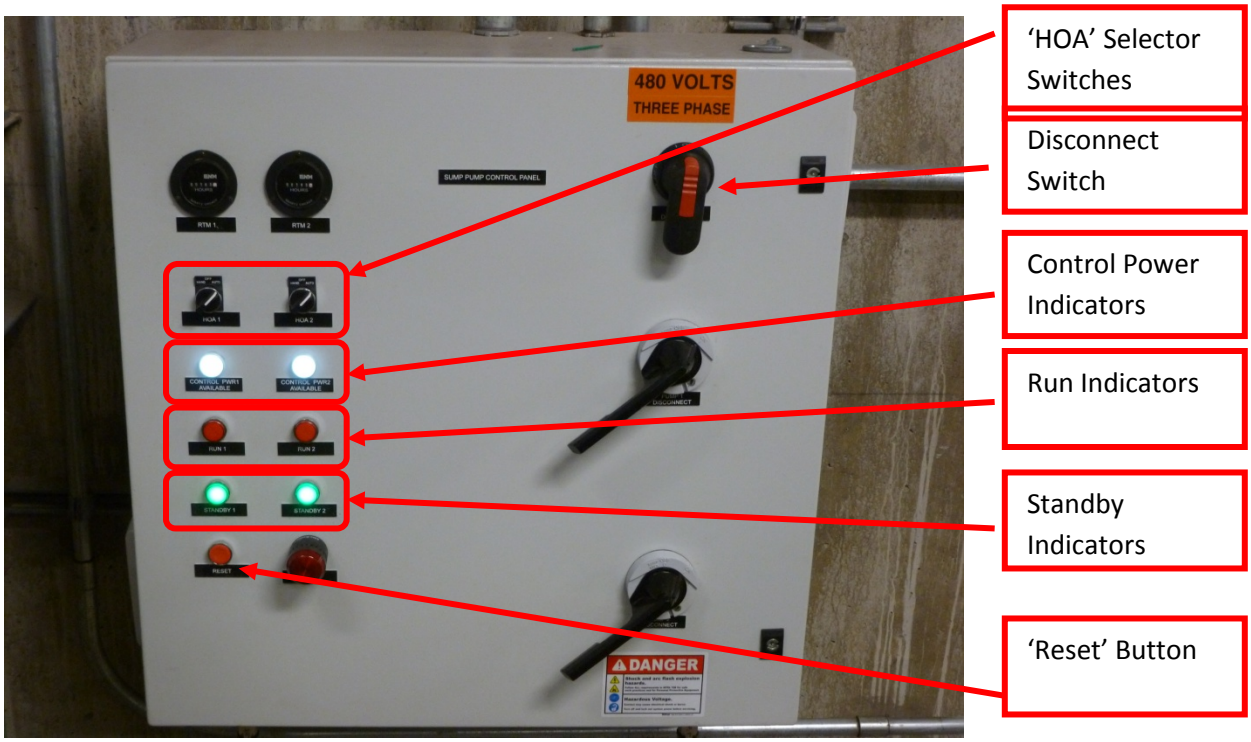


Figure 68 - Sump Pump Control Panel

4.2.5.6. Washdown Pipe System

The washdown pipe system can be operated at the Washdown Water System Cabinet.

Figure 7 - Washdown Water System

(a) (b)

Figure 8 - (a) Washdown Water Hydropneumatic Tank; (b) Opposite View

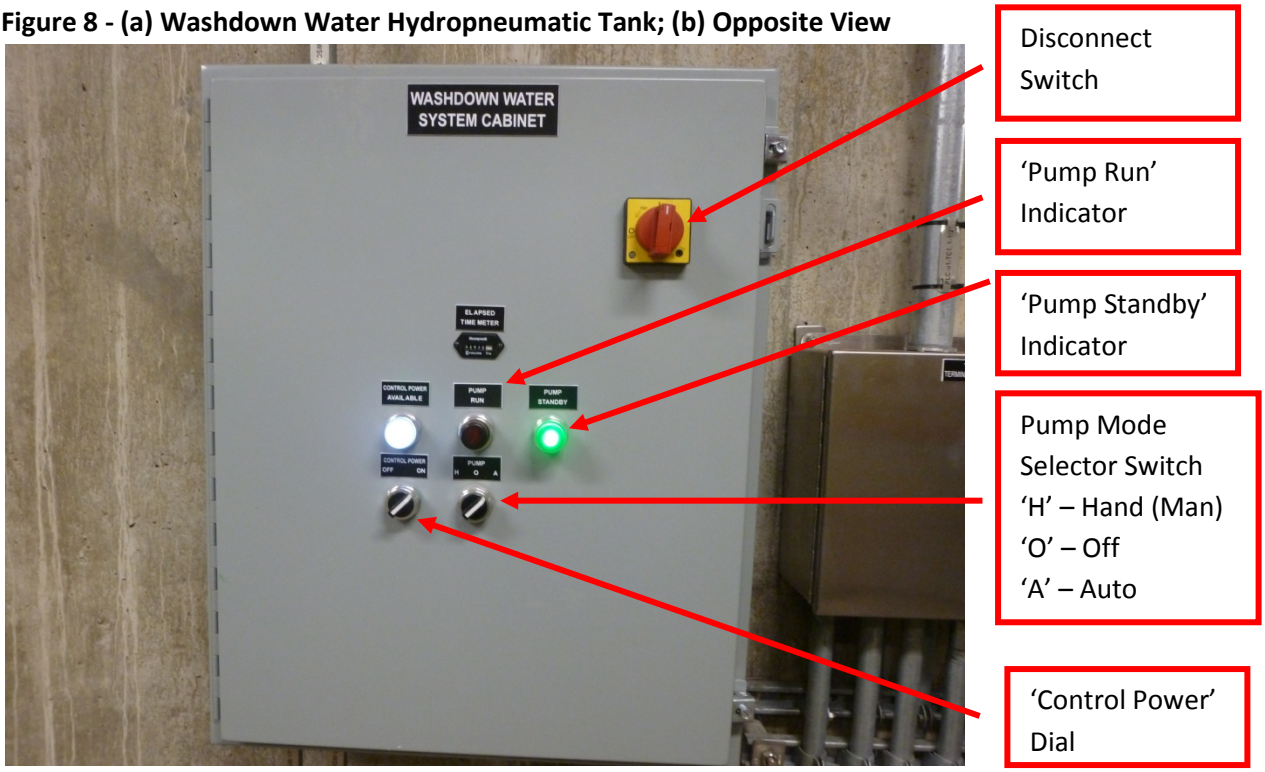


Figure 51 - Washdown Water System Cabinet

4.2.5.7. Dewatering Bulkheads

The dewatering bulkheads are normally stored dogged off in their slots while the facility is operating. A 5 Ton mobile crane is used to install and store the dewatering bulkheads.

Figure 52 Pump Intake Structure, Intake bulkhead

4.2.5.8. Airburst System

The airburst system is normally operated automatically based upon the difference in water level detected between the forebay and well within the IPS. The air for the airburst system is stored in the air receiver tanks. These tanks are filled by the air compressor; pressure within the tanks are monitored and regulated by pressure gauges and pressure transmitters. See section 4.2.5.2 IPS Intake Screen Differential.

4.2.5.9. IPS Ventilation System

The HVAC system is controlled from the HVAC control panel, illustrated in Figure 53.

Figure 53 - HVAC Control Panel

4.2.5.9.1. IPS Air Compressor

The air compressor can be operated at the IPS Air Compressor Control Cabinet (Figure 54). Ensure that the 'Control Power Available' indicator light is illuminated.

Figure 54 – IPS Air Compressor Control Panel

-To operate air compressor automatically, turn the 'Compressor HOA' selector switch to 'A'.

-To operate air compressor manually, set the selector switch to 'H'.

-To turn the compressor off, set the dial to 'O'.

Refer to the air compressor manufacturer's O&M data for manual operating instructions, see Volume 3.

The Airburst System is operated through a touch screen. From the main screen, login and navigate to the FWS Screen Cleaner screen (Figure 58).

The compressor has an air filtration system, filters should be changed at regular intervals per manufacturer's recommendation. The compressed air system will control air pressure by pressure switch. The airburst system should see a pressure between 90 and 110 PSI.

The compressor filters are designed to collect oil and condensate generated by the air compressor. Each filter discharges to the oil water separator. Oil is removed from the discharged slurry and collected. The cleaned water is discharged to the trough on the north wall. The oil water separator should be maintained in accordance with the manufacturer's recommendations.

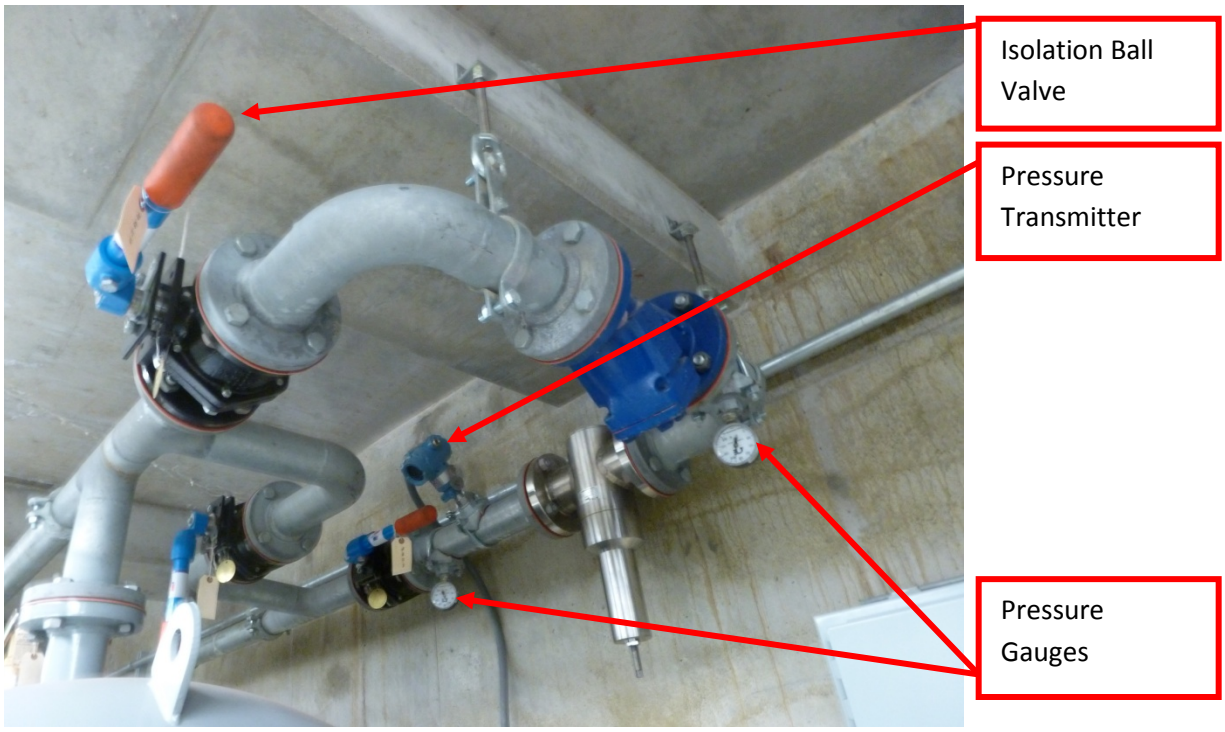


Figure 55 – Compressed Air Pipe at Receiver

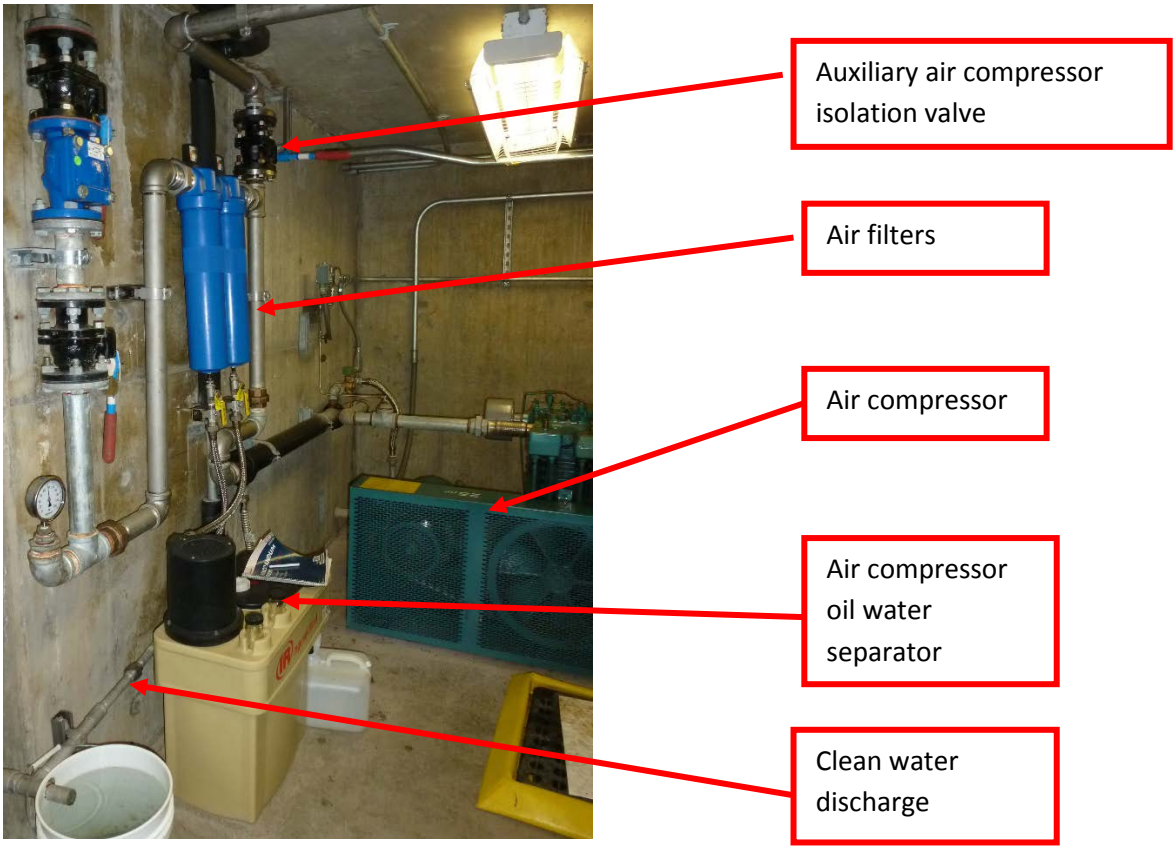


Figure 56 – IPS Compressor Room

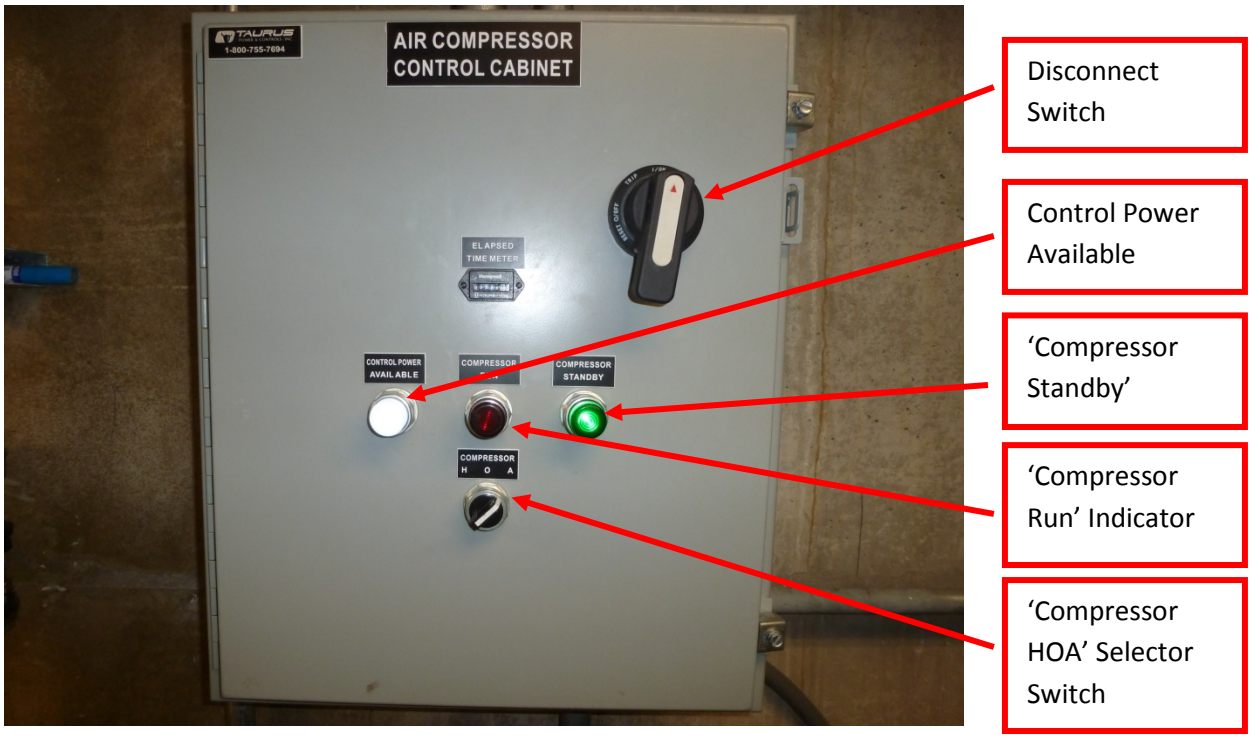


Figure 57 - Air Compressor Control Cabinet

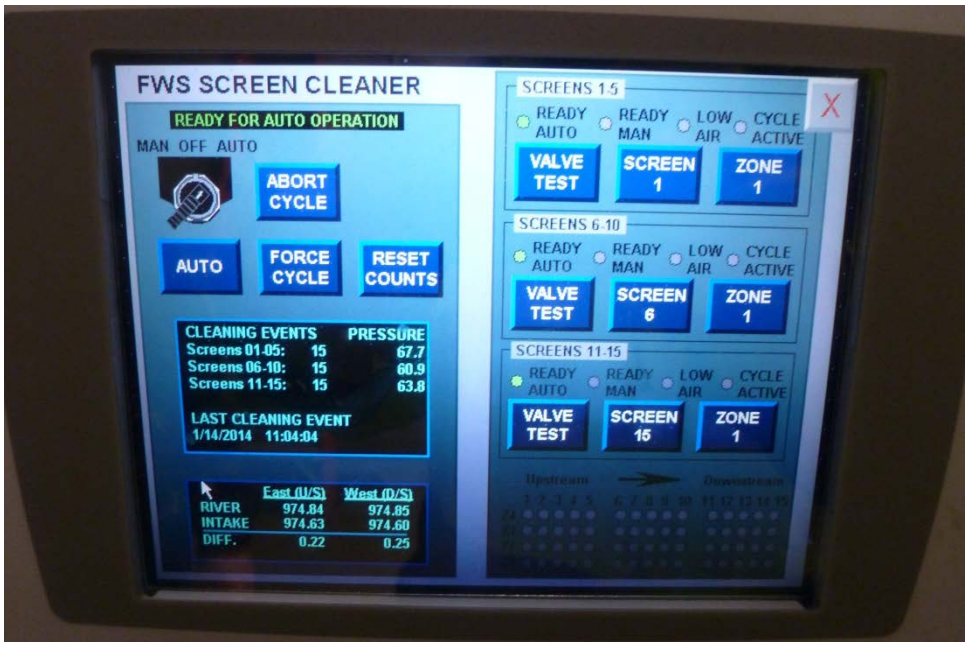


Figure 58 – Touch Screen, FWS Screen Cleaner

4.2.5.9.2. IPS Air Auxiliary Compressor

In the event that the air compressor cannot supply air to the air burst system an auxiliary air compressor is provided. The compressor is moved by fork lift from the maintenance building to a suitable location for connection to the air supply system.

CAUTION: Prior to making connections ensure piping is depressurized and disconnect is in the off position.

CAUTION: Once connections are made and prior to starting the auxiliary air compressor, ensure auxiliary valve is open so that system can be pressurized

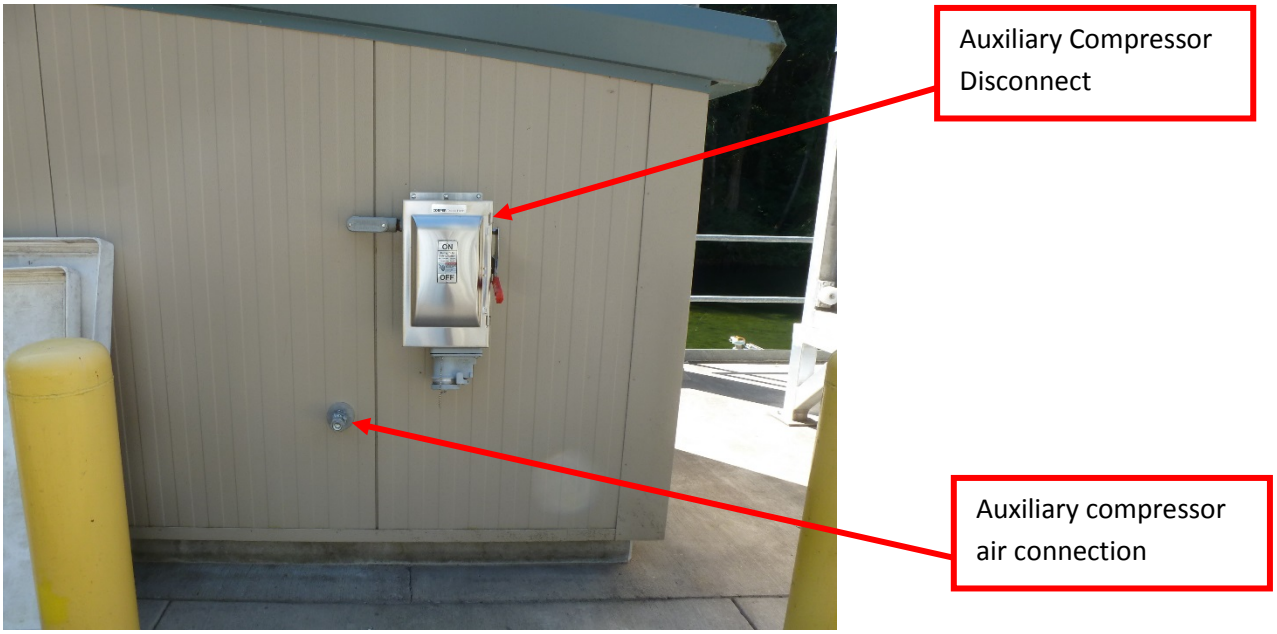


Figure 59 – Touch Screen, FWS Screen Cleaner

4.2.5.10. AWS Head Gate

When the fish ladder is in use, the AWS head gate is opened when attraction water is desired at the entrance. The AWS headgate must always be fully raised or lowered. Never operate in an intermediate position. The digital display on the electric actuator indicates a percentage open or closed The AWS head gate can be locally operated by electric actuator or manual hand wheel (Figure 61). To use the electric actuator, place the Local/Remote/Stop switch in 'LOCAL' and use the 'OPEN/CLOSE' switch to operate the gate. There is no control function associated with the 'REMOTE' mode. For manual operation, engage the clutch and use the hand wheel to open and lower the gate. Refer to the manufacturer's O&M data for actuator maintenance information, see Volume 3.

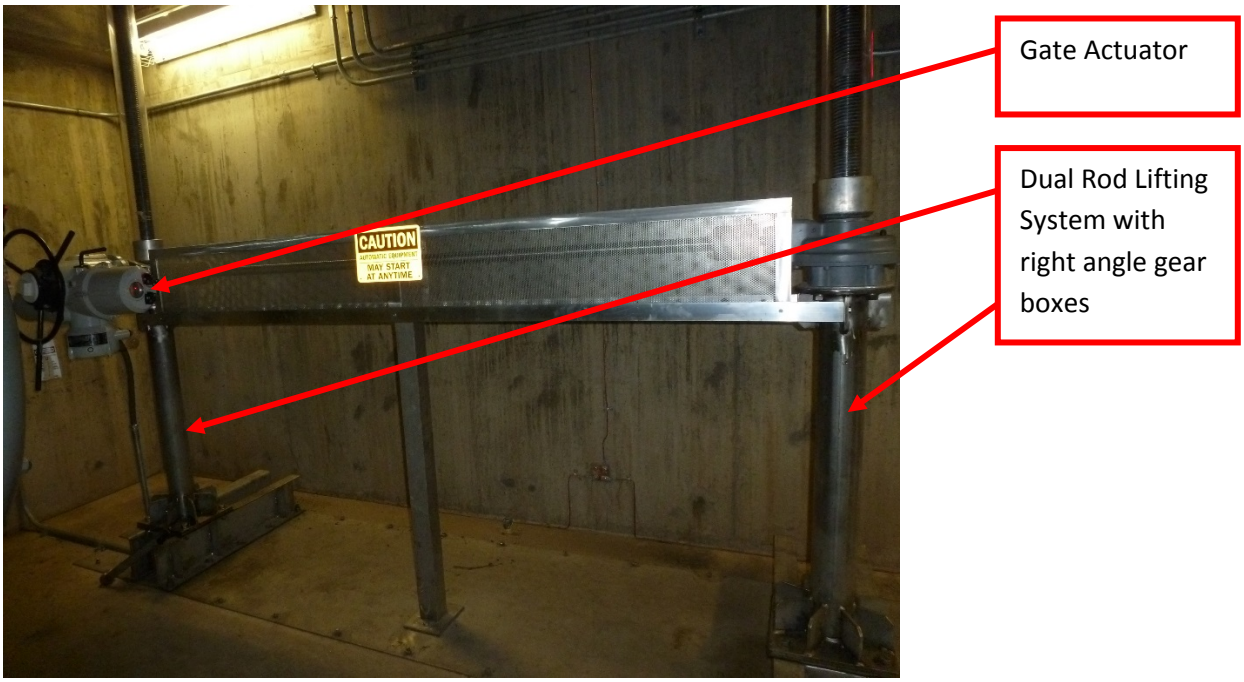


Figure 60 - AWS Head Gate

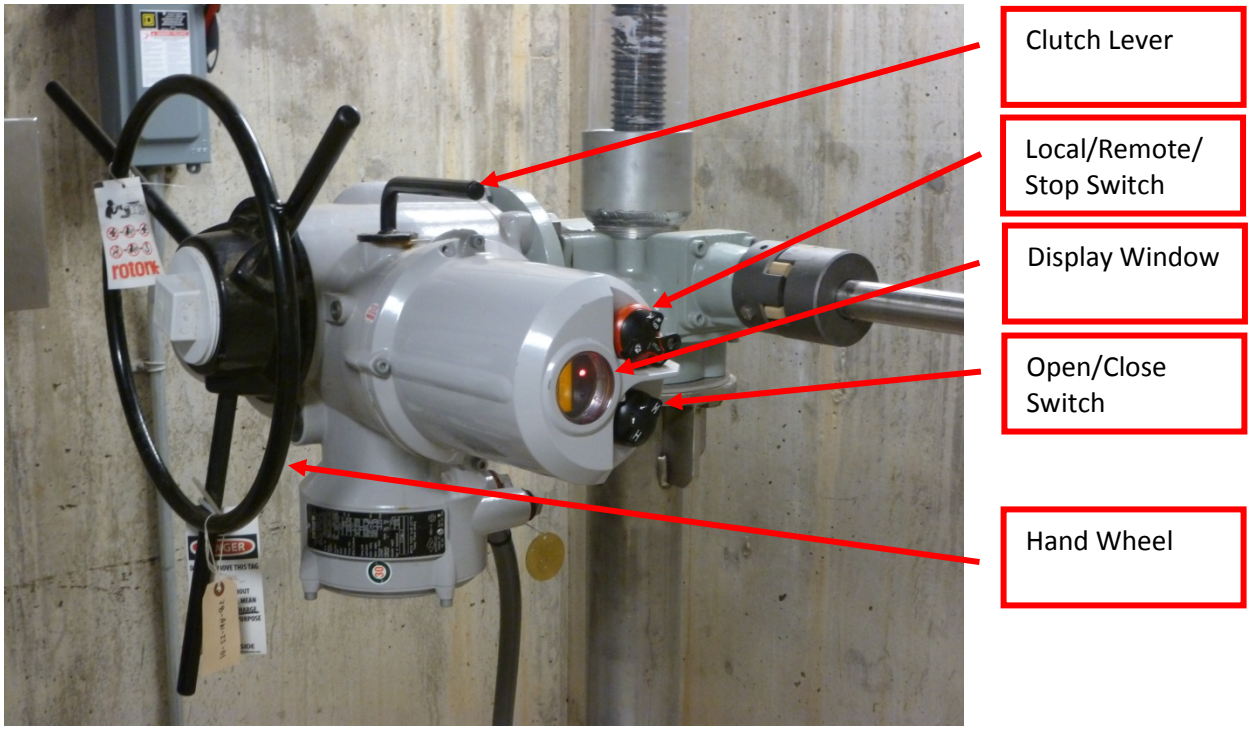


Figure 61 - AWS Head Gate Actuator

4.2.6. Fish Sorting Equipment

-SITE MAP AREA D2, E2, F2-

4.2.6.1. Fish Transport Flume

Fish travel from the pre-sort pool, down the flume toward the switch gates and anesthetic tank. See Figure 20.

4.2.6.2. Switch Gates

Switch gates are used to direct incoming fish to desired locations. The label above each button indicates the location where each fish will be deposited. Momentarily press the desired pushbutton to open the switch gate. Switch gate will close upon release of the pushbutton. The "Return-to-River" switch gate can be held open indefinitely by switching the "SWITCHGATE CONTROLS" selector switch (on the Pre-sort Control Console) to "WINTER RETURN" (Figure 15, para. 4.2.2). This selector switch should normally be in the "NORMAL" position. The switch gate speed can be adjusted by needle valve. Switch gate operation should only be set to a minimum actuation speed as faster speeds increase wear and tear on the switch gates. Refer to the manufacturer's O&M data for full operation information, see Volume 2.

Figure 62 – Switch gate Controls

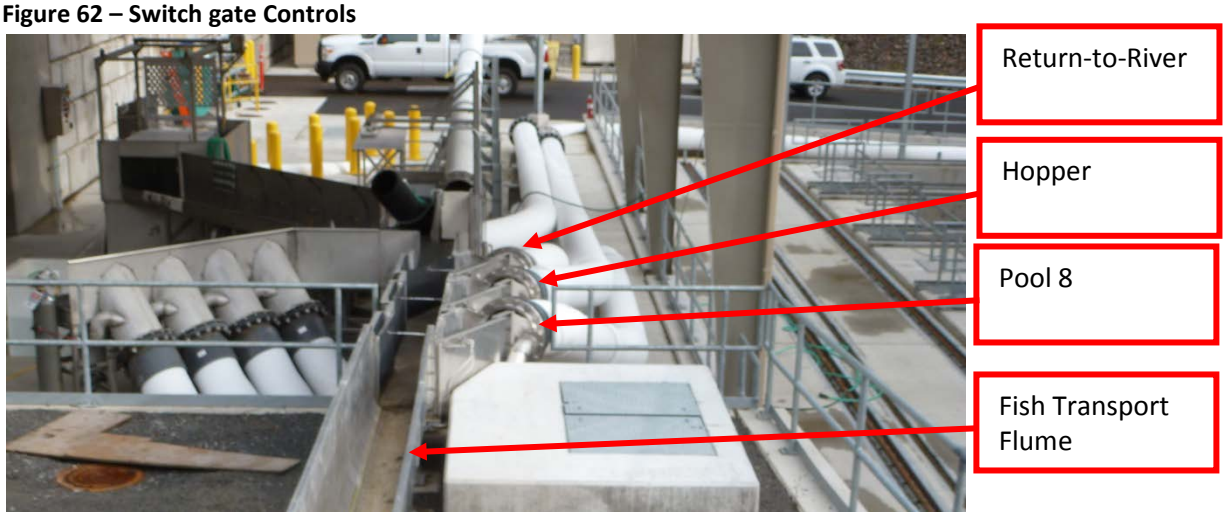


Figure 63 – Switch gates

4.2.6.3. Anesthetic Tank

Figure 64 Anesthetic Tank

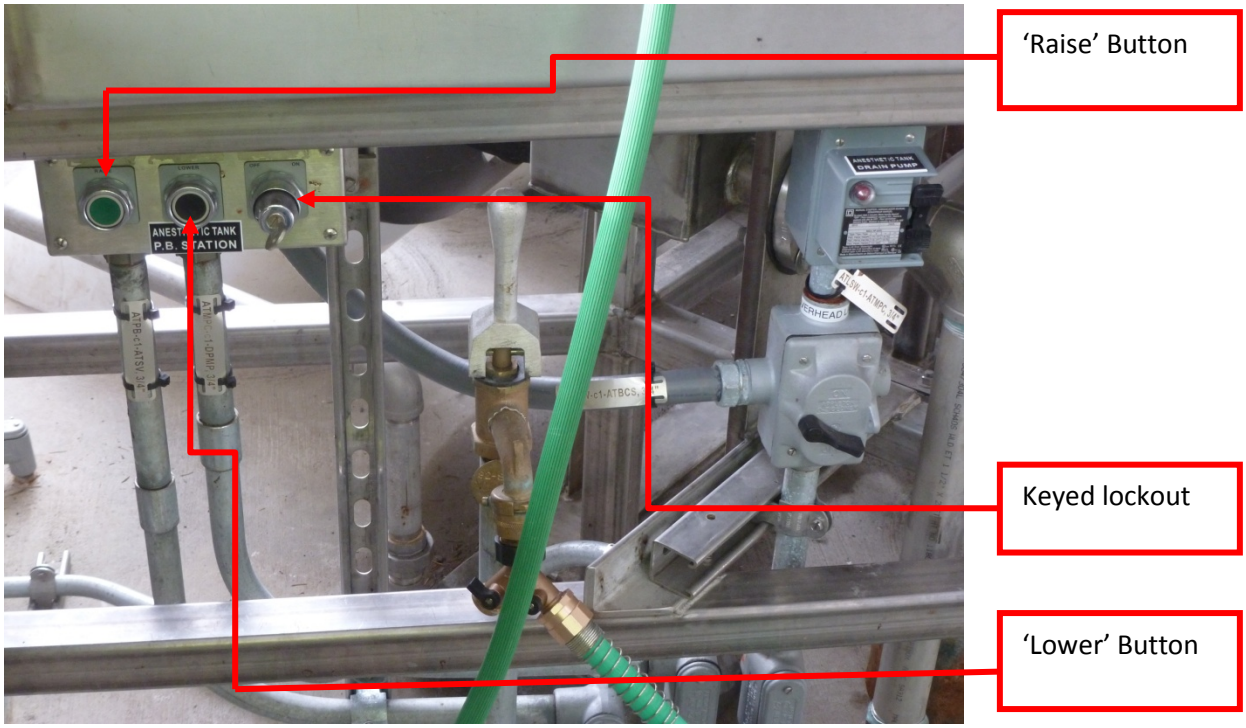


Figure 65 - Anesthetic Tank Brail Controls

RAISE: Raised the pneumatically operated brail

LOWER: Lowers the Brail

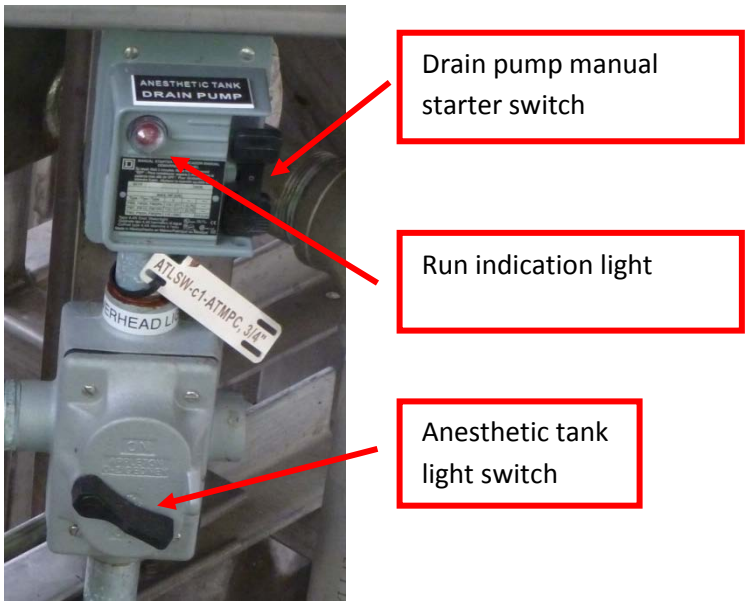


Figure 66 - Anesthetic Tank Drain Pump Controls

4.2.6.4. Sorting Table

The sorting table allows the operator to move fish from the anesthetic tank to various pools by way of fish pipe. The operator must decide which pipes will be used prior to processing fish and the then open the water supply valve for the desired fish pipe(s). Prior to processing fish the flushing water supply should be on keeping the working surface wetted to ensure fish can be moved easily and damage to scales is minimized.

Figure 67 – Sorting table

4.2.6.5. Recovery Tank

The recovery tank allows anesthetized fish to regain consciousness. Once awake the false weir should attract the fish to the tank exit taking the fish to the return to river outlet. Refer to the manufacturer's O&M data for miscellaneous equipment maintenance information, see Volume 2.

Figure 68 - False Weir 2 and Recovery Tank Brail Control Cabinet

4.2.6.6. Recovery Tank False Weir

The false weir flow is controlled at the cabinet and can be varied from 0 to 100 percent flow (Figure 70). To turn the false weir on, press the 'START VFD' button. Flow can be controlled by rotating the flow control dial; 0% for lowest flow and 100% for maximum flow. To turn the false weir off and stop flow, push the 'STOP VFD' button.

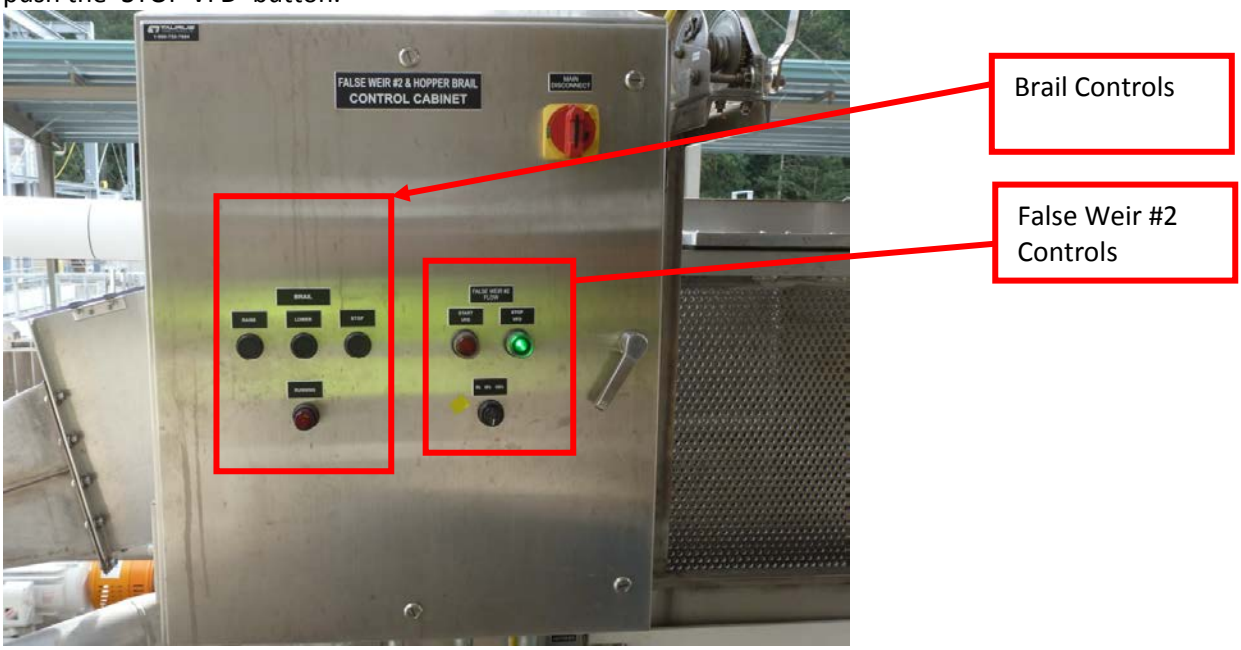


Figure 69 False Weir and Brail Control Panel

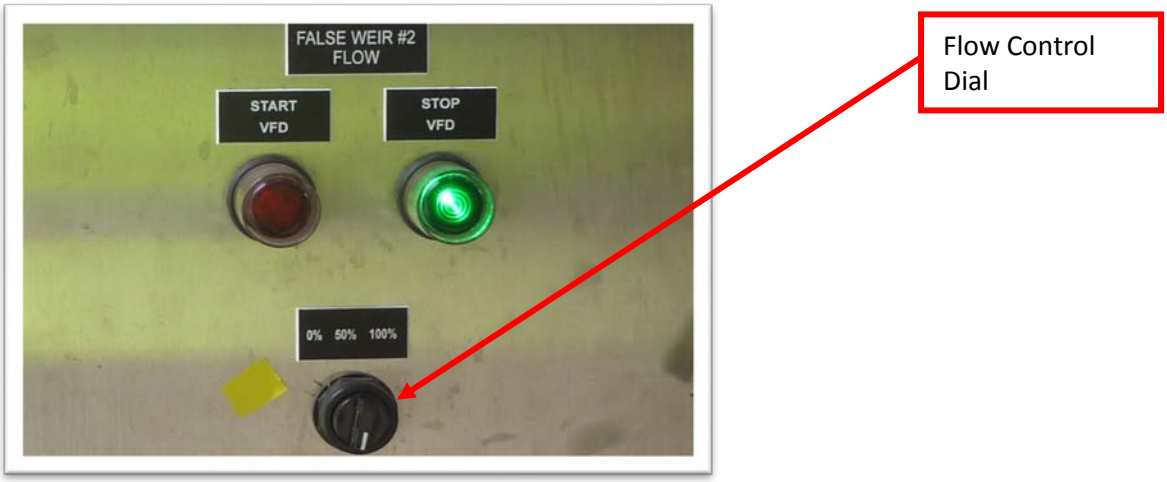


Figure 70 - False Weir 2 Flow Controls

4.2.6.7. Recovery Tank Brail

The recovery tank brail is used only if the fish remain in the recovery tank for an extended period of time. Operators should make an effort to "bump" the brail up, without fully dewatering the fish, in an effort to persuade the fish to jump or swim out of the tank on its own.

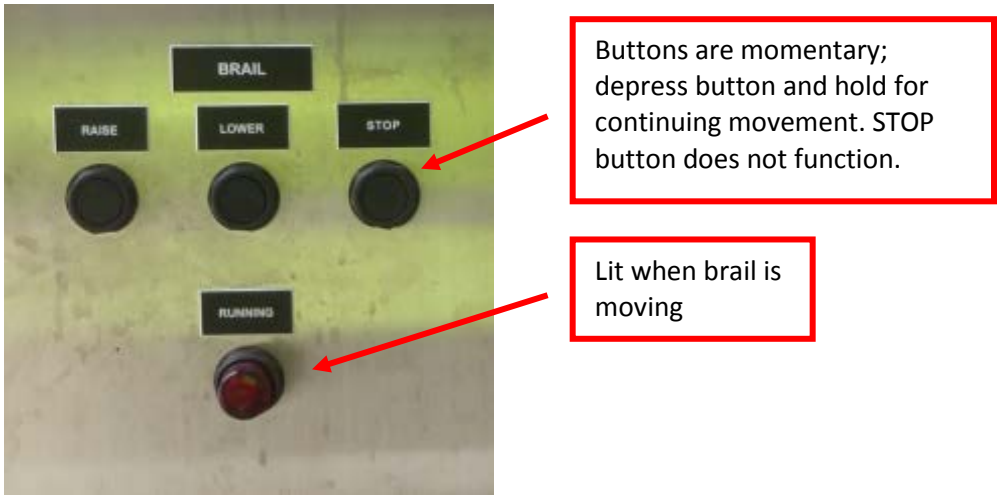


Figure 71 – Brail Control Panel

4.2.6.8. Spawning Table

This table is used to process fish for egg/sperm extraction.

Figure 72 – Spawning Table

4.2.7. Fish Transfer and Loading Equipment

-SITE MAP AREA F2, F3-

4.2.7.1. Hopper Crane

The hopper crane has two hoists. The first hoist is connected to hopper 1 and functions to move ESA listed fish in hopper 1 from the sorting channel pit to the fish transport truck. The second hoist is connected to hopper 2 and functions to move brood stock from the sorting channel pit to the hopper 2 support stand.

Hopper hoist 1 can be operated from the control cabinet (Figure 74) or from a pendant (Figure 75).

Hopper hoist 2 can be operated from the control cabinet (Figure 74) or from a pendant (Figure 75).

OPERATE BY AUTHORIZED PERSONNEL ONLY: Crane may only be operated by personnel with class 2 crane training. Contact the safety office for additional information and requirements.

CAUTION: No person may enter the area beneath a hanging load; only attempt the water transfer after the hopper is seated on the fish transport truck transfer opening.

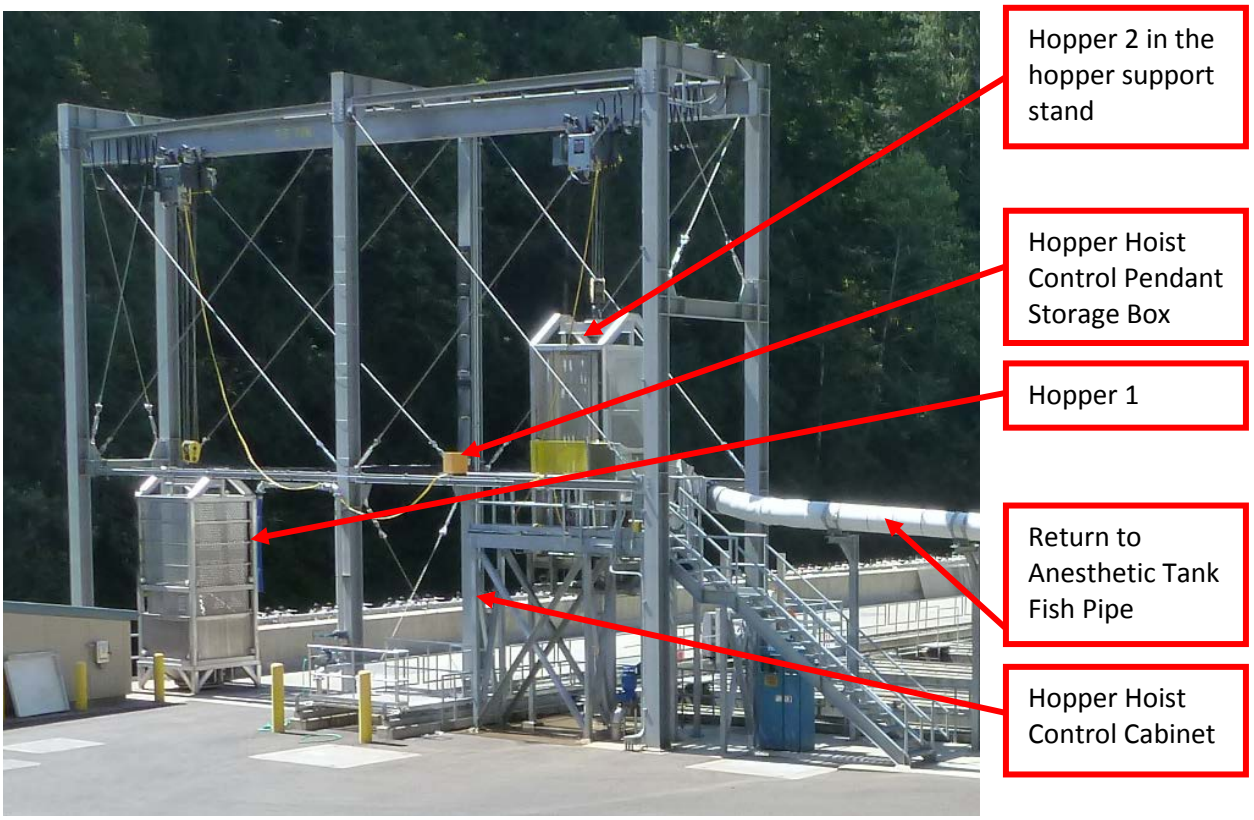


Figure 73 - Crane Assembly

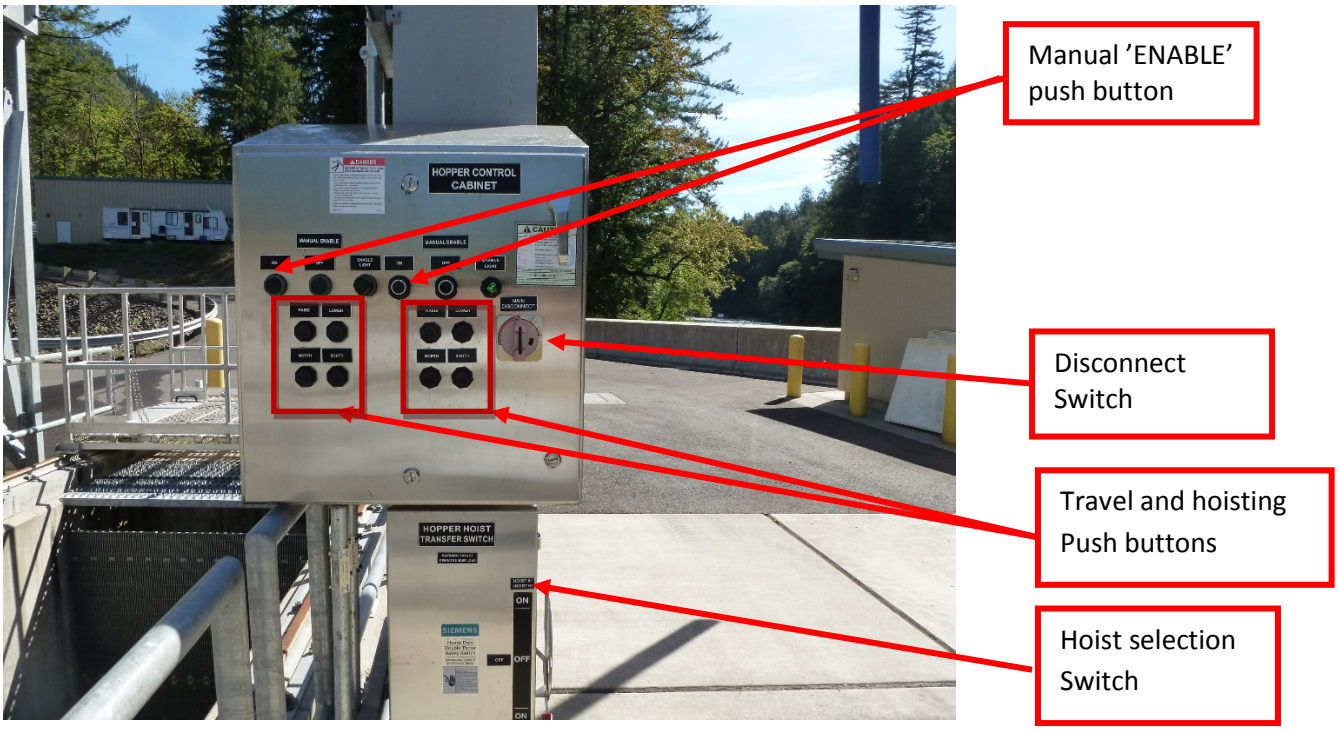


Figure 74 - Hopper Hoist Control Cabinet

Figure 75 Hopper 1 and Hopper 2 Pendant Controls

4.2.7.2. Hopper 1 – Fish truck

Hopper 1 is used to transfer fish to the fish truck using a water to water transfer method. The water to water method used to transfer fish into the truck is described in Appendix I. The hopper is designed to support 30 Chinook, this is the recommended maximum number of fish per transport event.

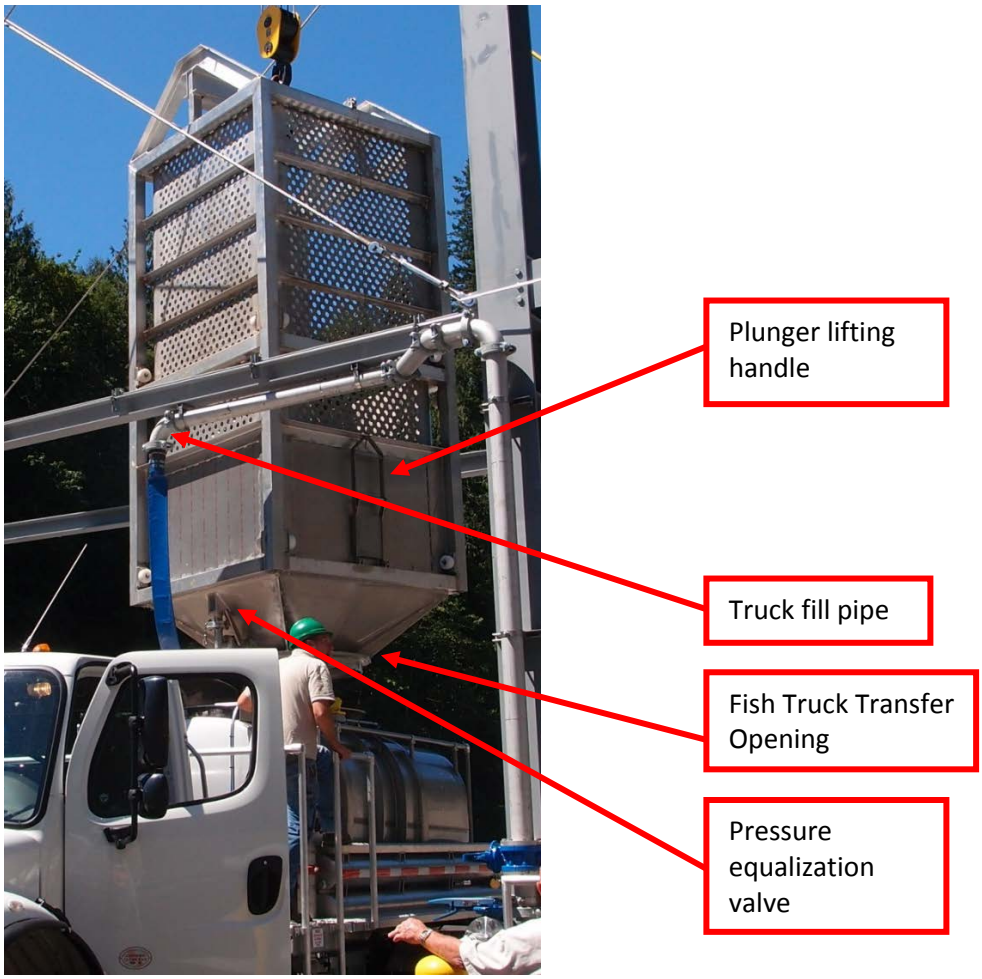


Figure 76 Hopper 1 and Fish Truck Transfer Operation

4.2.7.3. Hopper 2 – Spawning

Fish are moved from the pools to the sorting channel and then into hopper 2 positioned in the hopper pit. The hopper is lifted out of the pit and moved to the position shown in figure 71. The false weir is modified to drain water only. The VFD and pump was removed to improve the brood stock processing based on operator feedback. Hopper 2 is designed to hold 50 chinook fish, this is the recommended maximum number of fish per transport event

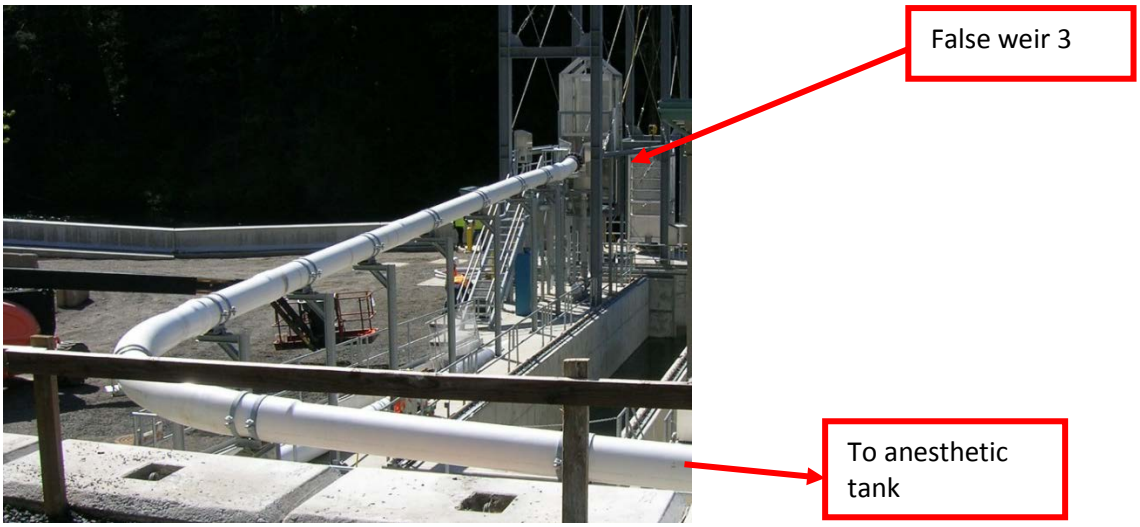


Figure 77 Hopper 2 Platform

4.2.7.4. Hopper 2 – False Weir 3

After decommissioning the false weir its water supply piping was rerouted so that water would up well from within the hopper. The amount of water is controlled using the valve shown in figure 76. Once the water out flow is set and the false weir drain is open to allow the desired fish pipe flow. Once the operator is satisfied with the processing conditions the closure gate is opened and the brail is moved upward to allow the desired number of fish to exit the hopper for processing.

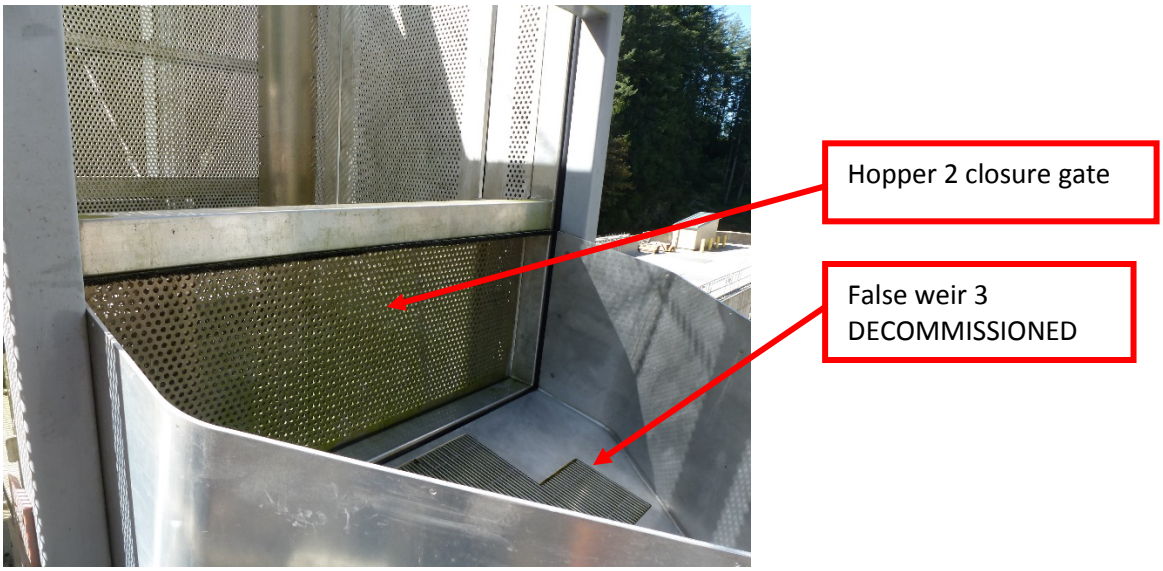


Figure 78 - False Weir 3 & Hopper Brail Control Console

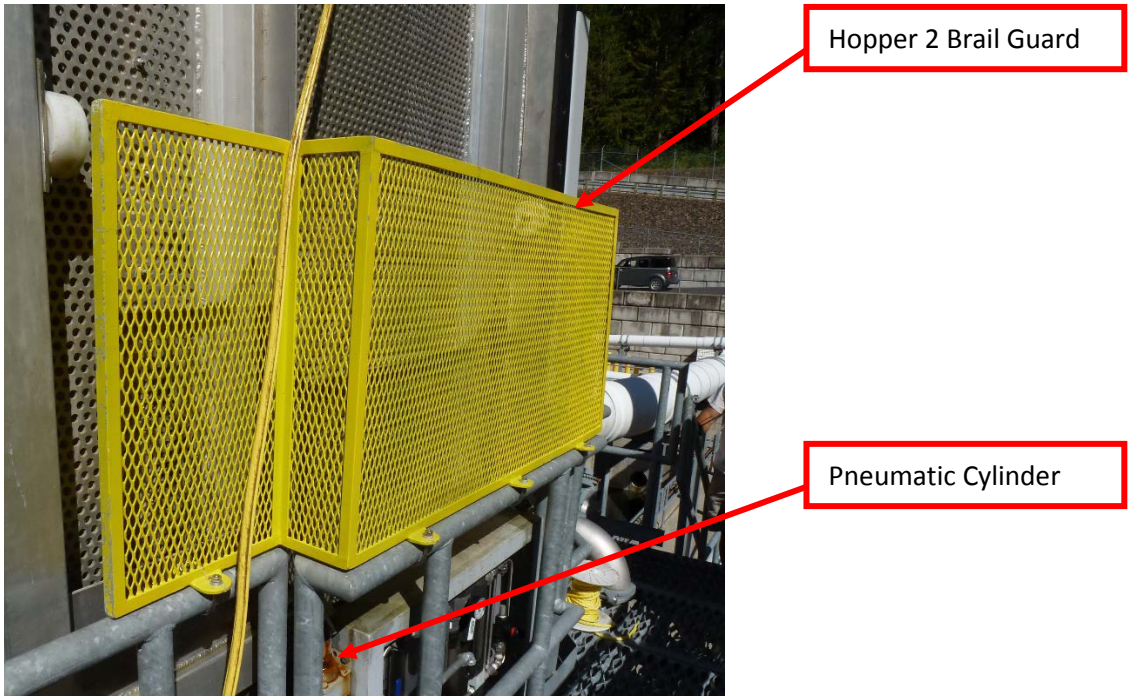


Figure 79 - False Weir 3 & Hopper Brail Control Console

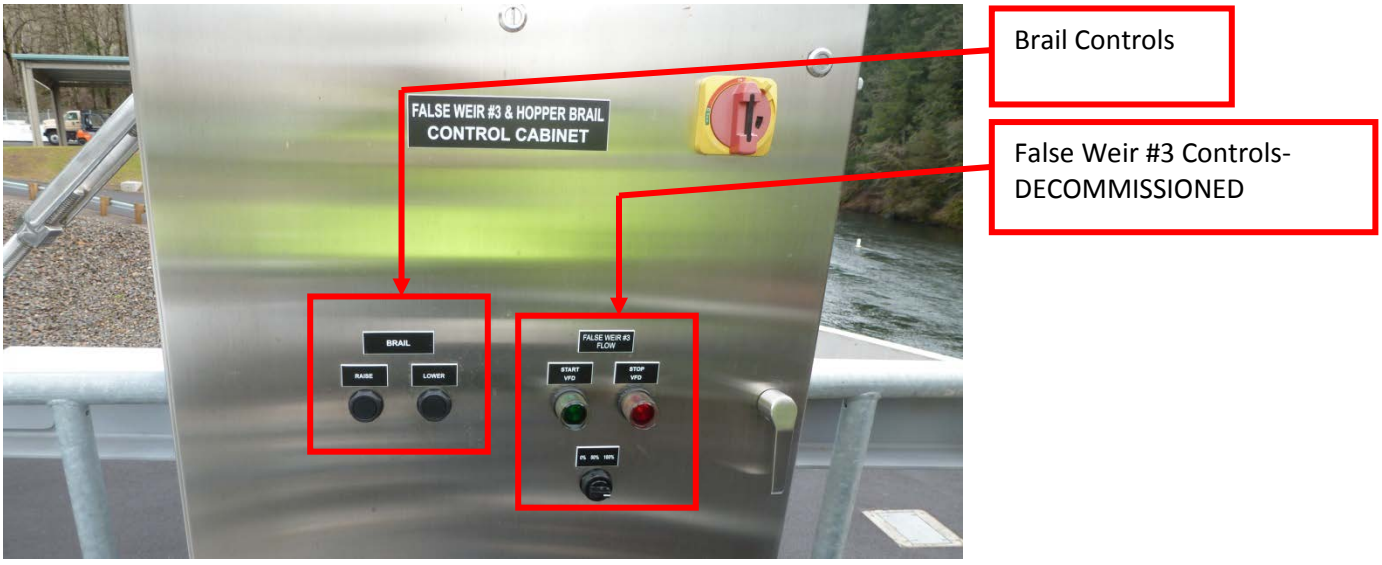


Figure 80 - False Weir 3 & Hopper Brail Control Console

Figure 81 – Hopper Water Supply Valve

4.2.7.5. Fish Truck

Used to move fish from hopper one to designated out plant sites.

Figure 82 - Fish Truck

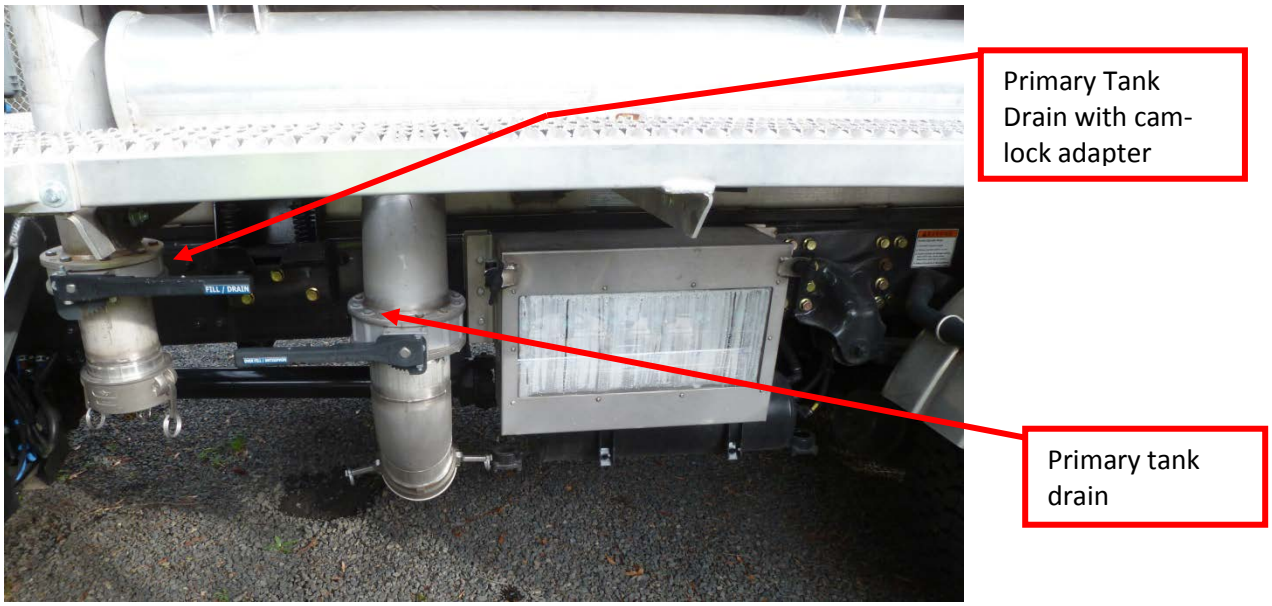


Figure 83 - Fish Truck, Driver Side

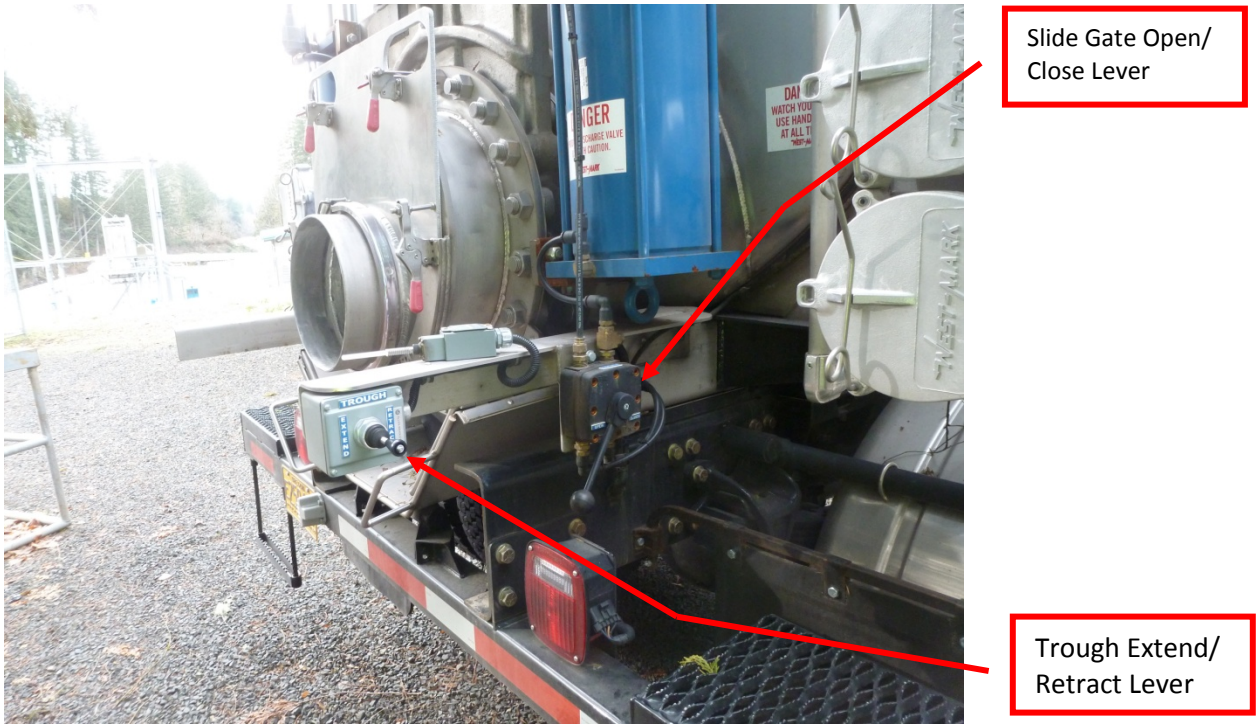


Figure 84 - Fish Truck, Rear

Figure 85 - Fish Truck, Passenger Side

4.2.8. Abatement Pond

-SITE MAP AREA A3, B3-

Figure 86- Abatement Pond

4.2.9. Ancillary Structures

-SITE MAP AREA F2, G2, D3, H2-

4.2.9.1. Emergency Generator Structure

Figure 87 - Generator Structure and Fuel Tank

4.2.9.1.1. Diesel Generator and Automatic Transfer Switch

The automatic transfer switch will allow the generator to feed power to the facility. Refer to the Contractor O&M manual volume 4.

Figure 88 - ATS transfer Switch

Figure 89 - Generator Control Panel

4.2.9.1.2. Fuel Storage System

The fuel tank capacity is approximately 3000 gallons allowing for continuous operation at full load for three days. Secondary containment is provided for the fuel piping and should be periodically checked for leaks. A serious leak will create a pool in the generator building, see figure xxx.

The kidney loop controller should run long enough to filter the entire quantity of fuel. Refer to manufacturer's operations and maintenance manual for recommended run times and filter changes.

Figure 90 - Fuel tank Volume

Figure 91 - Kidney Loop Filtration Controller

Figure 92 - Secondary Containment Trough Termination

4.2.9.2. Maintenance Building

The facility has a prefabricated metal building for general maintenance needs. The building is provided with a thermostatically controlled unit heater. This unit should be periodically inspected for dust buildup and any unusual operation should be reported immediately.

Due to the proximately of the building to river and various site drain sources any hazardous materials spilled should be abated immediately.

Figure 93 - Maintenance Building

4.2.9.3. Site Host Structure

Figure 94 - Site Host Structure

4.2.9.3.1. Power Pedestal

Power to the site host is provided from mini-power center MPC-2 (located in the IPS). The power pedestal provides receptacles for 50A (240V) and 30A (120V) service as well as a duplex 20A, 120V convenience receptacle. Circuit breakers are provided in the pedestal for each circuit. The pedestal also provides a jack for telephone service.

4.2.9.3.2. Potable Water

Potable water supply is provided as part of the site host structure.

4.2.10. Kayak Portage Path

The portage path will be maintained annually at minimum. The path and the area around the portage platforms down to the water will be free of encroaching vegetation with a vertical clearance of at least eight feet and side clearances of four to eight feet. Vegetation will be cleared at least once per year in April. Cleared vegetation will be removed; otherwise, it shall be spread on the ground to promote decomposition. There will be no piles of cleared vegetation left on-site. Vegetation spread on the ground will not be spread on the portage path, but several feet off so remaining growth hides the cut plants. Signage will remain legible and maintain location and alignment. Any signs that are removed or become more than 20% unreadable must be replaced.

4.2.11. Sanitary Sewer System

-SITE MAP AREA F2-

4.2.11.1. Septic Tank

In order to maximize system functionality, users shall adhere to the following guidelines:

- Do not put too much water into the septic system; typical water use is about 50 gallons per day for each person in the family.
- Do not add materials (chemicals, sanitary napkins, applicators, and so on) other than domestic wastewater.
- Restrict the use of your garbage disposal.

- Do not pour grease or cooking oils down the sink drain.
- Keep automobiles and heavy equipment off the system.
- Do not plan any building additions, pools, driveways, or other construction work near the septic system or the repair area.

In order to prevent the overflow of solids and the subsequent clogging of the drain field, the tank will be pumped every several years. The size of the installed septic tank is 1500 gallons. The following table will be used to determine the frequency of pumping.

Table 8 – Septic Tank Pumping Frequency

Estimated Septic Tank Inspection and Pumping Frequency in Years					
Tank Size (gallons)	**Number of People Using the System**				
	1	**2**	**4**	**6**	**8**
1,500	19	9	4	3	2
Source: Adapted from "Estimated Septic Tank Pumping Frequency," by Karen Mancl, 1984. *Journal of Environmental Engineering*. Volume 110.					

The surface area of the drain field will be inspected semi-annually for erosion. Ground not vegetated will be re-planted.

4.2.11.2. Controls

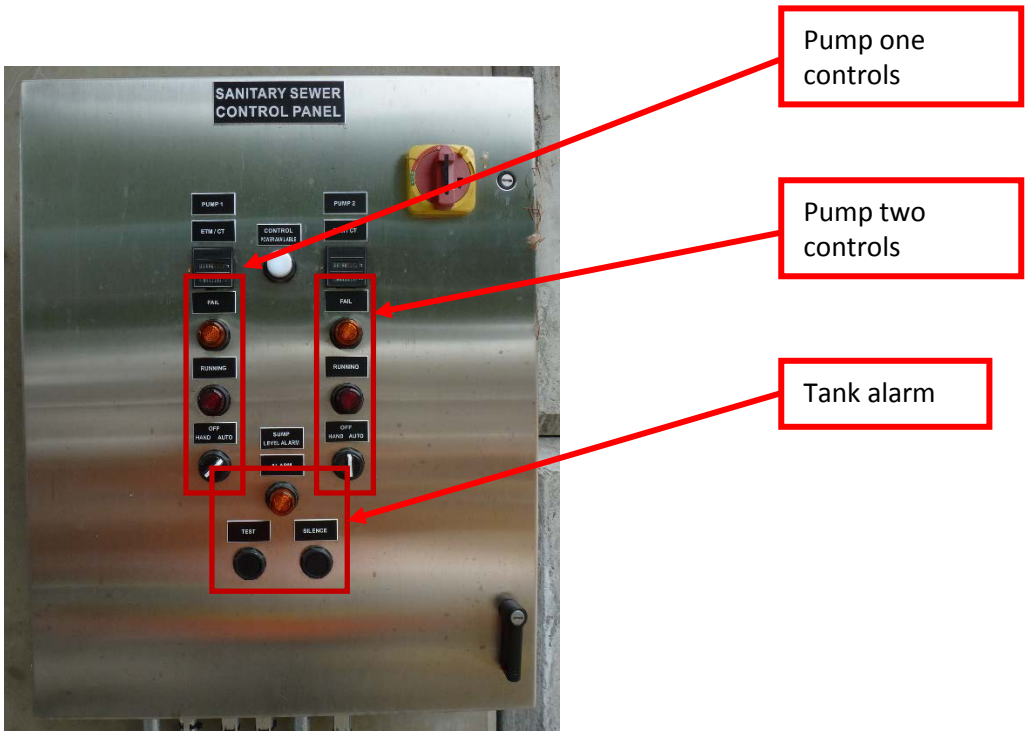


Figure 95 - Sewer Pump Control Panel

4.2.12. Potable Water System

-SITE MAP AREA D3-

4.2.12.1. Water Well

Figure 96 - Water Well

Figure 97 - Water Well Disconnect

4.2.13. SCADA

See Appendix H for the Minto Control System User Guide.

4.2.14. Intrusion Detection

Intrusion detection monitors for unauthorized access to all doors at the sorting/office building, generator building, maintenance building and intake structure. It also monitors for tampering of the vehicle entrance gates keypads. Any alarm from this system will initiate a general alarm on the SCADA system. Reference the full O&M manual for more detailed system description.

Chapter 5: Preventative Maintenance

5.1. System Maintenance

5.1.1. General Maintenance Policies

This section describes the equipment and routine operation and maintenance procedures for the Minto Fish Collection Facility. Additional reference data and revised procedures and parameters should be inserted into the manual as dictated by changing conditions and operator experience with this particular facility.

5.1.1.1. Contractor Supplied O&M Manual

All employees should become familiar with the equipment and the respective manufacturer's operation and maintenance (O&M) literature before performing the procedures described in this section. The equipment O&M manuals are located in Appendix B and contains 7 volumes. All equipment should be maintained in accordance with the manufacturer's recommendations. Detailed information is provided in the manufacturer-supplied O&M manual, such as operation, maintenance, adjustment, troubleshooting, lubrication, startup, shutdown, assembly, spare parts, and storage. The manufacturer-supplied O&M manual should be kept current by inserting or replacing information as equipment items are added or replaced.

5.1.1.2. Pre-startup Procedure

The following basic procedures are recommended before starting and operating all processes and equipment:

- Be sure that the appropriate HAND/OFF/AUTO switches, ON/OFF switches, etc. are turned OFF prior to energizing equipment electrical supply.
- Be sure all grating, equipment safety shields, and floor hatches are in place. Always keep grating, equipment shields, and floor hatches in place, except during maintenance procedures; then replace immediately upon completion of task.
- Check that all clothing, tools, etc. are removed from control panels and equipment.
- Check that all electrical junction boxes and control panels are properly closed.
- Valves and gates should work smoothly and seat properly.
- Valves and gates should be set in the correct position prior to start-up. Verify that all lock-out/tag-out procedures are completed.
- Make any needed repairs or adjustments prior to startup.
- Check that all equipment is properly lubricated and ready to operate. (Follow manufacturer's instructions.)
- Check that all foreign objects have been removed from equipment and piping.
- Check all equipment frequently during the first day of operation, after repair, replacement, or seasonal startup. If a malfunction occurs, do not continue to operate. Minor problems can often cause serious damage if not corrected.

5.1.2. Basic Maintenance Procedures

The operation and maintenance of equipment and structures is important for effective performance. The result of good maintenance is lower operating costs, better morale for staff, and better visitor image. To assist in achieving these objectives, the recommendations in this chapter should be followed. This chapter contains maintenance procedures common to many of the Minto Fish Collection Facility elements. For specific procedures for the various elements, see section 5.2 Equipment Maintenance and Contractor supplied O&M manuals. An overall inspection should be made twice a year for determination of maintenance work required for each element. Inspections and maintenance of specific elements should be made on the schedule noted herein, or as noted in the manufacturer's instructions. The best policy is to complete maintenance work as it is required. Delaying maintenance work will only increase the cost and amount of work required, and decrease the life of the equipment. This policy should not preclude more frequent inspections and resulting maintenance. The material used for maintenance repairs shall conform or be equal to the original construction contract specification requirements.

5.1.3. Preventative Maintenance Management

5.1.3.1. General

Proper and efficient maintenance of equipment and structures will extend the useful life. The use of a maintenance management program will help to ensure that all equipment is maintained at the required intervals.

5.1.3.2. Equipment Inspection and Maintenance

Visual and physical observations of the machinery and equipment should be performed by the operators on a regular basis. All unusual conditions are to be reported immediately to the facility manager. If the operator feels that damage to the piece of equipment and/or a safety hazard is created by this condition, the piece of equipment should be taken out of service immediately and the facility manager notified.

5.2. Equipment and Structure Maintenance

5.2.1. Fish Ladder

The fish ladder should be visually inspected annually to see that no objects and debris are present anywhere within the fish ladder. Visual inspection should also include the condition of concrete surfaces and the various steel items such as fish screens, diffusers, lifting frame, personnel guardrails and walkways located near the entrance. Connector machine bolts and concrete anchors should be visually inspected for corrosion and replaced in kind as needed.

5.2.1.1. Fish Ladder Entrance

5.2.1.1.1. Adult and Juvenile Fish Entrance Gates

Each gate and actuator should be visually inspected for damage and corrosion. Ensure Lead screw is lubricated per manufacturer’s recommendations. Do not attempt to repair damage. Exercise each actuator (open completely and close completely) every two weeks.

5.2.1.1.2. Fish Barrier Screen and Support Structure

A visual inspection should include the condition of various steel items such as fasteners, wire rope, and connection points on the screen. The lifting frame should not show significant corrosion clean the screen as needed to remove corrosion. Bolted connections and concrete anchors should be visually inspected for corrosion and replaced in kind as needed. Exercise the gate hoist from the full up position to 6 inches above the water surface, three times every two weeks.

5.2.1.2. AWS Diffusion Basins

A visual inspection of the basins should be performed during the annual ladder outage. Report any large concrete cracks or unusual surface erosion.

5.2.1.2.1. AWS Diffuser Slide Gates

Each gate and actuator should be visually inspected for damage and corrosion. Do not attempt to repair damage. Ensure Lead screw is lubricated per manufacturer's recommendations. Exercise each actuator (full open to full closed) every two weeks. Actuators that cannot be regularly exercised should be removed and placed in storage per manufacturer's recommendations.

See Contractor provided Operation and maintenance manual Volume 2

5.2.1.2.2. Diffuser Screens, Porosity Plate, and Bubbler Beams

Each diffuser screen and porosity plate should be cleaned annually. It may be necessary to perform the cleaning more frequently. Cleaning frequencies will fluctuate based on the quantity and type of river debris.

5.2.1.3. Pool 51 – Ladder Head Control with Level Sensor

5.2.2. Pre-Sort Pool

Visually inspect the concrete surface for surface damage annually. All steel features such as work platforms, walkways, personnel guard rails, Crowder rails, metal doors and the steel stairs should be inspected for corrosion. All connection fasteners for the work platforms and walkway system should be inspected and any corroded bolts replaced in kind as needed. Repaint or repair galvanizing as needed.

5.2.2.1. Finger Weir

Visually inspect the aluminum frame work for cracks and damage. All bolted connections, wire ropes, and sheaves should be inspected monthly and any deficiencies should be reported immediately. Operate the finger weir monthly through its full range of motion and ensure winch brake holds the weir at various elevations. The winch is sealed and does not require periodic lubrication however, it should be inspected for corrosion and damage; replace if inoperable or if operating is unsafe.

5.2.2.2. Crowder

Visually inspect the chassis for corrosion, cracks, and damage every two weeks. Items that are heavily corroded or damaged should be reported and replaced as needed. After the visual inspection, if the crowder has not been operated in the previous two weeks, the crowder should be exercised. Three cycles of screen Travel should be performed, observe the operation and report any problems. Three traversing cycles should be performed with the screen in the up position.

See Contractor provided Operation and maintenance manual Volume 2.

5.2.2.3. False Weir

Visually inspect for corrosion, cracks, leaks, and damage on a monthly basis. Items that are damaged should be reported and replaced as needed. Monitor leaks and report if deemed excessive or a threat to equipment or operator safety. The false weir pump should be exercised every two weeks if left idle for an extended period. This operation should be performed with the closure gate in the down position to avoid attracting fish into the flume. Unusual performance or noise should be reported immediately.

See Contractor provided Operation and maintenance manual Volume 2

5.2.2.4. Closure Gate

Visually inspect the frame for cracks and damage. All bolted connections, wire ropes, and sheaves should be inspected monthly and any deficiencies should be reported immediately. Operate the closure gate monthly through its full range of motion and ensure winch brake holds the gate at various elevations. The winch is sealed and does not require periodic lubrication however, it should be inspected for corrosion and damage; replace if inoperable or if operating is unsafe.
.

5.2.2.5. Pre-sort Pool Piping

Exposed pre-sort piping should be visually inspected for leaks on a month to month basis. Leaks should be reported and monitored. Graveled areas that experience erosion should be reported as this could indicate a buried pipe is leaking.

5.2.2.6. False Weir Drain

Visually inspect the false weir drain annually for leaks and damage to its coating system. The valve should be exercised on a month to month basis.

5.2.2.7. Valves

The valves in pre-sort piping area should be visually inspected for leaks and corrosion on a month to month basis. Leaks and significant corrosion should be reported and monitored. Valves should be exercised, full open to full closed, on a month to month basis. Unusual difficultly opening or closing the valve should be reported.

5.2.2.8. Diffusers

Diffuser maintenance is only performed during the annual facility shutdown period. The diffuser grating should be removed and cleaned annually. The diffuser pit should be inspected for debris accumulation and the low point drain should drain freely.

5.2.3. Sort Facility

The cover structure should be visually inspected for corrosion spots or peeling paint in the metal roof and support columns and beams. Corrosion on metal items should be cleaned and metal surfaces recoated with materials as needed to match the initial coating. All fasteners shall be checked for corrosion and replaced in kind as needed.

See Contractor provided Operation and maintenance manual Volume 1.

5.2.3.1. Mechanical/Electrical Room

5.2.3.1.1. Compressed Air and Oxygen

The air compressor and any exposed compressed air pipe should be visually inspected monthly. The Operator should note any unusually significant increase in compressor operation and report it to the appropriate personnel.

Visually inspect the oxygen system for corrosion and damage. Pressurize the system annually and individually operate each pool supply valve. Report any problems with flow delivery to the authorizing authority; *DO NOT ATTEMPT REPAIRS OR HAVE OPEN FLAMES IN AN OXYGEN RICH ENVIROMENT. CREATING SPARKS, SMOKING, AND OTHER ACTIVITIES THAT PROVIDE AN IGNITION SOURCE MAY CREATE AN UNSAFE WORK ENVIRONMENT.*

5.2.3.1.2. GAC Filter

The Granulated Activated Carbon filter should be visually inspected for leaks and damage every six months. The filter media requires back flushing after every use. If the back flushing does not immediately follow use, it is very likely the media will be rendered ineffective and will need to be replaced. Outflow should be tested at regular intervals to ensure the discharge meets DEQ standards. The system is designed for a carbon consumption rate of 1.8 pounds of media per 1000 gallons of waste water processed. Refer to the manufacturer's instructions for media replacement. Two factory supplied media replacements have been purchased for the fish facility.

See Contractor provided Operation and maintenance manual Volume 1.

5.2.3.2. Plumbing

The mechanical room piping should be visually inspected for leaks and damage every six months. Report or perform authorized repairs for any significant leak.

5.2.3.3. HVAC

The heater units should be inspected and cleaned per manufacturer's recommended interval.

The office heat pump should be inspected for debris infiltration and insect infestation every three months. Perform maintenance per manufacturer's recommendations.

5.2.4. Post-Sort Pools, Sorting Channel, and Hopper Pit

Visually inspect the concrete surface for surface damage annually. All steel features such as work platforms, walkways, personnel guard rails, Crowder rails, metal doors and the steel stairs should be inspected for corrosion. All connection fasteners for the work platforms and walkway system should be inspected and any corroded bolts replaced in kind as needed. Repaint or repair galvanizing as needed.

5.2.4.1. Post-sort Pool Crowders

Visually inspect the chassis for corrosion, cracks, and damage every two weeks. Items that are heavily corroded or damaged should be reported and replaced as needed. After the visual inspection the crowder should be exercised. Three cycles of screen Travel should be performed, observe the operation and report any problems. Three traversing cycles should be performed with the screen in the up position. If long term inactivity is expected park the crowder under the post sort pool shade structure.

See Contractor provided Operation and maintenance manual Volume 2

5.2.4.2. Sorting Channel Crowder

Visually inspect the chassis for corrosion, cracks, and damage every two weeks. Items that are heavily corroded or damaged should be reported and replaced as needed. After the visual inspection the crowder should be exercised. Three cycles of screen Travel should be performed, observe the operation and report any problems. Three traversing cycles should be performed with the screen in the up position.

See Contractor provided Operation and maintenance manual Volume 2

5.2.4.3. FWS Piping

Visually inspect exposed piping for leaks and damage once every 6 months. Report leaks and damage to the appropriate authorities.

5.2.4.4. Diffusers

Diffuser maintenance is only performed during the annual facility shutdown period. The diffuser grating should be removed and cleaned annually. The diffuser pit should be inspected for debris accumulation; clean debris as necessary. Pit drains should drain freely.

5.2.4.5. Removable Fish Screens and Overflow Stoplogs

The removable fish screens should be cleaned weekly; the change in water height across the screen should not exceed 6 inches between cleanings.

Overflow stoplogs are tongue and groove 2 inch by 6 inch boards. Replace like in kind as leakage or damage becomes excessive.

5.2.4.6. Juvenile Return Pipe

The pipe should be flushed prior to use. Annual inspections should be performed to ensure the interior of the pipe is not damaged.

5.2.4.7. Sort Channel Drain System

The pipe should be flushed prior to use. Annual inspections should be performed to ensure the interior of the pipe is not damaged.

5.2.5. Intake and Pump Structure (IPS)

Visually inspect the concrete surface for surface damage annually. All steel features such as work platforms, walkways, personnel guard rails, Crowder rails, metal doors and the steel stairs should be inspected for corrosion. All connection fasteners for the work platforms and walkway system should be inspected and any corroded bolts replaced in kind as needed. Repaint or repair galvanizing as needed.

5.2.5.1. FWS Pump System

Each Patterson 12x18 SAFV Vertical Pump should be inspected and/or serviced at 4,000, 8,000, and 40,000 hours of run time (or 6, 12, and 60 months of calendar time, whichever comes first) in accordance with the manufacturer's maintenance schedule.

See Contractor provided Operation and maintenance manual Volume 3

5.2.5.2. FWS Piping

The FWS pipe in the IPS should be visually inspected for damage, leaks, and corrosion. It is normal for the pipe to have condensed water dripping from the bottom of the pipe; the leak should be actively dripping water. If a leak is found report it to the appropriate authorities.

5.2.5.3. FWS Flowmeter

The flow meter should not require regular maintenance. Function is purely electronic in nature.

5.2.5.4. AWS Valve and Sump Pump System

The actuator and gearboxes should be inspected for leaks every 3 months. Exercise the gate every month to ensure components receive lubrication. Sump pumps operate are configured for lead-lag

See Contractor provided Operation and maintenance manual Volume 2

5.2.5.5. Washdown Pipe System

Visually inspect for corrosion, leaks, and damage on a bi-annual basis. Items that are damaged should be reported and replaced by authorized personnel. Monitor leaks and report if deemed excessive or a threat to equipment or operator safety. Each hose bib should be used at least once every three months. Washdown pump function should be verified while running the hose bibs.

See Contractor provided Operation and maintenance manual Volume 3

5.2.5.6. Intake Screens

Visually inspect for corrosion, cracks, and damage on an annual basis. Perform Power washing on each screen prior to the annual inspection. It is unlikely that repairs can be made at the facility; report the damage so it can be evaluated and replaced as necessary.

5.2.5.7. Porosity Plates

Visually inspect for corrosion, cracks, and damage on an annual basis. Perform Power washing on each screen prior to the annual inspection.

5.2.5.8. Dewatering Bulkheads

Inspect per HSS requirements.

5.2.5.9. Airburst System

Visually inspect for corrosion, cracks, compressed air leaks, and damage on a monthly basis. Items that are damaged should be reported and replaced by authorized personnel. Airburst solenoids should be exercised once a month. The operator should verify the function of each solenoid and report non-functioning solenoids.

Annual maintenance should also include airburst manifold inspection. Occasionally airburst nozzles loosen and are lost. A visual inspection of the nozzle array when the intake screens are removed for maintenance is necessary. Report missing nozzles to authorized repair personnel; lost nozzles should be replaced prior to placing the airburst system back into service.

5.2.5.10. AWS Gate

Inspect per HSS requirements.

5.2.6. Fish Sorting Equipment

5.2.6.1. Fish Transport Flume

Visually inspect for corrosion, cracks, leaks, and damage on a monthly basis. Items that are damaged should be reported and replaced as needed. Monitor leaks and report if deemed excessive or a threat to equipment or operator safety.

5.2.6.2. Switch Gates

Visually inspect for corrosion, cracks, leaks, and damage on a monthly basis. Items that are damaged should be reported and replaced as needed. Monitor water leaks and report if deemed excessive or a threat to equipment or operator safety. Report compressed air leaks for immediate repair. Cycle each switch gate three times every month.

5.2.6.3. Anesthetic Tank

Visually inspect for corrosion, cracks, leaks, and damage on a monthly basis. Items that are damaged should be reported and replaced as needed. Water leaks should be repaired immediately as it could lead to accelerated anesthetic dilution or fish un-watering and low dissolved oxygen levels. Report compressed air leaks for immediate repair. If freezing temperatures are expected crack the tank fill valve to keep pipe from freezing. Cycle the anesthetic tank brail three times every two weeks with water in the tank. Empty the tank using the drain pump this will serve to exercise the pump.

5.2.6.4. Sort Table

Visually inspect for corrosion, cracks, leaks, and damage on a monthly basis. Items that are damaged should be reported and replaced as needed. If freezing temperatures are expected crack each flume supply valve to keep the pipes from freezing.

5.2.6.5. Recovery Tank

Visually inspect for corrosion, cracks, leaks, and damage on a monthly basis. Items that are damaged should be reported and replaced as needed. If freezing temperatures are expected crack the tank fill valve to keep the pipes from freezing. Cycle the recovery tank brail three times every two weeks.

5.2.6.6. Recovery Tank False Weir

Visually inspect for corrosion, cracks, leaks, and damage on a monthly basis. Items that are damaged should be reported and replaced as needed. Monitor leaks and report if deemed excessive or a threat to equipment or operator safety. The recovery tank false weir pump should be exercised every two weeks. Unusual performance or noise should be reported immediately. If freezing temperatures are expected crack the flume supply valve to keep the pipe from freezing. Cycle the recovery tank brail three times every two weeks.

See Contractor provided Operation and maintenance manual Volume 2

5.2.6.7. Spawning Table

Visually inspect for corrosion, cracks, and damage on a monthly basis. Items that are damaged should be reported and replaced as needed.

5.2.7. Fish Transfer and Loading Equipment

5.2.7.1. Hopper Hoist

Visually inspect for corrosion, cracks, and damage on a monthly basis. Items that are damaged should be reported and replaced by authorized personnel. The hopper hoist maintenance is performed per manufacturer's recommendations. Reference EM 385-1-1 for additional requirements related to safe operation of a monorail crane.

See Contractor provided Operation and maintenance manual Volume 2

5.2.7.2. Hopper Loading Structure

Visually inspect for corrosion, cracks, and damage on a monthly basis. Items that are damaged should be reported; items are replaced by authorized personnel only.

5.2.7.3. Hopper 1 – Fish truck

Visually inspect for corrosion, cracks, leaks, and damage on a monthly basis. Items that are damaged should be reported and replaced as needed. Monitor leaks and report if deemed excessive or a threat to equipment or operator safety.

5.2.7.4. Hopper 2 – Spawning

Visually inspect for corrosion, cracks, leaks, and damage on a monthly basis. Items that are damaged should be reported and replaced as needed. Monitor leaks and report if deemed excessive or a threat to equipment or operator safety. Report compressed air leaks for immediate repair. Cycle the brail three times every two weeks.

5.2.7.5. Hopper #2 – False Weir

Visually inspect for corrosion, cracks, leaks, and damage on a monthly basis. Items that are damaged should be reported and replaced as needed. Monitor leaks and report if deemed excessive or a threat to equipment or operator safety. The false weir pump should be exercised every two weeks. Unusual performance or noise should be reported immediately. If freezing temperatures are expected crack the flume supply valve to keep the water supply pipe from freezing.

See Contractor provided Operation and maintenance manual Volume 2

5.2.7.6. Fish Truck

5.2.8. East Retaining Wall Structure

Visually inspect the concrete surface for surface damage annually. All steel features such as work platforms, walkways, personnel guard rails, Crowder rails, metal doors and the steel stairs should be inspected for corrosion. All connection fasteners for the work platforms and walkway system should be inspected and any corroded bolts replaced in kind as needed. Repaint or repair galvanizing as needed.

5.2.9. West Retaining Wall Structure

Visually inspect the concrete surface for surface damage annually. All steel features such as work platforms, walkways, personnel guard rails, Crowder rails, metal doors and the steel stairs should be inspected for corrosion. All connection fasteners for the work platforms and walkway system should be inspected and any corroded bolts replaced in kind as needed. Repaint or repair galvanizing as needed.

5.2.9.1. AWS Conduit

Visually inspect the interior concrete surface for surface damage annually.

5.2.10. Ancillary Structures

5.2.10.1. Emergency Generator Structure

The structure should be visually inspected for corrosion spots or peeling paint in the metal roof and support columns and beams. Corrosion on metal items should be cleaned and metal surfaces recoated with materials as needed to match the initial coating. All fasteners shall be checked for corrosion and replaced in kind as needed.

5.2.10.1.1. Diesel Generator

Visually inspect the generator and piping for leaks.

See Contractor provided Operation and maintenance manual Volume 4

5.2.10.1.2. Fuel Storage System

Visually inspect for corrosion, cracks, leaks, and damage on a monthly basis. Items that are damaged should be reported and only replaced by authorized personnel. Report and remediate hazardous materials. The Fuel level should not get below 2/3 full. Water will accumulate in the fuel supply system drain periodically per generator manufacturer recommended interval.

See Contractor provided Operation and maintenance manual Volume 4

5.2.10.2. Maintenance Building

The structure should be visually inspected for corrosion spots or peeling paint in the metal roof and support columns and beams. Corrosion on metal items should be cleaned and metal surfaces recoated with materials as needed to match the initial coating. All fasteners shall be checked for corrosion and replaced in kind as needed.

5.2.10.3. Site Host Structure

The cover structure should be visually inspected for corrosion spots or peeling paint in the metal roof and support columns and beams. Corrosion on metal items should be cleaned and metal surfaces recoated with materials as needed to match the initial coating. All fasteners shall be checked for corrosion and replaced in kind as needed.

5.2.10.3.1. Power Pedestal

This pedestal should be visually inspected on an annual basis. Report any unusual damage or functionality.

5.2.10.3.2. Potable Water

5.2.10.4. IPS Stairwell Access Structures

The structures should be visually inspected for corrosion spots or peeling paint in the metal roof and support columns and beams. Corrosion on metal items should be cleaned and metal surfaces recoated with materials as needed to match the initial coating. All fasteners shall be checked for corrosion and replaced in kind as needed.

5.2.10.5. Post-Sort Shade Structures

The structures should be visually inspected for corrosion spots or peeling paint in the metal roof and support columns and beams. Corrosion on metal items should be cleaned and metal surfaces recoated with materials as needed to match the initial coating. All fasteners shall be checked for corrosion and replaced in kind as needed.

5.2.11. Storm Water Absorption Swale

The storm water absorption swale should be regularly cleared of trash, debris, poisonous plants and an overgrowth of vegetation. Regularly check the overflow culvert for debris blockage at a minimum of once after every large storm event. Any pollutants, specifically oil, should be immediately cleaned with absorbent pads and disposed of properly. Sedimentation greater than 0.16 feet (2 inches) needs to be cleaned out to designed pond shape and depth. In the case of sedimentation, specific attention needs to be focused on keeping the catch basin clear. If erosion more than two inches deep occurs, slopes need to be stabilized through rock reinforcement, planting of grass or compaction. Most likely the only erosion that will occur will be the relocation of the conveyance ditch aggregate. If the aggregate begins to mound, it should be redistributed to a thickness of six inches over the whole swale, including the side slopes. If six inches is not achievable with the remaining material, more aggregate similar to the original (3/4 inch to 3 inch diameter) should be brought in and placed. Rodent holes should be repaired and the rodents removed. If settlement of four inches or more than the design elevation occurs, the source needs to be determined by a licensed civil engineer and resolved.

5.2.12. Sanitary Sewer System

5.2.12.1. Septic Tank

Refer to manufacturers O&M manual for pump maintenance.

See Contractor provided Operation and maintenance manual Volume 2

5.2.12.2. Pressure Sewer Line and Pumps

See Contractor provided Operation and maintenance manual Volume 2

5.2.13. Potable Water System

5.2.13.1. Water Well

See Contractor provided Operation and maintenance manual Volume 1

5.2.13.2. Hydro-pneumatic Tank

Periodic testing of double check valves may be required by Lane County. Replace filters as required.

See Contractor provided Operation and maintenance manual Volume 1

Chapter 6: Trouble Analysis

6.1. Alarms

See Table 6.1 for the Minto Fish Collection Facility Alarm Summary.

6.2. Outside Plant Alarms

See Table 6.2 for the Outside Plant Alarms.

6.3. Trouble Shooting

See Contractor supplied O&M manual volumes 1-7 for troubleshooting procedures.

MINTO FISH COLLECTION FACILITY ALARM SUMMARY

Draft Version. Last Updated September 27 2016

GRAPHIC TERMINAL (HMI) ALARM TEXT	ALARM DESCRIPTION	POSSIBLE CAUSE OR ADDITIONAL INFORMATION	ALARM DELAY	HORN	* AUTO DIALER
ANALOG SENSORS					
LIT.001A Error (Tailrace)	Ultrasonic Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LIT.003A Error (Pool 1)	Ultrasonic Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LIT.006A Error (Pool 52)	Ultrasonic Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
PIT.001A Error (FWS Pump Outlet)	Pressure Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
FIT.001 Error (FWS Pump Outlet)	Flow Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LIT.002 Error (Juvenile Chnl)	Ultrasonic Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LIT.012 Error (E.Forebay)	Ultrasonic Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LIT.008 Error (W.Forebay)	Ultrasonic Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LT.011 Error (E.IntakeScreen)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LT.009 Error (W.IntakeScreen)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LT.010 Error (E.IntakeConduit)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LT.007 Error (W.IntakeConduit)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LIT.004 Error (Diffusion Chamber)	Ultrasonic Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LT.005 Error (AWS Conduit)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
Unused Analog Input Ch1.14	n/a	n/a	n/a		
Unused Analog Input Ch1.15	n/a	n/a	n/a		
LIT.001B Error (Tailrace)	Ultrasonic Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LIT.003B Error (Pool 1)	Ultrasonic Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LIT.006A Error (Pool 52)	Ultrasonic Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
PIT.001B Error (FWS Pump Outlet)	Pressure Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
PIT.020A Error (Air Receiver Tanks 1)	Pressure Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
PIT.020B Error (Air Receiver Tanks 2)	Pressure Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
PIT.020C Error (Air Receiver Tanks 3)	Pressure Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LIT.099 Error (Diesel Fuel Tank)	Fuel Level Transmitter Trouble	Model #TMS2000 Diesel Leak Detection System never configured correctly during construction	Disabled		
LT.013 Error (Raceway 1)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LT.014 Error (Raceway 2)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LT.015 Error (Raceway 3)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LT.016 Error (Raceway 4)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LT.017 Error (Raceway 5)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LT.018 Error (Raceway 6)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LT.019 Error (Raceway 7)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
LT.020 Error (Raceway 8)	Submersible Water Level Transmitter Trouble	No Power, Broken wire, Signal Out-of-Range, Out-of-Calibration, Device Failure, etc	Instant		
AWS GATE ACTUATORS (01 through 14)					
AWS Gate 01 PLC Rejected Stop Command	HMI or PLC generated command blocked.	Missing permissive from actuator or equipment malfunction. Contact software developer.	Instant		
AWS Gate 01 Actuator Rejected Stop Command	Actuator failed to halt within allotted time	Verify Rotork actuator general operation	5 Sec		
AWS Gate 01 PLC Rejected Close Command	HMI or PLC generated command blocked.	Missing permissive from actuator or equipment malfunction. Contact software developer.	Instant		
AWS Gate 01 Actuator Rejected Close Command	Actuator did not move within allotted time	Verify Rotork actuator general operation	5 Sec		
AWS Gate 01 Close Failure within Allotted Time	Actuator close cycle did not complete within allotted time	Verify Rotork Actuator limit switch settings and general operation	120 Sec		
AWS Gate 01 PLC Rejected Open Command	HMI or PLC generated command blocked.	Missing permissive from actuator or equipment malfunction. Contact software developer.	Instant		
AWS Gate 01 Actuator Rejected Open Command	Actuator did not move within allotted time	Verify Rotork actuator general operation	5 Sec		
AWS Gate 01 Open Failure within Allotted Time	Actuator open cycle did not complete within allotted time	Verify Rotork Actuator limit switch settings and general operation	120 Sec		
AWS Gate 01 Actuator Rejected Setpoint Mode	Command for Setpoint Positioning Mode Rejected.	Alarm could occur due to signal loss at 0 & 100% setpoint or when fully open/closed.	5 Sec		
AWS Gate 01 Actuator Internal Alarm	Actuator Internal Alarm Active While in Remote	Rotork Actuator Obstructed, Jammed, Thermal Overload, Low Battery, or Monitor Error.	Instant		
AWS Gate 01 Actuator Network Error	DeviceNet Communications Error	Cycle power at actuator before checking Devicenet bus power supply & PLC module.	30 Sec		
AWS Gate 01 Actuator Not in Remote	Actuator Selector Switch Not In Remote	Rotork Actuator Selector Switch in Stop or Local position	Instant		
ENTRANCE GATE ACTUATORS (01 through 02)					
Entrance Gate 01 Close Failure within Allotted Time	Actuator close cycle did not complete within allotted time	Verify Rotork Actuator limit switch settings and general operation	600 sec		
Entrance Gate 01 Open Failure within Allotted Time	Actuator open cycle did not complete within allotted time	Verify Rotork Actuator limit switch settings and general operation	600 sec		
Entrance Gate 01 Actuator Rejected Setpoint Mode	Command for Setpoint Positioning Mode Rejected.	Alarm could occur due to signal loss at 0 & 100% setpoint or when fully open/closed.	2 Sec		
Entrance Gate 01 Actuator Internal Alarm	Actuator Internal Alarm Active While in Remote	Verify Auma Actuator limit switch settings and general operation	Instant		
Entrance Gate 01 Actuator Network Error	DeviceNet Communications Error	Cycle power at actuator before checking Devicenet bus power supply & PLC module.	30 Sec		
Entrance Gate 01 Actuator Not in Remote	Actuator Selector Switch Not In Remote	Rotork Actuator Selector Switch in Stop or Local position	Instant		

PRESORT POOL VALVE ACTUATORS (01 through 02)					
Presort Valve 01 Actuator Internal Fault (Type 1)	Actuator Type 1 Fault (medium priority)	Check general operation of Limitorque actuator	Instant		
Presort Valve 01 Actuator Internal Fault (Type 3)	Actuator Type 3 Fault (high priority)	Check general operation of Limitorque actuator	Instant		
Presort Valve 01 Actuator Internal Alarm	Actuator Internal Alarm (low priority)	Check general operation of Limitorque actuator	Instant		
Presort Valve 01 Actuator Not in Remote	Actuator Selector Switch Not In Remote	Limitorque Actuator Selector Switch in Stop or Local position	Instant		
Presort Valve 01 Actuator Network Error	DeviceNet Communications Error	Cycle power at actuator before checking Devicenet bus power supply & PLC module.	30 Sec		
AIR BURST (SCREEN CLEANER) SYSTEM					
Airburst Rsvd Alarm	Reserved for Future	N/A	N/A		
Airburst Not in Auto	Screen Cleaning System not in Automatic Mode	Place Screen Cleaning System in Automatic Mode from Graphic Terminal	Instant	YES	YES
Airburst Cleaning Cycle Aborted	Screen Cleaning System Cycle Aborted	System switched from Automatic Mode, PLC I/O Error, Incomplete Sequence Occurred, Stop Cmd Rec'd	Instant		
Airburst Rsvd Alarm	Reserved for Future	N/A	N/A		
Airburst Invalid Zone Elevation	Forebay Level Sensor Error or Out of Range.	Verify Sensor LIT.012 is functioning correctly.	Instant		
Airburst #1 Sustained Very Low Pressure	Receiver Tank 1 Pressure is less than 35 psi	Verify Air Compressor is operable and confirm pressure transmitter is functioning correctly.	60 Sec	YES	YES
Airburst #2 Sustained Very Low Pressure	Receiver Tank 2 Pressure is less than 35 psi	Verify Air Compressor is operable and confirm pressure transmitter is functioning correctly.	60 Sec	YES	YES
Airburst #3 Sustained Very Low Pressure	Receiver Tank 3 Pressure is less than 35 psi	Verify Air Compressor is operable and confirm pressure transmitter is functioning correctly.	60 Sec	YES	YES
Airburst #1 Sustained Low Pressure	Receiver Tank 1 Pressure is less than 55 psi	Verify Air Compressor is operable and confirm pressure transmitter is functioning correctly.	120 Sec		
Airburst #2 Sustained Low Pressure	Receiver Tank 2 Pressure is less than 55 psi	Verify Air Compressor is operable and confirm pressure transmitter is functioning correctly.	120 Sec		
Airburst #3 Sustained Low Pressure	Receiver Tank 3 Pressure is less than 55 psi	Verify Air Compressor is operable and confirm pressure transmitter is functioning correctly.	120 Sec		
Airburst #1 Incomplete Sequence	Group 1 Cleaning Cycle did not complete within allotted time	Verify correct operation of Air Compressor. System may hang waiting for tanks to recharge.	180 Sec		
Airburst #2 Incomplete Sequence	Group 2 Cleaning Cycle did not complete within allotted time	Verify correct operation of Air Compressor. System may hang waiting for tanks to recharge.	180 Sec		
Airburst #3 Incomplete Sequence	Group 3 Cleaning Cycle did not complete within allotted time	Verify correct operation of Air Compressor. System may hang waiting for tanks to recharge.	180 Sec		
Airburst #1 PLC or Power Supply Fault	Group 1 Screen Cleaner Cabinet Power Missing	Check Cabinet No.1 120VAC supply. Otherwise check PLC Input Modules Local:6 and Local:10	Instant		
Airburst #2 PLC or Power Supply Fault	Group 2 Screen Cleaner Cabinet Power Missing	Check Cabinet No.2 120VAC supply. Otherwise check PLC Input Modules Local:6, Local:10, & Local:11	Instant		
Airburst #3 PLC or Power Supply Fault	Group 3 Screen Cleaner Cabinet Power Missing	Check Cabinet No.3 120VAC supply. Otherwise check PLC Input Modules Local:6 and Local:11	Instant		
Airburst Diff-Pressure Out of Tolerance	East of West Screens: Differential outside range -3.0 to +3.0 Ft.	Check East Level Transmitters (LIT.012 and LT.011) and West Level Transmitters (LIT.008 and LT.009)	300 Sec		
Airburst Screen Dirty High Differential	East or West Screens: River to Intake Differential > 1.0 ft	Temporarily close AWS gates and perform airburst cleaning. Otherwise perform mechanical cleaning	300 Sec	YES	YES
Airburst Screen Dirty Very High Differential	East or West Screens: River to Intake Differential > 2.0 ft	Temporarily close AWS gates and perform airburst cleaning. Otherwise perform mechanical cleaning	5 Sec	YES	YES
Airburst Screen Dirty AWS Auto-Shutdown	East or West Screens: River to Intake Differential > 3.0 ft	Temporarily close AWS gates and perform airburst cleaning. Otherwise perform mechanical cleaning	30 Sec	YES	YES
POST SORT POOLS (RACEWAYS 1 through 8)					
Raceway 1 Water Level Low	Water Depth Below Setpoint	Check Pond Water Level, adjust setpoint, or disable alarm if raceway not in use	30 Sec	YES	YES
Raceway 1 Water Level High	Water Depth Above 7.0 Feet	Check Pond Water Level or disable alarm if raceway not in use	60 Sec	YES	YES
FWS PUMP VARIABLE SPEED DRIVE (VFD 001 through VFD 005)					
VFD.001 Network Error	Ethernet Error	Check VFD power & Ethernet switch within main PLC cabinet	30 Sec		
VFD.001 Internal Alarm/Fault	Internal Alarm or Fault Detected	Check VFD fault and alarm logs for specific error code(s)	Instant		
VFD.001 Disabled or SW not in Auto	Unit without power or Unit switch not in AUTO.	Check VFD Selector Switch and 480VAC power supply	5 Sec		
VFD.001 Stop Failure Timeout	Unit not at zero speed within allotted time	Verify general operation of VFD. Drive active feedback includes deceleration (controlled stop)	35 Sec		
VFD.001 Start Failure Timeout	Unit did not run within allotted time	Verify general operation of VFD. Drive power stage enabled and run command accepted	1.1 Sec		
DIESEL GENERATOR AND TRANSFER SWITCH					
Genset Bkr Invalid State	Circuit Breaker Status Conflict	Check device & wiring, as unit cannot be both open & closed at the same time	1 Sec		
Genset Not In Auto Mode	Selector Switch not in Auto position	Check generator circuit breaker selector switch	Instant		
Genset Not Ready	Diesel Generator not Ready to Run	Check general operation of diesel generator. Reference OEM manual	Instant		
Genset Running	Diesel Generator Running	Check normal utility power source	Instant		
Genset Battery Low	Diesel Generator Battery Low	Check battery voltage	Instant		
Genset Internal Alm	Diesel Generator Internal Alarm	Check unit for cause of alarm. Reference OEM manual	Instant		
Genset Internal Fault	Diesel Generator Internal Fault	Check unit for cause of fault. Reference OEM manual	Instant		
Genset High Temp	Diesel Generator High Temperature	Check unit for cause of alarm. Reference OEM manual	Instant		
Genset Low Oil Pressure	Diesel Generator Low Oil Pressure	Check unit for cause of alarm. Reference OEM manual	Instant		
Genset Overcrank Lockout	Diesel Generator Lockout on Overcrank Attempts	Check unit for cause of lockout. Reference OEM manual	Instant		
ATS Not in Auto	Automatic Transfer Switch not in Automatic Mode	Check unit selector switch	Instant		
ATS Switched to Emergency	Automatic Transfer Switch switched to Diesel Generator	Normal condition after utility power has been lost	Instant		
ATS Invalid State	Automatic Transfer Switch Status Conflict	Check device & wiring, as unit cannot be both open & closed at the same time	1 Sec		
ENTRANCE GATE CONTROL					
Entrance Gate Controller at Limit	PLC Output is at Upper (100%) or Lower Limit (20%)	The position command to the gate actuator is stuck at the upper limit (100%) or lower limit (20%)	300 Sec		
Entrance Gate Forced to Manual	Unscheduled event caused jump from Auto to Manual Mode	LIT.001 or LIT.003 error, DeviceNet error, Actuator alarm, Power loss, or Selector switch not in remote	Instant		
Entrance Gate Level Out of Tolerance	System Water Level is at Upper or Lower Limit	Pool 1 Water Level (LIT.003) is less than 1.0 Ft or greater than 1.5 Ft (SP=1.25 Ft.)	300 Sec	YES	
Entrance Gate Operating in Manual	System is being operated in manual instead of automatic mode	Place Entrance gate control in automatic mode	60 Sec		
Entrance Gate Return to Auto Attempted	Return to Auto Mode attempted after System Forced to Man	Power restored, Actuator & DeviceNet errors cleared, LIT.001/.003 functional, Actuator in "Remote"	240 Sec		
FWS PUMP CONTROL					

FWS Pumps Controller at Limit	PLC Output is at Upper (100%) or Lower Limit (78%)	If held at upper limit ensure addition pumps are available to run. If at lower limit only 2 pumps should run	600 Sec		
FWS Pumps Forced to Manual	Unscheduled event caused jump from Auto to Manual Mode	At least 1 pump running in hand, total pumps running /avail less than 2, PIT.001, VFD, or Ethernet Error(s)	Instant		
FWS Pumps PLC Rejected Start Cmd	PLC Reject Start Command from Graphic Terminal	No pumps shall be running in manual and at least one pump must be available when starting system	Instant		
FWS Only 1 Pump Running	Only 1 pump is running after system has been started.	Ensure at least two VFD's are energized with their selector switch in "auto" position	60 Sec	YES	YES
FWS No Pumps Running	No FWS pumps are running after system has been started.	Ensure at least two VFD's are energized with their selector switch in "auto" position	60 Sec	YES	YES
FWS Pressure Out of Tolerance	System Water Pressure is at Upper or Lower Limit	System Water Pressure (PIT.001) is less than 10 psi or greater than 14.0 psi	300 Sec	YES	YES
FWS Operating in Manual	System is being operated in manual instead of automatic mode	Place FWS pump control in automatic mode	60 Sec		
FWS Return to Auto Attempted	Return to Auto Mode attempted after System Forced to Man	480VAC Power Restored, PIT.001, VFD, & Ethernet Errors Cleared, no units running in hand/manual	60 Sec		
PRESORT POOL CONTROL					
Presort Pool 52 Level Out of Tolerance	Presort Pool Water Level at Upper or Lower Limit	Pool 52 Water Elev (LT.006) is less than 0.6 Ft or greater than 0.9 Ft	8 Hrs	YES	
AWS GATE CONTROL					
AWS Gates/Table Mismatch	Gate Position data does not match Controller Settings.	Check tailrace water level transmitters (LIT.001) & Gate Actuators for correct operation	1 Sec		
AWS Gates Forced to Manual	Unscheduled event caused jump from Auto to Manual Mode	Any Actuator has a loss of power , internal alarm, DeviceNet error, switch not remote, or LIT.001 error	Instant		
AWS Gates Invalid Case or State	Tailrace level outside allowed elevation (956.0 -- 975.0 Ft)	Check tailrace water level transmitters (LIT.001) for accurate measurement.	Instant		
AWS Gates Out of Sequence	Tailrace level has jumped beyond single increment/decrement	Check tailrace water level transmitters (LIT.001) for error or very sudden change in water level measurement	180 Sec		
AWS Gates Operating in Manual	System is being operated in manual instead of automatic mode	Place AWS Diffuser Gate system in automatic mode	60 Sec		
AWS Gates Return to Auto Attempted	Return to Auto Mode attempted after System Forced to Man	Power restored, All 14 Gate Actuator & DeviceNet errors cleared, LIT.001 functional, all actuator in "Remote"	180 Sec		
MISCELLANEOUS HARDWARE ALARMS					
PLC I/O Module Fault	Main PLC cabinet I/O module has faulted	Possible PLC hardware failure. Examine Modules in Chassis and go on-line with PLC to determine cause	Instant		
PLC 24VDC Power Supply Off	Main PLC cabinet Power Supply Not Detected	Check power supply plus fuses and/or circuit breakers	Instant		
PLC UPS Battery Low	Main PLC cabinet UPS Battery is Low.	Check UPS Battery	30 Sec		
Sewage Lift Station Pump Failure	Sewage Lift Station Pump Tripped or Failed to Run	Check Overload Relay and Current Sensing Relay within Lift Station Cabinet	60 Sec		
Sewage Lift Station High Level	Sewage Lift Station High Level	Check Lift Station Level	60 Sec		
IPS Sump Lag Pump On	Intake Pump Structure Sump Lag Pump Running	Investigate why lead pump cannot keep-up with sump in-flow	120 Sec		
IPS Sump High	Intake Pump Structure Sump High Water Level	Check IPS for flooding	120 Sec	YES	YES
IPS Sump Pump1 Overload	Intake Pump Structure Lead Sump Pump Tripped on Overload	Check motor for overload condition. Pump/motor shaft may not freely rotate	120 Sec	YES	YES
IPS Sump Pump2 Overload	Intake Pump Structure Lag Sump Pump Tripped on Overload	Check motor for overload condition. Pump/motor shaft may not freely rotate	120 Sec	YES	YES
IPS Sump Pump1 Not in Auto	Intake Pump Structure Lead Sump Pump Not in Auto Mode	Check power and selector switch on sump pump controller cabinet door	120 Sec	YES	YES
IPS Sump Pump2 Not in Auto	Intake Pump Structure Lag Sump Pump Not in Auto Mode	Check power and selector switch on sump pump controller cabinet door	120 Sec	YES	YES
Washdown Pump Not in Auto	Washdown Pump Not in Automatic Mode	Check power and selector switch on washdown pump controller cabinet door	5 Sec		
Washdown Pump Overload	Washdown Pump Tripped on Overload	Check motor for overload condition. Pump/motor shaft may not freely rotate	Instant		
Compressor Not in Auto	Air Compressor Not in Automatic Mode	Place Air Compressor in Automatic Mode	5 Sec	YES	YES
Compressor Trouble	Air Compressor Tripped on Overload or Phase Monitor Relay	Check Overload Relay, Input Voltage, and Phase Monitor Relay within Compressor Cabinet	60 Sec	YES	YES
Forebay Redundant Level Sensor Trouble	Trouble with Forebay Sensors East (LIT.012) & West (LIT.008)	Variation between sensors greater than 1.0 ft or measured elevation less than 972 or greater than 988 Ft	30 Sec		
Tailrace Redundant Level Sensor Trouble	Trouble with Redundant Sensors (LIT.001A/B)	Variation between sensors greater than 0.5 ft or measured elevation less than 956 or greater than 976 Ft	120 Sec	YES	
Pool 1 Redundant Level Sensor Trouble	Trouble with Redundant Sensors (LIT.003A/B)	Variation between sensors greater than 0.75 ft or measured elevation less than 956 or greater than 976 Ft	120 Sec	YES	
Pool 52 Redundant Level Sensor Trouble	Trouble with Redundant Sensors (LIT.006A/B)	Variation between sensors greater than 0.5 ft or measured elevation less than 955 or greater than 1005 Ft	120 Sec	YES	
Power Meter Trouble or Network Error	Internal Power Meter Error or Ethernet Error	Check Ethernet Switches, Power Supply, Fiber Optic Cables, Patch Cables, etc	Instant		
River Level Low	River Water Level below 973.7 Ft.	Verify River Level and operation of Forebay Sensors East (LIT.012) & West (LIT.008)	30 Sec		
River Level High	River Water Above below 985.0 Ft.	Verify River Level and operation of Forebay Sensors East (LIT.012) & West (LIT.008)	30 Sec		
Fuel Cleaning System Trouble	Diesel Fuel Maintenance System Trouble	Check OEM drawings and manual	60 Sec		
Remote I/O Trouble	Remote I/O cabinet PLC module has faulted	Possible PLC hardware failure. Examine modules and go on-line with PLC to determine cause	Instant		
Remote I/O UPS Battery Low	Main PLC cabinet UPS Battery is Low.	Check power supply and OEM manual	90 Sec		
FWS Redundant Pressure Sensor Trouble	Trouble with Redundant Sensors (PIT.001A/B)	Variation between sensors greater than 0.50 psi or measured pressure less than -1.0 or greater than 20 ps	30 Sec		

* 5 Minute Delay after horn before autodialing phone numbers

Minto FCF Outside Plant Alarms 9/27/2016

Process Alarms	Setpoint	Alarm Condition 1	Alarm Condition 2	Alarm Condition 3	Delay	HORN	** DIALER
Entrance Gate Differential Out of Tolerance	1.25 ft	1.0 Ft Low	1.5 ft High	N/A	5 Min	Y	N
PreSort Pool 52 Level Out of Tolerance	0.75 ft	0.6 ft Low	0.9 ft High	N/A	8 Hrs	Y	N
FWS Pressure Out of Tolerance	12.0 psi	10.0 ft Low	14.0 psi High	N/A	5 Min	Y	Y
Analog Sensor Alarms							
Tailrace Redundant Level Sensor Trouble		both sensors failed or at limits	Varition > 0.50 ft	956 > Elev > 0976	2 Min	Y	N
Pool 1 Redundant Level Sensor Trouble		both sensors failed or at limits	Varition > 0.75 ft	956 > Elev > 0976	2 Min	Y	N
Pool 52 Redundant Level Sensor Trouble		both sensors failed or at limits	Varition > 0.75 ft	955 > Elev > 1005	2 Min	Y	N
Discrete Alarms							
FWS No Pumps Running		Pumps Running = 0			1 Min	Y	Y
FWS Only 1 Pump Running		Pumps Running = 1			1 Min	Y	Y
Airburst #1 Sustained Very Low Pressure	35 Psi	Receiver Tank 1 Pressure < 35 Psi			1 Min	Y	Y
Airburst #2 Sustained Very Low Pressure	35 Psi	Receiver Tank 2 Pressure < 35 Psi			1 Min	Y	Y
Airburst #3 Sustained Very Low Pressure	35 Psi	Receiver Tank 3 Pressure < 35 Psi			1 Min	Y	Y
Airburst Screen Dirty High Differential	1.0 Ft	East or West Screens: River to Intake Diff > 1.0 ft			5 Min	Y	Y
Airburst Screen Dirty Very High Differentia	2.0 Ft	East or West Screens: River to Intake Diff > 2.0 ft			5 Sec	Y	Y
Airburst Screen Dirty AWS Auto-Shutdown	3.0 Ft	East or West Screens: River to Intake Diff > 3.0 ft			30 Sec	Y	Y
Airburst Not in Auto		Screen Clearning System not in Automatic Mode			None	Y	Y
Compressor Not in Auto		Air Compressor not in Automatic Mode			5 Sec	Y	Y
Compressor Trouble		OL Trip	Phase Monitor Trip	MCP Trip or No Pwr	1 Min	Y	Y
IPS Sump High		High Water Level			None	Y	Y
IPS Sump Pump1 Overload		Motor Overload			None	Y	Y
IPS Sump Pump2 Overload		Motor Overload			None	Y	Y
IPS Sump Pump1 Not in Auto		Selector Switch not in Auomatic Mode	No Power		None	Y	Y
IPS Sump Pump2 Not in Auto		Selector Switch not in Auomatic Mode	No Power		None	Y	Y
Raceway "X" Water Level Low	Variable	Water Depth Below Adjustable Setpoint			30 Sec	Y	Y
Raceway "X" Water Level high	7.0 Ft	Water Level > 7.0 Ft			60 Sec	Y	Y

** 5 Minute Delay after horn sounds before autodialing telephone numbers

Chapter 7: Corrective Maintenance and Checkout Procedures

Commissioning checklists are located in Appendix D and the Contractor supplied O&M manual Volume 8.