



## WATER RECYCLING FACILITY MASTER PLAN - 2025



**WATERWORKS**  
ENGINEERS

July 2025



# Ironhouse Sanitary District Water Recycling Facility Master Plan

Date: July 2025  
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Appendix A – Capital Improvement Project Cost Estimates

Appendix B – Equipment Proposals

## 1.0 Document Purpose

The over-arching purpose of this Master Plan document is to:

- Document the existing treatment system including the operations and capacity of each process unit
- Summarize recent operations and treatment plant performance
- Identify the need for expansion of capacity to serve future buildout of the service area
- Summarize the results of recent plant condition assessment inspections
- Identify capital improvement projects necessary for continued operation of the WRF

Each section of this report is dedicated to one main unit treatment process for the plant, moving from the influent pump station at the head of the plant through the effluent pump station at the end of the plant including all ancillary processes.

## 2.0 Water Recycling Facility Overview

### 2.1 ISD Service Area

Ironhouse Sanitary District (ISD) owns and operates both a sewer collection system and a Water Recycling Facility in order to treat wastewater generated within ISD’s service area prior to discharge in accordance with the requirements of the current National Pollutant Discharge Elimination System (NDPES) permit issued by the Regional Water Quality Control Board (RWQCB). ISD’s service area includes the City of Oakley as well as Bethel Island in eastern Contra Costa County. The service area is bounded by the San Joaquin River to the north, Highway 160 to the west, and the City of Brentwood to the South, as shown in **Figure 2.1** below. The sewer collection system includes over 140 miles of gravity pipelines and 19 miles of force mains from 31 lift stations.

#### 2.1.1 Service Area Population

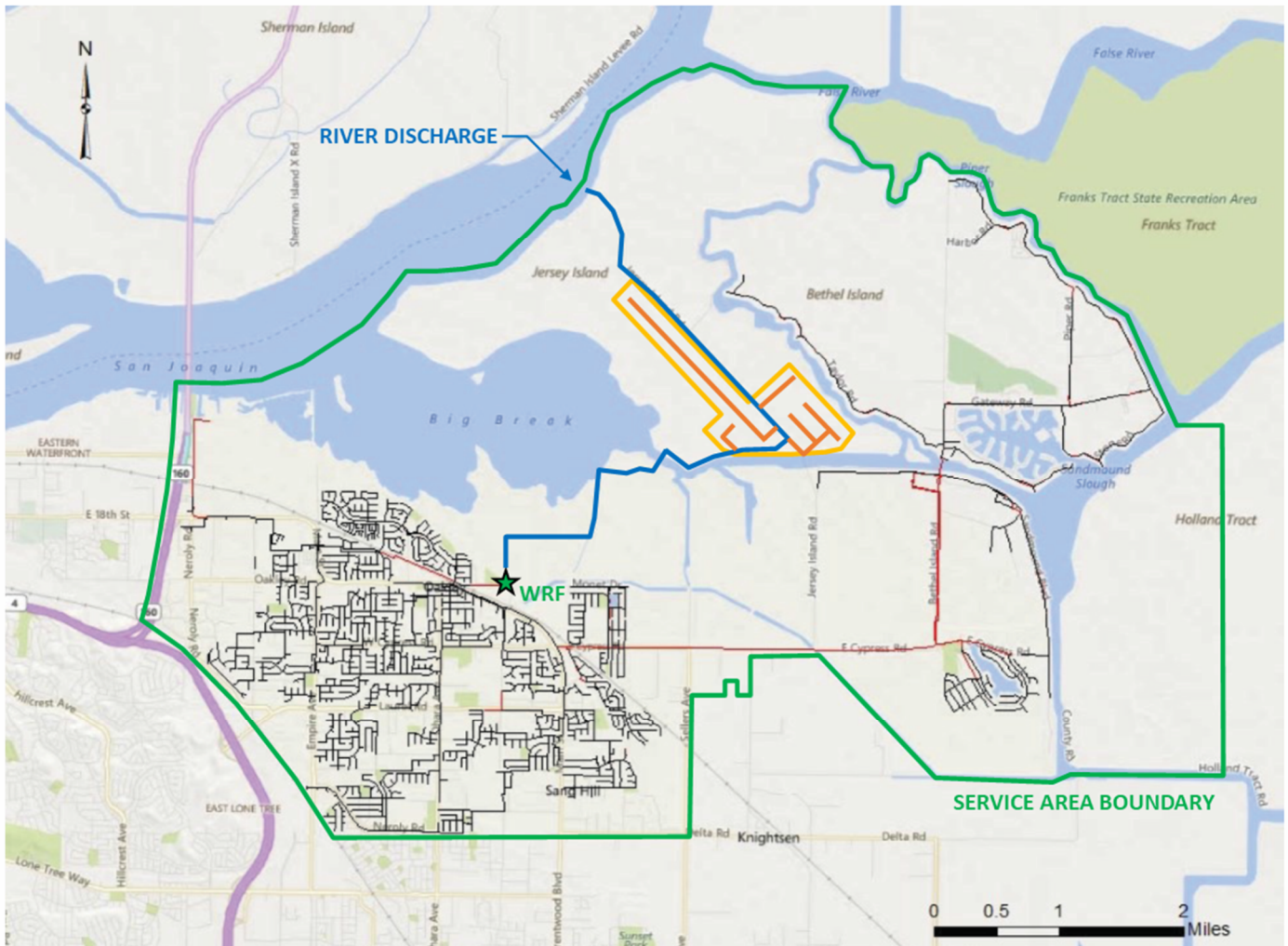
As of 2023 the City of Oakley population was 45,761 and the Bethel Island Population was 2,131 people. ISD serves approximately 98% of the City of Oakley population, as some homes are still on septic systems. The 2023 estimated total ISD service area population was 46,977 people. From 2020-2023, the City of Oakley was adding approximately 800-825 people a year to its population. So therefore the estimated 2024 total service area population is 47,800.

The 2022 City of Oakley General Plan states that the buildout population for the City of Oakley is 70,797. With a 2024 estimated population of 46,586, this represents an estimated additional 24,211 residents to buildout.

Further, there is expected additional growth on Bethel Island, which is outside of the City of Oakley’s boundaries and not included in the 2022 General Plan. Per a December 2024 Water Demand Projection completed by Diablo Water District, the Delta Coves Project on Bethel Island will include 538 dwelling units once complete. As of the end of 2024, 297 of these units are estimated to be occupied by ISD, indicating that 241 more units will be added in the future. With an assumed population of 3.4 persons per dwelling unit (from Oakley General Plan), future growth on within Delta Coves is estimated to be 820 people. Outside of Delta Coves, Diablo Water estimates an additional ~1,470 people could be added with undefined small-scale infill or densification of existing parcels.

The buildout total population estimated served by ISD is 74,300. This represents a 55.4% growth from the current total service area population. If 850-900 people per year are added to the service area in following years, buildout would occur within 30 years. However buildout may occur sooner (20 years or less) if the pace of development increases. The planning horizon for the 2022 General Plan is stated as 2040 which assumes that development would accelerate significantly.

Sources of wastewater in the service area are primarily domestic but include a limited number of commercial connections (mostly food service establishments). No significant industrial users exist in the service area.



- SERVICE AREA BOUNDARY
- GRAVITY SEWER
- FORCE MAIN (not all force mains shown)
- EFFLUENT PIPELINE
- IRRIGATION / LAND APPLICATION PIPE (not currently in use)
- LAND APPLICATION AREA (application of treated effluent and biosolids is not currently practiced)

**Figure 2.1. ISD Service Area**

## 2.2 WRF Permits

The WRF was constructed in 2011 to replace an existing wastewater treatment facility that had reached its capacity and also could not comply with newer more stringent discharge limits. The WRF was designed for an average dry weather flow (ADWF) of 4.3 MGD with a peak wet weather flow (PWWF) of 8.6 MGD, with expansion capability to 6.8 MGD ADWF / 13.6 MGD PWWF in the future. Currently the WRF is receiving an average annual flow of approximately 2.75 MGD and ADWF of 2.60 MGD (last 3 year average). Treated effluent from the WRF had previously been land applied via irrigation of hay fodder fields for cattle grazing on Jersey Island during the months of May-September, and discharged directly to the San Joaquin River during the months of October-April. However, now treated effluent is directly discharged to the San Joaquin River year-round. Operation of the WRF is regulated by two permits issued by the Central Valley Regional Water Quality Control Board.

### 2.2.1 Direct Discharge to San Joaquin River: NPDES Order No: R5-2024-0038

The primary chemical and biological limits listed in the NPDES permit are summarized in **Table 2.1** below. These effluent limits only apply to Discharge to the San Joaquin River. This permit does not cover any discharges to land (covered by Order R5-2018-0050) or recycled water (covered by Order 2016-0068-DDW).

**Table 2.1 NPDES Permit Discharge Limit Summary**

Parameter	Units	Average Monthly	Average Weekly	Daily Maximum	Instantaneous (at any given time)
BOD <sub>5</sub>	mg/L	10	15	--	
TSS	mg/L	10	15	--	
Ammonia (as N)	mg/L	1.7	3.8	--	
Nitrate + Nitrite (as N)	mg/L	10	13	--	
Copper, Total	µg/L	18	--	34	
Lead, Total	µg/L	7.5	--	23	
Total Coliform	MPN	--	2.2 / 100 mL *	23 / 100 mL **	240 / 100 mL
pH	SU	--	--	--	6.5 – 8.5

\*as a 7-day median    \*\* more than once in any 30-day period

Other key permit requirements include:

1. **Percent Removal** – The average monthly percent removal of BOD<sub>5</sub> and TSS shall not be less than 85%.
2. **Temperature** – Effluent shall not exceed the natural receiving water (San Joaquin River) by more than 20 °F.
3. **Dissolved Oxygen** – Effluent shall not cause natural receiving water (San Joaquin River) dissolved oxygen concentration to be reduced below 5.0 mg/L at any time.
4. **Methylmercury** – Total Methylmercury shall not exceed 8.65 grams/year until December 30<sup>th</sup>, 2030 at which time the limit will be 0.030 grams/year on a calendar year average.
5. **Filtration Performance** – Filter Effluent shall not exceed 0.2 NU more than 5% of the time in a 24-hour period and 0.5 NTU at any time.
6. **UV Disinfection System Operation Requirements -**
  - a. Provide minimum hourly UV dose per channel of 80 mJ/cm<sup>2</sup> at peak daily flow
  - b. The UVT (@ 254 nanometers) in the wastewater exiting the UV disinfection system shall not fall below 55 percent at any time.

The NDPEs permit allows for discharge of treated effluent to the San Joaquin River year-round.

### 2.2.2 Land Application on Jersey Island: WDR Order No: R5-2018-0050

WDR Order R5-2018-0050 amends ISD’s previous WDR Order No. R5-2013-0010 for discharges of waste to land and includes effluent and biosolids.

A summary of the discharge limits from the WDR is provided in in **Table 2.1** below.

**Table 2.2. WDR Permit Discharge Limit Summary**

Parameter	Units	Average Monthly	Maximum Daily
BOD <sub>5</sub>	mg/L	20	--
Total Nitrogen	mg/L	15	--
pH	mg/L	--	6.5 – 10.0
Total Coliform	MPN	23 / 100 mL (median monthly)	240 / 100 mL (one time max per month)

The permit also requires the following:

- **Mass Loading Limitations** – The total nitrogen mass loading to the LAAs shall not exceed the agronomic rates for the crops grown.
- **BOD<sub>5</sub> Mass Loading Limitations** –
  - a. 300 lbs/acre on any single day
  - b. 100 lbs/acre as a 7-day average

The permit also specifies that irrigation shall not be performed during rainfall or when the ground is saturated, and shall not result in runoff from the application area. During the winter, the land application area on Jersey Island can be saturated at times depending on the weather because Jersey Island is below the flow level of the San Joaquin River and has shallow groundwater particularly in the winter.

The District decided to stop land application of treated effluent in 2020 on Jersey Island and biosolids in early 2025 and is planning on selling Jersey Island in the near future.

### 2.2.3 Recycled Water Permit: Enrollee in General Order 2016-0068-DDW

ISD was originally enrolled in 2015 into General Order 2014-0090-DDQ, and then rolled over into 2016-0068-DDW, which replaced and improved 2014-0090-DDQ. The recycled water General Order establishes standard conditions for recycled water use and delegates authority to the Water Recycling Program (in this case ISD) to issue water recycling permits to recycled water users. No potable reuse, whether indirect or direct, is authorized under the General Order with only the following categories of recycled water allowed:

- Undisinfected Secondary Recycled Water (Cal. Code Regs., tit. 22, § 60301.900.)
- Disinfected Secondary-23 Recycled Water (Cal. Code Regs., tit. 22, § 60301.225.)
- Disinfected Secondary-2.2 Recycled Water (Cal. Code Regs., tit. 22, § 60301.220.)
- Disinfected Tertiary Recycled Water (Cal. Code Regs., tit. 22, § 60301.230.)

Beyond the quality of the recycled water listed above, this permit requires:

- **Agronomic Application:** Recycled water used for irrigation purpose (regardless of applicator) must be applied at agronomic rates (i.e. limit nutrient application to that which is required by the crop).
- **Salt and Nutrient Management Plan:** Contribute funds and develop plans to comprehensively address all sources of salts and nutrients. This is now the CV-SALTS program. However the general order does not specifically call out salinity limits or enrollment in this program in lieu of salinity limits.
- **Primary Pollutant Monitoring:** Monitoring for primary pollutants (listed in Appendix A of 40 Code of Federal Regulations, Part 423) is required at the following frequencies:
  - Annual for recycled water flow > 1.0 MGD
  - Every five years for recycled water flow <1.0 MGD

#### 2.2.4 PFAS Monitoring: Enrollee in 2020-0015-DWQ

General Order 2020-0015-DWQ requires ISD to complete the following two tasks:

1. Conduct sampling and analysis for PFAS
  - a. Sampling quarterly for one year at the influent and effluent.
  - b. Sampling biosolids once.
  - c. Sampling at groundwater wells once.
    - i. Dischargers must provide rationale for groundwater monitoring well selection of at least three wells prior to sampling.
2. Complete questionnaire.

ISD completed these requirements in November of 2021 and per public water board records (CIWQS and GeoTracker) have no further requirements for testing under this General Order at this time.

### 2.3 WRF Treatment Process

The wastewater treatment process includes an influent pump station, perforated plate (3/16-inch or 4.8mm) primary screens, a vortex grit separator, 1.0 mm fine drum screens, Modified Ludzack-Ettinger (MLE) anoxic-aeration basins, membrane bioreactors, and UV disinfection. Biosolids are dewatered using belt-filter presses and currently land applied offsite as Class B biosolids. The WRF includes an emergency retention basin (South Pond) which can receive both diverted raw sewage in the case of a plant upset or equipment failure, and diverted treated effluent in the case of permit non-compliance. Water sent to the South Pond can drain by gravity back to the influent pump station.

The WRF also includes an effluent storage basin (North Pond) which had historically received treated effluent in the summer when effluent was being land applied, to allow for equalization when the land application irrigation equipment was not in operation. However, the use of treated effluent for irrigation was stopped in 2020 and the North Pond is currently not used. None of the infrastructure associated with it (piping, gates, etc.) has been removed from the plant.

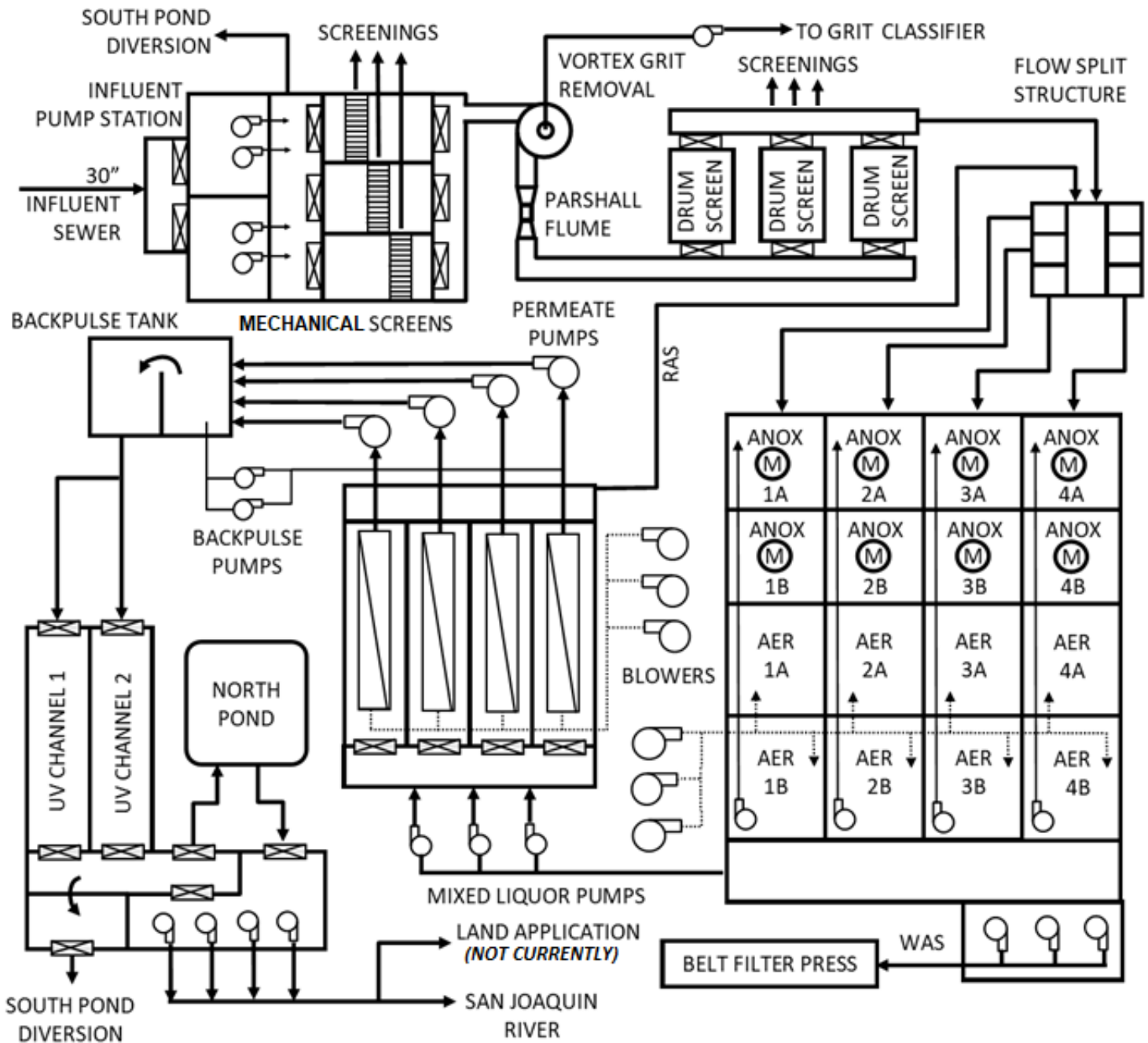
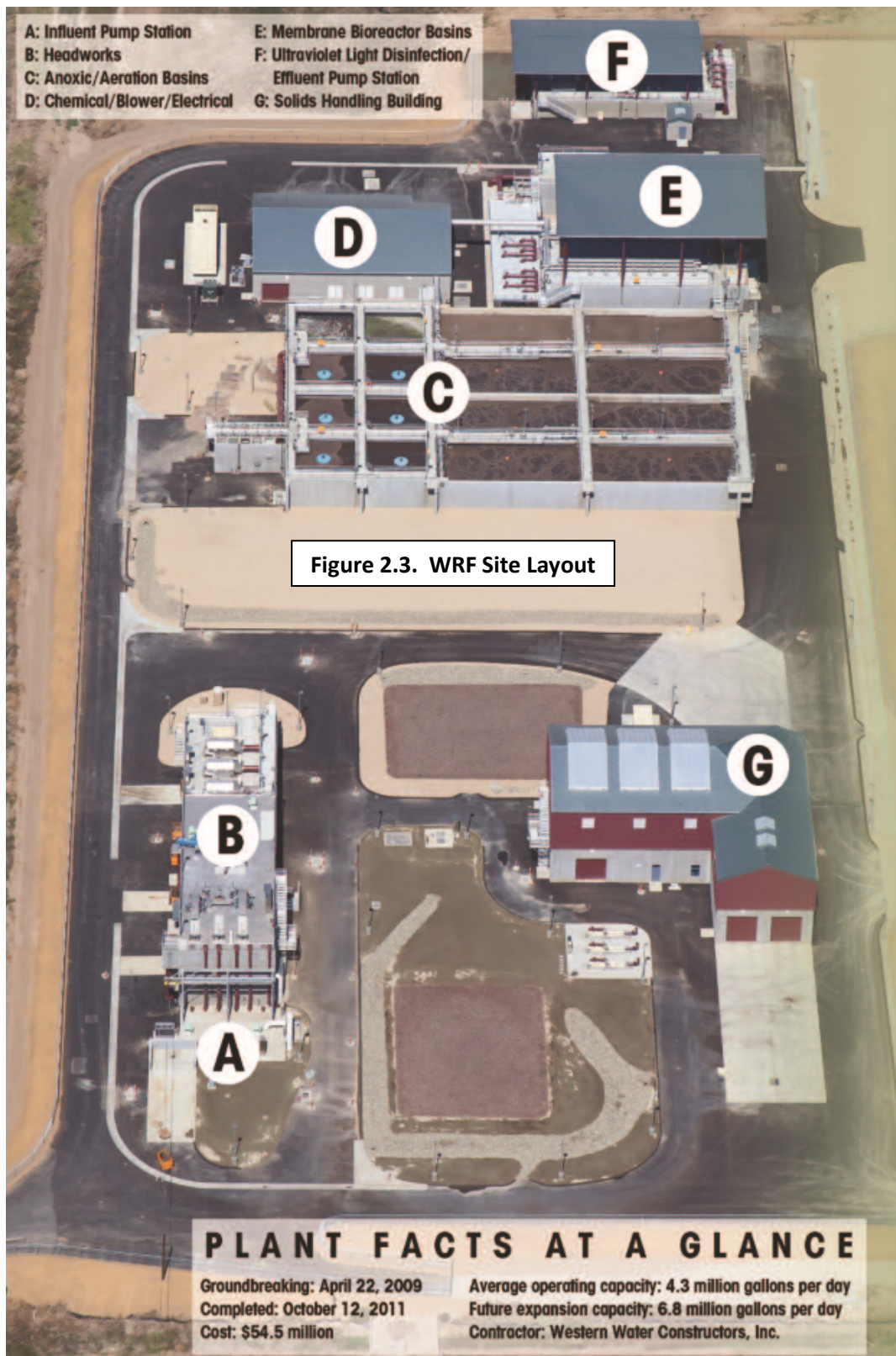


Figure 2.2. Simplified Wastewater Treatment Process Schematic

The WRF also includes the following support facilities which are not depicted in the process schematic above:

1. Plant utility water pumping and distribution system
2. Membrane cleaning chemicals (sodium hypochlorite and citric acid)
3. Odor control systems for the headworks and dewatering facilities
4. Alum feed system to improve UV transmittance during storm events
5. Generators for backup power

Figure 2.3 below shows the site layout of the WRF.



## 3.0 Influent Pump Station

### 3.1 Process Description

Raw wastewater enters the WRF Influent Pump Station through a 30-inch gravity sewer. The pump station has a divided wet well with two pumps in each wet well, and provisions to add a 3<sup>rd</sup> pump in each wet well. The pump station transfers the wastewater through individual pump discharge pipes into the influent screenings channel.

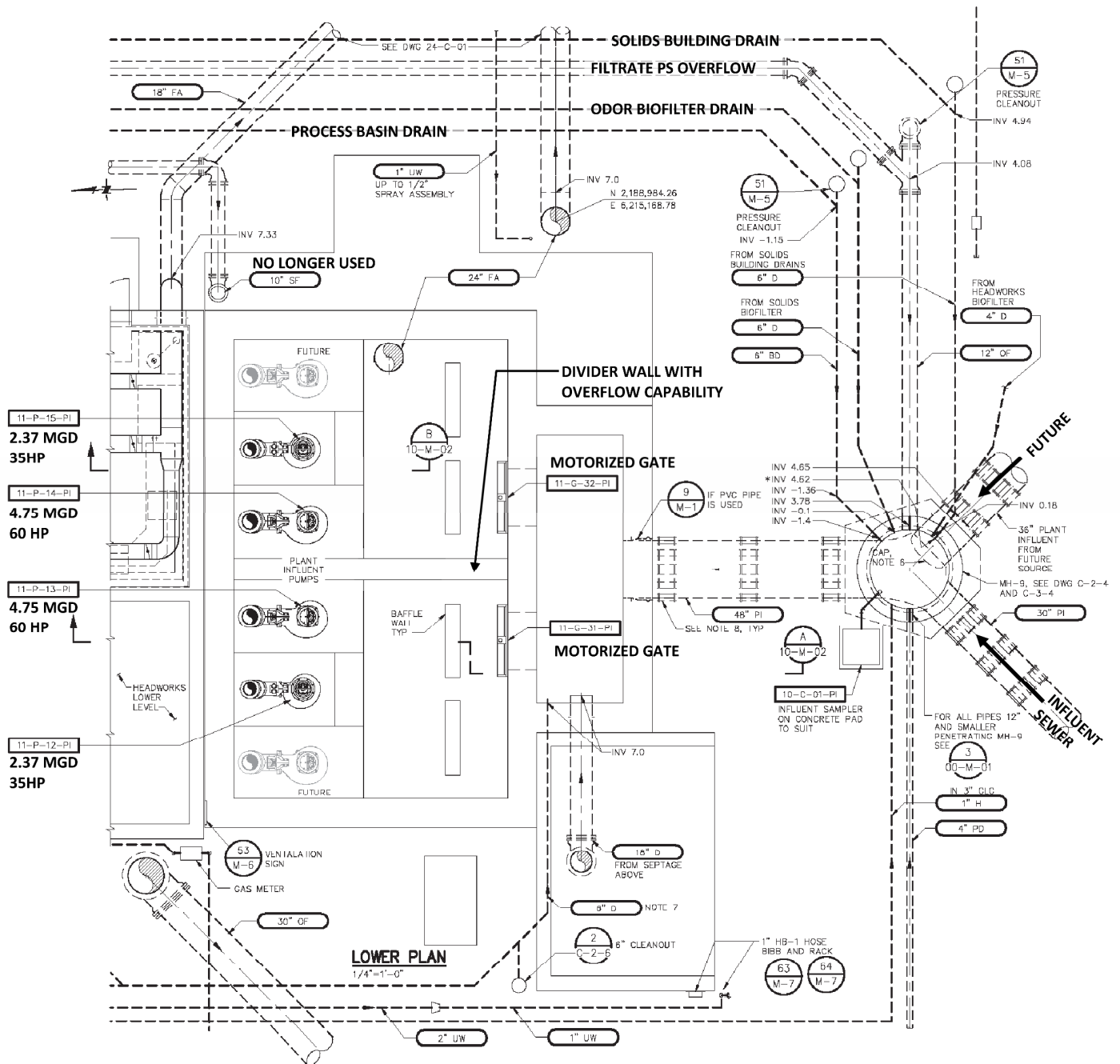
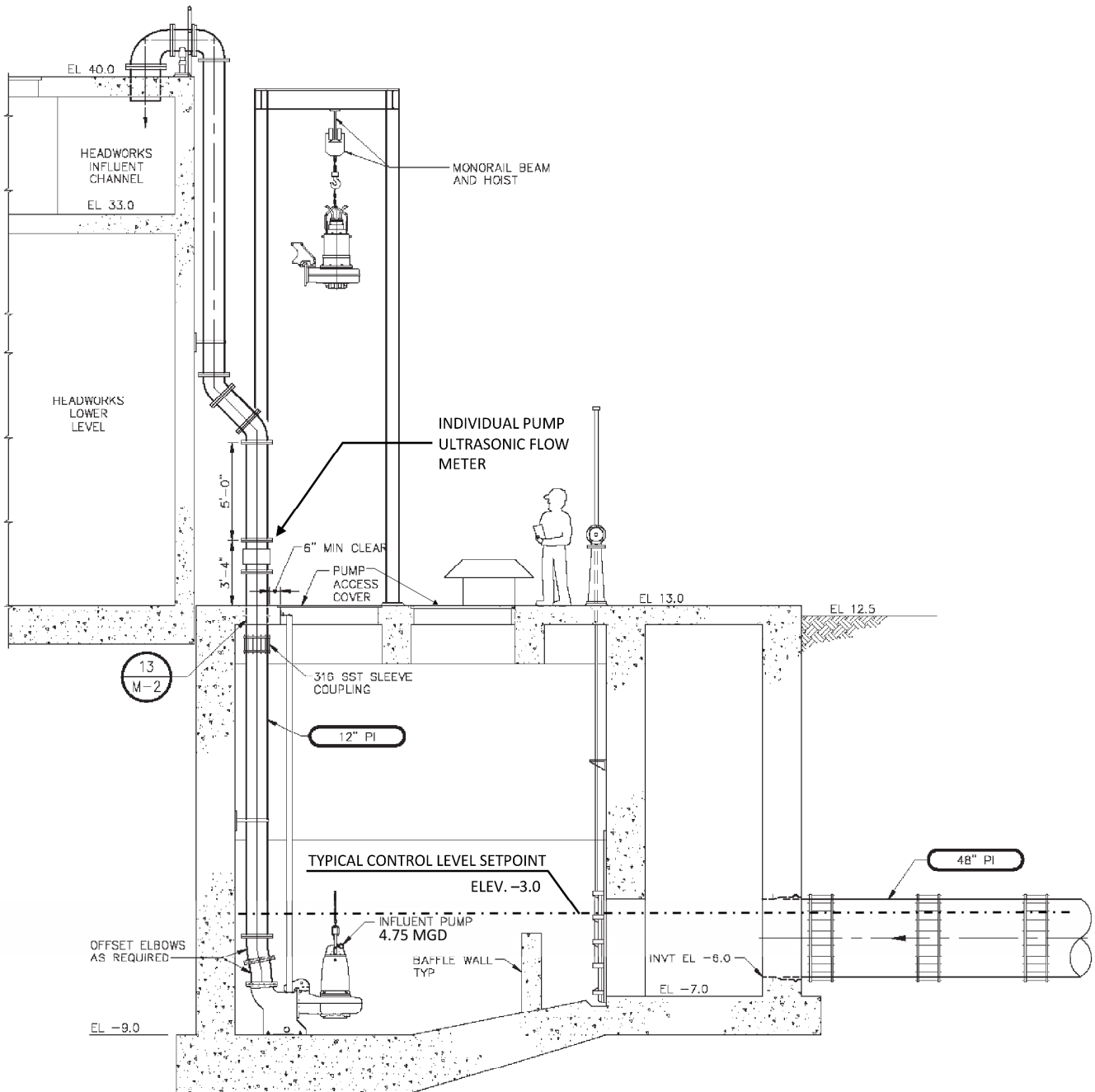
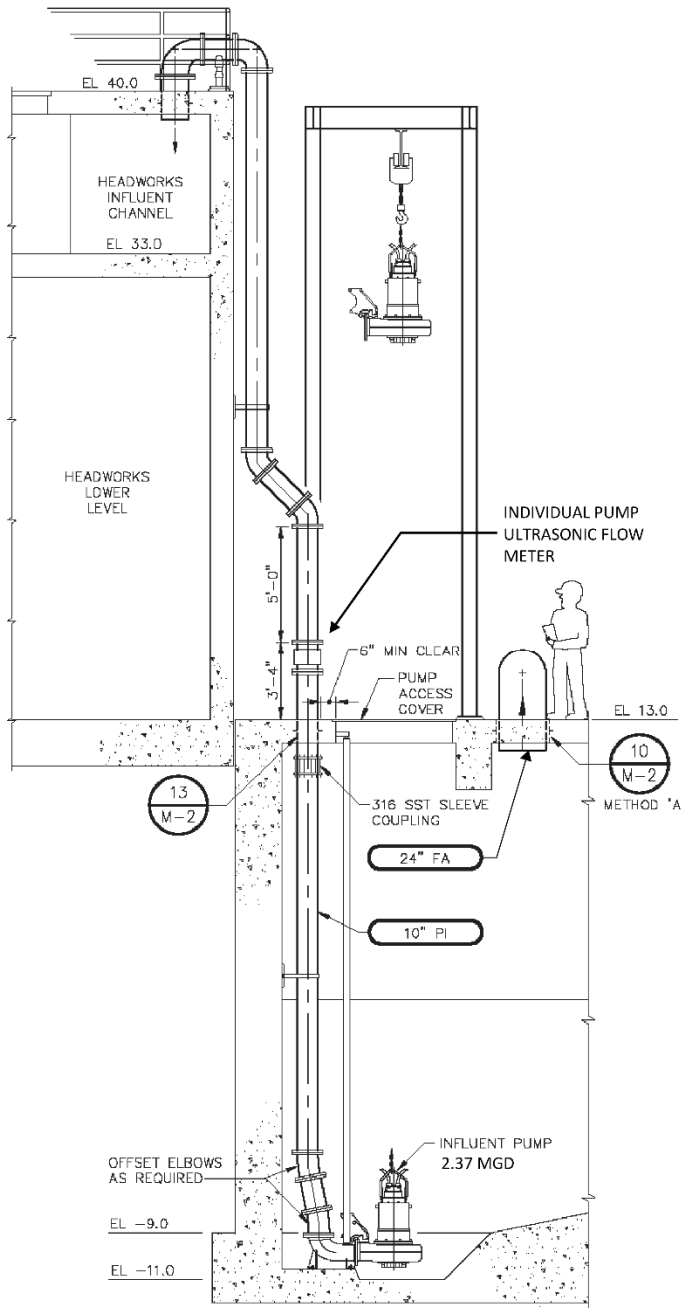


Figure 3.1. Influent Pump Station Plan

The separate wet wells were provided to allow access for cleaning and maintenance of one of the wet well compartments while the other remains in operation. Under normal operating conditions the wet wells can operate in tandem, or with one of the wet wells offline. In the event only one wet well is in operation and flows exceed the capacity of the pumps in that wet well, flow can enter the other wet well by flowing over the interior dividing wall. **Figure 3.2** below shows a section through the wet well at the larger size pump.



**Figure 3.2. Influent Pump Station Section Through 60 HP Pump**



The pump station includes a bubbler-type level transmitter in each wet well. The pumps are controlled to maintain a liquid level setpoint, essentially matching the pumping rate with the influent sewer flow rate. Each wet well also includes a backup low level and high level alarm float. The wet well level setpoint is normally set at approximately Elevation -3.0', which results in a liquid depth of 6.0' at the larger size pumps.

Each wet well currently has a larger and smaller sized pump, both operating on variable frequency drives (VFDs) to allow for more efficient operation over a wide range of flows. Design criteria for the pumps is shown in **Table 3.1** below.

**Table 3.1. Influent Pump Design Criteria**

Criteria	Value
Equipment Tags 11-P-13, 11-P-14	
Model	Flygt Model NP3301
Power	60 HP
Design Point	3,300 gpm @ 49' TDH
Equipment Tags 11-P-12, 11-P-15	
Model	Flygt Model NP3301
Power	35 HP
Design Point	1,650 gpm @ 54' TDH

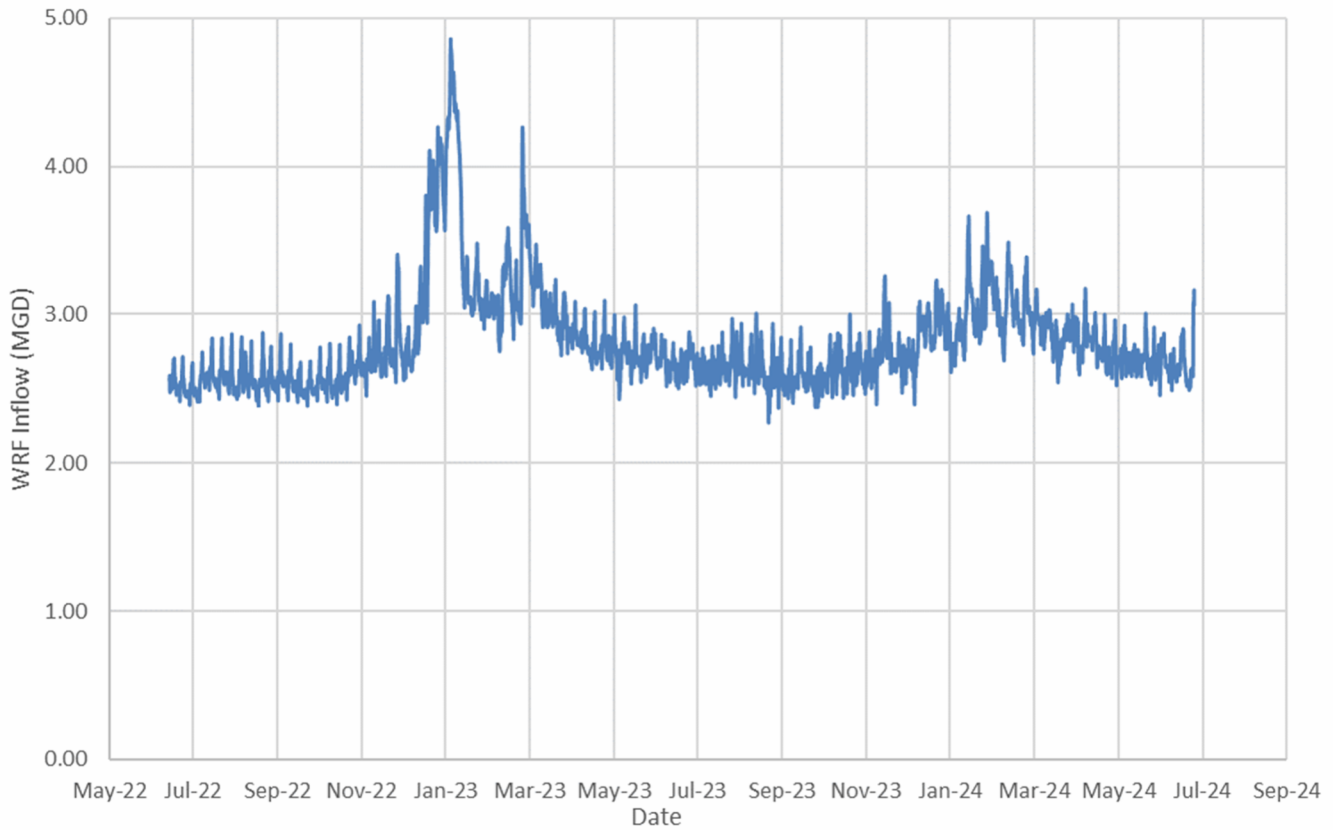
The smaller 35 HP pumps were designed in a recessed sump to allow for the wet well to be pumped essentially dry. Elevation -9.0' is the minimum allowable submergence for the 35 HP pumps.

**Figure 3.3. Influent Pump Station Section Through 35 HP Pump**

The influent wet well also receives drains from all of the buildings and treatment process tanks, as well as from a seepage receiving station that was included in the design (but has not been used). The City's Vac-Con sewer cleaning trucks currently dump at a station located in the South Pond that allows for separation and physical removal (to landfill) of significant fats and grease before being returned to the head of the plant in efforts to keep this material out of the treatment process as it has negative effects on the MBRs.

### 3.2 Current Operations

Daily WRF inflow from July 2022 – July 2024 is shown in **Figure 3.4** below. There were several historically large rain events in January of 2023.



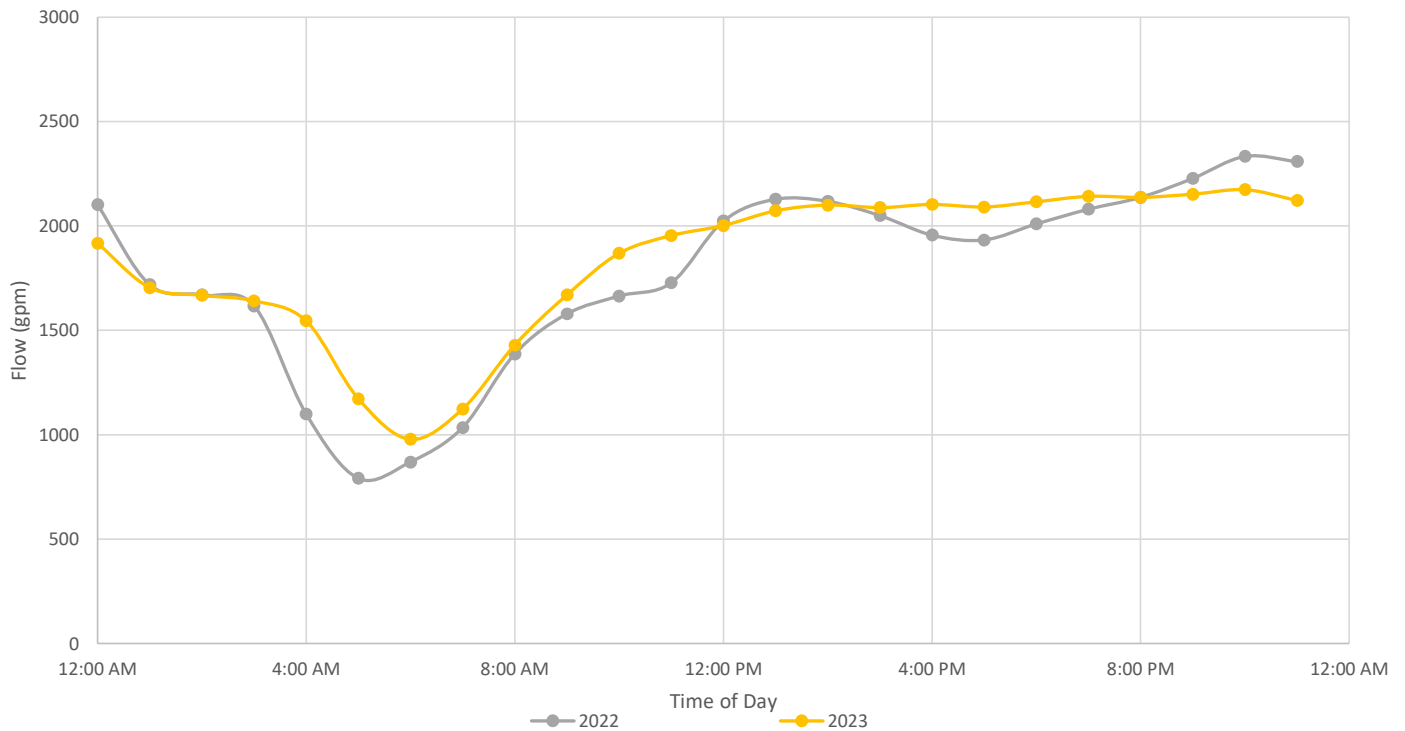
**Figure 3.4. 2022 - 2024 WRF Daily Inflow**

**Table 3.2. Influent Flow Summary (By Water Year)**

Parameter	WY 2021	WY 2022	WY 2023	WY 2024
ADWF	2.49	2.56	2.64	2.55
Population	45,140	46,010	46,897	47,800
ADWF gpd/capita	55.10	55.55	56.30	53.27
AAF	2.54	2.63	2.88	2.74
ADMMF	2.69	3.05	3.94	3.11

The maximum instantaneous flow rate pumped by the influent pump station was approximately 5.2 MGD occurring on 12/31/2022 at 3PM and 1/17/2023 at 10PM. This was essentially the maximum flow being pumped by a single 60 HP pump at 100% speed. Note that 4.1 inches of rain fell on 12/31 which is the 100-year storm.

A typical dry weather WRF inflow diurnal curve is shown in **Figure 3.5** below. Note that this trend is dampened on it’s true daily low and high flow rates since the flow measured is that pumped out of the wet well, and the influent sewer line and wet well is providing some level of equalization of actual plant inflows.



**Figure 3.5. Current Typical Dry Weather Diurnal WRF Inflow**

### 3.2.1 Typical Pump Operation

One of the smaller 35 HP pumps will operate when flows are between 500 gpm to approximately 1,650 gpm to maintain the level setpoint, and when flows rise above 1,600 gpm one of the 60 HP pumps begins to operate. During periods of wet weather and high flows with both wet wells online, typically one or two 60 HP pumps will operate, which together can convey up to 10 MGD, which is in excess of the current design PWWF value of 8.6 MGD. During peak flows in 2023, only one 60 HP operated up to approximately maximum speed.

### 3.2.2 Pumping Redundancy

The current peak wet weather design capacity of the WRF is 8.6 MGD. The firm capacity of the influent pump station with the largest pump out of service is 9.5 MGD according to the pump design capacities. This is an industry standard level of redundancy for wastewater pumping capacity. However, hydraulic calculations and actual plant data indicate the small pumps can pump up to 1,800 gpm (2.59 MGD) at full speed and the large pumps can pump up to 3,600 gpm (5.18 MGD), providing an actual firm capacity of 10.36 MGD. The fact that each pump has an independent discharge pipe adds an additional level of reliability. Further, the divider wall between the wet wells allows for overflow, providing additional safety in the event that a wet well is isolated (i.e. inlet gate is closed).

### 3.2.3 Instrumentation Redundancy

Each wet well includes a bubbler type level transmitter and high and low alarm float switches. If both wet wells are online and the level transmitter fails in one of the wet wells, the wet wells are hydraulically connected and will operate at essentially the same level. Therefore, there is adequate redundancy in the critical instrumentation for pump operation. Additionally, there is a submersible level transmitter located in the splitter box upstream of the wet wells, which provides even further redundancy. The level in the splitter box should not differ substantially

from the level in either wet well.

### 3.2.4 FOG Removal and Disposal



**Figure 3.6. FOG Accumulation in Wet Well**

Operations Staff experience significant accumulations of fats, oils and grease (FOG) floating on the upper surface of the pump station wet wells due to the constant level control scheme used. FOG can cause operational problems in the WRF including blinding and fouling of the drum screens, the formation of foams in the aeration basins that are hard to control, and fouling of the belt filter press that requires manual cleaning of the belts.

Starting in 2018, WRF Operations Staff began operating the influent pumps with an upper

flow limit that is less than the typical daily diurnal peak flow, allowing the wet well level to rise during the day and essentially using the wet well and upstream primary influent sewer to provide some equalization. The reason for this was that the WRF aeration process was having difficulty with nitrate removal and over-aeration during low flows at night, and with this new operational strategy, the minimum pumped flow rate at night has increased.

Also, a minimum level is maintained in the wet well with the level control strategy so that the FOG floating at the top is never drawn into the plant. Instead, ISD Collection System Staff manually clean out the wet wells every 4-5 weeks using a vactor truck, and the FOG is dried in an area of the South Pond and eventually disposed of as solid waste. The removal of FOG upstream of the treatment process rather than moving it through the plant has shown to be beneficial in terms of reduced maintenance requirements.

As part of the WRF Phase 1 Improvements constructed in 2019-2020, additional access hatches were added to the influent pump station to improve access for vactor truck operations. As part of the 2018 Reliability Study several alternatives for more automated removal of FOG from the wet wells were explored but ultimately the continuation of manual FOG removal was selected and has been successful in recent years.

### 3.3 Major Condition Assessment Findings

The existing influent pump discharge riser piping in the wet well is painted ductile iron, and appears to be corroded with paint failure, refer to **Figure 3.7**. Ductile iron piping in this environment with compromised paint will likely fail in the near term.



**Figure 3.7. Paint Failure in Wet Well Piping**

### 3.4 Recommended Improvements

#### 3.4.1 Replace Influent Piping

It is recommended to replace the influent pump riser piping in the wet well with Schedule 10 stainless steel pipe, and to repaint the existing ductile iron piping that is above grade exposed above the wet well.

**Refer to CIP Project 3-1 Profile.**

## 4.0 Mechanical Screens

### 4.1 Process Description

There are primary screens installed in three parallel channels downstream of the headworks influent channel. Two automatic mechanical screens are currently installed, with a manually cleaned bar screen located in the center channel. The screens have automated slide gates located upstream and downstream to allow for isolation and for the units to be taken on-line and off-line automatically. The mechanical screens originally had 6 mm opening vertical bar grids made of high impact plastic including teeth that captured screenings and allowed them to be lifted out of the flow channel as the grid rotated on a chain and sprocket system. Each bar screen was sized to pass 9 MGD with a head loss of 12” at 30% screen blinding. The layout of the bar screen facility is shown below in **Figure 4.1**.

The two mechanical screens have a bubbler type level transmitter upstream and downstream of the screen to measure differential level and allow for actuation of screen grid movement automatically.

As part of the WRF Phase 1 Improvements constructed in 2019-2020, the Parkson screens were retrofitted from 6mm vertical bar to 3/16” (4.8mm) perforated plate, and the washer-compactor units that wash the screenings (to remove organics and return to the process) and then compact them prior to discharge to a dumpster were replaced with new Parkson Aqua Washpress units, which match the washer-compactor units in the secondary drum screen area. This retrofit was done for two reasons: (1) to increase capture at the primary mechanical screens as capture was low with the 6mm bar grids and the secondary drum screens were being overwhelmed with screenings which was significantly reducing their capacity; (2) the existing washer-compactors were essentially non-functional and heavily corroded requiring replacement.

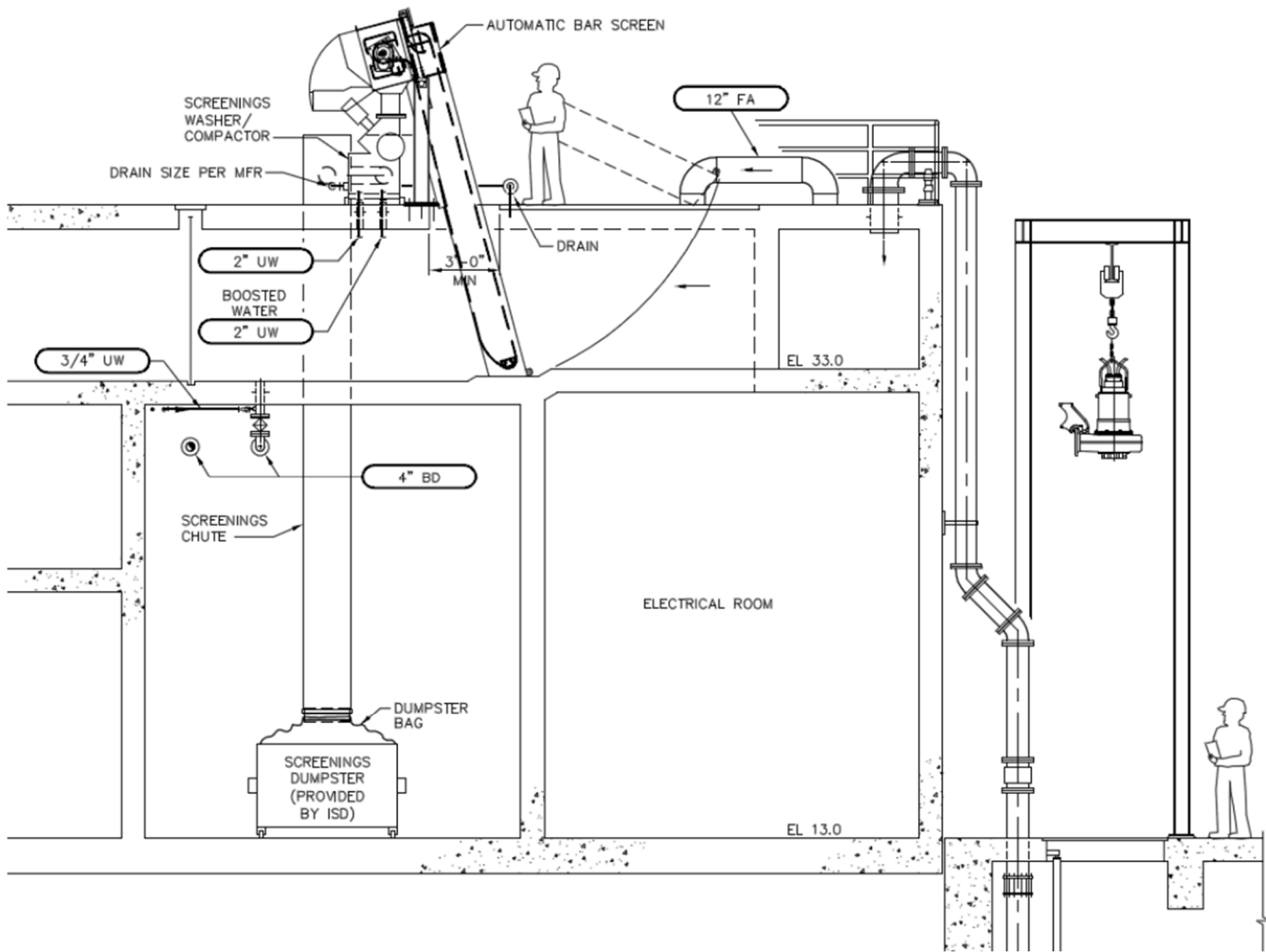
The new perforated plate mechanical screens were designed for a flow rate of 6.8 MGD each with 12” of headloss at 30% blinding (per submittal hydraulic calculations by Parkson). Design criteria for the mechanical screen systems are shown in **Table 4.1** below. In the future, 2 units in service were intended for a PWWF of 13.6 MGD.

**Table 4.1. Mechanical Screen Design Criteria**

<b>Bar Screen Criteria</b>	<b>Value</b>
Equipment Tags	21-ME-11, 20-ME-31
Screen Width	36”
Screen Opening Size	4.8 mm perforations (3/16”)
Screen Drive Motor Power	1/2 HP
Brush Drive Motor Power	1/2 HP
<b>Washer/Compactor Criteria</b>	<b>Value</b>
Equipment Tags	21-ME-12, 21-ME-32
Drive Motor Power	3HP

The mechanical screens are triggered to operate on a high differential level setpoint, and when they operate the screen grid is rotated and cleaned with a spray and brush system at the top of the screen. The screen rotates and operates until the differential level is returned to a low setpoint.





**Figure 4.2. Mechanical Screen Section**

## 4.2 Current Operations

Each of the two mechanical screens has an intended design capacity of 6.8 MGD. However, two screens are typically currently operated together to reduce cycling frequency with a differential level setpoint of 18-24". The perforated plate mechanical screens are capturing significantly more screenings than the original vertical bar screen elements, which was the intent of the retrofit. This protects the capacity of the drum screens. During daytime operations when flows are higher, the screens are cycling approximately every 10 minutes. During low flow periods of night the screens are cycling approximately every 13-15 minutes. The screens need to operate approximately 2 minutes to clear the submerged portion of the grid which is cleaned by the screen operation process.

One operational problem that has been apparent since the new plant began operation is that when the influent sewage pumps are rotated, the new pump that starts picks up settled solids around it (since that area of the wet well was quiescent when the pump was off) for a period of time until the settled solids are cleared. This sends a slug of very high TSS wastewater to the mechanical screens that can overwhelm them even at very low flows,

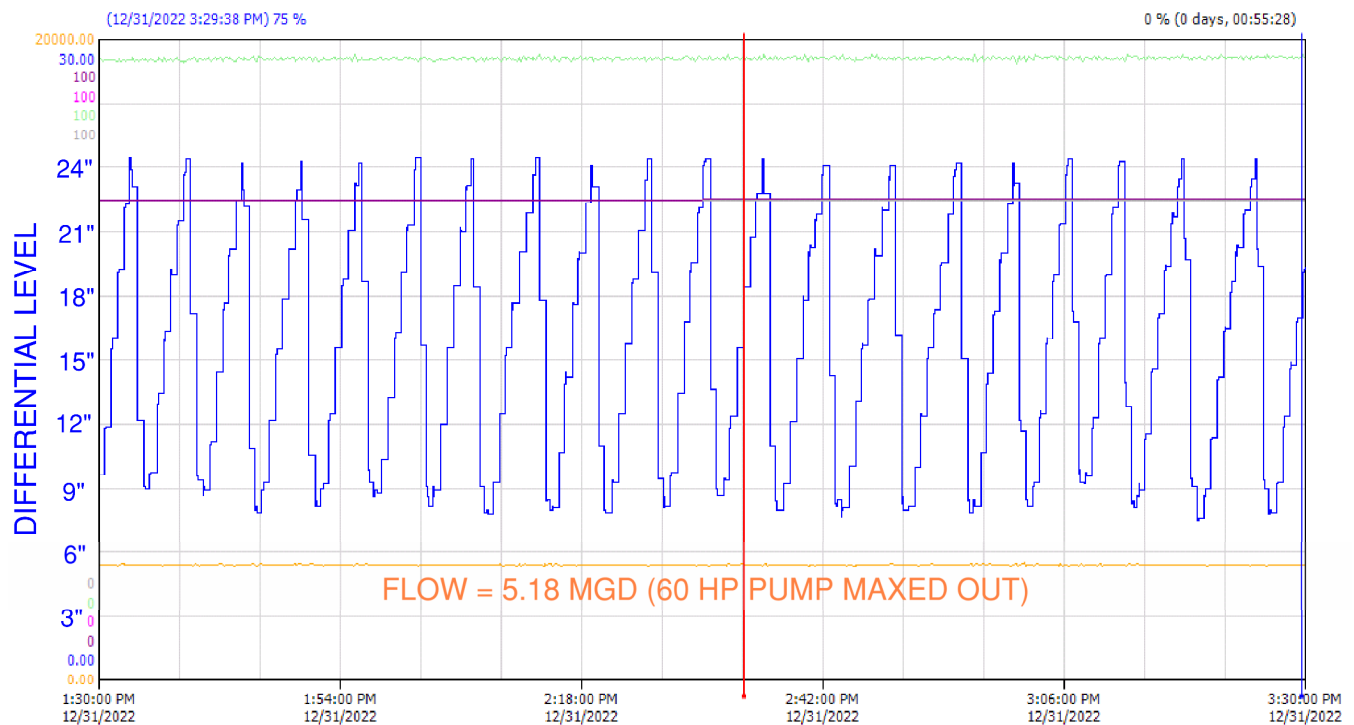
causing them to go into constant operation until the slug passes and in the worst case raising the level upstream of the screens to the overflow point, which is a water depth of 4.0-feet upstream of the screens. Operations Staff have learned to have pumps rotate during low flow periods at night to minimize this phenomenon.

Prior to the perforated plate retrofit, when this happened it would not affect the bar screens, but would pass to the drum screens and cause them to overflow uncontrolled into the washer-compactors below, causing a significant mess in the washer-compactor area. With the perforated plate retrofit, now the mechanical screens may get overwhelmed by solids and be called to run continuously for a short period of time, and any overflow would happen through the South Pond overflow which is controlled and intended, and the flow can be later returned to the plant. Since the perforated plate retrofit, drum screen overflows reduced from occurring multiple times a day to far more isolated and smaller volume events dependent on operations.

The perforated plate screens are also capturing far more screenings. Prior to the retrofit the bar grid screens were capturing ~3CY per week, and now the perforated plate screens are capturing 9-10 CY per week.

#### 4.2.1 Peak Wet Weather Operation and Redundancy

The storm that occurred on 12/31/2022 represented one of the strongest storms in Northern California in some areas in recent history, over 4-inches in 24-hours with the majority of it falling from 5am-3pm. Between the hours of 1:30 PM and 3:30 PM one of the 60HP pumps operated at 100% speed continuously, pumping 5.18 MGD. This was the highest inflow value to the plant seen in SCADA data from 2021-2024. As can be seen below in **Figure 4.3**, during this 2-hour period the screens cycled approximately 20.2 times with a cycle time of ~6 minutes.



**Figure 4.3. Mechanical Screen Operations During Peak Storm Event**

Within a cycle time of 6 minutes, the screen is off for approximately 4 minutes and running to clear itself approximately 2 minutes.

After observing operations of the perforated plate mechanical screens for some time, it has become clear that the capacity of the screen is somewhat dependent on the speed with which the screen moves and can remove solids that have accumulated on it. Hydraulically they can pass the design 6.8 MGD with 30% blinding at no more than 18" differential, however because the capture rate is so high, it may not be possible for the screen to move fast enough to clear the solids and maintain 30% blinding during high flow / high solids events (this is what happens when a large slug of solids hits the screens during a pump rotation even at lower flows).

During peak wet weather storm events, the concentration of solids in the wastewater is significantly reduced from average conditions, as the amount of solids generated by the population does not increase, the solids are simply diluted by infiltration and inflow into the sewer collection system.

One way to look at the true capacity of the screens would be with respect to cycling time during a peak wet weather event such as that of 12/31/2022. If the capacity of the screens is related to the rate at which solids can be removed from the screen and thus the actual screenings load, the run time of the screens can be used to predict capacity. At a constant flow of 5.18 MGD on 12/31/2022, the 2 perforated plate screens were cycling consistently 2 minutes on and 4 minutes off with a 6 minute total cycle time. The maximum capacity of the screen could be considered at constant operation. Theoretically, constant operation would triple the capacity of the screen from 2 minute on / 4 minute off operation. If the maximum capacity of the screen were to be considered at 2 minutes on / 1 minute off (non-constant operation) this would double the capacity of the screen from the 12/31/2022 event:

- Constant Operation Capacity Estimate =  $5.18 \text{ MGD} / 2 \text{ screens} \times 3 = 7.7 \text{ MGD}$  capacity estimate each
- 2 Minute On / 1 Minute Off Capacity Estimate =  $5.18 \text{ MGD} / 2 \text{ screens} \times 2 = 5.18 \text{ MGD}$  capacity each

***A conservative estimate of screen capacity, given the challenge in estimating it with respect to potentially variable screenings loading, would be 5.0 MGD per screen under actual field conditions.***

Based on the peak flow pumped into the plant between 2021-2024 being 5.2 MGD with an average dry weather flow of 2.6 MGD, the 2.0 peaking factor of ADWF to PWWF that was used for original design of the plant appears to be holding true. For the purposes of this Master Plan, buildout peak wet weather flow will be held at 8.6 MGD. Therefore, 2 mechanical screens in service have an additional capacity of up to 1.4 MGD PWWF available.

### 4.3 Major Condition Assessment Findings

The existing mechanical screen drives and motors are corroded, refer to **Figure 4.4**. This is after 5 years of service, and during specification and submittal review of the new screens which were installed in 2020, particular care was taken to maximize the corrosion resistance of these components. Regular replacement of the drive gear boxes and motors will be listed as a planned maintenance activity every 10 years, but not as a capital improvement project. These assets should also be an area of focus for a regular coatings maintenance program.



## 4.4 Recommended Improvements

### 4.4.1 Install 3<sup>rd</sup> Mechanical Screen

If we consider the existing mechanical screen capacity as a conservative value of 5 MGD each screen and that current peak wet weather flow is currently just exceeding 5 MGD based on recent large storm events, then addition of a 3<sup>rd</sup> screen in the near future would be recommended as current firm capacity with 1 screen out of service is 5 MGD. With 3 screens installed and 2 operating at all times with 1 redundant, firm capacity would be 10 MGD and this would be in excess of the buildout peak wet weather flow estimate of 8.6 MGD.

**Refer to CIP Project 4-1 Profile.**

## 5.0 Vortex Grit Removal System

### 5.1 Process Description

Downstream of the mechanical screens, the vortex grit system removes higher density inorganic materials such as sand, gravel, small metal pieces, grains, etc. Grit can cause problems in downstream equipment such as excessive pump wear and deposition in the aeration basins that must be removed manually. The grit removal system includes inlet and outlet isolation gates, as well as a bypass gate that allows the vortex grit system to be taken offline without interrupting plant flow, as shown in **Figure 5.1** below. Downstream of the grit tank, treatment plant flow is measured at a Parshall flume. The Parshall flume also serves to control the depth of flow in the grit and mechanical screen channels. The vortex grit tank induces a negligible hydraulic head loss of less than 1/4". The grit chamber is sized for a PWWF of 14.4 MGD.

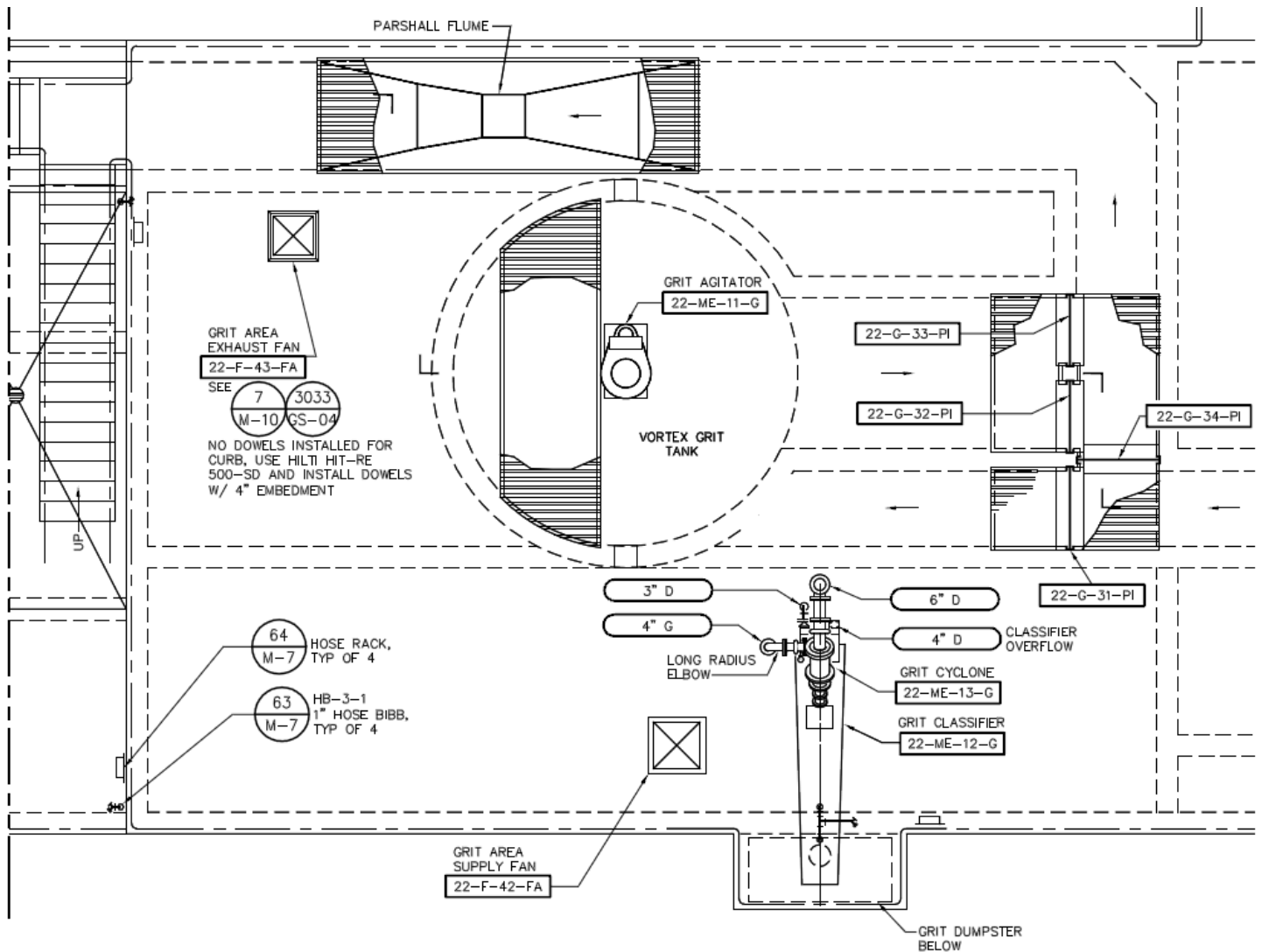
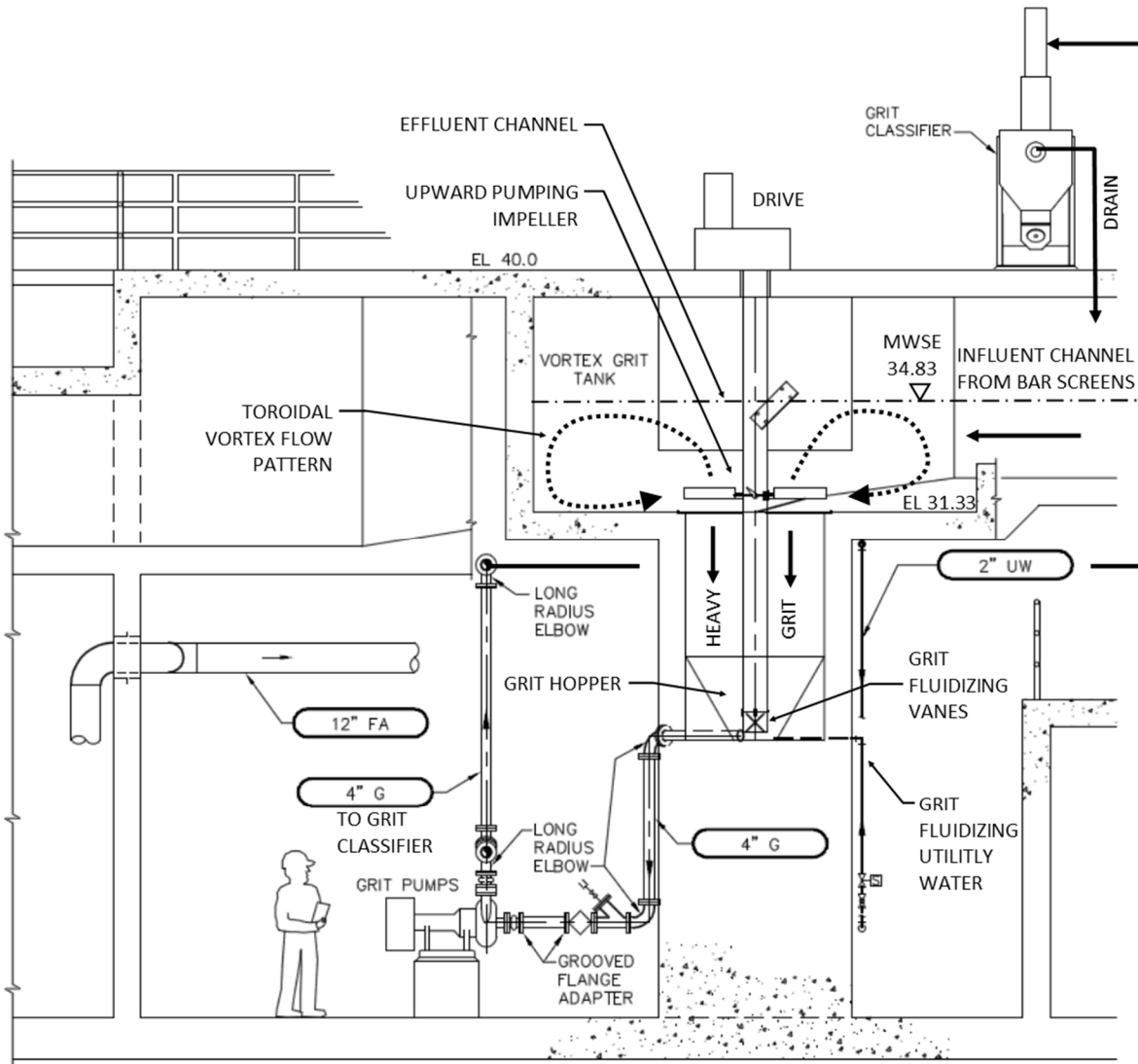


Figure 5.1. Vortex Grit Removal System Plan

The bottom of the grit tank serves as a location for grit to drop out. The key to the removal of grit is the agitating pumping impeller located in the center of the tank, which pumps gently upward, generating a toroidal vortex which encourages grit to be removed when it contacts the floor of the tank. The impeller is driven by a 2HP motor at a speed of 21 RPM. Solids at the bottom of the tank are drawn to the impeller. Heavier grit will drop below the impeller into the grit hopper, and lighter organics will be pumped back upward and re-enter the main flow stream, as shown below.



**Figure 5.2. Vortex Grit Removal System Section**

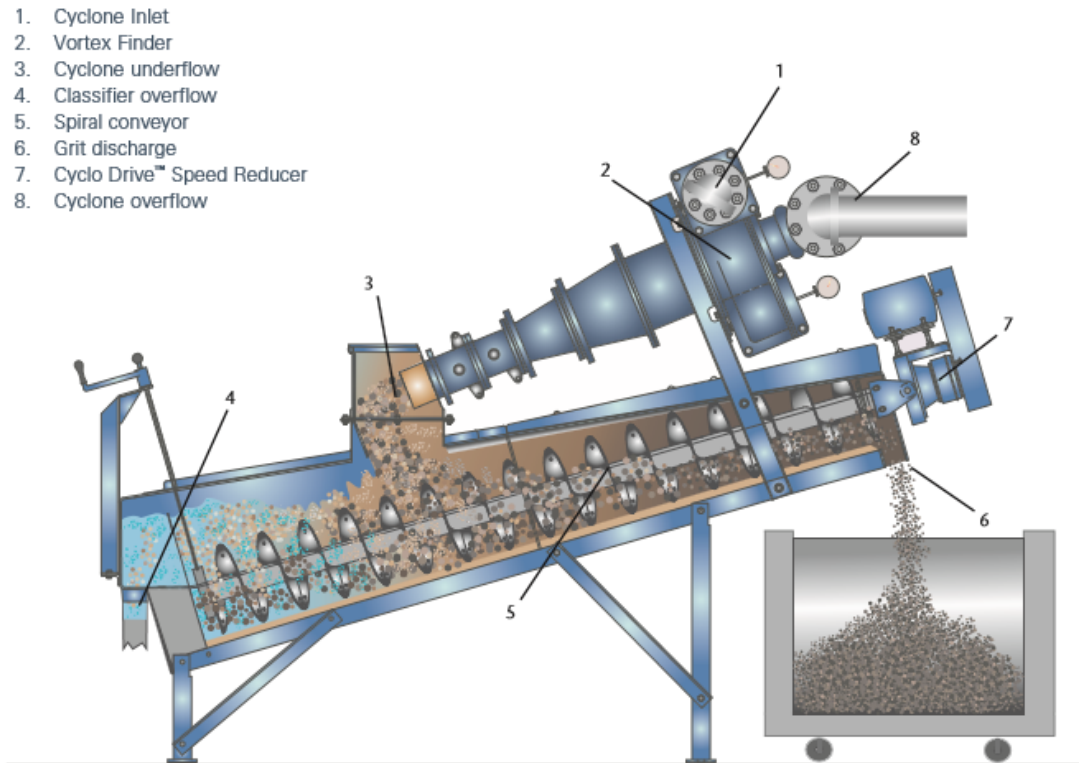
The grit hopper has a cone bottom shape, and two grit pumps are plumbed with suction piping connecting at the bottom of the hopper to remove accumulated grit. The drive shaft for the agitating pumping impeller extends into the grit hopper and includes additional fluidizing vanes at the end of the shaft that also pump the grit gently upwards, preventing the grit from compacting. A connection to the utility water system is provided with a solenoid valve which can also fluidize settled grit to prevent plugging of the pump suction piping.

There are two grit pumps, one duty plus one standby, which pump grit to the grit cyclone / classifier. The grit pumps are set to operate on a timer for periodic removal of the accumulated grit. The grit hopper has a volume of 760 gallons, and therefore the grit pumps can empty the hopper in 2.5 minutes. The grit hopper volume is designed to hold approximately 24 hours of grit accumulation.

**Table 5.1. Grit Pump Design Criteria**

Criteria	Value
Equipment Tags	22-P-21, 22-P-22
Pump Type	Recessed Impeller Centrifugal
Design Capacity	305 gpm @ 75'
Motor Horsepower	25 HP

The grit cyclone / classifier is sized for a flow of 300 gpm. Influent from the grit pumps enters the unit and flows through the cyclone, which concentrates grit using centrifugal force generated by the circular motion of the pumped fluid through the cyclone. 95% of the pumped flow exits the cyclone overflow piping and is returned to the plant influent flow channel. The cyclone is lined with a replaceable rubber liner and contains no moving parts. The remaining 5% of the concentrated grit enters the classifier, which allows the grit to settle and be transported by a 2HP screw conveyor to the dewatered grit outlet where it is discharged into a dumpster. Utility water is connected near the discharge of the classifier for final further washing of the grit prior to discharge. Overflow from the grit classifier is also returned to the plant influent flow channel.



**Figure 5.3. Grit Cyclone / Classifier Schematic**

## 5.2 Current Operations

The vortex grit tank agitator impeller drive operates continuously. The grit pumps are typically set to operate for a few minutes every 3 to 6 hours. The duty and standby pump are rotated weekly. The grit classifier drive operates for a setpoint amount of time starting when the grit pumps operate.

The grit removal system has been reliable, with no notable outages that have significantly affected plant operation. In general, the grit removal system could be down for several days and be bypassed without causing harm to the plant. Going without grit removal for a short period of time will not result in a level of grit accumulation in the system that will cause any significant damage to downstream equipment.

The vortex grit tank agitator drive gear box operates at a relatively slow speed and is not prone to any regular maintenance problems. All of the moving parts are located above the wastewater channel. It is not practical to have a redundant mixer system in place, and therefore there is no backup unit. However, having a spare drive, including drive motor, pinion gear, and drive gear on hand as shelf spares would increase reliability in that it would reduce downtime in the case of a failure in the existing drive.

The grit pumps have duty + standby firm redundancy, and independent seal water systems for each pump. This is an adequate level of redundancy.

The grit cyclone and classifier does not have a redundant backup unit, and a redundant unit is not recommended. However, having a spare drive and lower sealed bearing on hand as shelf spares would increase reliability in that it would reduce downtime in the case of a failure in the existing drive.

## 5.3 Major Condition Assessment Findings

The vortex grit agitator drive is corroded and has had moisture incursion in the past. The drive shaft appears to be painted steel, and is corroded. The grit classifier unit is heavily corroded and appears to be beyond repair.



**Figure 5.4. Grit Removal System Corrosion**

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## 5.4 Recommended Improvements

### 5.4.1 Rehabilitate Grit Agitator

Replacement of the grit agitator gear box and motor is recommended, and the drive shaft should be recoated.

**Refer to CIP Project 5-1 Profile.**

### 5.4.2 Replace Grit Classifier

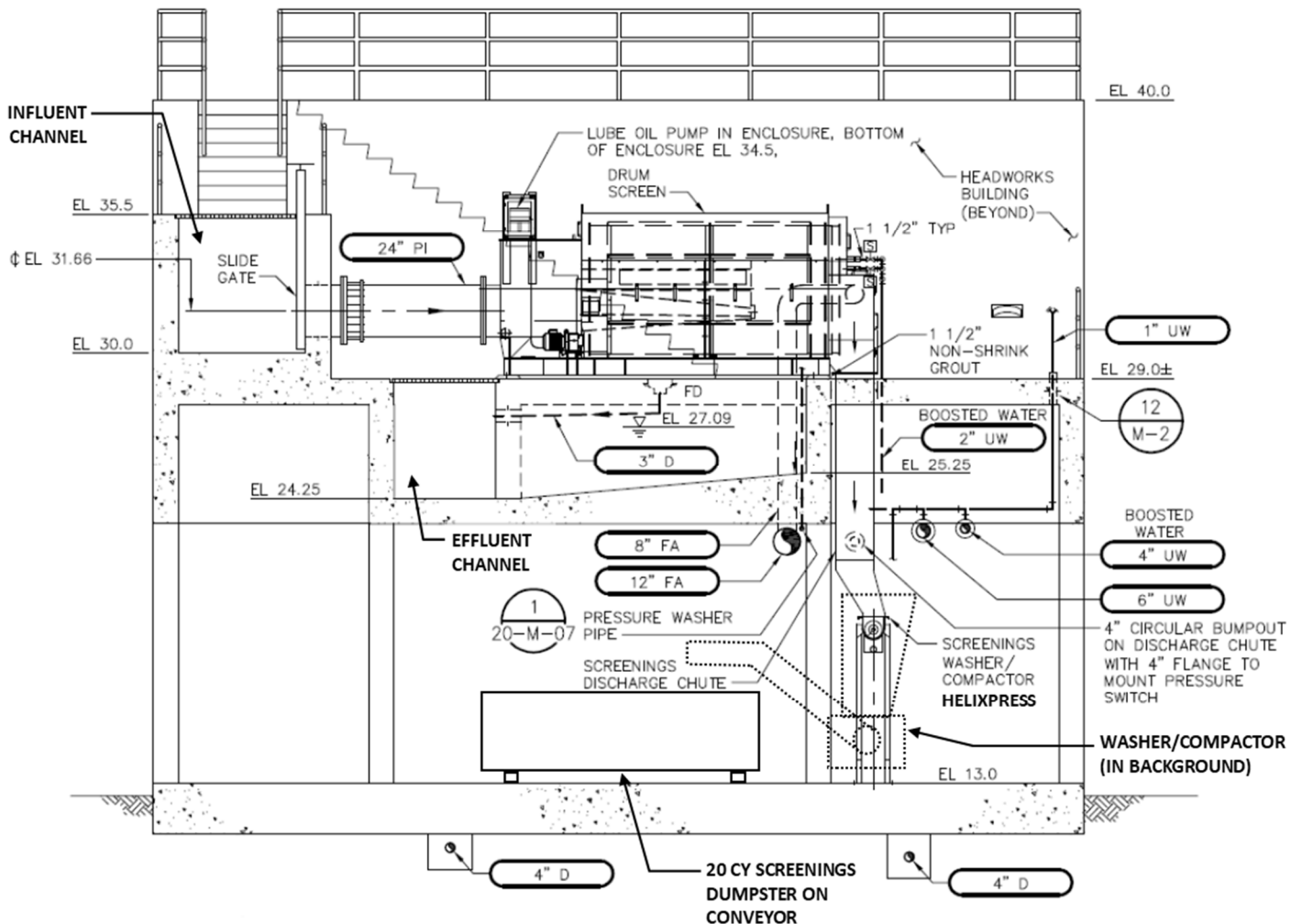
Full replacement of the grit classifier unit is recommended, as its condition indicates it is near the end of its useful life.

**Refer to CIP Project 5-2 Profile.**

## 6.0 Drum Screens

### 6.1 Process Description

The drum screens provide fine screening following grit removal to protect the downstream MBRs. The drum screens have a 1 mm opening size. The MBRs require a minimum 2 mm fine screen to be in place to maintain the equipment warranty. There are currently 3 drum screens installed, with provisions to add a fourth drum screen in the future. The drum screens are installed in the upper level of the headworks building, and receive flow from a common inlet channel. The inlet to each drum screen includes an automatically operated isolation slide gate. Refer to **Figure 6.1** below.



**Figure 6.1. Headworks Section at Drum Screens**

Flow enters the drum screen via an inlet distribution box that includes a weir which evenly distributes flow to the interior of the screen. The rotating cylindrical perforated stainless steel screen retains solids on the inside while water passes through the screen and flows downward through an opening in the floor into the effluent channel.

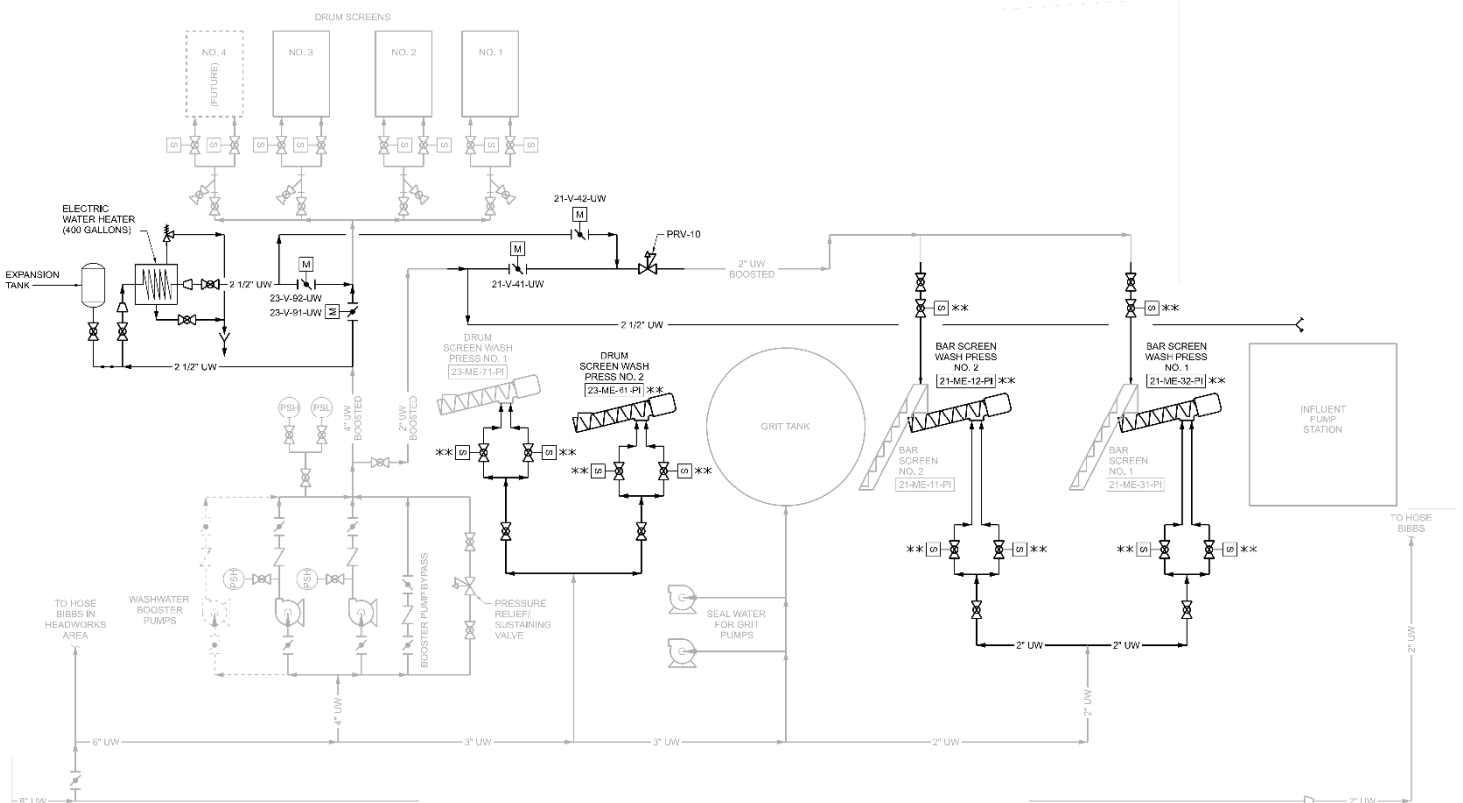
The drum screens do not require an isolation gate or valve on the discharge of the screen as the maximum water surface in the effluent channel is below the base of the drum screen.

The screen includes a continuous spiral flight welded to the inside face of the screen which moves captured screenings towards a discharge chute at the end of the screen, where they drop down vertically to the screenings handling area on the bottom floor of the headworks building. To prevent the screenings from blinding the perforated drum screen, each drum is equipped with high-pressure (80 psi) spray nozzles that spray both the interior and exterior of the screen. The nozzles are fed with utility water and flow is controlled by solenoid valves. The spray duration is operator adjustable. Design criteria for the drum screens is provided in **Table 6.1**.

**Table 6.1. Drum Screen Design Criteria**

Criteria	Value
Equipment Tags	23-ME-11, 23-ME-21, 23-ME-31
# of Units	2+1 Standby
Original Design Capacity	5 MGD Peak Flow @ 300 mg/L TSS
Screen Opening Size	1 mm Perforated Plate

The drum screens are served by two washwater booster pumps that boost the utility water pressure to approximately 85 psi as required to appropriately clean the screen elements. The washwater booster pump suction header is connected to the utility water system, and the discharge from the booster pump serves wash water to the drum screen and mechanical screens. The wash water schematic is shown below.



**Figure 6.2. Headworks Wash Water Schematic**

The pump station is set up with a pressure sustaining / relief valve that maintains the utility water system pressure, and allows the recycle of water from the discharge side of the pumps back to the suction side of the pumps. A low pressure switch (PSL- 2310) on the pump discharge header calls a booster pump to start, and a high pressure switch (PSL-2310) calls a pump to stop. The pressure switches are set such that when utility water begins to be demanded, the low pressure switch will trip, causing a pump to start, and the pressure relief / sustaining valve is set to prevent the high pressure switch from tripping unless all utility water demand stops, at which point the high pressure switch will trip.

**Table 6.2. Washwater Booster Pump Design Criteria**

Criteria	Value
Equipment Tags	23-P-71, 23-P-72
Pump Type	Vertical Inline Centrifugal
Design Capacity	80 gpm @ 80'
Motor Horsepower	5 HP

As part of the WRF Phase 1 Improvements constructed in 2019-2020, a 400-gallon electric water heater system was added to the “boosted” side of the wash water system to allow for hot water to be used for both the mechanical screens and the drum screens to control the buildup of FOG on the perforated plate elements which was previously requiring manual hot water washing to control and limiting screen capacity. The hot was system that was added is shown in bolder dark lines in **Figure 6.2**. Two automated butterfly valves were added on the utility water lines feeding both the mechanical screens and drum screens that allows either hot-water or unheated water to be delivered to the screen. Setpoints in SCADA were added to allow hot water screen washing to occur at user selected time intervals. The water heater is located in an FRP enclosure on the roof of the headworks building adjacent to the vortex grit removal system.

The drum screens discharge captured screenings through a vertical chute to the conveyor/washer/compactor units below. Currently, Drum Screens #2 and #3 discharge directly into Aqua Washpress washer/compactors. There are the same model of washer/compactor used for the mechanical screens. Drum Screen #1 discharges to a Helix Press conveyor which conveys screenings into the Aqua Washpress below Screen #2. When Screen #4 is installed, a similar Helix Press conveyor could be installed under Screen #4 to convey screenings into the Aqua Washpress below Screen #3.

The Aqua Washpress washer/compactors discharge cleaned and compacted screenings into a 20 cubic yard dumpster. The dumpster is set on a conveyor which allows the dumpster to be indexed to spread out the screenings across the dumpster (called a dumpster-veyor). A section of the system is shown in **Figure 6.3**.

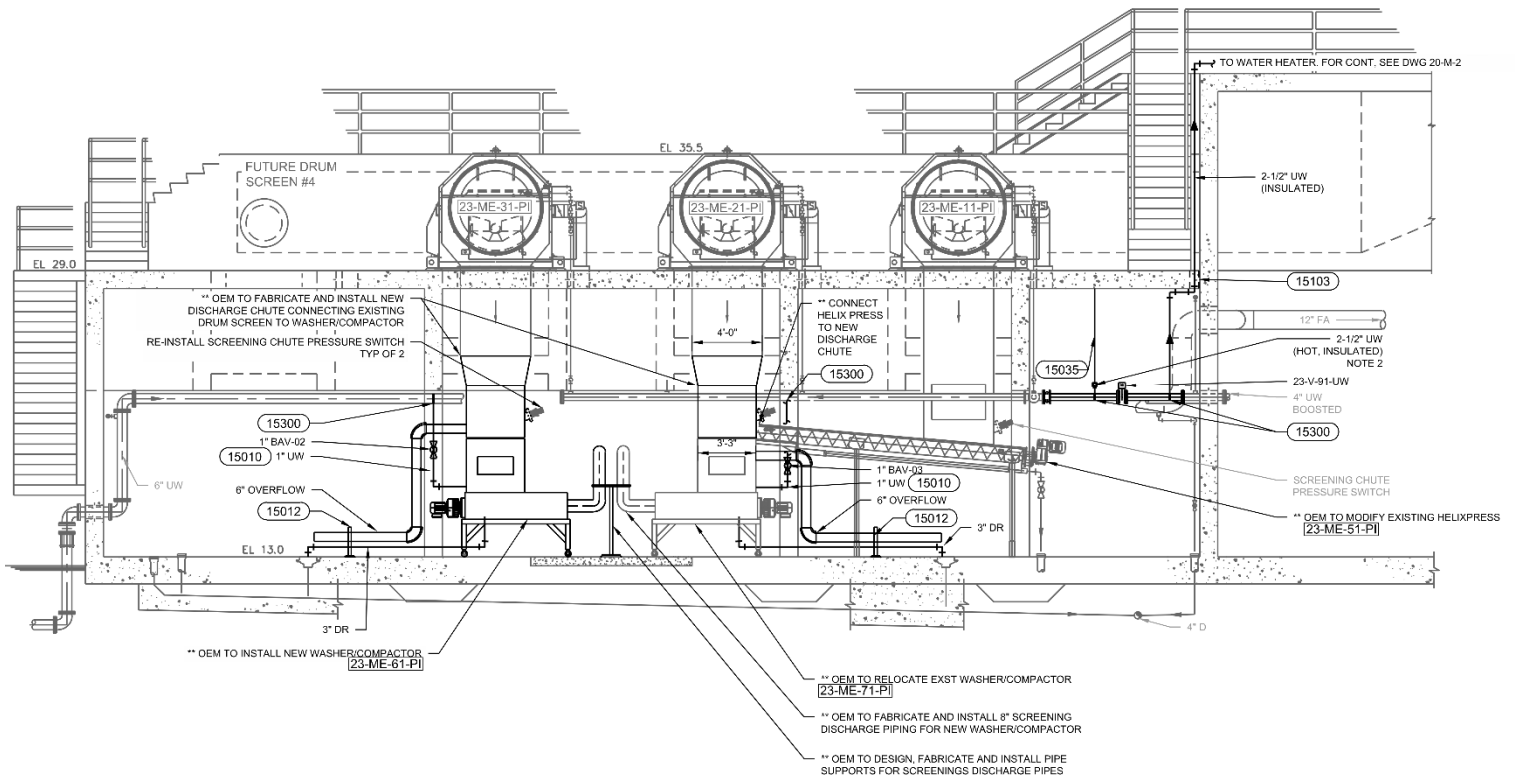


Figure 6.3. Headworks Section at Drum Screens

Table 6.3. Helix Press Design Criteria

Criteria	Value
Equipment Tags	23-ME-51
# of Units	1
Design Capacity	70.5 cubic feet screenings / hr
Motor Horsepower	5 HP

Table 6.4. Washer-Compactor Design Criteria

Criteria	Value
Equipment Tags	23-ME-61, 23-ME-71
# of Units	2
Design Capacity	35 cubic feet screenings / hr
Motor Horsepower	3 HP

## 6.2 Current Operations

### 6.2.1 Screenings Loading

The drum screens are currently capturing on average 40 CY of screenings per week (5.7 CY/day, or 6.4 CF/hr). The current screenings load is well within the capacity ratings of the Helixpress and Aqua Washpress equipment.

### 6.2.2 Drum Screen Operation

The drum screen inlet isolation gates are motorized, and can be controlled to isolate drum screens automatically when drum screens are brought online and offline based on influent flow. Each drum screen includes alarms and automatic shutdowns for the following conditions:

1. Drum screen motor overcurrent
2. High drum screen motor temperature
3. High drum screen torque (overload)
4. Low drum screen speed (loss of motion)
5. Drum screen discharge chute high pressure (clogging)

If the high-high alarm level is reached for any of these conditions, the drum screen will stop and the inlet isolation gate will automatically close.

The number of drum screens operating is based on the pumped influent flow rate. Currently, one drum screen operates below 3,000 gpm (4.3 MGD) which is a majority of the plant's operating time. A second drum screen is called to run if the flow goes over 3,000 gpm, and a 3<sup>rd</sup> is called to run over 3,500 gpm.

Whenever the influent wet well pumps are rotated, an extra drum screen is called to operate for approximately 30 minutes to handle the "slug" of extra solids that hit the headworks on a pump rotation as discussed in previous sections of this report.

The Helix Press is always running if Drum Screen #1 is in operation. The Aqua Wash Press which serves Screens #1 and #2 is always running if either of those screens is running. The Aqua Wash Press which services Drum Screen #3 is always running if that screen is in operation.

### 6.2.3 Drum Screen Redundancy

The drum screens were designed for 2+1 redundancy. Each drum screen was designed to handle a peak hydraulic capacity of 5.0 MGD at 300 mg/L TSS, and with two units online the firm capacity was intended to be 10.0 MGD.

Prior to retrofit of the mechanical screens to perforated plate elements and installation of the hot washwater system, WRF Operations Staff found that the drum screens were unable to reliably handle flows in excess of approximately 3 MGD without the potential for causing excessive liquid spillover into the screenings discharge chute. After the WRF Phase 1 Improvements project and installation of perforated plate mechanical screens, 1 drum screen can reliably handle up to 3,000 gpm or 4.3 MGD of dry weather flow. The reason this value is less than the design value of 5.0 MGD is that TSS concentrations during dry weather flow are routinely above 300 mg/L, with an average of approximately 350 mg/L, and values frequently in the 400-600 mg/L range and sometimes higher.

However, during peak wet weather flows, TSS concentrations should be reliably below 300 mg/L given that the cause of peak flows during storm events is sewer collection system infiltration and inflow which dilutes influent sewer TSS concentrations. Therefore, the design capacity of the drum screens at 5.0 MGD per drum screen for PWWF is still valid, providing a firm redundant PWWF capacity of 10.0 MGD with 2 units online.

#### 6.2.4 Wash Water Booster Pump Redundancy

The drum screen wash water booster pumps are designed for 1+1 redundancy. An estimate of washwater demand including potential future headworks screen and washer/compactor units is provided below:

- Washer Compactor Average Demand = 12.5 gpm x 5 units (3 mech + 2 drum) = 62.5 gpm
- Mechanical Screen Average Demand = 15 gpm x 3 units = 45 gpm
- Drum Screen Average Demand = 15 gpm x 3 units = 45 gpm
- Total Potential Demand = 152 gpm

With 2 existing pumps rated each at 80 gpm, there is not currently 1+1 redundancy in the case that all washwater demands occur at the same time.

#### 6.2.5 Washer-Compactor Redundancy

One washer-compactor serves Drum Screen #3, and one washer-compactor serves Drum Screens #1 and #2. If the unit serving Screens #1 and #2 goes out of service, only 1 drum screen can operate until the unit is repaired. This washer-compactor could be rolled out of the way (it has wheels) and a dumpster placed in it's footprint temporarily while the unit is being repaired to maintain plant operations, however this is not an ideal plan to maintain redundancy.

### 6.3 Major Condition Assessment Findings

The existing drum screens are in relatively poorer condition compared to most major equipment in the WRF due to the high levels of hydrogen sulfide within the units themselves during operation. The drum screens cause turbulence which further releases hydrogen sulfide and the existing ventilation system does not work optimally because there is no air intake into the units which restricts air flow.

The existing drum screen drives are corroded and there is significant concrete damage around the unit bases due to sulfuric acid being generated by hydrogen sulfide laden condensation.

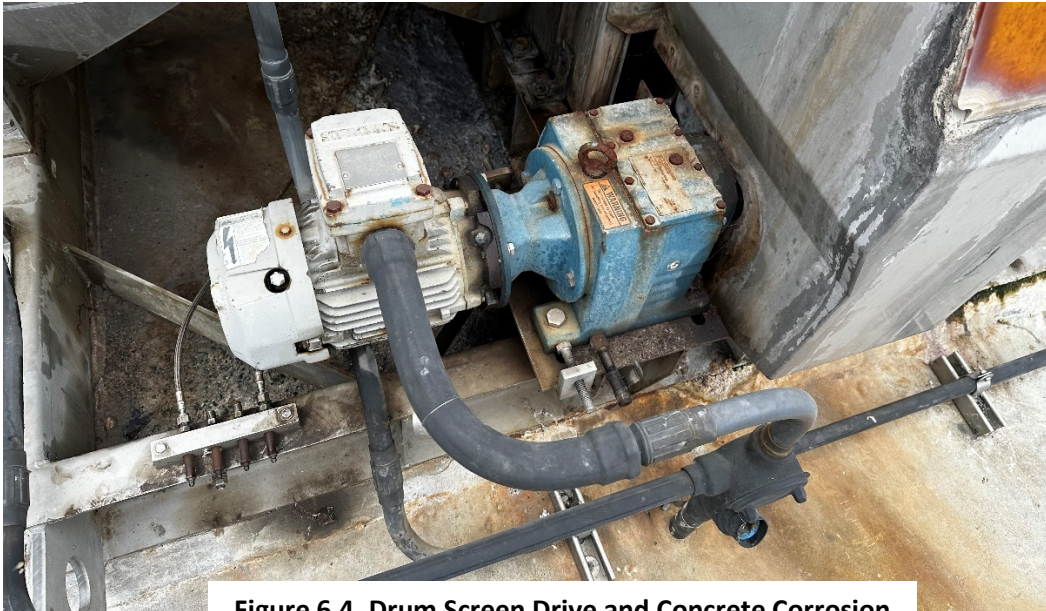


Figure 6.4. Drum Screen Drive and Concrete Corrosion

### 6.4 Recommended Improvements

#### 6.4.1 Drum Screen #2 and #3 Rehabilitation

Drum Screens #2 and #3 will be temporarily removed to allow the corroded concrete around their bases to be repaired and new concrete coatings to be applied. Also, the following minor repairs will be completed by the original equipment manufacturer:

- Replace drive gear boxes and motors that are corroded
- Install new screened air intake
- Replace corroded components such as sprayers, solenoids valves, hardware, etc.

Refer to CIP Project 6-1 Profile.

#### 6.4.2 Add Fourth Drum Screen and Third Washer-Compactor

It is recommended that a 4<sup>th</sup> drum screen is added in the open space and that a 3<sup>rd</sup> washer compactor is installed below it. Under Drum Screen #4 is the ideal place for a 3<sup>rd</sup> washer compactor due to the geometry of the existing washer compactor discharge pipes being angled toward the north.

The discharge piping for the 3<sup>rd</sup> washer compactor can be angled toward the south so that all 3 units discharge in the same general location which is ideal for dumpster-veyor operation. The reasoning behind installation of a 4<sup>th</sup> drum screen is as follows:

- Remaining service life of existing drum screens is likely limited, ~5 years remaining.
- Existing concrete under Drum Screens #1-3 needs rehabilitation. Existing concrete under space spare for Drum Screen #4 is good.
- Rehabilitate concrete for Drum Screens #2 and #3, which will require taking these screens offline.
- Run Drum Screen #1 to failure, and salvage any of its remaining parts for spares. Do not repair concrete for Drum Screen #1.
- When Drum Screen #1 fails and is decommissioned, decommission the helix press below it as well. Drum Screen #1 can be used to scavenge spare parts.
- Having a new drum screen (in spot #4) will ensure some additional level of reliability in the case that all 3 of the existing screens have operational issues in a similar timeframe as all are on the same lifecycle with similar run hours.

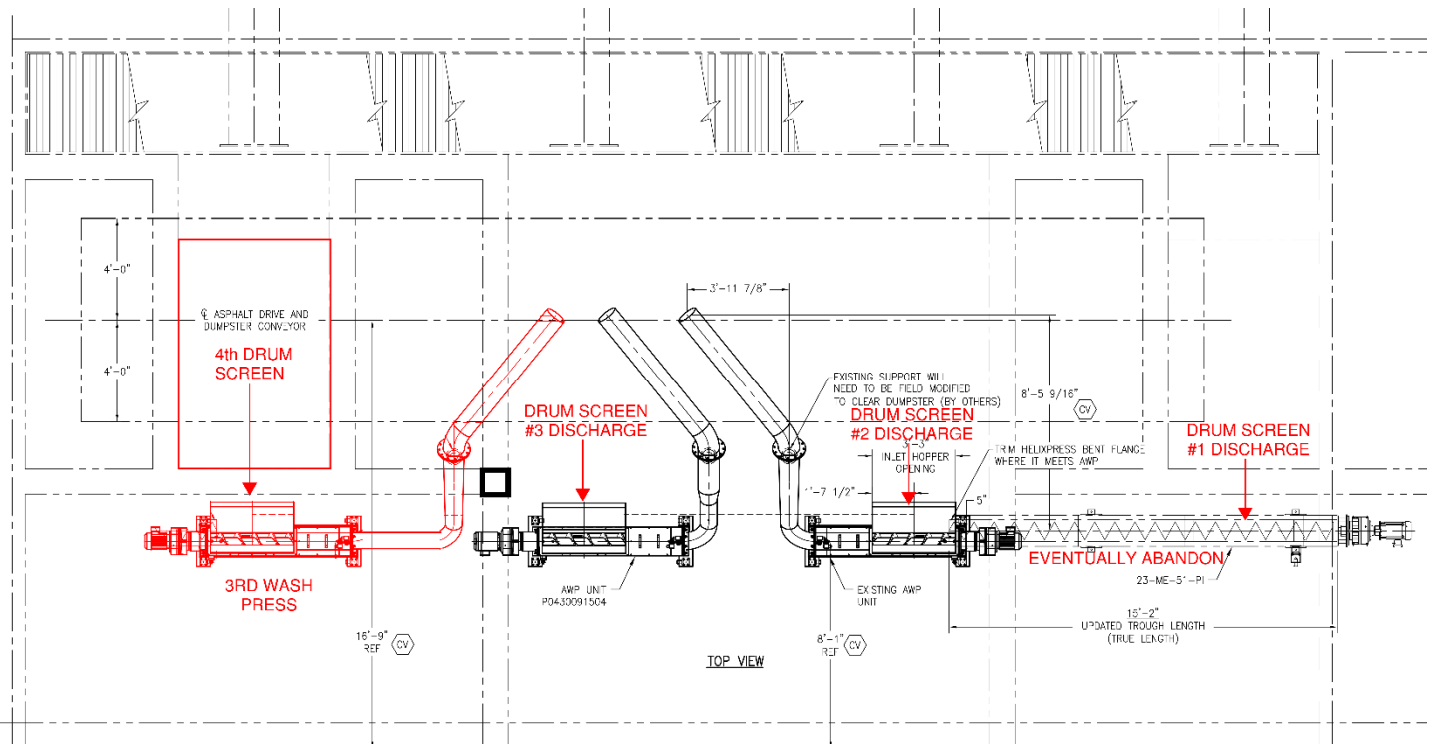


Figure 6.5. 3<sup>rd</sup> Washer Compactor Addition Concept

Refer to CIP Project 6-2 Profile.

### 6.4.3 Add Third Wash Water Booster Pump

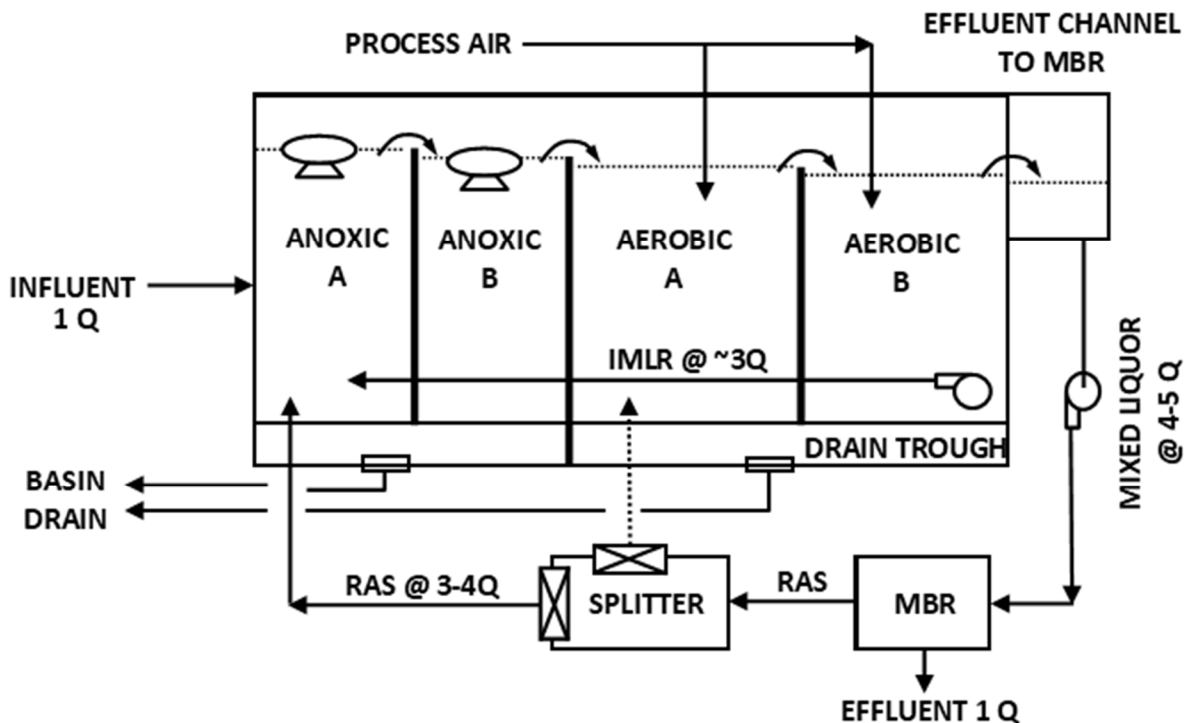
A third wash water booster pump should be added in the spare space to ensure 2+1 redundancy as wash water demands have increased and will increase with the addition of a third mechanical screen, a fourth drum screen, and potentially two more washer-compactors (one for 3<sup>rd</sup> mechanical screen and additional drum screen unit).

**Refer to CIP Project 6-3 Profile.**

## 7.0 Aeration Basins

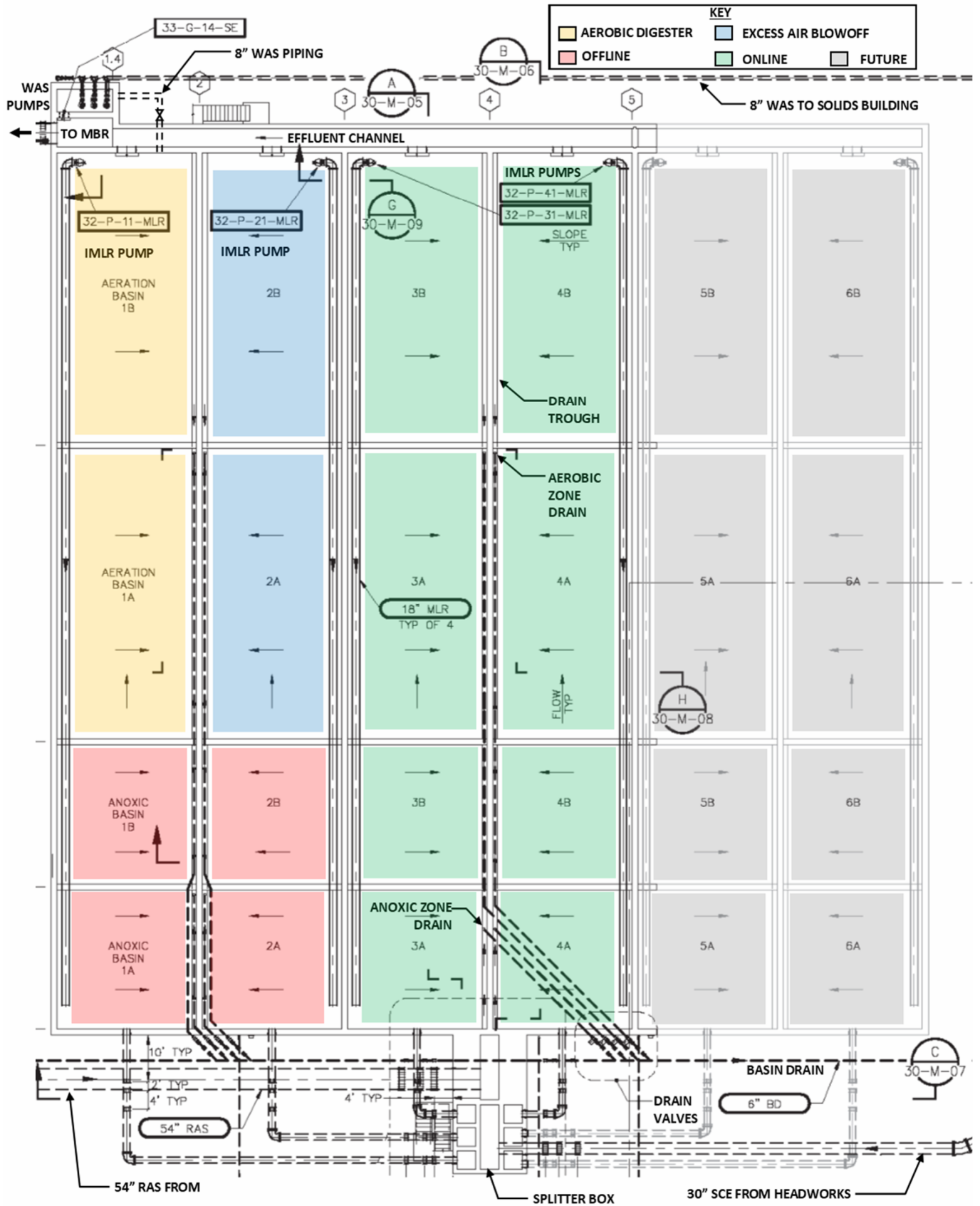
### 7.1 Process Description

The WRF aeration basins are configured as a 4-train Modified Ludzack-Ettinger (MLE) system, which is designed for BOD removal, nitrification, and denitrification. The MLE process is configured as shown in **Figure 7.1** below.



**Figure 7.1. MLE Biological Process Diagram**

Each train includes two anoxic zones, followed by two aerated zones. Each zone is separated by an overflow baffle wall to encourage plug flow conditions and prevent back-mixing. Aerobic Zone B includes an internal mixed liquor recycle (IMLR) pump which returns between 1-4 times the influent flow rate back to Anoxic Zone A. The MLE process is designed to provide both BOD removal and nitrification in the aerobic zones, and then return nitrified mixed liquor (high in nitrate) back to the anoxic zones via IMLR where de-nitrification occurs in a low-oxygen / high substrate environment. The anoxic zones include floating mixers to keep the solids suspended, and the aerobic zones include a grid of fine bubble disc diffusers at the bottom which receive low pressure process air from the aeration basin blowers. Mixed liquor from the aeration basins is pumped to the membrane bioreactors (MBRs). Mixed liquor from the feed side of the MBRs is returned back to the aeration basins as return activated sludge (RAS) by gravity. The plant is set up to allow RAS to be delivered either to Anoxic Zone A or Aerobic Zone A with a splitter box. Currently, WRF Operators are delivering the RAS to Anoxic Zone A. The RAS flow is typically 3-4 times the influent flow rate. The aeration basins include a drain trough. The drain trough is split by the wall between Anoxic Zone B and Aerobic Zone A. Each train therefore has two drains, one for both anoxic zones and one for both aerobic zones. The basins can be drained using buried plug valves located outside the basins. A plan view of the aeration basins is shown in **Figure 7.2** below.



The aeration basins are currently not being operated as initially intended per the original design of the WRF. Current WRF flows and loads are such that only two basins are required to be operated year-round. The WRF is currently operating Trains 3 and 4, as indicated in **Figure 7.2** above.

The aerobic zones of Train 1 are being used as an “abbreviated” aerobic digester, and the anoxic zones are offline. The WRF was originally designed to waste WAS directly from the aeration basin effluent channel to the dewatering facility, without any separate WAS storage or equalization. However, this mode of operation was found to be untenable because it only allowed wasting to occur when the dewatering facility could be operated. The WRF is not staffed to allow continuous / daily operation of the dewatering facility, and is not staffed on the weekends and therefore wasting could not occur on the weekends. This led to a high level of instability in the MLSS levels in the aeration basins and ultimately an unstable biological process overall. Further, it was discovered that without the additional aerobic digestion time, the dewatered biosolids was not meeting the 2,000,000 MPN criteria for Class B biosolids, which would not be an issue for landfill disposal but is an issue for land application.

Therefore, Train 1 was converted to an abbreviated aerobic digester to provide the necessary WAS storage. WAS is sent to the aerobic zones of Train 1 from the RAS splitter box using the train’s RAS piping. A flow meter has been added to the RAS line to be able to meter the WAS flow. The WAS is aerated and further digested in the Train 1 aeration basin. An additional pipe was added connecting Train 1 Aerobic Zone B to the WAS pump station, to allow the WAS pumps to deliver stored RAS from the “aerobic digester” to the dewatering process. The aerobic zones of Train 2 are filled with plant utility water and used to blow off excess air from the aeration basin blowers, as the blowers do not have the turndown required to provide the lower than anticipated air demand from the biological process.

Design criteria for the aeration basins is provided in **Table 7.1** below.

**Table 7.1. Aeration Basin Design Criteria**

Anoxic Zones A,B		Aerobic Zones A,B	
Criteria	Value	Criteria	Value
Zone Dimensions	30’L x 30’W x 16.25’D	Zone Dimensions	125’L x 30’W x 15.5’D
Zone Volume	200,000 gallons total	Zone Volume	430,000 gallons total
Mixer Power	5HP	# of 9” Disc Diffusers	1005 Zone A, 495 Zone B

Design criteria for the process pumps is provided in **Table 7.2** below.

**Table 7.2. Process Pump Design Criteria**

IMLR Pumps		Mixed Liquor Pumps	
Criteria	Value	Criteria	Value
Equipment Tags	32-P-11, 32-P-21, 32-P-31, 32-P-41	Equipment Tags	47-P-11, 47-P-12, 47-P-13
Pump Type	Submersible Propeller	Pump Type	Submersible Propeller
Design Capacity	3,000 gpm @ 2.0’	Design Capacity	9,500 gpm @ 10’
Motor Horsepower	4 HP	Motor Horsepower	44 HP

### 7.1.1 Instrumentation

A list of the critical instrumentation for the aeration basins is provided in **Table 7.3** below.

**Table 7.3. Aeration Basin Instrumentation**

Instrument	Location / Tag Number	# of Instruments
Aeration Zone A Dissolved Oxygen Sensor	Aeration Zone A Each of 4 Basins AIT 3215, 3225, 3235, 3245	1 for each aeration basin zone
Aeration Zone B Dissolved Oxygen Sensor	Aeration Zone B Each of 4 Basins AIT 3217, 3227, 3237, 3247	1 for each aeration basin zone
Aeration Zone A Air Flow Meter	Aeration Zone A Each of 4 Basins FIT 3215, 3225, 3235, 3245	1 for each aeration basin zone
Aeration Zone B Air Flow Meter	Aeration Zone B Each of 4 Basins FIT 3217, 3227, 3237, 3247	1 for each aeration basin zone

## 7.2 Current Operations

### 7.2.1 Current Flows and Loads

The influent BOD and TSS loads for 2020-2024 (each year July 1 – June 30) are shown in **Table 7.4** below.

**Table 7.4. Raw Influent BOD and TSS Loading**

Year	AA BOD lb/d	ADMMF BOD lb/d	AA TSS lb/d	ADMMF TSS lb/d
2019-2020	7,833	13,452	6,612	9,204
2020-2021	7,685	10,268	7,343	11,735
2021-2022	8,104	12,082	6,759	11,286
2022-2023	8,764	15,065	9,561	16,844
2023-2024	8,607	15,346	9,028	16,619

A sampler was added in September of 2024 to measure BOD and TSS values downstream of the drum screens to identify the removal being achieved by the screens. As of the writing of this report there was only a few months worth of data available from September through December of 2024:

- Average Secondary Influent BOD Load : 6,719 lb/day (18% removal through headworks)
- Average Secondary Influent TSS Load: 3,766 lb/day (51% removal through headworks)

The data indicates significant TSS reduction in the range of 45-55% due to the tight drum screen perforation size of 1mm, with a lesser reduction in BOD which is expected with washing and compacting of the screenings.

It should also be noted that the current annual influent BOD and TSS loadings per capita upstream of the screens were approximately 0.18 lb/day/person for BOD and 0.19 lb/day/person for TSS. This is indicative of wastewater that is on the “weak” end of the spectrum. Typical average design BOD loading ranges are 0.17-0.22 lb/day/person and TSS loading ranges are 0.20-0.25 lb/day/person.

### 7.2.2 Current Aeration Basin Operations

Figure 7.3 below shows aeration basin mixed liquor suspended solids from 2021-2024.

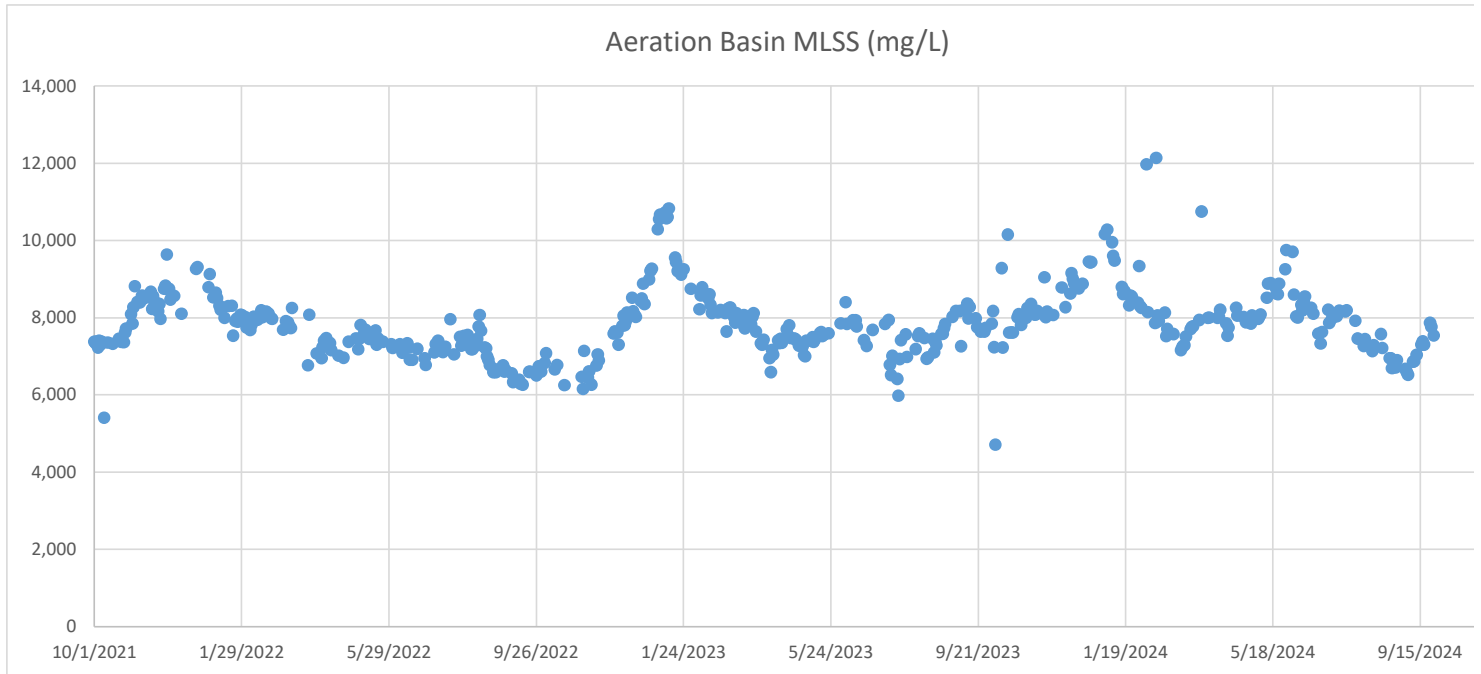


Figure 7.3. Aeration Basin MLSS

The MLSS average in 2024 was 8,150 mg/L. The MLSS temporarily peaked above 10,000 mg/L during some winter storm events, but was able to be quickly brought back into the normal operating range. The goal for operation of the system to operate below 10,000 mg/L in the MBR basin although temporary operation up to 12,000 mg/L is allowable.

The aeration basins are consistently operated at 1.0 mg/L dissolved oxygen residual and control of this is stable and reliable.

### 7.2.3 Current WRF Treatment Performance

Effluent BOD averages approximately 1.9 mg/L and is always well below the limit of 10 mg/L average month.

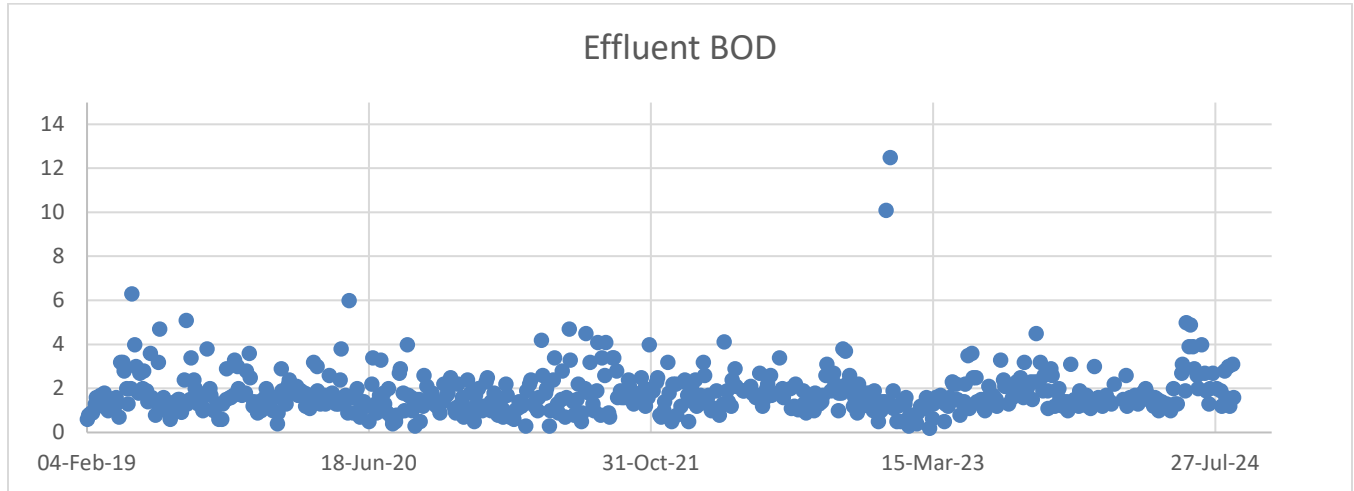


Figure 7.4. WRF Effluent BOD (mg/L)

WRF effluent turbidity is consistently below 0.2 NTU as required by the NPDES permit. The plant SCADA system has an alarm based on percentage of final effluent turbidity values that are above 0.2 NTU, and plant effluent would be automatically diverted to prevent a violation of the discharge permit. This has not been an issue for the plant. Brief diversions do occur on a somewhat regular basis during extended periods of wet weather flows, but this flow is returned to the head of the plant without issue.

WRF effluent TSS is also consistently below 1 mg/L and never approaches the average monthly limit of 10 mg/L.

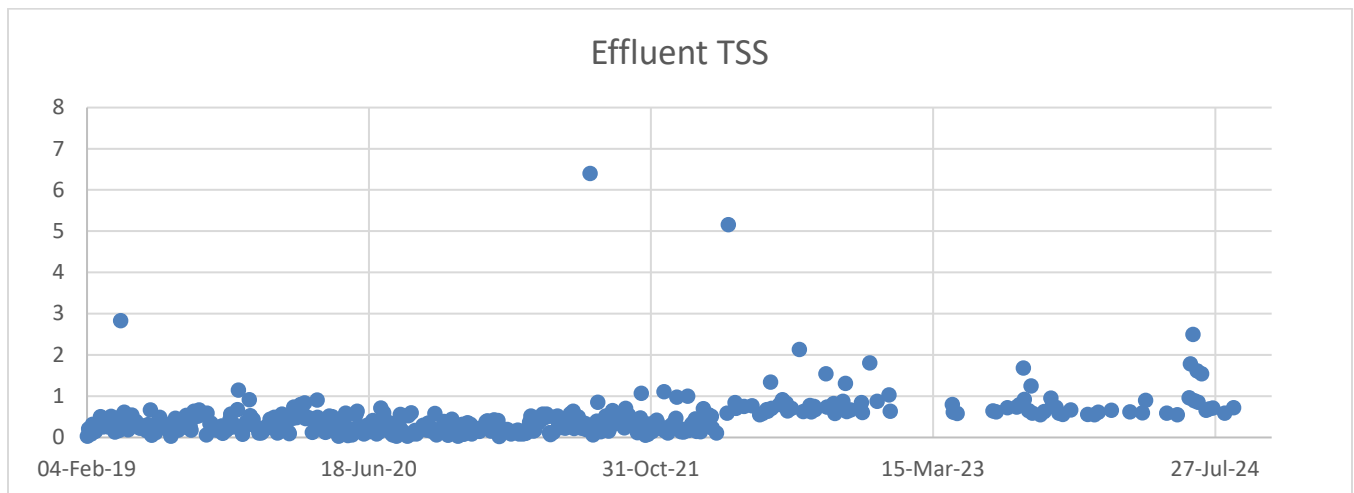
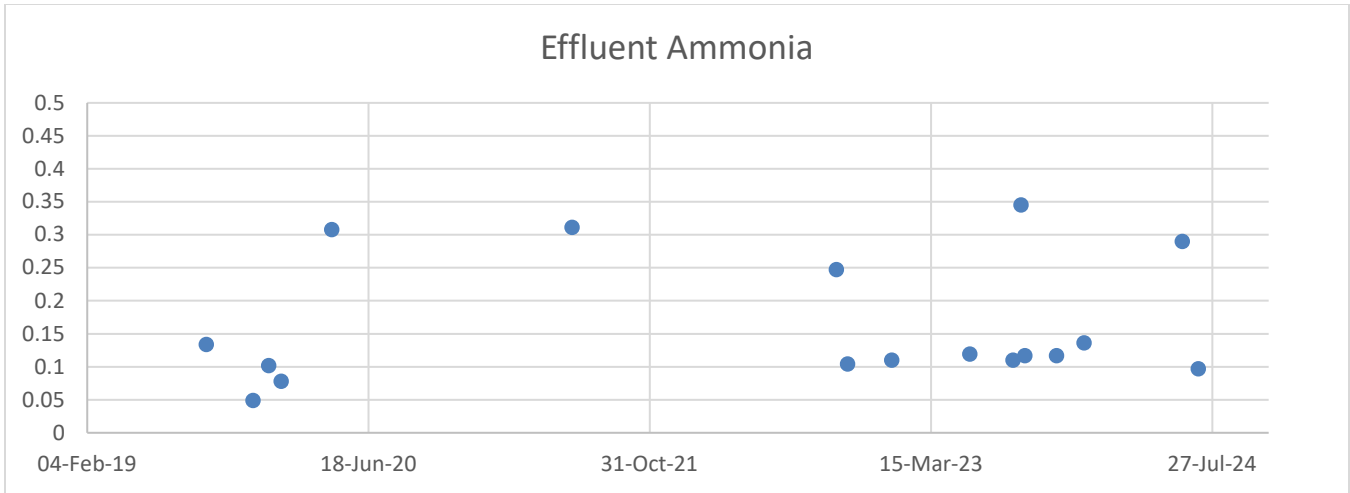


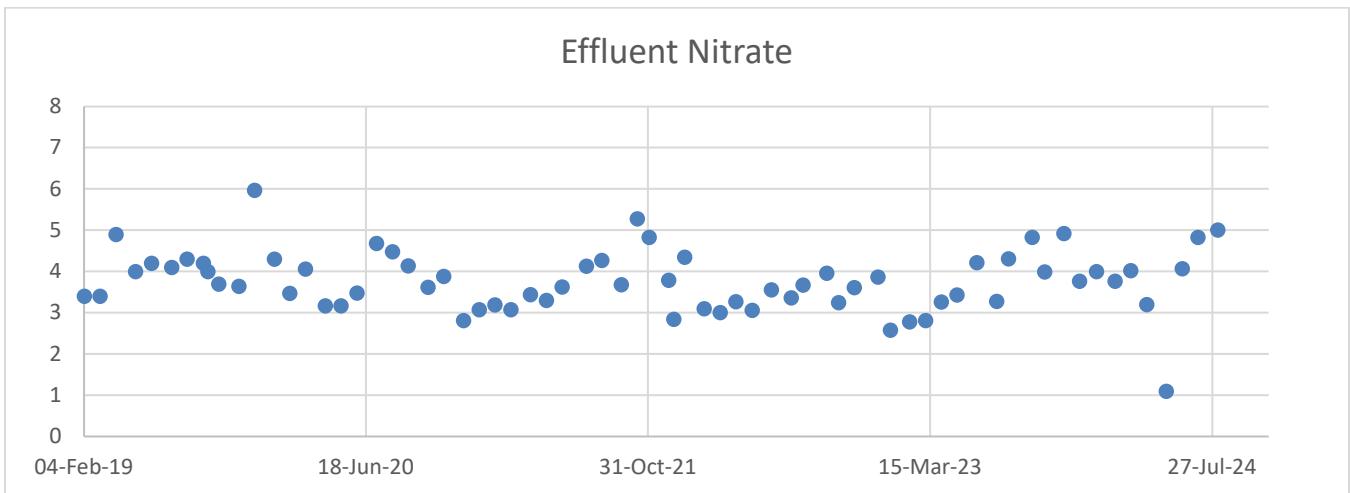
Figure 7.5. WRF Effluent TSS (mg/L)

Effluent ammonia is consistently well below the permit limit of 1.7 mg/L average month.



**Figure 7.6. WRF Effluent Ammonia (mg/L)**

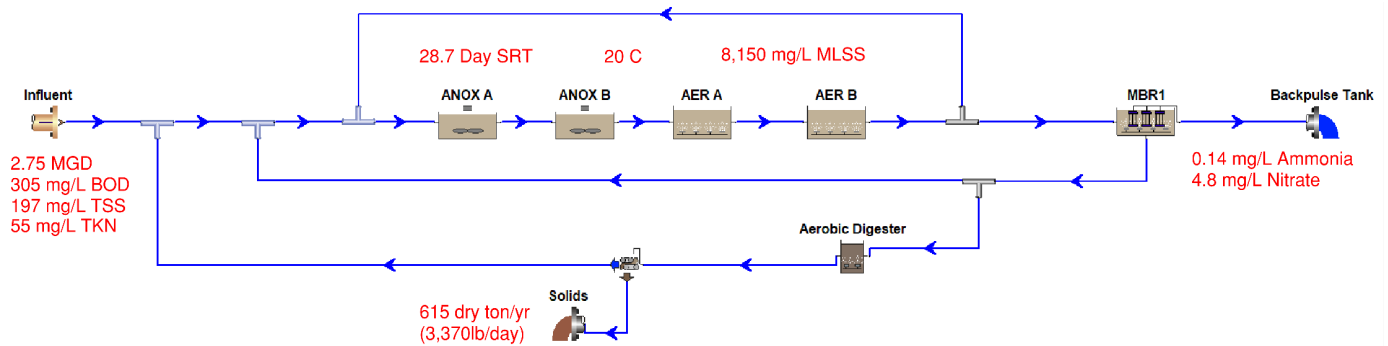
Effluent nitrate averages approximately 4.0 mg/L and is always well below the limit of 10 mg/L average month.



**Figure 7.7. WRF Effluent Nitrate (mg/L)**

### 7.2.4 BioWin Model – Existing Conditions Scenarios

Water Works developed a BioWin model of the existing MLE aeration basin and MBR system. A single train is modeled, for simplicity, with half the flow and load being routed through each train.



**Figure 7.8. BioWin Model Average Annual Flow (AAF) Results (2024)**

First, an average annual model was developed to simulate average 2024 operations with the following inputs:

- Flow = 2.75 MGD, BOD = 305 mg/L (6,995 lb/d), TSS = 197 mg/L (4,518 lb/d), TKN = 55 mg/L (1,261 lb/d)

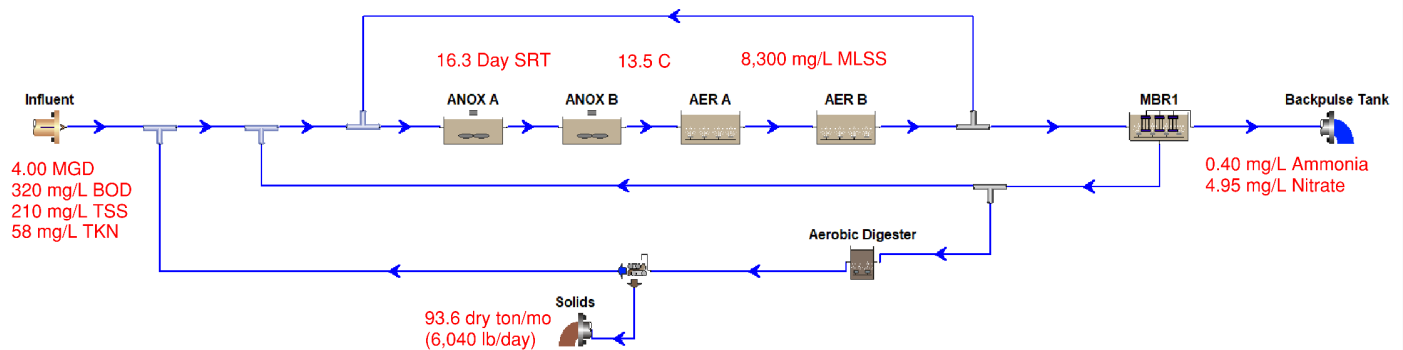
Note that the BOD, TSS, in TKN inputs were selected to more closely match the limited post-headworks screening values and removal percentages that started to be measured in September 2024, thus screenings removed at the headworks are not included in the Biowin model. The BOD load is equal to the 2024 annual average with 19% removal, and the TSS load is equal to the 2024 annual average with 50% removal. The TKN load represents the secondary influent average values. The results of the model run at 20°C correspond very closely with the actual average annual WRF effluent data:

1. MLSS = 8,150 mg/L
2. Effluent Ammonia = 0.14 mg/L
3. Effluent Nitrate = 4.80 mg/L
4. Average Annual Solids to Disposal = 3,370 lb/day (615 dry ton/yr)

This gives confidence that the standard BioWin modeling parameters are reasonably accurate for the purposes of modeling this facility.

A maximum month loading model was run and the results are shown in **Figure 7.9**

- Flow= 4.00 MGD, BOD = 320 mg/L (10,675 lb/d), TSS = 210 mg/L (7,006 lb/d), TKN = 58 mg/L (1,935 lb/d)
- Peaking Factors on all loads are ~1.54 for maximum month vs. average annual



**Figure 7.9. BioWin Model Maximum Month Flow (ADMMF) Results (2024)**

The results of the model run at 13.5°C (colder winter temperatures) correspond very closely with MLSS values seen in the plant data and also the solids production closely matches the maximum month disposal that occurred in March of 2023 (94.14 recorded).

**Table 7.5. Influent and Post-Screen Loading Criteria Summary (2024)**

	BOD	TSS	TKN
2024 AAF Loading Rate per capita	0.18 lb/d	0.19 lb/d	0.035 lb/d
2024 Population	47,800	47,800	47,800
2024 AAF Headworks Load (calc'd)	8,604 lb/d	9,082 lb/d	1,673
Headworks % Removal	19%	50%	25%
2024 Post-Screen AAF Load	6,970 lb/d	4,541 lb/d	1,254 lb/d
	<i>Values above compare closely to values used for current AAF model</i>		
2024 ADMMF Loading Rate per capita	0.275 lb/d	0.280 lb/d	0.054 lb.d
2024 Population	47,800	47,800	47,800
2024 ADMMF Headworks Load (calc'd)	13,145 lb/d	13,384 lb/d	2,581 lb/d
Headworks % Removal	19%	50%	25%
2024 Post-Screen ADMMF Load	10,647 lb/d	6,692 lb/d	1,935 lb/d

While higher recorded 30-day average BOD and TSS loads were measured by the headworks influent sampler in recent years (15,346 lb/day BOD and 16,844 lb/day TSS) than are used for ADMMF modeling above, it does appear that there are some abnormally high individual values in the data affecting these maximum monthly averages that are questionable. WRF Operations Staff have noted that the influent sampler may be affected by fats, oils, and grease in the wet well. The ADMMF loading rates per capita used above match well with values Water Works has seen at other Northern California wastewater plants, and also if higher loading rates were used in the 2024 ADMMF model, the solids production would exceed the value actually seen in March 2023 and would not correlate as well with real-world results seen at the plant.

### 7.2.5 Biological System Design Capacity and Redundancy Discussion

The design capacity of the WRF is stated in the permit as 4.3 MGD ADWF and 8.6 MGD PWWF. When the WRF was originally designed in 2007, the service population was 31,120 and the ADWF was approximately 2.45 MGD. Since 2007, the ADWF has only increased to approximately 2.60 MGD while the service population has increased by 53% to 47,800 (2024). While the plant capacity is defined in terms of ADWF in the WRF permit, the capacity of the biological treatment system is actually more dependent on and limited by BOD, TSS, and TKN loading and the ability of the aeration basins to maintain an adequate SRT for nitrification without regularly exceeding the 10,000 mg/L MLSS design limit for the MBRs.

With an ADWF flow contribution of 57 gpd/capita (slightly conservative), buildout dry weather flows would result in an ADWF of approximately 4.25 MGD, and therefore the plant may never exceed its current permitted ADWF through buildout of residential development if current dry weather flow contributions per capita hold to current values.

However, it appears that the existing aeration basins are essentially at capacity with 2 operational basins at this time during maximum month loading conditions, based on the fact that to maintain the MLSS in the MBR basin

below approximately 10,000 mg/L, MLSS in the aeration basins must be kept below approximately 8,300 mg/L which requires SRT to be at just over 16 days, which is near the minimum recommended value to maintain adequate nitrification in cold temperatures. If we consider that 2 aeration basins are at capacity currently with a service population of 47,800, this indicates the maximum service area population per basin is 23,900 people. For a buildout residential population of 74,300, 3.1 aeration basins would be required, meaning 4 basins would be recommended to be in service at buildout in order to comfortably treat ADMMF flows and loads.

Further, although there are no significant industrial dischargers in the City of Oakley, there may be interest in the future in allowing a significant industrial facility within the City. If we consider that 4 aeration basins would be required to operate in the future at residential buildout, we can estimate a remaining flow/load available.

**Table 7.6. Potential Available Capacity for Industrial Loading**

Average Annual Conditions	BOD	TSS	TKN
After Screen Capacity / basin	3,500 lb/d	2,250 lb/d	630 lb/d
% Removal (Conservative)	~15%	~46%	~18%
Headworks Capacity / basin	4,100 lb/d	4,170 lb/d	768 lb/d
4 Basin Capacity	16,400 lb/d	16,670 lb/d	3,070 lb/d
Per Capita Average Annual	0.18 lb/d per capita	0.19 lb/d per capita	0.035 lb/d per capita
Buildout Population	74,300	74,300	74,300
Residential Buildout Load	13,375 lb/d	14,100 lb/d	2,600 lb/d
Available Capacity	3,025 lb/d	2,570 lb/d	470 lb/d
Available Capacity (People)	16,800	13,500	13,400
ADWF Limit (57 gpd/capita)	0.95 MGD	0.77 MGD	0.76 MGD
People / EDU	3.4	3.4	3.4
EDU Capacity	4,940	3,970	3,940

The maximum industrial flow to be accepted is approximately 0.70-0.75 MGD, which is equivalent to 3,500-4,000 EDUs.

### 7.2.6 Process Pump Redundancy

The IMLR pumps are designed for 3,000 gpm, or 4.32 MGD. IMLR pumps would normally be sized to allow up to 2Q flow at peak day flow. With 4 basins online in the future, this would represent a total flow of 17.28 MGD supporting up to 8.6 MGD of peak day flow. Current peak day flow is approximately 4.8 MGD with ADWF at 2.65 MGD, or a peaking factor of ~1.8. At 4.3 MGD future ADWF, peak day flow would be expected at 7.75 MGD. With recycled utility water flows the IMLR pumps are still appropriately sized.

The mixed liquor pumps are designed for 9,500 gpm, or 13.68 MGD at 10' of head. However, hydraulic modeling of the mixed liquor pumps using expected peak day flow water surface elevations and the pump test curves indicates the pumps would actually operate at approximately 10,600 gpm at 8.1' of head with 2 pumps online. With one pump out of service, firm capacity is currently 30.5 MGD with 2 pumps at actual operating conditions. This would support up to 7.6 MGD of membrane flow with minimum 3Q returning to the aeration basins. With approximately 1.15 MGD of recycled water flows, the existing pumps can support up to ~6.5 MGD of peak daily flow.

Because peak day flow is expected to exceed that as stated above, it is recommended that the mixed liquor pumps are replaced with larger capacity pumps when they are due for replacement, which is expected in approximately 2033-2025. The pumping capacity would be recommended as follows:

- Peak Day Buildout Flow Estimate:
  - 7.75 MGD through flow, 1.15 MGD utility water recycle flow, 0.7 MGD industrial flow
  - Total = 9.6 MGD x 4.0 (3.0 recycled to aeration basin) = 38.4 MGD
  - Pump Capacity = 38.4 MGD / 2 pumps (1 standby) = 19.2 MGD per pump (15.3 MGD currently)

### 7.2.7 Instrumentation Redundancy

Each aerated zone includes a single dissolved oxygen sensor, air flow meter, and modulating valve to control the air flow rate. This is industry standard, as it is not cost effective to provide on-line redundant instruments and modulating valves in aeration basins. The necessary redundancy lies in the fact that an entire redundant aeration basin should be available. In the worst case, air flow into an aeration basin can be manually controlled by locally operating the control valve and measuring dissolved oxygen levels by hand while instruments are being repaired or replaced, if necessary.

## 7.3 Major Condition Assessment Findings

The RAS piping in the aeration basins is painted ductile iron and has coatings failure.



**Figure 7.11. RAS Piping Coatings Failure**

There is a large crack in the aeration basins that appears to span all 4 basins. Cracks were noted to typically follow the control joints at most locations.

A continuous crack was observed along the interior face of the north wall of the aeration basin. The crack runs along the control joint and shows varying crack width as seen below. Significant spalling of concrete was noted in some sections of the crack. As the basin was online during the condition assessment, we could not trace the crack to the base slab and verify if the crack propagates through the base slab, but it is assumed at this time that it does. The exterior face of this control joint shows visible minor cracking but not leakage.



Photo 1 – Crack along CJ at north basin wall interior face



Photo 2 – Close up of crack in photo 1 depicting varying crack widths



Photo 3 – Spalled concrete in sections of crack seen in photo 1

**Figure 7.12. Aeration Basin Crack in North Wall (of Aerobic Digester Basin 1)**

Another continuous crack was observed along the south wall control joint. Photo 4 shows the crack at the interior face of the joint. As the basin was in operation, the extent to which the crack propagates along the control joint was not fully visible. This crack location aligns with the control joint on the north side which indicated possibly a weak plane in the basin structure which can significantly impact the structural integrity of the basin. It is recommended that the basin be drained, and the complete length of crack should be traced along the walls and the slab between the north and south outer walls.

The exterior face of the south wall shows minor cracks at a couple locations as seen in photo 5. These cracks are localized and don't run along the entire length of the joint. The cracks show varying crack widths ranging from ½" to 1" at some sections. Damage observed on some portions indicates significant spalling potential in the future. No visible leakage was noted at the exterior face minor cracks.



Photo 4 – Crack at interior face in south wall of aeration basin

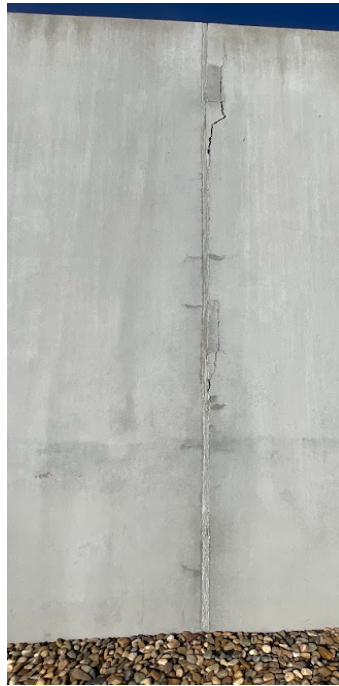


Photo 5 – Minor crack at exterior face of south wall



Photo 6 – Spalling at exterior face of south wall crack

**Figure 7.13. Aeration Basin Crack in South Wall (of Basin 4)**

## 7.4 Recommended Improvements

A third aeration basin should be placed online in 2025-2026. The existing “abbreviated aerobic digester” may remain online.

### 7.4.1 Major Crack Repair and RAS Pipe Coating

Repair cracking which is anticipated to span through all 4 aeration basins. The anticipated repair methodology is epoxy injection, but requires further inspection and investigation to confirm.

As aeration basins are taken offline one at a time for the repair, inspect air diffusers to determine condition and possible timeline for replacement due to end of service life.

The RAS piping in the aeration basins should be completely recoated as basins are taken offline as well.

**Refer to CIP Project 7-1 Profile.**

## 7.4.2 Number of Aeration Basins and Potential Industrial Loading Discussion

### 7.4.2.1 Aeration Basins Without Additional Industrial Loading

Without any potential industrial loading, or otherwise, considered beyond the planned buildout residential population of 74,300, it would be recommended to operate 3 aeration basins normally, in addition to the existing aerobic digester up to at least a service population of 70,000-71,000. In the case that maintenance or repair work is needed on an aeration basin, the aerobic digester would be placed into aeration basin service and WAS would need to be drawn directly from the aeration basin effluent channel per the original design intent.

As plant flows and loads increase and begin to approach the plant's permitted ADWF of 4.3 MGD, the SWRCB typically requires an agency to begin planning of plant improvements for additional capacity when 80% of the permitted flow is reached. This would occur at an ADWF of approximately 3.45 MGD or a service population of 60,350. At current rate of population growth this is expected to occur in approximately 10 years (or ~3,700 additional EDUs at 3.4 persons per EDU from 2024 population).

At that time, ISD could go through a process to "re-rate" the existing plant to show that it has capacity for up to 5.0 MGD with all 4 basins online based on current plant flows, loads, and modeling as presented in this report. If the plant were re-rated to 5.0 MGD (10.0 MGD PWWF), this would allow for growth to a population of 70,000 or more:

- New re-rated ADWF=5.0 MGD
- 80% Capacity = 4.0 MGD ADWF (70,000 persons x 57 gpd/capita)
- Anticipated Peak Day Flow @ 4.0 MGD = 7.2 MGD (1.8 peaking factor)
- Anticipated PWWF @ 4.0 MGD = 8.0 MGD (2.0 peaking factor)

Improvements discussed in this report that would likely be required associated with the plant re-rating to 5.0 MGD ADWF / 10 MGD PWWF would include:

1. Replacing the UV system (due to service life) with new Trojan system design and adding 2 banks
2. Adding an additional (7<sup>th</sup>) cassette of membranes to each basin (recommended at 7.2 MGD PWWF)
3. Upsizing the mixed liquor transfer pumps (recommended at 6.5 MGD peak day flow)
4. Installation of 3<sup>rd</sup> 150HP effluent pump (recommended at 7.4 MGD PWWF)

Once the service population reaches 70,000-71,000, this is the point where 3 aeration basins will be nearing capacity. At that time, further detailed assessment of continued future growth will need to be made. If growth beyond 74,300 residential service population can be proven to be non-viable based on current planning within the service area boundary, the State Water Board may not require additional planning and improvements in order to reach 4.3 MGD ADWF which would represent 86% of capacity with no further development on the horizon.

Over a service area population of 71,000, it would be recommended to operate all 4 of the aeration basins normally. Between a service area population of 71,000-74,300, 4 aeration basins would be relatively "lightly loaded". At that point, if an additional aeration basin is not constructed the existing aerobic digester would need to be converted back to at least a part-time aeration basin. **However this may affect biosolids treatment options.**

The main reason that the existing makeshift aerobic digester was implemented was that without it, pumping WAS straight out of the aeration basin effluent channel (and effectively out of the aeration basin MLSS inventory) relatively rapidly decreases the MLSS and SRT in the basins. This has 2 negative effects:

1. The % solids of the WAS will drop throughout the day during belt filter press operation, and changing solids content requires adjustment of polymer feed and closer operator attention.
2. Changing (dropping) MLSS in the aeration basin process can be disruptive or tougher to manage. Operators want to maintain a stable SRT within a relatively consistent operating band if at all possible.

**Table 7.7. Effect on MLSS from Belt Filter Press Dewatering**

Parameter	Value 2 Basins	Value 4 Basins
Aeration Basin Volume (each)	434,000 gal	434,000 gal
MLSS	8,100 mg/L	8,100 mg/L
lbs/basin	29,318	28,318
# of Basins	2	4
Total lbs MLSS	58,637	117,274
Max Processing*	14,000	14,000
Percentage of Inventory Processed	23.9%	11.9%
MLSS at End	6,163	7,129

\* 2 Machines @ 2,000 lb/hr total for 7 hours per day

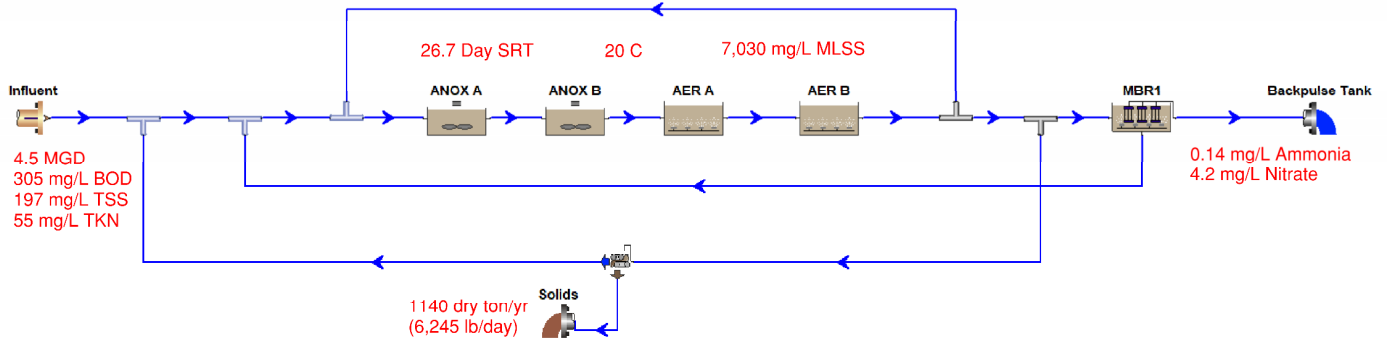
Under current operations with 2 trains in service near capacity, at 8,100 mg/L MLSS to start with the SRT may be hovering at the lower end of desired values for nitrification/denitrification. Dropping the MLSS to near 6,000 could push the SRT over the edge and lead to process upsets.

Under future operations with 4 trains operating lightly loaded with a comfortably high SRT and a much higher total MLSS inventory, pumping WAS directly from the effluent channel would have much less effect on the biological process and also require less polymer dose adjustment during a belt filter press processing run. With 4 trains in operation under future flows and loads, operation of the plant under the original design intent with no makeshift aerobic digester is much more feasible, assuming Class B biosolids are not needed out of the BFPs.

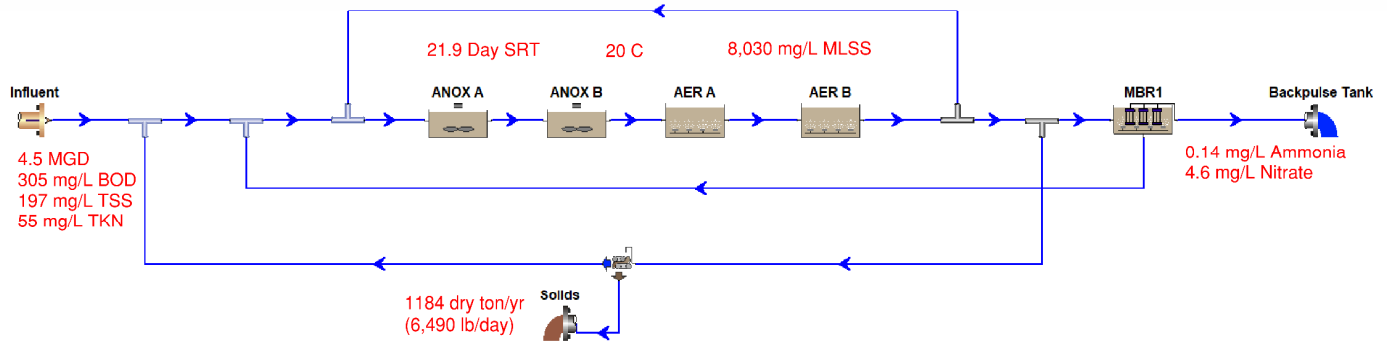
Further, with 4 basins operating lightly loaded, if one of the basins needed to be taken down for repairs or maintenance, there would be few if any times during the year that removing a basin from service would not be possible. It is common design practice to design a plant with all aeration basins in service under average dry or annual conditions in a lightly loaded state, with the ability to take one out of service and operate the remaining basins heavily loaded. This is how the ISD WRF was originally designed.

Future residential buildout average annual operations are shown below with 3 basins and 4 basins in service. In this model, the aerobic digester has been removed and WAS is pumped from the effluent of the aeration basins. With 4 basins in service the MLSS would be in the low 7,000 mg/L range and SRT greater than 26 days. With 1 basin out of service (3 in service) the SRT is still greater than 21 days with MLSS at just over 8,000 mg/L which is still comfortable for operations. This would allow potential flexibility to continue operating the “aerobic digester” during the warmer months of the year and only operating 4 basins during the colder months.

### RESIDENTIAL BUILDOUT AVERAGE ANNUAL 4 BASINS



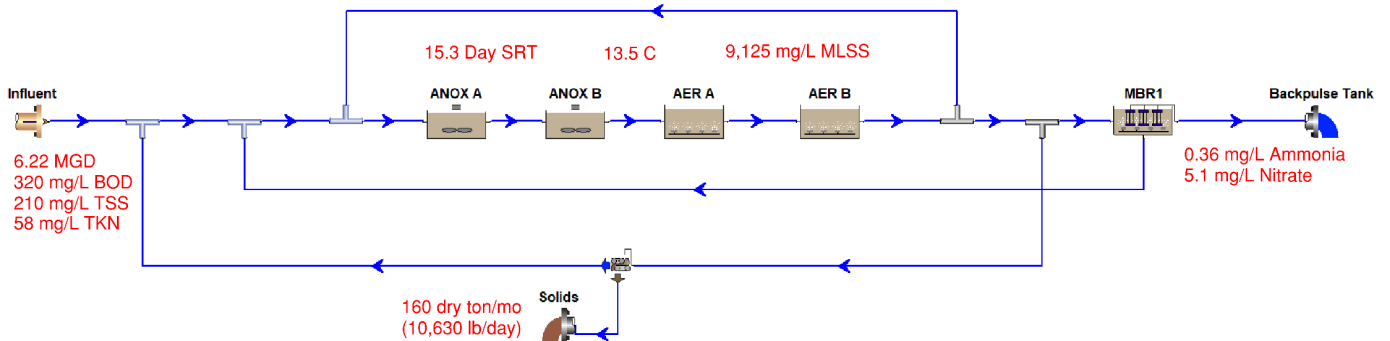
### RESIDENTIAL BUILDOUT AVERAGE ANNUAL 3 BASINS



**Figure 7.14. Residential Buildout Average Annual Results with 3 and 4 Basins Online**

If a basin has to go out of service under future residential buildout maximum month conditions leaving 3 in service, the model indicates that treatment will still be adequate, however MLSS will exceed 10,000 mg/L in the MBR basin and SRT will be near the bare minimum. Essentially the system would be highly stressed near its limitation.

### RESIDENTIAL BUILDOUT MAXIMUM MONTH 3 BASINS



**Figure 7.15. Residential Buildout Maximum Month Results with 3 Basins Online**

#### ***7.4.2.2 Aeration Basins with Additional Industrial Loading***

If any loading above planned residential buildout, industrial or otherwise, is added for consideration, it essentially disturbs the logic presented in the previous section and causes some critical tipping points to be reached.

If for example 0.7 MGD of industrial flow were added to the 4.3 MGD residential flow for a total of 5.0 MGD and the plant had been re-rated to 5.0 MGD, it would be more likely that SWRCB would require further improvements and may not allow the plant to actually operate at 100% of its design flow. If the plant capacity has to be increased above 5.0 MGD ADWF / 10.0 MGD PWWF, this would trigger additional mechanical screens and drum screens, as the PWWF capacity of each unit is up to 5.0 MGD with 2 duty units and 1 standby unit. There is space for a 4<sup>th</sup> drum screen, but there is not space for a 4<sup>th</sup> mechanical screen.

Additional membrane cassettes (8<sup>th</sup> and possibly 9<sup>th</sup>) would also be triggered.

Most critically, with additional flows above the planned residential buildout capacity, the construction of an additional aeration basin (5<sup>th</sup>) would need to be considered, since it would be very unlikely that the plant could treat ADMMF with one basin out of service. Without an additional basin, there would be more times of the year that the plant could potentially not treat all influent flow if a basin were to go out of service during peak flows and loads as the amount of flow over planned residential buildout capacity increases (on a sliding scale).

With respect to the UV system, additional flows over the planned residential buildout would also increase times where the UV system may be over capacity if UVT were running at 55% minimum during major storm events and one bank is offline in each basin, requiring effluent to be diverted to the South Pond. With 2 additional banks added (4 each basin, 3 online each basin) the system can adequately treat 10 MGD PWWF at a UVT of approximately 57%, but only 9 MGD at 55%.

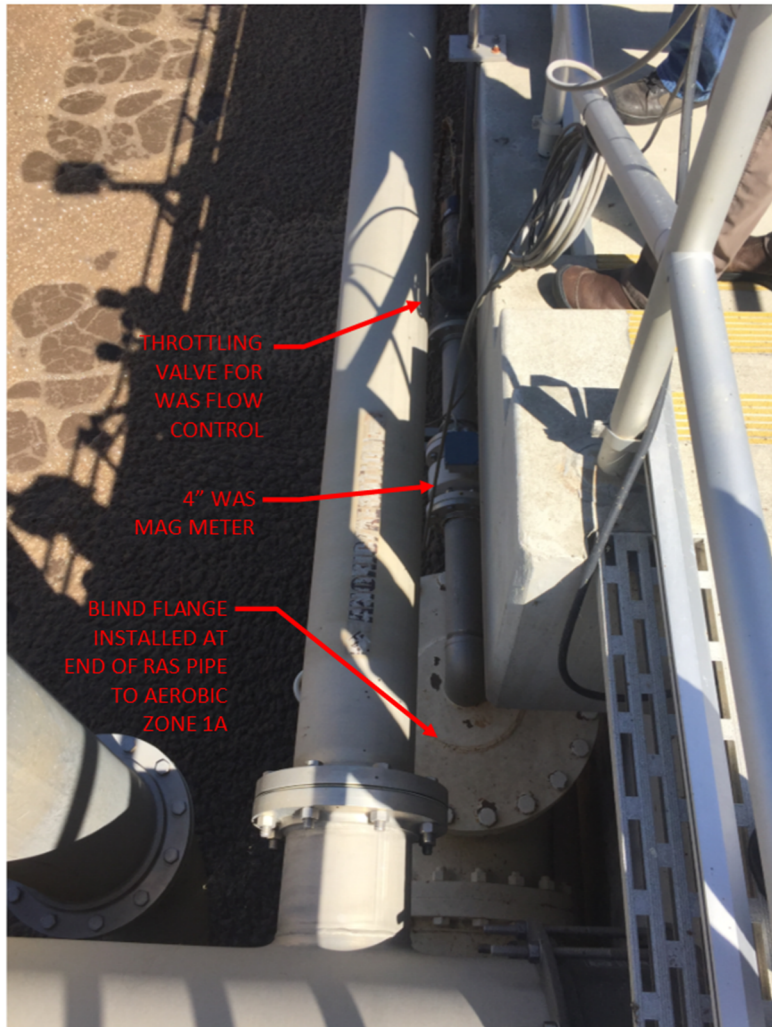
In summary, flows above planned residential buildout could trigger very expensive improvements that may make receiving such additional flows economically infeasible, however this would need to be assessed in further detail in the future as the extent and timing of residential buildout becomes more clear and well defined, and would be heavily dependent on whether the SWRCB would allow the plant operate near 100% of its rated capacity.

## 8.0 WAS Management

### 8.1 Process Description

The aerobic zones of Aeration Basin Train 1 are being used as an aerobic digester, and the anoxic zones are offline. The WRF was originally designed to waste WAS directly from the aeration basin effluent channel to the dewatering facility, without any WAS storage or equalization. However, this mode of operation was found to be untenable

because it only allowed wasting to occur when the dewatering facility could be operated. Also, the biosolids out of the belt filter presses were not meeting the Class B requirement for less than 2,000,000 MPN fecal coliform per gram of dry solids.



The WRF is not currently staffed to support daily operation of the dewatering facility, and is not staffed on the weekends and therefore wasting could not occur on the weekends. This led to a high level of instability in the MLSS levels in the aeration basins and ultimately an unstable biological process overall. Therefore, Train 1 was converted to an aerobic digester to provide the necessary WAS storage. WAS is sent to the aerobic zones of Train 1 from the RAS splitter box using the Train 1 RAS piping. A flow meter has been added to the RAS line to be able to meter the WAS flow (see picture at left). The WAS is aerated and further digested. An additional pipe was added connecting Train 1 Aerobic Zone B to the WAS pump station, to allow the WAS pumps to deliver stored WAS from the “aerobic

digester” to the dewatering process. The aerated Zones 1A and 1B provides a maximum of approximately 400,000 gallons of WAS storage.

**Table 8.1. WAS Pump Design Criteria**

Criteria	Value
Equipment Tags	33-P-11, 33-P-12, 33-P-13
Pump Type	Submersible Solids Handling
Design Capacity	425 gpm @ 34'
Motor Horsepower	7.5 HP

The WAS pumps are designed for 2 duty + 1 standby operation, and operate on VFDs.

### 8.1.1 Instrumentation

The existing WAS pump station includes a bubbler level transmitter (LE 3310) and a low level switch (LSL 3330) which will stop the WAS pumps at low level in the pump station.

## 8.2 Current Operations

In the last year's worth of WRF data, the annual average WAS rate was 44,000 gallons per day. With the current ~400,000 gallon WAS storage volume in aeration Zones 1A and 1B, an average storage capacity of 9 days of WAS production is available. The maximum daily WAS rate was 75,735 gallons in the last year which matches well with the Biowin maximum month model of current operations. The WAS TSS averages approximately 10,000 mg/L (i.e. 1% solids).

In the last several years, the dried biosolids from the belt filter press were hauled and land applied as Class B sludge by Synagro for approximately 7 months per year (mid October to mid May) and land applied on Jersey Island for approximately 5 months per year. As of 2025, land application on Jersey Island has been halted and Synagro is land applying all of the District's biosolids year-round.

The belt filter presses typically produces 14-16% dry solids cake. Currently ISD is complying with the Class B biosolids requirements contained in 40 CFR Part 503 as follows:

1. Pathogen Reduction Requirement: The geometric mean of the density of fecal coliform in the samples shall be less than either 2,000,000 Most Probable Number per gram of total solids (dry weight basis) or 2,000,000 Colony Forming Units per gram of total solids (dry weight basis).
2. Vector Attraction Reduction Requirement: Sewage sludge applied to the land surface or placed on an active sewage sludge unit shall be incorporated into the soil within six hours after application to or placement on the land, unless otherwise specified by the permitting authority.

Synagro is allowing compliance with the vector attraction reduction requirement through their documented application procedures at the offsite land application site.

### 8.2.1 Pumping Redundancy

Currently both belt filter presses are operated together at approximately 420 gpm total flow rate, and this is done by operating 1 out of 3 WAS pumps at essentially full speed. There is more than adequate available capacity and redundancy.

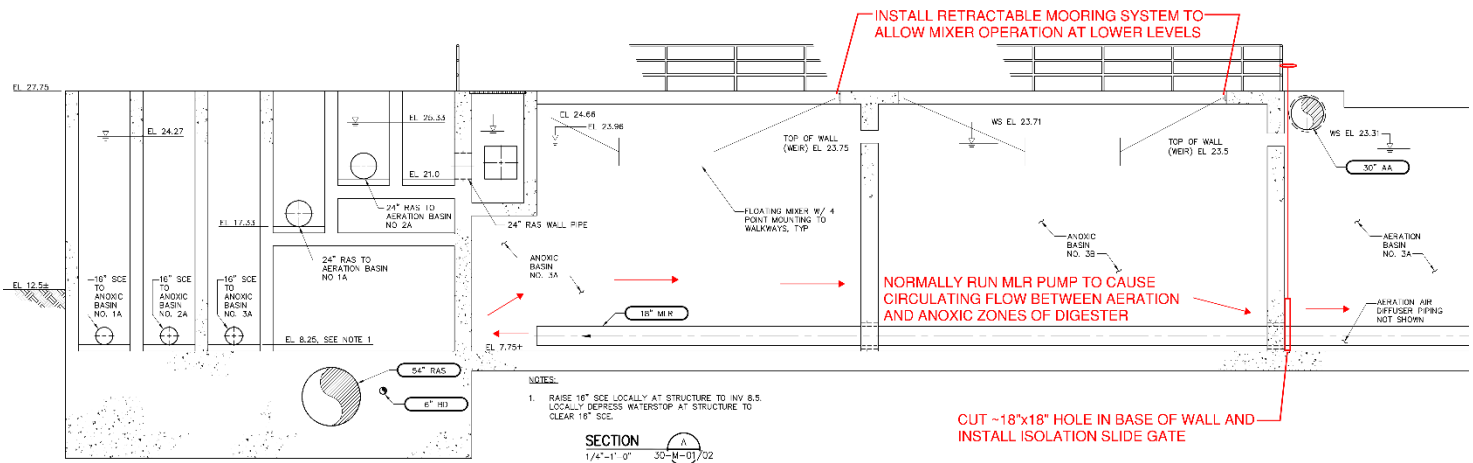
### 8.2.2 Instrumentation Redundancy

The level instrumentation in the existing WAS pump station has adequate redundancy, with a low level switch backing up the bubbler level transmitter. Level in the WAS pump station is not used to control the WAS pumps, as they are controlled based on flow rate to the dewatering facility, and therefore level instrumentation is not critical for operation of the WAS pump station, other than low level alarming and pump shutdown.

## 8.3 Recommended Improvements

### 8.3.1 Aerobic Digester Expansion

As plant flows and loads increase, expansion of the existing aerobic digester is recommended if it is continued to be used to equalize WAS. This could be done by utilizing the currently un-used anaerobic area of Train #1. If a hole is cut in the divider wall between Anoxic Zone B and Aerobic Zone A and the MLR pump is operated, this would continuously recirculate flow between the aerobic and anoxic zones, which is actually beneficial to help control nitrates and pH in any filtrate from the dewatering process that is subsequently returned to the aeration basins.



**Figure 8.1. Aerobic Digester Expansion**

To accommodate this, the hole would need to be cut near the bottom of the divider wall to allow operation down to low levels, and a slide gate would be recommended to allow isolation for maintenance events and also to allow this basin to operate normally if it were to be used for regular aeration basin service.

Additionally, the mooring systems for the anoxic mixers would need to be improved to retractable systems that would allow the mixers to follow a more greatly varying water level.

Alternatively, coarse air bubble mixing (using air from the aeration basin blower) could be used to provide anoxic mixing without the addition of significant dissolved oxygen. This would require the installation of coarse air diffusers in the anoxic zone.

The former solution is recommended, however as this would allow the basins to be placed back into regular aeration basins service more easily in the future, if needed.

**Refer to CIP Project 8-1 Profile.**

## 9.0 MBR Facility

### 9.1 Process Description

The MBR equipment is the ZeeWeed 500d system manufactured by Suez / Veolia. The membrane filter element is a reinforced hollow fiber with the following properties:

1. Material: PVDF
2. Nominal Pore Size: 0.04 micron (ultrafiltration)
3. Fiber Diameter: 1.9m OD / 0.8mm ID
4. Flow Path: Outside-In

The membrane hollow fiber elements are installed on modules, each of which contain a number of fibers that provides 340 ft<sup>2</sup> of membrane surface area. The modules are installed into cassettes that contain up to 48 modules each. Each cassette contains a common permeate/backwash header that connects all of the modules, and two connections to the air scour system.



**MEMBRANE MODULE**



**MEMBRANE CASSETTE**



**Table 9.1. MBR Basin Design Criteria**

Criteria	Value
Basin Dimensions (each of 4)	63' L x 10' W x 9' D (45,000 gallons each)
# of Cassettes per each of 4 Basins	7 Full – 2 Spare (for possible expansion)
# of Modules per each of 4 Basins	48 in 7 cassettes, 336 modules per basin
Filter Surface Area per each of 4 Basins	114,240 square feet per basin
Current Average ADWF Flux 2 Basins Online	11.8 gfd average (@2.7 MGD)
Current Peak Flux Rate 3 Basins Online	17.5 gfd instantaneous peak (@ 6.0 MGD)

The membrane system operates under a low-pressure vacuum created by the permeate pumps which draw clean water to the inside of the fiber while leaving impurities in the membrane tank. The membrane air scour system provides both mixing of the membrane basin contents and agitation of membrane fibers to reduce the fouling effects of suspended solids accumulating on the surface. The air also provides additional process aeration while the mixed liquor is in the membrane cassette basins. The mixed liquor transfer pumps, which deliver mixed liquor from the aeration basins to the MBR basins, run at a flow that averages 4-5 times the permeate flow (Q) of the membranes. The remaining 3-4Q of flow exits the MBR basins over an overflow weir and is returned as RAS through gravity piping to the aeration basin RAS splitter box.

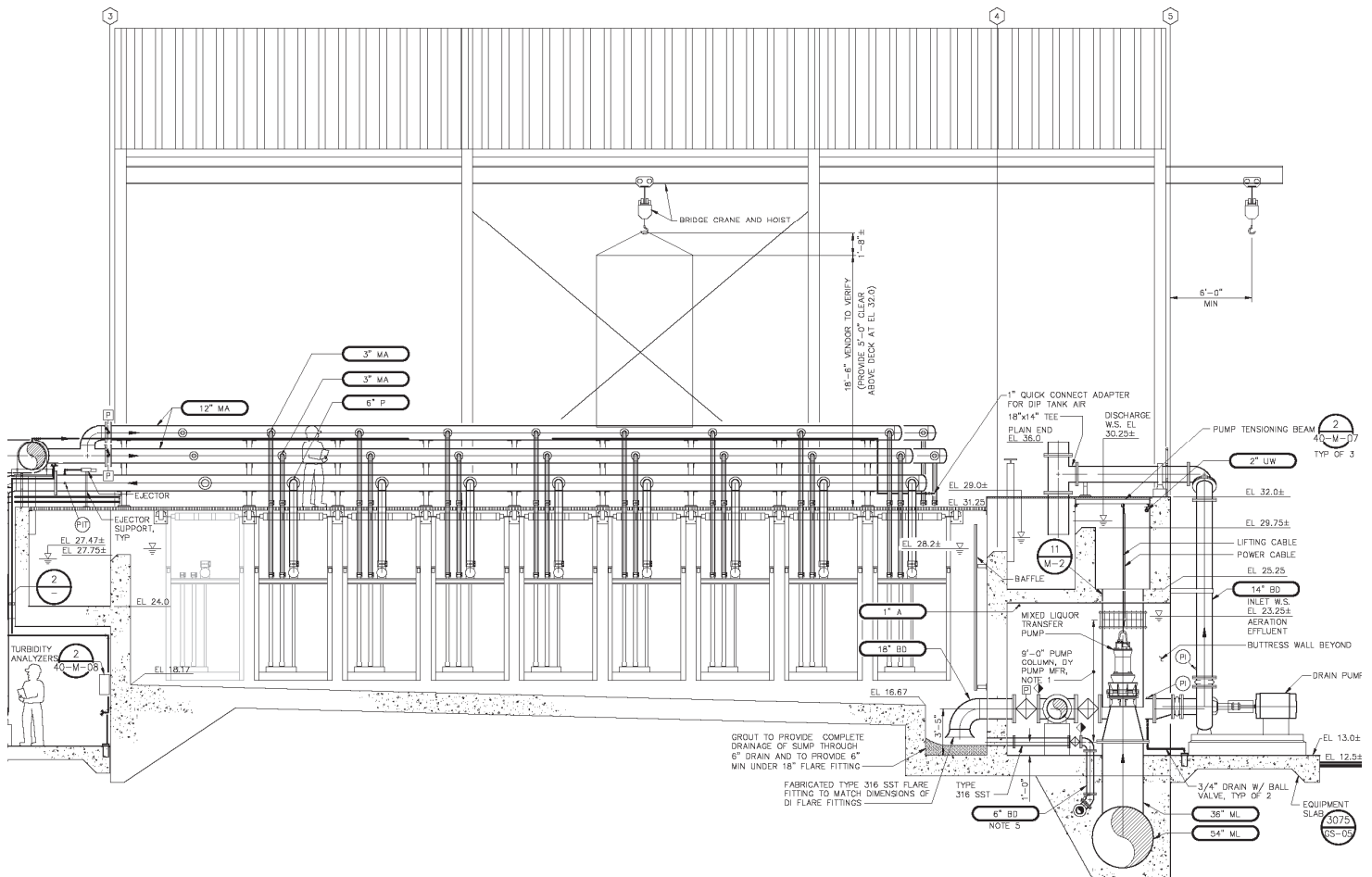
As the mixed liquor from the aeration basins is drawn through the membranes during filtration, solids accumulate on the membrane surface. As solids accumulate, they restrict flow through the membranes and eventually membrane cleaning is required in order to maintain the filtered water flow rate. There are four types of membrane cleaning methods: (1) Backpulse, (2) Relax, (3) Maintenance Cleaning, and (4) Recovery Cleaning.

Backpulse cleaning is achieved by pumping a portion of the permeate that is stored in the backpulse tank through the membranes in the reverse flow direction. Relax cleaning is achieved by simply stopping the permeate pumps and allowing the air scour system to clean the membranes when not drawing fluid through the media. Currently, relax cleaning is utilized rather than backpulse cleaning. Backpulse cleaning requires more energy to run the backpulse pumps and “wastes” clean produced filtrate. WRF Operations Staff have found that trans-membrane pressure (TMP) can be maintained in a stable manner using relax cleaning. Relax cleaning is currently programmed to stop permeate production for 40 seconds every 18 minutes for each membrane tank that is online.

Maintenance cleans are completed for each membrane tank one time per week. These are initiated manually by the Plant Operator. During a maintenance clean, flow to the membrane tank is stopped and the train is aerated for a period of two minutes. Over a forty-five minute period, approximately 500 mg/L of sodium hypochlorite (for oxidation of organic foulants) is injected into the backwash flow from the backpulse pump, and pumped through the membranes in regular pulses flowed by a clean water flush at the end. Following the sodium hypochlorite clean, citric acid (for dissolution of inorganic foulants) is injected in a similar manner. The operator must ensure that the liquid in the membrane tank is neutralized prior to returning to forward flow to prevent discharge violations. This is typically done by circulating mixed liquor through the basin for a period of time prior to re-starting the permeate pumps.

Recovery Cleans may be required to restore the permeability of the membrane once the membrane becomes fouled. The recovery cleaning procedure consists of draining the basin to remove mixed liquor from the tank, a chemical backpulse sequence to refill the tank and submerge the membrane fibers with filtrate and cleaning chemical, followed by a chemical soak period for a duration of 6 to 8 hours. The cleaning chemical concentration typically used to soak the membranes is 1,000 mg/L sodium hypochlorite for the removal of organic foulants. A separate, but not frequently used, 2,000 mg/L citric acid clean may be used for removal of inorganic foulants. To drain the basin, two drain pumps are located on the east side of the membrane basins. The drain pumps drain the tank in which the membranes are being cleaned and discharge the basin contents into the membrane influent channel where the flow is diluted and routed to membrane basins that are in service.

A section of the MBR basins is shown in **Figure 9.2** below.



**Figure 9.2. MBR Basin Section**

### 9.1.1 Permeate Pumps

Each MBR train has a dedicated permeate pump, and there are also two standby permeate pumps. One of the pumps provides redundancy to Trains 1 and 2, and the other provides redundancy to Trains 3 and 4. The permeate pumps are sized as follows:

**Table 9.2. MBR Permeate Pump Design Criteria**

Criteria	Value
Equipment Tags	41-P-20, 42-P-20, 43-P-20, 44-P 20, 48-P-11, 48-P-12
Pump Type	End Suction Centrifugal
Design Capacity	2,050 gpm @ 33'
Motor Horsepower	25 HP

With a design capacity of 2,050 gpm permeate per train, the WRF has a peak hydraulic capacity of 8.86 MGD with one train out of service. The permeate pumps are operated on VFDs in order to match the influent flow of the treatment plant and also to maintain a stable operating level in the membrane tanks. The permeate pumps have actual capacities exceeding 2,050 gpm that allows them to also handle additional flows that may impact the membranes such as recycled utility water flows.

### 9.1.2 Backpulse Tank

Permeate pumped from the MBRs is delivered to a backpulse/equalization tank, which supplies filtered water to the downstream UV system, to the backpulse pumps, and also to the plant utility water pump station. Design criteria for the backpulse tank is shown below:

**Table 9.3. Backpulse Tank Design Criteria**

Criteria	Value
Length x Width	21' x 28'
Sidewater Depth	12'
Maximum Volume	52,000 gallons

The backpulse tank was originally designed with weirs to separate the main volume of the tank, which was intended to be reserved for backpulse water supply, from the outlet of the tank to the UV system. However, ISD drilled holes in the weirs to essentially eliminate them because it was found that the weirs caused undue fluctuations in the flow rate and hydraulic grade line feeding the UV system, which resulted in operational problems. Also, the need to reserve a specific amount of backpulse water supply is lessened since the relax mode of membrane maintenance is used rather than regular backpulsing.

### 9.1.3 Backpulse Pumps

There are two backpulse pumps in a duty/standby configuration. Only one backpulse pump is required to operate at a time. The PLC programming only allows one MBR train to go into backpulse/relax cleaning or maintenance cleaning at a time. The permeate pumps are operated on VFDs such that the backwash rate can be adjusted by the Operator. The backpulse pumps are sized as follows:

**Table 9.4. MBR Backpulse Pump Design Criteria**

Criteria	Value
Equipment Tags	49-P-21, 49-P-28
Pump Type	End Suction Centrifugal
Design Capacity	2,040 gpm @ 35'
Motor Horsepower	25 HP

### 9.1.4 Drain Pumps

There are two MBR basin drain pumps, in a duty/standby configuration. Only one drain pump is required to operate at a time. The drain pumps are operated on VFDs such that the drain rate can be adjusted by the Operator. The drain pumps are sized as follows:

**Table 9.5. MBR Drain Pump Design Criteria**

Criteria	Value
Equipment Tags	49-P-11, 49-P-12
Pump Type	End Suction Centrifugal
Design Capacity	3,100 gpm @ 21'
Motor Horsepower	25 HP

### 9.1.5 Isolation Gates

The MBR tank inlet isolation gates are motor actuated and open/close only.

### 9.1.6 Automated Valves

All of the main MBR process isolation valves are butterfly valves with open/close pneumatic actuators.

### 9.1.7 Instrument Air System

The compressed air system that supplies the pneumatically actuated valves, permeate pump priming ejectors, and air actuated chemical pumps was also supplied as part of the overall MBR package. This system consists of 1 duty + 1 standby air compressors that feed a single 240 gallon air receiver tank. Each compressor includes an integrated refrigerated air dryer. Downstream of the air receiver, a pressure transmitter and low pressure switch are installed on the main instrument air line to monitor the pressure and provide an alarm on low pressure. Additionally, there are separate low pressure switches on the main air line feeding the pneumatically actuated valves and the air line feeding the ejector systems.

**Table 9.6. MBR Compressed Air System Design Criteria**

Criteria	Value
Compressor Equipment Tags	51-ME-31, 51-ME-32
Compressor Capacity	46 scfm @ 125 psig
Motor Power	10 HP

### 9.1.8 Membrane Chemical Systems

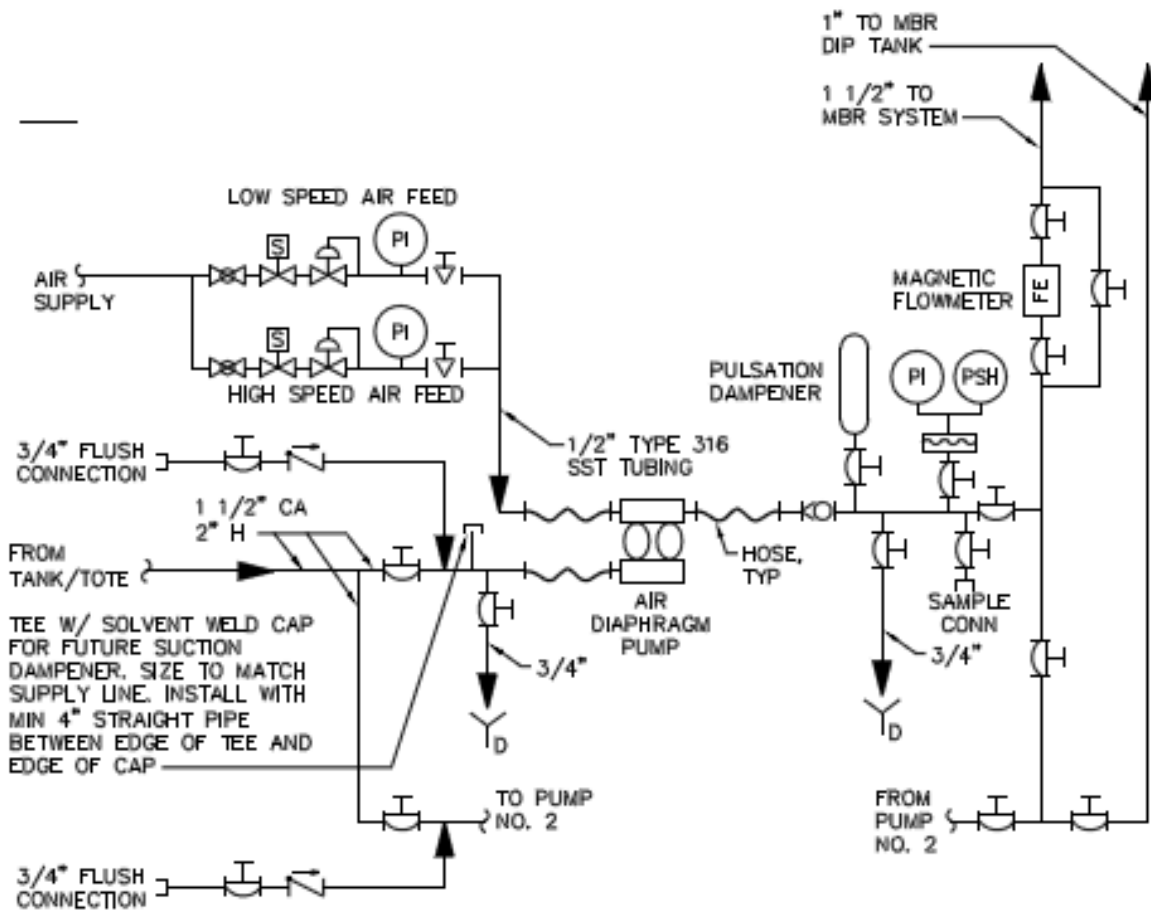
Sodium hypochlorite and citric acid storage and feed systems are in place for the MBR system maintenance and

recovery clean operations. The chemical pumps were not provided as part of the MBR package.

The sodium hypochlorite system includes a 1,550 gallon HDPE storage tank and two air actuated diaphragm pumps (1 duty + 1 standby) that are dedicated to MBR maintenance and recovery clean operations. The diaphragm pumps are powered by the compressed air system, and have “high” and “low” air/flow rate settings. The “high” setting is for recovery cleans at 26 gpm. The “low” setting is for maintenance cleans at 1.55 gpm.

The citric acid system is supplied by 330 gallon IBC totes and two air actuated diaphragm pumps (1 duty + 1 standby). The diaphragm pumps are powered by the compressed air system, and have “high” and “low” air/flow rate settings. The “high” setting is for recovery cleans at 11 gpm. The “low” setting is for maintenance cleans at 3.2 gpm.

All of the air actuated chemical pumps have dedicated pulsation dampeners and high pressure switches at the pump discharge that will shut down the pumps automatically. See **Figure 9.3** below.



**Figure 9.3. Air Diaphragm Pump Schematic**

### 9.1.9 Instrumentation

A list of the critical instrumentation for the MBR process is provided in **Table 9.7** below.

**Table 9.7. MBR Process Instrumentation**

Instrument	Location / Tag Number	# of Instruments
Membrane Permeate Pressure Transmitter	Suction Side of Permeate Pumps PIT 4113, 4213, 4313, 4413	1 pressure transmitter per train
Permeate Pump Air Ejector System	Suction Side of Permeate Pumps 41-SV-32, 42-SV-32, 43-SV-32, 43-SV-32,	1 ejector system per train – consists of solenoid valves and a venturi ejector
Permeate Flow Meter	Discharge Side of Permeate Pumps FIT 4112, 4212, 4312, 4412	1 flow meter per train – inline mag meter
Permeate Turbidimeter	Discharge Side of Permeate Pumps AIT 4111, 4211, 4311, 4411	1 turbidimeter per train
Permeate Temperature	Upstream of Backpulse Tank	1 temperature transmitter for overall MBR system
Membrane Tank Level Transmitter	Deep end of Membrane Tank LIT 4144, 4214, 4314, 4414	1 submersible level transmitter per train
Backpulse Tank Level Transmitter	Backpulse Tank LE/LIT 0110	1 ultrasonic level transmitter
Backpulse Tank High / Low Level Switches	Backpulse Tank LSHH/LSLL 0140	2 float switches
UVT Analyzer	Backpulse Tank – AE/AIT 4901 UV Effluent Channel – AE/AIT 6324	2 for UV system
Backpulse Pump Pressure Switches	Backpulse Pump Discharge Headers PSH 3931, 3932	1 for each backpulse pump
Backpulse Flow Meter	Backpulse Pump Discharge Header	1 mag meter
Instrument Air Pressure Transmitter	At Instrument Air Receiver PIT 5001	1 for MBR instrument air system
Instrument Air Low Pressure Switches	At Instrument Air Receiver and Main Instrument Air Supply Lines PSL 5001, 4002, 4003	1 for instrument air system as a whole, and 1 each for valve and ejector supply lines
Sodium Hypochlorite Tank Level Transmitter	At Sodium Hypochlorite Tank LIT 5461	1 level sensor for tank
Sodium Hypochlorite Pump High Pressure Switch	Discharge of Sodium Hypochlorite Pump	1 for each of 2 pumps
Sodium Hypochlorite Flow Meter	Discharge of Sodium Hypochlorite Pumps	1 for both chemical pumps
Citric Acid Pump High Pressure Switch	Discharge of Citric Acid Pump	1 for each of 2 pumps
Citric Acid Flow Meter	Discharge of Citric Acid Pumps	1 for both chemical pumps

## 9.2 Current Operations

### 9.2.1 Membranes

The MBR basin inlet isolation gates are motorized, and can be controlled to isolate MBR basins automatically when they are brought online and offline based on influent flow. During the dry weather season 2 MBR basins are operated continuously and during the wet weather season 3 MBR basins are operated continuously. The offline basins are rotated quarterly.

### 9.2.2 Membrane Air Scour

The MBR air scour system must run continuously in order to keep the contents of the membrane basins mixed and to prevent solids from blinding the membrane fibers. Each MBR cassette has two connections to the air scour system. The coarse bubble diffusers within the cassettes are split such that one half of the cassette is aerated at a time, and each half is served by a separate 12" membrane air header line (upper header and lower header). This allows the air to cycle such that the entire cassette is not scoured at all times, which helps to reduce the amount of air used while still maintaining clean membranes. The SCADA control programming allows the air scour system to cycle each cassette air scour section for either 10 seconds on / 10 seconds off (called 10-10 control) or 10 seconds on / 30 seconds off (called 10-30 control). WRF Operations Staff have found that 10-30 control, which uses less air, is adequate to keep the solids in the membrane tanks in suspension and to maintain a stable TMP. With 10-30 control, the automated valves which control air flow to the cassettes cycle such that 2 of the 8 air header isolation valves (there are 2 per basin) are open for 10 seconds at a time, and the valves continuously cycle through the rotation. This allows for the air flow in the air supply system to remain relatively constant.

If only 2 MBR basins are online, the system is in 10/10 control, so that 1 of the 2 air headers in each basin is open at all times, with 2 valves open at all times. If 3 MBR basins are online, the system is allowed to go into 10/30 control.

### 9.2.3 Permeate Turbidity and Flux

The WRF's permit for discharge to the San Joaquin River with respect to the UV disinfection system states that "The Discharger shall operate the treatment system to ensure that turbidity prior to disinfection shall not exceed 0.2 NTU more than 5 percent of the time within a 24-hour period, and 0.5 NTU at any time."

The 95<sup>th</sup> percentile of the average of the MBR effluent turbidity values July 2022-July 2024 were as follows:

- MBR Train #1: 0.13 NTU
- MBR Train #2: 0.10 NTU
- MBR Train #3: 0.16 NTU
- MBR Train #4: 0.11 NTU

If there is more than 72 minutes in a day where effluent turbidity exceeds 0.2 NTU or if the the UV effluent channel turbidity ever exceeds 0.5 NTU, the WRF effluent diversion gate is automatically opened and the effluent is diverted to the South Pond for emergency storage and eventual return to the influent wet well. This only happens on rare occasions and for short periods of time, and is a manageable situation.

The typical maximum recommended membrane flux is 17.5 gfd for the existing membranes. This represents a maximum flow per basin with the current number of modules at 2.0 MGD or 1388 gpm. With 3 basins online the maximum flow rate is 6.0 MGD which is roughly equivalent to the current wet weather peak flows at the plant.

### 9.2.4 UV Transmittance (UVT) and Alum Feed System

Figure 9.4 below shows the UVT trend for 2022-2024.

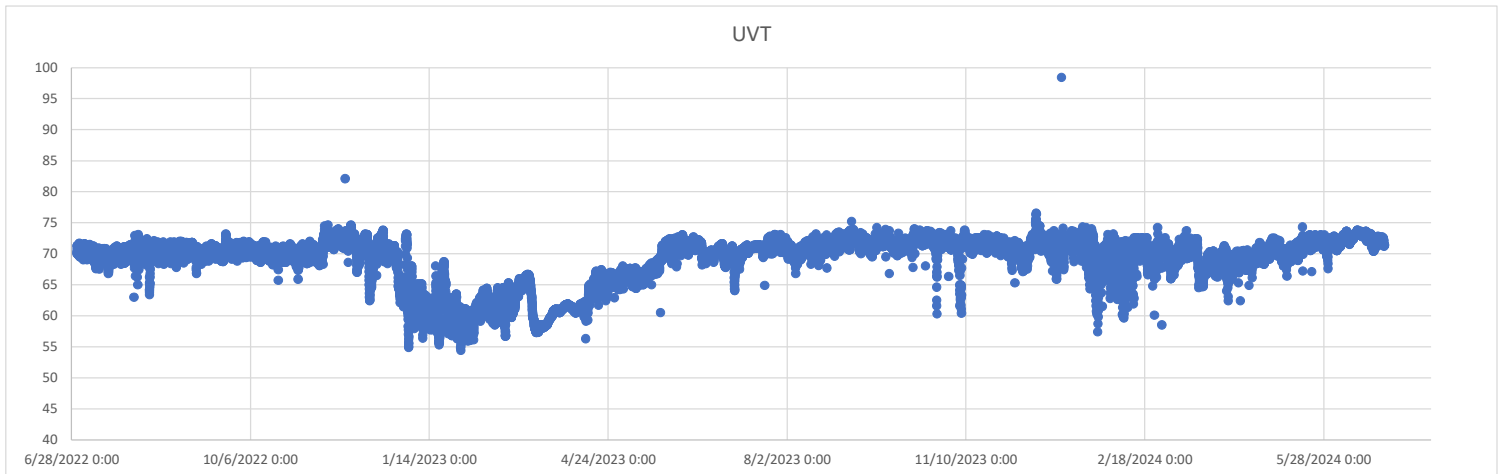


Figure 9.4. 2022-2024 Effluent UVT

The WRF discharge permit states “The UVT (@ 254 nanometers) in the wastewater exiting the UV disinfection system shall not fall below 55 percent at any time.” If the UVT drops below 55%, the WRF effluent diversion gate is automatically opened and the effluent is diverted to the South Pond for emergency storage and eventual return to the influent wet well.

The ISD WRF experiences elevated I/I contribution from the sewer collection system during winter rain storm events from Bethel Island that has very peaty / organic soils, with high levels of organics and tannins. The organics from the I/I are not removed effectively in the MBR treatment process, which can result in lower UVT values at the UV disinfection system in the winter. This can be seen in the depression in effluent UVT from December 2022 through April 2023 that occurred during an extended period of wet weather.

An alum feed system was added at the plant Headworks area as part of the WRF Phase 1 Improvements constructed in 2019-2020. Alum is stored in a 6,600 gallon HDPE tank and can be fed downstream of the drum screens using peristaltic pumps. Design criteria for this system is listed below.

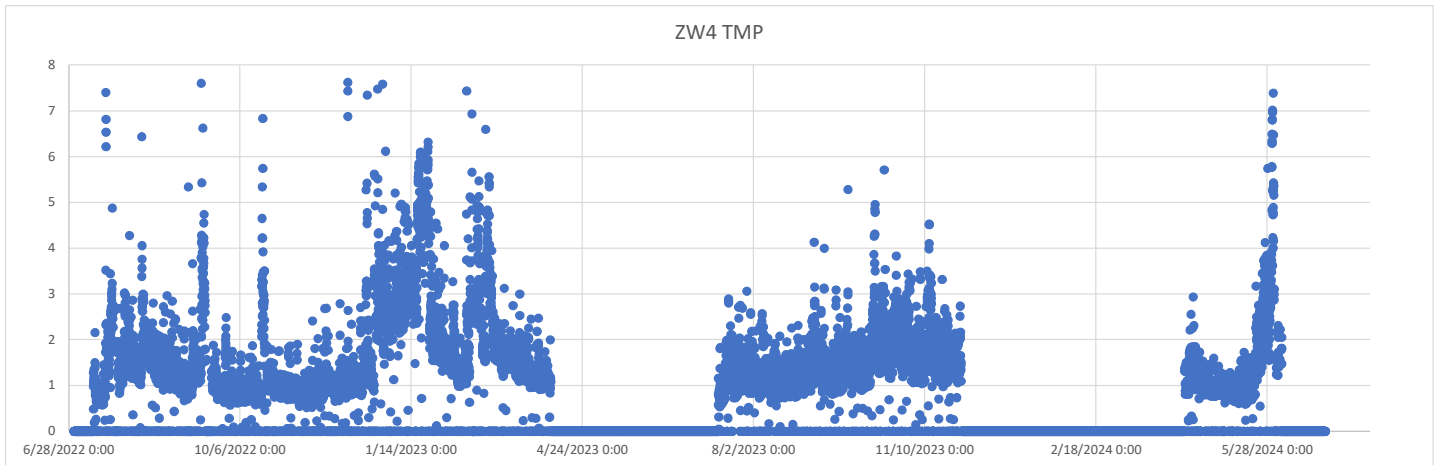
Table 9.8. Alum System Design Criteria

Equipment Item	Design Capacity
Alum Storage Tank 24-T-11-AL	10'-0" Diameter, 6,600 gallons
Alum Feed Pump 1 24-P-21-AL	100 gph @ 20 psi
Alum Feed Pump 2 24-P-31-AL	100 gph @ 20 psi
Alum Dosage @ 8.6 MGD PWWF	178 mg/L @ 8.6 MGD = 100 gph
Typical Max Dosage During PWWF	70-100 mg/L

WRF staff only feed alum during storm events when UVT is clearly dropping, and have been able to prevent the UVT from going below 55% during the largest recent storm events including the events of January 2023.

### 9.2.5 Trans Membrane Pressures (TMP)

The membrane elements are rated to 8 psi of vacuum. The O&M Manual for the WRF states that a recovery clean should be performed if the TMP ever reaches 3 gfd/psi, or approximately 5 psi at average flow conditions. Figure 9.5 below shows the TMP trend for MBR Train 4 for 2022-2024.



**Figure 9.5. 2022-2024 MBR Train 4 TMP**

MBR Train 4 had the highest average operating TMP of the 4 units at 1.68 psi. TMPs rise in the winter when alum is being used to reduce UVT and can be seen peaking in the graph above coincident with large rain events and high flux rates. Even the increased TMPs during winter storm events are generally within the allowable TMP operating range of up to 5 psi with only isolated data points between 5-8 psi when the membranes are operating near the maximum recommended flux at peak wet weather flows with alum dosing.

### 9.2.6 Process Pump Reliability

The permeate pumps, backpulse pumps, and drain pumps have firm capacity to handle the 8.6 MGD design PWWF flow for the WRF with the largest unit out of service, representing an industry standard level of redundancy. These pumps have been reliable and have not contributed to any notable treatment process disruptions.

### 9.2.7 Control Valve Reliability

The automated isolation control valves for the permeate pumps, backpulse pumps, and drain pumps are pneumatic open/close actuators, which are robust and not particularly prone to routine failure with routine maintenance. Given that there are dedicated isolation valves for each pump and the pumps have firm capacity redundancy, adequate control valve redundancy and reliability is also provided.

One item of note is that the isolation valves that are downstream of permeate pump flow meters were modified during the project construction to change the valve closed position limiters such that in the closed position the valves are still partially open.



**Figure 9.6. Permeate Flow Meter Isolation Valves**

This was done because at lower permeate pump flow rates, the flow meters were not flowing full since there is a downward leg after the flow meter and isolation valves. So, at lower flow rates the valves are called to closed, but are still partially opened which essentially throttles the pump and the flow such that the piping in the flow meter says full. There is “low flow” setpoint in SCADA which triggers the these valves to close even though the permeate pumps are operating. What can happen is that if the flow rate is near this “low flow” setpoint and is bouncing around it, the flow meters will chatter open and closed at a high rate.

The pneumatically actuated valves that cycle the MBR air scour headers operate frequently at 2,160 cycles per day in 10/30 control. There are two valves per MBR train, and the redundancy lies in the fact that there is a redundant MBR train. The plant maintains shelf spare actuators on hand to allow for rapid repair or replacement of these actuators in the case of a failure.

### 9.2.8 Compressed Air System Reliability

Operations Staff have noticed that the two membrane system air compressors (51-ME-31-A and 51-ME-32-A) both run almost constantly. The original design drawings indicate these compressors at 15HP each, however the current units are both 10HP. The units have been replaced since original construction so it’s possible that smaller replacement units were ordered either unintentionally or because that was all that was available at the time. The units should be upsized such that only 1 compressor is normally required to operate continuously.

### 9.2.9 Chemical Feed System Reliability

The MBR chemical feed system has an adequate level of redundancy with redundant chemical metering pumps with independent high pressure switch alarms, including the ability to feed sodium hypochlorite, the more important and regularly used chemical, from either storage tanks or totes.

### 9.2.10 Instrumentation Reliability

**Table 9.8** below provides recommendations regarding the redundancy of the MBR system instrumentation.

**Table 9.9. MBR Process Instrumentation Redundancy**

<b>Instrument</b>	<b>Current Redundancy</b>	<b>Comments / Recommendations</b>
Membrane Permeate Pressure Transmitter	1 pressure transmitter per train	Acceptable redundancy. Permeate pressure transmitter failure will not shut down process.
Permeate Pump Air Ejector System	1 ejector system per train – consists of solenoid valves and a venturi	Acceptable redundancy with 1 ejector per train. Ejectors are simple, reliable, and not particularly prone to failure.
Permeate Flow Meter	1 flow meter per train – inline mag meter	Acceptable redundancy.
Permeate Turbidimeter	1 turbidimeter per train	Acceptable redundancy.
Permeate Temperature	1 temperature transmitter for overall MBR system	Although there is only 1 temperature transmitter for the entire MBR process, it is not a critical instrument and therefore a standby instrument is not considered necessary.
Membrane Tank Level Transmitter	1 submersible level transmitter per train	Acceptable redundancy.
Backpulse Tank Level Transmitter	1 ultrasonic level transmitter	Acceptable redundancy with backup float switches in relatively clean water application.
Backpulse Tank High / Low Level Switches	2 float switches	Acceptable redundancy.
Backpulse Tank UVT Analyzer	2 for UV system	Acceptable redundancy, a backup UVT analyzer is good to have for this critical instrument.
Backpulse Pump Pressure Switches	1 for each backpulse pump	Acceptable redundancy.
Backpulse Flow Meter	1 mag meter	Acceptable redundancy.
Instrument Air Pressure Transmitter	1 for MBR instrument air system	Acceptable redundancy with backup low pressure switches.
Instrument Air Low Pressure Switches	1 for instrument air system as a whole, and 1 each for valve and ejector supply lines	Acceptable redundancy.
Sodium Hypochlorite Tank Level Transmitter	1 level sensor for tank	Acceptable redundancy.
Sodium Hypochlorite Pump High Pressure Switch	1 for each of 2 pumps	Acceptable redundancy.
Sodium Hypochlorite Flow Meter	1 for both chemical pumps	Acceptable redundancy.
Citric Acid Pump High Pressure Switch	1 for each of 2 pumps	Acceptable redundancy.
Citric Acid Flow Meter	1 for both chemical pumps	Acceptable redundancy.

## 9.3 Major Condition Assessment Findings

### 9.3.1 Permeate Pump Isolation Valves



Figure 9.7. Permeate Valve and Actuator Corrosion

Isolation valves associated with the Permeate Pumps have all suffered from leakage and are being replaced. This appears to be due to the corrosivity of the permeate which is likely due to low alkalinity in the MBR effluent.

The useful life of the valves and actuators in this area has been reduced in the WRF asset replacement analysis to 13 years as opposed to most other valve and actuator assets at 20-25 years due to this observation so that more frequent replacement can be planned for.

## 9.4 Recommended Improvements

### 9.4.1 Membrane Element Replacements

The typical estimated service life of the hollow fiber membrane elements is 10-15 years. The condition of the membranes has been reported to be excellent based on Operations Staff and manufacturer observations of the membranes, and the long term TMP trends for the membranes indicate that irreversible fouling of the membranes is far slower than the industry average. The membranes have been in service for 13 years. It is estimated that the membrane elements will have a service life of 15-20 years for planning purposes.

The newest version of the membrane elements have a larger surface area of 430 ft<sup>2</sup> per module versus the existing versions which are 340 ft<sup>2</sup>. In past years, ISD pre-negotiated and paid for future membrane replacements before the pricing structure changed for the newest version of the elements. Per the contract agreement, ISD is required to replace the membranes in at least 2 basins at a time, with the option to do all 4 basins at once. The pricing includes support from the supplier in addition to ISD staff to execute the replacement in-house. With the larger surface area per module, only 6 out of 9 cassettes will be filled with new membranes.

**Table 9.10. Pre-Paid Membrane Replacement Comparison**

configuration data	units	existing plant configuration	proposed configuration after replacement/upgrade
number of trains, plant		4	4
type of ZeeWeed membrane		500D	500D
module surface area	ft <sup>2</sup>	340	430
total number of cassette spaces per train		9	9
maximum number of modules per cassette		48	48
fully populated cassettes installed per train		7	6
flex cassettes installed per train		---	---
total module count, train		336	288
total surface area in operation, train	ft <sup>2</sup>	114,240	123,840
total module count, plant		1,344	1,152
total surface area in operation, plant	ft <sup>2</sup>	456,960	495,360
% surface area change from existing, plant	%	---	8.4%

The replacement will increase the current surface area by 8.4% from the current system. The operating parameters provided by the membrane manufacturer are shown below in **Table 9.11**. The noted maximum flux rate for maximum day flow is 23.8 GFD. At buildout the peak flow is 8.6 MGD + utility water recycle flows for a total of up to 3.25 MGD per basin (with one out of service). This represents a flux of 26.2 GFD. ISD should consider adding membranes to the 7<sup>th</sup> cassette in the future to reduce this to 22.5 GFD as flows and loads increase. This is recommended when PWWF exceeds approximately 7.2 MGD (estimated to occur in ~10 years – **shown as Project 9-1 in the Capital Improvement Plan**). Also, if additional significant industrial user flows above the planned residential buildout are to be considered, additional membranes should be added to the 8<sup>th</sup> and possibly 9<sup>th</sup> cassette spaces to accommodate additional flows.

**Table 9.11. Replacement Membrane Design Criteria**

Parameter	MGD	Design Flux Value	Accepted Operating Range
Average Filtrate Flow (with all Trains)	5.39	11.6 GFD	< 14.5 GFD
Average Filtrate Flow (with 1 Train out of Service)	5.39	15.4 GFD	< 22.0 GFD
Maximum 2-hour Diurnal Filtrate Flow with Sludge Dewatering (Dry Weather, with 1 Train out of Service)	7.64	21.8 GFD	< 23.0 GFD
Maximum 2-hour Diurnal Filtrate Flow without Sludge Dewatering (Dry Weather, with 1 Train out of Service)	7.35	20.95 GFD	< 23.0 GFD
Maximum Day Filtrate Flow (24-hour Wet Weather) (with all Trains)	8.09	17.3 GFD	< 22.0 GFD
Maximum Day Filtrate Flow (24-hour Wet Weather) (with 1 Train out of Service)	8.09	23.1 GFD	< 23.8 GFD
Maximum 3-hour Average Filtrate Flow (Wet Weather) (with all Trains)	9.15	19.6 GFD	< 21.0 GFD
Design Temperature		16°C (minimum)- 23°C (maximum)	16-30°C
Instantaneous Membrane Airflow rate to independent membrane modules during air scour at diffuser		11.90	11.3 to 12.5
Membrane Tank MLSS Concentration		10,000 mg/L	5,000 - 12,000 mg/L
MLVSS fraction in the membrane tank		85% of MLSS	> 50% of MLSS
Aerobic solids retention time			Minimum of 10 days
Soluble alkalinity in the membrane tank as CaCO <sub>3</sub>		280 (raw wastewater)	Less than 150 (in the membrane tank)
NH <sub>3</sub> -N concentration entering the membrane tank			Less than 1 mg/L
Colloidal TOC concentration in the membrane tank			Less than 10 mg/L
Total time to filter for the mixed liquor at 10,000 mg MLSS/L for 200 mL of sample		200 Seconds	Less than 300 seconds
pH		7	5 - 9
Membrane Tank Dissolved Oxygen		5.0 ppm	2-5 ppm
Solids mass flux (g MLSS/m <sup>2</sup> membrane surface area/hour)		229 at ADF 407 at PHF	Less than 407
Mixed liquor recirculation from the membrane tanks to the aeration tanks.		4 times influent flow rate	> 3 times influent flow rate

### 9.4.2 MBR Air Compressors and Flow Meter Piping Improvements

The MBR air compressors (51-ME-31 and 51-ME-32) were originally 15HP, and were replaced with 10HP units in 2021. The 10HP units are undersized and both are needed to operate a majority of the time. It is recommended that the existing 10HP units are replaced with 15HP units as originally intended. This project will be timed around the expected replacement of these units due to their predicted lifespan.

A solution to the problem described in Section 9.2.7 would include installing “head maker” piping downstream of the flow meter to ensure that the flow meter is always a full pipe at all flows. There is enough room in the piping to provide 5D upstream and 2D downstream of straight pipe for the flow meter (typical clearance) and allow for the head maker piping to be installed. The existing valve could be moved, and the existing air release valve would be replaced with a combination air valve.

Refer to CIP Project 9-2 Profile.

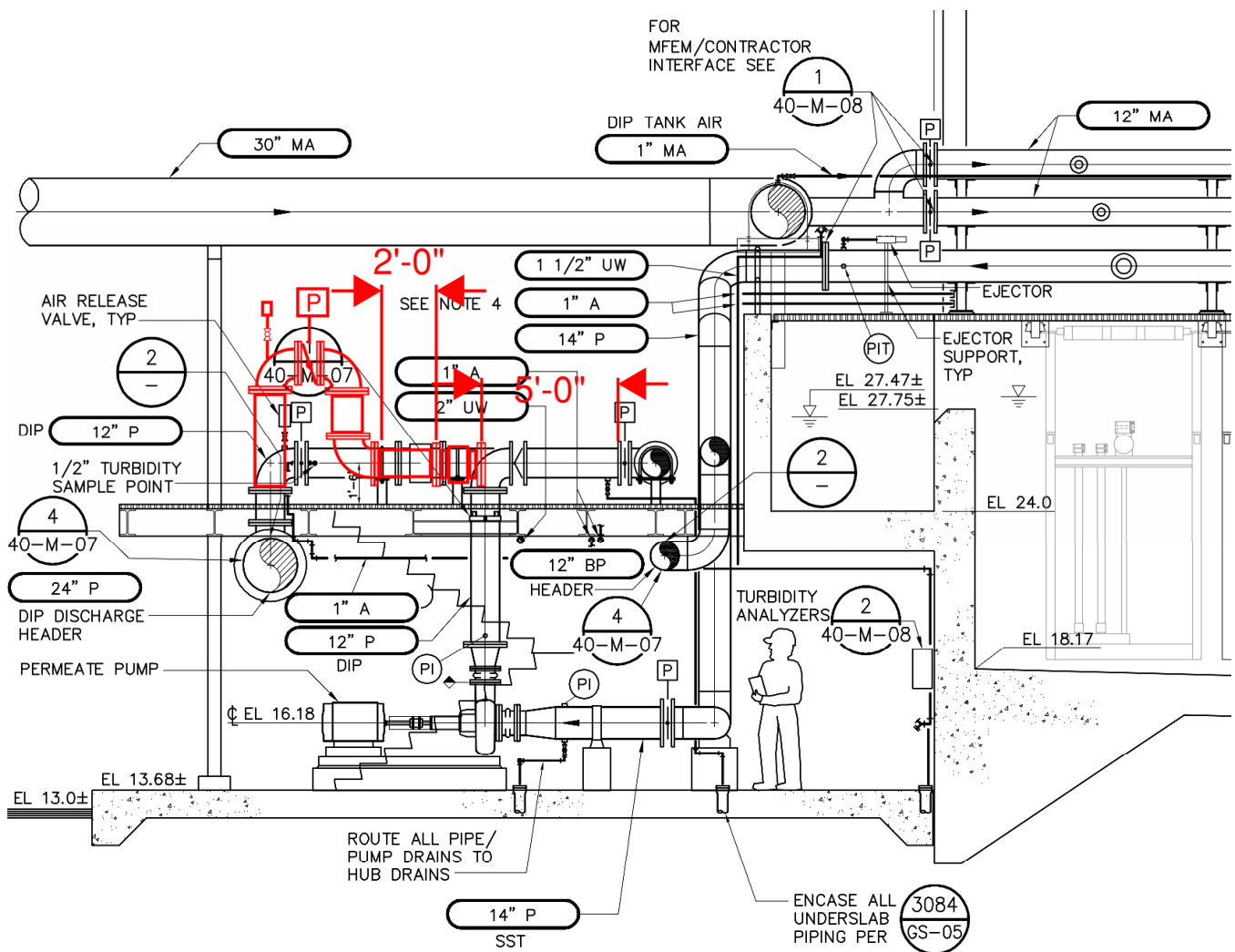


Figure 9.8. Permeate Flow Meter Piping Modification

### 9.4.3 MBR Bird Mitigation

WRF Operations Staff would like to add bird netting or some other type of active bird mitigation (i.e. sonic) to the underside of the MBR facility canopy in order to prevent birds from roosting and nesting under it. The canopy has attracted birds, and this causes additional maintenance and cleaning work for Operations Staff.



Bird netting could be installed to the level of the hanging lighting, and supported from the lighting support system. The light ballasts could be cut out of the netting to allow for lights to be changed. The netting would look similar to that depicted below. Similar improvements could be made at the canopy over the UV facility.

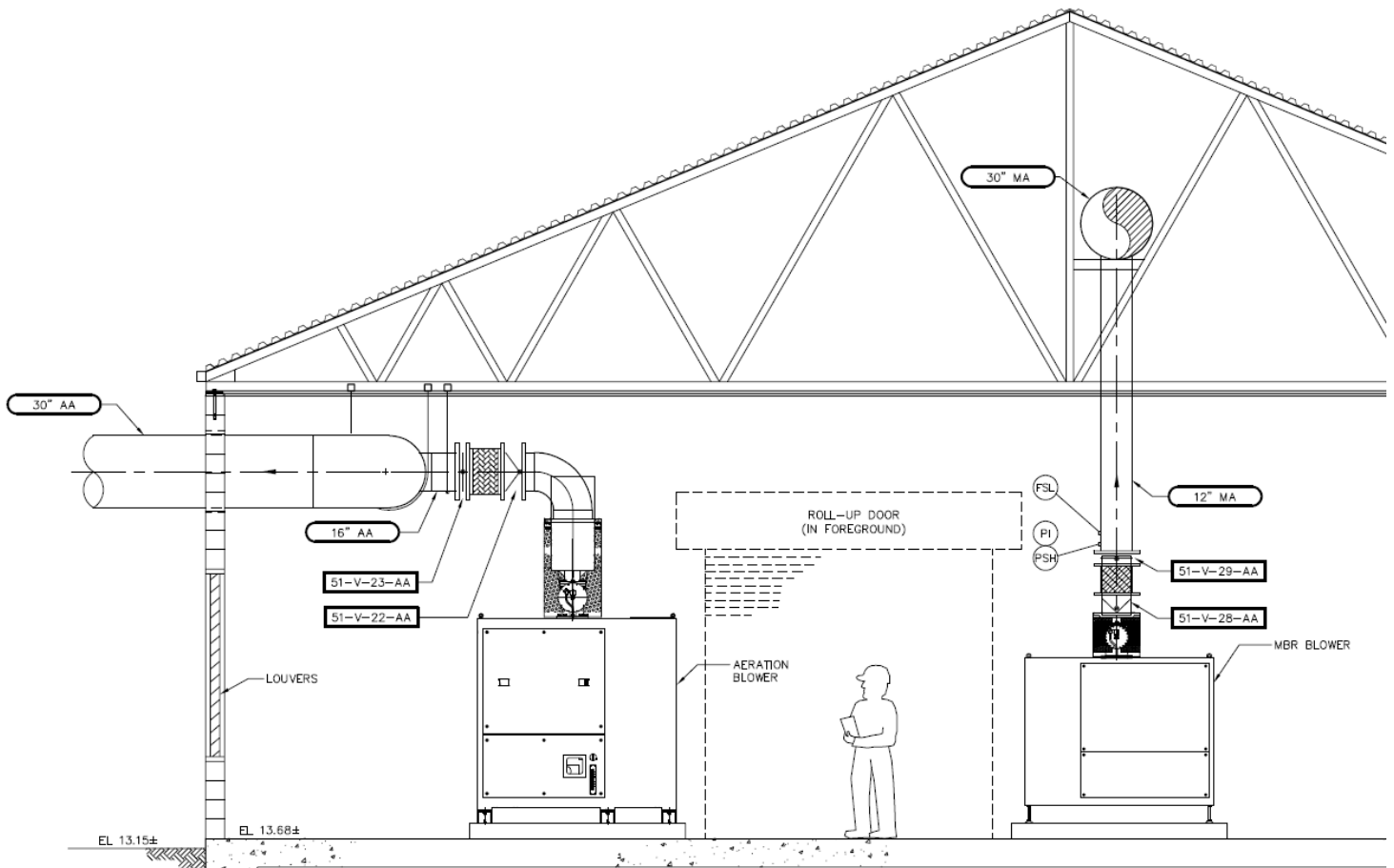


Refer to CIP Project 9-3 Profile.

## 10.0 Blower Facility

### 10.1 Process Description

The WRF currently includes 3 blowers to serve the aeration basins, and 3 blowers to serve the MBR air scour system. The blowers are housed in a CMU block building, with space to add a fourth blower of each type. There are separate 30" process air headers for the aeration basins and MBRs which the blowers are connected to, as shown in **Figure 10.1** below.



**Figure 10.1. Blower Building Section**

Design criteria for the blowers is shown in **Table 10.2** and **Table 10.2** below.

**Table 10.1. Aeration Basin Blower Design Criteria**

Criteria	Value
Aeration Basin Blower Equipment Tags	51-B-15, 51-B-16, 51-B-17
Aeration Basin Blower Maximum Design Operating Point	6,000 scfm @ 8.0 psig
Aeration Basin Blower Minimum Design Operating Point	3,000 scfm @ 7.0 psig
Aeration Basin Blower Motor Power	300 HP

**Table 10.2. MBR Blower Design Criteria**

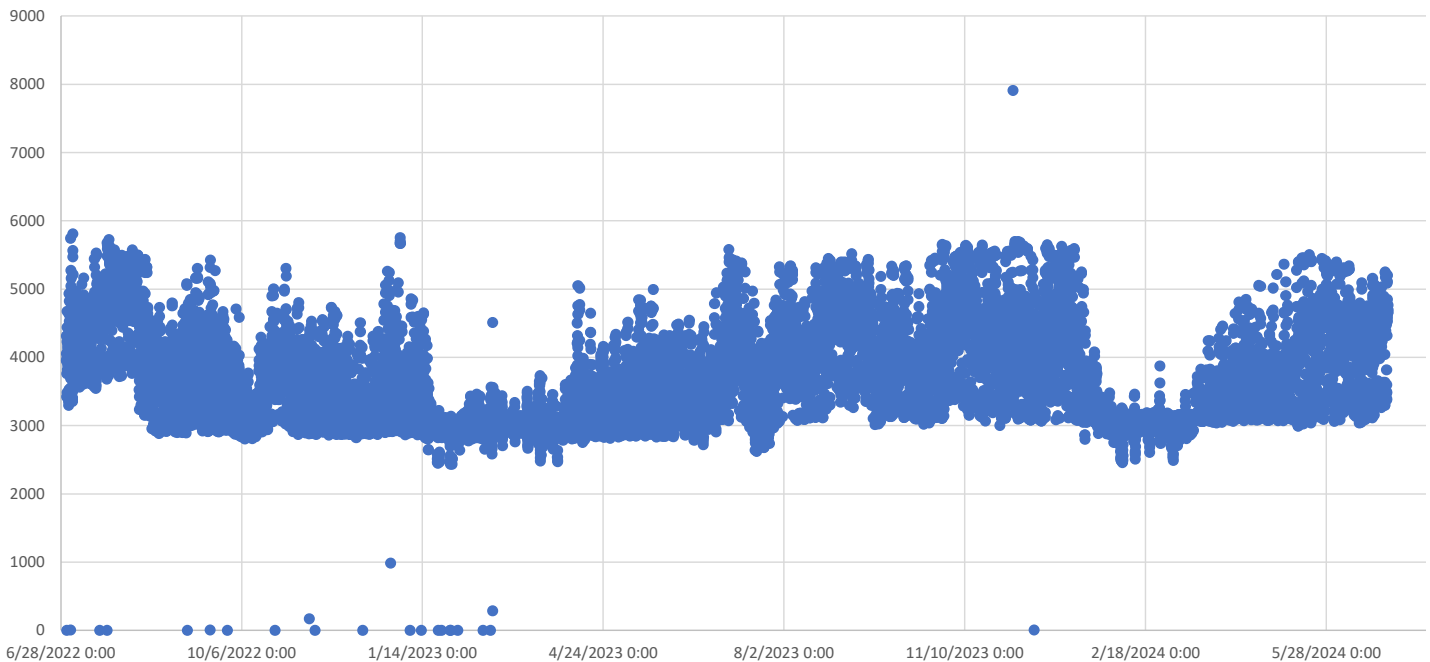
Criteria	Value
MBR Blower Equipment Tags	51-B-11, 51-B-12, 51-B-13
MBR Blower Maximum Design Operating Point	5,568 scfm @ 5.1 psi
MBR Blower Minimum Design Operating Point	2,200 scfm @ 4.7 psi
MBR Blower Motor Power	200 HP

The blowers for the aeration basins require a higher operating pressure because the aeration basins are 15’-6” deep, whereas the air distribution in the MBR basins is only approximately 9’-0” deep. The blowers are Neuros high speed turbo blowers, operating on VFDs.

## 10.2 Current Operations

### 10.2.1 Aeration Basin Blowers

Total aeration basin air flow for 2022-2024 is shown in Figure 10.2 below. The total air demand averages 3,700 scfm. The minimum allowable flow setpoint for one blower at minimum speed is 3,000 scfm.

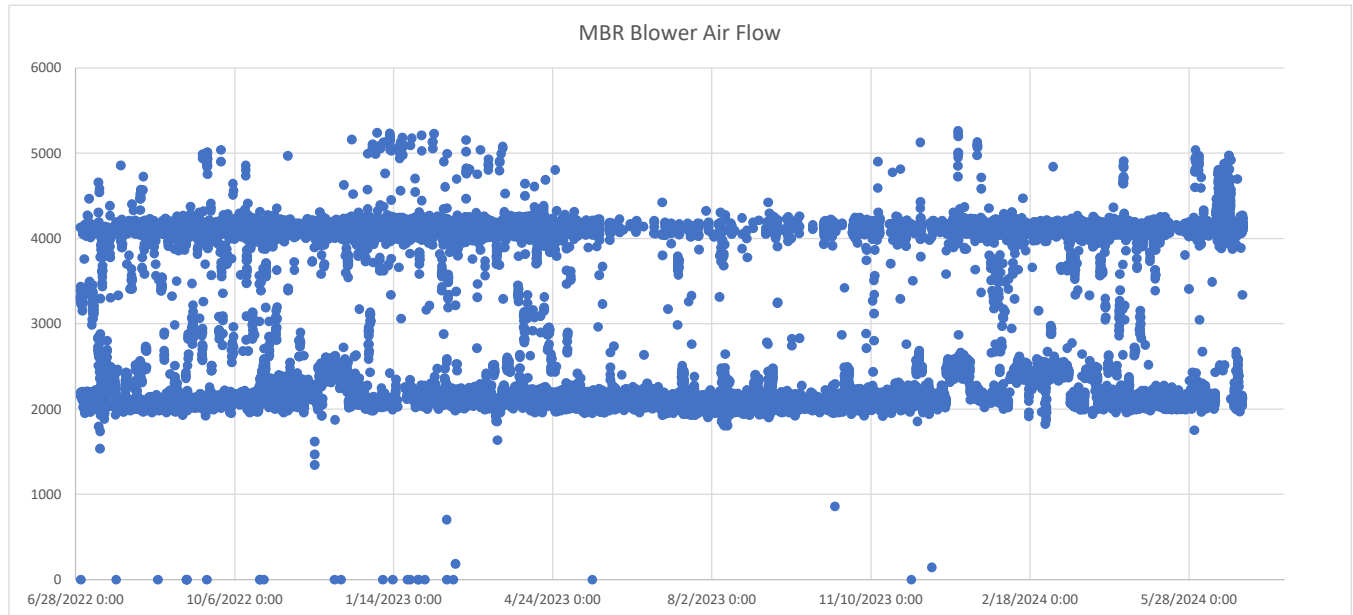


**Figure 10.2. Total Aeration Basin Air Flow**

The average air demand for online aeration basins 3 and 4 is 2,700 scfm. The “aerobic digester” in aeration basin 1 uses an average of 840 scfm and an average of 160 scfm is being wasted constantly into basin 2. Aeration basins 1, 3, and 4 are currently operated with DO setpoint control, and aeration basin 2 is programmed to demand and use the remainder of the air required for 1 aeration basin blower to operate at its minimum turndown air flow rate and also to maintain functionality of the membranes in that basin.

### 10.2.2 MBR Blowers

The MBR blowers operate at approximately 2,100 or 4,100 scfm, depending on the number of basins online and the timing of the MBR 10/30 air control valve operation. Only 1 MBR blower is ever operating at a time.



**Figure 10.3. Total MBR Basin Air Flow**

### 10.2.3 Aeration Basin Blowers

The aeration basin blower system has more than acceptable available redundancy. One blower can supply the maximum day air demand of approximately 6,000 scfm with 2 aeration basins online. Therefore, two blowers with a redundant unit available can supply the maximum day air demand with 4 basins online, which would exceed the buildout capacity of the WRF.

### 10.2.4 MBR Blowers

The MBR blower system has acceptable available redundancy. All 4 MBR basins require 1 blower to operate at 4,100 scfm using 10/30 control, and would require 2 blowers to operate in 10/10 control with a redundant unit available.

### 10.2.5 Instrumentation

Each 30" process air header includes an air flow meter, pressure transmitter, and high pressure switch. Each blower package also includes an internal air flow meter and pressure transmitter. This provides redundancy in the critical air flow and air pressure instrumentation for process control.

## 10.3 Major Condition Assessment Findings

The blowers are in excellent condition with low running hours for their age and maintained yearly by the OEM on a service contract.

Chemical damage was observed along the base of the CMU wall between the blower room and chemical room. The source of the damage was noted to be a prior chemical leak in the chemical room which seeped through the masonry wall into the blower room.

Visible efflorescence from chemical attack was seen at the base of the CMU wall shown in photos 1,2 below. The residue was noted in the first row of blocks for a 12' wide section (8 consecutive blocks) and some more seepage was seen on the 2nd row and 3rd row of masonry blocks for 3-4 additional blocks as shown in photo 3. Additional minor damage was observed on the floor and equipment base around the leak area, see photo 4.



Photo 1. Damaged CMU wall at blower room due to H2S leakage.



Photo 2. Close up of photo 1



Photo 3. Damaged CMU blocks adjacent to area seen in photo 1.



Photo 4. Minor damage to slab in area of leakage

#### Figure 10.4. Chemical Damage to Blower Building Wall

To evaluate the severity of damage, a destructive test of the existing masonry wall is recommended. Small diameter core testing method shall be employed to assess the extent of structural damage to the wall and devise a complete repair plan.

1. Thoroughly remove all deteriorated material from the damaged area. Clean the exposed surface to remove any other contaminants.
2. Extract 3 cylindrical cores from area shown of the damaged wall using a core drilling machine. Samples shall be 6" in diameter and extracted from a mid-depth section of the block in one of the cells.

3. Assess corrosion in rebar, deterioration of mortar and compressive strength from the cores per ASTM C140 to determine the extent of damage.

In case of excessive corrosion of rebar and material deterioration, it will be crucial to replace the masonry section with a new cast-in-place concrete wall, dowelled into adjacent wall sections to restore the structural integrity of the wall. In the case that the observed damage is minor, a surface repair approach shall suffice where surface damage shall be thoroughly removed and sealed with a protective coating.

#### **10.4 Recommended Improvements**

There are no recommended improvements for the blower system.

Repair of the CMU wall will be determined through the destructive testing noted above and likely addressed under the WRF's annual maintenance budget.

## 11.0 UV Disinfection System

### 11.1 Process Description

The ultraviolet (UV) disinfection system is located downstream of the backpulse/equalization basin. The objective of the UV disinfection system is to provide another barrier to harmful bacteria that may have passed through the membrane bioreactor (MBR) treatment system. UV light inactivates these pathogens without the addition of disinfecting chemicals, such as chlorine, chloramines, or chlorine dioxide. The UV light inactivates the microbes by modifying their genetic material and making it impossible for the DNA to replicate. The dose of UV light is determined based upon actual flow, UV transmittance of the filtered water, and UV intensity adjusted by safety factors to account for lamp aging and quartz sleeve fouling.

The effluent from the MBR system is discharged from the permeate pumps to the backpulse/equalization tank. An analyzer in the backpulse/equalization tank continuously measures UV transmittance. From the backpulse/equalization tank, flow is routed by gravity to the UV disinfection system via a 24-inch pipe. Just upstream of the UV system, the flow is split to two parallel 24-inch pipes with motorized butterfly valves for process isolation of the two in-channel UV disinfection treatment trains. Each UV treatment train contains three high intensity / low pressure UV disinfection banks in series. The disinfection banks contain several individual components: (1) a stainless steel disinfection unit which houses the lamps; (2) low pressure high intensity UV lamps mounted perpendicular to flow; (3) UV intensity sensor; and (4) temperature sensor. Low level switches are provided at each bank. Each channel has provisions to add a fourth UV bank. Water level within each channel is controlled by a counterweighted effluent gate located at the downstream end of each channel.

Each UV disinfection bank is powered from an independent Power Distribution Center (PDC). Also provided is one System Control Center (SCC) that consists of a Programmable Logic Controller, Human Machine Interface (HMI) display screen and message keypad to allow complete operator interface. The PLC communicates with the plant SCADA system. A Hydraulic Systems Center (HSC) is provided to house all components required to operate the automatic lamp cleaning system.

The disinfected effluent exits each UV train into a common channel. From that channel, flow is routed to either the effluent pump station which pumps treated effluent through the outfall into the San Joaquin River, the north effluent storage pond (through a diversion gate), or the non-compliant south storage pond (through another diversion gate).

The delivered UV dose is based on the flow rate, UV transmittance, and UV intensity. The total UV system influent flow rate is measured by a magnetic flowmeter located on the outlet of backpulse/equalization tank. The UV transmittance, a measure of the clarity of the water, is sampled at the 24-inch pipe between the backpulse/equalization tank and the UV Disinfection System. A sensor contained in each UV unit measures the UV intensity. These parameters are transmitted to the UV control system and SCADA system, which calculates the dosage and adjusts the power level to deliver the required UV dose for the system.

Process control of the UV reactors is by the UV system PLC which is within the SCC located at the UV deck. Once the Operator inputs the set point UV dose at each UV control module, the UV PLC adjusts lamp intensity in the UV system to maintain the set point dose regardless of number of online channels, flow rate, effluent quality, or lamp fouling while conserving power. The typical UV dose setpoint is 10 or more mJ/cm<sup>2</sup> above the minimum discharge permit limit to provide an operational factor of safety. The Operator also chooses the lamp-cleaning mode, and various other timer, alarm, and systems set points via the operator interface screen.

The UV system original design criteria is summarized in **Table 11.1**, below, per the UV system construction submittals.

**Table 11.1. UV Disinfection System Design Criteria**

Parameter	Units	Phase 1	Phase 2
Design Flow Peak Flow	mgd	9.6	14.3
Design Average Flow	mgd	5.2	7.7
Design Minimum Flow	mgd	0.5	1.0
Design UVT	%	65*	
Design UV Dose	mJ/cm <sup>2</sup>	80	
End of Lamp Life Factor	-	0.98	
Fouling Factor	-	0.95	
No. Channels	ea	2	
Peak Flow per Channel	mgd	4.8	7.15
Duty Banks per Channel	ea	2	3
Redundant Banks per Channel	ea	1	
Modules per Bank	ea	10	
Lamps per Module	ea	8	
Lamps per Bank	ea	80	
Duty Lamps per Channel	ea	160	240
Total Lamps per Channel	ea	240	320
Total Lamps per System	ea	480	640

\* Note that the current WDR permit states that the minimum allowable UV transmittance is 55%, although 65% was used for UV system sizing based on National Water Research Institute (NWRI) guidelines for effluent from MBR. In addition, the WDR permit states the minimum allowable dose of 80 mJ/cm<sup>2</sup>.

## 11.2 Current Operations

Hourly UV system operations data from the SCADA system for the period from July 1, 2016 through July 1, 2017 was reviewed and compared to the design criteria. A summary of these data are provided in **Table 11.2**, below. Data percentiles were used rather than just minimum, average and maximum to provide a clearer snapshot of the spread in the data. For example, “Q50” refers to the 50% percentile, for which 50% of the data are less than the value shown. Values that are outside of the design criteria range are formatted as ***bold/italic***.

**Table 11.2. Summary of UV System Operating Parameters for Period July 1, 2022 through July 1, 2024**

Statistic	Total Flow (mgd)	UVT (%)	# Banks Online	# Lamps Online	Calc'd Dose (mJ/cm <sup>2</sup> )
Design Value	<= 9.6	>= 65	<= 4	<= 320	>= 80
Q1	1.04	<b>57.8</b>	1	72	<b>80</b>
Q5	1.17	<b>60.5</b>	1	75	80.4
Q50	2.96	70.3	2	156	83.2
Average	2.91	69	2	135	86.3
Q95	4.13	72.8	3	237	123.1
Q99	4.799	73.5	<b>4</b>	<b>316</b>	158.1
Max	7.58	82.1	<b>6</b>	<b>478</b>	327

The UV system was designed and constructed with adequate redundancy, and in accordance with NWRI guidelines. The system has two independent UV channels which allows one channel to be taken completely offline for maintenance during low flow periods (less than 4.8 MGD), which currently occurs approximately 99% of the time. Additionally, the system is designed to operate with one bank out of service per channel at the peak design flow.

### 11.2.1 Total Flow

The peak flow to the UV system was 7.58 mgd. At that time the UV transmittance was 63.7%. The average flow to the UV system was 2.91 mgd. The minimum flow to the UV system was approximately 1.04 mgd (1<sup>st</sup> percentile of data, excluding zero value data).

### 11.2.2 UV Transmittance

The UV transmittance (UVT) was less than the design value of 65% about 16% of the time. The UV transmittance (UVT) was less than the permitted value of 55% about 0.02% of the time and occurred on January 31, 2023 for two separate 1 hour periods.

### 11.2.3 Number of Online Banks

In general, the UV system operated with 4 banks or less online, in accordance with the design criteria of 2 duty banks per channel. However, in January 2023 there were five 1-hour periods of time that more than 4 UV banks were on-line.

### 11.2.4 Number of Lamps Online

In general, the UV system operated with less than 320 lamps online at a time, in accordance with the design criteria of 320 duty lamps. However, in January 2023 there were five 1-hour periods of time that more than 320 lamps were online at a time.

### 11.2.5 Calculated UV Dose

In general, the UV system operated at a calculated dose significantly higher than 80 mJ/cm<sup>2</sup>, in accordance with the design criteria. The average dose was 86 mJ/cm<sup>2</sup>.

### 11.2.6 UV Capacity

The capacity of the UV system, based on NWRI requirements at the time of design, at various transmittance levels and number of banks in service is provided in Table 11.3.

**Table 11.3. Summary of UV Disinfection Capacity**

<b>Disinfection Capacity</b>				
Each Channel 2+1 two duty banks + one standby in each channel	Transmittance	Number of Channels on-line	Number of Banks on- Line	Disinfection Capacity
	55%	2	4	5.1
	60%	2	4	7.1
	65%	2	4	9.6

Each Channel 3+1 three duty banks + one standby in each channel	Transmittance	Number of Channels on-line	Number of Banks on- Line	Disinfection Capacity
	55%	2	6	9.0
	60%	2	6	12.6
	65%	2	6	17.2

The peak design flow for the UV system is 9.6 MGD. However, based on current proposed residential buildout conditions the estimated dry weather flow is 4.3 MGD and the estimated peak wet weather flow is 8.6 MGD. Based on information provided in Table 11.3 if UV transmittance is maintained above 65 percent the disinfection capacity is 9.6 MGD, the original design capacity. If however, UV transmittance drops to 55% the capacity of the existing UV system is only 5.1 MGD. The District should monitor UV transmittance and flows closely to determine if and when an additional UV bank per channel may need to be installed. Currently if the UVT drops below 55% or dose below 80 mJ/cm<sup>2</sup>, the WRF effluent diversion gate is automatically opened and the effluent is diverted to the South Pond for emergency storage and eventual return to the influent wet well.

### 11.2.7 Instrumentation Reliability

Each UV bank has independent UV intensity, temperature and low level probes. Also, there are redundant UV Transmittance sensors, one located near the backpulse tank and one located downstream of UV.

## 11.3 Major Condition Assessment Findings

### 11.3.1 UV Equipment

As described above, the UV system is generally operating as intended with infrequent events in which more lamps may be necessary to accommodate the low UVT of the feedwater. This situation is also addressed by operation of the alum feed system upstream of the aeration basins as-needed, however UVT still drops below 65% during major storm events.

The current UV system was installed in 2011 and has an estimated useful life of 20-25 years (depending on the level of individual component replacement along the way). The option of replacing the entire UV system with a new system or improving and replacing components of the current UV system to “like new” conditions was discussed with the District. It was determined that improving and replacing components of the existing system is the desired alternative at this time based on the following considerations:

- The current UV system is a horizontal system with a shallow water depth making it very difficult to replace the UV system with equipment from a different manufacturer. Options considered were:
  - Replace all the existing UV lamps with new Integra lamps supplied by Trojan. This was dismissed as the Integra lamps are three times the cost of the current lamps which would drastically increase operations and maintenance costs.
  - The system that was considered to replace the current Trojan 3000+ system was the DeNora system which has 500 watt lamps in lieu of the current 250 watt lamps. This was also dismissed as channel modifications would be required and the lamp life seen at recent installations is 600 to 800 hrs, far below what was warranted by the manufacturer (16,000 hrs) and far below the 12,000 hrs for the currently installed Trojan 3000+ lamps.
  - When the useful life of the current UV system expires, additional options to replace the entire UV system should become available that would not require significant UV channel structural modifications. Trojan is currently working on a new system design (Signa) with 500 watt lamps that would be direct replacement for the 3000+ system that should be available in coming years.

### 11.3.2 UV Effluent Gates

The existing counterweighted effluent level control gates at the downstream end of each channel are not watertight and leak. The leakage is not an issue when the UV channel is online, but when the UV channel is offline, the leakage will slowly drain the channel and cause the low level alarm to be tripped. Subsequently, when the channel is later called to operate, there is a delay in operation of the lamps until the channel is able to refill which may require effluent to be diverted because it is not being treated for a short period of time. The minimum flow per UV channel is 0.5 MGD, and a minimum flow is required in order to ensure proper lamp cooling. In the summer time, minimum flow at night can be below 1 MGD (694 gpm), and this low flow requires that one of the UV channels is taken offline to ensure a minimum flow of 0.50 MGD in the channel that is online. This channel then leaks and reaches low level as described above.

In efforts to correct this problem, ISD staff have replaced the seats, adjusted the weights, and ultimately added small pumps to recirculate water from downstream of the gates to upstream in order to keep the UV channels

above minimum level. The District consulted with Trojan on this issue in August of 2015, and requested assistance in determining if the tilting gates can be replaced with fixed weirs. Trojan responded that the weirs would need to be designed to limit headloss in the channel to less than 1.5”. The weirs would need to be sized to handle the future peak flow of 7.15 mgd per channel, resulting in a crest length of approximately 1025-inches and a channel width of approximately 128-inches for each channel. Trojan’s recommendation at that time was to consider installing motorized weir gates.

## 11.4 Recommended Improvements

### 11.4.1 UV Equipment Renewal

Based on the above operational and condition assessment evaluations and considerations, a number of UV system components are in need of near-term improvement or replacement. Recommended replacements and improvements to the UV system are noted below along with associated costs that include tax and freight. Installation labor is included separately in the complete CIP project cost estimate assuming work is done by ISD Maintenance Staff. In general it is estimated that half of the system’s components will be replaced in 2026 and the other half in 2031 which takes into account previous replacement cycles of some of these items.

**Table 11.4. Recommend UV Equipment Replacement Schedule**

Year	Description	Quantity	Price (ea) (2025 dollars)	Total (2025 dollars)
2026	Upgrade HSC System	1 Lump Sum	\$17,146	\$17,146
2026	Hydraulic Wiping Cylinders (Replace 30 of 60) - <i>Note other half is being done in 2025</i>	30	\$3,043	\$91,316
2026	Lamp Driver Kits (Replace 120 of 240)	120	\$1,522	\$182,631
2026	Sensor Assemblies (Replace 3 of 6)	3	\$4,058	\$12,175
2026	Lamp Sleeve Combos (Replace 60 of 120)	60	\$2,475	\$148,540
2026	Wiper Canisters (Replace 240 of 480)	240	\$117	\$28,003
2031	Lamp Driver Kits (Replace 120 of 240)	120	\$1,522	\$182,631
2031	Sensor Assemblies (Replace 3 of 6)	3	\$4,058	\$12,175
2031	Lamp Sleeve Combos (Replace 60 of 120)	60	\$2,475	\$148,540
2031	Wiper Canisters (Replace 240 of 480)	240	\$117	\$28,003

Refer to CIP Project 11-1 Profile.

### 11.4.2 UV Effluent Level Control Improvements

According to Trojan, counterweighted gates are not drip-tight and leak by design. Gates manufactured since this project was constructed have made improvements, but not enough to warrant recommending replacing the gates in-kind.

To address the leakage issue, open-close weir gates could be added downstream of the counterweighted gates, which could be left in place. The open-close weir gates would simply open fully when the channel is online, and close fully when it is offline to prevent leakage. This option is preferred vs. modulating weir gates to replace the mechanical counterweighted gates, as open-close gate operators are much less expensive, and additional level sensing and more complicated additional SCADA controls would not be needed.

However, in recent years flows have been increasing and the occurrence of night time flows < 1 MGD has been decreasing. At some point in the near future if growth continues at its current pace, flows < 1 MGD may not occur anymore at all. Therefore, UV effluent gates are not recommended due to their cost and the limited lifespan of any benefit this improvement would provide.

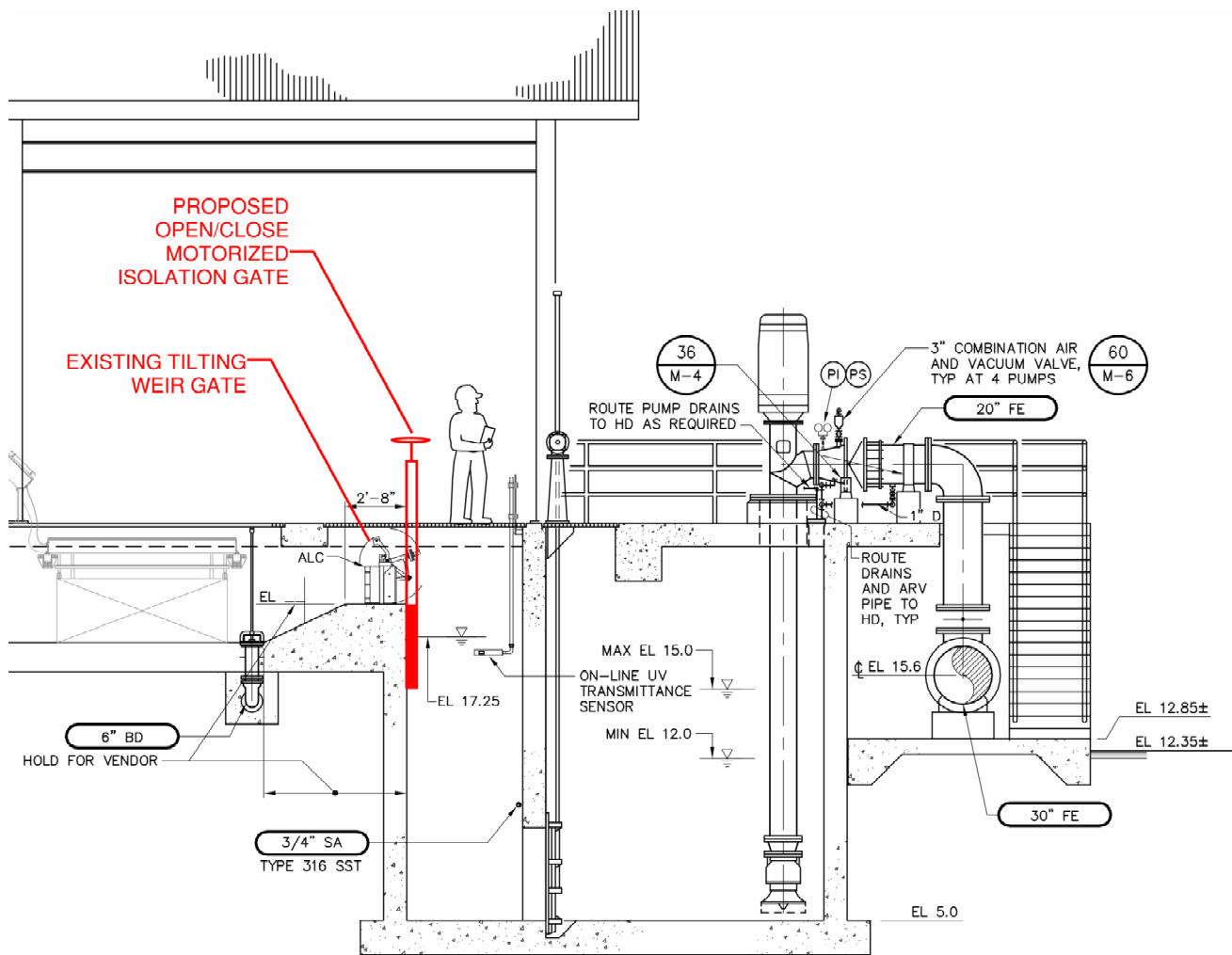


Figure 11.1. UV Isolation Gate Concept

### 11.4.3 UV Facility Expansion and Upgrade

With the near-term renewal improvements identified in Section 11.4.1 above, it is estimated that the existing UV system can last another ~10 years with continued diligent maintenance. At that time, the system will have reached the end of its useful life and may no longer be supported as Trojan will have likely developed the new Signa system and may stop manufacturing components for the existing 3000+ system.

Complete replacement of the entire UV system, with 2 additional banks (for a total of 8) should be planned for ~10 years in the future. The cost included in the Capital Improvement Plan is only a rough estimate, since the Signa system has not even been fully developed and therefore it is not possible to receive budgetary equipment pricing at this time. It is assumed that structural modifications to the channels will not be necessary, and that the costs will only include existing equipment removal, new equipment installation, some potential electrical and programming modifications, and startup.

**Refer to CIP Project 11-2 Profile**

## 12.0 North Effluent Storage Pond and South Emergency Storage Pond

### 12.1 Process Description

The north effluent storage pond may be used to store treated effluent during the irrigation season as equalization for its use in land application. Treated effluent may not be land applied continuously, and therefore equalization may be desired. The north effluent storage pond has an area of approximately 35.5 acres, a maximum depth of 6.5 feet, and a maximum volume of approximately 76 million gallons. Water stored in the north pond can be pumped by the irrigation supply pump station (located outside the new plant main area) out for land application, or can be returned into the WRF’s effluent pump station if desired. A flow meter is in place to measure water returned from the north pond. Refer to the piping schematic in **Figure 12.1**.

The south emergency storage pond is used to store diverted raw sewage from the headworks or diverted tertiary effluent (non-compliant) from the UV effluent channel. The south pond has an area of approximately 16.0 acres, a maximum depth of 7.0 feet, and a maximum volume of approximately 38 million gallons. Water stored in the south pond can be returned by gravity back into the 30” plant influent sewer line using a buried gate valve.

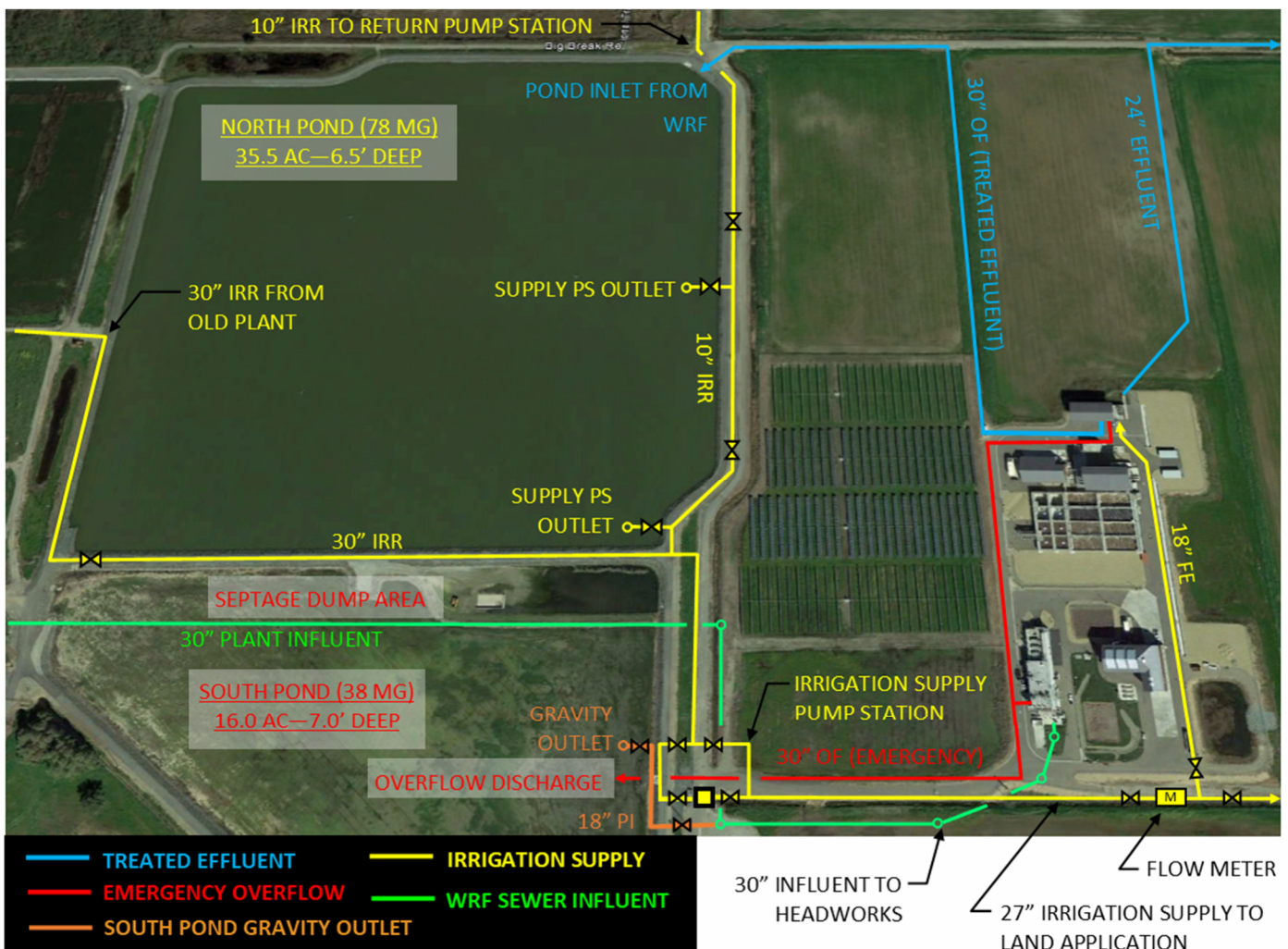


Figure 12.1. North and South Pond Piping Schematic

The north and south ponds are lined with a low permeability clay liner to limit infiltration and exfiltration.

## 12.2 Current Operations

ISD stopped using the north pond for effluent storage in 2019-2020 and began discharging all effluent to the San Joaquin River year round, stopping effluent irrigation/land-application. Use of the north pond requires maintenance including weed clearing and management of the water quality and pH in the pond due to possible algae growth. ISD was not seeing a significant benefit of using recycled water to irrigate crops on Jersey Island versus using surface water. Currently the north pond is sitting empty.

The south emergency storage pond is also used for temporary storage of FOG removed from the influent wet well by the District’s Vac-Con pumping trucks. A raised area in the South Pond with 3 concrete walls of approximately 10,000 square feet is used for this temporary storage, and the FOG is eventually disposed of in dumpsters as solid waste to landfill.

## 12.3 Recommended Improvements

### 12.3.1.1 South Pond Return to Headworks

As part of the 2011 WRF construction project, a gravity diversion from the suction side of the supply pump station to the 30” primary influent sewer line was added to allow the south pond to be drained back into the WRF headworks. The return flow from the south pond to the headworks is not easily controllable, as it is only initiated by a buried manual plug valve with no means of flow measurement. It is recommended that improvements be made to address this issue, as uncontrolled south pond flow return to the headworks can overload headworks equipment.

The recommended improvement involves reconfiguring the 18” piping connecting the south pond intake to the main 30” primary influent sewer to install a motor actuated plug valve and several manholes, one of which would include an open channel sewer flow meter. PLC programming would be added to allow for the Operator to set a desired flow rate, and for automatic control of the plug valve to obtain the specified flow rate set point. The recommended improvements are shown in **Figure 12.2** below.

**Refer to CIP Project 12-1 Profile.**



## 13.0 Effluent Pump Station

### 13.1 Process Description

Effluent from the UV disinfection system is discharged into the UV effluent channel. From this channel, effluent can either flow through an automatically actuated gate (62-G-11) to the effluent pump station, or over a weir to be diverted to either the north storage pond (via gate 62-G-12) or south emergency diversion pond (via gate 62-G-13) as shown in **Figure 13.1** below. Effluent pump design criteria is provided in **Table 13.1** below.

**Table 13.1. Effluent Pump Design Criteria**

Low Capacity Effluent Pumps		High Capacity Effluent Pumps	
Criteria	Value	Criteria	Value
Equipment Tags	62-P-16, 62-P-17	Equipment Tags	62-P-18, 62-P-19
Pump Type	Vertical Turbine	Pump Type	Vertical Turbine
Design Capacity	3,000 gpm @ 40'	Design Capacity	4,750 gpm @ 95'
Motor Horsepower	40 HP	Motor Horsepower	150 HP

Typically, the gate to the effluent pump station is always left open. Currently, the effluent pumps are conveying all of the effluent to the San Joaquin River discharge point and are operated at variable speed to maintain a level setpoint in the effluent pump station wet well.

Currently, gate 62-G-12 is always closed as treated effluent is not sent to the north pond. Gate 62-G-13, which diverts effluent to the south pond, opens automatically in the cases of alarms that indicate non-compliant effluent, such as high turbidity, low UVT, or low UV dose. If Gate 62-G-13 opens, the other two gates would close to ensure that this non-complaint effluent does not reach the north pond or the San Joaquin River.

#### 13.1.1 Effluent Pump Station Instrumentation

The UV effluent channel and effluent pump station each have an ultrasonic level sensor, and low/high level float switch backups. The effluent pumps have a magnetic flow meter on the common pump discharge header to measure the flow rate discharged to the river. Each of the effluent pumps has a high pressure switch to automatically shut down the pump in the case of an over-pressure situation. The common pump discharge header also has a pressure transmitter and high pressure switch.

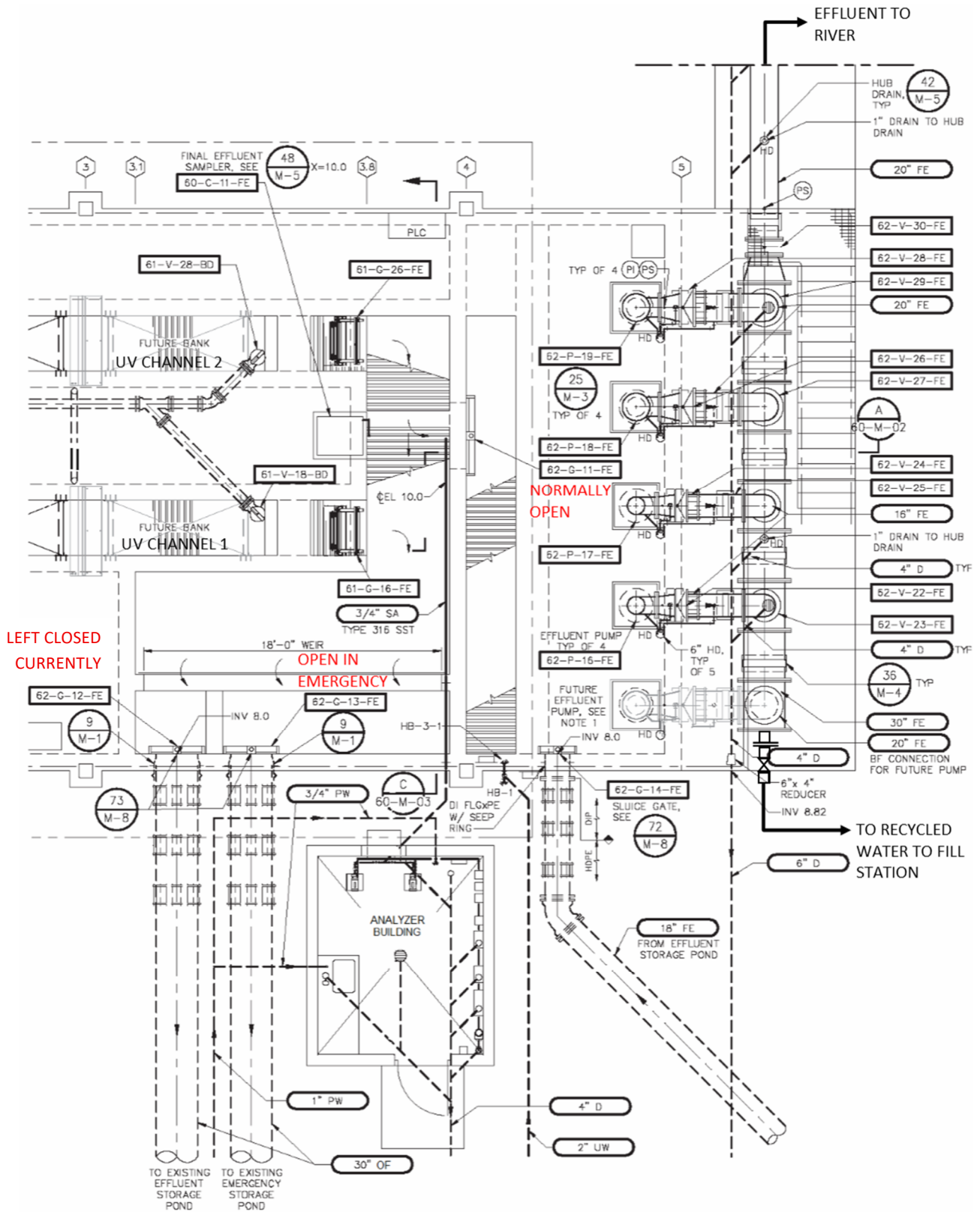


Figure 13.1. Effluent Pump Station

### 13.1.2 Final Effluent Water Quality Building

The compliance point for WRF effluent is a sample stream taken from the UV effluent channel that is pumped to instruments located in the Water Quality Building that is adjacent to the effluent pump station. The final effluent instruments include those shown in **Table 13.2** below.

**Table 13.2. Final Effluent Instrumentation**

Instrument	Tag Number	# of Instruments
Automatic Composite Sampler	60-C-11	1
Final Effluent Sample Pumps	63-P-11, 63-P-12	2 - 1 duty + 1 standby
Low Sample Flow Switch	FSL-6317	1
Low Sample Pressure	PSL-6316	1
Effluent pH	AIT-6311, AIT-6321	2 – 1+1 redundant
Effluent Temperature	TIT-6311, TIT-6321	2 – 1+1 redundant
Effluent Conductivity	AIT-6312	1
Effluent Turbidity	AIT-6313, AIT-6323	2 – 1+1 redundant
UV Transmitter	AIT-6324	redundant unit AIT-4901 located in backpulse tank
Effluent Chlorine Residual	AIT-6314	1
Effluent Dissolved Oxygen	AIT-6315	1

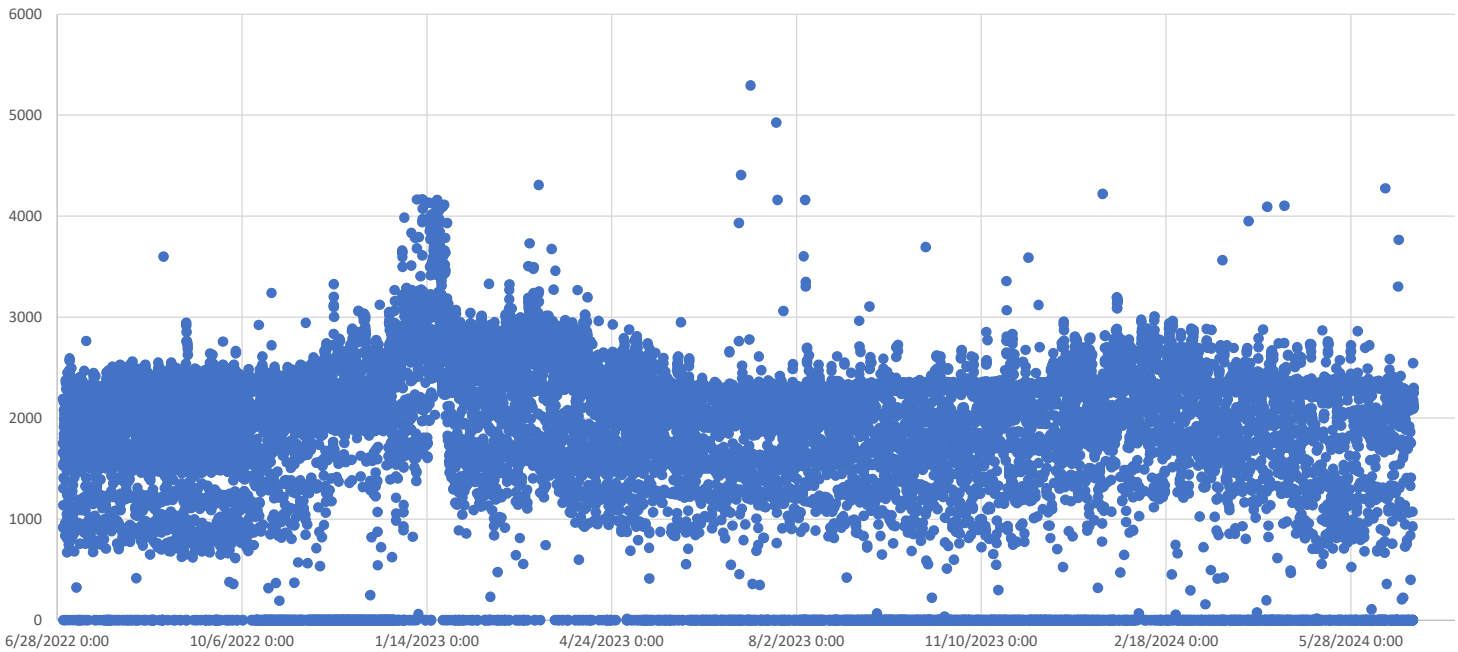
## 13.2 Current Operations

### 13.2.1 Pumping Capacity

The maximum effluent flow from 2022-2024 was approximately 4,200 during a period of prolonged wet weather with isolated flow rates above that due to short term pumping operations and not driven by the plant influent flow rate. **Refer to Figure 13.2.**

At flows below 3,000 gpm, the 40 HP pumps are operated. At flows over 3,000 gpm, one of the 150 HP pumps is operated. The 40 HP and 150 HP pumps are typically not operated together because their pump curves are very different.

The peak wet weather design flow for the WRF is currently 8.6 MGD, or approximately 6,000 gpm. The required discharge head of the pump station for 6,000 gpm is approximately 107 feet of head. This is beyond the operating head range of the 40HP pumps, which have a shutoff head of 72 feet. Both of the 150 HP pumps would be required to operate at a reduced speed to produce 6,000 gpm at 107 feet of head. The maximum capacity of a single 150HP pump is approximately 5,150 gpm (7.4 MGD) @ 81' of head. There has not been a time yet that both 150HP pumps have been called to operate.



**Figure 13.2. WRF Effluent Flow Rate**

Given that there is not a third 150 HP pump installed currently, the pump station does not technically have firm redundancy for buildout PWWF. However, peak wet weather flows typically have a limited duration, and the WRF could always divert treated effluent to the north and/or south pond if necessary in the case of a pump failure during peak wet weather flow. The District is currently in the process of performing I/I reduction work throughout the collection system and it is unknown when the buildout PWWF of 8.6 MGD would be realized.

### 13.2.2 Instrumentation

All of the critical instruments that demonstrate compliance with the WRF’s discharge permit have redundant units in place. There is also redundant instrumentation in place to signal for loss of the sample stream, with both low flow and low pressure switches in place.

### 13.2.3 Recycled Water Fill Station Operation

After initial construction of the WRF, a 6” connection was added to the blind flange at the end of the effluent pump discharge header, and a 6” pipe was installed to supply recycled water to a fill station. Also, this line serves recycled water for irrigation of the administration building landscaped area. A booster pump and hydropneumatic tank with a pressure switch were added to provide adequate pressure for fill station operation and irrigation.

One current operational issue is that if the effluent pumps stop operation for any reason, such as low effluent channel level or diversion of effluent to the South Pond, the recycled water booster pump may lose suction and the system can run dry.

## 13.3 Recommended Improvements

### 13.3.1 Third 150 HP Effluent Pump

A third 150HP effluent pump should be added at which time the WRF effluent flow rate exceeds the current capacity of a single 150HP pump, and a second 150HP pump is called to run during a high flow event. This has not occurred to date, but when it does this indicates that the third pump should be added for redundancy. For planning purposes this will be estimated to occur within ~10 years.

**Refer to CIP Project 13-1 Profile.**

### 13.3.2 Diablo Water Direct Potable Reuse (DPR) Demonstration Project

The information in this section was collected from ISD’s September 2024 “Insider” newsletter. ISD has partnered with Diablo Water District (DWD) to explore the feasibility of advanced purified water. Advanced purified water is groundwater, surface water, or recycled water cleaned through an advanced water treatment system that produces high-quality drinking water.

ISD’s shared vision for the future includes exploring the addition of recycled water and alternative water sources to ensure that DWD can meet customers’ water demands, even during extended drought periods. Researching advanced purified water as a potential alternative future drinking water supply source aligns with DWD’s commitment to a sustainable water supply while keeping water costs affordable to their customers.

The State Water Resources Control Board (SWRCB) adopted new regulations allowing for advancements in Direct Potable Reuse (DPR) treatment plants. DPR transforms treated recycled water into high-quality advanced purified water through a multi-barrier process that separates water molecules from pollutants through a series of purification processes that yield high-quality water that is safe for drinking. The purification system includes some of the most advanced, proven technologies used in water treatment, such as reverse osmosis and advanced oxidation (hydrogen peroxide plus ultra- violet light disinfection).

Ironhouse and DWD received a \$3 million grant from USEPA for the designing, permitting, regulatory compliance, and environmental determination of Phase One of the joint Recycled Water Project. The partnership will create a new demonstration treatment facility, managed and operated by DWD, to evaluate drinking water treatment technologies while providing a space for the public to see the process and taste the final purified water. The project will also fund demonstration gardens where the landscaping will be irrigated with recycled water produced by Ironhouse.

ISD plans to make improvements to its recycled water delivery system to provide the feed water for the Diablo Water DPR demonstration facility.

### 13.3.3 Recycled Water Pump Improvements

The District plans to expand and upgrade the existing recycled water (RW) system to provide a more reliable system for the following uses:

- 80 GPM to the fill stations (existing connection)
- 200 GPM to the vac con (existing connection)
- 50 GPM to ISD landscape irrigation (existing connection)
- 50 GPM to Diablo Water irrigation (new end use)
- 15 GPM to Diablo demonstration project (new end use)

To upgrade the recycled water system three alternatives were evaluated, which are described below.

#### Alternative 1 – New Pumps and Two New 792-Gallon Hydropneumatic Tanks

Alternative 1 includes the following:

- Installing a dedicated suction pipe from the existing effluent pump station which involves core drilling through the pump station wall.
- Installing two new 200 gpm, 20 hp pumps without VFDs. Each pump will provide 200 gpm at 172 ft of head. Both pumps will be running when all 5 end uses are on at the same time.
- Installing two new 792-gal hydropneumatics tanks for a total of 1,584 gallons. Without VFDs and to limit the number of start and stops for the pumps per hour, the hydropneumatic tank volume needed is 1,463 gallons. Each pump will provide 200 gpm at 172 ft of head. Both pumps will be running when all 5 end uses are on at the same time.
- Installing a new electrical panel to power the pumps along with new conduit and wiring to the existing electrical building.
- Installing new piping to Diablo water for their Direct Potable Reuse Demonstration Project.

#### Alternative 2 – New Pumps with VFDs and One New 90-Gallon Hydropneumatic Tank

Alternative 2 includes the following:

- Installing a dedicated suction pipe at the existing effluent pump station which involves core drilling through the pump station wall.
- Installing two new 200 gpm, 20 hp pumps with VFDs. Each pump will provide 200 gpm at 172 ft of head. Both pumps will be running when all 5 end uses are on at the same time.
- Installing one new 90-gal tank. With VFDs, the required hydropneumatic tank volume lowers to 79 gallons. This is because pumps without VFDs have a limited number of starts per hour for proper pump operation whereas pumps with VFDs do not have the high starting amps and can therefore turn on and off much more frequently.
- Installing a new electrical panel to power the pumps along with new conduit and wiring to the existing electrical building.
- Installing new piping to Diablo water for their Direct Potable Reuse Demonstration Project.

### Alternative 3 – New Pumps with VFDs and Reuse of Existing Two 87-Gallon Hydropneumatic Tank

Alternative 3 includes the following:

- Installing a dedicated suction pipe at the effluent pump station which involves core drilling through the pump station wall.
- Installing two new 200 gpm, 20 hp pumps with VFDs. Each pump will provide 200 gpm at 172 ft of head. Both pumps will be running when all 5 end uses are on at the same time.
- Reusing the existing two 90-gal hydropneumatics tanks. With VFDs, the required hydropneumatic tank volume lowers to 79 gallons. This is because pumps without VFD's have a limited number of starts per hour for proper pump operation whereas pumps with VFD's do not have the high starting amps and can therefore turn on and off much more frequently.
- Installing a new electrical panel to power the pumps along with new conduit and wiring to the existing electrical building.
- Installing new piping to Diablo water for their Direct Potable Reuse Demonstration Project.

It is recommended to implement Alternative 3 for the following reasons:

- Least cost alternative.
- Allows reuse of existing equipment
- Provides best pump operation of the alternatives

Refer to **Figure 13.3 through 13.5** below.

**Refer to CIP Project 13-2 Profile.**

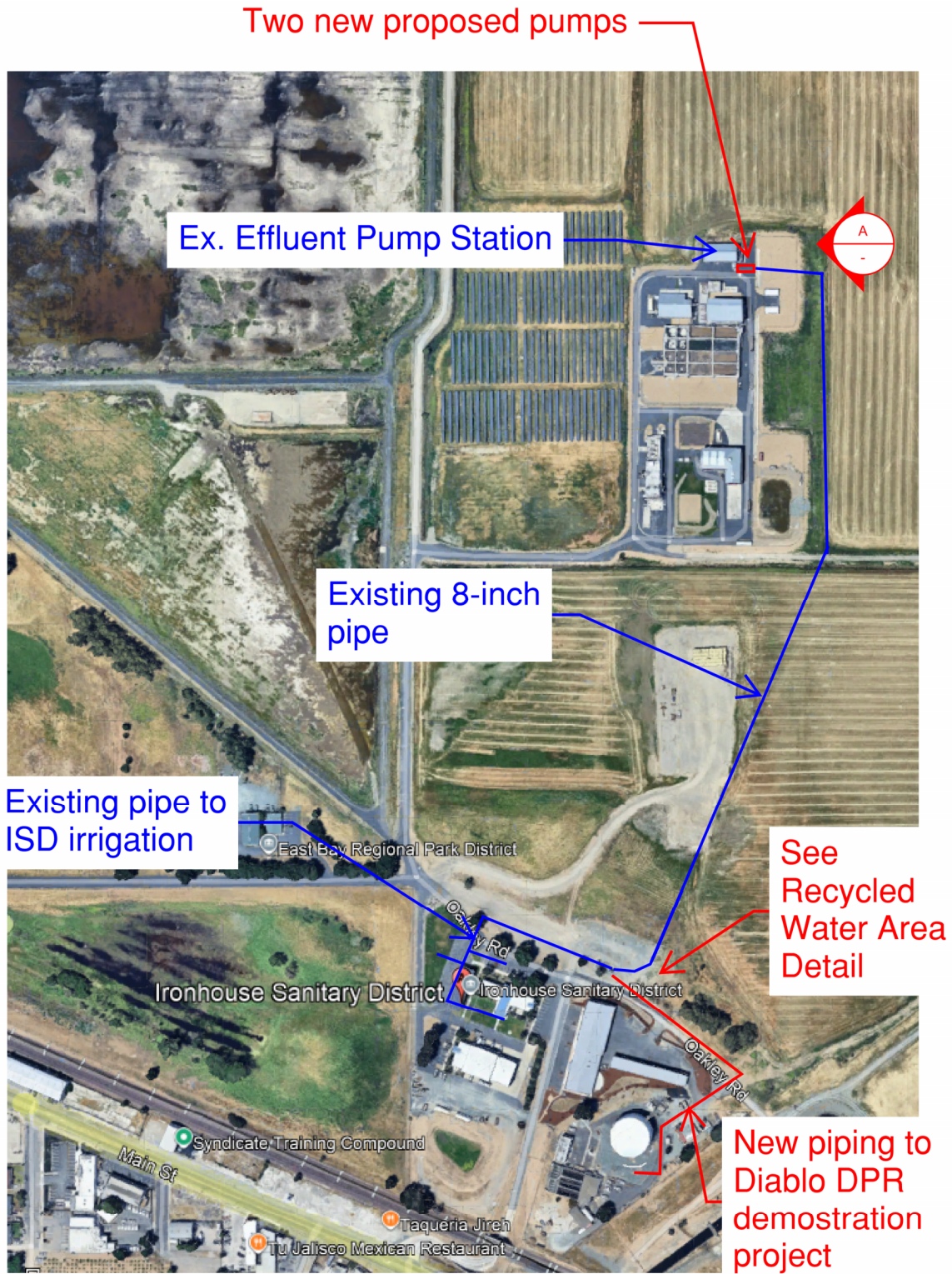


Figure 13.3 Recycled Water System Site Plan

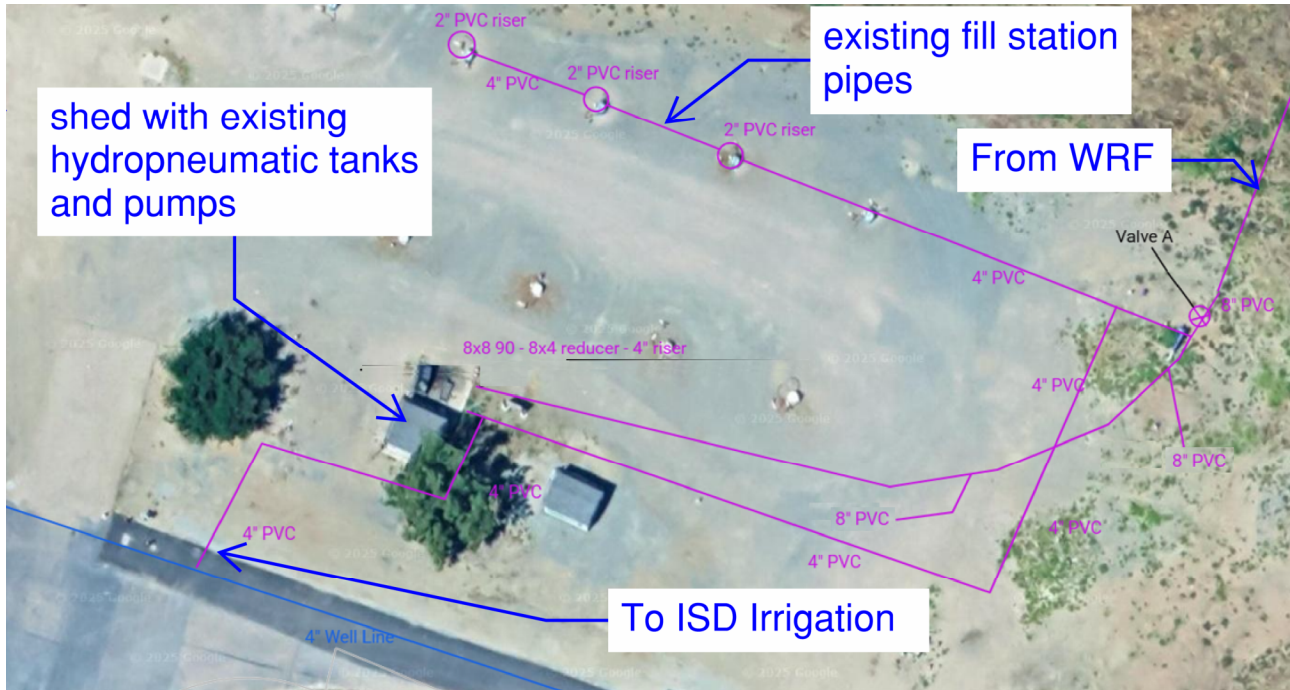


Figure 13.4 Recycled Water Area Detail

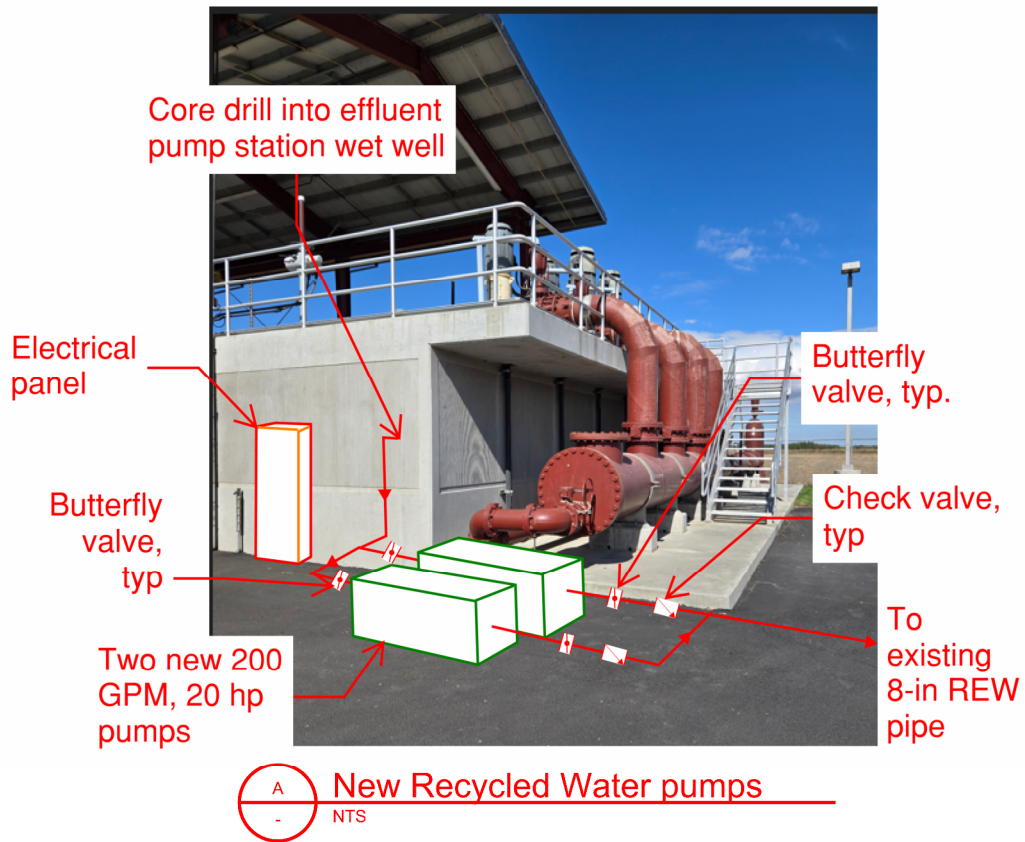


Figure 13.5 Recycled Water Pump Location

### 13.3.4 Potential Use of Recycled Water for Mainland Crop Irrigation

The fields surrounding the WRF are currently dry-farmed. These fields were originally irrigated with water pumped from March Creek up until 1982, when effluent from the original pond-based treatment plant was started to be used to irrigate these fields as a primary method of effluent disposal through flood irrigation. In 1992, the remaining mainland fields were also incorporated into the effluent irrigation process. Once the WRF was constructed, application of WRF effluent to these fields was ceased mainly due to concerns from Contra Costa Water District which has a raw water canal nearby the plant and the fields.

The total measured amount of water applied to the “mainland” fields for the year 2006 (the last year with data available) totaled 120.18 million gallons. However, this number does not account for water that does not percolate and is returned to the effluent storage ponds. This return water is a combination of tail-water which did not infiltrate or evaporate on the irrigation fields and groundwater. Only Fields A, B, C, D, E, F&G have return flow capability. Fields J/L, M and S have no return flow capabilities. The return water was routed to the north effluent storage pond and pumped by a return pump station located near Field F&G. Based on previous years’ data 37% of the water applied through flood irrigation is returned. Taking into account the 37% reduction for Fields A, B, C, D, E, F&G the estimated water applied to the “mainland” fields in 2006 was 94.08 million gallons.

Historically, a combination of overland flow and flood irrigation of each field would occur once per month, 4-5 applications per year during the summer (April-September). To flood irrigate the largest field E (39 acres), would require approximately 2,200 gpm for 24 hours to develop 3 inches of flooding across the entire field with an ultimate application of ~5 inches of water to the field.

Without irrigation, dry farming of these fields currently only yields 1 cutting per year of wheat or forage mix. With irrigation the fields historically would yield 3-4 cuttings.

The re-introduction of recycled water to the mainland fields is attractive to consider in tandem with biosolids disposal. With the likely sale of Jersey Island, ISD is losing a potential biosolids disposal option. With the use of recycled water on the mainland crops which would increase cuttings and yield, this could increase nitrogen uptake and make the use of biosolids on the mainland for fertilizer more attractive, particularly with Class A or Class A/EQ biosolids (as long as PFAS in biosolids does not become a regulatory hindrance to land application).

Use of the North Effluent Storage Pond and irrigation with recycled water at Jersey Island stopped in 2019. When it was in use in the summer, all WRF treated effluent would flow by gravity to the North Pond, and then the irrigation pump station would operate as required to deliver water from the North Pond to Jersey Island irrigation through the effluent pipeline.

A potential modified use of the North Pond with respect to mainland field irrigation would be as follows:

1. Flood irrigation would happen by gravity from the effluent pump station wet well by opening 62-G-14-FE, flowing backward through the 18" pond return line, into the main 27" mainland irrigation piping to the fields. This would primarily occur between noon and midnight when typical plant ADWF flows are 2,000 – 2,300 gpm (refer to Figure 3.5). When flood irrigating from the effluent pump station wet well, the effluent pumps would be disabled.
2. When flood irrigating, return flows through the return ditches would be pumped by the return pump station back into the North Pond.
3. Accumulated water in the North Pond can also be pumped by the irrigation pump station at the same time as water is flowing by gravity from the effluent pump station to supplement the flow rate. This will effectively mix WRF effluent flows and returned North Pond water to mitigate any pH effects.
4. Whenever flood irrigation is not happening, the effluent pumps would be enabled. Water in the North Pond would never be discharged to the San Joaquin River.

From the months of May-September the WRF currently produces approximately 390 MG of effluent. Based on previous irrigation records, irrigation of the mainland could utilize approximately 25% of the volume. There are 8 different fields that can be irrigated one at a time. A potential schedule could be to irrigate 2 fields for 2 days each week, covering all 8 each month. Refer to **Figure 13.6** below.

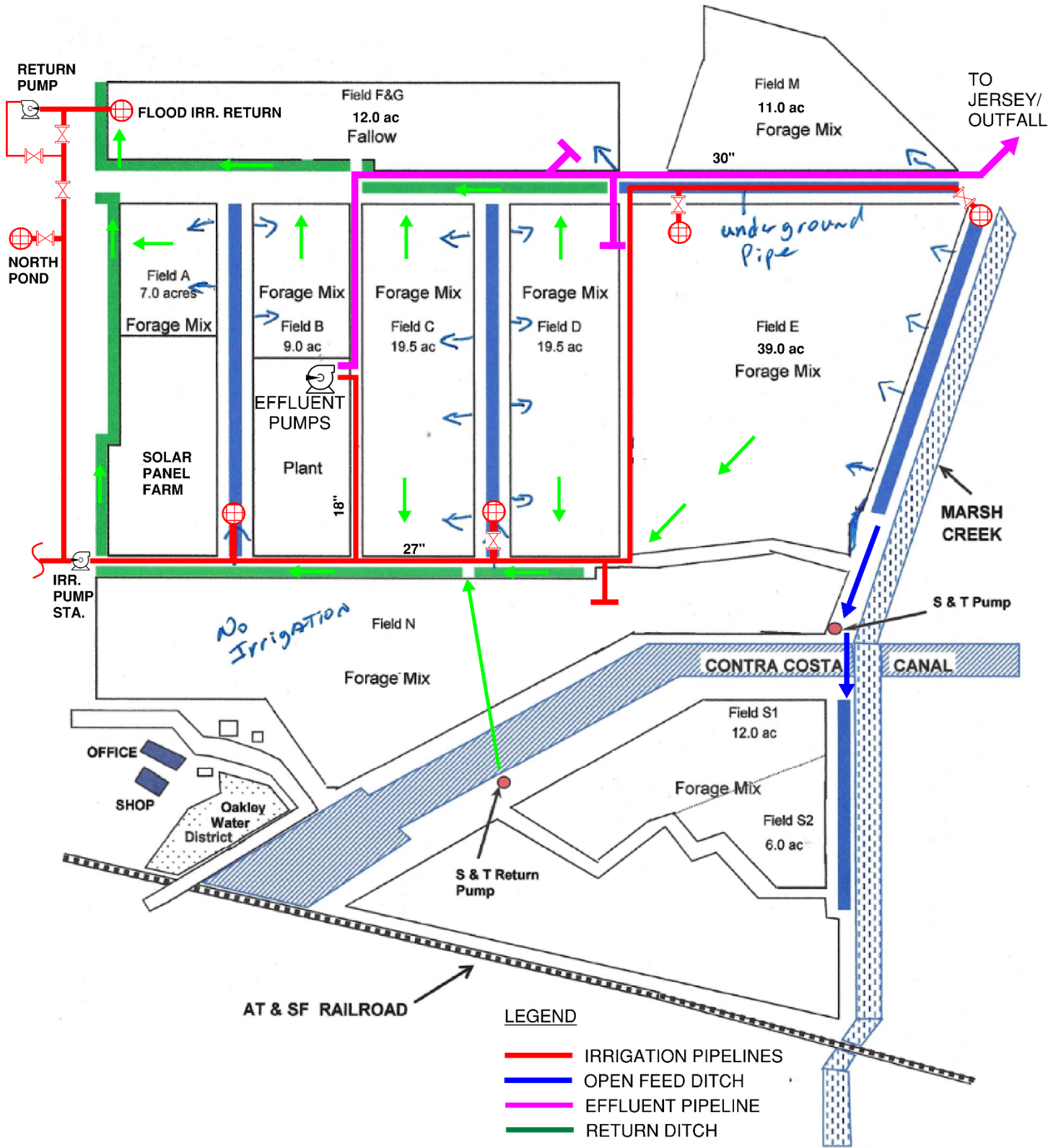


Figure 13.6 Mainland Field Irrigation Map

One past conflict with use of recycled water for irrigation was with the Contra Costa Water District (CCWD) intake canal, which historically ran east to west between fields N and S. CCWD's concern was that runoff and infiltration from the irrigation of the fields could be degrading the quality of their raw drinking water supply.

Past groundwater monitoring reports did show a hydraulic gradient to the northeast which could have seepage from mainland irrigated groundwater into the canal. However groundwater does not just include the most recent irrigation constituents but historical applications and groundwater basin-wide impacts. The possibility of the recycled water degrading the local groundwater supply and the CCWD canal raw water supply via seepage was explored in the 2004 Hydrofocus Beneficial Use Impact Study (BUIS). Some key findings from this study include:

- All monitoring well water samples had water age greater than 12-years. This indicates that effects from irrigation water are diluted by pre-existing groundwater which itself is a makeup of many previous years of irrigation water from various sites, rainfall, and effects from non-local sources moving in the groundwater gradient.
- No short circuiting or direct connection between the reclaimed water used for irrigation and the CCWD canal was identified. The seepage rates used were in agreement with CCWD's own canal study.
- Because the bottom of the canal was constructed below the groundwater table, the canal did experience groundwater seepage (approximately 0.4% of their supply) which was determined to be a mixture of groundwater originating up-gradient from ISD, groundwater influenced by decades of irrigation with Marsh Creek water (pre-existing groundwater), and some groundwater influenced by irrigation with reclaimed water. However the influence of reclaimed water was shown to not significantly affect the concentration of dissolved constituents in the canal.
- Degradation of groundwater is unable to be quantified but is likely from past irrigation by Marsh Creek water and natural soil salinity.

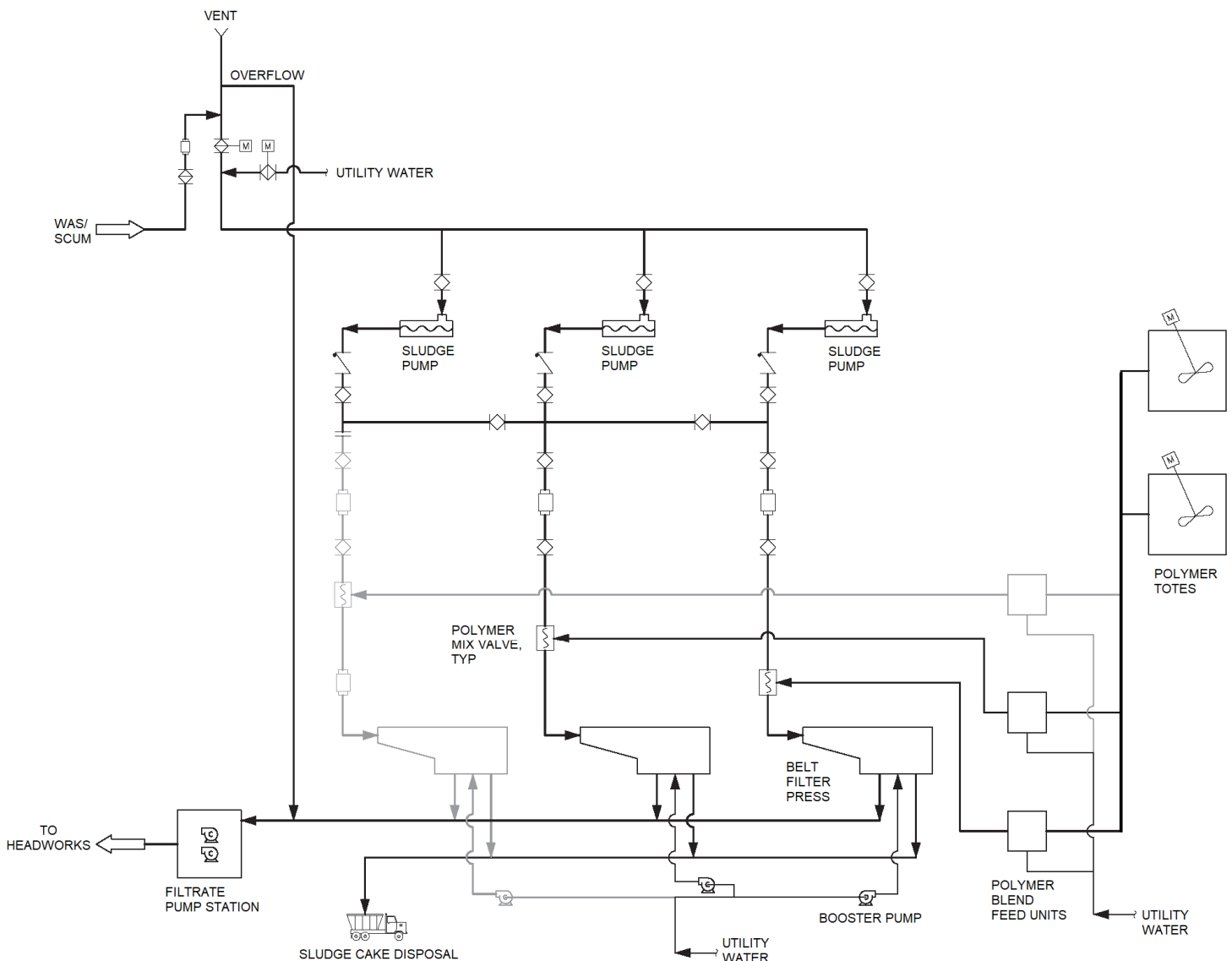
In 2006, CCWD reconfigured the canal near ISD land to a below grade pipeline, removing any concern about the influence of ISD groundwater seepage in the proximity of it's mainland fields. In 2014, CCWD continued the canal to pipeline conversion to the east of marsh creek. The nearest open raw water for CCWD is their intake structure, now located next to the Diablo Water District site at the corner of Main St. and Rose Ave.

Reinstating recycled water irrigation will require a LAA Expansion Workplan via the Water Board which will likely come with extensive commenting from CCWD. Increasing groundwater monitoring, by monitoring a larger area of wells, prior to starting any irrigation (whether recycled water or other) would be beneficial to use as a baseline for future groundwater monitoring, which will be increased to irrigate with recycled water.

## 14.0 Biosolids Dewatering System

### 14.1 Process Description

WAS is pumped from the aeration basin effluent channel to the belt filter press sludge feed pumps. There is a stand pipe overflow between the WAS pumps and belt press feed pumps to act as a hydraulic break between the two sets of pumps. Emulsion polymer is prepared and fed using polymer blend units to the sludge prior to entering the belt filter presses. The belt filter presses dewater the biosolids first in a gravity drainage section, and secondarily through a pressure section where the sludge is squeezed between two belts on a series of rollers. Pressurized utility water is used to clean the belts following cake discharge. Solids are dewatered to between 14-16% dry solids, and dropped out of the filter presses into a horizontal conveyor. This first conveyor can drop into one of two secondary conveyors that discharge into hauling trucks for offsite transport. A process flow diagram of the solids dewatering system is shown in **Figure 14.1** below.



**Figure 14.1. Solids Dewatering Process Flow**

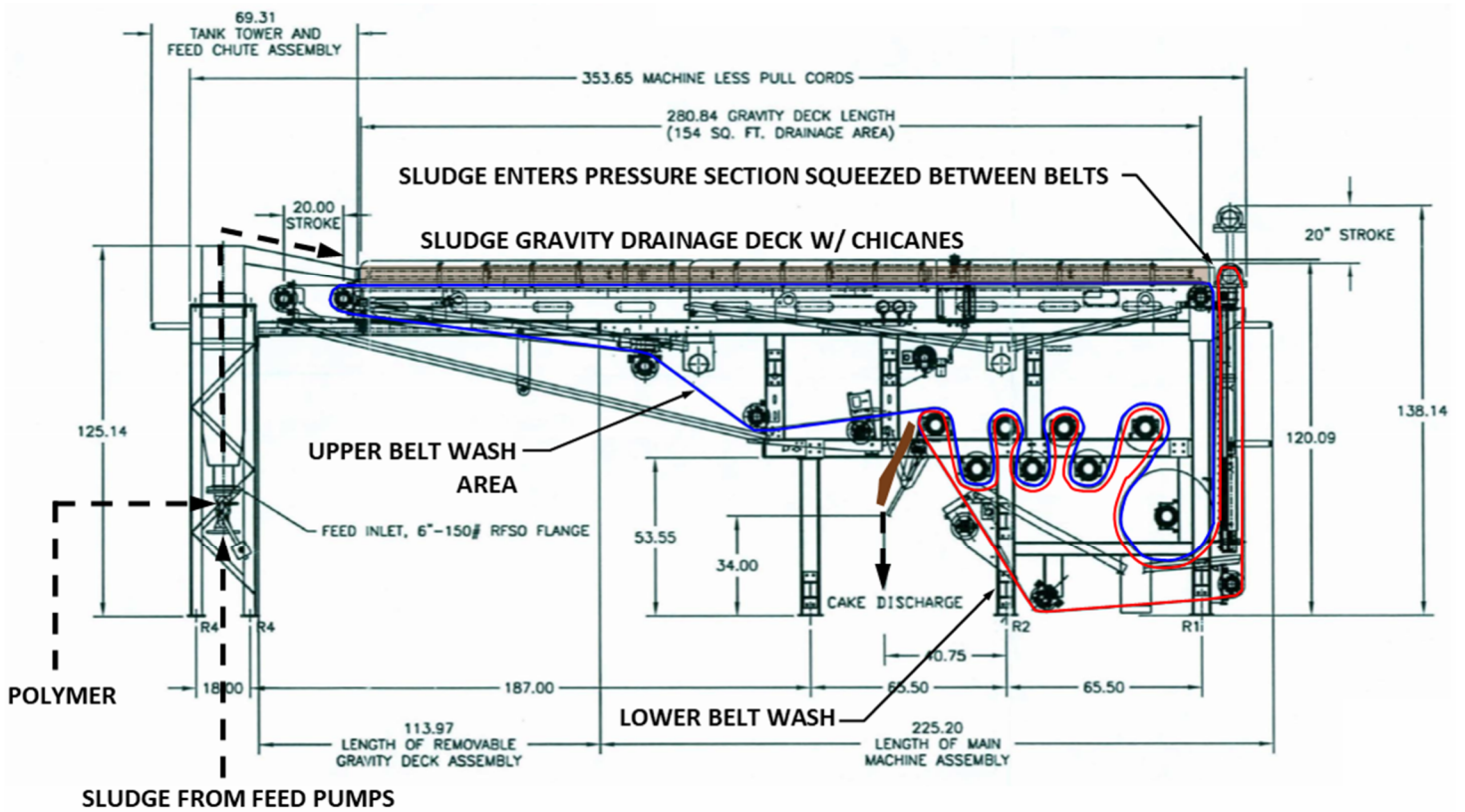


Figure 14.2. Belt Filter Press Section



Figure 14.3. Gravity Drainage Section with Chicanes

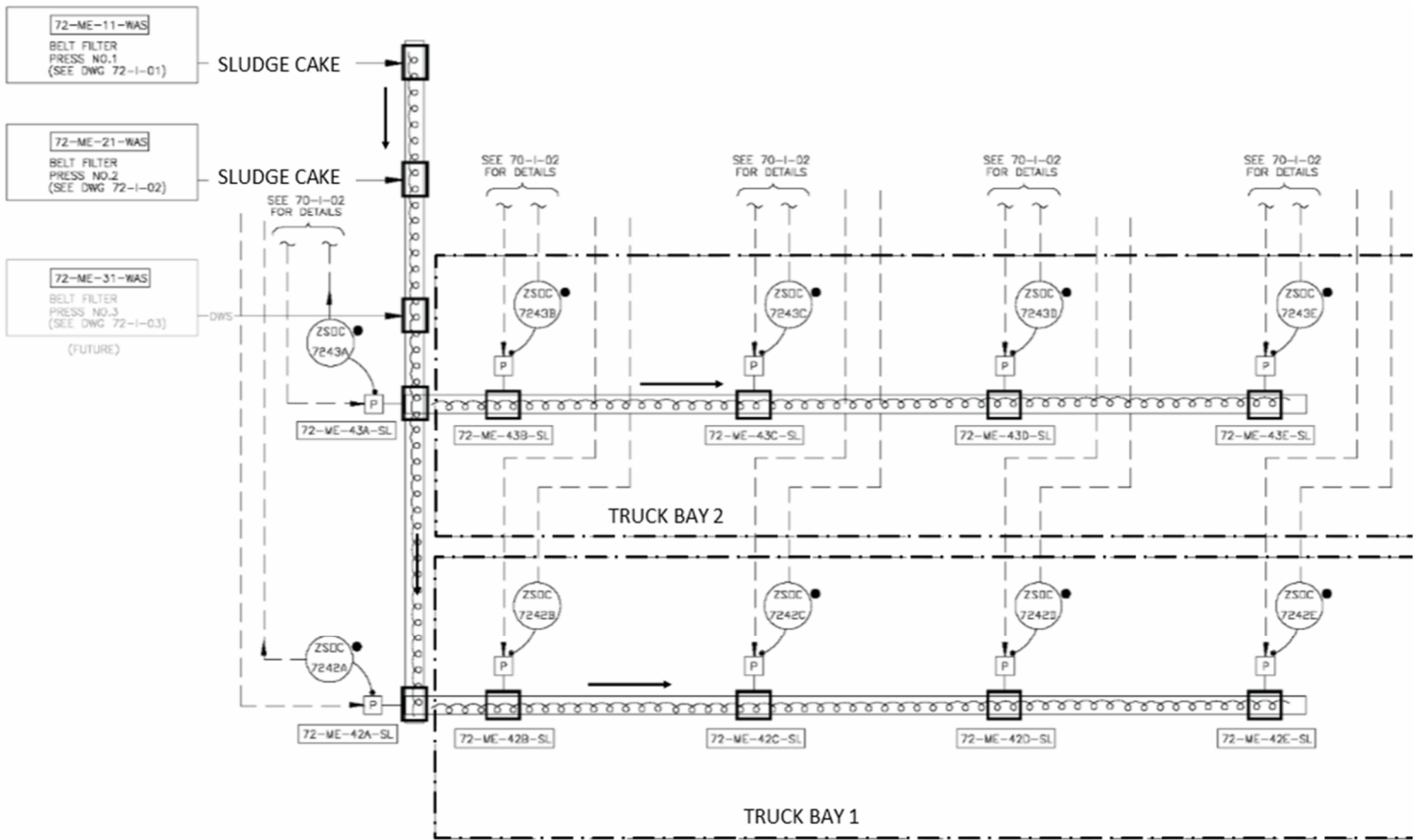


Figure 14.4. Conveyor Layout

Both of the belt filter presses discharge into a single primary conveyor that transports and discharges the cake into one of two secondary conveyors. The primary conveyor has one outlet chute for each of the secondary conveyors with a pneumatically actuated chute gate. There are two bays for hauling trucks, each served by one of the secondary conveyors. Each secondary conveyor has 4 discharge chutes that also have pneumatically actuated chute gates to allow for cake to be distributed over the length of the truck bed. Refer to **Figure 14.4** above.

Design criteria for the key equipment in the belt filter press dewatering system are presented in the tables below.

**Table 14.1. Belt Filter Press Feed Pump Design Criteria**

Criteria	Value
Equipment Tags	71-P-11, 71-P-12, 71-P-13
Pump Type	Progressive Cavity
Design Capacity	350 gpm @ 86'
Motor Horsepower	25 HP

**Table 14.2. Belt Filter Press Design Criteria**

Criteria	Value
Equipment Tags	72-ME-11, 72-ME-21
Belt Width	2 meter
Hydraulic Feed Rate	350 gpm
Solids Capacity	1,750 lb/hr dry solids
Belt Drive Power	Dual Drive – 7.5HP belt drive, 1.0 HP hydraulic drive

**Table 14.3. Polymer Blend System Design Criteria**

Criteria	Value
Equipment Tags	72-C-71, 72-C-72
Polymer Pump Type	Diaphragm
Typical Polymer Dose	15-20 lb/T
Neat Polymer Flow	0.8-8.0 gph

**Table 14.4. Washwater Booster Pump Design Criteria**

Criteria	Value
Equipment Tags	72-P-51, 72-P-52
Pump Type	In-Line Centrifugal
Design Capacity	80 gpm @ 190 ft
Motor Horsepower	7 HP

**Table 14.5. Conveyor Design Criteria**

Criteria	Value
Primary Conveyor Equipment Tag	72-ME-41
Primary Conveyor Power	15 HP
Secondary Conveyor Equipment Tags	72-ME-42, 72-ME-43
Secondary Conveyor Power	7.5 HP

**Table 14.6. Filtrate Pump Design Criteria**

Criteria	Value
Equipment Tags	73-P-11, 73-P-12
Pump Type	Submersible
Design Capacity	1,258 gpm @ 42'
Motor Horsepower	20 HP

### 14.1.1 Instrumentation

A list of the critical instrumentation for the solids dewatering process is provided in **Table 14.7** below.

**Table 14.7. Solids Dewatering Process Instrumentation**

Instrument	Location / Tag Number	# of Instruments
Influent WAS Flow Meter	Upstream of Stand Pipe FIT 7104	One for solids dewatering system
Standpipe Level Transmitter	In Standpipe LE 7105	1 for solids dewatering system
Standpipe High Level Switch	In Standpipe LSH 7105	1 for solids dewatering system
Belt Press Feed Pump Low Suction Pressure Switch	Upstream of Feed Pumps PSL 7111, 7112, 7113	1 per feed pump
Belt Press Feed Pump Low Seal Water Pressure Switch	Feed Pump Seal Water PSL 7101, 7102, 7103	1 per feed pump
Belt Press Feed Pump High Discharge Pressure Switch	Downstream of Feed Pumps PSH 7121, 7122, 7123	1 per feed pump
Belt Press Flow Meter	Downstream of Feed Pumps FIT 7111, 7112, 7113	1 per feed pump
Belt Press Washwater High Pressure Switch	Upstream of Belt Filter Press PSH 7211, 7221	1 per belt press
Washwater Booster Pump Low Suction Pressure Switch	Suction Side of Booster Pumps PSL 7250	1 for all 3 booster pumps
Washwater Booster Pump High Discharge Pressure Switch	Discharge Side of Booster Pumps PSH 7251, 7252, 7253	1 for each booster pump
Compressed Air System Pressure Transmitter	Compressed Air Receiver Tank PIT 7263	1 for compressed air system
Compressed Air System Low Pressure Switch	Compressed Air Receiver Tank PSL 7263	1 for compressed air system
Filtrate Flow Meter	Pump Discharge Header FIT 7300	1 for filtrate pump station
Filtrate Pump Station Bubbler Level Sensor	Filtrate Pump Station LE 7310	1 for filtrate pump station
Filtrate Pump Station Submersible Level Sensor	Filtrate Pump Station LE 7330	1 for filtrate pump station
Filtrate Pump Station Level Switches	Filtrate Pump Station LSH/LSL 7320	1 high/low for filtrate pump station

## 14.2 Current Operations

From 2022 to 2024 the average WAS rate was 46,000 gallons per day, for an annual total of approximately 16.8 million gallons. At an average WAS solids concentration of 10,000 mg/L with a VSS destruction of approximately 13% in the aerobic digester (post wasting), this equates to annual solids disposal of 609 dry tons, which matches closely to actual disposal data.

According to the SCADA information, the solids dewatering system is typically operated two days per week for 8 hours per day with both belt presses running at approximately 210 gpm each. Each belt press is processing approximately 1,000 lb/hr of dry solids, or 8,000 lbs in an 8 hour day.

### 14.2.1.1 Belt Press Capacity

There are currently 2 belt presses installed with the ability to add a 3<sup>rd</sup> unit in the future. The estimated peak month solids production at buildout of the plant is approximately 10,000 lb/day, or 70,000 lb/week. This is at future residential buildout (no additional industrial flows/loads or otherwise) with 4 aeration basins online and no aerobic digester. One belt press running at the maximum capacity of 1,750 lb/hr for 8.0 hrs/day and 5 days/wk can process 70,000 lb/week. Therefore, technically there is firm capacity for the plant to handle the buildout capacity peak month solids load with one unit out of service.

### 14.2.1.2 Sludge Feed Pumps

There are currently three sludge feed pumps installed, with the ability of the redundant feed pump to serve either of the belt presses. This is an adequate level of redundancy.

### 14.2.1.3 Polymer Feed System

The polymer feed system consists of two IBC neat polymer totes, and two polymer mix/feed systems. Each polymer mix/feed system is intended to be dedicated to one belt press. This is an adequate level of redundancy since only 1 belt press could technically service all future plant demands for biosolids dewatering.

The maximum capacity of the polymer feed systems is 8 gal/hr of neat polymer. The typical polymer demand is 20 lb per dry ton of solids. The belt presses can process 0.875 T/hr, therefore the maximum polymer demand is 17.5 lb/hr. Neat polymer weighs approximately 8.5 lb/gal, so the maximum polymer flow rate requirement is 2 gal/hr. The 8 gal/hr capacity of the polymer feed systems is conservatively adequate.

### 14.2.1.4 Washwater Booster Pump System

Each washwater booster pump is dedicated to one belt filter press. As long as firm redundancy is provided in belt filter press capacity, firm redundancy is provided in the dedicated washwater booster pumps as well.

The original 3HP booster pumps were replaced under the WRF Phase 1 Improvements constructed in 2019-2020 with 7HP pumps in order to provide the recommended 100 psi residual wash water pressure at the belt filter presses. Prior to this replacement residual pressure was only 75 psi.

### 14.2.1.5 Dewatered Cake Conveyors

Only 1 primary conveyor serves both filter presses. There is no redundancy for this conveyor. If this conveyor goes out of service, the dewatering facility cannot be operated.

### 14.2.1.6 Filtrate Pump Station

The capacity of a single filtrate pump is approximately 1,000 gpm. This is in excess of the maximum theoretical filtrate production from two belt presses including maximum washwater rate, which is 450 gpm per belt press. This means that the second filtrate pump is fully redundant with two belt presses in service. This is an acceptable level of redundancy.

### 14.2.1.7 Instrumentation Reliability

**Table 14.7** below provides recommendations regarding the redundancy of the solids dewatering system instrumentation.

**Table 14.7. Solids Dewatering Process Instrumentation**

Instrument	Current Redundancy	Comments / Recommendations
Influent WAS Flow Meter	One for solids dewatering system	Not a critical instrument, redundant unit not recommended
Standpipe Level Transmitter	1 for solids dewatering system	Adequate redundancy with backup high level switch
Standpipe High Level Switch	1 for solids dewatering system	Adequate redundancy
Belt Press Feed Pump Low Suction Pressure Switch	1 per feed pump	Adequate redundancy provided with redundant pump
Belt Press Feed Pump Low Seal Water Pressure Switch	1 per feed pump	Adequate redundancy provided with redundant pump
Belt Press Feed Pump High Discharge Pressure Switch	1 per feed pump	Adequate redundancy provided with redundant pump
Belt Press Flow Meter	1 per feed pump	Adequate redundancy provided with redundant pump
Belt Press Washwater High Pressure Switch	1 per belt press	Adequate redundancy provided with redundant belt press
Washwater Booster Pump Low Suction Pressure Switch	1 for all 3 booster pumps	<b>Recommend adding a redundant low-low pressure switch.</b>
Washwater Booster Pump High Discharge Pressure Switch	1 for each booster pump	Redundant high pressure switches located at belt press inlet.
Compressed Air System Pressure Transmitter	1 for compressed air system	Adequate redundancy with low pressure switch backup
Compressed Air System Low Pressure Switch	1 for compressed air system	Adequate redundancy
Filtrate Flow Meter	1 for filtrate pump station	Not a critical instrument, redundant unit not recommended
Filtrate Pump Station Bubbler Level Sensor	1 for filtrate pump station	Adequate redundancy with submersible backup.
Filtrate Pump Station Submersible Level Sensor	1 for filtrate pump station	Adequate redundancy with bubbler backup.
Filtrate Pump Station Level Switches	1 each for filtrate pump station	Adequate redundancy.

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### 14.3 Major Condition Assessment Findings

The belt presses are in excellent condition with relatively low run hours for their age.

### 14.4 Biosolids Storage and Disposal

Refer to a separate memorandum which analyzes biosolids storage and disposal alternatives.

### 14.5 Recommended Improvements

#### 14.5.1 Dewatered Cake Conveyor Spare Parts

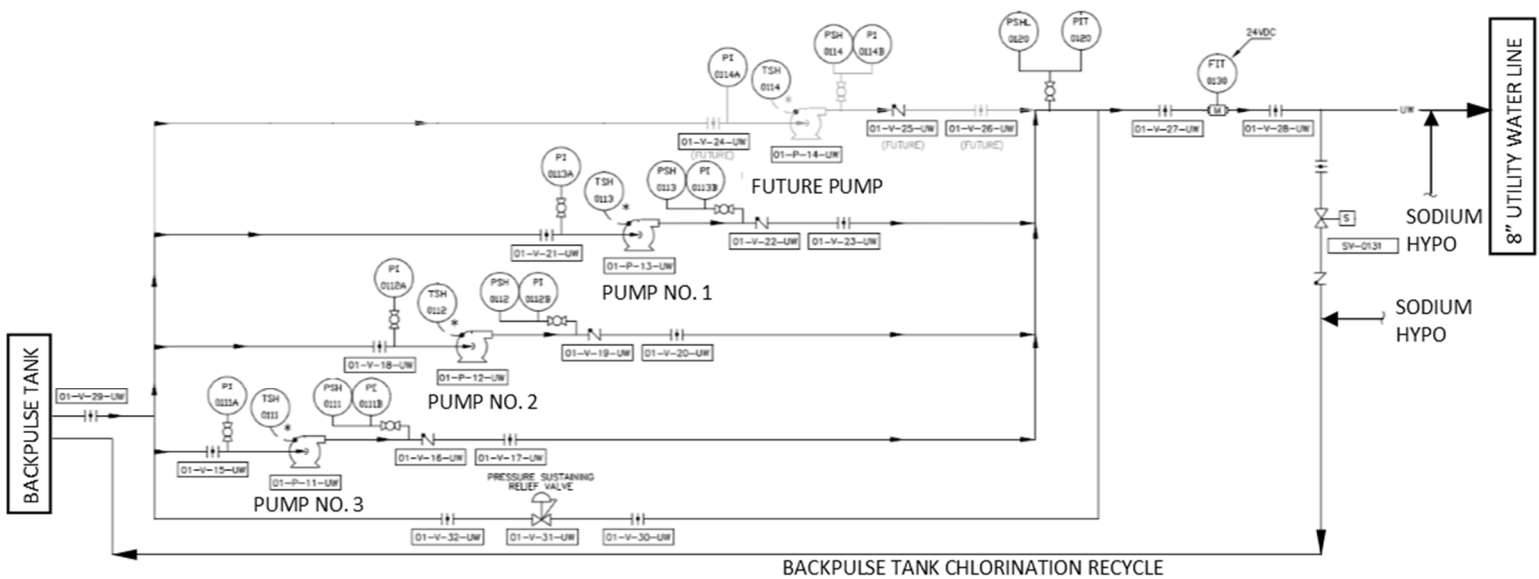
A complete set of spare parts for the common dewatered cake conveyor should be purchased, including drive, shaftless flight, liner, and conveyor body panels should be purchased and kept on the shelf to allow for rapid repair of the conveyor.

## 15.0 Utility Water Pump Station

### 15.1 Process Description

The utility water pump station provides utility water to the entire WRF, and the source of the utility water is the backpulse tank. The water in the backpulse tank has been filtered through the MBR system, but has not been disinfected through the UV system. The utility water pump station is set up with a pressure sustaining / relief valve that maintains the utility water system pressure, and allows the recycle of water from the discharge side of the pumps back to the backpulse tank (and suction side of the pumps).

Sodium hypochlorite from the blower / chemical building can be injected into the utility water for disinfection and to help prevent growth in the utility water distribution piping. The 8” utility water discharge line from the pump station runs through the WRF site, serving all facilities. Sodium hypochlorite can also be injected into a recycle line from the pump station discharge back into the backpulse tank. This is in place to allow for chlorination of the WRF effluent prior to UV disinfection, if desired. A process flow diagram for the utility water pump station is shown in **Figure 15.1** below.



**Figure 15.1. Utility Water Pump Station Process Flow Diagram**

Design criteria for the utility water pumps is presented in **Table 15.1** below.

**Table 15.1. Utility Water Pump Design Criteria**

Criteria	Value
Equipment Tags	01-P-11, 01-P-12, 01-P-13
Pump Type	Horizontal Split Case
Design Capacity	400 gpm @ 175'
Motor Horsepower	30 HP

### 15.1.1 Instrumentation

The instrumentation for the utility water pump station is listed in **Table 15.2** below.

**Table 15.2. Utility Water Pump Station Instrumentation**

Instrument	Location / Tag Number	# of Instruments
Utility Water Pump High Pressure Switch	Discharge of Utility Water Pump PSH 0111, 0112, 0113	One for each utility water pump
Utility Water System Pressure Transmitter	Utility Water Pump Station Header PIT 1020	One for utility water system
Utility Water System High / Low Pressure Switch	Utility Water Pump Station Header PSHL 0120	One for utility water system
Utility Water Flow Meter	Utility Water Pump Station Header FIT 0130	One for utility water system

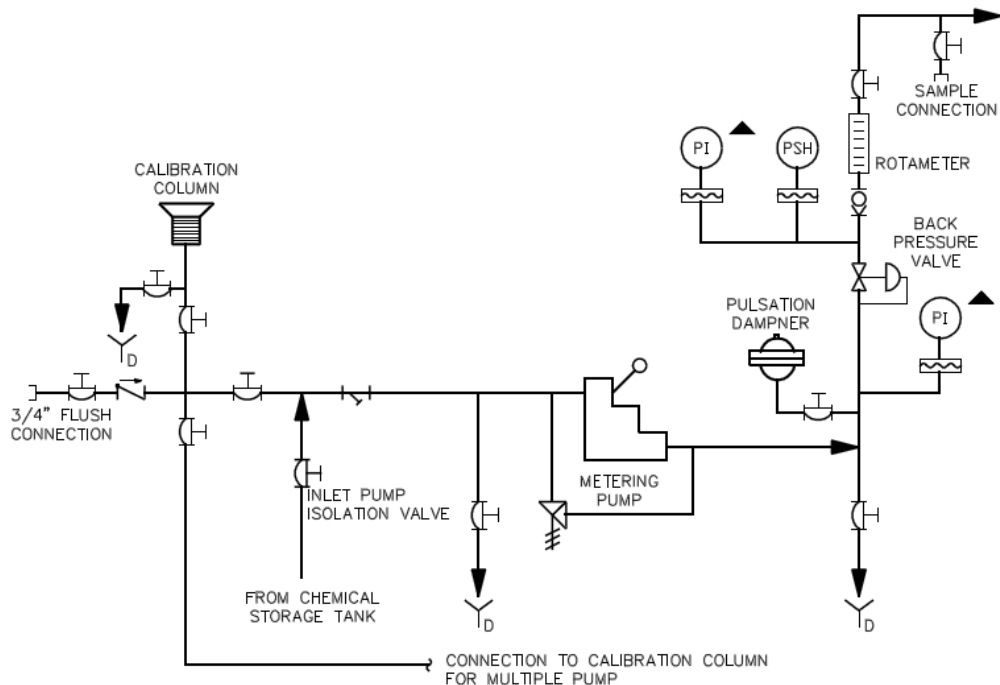
### 15.1.2 Sodium Hypochlorite Feed System

Design criteria for the sodium hypochlorite feed pumps is presented in **Table 15.3** below.

**Table 15.3. Sodium Hypochlorite Feed Pump Design Criteria**

Criteria	Value
Equipment Tags	54-C-21, 54-C-22
Pump Type	Hydraulic Diaphragm
Design Capacity	0-30 gallons per hour
Motor Horsepower	0.5 HP

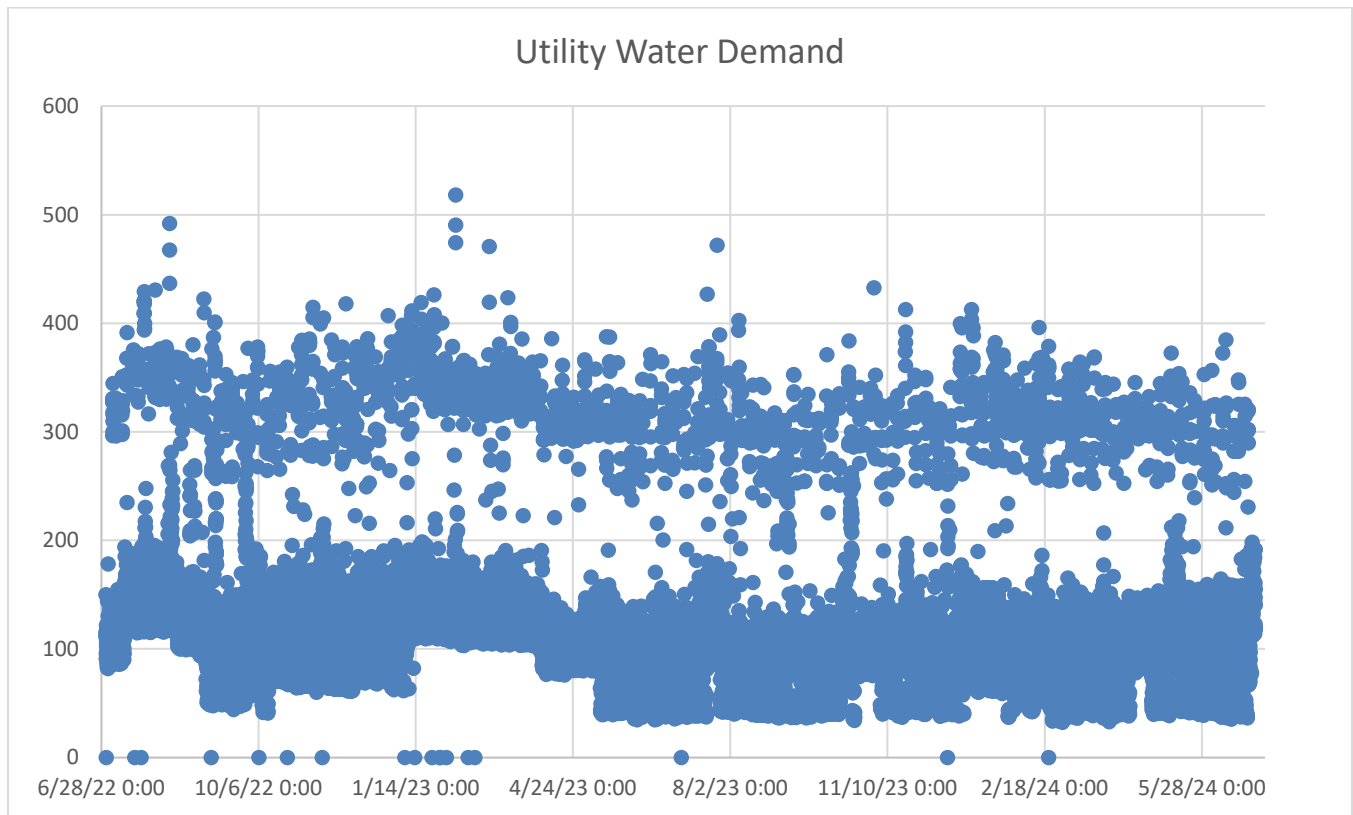
Each of the sodium hypochlorite feed pumps has a dedicated calibration column, pulsation dampener, back pressure valve, high pressure switches at the pump discharge, and low flow switch. See **Figure 15.2**.



**Figure 15.2. Hydraulic Diaphragm Pump Schematic**

## 15.2 Current Operations

Utility water demand for July 2022 – July 2024 is shown below in **Figure 15.3**. Demand averages 129 gpm. The utility water pumps operate 24/7, recycling excess flow back into the backpulse tank if necessary. One utility water pump is typically operated continuously for 1 week at a time, cycling through the three duty pumps each week. The pump speed is automatically controlled to maintain a pressure setpoint in the utility water pump station discharge header. The minimum pump speed setting is 79%.



**Figure 15.3. 2022-2024 Utility Water Demand**

### 15.2.1 Pumping Capacity

In terms of peak pumping capacity, two utility water pumps sometimes operate when both belt presses are operated. There is no expected significant growth in utility water demand, as the addition of a third mechanical screen is mainly for redundancy, since 2 screens operate now and 2 will operate into the future. More drum screens will operate on average into the future but that will only increase utility water demand on average less than 50 gpm which will still be within the capacity of 2 operating utility water pumps.

Two utility water pumps with a third redundant unit appears to be adequate.

### 15.2.2 Instrumentation

The utility water pump station has adequate redundancy in the instrumentation. Each utility water pump has a high pressure switch to indicate overpressure (i.e. operation against a closed valve). The main pressure transmitter for the utility water system has a high/low pressure switch backup to indicate a problem with the transmitter, and the utility water pumps could be operated in hand at a constant speed of 100% if necessary in the case of a disruption in the automated controls due to a pressure transmitter failure. In this case, more water would simply be recycled back to the backpulse tank temporarily until automated control could be restored.

### 15.2.3 Sodium Hypochlorite Feed System

The two feed pumps which can dose sodium hypochlorite to the utility water and to the backpulse tank are intertied such that each pump can potentially dose at both locations. This provides an adequate level of redundancy given that sodium hypochlorite is not normally fed to the backpulse tank. Each chemical pump has a dedicated high pressure switch and low flow switch, providing 1 duty + 1 standby redundancy for the utility water sodium hypochlorite feed system.

## 15.3 Major Condition Assessment Findings

There is significant corrosion in all smaller diameter galvanized steel utility water piping throughout the plant. Piping 4" and greater in size is generally ductile iron with cement mortar lining which does not appear to be suffering from significant degradation. However, galvanized steel piping is used for line sizes 3" or less. The utility water has moderately high salinity and is likely very low in alkalinity as nitrification in the wastewater treatment process consumes alkalinity. Low alkalinity water will be aggressive towards galvanized steel. In addition, air in the vicinity of the WRF has moderately high salinity due to its close proximity to the San Joaquin River which has brackish water, creating a semi-marine air environment which is also corrosive to metals.

## 15.4 Recommended Improvements

### 15.4.1 Replace Galvanized Steel Piping

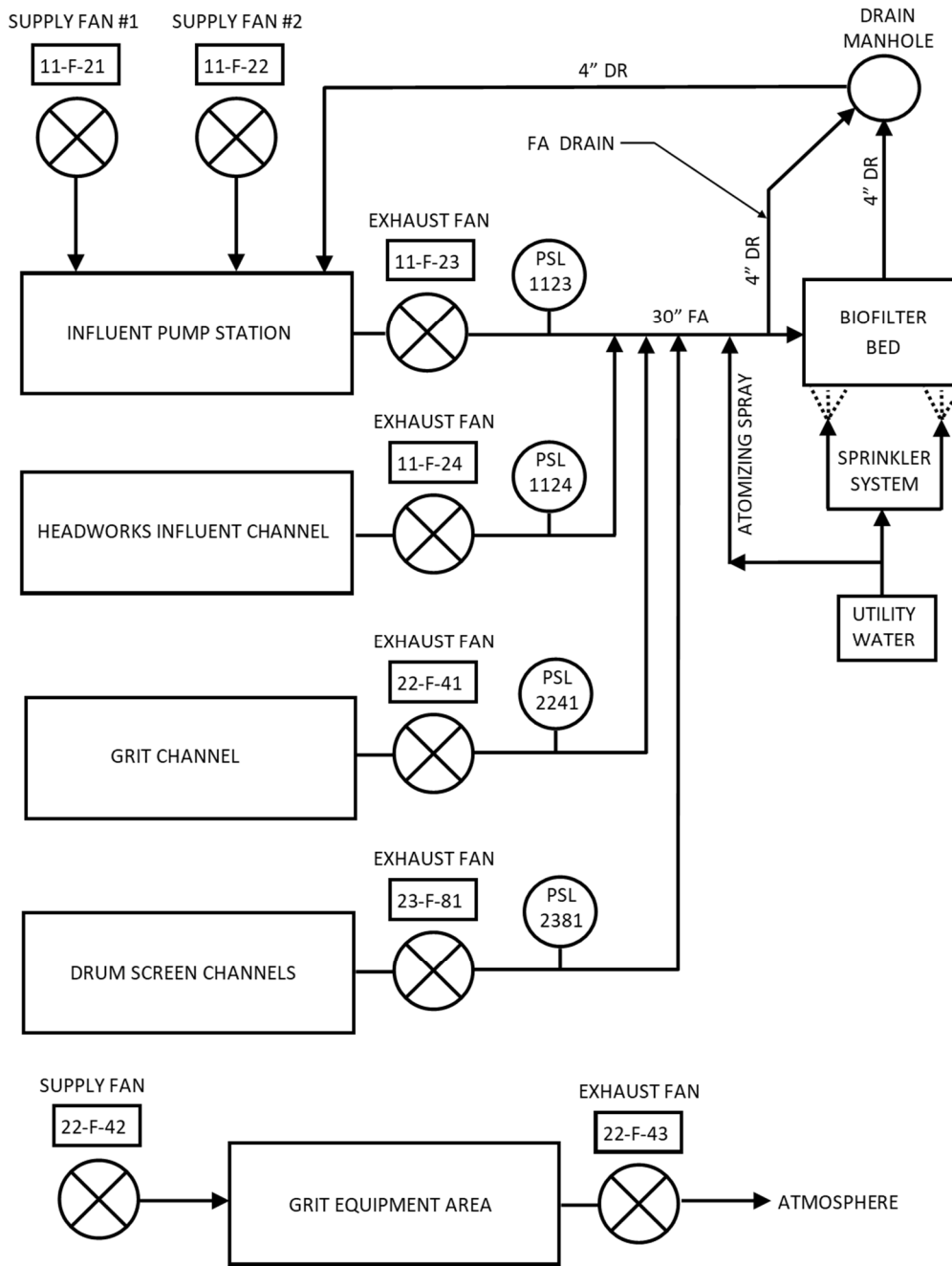
It is recommended that all galvanized steel utility water piping in the plant that is original to the WRF is replaced with 316 stainless steel piping. This would include all exposed (above grade) piping that is 3" diameter or less. Care would need to be taken to separate dissimilar metals using di-electric unions or insulating flanges at connection points to equipment or ductile iron pipe. Schedule 80 PVC pipe could be used in some areas where it would not be subject to regular contact by maintenance personnel where it may be a breakage concern.

**Refer to CIP Project 15-1 Profile.**

## 16.0 Headworks Odor Control System

### 16.1 Process Description

The headworks odor control system consists of foul air supply and exhaust fans dedicated to specific process areas that are tied into a common header that delivers foul air to a biological odor control media bed for treatment, as shown in **Figure 16.1**. The system works effectively, as the odor level at the headworks is currently satisfactory.



**Figure 16.1. Headworks Odor Control Schematic**

Design criteria for the foul air fans is presented in **Table 16.1** below.

**Table 16.1. Headworks Odor Control Fan Design Criteria**

Equipment Tag	Description	Type	Flow (scfm)	Motor Power
11-F-21	Influent PS Supply Fan #1	Propeller	2,850	1 HP
11-F-22	Influent PS Supply Fan #2	<i>Demolished Under Phase 1 Improvements</i>		
11-F-23	Influent PS Exhaust Fan	Centrifugal	5,800	15 HP
11-F-24	Influent Channel Exhaust Fan	In-line	400	3 HP
22-F-41	Grit Channel Exhaust Fan	In-line	1,500	5 HP
22-F-42	Grit Area Supply Fan	Propeller	2,000	1 HP
22-F-43	Grit Area Exhaust Fan	Propeller	2,100	1 HP
23-F-81	Drum Screen Exhaust Fan	In-Line	975	5 HP

The biofilter was sized to treat 10,000 scfm of foul air, whereas the total design fan discharge is 8,675 scfm. The 30" foul air header from the headworks delivers air to the biofilter bed through sixteen 6" diameter perforated laterals, as shown in **Figure 16.2**. The biofilter bed includes a 30 mil PVC liner at the bottom, and lava rock surrounding the air distribution laterals to evenly distribute air across the bed.

The original biofilter had a 6" layer of wood chips placed over the rock to prevent the migration of fines into the air laterals. The main biofilter media was composed of 3 parts volume wood chips and 1 part volume yard waste compost. Additionally, crushed oyster shells were blended into the media at a rate of 30 pounds per cubic yard of media. The hydrogen sulfide levels in the foul air required use of oyster shells as a buffering agent for pH control. The materials were blended together into a homogeneous mixture and placed on top of the 6-inch wood chip layer. The 3' thick media layer hosts microbes that consume the hydrogen sulfide gas in the foul air and convert it to carbon dioxide and water. An additional 6" layer of wood chips was placed as a protective cover over the treatment media. This media broke down and degraded over time and eventually the 3' thick layer shrunk to less than half of its original thickness.

The biofilter media was replaced under the WRF Phase 1 Improvements constructed in 2019-2020 as shown in **Figure 16.3**. The new media is Bohn inorganic soil media that has a guaranteed lifespan of 15 years. Since the media is inorganic, it will not break down or degrade over time the way that the original organic media did. The Bohn media is covered with 6" of protective river rock, and is kept moistened by utility water spray systems.

The microbes that naturally grow in the media require a certain level of moisture to survive. The incoming foul air is moisturized by a continuous utility water atomizing spray located downstream of the influent pump station exhaust fan. A sprinkler system periodically wets the surface of the media with plant utility water. The media bed includes a perforated 4" underdrain pipe to allow applied irrigation water and rain water to drain from the media bed back to the influent pump station. The 30" foul air line also includes a 4" drain at the bottom of the pipe to allow water applied from the atomizing spray to drain out of the air distribution system.

### EXISTING BIOFILTER ODOR CONTROL MEDIA SECTION

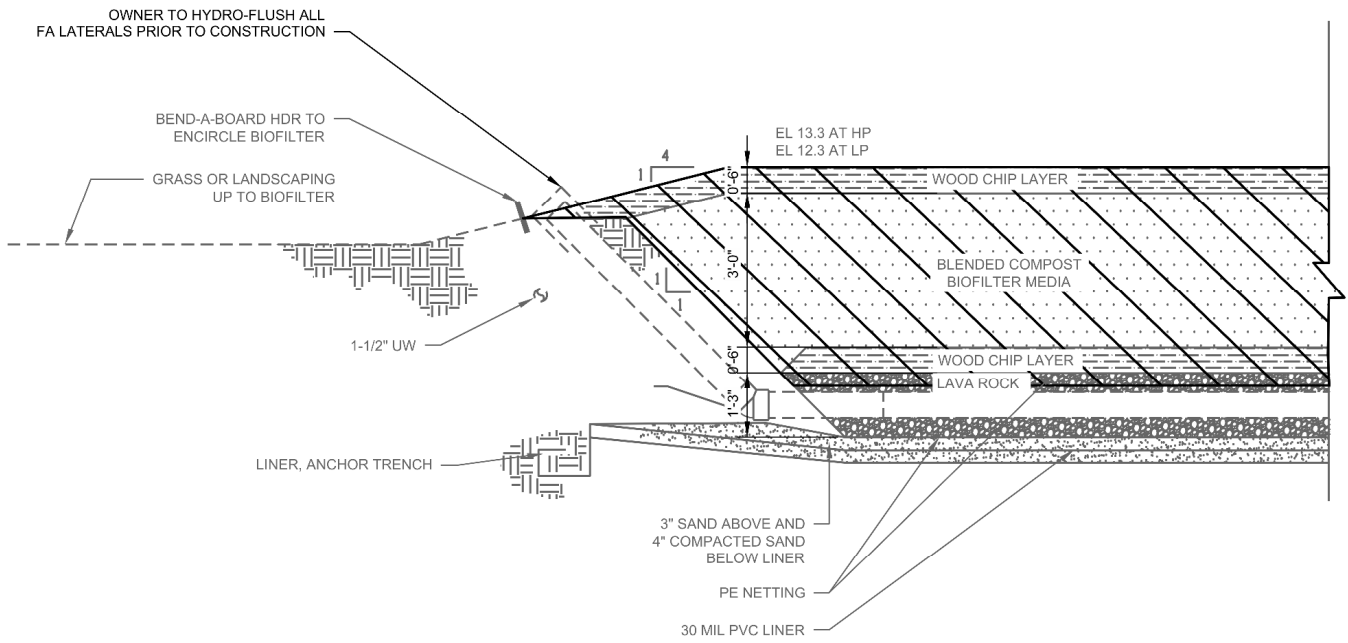


Figure 16.2. Existing Biofilter Section

### REPLACED BIOFILTER ODOR CONTROL MEDIA SECTION

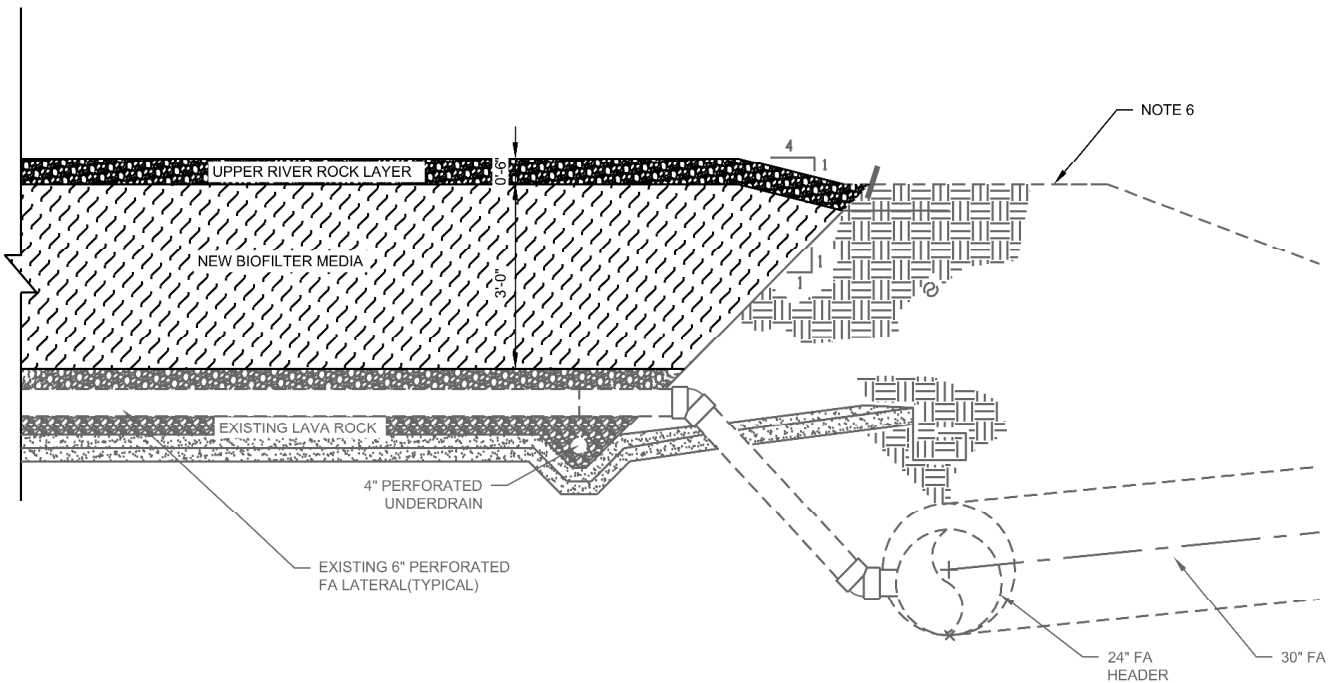


Figure 16.3. New Biofilter Section

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## 16.2 Current Operations

WRF Staff have noted that there does not appear to be adequate air flow through the drum screens, because the drum screens have no significant air intake. This causes hydrogen sulfide gas build-up in the drum screens, and corrosion to occur in the drum screens and surrounding concrete.

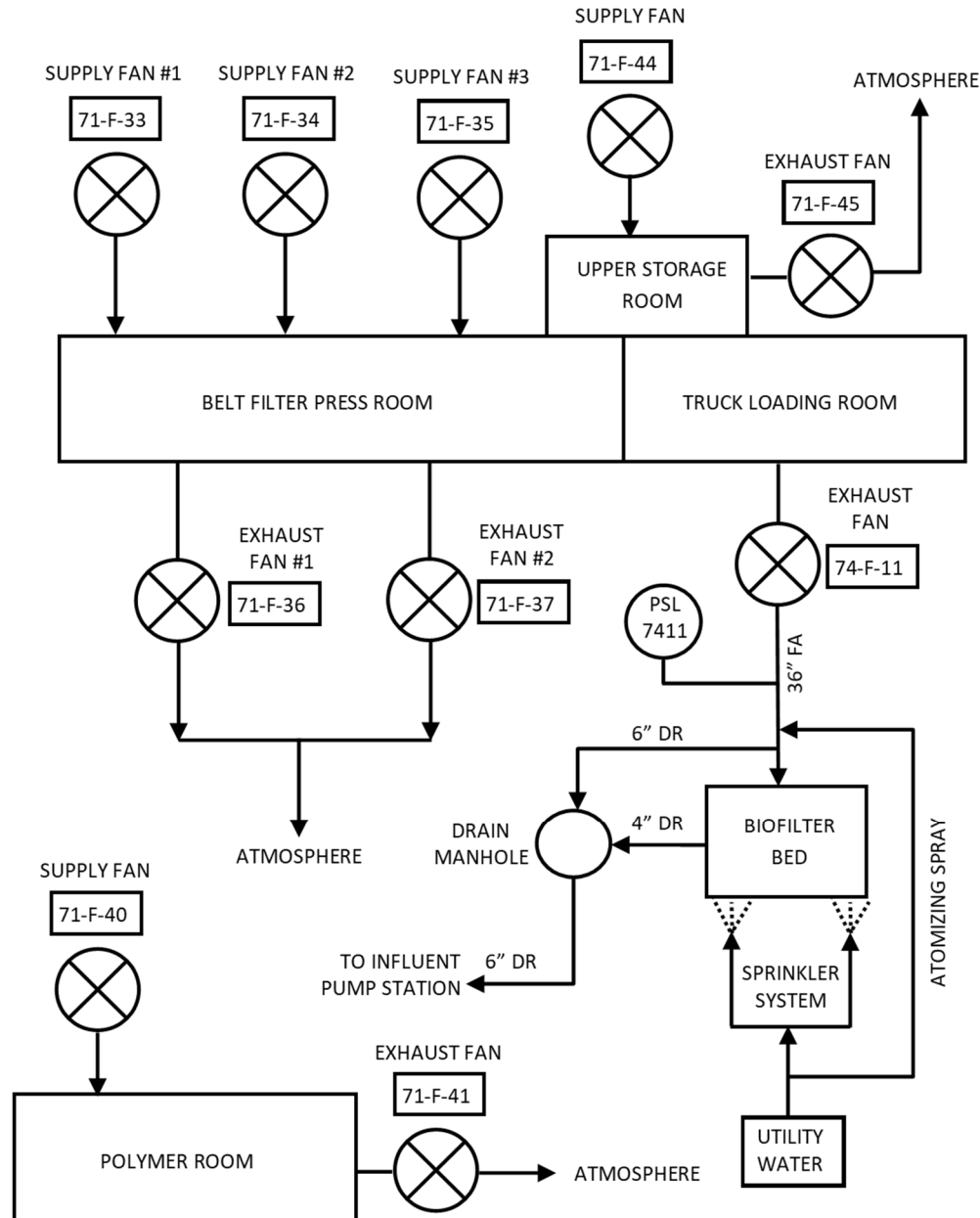
## 16.3 Recommended Improvements

It is recommended that screened air intake vents are added to each drum screen, and that the air flow of the entire ventilation system is measured and rebalanced to confirm and prioritize drum screen air flow.

## 17.0 Solids Dewatering Facility Odor Control System

### 17.1 Process Description

The solids dewatering facility odor control system serves four process areas, as shown in **Figure 17.1** below. The belt filter press room includes three supply fans, and two exhaust fans that ventilate to atmosphere. The upper storage room and polymer room in the solids dewatering building are also ventilated to atmosphere with a supply and exhaust fan. An exhaust fan dedicated to the truck loading room conveys foul air to a biofilter for treatment.



**Figure 17.1. Solids Dewatering Odor Control Schematic**

Design criteria for the foul air fans is presented in **Table 17.1** below.

**Table 17.1. Solids Dewatering Odor Control Fan Design Criteria**

Equipment Tag	Description	Type	Flow (scfm)	Motor Power
71-F-33	Belt Filter Press Supply Fan #1	Propeller	7,000	2 HP
71-F-34	Belt Filter Press Supply Fan #2	Propeller	7,000	2 HP
71-F-35	Belt Filter Press Supply Fan #3	Propeller	7,000	2 HP
71-F-36	Hood Exhaust Fan #1	Centrifugal	9,000	3 HP
71-F-37	Hood Exhaust Fan #2	Centrifugal	9,000	3 HP
71-F-40	Polymer Area Supply Fan	Propeller	1,900	1 HP
71-F-41	Polymer Area Exhaust Fan	Propeller	1,900	1 HP
71-F-44	Upper Storage Supply Fan	Propeller	2,500	1 HP
71-F-45	Upper Storage Exhaust Fan	Propeller	2,500	1 HP
74-F-11	Truck Area Exhaust Fan	Propeller	10,500	20 HP

The biofilter was sized to treat 10,500 scfm of foul air from the truck area exhaust fan. The 36” foul air header from the solids dewatering building delivers air to the biofilter bed through thirteen 6” diameter perforated laterals. The solids dewatering facility biofilter has the same media bed section and general configuration as the original headworks biofilter.

## 17.2 Current Operations

Currently, the solids dewatering facility supply and exhaust ventilation fans are used to ventilate the building, however the truck loading room exhaust fan which delivers air to the biofilter bed is not normally used and has not been necessary to control odors.

The solids dewatering facility biofilter media has experienced settling and compaction similar to the original headworks biofilter media, and is approaching the end of its useful life. This biofilter is not used and is essentially abandoned at this time, although it could be rehabilitated in the future if needed if operations in the Solids Building were to change.

## 17.3 Recommended Improvements

The existing solids dewatering facility biofilter bed could be either rehabilitated or demolished and used for future facilities. However, no capital improvement project is included in the CIP for this facility at this time.

## 18.0 Stormwater Basin and Original WWTP Site Demolition

### 18.1 Process Description

The WRF has a stormwater retention pond located in the southeast corner of the site. All of the on-site storm drain system discharges to the retention pond, which has a storage capacity of 40,278 cubic feet, or approximately 0.3 MG. Since all of the stormwater is retained on-site, the WRF is not required to have an Industrial Stormwater Permit or any additional stormwater treatment measures. The retention pond was engineered and constructed to contain the maximum historic precipitation event using precipitation data developed by the Contra Costa County Public Works Department by the original design engineer.

The retention pond has an overflow channel that does allow the pond to overflow into the adjacent field in the case that the storage capacity is exceeded. The pond also has a piped bottom outlet that discharges to the adjacent field with an isolation gate valve to allow the pond to be drained.

### 18.2 Current Operations

The design intent of the storm water retention basin is to allow percolation of the retained stormwater. However, in the case of prolonged stretches of wet weather and saturated ground conditions, WRF operators have found that percolation may slow to the point that the pond does not empty adequately between storm events.

### 18.3 Recommended Improvements

#### 18.3.1 Stormwater Basin Return Line

It is recommended that a drain return line from the stormwater retention basin to the headworks is added to allow the retention basin to be emptied and treated by the WRF in the case of prolonged periods of wet weather when the natural percolation rate is not adequate to remove accumulated stormwater. The recommended drain line configuration is shown below in **Figure 18.1**.

The bottom of the pond is at elevation 6.2. A new bottom outlet to a proposed 10" return line is proposed at elevation 6.0. The new return line would be run west to connect to the existing 30" primary influent line at MH-7 which has an invert of -4.5. The new return line would connect to MH-7 at an invert of 1.2, to ensure that the return line is not subject to backflow from the influent sewer. The return line would penetrate the manhole and also have a duckbill check valve on it to prevent backflow and odors from affecting the stormwater retention basin. The new return line would have a slope of 1% and a full gravity flow capacity of approximately 1,100 gpm (1.58 MGD). This would allow the stormwater basin to be emptied in approximately 4.5 hours if necessary.

The gate valve for the return line would include an actuator extension and outdoor-rated motor actuator to allow for automatic control of the stormwater return. Also, an open-channel flow meter would be added to a manhole on the return line to allow for measurement of the return flow. This would allow for the return flow rate to be controlled, or stopped automatically if the total influent flow rate to the plant becomes too high during periods of peak wet weather flows.

**Refer to CIP Project 18-1 Profile.**

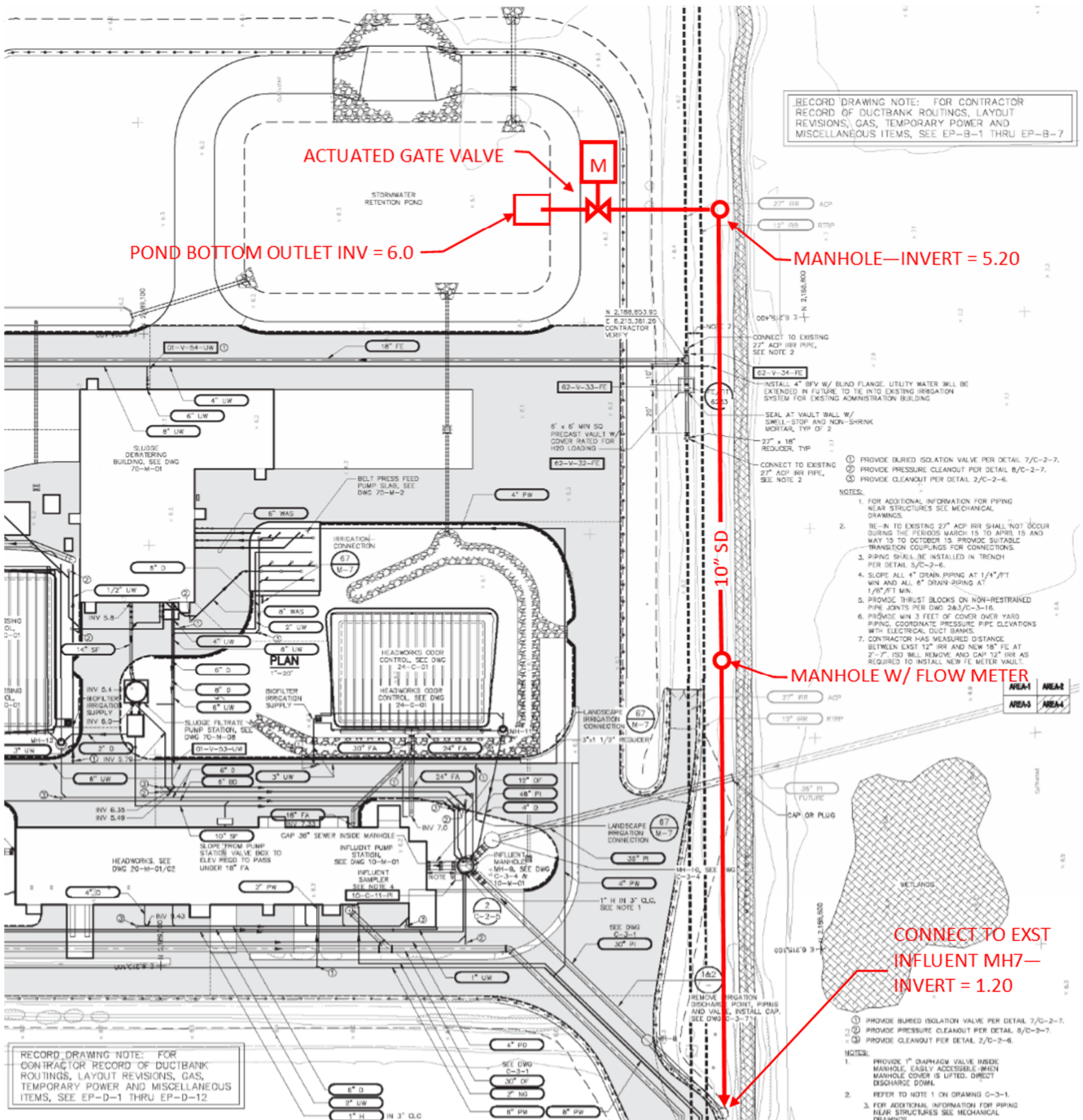


Figure 18.1. Stormwater Basin Return Line

### 18.3.2 Original WWTP Site Demolition

Existing facilities associated with the original aerated pond-based wastewater treatment plant still exist on a parcel of land to the west of the North Pond, including several buildings. These facilities should be demolished since they are no longer used or maintained.



**Figure 18.2. Original WWTP Site**

The ponds north of the existing buildings associated with the original wastewater treatment plant could be filled in over time. This could be done at a very low cost by accepting clean fill from contractors needing to dispose of soil from local projects. Consideration should be given to dredging and dewatering these ponds prior to placing fill in them.

This area may be considered as a possible site for a future Operations and Maintenance building.

**Refer to CIP Project 18-2 Profile.**



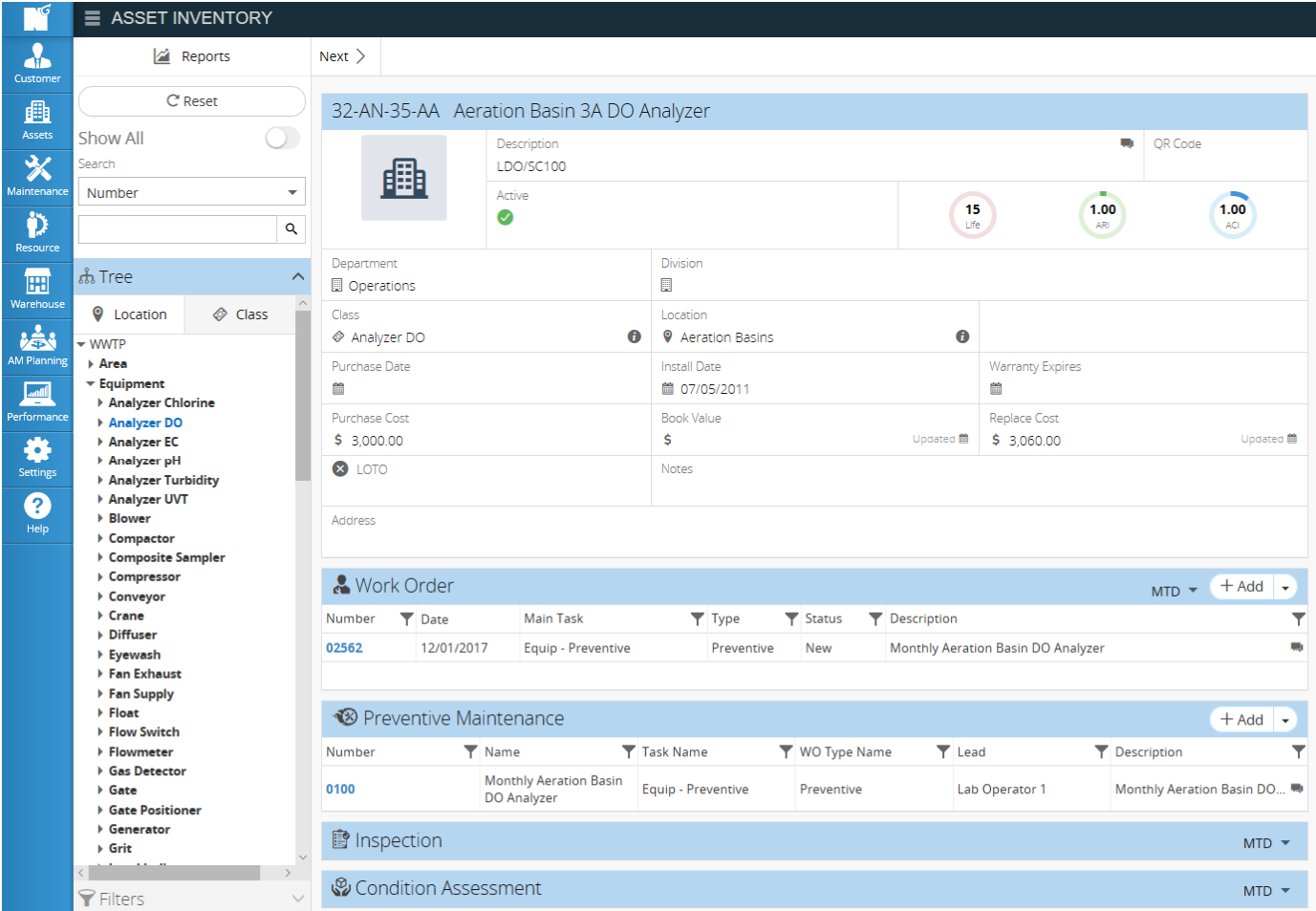
## 19.0 WRF Equipment Rehabilitation and Replacement Planning

### 19.1 Computerized Maintenance Management System (CMMS) Overview

Ironhouse Sanitary District has a CMMS for the sewer collection system and WRF hosted by Nexgen Asset Management. The CMMS includes a comprehensive database of the equipment assets in the WRF. Each equipment asset is identified according to the unique tag ID assigned in the original design drawings and specifications for the WRF.

The information available in the CMMS for each asset includes the following:

- Install Date (all assets have an install date of 7/5/2011 which was the date of completion of the WRF)
- Equipment Class
- Location (i.e. which general facility the equipment is a part of)
- Purchase Cost
- Replace Cost
- Assigned Preventative Maintenance Tasks and Work Orders



The screenshot displays the 'ASSET INVENTORY' page in the Nexgen CMMS. The interface includes a left-hand navigation menu with categories like Customer, Assets, Maintenance, Resource, Warehouse, AM Planning, Performance, Settings, and Help. The main content area shows details for the asset '32-AN-35-AA Aeration Basin 3A DO Analyzer'. Key information includes: Description (LDO/SC100), Active status (green checkmark), and performance metrics (15 Life, 1.00 ARI, 1.00 ACI). A table lists asset details such as Department (Operations), Division, Class (Analyzer DO), Location (Aeration Basins), Purchase Date (07/05/2011), Purchase Cost (\$3,000.00), Book Value, and Replace Cost (\$3,060.00). Below the asset details, there are sections for 'Work Order' (listing a preventive task on 12/01/2017) and 'Preventive Maintenance' (listing a task with ID 0100).

Figure 19.1. Example Screenshot from Nexgen CMMS for an Asset

A valuable function of the CMMS is planning for refurbishment and replacement of the WRF assets according to their useful life and replacement costs. There are 57 different equipment classes and 881 equipment item records in the CMMS database. For each of the 57 different equipment classes, the following inputs are available to allow for refurbishment and replacement cost planning:

- Useful Life: The equipment asset will require complete replacement at the Replace Cost at the end of its useful life.
- Refurbishment Task: A preventative maintenance task required for the asset to reach its useful life potential, such as bearing replacements on rotating equipment, belt replacements on fans, etc.
- Refurbishment Frequency: The required frequency in years of the specified refurbishment task.
- Refurbishment Activity Cost as % of Replacement Value

If the information described above is entered for all of the assets in the CMMS, this allows for development of a “funding curve” which totalizes the cost in each future year of the refurbishment and replacement requirements of the equipment in order to maintain the WRF in working order.

## 19.2 Equipment Purchase Costs

Equipment purchase costs were originally entered into the CMMS for almost all assets. However, the original source of the costs could not be verified. “Equipment” includes all mechanical treatment equipment, valves, gates, instruments, and HVAC, or essentially anything with a unique equipment ID tag. Items such as earthwork, structures, and pipe are not considered “Equipment” and do not have ID tags.

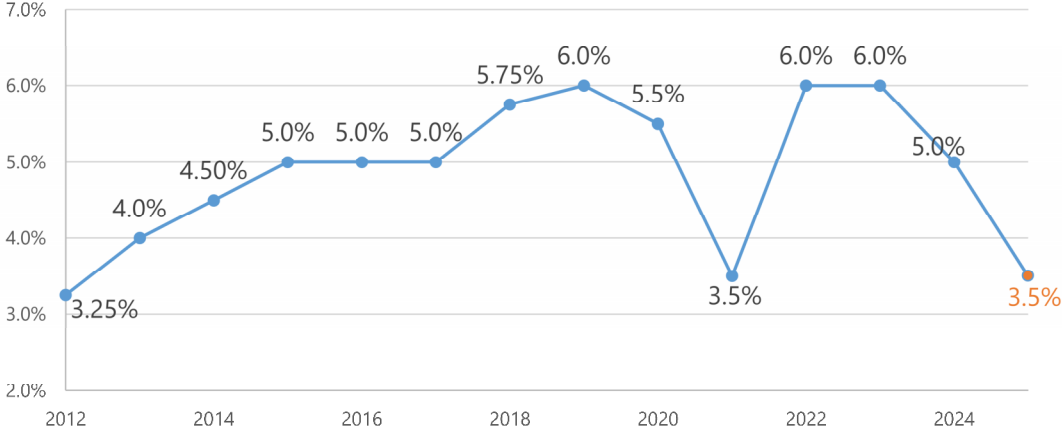
Water Works Engineers reviewed the original purchase costs, and made adjustments using the following methodology:

1. Obtained original WRF project cost estimate.
2. Compared CMMS purchase costs with equipment item cost in the project cost estimate and made adjustments based on this comparison for items listed in the cost estimate.
3. For equipment items not in the CMMS cost estimate, reviewed and adjusted based on similar costs for similar equipment from other Water Works projects.
4. The total cost of equipment items in the original project cost estimate was \$17.87M. The total project cost estimate was \$46.78M and the project bid came in at \$54.45M. Therefore the total cost of equipment was adjusted up by a factor of 1.16 to account for the actual bid price of the project, to \$20.81M. This represents 38% of the total project cost, which is in line with similar wastewater treatment plant projects. This figure includes both procurement and installation of equipment. The installation and startup cost of equipment is typically in the range of 20% of the purchase cost.
5. Equipment purchase costs were further adjusted until the total replacement cost of the equipment, including a 20% adder for installation, was equal to approximately \$20.8M.
6. Equipment purchase costs were again adjusted for construction cost inflation between 2009 and 2025 (a total multiplier of 2.01) to bring the costs to current 2025 prices. The total 2025 replacement cost estimate for the entire WRF is approximately \$108.5M, or nearly double the original construction cost in 2009-2010.

The inflation rates used to adjust 2009 to 2025 costs were obtained from the San Francisco Area 2025 Annual Infrastructure Construction Cost Inflation Estimate published on October 1, 2024. Construction cost inflation has significantly outpaced basic consumer index inflation over the past 13 years. A good example of this is that housing prices (and cost to rebuild) have more than doubled in many areas since 2010 while consumer prices are up on the order of 50%. Inflation going forward beyond 2026 is assumed at 3% per year.

**Proposed: 3.5% for CY 2025**

San Francisco AICCIE,  
2012-2025 (Proposed)



**Figure 19.2. San Francisco Construction Cost Inflation**

**19.3 Equipment Replacement Costs**

When equipment in a wastewater treatment plant is replaced, the total cost of replacement is in excess of just the cost to purchase and install the equipment. There are engineering costs for evaluation of the proper sizing and selection of the replacement equipment, for construction management of the replacement work, and overhead costs for administration of those projects. The following markup percentages on the equipment purchase cost are added to account for these costs to develop the total cost of replacement, with some minor equipment-specific deviations:

- Engineering and Construction Management: 20%
- Overhead: 10%
- Installation / Labor : 20%

**19.4 Equipment Useful Life**

A useful life in years was assigned to each of the equipment classes. Useful life values were selected from industry standard maintenance management literature and also adjusted based on the results of the WRF Condition Assessment and are listed in **Table 21.1** below.

## 19.5 Equipment Refurbishment Activities, Frequencies and Costs

Typical major maintenance requirements for each class of equipment are identified for each equipment class. The maintenance requirements and frequencies were determined based on the review of equipment operation and maintenance manuals, Water Works Engineers understanding of similar equipment, and also the WRF Condition Assessment that was completed. The cost for each activity was estimated as a % of the asset replacement value (% ARV) of the equipment based on Water Works Engineers judgement, experience with similar equipment, and input from WRF Operations Staff. Not all equipment has significant refurbishment requirements, and some equipment classes have no activities or costs.

The refurbishment activities, frequencies, and costs are listed in **Table 21.1** below.

**Table 21.1. Equipment Replacement and Refurbishment Requirements**

Equipment Class	Useful Life (yrs)	Refurbishment Activity Description	Maint. Freq. (yrs)	Maint. % of ARV
Analyzer Chlorine	12	Calibrate	1	1.00%
Analyzer DO	15	Calibrate	1	1.00%
Analyzer EC	13	Calibrate	1	1.00%
Analyzer pH	14	Calibrate	1	1.00%
Analyzer Turbidity	13	Calibrate	1	1.00%
Analyzer UVT	14	Calibrate	1	1.00%
Blower	30	Maintenance Contract	1	3.30%
Compactor	20	Gear Box Service / Replace Liner	3	3.00%
Composite Sampler	5	Replace Pump Tubes and Batteries	1	2.00%
Compressor	15	Maintenance Contract	1	10.00%
Air Dryers + Tank	8	Maintenance Contract	1	10.00%
Conveyor	22	Gear Box Service / Replace Conveyor Liner	3	3.00%
Crane	35	Maintenance Contract	1	1.00%
Diffuser	18	Inspect / Replace Failed Diffusers	1	1.00%
Fan Exhaust	18	Replace Belts / Bearings	5	7.00%
Fan Supply	18	Replace Belts / Bearings	5	7.00%
Float	16		0	0.00%
Flow Switch	16		0	0.00%
Flowmeter	20		0	0.00%
Gas Detector	15		0	0.00%
Gate	50	Replace Seals	10	5.00%
Gate Positioner	19	Maintenance Contract	1	3.00%
Generator	28	Preventative Maintenance	2	1.00%
Grit	15	Replace Liners / Bearings	5	10.00%
Infrastructure - Asphalt	50	Seal Coat	5	5.00%
Infrastructure - Paint	50	Coatings Maintenance Program	1	3.00%
Infrastructure - HVAC	10	Maintenance Contract	1	10.00%
Infrastructure - E&IT	30	Maintenance Contract	1	1.00%
Infrastructure - Pipe	75	Fixing Leaks	1	0.20%
Infrastructure - Structure	75	Maintenance and Crack Repair	1	0.15%

Equipment Class	Useful Life (yrs)	Maintenance Activity Description	Maint. Freq. (yrs)	Maint. % of ARV
Level Indicator	17		0	0.00%
Level Probe	17		0	0.00%
Local Control Panel	29	Maintenance Contract	1	5.00%
LCP H2S area	20	Maintenance Contract	1	5.00%
Louver	50		0	0.00%
Membrane	18		0	0.00%
Mixer	25	Replace Seal / Impeller	10	10.00%
Press	30	Replace Belts	5	5.00%
Pressure Indicator	25		0	0.00%
Pressure Switch	15		0	0.00%
Pressure Washer	20		0	0.00%
Pump Centrifugal	24	Replace Bearings / Impeller	10	12.00%
Pump Chemical	20	Replace Seals	5	10.00%
Pump Drain	12		0	0.00%
Pump Diaphragm	20	Replace Diaphragm	5	5.00%
Pump Horizontal	22	Replace Seals and Wear Parts	5	5.00%
Pump Permeate	23	Replace Bearings / Impeller	10	12.00%
Pump Progressive	20	Pump Overhaul, Stator Replacement	10	20.00%
Pump Sample	10		0	0.00%
Pump Submersible	21	Replace Seals and Wear Parts, Impeller (Maintenance Contract)	10	25.00%
Pump Vertical Turbine	25	Replace Mechanical Seal / Lineshaft Bearing	10	10.00%
Screen (Mechanical)	20	Repair Bearings / Drive Parts and Screen Element	10	20.00%
Screen (Drum)	17	Replace Trunnions, Drive Parts, Repair or Replace Screen Element	4	20.00%
Scale	15	Calibrate	1	1.00%
Speed Switch	15		0	0.00%
Tank	20		0	0.00%
Temperature Indicator	16		0	0.00%
Transmitter	16		0	0.00%
UV	20	Replace Hoses	12	2.00%
UV Lamps	N/A	Replace Lamps	1	1.80%
Valve Automatic	20	Check / Change Valve Packing	5	2.00%
Valve Automatic (Permeate)	13	Inspect / Repair Actuator	5	2.00%
Valve Indicator	26		0	0.00%
Valve Manual	26	Check / Change Valve Packing	5	3.00%
Valve Motor-Operated	20	Inspect / Repair Actuator	1	1.00%
Valve Positioner	20	Inspect / Repair Actuator	1	1.00%
Valve Positioner (Permeate)	13	Inspect / Repair Actuator	1	0.50%
Infrastructure – Conduit & Wire	50		0	0.00%
Water Heater	15	Replace Heating Elements	3	10.00%

The above maintenance activities and costs were discussed with WRF Operations Staff during the Condition Assessment Site Visit, and information from that visit was used to inform all values in **Table 21.1**. One of the main overall checks on the above information is that \$450-\$500K per year is spent in general maintenance activities for the WRF. The total 2025 cost of maintenance/refurbishment activities for all assets estimated in the asset database is \$480K which matches well to actual expenditures.

A summary of major refurbishment/maintenance activity information collected at the Condition Assessment Site Visit is provided below:

- \$80k/yr for Neuros to factory service all 6 blowers
- \$15K/yr for Shape service of Flygt submersible pumps
- \$25k/yr for Tesco to calibrate and maintain instruments and clean electrical panels
- \$10k/hr for air compressor maintenance
- \$25k/yr for Rotork gate/valve positioner maintenance
- \$15k/year for pump rebuilds from Pump repair services
- \$10k/yr for HVAC maintenance
- UV Lamp Replacement – UV lamps must be replaced after 12,000 hours of service
  - Based on the last 2 years of data, averaged 15,634 total run hours on various UV banks combined
  - Equivalent to replacing 1.3 UV banks per year, or plan for about \$45K/yr in lamp replacement costs (at ~\$430/lamp including replacement labor)

## 19.6 WRF Condition Assessment Results

Water Works Engineers completed a Condition Assessment Site Walk at the WRF on 12/10/2024. Major findings from the Site Walk are summarized below, and are also referenced in the various preceding sections of this report for each process area.

- Mechanical screens suffer from a corrosive environment and require more significant rehabilitation approximately every 10 years which includes replacement of drive components (gearbox, motor) and screen components (element plates where damaged, cleaning brushes, etc).
- Grit removal equipment suffers from a corrosive environment and requires near-term replacement and rehabilitation, with just under 15 years of service (included as a capital project).
- Drum screens suffer from a corrosive environment and require more significant rehabilitation approximately every 4-5 years including replacement of drive components (gearbox, motor), solenoid valves, screen element plates, and trunnions.
- Drum screens have significant concrete corrosion around their bases caused by H<sub>2</sub>S and inadequate ventilation, which will require the screens to be lifted and the concrete to be repaired and recoated. Ventilation will be improved as part of this effort. This is covered as a capital project.
- The headworks water heater is requiring heater element replacement every 3 years.
- Aeration Basin diffusers have suffered little to no failures, and useful life is extended to 18+ years whereas typical useful life is 10-15 years. This is likely due to the high level of screening at the headworks.
- MBR membranes have suffered little to no failures, and useful life is extended to 18+ years whereas typical useful life is 10-15 years. This is likely due to the high level of screening at the headworks.

- MRB permeate valves and actuators are suffering from a corrosive environment and have reduced life expectancy of ~13 years (many have been replaced or are in the process of being replaced) and increased frequency of required maintenance. Stainless steel components should be considered for future replacement.
- Blowers have very low operating hours for their age, and coupled with a contracted annual manufacturer's maintenance program have an extended anticipated useful life of 30+ years
- UV system hydraulic hoses were replaced this year and wiper rams require replacement as soon as possible and are already starting to fail (after ~13 years of service). The Hydraulic System Control Center is now considered obsolete but functional. Replacement of the rams and other mechanical components needed in the near-term are addressed as capital improvement projects in the CIP. Replacement of UV lamps is addressed as planned regular annual maintenance.
- Belt Filter Presses are in excellent condition and other than regular belt replacements (approximately every 5 years) they are expected to have an extended useful life of 30+ years.
- Belt Press Feed Pumps are now having rotors and stators replaced, needed every ~10 years which is a relatively significant cost relative to the value of the pump.
- Automatic Samplers are requiring replacement every 5 years.
- Air compressor equipment is already requiring replacement at ~15 years of service and is serviced under an annual maintenance contract.
- HVAC equipment has a short lifespan at the plant of ~10 years and is serviced under an annual maintenance contract.
- Paintings and coatings around the plant are starting to age and an annual paint maintenance contract should be initiated to paint the highest priority areas around the plant each year on the order of \$50-\$60k per year.
- All galvanized steel utility water piping in the plant is suffering from corrosion, likely due to low alkalinity in the recycled plant water. All galvanized steel piping should be replaced in the near future with stainless steel.
- Roadways around the plant require a regular paving sealcoat program.
- A structural crack was found that spans the aeration basins, this will be addressed as a capital project.
- A sodium hypochlorite leak in the chemical area caused some potential damage to the adjacent CMU wall in the Area 50 blower/chemical building, which requires further analysis to determine if repair is needed.

## 19.7 Electrical Equipment

Instrument and equipment local control panels are considered "Equipment" because those items have ID tags and are listed in the CMMS. The WRF's generator is also listed as equipment. However, the major electrical infrastructure such as MCCs, PLCs, conduit and wire, and PLC/SCADA programming are not listed in the CMMS.

Assets were added to the asset list to account for eventual replacement of these items as follows. The original purchase costs were adapted from the original project cost estimate.

- MCC Equipment – \$850,000 (2009)
- Computer Systems and Software - \$300,000 (2009)

- Buried Electrical Conduit and Wire - \$750,000 (2009)
- Above Grade Electrical Conduit and Wire - \$750,000 (2009)
- PLCs – \$500,000 (2009)

These assets were assigned a 1% annual maintenance costs to cover contracted maintenance with Tesco or other providers. The useful life of these assets are as follows:

- MCC Equipment – 30 yrs : takes into account near-term capital projects to replace many VFDs
- Computer Systems and Software – 30 yrs : takes into account near-term capital project to upgrade
- Buried Electrical Conduit and Wire – 50 yrs
- Above Grade Electrical Conduit and Wire – 50 yrs
- PLCs – 30 yrs : takes into account near-term capital projects to replace most PLCs

Mechanical pipe assets are not included in the CMMS. Assets were added to the asset list to account for eventual replacement of these items as follows. The original purchase costs were adapted from the original project cost estimate.

- Buried Yard Piping: \$3,000,000 (2009)
- Above Grade Mechanical Piping: \$5,800,000 (2009)

These assets were assigned a 0.15% annual maintenance activity for leak repair. The useful life of these assets are as follows:

- Buried Yard Piping: 75 years
- Above Grade Mechanical Piping: 75 years

## 19.8 Structures

Structure assets for each major facility building are included in the CMMS, however they had no assigned purchase costs or maintenance costs. A single asset was added to the asset list to account for the eventual replacement of the buildings as follows. The original purchase cost was adapted from the original project cost estimate as the total cost of all concrete and buildings structures.

- Building and Structure Replacement: \$13,000,000 with useful life of 75 years

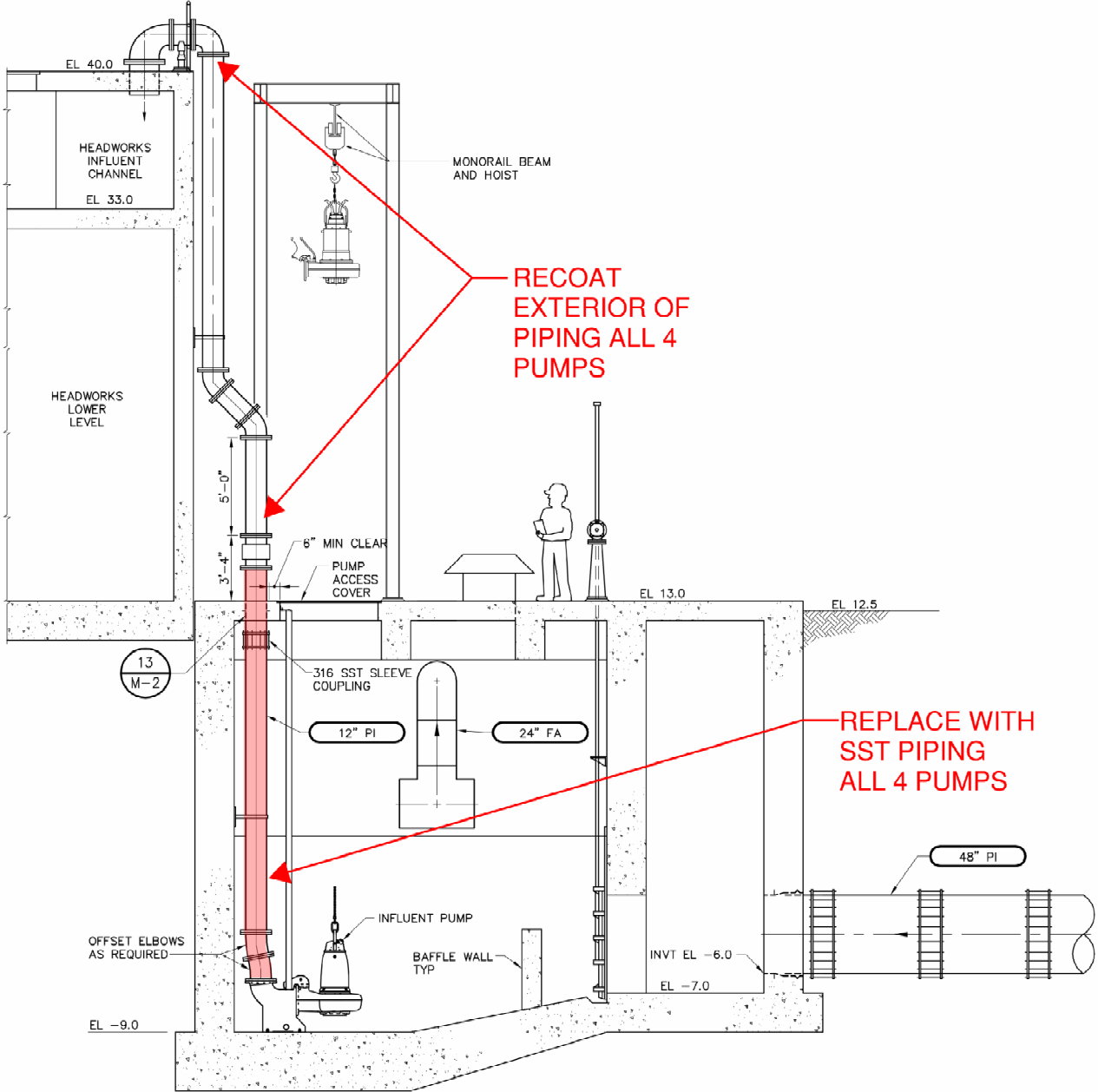
This asset was assigned an annual maintenance cost to account for spot concrete rehabilitation and repair.

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## Appendix A – Capital Improvement Project Cost Estimates

Ten Year Program: WRF		Fiscal Year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Project #	Project Title	10 Year Total	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
WRF-	1 WRF Master Planning	\$ 652,000.00	\$ 402,000.00	\$ -	\$ -	\$ -	\$ -	\$ 250,000.00	\$ -	\$ -	\$ -	\$ -	\$ 250,000.00	\$ -	\$ -	\$ -	\$ -
WRF-	2 3-1: Influent Pump Stations Piping Upgrade	\$ 186,430.00	\$ -	\$ 186,430.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	3 4-1: Influent Screening - Add 3rd Perf Plate Screen	\$ 1,150,000.00	\$ 1,150,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	4 5-1: Grit Removal Improvements	\$ 60,000.00	\$ 60,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	5 5-2: Grit Classifier Replacement	\$ 375,000.00	\$ 375,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	6 6-1: Drum Screen 2&3 Rehab	\$ 537,000.00	\$ 537,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	7 6-2: Install Drum Screen 4 + Wash Press	\$ 1,083,000.00	\$ 1,083,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	8 7-1: Aeration Basin Crack Repair / Paint Piping	\$ 177,000.00	\$ 100,000.00	\$ 77,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	9 9-2: MBR Improvement - Permeate Piping / Valves	\$ 225,101.76	\$ -	\$ -	\$ -	\$ -	\$ 225,101.76	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	10 11-1: UV Equipment Component Replacement	\$ 1,151,590.19	\$ 130,000.00	\$ 542,810.00	\$ -	\$ -	\$ -	\$ 478,780.19	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	11 13-2: Recycled Water Improvements	\$ 618,000.00	\$ -	\$ 618,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	12 9-1: Install Additional Membranes (7th Casette per Train)	\$ 1,000,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,000,000.00	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	13 Scheduled Equipment Replacement	\$ 12,166,768.36	\$ -	\$ 428,000.00	\$ 428,000.00	\$ 428,000.00	\$ 786,322.38	\$ 2,012,790.81	\$ 4,258,467.49	\$ 1,166,913.46	\$ 1,263,529.66	\$ 1,394,744.56	\$ 1,155,794.27	\$ 1,536,785.69	\$ 2,868,968.82	\$ 677,713.42	\$ 5,460,511.50
WRF-	14 Electrical Improvements (VFDs, Harmonics, Arc Flash)	\$ 1,400,000.00	\$ 100,000.00	\$ 300,000.00	\$ 300,000.00	\$ 350,000.00	\$ 350,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	15 SCADA	\$ 1,500,000.00	\$ 500,000.00	\$ 1,000,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	16 CMMS	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	17 PLC Upgrades	\$ 2,000,000.00	\$ 500,000.00	\$ 1,500,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	18 Scheduled Equipment Maintenance	\$ 6,278,734.56	\$ 480,274.62	\$ 614,216.90	\$ 487,574.15	\$ 510,360.28	\$ 648,087.61	\$ 646,782.27	\$ 857,121.15	\$ 703,792.35	\$ 636,037.62	\$ 694,487.61	\$ 732,368.90	\$ 692,250.99	\$ 762,595.55	\$ 670,848.49	\$ 766,102.47
WRF-	19 Biosolids Improvement (Facility)	\$ 16,000,000.00	\$ -	\$ 1,500,000.00	\$ 7,000,000.00	\$ 7,500,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	20 12-1 South Pond Return	\$ 734,957.25	\$ -	\$ -	\$ -	\$ -	\$ 734,957.25	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	21 Operations & Maintenance Facility	\$ 1,000,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,000,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	22 11-2 UV Facility Expansion and Upgrade (to new Trojan)	\$ 12,000,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 4,000,000.00	\$ 4,000,000.00	\$ 4,000,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	23 18-2: Old WWTP Facilities Demolition	\$ 409,223.75	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 409,223.75	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	24 WRF EV Charging Stations	\$ 50,000.00	\$ -	\$ 50,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	25 18-1: Storm Pond Return line	\$ 675,305.29	\$ -	\$ -	\$ -	\$ -	\$ 675,305.29	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	26 13-1: Third Large Effluent Pump (redundant)	\$ 1,099,323.60	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,099,323.60	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	27 Security System Upgrades	\$ 250,000.00	\$ -	\$ -	\$ -	\$ -	\$ 250,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	28 Effluent Pipe Line Inspections (External & Cathodic)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	29 6-3: Wash Water Pumps (headworks)	\$ 103,000.00	\$ -	\$ 103,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	30 9-3: Bird Mitigation	\$ 100,000.00	\$ -	\$ 100,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	31 15-1: Utility Water Pipe Rehabilitation / Replacement	\$ 770,440.00	\$ -	\$ 770,440.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	32 GW Well Access & Protection Improvements	\$ 50,000.00	\$ 50,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	33 8-1: Expand Aerobic Digester (use anaerobic)	\$ 169,950.00	\$ -	\$ 169,950.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	34 Utility Truck Replacement	\$ 125,000.00	\$ -	\$ 125,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	35 Perimeter Landscaping	\$ 200,000.00	\$ -	\$ -	\$ -	\$ -	\$ 200,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	36 Solar System and Battery Improvements	\$ 1,250,000.00	\$ -	\$ -	\$ -	\$ -	\$ 1,250,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	37 Spare Influent Pump and Solids Conveyor	\$ 50,000.00	\$ 50,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	38 LED Lighting Upgrades	\$ 50,000.00	\$ 50,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
WRF-	39																
	WRF CIP Program Total	\$ 65,647,824.76	\$ 5,567,274.62	\$ 8,084,846.90	\$ 8,215,574.15	\$ 8,788,360.28	\$ 5,119,774.29	\$ 4,797,577.03	\$ 5,115,588.64	\$ 5,870,705.81	\$ 5,899,567.29	\$ 8,188,555.77	\$ 2,138,163.17	\$ 2,229,036.68	\$ 3,631,564.37	\$ 1,348,561.91	\$ 6,226,613.97

**Project Description:** The existing influent pump riser piping in the wet wells has failed coatings and is beginning to corrode. Coatings maintenance on piping in influent wet wells needs to be on the order of every 10 years and is expensive due to the hazardous confined space environment. It is recommended to replace the pump discharge riser piping in the wet well with 304 or 316 stainless steel to prevent the need for future coatings maintenance, and to recoat the remaining ductile iron pipe that is also experiencing coatings degradation above the wet well.





Corroded Piping in Wet Well with Coatings Failure



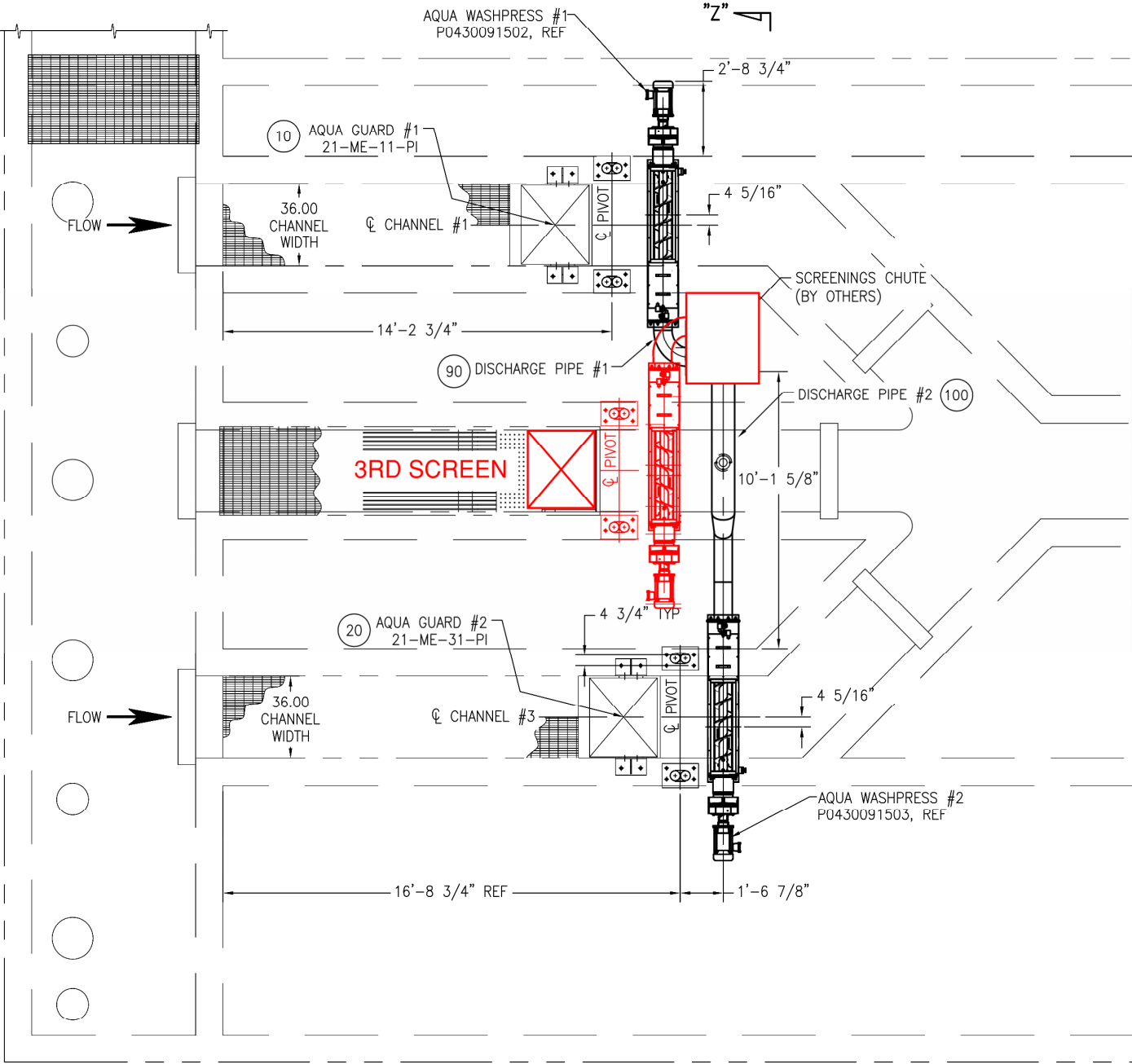
Beginnings of Coatings Failure on Above Grade Pipe

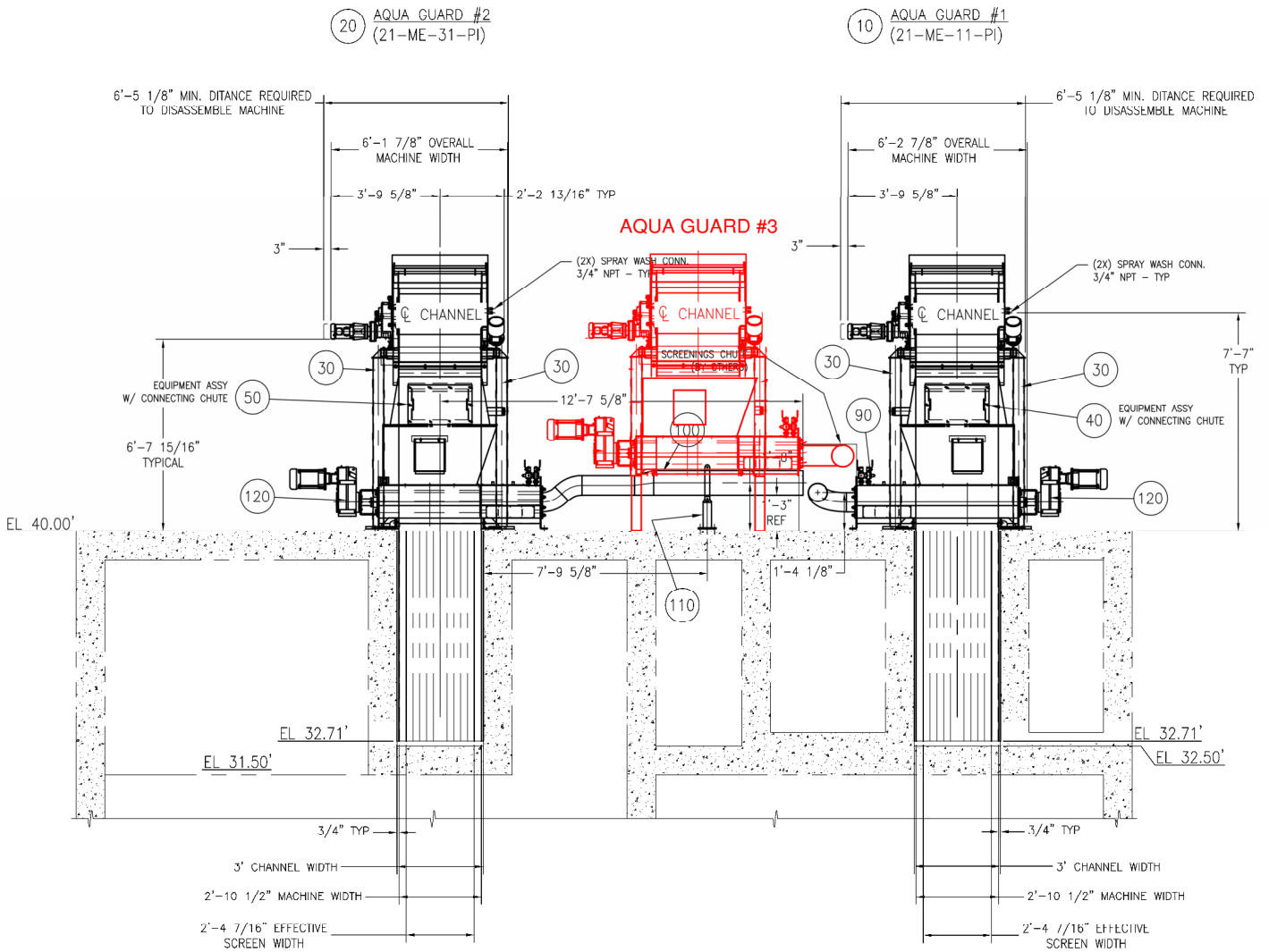
Project # 3-1	Replace Influent Wet Well Piping	FY 2026-2027	Project Cost: \$186,430
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Ironhouse Sanitary District		By: J. Ziemann
WRF Master Plan		Checked: J. Ziemann
<b>Project Number: 3-1</b>		Date: Mar. 2025
<b>Influent Pump Station</b>		
<b>Replace Wet Well Piping</b>		

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Confined Space Entry Procedures	1	LS	\$ 9,020.00	incl		\$ 9,020
Submittals				4	\$ 150	\$ 600
Demolish Existing Piping	1	LS	\$ 5,000.00	64	\$ 150	\$ 14,600
DIV 1 Subtotal						<b>\$ 24,220</b>
<b>Division 5 - Metals</b>						
Misc. Metals and Anchorage	1	LS	\$ 10,000.00	incl		\$ 10,000
DIV 5 Subtotal						<b>\$ 10,000</b>
<b>Division 9 - Painting</b>						
Paint Above Grade Piping	1	LS	\$ 5,000.00	80	\$ 150	\$ 17,000
DIV 9 Subtotal						<b>\$ 17,000</b>
<b>Division 15 - Mechanical</b>						
Stainless Steel Piping	88	LF	\$ 500.00	128	\$ 150	\$ 63,200
DIV 15 Subtotal						<b>\$ 63,200</b>
<b>SUBTOTAL 1</b>						<b>\$ 114,420</b>
DESIGN CONTINGENCY			20%			\$ 22,884
<b>SUBTOTAL 2</b>						<b>\$ 137,304</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$27,461
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 164,765</b>
ENGINEERING AND CM			10%			\$16,476
<b>TOTAL ESTIMATE</b>						<b>\$ 181,000</b>

**Project Description:** The hydraulic capacity of 1 of the 2 existing perforated plate mechanical screens may be exceeded under current peak wet weather flows if 1 of the screens is out of service. A third mechanical screen should be installed to ensure up to 10 MGD PWWF firm capacity with one unit out of service, as the capacity of each screen is conservatively estimated to be 5 MGD. Current peak wet weather flows are now exceeding 5 MGD. Installation of the third screen will include an associated washer/compactor and require the screenings discharge chute to be modified as well.





In order for the washer-compactor for the third screen to fit and also discharge into the common screenings chute, it will need to be installed elevated on support legs as shown above.

2 screens would continue to run normally, with the third unit serving as a redundant unit.

Ironhouse Sanitary District		By: J. Ziemann
WRF Master Plan		Checked: J. Ziemann
<b>Project Number: 4-1</b>		Date: Mar. 2025
<b>Mechanical Screens</b>		
<b>Add 3rd Mechanical Screen</b>		

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 26,712.00	incl		\$ 26,712
Submittals				32	\$ 150	\$ 4,800
Demolish Existing Bar Screen	1	LS	\$ 6,000.00	128	\$ 150	\$ 25,200
DIV 1 Subtotal						<b>\$ 56,712</b>
<b>Division 3 - Concrete</b>						
Equipment Bases	1	LS	\$ 6,000.00	incl		\$ 6,000
DIV 3 Subtotal						<b>\$ 6,000</b>
<b>Division 5 - Metals</b>						
Reconfigure Discharge Chute	1	LS	\$ 25,000.00	incl		\$ 25,000
Misc. Metals and Anchorage	1	LS	\$ 15,000.00	incl		\$ 15,000
DIV 5 Subtotal						<b>\$ 40,000</b>
<b>Division 11 - Equipment</b>						
3rd Perforated Plate Screen	1	EA	\$324,000.00	256	\$ 150	\$ 362,400
3rd Washer Compactor	1	EA	\$118,800.00	64	\$ 150	\$ 128,400
Crane	1	LS	\$ 5,000.00	incl		\$ 5,000
DIV 11 Subtotal						<b>\$ 495,800</b>
<b>Division 15 - Mechanical</b>						
Extend Utility Water Piping	1	LS	\$ 5,000.00	32	\$ 150	\$ 9,800
DIV 15 Subtotal						<b>\$ 9,800</b>
<b>Division 16 - Electrical and Instrumentation</b>						
Control Panel	1	LS	\$ 65,000.00	80	\$ 150	\$ 77,000
Conduit and Wire	1	LS	\$ 10,000.00	128	\$ 150	\$ 29,200
PLC/SCADA Programming	1	LS	\$ 10,000.00	incl		\$ 10,000
DIV 16 Subtotal						<b>\$ 116,200</b>
<b>SUBTOTAL 1</b>						<b>\$ 724,512</b>
DESIGN CONTINGENCY			15%			\$ 108,677
<b>SUBTOTAL 2</b>						<b>\$ 833,189</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$166,638
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 999,827</b>
ENGINEERING AND CM			15%			\$149,974
<b>TOTAL ESTIMATE</b>						<b>\$ 1,150,000</b>

**Project Description:** The existing vortex grit removal system includes a drive with a gear-reducer box which turns a shaft that has an agitator paddle attached to it. The gearbox has significant corrosion and is known to have had moisture intrusion in the past. The drive shaft appears to have significant corrosion. It is recommended that the drive be replaced, and to replace the drive the shaft would have to be removed at that time. When the shaft is removed it should be recoated and rehabilitated.



Corroded Vortex Grit Drive Gearbox and Motor



Corroded Vortex Grit Paddle Shaft

Ironhouse Sanitary District		By: J. Ziemann
WRF Master Plan		Checked: J. Ziemann
<b>Project Number: 5-1</b>		Date: Mar. 2025
<b>Grit Removal</b>		
<b>Grit Vortex Rehab</b>		

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Confined Space Entry Procedures	1	LS	\$ 5,000.00	incl		\$ 5,000
Submittals				16	\$ 150	\$ 2,400
Demolish Existing Grit Drive	1	LS	\$ 2,500.00	16	\$ 150	\$ 4,900
DIV 1 Subtotal						<b>\$ 12,300</b>
<b>Division 9 - Painting</b>						
Recoat Existing Grit Drive Shaft	1	LS	\$ 1,000.00	24	\$ 150	\$ 4,600
DIV 9 Subtotal						<b>\$ 4,600</b>
<b>Division 11 - Equipment</b>						
New Grit Drive	1	LS	\$ 15,000.00	24	\$ 150	\$ 18,600
DIV 11 Subtotal						<b>\$ 18,600</b>
<b>Division 16 - Electrical and Instrumentation</b>						
Reconnect Electrical	1	LS	\$ 2,000.00	incl		\$ 2,000
DIV 16 Subtotal						<b>\$ 2,000</b>
<b>SUBTOTAL 1</b>						<b>\$ 37,500</b>
DESIGN CONTINGENCY			15%			\$ 5,625
<b>SUBTOTAL 2</b>						<b>\$ 43,125</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$8,625
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 51,750</b>
ENGINEERING AND CM			15%			\$7,763
<b>TOTAL ESTIMATE</b>						<b>\$ 60,000</b>

**Project Description:** The existing grit classifier, which washes grit removed by the vortex grit removal system to recover organics prior to discharging into a dumpster, is severely corroded with significant metal damage that would be difficult and costly to repair, and therefore replacement is recommended. This equipment is nearing the end of its useful life. Most of the equipment associated with the headworks facilities operates in a highly corrosive environment and requires higher frequency coatings maintenance and equipment replacement than in other areas of the WRF.



The replacement would be “in-kind” to match the existing equipment dimensions, performance, and operations.

The possibility of rehabilitating the equipment vs. complete replacement may be explored during final design of the project with the equipment supplier, but for the purposes of master planning full replacement is assumed.

Ironhouse Sanitary District		By: J. Ziemann
WRF Master Plan		Checked: J. Ziemann
<b>Project Number: 5-2</b>		Date: Mar. 2025
<b>Grit Removal</b>		
<b>Replace Grit Classifier</b>		

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 8,348.00	incl		\$ 8,348
Submittals				24	\$ 150	\$ 3,600
Demolish Existing Grit Classifier	1	LS	\$ 6,000.00	64	\$ 150	\$ 15,600
DIV 1 Subtotal						<b>\$ 27,548</b>
<b>Division 5 - Metals</b>						
Misc. Metals and Anchorage	2	EA	\$ 5,000.00	incl		\$ 10,000
DIV 5 Subtotal						<b>\$ 10,000</b>
<b>Division 11 - Equipment</b>						
Crane	1	LS	\$ 2,500.00	incl		\$ 2,500
New Grit Classifier	1	LS	\$162,000.00	96	\$ 150	\$ 176,400
DIV 11 Subtotal						<b>\$ 178,900</b>
<b>Division 15 - Mechanical</b>						
Reconnect Utility Water Piping	1	LS	\$ 5,000.00	32	\$ 150	\$ 9,800
DIV 15 Subtotal						<b>\$ 9,800</b>
<b>Division 16 - Electrical and Instrumentation</b>						
Electrical Reconnect	1	LS	\$ 10,000.00	incl		\$ 10,000
DIV 16 Subtotal						<b>\$ 10,000</b>
<b>SUBTOTAL 1</b>						<b>\$ 236,248</b>
DESIGN CONTINGENCY			15%			\$ 35,437
<b>SUBTOTAL 2</b>						<b>\$ 271,685</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$54,337
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 326,022</b>
ENGINEERING AND CM			15%			\$48,903
<b>TOTAL ESTIMATE</b>						<b>\$ 375,000</b>

**Project Description:** The existing Drum Screens #1-3 are all suffering from significant concrete corrosion around the bases of the units. The actual screen effluent discharge channel (below the screens) has a chemical resistant coating that is protecting the channel, but the surface-level concrete is unprotected and being degraded by hydrogen sulfide. The screen drives and utility spray water components are also suffering from corrosion.

While the drum screens are connected to the overall headworks odor control fan and biofilter system, it is suspected that the screens do not have adequate air flow because they do not have a dedicated air intake to allow outside air into the units which is restricting air exchange.

This project would include modification of the screen housings to include an air intake (details worked out with the original equipment manufacturer), replacement of miscellaneous corroded drive and utility water components, and temporary removal of the screen units to allow for repair of the concrete around their bases as well as application of chemical resistant coatings. Removal of the screens would require a crane.

Drum Screen #1 will not be repaired under this project and will be run to failure.



Concrete Corrosion Around Base of Drum Screens



Corroded Utility Water Components

Ironhouse Sanitary District  
WRF Master Plan  
**Project Number: 6-1**  
**Drum Screens**  
**Rehab Drum Screens**



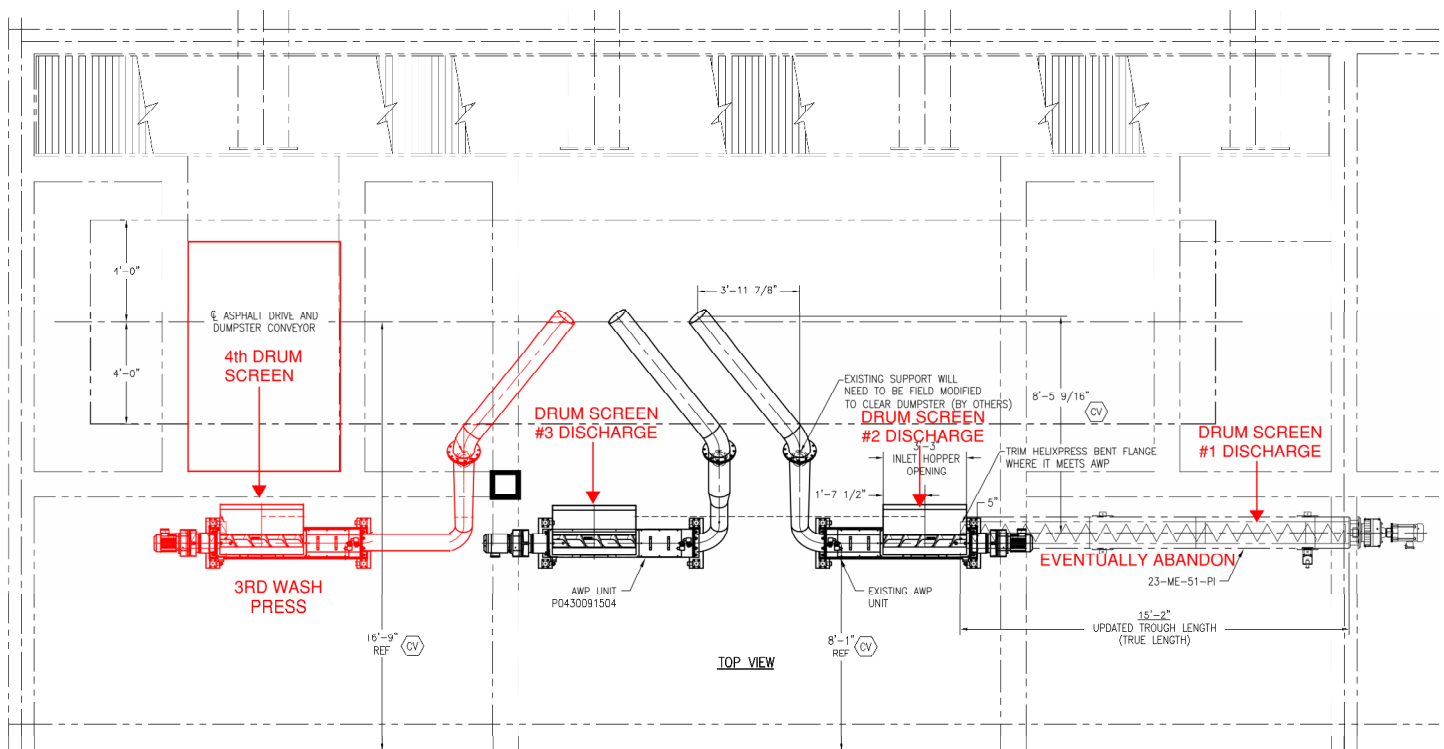
By: J. Ziemann  
Checked: J. Ziemann  
Date: Mar. 2025

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 11,752.00	incl		\$ 11,752
Submittals				24	\$ 150	\$ 3,600
DIV 1 Subtotal						<b>\$ 15,352</b>
<b>Division 3 - Concrete</b>						
Concrete Repair	1	LS	\$ 10,000.00	320	\$ 150	\$ 58,000
DIV 3 Subtotal						<b>\$ 58,000</b>
<b>Division 5 - Metals</b>						
Misc. Metals and Anchorage (2 screens)	2	EA	\$ 10,000.00	incl		\$ 20,000
DIV 5 Subtotal						<b>\$ 20,000</b>
<b>Division 6 - Wood and Plastics</b>						
New Drum Screen Air Ducting	2	EA	\$ 5,000.00	incl		\$ 10,000
DIV 6 Subtotal						<b>\$ 10,000</b>
<b>Division 9 - Finishes</b>						
Chemical Resistant Coatings	1	LS	\$ 4,000.00	80	\$ 150	\$ 16,000
DIV 9 Subtotal						<b>\$ 16,000</b>
<b>Division 11 - Equipment</b>						
Crane	1	LS	\$ 10,000.00	incl		\$ 10,000
Move and Modify Screens	2	EA	\$ 36,000.00	320	\$ 150	\$ 120,000
New Screen Drives	2	EA	\$ 15,000.00	incl		\$ 30,000
New Dumpster-Veyor Dumpster	1	EA	\$ 20,000.00	incl		\$ 20,000
DIV 11 Subtotal						<b>\$ 180,000</b>
<b>Division 15 - Mechanical</b>						
Reconnect Utility Water Piping	1	LS	\$ 5,000.00	32	\$ 150	\$ 9,800
DIV 15 Subtotal						<b>\$ 9,800</b>
<b>Division 16 - Electrical and Instrumentation</b>						
Electrical Reconnect	2	EA	\$7,500.00	incl		\$ 15,000
DIV 16 Subtotal						<b>\$ 15,000</b>
<b>SUBTOTAL 1</b>						<b>\$ 324,152</b>
DESIGN CONTINGENCY			20%			\$ 64,830
<b>SUBTOTAL 2</b>						<b>\$ 388,982</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$77,796
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 466,779</b>
ENGINEERING AND CM			15%			\$70,017
<b>TOTAL ESTIMATE</b>						<b>\$ 537,000</b>

**Project Description:** The WRF currently has 3 drum screens. Drum Screen 1 discharges into a conveyor which discharges into the same washer-compactor that services Drum Screen 2. Drum Screen 3 has its own washer-compactor. For full redundancy in washer-compactors, each Drum Screen should ideally have a dedicated washer-compactor. Right now, if the washer-compactor serving Drum Screen 2 fails, both Drum Screen 1 and 2 would need to be shut down at least temporarily. The existing washer-compactors are on wheels and in this case the failed unit could be moved out of the way and a dumpster placed in its footprint while the unit is repaired, but this is not ideal.

The drum screens are all suffering from concrete and even stainless steel corrosion due to a lack of adequate ventilation within the units as well as the high hydrogen sulfide levels inside the screens. It is recommended that a fourth drum screen with an associated washer-compactor is installed first, and then rehabilitation of Drum Screens 2 and 3 (a separate project) is completed. Drum Screen 1 may be run to failure including the associated conveyor below it, and when those units reach the end of their useful life, they may be demolished and the Drum Screen 1 space will be open.

After the WRF Phase 1 Improvements Project which added hot water wash for the Drum Screens, 1 screen can reliably handle up to 3,000 gpm or 4.3 MGD of flow. With 2 units online and 1 redundant, the firm capacity is 8.6 MGD which is equal to the projected buildout PWWF and also equal to the currently permitted PWWF. Therefore, only 3 Drum Screens are projected to be needed in the future.



The washer-compactor (or wash press) for the 4<sup>th</sup> drum screen would be installed with a similar discharge chute to the existing two units, angled so that all 3 discharge to a similar location. The limit switches which control dumpster-veyor movement would need to be moved slightly however the overall functionality of the dumpster-veyor would be mostly unaffected.

Ironhouse Sanitary District		By: J. Ziemann
WRF Master Plan		Checked: J. Ziemann
<b>Project Number: 6-2</b>		Date: Mar. 2025
<b>Drum Screens</b>		
<b>Add 4th Drum Screen</b>		

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 25,880.00	incl		\$ 25,880
Submittals				32	\$ 150	\$ 4,800
DIV 1 Subtotal						<b>\$ 30,680</b>
<b>Division 3 - Concrete</b>						
Equipment Bases	1	LS	\$ 10,000.00	incl		\$ 10,000
DIV 3 Subtotal						<b>\$ 10,000</b>
<b>Division 5 - Metals</b>						
Misc. Metals and Anchorage	1	LS	\$ 10,000.00	incl		\$ 10,000
Drum Screen Drop Chute	1	LS	\$ 20,000.00	incl		\$ 20,000
DIV 5 Subtotal						<b>\$ 30,000</b>
<b>Division 6 - Wood and Plastics</b>						
New Drum Screen Air Ducting	1	EA	\$ 5,000.00	incl		\$ 5,000
DIV 6 Subtotal						<b>\$ 5,000</b>
<b>Division 11 - Equipment</b>						
4th Drum Screen	1	EA	\$ 313,200.00	256	\$ 150	\$ 351,600
3rd Washer Compactor	1	EA	\$ 118,800.00	64	\$ 150	\$ 128,400
Crane	1	LS	\$ 5,000.00	incl		\$ 5,000
DIV 11 Subtotal						<b>\$ 485,000</b>
<b>Division 15 - Mechanical</b>						
Extend Utility Water Piping	1	LS	\$ 6,000.00	32	\$ 150	\$ 10,800
DIV 15 Subtotal						<b>\$ 10,800</b>
<b>Division 16 - Electrical and Instrumentation</b>						
Control Panel	1	LS	\$ 65,000.00	80	\$ 150	\$ 77,000
Conduit and Wire	1	LS	\$ 10,000.00	128	\$ 150	\$ 29,200
PLC/SCADA Programming	1	LS	\$ 5,000.00	incl		\$ 5,000
DIV 16 Subtotal						<b>\$ 111,200</b>
<b>SUBTOTAL 1</b>						<b>\$ 682,680</b>
DESIGN CONTINGENCY			15%			\$ 102,402
<b>SUBTOTAL 2</b>						<b>\$ 785,082</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$157,016
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 942,098</b>
ENGINEERING AND CM			15%			\$141,315
<b>TOTAL ESTIMATE</b>						<b>\$1,083,000</b>

**Project Description:** With 2 existing pumps rated each at 80 gpm, there is not currently 1+1 redundancy in the case that all washwater demands occur at the same time when a third mechanical screen is added and an additional washer/compactor is added under the drum screens, so a third pump is recommended in the spare space available. This would include installation of a high pressure switch on the discharge piping of the new 3<sup>rd</sup> pump.

Also, the existing 2 washwater booster pumps have not had any major maintenance or rebuilds done since original construction of the plant, and are due for a significant maintenance event and possibly replacement depending on the results of the rebuild assessment.



Existing (2) Washwater Booster Pumps With Space for Third

Ironhouse Sanitary District		By: J. Ziemann
WRF Master Plan		Checked: J. Ziemann
<b>Project Number: 6-3</b>		Date: Mar. 2025
<b>Drum Screens</b>		
<b>Washwater Booster Pumps</b>		

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 2,136.00	incl		\$ 2,136
Submittals				16	\$ 150	\$ 2,400
DIV 1 Subtotal						<b>\$ 4,536</b>
<b>Division 5 - Metals</b>						
Misc. Metals and Anchorage	1	EA	\$ 5,000.00	incl		\$ 5,000
DIV 5 Subtotal						<b>\$ 5,000</b>
<b>Division 11 - Equipment</b>						
New Washwater Booster Pump	1	EA	\$ 14,500.00	16	\$ 150	\$ 16,900
Rebuild/Service Existing Pumps	2	EA	\$ 10,000.00	incl		\$ 20,000
DIV 11 Subtotal						<b>\$ 36,900</b>
<b>Division 15 - Mechanical</b>						
Reconnect Utility Water Piping	1	LS	\$ 5,500.00	incl		\$ 5,500
DIV 15 Subtotal						<b>\$ 5,500</b>
<b>Division 16 - Electrical and Instrumentation</b>						
Electrical for 3rd Pump	1	LS	\$ 6,000.00	incl		\$ 6,000
DIV 16 Subtotal						<b>\$ 6,000</b>
<b>SUBTOTAL 1</b>						<b>\$ 57,936</b>
DESIGN CONTINGENCY			25%			\$ 14,484
<b>SUBTOTAL 2</b>						<b>\$ 72,420</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$14,484
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 86,904</b>
ENGINEERING AND CM			15%			\$13,036
<b>TOTAL ESTIMATE</b>						<b>\$ 100,000</b>

**Project Description:** The Aeration Basins have a structural crack at a control joint that appears to span all 4 basins. The recommended repair methodology is described below. Also, the exposed RAS piping in all 4 basins has deteriorated coatings that require recoating.



1. Drain basin and trace the actual length of crack on all interior walls and floor slab.
2. Thoroughly clean the surface about ½” wide on each side of the crack with wire brushes. Blow out the crack with pressurized water to clean dust and dry crack with compressed air. Ensure the crack is completely dry before proceeding.
3. If chunks of spalled concrete are dislodged during step 1 and 2, notify engineer for further steps. In case of exposed rebar with corrosion observed, epoxy crack repair is not recommended. If the exposed concrete is in good shape, proceed epoxy injection crack repair.
4. Apply surface seal in accordance with manufacturer’s instructions to designated crack face prior to injection. Seal surface of crack to prevent escape of injection epoxy.
5. Establish surface mounted entry ports for epoxy injection along the length of the crack per adhesive manufacturer. Spacing between entry ports shall be at least the width of wall.
6. Epoxy adhesive grout shall be a 100% solids 2-part water insensitive low-viscosity epoxy resin system with properties noted below. Install epoxy in strict conformance with manufacturer’s recommendations.

<b>Project # 7-1</b>	<b>Aeration Basin Repair</b>	<b>FY 2025-2027</b>	<b>Project Cost: \$177,000</b>
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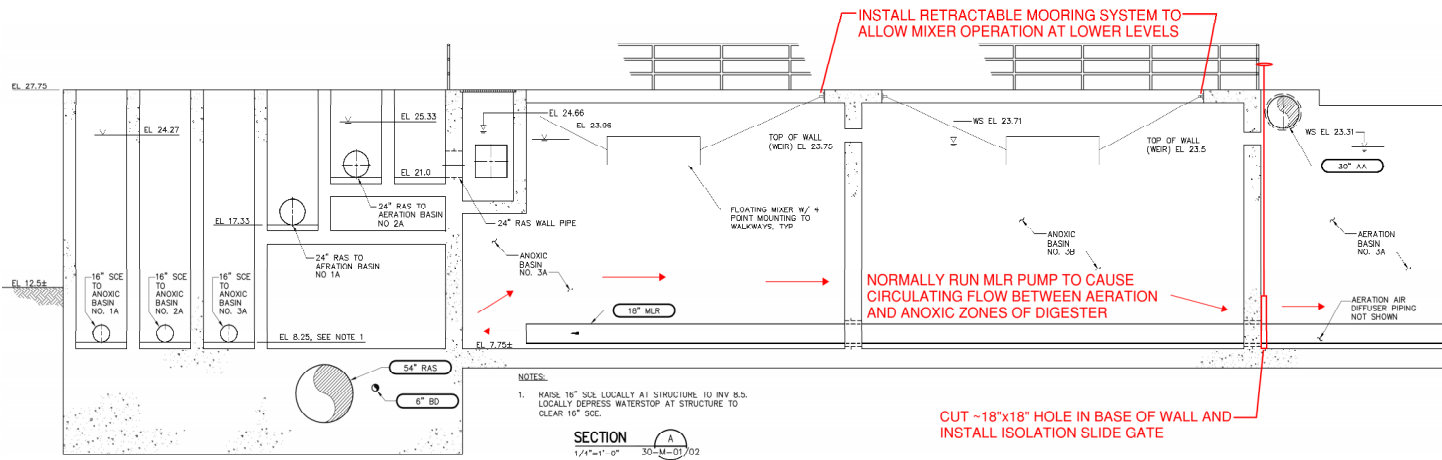
7-day, Tensile Strength, psi	ASTM D638	5,000 min.
Tensile Elongation @ Break, percent	ASTM D638	1.0% min.
Compressive Yield Strength, 7 days @ 73°F, psi	ASTM D695	8,000 min.
Compressive Modulus, psi	ASTM D695	1.5x10 <sup>5</sup> min.
Heat Deflection Temperature, °F	ASTM D648	120 min.
Water Absorption @ 24 hours, percent	ASTM D570	1.0% max.
Bond Strength @ 2 days, psi	ASTM C882	1,000 min.
Bond Strength @ 14 days, psi	ASTM C882	1,500 min.

7. Cure epoxy adhesive after cracks have been completely filled to allow surface seal removal without draining or epoxy from cracks.
8. Finish cracks face flush with adjacent concrete. Indentations from entry ports shall also be sealed and flush with adjacent concrete.
9. Core testing data shall be collected from 3 repair locations selected by engineer. 2” diameter cores shall be taken after the epoxy has fully set. Cores shall be visually inspected to confirm complete penetration of epoxy. Provide subsequent testing per ASTM C42 for compressive and split tensile strength. Patch core area upon completion of testing.
- 10.

Ironhouse Sanitary District		By: J. Ziemann
WRF Master Plan		Checked: J. Ziemann
<b>Project Number: 7-1</b>		Date: Mar. 2025
<b>Aeration Basins</b>		
<b>Crack Repair and Paint RAS Piping</b>		

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 3,360.00	incl		\$ 3,360
Submittals				16	\$ 150	\$ 2,400
DIV 1 Subtotal						<b>\$ 5,760</b>
<b>Division 3 - Concrete</b>						
Epoxy Crack Repair	280	LF	\$ 300.00	incl		\$ 84,000
DIV 3 Subtotal						<b>\$ 84,000</b>
<b>Division 9 - Finishes</b>						
Paint RAS Piping	1	LS	\$ 2,500.00	96	\$ 150	\$ 16,900
DIV 9 Subtotal						<b>\$ 16,900</b>
<b>SUBTOTAL 1</b>						<b>\$ 106,660</b>
DESIGN CONTINGENCY			20%			\$ 21,332
<b>SUBTOTAL 2</b>						<b>\$ 127,992</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$25,598
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 153,590</b>
ENGINEERING AND CM			15%			\$23,039
<b>TOTAL ESTIMATE</b>						<b>\$ 177,000</b>

**Project Description:** As plant flows and loads increase, expansion of the existing aerobic digester is recommended if it is continued to be used to equalize WAS. This could be done by utilizing the currently un-used anaerobic area of Train #1. If a hole is cut in the divider wall between Anoxic Zone B and Aerobic Zone A and the MLR pump is operated, this would continuously recirculate flow between the aerobic and anoxic zones, which is actually beneficial to help control nitrates and pH in any filtrate from the dewatering process that is subsequently returned to the aeration basins.



To accommodate this, the hole would need to be cut near the bottom of the divider wall to allow operation down to low levels, and a slide gate would be recommended to allow isolation for maintenance events.

Additionally, the mooring systems for the anoxic mixers would need to be improved to retractable systems that would allow the mixers to follow a more greatly varying water level. Alternatively, coarse bubble mixing could be installed in the anoxic zones and used instead of floating mixers.

Ironhouse Sanitary District		By: J. Ziemann
WRF Master Plan		Checked: J. Ziemann
<b>Project Number: 8-1</b>		Date: Mar. 2025
<b>Aeration Basins</b>		
<b>Aerobic Digester Expansion</b>		

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 3,592.00	incl		\$ 3,592
Submittals				16	\$ 150	\$ 2,400
DIV 1 Subtotal						<b>\$ 5,992</b>
<b>Division 3 - Concrete</b>						
Cut New Opening in Separator Wall	1	LS	\$ 10,000.00	incl		\$ 10,000
DIV 3 Subtotal						<b>\$ 10,000</b>
<b>Division 5 - Metals</b>						
New Anoxic Mixer Mooring Systems	2	EA	\$ 15,000.00	incl		\$ 30,000
DIV 5 Subtotal						<b>\$ 30,000</b>
<b>Division 11 - Equipment</b>						
Service Anoxic Mixers	2	EA	\$ 5,000.00	incl		\$ 10,000
New Isolation Slide Gate	1	LS	\$ 25,000.00	72	\$ 150	\$ 35,800
DIV 11 Subtotal						<b>\$ 45,800</b>
<b>Division 16 - Electrical and Instrumentation</b>						
Reconnect Electrical	2	EA	\$ 2,000.00	incl		\$ 4,000
DIV 16 Subtotal						<b>\$ 4,000</b>
<b>SUBTOTAL 1</b>						<b>\$ 95,792</b>
DESIGN CONTINGENCY			25%			\$ 23,948
<b>SUBTOTAL 2</b>						<b>\$ 119,740</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$23,948
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 143,688</b>
ENGINEERING AND CM			15%			\$21,553
<b>TOTAL ESTIMATE</b>						<b>\$ 165,000</b>

<b>Project # 9-1</b>	<b>MBR 7<sup>th</sup> Cassettes</b>	<b>FY 2034-2035</b>	<b>Project Cost: \$1,000,000</b>
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**Project Description:** ISD pre-purchased replacements of all the MBR elements in 2021 through Suez. The membrane elements are expected to have a service life of 15-20 years for planning purposes. It is assumed that ISD will begin replacing the elements in approximately 2-3 years.

The newest version of the membrane elements have a larger surface area of 430 ft<sup>2</sup> per module versus the existing versions which are 340 ft<sup>2</sup>. This allows the replacement modules to utilize 6 of the 9 available cassettes whereas the existing elements currently utilize 7 of them.

configuration data	units	existing plant configuration	proposed configuration after replacement/upgrade
number of trains, plant		4	4
type of ZeeWeed membrane		500D	500D
module surface area	ft <sup>2</sup>	340	430
total number of cassette spaces per train		9	9
maximum number of modules per cassette		48	48
fully populated cassettes installed per train		7	6
flex cassettes installed per train		---	---
total module count, train		336	288
total surface area in operation, train	ft <sup>2</sup>	114,240	123,840
total module count, plant		1,344	1,152
total surface area in operation, plant	ft <sup>2</sup>	456,960	495,360
% surface area change from existing, plant	%	---	8.4%



**MEMBRANE MODULE**



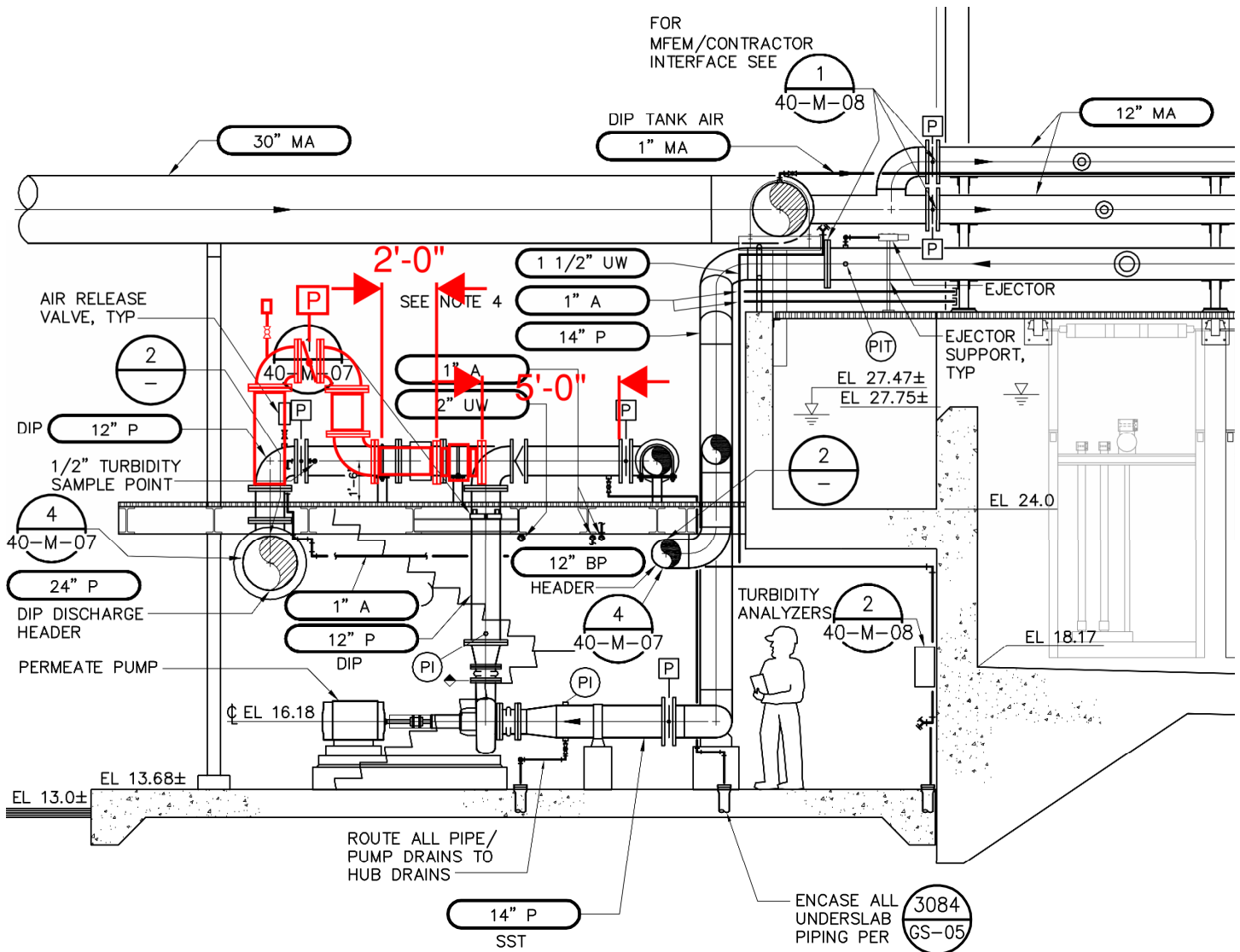
**MEMBRANE CASSETTE**

However, as identified in the Master Plan it is recommended that when PWWF exceeds approximately 7.2 MGD a 7<sup>th</sup> cassette is recommended to be filled with membrane modules to keep fluxes within manufacturer recommended ranges. Installation of new modules is straightforward and can be done by ISD WRF Operations Staff.

The cost of this project in the Capital Improvement Plan is the estimated cost of 4 cassettes worth of membrane modules (1 cassette per train) inflated 10 years into the future at 3% per year. This is approximately \$1.0M, however pricing of membrane modules this far into the future is difficult to predict.

**Project Description:** The MBR air compressors (51-ME-31 and 51-ME-32) were originally 15HP, and were replaced with 10HP units in 2021. The 10HP units are undersized and both are needed to operate a majority of the time. It is recommended that the existing 10HP units are replaced with 15HP units as originally intended.

Additionally, there has been an ongoing operational challenge with the permeate pump flow meters, where at lower flow rates, the flow meters run partially full and do not read correctly unless the pneumatic valves downstream of them are partially closed to create enough backpressure to prevent this from occurring. The work-around that was developed was to institute a permeate pump low flow setpoint below which these pneumatic valves are called to close, however the limits on the valves were set such that “closed” is actually still partially open. While this prevents the flow meters from losing their read value, if the permeate pump flow setpoint happens to be near this low-flow setpoint, the valves end up being called to open and close back and forth causing excessive valve cycling and flow instability.



A solution to this problem would include installing “head maker” piping downstream of the flow meter to ensure that the flow meter is always a full pipe at all flows. There is enough room in the piping to provide 5D upstream and 2D downstream of straight pipe for the flow meter (typical clearance) and allow for the head maker piping to be installed. The existing valve could be moved, and the existing air release valve would be replaced with a combination air valve.

Ironhouse Sanitary District		By: J. Ziemann
WRF Master Plan		Checked: J. Ziemann
<b>Project Number: 9-2</b>		Date: Mar. 2025
<b>Membrane Bioreactors</b>		
<b>MBR Improvements</b>		

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 4,376.00	incl		\$ 4,376
Submittals				16	\$ 150	\$ 2,400
DIV 1 Subtotal						<b>\$ 6,776</b>
<b>Division 5 - Metals</b>						
Pipe Supports	4	EA	\$ 3,000.00	incl		\$ 12,000
DIV 5 Subtotal						<b>\$ 12,000</b>
<b>Division 9 - Painting</b>						
Paint Piping	4	EA	\$ 2,000.00	incl		\$ 8,000
DIV 9 Subtotal						<b>\$ 8,000</b>
<b>Division 11 - Equipment</b>						
Purchase new 15HP Compressors	2	EA	\$ 25,000.00	incl		\$ 50,000
DIV 11 Subtotal						<b>\$ 50,000</b>
<b>Division 15 - Mechanical</b>						
Head Maker Piping @ Flow Meters	4	EA	\$ 5,000.00	96	\$ 150	\$ 34,400
New CARVs	4	EA	\$ 1,250.00	incl		\$ 5,000
DIV 15 Subtotal						<b>\$ 39,400</b>
<b>SUBTOTAL 1</b>						<b>\$ 116,176</b>
DESIGN CONTINGENCY			25%			\$ 29,044
<b>SUBTOTAL 2</b>						<b>\$ 145,220</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$29,044
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 174,264</b>
ENGINEERING AND CM			15%			\$26,140
<b>TOTAL ESTIMATE</b>						<b>\$ 200,000</b>

**Project Description:** WRF Operations Staff would like to add bird netting or some other type of active bird mitigation (i.e. sonic) to the underside of the MBR facility canopy in order to prevent birds from roosting and nesting under it. The canopy has attracted birds, and this causes additional maintenance and cleaning work for Operations Staff.



Bird netting could be installed to the level of the hanging lighting, and supported from the lighting support system. The light ballasts could be cut out of the netting to allow for lights to be changed. The netting would look similar to that depicted below. Similar improvements could be made at the canopy over the UV facility.



A detailed assessment of options and providers has not been completed for this project, the cost estimate is a placeholder budget “not to exceed” value for the project.


Project # 11-1	UV Equipment Replacement	FY 2025-2027	Project Cost: \$672,810
		FY 2030-2031	Project Cost: \$478,780

**Project Description:**

A number of UV system components are in need of near term improvement or replacement. As part of the Master Planning effort HDR, Inc. consulted with the original equipment manufacturer, Trojan, to develop costs for the items that require replacement, which should extend the life of the existing system approximately 10 years.

ISD Maintenance Staff can likely install/replace most of the new components, except for the Hydraulics System Controls (HSC) which could be done by Trojan. Estimated hours and labor costs are, however, included in the estimate.

In general it is estimated that half of the system’s components will be replaced in 2026 and the other half in 2031 which takes into account previous replacement cycles of some of these items.

Ironhouse Sanitary District					By: J. Skrel	
WRF Master Plan					Checked: J. Ziemann	
<b>Project Number: 11-1a</b>					Date: July 2025	
<b>UV Disinfection System</b>						
<b>UV Equipment Renewal 2026</b>						
Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 11 - Equipment</b>						
Upgrade HSC System	1	LS	\$ 17,146.00	incl		\$ 17,146
30 Hydraulic Wiping Cylinders	1	LS	\$ 91,316.00	40	\$ 150	\$ 97,316
120 Lamp Driver Kits	1	LS	\$182,631.00	80	\$ 150	\$ 194,631
3 Sensor Assemblies	1	LS	\$ 12,175.00	24	\$ 150	\$ 15,775
60 Lamp Sleeve Combos	1	LS	\$148,540.00	80	\$ 150	\$ 160,540
240 Wiper Canisters	1	LS	\$ 28,003.00	24	\$ 150	\$ 31,603
DIV 11 Subtotal						<b>\$ 517,011</b>
<b>Division 16 - Electrical and Instrumentation</b>						
Electrical Reconnections/Labor	1	LS	\$ 10,000.00	incl		\$ 10,000
DIV 16 Subtotal						<b>\$ 10,000</b>
<b>SUBTOTAL 1</b>						<b>\$ 527,011</b>
DESIGN CONTINGENCY			0%			\$ -
<b>SUBTOTAL 2</b>						<b>\$ 527,011</b>
CONTRACTOR OVERHEAD AND PROFIT			0%			\$0
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 527,011</b>
ENGINEERING AND CM			0%			\$0
<b>TOTAL ESTIMATE</b>						<b>\$ 527,000</b>

Project # 11-1	UV Equipment Replacement	FY 2025-2027	Project Cost: \$672,810
		FY 2030-2031	Project Cost: \$478,780

Ironhouse Sanitary District		By: J. Skrel
WRF Master Plan		Checked: J. Ziemann
Project Number: 11-1b		Date: July 2025
UV Disinfection System		
UV Equipment Renewal 2031		

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 11 - Equipment</b>						
120 Lamp Driver Kits	1	LS	\$ 182,631.00	80	\$ 150	\$ 194,631
3 Sensor Assemblies	1	LS	\$ 12,175.00	24	\$ 150	\$ 15,775
60 Lamp Sleeve Combos	1	LS	\$ 148,540.00	80	\$ 150	\$ 160,540
240 Wiper Canisters	1	LS	\$ 28,003.00	24	\$ 150	\$ 31,603
DIV 11 Subtotal						\$ 402,549
<b>Division 16 - Electrical and Instrumentation</b>						
Electrical Reconnections/Labor	1	LS	\$ 10,000.00	incl		\$ 10,000
DIV 16 Subtotal						\$ 10,000
<b>SUBTOTAL 1</b>						\$ 412,549
DESIGN CONTINGENCY			0%			\$ -
<b>SUBTOTAL 2</b>						\$ 412,549
CONTRACTOR OVERHEAD AND PROFIT			0%			\$0
<b>ESTIMATED CONSTRUCTION COST</b>						\$ 412,549
ENGINEERING AND CM			0%			\$0
<b>TOTAL ESTIMATE</b>						\$ 413,000

Project # 11-2	UV System Expansion and Upgrade	FY 2032-2035	Project Cost: \$12,000,000
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**Project Description:**

With the near-term renewal improvements identified in Project 11-1, it is estimated that the existing UV system can last another ~10 years with continued diligent maintenance under the regular plant maintenance program. At that time, the system will have reached the end of its useful life and may no longer be supported as Trojan will have likely developed the new Signa system and may stop manufacturing components for the existing 3000+ system.

Complete replacement of the entire UV system, with 2 additional banks (for a total of 8) should be planned for ~10 years in the future. The cost included in the Capital Improvement Plan is only a rough estimate, since the Signa system has not even been fully developed and therefore it is not possible to receive budgetary equipment pricing at this time. It is assumed that structural modifications to the channels will not be necessary, and that the costs will only include existing equipment removal, new equipment installation, some potential electrical and programming modifications, and startup.



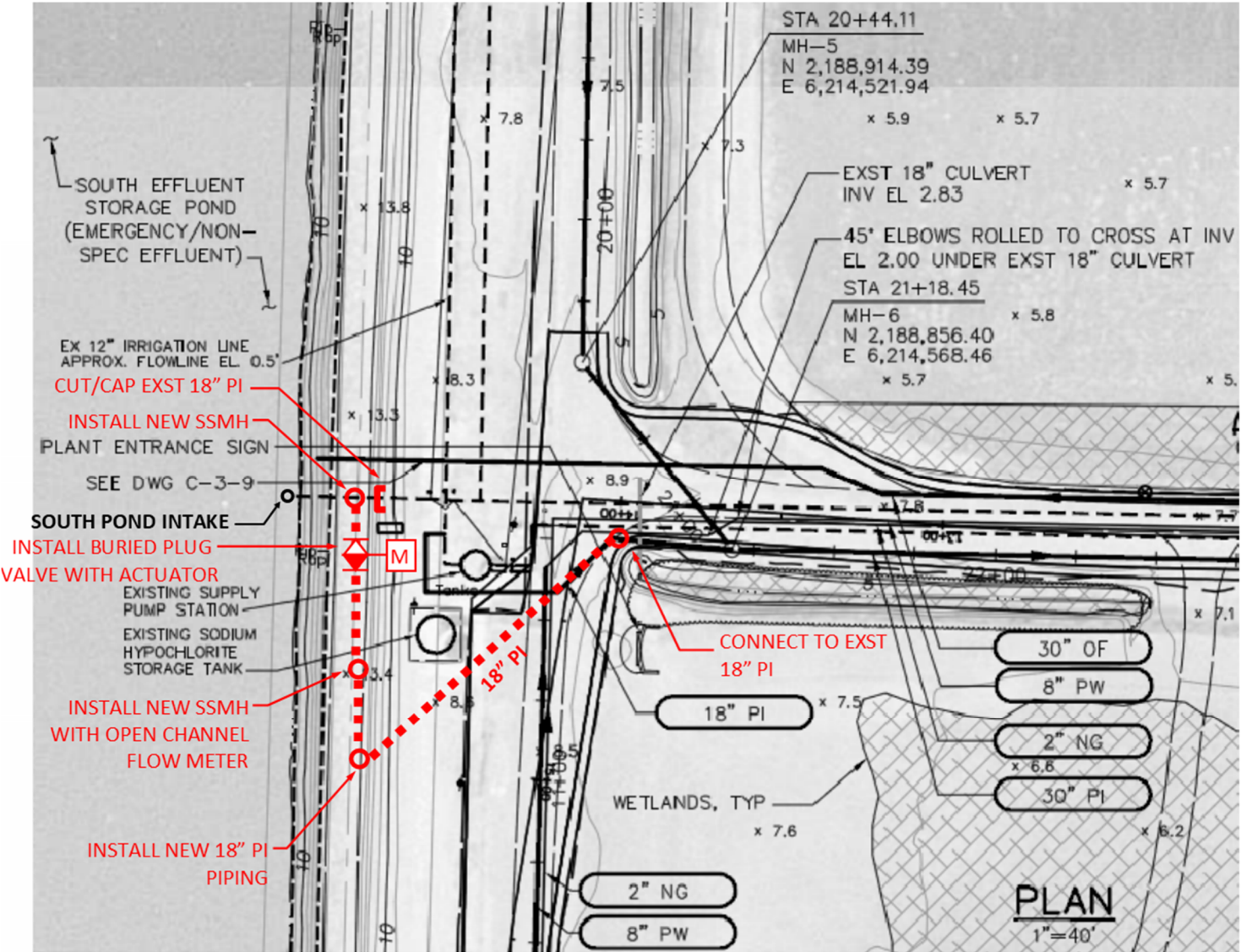
Existing Trojan UV System

Project # 12-1	South Pond Return Piping	FY 2029-2030	Project Cost: \$734,957
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**Project Description:**

As part of the 2011 WRF construction project, a gravity diversion from the suction side of the supply pump station to the 30" primary influent sewer line was added to allow the south pond to be drained back into the WRF headworks. The return flow from the south pond to the headworks is not easily controllable, as it is only initiated by a buried manual plug valve with no means of flow measurement. It is recommended that improvements be made to address this issue, as uncontrolled south pond flow return to the headworks can overload headworks equipment.

The recommended improvement involves reconfiguring the 18" piping connecting the south pond intake to the main 30" primary influent sewer to install a motor actuated plug valve and several manholes, one of which would include an open channel sewer flow meter. PLC programming would be added to allow for the Operator to set a desired flow rate, and for automatic control of the plug valve to obtain the specified flow rate set point. The recommended improvements are shown below.



South Pond Return Concept

Project # 12-1	South Pond Return Piping	FY 2029-2030	Project Cost: \$734,957
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Ironhouse Sanitary District  
WRF Master Plan  
**Project Number: 12-1**  
**South Pond**  
**Gravity Return Piping**



By: J. Ziemann  
Checked: J. Ziemann  
Date: Mar. 2025

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 23,695.00	incl		\$ 23,695
Submittals				8	\$ 100	\$ 800
DIV 1 Subtotal						\$ 24,495
<b>Division 3 - Concrete</b>						
4' Diameter Manhole	4	EA	\$ 20,000.00	incl		\$ 80,000
DIV 3 Subtotal						\$ 80,000
<b>Division 15 - Mechanical</b>						
Buried 18" PI	190	LF	\$ 650.00	incl		\$ 123,500
18" Actuated Plug Valve	1	EA	\$ 40,000.00	incl		\$ 40,000
DIV 15 Subtotal						\$ 163,500
<b>Division 16 - Electrical and Instrumentation</b>						
Open Channel Flow Meter	1	EA	\$ 30,000.00	incl		\$ 30,000
Site Electrical	1	LS	\$ 50,000.00	incl		\$ 50,000
PLC/SCADA Programming	1	LS	\$ 15,000.00	incl		\$ 15,000
DIV 16 Subtotal						\$ 95,000
<b>SUBTOTAL 1</b>						<b>\$ 362,995</b>
DESIGN CONTINGENCY			25%			\$ 90,749
<b>SUBTOTAL 2</b>						<b>\$ 453,744</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$90,749
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 544,493</b>
ENGINEERING AND CM			20%			\$108,899
<b>TOTAL ESTIMATE</b>						<b>\$ 653,000</b>

Project # 13-1	Third Large Effluent Pump	FY 2034-2035	Project Cost: \$1,099,323
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**Project Description:**

The peak wet weather design flow for the WRF is currently 8.6 MGD, or approximately 6,000 gpm. The required discharge head of the pump station for 6,000 gpm is approximately 107 feet of head. This is beyond the operating head range of the 40HP pumps, which have a shutoff head of 72 feet. Both of the 150 HP pumps would be required to operate at a reduced speed to produce 6,000 gpm at 107 feet of head. The maximum capacity of a single 150HP pump is approximately 5,150 gpm (7.4 MGD) @ 81' of head. There has not been a time yet that both 150HP pumps have been called to operate.

A third 150HP effluent pump should be added at which time the WRF effluent flow rate exceeds the current capacity of a single 150HP pump, and a second 150HP pump is called to run during a high flow event. This has not occurred to date, but when it does this indicates that the third pump should be added for redundancy. For planning purposes this will be estimated to occur within ~10 years.



Location for 3<sup>rd</sup> Large Effluent Pump

<b>Project # 13-1</b>	<b>Third Large Effluent Pump</b>	<b>FY 2034-2035</b>	<b>Project Cost: \$1,099,323</b>
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Ironhouse Sanitary District  
WRF Master Plan  
**Project Number: 13-1**  
**Effluent Pump Station**  
**Third 150 HP Effluent Pump**



By: J. Ziemann  
Checked: J. Ziemann  
Date: Jun. 2025

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 33,656.00	incl		\$ 33,656
Submittals				8	\$ 100	\$ 800
DIV 1 Subtotal						\$ 34,456
<b>Division 3 - Concrete</b>						
Pump Concrete Base and Anchorage	1	LS	\$ 10,000.00	incl		\$ 10,000
DIV 3 Subtotal						\$ 10,000
<b>Division 15 - Mechanical</b>						
150 HP Pump	1	EA	\$ 225,000.00	72	\$ 150	\$ 235,800
20" Check Valve	1	EA	\$ 17,500.00	incl		\$ 17,500
20" Butterfly Valve	1	EA	\$ 17,500.00	incl		\$ 17,500
Ductile Iron Piping	1	EA	\$ 40,000.00	incl		\$ 40,000
DIV 15 Subtotal						\$ 310,800
<b>Division 16 - Electrical and Instrumentation</b>						
150 HP VFD	1	EA	\$ 100,000.00	incl		\$ 100,000
Site Electrical	1	LS	\$ 50,000.00	incl		\$ 50,000
PLC/SCADA Programming	1	LS	\$ 10,000.00	incl		\$ 10,000
DIV 16 Subtotal						\$ 160,000
<b>SUBTOTAL 1</b>						<b>\$ 515,256</b>
DESIGN CONTINGENCY			15%			\$ 77,288
<b>SUBTOTAL 2</b>						<b>\$ 592,544</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$118,509
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 711,053</b>
ENGINEERING AND CM			15%			\$106,658
<b>TOTAL ESTIMATE</b>						<b>\$ 818,000</b>

**Project Description:**

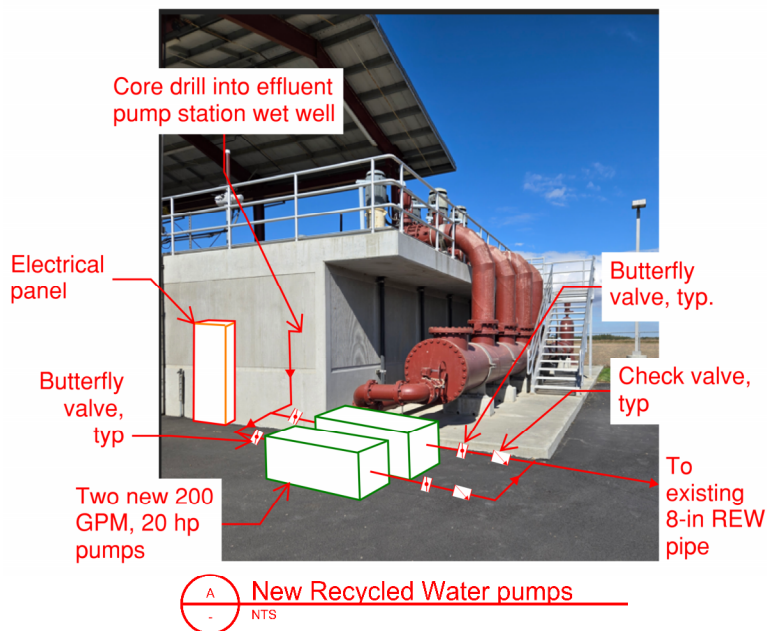
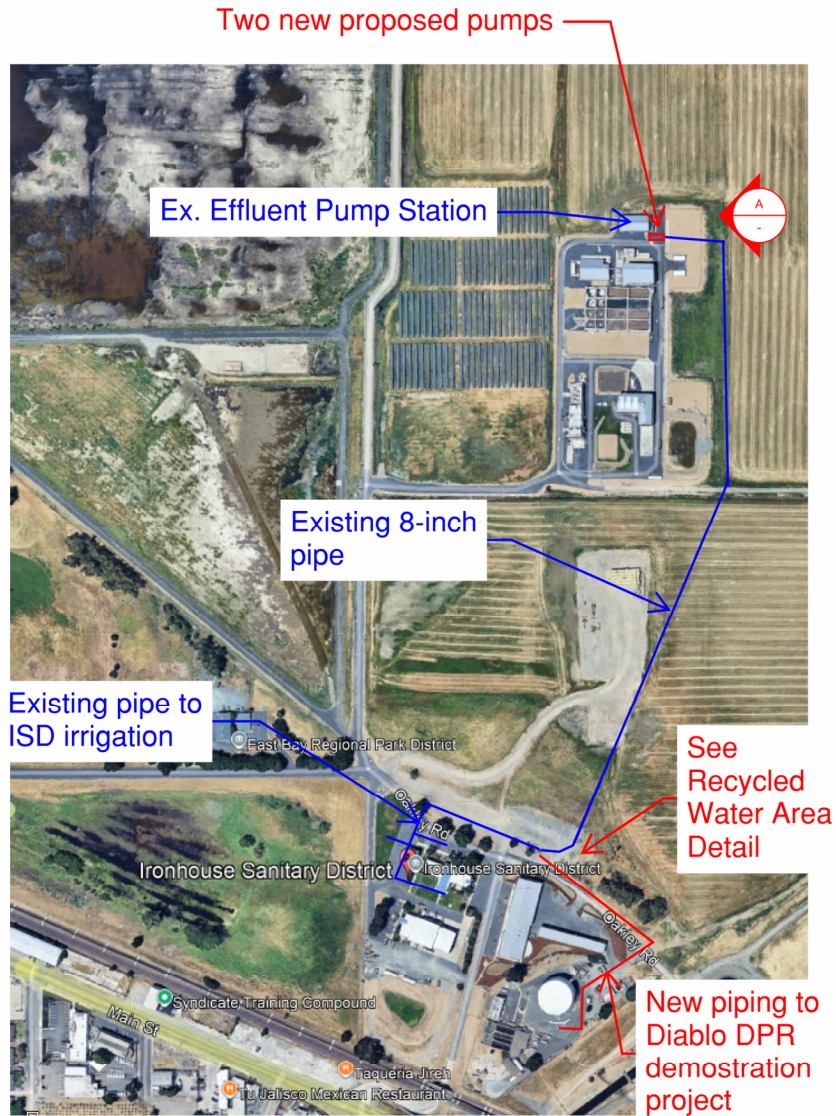
The existing recycled water booster pump (7.5 HP) will be replaced with (2) new 20HP pumps, which will be designed to deliver the maximum possible recycled water demand with both pumps operational (i.e. 50% redundancy). The pumps will run on variable frequency drives and utilize the (2) existing 90-gallon hydropneumatic tanks to maintain system pressure.

A new connection to the effluent wet well will be made to supply water to the recycled water system to replace the existing connection to the effluent pump discharge header so that the recycled water system is no longer affected by operation of the effluent pumps.

Water can be supplied to the Diablo Water Direct Potable Re-use (DRP) pilot from the recycled water system but an additional booster pump will likely be needed as part of the DPR skid to provide the required feed pressure (up to 150 psi) which would be in excess of the typical recycled water system pressure of 40-60 psi. On-on-skid booster pump is more appropriate to control the required flow and pressure locally to the DPR pilot project.



Existing Recycled Water Booster Pump and Hydropneumatic Tanks  
(existing pump to be removed, hydropneumatics tanks to remain)



Ironhouse Sanitary District  
WRF Master Plan  
**Project Number: 13-2**  
**Effluent Pump Station**  
**Recycled Water System Improvements**



By: P. Hermanson  
Checked: J. Skrel  
Date: Jun. 2025

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 20,034.00	incl		\$ 20,034
Submittals				16	\$ 100	\$ 1,600
DIV 1 Subtotal						<b>\$ 21,634</b>
<b>Division 3 - Concrete</b>						
Concrete Work	1	LS	\$ 5,000.00	incl		\$ 5,000
DIV 3 Subtotal						<b>\$ 5,000</b>
<b>Division 15 - Mechanical</b>						
20 HP Pump	2	EA	\$ 15,000.00	48	\$ 150	\$ 37,200
Pump Station Piping and Valves	1	LS	\$ 20,000.00	160	\$ 150	\$ 44,000
Core Drill Effluent Pump Station	1	LS	\$ 10,000.00	incl		\$ 10,000
Piping to Diablo Water	800	LF	\$ 75.00	incl		\$ 60,000
DIV 15 Subtotal						<b>\$ 151,200</b>
<b>Division 16 - Electrical and Instrumentation</b>						
20 HP VFD	2	EA	\$ 15,000.00	incl		\$ 30,000
Electrical Panels	1	LS	\$ 25,000.00	incl		\$ 25,000
Site Electrical	1	LS	\$ 50,000.00	incl		\$ 50,000
PLC/SCADA Programming	1	LS	\$ 25,000.00	incl		\$ 25,000
DIV 16 Subtotal						<b>\$ 130,000</b>
<b>SUBTOTAL 1</b>						<b>\$ 307,834</b>
DESIGN CONTINGENCY			30%			\$ 92,350
<b>SUBTOTAL 2</b>						<b>\$ 400,184</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$80,037
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 480,221</b>
ENGINEERING AND CM			25%			\$120,055
<b>TOTAL ESTIMATE</b>						<b>\$ 600,000</b>

<b>Project # 15-1</b>	<b>Replace Galvanized Steel Pipe</b>	<b>FY 2026-2027</b>	<b>Project Cost: \$770,440</b>
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**Project Description:** All utility water piping in the plant 3” and less is galvanized steel whereas piping 4” and greater is ductile iron. The existing galvanized steel pipe is suffering from significant corrosion and has started to fail in some locations. This is likely due to the fact that the utility water has very low alkalinity, which is consumed through nitrification and denitrification in the aeration basins, and further through alum dosing when that is employed. Water with low alkalinity is known to be corrosive to galvanized steel. The cement mortar lining of ductile iron pipe provides more protection for the larger diameter utility water piping.

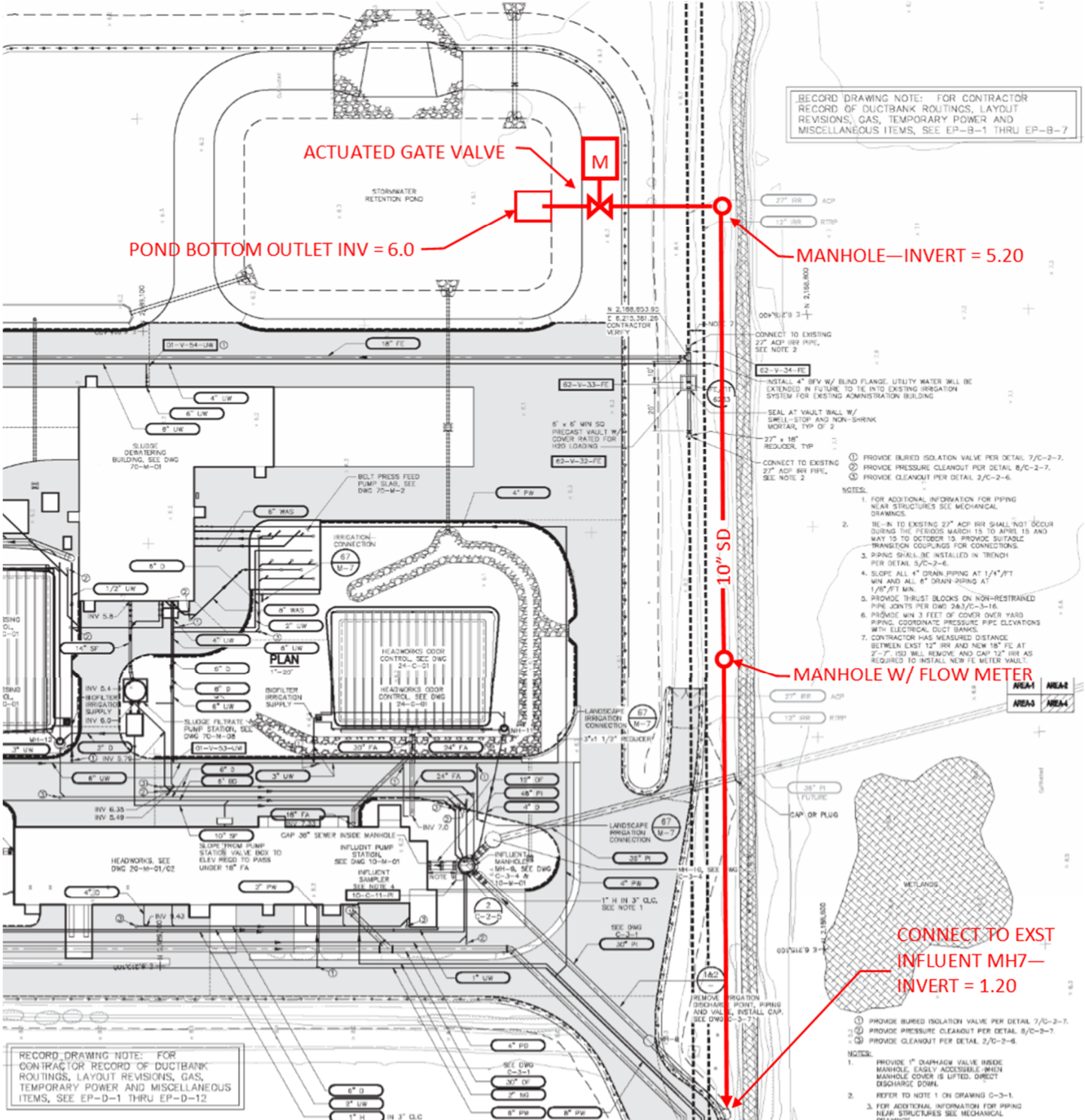
All galvanized steel utility water piping should be replaced with 316 stainless steel piping.

Ironhouse Sanitary District		By: J. Ziemann
WRF Master Plan		Checked: J. Ziemann
<b>Project Number: 15-1</b>		Date: Mar. 2025
<b>Utility Water Pump Station</b> <b>Replace all GSP Piping 3" and Less</b>		

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 27,212.50	incl		\$ 27,213
Submittals				8	\$ 100	\$ 800
DIV 1 Subtotal						<b>\$ 28,013</b>
<b>Division 3 - Concrete</b>						
Wall Penetrations	1	LS	\$ 25,000.00	incl		\$ 25,000
DIV 3 Subtotal						<b>\$ 25,000</b>
<b>Division 15 - Mechanical</b>						
Replace 1/2" Piping with SST	50	LF	\$ 50.00	incl		\$ 2,500
Replace 3/4" Piping with SST	50	LF	\$ 75.00	incl		\$ 3,750
Replace 1" Piping with SST	600	LF	\$ 100.00	incl		\$ 60,000
Replace 1-1/2" Piping with SST	50	LF	\$ 150.00	incl		\$ 7,500
Replace 2" Piping with SST	950	LF	\$ 200.00	incl		\$ 190,000
Replace 3" Piping with SST	250	LF	\$ 300.00	incl		\$ 75,000
Dissimilar Metals Connections	1	LS	\$ 15,000.00	incl		\$ 15,000
Pipe Support Modifications	1	LS	\$ 10,000.00	incl		\$ 10,000
DIV 15 Subtotal						<b>\$ 363,750</b>
<b>SUBTOTAL 1</b>						<b>\$ 416,763</b>
DESIGN CONTINGENCY			30%			\$ 125,029
<b>SUBTOTAL 2</b>						<b>\$ 541,791</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$108,358
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 650,150</b>
ENGINEERING AND CM			15%			\$97,522
<b>TOTAL ESTIMATE</b>						<b>\$ 748,000</b>

**Project Description:**

It is recommended that a drain return line from the stormwater retention basin to the headworks is added to allow the retention basin to be emptied and treated by the WRF in the case of prolonged periods of wet weather when the natural percolation rate is not adequate to remove accumulated stormwater.




The bottom of the pond is at elevation 6.2. A new bottom outlet to a proposed 10" return line is proposed at elevation 6.0. The new return line would be run west to connect to the existing 30" primary influent line at MH-7 which has an invert of -4.5. The new return line would connect to MH-7 at an invert of 1.2, to ensure that the

<b>Project # 18-1</b>	<b>Storm Pond Return Piping</b>	<b>FY 2029-2030</b>	<b>Project Cost: \$675,305</b>
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return line is not subject to backflow from the influent sewer. The return line would penetrate the manhole and also have a duckbill check valve on it to prevent backflow and odors from affecting the stormwater retention basin. The new return line would have a slope of 1% and a full gravity flow capacity of approximately 1,100 gpm (1.58 MGD). This would allow the stormwater basin to be emptied in approximately 4.5 hours if necessary.

The gate valve for the return line would include an actuator extension and outdoor-rated motor actuator to allow for automatic control of the stormwater return. Also, an open-channel flow meter would be added to a manhole on the return line to allow for measurement of the return flow. This would allow for the return flow rate to be controlled, or stopped automatically if the total influent flow rate to the plant becomes too high during periods of peak wet weather flows.

Ironhouse Sanitary District						By: J. Ziemann
WRF Master Plan						Checked: J. Ziemann
<b>Project Number: 18-1</b>						Date: Mar. 2025
<b>Stormwater Retention Basin</b>						
<b>Stormwater Gravity Return Line</b>						
Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 15,825.00	incl		\$ 15,825
Submittals				8	\$ 150	\$ 1,200
DIV 1 Subtotal						\$ 17,025
<b>Division 2 - Earth Work</b>						
Earthwork in Basin for Outlet	1	LS	\$ 20,000.00	incl		\$ 20,000
DIV 2 Subtotal						\$ 20,000
<b>Division 3 - Concrete</b>						
Core Drills and Grout	1	EA	\$ 1,500.00	incl		\$ 1,500
4' Diameter Manhole	2	EA	\$ 15,000.00	incl		\$ 30,000
DIV 3 Subtotal						\$ 31,500
<b>Division 15 - Mechanical</b>						
Bured 10" SD	500	LF	\$ 300.00	incl		\$ 150,000
10" Actuated Gate Valve	1	EA	\$ 20,000.00	incl		\$ 20,000
DIV 15 Subtotal						\$ 170,000
<b>Division 16 - Electrical and Instrumentation</b>						
Open Channel Flow Meter	1	EA	\$ 30,000.00	incl		\$ 30,000
Site Electrical	1	LS	\$ 50,000.00	incl		\$ 50,000
PLC/SCADA Programming	1	LS	\$ 15,000.00	incl		\$ 15,000
DIV 16 Subtotal						\$ 95,000
<b>SUBTOTAL 1</b>						<b>\$ 333,525</b>
DESIGN CONTINGENCY			25%			\$ 83,381
<b>SUBTOTAL 2</b>						<b>\$ 416,906</b>
CONTRACTOR OVERHEAD AND PROFIT			20%			\$83,381
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 500,288</b>
ENGINEERING AND CM			20%			\$100,058
<b>TOTAL ESTIMATE</b>						<b>\$ 600,000</b>

Project # 18-2	Old WWTP Facilities Demolition	FY 2030-2031	Project Cost: \$409,223
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**Project Description:** Existing facilities associated with the original lagoon-based wastewater treatment plant still exist on a parcel of land to the west of the North Pond. These facilities should be demolished since they are no longer used or maintained.



The remaining ponds north of the fields to the north of the existing buildings could be filled in over time. This could be done at a very low cost by accepting clean fill from contractors needing to dispose of soil from local projects.

Ironhouse Sanitary District

WRF Master Plan

**Project Number: 18-2**

Misc.

**Demolish Existing WWTP Facilities**



By: J. Ziemann  
 Checked: J. Ziemann  
 Date: Mar. 2025

Items	Qty	Units	Unit Price	Labor		Total
				Hrs.	Rate	
<b>Division 1 - General Requirements</b>						
Mobilization / Demobilization	1	LS	\$ 9,792.00	incl		\$ 9,792
Submittals				8	\$ 150	\$ 1,200
DIV 1 Subtotal						<b>\$ 10,992</b>
<b>Division 2 - Earth Work</b>						
Grading	1	LS	\$ -	96	\$ 150	\$ 14,400
DIV 2 Subtotal						<b>\$ 14,400</b>
<b>Division 3 - Concrete</b>						
Concrete Demo	1	LS	\$ 10,000.00	96	\$ 150	\$ 24,400
DIV 3 Subtotal						<b>\$ 24,400</b>
<b>Division 4 - Masonry</b>						
Building Demo	1	LS	\$ 40,000.00	800	\$ 150	\$ 160,000
DIV 4 Subtotal						<b>\$ 160,000</b>
<b>Division 15 - Mechanical</b>						
Mechanical Demo	1	LS	\$ 5,000.00	120	\$ 150	\$ 23,000
DIV 15 Subtotal						<b>\$ 23,000</b>
<b>Division 16 - Electrical and Instrumentation</b>						
Electrical Demo	1	LS	\$ 5,000.00	120	\$ 150	\$ 23,000
DIV 16 Subtotal						<b>\$ 23,000</b>
<b>SUBTOTAL 1</b>						<b>\$ 255,792</b>
DESIGN CONTINGENCY				15%		\$ 38,369
<b>SUBTOTAL 2</b>						<b>\$ 294,161</b>
CONTRACTOR OVERHEAD AND PROFIT				20%		\$58,832
<b>ESTIMATED CONSTRUCTION COST</b>						<b>\$ 352,993</b>
ENGINEERING AND CM				0%		\$0
<b>TOTAL ESTIMATE</b>						<b>\$ 353,000</b>

---

## Appendix B – Equipment Proposals

## Joe Ziemann

---

**From:** Brad Leidecker <brad@chcwater.com>  
**Sent:** Friday, November 15, 2024 1:02 PM  
**To:** Allyson Swain  
**Cc:** Joe Ziemann  
**Subject:** Re: ISD Parkson Screening Request

Hi Allyson,  
Budget costs per unit are as follows:

Primary screens: AquaGuard PF 3' wide x 13' discharge height in 316 SS, \$300K per screen.  
Secondary screens: Rotoshear PF model RDS6096 in 316 SS, \$290K per screen.  
Washer compactorts: AWP8, \$110K per unit.  
Controls are not included in this pricing.

Please confirm if this is sufficient for your needs.

Regards,  
Brad Leidecker, P.E. | Coombs-Hopkins Company  
1501 N Broadway, Suite 210 | Walnut Creek, CA 94596  
M: 925.876.0646 | [brad@chcwater.com](mailto:brad@chcwater.com)



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---

**From:** Allyson Swain <allysons@wwengineers.com>  
**Date:** Thursday, November 14, 2024 at 11:14 AM  
**To:** Brad Leidecker <brad@chcwater.com>  
**Cc:** Joe Ziemann <joez@wwengineers.com>  
**Subject:** RE: ISD Parkson Screening Request

Brad,  
Unit cost for each is fine. We have three as there will be one for the new mechanical bar screen, one for the new drum, and then one of the existing drums shares a compactor with another unit where operations would like each unit to have their own in the future.  
-Allyson

---

**From:** Brad Leidecker <brad@chcwater.com>  
**Sent:** Thursday, November 14, 2024 11:12 AM  
**To:** Allyson Swain <allysons@wwengineers.com>

**membrane replacement agreement**

<b>to:</b>	Ironhouse Sanitary District, referred to here as ISD or Buyer	<b>date:</b>	December 1, 2021
		<b>no. of pages:</b>	35 including cover
<b>attention:</b>	Chris Christean	<b>email:</b>	<a href="mailto:christean@isd.us.com">christean@isd.us.com</a>
<b>plant address:</b>	450 Walnut Meadows Drive Oakley, CA 94561 USA	<b>telephone no.:</b>	925 809 3033
<b>from:</b>	Jason Diamond regional lifecycle manager western USA	<b>email:</b>	<a href="mailto:jason.diamond@suez.com">jason.diamond@suez.com</a>
		<b>telephone no.:</b>	905 465 3030 x3273
		<b>cell no.:</b>	905 399 7055
<b>cc:</b>	Brad Leidecker (CHC)		
<b>subject:</b>	membrane replacement agreement: materials, off-site and on-site support	<b>proposal no.:</b>	239963-3
		<b>original project no.:</b>	500468
<b>plant data:</b>	Please provide corrections if inaccurate Ironhouse Sanitary District Wastewater Treatment Plant, municipal sanitary sewage treatment. 4 trains, 7 x ZW500D 48/48M cassettes, 340ft² modules plus two empty cassette spaces per train. Substantial completion date: July 18, 2011.		

## proposal provisos

This proposal has been issued based on the information provided by the customer and on information currently available to SUEZ Water Technologies & Solutions at the time of proposal issuance. Any changes or discrepancies in site conditions, including but not limited to changes in system influent water characteristics, changes in environmental health and safety (EH&S) conditions, changes in the reissued state/provincial disposal system permit, changes in buyer financial standing, buyer requirements, or any other relevant change or discrepancy in the factual basis upon which this proposal was created may lead to changes in the offering, including but not limited to changes in pricing, guarantees, quoted specifications, or terms and conditions.

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# 1 introduction

SUEZ Water Technologies & Solutions is pleased to present this proposal to initiate a long-term agreement with Ironhouse Sanitary District for wastewater membrane replacement and cassette refurbishment at the Ironhouse Sanitary District Wastewater Treatment Plant.

SUEZ's latest wastewater membrane is the ZW500D RX12 with 430ft<sup>2</sup> of surface area per module that is still fully compatible with the current ZW500D cassette in use at the plant. See attachment d for further product info.

It is expected that ISD will require replacement membranes within the next 10 years and that membrane replacement will be staggered, with two trains replaced in each of 2 replacement events.

The scope of this agreement will include the following:

- ❑ ZW500D membrane replacement – full plant;
- ❑ ZW500D cassette refurbishment components for 48/48M cassettes;
- ❑ on-site cassette refurbishment and membrane installation assistance;
- ❑ The option to add upgrading the system to LEAPmbr aeration, at a fixed maximum cost within the term of the agreement. LEAPmbr aeration upgrade to be completed at the time of a membrane replacement event. Scope details, included in SUEZ proposal #239963-1, dated August 18, 2021. Not to exceed price details are provided in section 3 and will be finalized at the time Ironhouse elects to proceed with the additional upgrade.

Details of the base and optional scope are set out in the sections below.

SUEZ is a proven leader in delivering tangible value to our clients over the life of the plant. Our measure of success is how well we deliver **solutions** that help our clients meet their critical business objectives. Benefits of this agreement include:

- ❑ fixed lifecycle costs over the period of the agreement;
- ❑ planned membrane replacement;
- ❑ continued operation well beyond the original expected membrane life while maintaining the advantage of the original contract guaranteed membrane replacement pricing beyond the original term.

Through long-acquired membrane experience, SUEZ has clearly distinguished itself from other membrane manufacturers. A mature service culture and deep technical expertise are at the ready to serve and support ISD through this next membrane lifecycle.

*SWTS would like to note that under the current exceptional circumstances under the COVID 19 Pandemic situation, SWTS may not be in a position to guarantee and comply with the planned schedule for project delivery or performance and that should there be any new measures taken by any governmental authority which may impede or delay the said schedule or performance, SWTS reserves the right to modify the schedule / contract*

accordingly. SWTS will promptly inform you of any changes which may impact the contract or the project.

## 2 membrane replacement agreement

Through the term of this agreement, SUEZ will provide a quantity of replacement membranes that replaces the existing full plant of membranes and provides a moderate surface area (ft<sup>2</sup>) increase to the Ironhouse Sanitary District Wastewater Treatment Plant.

The system design included an expected membrane replacement life in the range of 10 years which would have resulted in membrane replacement in 2021. With current plant operation strategies and based on the projected life of the current membranes, ISD and SUEZ anticipate the following replacement schedule:\*

agreement year:	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	total
membranes replaced						672		672			1,344
membrane provided						576		576			1,152

\*Through the term of this agreement, SUEZ will work with ISD to determine the actual timing of replacement events based on plant performance and membrane condition, with the ultimate goal to maximize membrane life.

It is possible that, through virtue of good membrane management and plant operation, ISD may extend membrane life of the current membranes beyond the end date of this agreement. To avoid unnecessary premature replacement, ISD may choose to defer delivery of membranes into a future year provided that all membranes are received and accepted within 15 years of billing for the up-front payment option or a 3-year period following final billing for the agreement.

This membrane replacement agreement provides assurance to Ironhouse Sanitary District that over the course of the agreement, SUEZ will provide the membrane modules specified or the future equivalent for use at the Ironhouse Sanitary District Wastewater Treatment Plant at no extra cost.

For optimal economics and to follow best membrane replacement practices, pricing is based on replacing multiples of at least 2 trains worth of membranes at a time. Should ISD request quantities other than a multiple of 2 full trains per installation event over the term of this agreement, an adjustment to the annual invoice may be made to account for additional costs.

### 3 SUEZ scope & price

SUEZ’s scope includes the material and services outlined in the table below. The sections that follow provide additional detail regarding each scope item.

Details of the optional upgrade to LEAPmbr aeration are provided in SUEZ proposal 239963-1, dated August 18, 2021.

#### 3.1 up-front payment option

item description	part #	quantity	price
ZW500D RX12 430 ft² modules, section 4.1 and attachment d	3168300	1,152	1,900,146
2-year full replacement membrane warranty, section 11		incl.	
ZeeWeed hardware, section 4.2		lot	
cassette refurbishment, ZW500D 48/48M, section 4.3		24 sets	
in-house support, project management, drafting, controls section 5.1		incl.	38,341
international shipment and fees, and duties, section 6		incl.	140,233
freight, DDP project site, section 6	3095534	2 shipments	29,368
on-site support, 2 trips x 3 x 10-hour days total on-site per trip per FSR plus travel & living, section 5.2	135491	2 FSRs over 2 trips	32,200
<b>total price</b>			<b>2,140,288</b>
<b>option to add LEAPmbr aeration upgrade during the term of the agreement – materials, off-site &amp; on-site support not to exceed</b>			<b>222,117</b>
<b>All figures are in USD and exclusive of taxes. Please make purchase order to ZENON Environmental Corporation. Applicable taxes will be added at time of invoicing.</b>			

invoicing schedule	% of total	invoice value, excluding tax
An invoice will be issued upon acceptance by SUEZ of customer purchase order. Shipment of membranes is contingent on receipt of this payment. Values do not include applicable taxes, which will be included at time of invoicing.	100%	<b>2,140,288</b>

### 3.2 annualized payment option

In lieu of upfront payment of the full agreement value, SUEZ can offer equalized annual payment alternatives. For this alternative, SUEZ has proposed an annual fee based on a proposed 10-year payment plan within the agreement duration starting in November 2021. For an extended payment plan, SUEZ incorporates an adjustment to the total price to arrive at a fixed annual fee to ISD over the course of the agreement, eliminating the recurring administrative effort and risk of annual adjustments for inflation. The annual fee will be invoiced each year at the beginning of the period. Should the agreement be terminated for any reason, please see section 12 item 8.

item description	part #	quantity	price
ZW500D RX12 430 ft <sup>2</sup> modules, section 4.1 and attachment d	3168300	1,152	2,349,070
2-year full replacement membrane warranty, section 11		incl.	
ZeeWeed hardware, section 4.2		lot	
cassette refurbishment, ZW500D 48/48M, section 4.3		24 sets	
in-house support, project management, drafting, controls section 5.1		incl.	
international shipment and fees, and duties, section 6		incl.	
freight, DDP project site, section 6	3095534	2 shipments	
on-site support, 2 trips x 3 x 10-hour days total on-site per trip per FSR plus travel & living, section 5.2	135491	2 FSRs over 2 trips	
<b>annual payment</b>		<b>10 payments</b>	<b>234,907</b>
<b>option to add LEAPmbr aeration upgrade during the term of the agreement – materials, off-site &amp; on-site support not to exceed</b>			243,780
<b>annual payment – membrane replacement &amp; LEAPmbr aeration upgrade</b>		<b>10 payments</b>	<b>TBD*</b>
<b>All figures are in USD. Please make purchase order to ZENON Environmental Corporation. Values do not include applicable taxes, which will be included at time of invoicing.</b>			
<b>*Final total and adjusted payments will be determined over remaining term of agreement if option to include LEAPmbr aeration upgrade is selected during the course of the agreement under the annual payment option.</b>			

### 3.3 contractual basis for membrane replacement price

The base price of replacement ZW500D 340ft<sup>2</sup> membrane modules for this project is USD\$925 per module.

SUEZ has guaranteed this price for 20 years subject to adjustment for inflation (North American Consumer Price Index) or a maximum equivalent price per gallon of treatment capacity in the event that the module area/permeability etc. changes such that the same amount of feed water can be treated with fewer modules of the next generation design.

MMRP price escalation - calculation of inflation begins on November 29, 2007 (ISD capital equipment proposal bid due date). MMRP validity will expire at the end of business on November 28, 2027.

Typically, to benefit from guaranteed membrane replacement pricing (MMRP) within the contracted time limits, the customer must both submit a PO and accept membrane delivery with a typical 20-week lead time prior to the GMRP expiry date. For ISD, the MMRP is scheduled to expire during year 7 of this agreement prior to the anticipated membrane replacement schedule of all trains. However, pricing included with this membrane replacement agreement is based on either up-front payment at the current MMRP or holding MMRP pricing through the term of the agreement, locking in the guaranteed membrane pricing beyond the original expiry date.

Membrane replacement prices are quoted FCA, Oakville, Ontario, Canada, with packaging, freight, and taxes extra as the cost of shipping and packaging the membranes to site will depend on the quantity per shipment. Membrane replacement prices are quoted without taxes.

<b>non-warranty adjusted membrane replacement price to November, 2021</b>	<b>USD\$</b>
contractually guaranteed membrane replacement price	\$925.00
inflation index value from NOV, 2007	210.177
forecasted inflation index– NOV, 2021 – (anticipated agreement start date)	271.357
inflation index factor	129.11%
surface area adjustment factor (340ft <sup>2</sup> vs. 430ft <sup>2</sup> )	126.47%
adjusted membrane replacement price for this proposal	\$1,510.38
Significant time delays between the forecasted start date and actual start date of the agreement may lead to adjustment of the membrane price.	

## 4 material description

The following materials are provided within SUEZ's scope of supply.

### 4.1 membrane modules

1,152 x ZeeWeed 500D RX12 430ft<sup>2</sup> wastewater membrane modules. See attachment d for further details.

### 4.2 hardware

- 100 x #118 EPDM permeate spigot o-rings;
- 25 x ZW500D element end cap keys;
- 3 x blank module header sets;
- 2 x DOW 111 o-ring lubricant.

### 4.3 cassette refurbishment

SUEZ will supply components for refurbishment of 24 x ZW500D 48/48M cassettes.

Cassette refurbishment service allows you to fully recondition your cassettes at less cost than purchasing new cassettes. Cassettes will be refurbished at the ISD facility. Cassette refurbishment will include the following:

- removal of all existing plastic parts and associated hardware;
- return of cassettes to the initial factory membrane slack position if slack adjustment has been completed on cassettes;
- installation of all new, current design parts (module mountings, securing mechanisms), and all associated hardware;
- on-site cassette refurbishment service by trained SUEZ field service representatives – details provided in sections 5.2 and 8.2.

### 4.4 warranty

ZeeWeed membrane modules are supplied with a base 2-year membrane module standard warranty against manufacturing defects. For details of the warranty coverage on the membrane modules supplied, please see section 11.

Cassette refurbishment components are provided with a 1-year mechanical warranty. For details of the warranty coverage, please see attachment a, item 6.e 'warranties & remedies'.

---

## 5 SUEZ support

### 5.1 off-site support

#### controls

Provide system controls programming adjustments as required for the new membranes including adjustment of set points for air flow.

#### documentation

The base level of documentation updates will include:

- programmer's table of code changes (change description recorded by tag with one distinct marker bit per change);
- field/hand markups of relevant electrical and P&ID drawings, re-issued electronically;
- P&IDs** – update the process (piping) & instrumentation drawings and reissue electronically;
- controls documents** – update control narrative (CN), controls logic sequence charge (CLSC, also known as CSC) and the operation sequence chart (OSC).

These updates should be filed in the O&M manual as interim documentation.

Due to the very high cost of comprehensive updating of plant documentation with each system upgrade, SUEZ recommends planning a complete documentation update every 1-4 years to coincide with a selected system upgrade.

SUEZ will be pleased to develop a documentation update price quotation on request which may include some or all of the following scope according to its relevance:

- O&M manual** - Provide a fully updated version of the operation & maintenance manual that indicates the changes made with this membrane replacement upgrade.
- electrical drawings** – Update the electrical drawings and reissue electronically.

#### **project management**

Provide planning and off-site assistance during the membrane upgrade project.

## 5.2 on-site technical services

The proposal includes technical services during the installation and commissioning process to support ISD's staff as outlined in section 3. Cassette refurbishment and membrane replacement work should be completed with a team of 3 to 4 people per cassette and SUEZ recommends at least 1 person from plant operations be a member of the team. Please see section 8.2 for SUEZ recommendations on the number of plant staff necessary to perform the work.

Installation and commissioning of membranes will be executed in a manner that minimizes down-time and to returns the system to beneficial use in a timely manner.

The following activities will be carried out jointly by plant staff and SUEZ:

- remove existing membranes/cassettes;
- install cassette refurbishment components;
- install the new membrane modules/cassettes;
- upload required revisions to the PLC program with adjusted set-points;
- perform bubble test where applicable to test membrane integrity and review trans membrane pressure (TMP) on the installed membranes and compare to expected values for new membranes.

**operating responsibility** - ISD retains control of the work site and retains final responsibility for the installation and commissioning process.

SUEZ will perform the services specified in the scope section of this document, but SUEZ will not operate the system. For the purposes of this agreement, the term "operate the system" shall mean to run or control the functioning of the equipment or to otherwise conduct or manage the affairs of any aspect of water or wastewater treatment or other functions at ISD's site, and shall include functions such as providing operators or laborers to adjust or control water treatment ("WT") equipment, wastewater treatment ("WWT") equipment or sludge management facilities ("SMF"), providing program oversight or directing on-site or contract operators/laborers to adjust or control WWT or SMF, providing personnel responsible for or providing oversight of water treatment residual quality,

wastewater effluent quality, sludge quality, waste characterization, or waste disposal activities, or providing personnel with continual or daily operational responsibilities with respect to water or wastewater treatment, influent or effluent compliance monitoring, process monitoring, government reporting or notification, or permit compliance.

**waiting time** - Any overtime or waiting times required due to unforeseen site events outside the control of SUEZ will be invoiced according to the prevailing SUEZ service labor rates sheet, available on request.

**reporting** - Before leaving site, SUEZ will record observations and discuss with operators concerning the condition of the equipment, tasks accomplished during the visit, and key operating and maintenance issues requiring further attention. SUEZ will provide a copy of a written report before leaving site and/or provide a service visit report to the plant operator within a reasonable timeframe of the SUEZ service representative's return to the office. In any case, ISD will be asked to sign a work order that describes the hours on site and tasks accomplished.

#### **SUEZ duties for on-site services**

- SUEZ will coordinate its work under this agreement in a reasonable manner with the operating staff of the facility.
- SUEZ will maintain public liability and property damage insurance covering all operations undertaken by SUEZ and its sub-contractors with a limit of \$5,000,000 inclusive for any one accident or occurrence. If for any reason additional insurance coverage (e.g. general construction/erection all risk, general liability) is required above and beyond SUEZ's standard insurance terms for on-site commissioning supervision, ISD must inform SUEZ in writing 60 days prior to work commencement at site. ISD will be billed for all additional insurance costs and processing fees.
- SUEZ will maintain workers compensation and employers' liability coverage as per statutory requirements.

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## 6 delivery

- freight**
  - DDP** - Delivery will be by standard ocean/ground on the basis of DDP Ironhouse Sanitary District Wastewater Treatment Plant, or other named place of destination; Incoterms 2020. DDP = delivery duty paid. Partial shipments will be acceptable unless otherwise specified. Where delivery cannot be accepted at this destination, ISD shall specify an alternate, equivalent destination without delay.

Due to varying origins and availability, non-membrane items included in this proposal may be shipped separately from the membranes. Should separate shipments be required, where possible, SUEZ will strive to provide these items on or before the delivery of the membranes

- ❑ **title & risk** - Title and risk of loss or damage to membrane modules, shipping frames, cassette refurbishment components and crating shall pass to ISD upon delivery at the named place of destination.
- ❑ **international shipment, fees, and duties**
  - ❑ **origin** - Delivery of ZeeWeed membranes originates from the SUEZ Water Technologies & Solutions, ZENON Membrane Products (ZEM), Bláthy Ottó u 4, Oroszlány, 2840 Hungary facility. Costs to transport membranes into North America are included in SUEZ's quoted price.
  - ❑ **export documents** - All ZeeWeed membrane module shipments into the USA require clearance documentation from the EPA. SUEZ will prepare and provide the required EPA documentation to the Carrier.
  - ❑ **MPF** - Merchandise processing fee is a fee assessed for formal custom entries based on 0.35% of the invoice value, with a minimum of USD \$25 per formal entry and a maximum of USD \$485. On the basis of DDP terms, this fee will be paid by SUEZ within the quoted price.
  - ❑ **duty** - A US Customs duty of 3.9% applies to all ZeeWeed membranes shipped individually or in shipping frames; not in operational cassette frames. On the basis of DDP terms, this duty will be paid by SUEZ within the quoted price. Any new duty imposed after the date of this proposal is the responsibility of ISD.
- ❑ **taxes** - All applicable local, state, or federal taxes are the responsibility of ISD.
- ❑ **temperature** - UF membranes cannot be allowed to freeze or overheat and may require temperature-controlled freight and handling according to the season and the planned routing. If required, the price of temperature control will be included within the firm quote on freight by SUEZ.
- ❑ **packaging** - membranes will be provided in a combination of factory-installed in shipping frames, and individually bagged, boxed and crated, ready for ocean shipment.
- ❑ **unloading** - may require one of or a combination of a loading dock, extended forks and an experienced fork lift driver at delivery destination. Please consult with SUEZ at the time of purchase order (PO) preparation on this.

shipping crate information (estimated) – for each replacement event (2 trains)

qty	description	dimensions (in)	weight (lb)
19	ZW500D 30M shipping frame	L=93 x W=37 x H=96	2,622
1	ZW500D 4-module crate	L=93 x W=38 x H=28	550
1	ZW500D 2-module crate	L=93 x W=38 x H=18	300

notes:

- only crates for membrane transport have been shown above to identify the largest and heaviest items that will need to be unloaded;
- smaller crates/skids not shown above will be used for hardware and cassette refurbishment components.

❑ **availability**

Delivery of membrane modules and cassette refurbishment components is currently 18 - 22 weeks after each request for membranes.

Definitive membrane module and cassette refurbishment components availability will be confirmed upon receipt of each request from ISD. SUEZ will work with ISD to plan ahead for replacements so that inventory is available when membranes are requested to ship to site.

## 7 ZeeWeed configuration

configuration data	units	existing plant configuration	proposed configuration after replacement/upgrade
number of trains, plant		4	4
type of ZeeWeed membrane		500D	500D
module surface area	ft <sup>2</sup>	340	430
total number of cassette spaces per train		9	9
maximum number of modules per cassette		48	48
fully populated cassettes installed per train		7	6
flex cassettes installed per train		---	---
total module count, train		336	288
total surface area in operation, train	ft <sup>2</sup>	114,240	123,840
total module count, plant		1,344	1,152
total surface area in operation, plant	ft <sup>2</sup>	456,960	495,360
% surface area change from existing, plant	%	---	8.4%

## 8 scope - ISD

### 8.1 installation preparation

- ❑ Receive, off-load, handle and provide temperature-controlled storage of the equipment and materials required for Seller to perform the duties outlined in the Seller’s scope of supply. Prior to off-loading, Buyer to confirm temperature indicators have not been tripped.
- ❑ Membranes must be stored in a sheltered area, protected from freezing, direct sunlight or extreme heat, and sealed as shipped until ready for use. Storage should be in a dark, dry, level area at a temperature of 5-30°C (41-86°F). Membranes have a shelf life of 1 year before requiring re-preservation and should not be stored longer

than necessary prior to installation. ISD is responsible for risk of loss of Seller's parts while in storage at the customer's plant.

- Inspect, evaluate and make repairs as required for the membrane tanks, mounting brackets, hoses and all connections prior to SUEZ arriving at site.
- Provide all access structures (such as scaffolding) and mechanical lifting equipment including cranes, forklifts and scissor lifts.
- Assure availability of a copy of the operating manual, all process and instrumentation drawings, and all electrical drawings on site and accessible for reference.
- Maintain adequate insurance coverage for the risks of fire, theft, vandalism, floods and personal injury to authorized or unauthorized visitors.

## 8.2 installation

- Provide 4-6 plant personnel to work continuously for the full duration of the SUEZ site visits during installation and commissioning of the modules. SUEZ recommends that at least one of the personnel be experienced with the ZeeWeed system.
- ISD will afford Seller's personnel free access and egress of the facility for all authorized work. ISD will provide reasonable access to workshop facilities with standard workshop tools and equipment as is necessary to meet any repair and maintenance requirements of the system during installation. ISD will provide Seller's personnel reasonable access to the facility amenities, including washrooms and break rooms.
- Provide adequate illumination and emergency lighting for all areas in which the Seller will be executing the scope of supply. Provide all site utilities such as raw water, instrument quality air, potable water and power required for operation of the proposed equipment included in this scope of supply. Assure that adequate quantities of membrane cleaning and neutralizing chemicals are on hand for wash procedures including sodium hypochlorite, sodium bisulphite, citric acid and sodium hydroxide. Supply telephone/fax/modem access while Seller's staff members are on-site.
- ISD will:
  - remove cassettes from the system as required;
  - clean each cassette as it is removed from the system;
  - return the cassettes to the system;
  - dispose of all retired membrane modules and cassette components;
  - dispose of shipping and packaging materials unless specifically requested not to do so by SUEZ;
  - prepare shipping frames for return to SUEZ – see section 8.3.
  - load shipping frames onto the truck for return to SUEZ – SUEZ will be responsible for organizing the logistics of delivery back to SUEZ.

- ❑ ISD will provide assistance to:
  - ❑ install cassette refurbishment components;
  - ❑ place new modules into each cassette.

### 8.3 empty shipping frame preparation

All shipping frames returning to Hungary must be well cleaned and packaged appropriately for trans-oceanic transport in shipping containers. Shipping frames should be cleaned using high pressure washers and mounted on wood skids to facilitate moving them in and out of the freight containers. Failure to properly clean the frames may lead to additional labor that will be passed along to ISD. SUEZ can provide ISD off-site assistance to facilitate the return of shipping frames.

All wooden packaging material used for international shipments must conform to current phytosanitary standards to reduce the risk of introduction and spread of quarantine pest species associated with the movement in international trade of wood packaging material made from raw wood.

All wood packaging material used to transport shipping frames internationally, must comply with ISPM15 which is the standard for phytosanitary measures and be properly stamped indicating compliance with the standard. Failure to comply with the standard may lead to shipment refusal and subsequent project delays. For detailed information on ISPM15 please visit the [ISPM15](#) website.

Whenever possible, save and re-use the wooden skids that the shipping frames arrived on for return freight purposes.

Frame shipping orientation: ZW500D shipping frames are shipped upright.

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## 9 solution design notes

### 9.1 permits

#### regulatory requirements

ISD is responsible to review and report to the permit granting agency on the impact of any of the proposed changes on the regulatory permit. SUEZ will provide the necessary manufacturer's technical support on regulatory issues.

***Please speak with your regional lifecycle manager (RLM) if there are any regulatory requirements or concerns.***

#### utilization

SUEZ understands that these modules are required as replacements for currently installed modules.

These modules are offered on the basis that the membrane modules will not be used to provide expanded flow beyond the current plant flow rating. SUEZ makes no guarantees,

implied or otherwise as to the performance of these modules in any other capacity than as replacement membranes.

Replacing the current 28 cassettes of ZW500D 340ft<sup>2</sup> modules with 24 cassettes of ZW500D RX12 430ft<sup>2</sup> modules provides a slight increase in current membrane surface area (495,360ft<sup>2</sup> vs. 456,960ft<sup>2</sup> = 8.4%) and takes 4 cassettes (1 per train) out of operation, leaving the cassette spaces empty for future module placement that could be used for flux reduction or for plant expansion subject to a review of the limitations of other equipment and hydraulic capacities.

**production interruption**

During installation of the ZeeWeed cassettes, trains will be shut down which will affect ISD treatment capacity. SUEZ’s project manager for each installation will consult with ISD to jointly develop the installation plan and work schedule with due regard for membrane delivery to the plant and plant preparation.

**9.2 maintenance notes for replacement membranes**

At the time of any full plant or train membrane replacement, it is recommended to evaluate whether it is the right time to address any tank coating repairs which may be required.

**preferential flow**

Preferential flows can create a risk of over-fluxing of new modules when they are installed in the same train with older modules. The mixing of old and new modules in the same cassette also makes management of slack adjustment more difficult. SUEZ recommends that ISD plan membrane module replacement on a complete cassette and complete train basis wherever possible to achieve both optimal performance and best value from the new membrane modules. In this case, by replacing all membrane modules on a train by train basis, this risk has been neutralized.

**membrane slack**

SUEZ’s membranes are supplied and shipped with an initial factory fiber slack designed to optimize membrane air scouring during operation as well as accommodate a degree of shrinkage. Membranes shrink in length early in their lifecycle when exposed to higher temperature water. The pace of shrinkage slows with age. With the installation of new membranes, the requirements for slack adjustment start a new cycle.

Due to the wide variety of operating environments in which our products can be utilized, it is difficult to generally predict the rate of shrinkage. If membranes operate in a condition of insufficient slack for an extended period of time, irreversible damage to the fiber-urethane bond may occur. Please refer below to the recommended inspection frequencies based on your plant’s membrane tank operating temperature. Visual inspections should begin during the membrane installation and be repeated over time on the same cassette. Digital pictures will allow for comparative analysis of the fiber slack over time.

maximum operating temperature	recommended slack inspection frequency
0-24 °C / 32-76 °F	every 2 years
25-30 °C / 77-86 °F	once per year
>30 °C / > 86 °F	twice per year

**bubble test pressure**

The bubble test pressure for the purchased membranes is 2 psi horizontally and 3 psi vertically.

**9.3 technical**

**benefits of ZW500D RX12 430ft<sup>2</sup> modules**

The technical and economic advantages of the ZW500D RX12 modules include:

- 26.5% increase in membrane module surface area to the current 500D 340ft<sup>2</sup> membrane, providing ISD a slight increase in total surface area using one less cassette per train;
- increased membrane module surface area without any changes to the overall dimensions of the module;
- no increase in chemicals for maintenance or recovery cleans due to increased surface area;
- improved membrane chemistry that allows for greater permeate productivity per square foot of membrane area without impacting water quality;
- manage membrane flux by increasing the membrane surface area in the plant while keeping plant flows the same. Lowering membrane flux puts less stress on the membrane modules and oftentimes extends the membrane's natural lifecycle.

**other considerations**

**hoses & fittings**

SUEZ has assumed for this proposal that the current aeration and permeate cassette connections for the ZW500D cassettes do not need replacing at this time. If this is not so, please advise SUEZ and request that they be added to this proposal.

**blowers**

SUEZ has reviewed the range of blower capacity which is sufficient for this upgrade. SUEZ will assist ISD in determining the correct air flow requirements for each stage of the membrane replacement.

**MLSS concentration**

MLSS concentration in the membrane tank during annual average, max month, and max week flows must not exceed 10 g/L and during max day and peak hour flows must not exceed 12 g/L.

**pre-screen**

Trash and non-biodegradable solids, such as hair, lint, grit and plastics may foul or damage the membranes if allowed to pass into the membrane chamber. SUEZ recommends that an internally-fed screen with mesh or punched-hole openings less than or equal to 2 mm with no possibility of bypass or carryover be operated upstream of the new membranes to ensure effective operation and to maximize membrane life.

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## 10 health & safety

### ISD

- ❑ ISD will provide orientation to Seller's personnel to ensure site-specific safety protocols are known. ISD will identify and inform Seller's personnel of any site-specific hazards present in the work place that could impact the delivery of Seller's scope of supply and agrees to work with Seller to remove, monitor, and control the hazards to a practical level.
- ❑ ISD will provide any site-specific or standard company operating procedures and practices for Seller's personnel to perform work on site, if required by ISD's policies. Such programs may include, but are not limited to, general environmental health & safety (EHS), HAZOP, fire protection, drug testing, incident notice, site conduct, standard first aid, chemical receiving, electrical safety, etc. ISD will provide a certificate of program completion for Seller's personnel. This program will be fully documented, training materials will be provided, and attendance list will be kept.
- ❑ If any type of lifting devices will be used on site, ISD will provide proof of its maintenance, inspection and certification documentation upon request and will assist the SUEZ service representative to complete a safety inspection checklist.
- ❑ Where confined space entry may be required, ISD will provide early notice and will collaborate with SUEZ in planning adequate staffing and in advising the local fire/rescue department as required.
- ❑ No time or cost provision has been made for preparations such as safety record clearances, drug testing, insurance confirmations or pre-job-training in excess of 1 hour. Prior to finalizing the Purchase Order and the work schedule, ISD will advise SUEZ of any pre-job or pre-mobilization requirements. Where these requirements exceed 1 hour, this time will be charged to ISD at rates set out in the prevailing SUEZ labor rate sheet.
- ❑ Where certain short duration activities require two people for safety and the SUEZ Service representative is alone at site, ISD will cooperate as required to assure that correct safety precautions are taken.
- ❑ ISD is responsible for the following environmental provisions:
  - environmental use and discharge permits for all chemicals at ISD's facility either listed in this document or proposed for use at a later date;
  - any special permits required for Seller's or ISD's employees to perform work related to the water treatment system at the facility;
  - all site testing, including soil, ground and surface water, air emissions, etc.;
  - disposal of all solid and liquid waste from the Seller's system including waste materials generated during construction, start up and operation.

- ❑ ISD is responsible for provision of health and safety facilities to Seller's field service representatives to the same extent that they are provided to ISD's own employees, including provision of:
  - eyewash and safety showers in the water treatment area;
  - chemical spill response;
  - security and fire protection systems per local codes;

**SUEZ**

- ❑ All work on site will be performed in accordance with applicable law and will be performed reasonably, in a clean and safe manner. The SUEZ service representative will abide by the more stringent of the applicable health, safety and environmental policies and procedures of either ISD or SUEZ.
- ❑ SUEZ will provide all applicable safety training required by SUEZ policies or by state or national health and safety regulations. The SUEZ service representative will have undergone workplace hazardous material information system (WHMIS) training and will come equipped with necessary personal protective equipment (PPE).
- ❑ Emergencies - In emergencies affecting the safety of persons, work or property at the site and adjacent thereto, SUEZ will act, without previous instructions from ISD, as the situation warrants. SUEZ will notify ISD immediately thereafter.

# 11 ZeeWeed Membrane Module Standard Warranty

This schedule sets out the warranty with respect to ZeeWeed membrane modules (“membrane modules”). No other warranties, expressed or implied are made in connection with the sale of these products, including, without limitation, warranties as to fitness for any purpose or use or merchantability of these products. The warranty provided herein will be the exclusive and sole remedy of Buyer. This warranty is not transferable.

## 1 Definitions

The following terms shall have the meaning set forth below when used in the warranty document:

- a. “Buyer” means the party purchasing the ZeeWeed Modules from the Seller
- b. “Seller” means a business component of, or legal entity within the SUEZ Water Technologies & Solutions business which is selling the ZeeWeed membranes.

## 2 Warranty Product

This warranty applies to only the membrane modules supplied under the contract of sale. Membrane module means the hollow fiber ultrafiltration membranes and the potted plastic headers. This warranty does not cover air piping to the membrane module, permeate piping from the membrane module, piping connection fittings, connecting hardware and cassette frames with their associated components including but not limited to spacers, aerator tubes, aerator assemblies, screen, module dummies or module blanks.

## 3 Scope of Warranty

The Seller warrants that its membrane module(s) will be free of defects due to faulty materials or errors in manufacturing workmanship.

Regular membrane module inspection and normal fiber repair shall be the responsibility of Buyer.

All replacement membrane modules will be shipped on the basis of INCOTERMS 2020 FCA SUEZ manufacturing facility.

All ancillary costs including but not limited to bagging, boxing, crating, freight, freight insurance, applicable taxes, import duties, certifications, brokerage, receiving, forklift services, storage at site, reattachment hardware, hose/clamp/camlock replacement, crane services, installation, fiber repair materials, glycerin flushing, commissioning and waste disposal are the responsibility of Buyer.

## 4 Warranty Start Date

Membrane warranty will start on the earlier of:

- a. The date that installation of the original membrane module(s) has been substantially completed, or
- b. Three (3) months from the date of delivery of the original membrane module(s) to Buyer.

## 5 Warranty Duration

**Total Warranty Duration:** a total of **24** months of full replacement warranty coverage.

## 6 Notification of Claim

All claims filed under this warranty shall be made in writing by Buyer within 30 days of identifying a defect.

Buyer shall provide the following information:

- a. A description of the defect giving rise to the claim;
- b. Photographs showing the manufacturing defect;
- c. The serial number(s) of the membrane module(s) which is (are) the subject of the warranty claim; and
- d. Operating data and repair history for the life of membrane modules which are the subject of a warranty claim.

## 7 Verification of Claim

After receipt of written notification of a defect, the Seller will promptly undertake such investigations as, in the Seller's opinion, are necessary to verify whether a defect exists. The Seller reserves the right to require additional data as necessary to validate claims. Buyer may, in the course of these investigations, be requested to return membrane module(s) to the Seller for examination (see item 11). The Seller may also conduct reasonable tests and inspections at Buyer's plant or premises. If the results of the investigation do not validate the defect claimed, Buyer will reimburse the Seller for all reasonable expenses associated with said investigation, including expenses for all tests, inspections, and associated travel.

## 8 Satisfaction of Claims

The Seller will have the right to satisfy claims under this warranty in a flexible manner. Such flexibility may include the repair of existing membrane modules or changes in operating protocols or membrane module replacement or by upgrading failed membrane modules with newer membrane module(s) that may embody design and efficiency improvements. Buyer consents to the supply of replacement membrane modules which may be of a different design than original membrane modules.

## 9 Operating Information

To maintain the membrane module warranty, membrane system operation records from initial start-up date until claim must be maintained by Buyer and made available to the Seller upon request. Records must be provided in sufficient detail as applicable to verify the subject of a warranty claim and can include but is not limited to, operation data including information on feed water quality, temperatures, flows, trans-membrane pressures, aeration rates, permeate quality, cleaning intervals, cleaning chemical concentrations, elapsed time since start-up, relevant analytical data and reporting of any screen bypass events.

Buyer shall maintain and share access to a single reference copy in electronic form of a membrane module map containing the history of activity by membrane module and the serial number for each module. Buyer shall log its procedures performed related to a membrane module including relocation of membrane modules, repairs, replacements and any other noteworthy events.

Buyer authorizes the Seller to conduct any reasonable review of operation and maintenance records or to inspect facilities where membrane modules are installed, upon reasonable notice to Buyer. Such reviews and/or inspections are intended to also assist the Seller and Buyer in detection of membrane system faults and to optimize the care and operation of the membrane modules.

## 10 Limitation of Warranties

Occurrence of any of the following as reasonably determined by the Seller will void this warranty:

- a. A material failure to operate the membrane system in accordance with Seller's operations and maintenance manual supplied to Buyer as part of the contract, including material failure to adhere to the Seller's specified membrane module cleaning procedures and the use of anything other than Seller-approved membrane module cleaning agents.
- b. Failure to adhere to the preventive maintenance program as presented in the Seller's operations and maintenance manual, in published product manuals and in specifications.
- c. Failure to adhere to all transportation and storage requirements. ZeeWeed membrane modules may be stored up to 12 months from date of receipt and must be transported and stored in original intact packaging out of direct sunlight in ambient temperatures between 5-35 Degrees Celsius. Storage beyond 12 months from date of receipt requires a written request to SUEZ to maintain membrane module warranties.
- d. Introduction of destructive foreign materials and chemical agents into the membrane module.
- e. Failure to maintain and provide system operating data and repair history for the life of membrane modules which are the subject of a warranty claim.
- f. Physical abuse or misuse, incorrect removal or installation of membrane modules by non-Seller personnel including fiber damage caused by operator error in handling of membrane modules or cassettes.
- g. Unauthorized alteration of any components or parts originally supplied by the Seller.
- h. Intentional damage.

## 11 Return Procedure

In the event that the return of a membrane module is required pursuant to this warranty, Buyer will first obtain a Return Goods Authorization (RGA) number from the Seller. Membrane module(s) shipped to the Seller for warranty examination must be shipped freight prepaid in environmentally controlled freight and storage with ambient air temperature between 5-35 degree Celsius. If Buyer desires temporary replacement membrane module(s) to replace those alleged to be defective and returned to the Seller for warranty examination, Buyer shall be responsible for the cost associated with any such replacements until examination of the returned membrane modules pursuant to this warranty is complete. Any membrane module examined by Seller as part of a warranty claim where the membrane module is subsequently found to be performing as warranted or where a membrane module failure is not covered under the warranty will be returned to Buyer, freight collect or disposed of by Seller and the cost associated with any membrane analysis and diagnostic work will be levied against the Buyer based on SUEZ standard labor rates.

## 12 Disclaimer and Limitation on Liability

To the maximum extent permitted by law, in no event shall Seller be liable for any loss of profit or revenues, loss of production, loss of use of equipment or services or any associated equipment, interruption of business, cost of capital, cost of replacement water or power, downtime costs, increased operating costs, claims of Buyer's customers for such damages, or for any special, consequential, incidental, indirect, punitive or exemplary damages arising out of or relating to the performance or actual or alleged breach of the agreement, regardless of whether a claim is based in contract (including warranty or indemnity), extra-contractual liability, tort (including negligence or strict liability), statute, equity or any other legal theory.

## 12 terms and conditions of sale

### a - specific terms and conditions of sale

These terms take precedence over the general terms and conditions of sale.

#### 1 legal entity for contracting

**ZENON Environmental Corporation** is the name of the Seller, and means a business component of, or legal entity within the SUEZ Water Technologies & Solutions business (SUEZ).

Please advise us if this SUEZ entity is not set up in your purchasing system as a vendor and you do have another SUEZ entity set up. We are keen to make the purchase process as convenient as possible for ISD.

**short form:** Where a short reference is required in this document, for convenience, we are called simply **SUEZ**.

#### 2 payment

SUEZ prefers to receive payment by wire transfer and will also accept payment by courier check.

<b>Wire transfer information for ZENON Environmental Corporation</b>	
send details to: SHD WATS REMIT-NAM <a href="mailto:shd-wats-remit-nam@suez.com">shd-wats-remit-nam@suez.com</a>	
Bank of America Merrill Lynch C/O ZENON Environmental Corporation 901 Main Street Dallas, TX 75202	ACCT# 4426318136 ABA# 026009593 SWIFT# BOFAUS3N ACH# 111000012

#### 3 payment terms

**On approved credit**, payment terms are net 30 days from customer receipt of invoice. Please see the invoicing schedule in the price section. In the event an invoice is issued on shipment of goods from a SUEZ Hungarian production facility, payment terms will be extended by an additional 45 days to account for the additional transit time to the delivery location.

#### 4 proposal validity

Prices quoted and proposal terms are valid up to thirty (30) days after the date of issue of this proposal unless confirmed with a purchase order.

#### 5 bonds

Performance or payment bonds are not included in the price. These bonds can be purchased on request but will be at an additional cost.

#### 6 assignment of membrane warranty

The Buyer will be entitled to assign to a subsequent owner of the membranes the warranties of the Seller under this Agreement, provided that a prior written notification is sent to the Seller and the assignment agreement contains terms and conditions which provide the Seller with the protections of the warranties and limitations on liability contained in the Agreement. Subject to Buyer's compliance with the foregoing requirement, such warranty rights are expressly assignable by the Buyer to a subsequent owner of the membranes. Except as provided herein, Buyer is not entitled to extend or transfer this warranty to any other party.

#### 7 flight booking

Prices quoted for installation which include airfare are either based on timely confirmation of a visit schedule or based on receipt of a purchase order in time to book any flights seven days in advance. Additional airfare charges related to late arrival of a purchase order will be extra and billed through to ISD without mark-up.

SUEZ confidential and proprietary information

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## 8 early termination

In the event of contract termination other than as defined in attachment a.15 of this agreement the following will apply:

- SUEZ will initiate delivery of all materials and services for which payment has been received in excess of the value of materials and services provided by SUEZ at the time of cancellation.
- Buyer will, within 30 days, make a payment to SUEZ equal to the value of materials and services provided to the point of termination, less the cumulative sum of payments paid by Buyer.
- Once terminated, there is no option to restart the agreement. No penalties or reimbursements, other than those outlined in this agreement, shall be paid by either party

## 9 warranty on programming

SUEZ warrants that the PLC program will conform to the specifications in the relevant sections of the CLSC and OSC (revised for the project) and will be free from defects in workmanship when operated at all times in accordance with SUEZ's written instructions. If any defects are found and reported by ISD within a period not exceeding twelve (12) months beyond the completion of the site acceptance test, SUEZ will make modifications to the PLC code as deemed necessary. Any changes requested by ISD after this period will be at the customer's expense.

## 10 purchase order guidelines

Please confirm that your purchase order has covered the following points. This will ensure accurate and prompt order entry, product delivery, invoicing and accounts receivables processing and will prevent administrative delays for all parties.

- documentation** – Our strong preference is to receive a hard or digital copy of your purchase order (PO) rather than a PO number alone. Your PO can be sent by email to [service.pocentral.wts@suez.com](mailto:service.pocentral.wts@suez.com). If you are not able to provide a PO, please contact us for alternatives.
- SUEZ legal entity** – Please be sure your purchase order is issued in the name of the specific SUEZ legal entity outlined in the quote. We will be glad to work with your purchasing department to set this entity up as an approved supplier/vendor. Please advise us if this SUEZ entity is not set up in your purchasing system as a vendor and you do have another SUEZ entity set up.
- quotation number** – Please reference the quotation number in your PO.
- product** – Please note which product(s) you wish to purchase along with the quoted price, particularly if quantities or scope differ from the quotation.
- taxes** – Please provide any required tax exemption certificates. Please indicate if taxes have been added in your PO.
- payment terms** – Please acknowledge the payment terms included with the quotation.
- bill-to address** – Please include contact information for your accounts payable.
- ship-to address** – Please clearly define the delivery location and the receiver's email & telephone. Please specify receiving hours and any special off-loading requirements.
- delivery date** – Please include your requested delivery date.

## b – general terms and conditions of sale

SUEZ's standard terms and conditions apply. See attachment a.

Note to purchasing agent: The SUEZ's standard set of commercial terms & conditions are written for moderate value transactions to allow an efficient and rapid provision of services and parts. Where corporate agreement terms have been previously agreed, these may be brought forward by either party and applied by mutual consent. If either of these terms sets are not immediately acceptable, please expect a typical 6-10 week cycle of mutual review to build agreement on changes.

# 13 signed agreement

Through the issue of this proposal, SUEZ signals their intent to enter into an agreement with ISD. ISD and SUEZ acknowledge that they have read and understood this agreement and agree to be bound by the terms and conditions specified in it.

**offered by legal entity:** ZENON Environmental Corporation, also known as SUEZ or Seller

**accepted by legal entity:** Ironhouse Sanitary District, also known as ISD or Buyer

**authorized signature by:** \_\_\_\_\_

**title:** \_\_\_\_\_

**signature date:** \_\_\_\_\_

**signature:** \_\_\_\_\_

x

**purchase order no:** \_\_\_\_\_

Upon acceptance of this proposal, please forward the following either

• by email with .pdf attachments or • by postal mail or • by fax.

1) this signature page completed to:

- 2) a hard copy of your purchase order, and
- 3) any required tax exemption certificates

[service.pocentral.wts@suez.com](mailto:service.pocentral.wts@suez.com)

or

SUEZ Water Technologies & Solutions

attention: Contracts Administrator

Please contact

[service.pocentral.wts@suez.com](mailto:service.pocentral.wts@suez.com)

for correct address

or

fax no.: 905 465 3050

This agreement comes into force when SUEZ has issued a formal acceptance of ISD's Purchase order or formal acceptance of this ISD signed agreement.

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## attachment a SUEZ standard terms and conditions

### general terms and conditions of sale

- 1. exclusive terms and conditions.** Together with any other terms the Parties agree to in writing, these General Terms and Conditions – together with the last proposal in order of time issued by the Seller – form the exclusive terms (“Agreement”) whereby Buyer agrees to purchase, and Seller agrees to sell products and equipment (jointly “Equipment”) and to provide advice, instruction and other services in connection with the sale of that Equipment (“Services”). If Buyer sends to Seller other terms and conditions to which Seller may not respond, including but not limited to those contained in Buyer’s purchase order, such shall not apply. This Agreement may only be revised by a change order approved in writing by both Parties. All terms not defined herein shall be defined in Seller’s proposal.
- 2. equipment and services.** The Equipment to be delivered and the Services to be provided shall be as set out in this Agreement. Unloading, handling, storage, installation, and operation of Buyer’s systems or the Equipment are the responsibility of Buyer. Buyer shall not require or permit Seller’s personnel to operate Buyer’s systems or the Equipment at Buyer’s site.
- 3. prices and payment.** Buyer shall pay Seller for the Equipment and Services in accordance with the payment schedule (as set forth in Seller’s proposal or, if applicable, in any special conditions agreed to in writing by the Parties). Unless otherwise specified in writing, payment is due net thirty (30) days from the date of Seller’s invoice. Seller may require a Letter of Credit or other payment guarantee, in which case the stated amount of the guarantee will be adjusted by Buyer in the event of any currency-based adjustment to prices or payment amounts per the Payment Schedule, and Buyer shall deliver the adjusted guarantee within five (5) days of request by Seller. Buyer agrees to reimburse Seller for collection costs, including 2% (two percent) interest per month (not to exceed the maximum amount permitted by applicable law), should Buyer fail to timely pay. Buyer shall have no rights to make any deduction, retention, withholding or setoff relating to any payments due under this Agreement.
- 4. taxes and duties.** Seller shall be responsible for all corporate taxes measured by net income due to performance of or payment for work under this Agreement (“Seller Taxes”). Buyer shall be responsible for all taxes, duties, fees, or other charges of any nature (including, but not limited to, consumption, gross receipts, import, property, sales, stamp, turnover, use, or value-added taxes, and all items of withholding, deficiency, penalty, addition to tax, interest, or assessment related thereto, imposed by any governmental authority on Buyer or Seller or its subcontractors) in relation to the Agreement or the performance of or payment for work under the Agreement other than Seller Taxes (“Buyer Taxes”). The Agreement prices do not include the amount of any Buyer Taxes. If Buyer deducts or withholds Buyer Taxes, Buyer shall pay additional amounts so that Seller receives the full Agreement price without reduction for Buyer Taxes. Buyer shall provide to Seller, within one month of payment, official receipts from the applicable governmental authority for deducted or withheld taxes. Buyer shall furnish Seller with evidence of tax exemption acceptable to taxing authorities if applicable, prior to execution of the Agreement by both Parties or issuance by the Seller of the order acceptance. Buyer’s failure to provide evidence of exemption at time of order will relieve Seller of any obligation to refund taxes paid by Seller.
- 5. delivery, title, risk of loss.** Unless otherwise specified in this Agreement, Seller shall deliver all Equipment to Buyer FCA (Incoterms 2020) Seller’s facility. The time for delivery of the Equipment to Buyer shall be specified in this Agreement. Seller’s sole liability for any delay in delivery of the Equipment shall be as expressly set out in this Agreement. The place of delivery specified herein shall be firm and fixed, provided that Buyer may notify Seller no later than forty-five (45) days prior to the scheduled shipment date of the Equipment of an alternate point of delivery, Buyer shall compensate Seller for any additional cost in implementing the change. If any part of the Equipment cannot be delivered when ready due to any cause not attributable to Seller, Buyer shall designate a climate-controlled storage location, and Seller shall ship such Equipment to storage. Title and risk of loss shall thereupon pass to Buyer, and amounts payable to Seller upon delivery or shipment shall be paid by Buyer along with expenses incurred by Seller. Services provided herein shall be charged at the rate prevailing at the time of actual use and Buyer shall pay any increase, and Buyer shall pay directly all costs for storage and subsequent transportation. Failure by Buyer to take delivery of the Equipment shall be a material breach of this Agreement.

Title and risk of loss to the Equipment shall be transferred from Seller to Buyer at the point of delivery upon handover in accordance with this Agreement. Title and risk of loss to the Services shall pass as they are performed.

- 6. warranties and remedies.** Seller warrants that Equipment shall be delivered free from defects in material, workmanship and title and that Services shall be performed in a competent, diligent manner in accordance with any mutually agreed specifications. Seller’s warranty does not cover the results of improper handling, storage, installation,

commissioning, operation or maintenance of the Equipment by Buyer or third parties, repairs or alterations made by Buyer without Seller's written consent, influent water which does not comply with agreed parameters, or fair wear and tear.

Unless otherwise expressly provided in this Agreement, the foregoing warranties are valid for:

- (a) chemicals and Services, for six (6) months from their date of delivery or the provision of Services;
- (b) consumables, including filters and spiral wound membranes (other than spiral wound membranes for process treatment), the earlier of twelve (12) months from date of first use or fifteen (15) months from their date of delivery;
- (c) spiral wound membranes for process fluid treatment, ninety (90) days from their date of first use;
- (d) ultrafiltration membranes (ZW500, ZW700B, ZW1000, ZW1500), twelve (12) months from their date of delivery;
- (e) Equipment other than chemicals and consumables, the earlier of, fifteen (15) months from delivery or shipment to storage, or twelve (12) months from start-up/first use;
- (f) software, ninety (90) days from the date of receipt;
- (g) Equipment not manufactured by Seller, the warranty shall be the manufacturer's transferable warranty only,

Any claim for breach of these warranties must be promptly notified in writing, and Buyer shall make the defective item available to the Seller, or the claim will be void. Seller's sole responsibility and Buyer's exclusive remedy arising out of or relating to the Equipment or Services or any breach of these warranties is limited to repair at Seller's facility or (at Seller's option) replace at Seller's facility the defective item of Equipment, and re-perform defective Services. In performance of its obligations hereunder, Seller will not control the actual operation of either Buyer's systems or the Equipment at the Buyer's site.

Warranty repair, replacement or re-performance by Seller shall not extend or renew the applicable warranty period.

The warranties and remedies are conditioned upon (a) proper unloading, handling, storage, installation, use, operation, and maintenance of the Equipment and Buyer's facility and all related system in accordance with Seller's instructions and, in the absence, generally accepted industry practice, (b) Buyer keeping accurate and complete records of operation and maintenance during the warranty period and providing Seller access to those records, and (c) modification or repair of Equipment or Services only as authorized by Seller in writing. Failure to meet any such conditions renders the warranty null and void.

The Buyer will be entitled to assign to a subsequent owner of the Equipment the warranties of the Seller under this Agreement, provided that a prior written notification is sent to the Seller and the assignment agreement contains terms and conditions which provide the Seller with the protections of the warranties and limitations on liability contained in the Agreement. Subject to Buyer's compliance with the foregoing requirement, such warranty rights are expressly assignable by the Buyer to a subsequent owner of the Equipment. Except as provided herein, Buyer is not entitled to extend or transfer this warranty to any other party. The warranties and remedies set forth in this article are in lieu of and exclude all other warranties and remedies, statutory, express or implied, including any warranty of merchantability or of fitness for a particular purpose.

Unless otherwise expressly stipulated in this Agreement, Seller gives no warranty or guarantee as to process results or performance of the Equipment, including but not limited to product quality, flow, production, capacity, membrane life, chemical consumption, regulatory compliance or energy consumption.

**7. general indemnity.** Seller shall indemnify and hold harmless Buyer from claims for physical damage to third party property or injury to persons, including death, to the extent caused by the negligence of Seller or its officers, agents, employees, and/or assigns while engaged in activities under this Agreement. Buyer shall likewise indemnify and hold harmless Seller from claims for physical damage to third party property or injury to persons, including death, to the extent caused by the negligence of the Buyer, its officers, agents, employees, and/or assigns. In the event such damage or injury is caused by the joint or concurrent negligence of Seller and Buyer, the loss shall be borne by each Party in proportion to its negligence. For the purposes of this article (i) "Third party" shall not include Buyer or any subsequent owner of the Equipment, their subsidiaries, parents, affiliates, agents, successors or assigns including any operation or maintenance contractor, or their insurer; and (ii) no portion of the Equipment is "third party property".

**8. compliance with laws and permits.** All permits, authorizations, and licenses which are required to construct, install and/or operate Buyer's facility or equipment, to use the Equipment, or to manage and dispose of any wastes, discharges, and residues resulting from Buyer's use of the Equipment, shall be obtained and maintained by Buyer at Buyer's sole expense. Buyer is responsible for compliance with all laws and regulations applicable to the storage, use,

handling, installation, maintenance, removal, registration, and labeling of all Equipment after delivery of the Equipment, as well as for the proper management and disposal of all wastes, discharges, and residues.

**9. buyer's site conditions.** Buyer warrants that any data furnished to the Seller concerning conditions at Buyer's site (including but not limited to any existing Buyer facility, equipment or processes, influent water or other substances to be treated or measured with the Equipment) is accurate and complete, and the Seller reserves the right to utilize the most appropriate design compatible with generally accepted engineering practices, and to make changes in details of design, manufacture and arrangement of Equipment unless precluded by any limitations specified in this Agreement. Seller shall notify Buyer of (1) any conditions at Buyer's site which materially differ from those indicated in the data furnished by Buyer, (2) any previously unknown physical conditions at Buyer's site of an unusual nature, not revealed by previous investigations and differing from those ordinarily encountered in the type of work provided for in this Agreement, and (3) the presence of any Hazardous Materials (as defined below), the existence of a contaminated soil, unexploded ordinance, or archaeological remains. If such conditions cause an increase in Seller's cost or in the time required for the performance of Seller's obligations, Seller shall be entitled to an equitable adjustment in the Agreement price and an extension in the time for performance.

**10. hazardous materials and wastes.** In the event that Seller encounters any Hazardous Materials (meaning toxic substances, hazardous substances, pollutants, contaminants, regulated wastes, or hazardous wastes as such terms may be defined or classified in any law, statute, directive, ordinance or regulations promulgated by any applicable governmental entity) at Buyer's site, other than Hazardous Materials introduced by Seller or that are otherwise the express responsibility of Seller under this Agreement, Buyer shall immediately take whatever precautions are required to legally eliminate such Hazardous Materials so that the Seller's work under this Agreement may safely proceed. At no time shall Seller be deemed to have taken title to or the responsibility for the management or disposal of any wastes, Hazardous Materials, influent water, any resultant product streams, wastewater streams, discharges, cleaning materials, or any other materials or substances processed by the Equipment or otherwise located at Buyer's site. Seller does not take responsibility for and hereby expressly disclaims responsibility for the characterization or disposal of wastes, Hazardous Materials, or for the identification, selection, or management of disposal facilities for any wastes.

**11. excusable delays.** Seller shall not be liable nor in breach or default of its obligations under this Agreement to the extent performance of such obligations is delayed or prevented, directly or indirectly, due to causes beyond the reasonable control of Seller, including, but not limited to: acts of God, natural disasters, unusually severe weather, fire, terrorism, war (declared or undeclared) epidemics, material shortages, insurrection, act (or omissions) of Buyer or Buyer's contractors/suppliers or agents, any act (or omission) by any governmental authority, strikes, labor disputes, transportation shortages, or vendor non-performance. The delivery or performance date shall be extended for a period equal to the time lost by reason of delay or non-performance, plus such additional time as may be necessary to overcome the effect of the delay or non-performance. If delivery or performance is delayed for a period exceeding 180 (one hundred and eighty) days, either Party may terminate this Agreement without further liability provided that Seller shall be paid an amount equal to that which would be payable to Seller under the article entitled "Termination". If Seller is delayed by any acts (or omissions) of Buyer, or by the prerequisite work of Buyer's other contractors or suppliers, Seller shall be entitled to an equitable adjustment in schedule, price and/or performance, as applicable.

**12. emergencies.** If the safety of Seller's personnel is threatened or likely to be threatened by circumstances outside the reasonable control of Seller, including but not limited to war, armed conflict, civil unrest, riots, terrorism, kidnapping, presence of or exposure to hazardous materials, unsafe working conditions, or by the threat of such circumstances or a lack of adequate protections against such circumstances, Seller shall be entitled to take all necessary steps to ensure the security and safety of its personnel including the evacuation of personnel until such circumstances no longer apply. Any such occurrence shall be considered an excusable delay event. Buyer shall reasonably assist in the event of any such evacuation.

**13. confidentiality, intellectual property.** Both Parties agree to keep confidential the other Party's proprietary non-public information, if any, which may be acquired in connection with this Agreement. Buyer will not, without Seller's advance written consent, subject Equipment to testing, analysis, or any type of reverse engineering. Seller retains all intellectual property rights including copyright which it has in all drawings and data or other deliverables (including the Equipment) supplied or developed under this Agreement. Buyer agrees that it will not file patent applications on the Equipment or any development or enhancement of the Equipment, or of processes and methods of using the Equipment, without Seller's express prior written permission. Buyer further agrees that in any event any such patents will not be asserted against Seller or its other buyers based upon purchase and use of such Equipment. Seller grants to Buyer a non-exclusive, non-terminable, royalty free license to use the intellectual property embedded in Equipment delivered to and paid for by the Buyer, as well as any drawings, design or data delivered to and paid for by the Buyer, for the purposes of owning, financing, using, operating and maintaining the relevant Equipment at Buyer's site. Such license may only be assigned to a subsequent owner of the Equipment or to an operations and maintenance

subcontractor. Such license does not extend to the re-creation of the Equipment or the manufacture of spares or consumables by Buyer or third parties.

Any software Seller owns and provides pursuant to this Agreement shall remain Seller's property. Seller provides to Buyer a limited, non-exclusive and terminable royalty free project-specific license to such software for the use, operation or maintenance at Buyer's site of any Equipment purchased hereunder to which the software is a necessary component. Buyer agrees not to copy, sub-license, translate, transfer, reverse engineer, or decode the software.

Seller shall indemnify and hold harmless Buyer from any rightful claim of any third party that any Equipment or Service infringe a patent in effect in the USA, or country of delivery (provided there is a corresponding patent issued by the USA), or USA copyright or copyright registered in the country of delivery. If the Buyer notifies the Seller promptly of the receipt of any such claim, does not take any position adverse to the Seller regarding such claim and gives the Seller information, assistance and exclusive authority to settle and defend the claim, the Seller shall, at its own expense and choice, either (i) settle or defend the claim and pay all damages and costs awarded in it against the Buyer, or (ii) procure for the Buyer the right to continue using the Equipment or Service, or (iii) modify or replace the Equipment or Service so that it becomes non-infringing, or (iv) remove the infringing Equipment and refund the price. The above paragraph shall not apply to any misuse of Equipment or Equipment which is manufactured to the Buyer's design, or to alleged infringement arising from the combination, operation, or use of any Equipment or Services with other equipment or services when such combination is part of any allegedly infringing subject matter. The foregoing list of sub-sections (i), (ii), (iii), and (iv) and related terms state the entire liability of the Seller for intellectual property infringement by any Equipment or Service.

**14. limitations on liability.** Notwithstanding anything else contained in this Agreement, to the maximum extent permitted by law, and regardless of whether a claim is based in contract (including warranty or indemnity), extra-contractual liability, tort (including negligence or strict liability), statute, equity or any other legal theory:

- (a) THE TOTAL LIABILITY OF THE SELLER AND OF ITS INSURER FOR ALL CLAIMS ARISING OUT OF OR RELATING TO THE PERFORMANCE OR BREACH OF THIS AGREEMENT OR USE OF ANY EQUIPMENT OR SERVICES SHALL NOT EXCEED THE TOTAL PRICE PAID BY BUYER UNDER THIS AGREEMENT OR (IN THE CASE OF AN AGREEMENT FOR SERVICES WITH A TERM OF MORE THAN ONE YEAR) THE ANNUAL PRICE PAYABLE BY BUYER UNDER THIS AGREEMENT;
- (b) IN NO EVENT SHALL SELLER BE LIABLE FOR ANY LOSS OF PROFIT OR REVENUES, LOSS OF PRODUCTION, LOSS OF USE OF EQUIPMENT OR SERVICES OR ANY ASSOCIATED EQUIPMENT, INTERRUPTION OF BUSINESS, COST OF CAPITAL, COST OF REPLACEMENT WATER OR POWER, DOWNTIME COSTS, INCREASED OPERATING COSTS, CLAIMS OF BUYER'S CUSTOMERS FOR SUCH DAMAGES, OR FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL, INDIRECT, PUNITIVE OR EXEMPLARY DAMAGES;
- (c) SELLER'S LIABILITY SHALL END UPON EXPIRATION OF THE APPLICABLE WARRANTY PERIOD, PROVIDED THAT BUYER MAY CONTINUE TO ENFORCE A CLAIM FOR WHICH IT HAS GIVEN NOTICE PRIOR TO THAT DATE BY COMMENCING AN ACTION OR ARBITRATION, AS APPLICABLE UNDER THIS AGREEMENT, BEFORE EXPIRATION OF ANY STATUTE OF LIMITATIONS OR OTHER LEGAL TIME LIMITATION BUT IN NO EVENT – TO THE EXTENT PERMITTED BY APPLICABLE LAW – LATER THAN FIVE (5) MONTHS AFTER EXPIRATION OF SUCH WARRANTY PERIOD.

For the purposes of this article, "Seller" shall mean Seller, its affiliates, subcontractors and suppliers of any tier, and their respective agents and employees, individually or collectively. If Buyer is supplying Seller's Equipment or Services to a third party, Buyer shall require the third party to agree to be bound by this article. If Buyer does not obtain this agreement for Seller's benefit for any reason, Buyer shall indemnify and hold Seller harmless from all liability arising out of claims made by the third party in excess of the limitations and exclusion of this article.

**15. termination.** This Agreement and any performance pursuant to it may be terminated by either Party, and the consequences of such termination shall be as set out in the next paragraph, if the other Party

- (a) becomes insolvent, makes an assignment for the benefit of its creditors, has a receiver or trustee appointed for the benefit of its creditors, or files for protection from creditors under any bankruptcy or insolvency laws; or
- (b) fails to make any payment when due or to establish any payment security required by this Agreement, or commits a material breach or defaults in its material obligations under this Agreement, and such default is not cured within thirty (30) days of written notice from the other Party.

Upon the termination of this Agreement by Buyer for cause (i) Seller shall reimburse Buyer the difference between that portion of the Agreement price allocable to the terminated scope and the actual amounts reasonably incurred by Buyer

SUEZ confidential and proprietary information

membrane replacement agreement for the Ironhouse Sanitary District Wastewater Treatment Plant

proposal number 239963 – revision #3 – December 1, 2021

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to complete that scope, and (ii) Buyer shall pay to Seller (a) the portion of the Agreement price allocable to Equipment completed, and (b) amounts for Services performed before the effective date of termination. Upon the termination of this Agreement by Seller for cause Buyer shall pay to Seller within thirty (30) days of receipt of invoice the price of all Equipment or Services delivered at the date of termination, plus an amount equal to all costs and expenses incurred in the engineering, sourcing, financing, procurement, manufacture, storage and transportation of the Equipment including materials, work in progress and any cancellation charges assessed against Seller by Seller's suppliers including reasonable overhead and profit on all such costs and expenses. Alternatively, if any schedule of termination payments has been agreed between the Parties, Buyer shall pay to Seller within thirty (30) days of receipt of invoice the amounts set out in that schedule.

Seller shall have the right to suspend performance upon written notice to Buyer in any case where Seller would have the right to terminate the Agreement under this article, without prejudice to Seller's right to terminate this Agreement for cause. Any cost incurred by Seller in accordance with any such suspension (including storage costs) shall be payable by Buyer upon submission of the Seller's invoice(s). Performance of the Seller's obligations shall be extended for a period of time reasonably necessary to overcome the effects of such suspension.

**16. governing law, dispute resolution.** This Agreement shall be governed by the substantive laws of the State of California. In the event of a dispute concerning this Agreement, the complaining Party shall notify the other Party in writing thereof. Management level representatives of both Parties shall meet at an agreed location to attempt to resolve the dispute in good faith. Should the dispute not be resolved within thirty (30) days after such notice, the complaining Party shall seek remedies exclusively through arbitration. The seat of arbitration shall be the federal district court closest to the Buyer and the rules of the arbitration will be the Commercial Arbitration Rules of the American Arbitration Association, which are incorporated by reference into this article.

Notwithstanding the foregoing, each Party shall have the right to commence an action or proceeding in a court of competent jurisdiction, subject to the terms of this Agreement, in order to seek and obtain a restraining order or injunction to enforce the confidentiality intellectual property provisions set forth in the first two paragraphs of article 13; nuclear use restrictions set forth in article 17, or to seek interim or conservatory measures not involving monetary damages.

**17. no nuclear use.** Equipment and Services sold by Seller are not intended for use in connection with any nuclear facility or activity, the Buyer warrants that it shall not use or permit others to use the Equipment or Services for such purposes, without the advance written consent of Seller. If, in breach of this, any such use occurs, Seller (and its parent, affiliates, suppliers and subcontractors) disclaims all liability for any nuclear or other damage, injury or contamination, and, in addition to any other rights of Seller, Buyer shall indemnify and hold Seller (and its parent, affiliates, suppliers and subcontractors) harmless against all such liability.

**18. export control.** Seller's obligations are conditioned upon Buyer's compliance with all USA and other applicable trade control laws and regulations. Buyer shall not trans-ship, re-export, divert or direct Equipment (including software and technical data) other than in and to the ultimate country of destination declared by Buyer and specified as the country of ultimate destination on Seller's invoice.

**19. changes.** Each Party may at any time propose changes in the schedule or scope of Equipment or Services. All changes to the Equipment or Services shall be subject to mutual agreement via a written change order or variation, which shall only become effective once signed by both Parties. The scope, Agreement price, schedule, and other provisions will be equitably adjusted to reflect additional costs or obligations incurred by Seller resulting from a change, after Seller's proposal date, in Buyer's site-specific requirements or procedures, or in industry specifications, codes, standards, applicable laws or regulations. It shall be acceptable and not considered a change if Seller delivers Equipment (including Equipment replacement under warranty) that bears a different, superseding or new part or version number compared to the part or version number listed in the Agreement, provided that in no circumstance shall this affect any other of Seller's obligations including those set forth in article 6.

**20. conflicts; survival, assignment.** If there is any conflict between this Agreement and any written proposal or quotation provided by Seller, then the terms and conditions set forth in this Agreement shall prevail. If any term or condition of this Agreement or any accompanying terms and conditions are held invalid or illegal, then such terms and conditions shall be reformed to be made legal or valid, or deleted, but the remaining terms and conditions shall remain in full force and effect, and this Agreement shall be interpreted and implemented in a manner which best fulfills Parties' intended agreement. Those provisions which by their nature remain applicable after termination shall survive the termination of this Agreement for any reason. Seller may assign or novate its rights and obligations under the Agreement, in whole or in part, to any of its affiliates or may assign any of its accounts receivable under this Agreement to any party without Buyer's consent, and the Buyer hereby agrees, by signing this Agreement, to such assignment and to execute any document that may be necessary to complete Seller's assignment or novation. This Agreement shall not

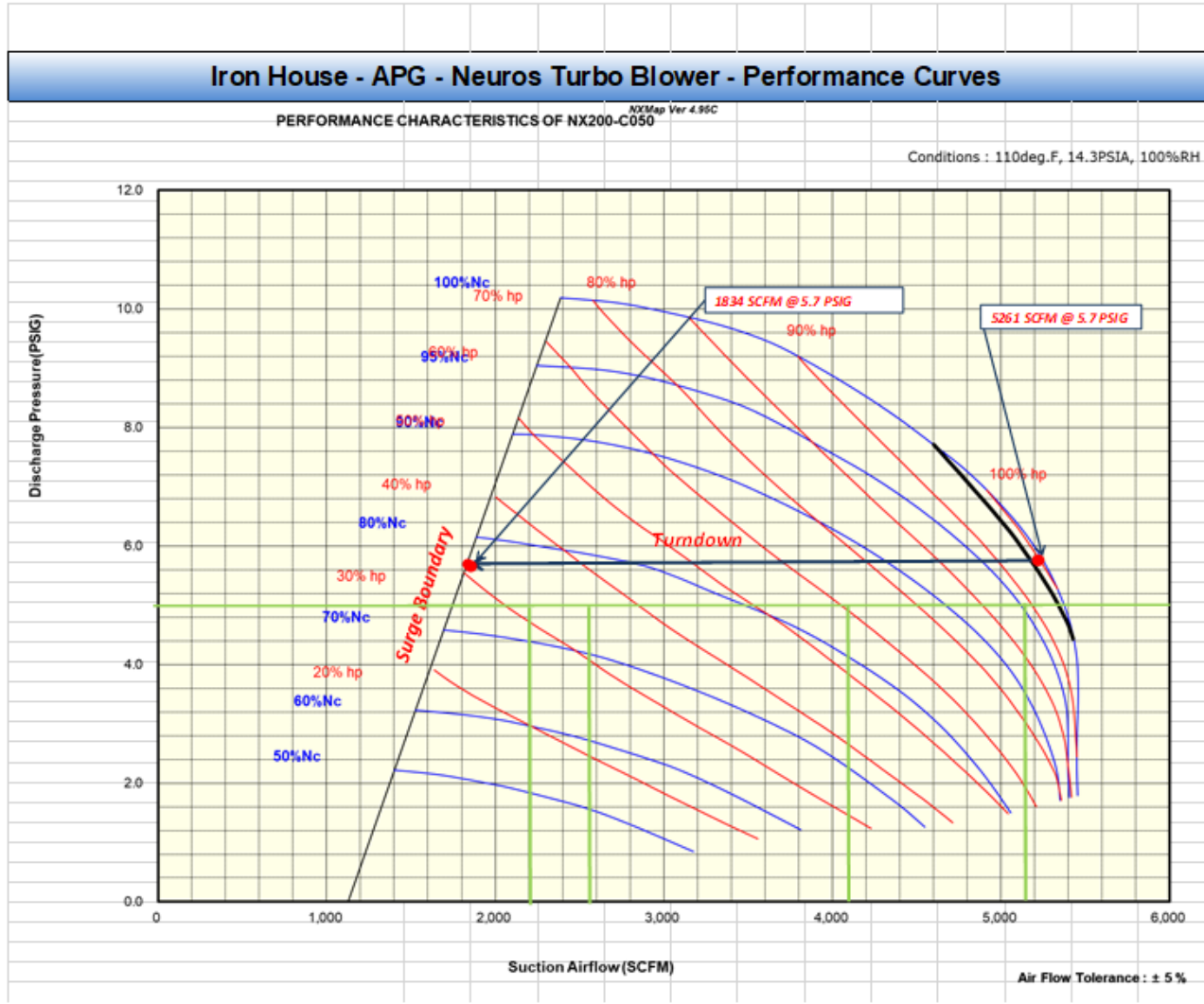
otherwise be assigned by either Party without the other Party's prior written consent, and any assignment without such consent shall be void.

Seller may (i) manufacture and source the Equipment and any part thereof globally in the country or countries of its choosing; and (ii) may subcontract portions of the Services, so long as Seller remains responsible for such.

**21. no third party beneficiary.** Except as specifically set forth in the article entitled "Limitations on Liability" and "No Nuclear Use", this Agreement is not intended to, and does not, give to any person who is not a party to this Agreement any rights to enforce any provisions contained in this Agreement.

**22. entire agreement.** This Agreement embodies the entire agreement between Buyer and Seller and supersedes any previous documents, correspondence or agreements between them. No modification, amendment, revision, waiver, or other change shall be binding on either Party unless agreed in writing by the Party's authorized representative. Any oral or written representation, warranty, course of dealing, or trade usage not specified herein shall not be binding on either Party. Each Party agrees that it has not relied on, or been induced by, any representations of the other Party not contained in this Agreement.

## attachment b Neuros performance curve estimates



Flow	Pressure	% hp	kW
5,261	5.7	100	155
4,126	5	60.5	93.7375
2,200	5	32	49.5802
2,592	5	37	57.3271
5,184	5	89	137.895

attachment c ZW500D shipping frames

# ZeeWeed\* 500D shipping frame

**description and use**

The shipping frame for ZeeWeed 500D modules is a robust, stainless steel unit that can reduce the shipping cost per module by nearly 60% through reduced packaging, increased packing density and reduced handling.

A single shipping frame safely and securely carries up to 30 ZW500D modules.

ZW500D shipping frames are available for purchase or for rent depending on your needs. SUEZ can help you determine the most cost-effective alternative for you.

**packaging information**

Twelve fully loaded shipping frames fit inside a 40 ft. shipping container. This allows you to transport more modules per container compared to the bag, box and crate methods.

Table 1 offers a comparison of the number of modules that will fit in a 40 foot container using the bag, box and crate method vs. the ZW500D shipping frame method.



**Table 1: ZW500 modules per shipping container**

Bag, Box & Crate	Frame
112 <sup>1</sup>	360 <sup>1</sup>

<sup>1</sup> Number of modules per 40 foot container

Find a contact near you by visiting [www.suezwatertechnologies.com](http://www.suezwatertechnologies.com) and clicking on "Contact Us."

\*Trademark of SUEZ; may be registered in one or more countries.

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FSufZW500ShippingFrame\_EN.docx Apr-17

**Dimensions and Weights**

Tables 2 and 3 show the specifications of the ZW500D shipping frame only and the crated ZW500D shipping frame, respectively.

**Table 2: Shipping frame specifications**

Item	Measurement
Width	82.6 inch (209.8 cm)
Height	88.7 inch (225.3 cm)
Depth	33.5 inch (85.1)
Volume	142 ft <sup>3</sup> (4.02 m <sup>3</sup> )
Weight – empty	532 lbs. (242 kg)
Weight – full	2,542 lbs. (1,156 kg)

**Table 3: Crated frame specifications**

Item	Measurement
Width	88.6 inch (225.0 cm)
Height	94.5 inch (240.0 cm)
Depth	37.0 inch (94.0 cm)
Volume	179.3 ft <sup>3</sup> (5.08 m <sup>3</sup> )
Weight – empty	942 lbs. (482 kg)
Weight – full	2,952 lbs. (1,342 kg)
Weight – shipping crate	410 lbs. (187 kg)
Capacity	30 Modules
Material of Construction	Stainless Steel 316



**More Information**

For more information about the ZW500D shipping frame and for all your water treatment needs, contact your Regional Sales Manager or Regional Lifecycle Manager to discuss options.

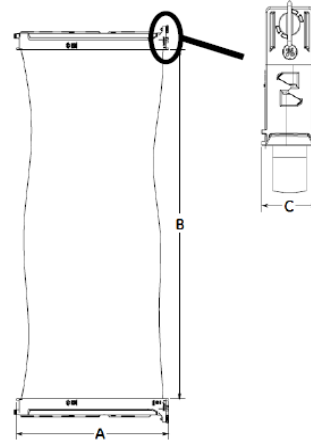
# attachment d ZW500D RX12 430ft<sup>2</sup> fact sheet



Water Technologies & Solutions  
fact sheet

## ZeeWeed\* 500D Module

Module Dimensions				
Applica-tion	Product	Width (A) mm (in)	Header-to-Header Length (B) mm (in)	Depth (C) mm (in)
MBR	500D	844 (33.2)	1,940 (76.4)	49 (1.9)
Water	500D			52 (2.1)
	500Ds			52 (2.1)



Module Properties									
Application	Membrane Surface Area m <sup>2</sup> (ft <sup>2</sup> )	Max. Shipping Weight <sup>1</sup> kg (lb)	Lifting Weight <sup>2</sup> kg (lb)	Material	Nominal Pore Size (µm)	Fibre Diameter (mm)	Surface Properties	Fibre Tensile Strength (N)	Flow Path
MBR	40.0 (430)	28 (61)	28 – 75 (61 – 164)	PVDF	0.04	2.2	Non-ionic & Hydrophilic	> 600	Outside-In
Water	40.9 (440)	32 (70)	30 – 74 (66 – 163)			1.9			
	32.5 (350)	26 (57)	26 – 72 (57 – 159)			1.9			

<sup>1</sup> Packaged

<sup>2</sup> Varies with solids accumulation

Operating & Cleaning Specifications						
Application	TMP Range kPa (psig)	Max. Operating Temp. °C (°F)	Operating pH Range	Max. Cleaning Temp. °C (°F)	Cleaning pH Range	Max. Cl <sub>2</sub> Conc'n (ppm)
MBR	-55 to 55 (-8 to 8)	40 (104)	5.0-9.5	40 (104)	2.0 – 10.5 (<30°C)	1,000
Water	-90 to 90 (-13 to 13)				2.0 -10.0 (30-40°C)	

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