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WESTON & SAMPSON ENGINEERS, INC.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
tel: 978.532.1900

WWTF & Pump Station Evaluation

FINAL Report

September 2024

TOWN OF JAMESTOWN, RHODE ISLAND

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1.0 INTRODUCTION

The Town of Jamestown selected Weston & Sampson to conduct an evaluation of all wastewater facilities throughout the Town, including collections, pumping, and treatment. The collection system findings are presented in a separate report, included as Appendix F. The remaining items in the evaluation are summarized in this report document, separated into the following categories:

- Condition Assessment
 - Pump Stations
 - Architectural & Buildings
 - Process Mechanical
 - Electrical
 - Instrumentation
 - Heating Ventilation and Air Conditioning (HVAC) & Plumbing
 - WWTF
 - Architectural & Buildings
 - Process Mechanical
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- Recommended Improvements
 - Pump Stations
 - Architectural & Buildings
 - Process Mechanical
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 - HVAC & Plumbing
 - WWTF
 - Architectural & Buildings
 - Process Mechanical
 - Electrical
 - Instrumentation
 - HVAC & Plumbing

2.0 CONDITION ASSESSMENT

Weston & Sampson evaluated the condition of the WWTFs assets using information collected through discussions with the systems operators and equipment manufacturers; site observations and assessment of existing conditions; and review of the system design drawings and process data. Each asset was assigned an estimated useful lifetime based on the information collected. The estimated lifetimes were then used to develop two evaluation criteria for each asset: a conditional rating and a probability of failure.

Conditional ratings of one through five were calculated for each asset by multiplying a value of five by the proportion of a given asset's age versus its estimated lifetime. Ratings of one represent assets in the best condition with only a small portion of their estimated lifetime having elapsed while ratings of five represent assets in the worst condition with a large portion of their estimated lifetime having elapsed. Equipment beyond its estimated lifetime was given a conditional rating of five.

The probability of failure for each asset was calculated using the Weibull Reliability Function:

$$R(t) = e^{-\left(\frac{t}{\eta}\right)^\beta}$$

The Weibull Reliability Function is a form of the Weibull distribution which is commonly used in reliability as a model for time to failure (Meyers RA 2002), where β is the Weibull shape parameter, η is the estimated useful lifetime of the asset, and t is the age of the asset. As described previously, the age and estimated useful lifetime of each asset were determined as part of the investigation portion of this assessment. The values determined for each asset were used to develop the probability of failure estimates for each asset. A Weibull shape parameter greater than one results in failure rate estimates that increase over time which accurately describes all the assets in this condition assessment. A Weibull shape parameter of 1.2 is commonly used for mechanical equipment such as pumps, actuators, drives, and motors. This value is also considered representative of the other assets reviewed in this conditional assessment including instrumentation, HVAC, plumbing, and electrical components. Therefore, this value was used for the Weibull shape parameter calculation for all probability of failure estimates.

Using the calculated conditional ratings and probability of failure estimates coupled with observations made in the field and information gathered from discussions with the systems operators, Weston & Sampson was able to determine which assets should be recommended for replacement or repair, which are listed in the improvement section of this report.

The assets of the collection system and the WWTF were sorted into five discipline-based categories so that each asset could be evaluated by an expert familiar with it. The five categories used for the evaluation are Process Mechanical, Architectural & Buildings, Electrical, Instrumentation, and HVAC and Plumbing. An overview of the inventory assessment observations and conclusions for each category are included below. Due to the large number of assets evaluated as part of this inventory assessment, the specific details for each asset are tabulated and included as Appendix A for both the pump stations and WWTF. It should be noted that probability of failure and conditional rating estimates were not developed for assets in the architectural and building discipline. These assets were evaluated based solely on the observations and assessments of the architectural experts. Inventory lists are provided for

the architectural assets in Appendix A without corresponding probability of failure and conditional rating estimates.

2.1 Collections

The collection system consists of both pump stations and gravity sewers. For clarity, these two portions of the collection system were evaluated separately, and the findings for the gravity sewers are provided in a separate report, which is included as Appendix F. A summary of the evaluations for the pump stations is included below.

2.1.1 Pump Stations

Four remote pump stations convey sanitary wastewater to the WWTF. The pump stations were constructed in 1979 and received major renovations in 2005. Much of the equipment in the stations is from 2005 and still functions properly, but some of the equipment that is less durable or that is used in harsh operating environments is at the end of its estimated useful lifetime and must be replaced. An overview of the inventory assessment observations and conclusions for each discipline-based category are included below.

Process Mechanical

Most of the process and mechanical equipment in the four pump stations are in good condition and function without issue. The only major pieces of mechanical equipment in these pump stations are raw sewage pumps. Each pump station contains two raw sewage pumps. All of these pumps are within their estimated useful lifetimes and did not show significant signs of wear during the site inspection. Some of the less durable ancillary equipment for the raw sewage pumps including valving and instruments are at the end of their useful lives and need to be replaced. In particular, the check valves on the outlet side of the raw sewage pumps are leaking in several of the pump stations.

On the wet well side of Pump Stations #1 and #2 there are sluice gates with operators in the influent channel. These gates are heavily worn and corroded. The system operators report that the gates have become difficult to operate due to their condition. All of these sluice gates need to be replaced.

Two process adjustments are needed for the pump stations. The first is the replacement of the raw sewage pumps in Pump Station #3. Pump Station #3 has large variations in its influent flow, receiving minimal flow during dry periods and high flow during rain events. The raw sewage pumps in the station cannot handle the influent flow during large rain events. These pumps need to be replaced with larger pumps that can manage the high inflow during rain events. Maximum inflow into the station during rain events is approximately 500 gallons per minute (gpm). Therefore, the replacement pumps must be rated to pump a minimum of 250 gpm each. Additionally, because the pump station receives minimal flow during dry periods, the replacement pumps should be VFD operated to allow for variable pumping rates. This will minimize unnecessary wear on the pumps.

The second process adjustment is the replacement of the mixing system used in Pump Station #2. This station struggles with substantial amounts of grit settling in the wet well. Currently the system operators suspend this grit using a compressor with a submersible diffuser. This system requires substantial amounts of effort on the part of the system operators and does not efficiently suspend the grit in the well. The compressor should be replaced with a submersible mixer capable of mixing the grit in the wet well effectively.

Architectural & Buildings

All three of the pump station buildings are comprised of brick veneer with concrete masonry units (CMU) in a cavity wall assembly. Overall, the brick veneer in all three buildings is in good condition. It should be noted that the brick veneer in Pump Station #3 was in the best overall condition with minimal observed defects while some minor cracking was observed on the brick veneer of Pump Stations #1 and #2 and some minor settling of the brick veneer was observed at Pump Station #1.

The roofs of all three pump stations are comprised of asphalt shingles with aluminum gutters, wood rakes and fasciae at the roof perimeter. Each building has a single downspout for the gutter system. All three roofs have served past their useful life expectancy and are in poor condition. The roofs of Pump Stations #2 and #3 were particularly worn due to their proximity to the nearby waterfront.



Figure 1 – Pump Station no. 3 Structure

The doors at all three pump stations are constructed of painted hollow metal and were observed to be in good condition. The hardware for the doors at all three pump stations is dated and in need of replacement with lever hardware.

Pump Stations #1 and #2 are split structures with separate wet and dry sides. For each structure both the wetwell and dry sides were inspected. In each pump station both sides had aluminum railings with CMU and concrete painted walls. The ceilings on each side of both pump stations were gypsum board at the top and concrete in the lower levels. Overall, the interiors of both buildings were in good condition. One hole on the ceiling of Pump Station #1 was noted during the inspection. Additionally, mortar is eroded in the brick masonry vent structure adjacent to the building at Pump Station #2 and the vent masonry is in poor condition compared to the brick veneer on the adjacent building.

Pump Station #3 consists of a building and a vertical wetwell below. The wetwell is accessed by a hatch and ladder on the floor of the pump station building. This structure was observed to be in good condition.

Electrical

Pump Stations #1, #2, and #3 include major electrical systems that were visited by the electrical team. Below are the findings for the pump stations.

The electrical equipment in all three stations contains some older equipment that was installed during the original construction of the stations in 1979, including lighting, receptacles, switches, etc. The stations also have a variety of newer electrical equipment installed as part of the 2005 upgrades including motor control centers, panelboards, disconnect switches, etc.

During the site visit, a portion of the lighting in each pump station was observed to be more recently installed, and it is assumed that lighting was upgraded as needed during the 2005 renovations. All lighting in the three pump stations has explosion proof fixtures with twist in type A lamp bulbs. Most of this lighting has been upgraded to light-emitting diode (LED) lamps, but there are still some incandescent and fluorescent bulbs. Exterior lighting at the pump stations is not the latest energy-efficient type. Receptacles observed at the three pump stations were minimal and mostly date back to the building's installation in 1979. Not all the receptacles are ground fault circuit interrupter (GFCI) type and should be upgraded accordingly where required by code.

The conduit runs exposed in the pump station are all schedule 40 polyvinyl chloride (PVC). All exposed fittings and boxes observed were also PVC. Connections to equipment in the stations are made with liquid tight flexible conduit. In the pump areas of each station, disconnect switches are all National Electric Manufacturers Association (NEMA) 4X stainless steel type. On the wetwell sections of the three pump stations, all fixtures and switches were observed to have explosion proof seals and exposed thread rigid galvanized steel (RGS) conduit. The motor control center, transformer, panels, exhaust fan disconnect, and the starters at each pump station were replaced in 2005 and are in good condition. Despite this, a portion of this equipment has become obsolete, and operations reports that it is increasingly difficult to locate parts for certain electrical assets. Assets that cannot be easily repaired and maintained will need to be replaced to ensure process reliability. The generators and automatic transfer switches (ATS) are also in good condition at each station. It should be noted that rust was observed at Pump Station #1 on the exterior ATS enclosure at the hinge.

Instrumentation

All pump stations are equipped with Flygt Multitrode control systems and Verbatim dialers for alarms. Upon inspection the systems appeared to be functional and in good working condition. Each station utilizes multi-point level measurement systems that are outdated, but still functional. The instruments shall be upgraded during the next major renovation of each lift station or as systems reach failure, whichever comes first.

Heating Ventilation and Air Conditioning (HVAC) and Plumbing

The primary HVAC equipment in the pump stations includes exhaust fans, supply fans, and electrical unit heaters (EUH). Exhaust and supply fans in the pump stations were installed in 1999. The supply and exhaust fans in the dry portions of the pump stations were in working condition and were observed to have minimal external wear during the site inspection. Exhaust fans in the wetwell portions of the pump stations were universally in poor condition and appeared considerably worn. This is primarily attributed to the harsh operation conditions of the wetwell areas. Therefore, wetwell exhaust fans are the primary candidates for HVAC replacements in the pump stations. During the replacement of the wet well exhaust fans, it may be prudent to replace the supply and exhaust fans in the dry portions of the pump stations. Despite the observed condition of these fans, they are all approaching the end of their estimated lifetimes and have a high probability of mechanical failure. This is especially true over the next five-to-10-year period as the fans age further. EUHs were installed in the pump stations in 2005. These units were observed to be in working conditions with minimal observable wear. The EUHs are halfway through their estimated useful lifetimes and have a lower probability of failure.

Plumbing equipment in the pump stations includes several mop sinks, sump pumps, and water services. Most of these assets are original to the pump station installations and are past their estimated useful lifetime. The only plumbing equipment observed to be in good condition during the

site visit was the sump pump in Pump Station #2 which was installed in 2005. The rest of the equipment inspected was in poor condition and requires replacement.

2.2 Wastewater Treatment Facility

The WWTF was originally constructed in 1979 and received major renovations in 2007. Much of the equipment and infrastructure was replaced or repaired during the 2007 renovations. Assets that were not replaced or repaired during the renovations are past their useful lifetime. Much of the equipment and infrastructure from the 2007 renovations is in good condition and functions properly. Some of the equipment installed in 2007 that is less durable or that is used in harsh operating environments is at the end of its estimated useful lifetime and must be replaced. An overview of the inventory assessment observations and conclusions for each discipline-based category are included below.

Process Mechanical

Pieces of mechanical equipment replaced during the 2007 renovations range in condition based on their durability, usage, and environment. Mechanical equipment with lower estimated lifetimes include diffusers, valves, and gear operated sluice gates. Equipment of these types, installed in 2007, is more likely to be recommended for replacement. Conversely, more durable equipment like process pumps, pipes, and tanks that were installed or repaired in 2007 are less likely to require replacement. All mechanical equipment that remains from the 1979 construction of the facility is considered past its useful operating lifetime and recommended for replacement.

Aside from the general replacement of aging equipment, two areas of concern were identified for major process adjustments during the inventory assessment.

The first area of concern involves the septage receiving tank and aerobic digester tanks. The WWTF no longer receives substantial amounts of septage and no longer digests its sludge. Because of these two changes, the operators now use the digester tanks onsite as settling tanks for the thickening of sludge. Sludge is stored in the tanks and allowed to settle and thicken. The thickened sludge is sent offsite for disposal. Water from the top of the settling sludge siphoned and removed from the tanks via suction lines that discharge directly into the system's headworks channel. This water tends to overload the system and negatively affect treatment when it is added to the headworks. Adjustments to the suction lines in these tanks are necessary to mitigate this problem.

The second area of major concern is the aeration process in the aeration basins. Two of the four aerators in these tanks are well past their expected useful life and need to be replaced immediately. The other two aerators are nearing their useful life expectancy and should be replaced with the original two. A modern aerator and separate mixing system can provide more efficient aeration, increased operator control, and lower operational costs than the technology currently in use, assuming a completely mixed basin. As a result, it has been determined that replacing the aging aerators with upgraded aerators will increase efficacy of the treatment process.

Architectural & Buildings

The site consists of multiple structures, but the main building is referred to as the Control Building. The multi-story building is subdivided into two primary sections: an administrative section with an adjacent laboratory space within the northern parcel; and a maintenance zone situated at the

southern parcel, housing both processing areas and a mezzanine level. The buildings asphalt shingle roof was replaced in 2010 which joined the two existing roof lines. The building's siding and windows were replaced in 2007.

The Control Building is surrounded by asphalt, creating exterior circulation around the site. Parking in front of the building is slightly sloped, gradually running north towards the waterfront. Access into the building is primarily from the front, but there are entrance points on every elevation of the building.

The building itself is generally not accessible to persons with disabilities. Most of the deficiencies are concentrated in and around the restrooms and door clearances. These include:

- Door clearances and hardware – The accessible-required latch/pull and latch/push clearances were not present at most doors. Door hardware levers throughout were observed to be non-conforming to accessibility requirements.
- Toilet room – Does not conform to accessible requirements.

Deterioration and discoloring were observed at the concrete block courses close to grade as shown in Figure 2. The extreme of these conditions was observed on the west side of the building where the exterior process tanks are located. Results are most likely due to poor water management from storm events. The exterior pine tongue & groove (T&G) siding has failed. Deterioration was observed around all faces of the building, especially on the western elevation.

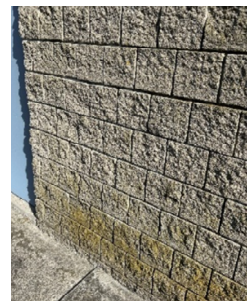


Figure 2 – Control Bldg. Block Wall

The asphalt shingle roof was replaced in 2010 which joined the two existing roof lines that were split by a lower membrane roof that was infilled. The roof is in need of replacement. The lack of gutters and downspouts has caused multiple issues relating to the CMU and T&G siding.

There are six personnel doors located around the building which are all in fair condition. Door hardware throughout the building is dated and the locksets are “knob” style. There are two coiling doors. Both coiling doors have issues with opening and closing.



Figure 3 – Control Bldg. Façade

The building's windows were replaced in the 2007 renovation without screens. Since then, there is visible water damage around the cased windows on the North side of the building. The windows have, for the most part, failed throughout the building.

The interior of the building has several components past their useful lifetimes that require replacement. The flooring in the building consists of Epoxy Paint and Vinyl Tile and was observed to be worn and in very poor condition. The interior walls consist of Gypsum Board and CMU throughout and were also observed to be considerably worn and in poor condition.

Other components on the interior of the building that were observed to be insufficient or require replacement include:

- Cabinetry in the breakroom is dated and not adequate for the staff
- Lack of appliances for breaks and lunch for employees
- Lab cabinetry and millwork is in need of replacement
 - Some cabinets and fume hood to remain or be relocated
 - Lab Fridge to remain but be relocated.

Other buildings onsite include the RAS building located between the secondary clarifiers and a small shed adjacent to the chlorine contact tank.

The RAS Building is in relatively good condition. The roof needs replacement and that would align with the work on the main control building. The skylight on the tanks needs replacement due to age. The tongue & groove siding needs replacement like the main building. However, the interior is in relatively good shape.



Figure 5 – RAS Bldg.



Figure 4 – Shed Structure at WWTF

The shed building has failed at the base due to water damage. It is in poor condition and should be replaced.

Electrical

Electrical equipment at the WWTF includes some older equipment installed during the original construction in 1979 which includes lighting, receptacles, switches, etc. The WWTF also has a variety of newer electrical equipment installed as part of the 2007 upgrades, including motor control centers, panelboards, disconnect switches, etc. A portion of the electrical equipment installed in 2007 has become obsolete. Operations reports they are unable to easily locate replacement parts and service for obsolete equipment. Any equipment that is obsolete must be replaced to ensure system reliability.

The lighting has had few updates since the construction of the WWTF in 1979. Lighting types observed onsite include recessed, pendant mounted, mostly fluorescent tube lamps, quad pin fluorescent lamps, screw-in fluorescent lamps, incandescent lamps, and LED screw-in lamps. The majority of this lighting is well past its useful life and requires replacement. Exterior lighting onsite is limited in coverage and nonexistent in many of the process areas. Additionally, existing outdoor lighting is not the latest energy efficient type and needs to be upgraded.

Receptacles were minimal and mostly original to the building. Not all receptacles are GFIC where required by code and need to be upgraded accordingly.

The conduit observed in the Control Building included intermediate metal conduit (IMC), RGS, electric metallic tubing (EMT), and schedule 40 PVC. All exposed fittings and boxes were a mixture of the types of conduits noted. All Whips to equipment in at the WWTF were made with liquid-tight flexible conduit, or metal clad (MC) cable. In the pump areas, disconnect switches are NEMA 4x stainless steel type.

Instrumentation

The WWTF contains a variety of instrumentation and associated equipment. The largest of these assets is the main control panel (MCP) located in the front office of the control building. The existing

MCP is in good condition but the Programmable Logic Controller (PLC) inside the panel is outdated and limited in the level of controls and monitoring it can provide. The PLC should be updated during the next major process overhaul at the WWTF to provide a higher level of monitoring and control capabilities to the systems operators. For this upgrade, the existing MCP can be reused with the PLC replaced.

Other instrumentation assets onsite consist primarily of a variety of probes and meters used to monitor water quality parameters and record process data throughout the WWTF. During the site visit instruments appeared to be functional and the control system was functioning to its original intention. Some of the installation dates for instruments onsite were available and others are estimates based on operator input and observations. Some of the instruments have been replaced since the original installation dates but in general all instruments are past or nearing the end of their estimated useful life. It is important to maintain and replace all instruments as necessary once they display signs of deterioration or inaccuracies.

Heating Ventilation and Air Conditioning (HVAC) and Plumbing

HVAC assets at the WWTF range in installation date and relative condition. HVAC equipment is several portions of the control building is original to the building's installation in 1979 and well beyond its estimated useful lifetime. Equipment observed in this category included all HVAC equipment in the laboratory, fin tube radiation heaters throughout the building, and the exhaust fan in the shop room. The exhaust fans in the sludge processing room are also in this category but have been abandoned and are not considered for replacement. Despite this, it may be worthwhile to remove these abandoned exhaust fans as part of larger HVAC renovations.

The other portion of the buildings HVAC equipment was installed in 2006 and ranges in condition from good to poor depending on the durability, use, and locations of equipment. Equipment in this category observed to be in particularly poor condition included the air handling unit (AHU) in the attic which no longer functions, the air-cooled condensing unit (ACCU) on the building's roof that no longer functions, the hot water heaters in the basement, and the exhaust and supply fans in the basement. Other HVAC equipment in the building is in fair to good condition and is not in need of replacement currently. HVAC equipment in the RAS building was observed to be in good working condition with minimal signs wear. None of this equipment is believed to need replacement in the near term.

The plumbing assets at the WWTF are primarily located in the administrative portion of the control building. A variety of the administrative rooms have plumbing systems including the laboratory, locker room, laundry area, and boiler room. Equipment in the laboratory includes an eyewash and emergency shower station, two sinks, and a dishwasher. All of these assets were installed in 1979 and are well past their useful lifetimes. Upon inspection the laboratory plumbing assets appeared worn and in poor condition.

Plumbing assets in the locker room include a mop receptor, shower, lavatory, and water closet. The locker room assets were installed in 2006 and are within their estimated useful lifetime. Upon inspection these assets were working and in conditions ranging from fair to good. The laundry area has a domestic hot water system and a tempering valve. Both assets were observed to be in good working condition and are within their estimated useful lifetimes. The boiler room contains a water service, indirect domestic hot water heater, and a pump. these assets are in good condition and were observed to have minimal wear.

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Other miscellaneous plumbing assets throughout the control building include the eye wash and emergency shower in the chlorine room, the air compressor in the sludge area, and a sewer ejector in the building's basement. No significant issues were observed with any of these assets, but the compressor and ejector are believed to be nearing the end of their estimated useful lifetimes.

Plumbing assets related to the treatment process include sump pumps in the basement of the control building and in the pump room between the secondary clarifiers. Both sump pumps are in fair condition with some wear and corrosion observed on their exterior.

3.0 RECOMMENDED IMPROVEMENTS

All assets that were evaluated in the inventory assessment and received a condition rating of three or more (on a scale of one to five, five being worst) were considered for replacement or repair as part of the recommended improvements of this evaluation. Much of this equipment is recommended for replacement due to age-related wear and is considered correctly rated for the given application at the WWTF. This equipment is generally recommended for replacement with new equipment of equal rating and output.

To provide a measurement of the importance of individual improvements, each of the assets were grouped into priority groups numbered one to five, with one being the highest priority components to replace or improve. These are recommended to be implemented immediately. Priority group two is recommended to be completed in five years, group three in 10 years, group four in 15 years, and group five in 20 years. Full lists of assets for each of the five discipline-based categories, their recommended improvements, associated cost, and priority group are provided in the tables included as Appendix B. It should be noted that recommended improvements for the architectural and building discipline were not given priority group ratings. All WWTF improvements in this discipline are priority one and all pump station improvements in this discipline are considered to be priority three. Tables with the estimates of probable cost for the architectural and building improvements are included in Appendix B.

The cost for each asset includes an estimated installation cost. The total project cost for each priority group adds these installed costs and multiplies them by a factor that anticipates inflation from 2024 to the anticipated implementation date and a multiplier that anticipates contractor overhead, contingency, and engineering. A summary of the priority groups for each discipline and their estimated project costs for both pump station and WWTF improvements are given in Tables 1 and 2 Respectively.

Table 1 – Summary of Pump Station Priority Groups								
Priority	Year Expected	Process Mechanical	Architectural	Electrical	HVAC	I&C	Plumbing	Total
1	2025	\$ 595,000.00	\$ -	\$ 852,250.00	\$ 213,500.00	\$ -	\$ 21,000.00	\$ 1,681,750.00
2	2030	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
3	2035	\$ 1,275,750.00	\$ 483,000.00	\$ 231,000.00	\$ 52,500.00	\$ 264,250.00	\$ 5,250.00	\$ 2,311,750.00
4	2040	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
5	2045	\$ 327,250.00	\$ -	\$ 1,025,500.00	\$ -	\$ -	\$ -	\$ 1,352,750.00
	Total	\$ 2,198,000.00	\$ 483,000.00	\$ 2,108,750.00	\$ 266,000.00	\$ 264,250.00	\$ 26,250.00	\$ 5,346,250.00

Notes:

1. Includes 3% inflation per year from 2024
2. Includes 75% multiplier for contractor overhead, contingency, and engineering

Table 2 – Summary of WWTF Priority Groups								
Priority	Year Expected	Process Mechanical	Architectural	Electrical	HVAC	I&C	Plumbing	Total
1	2025	\$ 4,105,500.00	\$ 1,270,500.00	\$ 855,750.00	\$ 187,250.00	\$ 138,250.00	\$ 126,000.00	\$ 6,683,250.00
2	2030	\$ 206,500.00	\$ -	\$ -	\$ -	\$ 84,000.00	\$ -	\$ 290,500.00
3	2035	\$ 2,401,000.00	\$ -	\$ 150,500.00	\$ 225,750.00	\$ -	\$ 35,000.00	\$ 2,812,250.00
4	2040	\$ 616,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 616,000.00
5	2045	\$ 24,500.00	\$ -	\$ 521,500.00	\$ -	\$ -	\$ -	\$ 546,000.00
	Total	\$ 7,353,500.00	\$ 1,270,500.00	\$ 1,527,750.00	\$ 413,000.00	\$ 222,250.00	\$ 161,000.00	\$ 10,948,000.00

Notes:

1. Includes 3% inflation per year from 2024

2. Includes 75% multiplier for contractor overhead, contingency, and engineering

Several of the assets evaluated in the inventory assessment required alterations or upgrades to meet the needs of the WWTF. The major alterations proposed are described in detail below. The associated costs for these improvements are included in the tables in Appendix B as the replacement cost for the asset slated for improvements. These costs are also incorporated into the cost and priority summary Tables 1 and 2 above.

3.1 Collection System

3.1.1 Pump Stations

Process Mechanical

All pumping components in the four lift stations are generally in good working condition. All sewage pumps were installed in 2005. Some have been rebuilt since then. It is recommended to replace these at the end of their useful life in the year 2035 (and respective year for re-built pumps) and are included in priority group three or five. Pump Station #2 has issues of solids settling in the wet well. Around 2018, the operators installed an air compressor (see Figure 6) to transfer pulses of air in the wetwell to mix the contents. It is recommended to install a more permanent mixing system using a compressor installed in the dry well of the structure to prevent corrosion. This can be an Enviromix system or similar, which includes stainless steel piping and nozzles in the wet well, with a compressor and local controller in the dry well. These are included in priority group one for the Pump Stations. The cost of the new mixing system and appurtenances is included for reference as the replacement cost shown in Appendix B for the current mixing system.

Pump Stations #1 and #2 have existing wet wells that include an influent channel with gates to split the flow to either half of the wet well (see Figure 6). These channels need to be repaired and the gates (three at each station) need to be replaced to regain functionality. These are included in priority group 1 for the Pump Stations.



Figure 6 – Pump Station no. 2 Wet Well

The other process alteration recommended for pump stations is the replacement of the RAW sewage pumps in Station #3. These pumps need to be replaced with new pumps that can provide adjustable pumping rates to match the changing inflow into the station. Additionally, the pumps need to be upgraded to models that provide sufficient pumping rates to meet the station's needs during peak flow periods, as this lift station receives a large fluctuation in flows. To achieve these two functions, Weston & Sampson recommends replacement pumps be VFD controlled to change their pumping rate based on the water levels in the wet well. There is only space for two pumps in the existing dry well, but in order to provide the most reliable system, it is recommended to install a suction lift pump outside the lift station wetwell



Figure 7 – Pump Station no. 3 Dry Well

in addition to the two dry-pit submersible pumps that would replace the existing. The suction lift pump could provide a higher capacity to assist with high flow situations. This upgrade is included in priority group 1 for the pump stations. The cost of the new pumps and appurtenances is included for reference as the replacement cost shown in Appendix B for the current Pump Station #3 pumps.

A summary of the priority groups for the pump station process mechanical improvements and their estimated project costs are given in Table 3.

Table 3 – Summary of Pump Station Process Mechanical Priority Groups					
Priority	Capital Costs	Year Expected	Adjusted Cost	OH&P, Contingency, Eng	Total Project Cost
1	\$ 330,000	2025	\$ 340,000	75%	\$ 595,000
2	\$ -	2030	\$ -	75%	\$ -
3	\$ 526,000	2035	\$ 729,000	75%	\$ 1,275,750
4	\$ -	2040	\$ -	75%	\$ -
5	\$ 100,000	2045	\$ 187,000	75%	\$ 327,250

Notes:

1. Adjusted Cost includes 3% inflation per year from 2024

2. OH&P, Contingency, & Eng cost includes 75% multiplier for contractor overhead, contingency, and engineering

Architectural & Buildings

All architectural and building recommendations take into account Rhode Island State Building Code (RISBC). Applicable sections of the RISBC include the following:

- RISBC-1 Rhode Island Building Code (IBC 2018 w/ amendments)
- RISBC-3 Rhode Island Plumbing Code (IPC 2018 w/ amendments)
- RISBC-4 Rhode Island Mechanical Code (IMC 2018 w/ amendments)
- RISBC-5 Rhode Island Electrical Code (NEC 2020 w/ amendments)
- RISBC-8 Rhode Island Energy Conservation Code (IECC 2018 w/ amendments)
- RISRC-1 State Rehabilitation Building and Fire Code for Existing Structures
- RI Fire Code (NFPA 1 2018 w/ amendments)
- RI Life Safety Code (NFPA 101 2018 w/ amendments)
- Accessibility Code – ANSI A117.1

Most of the proposed work for the architectural discipline falls under the RISRC-1 State Rehabilitation and Fire Code for Existing Structures. Below is an excerpt relating to the work anticipated:

20.4.1401.0 General Requirements

401.1 Renovations are defined as the change, strengthening or addition of load bearing elements, the refinishing, replacement, bracing, strengthening, upgrading or extensive repair of existing materials, elements, components, equipment and/or fixtures. Renovation involves no reconfiguration of spaces. All renovations shall comply with the requirements of this Chapter.

Exception: As modified in Part 904.0 for historical buildings.

401.2 All new work shall comply with the materials and methods requirements, as defined in § Chapter 2.

401.3 The work shall not make the building less conforming with the Building Code, Mechanical Code, Plumbing Code, Rhode Island Fire Safety Code, Rhode Island Fire Prevention Code, NFPA 101, Life Safety Code for existing buildings, Electrical Code, Boiler Safety Code, Energy Code, Elevator Code, or Accessibility Code as applicable, or with any previously approved alternative arrangements, than it was before the renovation was undertaken. BFO

Exception: Minor reductions in the clear opening dimensions of replacement doors and windows that result from the use of different materials shall be allowed, unless such reductions are prohibited by ADAAG.

Pump Station #1

Exterior Recommended Work:

- Repoint masonry as needed.
- Replace asphalt shingle roof:
 - Provide ice and water roof underlayment.
 - Replace gutters and downspouts.
 - Replace wood rake and fasciae with PVC trim.
- Prepare and paint hollow metal Door.
- Replace door hardware set, gasketing, threshold.

Interior Recommended Work:

- Patch gypsum board ceiling.
- Prepare and paint gypsum board, CMU, & concrete surfaces throughout.
- Prepare and paint wet well side walls and ceilings.
- Patch any work related to other discipline work:
 - Housekeeping pads.
 - Patch holes from new or removed pipe in floors, walls, and/or ceilings.

Pump Station #2

Exterior Recommended Work:

- Repoint masonry as needed.
- Repoint masonry and replace brick as needed on masonry vent adjacent to station.
- Replace asphalt shingle roof:
 - Provide ice and water roof underlayment.
 - Replace gutters and downspouts.
 - Replace wood rake and fasciae with PVC trim.
- Prepare and paint hollow metal Door.
- Replace door hardware set, gasketing, threshold.

Interior Recommended Work:

- Prepare and paint gypsum board, CMU, & concrete surfaces throughout.
- Prepare and paint interior of wet well side, walls and ceilings.
- Patch any work related to other discipline work:
 - Housekeeping pads.
 - Patch holes from new or removed pipe in floors, walls, and/or ceilings.

Pump Station #3

Exterior Recommended Work:

- Replace asphalt shingle roof:
 - Provide ice and water roof underlayment.
 - Replace gutters and downspouts.
 - Replace wood rake and fascia with PVC trim.
- Prepare and paint hollow metal door.
- Replace door hardware set, gasketing, threshold.

Interior Recommended Work:

- Prepare and paint gypsum board, CMU, & concrete surfaces throughout.
- Patch any work related to other discipline work:
 - Housekeeping pads.
 - Patch holes from new or removed pipe in floors, walls, and/or ceilings.

A summary of the priority groups for the pump station architectural improvements and their estimated project costs are given in Table 4.

Table 4 – Summary of Pump Station Architectural Priority Groups					
Priority	Capital Costs	Year Expected	Adjusted Cost	OH&P, Contingency, Eng	Total Project Cost
1		2025	\$ -	75%	\$ -
2		2030	\$ -	75%	\$ -
3	\$ 199,000.00	2035	\$ 276,000.00	75%	\$ 483,000.00
4		2040	\$ -	75%	\$ -
5		2045	\$ -	75%	\$ -

Notes:

1. Adjusted Cost includes 3% inflation per year from 2024

2. OH&P, Contingency, & Eng cost includes 75% multiplier for contractor overhead, contingency, and engineering

Electrical

It is recommended that the following improvements be made during the project periods of the respective priority group items. All three lift stations have similar recommendations.

Priority Group 1 (2025)

- Provide new LED Lighting.
- Provide new receptacles and devices.
- Provide new exit signage with battery back-up.
- Upgrade existing wiring to lighting, receptacle, and devices.
- VFDs and Controls Systems

- MCC Panels and Switches
- Breakers

Priority Group 3 (2035)

- Disconnects

Priority Group 5 (2045)

- Emergency Generators
- Automatic Transfer Switches

A summary of the priority groups for the pump station electrical improvements and their estimated project costs are given in Table 5.

Table 5 – Summary of Pump Station Electrical Priority Groups					
Priority	Capital Costs	Year Expected	Adjusted Cost	OH&P, Contingency, Eng	Total Project Cost
1	\$ 472,000.00	2025	\$ 487,000.00	75%	\$ 852,250.00
2	\$ -	2030	\$ -	75%	\$ -
3	\$ 95,000.00	2035	\$ 132,000.00	75%	\$ 231,000.00
4	\$ -	2040	\$ -	75%	\$ -
5	\$ 315,000.00	2045	\$ 586,000.00	75%	\$ 1,025,500.00

Notes:

1. Adjusted Cost includes 3% inflation per year from 2024

2. OH&P, Contingency, & Eng cost includes 75% multiplier for contractor overhead, contingency, and engineering

Instrumentation

It is recommended that the following improvements be made when major process upgrades occur at each station or when these systems fail, whichever comes first:

- Level measurement systems in each pump station be replaced with radar level sensors.
- Verbatim Dialers be replaced and/or upgraded.
- Pertinent monitoring and controls be integrated to a SCADA system if SCADA is utilized at the WWTF.

A summary of the priority groups for the pump station instrumentation and control improvements and their estimated project costs are given in Table 6.

Table 6 – Summary of Pump Station I&C Priority Groups					
Priority	Capital Costs	Year Expected	Adjusted Cost	OH&P, Contingency, Eng	Total Project Cost
1	\$ -	2025	\$ -	75%	\$ -
2	\$ -	2030	\$ -	75%	\$ -
3	\$ 109,000	2035	\$ 151,000	75%	\$ 264,250
4	\$ -	2040	\$ -	75%	\$ -
5	\$ -	2045	\$ -	75%	\$ -

Notes:

1. Adjusted Cost includes 3% inflation per year from 2024

2. OH&P, Contingency, & Eng cost includes 75% multiplier for contractor overhead, contingency, and engineering

Heating Ventilation and Air Conditioning (HVAC) and Plumbing

Priority one pump station improvement items for the HVAC discipline include all exhaust and supply fans. The EUHs are considered priority three improvement items and are designated for replacement in the next 10 years.

A summary of the priority groups for the pump station HVAC improvements and their estimated project costs are given in Table 7.

Table 7 – Summary of Pump Station HVAC Priority Groups					
Priority	Capital Costs	Year Expected	Adjusted Cost	OH&P, Contingency, Eng	Total Project Cost
1	\$ 118,000	2025	\$ 122,000	75%	\$ 213,500
2	\$ -	2030	\$ -	75%	\$ -
3	\$ 21,000	2035	\$ 30,000	75%	\$ 52,500
4	\$ -	2040	\$ -	75%	\$ -
5	\$ -	2045	\$ -	75%	\$ -

Notes:

1. Adjusted Cost includes 3% inflation per year from 2024

2. OH&P, Contingency, & Eng cost includes 75% multiplier for contractor overhead, contingency, and engineering

Plumbing assets in the pump stations are limited. Of these assets nearly all are past their useful lifetimes and considered priority one improvements slated for replacement in the next one to two years. These assets include mop sinks, sump pumps, and water services. The only plumbing asset in the pumping stations not designated as a priority one replacement is the sump pump in Pump Station #2 which has recommended as a priority three improvement designated for replacement in the next 10 years.

A summary of the priority groups for the pump station plumbing improvements and their estimated project costs are given in Table 8.

Table 8 – Summary of Pump Station Plumbing Priority Groups					
Priority	Capital Costs	Year Expected	Adjusted Cost	OH&P, Contingency, Eng	Total Project Cost
1	\$ 11,500	2025	\$ 12,000	75%	\$ 21,000
2	\$ -	2030	\$ -	75%	\$ -
3	\$ 1,500	2035	\$ 3,000	75%	\$ 5,250
4	\$ -	2040	\$ -	75%	\$ -
5	\$ -	2045	\$ -	75%	\$ -

Notes:

1. Adjusted Cost includes 3% inflation per year from 2024

2. OH&P, Contingency, & Eng cost includes 75% multiplier for contractor overhead, contingency, and engineering

3.2 Wastewater Treatment Facility

Process Mechanical

Major priority one improvements for the process mechanical discipline mostly consist of equipment installed during the systems original construction in 1979, equipment designated for alterations to improve the treatment process, and equipment installed in the 2007 renovations with lower estimated lifetimes. Equipment from 1979 that is designated for replacement in the next one to two years includes the two plant water pumps, most of the

laboratory equipment, and the majority of chlorination equipment including storage tanks and dosing pumps. Additionally, while the clarifier internal components were replaced in 2007, the coating on these components appears to be significantly worn. It is recommended the mechanical components and the launders in both clarifiers be sand blasted to remove any corrosion and then be re-coated to maximize the lifetime of the equipment. This work is included as a priority one improvement to be made in the next one to two years.

Two areas of the treatment facility are designated for process alterations and the assets involved in those processes are all designated as priority one improvements to be made in the next one to two years. Lastly the influent slide gates and operators in the aerobic tanks are designated as priority one improvements for replacement in the next one to two years. These gates and operators have a portion of their mechanisms submerged in incoming wastewater and have worn down considerably despite their more recent installation.

Other process equipment is divided into the other priority groups. The most substantial of this equipment includes the internal components of the two secondary clarifiers and the RAS pumps which are all designated as priority three improvements for replacement in approximately 10 years. The majority of other process pumps are included in priority group four and designated for replacement in approximately 15 years. A variety of smaller equipment is also included in each of the priority groups as shown in appendix B.

A summary of the priority groups for the WWTF process mechanical recommended improvements and their estimated project costs are given in Table 9.

Table 9 – Summary of WWTF Process Mechanical Priority Groups					
Priority	Capital Costs	Year Expected	Adjusted Cost	OH&P, Contingency, Eng	Total Project Cost
1	\$ 2,277,000	2025	\$ 2,346,000	75%	\$ 4,105,500
2	\$ 98,000	2030	\$ 118,000	75%	\$ 206,500
3	\$ 990,500	2035	\$ 1,372,000	75%	\$ 2,401,000
4	\$ 219,000	2040	\$ 352,000	75%	\$ 616,000
5	\$ 7,000	2045	\$ 14,000	75%	\$ 24,500

Notes:

1. Adjusted Cost includes 3% inflation per year from 2024

2. OH&P, Contingency, & Eng cost includes 75% multiplier for contractor overhead, contingency, and engineering

As mentioned previously, there are two areas of the facility that are recommended to be modified. The following sections will describe the recommended modifications.

Aerobic Digester Tanks

As noted in Section 2.2 the WWTF no longer receives substantial amounts of septage and no longer digests its sludge. Because of these two changes, the operators now use the two digester tanks onsite as settling tanks for the thickening of sludge. Sludge is stored in the tanks and allowed to settle and thicken. The thickened sludge is sent offsite for disposal. Decant water on the top of sludge is currently fed directly into the headworks via suction lines in the tanks. This discharge tends to overload the system and negatively affects treatment.

To accommodate this problem, Weston and Sampson Recommends rerouting a portion of the piping in the aerobic digester tanks. The reconfiguration would consist of three major changes. First, the current suction lines in the aerobic digester tanks will be rerouted to discharge directly into the septage receiving tanks. We recommend that both lines be tied into a newly installed common discharge line that can selectively discharge into either of the two Septage Receiving Tanks. The combined discharge line will allow operators to transfer water from either Aerobic Tank to either

Septage Receiving Tank via a series of valves. Overall, this alteration will allow for pretreatment and aeration of decant water prior to discharge into the system. Second, the overflow line for the Septage Receiving Tanks will have the invert of its effluent end raised to allow for increased tank volume for the new process. Lastly, the piping, valving, and diffusers in the current Septage Receiving Tanks and the Septage Loading Station will be replaced with stainless steel equipment of the same size and duty. A conceptual sketch and a breakdown of the estimated cost for the proposed alterations are included as Appendix C. The estimated cost for the proposed alterations is also included in the Appendix B tables divided equally between the replacement cost for the two digester tanks and the Septage Receiving Tank.

Aeration System

Aeration Basins #2 and #4 have aerators that are significantly overdue for replacement. Aerators #1 and #3 are nearing the end of their useful life and should also be replaced soon. Currently, all aerators are bridge-mounted paddle-style surface aerators. These aerators are used to supply oxygen and mix the contents of the aeration basin and are the only available equipment that can keep the tank contents mixed. When the dissolved oxygen (DO) content of the tank is sufficient, the aerators must continue running to mix the tank which uses superfluous energy or they must be turned off entirely, which allows solid material to settle, negatively impacting the biomass. It is recommended a system be installed that can keep these tanks mixed when the DO content is sufficient.

Weston & Sampson evaluated three different options for replacing the aerator:

- Option 0 – Replace In-Kind,
- Option 1 – Hyperbolic Mixer with a Blower and Sparge Ring Diffuser,
- Option 2 – Surface Aerator with a Pulsed Air Mixing System.
- Option 3 – Fine Bubble Diffused Air with Paddle Mixing System

Budgetary proposals and drawings for each option are included in Appendix D.

This analysis was conducted under the assumption that the tanks require full mixing when aeration is not required. Other assumptions include a current average electrical cost of \$0.25/kWh and an annual inflation rate of 3%. Table 10 shows the operational data used to calculate the oxygen transfer and annual energy use for each option. It is recommended to replace all four aerations, but the calculations conservatively involve only two of four tanks being operated at a time. The equation below was used to calculate Oxygen Transfer Rate (OTR).

$$OTR = SOTR * \alpha * F * \theta^{T-20} * \frac{(\tau\beta\Omega C_{20} - C)}{C_{20}}$$

Table 10 – Aeration Analysis Energy Calculations

Scenario	Current - Option 0	Option 1	Option 2	Option 3
Equipment	Surface Aerator Only	Invent/Blower	Surface Aerator w/ EnviroMix	Diffused Air w/ Paddle Mixing
Average Plant Flow, MGD	0.348	0.348	0.348	0.348
No. of Tanks	4	4	4	4
No. of Replaced Tanks	2	2	2	2
*Number of Tanks on line	2	2	2	2
Avg. Flow per Tank, MGD	0.174	0.174	0.174	0.174
Aeration Horsepower per tank, hp	20	30	20	30
Aeration Power per tank, kW	15	22.5	15	22.5
Mixing Horsepower per tank, hp	20	4.5	3.8	8
Mixing Power per tank, kW	15	3.375	2.85	6
BOD Influent, mg/L	200	200	200	200
Influent BOD Per Tank, lb./day	290.2	290.2	290.2	290.2
BOD Effluent Required, mg/L	0	0	0	0
Avg BOD Effluent Required per tank, lb./day	0.0	0.0	0.0	0.0
BOD Reduction Required per tank, lb./day	290.2	290.2	290.2	290.2
Volume per Tank, gal	165,000	165,000	165,000	165,000
Actual Oxygen Required (AOR), lb. O ₂ /lb. BOD	1.2	1.2	1.2	1.2
Actual Oxygen Required (AOR), lb. O ₂ /day	348.3	348.3	348.3	348.3
SOTR, lb. O ₂ /HP-hr.	3.35	2.2	3.35	3.3
SOTR, lb. O ₂ /hr.	67	66	67	99
α , Wastewater Correction Factor for O ₂ Transfer	0.7	0.85	0.7	0.6
F, Fouling Factor	1	1	1	1
θ , Temperature Correction Factor for O ₂ Transfer	1.024	1.024	1.024	1.024
T, Liquid Temperature degC	20	20	20	20
τ , Temperature Correction Factor for O ₂ Saturation	1.024	1	1.024	1
β , Oxygen Solubility Correct Factor	0.99	0.98	0.99	0.98
Ω , Pressure Correction Factor	1	1	1	1
C ₂₀ , Steady State DO content, mg/L	9.2	9.2	9.2	9.2
C, DO target, mg/L	2	2	2	2
OTR, Oxygen Transfer Rate, lb. O ₂ /hr.	37.3	43.0	37.3	45.3
OTR/SOTR ratio	0.557	0.648	0.557	0.458
Aeration hours required per tank per day	9.32	8.09	9.32	7.69
Aeration Power used per tank per day, kWh	139.87	182.13	139.87	172.99
% of Non-Aerated Time to be Mixing	61%	66%	61%	68%
Mixing hours required per day	14.68	15.91	14.68	16.31
Mixing Power used per tank per day, kWh	220.1	53.7	41.8	97.9
Total Power used per day per tank, kWh	360.0	235.8	181.7	270.9
Total Power used per day, 2 tanks, kWh	720.0	471.6	363.4	541.7
Total Power used per year for 2 Tanks, kWh	262,980	172,260	132,729	197,863

**Based on all flow going through two tanks*

Option 2 (surface aerator with pulsed air mixing) provides the lowest energy use per year. While replacing in-kind may appear to be the lowest capital cost option, it is prudent to analyze these options over the total anticipated lifetime of the equipment. The other two options utilize less energy to keep the tank mixed when aeration is not necessary. These assets have estimated useful lifetimes between 20- and 30-years. Weston & Sampson has included the total life cycle costs for both 20- and 30-year system lifetimes. The results are displayed in Table 11.

Table 11 – Aeration Analysis Life Cycle Opinion of Probably Cost				
Parameter	Option 0 – Replace In-Kind	Option 1 – Hyperbolic Mixer/Blower	Option 2 – Surface Aerator/Pulsed Air	Option 3 – Diffused Air/Paddle Mixing
*Total Capital Cost	\$1,960,000.00	\$1,812,000.00	\$2,625,000.00	\$1,847,000.00
Annual Electric Use, kWh	262,980	172,260	132,729	197,863
Annual Electricity Cost	\$65,745.00	\$43,065.05	\$33,182.29	\$49,465.68
Annual O&M	\$10,000.00	\$20,000.00	\$12,000.00	\$20,000.00
Total Annual Cost	\$75,745.00	\$63,065.05	\$45,182.29	\$69,465.68
Total 20-Year Cost**	\$4,133,000.00	\$3,621,000.00	\$3,921,000.00	\$3,840,000.00
Total 30-Year Cost**	\$5,748,000.00	\$4,966,000.00	\$4,885,000.00	\$5,321,000.00

**Capital Cost includes contingency, contractor OH&P, and engineering*

***Assumptions: 3% inflation, \$0.25/kWh electrical cost*

Option 1 (Hyperbolic Mixer/Blower) provides the lowest estimated 20-year life cycle cost. Option 2 (Surface Aerator and Pulsed Air Mixing) provides the lowest 30-year life cycle cost.. Option 2 provides the lowest operational costs but is the highest capital cost of the options. All four options will provide reliable aeration and mixing, and there are assumptions involved that result in a margin of error larger than the differences between options 1, 2, and 3. If the tanks are always mixed, it is recommended to avoid Option 0 and provide a separate mixing system than the aeration system. In summary, the higher initial cost of Option 2 is expected to be offset by lower operational costs to provide the lowest cost over the life cycle of the equipment under the assumed operating conditions. It is recommended to proceed with Option 2.

Option 2 is similar to the existing process in that it utilizes surface aerators, adding in the functionality of low energy mixing. The mixing system utilizes a single compressor (multiple can be installed if desired for redundancy), fixed stainless steel pipe with diffuser nozzles, and a series of control valves that are automatically operated based on an adjustable timer. This allows for the tanks to be mixed during periods where the aerator is turned off. This system has been proven to successfully mix aeration basins while utilizing a fraction of the electricity. It is also a simple process to operate. Therefore, it is recommended that the WWTF implement the replacement of the existing aerators with new surface aerators and a pulsed air mixing system. These improvements are included in priority group one. Refer to conceptual layout drawings for the aeration system options in Appendix D.

Architectural

All architectural and building recommendations take into account Rhode Island State Building Code (RISBC). Applicable sections of the RISBC Include the following:

- RISBC-1 Rhode Island Building Code (IBC 2018 w/ amendments)
- RISBC-3 Rhode Island Plumbing Code (IPC 2018 w/ amendments)
- RISBC-4 Rhode Island Mechanical Code (IMC 2018 w/ amendments)
- RISBC-5 Rhode Island Electrical Code (NEC 2020 w/ amendments)
- RISBC-8 Rhode Island Energy Conservation Code (IECC 2018 w/ amendments)
- RISRC-1 State Rehabilitation Building and Fire Code for Existing Structures
- RI Fire Code (NFPA 1 2018 w/ amendments)
- RI Life Safety Code (NFPA 101 2018 w/ amendments)
- Accessibility Code – ANSI A117.1

Most of the proposed work for the architectural discipline falls under the RISRC-1 State Rehabilitation and Fire Code for Existing Structures. Below is an excerpt relating to the work anticipated:

20.4.1401.0 General Requirements

401.1 Renovations are defined as the change, strengthening or addition of load bearing elements, the refinishing, replacement, bracing, strengthening, upgrading or extensive repair of existing materials, elements, components, equipment and/or fixtures. Renovation involves no reconfiguration of spaces. All renovations shall comply with the requirements of this Chapter.

Exception: As modified in Part 904.0 for historical buildings.

401.2 All new work shall comply with the materials and methods requirements, as defined in § Chapter 2.

401.3 The work shall not make the building less conforming with the Building Code, Mechanical Code, Plumbing Code, Rhode Island Fire Safety Code, Rhode Island Fire Prevention Code, NFPA 101, Life Safety Code for existing buildings, Electrical Code, Boiler Safety Code, Energy Code, Elevator Code, or Accessibility Code as applicable, or with any previously approved alternative arrangements, than it was before the renovation was undertaken. BFO

Exception: Minor reductions in the clear opening dimensions of replacement doors and windows that result from the use of different materials shall be allowed, unless such reductions are prohibited by ADAAG.

Control Building

Exterior Recommended Work

- Reconfigure walkway and paved area at building entrance to slope away from door for positive drainage outward and to avoid water from coming into the building and runoff from deteriorating the foundation.

- Repoint masonry as needed.
- Clean and seal masonry throughout.
- Remove and replace tongue & groove siding with fiber cement siding similar to salt shed.
 - Need to hold allowance or minimum wall sheathing replacement cost.
 - Provide peel and stick weather barrier in lieu of stapled weather barrier due to proximity to waterfront.
- Replace asphalt shingle roof.
 - Provide ice and water roof underlayment.
 - Add gutters and downspouts to the entire building.
 - Replace wood rake and fascia with PVC trim.
- Replace two (2) coiling doors with modern operators.
- Replace exterior doors and hardware throughout.
- Replace windows throughout with impact rated windows due to proximity of waterfront.
 - Provide shades.

Interior Recommended Work

- Prepare and paint gypsum board, CMU, & concrete surfaces throughout.
- Replace lever hardware sets throughout in lieu of “knob” style hardware.
- Patch walls and ceilings throughout.
- Patch any work related to other discipline work.
 - Housekeeping pads.
 - Patch holes from new or removed pipe in floors, walls, and/or ceilings.
- Replace breakroom appliances and millwork with modern items.
- Replace some of the laboratory casework.
 - Fume hood to remain.
- Replace washer and dryer in grit room.
- All public-use areas should be fully compliant with ADA (Americans with Disabilities Act) and MAAB (Massachusetts Architectural Access Board) regulations. Where possible, staff areas should also comply to allow full flexibility for personnel and operations.

Recommendations for Other Buildings on Site

RAS building

- Repoint masonry as needed.
- Clean and seal masonry throughout.
- Remove and replace tongue & groove siding with fiber cement siding similar to salt shed.
 - Need to hold allowance or minimum wall sheathing replacement cost.
 - Provide peel and stick weather barrier in lieu of stapled weather barrier due to proximity to waterfront.
- Replace asphalt shingle roof.
 - Provide ice and water roof underlayment.
 - Add gutters and downspouts to the entire building.
 - Replace wood rake and fascia with PVC trim.
- Replace skylights on tank above RAS pump building.
- Paint interior of building with pumps and stair well.

Shed Building

- Replace in its entirety.

A summary of the priority groups for the WWTF architectural recommended improvements and their estimated project costs are given in Table 12.

Priority	Capital Costs	Year Expected	Adjusted Cost	OH&P, Contingency, Eng	Total Project Cost
1	\$ 704,000.00	2025	\$ 726,000.00	75%	\$ 1,270,500.00
2	\$ -	2030	\$ -	75%	\$ -
3	\$ -	2035	\$ -	75%	\$ -
4	\$ -	2040	\$ -	75%	\$ -
5	\$ -	2045	\$ -	75%	\$ -

Notes:

1. Adjusted Cost includes 3% inflation per year from 2024

2. OH&P, Contingency, & Eng cost includes 75% multiplier for contractor overhead, contingency, and engineering

Electrical

It is recommended that the following improvements be made when major process upgrades occur at the WWTF, in conjunction with the other priority groups.

Priority Group 1 (2025)

- Provide new LED Lighting.
- Provide new receptacles and devices.
- Provide new exit signage with battery back-up.
- Upgrade existing wiring to lighting, receptacle, and devices.
- Replace existing exterior disconnect switches at shed area.
- Provide all new exterior lighting at roadway and at aeration area to provide lighting at nighttime.
- MCC Panels and Switches
- VFDs and Controls Systems

Priority Group 3 (2035)

- Circuit Breakers and Disconnects

Priority Group 5 (2045)

- Emergency Generators
- Automatic Transfer Switches

A summary of the priority groups for the WWTF electrical recommended improvements and their estimated project costs are given in Table 13.

Table 13 – Summary of WWTF Electrical Priority Groups					
Priority	Capital Costs	Year Expected	Adjusted Cost	OH&P, Contingency, Eng	Total Project Cost
1	\$ 474,500.00	2025	\$ 489,000.00	75%	\$ 855,750.00
2	\$ -	2030	\$ -	75%	\$ -
3	\$ 61,500.00	2035	\$ 86,000.00	75%	\$ 150,500.00
4	\$ -	2040	\$ -	75%	\$ -
5	\$ 160,000.00	2045	\$ 298,000.00	75%	\$ 521,500.00

Notes:

1. Adjusted Cost includes 3% inflation per year from 2024

2. OH&P, Contingency, & Eng cost includes 75% multiplier for contractor overhead, contingency, and engineering

Instrumentation

Proposed improvements at the WWTF for the instrumentation and controls systems include the following:

MCP PLC replacement to allow for more inputs/outputs and control capacity.

Implementation of a SCADA system that includes all WWTF processes and lift stations.

Instrument replacements during any renovation to its related process (e.g. DO probe replacement during aeration upgrades).

Installation of a radar level sensor in the chlorine contact tank for upgrades to the effluent water pump system.

A summary of the priority groups for the WWTF instrumentation and control improvements and their estimated project costs are given in Table 14.

Table 14 – Summary of WWTF I&C Priority Groups					
Priority	Capital Costs	Year Expected	Adjusted Cost	OH&P, Contingency, Eng	Total Project Cost
1	\$ 76,000	2025	\$ 79,000	75%	\$ 138,250
2	\$ 40,000	2030	\$ 48,000	75%	\$ 84,000
3	\$ -	2035	\$ -	75%	\$ -
4	\$ -	2040	\$ -	75%	\$ -
5	\$ -	2045	\$ -	75%	\$ -

Notes:

1. Adjusted Cost includes 3% inflation per year from 2024

2. OH&P, Contingency, & Eng cost includes 75% multiplier for contractor overhead, contingency, and engineering

Heating Ventilation and Air Conditioning (HVAC) and Plumbing

The highest priority improvement items in the WWTF are the AHU in the attic of the control building and the UH on the roof of the control building. These units no longer function and must be replaced as soon as possible. Other priority one replacement HVAC items at the WWTF include exhaust fans, supply fans, hot water unit heaters, cabinet unit heaters, inline hot water circulators, and fin tube radiation units that were observed to be in fair to poor conditions throughout the control building. Note some of the priority 1 replacement items were observed to be in good condition but are part of larger systems that are designated for replacement, and it is considered prudent to replace these components as part of the larger renovations. Priority 3 improvements designated for replacement in

the next 10 years consist primarily of equipment for hot water systems including the buildings boiler and hot water heating units which were all observed to be in good condition. The HVAC equipment in the RAS building is all designated as priority 3 improvement items.

A summary of the priority groups for the WWTF HVAC improvements and their estimated project costs are given in Table 15.

Table 15 – Summary of WWTF HVAC Priority Groups					
Priority	Capital Costs	Year Expected	Adjusted Cost	OH&P, Contingency, Eng	Total Project Cost
1	\$ 103,000	2025	\$ 107,000	75%	\$ 187,250
2	\$ -	2030	\$ -	75%	\$ -
3	\$ 93,000	2035	\$ 129,000	75%	\$ 225,750
4	\$ -	2040	\$ -	75%	\$ -
5	\$ -	2045	\$ -	75%	\$ -

Notes:

1. Adjusted Cost includes 3% inflation per year from 2024
2. OH&P, Contingency, & Eng cost includes 75% multiplier for contractor overhead, contingency, and engineering

Most plumbing assets are recommended as priority one improvements to be replaced in the next one to two years. This includes all of the plumbing assets in the laboratory, boiler room, laundry area, and basement. Equipment in the locker room and the chlorine room eyewash and emergency shower were in better condition than other plumbing assets and are designated as priority three improvements to be replaced in approximately 10 years.

A summary of the priority groups for the WWTF plumbing improvements and their estimated project costs are given in Table 16.

Table 16 – Summary of WWTF Plumbing Priority Groups					
Priority	Capital Costs	Year Expected	Adjusted Cost	OH&P, Contingency, Eng	Total Project Cost
1	\$ 69,000.00	2025	\$ 72,000	75%	\$ 126,000
2	\$ -	2030	\$ -	75%	\$ -
3	\$ 14,000.00	2035	\$ 20,000	75%	\$ 35,000
4	\$ -	2040	\$ -	75%	\$ -
5	\$ -	2045	\$ -	75%	\$ -

Notes:

1. Adjusted Cost includes 3% inflation per year from 2024
2. OH&P, Contingency, & Eng cost includes 75% multiplier for contractor overhead, contingency, and engineering

4.0 REFERENCES

Meyers RA. Encyclopedia of Physical Science and Technology. Academic Press; 2002.

APPENDIX A

Inventory Assessment Tables

Table A1: Pump Station Architectural Inventory Assessment

Location	Asset Name
PUMP STATION #1	ROOF
PUMP STATION #1	GUTTERS
PUMP STATION #1	RAKERS
PUMP STATION #1	MASONRY AT VENT
PUMP STATION #1	GLAZING
PUMP STATION #1	FLOOR PAINT
PUMP STATION #1	CEILING PAINT
PUMP STATION #1	WALL PAINT
PUMP STATION #1	DOOR HARDWARE
PUMP STATION #1	CEILING PATCH
PUMP STATION #2	MASONRY WASH
PUMP STATION #2	VENT
PUMP STATION #2	ROOF
PUMP STATION #2	GUTTERS
PUMP STATION #2	WALL PAINT
PUMP STATION #2	CEILING PAINT
PUMP STATION #2	FLOOR PAINT
PUMP STATION #3	MASONRY WASH
PUMP STATION #3	VENT
PUMP STATION #3	ROOF
PUMP STATION #3	GUTTERS
PUMP STATION #3	WALL PAINT
PUMP STATION #3	CEILING PAINT
PUMP STATION #3	FLOOR PAINT

Table A2: Pump Station Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Pump Station #1	Raw Sewage Pump #1	2005	30	3	43.90%	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment show signs of wear and require maintenance or replacement. The outlet side check valve is leaking.
Pump Station #1	Pump #1 VFD	2013	15	4	49.80%	The VFD is still working but is an older model and is aging. The unit will reach the end of its estimate useful lifetime in the near futures.
Pump Station #1	Raw Sewage Pump #2	2005	30	3	43.90%	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment show signs of wear and require maintenance or replacement. The outlet side check valve is leaking.
Pump Station #1	Pump #2 VFD	2013	15	4	49.80%	The VFD is still working but is an older model and is aging. The unit will reach the end of its estimate useful lifetime in the near futures.
Pump Station #1	Sump Pump	2005	30	3	43.90%	The Sump Pump is in good working condition and about halfway through its estimated useful lifetime. Sump pumps are generally cheap and easily replaceable by the system operators.
Pump Station #1	Influent Channel	2005	60	2	22.24%	This channel is well within its estimated useful lifetime. General wear was observed on the concrete including spalling around gates. Due to the hash operating conditions the channel may be wearing down faster than expected.

Table A2: Pump Station Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Pump Station #1	Sluice Gates & Operators (3 Total)	2005	30	3	43.90%	Although within their estimated useful lifetimes these sluice gates and operators are in very poor condition. Significant wear and corrosion was observed on all three units and the system operators report the gates are difficult to operate due to corrosion. Due to the harsh operating conditions the channel may be wearing down faster than expected.
Pump Station #1	PS#1 Controls	2005	20	5	60.95%	The PS#1 is in good working condition and minimal wear was observed on the unit during the site inspection. The Panel is still made and parts are available for maintenance and repairs. The water level measurement is not functioning properly. The autodials appear to be in good condition with minimal wear and are connected to a Verizon cellular device. See Table TA4 Pump Station Instrumentation and Controls Inventory Assessment for more details.
Pump Station #2	Raw Sewage Pump #1	2005	30	3	43.90%	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment shows signs of wear and require maintenance or replacement. The pump does not have a VFD.
Pump Station #2	Raw Sewage Pump #2	2005	30	3	43.90%	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment shows signs of wear and require maintenance or replacement. The pump does not have a VFD.
Pump Station #2	Sump Pump	2005	30	3	43.90%	The Sump Pump is in good working condition and about halfway through its estimated useful lifetime. Sump pumps are generally cheap and easily replaceable by the system operators.
Pump Station #2	Influent Channel	2005	60	2	22.24%	This channel is well within its estimated useful lifetime. General wear was observed on the concrete including spalling around gates. Due to the harsh operating conditions the channel may be wearing down faster than expected.

Table A2: Pump Station Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Pump Station #2	PS#2 Compressor	2018	30	1	13.49%	This compressor is in good working condition. The compressor is used to mix the water in the well and suspend settling grit. The compressor is not ideal for its current application and the operator struggle with grit settling in the wet well.
Pump Station #2	Sluice Gates & Operators (3 Total)	2005	30	3	43.90%	Although within their estimated useful lifetimes these sluice gates and operators are in very poor condition. Significant wear and corrosion was observed on all three units and the system operators report the gates are difficult to operate due to corrosion. Due to the harsh operating conditions the channel may be wearing down faster than expected.
Pump Station #2	PS#2 Controls	2005	20	5	60.95%	The PS#2 is in good working condition and minimal wear was observed on the unit during the site inspection. The Panel is still made and parts are available for maintenance and repairs. The water level measurement is not functioning properly. The autodials appear to be in good condition with minimal wear and are connected to a Verizon cellular device. See Table TA4 Pump Station Instrumentation and Controls Inventory Assessment for more details.
Pump Station #3	Raw Sewage Pump #1	2005	30	3	43.90%	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment shows signs of wear and may require maintenance or replacement. The operators report the pumping rate is too high during dry periods and too low during rain events. The pump has no VFD.
Pump Station #3	Raw Sewage Pump #2	2005	30	3	43.90%	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment shows signs of wear and may require maintenance or replacement. The operators report the pumping rate is too high during dry periods and too low during rain events. The pump has no VFD.
Pump Station #3	Sump Pump	2005	30	3	43.90%	The Sump Pump is in good working condition and about halfway through its estimated useful lifetime. Sump pumps are generally cheap and easily replaceable by the system operators.

Table A2: Pump Station Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Pump Station #3	PS#3 Controls	2005	20	5	60.95%	The PS#3 is in good working condition and minimal wear was observed on the unit during the site inspection. The Panel is still made and parts are available for maintenance and repairs. The water level measurement is not functioning properly. The autodialers appear to be in good condition with minimal wear and are connected to a Verizon cellular device. See Table TA4 Pump Station Instrumentation and Controls Inventory Assessment for more details.
Pump Station #4	PS #4 Wet well	1980	60	4	49.80%	The well structure is within its estimated useful lifetime and minimal wear and corrosion were observed on the structure.
Pump Station #4	Raw Sewage Pump #1	2005	30	3	43.90%	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment show signs of wear and require maintenance or replacement. The outlet side check valve is leaking.
Pump Station #4	Raw Sewage Pump #2	2005	30	3	43.90%	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment show signs of wear and require maintenance or replacement. The outlet side check valve is leaking.
Pump Station #4	Valve Chamber	1980	60	4	49.80%	All piping and valves are Sch 80 PVC and show minimal wear.
Pump Station #4	PS#4 Controls	2005	20	5	60.95%	The PS#3 is in good working condition and minimal wear was observed on the unit during the site inspection. The Panel is still made and parts are available for maintenance and repairs. The water level measurement is not functioning properly. The autodialers appear to be in good condition with minimal wear and are connected to a Verizon cellular device. See Table TA4 Pump Station Instrumentation and Controls Inventory Assessment for more details.

Table A3: Pump Station Electrical Inventory Assessment

Process	Location	Asset Name	Year Installed	Estimated Useful Life (yrs.)	Condition	Probability of Failure	Comments
PANEL LV1 (STATION #1)	PUMP STATION #1	CIRCUIT BREAKER PANEL	2008	40	2	32.97%	PUMP STATION #1 - BAY VIEW DRIVE
PANEL LX1 (STATION #1)	PUMP STATION #1	CIRCUIT BREAKER PANEL	2008	40	2	32.97%	PUMP STATION #1 - BAY VIEW DRIVE
30 KVA TRANSFORMER	PUMP STATION #1	TRANSFORMER	2008	40	2	32.97%	PUMP STATION #1 - BAY VIEW DRIVE
MCC #3 (MCC-1)	PUMP STATION #1	MOTOR CONTROL CENTER	2008	40	2	32.97%	PUMP STATION #1 - BAY VIEW DRIVE
PUMP - 1	MCC#3 SECTION 1	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 3
SF-20	MCC#3 SECTION 1	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 3
PUMP - 2	MCC#3 SECTION 2	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 3
50A FEEDER FOR 30KVA TRANSFORMER	MCC#3 SECTION 2	CIRCUIT BREAKER	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 3
PUMP CONTROL PANEL	MCC#3 SECTION 3	INDICATING LIGHTS	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 3
SF-19	PUMP STATION #1	DISCONNECT SWITCH	2008	40	2	32.97%	VIA PANEL LX1
SF-20	PUMP STATION #1	DISCONNECT SWITCH	2008	40	2	32.97%	VIA MCC#3
EF-21	PUMP STATION #1	DISCONNECT SWITCH HAND/OFF/AUTO	2008	40	2	32.97%	VIA PANEL LX1
EF-22	PUMP STATION #1	DISCONNECT SWITCH	2008	40	2	32.97%	VIA PANEL LX1
EF-23	PUMP STATION #1	DISCONNECT SWITCH	2008	40	2	32.97%	VIA PANEL LX1
PUMP #1	PUMP STATION #1	DISCONNECT SWITCH	2008	40	2	32.97%	VIA MCC#3
PUMP #2	PUMP STATION #1	DISCONNECT SWITCH	2008	40	2	32.97%	VIA MCC#3
LIGHTING	PUMP STATION #1	LIGHTING	1976	25	5	85.34%	ALL DIFFERENT MANUFACTURERS, LAMP TYPES, SOME EXPLOSION PROOF. WIRING MIGHT BE ORIGINAL
RECEPTACLES	PUMP STATION #1	RECEPTACLES	1976	30	5	79.81%	ALL DIFFERENT MANUFACTURERS, SOME EXPLOSION PROOF. WIRING MIGHT BE ORIGINAL. NOT ALL GFIC
EMERGENCY GENERATOR	PUMP STATION #1 BUILDING EXTERIOR	EMERGENCY GENERATOR	2023	30	0	3.28%	PUMP STATION #1 - BAY VIEW DRIVE
AUTOMATIC TRANSFER SWITCH	PUMP STATION #1 BUILDING EXTERIOR	AUTOMATIC TRANSFER SWITCH	2023	30	0	3.28%	NEWLY INSTALLED BUT SHOWING SIGNS OF RUST AT DOOR HINGE AREA, NEMA 3R

Table A3: Pump Station Electrical Inventory Assessment

Process	Location	Asset Name	Year Installed	Estimated Useful Life (yrs.)	Condition	Probability of Failure	Comments
PANEL LV1 (STATION #2)	PUMP STATION #2	CIRCUIT BREAKER PANEL	2008	40	2	32.97%	PUMP STATION #2 - HAMILTON AVENUE
PANEL LX1 (STATION #2)	PUMP STATION #2	CIRCUIT BREAKER PANEL	2008	40	2	32.97%	PUMP STATION #2 - HAMILTON AVENUE
30 KVA TRANSFORMER	PUMP STATION #2	TRANSFORMER	2008	40	2	32.97%	PUMP STATION #2 - HAMILTON AVENUE
MCC #4 (MCC-2)	PUMP STATION #2	MOTOR CONTROL CENTER	2008	40	2	32.97%	PUMP STATION #2 - HAMILTON AVENUE
PUMP - 1	MCC#4 SECTION 1	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 3
SF-20	MCC#4 SECTION 1	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 3
PUMP - 2	MCC#4 SECTION 2	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 3
50A FEEDER FOR 30KVA TRANSFORMER	MCC#4 SECTION 2	CIRCUIT BREAKER	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 3
PUMP CONTROL PANEL	MCC#4 SECTION 3	INDICATING LIGHTS	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 3
SF-19	PUMP STATION #2	DISCONNECT SWITCH	2008	40	2	32.97%	PUMP STATION #2 - HAMILTON AVENUE
SF-20	PUMP STATION #2	DISCONNECT SWITCH	2008	40	2	32.97%	PUMP STATION #2 - HAMILTON AVENUE
EF-21	PUMP STATION #2	DISCONNECT SWITCH HAND/OFF/AUTO	2008	40	2	32.97%	PUMP STATION #2 - HAMILTON AVENUE
EF-22	PUMP STATION #2	DISCONNECT SWITCH	2008	40	2	32.97%	PUMP STATION #2 - HAMILTON AVENUE
EF-23	PUMP STATION #2	DISCONNECT SWITCH	2008	40	2	32.97%	PUMP STATION #2 - HAMILTON AVENUE
PUMP #1	PUMP STATION #2	DISCONNECT SWITCH	2008	40	2	32.97%	PUMP STATION #2 - HAMILTON AVENUE
PUMP #2	PUMP STATION #2	DISCONNECT SWITCH	2008	40	2	32.97%	PUMP STATION #2 - HAMILTON AVENUE
LIGHTING	PUMP STATION #2	LIGHTING	1976	15	5	95.92%	ALL DIFFERENT MANUFACTURERS, LAMP TYPES, SOME EXPLOSION PROOF. WIRING MIGHT BE ORIGINAL
RECEPTACLES	PUMP STATION #2	RECEPTACLES	1976	20	5	90.93%	ALL DIFFERENT MANUFACTURERS, LAMP TYPES, SOME EXPLOSION PROOF. WIRING MIGHT BE ORIGINAL. NOT ALL GFIC
EMERGENCY GENERATOR	PUMP STATION #2 BUILDING EXTERIOR	EMERGENCY GENERATOR	2023	30	0	3.28%	PUMP STATION #2 - HAMILTON AVENUE
AUTOMATIC TRANSFER SWITCH	PUMP STATION #2 BUILDING EXTERIOR	AUTOMATIC TRANSFER SWITCH	2023	25	0	3.92%	PUMP STATION #2 - HAMILTON AVENUE

Table A3: Pump Station Electrical Inventory Assessment

Process	Location	Asset Name	Year Installed	Estimated Useful Life (yrs.)	Condition	Probability of Failure	Comments
PANEL LV1 (STATION #3)	PUMP STATION #3	CIRCUIT BREAKER PANEL	2008	40	2	32.97%	PUMP STATION #3 - NARRAGANSETT AVENUE
PANEL LX1 (STATION #3)	PUMP STATION #3	CIRCUIT BREAKER PANEL	2008	40	2	32.97%	PUMP STATION #3 - NARRAGANSETT AVENUE
45 KVA TRANSFORMER	PUMP STATION #3	TRANSFORMER	2008	40	2	32.97%	PUMP STATION #3 - NARRAGANSETT AVENUE
MCC #4 (MCC-3)	PUMP STATION #3	MOTOR CONTROL CENTER	2008	40	2	32.97%	PUMP STATION #3 - NARRAGANSETT AVENUE
PUMP - 1	MCC#4 SECTION 1	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 4
50A FEEDER FOR 30KVA TRANSFORMER	MCC#4 SECTION 2	CIRCUIT BREAKER	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 4
PUMP - 2	MCC#4 SECTION 2	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 4
PUMP CONTROL PANEL	MCC#4 SECTION 3	INDICATING LIGHTS	2008	40	2	32.97%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 4
PUMP #1	PUMP STATION #3	DISCONNECT SWITCH	2008	40	2	32.97%	PUMP STATION #3 - NARRAGANSETT AVENUE
PUMP #2	PUMP STATION #3	DISCONNECT SWITCH	2008	40	2	32.97%	PUMP STATION #3 - NARRAGANSETT AVENUE
LIGHTING	PUMP STATION #3	LIGHTING	1976	40	5	69.88%	ALL DIFFERENT MANUFACTURERS, LAMP TYPES, SOME EXPLOSION PROOF. WIRING MIGHT BE ORIGINAL
RECEPTACLES	PUMP STATION #3	RECEPTACLES	1976	40	5	69.88%	ALL DIFFERENT MANUFACTURERS, SOME EXPLOSION PROOF. WIRING MIGHT BE ORIGINAL. NOT ALL GFIC
EMERGENCY GENERATOR	PUMP STATION #2	EMERGENCY GENERATOR	2023	30	0	3.28%	PUMP STATION #3 - NARRAGANSETT AVENUE
AUTOMATIC TRANSFER SWITCH	PUMP STATION #2	AUTOMATIC TRANSFER SWITCH	2023	30	0	3.28%	PUMP STATION #3 - NARRAGANSETT AVENUE
REMOTE LIFT STATION	MAPLE AVENUE	REMOTE LIFT STATION	2008	40	2	32.97%	REMOTE LIFT STATION - MAPLE AVENUE

Table A4: Pump Station Instrumentation and Controls Inventory Assessment

Location	Asset Name	Year Installed	Useful Life (yrs.)	Calculated Condition	Observed Condition	Probability of Failure	Comments
MCC	MultiTrode	2005	30	3	3	46.92%	This is still made, but not a controller I have used. They seem unified on Flygt products so I see nothing wrong with it, though I believe they want to move to a different type of level measurement. I would suggest either ultrasonic in a stilling well or submersible pressure. The MT2PC is still made and it can be retrofitted for any level measurement device
MCC area / Dry Well	Autodialer	2005	30	3	2	46.92%	The verbatim autodialers should be tested out and made sure that they have all critical alarms. They appear functional and wired to Verizon cellular service.
Dry Well / Exterior	Remote Comms	2005	30	3	NA	46.92%	It is unclear what, but staff mentioned that there is radio communication between the pump stations and the main plant. I did see radio antenna, but I did not see the devices. Only the Verizon equipment. Recommend performing a site study and ensuring it's on a licensed frequency or going to everything on existing Verizon service. There is equipment by datalinc but it does not match existing equipment by them. Could be this for long range IP radio.
Dry Well	RTU	2005	30	3	2	46.92%	There does not seem to be any issue with the RTU and it likely does not need to be upgraded, merely incorporated into a new SCADA system.

Table A5: Pump Station HVAC Inventory Assessment

Process	Location	Asset Name	Year Installed	Useful Life (yrs.)	Useful Life Remaining	Calculated Condition	Observed Condition	Probability of Failure
Pump Station #1					-2024	#DIV/0!		#DIV/0!
Heat	Stairwell Upper Level	EUH1	2005	30	11	3	good	46.92%
Heat	Generator Room	EUH2	2005	30	11	3	good	46.92%
Heat	Pump Room	EUH3	2005	30	11	3	good	46.92%
Heat	Stairwell Lower Level	EUH4	2005	30	11	3	good	46.92%
Exhaust Fan	Toilet	EF-18	2005	30	11	3	not observed	46.92%
Supply Fan	Pump Room	SF-19	1999	30	5	4	good	56.54%
Exhaust Fan	Pump Room	EF-20	1999	30	5	4	good	56.54%
Exhaust Fan	Wet Well	EF-21	1999	30	5	4	Poor	56.54%
Exhaust Fan	Wet Well	EF-22	1999	30	5	4	Poor	56.54%
Pump Station #2								
Heat	Stairwell Upper Level	EUH1	2005	30	11	3	good	46.92%
Heat	Generator Room	EUH2	2005	30	11	3	good	46.92%
Heat	Pump Room	EUH3	2005	30	11	3	good	46.92%
Heat	Stairwell Lower Level	EUH4	2005	30	11	3	good	46.92%
Exhaust Fan	Toilet	EF-22	1999	30	5	4	not observed	56.54%
Supply Fan	Pump Room	SF-23	1999	30	5	4	good	56.54%
Exhaust Fan	Generator Room	EF-24	1999	30	5	4	good	56.54%
Exhaust Fan	Wet Well	EF-25	1999	30	5	4	Poor	56.54%

Table A6: Pump Station Plumbing Inventory Assessment

Asset Type	Process	Location	Year Installed	Useful Life (yrs.)	Calculated Condition	Observed Condition	Probability of Failure
1st Pump Station							
Plumbing	Mop Sink	Restroom	1976	30	5	Fair	82.76%
Plumbing	Water Closet	Restroom	1976	30	5	Fair	82.76%
Plumbing	Water Service/Backflow	Pump Room	1976	30	5	Fair	82.76%
2nd Pump Station							
Plumbing	Mop Sink	Generator Room	1976	30	5	Fair	82.76%
Plumbing	Sump Pump	Pump Room	2005	30	3	Fair	43.90%
Plumbing	Water Service/Backflow	Pump Room	1976	30	5	Fair	82.76%

Table A7: WWTF Architectural Inventory Assessment

Asset Type	Location	Asset Name
STRUCTURE	WTFF EXTERIOR	ROOF
STRUCTURE	WTFF EXTERIOR	SIDING
ACCESSORY	WTFF EXTERIOR	WINDOW
SYSTEM	WTFF INTERIOR	FIRE PROTECTION / SPRINKLERS
COMPONENT	BREAKROOM	REFRIGERATOR
COMPONENT	BREAKROOM	SINK
COMPONENT	BREAKROOM	MICROWAVE
COMPONENT	BREAKROOM	CABINETS
COMPONENT	LABORATORY	REFRIGERATOR
COMPONENT	RESTROOM	DOOR HARDWARE
FINISHES	RESTROOM	FLOOR TILE
FINISHES	RESTROOM	WALL TILE
FINISHES	PLAN ROOM	FLOOR (EPOXY?)
ACCESSORY	PLAN ROOM	WINDOW
FINISHES	HALLWAY	CEILING PAINT
ACCESSORY	MECHANICAL ROOM	LOUVERS
FINISHES	TREATMENT ROOM	FLOOR PATCHING
ACCESSORY	TREATMENT ROOM	OVERHEAD DOOR
COMPONENT	GRIT ROOM	WASHER & DRYER
FINISHES	GRIT ROOM	CEILING PATCHING
FINISHES	GRIT ROOM	FLOOR PATCHING
COMPONENT	GRIT ROOM	PAD AT WATER HEATER
FINISHES	PUMP ROOM	FLOOR PAINT
FINISHES	PUMP ROOM	PIPPING PAINT
FINISHES	PUMP ROOM	CEILING PAINT
STRUCTURE	RAS BUILDING	SIDING
STRUCTURE	RAS BUILDING	ROOF

Table A7: WWTF Architectural Inventory Assessment

Asset Type	Location	Asset Name
FINISHES	RAS BUILDING	WASH MASONRY
FINISHES	RAS BUILDING	FLOOR PAINT
ACCESSORY	RAS BUILDING	SKYLIGHT

Table A8: WWTF Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Aeration Tanks	Aerator Assembly #2	1979	30	5	80.34%	Aerator Assembly #2 is in very poor condition. The assembly's paddle is destroyed and not operational. Additionally, the assembly is well beyond its estimated useful lifetime and the operators have requested the unit be replaced and upgraded.
Aeration Tanks	Aerator Motor #2	1979	30	5	80.34%	Aerator Motor #2 is in very poor condition and well beyond its estimated useful lifetime. The operators have requested the unit be replaced.
Aeration Tanks	Aerator Assembly #4	1979	30	5	80.34%	Aerator Assembly #4 is in very poor condition. The assembly is well beyond estimated useful lifetime and the operators have requested the unit be replaced and upgraded.
Aeration Tanks	Aerator Motor #4	1979	30	5	80.34%	Aerator Motor #4 is in very poor condition and well beyond its estimated useful lifetime. The operators have requested the unit be replaced.
Aeration Tanks	Slide Gate #1 & Operator	2007	30	3	39.70%	Slide gate and Operator #1 are heavily corroded and worn. It is difficult to adjust the slide gate due to the corrosion. Operations staff requested the unit be replaced.
Aeration Tanks	Slide Gate #2 & Operator	2007	30	3	39.70%	Slide gate and Operator #2 are heavily corroded and worn. It is difficult to adjust the slide gate due to the corrosion. Operations staff requested the unit be replaced.
Aeration Tanks	Slide Gate #3 & Operator	2007	30	3	39.70%	Slide gate and Operator #3 are heavily corroded and worn. It is difficult to adjust the slide gate due to the corrosion. Operations staff requested the unit be replaced.
Aeration Tanks	Slide Gate #4 & Operator	2007	30	3	39.70%	Slide gate and Operator #4 are heavily corroded and worn. It is difficult to adjust the slide gate due to the corrosion. Operations staff requested the unit be replaced.
Aeration Tanks	Aerator Assembly #1	2007	30	3	39.70%	Aerator Assembly #1 is in good condition and the systems operators reported no operational issues with the unit. The unit is within its estimated useful lifetime.

Table A8: WWTF Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Aeration Tanks	Aerator Motor #1	2007	30	3	39.70%	Aerator Motor #1 is in good condition and the systems operators reported no operational issues with the unit. The unit is withing its estimated useful lifetime.
Aeration Tanks	Aerator Assembly #3	2007	30	3	39.70%	Aerator Assembly #1 is in good condition and the systems operators reported no operational issues with the unit. The unit is withing its estimated useful lifetime.
Aeration Tanks	Aerator Motor #3	2007	30	3	39.70%	Aerator Motor #1 is in good condition and the systems operators reported no operational issues with the unit. The unit is withing its estimated useful lifetime.
Aeration Tanks	Froth Spray System	2007	30	3	39.70%	The froth system is in poor condition and past its useful lifetime. Additionally, the operators report the system is no longer necessary for treatment and has been abandoned in place.
Aeration Tanks	Aerator #1 Outlet Weir/Baffle Systems & Operators (2/4Total)	2007	30	3	39.70%	This mechanism is in fair condition but shows some signs of wear and corrosion. The mechanism is difficult to operate due to corrosion but the operators report minimal need for adjustments to the weir.
Aeration Tanks	Aerator #2 Outlet Weir/Baffle Systems & Operators (2/4Total)	2007	30	3	39.70%	This mechanism is in fair condition but shows some signs of wear and corrosion. The mechanism is difficult to operate due to corrosion but the operators report minimal need for adjustments to the weir.
Aeration Tanks	Aerator #3 Outlet Weir/Baffle Systems & Operators (2/4Total)	2007	30	3	39.70%	This mechanism is in fair condition but shows some signs of wear and corrosion. The mechanism is difficult to operate due to corrosion but the operators report minimal need for adjustments to the weir.
Aeration Tanks	Aerator #4 Outlet Weir/Baffle Systems & Operators (2/4Total)	2007	30	3	39.70%	This mechanism is in fair condition but shows some signs of wear and corrosion. The mechanism is difficult to operate due to corrosion but the operators report minimal need for adjustments to the weir.
Between Aerated Grit Tank & Digestor Tanks	Septage Receiving Tank	1979	60	4	50.74%	the concrete of the septage receiving tank is in good condition. Much of the Internal equipment including air lines and diffusers are in very poor condition and require replacement. the Inlet valves and piping are all in poor condition and require replacement. The system operators would like to reconfigure the tank to receive water siphoned from the top of the sludge that is thickening in the digester tanks.

Table A8: WWTF Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Between clarifiers	Clarifier Building	1979	60	4	50.74%	Building is aging but in fair condition. Siding is considerably worn and deteriorating. Roof could not be inspected but is nearing the end of its estimated useful lifetime.
Between Clarifiers & Aeration Tanks on Slope	Clarifier #1 Inlet Valve & Operator	2007	20	4	56.08%	This equipment is in fair condition with some visible corrosion and wear on the above grade operator. The valve and operator are approaching the end of their estimated useful lifetime but the system operators reported no operational issues.
Between Clarifiers & Aeration Tanks on Slope	Clarifier #2 Inlet Valve & Operator	2007	20	4	56.08%	This equipment is in fair condition with some visible corrosion and wear on the above grade operator. The valve and operator are approaching the end of their estimated useful lifetime but the system operators reported no operational issues.
Chlorine Contact Tank	Chlorine Contact Tank	1979	60	4	50.74%	The chlorine contact tank is in good condition and no significant damage was observed on the tanks concrete. The tank is well withing its useful lifetime.
Clarifier #1	Clarifier #1 Structure	1979	60	4	50.74%	The Clarifier #1 tank is in good condition and no significant damage was observed on the tanks concrete. The center pier of the clarifier is not plum and has damaged return activated sludge recycle line. The tank is well withing its useful lifetime. Some of the handrails around the perimeter of the tank are loose and need to be reset.
Clarifier #2	Clarifier #2 Structure	1979	60	4	50.74%	The Clarifier #1 tank is in good condition and no significant damage was observed on the tanks concrete. The center pier of the clarifier is not plum and has damaged return activated sludge recycle line. The tank is well withing its useful lifetime. Some of the handrails around the perimeter of the tank are loose and need to be reset.
Control Building/ Basement	WAS Pump #1	2007	30	3	39.70%	WAS Pump #1 is in good condition and shows minimal signs of corrosion and wear. The pump is about halfway through its estimated useful lifetime and should function for the next 10 year period with proper maintenance. Some of the ancillary equipment including the valving and piping shows signs of aging and wear. This ancillary equipment should be considered for replacement.
Control Building/ Basement	WAS Pump #1 Motor	2007	30	3	39.70%	This motor is showing minimal signs of wear and corrosion. The Motor is about halfway through its estimated useful lifetime and should function for the next 10 year period with proper maintenance.
Control Building/ Basement	WAS Pump #2	2007	30	3	39.70%	WAS Pump #2 is in good condition and shows minimal signs of corrosion and wear. The pump is about halfway through its estimated useful lifetime and should function for the next 10 year period with proper maintenance. Some of the ancillary equipment including the valving and piping shows signs of aging and wear. This ancillary equipment should be considered for replacement.

Table A8: WWTF Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Control Building/ Basement	WAS Pump #2 Motor	2007	30	3	39.70%	This motor is showing minimal signs of wear and corrosion. The Motor is about halfway through its estimated useful lifetime and should function for the next 10 year period with proper maintenance.
Control Building/ Basement	Septic Sewage Line #1 Actuator	2007	30	3	39.70%	Actuator is in good condition and the operators did not report any issues with operation. The unit is well within its estimated useful lifetime.
Control Building/ Basement	Septic Sewage Line #2 Actuator	2007	30	3	39.70%	Actuator is in good condition and the operators did not report any issues with operation. The unit is well within its estimated useful lifetime.
Control Building/ Basement	Digester 1 Drain Line Actuator	2007	30	3	39.70%	Actuator is in good condition and the operators did not report any issues with operation. The unit is well within its estimated useful lifetime.
Control Building/ Basement	Digester 2 Drain Line Actuator	2007	30	3	39.70%	Actuator is in good condition and the operators did not report any issues with operation. The unit is well within its estimated useful lifetime.
Control Building/ Basement	WAS Suction Line Actuator	2007	30	3	39.70%	Actuator is in good condition and the operators did not report any issues with operation. The unit is well within its estimated useful lifetime.
Control Building/ Basement	Facility Sanitary Pumps	2007	30	3	39.70%	Poor condition. Although within its estimated useful lifetime the pumps appear to be in very poor condition and should be replaced.
Control Building/ Ground Level	Septage Blower	2007	30	3	39.70%	The septage blower is in good condition and minimal wear was observed on the unit. The blower is approximately halfway through its estimated useful lifetime and should continue to function for the next 10 years with proper maintenance. Operators reported no operational issues.
Control Building/ Ground Level	Septage Blower Motor	2007	30	3	39.70%	The septage Motor is in good condition and minimal wear was observed on the unit. The Motor is approximately halfway through its estimated useful lifetime and should continue to function for the next 10 years with proper maintenance. Operators reported no operational issues.

Table A8: WWTF Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Control Building/ Ground Level	WAS Blower #1	2007	30	3	39.70%	The WAS blower #1 is in good condition and minimal wear was observed on the unit. The blower is approximately halfway through its estimated useful lifetime and should continue to function for the next 10 years with proper maintenance. Operators reported no operational issues.
Control Building/ Ground Level	WAS Blower #1 Motor	2007	30	3	39.70%	The WAS Blower #1 Motor is in good condition and minimal wear was observed on the unit. The Motor is approximately halfway through its estimated useful lifetime and should continue to function for the next 10 years with proper maintenance. Operators reported no operational issues.
Control Building/ Ground Level	WAS Blower #2	2007	30	3	39.70%	The WAS Blower #2 is in good condition and minimal wear was observed on the unit. The blower is approximately halfway through its estimated useful lifetime and should continue to function for the next 10 years with proper maintenance. Operators reported no operational issues.
Control Building/ Ground Level	WAS Blower #2 Motor	2007	30	3	39.70%	The WAS Blower #2 Motor is in good condition and minimal wear was observed on the unit. The Motor is approximately halfway through its estimated useful lifetime and should continue to function for the next 10 years with proper maintenance. Operators reported no operational issues.
Control Building/ Ground Level	Grit Blower	2007	30	3	39.70%	The Grit Blower is in good condition and minimal wear was observed on the unit. The blower is approximately halfway through its estimated useful lifetime and should continue to function for the next 10 years with proper maintenance. Operators reported no operational issues.
Control Building/ Ground Level	Grit Blower Motor	2007	30	3	39.70%	The Grit Blower Motor is in good condition and minimal wear was observed on the unit. The Motor is approximately halfway through its estimated useful lifetime and should continue to function for the next 10 years with proper maintenance. Operators reported no operational issues.
Control Building/ Ground Level	Septic/Sludge Pump #1	2007	30	3	39.70%	Septic Pump #1 is in fair condition and shows signs of corrosion and wear. The pump is about halfway through its estimated useful lifetime but may require earlier replacement due to the harsh conditions of its use. Some of the ancillary equipment including the valving and piping shows considerable signs of aging and wear. This ancillary equipment should be considered for replacement. The outlet side gate valve for this pump is difficult to access due to its location and the operators requested the valve replaced with an actuator operated valve.
Control Building/ Ground Level	Septic/Sludge Pump #1 Motor	2007	30	3	39.70%	This motor is showing signs of wear and corrosion typical of older equipment. This wear can likely be contributed to harsh operating conditions. The motor may require replacement before the end of its estimates useful lifetime.
Control Building/ Ground Level	Septic/Sludge Pump #2	2007	30	3	39.70%	Septic Pump #2 is in fair condition and shows signs of corrosion and wear. The pump is about halfway through its estimated useful lifetime but may require earlier replacement due to the harsh conditions of its use. Some of the ancillary equipment including the valving and piping shows considerable signs of aging and wear. This ancillary equipment should be considered for replacement. The outlet side gate valve for this pump is difficult to access due to its location and the operators requested the valve replaced with an actuator operated valve.

Table A8: WWTF Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Control Building/ Ground Level	Septic/Sludge Pump #2 Motor	2007	30	3	39.70%	This motor is showing signs of wear and corrosion typical of older equipment. This wear can likely be contributed to harsh operating conditions. The motor may require replacement before the end of its estimates useful lifetime.
Control Building/Chlorinator Room	Chlorine Storage Tank #1	2007	20	4	56.08%	This tank is in fair condition and showed some signs of wear. The tank is difficult to access and makes maintenance and filling the tank difficult for operations staff. Operations requested this tank be replaced with a smaller tank.
Control Building/Chlorinator Room	Chlorine Storage Tank #2	2007	20	4	56.08%	This tank is in fair condition and showed some signs of wear. The tank is difficult to access and makes maintenance and filling the tank difficult for operations staff. Operations requested this tank be replaced with a smaller tank.
Control Building/Chlorinator Room	Chlorinator pump #1 (golf course)	2007	30	3	39.70%	This pump is in poor condition and wear was observed on the unit typical of older equipment. Operators report this pump is difficult to maintain and operate. Operators would like to switch to peristaltic chemical pumps.
Control Building/Chlorinator Room	Chlorinator pump #2 (golf course)	2007	30	3	39.70%	This pump is in poor condition and wear was observed on the unit typical of older equipment. Operators report this pump is difficult to maintain and operate. Operators would like to switch to peristaltic chemical pumps.
Control Building/Chlorinator Room	Chlorinator Pump #1	2007	30	3	39.70%	This pump is in poor condition and wear was observed on the unit typical of older equipment. Operators report this pump is difficult to maintain and operate. Operators would like to switch to peristaltic chemical pumps.
Control Building/Chlorinator Room	Chlorinator Pump #2	2007	30	3	39.70%	This pump is in poor condition and wear was observed on the unit typical of older equipment. Operators report this pump is difficult to maintain and operate. Operators would like to switch to peristaltic chemical pumps.
Control Building/Chlorinator Room	Chlorinator Pump #3	2007	30	3	39.70%	This pump is in poor condition and wear was observed on the unit typical of older equipment. Operators report this pump is difficult to maintain and operate. Operators would like to switch to peristaltic chemical pumps.
Control Building/Grit Processing Room	Influent Sampler	2015	10	5	58.57%	This sampler is in good condition and well within estimated useful lifetime. Operations staff replace the unit as needed and reported no issues at the moment with the equipment.

Table A8: WWTF Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Control Building/Grit Processing Room	Effluent Sampler	2010	10	5	77.63%	This sampler is in good condition and well within estimated useful lifetime. Operations staff replace the unit as needed and reported no issues at the moment with the equipment.
Control Building/Headworks	Grit Chamber Diffusers	2007	10	5	84.90%	The diffusers are submerged and could not be inspected. Operators reported no issues with the diffusers. Despite this, diffusers and submerged equipment tend to have a shorter lifetime and these diffusers are beyond their estimated useful lifetime.
Control Building/Headworks	Bar Screen (Coarse)	2007	30	3	39.70%	The bar screen is submerged and was not visible for inspection during the site visit. Operators did not report any issues with this equipment. This equipment is well within its estimated useful lifetime and should not require replacement in the next 10 years.
Control Building/Headworks	Weir Plate	2007	30	3	39.70%	The weir plate is submerged and was not visible for inspection during the site visit. Operators did not report any issues with this equipment. This equipment is well within its estimated useful lifetime and should not require replacement in the next 10 years.
Control Building/Headworks	Bar Screen (Fine)	2007	30	3	39.70%	The bar screen is submerged and was not visible for inspection during the site visit. Operators did not report any issues with this equipment. This equipment is well within its estimated useful lifetime and should not require replacement in the next 10 years.
Control Building/Headworks	Aerated Grit Chamber	2007	60	1	19.76%	The Aerated Grit tank is in good condition and no significant damage was observed on the concrete. The tank is well withing its useful lifetime.
Inside Clarifier #1	Clarifier #1 Rake & Skim Arms	2007	30	3	39.70%	The internal components of Clarifier #1 were in fair condition with some signs of wear including pealed coating and corrosion in areas. The internals are well within their estimated useful lifetime but require maintenance to ensure they will remain operational over the next 10 year period.
Inside Clarifier #2	Clarifier #2 Rake & Skim Arms	2007	30	3	39.70%	The internal components of Clarifier #2 were in fair condition with some signs of wear including pealed coating and corrosion in areas. The internals are well within their estimated useful lifetime but require maintenance to ensure they will remain operational over the next 10 year period.
Laboratory	Water Still	1979	15	5	97.62%	The water still is in poor condition and past its estimated useful lifetime. Operators requested the unit be replaced.

Table A8: WWTF Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Laboratory	Fume Hood	2007	15	5	68.72%	Fume Hood was replaced during the 2007 facility renovations. The system is in good conditions and the operators did not report any issues with the equipment.
Laboratory	Convection Oven	1979	15	5	97.62%	Convection Oven is in poor condition and past its estimated useful lifetime. Operators requested the unit be replaced.
Laboratory	Furnace	1979	15	5	97.62%	Furnace is in poor condition and past its estimated useful lifetime. Operators requested the unit be replaced.
Laboratory	Vacuum Pump	1979	15	5	97.62%	Vacuum pump is in poor condition and past its estimated useful lifetime.
On Top of Clarifier #1	Clarifier #1 Drive	2007	30	3	39.70%	The Clarifier #1drive is in fair condition with minimal signs of wear. in operational over the next 10 year period.
On Top of Clarifier #1	Clarifier #1 Motor	2007	30	3	39.70%	The internal components of Clarifier #1 were in fair condition with some signs of wear including pealed coating and corrosion in areas. The internals are well within their estimated useful lifetime but require maintenance to ensure they will remain operational over the next 10 year period.
On Top of Clarifier #1	Clarifier #2 Drive	2006	30	3	41.83%	The Clarifier #2 drive is in fair condition with some signs of wear. in operational over the next 10 year period.
On Top of Clarifier #2	Clarifier #2 Motor	2006	30	3	41.83%	The internal components of Clarifier #2 were in fair condition with some signs of wear including pealed coating and corrosion in areas. The internals are well within their estimated useful lifetime but require maintenance to ensure they will remain operational over the next 10 year period.
Outlet of Chlorine Contact Tank	Effluent Parshall Flume	2007	10	5	84.90%	Fair condition and within it's estimated useful lifetime.

Table A8: WWTF Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Pump Room Between Clarifiers	Scum Chamber	1979	60	4	50.74%	The concrete wall s of the tank appeared to be in good condition with minimal wear and cracking. The inside of the tank was not inspected. Despite this, the tank is well within its estimated useful lifetime and should not require replacement in the near future.
Pump Room Between Clarifiers	Strainer 1	2007	30	3	39.70%	Strainer #1 is in good condition and minimal wear was observed on the unit. The strainer is well within its estimated useful lifetime and should reliably function for the next 10 years with proper maintenance.
Pump Room Between Clarifiers	Strainer 2	2007	30	3	39.70%	Strainer #2 is in good condition and minimal wear was observed on the unit. The strainer is well within its estimated useful lifetime and should reliably function for the next 10 years with proper maintenance.
Pump Room Between Clarifiers	Plant Water Pump #1	1979	30	5	80.34%	Plant Water Pump #1 is in aging and shows significant signs of wear and corrosion. The majority of the ancillary equipment including the instrumentation, valving, and piping shows considerable signs of aging and wear.
Pump Room Between Clarifiers	Plant Water Pump #1 Motor	1979	30	5	80.34%	Plant Water Pump #1 is in aging and shows significant signs of wear and corrosion.
Pump Room Between Clarifiers	Plant Water Pump #2 (Golf Pump)	1979	30	5	80.34%	Plant Water Pump #1 is in aging and shows significant signs of wear and corrosion. The majority of the ancillary equipment including the instrumentation, valving, and piping shows considerable signs of aging and wear.
Pump Room Between Clarifiers	Plant Water Pump #2 (Golf Pump) Motor	1979	30	5	80.34%	Plant Water Pump #1 is in aging and shows significant signs of wear and corrosion.
Pump Room Between Clarifiers	RAS Pump #1	2007	30	3	39.70%	WAS Pump #1 is in good working condition and about halfway through its estimated useful lifetime. The pump should reliably function for the next 10 years with proper maintenance. Some of the ancillary equipment including the inlet valving and piping shows considerable signs of aging and wear. This ancillary equipment should be considered for replacement.
Pump Room Between Clarifiers	RAS Pump #2	2007	30	3	39.70%	WAS Pump #1 is in good working condition and about halfway through its estimated useful lifetime. The pump should reliably function for the next 10 years with proper maintenance. Some of the ancillary equipment including the inlet valving and piping shows considerable signs of aging and wear. This ancillary equipment should be considered for replacement.

Table A8: WWTF Process Mechanical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Pump Room Between Clarifiers	RAS Pump #3	2007	30	3	39.70%	WAS Pump #1 is in good working condition and about halfway through its estimated useful lifetime. The pump should reliably function for the next 10 years with proper maintenance. Some of the ancillary equipment including the inlet valving and piping shows considerable signs of aging and wear. This ancillary equipment should be considered for replacement.
Pump Room Between Clarifiers, RAS pump 1 suction	Electric Actuator #1	2007	30	3	39.70%	This actuator is in good working condition and about halfway through its estimated useful lifetime. The actuator should reliably function for the next 10 years with proper maintenance.
Pump Room Between Clarifiers, RAS pump 3 suction	Electric Actuator #2	2007	30	5	39.70%	This actuator is in good working condition and about halfway through its estimated useful lifetime. The actuator should reliably function for the next 10 years with proper maintenance.
Valves in basement of clarifier building operators at grade between clarifiers	Scum & Waste valves & Operators	2007	30	3	39.70%	Valves and operators are in poor condition and show signs of aging and wear. The operators are difficult to adjust due to corrosion. Operations staff requested this equipment be replaced.
Adjacent to septage receiving tank and septage loading station	Digestor Tank #1	1979	60	4	50.74%	the concrete of Digestor tank #1 is in good condition. Much of the Internal equipment including air lines, valves, and diffusers are in good condition and do not require replacement. The system operators no longer use the tank to digest sludge and instead use the tank to thicken septage before disposal. Operators would like to reconfigure the tank to receive septage directly and install a siphon system to transport water to the septage receiving tank.
Adjacent to septage receiving tank and septage loading station	Digestor Tank #2	1979	60	4	50.74%	the concrete of Digestor tank #1 is in good condition. Much of the Internal equipment including air lines, valves, and diffusers are in good condition and do not require replacement. The system operators no longer use the tank to digest sludge and instead use the tank to thicken septage before disposal. Operators would like to reconfigure the tank to receive septage directly and install a siphon system to transport water to the septage receiving tank.

Table A9: WWTF Electrical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life (yrs.)	Calculated Condition	Observed Condition	Probability of Failure	Comments
CONTROL BUILDING	MAIN BREAKER	2008	40	2	3	28.32%	LOCATED ADJCENT TO MOTOR CONTROL CENTER MCC 1
CONTROL BUILDING	MOTOR CONTROL CENTER	2008	40	2	3	28.32%	REPLACED IN UPGRADE IN 2008
MCC#1 SECTION 2	ATS	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
CONTROL BUILDING	POWER LOGIC CONTROLLER	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 2	TIMER/D.O. SWITCH	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 2	PERCENTAGE TIMER	2008	40	2		28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 2	TIMER/D.O. SWITCH	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 2	TIMER/D.O. SWITCH	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 2	PERCENTAGE TIMER	2008	40	2		28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 2	TIMER/D.O. SWITCH	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 2	CIRCUIT BREAKER	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 3	ATS	2023	40	0	3	1.19%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 1	SUB METER	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1SECTION 1	MOTOR CONTROL	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 1	MOTOR CONTROL	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 1	MOTOR CONTROL	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 1	CIRCUIT BREAKER	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
CONTROL BUILDING	TRANSFORMER	1976	40	5	3	71.19%	PLAN ROOM
MCC#1 SECTION1	SURGE ARRESTOR	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 7	ON/OFF/START/STOP/ HAND /OFF/AUTO	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 7	ON/OFF/START/STOP/ HAND /OFF/AUTO	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SCETION 7	ON/OFF/START/STOP/ HAND /OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 7	ON/OFF/START/STOP/ HAND /OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 7	ON/OFF/START/STOP/ HAND /OFF/AUTO	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 7	CIRCUIT BREAKER	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1

Table A9: WWTF Electrical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life (yrs.)	Calculated Condition	Observed Condition	Probability of Failure	Comments
MCC#1 SECTION 7	CIRCUIT BREAKER	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 8	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 8	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 8	CIRCUIT BREAKER	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 9	CIRCUIT BREAKER PANEL	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 9	CIRCUIT BREAKER	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 4	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 4	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 4	CIRCUIT BREAKER	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 5	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 5	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 5	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 5	ON/OFF/START/STOP/ HAND /OFF/AUTO	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 5	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 6	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 6	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 6	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 6	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 6	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 6	CIRCUIT BREAKER	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
MCC#1 SECTION 6	CIRCUIT BREAKER	2008	40	2	3	28.32%	LOCATED IN MODEL 6 MOTOR CONTROL CENTER MCC 1
CONTROL BUILDING	PROGRAM LOGIC CONTROLLER	2008	40	2	3	28.32%	PROVIDES SYSTEM MONITORING FOR THE WASTE WATER TREATMENT FACILITY, BAYVIEW DRIVE, HAMILTON AVE, NARRAGANSETT AVE, AND MAPLE AVE STATIONS
LABORATORY	CIRCUIT BREAKER PANEL	1976	40	5	4	71.19%	CONTROL BUILDING, IN 2018 GENERAL ELECTRIC WAS ACQUIRED BY ABB INC. FED FROM 'LP1'

Table A9: WWTF Electrical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life (yrs.)	Calculated Condition	Observed Condition	Probability of Failure	Comments
GARAGE AREA	CIRCUIT BREAKER PANEL	1976	40	5	4	71.19%	CONTROL BUILDING, IN 2018 GENERAL ELECTRIC WAS ACQUIRED BY ABB INC. FED FROM 'LP1'
SECONDARY PUMP ROOM	CIRCUIT BREAKER PANEL	1976	40	5	3	71.19%	SECONDARY PUMP ROOM, IN 2018 GENERAL ELECTRIC WAS ACQUIRED BY ABB INC. FED FROM 'LP1'
CONTROL BUILDING MEZZANINE	MOTOR CONTROL CENTER	1976	40	5	4	71.19%	ORIGINAL BUILDING INSTALL 1976, NOT ON LINE AS A MOTOR CONTROL CENTER, FEEDS BRIDGE CRANE AND AQUADISK SYSTEM ON MEZZANINE
CONTROL BUILDING EXTERIOR	EMERGENCY GENERATOR	2023	30	0	1	1.67%	NEWLY INSTALLED
CONTROL BUILDING FACILITY	LIGHTING	1976	25	5	5	88.78%	ALL DIFFERENT MANUFACTURERS, LAMP TYPES, SOME EXPLOSION PROOF. WIRING MIGHT BE ORIGINAL. EXTERIOR LIGHTING IS NON-EXISTENT AT PROCESS AREAS. ALL LIGHTING SHOULD BE REPLACED AND ADDED WHERE REQUIRED
CONTROL BUILDING FACILITY	RECEPTACLES	1976	30	5	5	82.76%	ALL DIFFERENT MANUFACTURERS, SOME EXPLOSION PROOF. WIRING MIGHT BE ORIGINAL NOT ALL GFCI WHERE REQUIRED BY CODE
CONTROL BUILDING	FIRE ALARM	2017	30	1	2	16.00%	NA
SECONDARY PUMP ROOM	DISCONNECT SWITCH AND CONTROLLER	2008	40	2	2	28.32%	NA
SECONDARY PUMP ROOM	DISCONNECT SWITCH AND CONTROLLER	2008	40	2	2	28.32%	NA
SECONDARY PUMP ROOM	DISCONNECT SWITCH AND CONTROLLER	2008	40	2	2	28.32%	NA
SECONDARY PUMP ROOM	DISCONNECT SWITCH AND CONTROLLER	2008	40	2	2	28.32%	NA
SECONDARY PUMP ROOM	DISCONNECT SWITCH AND CONTROLLER	2008	40	2	2	28.32%	NA
SECONDARY PUMP ROOM	DISCONNECT SWITCH AND CONTROLLER	2008	40	2	2	28.32%	NA
SECONDARY PUMP ROOM	DISCONNECT SWITCH AND CONTROLLER	2008	40	2	2	28.32%	NA
SECONDARY PUMP ROOM	VFD	2008	40	2	2	28.32%	NA
SECONDARY PUMP ROOM	VFD	2008	40	2	2	28.32%	NA
SECONDARY PUMP ROOM	VFD	2008	40	2	2	28.32%	NA
SECONDARY PUMP ROOM	LIGHTING	1976	25	5	4	88.78%	ALL DIFFERENT MANUFACTURERS, LAMP TYPES, SOME EXPLOSION PROOF. WIRING MIGHT BE ORIGINAL. EXTERIOR LIGHTING IS NON-EXISTENT AT PROCESS AREAS. ALL LIGHTING SHOULD BE REPLACED AND ADDED WHERE REQUIRED

Table A9: WWTF Electrical Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life (yrs.)	Calculated Condition	Observed Condition	Probability of Failure	Comments
SECONDARY PUMP ROOM	RECEPTACLES	1976	30	5	5	82.76%	ALL DIFFERENT MANUFACTURERS, SOME EXPLOSION PROOF. WIRING MIGHT BE ORIGINAL NOT ALL GFIC WHERE REQUIRED BY CODE
EFFLUENT SHED	EXTERIOR CONTROL	2008	25	3	5	44.31%	NA

Table A10: WWTF Instrumentation and Controls Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Office /treatment building	MCC-1	2007	10	5	84.90%	The MCP is in fair condition, with a relatively modern PLC in it. The PLC is a Micro1400 and has limited capacity beyond monitoring and simple control. The MCP can be reused and retrofitted to gain the additional functionality desired, but may require a PLC upgrade. The Micro1400 is in end of life status and is replaced by the 800 series, an even weaker PLC. Nothing wrong with the HMI, but it is old and has limited functions. If we are to add more monitoring, a larger screen would be desired to adequately show everything (10" typ)
Main Control Room	MCP PLC	2015	10	5	58.57%	2015 is a general guess
Main Control Room	MCP HMI	2015	10	5	58.57%	Nothing wrong with this HMI, but is old and has limited functions. If we are to add more monitoring, a larger screen would be desired to adequately show everything (10" typ)
Aeration Tanks	Aeration 1 & 2 DO/Temperature Probes and Controllers	2007	10	5	84.90%	The DO probes and controllers are at the end of their useful life. The DO probes and controllers in use are commonly replaced by the new model SC4500. The plant is evaluating YSI probes. For longevity, DO probes and controllers should be replaced with either the YSI equivalent or an SC4500.
Aeration Tanks	Aeration 3 & 4 DO/Temperature Probes and Controllers	2007	10	3	84.90%	The DO probes and controllers are at the end of their useful life. The DO probes and controllers in use are commonly replaced by the new model SC4500. The plant is evaluating YSI probes. For longevity, DO probes and controllers should be replaced with either the YSI equivalent or an SC4500.
Control Building/Chlorinator Room	Leak probe	2007	10	3	84.90%	CLS200 is still current production. See no reason to change it, but if "completely overhauling" would suggest replacement or staging a new probe 'just in case.'
Pump Room Between Clarifiers	RAS Flow Meter 1	2007	25	3	46.72%	20-30 years is typical life of a magmeter, if these were installed close to the manufacturing date they are coming up on EOL.
Pump Room Between Clarifiers	RAS Flow Meter 2	2007	25	3	46.72%	20-30 years is typical life of a magmeter, if these were installed close to the manufacturing date they are coming up on EOL.

Table A10: WWTF Instrumentation and Controls Inventory Assessment

Location	Asset Name	Year Installed	Estimated Useful Life	Condition	Probability of Failure	Comments
Pump Room Between Clarifiers	Golf Pump Flow Meter	2007	25	3	46.72%	This flow meter is designated for replacement as part of the upgrades to the golf course pumping system.
Control Building Basement	Septage Flow Meters	2007	25	3	46.72%	Several meters in the control building basement, but they said they don't use this area.
Outlet of Chlorine Contact Tank	Effluent Ultrasonic Level Sensor	2007	15	3	68.72%	Install date is a guess, but while the HR200 is still made it does not look like this. There's nothing wrong with it, but in a "total upgrade" could be upgraded to the modern version or have the modern version staged. No additional work required other than swapping parts.

Table A11: WWTF HVAC Inventory Assessment

Process	Location	Asset Name	Year Installed	Useful Life (yrs.)	Useful Life Remaining	Calculated Condition	Observed Condition	Probability of Failure
Office/Lab AHU	Attic	AHU-1	2006	30	12	3	Inoperable/Not Observed	100.00%
Office/Lab Condensing Unit	Roof	ACCU-1	2006	20	2	5	Inoperable/Not Observed	100.00%
Hot Water Unit Heater	Basement	UH-1	2006	30	12	3	Poor	41.83%
Hot Water Unit Heater	Basement	UH-2	2006	30	12	3	Poor	41.83%
Hot Water Unit Heater	Sludge Area	UH-3	2006	30	12	3	Good	41.83%
Hot Water Unit Heater	Storage Room	UH-4	2006	30	12	3	Good	41.83%
Hot Water Unit Heater	Chlorine Room	UH-5	2006	30	12	3	Good	41.83%
Hot Water Unit Heater	Work Room	UH-6	2006	30	12	3	Good	41.83%
Hot Water Unit Heater	Work Room	UH-7	2006	30	12	3	Good	41.83%
Hot Water Unit Heater	Sludge Area	UH-8	2006	30	12	3	Good	41.83%
Hot Water Unit Heater	Sludge Area	UH-9	2006	30	12	3	Good	41.83%
Hot Water Unit Heater	Sludge Area	UH-10	2006	30	12	3	Good	41.83%
Hot Water Unit Heater	Sludge Area	UH-11	2006	30	12	3	Good	41.83%
Hot Water Unit Heater	Sludge Area	UH-12	2006	30	12	3	Good	41.83%
Hot Water Unit Heater	Generator Room	UH-13	2006	30	12	3	Good	41.83%
Hot Water Unit Heater	Boiler Room	UH-14	2006	30	12	3	Good	41.83%
Cabinet Unit Heater	Lab/Office	CUH-1	2006	30	12	3	Fair	41.83%
Cabinet Unit Heater	Vestibule	CUH-2	2006	30	12	3	Fair	41.83%
Lab	Lab/Outside	-	2010	15	1	5	Fair	60.17%
Lab	Office	-	2010	15	1	5	Fair	60.17%
Boiler	Boiler Room	B-1		30	-1994	5	Good	100.00%
Inline Hot Water Circulator	Boiler Room	-	2006	30	12	3	Good	41.83%
Inline Hot Water Circulator	Boiler Room	-	2006	30	12	3	Good	41.83%

Table A11: WWTF HVAC Inventory Assessment

Process	Location	Asset Name	Year Installed	Useful Life (yrs.)	Useful Life Remaining	Calculated Condition	Observed Condition	Probability of Failure
Fin Tube Radiation	Various Locations	FTR	1976	50	2	5	Poor	61.41%
Lab Hood	Lab	-	1976	30	-18	5	Poor	82.76%
Exhaust Fan	Locker/Toilet	EF-1	2006	25	7	4	Not Observed	49.04%
Exhaust Fan	Grit Processing	EF-16	2006	25	7	4	Fair	49.04%
Exhaust Fan	Basement	EF-2	2006	25	7	4	Poor	49.04%
Exhaust Fan	Basement	EF-3	2006	25	7	4	Poor	49.04%
Supply Fan	Basement	SF-4	2006	25	7	4	Poor	49.04%
Exhaust Fan	Sludge Area	EF-5	1976	25	-23	5	Decommissioned	88.78%
Exhaust Fan	Sludge Area	EF-6	1976	25	-23	5	Decommissioned	88.78%
Exhaust Fan	Sludge Area	EF-7	1976	25	-23	5	Decommissioned	88.78%
Exhaust Fan	Sludge Area	EF-8	2006	25	7	4	Decommissioned	49.04%
Supply Fan	Mezzanine	SF-9	2006	25	7	4	fair	49.04%
Exhaust Fan	Shop Room	EF-10	1976	25	-23	5	fair	88.78%
Exhaust Fan	Chlorine Room	EF-11	2006	25	7	4	fair	49.04%
Exhaust Fan	Stairway	EF-17	2006	25	7	4	fair	49.04%
Clarifyer Pump Room Heat	Clarifier Pump Room	EH-1	2006	30	12	3	Good	41.83%
Clarifyer Pump Room Heat	Clarifier Pump Room	EH-2	2006	30	12	3	Good	41.83%
Fuel Oil Storge Tank	Sludge Area	-	2012	30	18	2	Good	28.32%
Fuel Oil Storge Tank	Sludge Area	-	2012	30	18	2	Good	28.32%
Portable Dehumidifier	Clarifier Pump Room	-	2012	15	3	4	Good	53.47%

Table A12: WWTF Plumbing Inventory Assessment

Process	Location	Year Installed	Useful Life (yrs.)	Calculated Condition	Observed Condition	Probability of Failure
Water Closet	Locker/Restroom	2006	30	3	Good	41.83%
Lavatory	Locker/Restroom	2006	30	3	Good	41.83%
Shower	Locker/Restroom	2006	30	3	Fair	41.83%
Mop Receptor	Locker/Restroom	2006	30	3	Fair	41.83%
Eyewash/Shower	Chlorine Room	2006	30	3	Good	41.83%
Kitchen Sink /Stove	Break Room	1980	15	5	Poor	97.37%
Eyewash/Shower	Laboratory	1980	30	5	Poor	79.47%
Lab Sink/Aerated Spigot	Laboratory	1980	30	5	Poor	79.47%
Lab Sink	Laboratory	1980	30	5	Poor	79.47%
Dishwasher	Laboratory	2006	15	5	Fair	71.19%
Lab Sink Under Hood	Laboratory	1980	30	5	Poor	79.47%
Water Service/Backflow Preventer	Boiler Room	2006	30	3	Fair	41.83%
Indirect DHW	Boiler Room	2006	20	5	Good	58.57%
HW to DHW Pump	Boiler Room	2006	25	4	Good	49.04%
Air Compressor/Hose Reel	Sludge Area	2006	20	5	Good	58.57%
Electric DHW	Laundry Area	2006	15	5	Good	71.19%
Tempering Valve	Laundry Area	2006	30	3	Fair	41.83%

Table A12: WWTF Plumbing Inventory Assessment

Sewerage Ejector	Basement	2006	30	3	Fair	41.83%
Sump Pump	Basement	2006	20	5	Fair	58.57%
Sump Pump	Clarifier Room	2006	20	5	Fair	58.57%
Water Service/Backflow	Clarifier Room	2006	30	3	Good	41.83%

APPENDIX B

Recommended Improvements Tables

Date: May 2024

Table B1: Pump Station 1

Discipline: Architectural - PS's

Architectural Recommended Improvements

DESCRIPTION	QTY	UNIT	UNIT COST	EST'D	TOTAL COST
PUMP STATION #1					
DEMOLITION					
Asphalt Shingle Roof Assembly	1	LS	\$ 3,500.00	\$ 3,500.00	
Misc Other Items - Sealant, Prep Paint Etc.	1	LS	\$ 5,000.00	\$ 5,000.00	
Subtotal					\$ 8,500.00
ROOF CONSTRUCTION					
Asphalt Shingle Roof Assembly					
Asphalt Shingles	256	SF	\$ 12.50	\$ 3,200.00	
Gutters and Downspouts	1	LS	\$ 3,000.00	\$ 3,000.00	
Roofing Felt / Ice Shield	256	SF	\$ 1.50	\$ 384.00	
Plywood Roof Deck (Replacement)	256	SF	\$ 4.50	\$ 1,152.00	
Subtotal					\$ 7,736.00
EXTERIOR CLOSURE					
Brick Veneer (Repoint, Replace)	525	sf	\$ 20.00	\$ 10,500.00	
Brick Veneer (Repoint, Replace at Vent)	200	sf	\$ 35.00	\$ 7,000.00	
Clean and Seal	725	sf	\$ 4.00	\$ 2,900.00	
Subtotal					\$ 20,400.00
SPECIALTIES					
Fire Extinguishers	1	ea	\$ 250.00	\$ 250.00	
Signage	1	ls	\$ 3,000.00	\$ 3,000.00	
Subtotal					\$ 3,250.00
WALL FINISHES					
Paint Interior Walls	7680	sf	\$ 4.50	\$ 34,560.00	
Paint Interior Floors	960	sf	\$ 4.00	\$ 3,840.00	
Paint Interior Ceilings	960	sf	\$ 5.00	\$ 4,800.00	
Paint Door	2	ea	\$ 160.00	\$ 320.00	
Patch Ceiling Hole	1	ea	\$1,500	\$ 1,500.00	
Subtotal					\$ 45,020.00
DOORS					
Replace Hardware Set	2	sets	\$ 750.00	\$ 1,500.00	
Backer Rod and Sealant replacement	34	lf	\$ 12.00	\$ 408.00	
Subtotal					\$ 1,908.00
Total					\$ 86,814.00

DESCRIPTION	QTY	UNIT	UNIT COST	EST'D	TOTAL COST
PUMP STATION #2					
DEMOLITION					
Asphalt Shingle Roof Assembly	1	LS	\$ 3,500.00	\$ 3,500.00	
Misc Other Items - Sealant, Prep Paint Etc.	1	LS	\$ 5,000.00	\$ 5,000.00	
Subtotal					\$ 8,500.00
ROOF CONSTRUCTION					
Asphalt Shingle Roof Assembly					
Asphalt Shingles	256	SF	\$ 12.50	\$ 3,200.00	
Gutters and Downspouts	1	LS	\$ 3,000.00	\$ 3,000.00	
Roofing Felt / Ice Shield	256	SF	\$ 1.50	\$ 384.00	
Plywood Roof Deck (Replacement)	256	SF	\$ 4.50	\$ 1,152.00	
Subtotal					\$ 7,736.00
EXTERIOR CLOSURE					
Brick Veneer (Repoint, Replace)	525	sf	\$ 20.00	\$ 10,500.00	
Clean and Seal	525	sf	\$ 4.00	\$ 2,100.00	
Subtotal					\$ 12,600.00
SPECIALTIES					
Fire Extinguishers	1	ea	\$ 250.00	\$ 250.00	
Signage	1	ls	\$ 3,000.00	\$ 3,000.00	
Subtotal					\$ 3,250.00
WALL FINISHES					
Paint Interior Walls	7680	sf	\$ 4.50	\$ 34,560.00	
Paint Interior Floors	960	sf	\$ 4.00	\$ 3,840.00	
Paint Interior Ceilings	960	sf	\$ 5.00	\$ 4,800.00	
Paint Door	2	ea	\$ 160.00	\$ 320.00	
Subtotal					\$ 43,520.00
DOORS					
Replace Hardware Set	2	sets	\$ 750.00	\$ 1,500.00	
Backer Rod and Sealant replacement	34	lf	\$ 12.00	\$ 408.00	
Subtotal					\$ 1,908.00
Total					\$ 77,514.00

DESCRIPTION	QTY	UNIT	UNIT COST	EST'D	TOTAL COST
PUMP STATION #3					
DEMOLITION					
Asphalt Shingle Roof Assembly	1	LS	\$ 3,500.00	\$ 3,500.00	
Misc Other Items - Sealant, Prep Paint Etc.	1	LS	\$ 5,000.00	\$ 5,000.00	
Subtotal					\$ 8,500.00
ROOF CONSTRUCTION					
Asphalt Shingle Roof Assembly					
Asphalt Shingles	225	SF	\$ 12.50	\$ 2,812.50	
Gutters and Downspouts	1	LS	\$ 3,000.00	\$ 3,000.00	
Roofing Felt / Ice Shield	225	SF	\$ 1.50	\$ 337.50	
Plywood Roof Deck (Replacement)	225	SF	\$ 4.50	\$ 1,012.50	
Subtotal					\$ 7,162.50
EXTERIOR CLOSURE					
Brick Veneer (Repoint, Replace)	480	sf	\$ 20.00	\$ 9,600.00	
Clean and Seal	480	sf	\$ 4.00	\$ 1,920.00	
Subtotal					\$ 11,520.00
SPECIALTIES					
Fire Extinguishers	1	ea	\$ 250.00	\$ 250.00	
Signage	1	ls	\$ 1,000.00	\$ 1,000.00	
Subtotal					\$ 1,250.00
WALL FINISHES					
Paint Interior Walls	480	sf	\$ 4.50	\$ 2,160.00	
Paint Interior Floors	225	sf	\$ 4.00	\$ 900.00	
Paint Interior Ceilings	225	sf	\$ 5.00	\$ 1,125.00	
Paint Door	1	ea	\$ 160.00	\$ 160.00	
Subtotal					\$ 4,345.00
DOORS					
Replace Hardware Set	1	sets	\$ 750.00	\$ 750.00	
Backer Rod and Sealant replacement	34	lf	\$ 12.00	\$ 408.00	
Subtotal					\$ 1,158.00
Total					\$ 33,935.50

Table B4: Pump Station Process Mechanical Recommended Improvements

Location	Asset Name	Comments	Cost Estimates 2024	Priority (1-5)
Pump Station #1	Pump #1 VFD	The VFD is still working but is an older model and is aging. The unit will reach the end of its estimate useful lifetime in the near futures.	\$20,000.00	1
Pump Station #1	Pump #2 VFD	The VFD is still working but is an older model and is aging. The unit will reach the end of its estimate useful lifetime in the near futures.	\$20,000.00	1
Pump Station #1	Influent Channel	This channel is well within its estimated useful lifetime. General wear was observed on the concrete including spalling around gates. Due to the hash operating conditions the channel may be wearing down faster than expected.	\$40,000.00	1
Pump Station #1	Sluice Gates & Operators (3 Total)	Although within their estimated useful lifetimes these sluice gates and operators are in very poor condition. Significant wear and corrosion was observed on all three units and the system operators report the gates are difficult to operate due to corrosion. Due to the hash operating conditions the channel may be wearing down faster than expected.	\$50,000.00	1
Pump Station #1	PS#1 Controls	The PS#1 is in good working condition and minimal wear was observed on the unit during the site inspection. The Panel is still made and parts are available for maintenance and repairs. The water level measurement is not functioning properly. The autodialers appear to be in good condition with minimal wear and are connected to a Verizon cellular device.	\$20,000.00	1

Table B4: Pump Station Process Mechanical Recommended Improvements

Location	Asset Name	Comments	Cost Estimates 2024	Priority (1-5)
Pump Station #2	Influent Channel	This channel is well within its estimated useful lifetime. General wear was observed on the concrete including spalling around gates. Due to the harsh operating conditions the channel may be wearing down faster than expected.	\$40,000.00	1
Pump Station #2	PS#2 Compressor	This compressor is in good working condition. The compressor is used to mix the water in the well and suspend settling grit. The compressor is not ideal for its current application and the operator struggle with grit settling in the wet well.	\$50,000.00	1
Pump Station #2	Sluice Gates & Operators (3 Total)	Although within their estimated useful lifetimes these sluice gates and operators are in very poor condition. Significant wear and corrosion was observed on all three units and the system operators report the gates are difficult to operate due to corrosion. Due to the harsh operating conditions the channel may be wearing down faster than expected.	\$50,000.00	1
Pump Station #2	PS#2 Controls	The PS#2 is in good working condition and minimal wear was observed on the unit during the site inspection. The Panel is still made and parts are available for maintenance and repairs. The water level measurement is not functioning properly. The autodials appear to be in good condition with minimal wear and are connected to a Verizon cellular device.	\$20,000.00	1
Pump Station #3	PS#3 Controls	The PS#3 is in good working condition and minimal wear was observed on the unit during the site inspection. The Panel is still made and parts are available for maintenance and repairs. The water level measurement is not functioning properly. The autodials appear to be in good condition with minimal wear and are connected to a Verizon cellular device.	\$20,000.00	1

Table B4: Pump Station Process Mechanical Recommended Improvements

Location	Asset Name	Comments	Cost Estimates 2024	Priority (1-5)
Pump Station #1	Raw Sewage Pump #1	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment show signs of wear and require maintenance or replacement. The outlet side check valve is leaking.	\$60,000.00	3
Pump Station #1	Raw Sewage Pump #2	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment show signs of wear and require maintenance or replacement. The outlet side check valve is leaking.	\$60,000.00	3
Pump Station #1	Sump Pump	The Sump Pump is in good working condition and about halfway through its estimated useful lifetime. Sump pumps are generally cheap and easily replaceable by the system operators.	\$2,000.00	3
Pump Station #2	Raw Sewage Pump #1	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment shows signs of wear and require maintenance or replacement. The pump has no VFD add VFD to new pump as part of replacement.	\$75,000.00	3
Pump Station #2	Raw Sewage Pump #2	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment shows signs of wear and require maintenance or replacement. The pump has no VFD add VFD to new pump as part of replacement.	\$75,000.00	3

Table B4: Pump Station Process Mechanical Recommended Improvements

Location	Asset Name	Comments	Cost Estimates 2024	Priority (1-5)
Pump Station #2	Sump Pump	The Sump Pump is in good working condition and about halfway through its estimated useful lifetime. Sump pumps are generally cheap and easily replaceable by the system operators.	\$2,000.00	3
Pump Station #3	Raw Sewage Pump #1	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment shows signs of wear and may require maintenance or replacement. The operators report the pumping rate is too high during dry periods and too low during rain events. The pump has no VFD add VFD to new pump as part of replacement	\$75,000.00	3
Pump Station #3	Raw Sewage Pump #2	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment shows signs of wear and may require maintenance or replacement. The operators report the pumping rate is too high during dry periods and too low during rain events. The pump has no VFD add VFD to new pump as part of replacement	\$75,000.00	3
Pump Station #3	Sump Pump	The Sump Pump is in good working condition and about halfway through its estimated useful lifetime. Sump pumps are generally cheap and easily replaceable by the system operators.	\$2,000.00	3
Pump Station #4	Raw Sewage Pump #1	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment show signs of wear and require maintenance or replacement. The outlet side check valve is leaking.	\$40,000.00	3

Table B4: Pump Station Process Mechanical Recommended Improvements

Location	Asset Name	Comments	Cost Estimates 2024	Priority (1-5)
Pump Station #4	Raw Sewage Pump #2	This pump is in good working condition and showed minimal signs of wear during the site inspection. Some of the ancillary equipment show signs of wear and require maintenance or replacement. The outlet side check valve is leaking.	\$40,000.00	3
Pump Station #4	PS#4 Controls	The PS#4 is in good working condition and minimal wear was observed on the unit during the site inspection. The Panel is still made and parts are available for maintenance and repairs. The water level measurement is not functioning properly. The autodialers appear to be in good condition with minimal wear and are connected to a Verizon cellular device.	\$20,000.00	3
Pump Station #4	PS #4 Wet well	The well structure is within its estimated useful lifetime and minimal wear and corrosion were observed on the structure.	\$50,000.00	5
Pump Station #4	Valve Chamber	All piping and valves are Sch 80 PVC and show minimal wear.	\$50,000.00	5

Table B5: Pump Station Electrical Recommended Improvements

Process	Location	Asset Name	Replacement Cost	Priority Code
MCC #3 (MCC-1)	PUMP STATION #1	MOTOR CONTROL CENTER	\$ 50,000.00	1
PUMP - 1	MCC#3 SECTION 1	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	\$ 1,500.00	1
SF-20	MCC#3 SECTION 1	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	\$ 1,500.00	1
PUMP - 2	MCC#3 SECTION 2	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	\$ 1,500.00	1
50A FEEDER FOR 30KVA TRANSFORMER	MCC#3 SECTION 2	CIRCUIT BREAKER	\$ 2,500.00	1
PUMP CONTROL PANEL	MCC#3 SECTION 3	INDICATING LIGHTS	\$ 1,500.00	1
LIGHTING	PUMP STATION #1	LIGHTING	\$ 50,000.00	1
RECEPTACLES	PUMP STATION #1	RECEPTACLES	\$ 25,000.00	1
PANEL LV1 (STATION #2)	PUMP STATION #2	CIRCUIT BREAKER PANEL	\$ 5,000.00	1
PANEL LX1 (STATION #2)	PUMP STATION #2	CIRCUIT BREAKER PANEL	\$ 5,000.00	1
MCC #4 (MCC-2)	PUMP STATION #2	MOTOR CONTROL CENTER	\$ 50,000.00	1
PUMP - 1	MCC#4 SECTION 1	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	\$ 1,500.00	1
SF-20	MCC#4 SECTION 1	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	\$ 1,500.00	1
PUMP - 2	MCC#4 SECTION 2	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	\$ 1,500.00	1
50A FEEDER FOR 30KVA TRANSFORMER	MCC#4 SECTION 2	CIRCUIT BREAKER	\$ 1,500.00	1
PUMP CONTROL PANEL	MCC#4 SECTION 3	INDICATING LIGHTS	\$ 1,500.00	1

Table B5: Pump Station Electrical Recommended Improvements

Process	Location	Asset Name	Replacement Cost	Priority Code
LIGHTING	PUMP STATION #2	LIGHTING	\$ 50,000.00	1
RECEPTACLES	PUMP STATION #2	RECEPTACLES	\$ 25,000.00	1
PANEL LV1 (STATION #3)	PUMP STATION #3	CIRCUIT BREAKER PANEL	\$ 5,000.00	1
PANEL LX1 (STATION #3)	PUMP STATION #3	CIRCUIT BREAKER PANEL	\$ 5,000.00	1
MCC #4 (MCC-3)	PUMP STATION #3	MOTOR CONTROL CENTER	\$ 50,000.00	1
PUMP - 1	MCC#4 SECTION 1	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	\$ 1,500.00	1
50A FEEDER FOR 30KVA TRANSFORMER	MCC#4 SECTION 2	CIRCUIT BREAKER	\$ 1,500.00	1
PUMP - 2	MCC#4 SECTION 2	CIRCUIT BREAKER/ HAND/OFF/AUTO/RESET	\$ 1,500.00	1
PUMP CONTROL PANEL	MCC#4 SECTION 3	INDICATING LIGHTS	\$ 1,500.00	1
LIGHTING	PUMP STATION #3	LIGHTING	\$ 30,000.00	1
RECEPTACLES	PUMP STATION #3	RECEPTACLES	\$ 25,000.00	1
REMOTE LIFT STATION	MAPLE AVENUE	REMOTE LIFT STATION	\$ 75,000.00	1
PANEL LV1 (STATION #1)	PUMP STATION #1	CIRCUIT BREAKER PANEL	\$ 5,000.00	3
PANEL LX1 (STATION #1)	PUMP STATION #1	CIRCUIT BREAKER PANEL	\$ 5,000.00	3
30 KVA TRANSFORMER	PUMP STATION #1	TRANSFORMER	\$ 15,000.00	3
SF-19	PUMP STATION #1	DISCONNECT SWITCH	\$ 2,500.00	3

Table B5: Pump Station Electrical Recommended Improvements

Process	Location	Asset Name	Replacement Cost	Priority Code
SF-20	PUMP STATION #1	DISCONNECT SWITCH	\$ 2,500.00	3
EF-21	PUMP STATION #1	DISCONNECT SWITCH HAND/OFF/AUTO	\$ 2,500.00	3
EF-22	PUMP STATION #1	DISCONNECT SWITCH	\$ 2,500.00	3
EF-23	PUMP STATION #1	DISCONNECT SWITCH	\$ 2,500.00	3
PUMP #1	PUMP STATION #1	DISCONNECT SWITCH	\$ 2,500.00	3
PUMP #2	PUMP STATION #1	DISCONNECT SWITCH	\$ 2,500.00	3
30 KVA TRANSFORMER	PUMP STATION #2	TRANSFORMER	\$ 15,000.00	3
SF-19	PUMP STATION #2	DISCONNECT SWITCH	\$ 2,500.00	3
SF-20	PUMP STATION #2	DISCONNECT SWITCH	\$ 2,500.00	3
EF-21	PUMP STATION #2	DISCONNECT SWITCH HAND/OFF/AUTO	\$ 2,500.00	3
EF-22	PUMP STATION #2	DISCONNECT SWITCH	\$ 2,500.00	3
EF-23	PUMP STATION #2	DISCONNECT SWITCH	\$ 2,500.00	3
PUMP #1	PUMP STATION #2	DISCONNECT SWITCH	\$ 2,500.00	3
PUMP #2	PUMP STATION #2	DISCONNECT SWITCH	\$ 2,500.00	3
45 KVA TRANSFORMER	PUMP STATION #3	TRANSFORMER	\$ 15,000.00	3
PUMP #1	PUMP STATION #3	DISCONNECT SWITCH	\$ 2,500.00	3

Table B5: Pump Station Electrical Recommended Improvements

Process	Location	Asset Name	Replacement Cost	Priority Code
PUMP #2	PUMP STATION #3	DISCONNECT SWITCH	\$ 2,500.00	3
EMERGENCY GENERATOR	PUMP STATION #1 BUILDING EXTERIOR	EMERGENCY GENERATOR	\$ 100,000.00	5
AUTOMATIC TRANSFER SWITCH	PUMP STATION #1 BUILDING EXTERIOR	AUTOMATIC TRANSFER SWITCH	\$ 25,000.00	5
EMERGENCY GENERATOR	PUMP STATION #2 BUILDING EXTERIOR	EMERGENCY GENERATOR	\$ 75,000.00	5
AUTOMATIC TRANSFER SWITCH	PUMP STATION #2 BUILDING EXTERIOR	AUTOMATIC TRANSFER SWITCH	\$ 20,000.00	5
EMERGENCY GENERATOR	PUMP STATION #2	EMERGENCY GENERATOR	\$ 75,000.00	5
AUTOMATIC TRANSFER SWITCH	PUMP STATION #2	AUTOMATIC TRANSFER SWITCH	\$ 20,000.00	5

Table B6: Pump Station Instrumentation and Controls Recommended Improvements

Location	Asset Name	Replacement Cost	Priority (1-5)
MCC (All Stations)	MultiTrode	\$ 4,000.00	3
MCC area / Dry Well (All Stations)	Autodialers	\$ 10,000.00	3
Dry Well / Exterior (All Stations)	Remote Comms	\$ 15,000.00	3
Dry Well (All Stations)	RTU	\$ 80,000.00	3

Table B8: Pump Station Plumbing Recommended Improvements

Asset Type	Process	Location	Year Installed	Consequence of Failure	Priority (1-5)
1st Pump Station					
Plumbing	Mop Sink	Restroom	1976	\$ 2,500.00	1
Plumbing	Water Closet	Restroom	1976	\$ 1,500.00	1
Plumbing	Water Service/Backflow	Pump Room	1976	\$ 2,500.00	1
2nd Pump Station					
Plumbing	Mop Sink	Generator Room	1976	\$ 2,500.00	1
Plumbing	Sump Pump	Pump Room	2005	\$ 1,500.00	3
Plumbing	Water Service/Backflow	Pump Room	1976	\$ 2,500.00	1

Table B7: Pump Station HVAC Recommended Improvements

Process	Location	Asset Name	Estimated Replacement Cost	Priority (1-5)
Exhaust Fan	PS#2 Toilet	EF-18	\$ 1,000.00	1
Supply Fan	PS#2 Pump Room	SF-19	\$ 15,000.00	1
Exhaust Fan	PS#2 Pump Room	EF-20	\$ 15,000.00	1
Exhaust Fan	PS#2 Wet Well	EF-21	\$ 20,000.00	1
Exhaust Fan	PS#2 Wet Well	EF-22	\$ 15,000.00	1
Exhaust Fan	PS#3 Toilet	EF-22	\$ 1,000.00	1
Supply Fan	PS#3 Pump Room	SF-23	\$ 15,000.00	1
Exhaust Fan	PS#3 Generator Room	EF-24	\$ 15,000.00	1
Exhaust Fan	PS#3 Wet Well	EF-25	\$ 20,000.00	1
Dehumidifier	PS#3		\$ 1,000.00	1
Heat	PS#2 Stairwell Upper Level	EUH1	\$ 1,500.00	3
Heat	PS#2 Generator Room	EUH2	\$ 1,500.00	3
Heat	PS#2 Pump Room	EUH3	\$ 1,500.00	3
Heat	PS#2 Stairwell Lower Level	EUH4	\$ 6,000.00	3
Heat	PS#3 Stairwell Upper Level	EUH1	\$ 1,500.00	3
Heat	PS#3 Generator Room	EUH2	\$ 1,500.00	3
Heat	PS#3 Pump Room	EUH3	\$ 1,500.00	3

Table B7: Pump Station HVAC Recommended Improvements

Process	Location	Asset Name	Estimated Replacement Cost	Priority (1-5)
Heat	PS#3 Stairwell Lower Level	EUH4	\$ 6,000.00	3

Table B10: WWTF Process Mechanical Recommended Improvements

Location	Asset Name	Recommended Improvements	Cost Estimates	Priority (1-5)
Aeration Tanks	Aerator Assembly #1	Aerator Assembly #1 is in working condition. Despite this, it is worthwhile to upgrade the assembly during the replacement of Aerator Assembly's #1 and #2 to decrease installation costs and increase the overall efficiency and effectiveness of the aeration process.	\$405,000.00	1
Aeration Tanks	Aerator Assembly #2	Aerator Assembly #2 must be replaced. To increase efficiency of the aeration process it is recommended the aerator be replaced with an upgraded model. Given the condition of this equipment, replacement should be a high priority to be completed within the next two year period.	\$405,000.00	1
Aeration Tanks	Aerator Assembly #3	Aerator Assembly #3 is in working condition. Despite this, it is worthwhile to upgrade the assembly during the replacement of Aerator Assembly's #1 and #2 to decrease installation costs and increase the overall efficiency and effectiveness of the aeration process.	\$405,000.00	1
Aeration Tanks	Aerator Assembly #4	Aerator Assembly #4 must be replaced. To increase efficiency of the aeration process it is recommended the aerator be replaced with an upgraded model. Given the condition of this equipment, replacement should be a high priority to be completed within the next two year period.	\$405,000.00	1
Aeration Tanks	Aerator Motor #1	Aerator Motor #1 is in working condition. Despite this, it is worthwhile to upgrade the motor during the replacement of Aerator Motor's #1 and #2 to decrease installation costs and increase the overall efficiency and effectiveness of the aeration process.	Included with Aerator Assembly #1 pricing	1
Aeration Tanks	Aerator Motor #2	Aerator Motor #2 should be replaced with Aerator Assembly #2. the replacement motor should be rated as needed for the new aerator assembly. Given the condition of the equipment replacement should be a high priority to be completed within the next two year period.	Included with Aerator Assembly #2 pricing	1
Aeration Tanks	Aerator Motor #3	Aerator Motor #3 is in working condition. Despite this, it is worthwhile to upgrade the motor during the replacement of Aerator Motor's #1 and #2 to decrease installation costs and increase the overall efficiency and effectiveness of the aeration process.	Included with Aerator Assembly #3 pricing	1
Aeration Tanks	Aerator Motor #4	Aerator Motor #2 should be replaced with Aerator Assembly #2. the replacement should be rated as needed for the new aerator assembly. Given the condition of the equipment replacement should be a high priority to be completed within the next two year period.	Included with Aerator Assembly #4 pricing	1

Table B10: WWTF Process Mechanical Recommended Improvements

Location	Asset Name	Recommended Improvements	Cost Estimates	Priority (1-5)
Control Building/Chlorinator Room	Chlorinator Pump #1	This pump needs to be replaced. The replacement should be an equally rated peristaltic chemical feed pump.	\$2,000.00	1
Control Building/Chlorinator Room	Chlorinator pump #1 (golf course)	This pump needs to be replaced. The replacement should be an equally rated peristaltic chemical feed pump.	\$2,000.00	1
Control Building/Chlorinator Room	Chlorinator Pump #2	This pump needs to be replaced. The replacement should be an equally rated peristaltic chemical feed pump.	\$2,000.00	1
Control Building/Chlorinator Room	Chlorinator pump #2 (golf course)	This pump needs to be replaced. The replacement should be an equally rated peristaltic chemical feed pump.	\$2,000.00	1
Control Building/Chlorinator Room	Chlorinator Pump #3	This pump needs to be replaced. The replacement should be an equally rated peristaltic chemical feed pump.	\$2,000.00	1
Control Building/Chlorinator Room	Chlorine Storage Tank #1	This storage tank needs to be replaced with properly sized tanks of 1000 to 1500 gallon capacity.	\$10,000.00	1
Control Building/Chlorinator Room	Chlorine Storage Tank #2	This storage tank needs to be replaced with properly sized tanks of 1000 to 1500 gallon capacity.	\$10,000.00	1
Laboratory	Convection Oven	Convection oven should be replaced with a new unit that is rated for an equal output. Given the condition of the equipment replacement should be a high priority to be completed within the next two year period.	\$2,000.00	1

Table B10: WWTF Process Mechanical Recommended Improvements

Location	Asset Name	Recommended Improvements	Cost Estimates	Priority (1-5)
Adjacent to septage receiving tank and septage loading station	Digester Tank #1	This tank does not require repairs at this time. The tank does require modifications to its piping. The suction line that siphons water from this tank needs to be rerouted to discharge into the Septage Receiving Tanks. These alterations are described in detail in the Section 3.3 of the Engineering Evaluation Report. Projected costs for the proposed alterations are divided equally into thirds and listed as the cost estimates for each of the three individual tanks designated for modification.	\$77,000.00	1
Adjacent to septage receiving tank and septage loading station	Digester Tank #2	This tank does not require repairs at this time. The tank does require modifications to its piping. The suction line that siphons water from this tank needs to be rerouted to discharge into the Septage Receiving Tanks. These alterations are described in detail in the Section 3.3 of the Engineering Evaluation Report. Projected costs for the proposed alterations are divided equally into thirds and listed as the cost estimates for each of the three individual tanks designated for modification.	\$77,000.00	1
Control Building/ Basement	Facility Sanitary Pumps	These pumps need to be replaced with a modern sewage pumping system. The pumps are properly sized and can be replaced with equally rated pumps.	\$40,000.00	1
Laboratory	Furnace	Furnace should be replaced with a new unit that is rated for an equal output. Given the condition of the equipment replacement should be a high priority to be completed within the next two year period.	\$2,000.00	1
Pump Room Between Clarifiers	Plant Water Pump #1	This pump and its ancillary equipment including piping, valving, and instrumentation require replacement. The current equipment is properly rated and can be replaced with equally rated equipment. Due to the age and condition of the pump these upgrades should be a high priority to be completed in the next two year period.	\$40,000.00	1
Pump Room Between Clarifiers	Plant Water Pump #1 Motor	This motor should be replaced with its corresponding pump.	Included in Plant Water Pump #1 pricing	1
Valves in basement of clarifier building operators at grade between clarifiers	Scum & Waste valves & Operators	These valves and operators need to be replaced. Based on the age and condition of the equipment it should be a high priority for replacement within the next two year period.	\$40,000.00	1
Between Aerated Grit Tank & Digester Tanks	Septage Receiving Tank	The septage receiving tank needs to have its internal equipment replaced including piping, valves, and diffusers. Additionally, it is recommended the tank piping be reconfigured to receive decant water from Aerobic Digesters. Alterations are described in detail in the Section 3.3 of the Engineering Evaluation Report. Projected costs for the proposed alterations are divided equally into thirds and listed as the cost estimates for each of the three individual tanks designated for modification.	\$77,000.00	1

Table B10: WWTF Process Mechanical Recommended Improvements

Location	Asset Name	Recommended Improvements	Cost Estimates	Priority (1-5)
Aeration Tanks	Slide Gate #1 & Operator	This slide gate and its operator need to be replaced. The replacement gate and operator should be sized equally to the current equipment. Because this equipment is used in harsh conditions a replacement with corrosion resistant metal should be considered. Due to the condition of this equipment and the its operational problems this replacement should be a high priority to be completed within the next two year period.	\$15,000.00	1
Aeration Tanks	Slide Gate #2 & Operator	This slide gate and its operator need to be replaced. The replacement gate and operator should be sized equally to the current equipment. Because this equipment is used in harsh conditions a replacement with corrosion resistant metal should be considered. Due to the condition of this equipment and the its operational problems this replacement should be a high priority to be completed within the next two year period.	\$15,000.00	1
Aeration Tanks	Slide Gate #3 & Operator	This slide gate and its operator need to be replaced. The replacement gate and operator should be sized equally to the current equipment. Because this equipment is used in harsh conditions a replacement with corrosion resistant metal should be considered. Due to the condition of this equipment and the its operational problems this replacement should be a high priority to be completed within the next two year period.	\$15,000.00	1
Aeration Tanks	Slide Gate #4 & Operator	This slide gate and its operator need to be replaced. The replacement gate and operator should be sized equally to the current equipment. Because this equipment is used in harsh conditions a replacement with corrosion resistant metal should be considered. Due to the condition of this equipment and the its operational problems this replacement should be a high priority to be completed within the next two year period.	\$15,000.00	1
Clarifier #1	Steel Coatings	All steel parts and launders need to be sand blasted to remove corrosion and recoated.	\$100,000.00	1

Table B10: WWTF Process Mechanical Recommended Improvements

Location	Asset Name	Recommended Improvements	Cost Estimates	Priority (1-5)
Clarifier #2	Steel Coatings	All steel parts and launders need to be sand blasted to remove corrosion and recoated.	\$100,000.00	1
Laboratory	Vacuum Pump	Vacuum pump should be replaced with a new unit that is rated for an equal output. Given the condition of the equipment replacement should be a high priority to be completed within the next two year period.	\$2,000.00	1
Laboratory	Water Still	Water still should be replaced with a new unit that is rated for an equal output. Given the condition of the equipment replacement should be a high priority to be completed within the next two year period.	\$10,000.00	1
Pump Room Between Clarifiers, RAS pump 1 suction	Electric Actuator #1	This actuator does not need to be replaced. The equipment is approximately halfway through its estimated useful lifetime and should function for the next 10 years with proper maintenance.	\$3,000.00	2
Pump Room Between Clarifiers, RAS pump 3 suction	Electric Actuator #2	This actuator does not need to be replaced. The equipment is approximately halfway through its estimated useful lifetime and should function for the next 10 years with proper maintenance.	\$3,000.00	2
Control Building/Headworks	Grit Chamber Diffusers	The diffusers should be inspected and replaced if needed. Given the age of the diffusers it is likely they require replacement.	\$12,000.00	2
Control Building/ Ground Level	Septic/Sludge Pump #1	Given the condition and age of the pump it does not currently require replacement. The pump does appear to be wearing down quickly and could be considered for preemptive replacement.	\$40,000.00	2
Control Building/ Ground Level	Septic/Sludge Pump #1 Motor	Given the condition and age of the motor it does not currently require replacement. The motor does appear to be wearing down quickly and could be considered for preemptive replacement.	Included with Sludge Pump #1 pricing	2
Control Building/ Ground Level	Septic/Sludge Pump #2	Given the condition and age of the pump it does not currently require replacement. The pump does appear to be wearing down quickly and could be considered for preemptive replacement.	\$40,000.00	2
Control Building/ Ground Level	Septic/Sludge Pump #2 Motor	Given the condition and age of the motor it does not currently require replacement. The motor does appear to be wearing down quickly and could be considered for preemptive replacement.	Included with Sludge Pump #2 pricing	2

Table B10: WWTF Process Mechanical Recommended Improvements

Location	Asset Name	Recommended Improvements	Cost Estimates	Priority (1-5)
On Top of Clarifier #1	Clarifier #1 Drive	The clarifier drive does not require replacement at this time. The drive should continue to be serviced as specified by the manufacturer.	\$15,000.00	3
Between Clarifiers & Aeration Tanks on Slope	Clarifier #1 Inlet Valve & Operator	This valve and operator does not currently need to be replaced. However, the equipment may reach the end of its life in the next 10 years. The equipment could be considered for replacement as part of renovations if replacement will be unfeasible in the foreseeable future.	\$25,000.00	3
On Top of Clarifier #1	Clarifier #1 Motor	The clarifier drive motor does not require replacement at this time.	Included with Clarifier #1 Drive pricing	3
Inside Clarifier #1	Clarifier #1 Rake & Skim Arms	The mechanical components of clarifier #1 need to have any corrosion on exposed metal removed and any damaged coating repaired. This maintenance work will help prolong the life of the equipment and should be completed in the next two year period to ensure the equipment remains in working condition.	\$225,000.00	3
Clarifier #1	Clarifier #1 Structure	Clarifier tank does not require any significant maintenance or repairs. The loose handrails around the tank need to be reset. The tank should be inspected when it is drained as part of maintenance on mechanical components. Cost estimates provided are for minor repairs and do not reflect the cost a full tank replacement.	\$40,000.00	3
On Top of Clarifier #1	Clarifier #2 Drive	The clarifier drive does not require replacement at this time. The drive should continue to be serviced as specified by the manufacturer.	\$15,000.00	3
Between Clarifiers & Aeration Tanks on Slope	Clarifier #2 Inlet Valve & Operator	This valve and operator does not currently need to be replaced. However, the equipment may reach the end of its life in the next 10 years. The equipment could be considered for replacement as part of renovations if replacement will be unfeasible in the foreseeable future.	\$25,000.00	3
On Top of Clarifier #2	Clarifier #2 Motor	The clarifier drive motor does not require replacement at this time.	Included with Clarifier #2 Drive pricing	3
Inside Clarifier #2	Clarifier #2 Rake & Skim Arms	The mechanical components of clarifier #1 need to have any corrosion on exposed metal removed and any damaged coating repaired. This maintenance work will help prolong the life of the equipment and should be completed in the next two year period to ensure the equipment remains in working condition.	\$225,000.00	3
Clarifier #2	Clarifier #2 Structure	Clarifier tank does not require any significant maintenance or repairs. The loose handrails around the tank need to be reset. The tank should be inspected when it is drained as part of maintenance on mechanical components. Cost estimates provided are for minor repairs to tank concrete and do not reflect the cost a full tank replacement.	\$40,000.00	3

Table B10: WWTF Process Mechanical Recommended Improvements

Location	Asset Name	Recommended Improvements	Cost Estimates	Priority (1-5)
Control Building/ Basement	Digester 1 Drain Line Actuator	This actuator does not need to be replaced. The equipment is approximately halfway through its estimated useful lifetime and should function for the next 10 years with proper maintenance.	\$4,500.00	3
Control Building/ Basement	Digester 2 Drain Line Actuator	This actuator does not need to be replaced. The equipment is approximately halfway through its estimated useful lifetime and should function for the next 10 years with proper maintenance.	\$4,500.00	3
Outlet of Chlorine Contact Tank	Effluent Parshall Flume	The Parshall flume does not require replacement at this time.	\$10,000.00	3
Aeration Tanks	Froth Spray System	The froth Spray System should be removed. Given the system is currently abandoned in place and not effecting the treatment process the removal of the system is not a high priority. The system should be removed in conjunction with other work when the cost of removal will be minimal.	\$15,000.00	3
Pump Room Between Clarifiers	Plant Water Pump #2 (Golf Pump)	This pump and its ancillary equipment including piping, valving, and instrumentation are aging and are expected to require replacement by 2035.	\$40,000.00	3
Pump Room Between Clarifiers	Plant Water Pump #2 (Golf Pump) Motor	This motor should be replaced with its corresponding pump.	Included in Plant Water Pump #2 pricing	3
Pump Room Between Clarifiers	RAS Pump #1	This RAS pump does not require replacement at this time. Due to the high cost of the pump a budget should be created to fund the future replacement of the pump. Based on the age of the pump it is expected to require replacement in 10 to 15 years.	\$40,000.00	3
Pump Room Between Clarifiers	RAS Pump #2	This RAS pump does not require replacement at this time. Due to the high cost of the pump a budget should be created to fund the future replacement of the pump. Based on the age of the pump it is expected to require replacement in 10 to 15 years.	\$40,000.00	3
Pump Room Between Clarifiers	RAS Pump #3	This RAS pump does not require replacement at this time. Due to the high cost of the pump a budget should be created to fund the future replacement of the pump. Based on the age of the pump it is expected to require replacement in 10 to 15 years.	\$40,000.00	3
Pump Room Between Clarifiers	Scum Chamber	The scum chamber does not require replacement but should be drained and inspected in the next 10 year period.	\$7,000.00	3

Table B10: WWTF Process Mechanical Recommended Improvements

Location	Asset Name	Recommended Improvements	Cost Estimates	Priority (1-5)
Control Building/ Basement	Septic Sewage Line #1 Actuator	This actuator does not need to be replaced. The equipment is approximately halfway through its estimated useful lifetime and should function for the next 10 years with proper maintenance.	\$4,500.00	3
Control Building/ Basement	Septic Sewage Line #2 Actuator	This actuator does not need to be replaced. The equipment is approximately halfway through its estimated useful lifetime and should function for the next 10 years with proper maintenance.	\$4,500.00	3
Pump Room Between Clarifiers	Strainer 1	This strainer does not require replacement at this time.	\$8,000.00	3
Pump Room Between Clarifiers	Strainer 2	This strainer does not require replacement at this time.	\$8,000.00	3
Control Building/ Basement	WAS Suction Line Actuator	This actuator does not need to be replaced. The equipment is approximately halfway through its estimated useful lifetime and should function for the next 10 years with proper maintenance.	\$4,500.00	3
Outside Control Building	WWTF Generator	The generator does not require replacement at this time.	\$150,000.00	3
Control Building/Headworks	Aerated Grit Chamber	The grit chamber does not require replacement but should be drained and inspected in the next 10 year period.	\$5,000.00	4
Aeration Tanks	Aerator #1 Outlet Weir/Baffle Systems & Operators (2/4Total)	This equipment does not currently need to be replaced. Because the equipment shows some wear and will likely require replacement in the next years it should be considered for replacement during the implementation of other upgrades in the aeration tanks because the cost of replacement will be at its lowest during these upgrades.	\$20,000.00	4
Aeration Tanks	Aerator #2 Outlet Weir/Baffle Systems & Operators (2/4Total)	This equipment does not currently need to be replaced. Because the equipment shows some wear and will likely require replacement in the next years it should be considered for replacement during the implementation of other upgrades in the aeration tanks because the cost of replacement will be at its lowest during these upgrades.	\$20,000.00	4
Aeration Tanks	Aerator #3 Outlet Weir/Baffle Systems & Operators (2/4Total)	This equipment does not currently need to be replaced. Because the equipment shows some wear and will likely require replacement in the next years it should be considered for replacement during the implementation of other upgrades in the aeration tanks because the cost of replacement will be at its lowest during these upgrades.	\$20,000.00	4

Table B10: WWTF Process Mechanical Recommended Improvements

Location	Asset Name	Recommended Improvements	Cost Estimates	Priority (1-5)
Aeration Tanks	Aerator #4 Outlet Weir/Baffle Systems & Operators (2/4Total)	This equipment does not currently need to be replaced. Because the equipment shows some wear and will likely require replacement in the next years it should be considered for replacement during the implementation of other upgrades in the aeration tanks because the cost of replacement will be at its lowest during these upgrades.	\$20,000.00	4
Control Building/Grit Processing Room	Effluent Sampler	The effluent sampler does not require replacement. The operators of the system replace this unit as needed and can continue to do so.	\$5,000.00	4
Laboratory	Fume Hood	Fume Hood was replaced during the 2007 facility renovations. The system is in good conditions and the operators did not report any issues with the equipment.	\$10,000.00	4
Control Building/ Ground Level	Grit Blower	Given the condition and age of the blower it does not currently require replacement. The blower will reach the end of its estimated useful lifetime in 2037. A budget should be created and fully funded by 2035 for the replacement of this equipment.	\$8,500.00	4
Control Building/ Ground Level	Grit Blower Motor	Given the condition and age of the motor it does not currently require replacement. The motor will reach the end of its estimated useful lifetime in 2037. A budget should be created and fully funded by 2035 for the replacement of this equipment.	Included with Grit Blower pricing	4
Control Building/Grit Processing Room	Influent Sampler	The influent sampler does not require replacement. The operators of the system replace this unit as needed and can continue to do so.	\$5,000.00	4
Control Building/ Ground Level	Septage Blower	Given the condition and age of the blower it does not currently require replacement. The blower will reach the end of its estimated useful lifetime in 2037. A budget should be created and fully funded by 2035 for the replacement of this equipment.	\$8,500.00	4
Control Building/ Ground Level	Septage Blower Motor	Given the condition and age of the motor it does not currently require replacement. The motor will reach the end of its estimated useful lifetime in 2037. A budget should be created and fully funded by 2035 for the replacement of this equipment.	Included with Septage Blower pricing	4
Control Building/ Ground Level	WAS Blower #1	Given the condition and age of the blower it does not currently require replacement. The blower will reach the end of its estimated useful lifetime in 2037. A budget should be created and fully funded by 2035 for the replacement of this equipment.	\$8,500.00	4
Control Building/ Ground Level	WAS Blower #1 Motor	Given the condition and age of the motor it does not currently require replacement. The motor will reach the end of its estimated useful lifetime in 2037. A budget should be created and fully funded by 2035 for the replacement of this equipment.	Included with WAS Blower #1 pricing	4

Table B10: WWTF Process Mechanical Recommended Improvements

Location	Asset Name	Recommended Improvements	Cost Estimates	Priority (1-5)
Control Building/ Ground Level	WAS Blower #2	Given the condition and age of the blower it does not currently require replacement. The blower will reach the end of its estimated useful lifetime in 2037. A budget should be created and fully funded by 2035 for the replacement of this equipment.	\$8,500.00	4
Control Building/ Ground Level	WAS Blower #2 Motor	Given the condition and age of the motor it does not currently require replacement. The motor will reach the end of its estimated useful lifetime in 2037. A budget should be created and fully funded by 2035 for the replacement of this equipment.	Included with WAS Blower #2 pricing	4
Control Building/ Basement	WAS Pump #1	Given the condition and age of the pump it does not currently require replacement. The pump will reach the end of its estimated useful lifetime in 2037. A budget should be created and fully funded by 2035 for the replacement of this equipment.	\$40,000.00	4
Control Building/ Basement	WAS Pump #1 Motor	Given the condition and age of the motor it does not currently require replacement. The pump will reach the end of its estimated useful lifetime in 2037. A budget should be created and fully funded by 2035 for the replacement of this equipment.	Included with WAS Pump #1 pricing	4
Control Building/ Basement	WAS Pump #2	Given the condition and age of the pump it does not currently require replacement. The pump will reach the end of its estimated useful lifetime in 2037. A budget should be created and fully funded by 2035 for the replacement of this equipment.	\$40,000.00	4
Control Building/ Basement	WAS Pump #2 Motor	Given the condition and age of the motor it does not currently require replacement. The pump will reach the end of its estimated useful lifetime in 2037. A budget should be created and fully funded by 2035 for the replacement of this equipment.	Included with WAS Pump #2 pricing	4
Control Building/Headworks	Bar Screen (Coarse)	This bar screen does not require replacement.	\$2,500.00	5
Control Building/Headworks	Bar Screen (Fine)	This bar screen does not require replacement.	\$2,500.00	5
Chlorine Contact Tank	Chlorine Contact Tank	The chlorine contact tank does not require any significant maintenance or repairs at this time.	NA	5
Control Building/Headworks	Weir Plate	This weir plate does not require replacement.	\$2,000.00	5

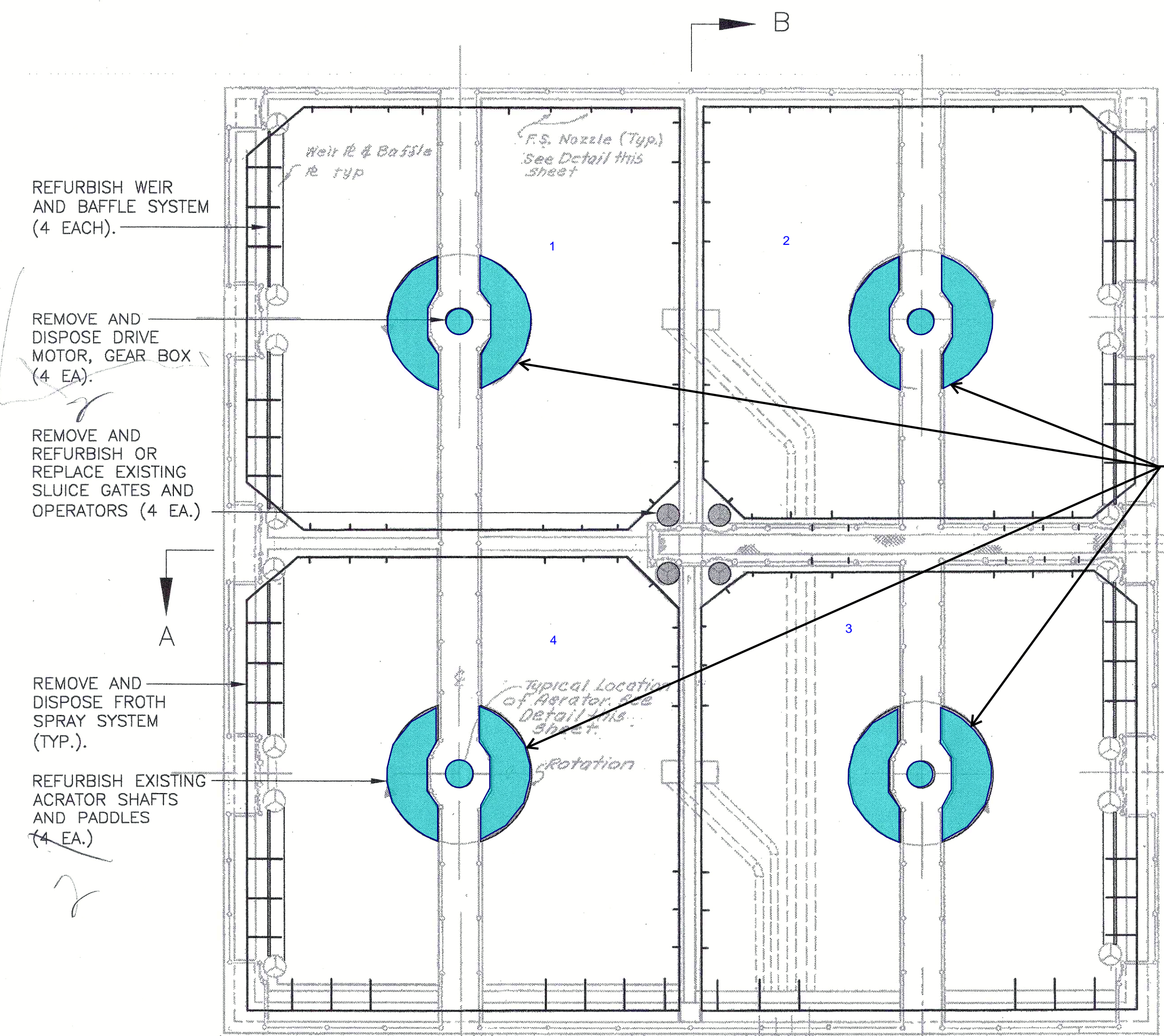
APPENDIX C

Digestion Tank Alterations Supporting Documents

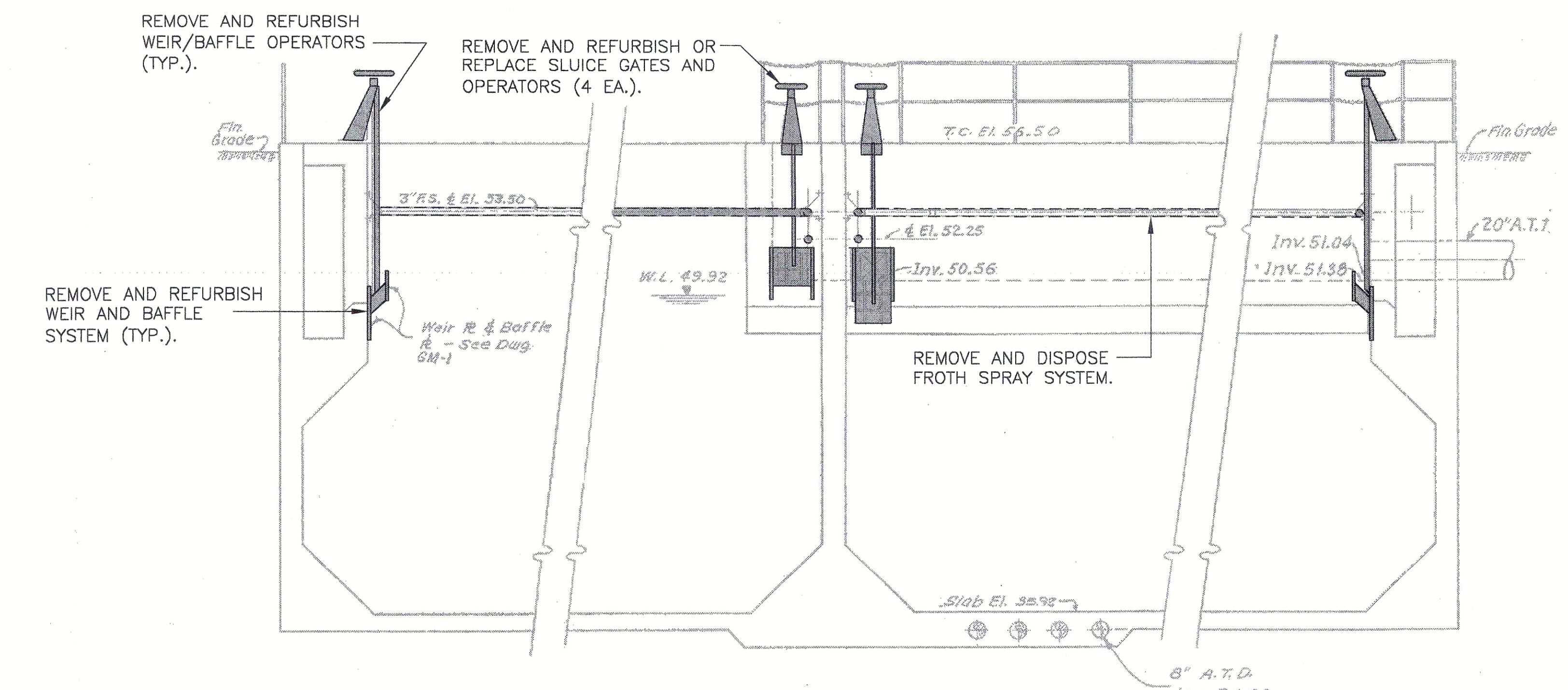
Jamestown WWTF Digester Tank Alterations Conceptual Cost Estimate							
	Engineer's Preliminary Opinion of Probable Cost						
	Project no. 24-0088						
Item no.	Description	Qty	Units	Material Cost	Installation Cost	Total Unit Cost	Total Cost
1	Mobilization	0.05	LSUM	N/A	N/A	\$ 220,000.00	\$ 11,000.00
2	Demolition of Piping (w/valving, fittings, diffusers, etc.)	1	LSUM	\$ -	\$ 20,000.00	\$ 20,000.00	\$ 20,000.00
3	Septage Piping Valves	10	EA	\$ 4,500.00	\$ 2,500.00	\$ 7,000.00	\$ 70,000.00
4	Septage Piping, w/ Paint	250	FT	\$ 200.00	\$ 200.00	\$ 400.00	\$ 100,000.00
5	Diffusers	10	EA	\$ 2,000.00	\$ 1,000.00	\$ 3,000.00	\$ 30,000.00
						<i>Sub-total</i>	<i>\$ 231,000.00</i>

APPENDIX D

Aeration Analysis Supporting Documents



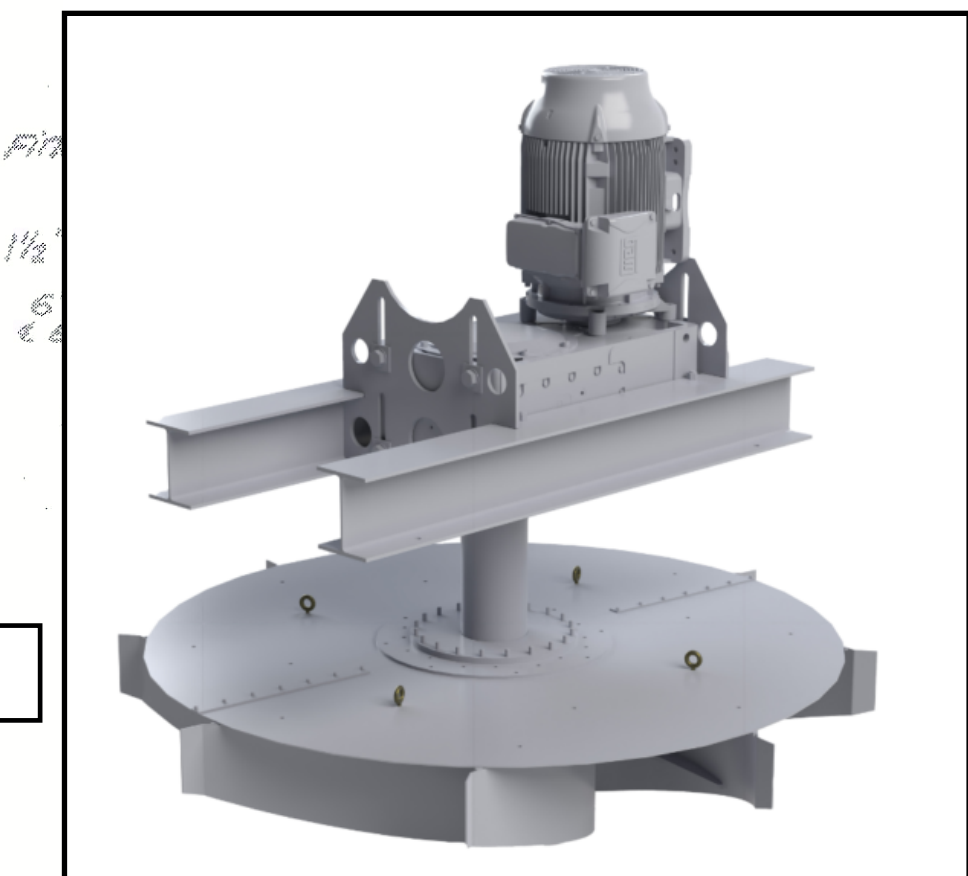
AERATION TANKS - PLAN
SCALE: 1/8" = 1'-0"



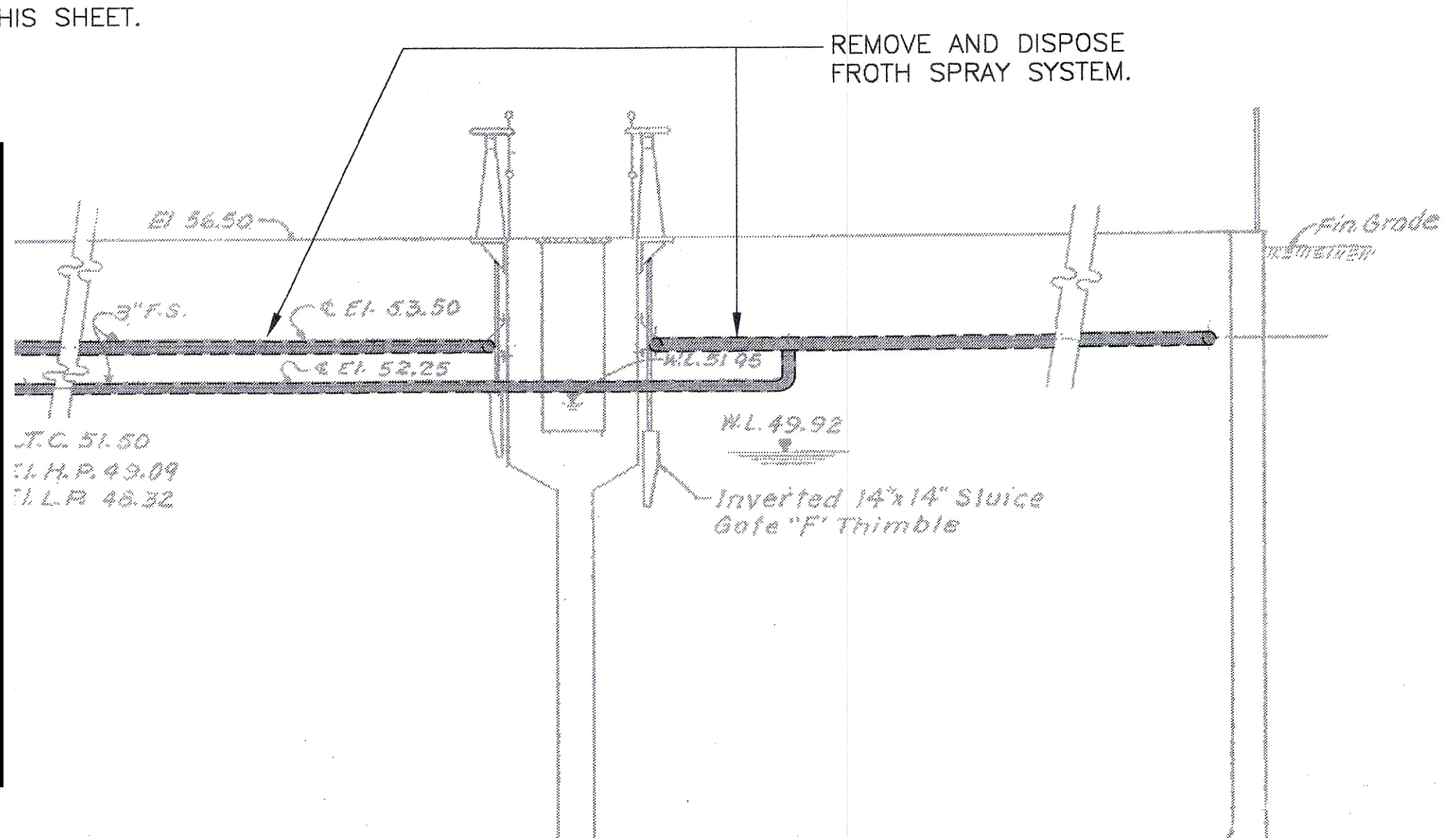
AERATION TANKS - SECTION A
SCALE: 1/4" = 1'-0"

OPTION 0 - REPLACE IN KIND
WITH SURFACE AERATOR

VALVE CHAMBER. SEE
DETAIL THIS SHEET.



PROPERTY OF OVIVO

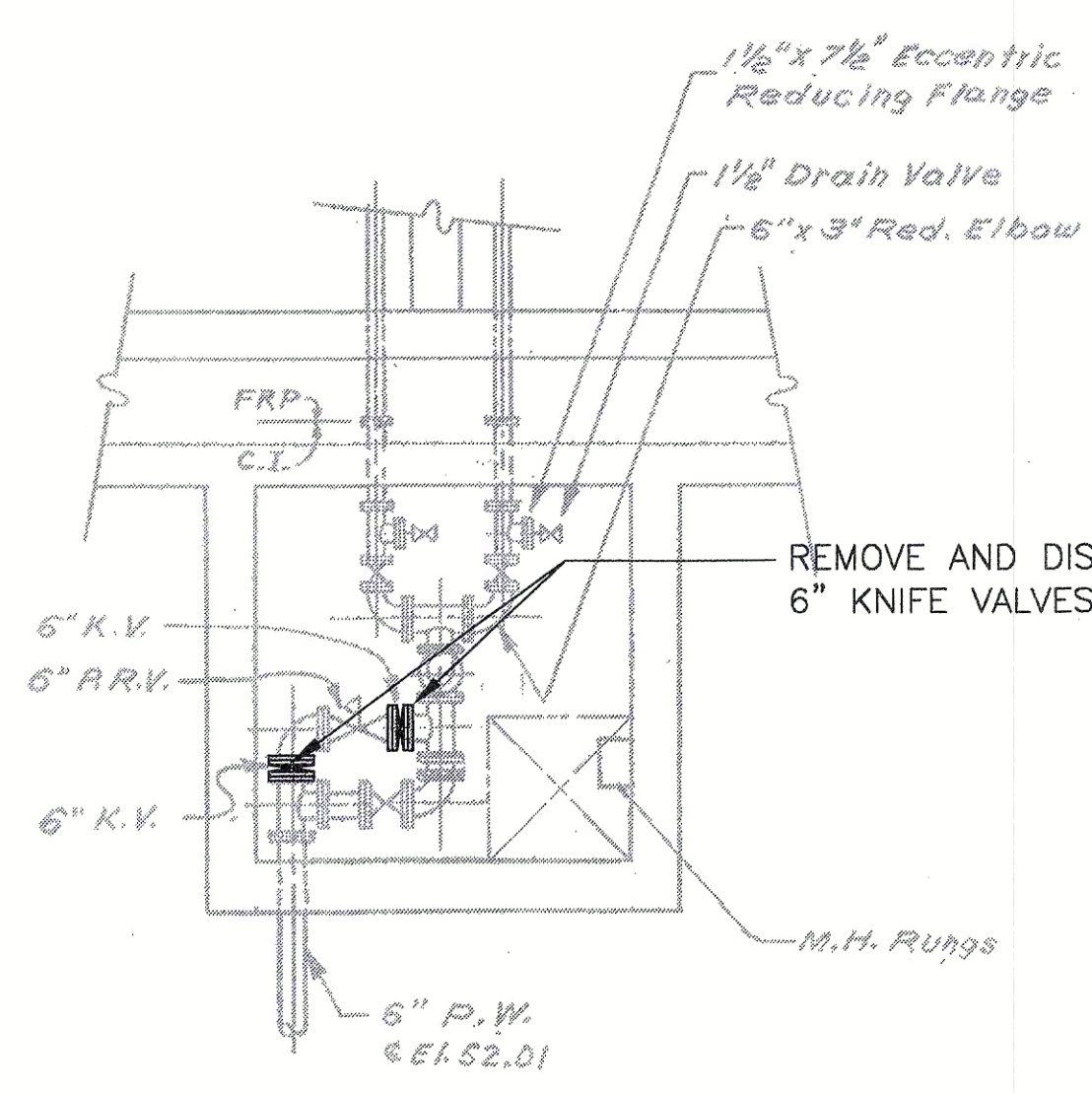


JAMESTOWN WWTF AERATION OPTION 0
REPLACE IN-KIND

Engineer's Opinion of Probable Cost

Item no.	Description	Qty	Units	Total Unit Cost	Total Cost
1	Demolition of Existing Aerators	4 ea		\$ 12,500.00	\$ 50,000.00
2	Aerators, Drive Motor, Gear Box	4 ea		\$ 255,000.00	\$ 1,020,000.00
3	Electrical/Instrumentation	1 LS		\$ 50,000.00	\$ 50,000.00
				Sub-total	\$ 1,120,000.00

NOTE: COST IS FOR REMOVAL & INSTALLATION COSTS ONLY. THESE DO NOT INCLUDE CONTRACTOR OH&P, CONTINGENCY, OR ENGINEERING. THESE ARE APPLIED TO THE OVERALL PRIORITY CATEGORY PROJECT ESTIMATES IN THE REPORT



VALVE CHAMBER - PLAN
SCALE: 1/4" = 1'-0"

VOLLMEYER ASSOCIATES LLP
Engineers
Architects
Landscape Architects
Surveyors
Planners
38 Chauncy Street
Boston, MA 02111
(617) 451-0044

No.	Description	Date

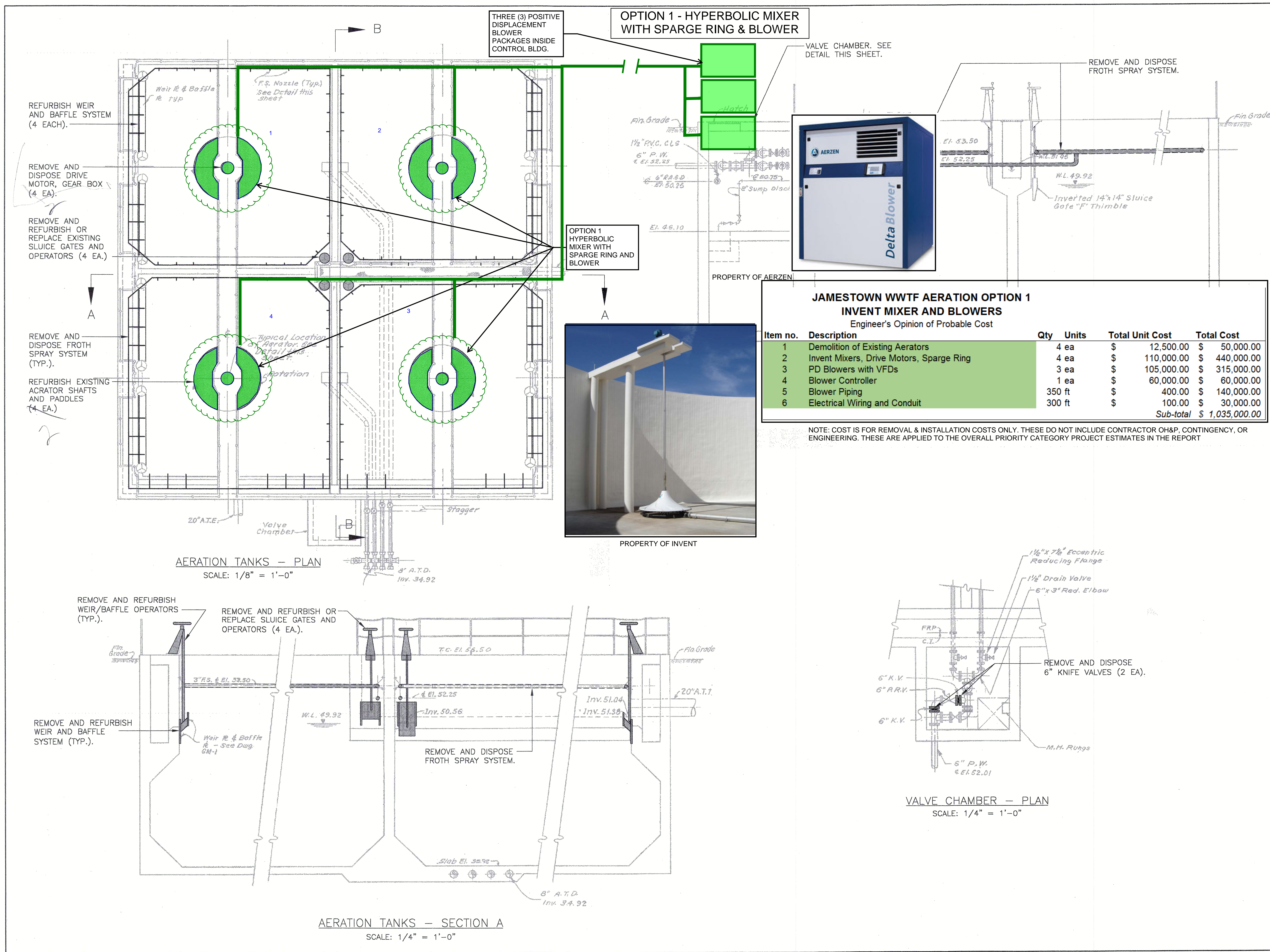
Prepared By:
JOHN T. HANNIGAN
No. 3393
REGISTERED PROFESSIONAL ENGINEER

Project Name:
Jamestown Wastewater Treatment Plant Rehabilitation

Prepared For:
**Town of Jamestown
Department of Public Works
44 Southwest Avenue
Jamestown, RI 02835**

Drawing Title
Aeration Tank Equipment

Scale AS NOTED	Dwg. No. 13 OF 74
Date DEC. 2005	D-6
Ref. 2003207.04	
Design by: DKB/JC	
Checked by: WPM	



VOLLMEYER ASSOCIATES LLP
Engineers
Architects
Landscape Architects
Surveyors
Planners
38 Chauncy Street
Boston, MA 02111
(617) 451-0044

Revisions

No.	Description	Date

Prepared By:

JOHN T. HANNIGAN
No. 3393
REGISTERED PROFESSIONAL ENGINEER

Project Name:

Jamestown Wastewater Treatment Plant Rehabilitation

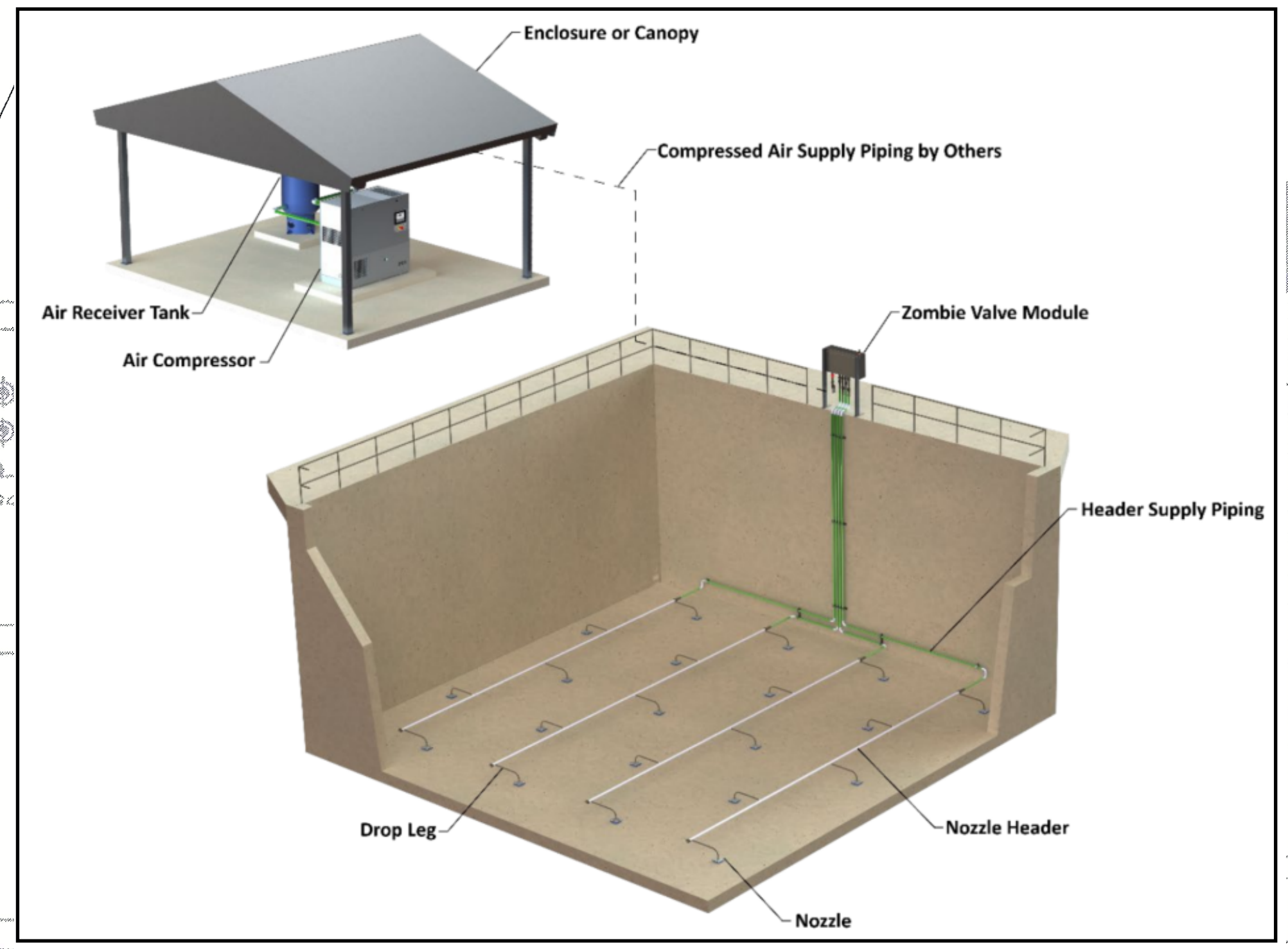
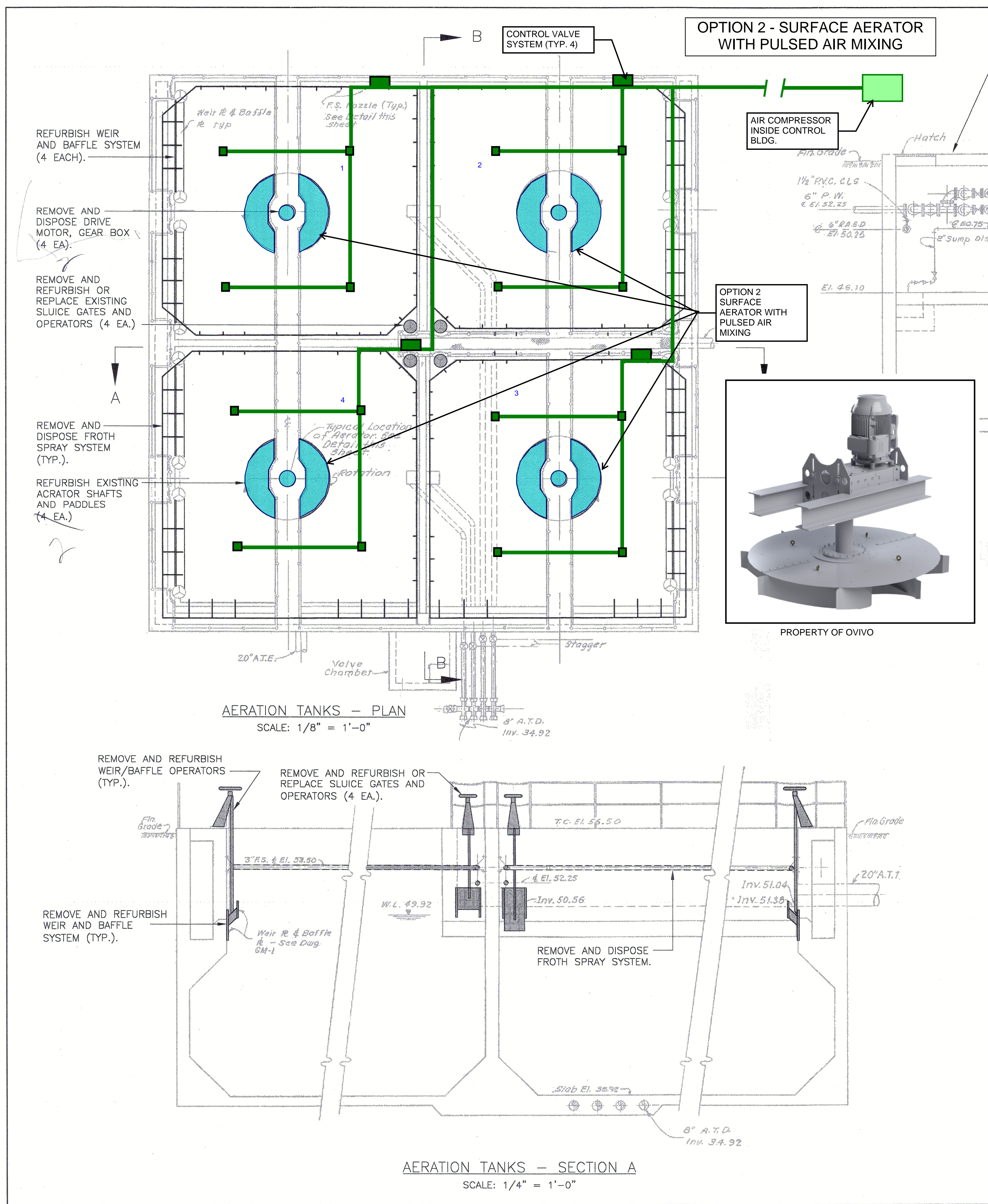
Prepared For:

Town of Jamestown
Department of Public Works
44 Southwest Avenue
Jamestown, RI 02835

Drawing Title

Aeration Tank Equipment

Scale AS NOTED	Dwg. No. 13 OF 74
Date DEC. 2005	D-6
Ref. 2003207.04	
Design by: DKB/JC	
Checked by: WPM	

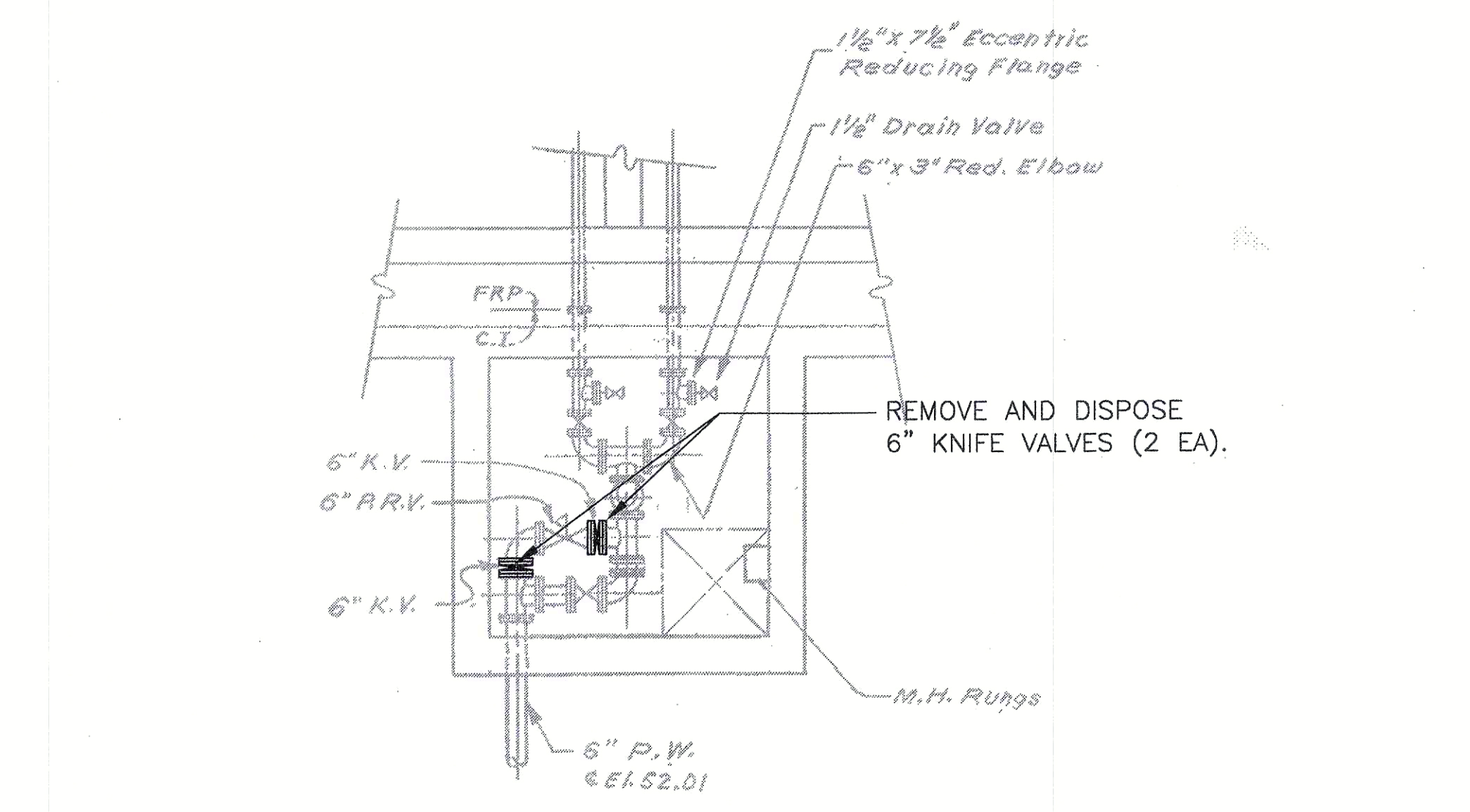


**JAMESTOWN WWTF AERATION OPTION 2
SURFACE AERATOR WITH PULSED AIR SYSTEM**
Engineer's Opinion of Probable Cost

Item no.	Description	Qty	Units	Total Unit Cost	Total Cost
1	Demolition of Existing Aerators	4 ea	\$	12,500.00	\$ 50,000.00
2	Aerators, Drive Motor, Gear Box, VFD, Controller	4 ea	\$	255,000.00	\$ 1,020,000.00
3	Enviomix Package, Nozzles, Headers, Valves, Compressor	1 LS	\$	325,000.00	\$ 325,000.00
4	Piping from Compressor to Valve Panel	200 Lft	\$	300.00	\$ 60,000.00
5	Electrical/Instrumentation	1 LS	\$	45,000.00	\$ 45,000.00
Sub-total				\$ 1,500,000.00	

Project no. ENG23-0487

NOTE: COST IS FOR REMOVAL & INSTALLATION COSTS ONLY. THESE DO NOT INCLUDE CONTRACTOR OH&P, CONTINGENCY, OR ENGINEERING. THESE ARE APPLIED TO THE OVERALL PRIORITY CATEGORY PROJECT ESTIMATES IN THE REPORT



VOLLMEYER ASSOCIATES LLP
Engineers
Architects
Landscape Architects
Surveyors
Planners

38 Chauncy Street
Boston, MA 02111
(617) 451-0044

Revisions

No.	Description	Date

Prepared By:

JOHN T. HANNIGAN
No. 3393
REGISTERED PROFESSIONAL ENGINEER

Project Name:

Jamestown Wastewater Treatment Plant Rehabilitation

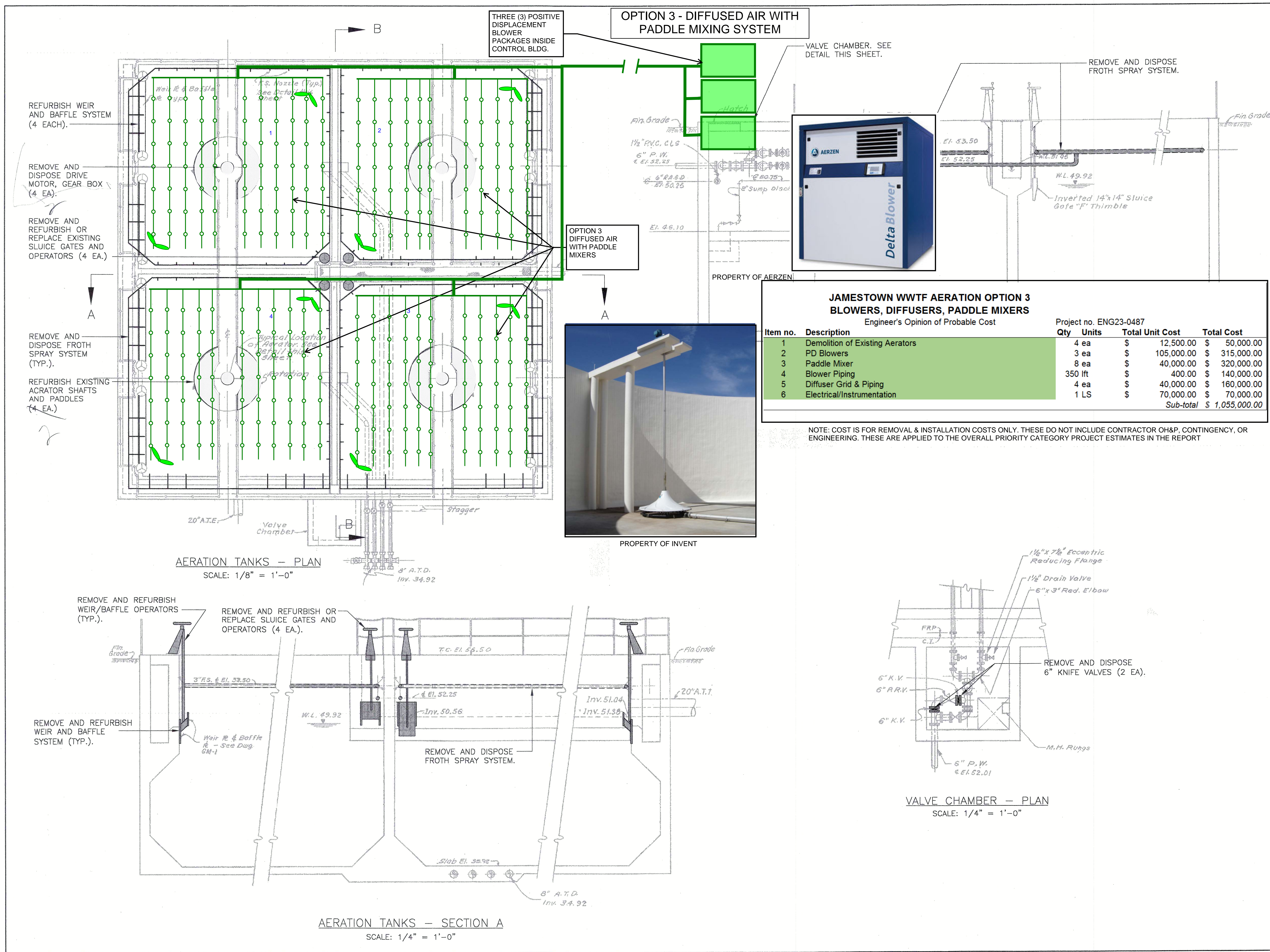
Prepared For:

**Town of Jamestown
Department of Public Works
44 Southwest Avenue
Jamestown, RI 02835**

Drawing Title

Aeration Tank Equipment

Scale AS NOTED	Dwg. No. 13 OF 74
Date DEC. 2005	D-6
Ref. 2003207.04	
Design by: DKB/JC	
Checked by: WPM	



Revisions		
No.	Description	Date

Prepared By:

JOHN T. HANNIGAN
No. 3393
REGISTERED
PROFESSIONAL ENGINEER

Project Name:

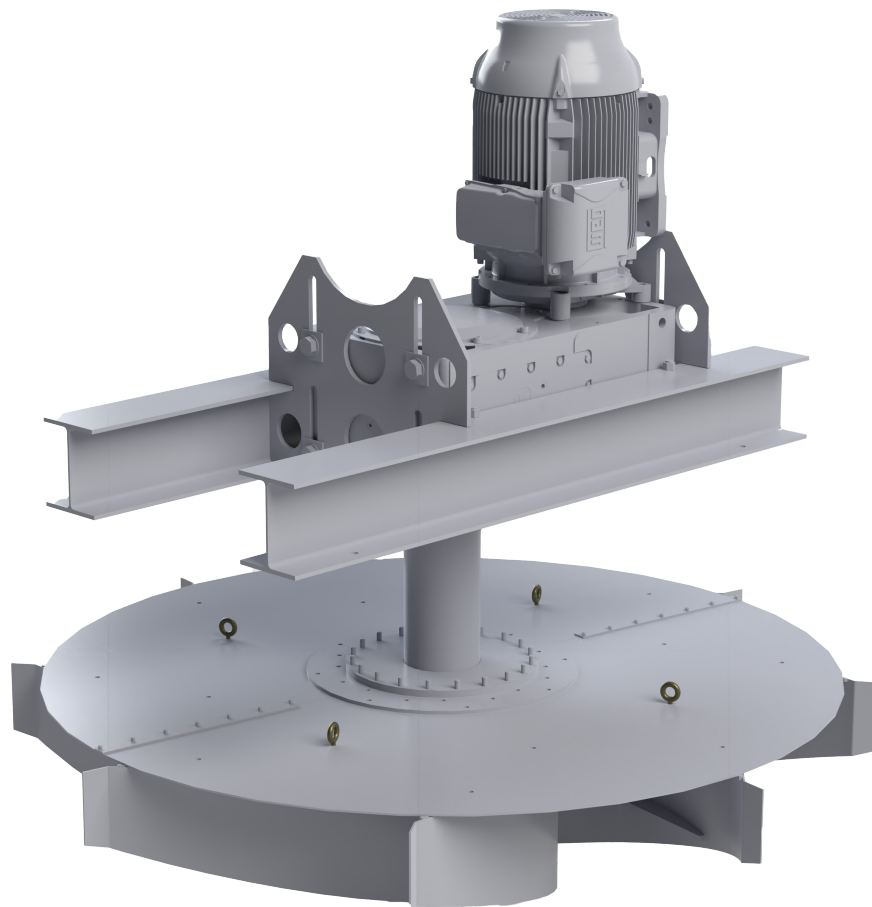
**Jamestown
Wastewater
Treatment
Plant
Rehabilitation**

Prepared For:

**Town of Jamestown
Department of Public Works
44 Southwest Avenue
Jamestown, RI 02835**

Drawing Title	
Aeration Tank Equipment	
Scale AS NOTED	Dwg. No. 13 OF 74
Date DEC. 2005	D-6
Ref. 2003207.04	
Design by: DKB/JC	
Checked by: WPM	

LOW SPEED AERATORS | MA SERIES



ENGINEERED FIRSTS | BUILT TO LAST

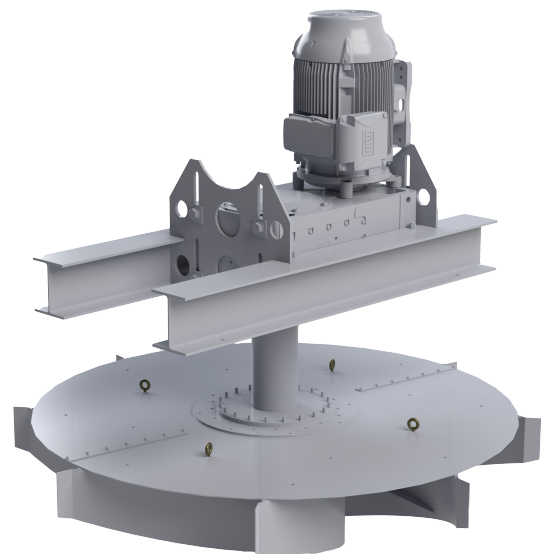
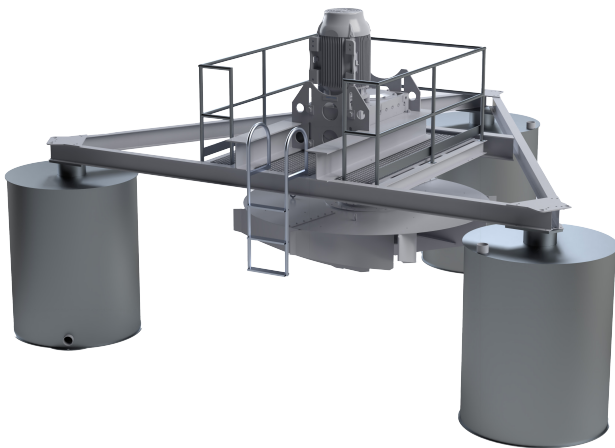
OVERVIEW

With over 50 years of experience in designing and building aerators, DBS will provide you with the right solution for every application. Our MA low-speed aerators are cost competitive with and at least 30% more efficient than high-speed aerators. In many cases, the energy cost savings will pay back the investment made in a DBS aerator.

SURFACE AERATORS

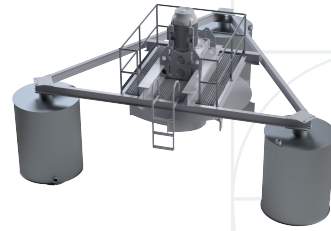
Surface mechanical aerators fall into two categories:

- High-speed aerators use an electric motor to directly drive an impeller that pumps water up and sprays it out horizontally. While this design is inexpensive, it has low oxygen transfer efficiency because the pump impeller wastes significant energy by moving water faster than needed.
- Low-speed aerators are more efficient because the rotor operates nearer the optimum aeration speed. But they are more expensive because they require a gearbox to reduce motor speed to turn a large diameter aeration rotor.



TECHNICAL FEATURES

MA Aerators are designed to provide the efficiency of low-speed aerators with the cost savings of high-speed aerators.



GEARBOX

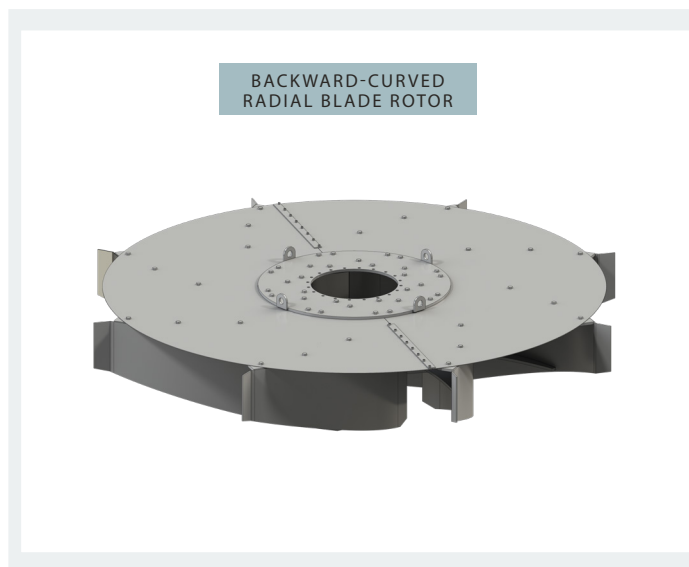
The MA aerator uses a helical gearbox to drive the aerator rotor. This mass-produced gearbox offers an excellent power/cost ratio. The gearbox is uniquely mounted directly in the aerator rotor, which provides a number of benefits:

- The gearbox operates partially submerged. Water flowing through the impeller cools the gearbox to near ambient temperature, allowing longer oil life.
- The gearbox directly drives the rotor preventing inherent driveshaft vibration problems common in traditional low-speed aerators.

- The gearbox and rotor assembly is attached to the electric motor by a “torque tube,” which flexes laterally to dampen shocks caused by wave impact on the rotor.

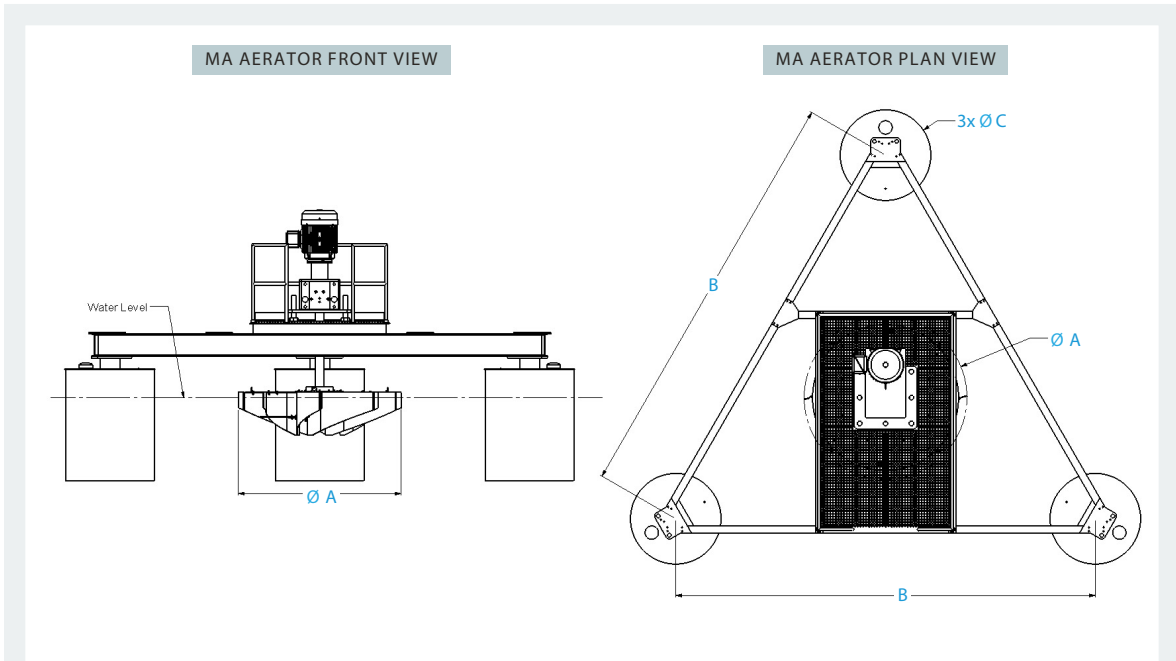
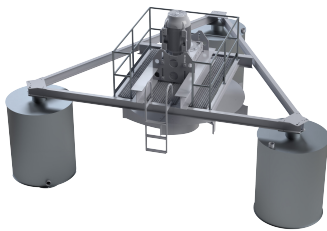
ROTOR

The MA features a traditional high-efficiency backward-curved radial blade rotor.



FLOATING MA AERATOR

DBS offers floating aerators from 7.5 HP to 200 HP to match any aeration requirement.



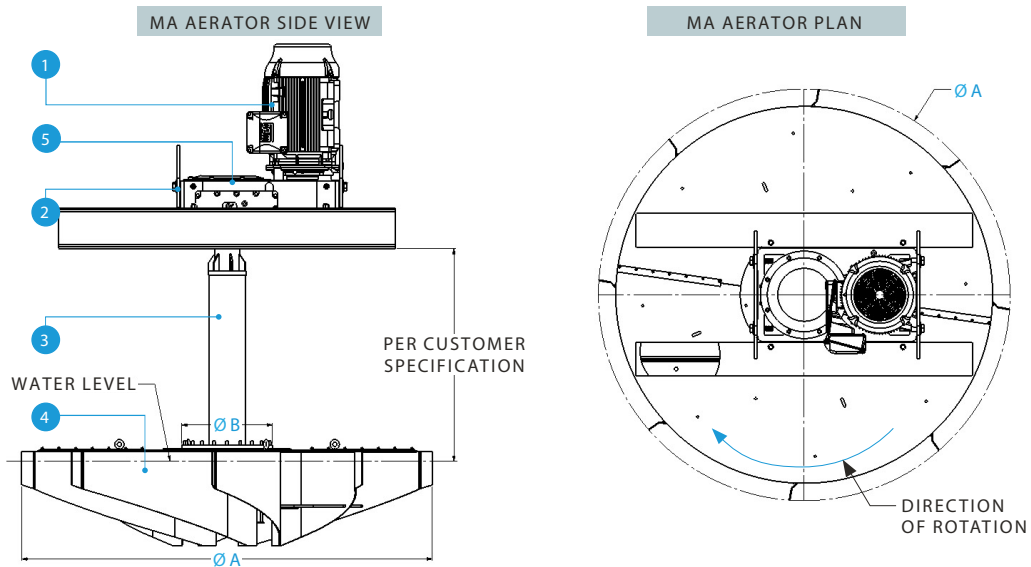
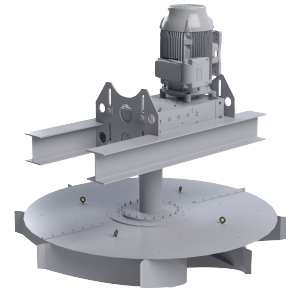
MODEL	HORSE POWER		SERVICE FACTOR ¹		O ₂ /HOUR ²		ØA 1800 RPM INPUT		ØA 1500 RPM INPUT		B		ØC		WEIGHT	
	HP	KW	50hz	60hz	LB	KG	IN	MM	IN	MM	IN	MM	IN	MM	LB	KG
MA-08	7.5	5.6	6.97	8.41	26	12	42	1,067	46	1,168	98	2,489	40	1,016	4,729	2,145
MA-10	10	7.5	5.22	6.3	35	16	46	1,168	49	1,245	98	2,489	40	1,016	4,779	2,168
MA-15	15	11	3.48	4.20	53	24	49	1,245	52	1,321	98	2,489	40	1,016	4,969	2,254
MA-20	20	15	2.61	3.15	70	32	52	1,321	57	1,448	98	2,489	40	1,016	5,019	2,277
MA-25	25	19	2.95	3.57	88	40	68	1,727	74	1,880	240	6,096	46	1,168	7,141	3,239
MA-30	30	22	2.46	2.97	105	48	72	1,829	78	1,981	240	6,096	46	1,168	8,091	3,670
MA-40	40	30	3.17	3.83	140	63	80	2,032	86	2,184	240	6,096	52	1,321	8,341	3,783
MA-50	50	37	2.54	3.06	175	79	86	2,184	96	2,438	240	6,096	52	1,321	10,176	4,616
MA-60	60	45	2.12	2.55	210	95	88	2,235	99	2,515	240	6,096	52	1,321	11,476	5,205
MA-75	75	56	3.95	4.76	263	119	116	2,946	122	3,099	300	7,620	52	1,321	11,776	5,342
MA-100	100	75	3.59	2.97	350	159	122	3,099	130	3,302	300	7,620	62	1,575	17,574	7,972
MA-125	125	93	2.37	2.86	438	198	130	3,302	136	3,454	300	7,620	62	1,575	18,175	8,244
MA-150	150	112	1.97	2.38	525	238	136	3,454	144	3,658	300	7,620	70	1,778	25,429	11,534
MA-200	200	149	2.23	2.69	700	317	144	3,658	165	4,191	300	7,620	70	1,778	26,229	11,897

¹ Minimum recommended service factor is 1.8.
At 1.0 service factor, gears have a theoretical infinite life.

² Under standard conditions. Performance under field conditions may vary.

BRIDGE-MOUNTED MA AERATOR

DBS offers bridge mounted aerators from 7.5 HP to 300 HP to match any aeration requirement.



ITEM DESCRIPTION

- 1 Electric Motor
- 2 Mounting Plate
- 3 Spool
- 4 Rotor
- 5 Gearbox

MODEL	HORSE POWER		SERVICE FACTOR ¹		O ₂ /HOUR ²		ØA 1800 RPM INPUT		ØA 1500 RPM INPUT		B ³		WEIGHT	
	HP	KW	50hz	60hz	LB	KG	IN	MM	IN	MM	IN	MM	LB	KG
MA-8B	7.5	5.6	6.97	8.41	26	12	42	1,067	46	1,168	19	483	1,310	594
MA-10B	10	7.5	5.22	6.30	35	16	46	1,168	49	1,245	19	483	1,359	616
MA-15B	15	11	3.48	4.20	53	24	49	1,245	52	1,321	19	483	1,523	691
MA-20B	20	15	2.61	3.15	70	32	52	1,321	57	1,448	19	483	1,598	725
MA-25B	25	19	2.95	3.57	88	40	68	1,727	74	1,880	19	483	1,793	813
MA-30B	30	22	2.46	2.97	105	48	72	1,829	78	1,981	20	508	2,735	1,240
MA-40B	40	30	3.17	3.83	140	63	80	2,032	86	2,184	20	508	2,987	1,355
MA-50B	50	37	2.54	3.06	175	79	86	2,184	96	2,438	20	508	3,094	1,403
MA-60B	60	45	2.12	2.55	210	95	88	2,235	99	2,515	20	508	4,397	1,986
MA-75B	75	56	NR	2.04	263	119	91	2,311	NR	NR	20	508	4,636	2,103
MA-100B	100	75	2.96	3.57	350	159	122	3,099	130	3,302	28	711	7,452	3,380
MA-125B	125	93	2.37	2.86	438	198	130	3,302	136	3,454	28	711	8,095	3,672
MA-150B	150	112	1.97	2.38	525	238	136	3,454	144	3,658	28	711	12,369	5,610
MA-200B	200	149	2.23	2.69	700	317	144	3,658	165	4,191	28	711	13,125	5,953

¹ Minimum recommended service factor is 1.8.
At 1.0 service factor, gears have a theoretical infinite life.

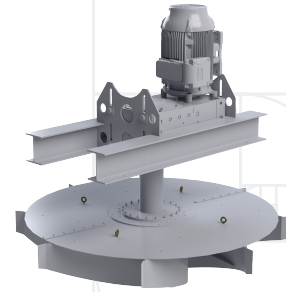
² Under standard conditions. Performance under field conditions may vary.

³ Bridge platform must have a hole larger than B dimension for installation.

NR Not recommended.

DBS “RACETRACK” OXIDATION DITCH

Oxidation ditches have proven to be efficient, economical wastewater treatment systems for decades. DBS Manufacturing Inc., has improved upon this technology by incorporating their new DBS Aerator.



DESCRIPTION

DBS Racetrack Oxidation Ditches are powered by the patented MA low-speed aerator that provides high efficiency and long life at a substantially lower cost than competitive aerators. Plus, maintenance parts are available worldwide.

Equipped with DBS stainless steel high-efficiency backward curved aeration rotors, DBS Racetrack

Oxidation Ditch aerators maximize pumping rate for superior mixing and aeration.

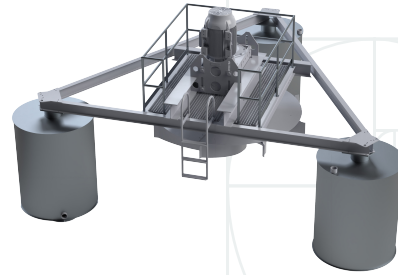
The DBS Racetrack Oxidation Ditch not only offers guaranteed performance for the mechanical equipment, but also for the biological process and ditch velocity.



DBS Racetrack OXIDATION DITCH

LOW SPEED AERATORS AEROBIC DIGESTORS – LAGOON AERATION

DBS Floating Aerators are ideal for lagoon and aerobic digester applications because their compact design makes these units easy to assemble and install.



DESCRIPTION

All wetted parts such as the aeration rotor, float arm lower link, and float hardware are made from corrosion resistant stainless steel for long life and reliability. The flexibility of the DBS stainless steel mooring winch

may significantly benefit lagoon applications. Two winches make easy work of moving the DBS aerator across the lagoon to maximize mixing efficiency.



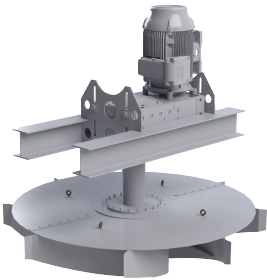
Post Mounted AERATOR

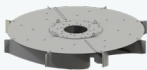


Floating Aerator WITH WINCH

ORDERING INFORMATION

DBS offers several options for our MA Low Speed Aerators. Contact DBS or a DBS representative for assistance in deciding your equipment requirements.

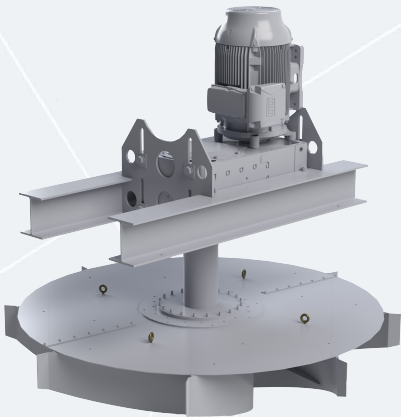


MA LOW SPEED AERATOR MODEL OPTIONS					
MA Aerator	ROTORS	HORSEPOWER		MOUNTING	
					
	CODE	CODE	HP	CODE	MOUNTING
	A Standard backwards curved rotor	08	7.5	B	Bridge
		10	10	Omit	Floating
		15	15		
		20	20		
		25	25		
		30	30		
		40	40		
		50	50		
		60	60		
		75	75		
		100	100		
		125	125		
		150	150		
		200	200		

EXAMPLE: MODEL MA-200B is for an Aerator with a standard backward-curved rotor, 200 HP electric motor, and bridge mounting.

OPTIONS

- Stainless steel construction
- Special coating
- Maintenance platform
- Low oil level switch



LOW SPEED | AERATORS
MA SERIES
MODEL MA-100B

- CLARIFIER & THICKENER DRIVES
- RETROFITS
- LOW-SPEED SURFACE AERATORS
- ROTARY DISTRIBUTOR CENTER MECHANISMS

DBS MANUFACTURING

404.768.2131
engineering@dbsmfg.com
dbsmfg.com
45 SouthWoods Parkway
Atlanta, Georgia. 30354

<p>OPTION 0 AND 2 - LOW SPEED SURFACE AERATOR</p>

DBS DDT Calculator

V2.2

Project - Jamestown RI WWTF

4/17/2024

BOD ₅ mg/l Influent	150
NH ₃ mg/l Influent	30
Altitude - ft.	500
Flow MGD	0.35

Non Nutirent excess NH ₃	22.5
Flow GPM	243
Flow LPM	920
BOD ₅ loading lb./day	437
NH ₃ loading lb./day	66

lb. O₂/lb. BOD₅ required	1.2
lb. O₂/lb. NH₃ required	4.70
Basin Vol. Million gal.	0.165
Basin Vol. Cubic feet	22060.5
Basin Depth - ft.	14
Basin Surface Area - sq. ft.	1576
Channel width - ft.	20
Basin Width (two channels)	41
Channel length - straight segment	6

AOR lb. O₂/hour	35
-----------------------------------	-----------

Water Temp. Deg. C	20
Alpha Factor	0.7
Beta Factor	0.99
Theta Factor	1.024
DO Oxygen Concentration	2
C	9.09
C _{W-ALT} (at specified altitude)	8.95
C _{SS} (at standard conditions)	9.09

SOR lb. O₂/hour	67
-----------------------------------	-----------

Motor Efficiency	0.92
Gearbox Efficiency	0.94
SAE lb O ₂ /hr/HP _{MOTOR}	3.5

**DITCH VELOCITY POWER
REQUIREMENT:**

HP_{MOTOR}	20
HP _{DELIVERED}	15
Mixing Level (HP/1000 Ft. ³)	0.68
Avg. Ditch Velolcity (ft./sec.)	1.8

HP _{WIRE}	21
HP_{MOTOR}	19

OPTION 1 -
HYPERBOLIC MIXER
AND SPARGE RING



The **HYPERCLASSIC**® - Mixing and Aeration System

Offer-No.: IET-2403006-HCMA-Rev00

Project: Jamestown, RI WWTP

Submitted to: AquaSolutions

Date: March 29, 2024



INVENT Environmental Technologies, Inc.

By: Patrick O'Donnell

Phone: 201-286-3307

podonnell@[invent-et.com](mailto:podonnell@invent-et.com)

218 Little Falls Road, Unit 7 & 8

Cedar Grove, NJ 07009

Phone: 973-571-2223

<http://www.invent-et.com>

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1 The **HYPERCLASSIC®**- Mixing and Aeration System

The **INVENT HYPERCLASSIC®**-Mixing and Aeration System incorporates the uniquely designed and patented hyperboloid mixer technology. The hyperboloid shape was developed for optimum tank flow mechanics and provides unmatched mixing, solids suspension, and tank homogenization as well as high oxygen transfer efficiency. The **HYPERCLASSIC®**-Mixing and Aeration System is a rugged and versatile device that can be used in wastewater treatment as well as numerous industrial applications.

1.1 Project Overview

This proposal was intended specifically for Jamestown, RI. The design of the **HYPERCLASSIC®**-Mixing and Aeration System is tailored to the application to ensure complete mixing and prevent sedimentation at the lowest possible energy consumption while meeting air requirements when required. With each application, **INVENT** includes project specific additions as necessary which are noted in the scope. These additions can include but are not limited to walkways, bottom guides, and specialty product materials.

INVENT also offers **THINK Fluid Dynamix®** computational fluid dynamics (CFD). CFD results can address concerns with sedimentation, bulk fluid flow, overall mixing quality, mixing intensity, G-values and short-circuiting to ensure the optimal product is selected for the application.



Figure 1: **HYPERCLASSIC®**-Mixing and Aeration System in Manchester, CT

2 Design Basis

2.1 Application

The **HYPERCLASSIC®**-Mixing and Aeration System ensures complete mixing and prevents sedimentation at the lowest possible energy consumption while supplying enough air required by the biology.

2.2 Wastewater Properties

Wastewater Properties	Origin of the Wastewater	municipal
	Medium	activated sludge
	MLSS	≤ 5,000 ppm
	Sludge Volume Index (SVI)	≥ 80 ml/g
	Temperature	68 °F
	Total Dissolved Solids (TDS)	≤ 2,000 ppm
	pH-Value	6 - 8

2.3 Basin/Tank Data -Aeration Basin

Plant Data	Number of Basins	4
	Basin Type	Rectangular
	Length	40.0 ft
	Width	40.0 ft
	Water Depth	15.0 ft
	Freeboard	7.0 ft
	Basin Volume	0.168 Mgal

2.4 Oxygen Requirements per Basin

Air Data	AOR	59.3 lb/hr
	SOTR	88.5 lb/hr

3 Scope of Supply

3.1 HYPERCLASSIC®- Mixing and Aeration System Configuration

	Number	Mixer/Aerator Part	Material
Mixer/Aerator Configuration	1	Motor Gearbox	Housing made from cast iron/cast aluminum with high-quality coating <ul style="list-style-type: none"> • SEW Eurodrive or equal • Premium Efficiency, TEFC motor • IP 66 • Oil sight glass • 3 PTC Thermistor Sensors thermal class F-standard or Temperature (bimetallic) Switches- alternate
	1	Mounting Base	Carbon steel with powder coating and vibration dampeners
	1	Shaft with flanged connection	ASTM 316
	1	Hyperboloid Mixer Body with flanged connection	High quality FRP
	1	Bottom Guide	Bushing made from ASTM 316, with self-lubricating bearing composite
	1	Sparger Ring	HDPE
	1 set	Assembly Hardware	ASTM 316

3.2 Further Options - HYPERCLASSIC®- Mixing and Aeration System

	Description	Inclusion
Available Options	<u>Synthetic Oil</u> : The common intervals of the lubricant exchange can be increased from 1 to 2 years.	Included
	<u>Anti-Condensation Heating</u> : Protection against condensed water inside the motor. The motor is equipped with a space heater.	Not included
	<u>CFD Modeling</u> : Please See Attachment	Not included
	<u>Support Structure</u> : Platforms or Walkways, See Attachment	Not included

3.3 Remarks on Scope of Supply

VFDs are required and are not included in this proposal. Other excluded items include but are not limited to: local control panels, installation labor, assembly lifting device (crane), proper storage and unloading of goods, chemical anchor holes, handrails on walkways, electrical connections, and installation scaffolding.

4 Mixing and Aeration Properties and Layout

4.1 Aeration Basin Technical Design

Aeration system			
Number of mixers per basin	1	-	
Total number of mixers	1	-	
Required SOTR per basin	88.5	lbO ₂ /h	
Air flow per HCMA	463	scfm	
Air flow per basin	463	scfm	
Total air flow (68 °F, 14.7 PSI)	927	scfm	
Aeration depth	14.0	ft	
SOTE (oxygen utilisation)	18.3	%	
Pressure loss @ battery limits	6.4	PSI	
Atmospheric pressure	14.7	PSI	
SOTR design			
Standard temperature	68	°F	
Alpha value	0.85	-	
Beta value	0.98	-	
Altitude a.s.l.	0	ft	
Dissolved oxygen (DO)	2.0	mg/l	
AORh (AOR/tAer)	59.3	lbO ₂ /h	
aSOTR	75.2	lbO ₂ /h	
AORh/SOTR	0.67	-	
Mixer			
	Mixing mode	Aeration mode	
Output speed	20.0	27.9	rpm
Power input	4.5	9.9	hp
Power consumption	5.2	11.4	hp
Power density	0.2	0.44	hp/1000 cuft
Power reserve	65	25	%
Type	HCMA/2500-28-15.0hp		
Selected diameter		98.4	in
Rated power		15.0	hp
Grid frequency		60	Hz
Rated voltage		460	V
Rated current		18.4	A
Start-up current		163.8	A
Static axial force		2,118	lbf
Dynamic axial force		1,488	lbf
Rated torque		33,300	lb.in
Start-up torque		109,890	lb.in
Total mixer weight		2,116	lb

5 Budget Pricing

Product(s) and Service(s)	HYPERCLASSIC® -Mixer/Aerators(s) HCMA 2500 –28 –15 hp	Qty (2)
	Transportation and delivery (DDP), Jamestown, RI	Included
	Spare Parts	Not included
	Maintenance Parts, Shaft Clamp	Included
	Start-up and Training, X Trips, Total X Days	Not Included
	Budget Price	\$ 145,000.-

6 Terms and Conditions

INVENT standard terms and conditions apply.

6.1 Guarantee

The guarantee period is 12 months after start-up of the system, but no later than 18 months after delivery.

6.2 Delivery Time

Submittal drawings will be provided 6-8 weeks after acceptance of purchase order. The equipment will be ready to ship approximately 22 –26 weeks after approval of submittal documents.

6.3 Terms of Payment

30 % upon approval of submittals or release to manufacture
70 % upon delivery or confirmation of readiness for shipping

All prices are payable net 30 days after the receipt of the invoice.
The offer is for budgetary purposes only.

We reserve the right to carry out technical changes, which serve to improve our products.

Thank you for your interest in **INVENT** Environmental Technologies. We look forward to the opportunity to work together.

INVENT Environmental Technologies Inc.

Patrick O'Donnell

Attachment A – Calculation of Oxygen Demands

Calculation of Standard Oxygen Transfer Rate SOTR

SOTR for the aeration system is calculated using the following equation:

$$SOTR_{20} = \frac{1}{\alpha} \cdot \frac{C_{\infty,20}^*}{\beta \cdot C_{\infty}^* - C_L} \cdot \theta^{20-T} \cdot AOR \cdot \frac{1}{24}$$

The values are given in the following table:

Parameter	Definition	Values used
SOTR	Standard Oxygen Transfer Rate in clean water (+20°C, 1013 hPa)	
α	alpha coefficient	0.85
β	beta coefficient	0.98
$C_{\infty, 20}^*$	Steady state dissolved oxygen saturation concentration in clean water under standard conditions (+20°C, 1013 mbar) at aeration depth	
C_{∞}^*	steady state dissolved oxygen saturation concentration in clean water under field conditions (process temp., field atmospheric pressure) at aeration depth	
C_L	actual oxygen concentration in the aeration basin (process conditions)	
θ	temperature correction coefficient	1.024
T	process temperature in aeration basin	20
AOR	Actual Oxygen Requirement	59.3

Note:

Saturation concentrations are calculated for dry air (oxygen content 20.95 %), hydraulic pressure at medial water depth and field atmospheric pressure at ** ft above sea level is considered.

Attachment B – HYPERCLASSIC®-Mixing and Aeration System Description, Design, and Layout

Technical Description

Figure 2 illustrates the **HYPERCLASSIC®**-Mixing and Aeration System with a dry, top-mounted drive in a typical tank. The characteristic features of the system are the hyperboloid form of the mixer body, aeration through an **INVENT** provided sparger ring (from a separate compressed air supply, like **INVENT iTURBO®**-Blower), and the position of the drive. The system is powered a dry mounted drive with a vertical shaft.

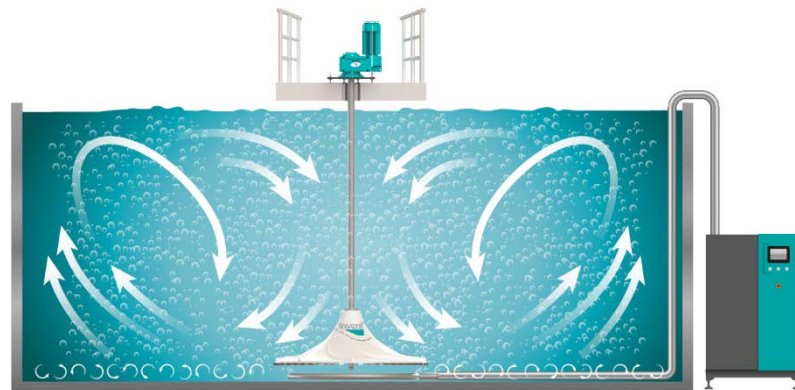


Figure 2: Diagram of the **HYPERCLASSIC®**-Mixing and Aeration System

Mechanical Advantages	Non-clogging, non-ragging Hyperboloid-Body, and non-clogging sparger ring.
	No maintenance relevant parts under process liquid.
Process Advantages	Consistent aeration efficiency for all waste/process waters (no deterioration in performance as typical with fine bubble diffused aeration systems). The system is highly resistant to chemical and biological fouling.
	The Hyperboloid mixer-body shape follows the streamlines of the flow preventing any flow separation and guarantees high efficiency.
	Coarse bubble diffused aeration is introduced at the base of the mixer from a series of engineered orifices in the sparge ring. The energy imparted by the rotating mixer shears the coarse bubbles and forces them outward as small bubbles. Surface active agents have minimal effect on oxygen transfer (alpha-values have been observed at 0.85) resulting in reduced air requirements, smaller diameter piping and accessories, as well as smaller blowers and motors.
	The large diameter mixer body and low operating speed ensures high energy efficiency and low shear. The sludge floc is not damaged or sheared.
	Complete and uniform mixing of the entire tank contents results in increased retention times and excellent sludge characteristics.
	The air supply system can be controlled to optimize treatment. The System can also be operated without air as a mixer only which can be necessary in some applications.
	Winter heat loss is reduced due to the compressed air supply and low surface turbulence.

Product Design

The **HYPERCLASSIC**®-Mixing and Aeration System consists of non-clogging Hyperboloid mixer body including integrated transport ribs and stainless steel shear fins. The system also includes a vertical shaft with a motor and mounting base, air sparge ring with connection to air supply (by contractor), and bottom guide. The system is supplied complete including all necessary parts for assembly on either a steel or a concrete bridge (bridge not included). Figure 3 shows the design breakdown in detail.



Drive with a parallel shaft and helical gears for reliable operation under heavy duty conditions

Mounting Base with isolation buffers

Bridge (alternative variations available not included in this proposal)

Shaft made from high quality stainless steel.

Hyperboloid-Body with integrated transport ribs for energy efficient and smooth fluid acceleration

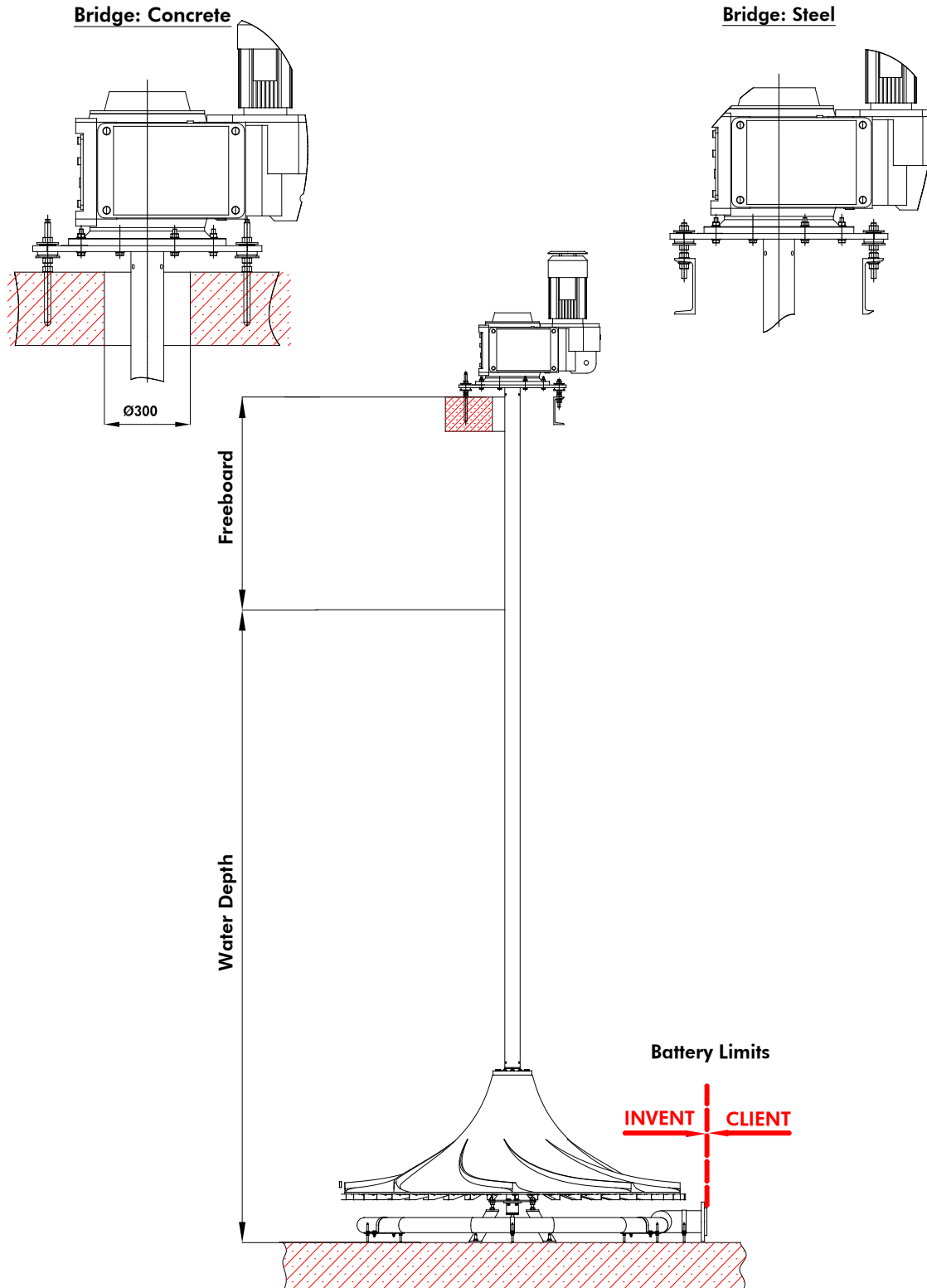
Shear Fins made from high quality stainless steel which ensure the dispersing of the air into fine bubbles

Sparger Ring delivers air to the system which is non-clogging with no pressure loss

Bottom Guide includes self-lubricating bearing

Figure 3: Overview on a **HYPERCLASSIC**®-Mixing and Aeration System

Layout Drawing



AERZEN USA CORPORATION

108 Independence Way

Coatesville, PA 19320

Tel. (610) 380-0244 ♦ Fax. (610) 380-0278

**OPTION 1 - BLOWER
PACKAGE****AERZEN****AERZEN** Reference Number: ENV-495307.0

2-Apr-24

Re: Jamestown, RI

To: Jarod Stuyvesant, P.E.

Firm - Weston & Sampson

email - stuyvesant.jarod@wseinc.com

phone - (616) 318-5453

AERZEN Representative Info:

Name - Jim DeLuca of Aqua Solutions

e-mail - jdeluca@aquasolutionsinc.net

phone - (508) 947-5777

AERZEN Proposal Prepared By:

Name - Dan Coleman

email - dan.coleman@aerzen.com

phone - (484) 718-3607

AERZEN Regional Manager:

Name - Scott Trail

e-mail - scott.trail@aerzen.com

phone - (484) 678-6578

Blower**Model: GM 35 S DN 150****Performance Data:**

		Design	Min
Intake volume, handled at intake condition	cfm	1,113	179
Volume handled at normal condition (dry) per ASME	scfm	1,000	161
Mass flow	lb/h	4,630	747
Density at inlet conditions	lb/cf	0.069	0.069
Relative humidity	Φ	80%	80%
Inlet pressure (abs.)	psia	14.65	14.65
Discharge pressure (abs.)	psia	21.6	21.6
Pressure difference	psig	7.0	7.0
Intake temperature	°F	100	100
Discharge temperature	°F	187	234
Main rotor speed	rpm	3124	781
Power consumption at coupling	bHP	45	10
Motor Rating	HP	60	
Motor Speed	rpm	3560	444
Motor frame		364TS	
Tolerance on flow & power	± 5 %		
Sound pressure level w/o enclosure	dB(A)	96	*Measured in free field at 3ft. distance from the outline of the unit
Sound pressure level w/ enclosure	dB(A)	70	*does not include system piping noise (tol. ± 2 dB(A)).

Weights & Dimensions:

Discharge connection	ANSI Flange	6"
Blower torso weight	lbs.	2,355
Blower motor weight	lbs.	825
Blower pkg weight	lbs.	3,180
Envelope dim.*	L x W x H in.	71 x 59 x 78
Cooling Fan	shaft driven	

* non binding dimensions includes, inlet filter silencer, relief valve, check valve, and flex connector

AERZEN USA CORPORATION

108 Independence Way

Coatesville, PA 19320

Tel. (610) 380-0244 ♦ Fax. (610) 380-0278

**AERZEN****GM 35 S DN 150**

Aerzen Generation 5 Delta Blower Package consists of the following components, assembled in our factory.

Aerzen Rotary Lobe Blower GM Series

- Narrow V-belt drive
- V-belt drive guard
- First fill of Delta Lube 06 oil
- Service Accessories
- Inlet filter-silencer, G4 per EN 779 (equivalent to MERV 7)
- Discharge Silencer, Reactive type, integrated with base frame
- Spring loaded pressure relief valve(s), sized for full flow
- Set of vibration isolating mounts
- Discharge manifold with externally accessible integrated check valve
- Hinged motor support as automatic belt tensioning device
- Sound enclosure, powder-coated galvanized steel, fire retardant HDP foam construction
- 6" ANSI Flanged discharge connection
- VFD, NEMA 12/IP55 enclosure, 60 HP, w/ DC choke, (150 A) fused disconnect
- Expanded General Purpose I/O
- VFD comes installed mounted on blower
- Simplified ISO-1217, Annex B test report(s)
- Factory set PRV to 10.9 psig
- Wire Blower Switches to VFD
- Program VFD with local switch indication
- Danfoss Warranty 3-Yr DrivePro.
- Blower Warranty 24/30
- Domestic packaging

Drive motor

- Motor 60 HP, 2-pole, NEMA, TEFC, 208-230/460 V / 60 Hz, NEMA Premium Efficiency, 364TS
- Motor thermostats, one per phase @ 155 deg C
- Motor shaft grounding ring
- Motor Warranty 3-Yr Motor

Instrumentation and Controls

- Set of instrumentation (4" gauges, P1 gauge, P2 gauge & switch, T2 gauge & switch)
- Discharge pressure switch
- Junction box

Spare Parts

- 2 spare air filter(s)
- 2 spare belt set(s)
- Set of 2 Delta Lube 06 - 1 gallon(s)

Start Up & Services

- 1 trip(s), 2 day(s) total installation, startup, & training

Freight

- Estimated Freight to jobsite

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108 Independence Way

Coatesville, PA 19320

Tel. (610) 380-0244 ♦ Fax. (610) 380-0278

**AERZEN****Pricing****Quantity: 2**

Description		Price Total
1	Quantity (2) Aerzen Blower package as described above	c/o: Jim DeLuca of Aqua Solutions

Price does not include any tax or VAT.

Delivery Terms: CIP Aerzen USA Coatesville, PA**General Terms: This offer is subject to Aerzen Standard Terms and Conditions (AMUSA.08.22.001)****Payment Terms: Net 30 days, 20% of order value with approved submittals. 75% of order value at shipment. 5% of order value upon startup.****Submittals: 4-6 weeks after receipt of purchase order****Delivery Time: presently approximately 14 weeks after technical release by customer.****Warranty: 24 months after start up, 30 months after delivery, whichever comes first.**

*Maintenance must be performed per the Instruction Manual using Aerzen spare parts.

*Equipment not manufactured by Aerzen will carry the manufacturer's standard warranty.

Quote Validity: All prices and lead times quoted are valid for 30 days from the date stated on the quotation.

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Coatesville, PA 19320

Tel. (610) 380-0244 ♦ Fax. (610) 380-0278



AERZEN

Aerzen USA Corp Terms and Conditions of Sale New Equipment Packages

AERZEN USA CORP (hereinafter called "Seller") agrees to sell equipment (hereinafter called the "Goods") to the Purchaser (hereinafter called the "Buyer") on the following terms and conditions of sale. Any alteration of these terms and conditions shall have no force or effect unless agreed to in writing by an officer of Seller or such other authorized signatory of Seller as designated in writing by Seller.

The terms and conditions as set forth herein and our quotation or as modified by written agreement shall constitute the entire agreement (hereinafter called the "Agreement") between Seller and Buyer. A failure by either party to enforce any rights under this Agreement shall not be deemed to constitute a waiver of those or any other rights under this Agreement. These Terms and Conditions of Sale shall be deemed accepted by Buyer upon Seller's receipt of Purchase Order from Buyer. No condition stated by Buyer shall be binding upon Seller if in conflict with, inconsistent with, or in addition to the Terms and Conditions of Sale, unless expressly accepted in a writing signed by Seller. In the event of conflict or differences in the terms or conditions of Buyer's Purchase Order and the Terms and Conditions of Sale herein, the Terms and Conditions of Sale shall govern.

1. **ORDERS:** All orders are subject to acceptance and approval by Seller's credit department and are not binding until and unless so approved and accepted. Written acknowledgement of an order shall constitute acceptance and will thereby be a binding contract which cannot be modified or cancelled by Buyer without written consent of Seller.

2. **PRICES AND PAYMENTS:** All prices are quoted and payable in U.S. dollars, unless otherwise noted. Quoted prices shall remain valid for thirty days unless written communication is received by Seller prior to such time. Seller reserves the right to restrict or modify the terms of payment or to require payment prior to shipment if, in Seller's opinion, the Buyer's financial condition or other circumstances do not warrant shipment on the terms originally specified in the Agreement. Unless expressly agreed to in writing on a specific contract or order, pending satisfactory credit review, Seller standard payment terms are: (a) For orders under \$100,000 the payment terms shall be Net 30 days from date of shipment, with no retainage held. (b) For orders over \$100,000 the following terms shall apply, assuming satisfactory credit review: 20% of order value from date of accepted purchase order. 30% of order value upon release for production for material procurement. 50% of order value at readiness to ship. (c) All invoices are to be paid Net 30 days. (d) In those cases where progress payments are required, all work on the order will cease if payment is not received in accordance with the payment schedule. (e) Payment retention will not be allowed. In the instance where an invoice is disputed, all undisputed portions remain payable within Net 30 days terms. (f) Interest at the rate of one and one-half percent (1 ½%) per month or at the highest rate allowed by law, whichever is less, shall be charged to all overdue accounts. Buyer will reimburse Seller for all costs and expenses (including attorney's fees and the costs of bringing any action) incurred in collecting any amounts past due.

3. **TAXES:** The prices quoted do not include any taxes. Any sales tax, use tax, excise tax, goods, and service tax (GST), value added tax (VAT), customs tax, or other tax of any nature whatsoever imposed by any government authority on the transaction between Seller and Buyer (plus interest and penalties thereon, if any) shall be paid by the Buyer in addition to the prices quoted and invoiced. In the event that Seller is required to pay any such taxes, Buyer shall reimburse Seller on demand. At the time of an order, Buyer shall provide Seller with any tax exemption certificates or other documents acceptable to the taxing or customs authorities.

4. **LIABILITY:** Seller's liability with respect to the Goods sold hereunder shall be limited to the warranty provided in Section 10 of these Terms and Conditions and shall be limited to the contract price. In no event shall Seller be liable for special, indirect, incidental, consequential or punitive damages, or expenses incurred by Buyer, Buyer's customers or any third party, whether arising from breach of contract, warranty, negligence, strict liability in tort or other theories of law or equity, including, but not limited to, liquidated damages, loss of profits or revenue, loss of use, cost of capital, cost of substitutes, downtime, service interruption, or any other type of economic loss.

5. **SHIPPING OR SERVICE DATE:** Shipping or service dates are estimates and not a guarantee of a particular day of shipment or service. Seller shall not be liable in any way for any default or delay in shipping or service due to contingencies beyond its control which prevent or interfere with Seller making delivery or providing service on the date specified, including, but not limited to, war, restraints affecting shipping, delivery of materials or credit as a result of war or war restrictions, non-arrival, delay or failure to procure materials as a result of war or war restrictions, rationing of fuel, strikes, lockouts, fires, bombings, terrorism, accidents, floods, droughts, cyber-attacks, and any other contingency affecting Seller, its suppliers, or subcontractors; and Seller shall have the right to cancel a contract of sale or to extend the shipping or service date in the event that one or more of such contingencies prevents or delays shipment or service.

6. **DELIVERY:**

a. **Title and Risk of Loss:** All products will be delivered EXW Aerzen, Coatesville, PA unless otherwise agreed by both parties in writing. In no event shall Seller be liable for any delay in delivery or assume any liability in connection with shipment, nor shall the carrier be deemed an agent of Seller.

b. **Acceptance of Products:** Buyer shall inspect all products promptly upon receipt. All claims by Buyer, except only those provided for under Warranty clauses, which are not asserted in writing by Buyer within five (5) days of receipt are waived.

c. **Delays by Buyer:** In the event that Goods cannot be shipped to Buyer when ready due to any cause not attributable to Seller, upon notice to Buyer, Seller may ship such Goods to storage. If such Goods are placed in storage, including storage at the facility where manufactured, the following conditions shall apply: (i) all risk of loss or damage shall thereupon pass to Buyer; (ii) title shall transfer to Buyer; (iii) any amounts otherwise payable to Seller upon delivery shall be payable upon presentation of Seller's invoice; (iv) the Goods shall be deemed as shipped and the warranty time period shall commence; (v) all expenses incurred by Seller, such as preparation for and placement into storage, handling, inspection, preservation, insurance, storage and removal charges, and any taxes shall be payable by Buyer; and (vi) when conditions permit and upon payment of all amounts due hereunder, Seller shall resume delivery of Goods to the originally agreed point of delivery.

d. **Delays in Inspection:** In the event that Goods cannot be shipped to Buyer when ready due to delay of Buyer's in-person inspection, upon notice to Buyer, such delay shall constitute a waiver of Buyer's rights of in-person inspection and rejection and an acceptance by Buyer of an inspection report, as determined and compiled at Seller's sole discretion. Such acceptance shall be in addition to the remedies for Delays by Buyer outlined herein.

e. **Partial Shipment:** Partial shipment of an order will not be made without Buyer's knowledge or consent. In the event a complete shipment cannot be made by the required date, Buyer will be promptly notified. If partial shipment with Buyer's approval is made, excess freight charges, if any, will be billed to the Buyer.

7. **CANCELLATION, POSTPONEMENT OR CHANGE ORDERS:** Orders are not subject to Buyer's cancellation, postponement, or change in specifications, shipping schedules, or other conditions originally agreed upon without Seller's written consent and then only upon agreement to compensate Seller for any or all losses caused by such cancellation, postponement, or changes. Cancellation charges of between twenty percent (20%) and one hundred percent (100%) of the total price of the contract will be invoiced, as determined at Seller's sole discretion, depending on the status of completion plus Seller's non-recoverable costs attributed to the Buyer's order.

If Seller's manufacturing is delayed or postponed by Buyer, Seller shall be entitled to an equitable price adjustment. If Buyer delay extends for more than ninety (90) days and the parties have not agreed upon a revised basis for continuing the work at the end of the delay, including adjustment of the price, then upon written notice, Seller may terminate the order whereupon Buyer shall promptly pay Seller its cancellation charges as described herein.

Seller may terminate the Agreement without liability to Buyer if (i) Buyer shall materially breach any of the terms and conditions of this Agreement and shall fail to cure such material breach within five (5) days after written notice from Seller; or (ii) Buyer shall become insolvent; or (iii) a petition under the Bankruptcy Act or any other insolvency law shall be filed by or against Buyer; or (iv) Buyer shall make assignment for the benefit of creditors; or (v) Buyer shall fail to make timely payment of any obligation owed by it to Seller; or (vi) in the event Seller reasonably believes that Buyer is unable to make full and prompt payment as required hereunder.

Buyer agrees that it shall, no later than thirty (30) days following the effective date of termination of this Agreement, pay all monies owed to Seller at the time of any such termination regardless of any terms of payment that may have otherwise been granted to Buyer by Seller. Seller shall not by reason of its termination of this Agreement in accordance with the terms hereof, be liable to Buyer for compensation or reimbursement of any damages on account of loss of profits or prospective profits on anticipated sales, or on commitments in connection with the business or goodwill of Buyer or otherwise or for direct, indirect, punitive, special, consequential, or liquidated damages.

8. **LIMITED WARRANTY:** Unless otherwise stated in Seller's quotation, Seller warrants the products and parts that it manufactures will be free from defect in materials and workmanship for twenty-four (24) months from the date of start-up, but not to exceed thirty (30) months from the date of readiness to ship. Performance warranties (if any) are limited to those specifically included in Seller's proposal and identified as such. Goods (including accessories, components, and parts thereof) furnished by Seller but manufactured by others is not warranted by Seller and such Goods shall carry the warranty (if any) which the manufacturer has conveyed to Seller to the extent it can be passed on to the Buyer. Seller shall, upon prompt written notice by the Buyer, correct such non-conformities, at Seller's option, by either repair or replacement. All such defective Goods shall follow the RMA policy set forth in clause 10. and be sent at Buyer's expense directly to Seller's headquarters located at 108 Independence Way, Coatesville, PA, USA, 19320 or an Authorized Service Center. Shipment of repaired or replacement Goods will be at Seller's expense. Seller warrants any Goods repaired or replaced pursuant to the above warranty to be free from defects in materials and workmanship for the longer of: (a) a period of ninety (90) days after the start-up of such repaired or replaced Goods or (b) the period remaining on the warranty.

Goods must be maintained per Seller's Operations and Maintenance manual, including proper maintenance documentation, for the warranty to remain valid.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, OR IMPLIED, INCLUDING ANY WARRANTY OF PERFORMANCE, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. NO REPRESENTATION, CONDITION OR WARRANTY, INCLUDING, BUT NOT LIMITED TO,

AERZEN USA CORPORATION

108 Independence Way

Coatesville, PA 19320

Tel. (610) 380-0244 ♦ Fax. (610) 380-0278

**AERZEN**

STATEMENTS OF CAPACITY, SUITABILITY FOR USE, OR PERFORMANCE, WHETHER MADE BY SELLER, EMPLOYEES OR REPRESENTATIVE PERSONNEL, SHALL BE CONSIDERED TO BE A WARRANTY BY SELLER FOR ANY PURPOSE OR GIVE RISE TO ANY LIABILITY OF SELLER WHATSOEVER AND ALL SUCH IMPLIED WARRANTIES ARE HEREBY DISCLAIMED BY SELLER AND EXCLUDED FROM ANY CONTRACT RESULTING OR ARISING FROM OR OTHERWISE EVIDENCED BY THIS AGREEMENT.

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9. NONCONFORMING GOODS: Any rejection of nonconforming Goods must be made by the Buyer within five (5) days of delivery and Buyer must give written notice to Seller within that period. Such notice shall contain a description of the alleged non-conformity. Upon receipt of such notification, Seller will arrange for the return of the Goods, at Seller's expense, and upon confirmation of the nonconformity, Seller, at Seller's expense, will ship conforming Goods to Buyer.

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11. RETURNS FOR CREDIT: No returns for credit will be accepted unless Seller's written permission has been obtained in each case in advance, pursuant to clause 10.

12. APPLICABLE LAWS: This Agreement and the respective rights and obligations of the Buyer and Seller with regard hereto shall be governed by and construed according to the laws of the Commonwealth of Pennsylvania, without regard to the principles of conflicts of law thereof.

13. NOTICE: Any and all notices or other communications or deliveries required or permitted to be provided hereunder shall be in writing and shall be sent to Aerzen USA, 108 Independence Way, Coatesville, PA, 19320

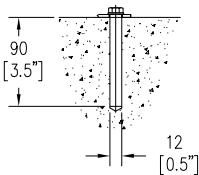
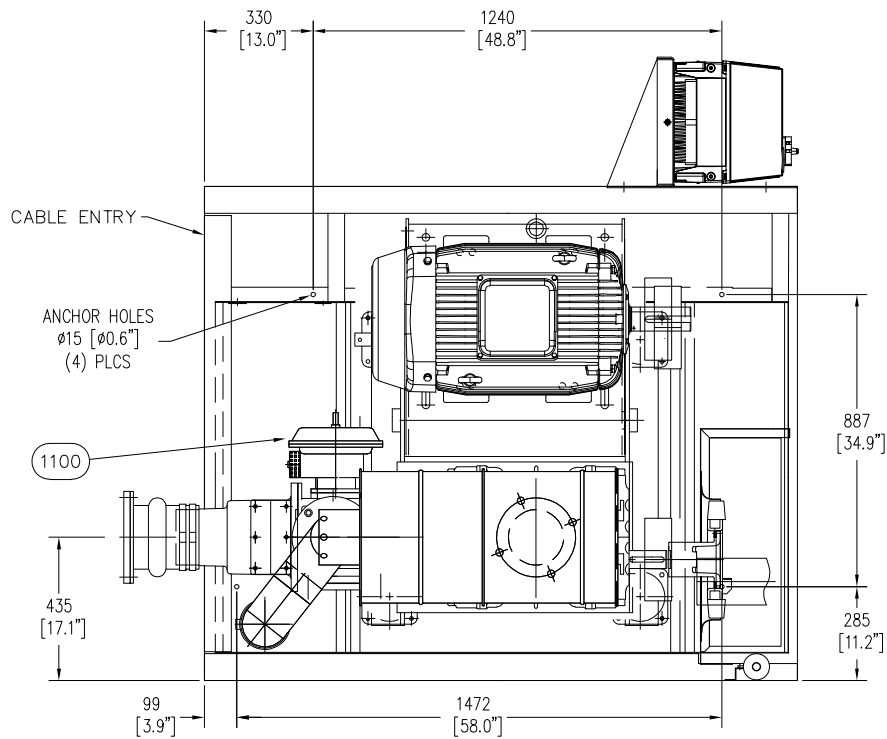
14. ASSIGNMENT: Neither party may assign or transfer this Agreement without the prior written consent of the other party.

15. CONFIDENTIAL INFORMATION: Any design specifications, manufacturing drawings, technical data or other information or materials submitted to Buyer and identified by Seller as confidential are and shall remain the exclusive property of Seller. Buyer agrees to treat such information as confidential and shall not reproduce or disclose such information without the express prior written consent of Seller.

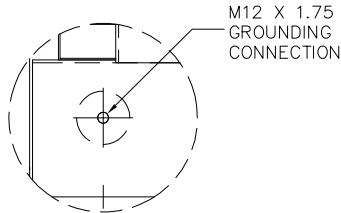
16. WAIVER OF SUBROGATION: Buyer agrees to waive any and all subrogation rights towards Seller.

17. DATA USE: The Goods may include data monitoring services. The data received by Seller may be used by Seller and certain third-party distributors and contractors for the sole purposes of increasing overall customer service and determining claims of warrantability. Seller will use commercially reasonable efforts to ensure that Buyer's data is kept confidential. Buyer may request discontinuance of data monitoring service at any time, subject to waiver of all and any remaining warranties.

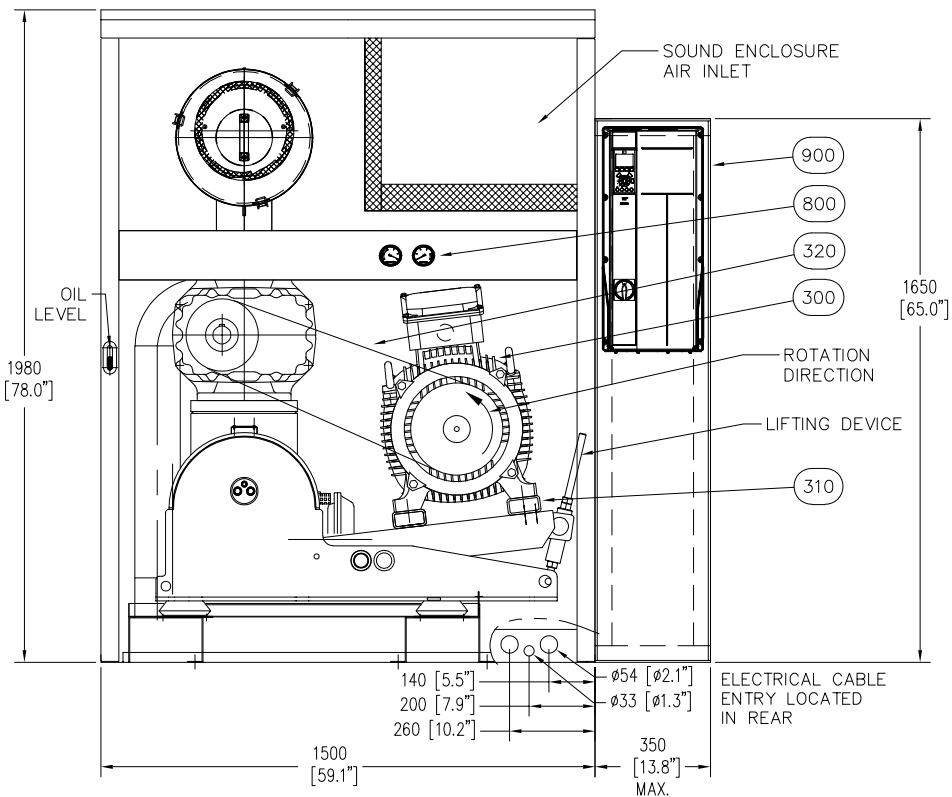
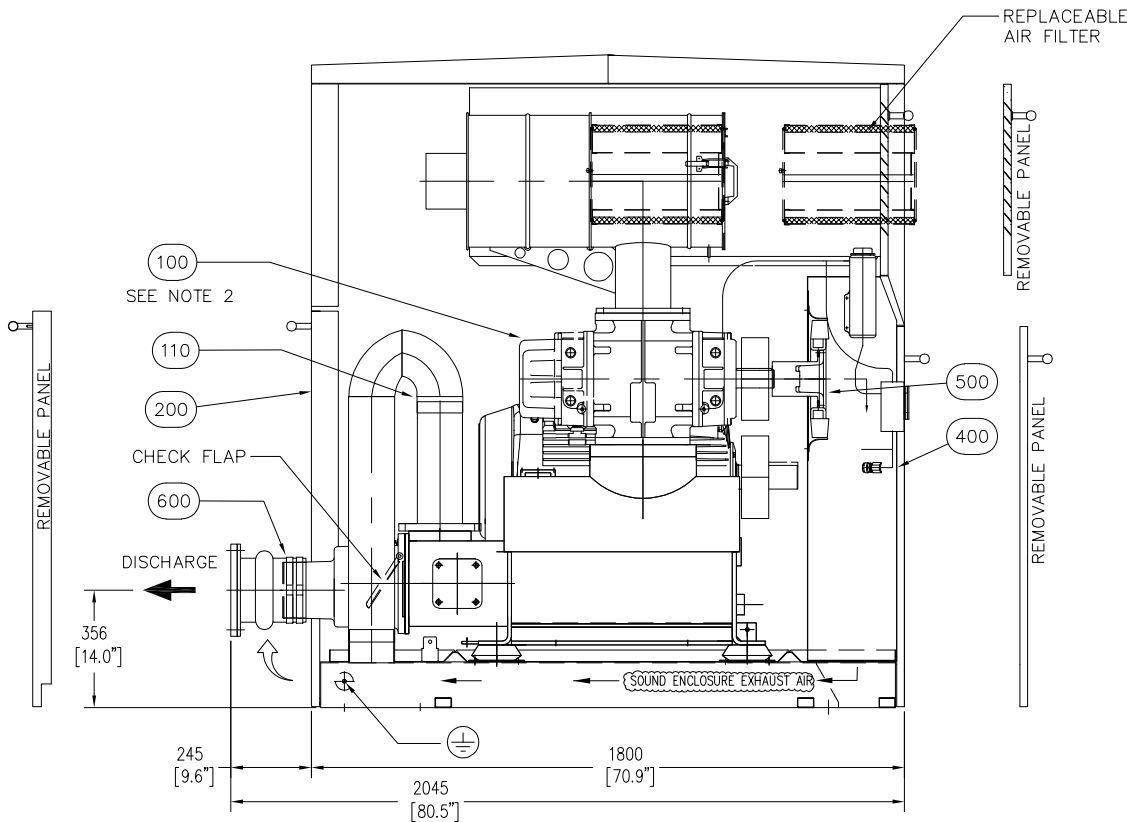
PLAN VIEW



SOUND ENCLOSURE ANCHOR
RECOMMENDATION
SHOW WITH OPTIONAL ANCHOR
AERZEN PART NO. 2000053552
3X SCALE



EARTH GROUND
MAT'L: 304 SS
3X SCALE





**ENERGY
EFFICIENCY**



**STRAIGHTFORWARD
OPERATION**



**PROCESS
OPTIMIZATION**



**UNPARALLELED
FLEXIBILITY**



BioMix™

Compressed Gas Mixing System

RI Jamestown WWTF

Preliminary Proposal

EnviroMix Proposal Number:

OM-24-125775

Engineering Firm:

Weston & Sampson

EnviroMix Representative:

Tech Sales NE

Date:

4/29/2024

701 East Bay St. Suite 502 • Charleston, SC 29403

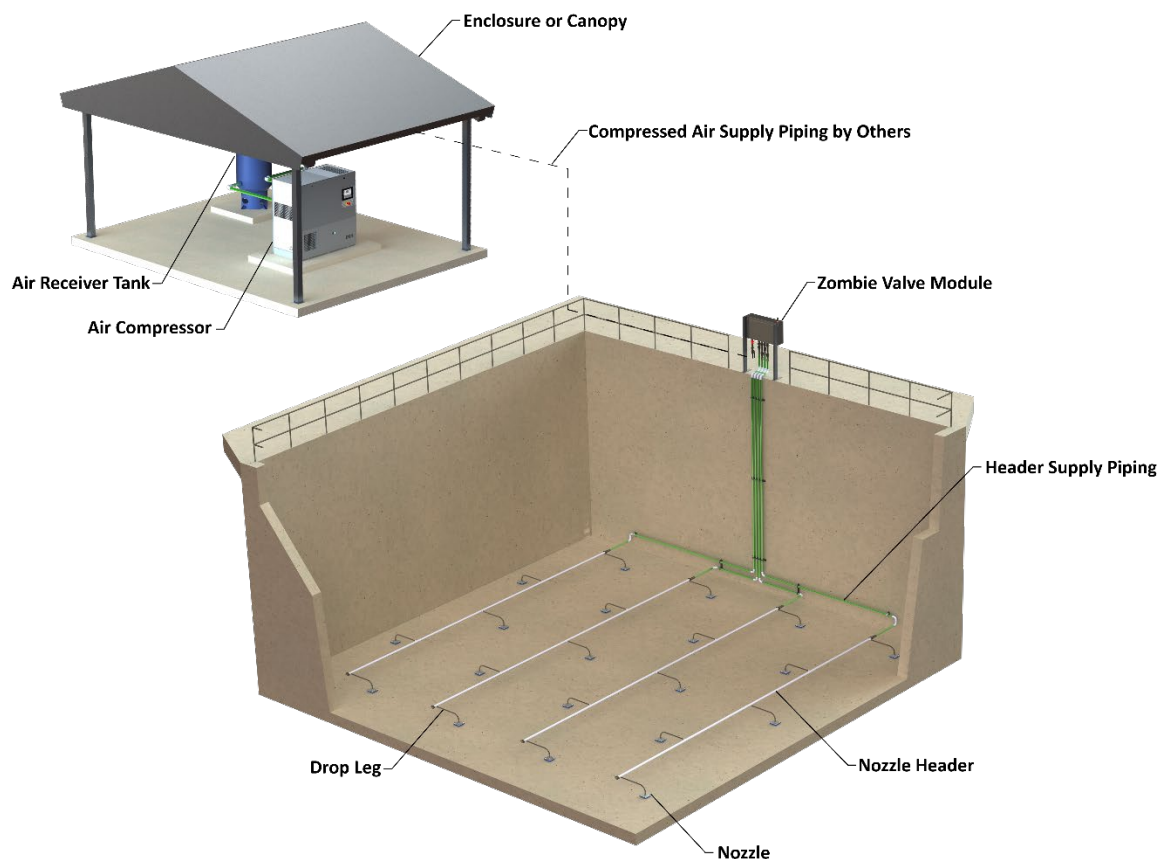
T: 843-573-7510 • enviro-mix.com



Product Description

BioMix™ Compressed Gas Mixing System provides uniform mixing of tank contents by firing programmed, short-duration bursts of compressed air through patented, engineered nozzles located near the tank floor. The mixing parameters may be adjusted to optimize mixing and power utilization, either through operator input or automated process feedback. The small surface area of the large gas volumes and their rapid upward velocity enable BioMix to provide efficient mixing without transferring oxygen.

Zombie™ Valve Modules (ZVM) mounted near the basin, will control the firing of compressed air through the BioMix nozzles. Potentiometers for firing Frequency and Duration allow user input to optimally control the mixing intensity in the tank.



System Benefits

ROBUST EQUIPMENT DESIGN WITHOUT SACRIFICING ENERGY EFFICIENCY OR FLEXIBILITY



ENERGY EFFICIENCY

- Energy savings up to 50% over mechanical mixing or diffused aeration
- Unequaled mixing efficiency of less than 0.17 hp / 1000 ft³
- Unlimited turn-down capability



STRAIGHTFORWARD OPERATION

- Zero in-tank maintenance
- No mechanical or electrical components in the wastewater
- Minimal maintenance items located in accessible locations



PROCESS OPTIMIZATION

- Guaranteed uniform mixing with onsite performance testing
- Operator-adjustable firing parameters that enable ideal mixed conditions without deposition and minimum energy input
- Bottom-up mixing to develop a homogeneous mixture as opposed to simply stirring



UNPARALLELED FLEXIBILITY

- Variable mixing intensity based on process parameters
- Compatible with any tank geometry, configuration, or depth
- Eliminates the need for multi-technology redundancy

APPLICATION HIGHLIGHTS:

The following pages highlight application-specific benefits related to the proposed BioMix system.



BioMix™ Compressed Gas Mixing System

MIXING LIMITED AERATION

BioMix provides mixing of tank contents by firing **programmed, short bursts of compressed air through patented, engineered nozzles** located at the floor of the tank. The mixing parameters may be adjusted to optimize mixing and power utilization, either manually or through automated process feedback.

▶ WHAT DOES "MIXING LIMITED" MEAN?

In aerobic tanks, the aeration equipment is designed to both deliver oxygen and mix the contents of the basin. Under mixing limited conditions, more air is required to mix the basin contents than is needed to satisfy the oxygen demand.

▶ WHAT CAUSES MIXING LIMITED CONDITIONS?

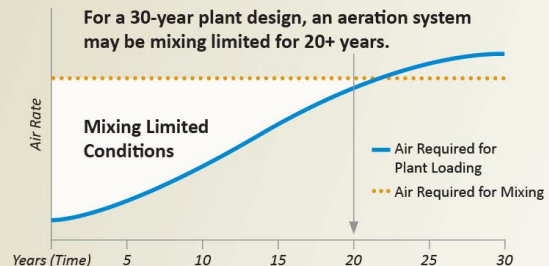
- Underloading compared to design conditions
- Daily or seasonal load fluctuations
- Hydraulic limitations that prevent taking trains out of service
- Oxygen demand that is diminished by upstream aerobic zones

▶ HOW DOES EXCESSIVE AERATION IMPACT A TREATMENT PLANT?

- Residual dissolved oxygen in RAS and mixed liquor return that inhibit biological nutrient removal (BNR)
- Poor settling
- Excess treatment chemicals in post-anoxic zones
- Wasted energy

www.enviro-mix.com

701 East Bay Street, Suite 502, Charleston, SC 29403
P: 843.573.7510 · F: 843.573.7531 · E: sales@enviro-mix.com



▶ WHY IS BIOMIX THE RIGHT SOLUTION?

Decoupling oxygen demand from mixing requirements provides the operational flexibility to reduce the airflow rate to meet the air required for plant loading. BioMix compressed gas mixing system can be interlaced with diffused aeration grids, allowing simultaneous operation at a wide range of airflow rates. This results in:

- Promotion of anoxic and anaerobic conditions to enable BNR
- Conditions that promote good settling
- Stable dissolved oxygen profile throughout the aeration tank
- Significant energy savings

Contact sales@enviro-mix.com

TO DISCUSS HOW BIOMIX CAN OPTIMIZE
YOUR MIXING LIMITED SOLUTIONS.



Design Summary

Site Conditions	Elevation	Max Ambient Temp
RI Jamestown WWTF	55 FASL	95 °F

Designation		Aeration Tank
Quantity of Tanks		2
Length	ft	40.0
Width	ft	40.0
Side Water Depth	ft	14.0
Design Solids Conc.	%	0.3
BioMix Configuration		
Header Layout		Straight
Headers per Tank		4
Nozzles per Header		6
Nozzles per Tank		24
Nozzle Count		48
Header Pipe Diameter	in	1.5

ZOMBIE VALVE MODULE CONFIGURATION

Tank	No. Valves/ Valve Module	Module Qty	Valve Total
Aeration Tank	4	1	4

POWER REQUIREMENTS

	No Operating	Hours of Operation	BHP	Total kWh/d
BioMix Compressor	1	24	7.6	136



Scope of Supply

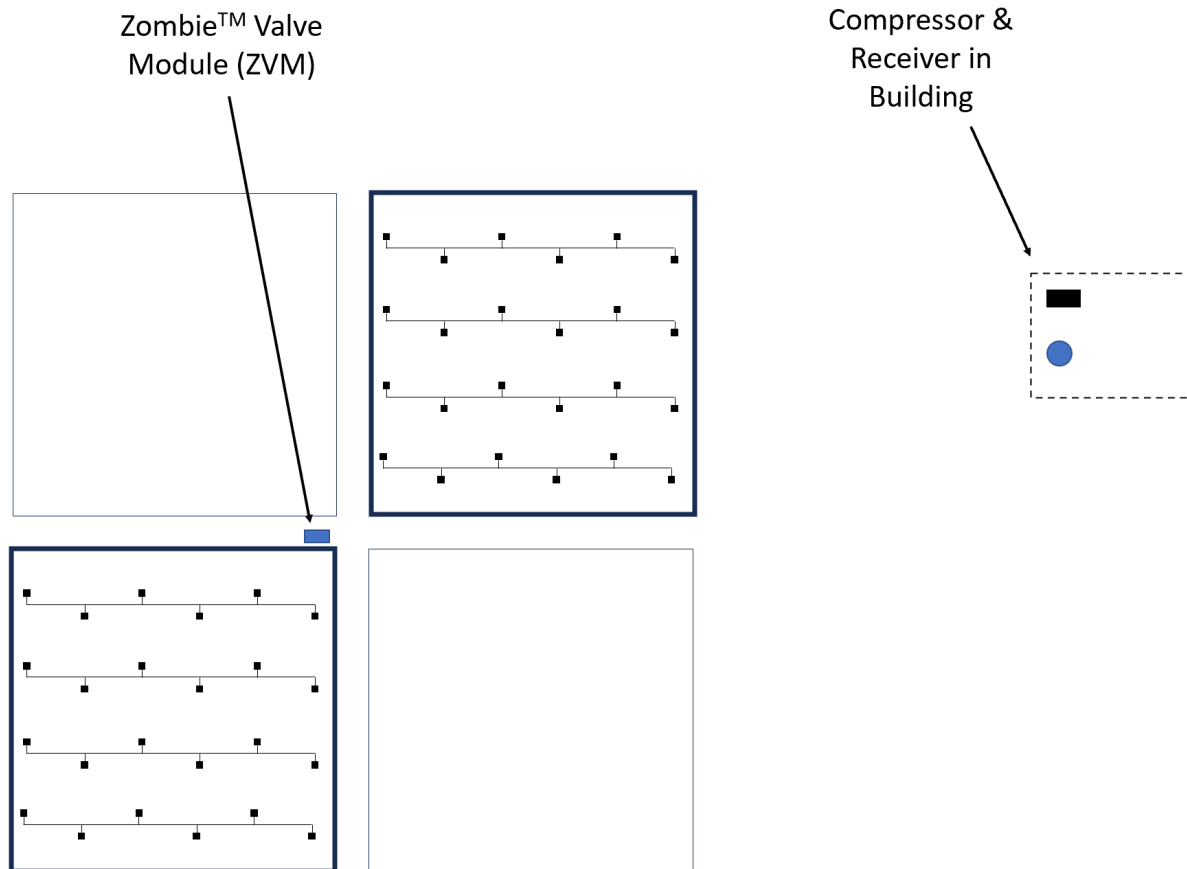
EQUIPMENT SUMMARY

Item	Quantity	Description
Zombie Valve Modules (ZVM)	1	Type 304SS NEMA 4X enclosure - Electrically actuated valves - Local control through potentiometers - Zombie Controller
BioMix Nozzles	48	Type 304 SS engineered nozzles to be threaded onto header piping
Headers	8	Type 304 SS prefabricated headers with linear or offset drop legs
Header Supply Piping	1 lot	Type 304 SS Sch 5 press-technology from VMs to BioMix Headers includes fittings, 304 SS wall/pipe supports and anchors
Compressor	1 Duty	10 HP Rotary Screw Compressor Capacity 46 scfm at 100 PSIG Compressor package includes: - Inlet filter - Refrigerated dryer - Particulate and oil coalescing filter
Receiver Tank	1	Vertical Receiver(s) with auto drain valve: One (1) @ 200-gallons

CLARIFICATIONS

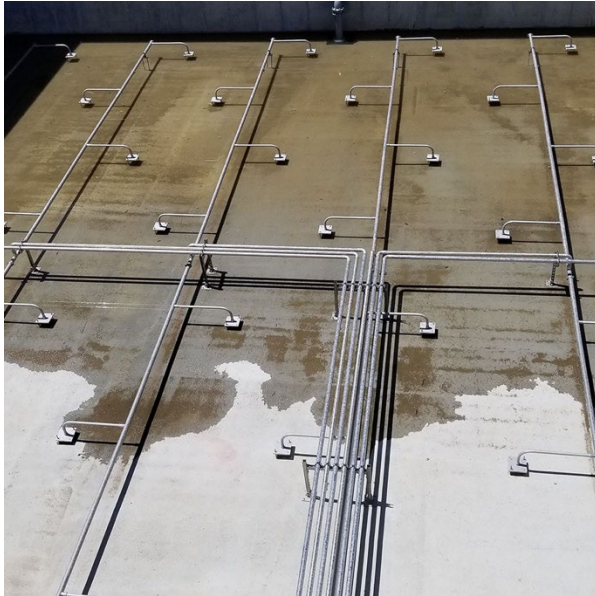
- Electrical connection to each compressor (460/3/60) and VM/receiver auto-drain valve (120/1/60) by others
- Interconnecting piping between each compressor, receiver and VM by others
- Control wiring (if required) between VM and compressor by others
- Compressor and Receiver to be installed in a building

Preliminary BioMix Configuration



Pictures from Similar Installations

STRAIGHT HEADERS



Straight headers with offset nozzles

COMPRESSORS



Compressors to be located indoors for weather protection and ease of maintenance

INDOOR RECEIVER TANK



Indoor receiver tank

ZOMBIE™ VALVE MODULE



Zombie valve module (ZVM), with throttling valve and individual air control valve (ACV) isolation valves

ZOMBIE™ VALVE MODULE



The Zombie™ Valve Module facilitates local adjustment of mixing parameters for fine tuning



Service

The services of a qualified representative are included for two (2) trips with two (2) days per trip onsite to inspect installation, oversee testing and start-up and provide operations and maintenance training. Additional EnviroMix field service is available at a cost of \$1,500 per day plus travel and living expenses.

Pricing

This estimate does not include equipment installation, electrical wiring, conduit, or taxes, if applicable. The preliminary price for the EnviroMix equipment and service outlined in this proposal, FOB jobsite is \$164,900.

Patents

The proposed Compressed Gas Mixing System for this project, including the specific layout of header piping, nozzles, air distribution and its operation is covered by US Patents 8,323,498 / 8,505,881 / 8,702,070 / 9,416,037 / 9,567,245 and any pending patent applications. EnviroMix reserves all rights and remedies for any unauthorized and infringing activity covered by any of its patents and those subsequently issued that are currently pending with the USPTO.

Contact

Upon acceptance of this Preliminary Proposal, the EnviroMix Team would be pleased to assist in the development of a more detailed design package including drawings and specifications. We appreciate your consideration of BioMix Compressed Gas Mixing System for this application and look forward to the opportunity of working further with you.

EnviroMix Contact:

Mark Gehring
Director of Regional Sales
mgehring@enviro-mix.com
(262) 389-9017

EnviroMix Representative Contact:

Mike Caso
Tech Sales NE
mcaseo@techsalesne.com
(508) 878-7641

APPENDIX E

Collection System Evaluation Report



westonandsampson.com

WESTON & SAMPSON ENGINEERS, INC.
100 Foxborough Boulevard, Suite 250
Foxborough, MA 02035
tel: 508.698.3034

REPORT

August 2024

TOWN OF

Jamestown

Rhode Island

Annual Sewer Investigation and
Rehabilitation Program

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TABLE 1 EXISTING SEWER SUMMARY

TABLE 2 ANNUAL PROGRAM PRIORITIZATION

1 OVERVIEW

August 16, 2024

Michael Gray, PE
Public Works Director
93 Narragansett Avenue
Jamestown, RI 02835

Dear Michael Gray:

Weston & Sampson is pleased to provide you with the following Annual Sewer Investigation and Rehabilitation Program (Annual Program) in relation to the wastewater facilities improvements agreement dated December 20, 2023. The goal of this program is to reduce inflow and infiltration (I/I) which contributes to elevated wet weather flow to the Wastewater Treatment Facility (WWTF).

An Annual Program is typically established to investigate and repair the collection system on a regular basis, thereby identifying and repairing I/I sources to reduce flow. A specific annual plan of capital improvements and maintenance is also a beneficial way to operate, manage, and maintain the collection system and minimize problems, including backups and sewer system overflows (SSOs). In addition, the activities incorporated in the program will allow the town to comply with potential regulations related to the management of wastewater collection systems.

A comprehensive Annual Program ensures that the collection system properly serves this intended purpose on a perpetual basis. By following a regular program to investigate and repair the sewer system, the town will be in a better position for regulatory compliance, maintenance and management, and addressing capital improvements.

Proper attention to each of these components, with financial controls and capital planning, will promote proper operation and maintenance of the collection system and pump stations, and can provide many benefits to the town.

A regular investigation and improvement program can achieve the following:

- Reduce I/I and increase available capacity of the system.
- Provide clear goals and budgets for decision-makers.
- Protect the capital investment in the collection system components and equipment.
- Prevent public health hazards and minimize damage to public and private property.
- Provide efficient use of funding through reduced operating and capital costs.
- Promote a safer work environment with fewer accidents and reduce worker's compensation claims.
- Gain public approval and support for repairs and capital improvement projects.
- Benefit the environment.
- Create prompt and efficient service to customers.
- Correct historic maintenance problems such as backups to private property and surcharging.
- Reduce pump station wear and tear.

- Establish a proactive and preventative maintenance operating mode for efficient collection system management.
- Provide valuable long-term information on the town's collection system.

A long-term program will allow the town to harvest existing available capacity through I/I reduction while the collection system management component of the program will endeavor to decrease the number of blockages, back-ups or overflows, and customer claims. This will be accomplished through regular inspection, cleaning, and repair of sewer lines and manholes which allows the town to operate the collection system in a proactive manner.

1.1 System Description

The municipal sewer system in the Town of Jamestown is comprised of approximately 16.5 miles of gravity sewer ranging in size from 4-inches to 18-inches in diameter, and approximately 375 sewer manholes. The town-wide sewer system serves approximately 2,100 customers is shown in Figure 1, Existing Sewer System. Wastewater is treated at the WWTF located at 165 Freebody Drive.

This Annual Program will concentrate on the gravity system. Weston & Sampson compiled data on the existing gravity sewer system, which is summarized in Table 1, Existing Sewer System.

2 PRIORITY EVALUATION

The town is divided into four sewer subareas and is delineated by sewer pump stations. The town does not have recent flow metering data, therefore, the priority evaluation will rank each subarea based on the town's needs using a practical approach. As discussed with the town staff, each subarea will be ranked based on existing problem areas and percentage of pipe that is lined by cured-in-place pipe (CIPP) or is polyvinyl-chloride (PVC). Because the town's primary goal is to reduce extraneous flow, investigation phases will focus on identification and removal of I/I. Removal of infiltration sources will reduce extraneous flow on a day-to-day basis, while removing inflow will reduce sewer surcharging and overflows. In addition, inflow that may enter the system through sewer manholes will be identified as part of the manhole inspections that are recommended to be performed.

Weston & Sampson met with town staff on June 5, 2024 to discuss existing problem areas and areas of concern. A meeting was held at the WWTF and then site visits were performed at a variety of locations throughout town. At this meeting the following concerns were raised which were documented to help prioritize areas of the existing sewer system as part of this program:

- Sewer Subarea 1 historically has contributed excessive I/I to the system.
- Sewer Subarea 2 has a neighborhood the Town of Jamestown is interested in prioritizing. This includes approximately 6,000LF of sewer upstream of sewer manhole 2-7 on North Road. This includes the following streets: Swinburne St, Valley St, Douglas St, Luther St, Plymouth Rd, Fowler St and parts of Whittier Rd and Longfellow Rd.
- The town experiences high flows at Pump Station 3 off Narragansett Ave and Westwood Rd. Based on the description of the problems that occur, it is believed that private inflow sources may contribute to the flows at this pump station.
- The following two areas are frequently cleaned, and it is recommended that they be investigated:
 - Subarea 2 – SMH 2-80 to 2-81 (Howland Ave)
 - Subarea 1 – Upstream of SMH 1-176 (Pardon Tucker Place)

Table 2, Annual Program, shows the sewer basins ranked according to the above-mentioned criteria. The annual program is based on the tasks listed below. The program is a modified program with manhole inspections being performed town-wide in the first phase, and television inspection of sewer pipes in one or two subareas every phase. In addition, due to the potential private inflow concerns in Subarea 3, private sewer building inspections are recommended to be performed in the fall of 2024, to confirm if private inflow sources are contributing to the high flows at Pump Station 3. Aside from these modifications, each phase the program will include the following items:

- I/I investigations (spring/summer)
- Evaluation of data
- Cost-effective analysis
- Letter reporting
- Mapping updates
- Update database and link to Geographic Information System (GIS)
- Improvement design
- Contract bid and award
- Construction & Construction services (winter)

It is estimated that the above items will take approximately 12 months, formulating one cycle, or phase, of the program. If necessary, the cycle can be adjusted to accommodate the town's yearly budget.

The data evaluation and reporting stages will be structured such that television, manhole and building inspections may be entered into a database over the course of the program. This will allow for easy data management and will be integrated to the town's current mapping system to continue the development of the GIS mapping. Over time this will create a comprehensive inventory and record of the sewer system.

The proposed annual program is presented in Table 2 and includes investigation and reporting, design, bid and award assistance and construction.

3 SUMMARY AND CONCLUSIONS

Based on the work the town has already completed and the information provided by the town, Weston & Sampson has developed an Annual Program for the wastewater gravity collection system. The first phase will prioritize the following which are of particular concern to the town:

- Town-wide manhole inspections to confirm the accuracy of the existing GIS mapping.
- Television inspection in Subarea 1 due to concerns of infiltration in this subarea.
- Television inspection in approximately 6,000 LF of Subarea 2 due to infiltration and O&M concerns.
- Internal building inspections in Subarea 3 to investigate private inflow sources upstream of Pump Station 3.

After manhole and television inspections have been completed in each subarea, along with building inspections in Subarea 3, a town-wide flow metering of sewers could be conducted to assess the effectiveness of the previous construction projects and to reprioritize subareas for subsequent investigation and construction.

The actual duration of each phase can be based on the town's current available yearly budget. Repairs will be prioritized each program year to stay within this budget while maximizing the value to the town. For this report, it is assumed each phase is approximately one calendar year in duration. Throughout the course of this program funding may be sought through other sources, if available.

By implementing this Annual Sewer Investigation and Rehabilitation Program, the town will be able to: 1) harvest available capacity through I/I removal; 2) follow a specific plan of capital improvements to operate, manage and maintain the collection system; 3) reduce SSOs; and 4) comply with potential upcoming regulations.

Special thanks to you and your staff for your assistance. We are available to meet with you at your earliest convenience to discuss this report. Please do not hesitate to contact me with any questions or comments you may have.

Sincerely,

WESTON & SAMPSON ENGINEERS, INC.

Nathan E. Michael, PE
Team Leader

cc: Douglas Ouellette, Superintendent

FIGURE 1
EXISTING SEWER SYSTEM



TABLE 1
EXISTING SEWER SUMMARY

TABLE 1 - EXISTING SEWER SUMMARY
TOWN OF JAMESTOWN, RI
WASTEWATER FACILITIES IMPROVEMENTS

Subarea	Total Length (lf)										Total (lf)	Est. Sewer Manholes	Inch Diameter Miles (idm)
	Diameter (in)	4	6	8	10	12	14	15	16	18			
1			2,412	28,622	4,864	5,464	1,666	1,065	3,093	212	47,398	190	85.3
2		233	1,377	25,190	1,624	1,356					29,780	135	46.1
3			85	5,640	72						5,797	25	8.8
4				4,172							4,172	25	6.3
Total		233	3,874	63,624	6,560	6,820	1,666	1,065	3,093	212	87,147	375	146.4

TABLE 2
ANNUAL PROGRAM

TABLE 2 - ANNUAL PROGRAM PRIORITIZATION
TOWN OF JAMESTOWN, RI
WASTEWATER FACILITIES IMPROVEMENTS

Tasks	Location	Estimated Quantities	Program Investigation Phase Notes	Estimated Schedule
PHASE 1				
Manhole Inspections	Town-Wide	375	Town-Wide to Evaluate Existing Mapping	Fall 2024 through Winter 2025
Television Inspection	Subarea 1	47,398	O&M & I/I Problem Areas Identified in Subarea 1 / 60% of Subarea is PVC or CIPP	
Television Inspection	Subarea 2	6,000	O&M & I/I Problem Areas Identified in parts of Subarea 2	
Building Inspections	Subarea 3	80	Subarea 3 due to High Flow in PS 3	
PHASE 2				
Television Inspection	Subarea 2	23,780	Remainder of Subarea 2 / 68% of Subarea is PVC or CIPP	Spring 2026 through Winter 2026
PHASE 3				
Television Inspection	Subarea 3	5,797	High Flows during Wet Weather / 96% of Subarea is PVC or CIPP	Spring 2027 through Winter 2027
Television Inspection	Subarea 4	4,172	100% of Subarea are PVC or CIPP	