



Town of Brownsburg

Wastewater Treatment Plant Master Plan – 2023

December 2023

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Acronyms and Abbreviations

AACE	Association for the Advancement of Cost Engineering
BFP	belt filter press
BOD	biochemical oxygen demand
CBOD ₅	five-day carbonaceous biochemical oxygen demand (CBOD ₅)
GBT	gravity belt thickener
hp	horsepower
MG	million gallons
MGD	million gallons per day
NH ₃ -N	nitrogen content of ammonia
NPDES	National Pollutant Discharge Elimination System
NPW	non potable water
RAS	return activated sludge
SRT	solids retention time
TSS	total suspended solids
TWAS	thickened waste activated sludge
VFD	variable frequency drive
VSR	volatile solids reduction
WAS	waste activated sludge
WWTP	wastewater treatment plant

Executive Summary

After the 2018 treatment plant capacity expansion, flows to the Brownsburg Wastewater Treatment Plant (WWTP) have consistently averaged approximately 3 MGD (million gallons per day), which is within the plant's average design capacity of 5.25 MGD. Wastewater flows to the WWTP are expected to increase in the future as the Town population expands and grows. The recommended improvements in this Master Plan comprise the next increment of treatment plant construction to increase the firm average design treatment capacity to 6.9 MGD. The recommended improvement projects will also increase the plant's peak capacity, enabling it to accept and treat higher flows during wet weather events, further reducing the frequency of wet weather overflows. The peak treatment capacity of the plant will be increased from 10 MGD to 15 MGD when the average design treatment capacity is increased to 6.9 MGD.

The improvements to the WWTP will allow the Town of Brownsburg (Town) to accept increased flows from industrial user expansions and extend sewer service to new residential areas of the Town. The town expects a steady increase in population and an increase in commercial users in the future 20-year planning period used for this master plan. The WWTP master plan coordinated with the collection system master plan to determine the future increased flow from more users and for extending sewer service to accommodate residential, commercial, and industrial growths. Based on the future sewer flow modeling in the Brownsburg Sanitary Sewer Master Plan 2023, the future wasteload and flow is expected to exceed the average design capacity of the existing plant in 2033.

The recommended WWTP improvements will be completed within the existing property that is owned by the Town. This Master Plan reviewed and evaluated different alternatives for plant processes to recommend the most suitable treatment alternatives. The evaluation of alternatives compares both monetary and non-monetary factors. The monetary evaluation compares estimated capital costs, operation and maintenance costs and salvage values for the various alternatives.

The biosolids treatment process, solids handling equipment and solids storage facility at the WWTP were not modified during the recent 2018 plant expansion project. The existing solids handling equipment was installed in the late 1990s and is operating beyond its estimated useful life. The existing sludge cake transport and cake storage facility is inefficient and currently requires constant attention from plant staff. The sludge dewatering equipment is recommended to be improved because there is not a dedicated standby dewatering unit. The WWTP's dewatering capacity is recommended to be increased as part of improving the aging solids handling equipment to provide more operational flexibility and reduce plant staff hours needed to handle the biosolids. The sludge cake transport capacity is also recommended to be increased as part of the solids treatment upgrade, so the existing biosolids conveyor system from the dewatering unit to the unloading area does not continue to be a treatment bottleneck.

The recommended WWTP master plan comprises of wastewater treatment projects to improve the solids handling treatment system, address known operations and maintenance issues and increase the treatment capacity of the plant. To be cost efficient, this master plan consists of new treatment units, utilization/rehabilitation of existing units, and combination of new and existing units. The preferred capital improvement plan recommends the following major treatment plant improvements: dewatering system expansion, additional sludge cake storage, tertiary filter improvements, various treatment process improvements identified based on discussions with plant operations and maintenance staff and treatment capacity expansion.

Two phases of improvements are proposed as follows: Phase 1 (Year 2025 to 2026) improve solids handling and address various operations and maintenance needs, Phase 2 (Year 2030 to 2033) increase treatment capacity of the plant for the future expected increase of influent flow and loads and Phase 3 (Year 2033 to 2043) major equipment rehabilitation. The first phase is recommended to address the immediate need of the aging solids handling process equipment and allow the solids equipment to continue reliable operation. Phase 2 will bring the

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average treatment capacity from 5.25 MGD up to 6.9 MGD. Phase 3 is recommended to include projects to maintain reliable treatment of existing equipment. Maintenance and equipment replacement projects are expected throughout the 2033 to 2043 time to address rehabilitation needs for equipment installed during the 2018 plant expansion project.

A summary of the recommended projects, preliminary cost estimates, and timing phases is included in the table below.

Table 1-1 Recommended Projects and Associated Project Costs

Recommended Projects and Associated Preliminary Cost Estimates			
Project Title	Project Description	Preliminary Cost Estimate	Sub Phase
<u>Phase 1: Solids Handling Improvements (2025-2026)</u>			
Thickening and Dewatering Equipment - Rehabilitate Existing Combination Unit and Add a Dewatering Centrifuge	Rehabilitating existing combination dewatering unit and adding a new dewatering centrifuge to increase dewatering capacity	\$4.0 million	1A
Solids Handling Improvements - Larger Conveyors and Add a New Discharge Location to a Pad Next to Existing Building	Adding larger solids handling conveyors to discharge to a new concrete pad next to the building. Also includes a new solids transport truck	\$680,000	1A
Solids Storage Improvements	Adding new covered drying beds	\$2.4 million	1A
Filter Influent and Bypass Gate Electric Actuator Addition	Adding electric actuators on the filter bypass gate and all influent gates. Also includes adding the filter bypass gate to the SCADA system.	\$130,000	1A
Replace Filter PLC Control Panel	Raising and replacing the damaged filter panel	\$90,000	1A
Larger Filter Backwash Sump Pumps	Adding larger pumps in the filter backwash wet well to prevent flooded conditions	\$50,000	1A
UV Control Panel Improvements	New canopy over control panel	\$30,000	1A
Phase 1A (2025) Subtotal		\$7.38 million	
Blower Improvements	New blowers in soundproof enclosures outside and near the digesters	\$1.8 million	1B
Digestion Diffuser Upgrades	Lowering the diffuser grid and replacing the diffusers with a different type	\$320,000	1B
Tertiary Filter Improvement - Disks With Larger Pore Sizes	Replacing the existing filter panels with stainless steel panels of 10 or 20 microns	\$160,000	1B

Recommended Projects and Associated Preliminary Cost Estimates			
Phase 1B (2026) Subtotal		\$2.28 million	
Oxidation Ditch Rehabilitation	Replacing all of the internal equipment	\$2.3 million	1C
Secondary Clarifier No. 1 Rehabilitation	Replacing all of the internal equipment	\$1.2 million	1C
Perimeter Fence Rehabilitation	Applying a protective coating	\$110,000	1C
Junction Chamber Coating	Concrete repair and adding a protective coating on the junction chamber with exposed rebar	\$100,000	1C
Light Pole Rehabilitation	Replacing the outdoor lights and wiring that is not operational	\$80,000	1C
Phase 1C (2026) Subtotal		\$3.88 million	
Phase 1 Subtotal		\$13.5 million	
<u>Phase 2: Capacity Expansion (2030-2033)</u>			
Additional Treatment Capacity	Adding an additional oxidation ditch, secondary clarifier, UV bank, and bar screen	\$17.9 million	
Tertiary Filter Improvements - 4 th Filter and New Cleaning System	Adding a 4 th Evoqua filter with a new chemical cleaning system	\$2.3 million	
Digester Type – Additional Aerobic Digester	Adding an aerobic digester	\$2.5 million	
Parts and Vehicle Storage Expansion	New pole barn type building (65 feet by 65 feet) for parts and vehicle storage	\$1.6 million	
East Plant Pump VFD Replacement	Replacing the VFDs on the two pumps at the East Plant	\$40,000	
Odor Control Improvements	Replacing the media in the screen building odor control equipment	\$90,000	
Phase 2 Subtotal		\$24.5 million	
<u>Phase 3: Major Equipment Rehabilitation (2033 to 2043)</u>			

Recommended Projects and Associated Preliminary Cost Estimates			
Oxidation Ditch 5 Rehabilitation	Replace aging components of the existing oxidation ditch to rehabilitate the equipment and gain additional service life	\$900,000	
Secondary Clarifier No. 5 Rehabilitation	Replace aging components of the existing clarifier to rehabilitate the equipment and gain additional service life	\$1.2 million	
Filter Rehabilitation	Replace aging components of the existing filters to rehabilitate the equipment and gain additional service life	\$1.8 million	
Screen Rehabilitation	Replace aging components of the mechanical screen 1 to rehabilitate the equipment and gain additional service life	\$412,500	
UV Equipment Replacement	Replace aging components of the UV channels 1 and 2 to rehabilitate the equipment and gain additional service life	\$600,000	
Phase 3 Subtotal		\$ 5.0 million	

1 Introduction

This section introduces the Town of Brownsburg Wastewater Treatment Plant Master Plan. The background of the report is presented, along with a discussion of the goals and objectives of this master plan.

1.1 Background Information

The Brownsburg Wastewater Treatment Plant (WWTP) provides service to the Town of Brownsburg and surrounding areas. The Town of Brownsburg, Indiana, is situated in the northeast corner of Hendricks County, approximately northwest of downtown Indianapolis. Based on recent United States Census Bureau estimates, the current population in the Town of Brownsburg is approximately 32,000. The Town comprises approximately 15 percent of Hendricks County by population. The area in and around the Town has experienced increasing residential and commercial development. The town population has increased by 30 percent since the last master plan was issued in 2012. For example, a large industrial bakery recently expanded operations with a pretreatment system and has historically been a major wastewater contributor in the Brownsburg WWTP service area.

The Brownsburg WWTP has seen increased flows from both industrial and residential growth in the area. The residential sector is anticipated to grow along with the industrial sector. The Town is primarily anticipating industrial type growth that does not use large volumes of water or discharge large volumes of wastewater.

1.2 Objectives

The purpose of this master plan is to evaluate the wastewater treatment needs of the Town and to evaluate, identify and schedule the recommendations for improvements for the planning period. The period for these planning efforts is the next 20 years until 2043. This plan has been prepared to enable the Town to accept and treat flows to meet the National Pollutant Discharge Elimination System (NPDES) requirements under the current permit pollutant limits and to plan for potential future effluent total nitrogen limits.

2 Existing WWTP Conditions and Capabilities

This section provides a summary of the existing WWTP conditions, treatment capacities and treatment schematic. An East Plant schematic and treatment capacities are also discussed. An asset table has been updated with the latest rehabilitation dates of major equipment. Minor revisions were made to match the existing equipment conditions at the WWTP and the East Plant. Minor revisions included removing the channel monster from the East Plant and other small equipment replacements. The updated asset table is included in **Appendix F**.

2.1 Wastewater Treatment Plant Background

The Brownsburg WWTP, or West Plant, was constructed west of White Lick Creek and placed into operation in 1987. A pretreatment and pumping facility, or East Plant, was constructed on the site of the original treatment plant when the original WWTP was demolished in 1987. The WWTP was expanded in 2000 and most recently expanded again in 2018 to a design average treatment capacity of 5.25 MGD and peak treatment capacity of 10 MGD. A detailed design summary is located in **Appendix A**. A Flow Schematic is shown below in **Figure 2-1**.

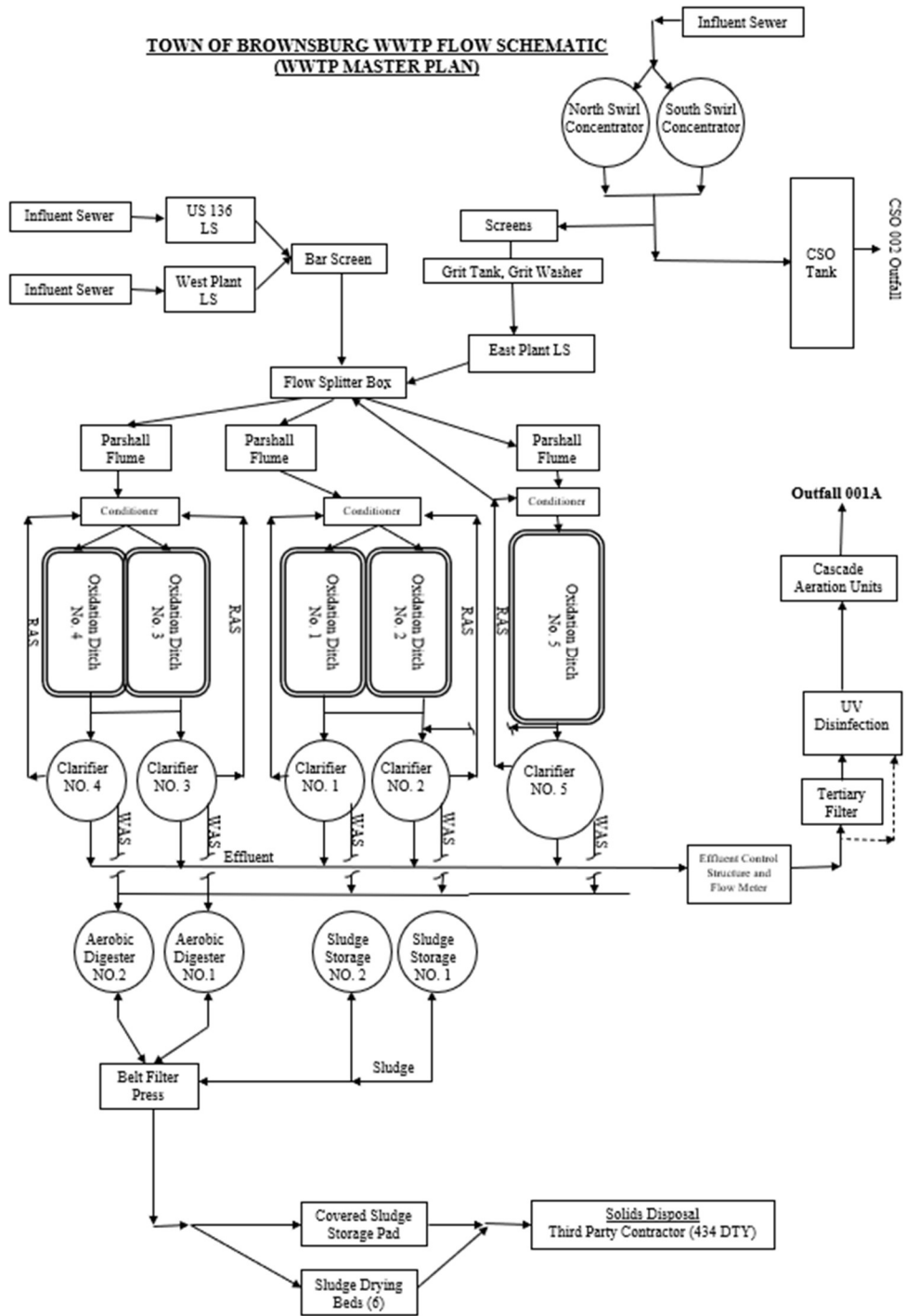


Figure 2-1 Existing Flow Schematic

The most recent WWTP treatment expansion completed in 2018, included a new screening building, chemical phosphorus removal, adding Oxidation Ditch No. 5, adding Secondary Clarifier No. 5, adding tertiary filters, replacing the chlorine disinfection system with a UV disinfection system, and other various improvements. The solids handling and storage systems were not expanded during the 2018 treatment plant capacity expansion project and are operating beyond their estimated useful life. The solids handling equipment at the WWTP are in need of improvements and capacity expansion to continue reliable treatment operation.

2.2 Existing East Plant Evaluation

The East Plant treatment system consists of screening and grit removal. A combined sewer overflow tank is located at the East Plant. The grit removal treatment system at East Plant was upgraded in 2021. There are four centrifugal pumps at East Plant that pump screened flow to the WWTP. These pumps were originally installed in 1984 and have since been rebuilt. One pump was rebuilt in 2003, one pump was replaced and a separate pump was rebuilt in 2020, and one pump was rebuilt in 2023. There is a need for a new HVAC odor control unit at the East Plant because the existing HVAC system is operating beyond its estimated useful life. The ancillary treatment support equipment, as well as the structural assets and screens, at East Plant are in an acceptable condition.

2.3 Existing WWTP Evaluation

The headworks building has one mechanical screen and one manually cleaned bar rack that were both installed in 2018. The mechanical screen sufficiently captures the solids for the majority of the flow scenarios, and the only operational challenge is that it is occasionally overwhelmed with larger debris or excess load. To alleviate this excess load condition, the isolation gate for the manual bar screen is left partially open to allow flow to pass through if the mechanical screen has issues. Overall, the headworks operates well and is in good condition.

There are a total of five oxidation ditches at the WWTP. Oxidation Ditch No. 5 was installed in 2018 and is operating in good condition. Oxidation Ditches No. 1 and No. 2 were recently rehabilitated. Oxidation Ditches No. 3 and No. 4 are currently offline and available to be cleaned and rehabilitated. The rehabilitation includes replacing the equipment internal components (rotors and drive motors) and rehabilitating the structural components. The rehabilitation of Oxidation Ditches No. 3 and No. 4 is included in this master plan.

Clarifier No. 2 was recently rehabilitated, and Clarifier No. 1 is still operation but is in need of rehabilitation. Clarifiers No. 3, No. 4, and No. 5 are still operational and in good condition. The return activated sludge (RAS) rate is typically 100 to 120 percent of WWTP influent flow to maintain a low sludge blanket in the clarifiers. The RAS pumps clog when the sludge blanket is allowed to build up and it is challenging to unclog the RAS pumps with their current configuration.

When in operation, the tertiary filters help to remove total suspended solids (TSS) and phosphorus. The tertiary filters are experiencing a lower treatment capacity than what was stated by the manufacturer, and they are frequently bypassed, especially during peak flow events. The filter backwash runtime is higher than stated by the manufacturer and the backwash pumps cannot handle the peak backwash flows, which has previously caused overflows inside the filter building. The filter backwash nozzles have had clogging issues when the filters experience high flow, which leads to significant additional maintenance of the units. Once clogged, all the individual nozzles between the filter disks must be cleaned by WWTP staff, which is a labor-intensive process. Algae buildup has been challenging for filter operations and requires regular bleach cleaning.

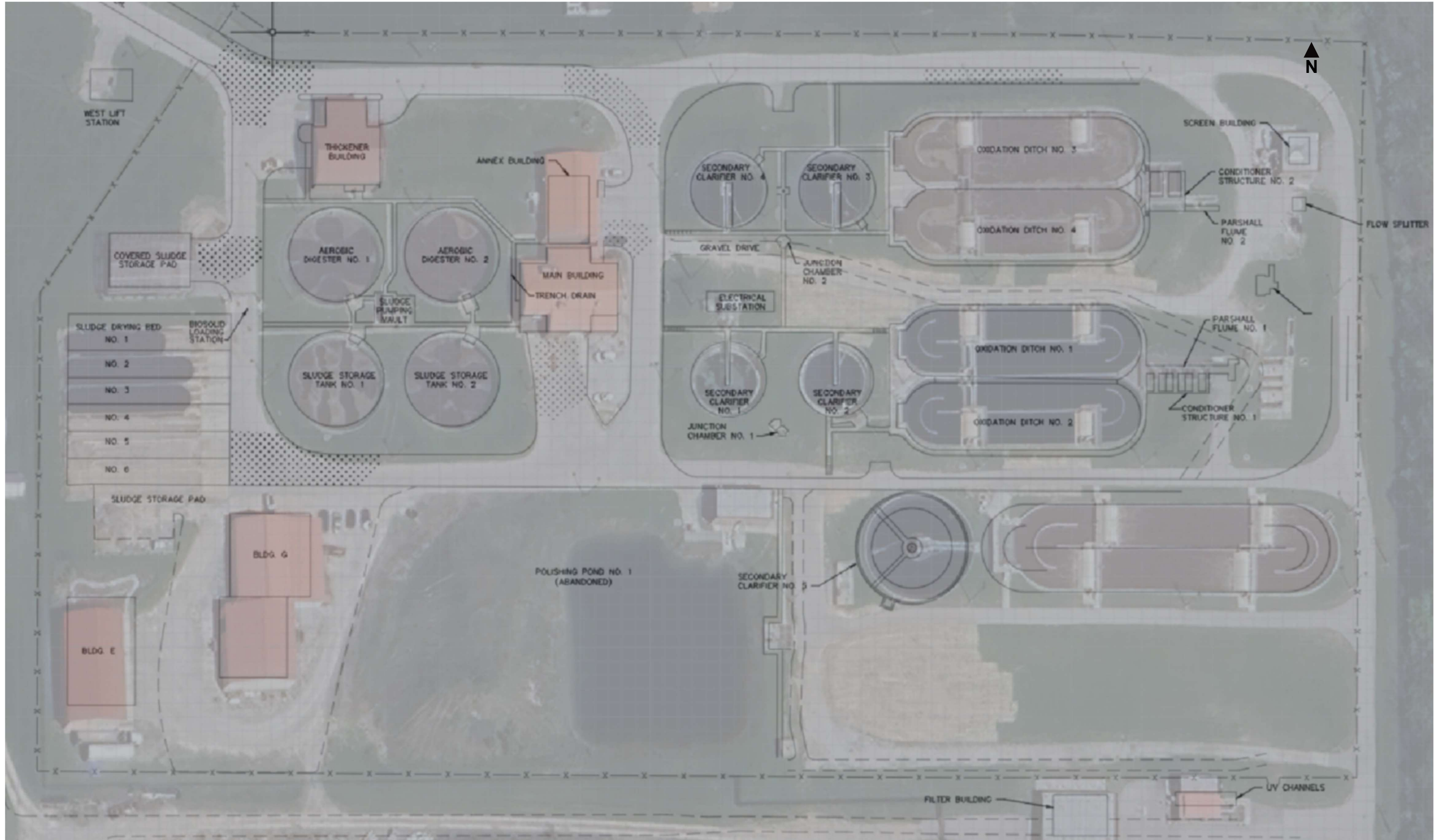


Figure 2-2 Existing Site Plan

The UV disinfection system is operating and in good condition. The main operational challenge with the UV disinfection system is the sun glare on the screen of the control panel when staff are operating it. There is an existing covering, but the control panel is located outdoors, and the covering is insufficient to block the sunlight. The cascade aerators are operational and are in good condition.

The digesters are operational and are in good condition. Digesters are cleaned regularly whenever they are emptied which has improved treatment operation. WAS is pumped to the sludge tanks and then thickened before returning the sludge to the aerobic digesters. When the percent solids in the digesters reaches 2 to 2.2 percent there are odor issues. The WWTP currently thickens WAS to 1.5 to 1.75 percent. The existing process of thickening involves pumping sludge and sending it through the gravity belt thickener. The thickened sludge is returned to the aerobic digesters and this process is repeated until the desired percent solids is reached in the digesters. The blowers for digester aeration are located in the basement of the Maintenance Building which creates noise and heat issues. The air is turned off in the digesters during decanting. After decanting the sludge is dewatered using the belt filter press. Dewatering is a labor intensive process and periodically requires staff to work outside of regular hours. The conveyor in the Thickener Building cannot handle the sludge cake from the belt filter press when the press is running at full capacity. The dewatered cake is loaded into a landscaping truck and dumped into one of the sludge drying beds or the covered storage pad. The belt filter press is generally not turned off when the truck is being moved to dump solids, so the dumping process is performed as quickly as possible to limit solids discharging onto the Thickener Building loading bay floor.

The WWTP has noted that the dewatered cake becomes sticky during transport and tends to stick to the bed of trucks. This is especially challenging when it is hauled offsite because most of the sludge sticks to the bed of the truck. A vibrating truck bed helped with this issue during short distances and shaking the bed of the existing landscape truck has caused damage. The existing sludge drying beds are not operating properly and the underdrain valves do not open or close fully. Sludge is currently hauled offsite by a third-party contractor who blends the sludge with other materials at their biosolid center.

2.4 Current Influent and Effluent Wastewater Parameters

Flow to the facility is monitored by influent and effluent flow meters. Sampling units and onsite laboratory testing are used to determine both influent and effluent water quality. **Table 2-1** shows the WWTP’s current NPDES permit limits for TSS, BOD, Ammonia and Phosphorus. The historical data analysis showed that the WWTP has been able to adequately meet their permit requirements.

Table 2-1 NPDES Permit Effluent Limits

Parameter	TSS (mg/L)	BOD (mg/L)	NH ₃ -N (mg/L)	Phosphorus (mg/L)
Summer Monthly Average	12	10	1.5	1.0
Winter Monthly Average	18	15	2.2	1.0
Summer Weekly Average	18	15	2.3	1.0
Winter Weekly Average	27	23	3.3	1.0

The WWTP has a current permitted average treatment capacity of 5.25 MGD and a peak treatment capacity of 10 MGD. Analyzing the last 3 years (2021-2023) of historical WWTP operating data, the average daily flow was 2.79 MGD. The WWTP is currently operating at approximately 53% of the design average flow treatment capacity. The wet weather flow average was assumed to be the average influent flow from the wettest 30 consecutive days, and was calculated to be 3.3 MGD. The dry weather flow was assumed to be the average influent flow for the driest 90 consecutive days which was calculated to be 2.34 MGD. Data from January of 2017 through December of 2022 was analyzed to determine the dry and wet weather flow averages. Historical data prior to 2022 was not included when calculating the nutrient loading predictions because of the abnormally high nutrient loading from the local industrial bakery that had a pretreatment system recently come online, which has significantly reduced the TSS and BOD loading to the plant.

The pretreatment system at the bakery was completed on December 27, 2019 and final performance testing was completed on January 12-14, 2020. The suspended solids loading was reduced to the WWTP in 2021, as shown below on **Figure 2-3**. The BOD loading was not significantly reduced until 2022 as shown below in **Figure 2-5**. Bar graphs of the annual average lbs/day to summarize the daily data points are included below in **Figure 2-4** and **Figure 2-6**.

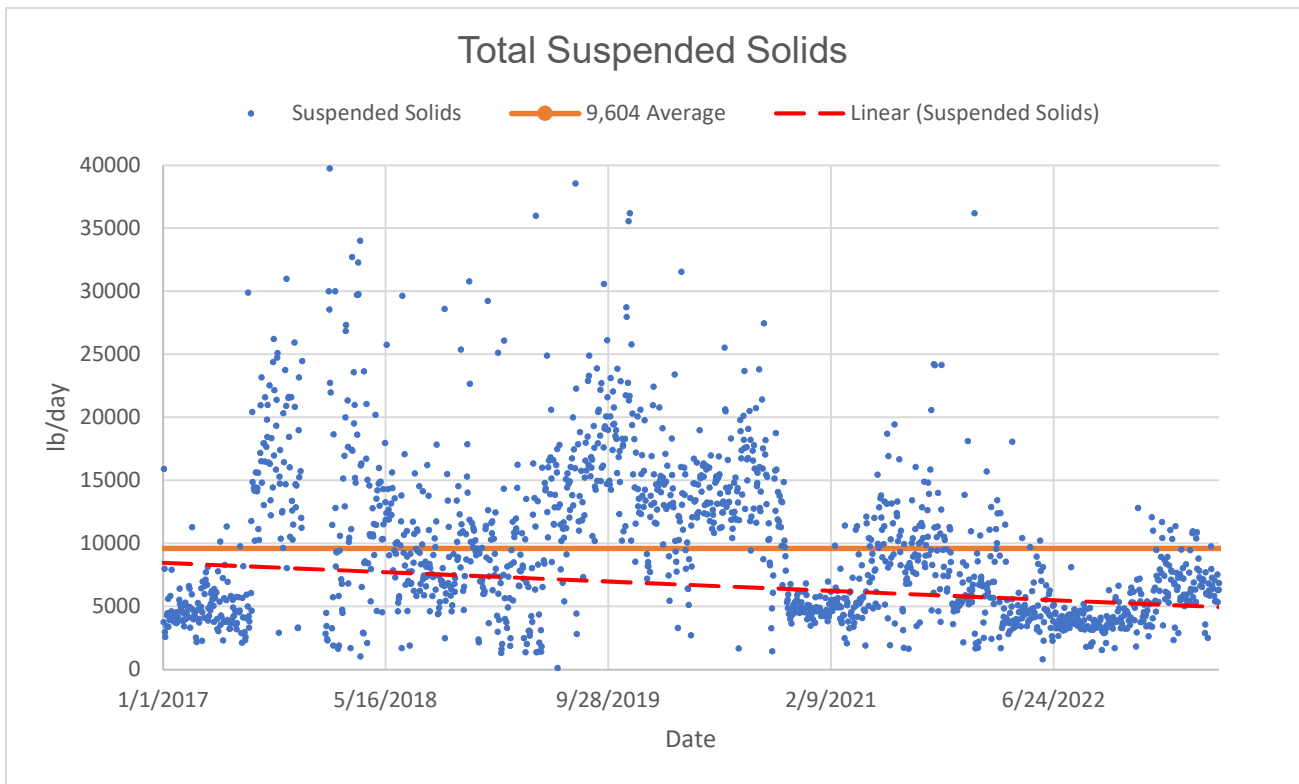


Figure 2-3 Historical Suspended Solids Data

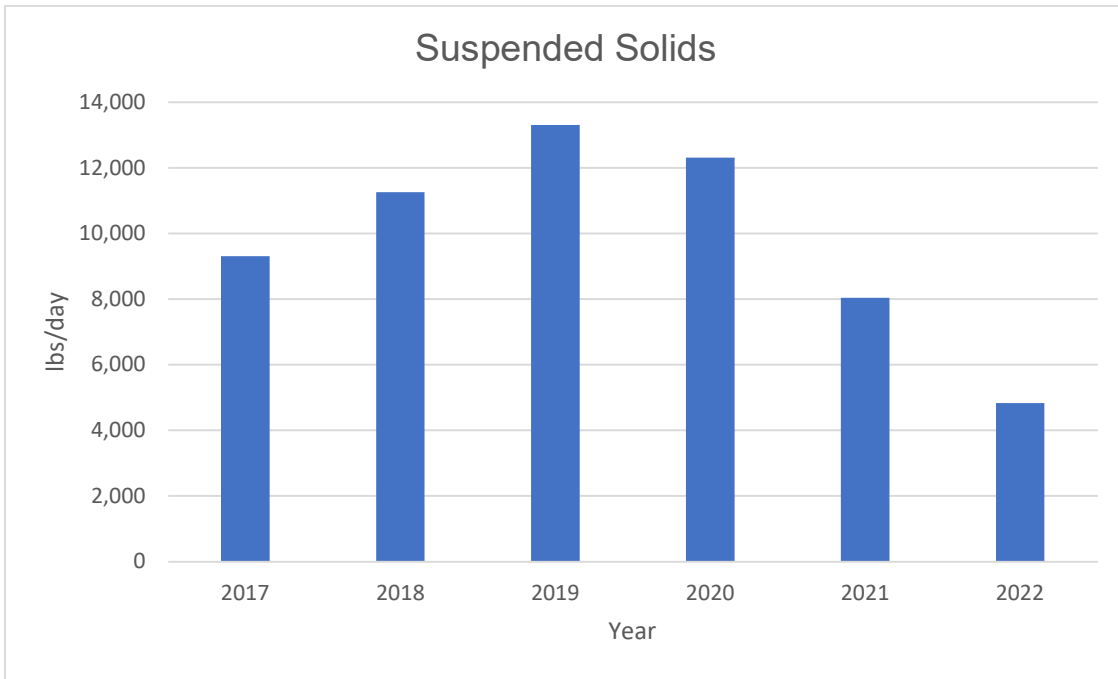


Figure 2-4 Annual Average of Suspended Solids Data

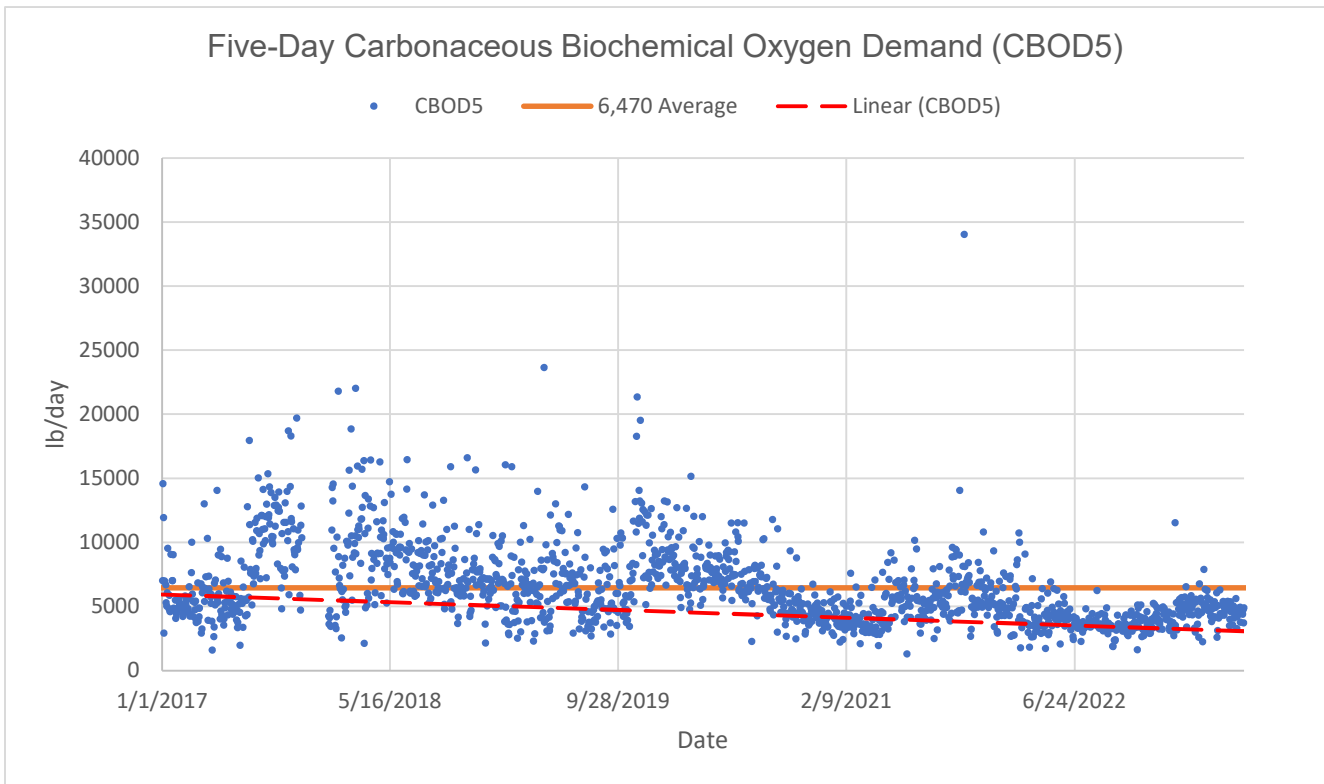


Figure 2-5 Historical CBOD5 Data

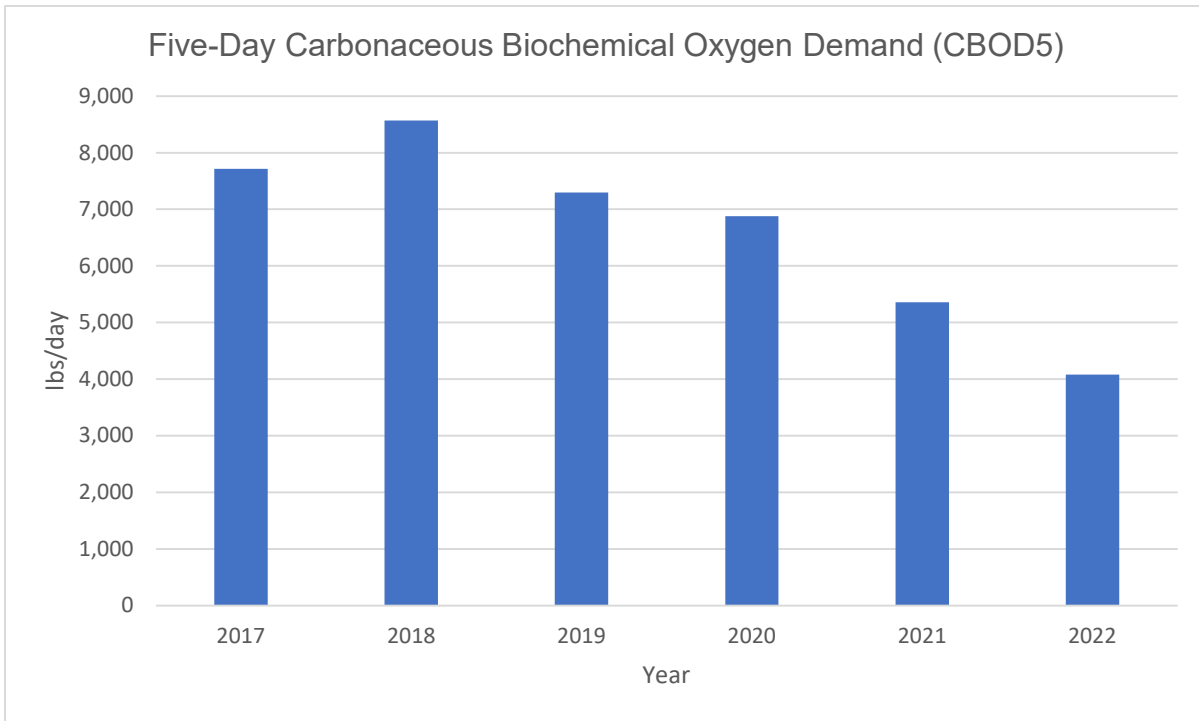


Figure 2-6 Annual Average of CBOD5 Data

The ammonia and phosphorus data were also graphed and analyzed. The historical ammonia loading has slightly increased according to the historical data which is shown in **Figure 2-7** and **Figure 2-8**. The historical phosphorus loading has been more variable year to year but also shows a slight increasing trend shown in **Figure 2-9** and **Figure 2-10**.

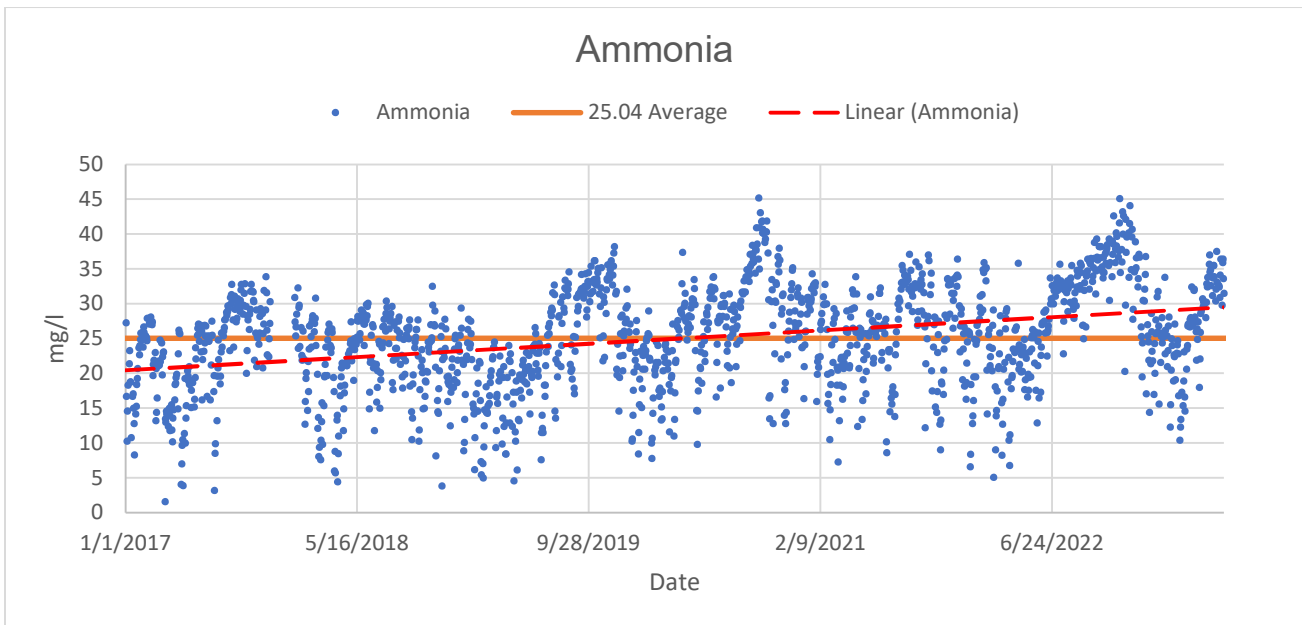


Figure 2-7 Historical Ammonia Data

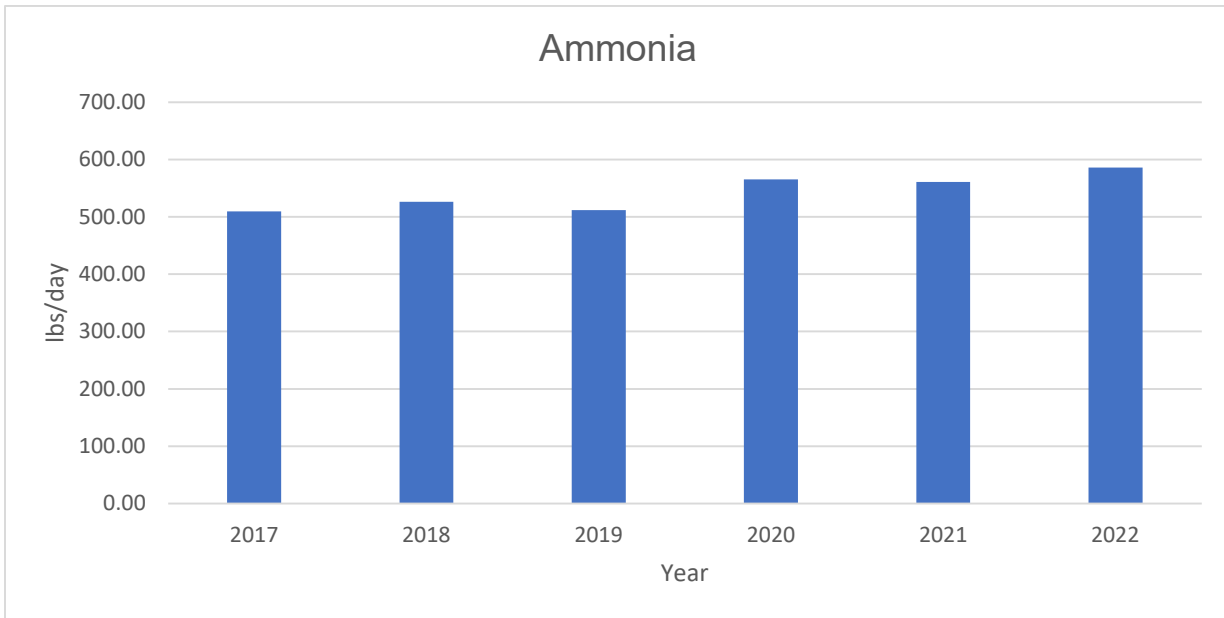


Figure 2-8 Annual Average of Ammonia Data

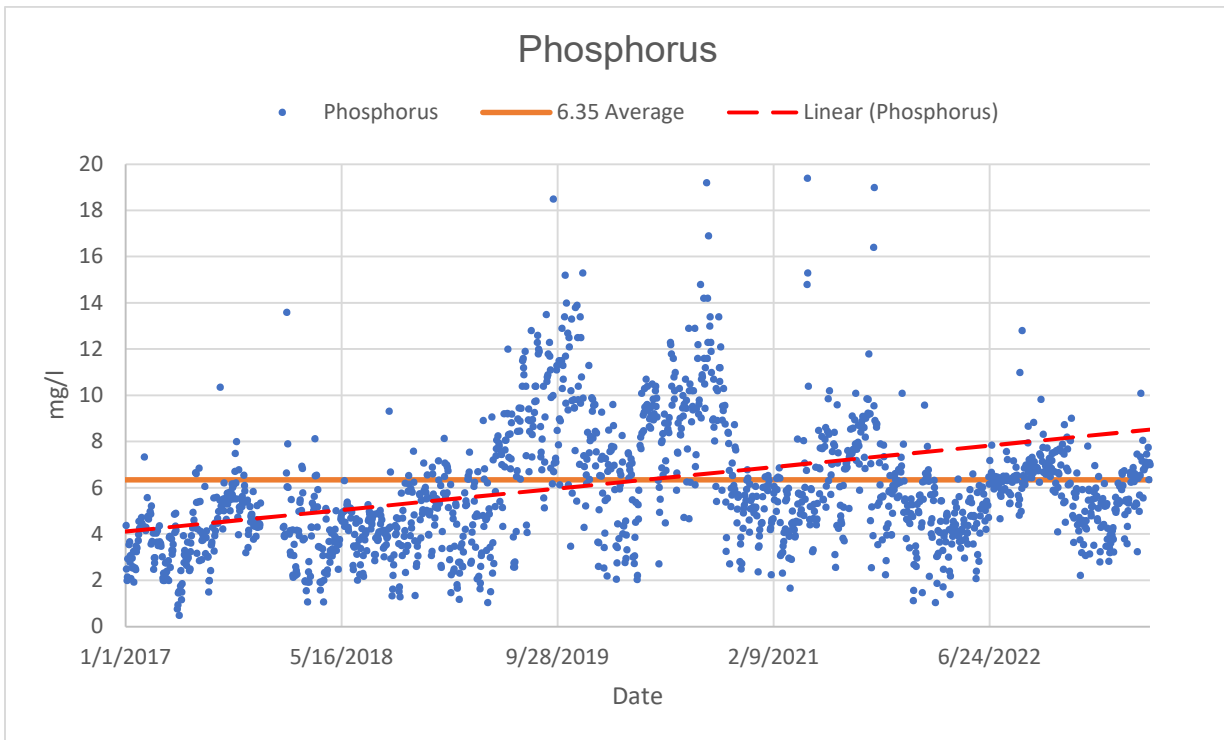


Figure 2-9 Historical Phosphorus Data

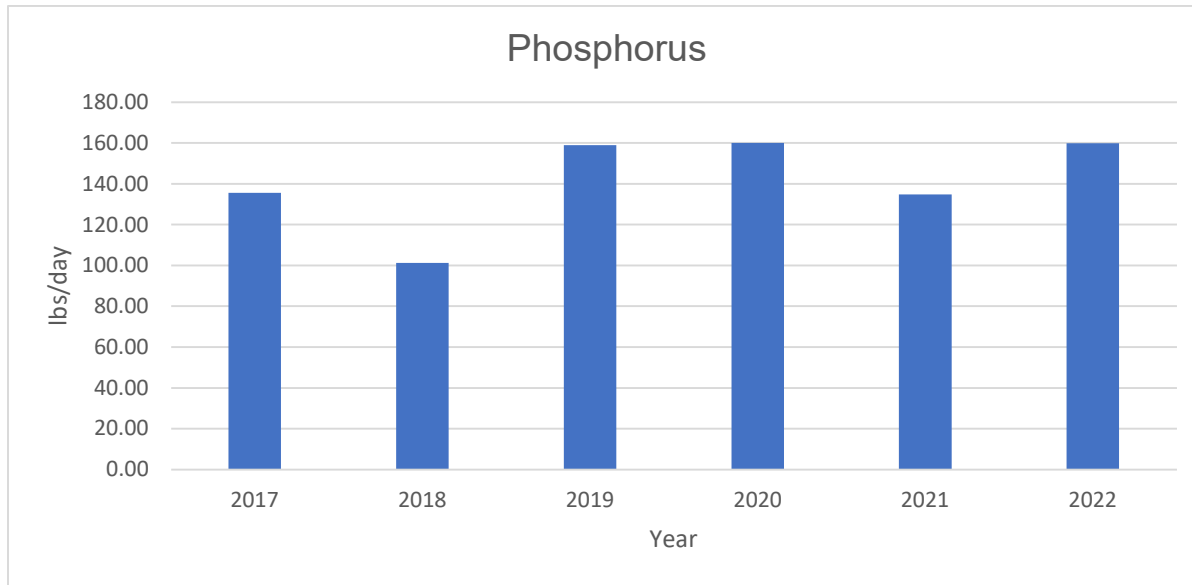


Figure 2-10 Annual Average of Phosphorus Data

The average daily influent flow has decreased in recent years from 3.02 MGD to 2.61 MGD (2017 to 2022). 2022 had less rainfall than previous years in the dataset. The average daily flow was calculated by averaging the influent daily flow for the year. The average daily CBOD5 and suspended solids in the influent has also decreased during this time period. The historical data summary is shown below in **Table 2-2**.

Table 2-2 Influent Flow Characteristics

Year	Average Influent Flow (MGD)	Average CBOD5 (lbs / day)	Average Susp. Solids (lbs / day)	Annual Rainfall (inches)	Ammonia (lbs / day)	Phosphorus (lbs / day)
2017	3.02	7,715	9,304	43.2	510	135
2018	3.09	8,569	11,253	47.0	526	101
2019	2.93	7,294	13,304	42.3	512	159
2020	2.75	6,880	12,312	44.0	565	160
2021	2.82	5,356	8,042	42.0	561	135
2022	2.61	4,078	4,826	32.7	586	160

The decreases in influent flow, CBOD5, and suspended solids are likely attributed to pretreatment at the bakery coming online during this time period and an ongoing effort to separate the combined sewers within the service area. The East Plant also had new equipment and treatment processes come online in recent years that likely reduced the suspended solids loads. The new south screen came online on April 27, 2017, and the grit removal

system was brought online on August 31, 2021. The City also has an ongoing effort to separate the combined sewers in the area which likely has decreased sewer infiltration and also reduces flow to the WWTP.

3 Future Conditions

To determine the future anticipated influent characteristics, the concentrations from historical WWTP influent data were evaluated with the anticipated future influent flow. The influent concentrations from 2022 were used for the future load prediction calculations because 2022 was the only recent year that reflected the pretreatment system at the bakery and the grit system at the East Plant. The 2022 influent concentrations are shown below in **Table 3-1**.

Table 3-1 2022 Influent Concentrations (Annual Average)

Influent Characteristic	Annual Average Concentration (mg/L)
CBOD ₅	197
Total Suspended Solids	227
Total Phosphorus	9
Ammonia	29

Based on anticipated future growth in the sewer service area and modeling performed in the Brownsburg Sanitary Sewer Master Plan 2023, it was predicted that the WWTP will experience an increase from current flows of 3.0 MGD in the average flow and 8.0 MGD in the peak flow over the next 10 years. The WWTP is predicted to experience an increase from current flows of 4.7 MGD in the average flow and 13.0 MGD in the daily peak flow over the next 20 years. The existing design average treatment capacity for the WWTP is 5.25 MGD and the existing design peak flow is 10 MGD. Assuming the increase in flow is linear, the increases in flow can be plotted each year in addition to the current influent average flows to determine when the design flow is predicted to be exceeded as shown below in **As** discussed earlier in this report, analyzing the last 3 years (2021-2023) of historical WWTP operating data, the average daily flow was 2.79 MGD. The future flow analysis assumed the existing average daily flow is 2.79 MGD.

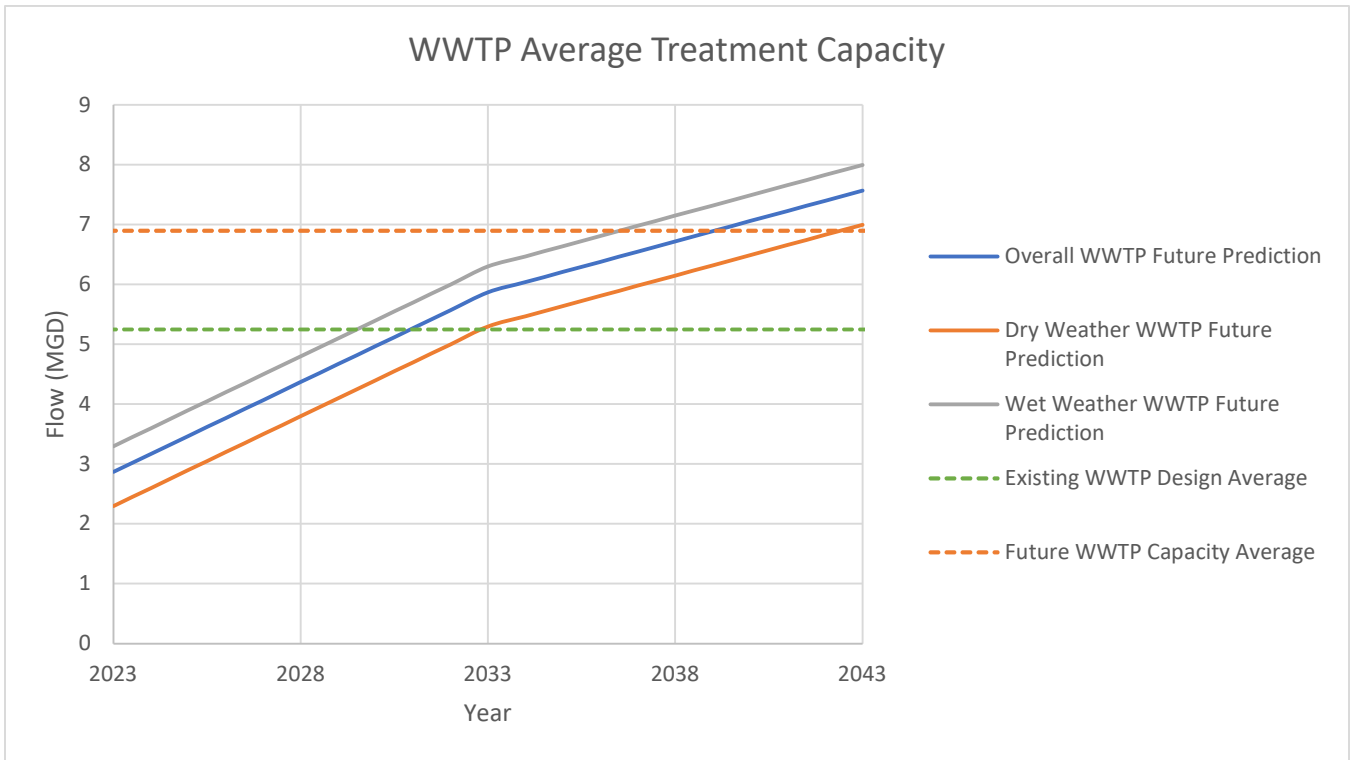


Figure 3-1 and **Figure 3-2**. As discussed earlier in this report, analyzing the last 3 years (2021-2023) of historical WWTP operating data, the average daily flow was 2.79 MGD. The future flow analysis assumed the existing average daily flow is 2.79 MGD.

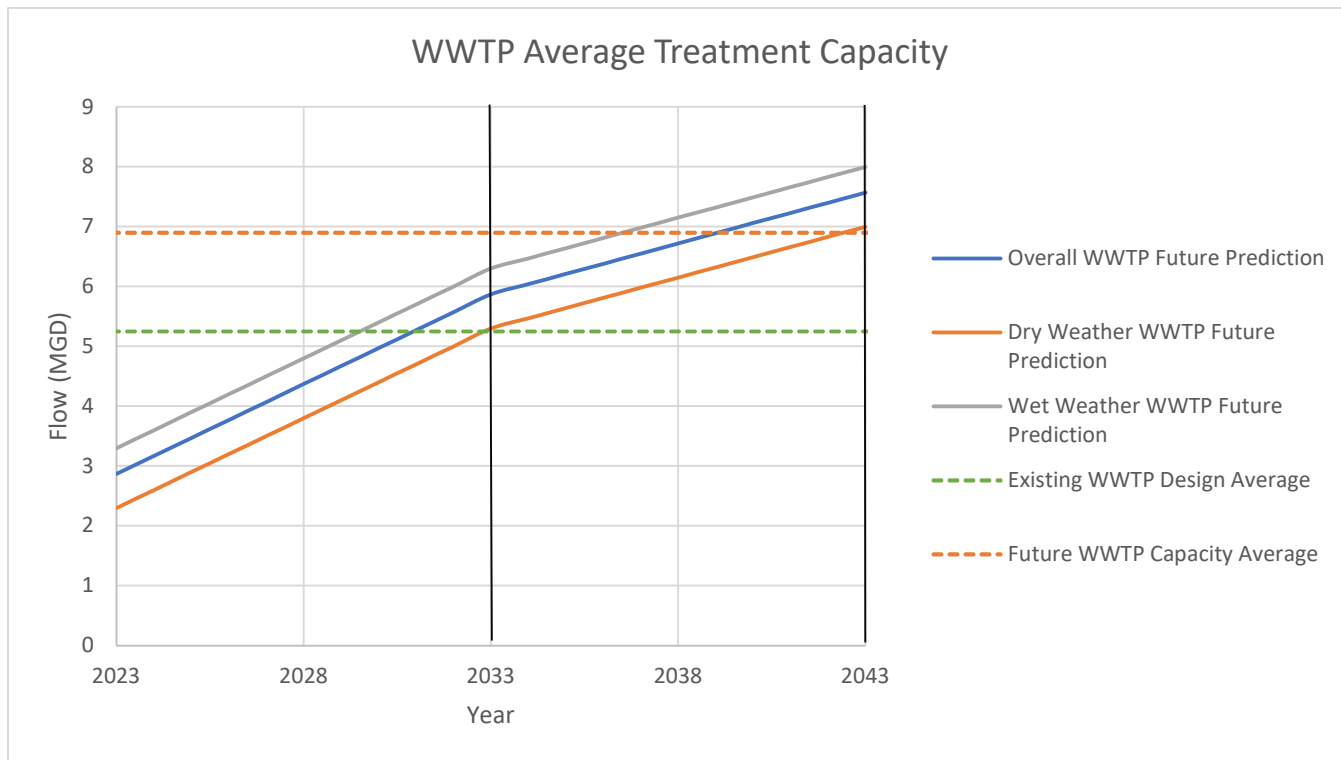


Figure 3-1 Future Average Flow Predictions

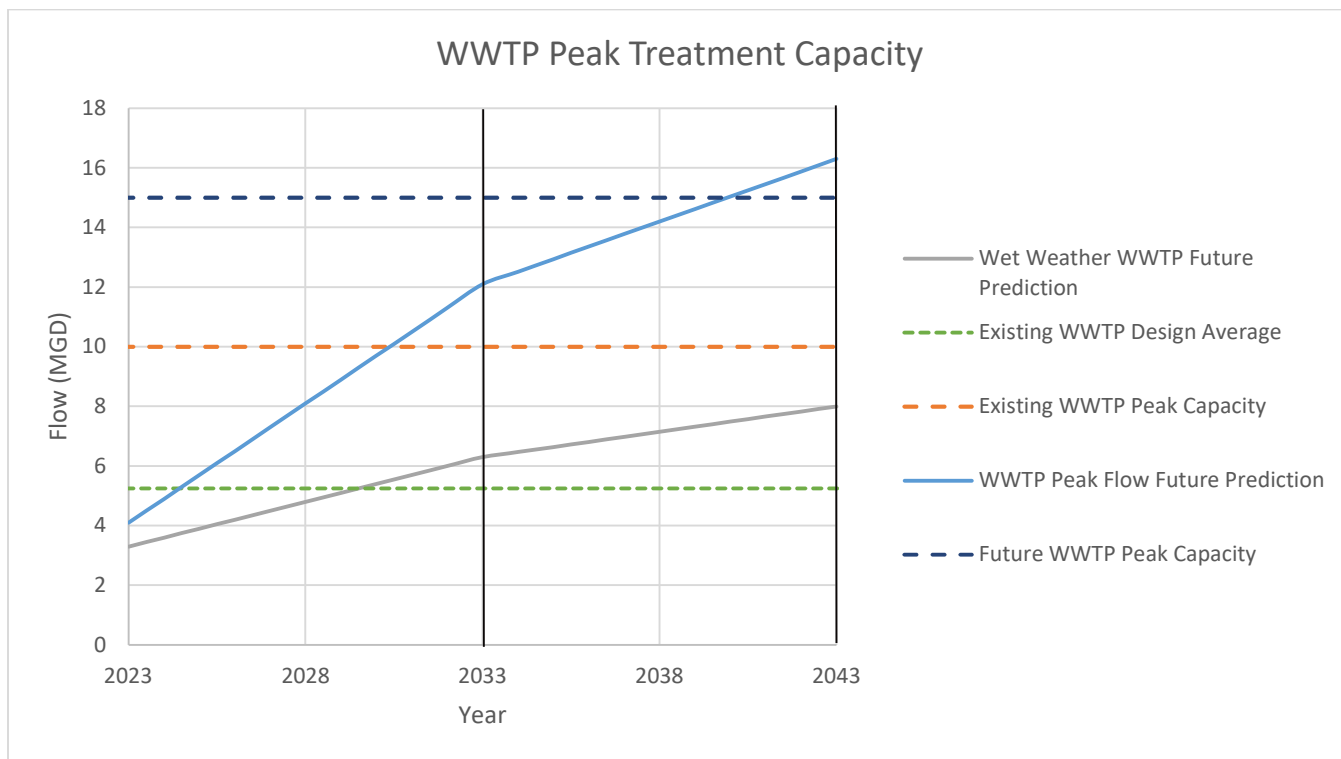


Figure 3-2 Future Peak Flow Predictions

Based on the linear trends plotted in the above figures, the overall average influent flow is predicted to exceed the design average capacity in the years 2031 to 2033. For peak flows, the wet weather average is predicted to operate above the design average flow capacity in 2029. For average flows the dry weather average is predicted to exceed the design average flow in 2033. Based on the Brownsburg Sanitary Sewer Master Plan 2023, the proposed future design average capacity of 6.9 MGD is projected to be exceeded in 2041 to 2043. The Brownsburg Sanitary Sewer Master Plan 2023 assumed a full build out of the available service area by 2043. The existing design capacity peak flow of 10 MGD is predicted to be exceeded in 2030 with the preliminary peaking factors assumed in the Brownsburg Sanitary Sewer Master Plan 2023. The future influent wasteload were calculated using the 2022 average concentrations and the anticipated future flows for years 2033 and 2043. The 2022 annual average influent concentrations were used to predict the future wasteload because the concentrations in 2022 reflected recent impacts in influent quality from a local bakery pretreatment system and the new grit removal system at the East Plant. The historical and future estimated wasteload values are shown below in **Table 3-2**.

Table 3-2 Predicted Future Influent Waste Load Analysis

Influent Parameter	2022 Average Concentration (mg/L)	2022 (lb/day)	2033 (lb/day)	2043 (lb/day)	Current WWTP Design Average Capacity (lb/day)
TSS	227	5,433	9,939	13,063	8,538
BOD	197	4,715	8,626	11,337	9,852
Ammonia	29	698	1,276	1,677	1,095
Total Phosphorus	8.8	212	387	509	438

Note: The values with red text exceed the existing WWTP design average capacity

The TSS and Ammonia influent loads are anticipated to be greater than the existing average design loading capacity by 2033. However, it should be noted that the plant has historically successfully operated at average influent total suspended solids loadings higher than the design average capacity.

3.1 PFAS Evaluation

There is growing awareness and concern about the presence of Per- and Polyfluoroalkyl substances (PFAS) in wastewater. PFAS chemicals can be found in both the biosolids and liquid stream at typical wastewater plants depending on the upstream contributors to the wastewater plant influent. Limits on the concentration of PFAS chemicals in Indiana are not anticipated in the near future for wastewater liquid or biosolids. Traditional wastewater treatment process technologies that the Brownsburg WWTP currently uses do not destroy PFAS in the liquid or solids streams. Additional treatment process equipment such as a granular activated carbon system is able to remove PFAS from liquid streams and the technology is becoming more common for wastewater treatment. Recent industry reports have indicated that higher concentrations of PFAS can be found in the biosolids than the liquid stream likely caused by the PFAS chemicals settling out of the liquid stream and into the wasted sludge.

If a PFAS regulation is implemented for the Brownsburg WWTP then a different treatment method of biosolids disposal may be needed to address the PFAS concentration in the solids stream if the existing solids hauling

company will not accept biosolids. Currently the biosolids are taken off-site by a third-party contractor who hauls the biosolids to their biosolid storage facility. At the biosolid storage facility the biosolids from the Brownsburg WWTP are mixed with other materials which are eventually land applied or disposed at a landfill. With new PFAS regulations the third-party contractor may not be able to accept the biosolids from the Brownsburg WWTP. PFAS treatment methods are still being developed but some treatment methods for biosolids are pyrolysis, gasification, incineration, and landfill disposal. A high temperature, greater than 1500 deg C, is needed to destroy PFAS compounds and some incineration facilities that accept biosolids do not reach high enough temperatures to destroy PFAS because they typically operate at less than 1000 deg C. Covanta is a local incineration facility which has capacity to accept the biosolids. If the local incineration facility cannot reach the required temperature to destroy PFAS compounds, then landfilling the biosolids is the other option without adding solids treatment processes at the WWTP. Three landfills around the Brownsburg WWTP were contacted as part of this project and all three reported that they currently accept class B biosolids for disposal. The following landfills were contacted: South Side Landfill, Waste Management Twin Bridges Landfill, and Noblesville Landfill. All of the landfills have capacity available to accept the biosolids from the Brownsburg WWTP. Based on discussions with the landfills, the current tipping fee estimate is \$60 to \$70 per ton. An initial profiling process is required prior to disposal at any of these landfill facilities to determine the appropriate tipping fees and daily disposal capacity.

4 Review of Treatment Process Alternatives

This section provides a summary of the alternative treatment process evaluation. All elements of the treatment process design including performance evaluation, cost, and layout are discussed. The highest ranked option is presented, and the treatment process evaluation process is described. The Town’s goal is to reuse as much of the existing infrastructure as practical and meet the long-term needs of the community and environment.

A wide range of technologies exist for the expansion and improvement of the Brownsburg Wastewater Treatment Plant. The factors that influence the selection of a preferred technology are case-specific and will vary between treatment processes. This section provides a preliminary evaluation of process technology alternatives. All technologies evaluated are applicable to treating influent at the Brownsburg WWTP. The alternatives for each process presented in this plan have been narrowed down to the most suitable alternatives. Each alternative is designed to fit within the existing WWTP treatment process with minimal modifications. A summary of the alternatives evaluated in this report is shown in **Table 4-1**.

Table 4-1 Summary of Treatment Process Alternatives

Summary of Treatment Process Alternatives	
Thickening and Dewatering Equipment	Sludge Classes
1. Dewatering Option 1: Rehab Existing BFP and Add an Additional Dewatering BFP	1. Sludge Class Option 1: Class B (existing)
2. Dewatering Option 2: Rehabilitate Existing Combination Unit and Add New Centrifuge	2. Sludge Class Option 2: Class B (digested)
Solids Handling	Digester Type
1. Solids Handling Option 1: Larger Conveyors and Newer Truck With Vibrating Bed	1. Digester Option 1: Aerobic

Summary of Treatment Process Alternatives	
2. Solids Handling Option 2: Larger Conveyors and New Discharge Location for a Larger Truck With Vibrating Bed / Expand Existing Building	2. Digester Option 2: Anaerobic
3. Solids Handling Option 3: Larger Conveyors and New Discharge Location to a New Storage Pad	Onsite Power Generation
Tertiary Filters	1. Power Generation Option 1: Hydropower
1. Filter Option 1: Aqua Aerobic Disk Filter	2. Power Generation Option 2: Diesel Generator
2. Filter Option 2: 4 th Evoqua Filter with Cleaning System	3. Power Generation Option 3: Natural Gas Generator
3. Filter Option 3: Disks with Larger Pore Sizes	Total Nitrogen Removal
	1. Nitrogen Removal Option 1: Oxidation Ditch Operations
	2. Nitrogen Removal Option 2: Oxidation Ditch with More Anoxic Volume and Carbon
	3. Nitrogen Removal Option 3: New Nitrogen Treatment Process

4.1 Thickening and Dewatering Equipment

The existing sludge treatment equipment is a combination thickening and dewatering belt filter press unit (BFP) that allows either thickening or dewatering to occur, but not both processes at the same time. The existing unit was installed in the late 1990s and is at the end of its estimated useful service life. The existing BFP requires constant operator attention and is in need of major rehabilitation or replacement. The WWTP has also experienced capacity challenges with the existing unit. All the following equipment alternatives will fit inside the existing thickening building. The polymer system has also been noted by WWTP staff to be old and in need of replacement. All the following alternatives will include a replacement of the polymer system for thickening and dewatering. There are two existing TWAS pumps in the Thickener Building and they have been noted by WWTP staff to be undersized for the current unit. Both alternatives for the dewatering equipment increase the capacity of the system and will need additional TWAS capacity to feed the equipment. A third TWAS pump is recommended with both alternatives. The layout and size of the TWAS pumps will be determined during design.

Table 4-2 Thickening and Dewatering Equipment Cost Summary

Alternative Description	Preliminary Cost Estimate	Solids Handling Capacity (ton/day)
Option 1: Rehabilitate Existing Combination Unit and Add a 1-meter BFP	\$2.4 million	4.8
Option 2: Rehabilitate Existing Combination Unit and Add a Dewatering Centrifuge	\$4.0 million	7

The existing dewatering unit has a capacity of 2.8 tons per day. All solids handling calculations assume all available dewatering capacity is in use for 8 hours. Additional equipment alternatives that were preliminarily evaluated include: Rotary Drum Thickener and Belt Filter Press, and Rotary Drum Thickener and Dewatering Centrifuge

4.1.1 Option 1 – Rehabilitate Existing Unit and Add 1-Meter Belt Filter Press

The existing BFP combination unit has aging internal parts, however the frame has been noted by Koline-Sanderson (original equipment manufacturer) to be in good condition, and that a rehabilitation of the existing combination thickening and dewatering unit is possible. This would include replacing all the moving parts and most of the internal components, but not the frame. Rehabilitation could be accomplished on site and would be a lower cost alternative compared to replacing the existing unit in-kind. The new internal components would provide similar expected service life to a new combination unit. The existing combination unit with a solids handling capacity of 700 lb/hr can also be replaced in-kind as an alternative to rehabilitation.

An additional 1-meter belt filter press can be installed next to the existing combination unit without modifying the building as shown on **Figure 4-1**. This additional dewatering unit would provide additional dewatering capacity and would allow for thickening and dewatering to occur at the same time which is not currently possible with the existing combination unit. Additional piping modifications would be needed to allow this alternative, but then the WWTP would have both a dewatering and thickening unit available at the same time. During workshops with the Town staff, it was discussed how there is more of a need for additional dewatering capacity compared to additional thickening capacity. If additional thickening capacity is desired, a 1-meter gravity belt thickener could also be placed in this location next to the existing combination unit. Since the existing MCC is going to be over 25 years old when the new dewatering equipment is installed, it may be in need of replacement and replacement of the MCC is included in the preliminary cost estimate.

Advantages

- Lower capital cost than the other alternative
- Additional dewatering capacity of 2 tons/day

Disadvantages

- Small electrical upgrade may be needed

Solids Handling Capacity: 4.8 (tons/day)

Preliminary Cost Estimate: \$2.4 million

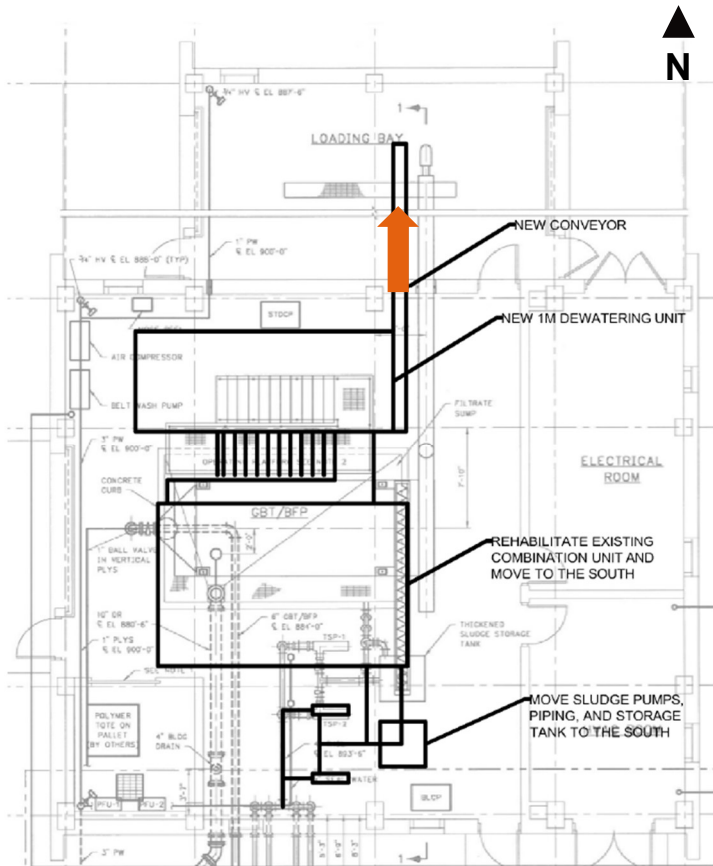


Figure 4-1 Layout of 1-Meter Dewatering Unit and Existing Unit

4.1.2 Option 2 – Rehabilitate Existing Unit and Add a Centrifuge

Rehabilitating the existing 1.5-meter combination unit and adding a dewatering centrifuge would provide more flexibility and capacity compared to the other alternatives. The dewatering centrifuge would provide a high-capacity dedicated dewatering unit to allow for thickening and dewatering to occur simultaneously if needed. An electrical upgrade within the Thickener Building MCC would be needed to be evaluated for this alternative to provide power for the combination unit and the centrifuge. The additional electrical load from the centrifuge’s high horsepower motors may require the WWTP’s electrical system and power feeds to be increased which would be a significant cost. Staff would be familiar with the combination BFP unit but would require additional training to operate the centrifuge. The centrifuge would provide a sludge cake with a higher percent solids. Grit has been known to gather at the bottom of the existing digesters. Grit can accelerate wear on centrifuges and can cause early bowl replacements. To help mitigate grit wear on the centrifuge, the WWTP can dewater the sludge at the bottom of the digester using the belt filter press in the combination unit to prevent excessive wear on the centrifuge.

An alternative centrifuge layout was evaluated where the dewatering centrifuge would be placed on a new second level inside the Thickening Building. The rotating assembly of the centrifuge is the heaviest piece of equipment and requires a crane capacity of 6,160 lbs. The bowl of the centrifuge weighs only a portion of the rotating assembly but still requires a crane to perform the replacement every 5 years. A maintenance crane would have to be installed inside the existing building for this lifting and there is not sufficient height available for the hoist to perform this maintenance. Putting the centrifuge on a second level may not provide significant floorspace due to the supports of the second floor and the stairs for WWTP staff to reach the centrifuge. For these reasons, placing the centrifuge on a new second level is not recommended.

The utility bills were analyzed, and the existing electrical service is adequate for the addition of the 150HP centrifuge. At this time, the plant is operating at 40% capacity of a single transformer. The power feed to the Thickener Building was also analyzed. Based on the loads shown on the 1999 record drawings, the project should be able to add the additional centrifuge load to the existing MCC. Since the MCC is going to be 25+ years old whenever the centrifuge is installed, it may be in need of replacement when the new dewatering equipment is installed and a cost to replace the thickener building MCC is included in this alternative.

Advantages

- Additional dewatering and thickening capacity of 4 tons/day
- Ability to thicken and dewater at the same time with piping modifications

Disadvantages

- Large electrical upgrade needed for the centrifuge
- Additional training needed on the new centrifuge
- Capital cost of the additional equipment

Solids Handling Capacity: 7 (tons/day)

Preliminary Cost Estimate: \$4.0 million

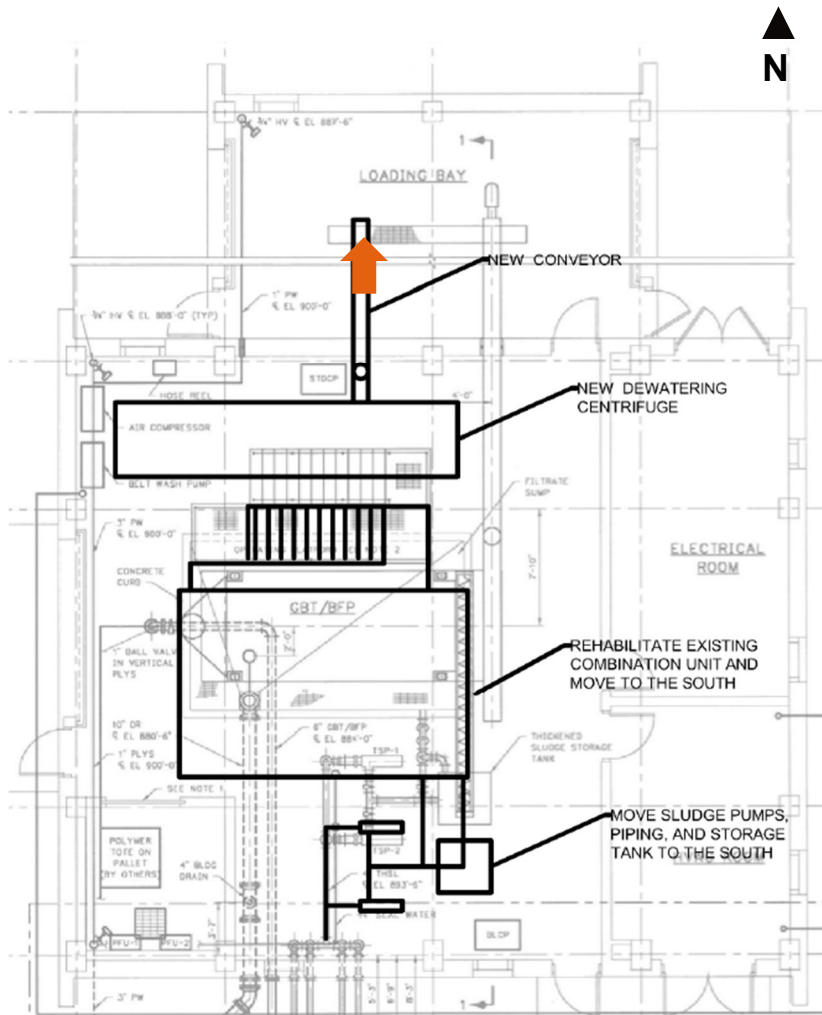


Figure 4-2 Layout of New Dewatering Centrifuge and Existing Unit

4.1.3 Additional Alternatives Evaluated

The following alternatives were included in the early evaluations but were not included in the final decision for the thickening and dewatering equipment. Both additional alternatives (Rotary Drum Thickener and Belt Filter Press, and Rotary Drum Thickener and Dewatering Centrifuge) do not provide the flexibility of the combination unit and additional dewatering unit. The rotary drum thickener and belt filter press alternative did not increase the capacity for dewatering which is why it was not considered further. The rotary drum thickener and centrifuge alternative was not considered because of the additional cost and decreased flexibility when compared to Option 1 above.

4.1.3.1 Rotary Drum Thickener and Belt Filter Press

Adding a rotary drum thickener with a belt filter press would provide additional dedicated thickening capacity and allow for thickening and dewatering to occur simultaneously with piping modifications. Both the rotary drum

thickener and the belt filter press are low horsepower pieces of equipment so electrical upgrades would not be needed or they would be relatively small.

Advantages

- Dedicated thickener and dewatering units
- Ability to thicken and dewater at the same time with piping modifications

Disadvantages

- Minimal additional dewatering capacity
- More space is utilized in existing building for similar capacities
- Small electrical upgrade may be needed

Preliminary Cost Estimate: \$2.8 million

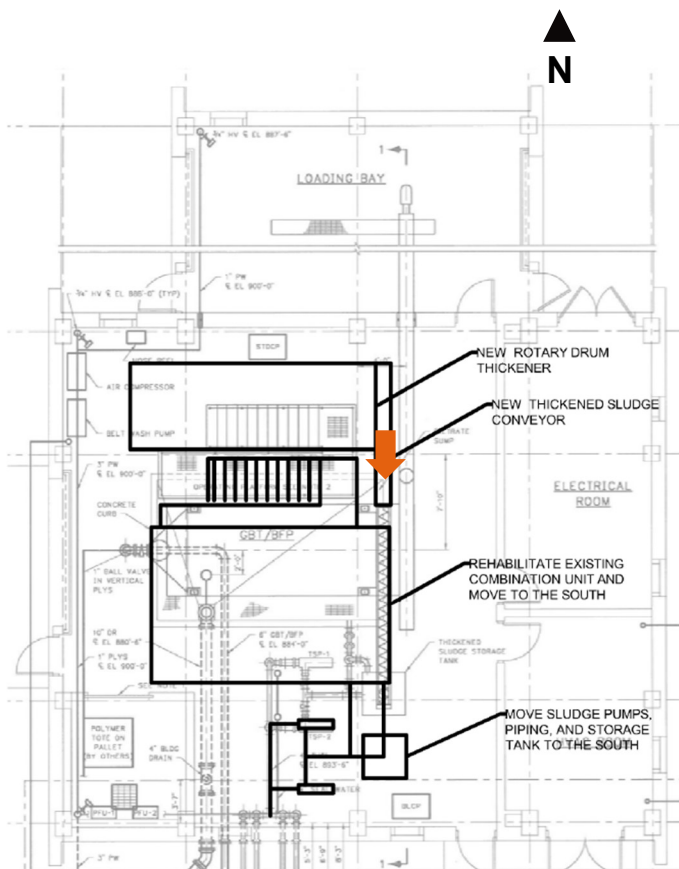


Figure 4-3 Layout of New Rotary Drum Thickener and Existing Unit

4.1.3.2 Rotary Drum Thickener with a Centrifuge

Replacing the existing combination unit with a rotary drum thickener and a centrifuge would provide dedicated equipment for both thickening and dewatering. The new pieces of equipment would be able to provide higher

capacities for thickening and dewatering because the filter technologies are more efficient within the existing footprint. The rotary drum thickener may require higher polymer usage for thickening. The centrifuge is a high horsepower piece of equipment so an electrical upgrade will be needed in the building and staff will need additional training on the new equipment.

Advantages

- Additional dewatering capacity
- Ability to thicken and dewater at the same time with piping modifications

Disadvantages

- Large electrical upgrade needed for the centrifuge
- Additional training needed for the new equipment
- Capital cost of the new equipment

Preliminary Cost Estimate: \$3.7 million

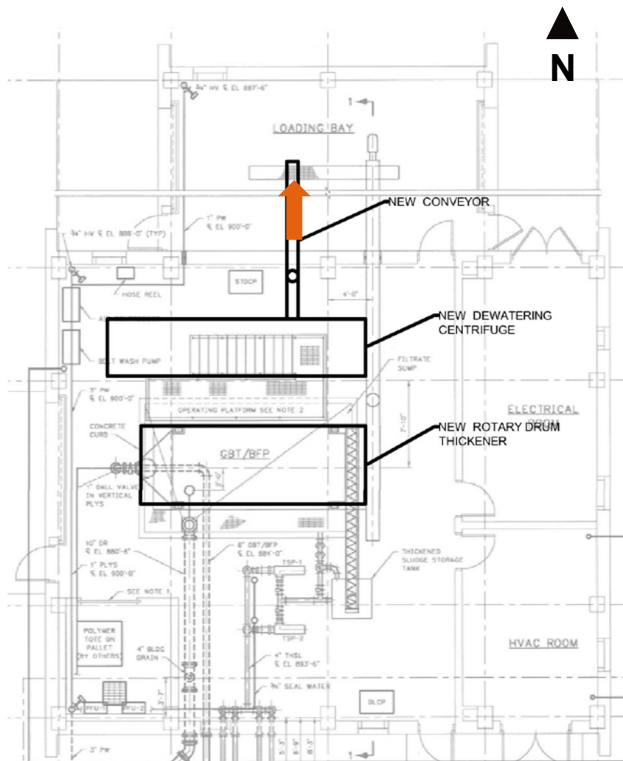


Figure 4-4 Layout of New Dewatering Centrifuge and New Rotary Drum Thickener

4.2 Solids Handling Improvements

The existing screw conveyor system cannot handle the solids generated when the existing dewatering unit is running at full capacity. The existing screw conveyor system is also 24 years old and is in need of replacement. A

replacement of all the conveyors in the thickener building is recommended with the previously discussed dewatering equipment alternatives. A small landscaping truck with a dump bed is used to haul sludge around the WWTP and shaking the bed to remove the sludge has caused damage to the truck in the past. The following table summarizes the solids handling improvement alternative costs.

Table 4-3 Sludge Handling Improvements Cost Summary

Alternative Description	Preliminary Cost Estimate
Option 1: Larger Conveyors and Newer Truck With Vibrating Bed	\$330,000
Option 2: Larger Conveyors and New Discharge Location for a Larger Truck With Vibrating Bed	\$700,000
Option 3: Larger Conveyors and New Discharge Location to a New Storage Pad	\$680,000

4.2.1 Option 1 – Larger Conveyors and Replace Solids Handling Truck with a Vibrating Bed

The existing screw conveyor system is undersized for the existing dewatering equipment. The conveyor cannot handle the volume of solids when the belt filter press is operating at full capacity. To accommodate this, it is recommended that the existing screw conveyors be replaced with a larger size screw conveyor. The existing conveyors are 10-inch diameter, and it is recommended that a 12-inch diameter conveyor be installed. A 14-inch or larger diameter conveyor may be recommended if additional dewatering equipment and capacity is added in the building using the same conveyor system. The specific conveyor size will be determined during detailed design.

The existing solids handling truck is a landscape truck with a hydraulic dump bed. The solids cake has been described as being sticky after dewatering and going through the screw conveyors. It has been sticking to the inside of trucks during transport. To dump the solids out of the truck, the bed is usually shaken which has damaged the hydraulics on the existing truck and has needed repairs in the past. It is recommended that the truck bed be replaced with a vibrating dump bed to help dump the sludge cake and not damage the hydraulics.

Advantages

- Increased solids transport capacity
- Vibrating truck bed will reduce sludge sticking to the truck bed

Disadvantages

- Truck capacity is not increased and will require the same number of trips as existing system

Preliminary Cost Estimate: \$330,000

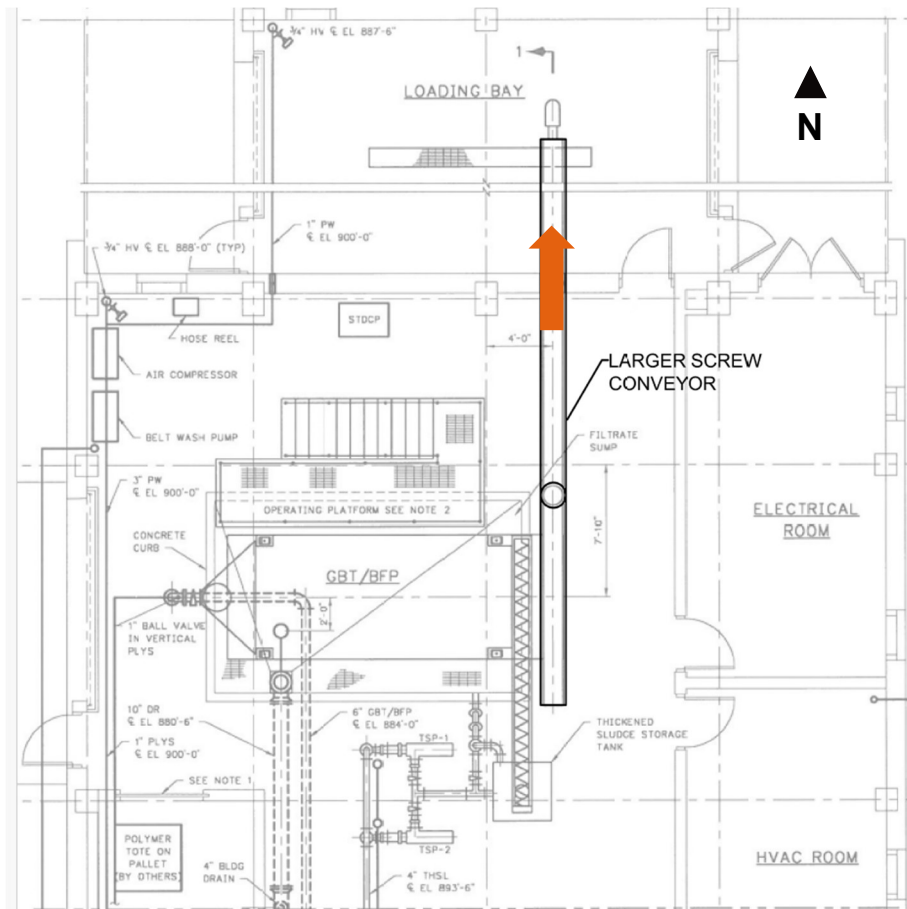


Figure 4-5 Layout of Larger Screw Conveyors

4.2.2 Option 2 – Larger Conveyors and Add a New Discharge Location for a Larger Truck with a Vibrating Bed

Replacing the existing conveyors with large conveyors is recommended to handle the full capacity of the existing dewatering equipment and possibly the additional solids from an additional dewatering unit. To handle the additional dewatering capacity and reduce the number of trips taken, a larger solids transporting truck with a vibrating bed can be used. The vibrating bed will be used to dump the dewatered cake because the cake currently has a tendency to stick to the bed of the existing truck. The existing loading bay is not large enough to accommodate a bigger truck so a new discharge location and driveway would be needed.

The screw conveyors can be reconfigured to discharge to the East of the building by routing the conveyor above a new ceiling of the electrical room as shown in

Figure 4-6. The discharge point would be higher than the existing to accommodate a larger truck and a new driveway would be needed as shown in **Figure 4-7**. The new truck could be a larger pickup with a larger dump bed or a dump truck. This alternative would help to accommodate the capacity of the existing dewatering equipment and accommodate an increase in dewatering capacity. The larger truck would also reduce the number

of trips and frequency of transporting the dewatered solids to the solids storage areas. The existing loading bay could be repurposed for storage or utilized to accommodate additional thickening or dewatering equipment.

Advantages

- Additional solids handling and trucking capacity
- Vibrating bed to help dump solids
- Additional truck capacity for reduced number of trips

Disadvantages

- Requires additional driveway near building for larger truck

Preliminary Cost Estimate: \$700,000

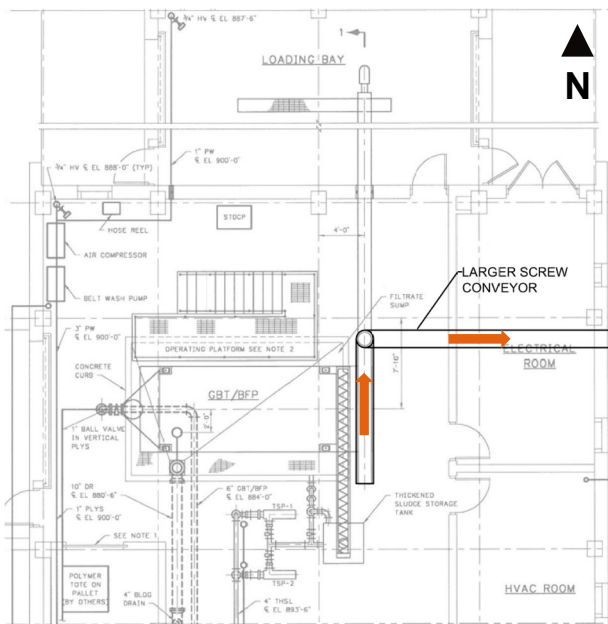


Figure 4-6 Layout of Screw Conveyors to Driveway

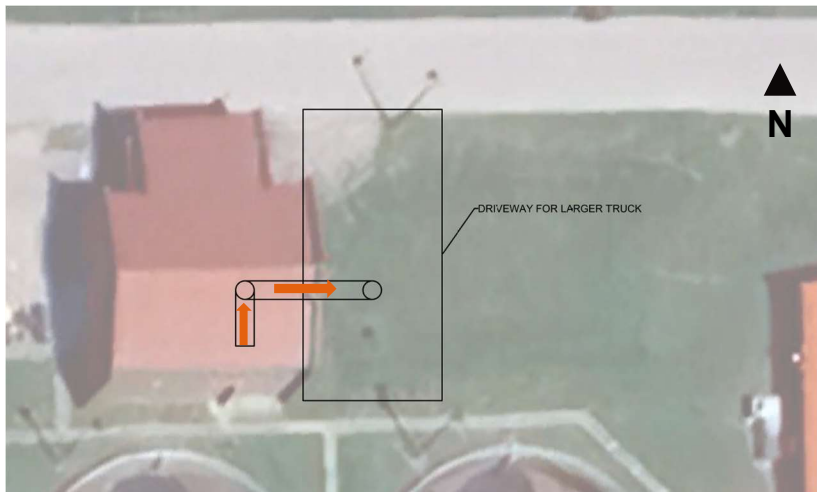


Figure 4-7 Site Layout of Screw Conveyors to Driveway

4.2.3 Option 3 – Larger Conveyors and Add a New Discharge Location to a Pad Next to Existing Building

Replacing the existing conveyors is recommended to increase the dewatering capacity. The screw conveyor layout can be rearranged to discharge out of the back of the building to a new sludge storage pad located to the east of the existing building. The discharge conveyor and pipe would have to be heat traced to prevent freezing in the winter months. This alternative would allow the dewatering equipment to run continuously and create a pile of dewatered cake on the sludge storage pad. A disadvantage of this alternative is that labor hours would be Required using the front-end loader and possibly a truck to move the sludge from the new pad to the other solids storage areas. There may not be a large savings in labor with this alternative, however, moving the sludge could be done all at once after many hours of dewatering and letting the solids pile as opposed to the current operation of transporting the solids multiple times during the dewatering process.

A ceiling will need to be constructed on top of the electrical room and the discharge piping will go above that ceiling. The pad dimensions are 60-feet by 60-feet. The pad will have a drain for any liquid that comes out of the sludge and rainwater that gets onto the pad. The pad should be covered with a covering high enough for a dump bed to be fully extended without hitting the covering. The existing conveyor route to the existing loading bay will still be operational to give the WWTP the flexibility to discharge to either location.

The discharge chute can be angled towards the front of the pad to have the ability to push solids towards the back when it begins to pile. This will also allow the option to back the truck into the pad and have the chute discharge directly into the truck. This alternative will also include a new truck with higher sides and a vibrating bed for hauling biosolids around the WWTP.

Advantages

- Additional solids handling capacity
- Dewatering can run continuously without dumping onto the loading bay floor because the solids can pile up on the pad

Disadvantages

- Space is required for the new pad near the existing building
- Similar amount of labor hours will be spent transporting solids as existing

Preliminary Cost Estimate: \$680,000

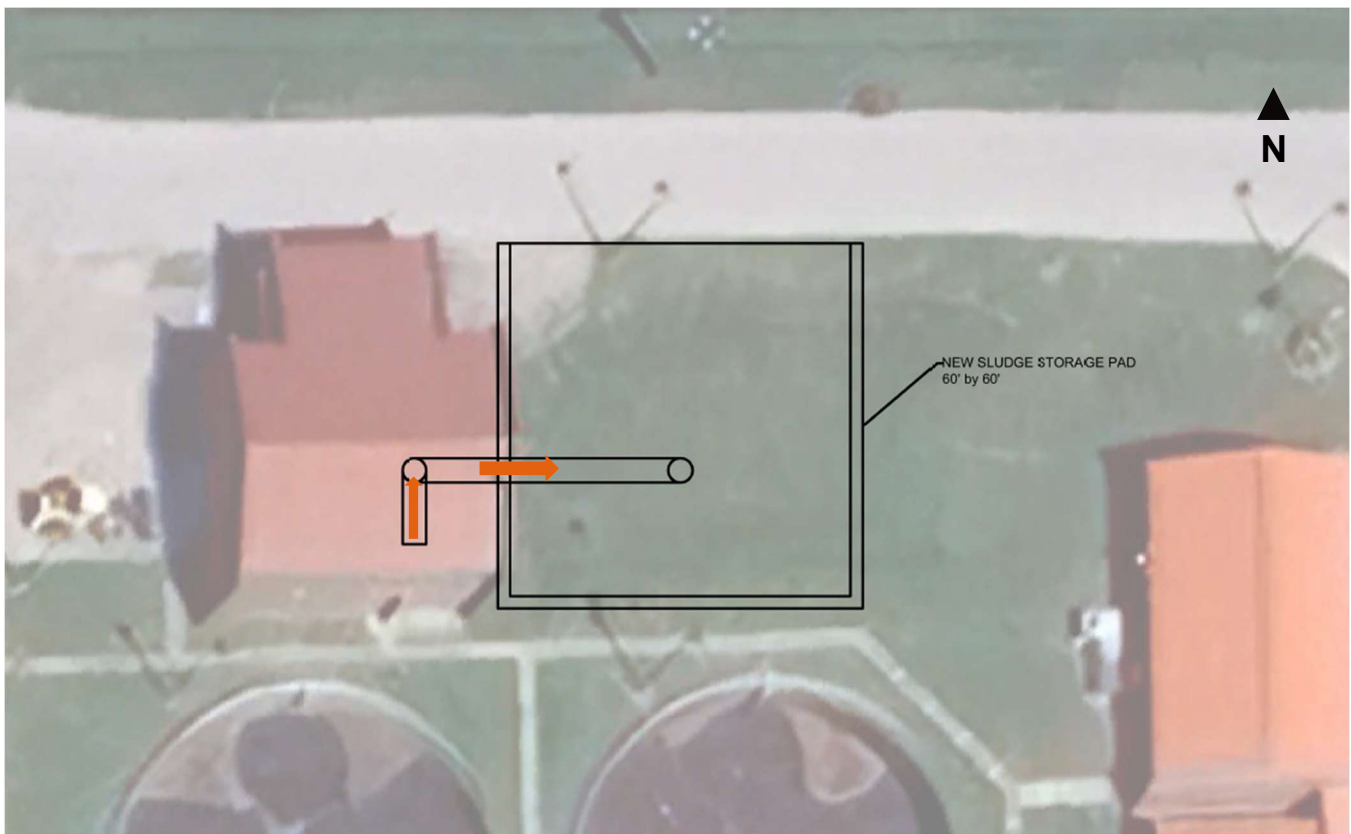


Figure 4-8 Layout of New Sludge Storage Pad

4.3 Tertiary Filter Improvements

The tertiary filters have experienced operational challenges including low capacity and significant maintenance. The existing capacity of the filters has resulted in the filter building flooding in the past when the WWTP has experienced high flows. To partially address this issue and prevent the building from flooding again, it is recommended to install larger sump pumps in the filter backwash wet well. It is also recommended to install electric actuators on the gates for the filter influent and the filter bypass. The electric actuator on the filter bypass gate will be connected to the SCADA system so the filters can be bypassed remotely during high flow events. These two improvements are discussed in the 'Improvement Projects Without Alternatives' section.

Table 4-4 Tertiary Filter Improvements Cost Summary

Alternative Description	Preliminary Cost Estimate
Option 1: Aqua Aerobic Disk Filter in place of 4th Filter	\$1.8 million
Option 2: 4th Evoqua Filter and Skid Mounted Chemical with Cleaning System	\$2.3 million
Option 3: Filter Disks with Larger Pore Sizes and Stainless-Steel panels	\$160,000

4.3.1 Option 1 – Aqua Aerobic Disk Filter

The Aqua Aerobic Mini Disk Filter would fit inside the footprint of the filter building where space was reserved for a future filter unit. The Aqua Aerobic filter units are smaller than the existing filters and two of them can be installed with a total capacity of 2 MGD (1 MGD each). The Mini Disk filters provide an alternative to the existing filter technology. The hydraulics in the existing building and configuration are not able to meet exactly what Aqua Aerobic recommends because the hydraulic head recommended for the Mini Disk Filter is higher than the head available. As a result of two filters being installed in the existing space in the building the influent and effluent piping would be complex and modifications would be needed to the existing space. Staff would also need to be trained on the new filter technology and the maintenance parts for the Mini Disk filter will be different than the parts for the existing filters. A layout of the Mini Disk filters is shown below on **Figure 4-9**.

Advantages

- Additional Filter Capacity
- Capital cost for the additional filter unit

Disadvantages

- Building was not design for this filter
- Two filter units required
- Less space in walkways around filters

Preliminary Cost Estimate: \$1.8 million

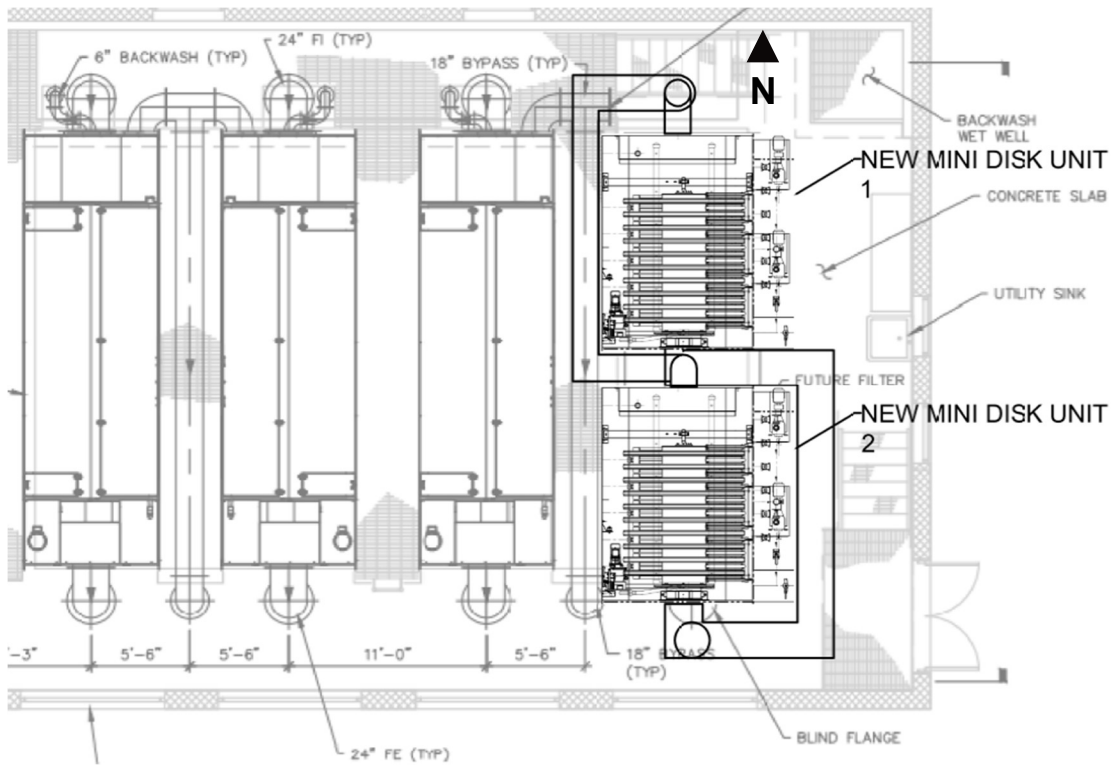


Figure 4-9 Layout of Filter Building with Mini Disks

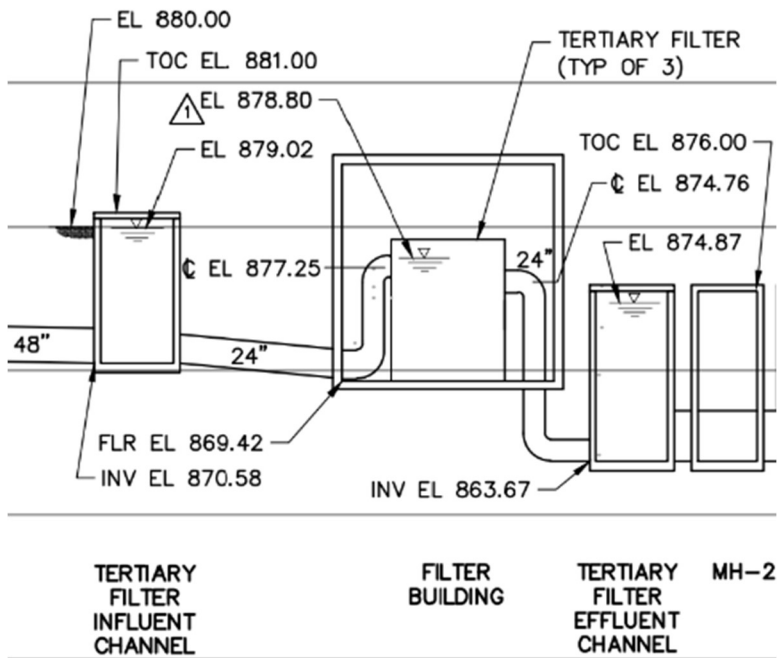


Figure 4-10 Hydraulic Profile of Filter Building

4.3.2 Option 2 – 4th Evoqua Filter and New Cleaning System

Adding a fourth Evoqua disk filter would provide additional filter capacity. There is an existing space in the filter building that was designed to accommodate a fourth Evoqua filter unit with the existing three units. This would minimize the construction costs when compared to adding a different type of filter. A fourth Evoqua unit would also provide easier operation and maintenance because WWTP staff are already familiar with the technology and parts could be used on all the filter units. A new cleaning system on a cart can also be used in the new Evoqua unit. This would help to address the algae and biological growth challenges experienced on the existing three filters.

Advantages

- Same equipment as existing for O&M
- Chemical cleaning system is included to reduce biofouling and labor associated with removing the biofouling
- Location was designed for this filter

Disadvantages

- New unit may have similar challenges to existing

Preliminary Cost Estimate: \$2.26 million



Figure 4-11 Existing Evoqua Filters

4.3.3 Option 3 – Disks With Larger Pore Sizes

The filter disk panels of the existing Evoqua units can be replaced with stainless steel mesh filter panels instead of the existing woven fabric media. The stainless steel mesh filter panels can be placed into the existing three filter units and a fourth unit if it is added. The stainless steel panels have been stated by the manufacturer to have

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increased flow through capacity when compared to the existing woven fabric media installed. This would increase the capacity of the filters. The stainless steel filter panels have also been stated to be more durable than the fabric panels, which have caused additional maintenance challenges when one panel has a tear. During detailed design, it should be evaluated if an automatic filter/strainer can be installed in the area of the backwash feed of the building to prevent the nozzles from clogging.

Stainless steel panels with larger pore sizes are also available. The existing panels have openings that are 10 microns. The stainless steel panels are available with 10 and 20 micron openings. The larger openings would provide higher capacity, but could potentially result in higher TSS levels additional maintenance if the additional material negatively affects the backwash nozzles. The 10-micron filter panels that are currently installed have been helping with phosphorus removal, and switching to a larger panel opening may decrease the effectiveness of the phosphorus removal. The replacement of these disks is independent of the additional filter units.

Advantages

- Potential increased filter throughput
- Low capital cost compared to other alternatives
- No modification beside filter panel replacement
- Steel panels are more durable

Disadvantages

- May have similar clogging challenges as existing fabric panels
- Larger pore sizes may allow more solids through and create nozzle issues

Preliminary Cost Estimate: \$160,000



Figure 4-12 Stainless Steel Filter Panels

4.4 Sludge Classes

Depending on the characteristics and treatment processes, WWTP solids are categorized into different sludge classes. These sludge classes determine where the biosolids can be disposed and what restrictions are placed

on them. Class A biosolids are highly treated and have few disposal restrictions or limits. Class B biosolids are treated less than Class A and have some restrictions on where and how they can be disposed. Biosolids that do not meet the requirements for Class B have the highest number of restrictions and the lowest disposal locations. The following tables summarize the cost of the sludge class alternatives.

Table 4-5 Sludge Classes Cost Summary

Alternative Description	Preliminary Cost Estimate
Option 1: Class B (Existing, Blending)	\$0
Option 2: Class B (Digested)	\$2.5 Million

The following table summarizes the SRF values with different digesters in operation. The Brownsburg WWTP currently operates 4 digesters during normal operation. A 5th digester is recommended if the plant treatment capacity increases.

Table 4-6 Calculated SRT Values with Different Amount of Digesters

Digesters	Existing Flows SRT	Future Flow SRT
4	19	11
5	24	13

4.4.1 Option 1 – Class B (Existing)

The existing solids treatment process meets the requirements for Class B biosolids through laboratory testing. The solids retention time (SRT) and the volatile solids reduction (VSR) are below what is typically considered class B. Most of the volatile solids reduction takes place in the oxidation ditches. The existing method of disposal for biosolids at the WWTP is using a third-party hauler that blends the solids. The third-party hauler accepts the biosolids, and they mix it with other material at their biosolid center. The biosolids can obtain the Class B designation with the current process through laboratory testing for fecal coliform. Laboratory testing for the Class B biosolids designation should be performed if other disposal methods are being evaluated or if an additional digester is being added to increase the SRT.

Advantages

- Low capital cost by continuing existing operations with existing equipment
- Ease of operation
- Existing operations

Disadvantages

- Dependent on hauler to accept biosolids that do not meet the SRT requirements for Class B

- Class B has restrictions for disposal and especially land application. Land application can only be done on certain areas and the biosolids cannot be stockpiled at the site. The biosolids also need to be incorporated into the soil in a specified time.

Preliminary Cost Estimate: \$0

4.4.2 Option 2 – Class B Digested

Modifications can be made to the current sludge treatment process to increase the SRT and VSR of the digesters. The physical modifications would be in the form of an additional aerobic digester to provide more digester volume. The additional digester would provide additional treatment capacity for the future and provide the digester volume needed for a higher SRT. WWTP operations may also be modified to gain the maximum SRT and aeration time in the digesters. The VSR may also be raised to the Class B requirement with the additional digester volume. The oxidations ditches already provide a reduction in volatile solids so the VSR in the digester is low and difficult to further remove volatile solids. The pathogen reduction needed to meet Class B sludge requirements can be proven through additional laboratory testing.

Class B characterized biosolids can be beneficial when looking at other forms of solids disposal such as land application. The WWTP previously gave the biosolids to local farmers for land application, but this operation has stopped. There are concerns from local farmers about odor complaints from neighbors after the land application and there are also concerns with the Per- and Polyfluoroalkyl substances (PFAS) levels potentially contained in the biosolids.

There is space available for an additional aerobic digester to be located south of Sludge Storage Tank No. 2 and west of the stormwater pond. The location of the additional digester tank is shown below on **Figure 4-13**.

Advantages

- Less restrictions for disposal of the biosolids and for land application. The biosolids can be stockpiled at the application site for longer and do not have to be incorporated into the soil as quickly.

Disadvantages

- Capital cost of the additional aerobic digester
- May have to modify existing operations

Preliminary Cost Estimate: \$2.5 million



Figure 4-13 Layout of Additional Digester

4.5 Digester Type

The existing sludge digestion system at the WWTP is aerobic and consists of 4 tanks that have a diameter of 70 feet and a side water depth of 15 feet. After digestion, the sludge is dewatered in the belt filter press and stored in the drying pads or covered storage area. The sludge is then hauled offsite to the third-party hauler’s biosolid center where it is mixed with other material, and they do not require all of the Class B sludge criteria to be met.

Table 4-7 Digester Type Cost Summary

Alternative Description	Preliminary Cost Estimate
Option 1: Aerobic Digestion	\$2.5 million
Option 2: Anaerobic Digestion	\$14 million

4.5.1 Option 1 – Aerobic Digestion

Aerobic digestion is the existing digester type used at the WWTP. Aerobic digesters have the advantage of requiring less equipment and capital cost when compared to an anaerobic digester. Aerobic digesters can also be easier to operate than other digester types. Aerobic digestion is generally preferred for smaller WWTPs (under 10 MGD) because aerobic digestion systems require a relatively large tank volume compared to the amount of sludge produced. Aerobic digesters are open to the air which have the potential to have odor challenges and it does not allow for methane capture. During detailed design, the TWAS piping will have to be evaluated. The plant has stated challenges with pumping TWAS into the two southern digesters which are furthest from the Thickening

Building. The TWAS gets stuck in the line and cannot be pumped. The proposed location of the additional digester is south of Sludge Storage Tank No. 2 and west of the stormwater pond, thereby exacerbating the pumping issues currently observed by plant staff.

Advantages

- Continues existing operations with aerobic digestion
- Capital cost of adding an additional aerobic digester

Disadvantages

- Requires a lot of volume if flows get above 5 MGD

Preliminary Cost Estimate: \$2.5 million



Figure 4-14 Inside of an Aerobic Digester

4.5.2 Option 2 – Anaerobic Digestion

Anaerobic digestion has a larger capital cost and needs more equipment and structural components than an aerobic digester. They can also be more difficult to operate. Anaerobic digesters are generally used at larger WWTPs (above 10 MGD) because they can treat a larger volume of sludge in the same footprint as an aerobic digester. Anaerobic digesters are enclosed structures so they have less of a potential for odor issues and can be easier to control the odor. The enclosures also allow for methane capture which can be used onsite for heating or

power generation. An estimate of the potential cost of replacing the existing digesters with anaerobic digesters is \$14 million (Including two new covered digesters, gas collection system, and gas engine). The payback period would be relatively long, and the methane would generate only a small amount of electricity because of the low flow going to the digester.

Advantages

- Methane generation and capture
- Power generation using the gas collected and burned in an engine
- More advantageous if flows increase beyond 5 MGD

Disadvantages

- High capital cost for the new aerobic digesters

Preliminary Cost Estimate: \$14 million



Figure 4-15 Anaerobic Digester Example

4.6 Onsite Power Generation

The existing power system has two feeds from two separate substations. If power is lost from one feed, then power could be obtained from the other feed. Having two feeds is required to make the WWTP power resilient during storms and power outages. To further improve this resiliency, on-site power generation can be added to decrease the dependency on the power plant feeds and potentially lower the of energy imported. The feasibility of solar power generation at the WWTP is being evaluated by others and is not discussed in this document. The following table summarizes the onsite power generation alternative costs.

Table 4-8 Onsite Power Generation Cost Summary

Alternative Description	Preliminary Cost Estimate
Option 1: Hydropower	\$50,000
Option 2: Diesel Generator	\$2.2 million
Option 3: Natural Gas Generator	\$ 2.7 million

4.6.1 Option 1 – Hydro Power

There are not many areas on the WWTP site that would accommodate a hydropower generation unit. The largest hydraulic potential is in the plant effluent pipe, which conveys flow over cascade aerators before discharging to the plant outfall. To not adversely affect the WWTP hydraulics or the cascade aeration system, a hydropower generation unit would have to be installed on the steps of the cascade aerator. Each one of these steps is relatively small and would not provide much power making the use of hydropower generation unfeasible. The wastewater flow is also pumped throughout the WWTP systems and sanitary sewer lift stations, and the power generated from a hydropower unit would be small compared to these loads.

A bypass pipe can be installed around the cascade aerators with a turbine installed in the pipe. This would potentially reduce the dissolved oxygen in the effluent and cause permit challenges. There is 9 feet of total drop at the cascade aerators, where a small hydropower turbine would be able to work. There is a total drop of 19 feet between the manhole before the cascade aerator and the effluent junction box. This would require a long section of bypass piping to divert flow around both cascade aerators. The total energy available would depend on how much effluent could be diverted to this bypass. A 1 kW hydropower system may be feasible on the bypass pipe, but this would not be able to power many processes on site and would have less overall capacity and a higher cost than a small solar panel system.

Advantages

- On site power generation for some lights on site
- Green technology
- Small footprint

Disadvantages

- Reduced dissolved oxygen in effluent
- Low power production capacity
- Less efficient and higher cost than solar

Preliminary Cost Estimate: \$50,000



Figure 4-16 Hydropower Turbine

4.6.2 Option 2 – Diesel Generator

An on-site generator would improve the resiliency of the WWTP's power system during power outages or extreme weather. The generator needs to power all the critical process equipment in a power outage. At a minimum, this should include the equipment associated with 4 oxidation ditches, all aerators, the UV system, and the RAS pumps. This equipment needs an estimated 750 kW generator.

A diesel generator is easy to use, and diesel fuel can be delivered to the WWTP. A reserve of diesel will have to be stored for the generator and the fuel can also go bad over time if it is not used. There is also the issue of diesel availability if the fuel cannot be transported to the site in the event of a snow or ice storm. The diesel generator is the most common and slightly cheaper option when compared to natural gas generators.

Advantages

- On site power production to improve resiliency in a power outage
- Independent from power feeds

Disadvantages

- High capital cost of the generator
- Fuel storage on site

Preliminary Cost Estimate: \$2.2 million

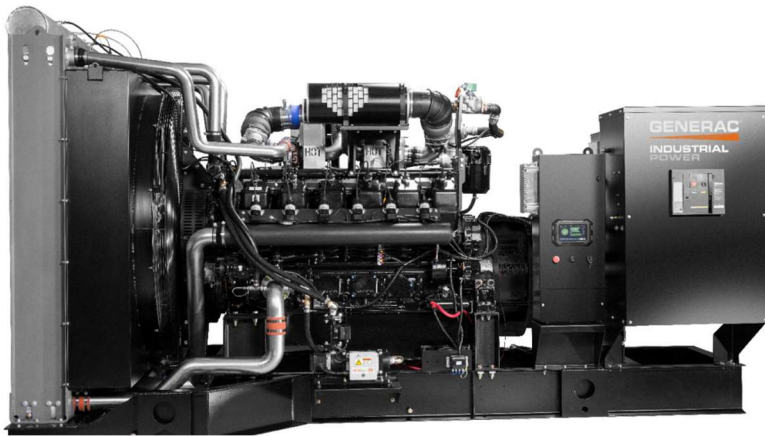


Figure 4-17 Diesel Generator

4.6.3 Option 3 – Natural Gas Generator

Another fuel source for the onsite generator is natural gas. In a power outage the natural gas network is still online with a constant supply of fuel. There is also no need for onsite fuel storage for natural gas because of the existing natural gas pipeline. Depending on the cost of the electricity to the plant, there is an opportunity to generate cheaper electricity using the generator if natural gas is cheaper than electricity at peak times. The natural gas generator has a higher capital cost but lower operation and maintenance cost because of the simplified fuel storage and delivery system. During design, the capacity of the existing natural gas line to the plant needs to be evaluated to confirm whether there is enough capacity to run the natural gas generator using the existing natural gas utility line.

Advantages

- On-site power production to improve resiliency in a power outage
- Independent from power feeds

Disadvantages

- High capital cost for the generator

Preliminary Cost Estimate: \$2.7 million

4.7 Total Nitrogen Removal Evaluation

It is anticipated that the Brownsburg WWTP will eventually receive future effluent permit limits for total nitrogen (TN), in addition to the nutrient limits already in place for effluent ammonia and total phosphorus. The WWTP is currently required to sample for effluent total nitrogen concentrations as part of the most recent NPDES permit. Alternatives were evaluated using an updated treatment process model for meeting an assumed future effluent monthly average TN concentration limit of 10 mg/L.

The following process model scenarios were evaluated to determine the ability to meet a future TN limit.

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- Baseline: Current operations with entirely aerobic, “high DO” oxidation ditch operations for nitrification only with a dissolved oxygen (DO) concentration of 2 mg/L or greater.
- Option 1: Operate the oxidation ditches at “low DO” concentrations around 0.2 to 0.3 mg/L to facilitate simultaneous nitrification and denitrification.
 - Evaluated with and without supplemental carbon addition.
- Option 2: Add anoxic volume upstream of the oxidation ditches:
 - Evaluated with and without supplemental carbon addition.
 - Evaluated with and without additional internal mixed liquor recycle (IMLR) pumping between the oxidation ditch and anoxic zone.
- Option 3: Add new unit treatment process between the secondary clarifier effluent and the tertiary filter influent for tertiary denitrification:
 - Process technologies considered include deep-bed denitrification filters, biologically aerated filters (BAFs), and moving bed bioreactors (MBBRs).
 - Note that tertiary denitrification for this alternative will require supplemental carbon addition. The type of carbon added is a function of the process technology being considered.
 - All nitrification is assumed to be completed in the oxidation ditches upstream.

A biological process model utilizing the EnviroSim BioWin v.6.2 software package was developed to simulate Options 1 and 2 and see what levels of TN removal are achievable for each scenario. The following figure shows the process model developed in BioWin to evaluate the alternatives.

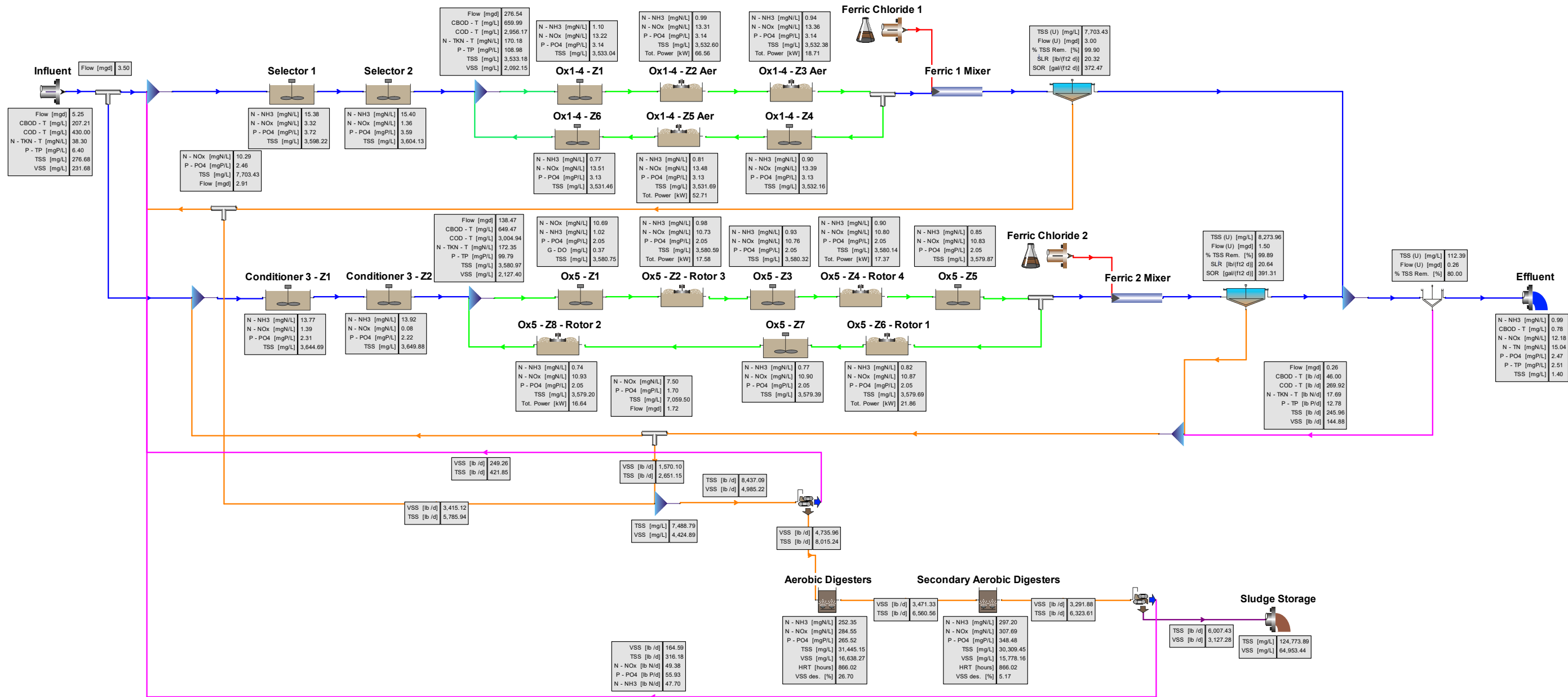


Figure 4-18 BioWin Process Model

The process model from the most recent plant expansion was calibrated to the latest two years (7/1/2021 through 6/30/2023) of plant operating data that the Town provided as part of their MRO records. Influent CBOD₅, TSS, ammonia, and TP design concentrations for the process model were determined based on this historical data, then prorated from the current average daily flow (ADF) of around 2.74 MGD up to the design ADF of 5.25 MGD. The following table provides a summary of the current data and prorated design conditions utilized for this evaluation.

Table 4-9 Process Model Influent Parameters

Parameter	Units	Raw Influent	
		Current Average Day (7/1/2021 – 6/30/2023)	Design Average Day
Flow	MGD	2.74	5.25
CBOD ₅	mg/L	210	210
	lbs/d	4,800	9,100
TSS	mg/L	280	280
	lbs/d	6,400	12,300
Ammonia	mg/L N	25.4	25.4
	lbs/d	580	1,120
TP	mg/L P	6.6	6.6
	lbs/d	150	280
Temperature, Minimum	deg. C	10	10
Assumed Influent Fractions			
COD:CBOD ₅ ratio	-	2.05	2.05
VSS:TSS ratio	-	0.84	0.84
Ammonia:TKN ratio	-	0.67	0.67

Based on the historical data provided, it was assumed that around 2 mg/L of total nitrogen in the influent is recalcitrant and cannot be practically removed without advanced water treatment processes (i.e. ultrafiltration plus reverse osmosis, etc.) not typically implemented outside of water reuse projects. Recalcitrant compounds are both soluble (i.e. not settleable or filterable) and inert (i.e. not biologically available), effectively making them untouchable for the purposes of this evaluation. To achieve an effluent TN limit of 10 mg/L reliably, the following nitrogen species concentrations in the effluent were targeted.

- Effluent ammonia: ≤ 1 mg/L N.
- Effluent nitrites and nitrates: ≤ 7 mg/L N.

Supplemental carbon will be required to drive denitrification for alternatives where the effluent nitrite and nitrate targets cannot be achieved otherwise. For the purposes of this evaluation, it was assumed that any supplemental carbon fed to secondary treatment will be in the form of glycerin. Unlike other carbon sources such as methanol, glycerin is not flammable and does not require continuous feed to sustain specific microorganisms that utilize methanol as a food source, called methylotrophs. Glycerin is more flexible and can be fed on an as-needed basis. The downside to glycerin, and generally other less hazardous carbon sources, is that they are more expensive

than methanol. To create low DO conditions in the oxidation ditches, VFDs will need to be added to the oxidation ditch rotor motors.

The table below provides a summary of the process modeling results for Options 1 and 2.

Table 4-10 Process Model Results

Alternative	High DO or Low DO?	Additional Anoxic Volume (MG, % added)	IMLR Pumping Rate (MGD, % of influent flow)	Glycerin Feed Flow (gpd)	Effluent Concentration (mg/L as N)			
					CBOD ₅	Ammonia	Nitrite + Nitrate	Total Nitrogen
Baseline	High DO	0	0	0	1.1	0.5	17.5	20.0
1	Low DO	0	0	n/a	0.8	1.0	12.2	15.0
	Low DO	0	0	650	0.7	1.3	5.7	8.9
2	High DO	0.60, +12%	0	0	1.1	0.5	14.3	16.8
	High DO	0.60, +12%	13.1, 250% of influent	0	1.1	0.5	11.1	13.6
	High DO	0.60, +12%	13.1, 250% of influent	200	1.0	0.5	6.5	9.0
	Low DO	0.60, +12%	13.1, 250% of influent	0	0.8	1.0	6.2	9.1
	Low DO	0.60, +12%	13.1, 250% of influent	200	0.8	1.1	4.3	7.2

Based on these results, Option 2 (adding anoxic volume upstream of the oxidation ditches) is the more viable alternative moving forward for achieving an effluent TN limit of 10 mg/L. The total additional anoxic volume included in the modeling scenarios was two 0.1-MG anoxic zones upstream of Oxidation Ditch No. 1 and No. 2, Oxidation Ditch No. 3 and No. 4, and Oxidation Ditch No. 5. Option 1 (operating existing ditches with low DO) can provide adequate total nitrogen removal, but the supplemental carbon feed rate is high and would present a high operating cost. Operating the oxidation ditches at low DO conditions without supplemental carbon feed helps lower effluent TN compared to high DO conditions, but not sufficiently enough to achieve the effluent TN target required.

Option 2 is optimized when the additional anoxic volume is combined with IMLR pumping between the oxidation ditches and the additional anoxic volume combined with low DO operations in the oxidation ditches. There is minimal benefit associated with adding the additional anoxic volume if IMLR pumping is not incorporated given

there is sufficient volume in the existing selector zones to denitrify the nitrite and nitrates present in the RAS. IMLR pumping increases the nitrite and nitrate load available that can be denitrified utilizing the plant's influent carbon/CBOD5. High DO operations could be continued moving forward, but it would likely require supplemental carbon feed to the additional anoxic volume to meet the effluent TN target required.

The main assumptions used in this total nitrogen removal process model evaluation include:

- All tanks and equipment in service.
- Equal flow split between tanks in service.
- Operating solids retention time (SRT) target: ≥ 15 days for extended aeration.
- Alum addition for chemical TP removal: 240 gpd to mixed liquor.
- Tertiary Filtration:
 - 80% solids capture.
 - 5% backwash flow fraction.
- Solids Handling:
 - Combination gravity belt thickener (GBT) and belt filter press (BFP) solids capture is assumed to be 95%.
 - Combination GBT and BFP is assumed to have sufficient capacity for design average day conditions.
 - All aerobic digester and aerobic solids storage tank volume is in service.
- Plant Recycle Streams:
 - Tertiary filter backwash is returned only to Oxidation Ditch No. 5 via its dedicated RAS/WAS pump station.
 - Solids handling recycles, such as GBT and BFP filtrate, are returned to Oxidation Ditch Nos. 1 through 4.
- Sludge volume index (SVI) of 150 mL/g used, as was used for model calibration.
- RAS/WAS:
 - RAS Flow: 4.5 MGD, or 86% of design influent flow.
 - TSS Concentration Target: $\leq 9,000$ mg/L.
 - Equal RAS split between all oxidation ditches in service.
- All runs were performed at the recorded minimum 30-day average wastewater temperature of 10 degrees C, in consideration of the temperature sensitivity of nitrification. The model was run at a minimum month wastewater temperature of 10 deg. C, which is inherently a winter condition and challenging for nitrification, for a conservative approach. The model results provided should be compared to the Town's winter ammonia limit of 2.2 mg/L, not the summer limit of 1.5 mg/L. During summer conditions, the effluent ammonia concentrations are generally around 0.3-0.5 mg/L, or around 0.5-0.8 mg/L lower than the winter values. Summer conditions are less challenging for nitrification in general.
- Equal RAS flow split to aeration tanks in service; model assumes even RAS distribution between aeration tanks.
- Target final clarifier solids loading rates of ≤ 20 lbs/d/sf at design average

The estimated alternative costs didn't include a cost associated with the carbon addition alternatives, simply noting that the alternatives with carbon addition would cost more. The estimated capital cost to implement Option 2 is about \$3.0 million to add the additional anoxic volume and internal mixed liquor recycle system. It was assumed that the existing oxidation ditches can operate at low DO concentrations and additional capital cost is

not required to implement Option 1. The following summarizes the advantages and disadvantages of Option 1 and Option 2.

Option 1 – Low DO Operations Advantages:

- Low capital cost
- Uses existing equipment and only requires modifications to existing operations

Option 1 – Low DO Operations Disadvantages:

- Cannot achieve low TN concentrations below 10 mg/l without carbon addition
- Requires operating ditches at very low DO concentrations which will affect BOD and ammonia removal; based on the model results, the effluent concentrations are still below the permit limits

Option 2 – Additional Anoxic Volume and Internal Mixed Liquor Recycle System Advantages:

- Can achieve low TN concentrations below 10 mg/l without carbon addition
- Uses existing equipment and tankage without adding a new treatment process

Option 2 – Additional Anoxic Volume and Internal Mixed Liquor Recycle System Disadvantages:

- Higher capital cost than Option 1
- Footprint for additional anoxic volume will limit access to existing facilities
- Requires operating ditches at very low DO concentrations which will affect BOD and ammonia removal; based on the model results, the effluent concentrations are still below the permit limits

4.7.1 Option 3 – New Nitrogen Treatment Process

Option 3 for total nitrogen removal includes adding a new tertiary treatment process. The facility is expecting a future total nitrogen limit of 10 mg/l to go into effect in the future. The new denitrification system will be located downstream of the final clarifiers and upstream of the UV disinfection system.

Most of the possible alternatives for adding a total nitrogen treatment polishing step after the oxidation ditch treatment process will require further evaluation of the treatment technology's hydraulic head requirements after the total nitrogen treatment technology is selected to confirm the technology can operate within the existing hydraulic head conditions. The new treatment process could require an intermediate pump station to provide adequate hydraulic head. There is approximately 2.4 feet of hydraulic head between the effluent control structure and the tertiary filter influent channel. The cost for a future intermediate pump station was not included in this evaluation. The denitrification filter technology recommends a design headloss of 48-inches which is more than the total hydraulic head available.

Some of the potential denitrification technologies that could be added for total nitrogen treatment are:

- Moving bed biofilm reactor
- Denitrification filter
- Denitrification BAF process

The preliminary cost estimate to add a total nitrogen treatment process without assuming a new intermediate pump station is \$6 million.

The following bullets summarize the advantages and disadvantages of Option 3.

Option 3 – New Nitrogen Treatment Process Advantages:

- Can achieve low TN concentrations below 10 mg/l without carbon addition

Option 3 – New Nitrogen Treatment Process Disadvantages:

- Higher capital cost than Options 1 and 2
- Likely requires an intermediate pump station because sufficient hydraulic head between clarifiers and UV disinfection does not exist
- Requires adding a new treatment process and additional waste stream

5 Improvement Projects Without Alternatives

Some of the improvement projects at the Brownsburg WWTP do not have alternatives because they are replacing aging equipment in-kind, addressing known operations and maintenance needs or they are smaller projects without other feasible alternatives. A list of these projects is shown below, and descriptions of the projects are located in the following sections.

- Oxidation Ditch Rehabilitation
- Secondary Clarifier No. 1 Rehabilitation
- UV Control Panel Improvements
- Light Pole Rehabilitation
- Perimeter Fence Rehabilitation
- Parts and Vehicle Storage Expansion
- Septage Receiving Station Addition
- Filter Influent and Bypass Gate Actuator Addition
- RAS Pump Maintenance Improvements
- East Plant Pump VFD Replacement
- Odor Control Improvements
- Grit Removal at WWTP Addition
- Plant Water Screening Improvements
- Replace Filter PLC Control Panel
- Larger Backwash Sump Pumps
- Junction Chamber Coating
- Blower Improvements
- Digestion Diffuser Upgrades
- Solids Storage Improvements
- Pump Replacement
- Additional Treatment Capacity

Table 5-1 Improvement Projects Without Alternatives Cost Summary

Improvement Projects Without Alternatives Cost Summary	
Project Description	Preliminary Cost Estimate
Oxidation Ditch Rehabilitation	\$2.3 million
Secondary Clarifier No. 1 Rehabilitation	\$1.3 million
UV Control Panel Improvements	\$30,000
Light Pole Rehabilitation	\$80,000
Perimeter Fence Rehabilitation	\$110,000
Parts and Vehicle Storage Expansion	\$1.6 million
Septage Receiving Station Addition	\$1.0 million
Filter Influent and Bypass Gate Actuator Addition	\$130,000
RAS Pump Maintenance Improvements	\$890,000
East Plant Pump VFD Replacement	\$40,000
Odor Control Improvements	\$90,000
Plant Water Screening Improvements	\$70,000
Replace Filter PLC Control Panel	\$90,000
Larger Backwash Sump Pumps	\$50,000
Junction Chamber Coating	\$100,000
Blower Improvements	\$1.8 million
Digestion Diffuser Upgrades	\$320,000
Solids Storage Improvements	\$2.4 million
Additional Treatment Capacity	\$17.9 million

5.1 Oxidation Ditch Rehabilitation

The existing equipment in Oxidation Ditch Nos. 3 and 4 is aging and in need of rehabilitation. The equipment is nearing the end of its service life and showing signs of wear and corrosion that need to be addressed to continue reliable treatment service. This improvement project will replace the oxidation ditch equipment including the

rotors, control baffles, plate weirs, motors, and add rotor covers. The WWTP has recently rehabilitated another one of the oxidation ditches by replacing the equipment and this project will be of a similar scope for these oxidation ditches. Adding the rotor covers will help prevent splashing and misting in the winter to reduce the amount of ice around the rotors. The structure of the oxidation ditches appear to be in good condition and replacing the equipment will extend the service life of the oxidation ditches.

Advantages

- Extends service life of oxidation ditch structure by replacing the internal components
- Replace equipment at the end of service life

Disadvantages

- Capital cost of the oxidation ditch equipment

Preliminary Cost Estimate: \$2.3 million



Figure 5-1 Existing Oxidation Ditch 3

5.2 Secondary Clarifier No. 1 Rehabilitation

The existing equipment in Secondary Clarifier No. 1 was installed in 1987 and is at the end of service life. While the equipment is still operable, it is nearing the end of service life and showing signs of corrosion. This

improvement project will replace this equipment including the center column, center cage and rake arms, skimmer and scum box assembly, bridge and platform, and the drive unit. The structural components of the clarifier appear to be in good condition and will be inspected further as part of the project. Replacing the internal equipment of the clarifier will extend the service life of the unit and improve reliability.

Advantages

- Extends service life of clarifier structure by replacing the internal components
- Replace equipment at the end of service life

Disadvantages

- Capital cost of replacing the equipment in the clarifier

Preliminary Cost Estimate: \$1.3 million



Figure 5-2 Existing Secondary Clarifier No. 1

5.3 UV Control Panel Improvements

The existing UV control panel is located outside west of the UV disinfection channels. There is a small hood around the display HMI of the control panel to prevent sun glare. The hood does not sufficiently keep sunlight off the screen, which can cause glare and make it challenging for WWTP staff to operate the UV disinfection system. The control panel is also located outside, exposing staff to wet weather during panel operation. This improvement project will add a more substantial covering to the existing panel in its current location. The recommended improvement will reduce or remove the sun glare on the screen face of the panel. A new canopy above the UV control panel is recommended to both reduce staff exposure to weather during panel operation and to eliminate the sun glare on the panel display.

Advantages

- Reduces glare on the UV control panel
- Improves the operability of the UV system

Disadvantages

- Capital cost of the additional canopy

Preliminary Cost Estimate: \$30,000



Figure 5-3 Existing UV Control Panel



Figure 5-4 Existing UV Canopy

5.4 Light Pole Rehabilitation

Some of the existing light poles are not working and the lights do not turn on. This improvement project would repair the light poles to return them to operable condition and reuse the poles themselves. The lights that are not working need replacement, including some of the wiring. WWTP staff investigated the poles while trying to repair them and found some of the wiring to be loose cables underground. Any wiring in need of replacement will be routed through conduit before being placed underground. The last WWTP expansion replaced some of the outdoor lighting with LEDs and this repair work will replace the lights that are not working with similar LED systems.

Advantages

- Improved lighting around the facility by repairing lights that are out of service
- Replace lights that are not functioning

Disadvantages

- Capital cost of repairing the lights and wiring
- May have to replace wiring under the road that is not inside of conduit. This may require cutting and patching sections of the plant drive

Preliminary Cost Estimate: \$80,000

5.5 Perimeter Fence Rehabilitation

The perimeter fence is aging and is starting to show signs of wear. To prevent further corrosion, a protective coating can be applied to the entire perimeter fence. This coating will extend the service life of the fence and also improve the appearance and safety of the fence. The product recommended by a painting contractor is PPG:Pitt-Tech Plus EP DTM - Acrylic Enamel:Satin. This is a rust and mildew resistant coating used in commercial and industrial applications. The contractor stated that the coating will be applied directly to the metal fencing with two coats after pressure washing to clean the surface. The coating color will be chosen during design.

Advantages

- Extend the service life of the fence by providing surface protections to reduce future corrosion
- Improve the fence aesthetic by painting it a neutral color instead of the rusted metal

Disadvantages

- Capital cost of the fence coating. The cost of coating the fence is less than the cost of replacing the fence

Preliminary Cost Estimate: \$110,000

5.6 Parts and Vehicle Storage Expansion

WWTP staff have mentioned a need for additional parts and vehicle storage. One of the main vehicle and parts storage buildings (Building E) is 65 feet by 65 feet and is located near the southwest corner of the property. An additional 65 feet by 65 feet building can be constructed along the southern edge of the property near the existing storage buildings. The new building could utilize the existing driveway in that area and be built west of the stormwater pond. The building included in the estimate is masonry block which was chosen for its durable construction and to improve heating costs. The project team talked with a structural expert who explained that there is only a small cost savings between masonry block and steel pre-engineered building after they are fully furnished. This is due to the electrical, plumbing, and HVAC costs being the same for both buildings. The durability and benefits of the masonry block building may outweigh the capital cost savings of a pre-engineered steel building.

Advantages

- Additional vehicle storage to reduce the existing practice of shuffling vehicles in and out of the facility
- Additional parts and equipment storage from the additional space

Disadvantages

- Capital cost of the additional building
- Uses available space at the WWTP that can otherwise be used for process equipment or another use in the future

Preliminary Cost Estimate: \$1.6 million



Figure 5-5 Layout of Parts and Vehicle Storage Building

5.7 Septage Receiving Station Addition

This project includes adding a septage receiving station to receive septage from the community. The WWTP does not currently accept septage from septage haulers and this would be a new system with unknown implications to the treatment process. There is demand in the community for the WWTP to receive septage, as well as potentially landfill leachate from nearby landfills. There is a growing concern about PFAS, and other contaminants contained in landfill leachate, so accepting this waste stream will require additional evaluation and selection. PFAS can be found in both the biosolids and the treated wastewater that is sent to the receiving stream. This additional PFAS concentration can cause regulatory issues in the future for the WWTP. There is a lower risk of PFAS from accepting other septage waste. Adding a septage receiving station would also give the WWTP a revenue stream that otherwise would not be available. This revenue stream would likely have a short payback period for the cost of adding the septage receiving equipment depending on the septage haulers in the area. There are also automated systems available for billing and receiving to reduce the staff hours that would be dedicated to the new process. Additional labor will be required of plant staff to sample each load of septage and operate the system. Discussions with other WWTPs that receive septage show that a daily composite sample is required to test the receiving station contents for %TS and %VS.

Advantages

- Added revenue stream from the tipping fee, which will pay for the cost of the septage receiving equipment

Disadvantages

- Additional volume from the septage received by the WWTP that would have otherwise been sent somewhere else
- Potentially additional contaminants, including PFAS and other concentrated wastes, that may be sent to the receiving station
- Additional labor to operate the septage receiving station and to monitor the additional traffic on site

Preliminary Cost Estimate: \$1.0 million



Figure 5-6 Proposed Septage Receiving Station

5.8 Filter Influent and Bypass Gate Actuator Addition

The existing gates for the tertiary filter influent and the filter bypass are manually operated. The WWTP has experienced issues with gate operations in the past especially during wet weather events. The bypass gate cannot be opened fast enough, and this is especially a challenge when the increased flows occur outside of normal staff hours. This project would add electric actuators to all the filter influent gates and the filter bypass gate. The filter bypass gate electric actuator will also be added to the WWTP’s SCADA system for remote operation.

Advantages

- Adding electric actuators to the gates will improve the operability of the filters and filter bypass
- Automate the bypass of the filter building
- Prevent the filter building from receiving excessive flow

Disadvantages

- Capital cost of the gate electric actuators

Preliminary Cost Estimate: \$130,000



Figure 5-7 Filter Influent and Bypass Gates

5.9 RAS Pump Maintenance Improvements

The RAS pumps require regular maintenance due to clogging issues. With the current pumps the motor and pump are aligned with shims, and it is difficult to perform maintenance on the pump and correctly align everything to put the pump back together. When the shims are not installed correctly, or the pump alignment changes, then it creates extra wear on the RAS pumps and reduces their service lives. This project aims to lessen the challenge of RAS pump maintenance by replacing the current RAS pumps with new RAS pumps on service sleds. After unbolting the pump, the pump can be slid apart using the track and roller system. This ensures the correct alignment and helps to shorten the maintenance time for the pumps. The pumps get clogged frequently and the newer pump may help reduce the occurrence of clogging in addition to making unclogging easier. During design, other improvements to prevent the RAS pumps from clogging will be evaluated.

Advantages

- Improve RAS pump maintenance
- Newer pumps that may not clog as frequently

Disadvantages

- Capital cost
- New pump to learn how to maintain

Preliminary Cost Estimate: \$890,000



Figure 5-8 RAS Pumps on Service Sleds

5.10 East Plant Pump VFD Replacement

There are two existing VFDs on the pumps at East Plant with only one VFD being able to run at a time. These VFDs help to reduce spikes in flow sent from East Plant to the WWTP. These spikes of flow have caused challenges at the WWTP in the past limiting the time for WWTP staff to open or close gates to handle the extra flow. The addition of the VFDs helps to equalize the flow and improve the response at the WWTP. These VFDs are aging and are in need of replacement in the future. VFDs are rotated through all 4 of the existing pumps. If more than one pump is required, then the additional pumps operate at full power. The HVAC system at the East Plant will also be evaluated during the design to determine if improvements are needed.

Advantages

- Replace VFDs at end of service life
- Assist in stabilization of influent at WWTP

Disadvantages

- Capital cost

Preliminary Cost Estimate: \$40,000

5.11 Odor Control Improvements

There is one existing odor control unit located at the headworks of the WWTP. This unit was installed in 2018 and the odor control media inside of it will degrade over time. The WWTP has received odor complaints from the surrounding community. Replacing the media when it is at the end of its service life in the existing unit should help to alleviate the odor challenges and reduce overall odor at the WWTP. The media replacement of the odor control unit is recommended to utilize the existing equipment at the plant. During design, additional odor control technologies can be evaluated, and to determine other sources of odor, including another potential source of odor

from the aerobic digesters that are open to the air. The digesters have a maximum of 2 to 2.2 percent solids because higher percent solids leads to increased odor challenges. The odors coming from the flow splitter will be evaluated during the design to determine if odor reduction is necessary. The odors at the East Plant will also be evaluated to determine if odor control is needed because there is currently no odor control at the East Plant.

Advantages

- Replace media that is at the end of service life to utilize the existing equipment
- Ensures existing odor control equipment is operating correctly by performing maintenance

Disadvantages

- Capital cost of the media. The media is a small cost compared to the cost of an additional odor control project with a different technology. If another odor control technology is determined, then the project cost will be increased.
- May not improve odors significantly because the odor control equipment is only located at the headworks of the plant.
- Only addresses odors at headworks and not the odors at other locations such as the digesters, solids storage, and other open-air processes.

Preliminary Cost Estimate: \$90,000



Figure 5-9 Existing Odor Control Equipment

5.12 Grit Removal at WWTP Addition

There is not an existing grit removal system at the WWTP. This causes grit to accumulate in the oxidation ditches, secondary clarifiers, and in the aerobic digesters. The grit also increases the wear and tear on process equipment such as pumps by wearing down the internal components. The ideal location for a grit removal system would be between the screening building and the flow splitter box. It would be very difficult to physically fit and construct a grit removal system in between these two structures and would require the grit influent and effluent channels to have sharp turns. There is only 0.14 feet (1.68 inches) of water surface elevation difference between the two structures which would make it also very tight hydraulically. The sharp turns in the channels and the headloss from the grit removal equipment would likely be greater than the water surface elevation difference, thereby

making a grit removal system unfeasible. Physical space for the grit removal system can be created by modifying the existing flow splitter, but this is a new structure having been constructed as part of the 2018 improvements project. Hydraulic head capacity could be created by raising the water level in the screening building, but it would be prohibitively expensive to make all the required equipment and structural modification in the building. The building and the equipment were also constructed as part of the 2018 improvements project.

Advantages

- Keeps grit out of downstream processes which would reduce the accumulation of grit in the oxidation ditches and digesters.
- Reduces excess wear on equipment such as pumps which can have a reduced service life due to grit wearing out internal components.

Disadvantages

- Sufficient hydraulic head is not available unless the screening building water level is raised.
- Physical space would be tight with existing configuration unless the splitter box is relocated
- Capital cost would be high to make the modifications to the screening building and the flow splitter. These costs are in addition to the cost of the grit removal equipment and piping.

5.13 Plant Water Screening Improvements

Basket strainers help to remove debris from the plant water before it clogs or damages other equipment. These units are placed into the plant water line piping system after the pumps to provide a level of filtration before being used throughout the WWTP. Debris in the plant water can clog nozzles, pipes, or damage pumps and other equipment if it is not removed. The WWTP has previously installed basket strainers with manual debris removal in the plant water system near the Thickening building. These strainers have helped to remove debris that otherwise may have clogged downstream equipment. This type of strainer requires WWTP staff to remove and empty the basket when full and can cause additional downtime while performing this maintenance.

An automatic backwashing basket strainer removes debris from plant water and backwashes on a routine interval to remove the debris from the strainer equipment. This alleviates the need for WWTP staff to empty the basket strainer which provides more reliable debris removal and removes a routine task for staff. The automatic backwashing will also adjust to remove debris during higher solids loading or during periods of high plant water usage.

Advantages

- Decreases maintenance for plant water system
- Removes debris from plant water system

Disadvantages

- Capital cost

Preliminary Cost Estimate: \$70,000



Figure 5-10 Automatic Backwash Basket Strainer

5.14 Filter PLC Control Panel Improvements

The operation and maintenance challenges experienced in the Filter Building created a situation where the interior of the building was subjected to flooding conditions that reached a level that affected the filter PLC control panel. Due to the safety risk of the damaged control panel, WWTP staff have been unable to utilize the panel for operation and control of the filter system. Replacing the panel will restore full operation of the filters. In addition to replacing the damaged components, the panel will also be raised to a higher elevation in the building to prevent the panel from being affected if the building experiences future flooded conditions. This improvement project will be completed with the filter influent and bypass gate actuator addition.

Advantages

- Replaces the damaged panel
- Allows WWTP staff to use the panel for filter operations

Disadvantages

- Capital cost of raising the filter panel and replacing some of the components

Preliminary Cost Estimate: \$90,000

5.15 Larger Backwash Sump Pumps

The existing sump pumps in the tertiary filter backwash wet well are not able to handle the flow from all the filters backwashing at the same time. This has caused flooded conditions within the Filter Building when high flows are sent through the filters, resulting in operation and maintenance challenges, including the previously discussed damage to the existing filter PLC control panel. Replacing the existing pumps with larger capacity pumps will help alleviate this issue and allow the backwash wet well to prevent flooding even when all the filters are backwashing at the same time. This project does not include upsizing the backwash piping. Two Flygt 3102 submersible pumps were preliminary selected to replace the existing pumps. These pumps provide the necessary capacity and will fit in the existing wet well which is 5 ft by 5 ft. The backwash sump pumps discharge into the RAS wet well for Oxidation Ditch No. 5. The RAS pumps in this wet well can accommodate the additional flow based on the calculations provided below.

Calculations and assumptions for the backwash sump pumps are as follows:

- There are 2 RAS pumps in the wet well each with a capacity of 2.6 MGD (5.2 MGD total).
- Oxidation Ditch No. 5 can treat 1.75 MGD average flow.
- The peak RAS return rate is 150% of the average design flow of the ditch.
 - 150% of 1.75 MGD is 2.6 MGD.
- The maximum flow for the backwash sump pumps if all of the filters are backwashing at the same time is 0.7 MGD.
- The peak return rate (2.6 MGD) plus the max backwash flow (0.7 MGD) is 3.3MGD which is less than the total capacity of 5.2 MGD of the RAS pumps.

Advantages

- Reduces the chance of flooding in the Filter Building from the backwash wet well
- Pumps are able to handle all filters backwashing at the same time

Disadvantages

- Capital cost of replacing the sump pumps

Preliminary Cost Estimate: \$50,000

5.16 Junction Chamber Coating

The junction chamber south of Clarifier No. 1 and 2 was previously used chlorine for disinfection prior to switching to UV disinfection in 2018. The junction chamber is downstream of the previous chlorine injection point which accelerated the corrosion inside the chambers. The visual inspection indicated exposed rebar inside the chamber that will also require rehabilitation of the concrete prior to installation of the coating.

Advantages

- Repairs the corrosion damage in the junction chamber
- Covers the exposed rebar in the chamber
- Extends service life of junction chamber

Disadvantages

- Capital cost of repairing the junction chamber and the new protective coating

Project Cost Estimate: \$100,000

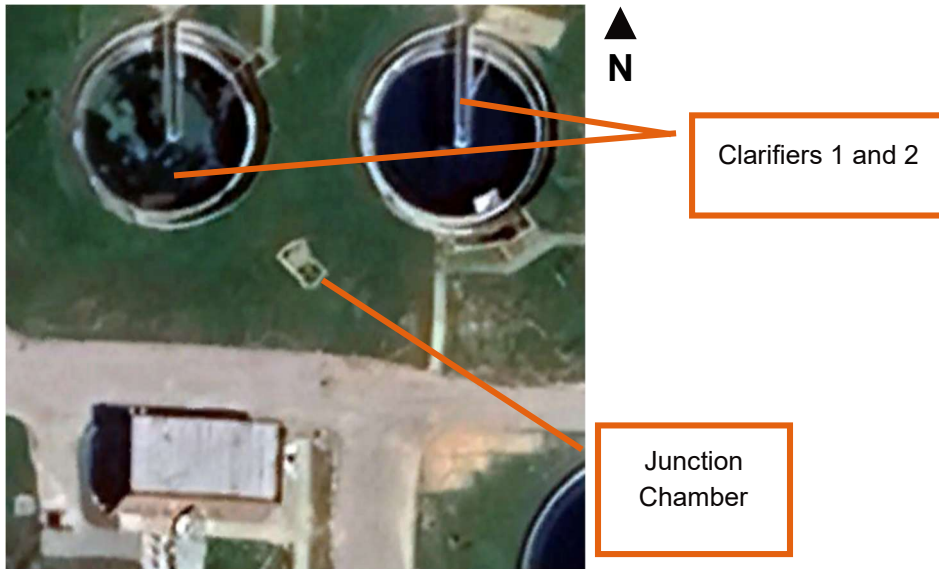


Figure 5-11 Existing Junction Chamber to be Coated

5.17 Blower Improvements

There are six existing blowers for the aerobic digesters with the most recent three being installed in 1999. The blowers are located in the basement of the Maintenance Building without soundproofing enclosures. Maintenance staff have requested that the blowers be relocated due to the noise level the blowers create. The existing blowers are 24 years old and are reaching the end of their service life. The quantity and size of the blowers will be evaluated during the design of the project to provide adequate aeration in the digesters.

Relocating the blowers outdoors next to the digesters can alleviate the noise issues from inside the Maintenance Building and shorten the piping distance for the blower air lines. The blowers would be located on concrete pads and within soundproof enclosures to reduce the outdoor noise. This project includes replacing the existing blowers with new larger blowers to provide adequate aeration and placing them outdoors in new enclosures with new VFDs. All six blowers will be replaced and placed on two concrete pads located near the existing air piping lines shown in the following figure.

Advantages

- Replacing aging blowers at the end of service life
- Reducing noise from blowers by removing them from the building

Disadvantages

- Capital cost of the new blowers, soundproof enclosures, and VFDs

Preliminary Cost Estimate: \$1.8 million

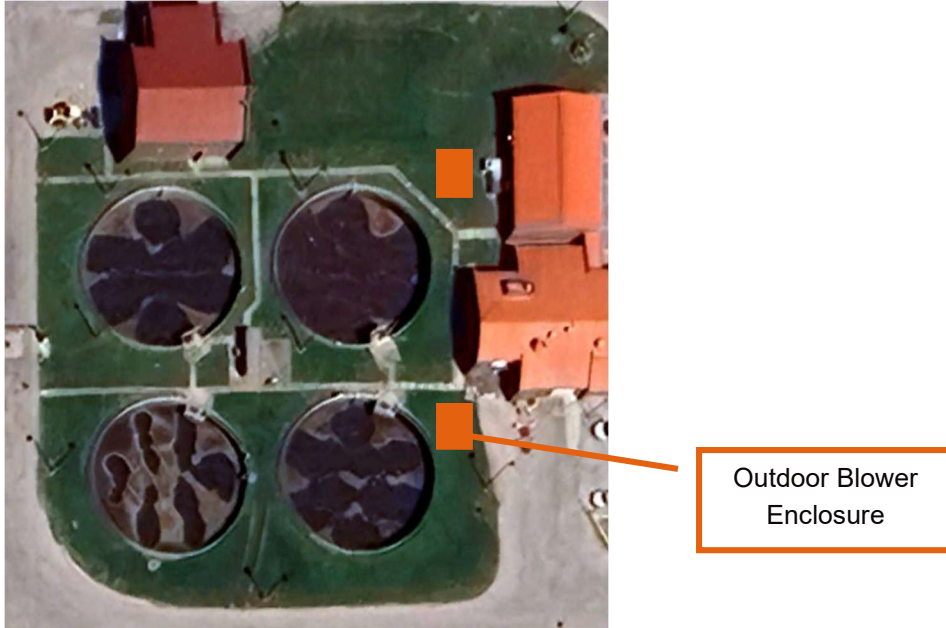


Figure 5-12 Layout of Proposed Blower Locations

5.18 Digestion Diffuser Upgrades

The existing air diffusers located in the aerobic digesters are aging, and more efficient types of diffusers are available. The diffuser grid is located 2 feet above the bottom of the digester at the tank edges and 4.5 feet above the bottom of the digester at the center of the tank, which has a sloped bottom. Grit and sludge have been known to accumulate on the bottom of the digesters below the diffuser grid with the existing configuration. The tanks have been cleaned whenever they are emptied, which has decreased the accumulation. However, digester cleaning can be labor intensive.



Figure 5-13 Existing Digester Diffusers

The aerobic digester air diffuser grid can be lowered closer to the floor of the digesters. The grid can be lowered a maximum of 1.5 feet to still have room for mounting brackets. The air diffuser grid may need to be oriented differently than the existing configuration to accommodate the 10-inch thickened sludge line running beneath the grid. Lowering the diffuser grid closer to the digester floor will increase oxygen transfer and increase mixing because there is less unmixed anaerobic volume below the digester grid. The sloped bottom of the digester will still cause the center portion to receive less mixing and oxygen diffusion below the diffuser grid, but this volume is being minimized by lowering the diffusers.

The existing diffusers are a mushroom type which produces coarse bubbles and decreases the surface area for oxygen in the blown air to diffuse into the thickened sludge. It is recommended to replace these diffusers with a different diffuser type to improve the efficiency of the digesters and decrease the buildup of sludge at the bottom of the digesters. Possible diffuser types are disk, duck bill, and rectangular style diffusers which can be evaluated during the detailed design of the diffuser replacement. The duck bill and rectangular style diffusers can be angled downward to induce mixing and some aeration below the diffuser grid.

Advantages

- Improved aeration efficiency
- Improved mixing at the tank bottom

Disadvantages

- Aeration system may need to be modified for the lower diffusers

Preliminary Cost Estimate: \$320,000



Figure 5-14 Proposed Duck Bill Digester Diffusers

5.19 Solids Storage Improvements

The existing drying beds are uncovered, and the valves do not operate properly. There is an existing covered storage pad located to the north of the original drying beds for additional storage. The existing drying beds were built in 1987 and are starting to deteriorate. The underdrains and the valves do not operate properly, and the drying beds were not designed to handle the front-end loader that is currently being used. The front-end loader is a tight fit for the drying beds and has damaged the beds. The drying beds are currently being used as solids storage space after the sludge is dewatered from the belt filter press. It is recommended that the drying beds be replaced, and a covering placed over them in 15 to 20 years when their condition is no longer usable. Covering the drying beds will prevent the solids from absorbing moisture from the rain and snow.

Advantages

- Increased solids storage capacity
- Increased covered storage area

Disadvantages

- High capital cost
- Additional area required if it is larger than existing footprint

Preliminary Cost Estimate: \$2.4 million

5.20 Pump Replacement

Based on the previous asset assessment conducted in 2022 and reviewing the asset lists, WWTP staff noted pumps in need of replacement in the short and long timeframe. The pumps needing replacement are listed in the time frames of 0-5 years, 5-10 years, and 10+ years before needing replacement as follows:

0-5 years

- Decant Pump Nos. 1 and 2
- Thickened Sludge Pump Nos. 1 and 2
- East Plant Flushing Water Pump
- East Plant Seal Water Pump Nos. 1 and 2
- Backup pump for RAS Pump Nos. 6 and 7
- Seal Water Pump Nos. 1 and 2
- Backup pump for NPW pumps
- East Plant Sump Pump
- Sump pump in the basement of Building B
- Secondary Clarifier Nos. 3 and 4 effluent station pumps

5-10 years

- Sludge Transfer Pump Nos. 1 and 2
- Replace two pump at East Plant
- Scum Pump Nos. 1 and 2 on Secondary Clarifier No. 5

10+ years

- Sludge Feed Pump Nos. 1 and 2 (These pumps may be replaced with the dewatering equipment)

Advantages

- Replaces pumps at end of service life to ensure reliable operation

Disadvantages

- Capital cost of the pumps

5.21 Additional Treatment Capacity

The previous master plan in 2012 recommended two WWTP expansions. The first expansion increased the average design flow to 5.25 MGD and was listed to be completed in 2014. This first expansion was completed in 2018 and included Oxidation Ditch No. 5, Secondary Clarifier No. 5, and a new flow splitter box. The second expansion was recommended to increase the average design flow to 6.9 MGD and was listed to be completed in 2025. The second expansion includes addition of Oxidation Ditch No. 6, Secondary Clarifier No. 6, Aerobic Digester No. 3, additional UV bank, and additional bar screen. The proposed location of Oxidation Ditch No. 6, and Secondary Clarifier No. 6 is shown below on **Figure 5-165**. The additional bar screen and UV bank are necessary to treat the anticipated future flows with one unit out of service which is required by the Ten State Standards. The additional treatment capacity is anticipated to be needed in 2033 as discussed in Section 3 because of historical influent data and future flow projections. The electrical switchgear expansion is included in

the treatment capacity expansion to provide the additional electrical capacity for the plant to power the additional motors and equipment.

The additional oxidation ditch and clarifier provide additional liquid stream treatment capacity and will be able to treat the anticipated future nutrient loads. The additional aerobic digester and sludge drying beds will provide additional solids treatment and storage capacity. The additional aerobic digester will help to increase the SRT of the digestion process. The additional treatment capacity expansion process schematic is summarized in Figure 5-16 Proposed Flow Schematic

Advantages

- Ability to handle predicted future flows
- Increase SRT in Aerobic Digesters

Disadvantages

- Capital cost of the additional treatment equipment and structures

Preliminary Cost Estimate: \$17.9 million

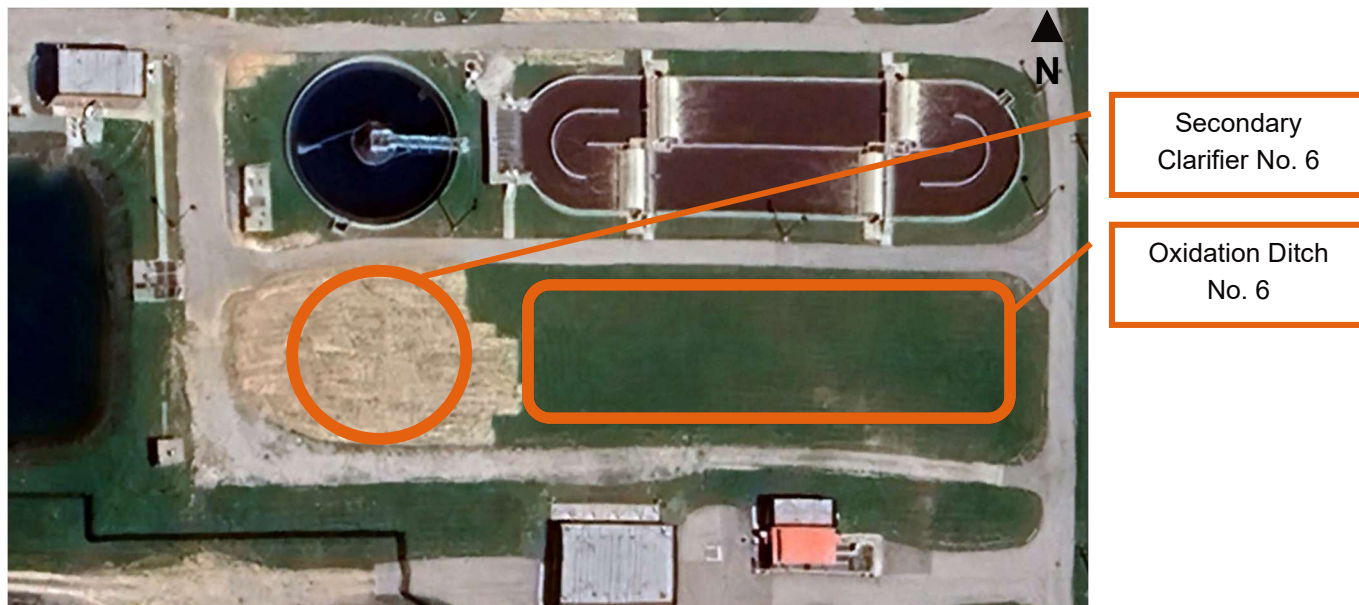


Figure 5-15 Proposed Location of Oxidation Ditch No. 6 and Secondary Clarifier No. 6

Wastewater Treatment Plant Master Plan - 2023

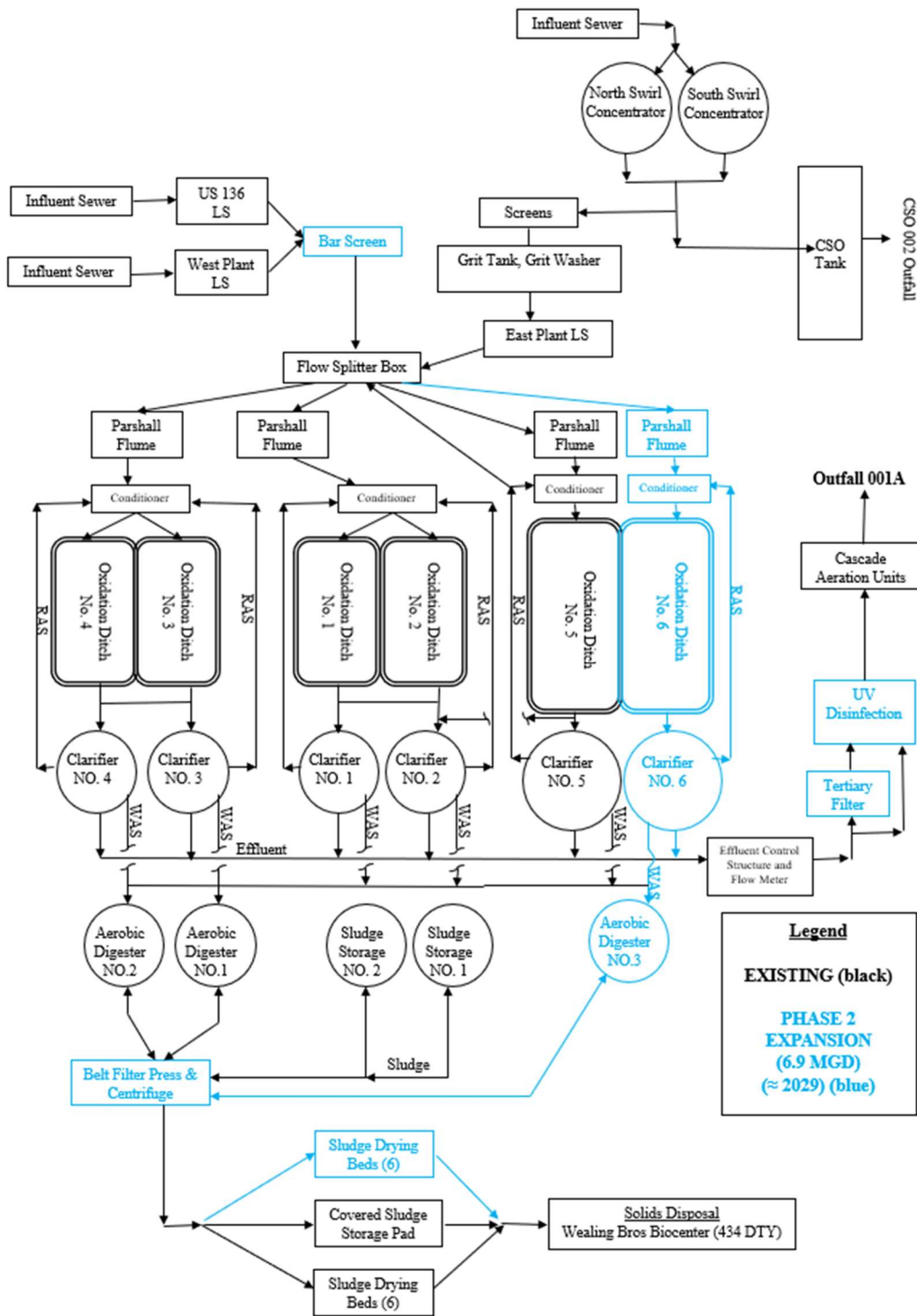


Figure 5-16 Proposed Flow Schematic with Treatment Plant Capacity Expansion

6 Recommended Plan

This section provides a summary of the Wastewater Treatment Plant Master Plan recommended capital improvement plan and capacity expansion improvements. Numerous elements and process areas of the treatment plant capital improvement plan have been taken into account with special consideration given to layout, increasing treatment reliability, and increased solids handling capacity. The preliminary basis of design for the treatment plant with the recommended process improvements can be found in the appendices. The Town has developed this master plan for the expansion and development of the wastewater treatment facility to meet the growing needs of the community.

6.1 Summary of Recommended Plan

Many alternative designs were evaluated, and the recommended alternatives represent cost effective options that will allow the facility to continue to operate at its current high level of treatment. Several project meetings have been held to discuss process alternatives for the wastewater treatment system for the solids handling improvements and plant expansion.

Phase 1 of the recommended improvements focuses on improving the solids handling and solids storage system and also addressing immediate needs to maintain reliable treatment. Phase 1 was separated into sub phases to address current plant needs and allow time for funding to be allocated. Sub phase 1A focuses on solids handling improvements and near term plant needs. Sub phase 1B focuses on solids treatment and filter improvements. Sub phase 1C focuses on liquid stream rehabilitation and plant maintenance projects. Phase 2 recommended wastewater treatment expansion plan proposes to increase the rated daily average treatment capacity of the WWTP from 5.25 MGD to 6.9 MGD. The design peak treatment capacity of the plant will increase from 10 MGD to 15 MGD.

None of the onsite power generation alternatives were recommended because the WWTP has two separate power feeds which have been operational and meet the requirements for having multiple power supplies. A new generator is not as necessary as the other recommended improvement projects. A total nitrogen treatment alternative has also not been included in the recommended plan because there is currently no regulatory limit that is the driver for that project. If a total nitrogen permit limit is required; then the total nitrogen treatment alternatives will need to be evaluated.

Thickening and dewatering Option 2 is recommended which includes rehabilitating the existing combination thickening and dewatering unit while adding an additional dewatering centrifuge. This option was selected because it provides additional dewatering capacity, still provides the ability to thicken and dewater, and provides additional service life from the existing unit. Solids handling improvements Option 3 is recommended which includes adding larger screw conveyors, a new biosolids discharge pad next to the existing building, and a new truck with higher sides and a vibrating bed. This option was selected to provide additional solids handling capacity, provide easier operations for solids handling with the pad, and replace the existing solids transporting truck with a newer model to alleviate some of the operational challenges with the existing truck. Tertiary filter improvement Option 3 is recommended which includes replacing the filter panels with stainless steel panels of 10 or 20 microns. This is recommended to improve filter operations and capacity. This may also help reduce filter maintenance because the stainless steel panels are more durable than the existing fabric panels.

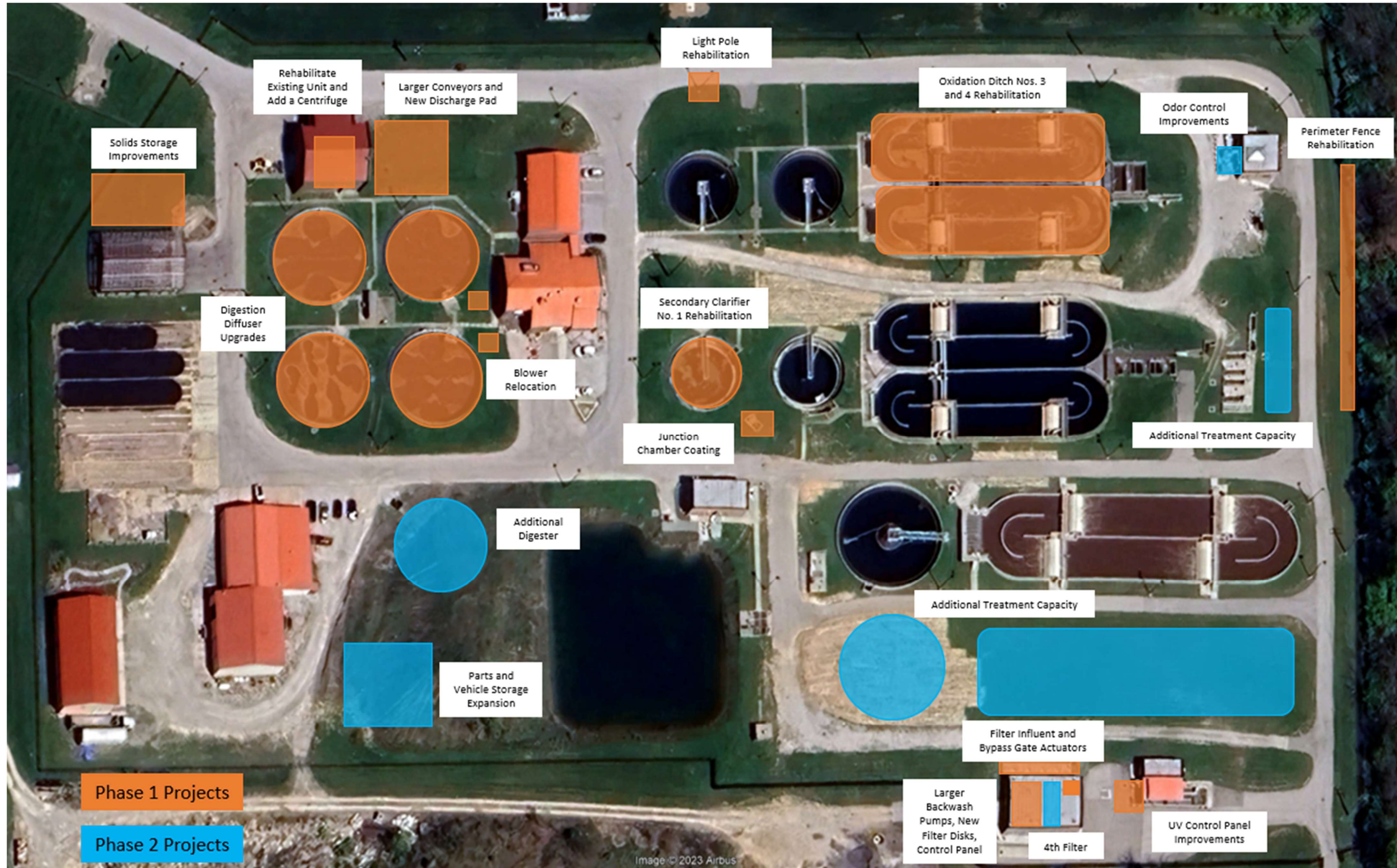


Figure 6-1 Aerial Layout of Improvement Projects

6.2 Summary of Costs

All the costs in this document and listed in the table below are preliminary project cost estimates unless otherwise specified. Estimated project costs include installation costs, engineering, administration, and inspections. The preliminary cost estimates are consistent with AACE Class 4 conceptual estimates, which are typically accurate to -30% to +50%. All estimated costs are presented in 2023 dollars.

The table below list the recommended project and their associated costs for this master plan project.

Table 6-1 Recommended Projects and Associated Costs

Recommended Projects and Associated Preliminary Cost Estimates			
Project Title	Project Description	Preliminary Cost Estimate	Sub Phase
<u>Phase 1: Solids Handling Improvements (2025-2026)</u>			
Thickening and Dewatering Equipment - Rehabilitate Existing Combination Unit and Add a Dewatering Centrifuge	Rehabilitating existing combination dewatering unit and adding a new dewatering centrifuge to increase dewatering capacity	\$4.0 million	1A
Solids Handling Improvements - Larger Conveyors and Add a New Discharge Location to a Pad Next to Existing Building	Adding larger solids handling conveyors to discharge to a new concrete pad next to the building. Also includes a new solids transport truck	\$680,000	1A
Solids Storage Improvements	Adding new covered drying beds	\$2.4 million	1A
Filter Influent and Bypass Gate Electric Actuator Addition	Adding electric actuators on the filter bypass gate and all influent gates. Also includes adding the filter bypass gate to the SCADA system.	\$130,000	1A
Replace Filter PLC Control Panel	Raising and replacing the damaged filter panel	\$90,000	1A
Larger Filter Backwash Sump Pumps	Adding larger pumps in the filter backwash wet well to prevent flooded conditions	\$50,000	1A
UV Control Panel Improvements	New canopy over control panel	\$30,000	1A
Phase 1A (2025) Subtotal		\$7.38 million	
Blower Improvements	New blowers in soundproof enclosures outside and near the digesters	\$1.8 million	1B
Digestion Diffuser Upgrades	Lowering the diffuser grid and replacing the diffusers with a different type	\$320,000	1B

Recommended Projects and Associated Preliminary Cost Estimates			
Tertiary Filter Improvement - Disks With Larger Pore Sizes	Replacing the existing filter panels with stainless steel panels of 10 or 20 microns	\$160,000	1B
Phase 1B (2026) Subtotal		\$2.28 million	
Oxidation Ditch Rehabilitation	Replacing all of the internal equipment	\$2.3 million	1C
Secondary Clarifier No. 1 Rehabilitation	Replacing all of the internal equipment	\$1.2 million	1C
Perimeter Fence Rehabilitation	Applying a protective coating	\$110,000	1C
Junction Chamber Coating	Concrete repair and adding a protective coating on the junction chamber with exposed rebar	\$100,000	1C
Light Pole Rehabilitation	Replacing the outdoor lights and wiring that is not operational	\$80,000	1C
Phase 1C (2026) Subtotal		\$3.88 million	
Phase 1 Subtotal		\$13.5 million	
<u>Phase 2: Capacity Expansion (2030-2033)</u>			
Additional Treatment Capacity	Adding an additional oxidation ditch, secondary clarifier, UV bank, and bar screen	\$17.9 million	
Tertiary Filter Improvements - 4 th Filter and New Cleaning System	Adding a 4 th Evoqua filter with a new chemical cleaning system	\$2.3 million	
Digester Type – Additional Aerobic Digester	Adding an aerobic digester	\$2.5 million	
Parts and Vehicle Storage Expansion	New pole barn type building (65 feet by 65 feet) for parts and vehicle storage	\$1.6 million	
East Plant Pump VFD Replacement	Replacing the VFDs on the two pumps at the East Plant	\$40,000	
Odor Control Improvements	Replacing the media in the screen building odor control equipment	\$90,000	
Phase 2 Subtotal		\$24.5 million	

Recommended Projects and Associated Preliminary Cost Estimates			
<u>Phase 3: Major Equipment Rehabilitation (2033 to 2043)</u>			
Oxidation Ditch 5 Rehabilitation	Replace aging components of the existing oxidation ditch to rehabilitate the equipment and gain additional service life	\$900,000	
Secondary Clarifier No. 5 Rehabilitation	Replace aging components of the existing clarifier to rehabilitate the equipment and gain additional service life	\$1.2 million	
Filter Rehabilitation	Replace aging components of the existing filters to rehabilitate the equipment and gain additional service life	\$1.8 million	
Screen Rehabilitation	Replace aging components of the mechanical screen 1 to rehabilitate the equipment and gain additional service life	\$412,500	
UV Equipment Replacement	Replace aging components of the UV channels 1 and 2 to rehabilitate the equipment and gain additional service life	\$600,000	
Phase 3 Subtotal		\$ 5.0 million	

6.3 Schedule

The recommended projects listed above have been grouped into two phases for projects needed in the short term and projects recommended for implementation further in the future. The phase 1 projects are recommended to start detailed design in 2025 after this master planning is completed and phase 1 projects are finalized. The phase 2 projects are focused on the capacity expansion which is projected to be needed in 2029. Low priority projects and maintenance projects will be conducted during 2033-2043 in Phase 3. During this time period some of the equipment installed during the 2018 expansion project will be nearing end of service life and in need of replacement or repair. Some of these items include a UV disinfection system replacement, rehabilitation of Clarifier No. 5 and Oxidation Ditch No. 5, Tertiary filter rehabilitation or replacement, as well as replacing or rehabilitating pumps. Some of these costs can be significant but they are highly variable based on the condition of the equipment in the next 20 years. A 1-year duration for the design period of each phase is used to establish a conservative schedule. The construction period is estimated to be 2 years for each phase based on conservative scheduling and estimated long lead times for major equipment included in each phase. When the final design of each phase is completed, the construction periods can be adjusted to include more exact equipment procurement times. A summary of the recommended project timeline is provided in **Table 6-2** and a visual summary of the project phases is included in **Figure 6-2**.

Wastewater Treatment Plant Master Plan - 2023

Table 6-2 Recommended Project Phase Schedule

Town Master Plan Project Phase	Duration	Start Date	Completion Date
Phase 1 Design	12 months	Jan-2025	Dec-2025
Phase 1 Construction	24 months	Mar-2026	Mar-2028
Phase 2 Design	12 months	Sep-2029	Sep-2030
Phase 2 Construction	24 months	Jan-2031	Dec-2032
Phase 3 Design	12 months	Sep-2034	Sep-2035
Phase 3 Construction	24 months	Jan-2036	Dec-2037

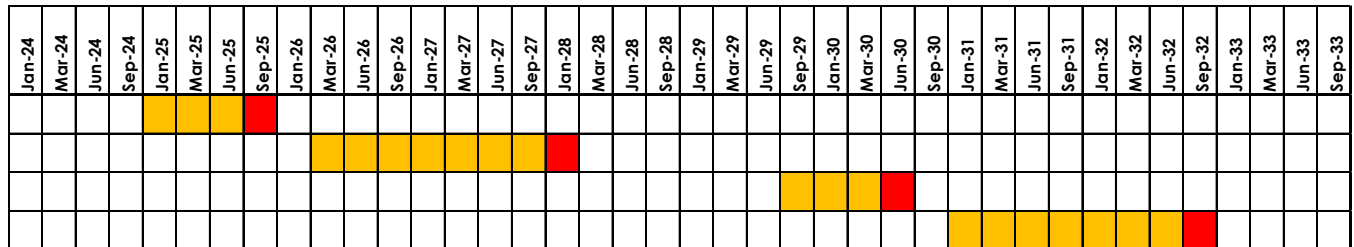


Figure 6-2 Recommended Project Timeline

Appendix A

Design Summary

Appendix B

Preliminary Cost Estimating Spreadsheets

Appendix C

Equipment Quotes and Data Sheets

Appendix D

NPDES Permit

Appendix E

CIP Spreadsheet

Appendix F

Asset Table

Arcadis U.S., Inc.
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