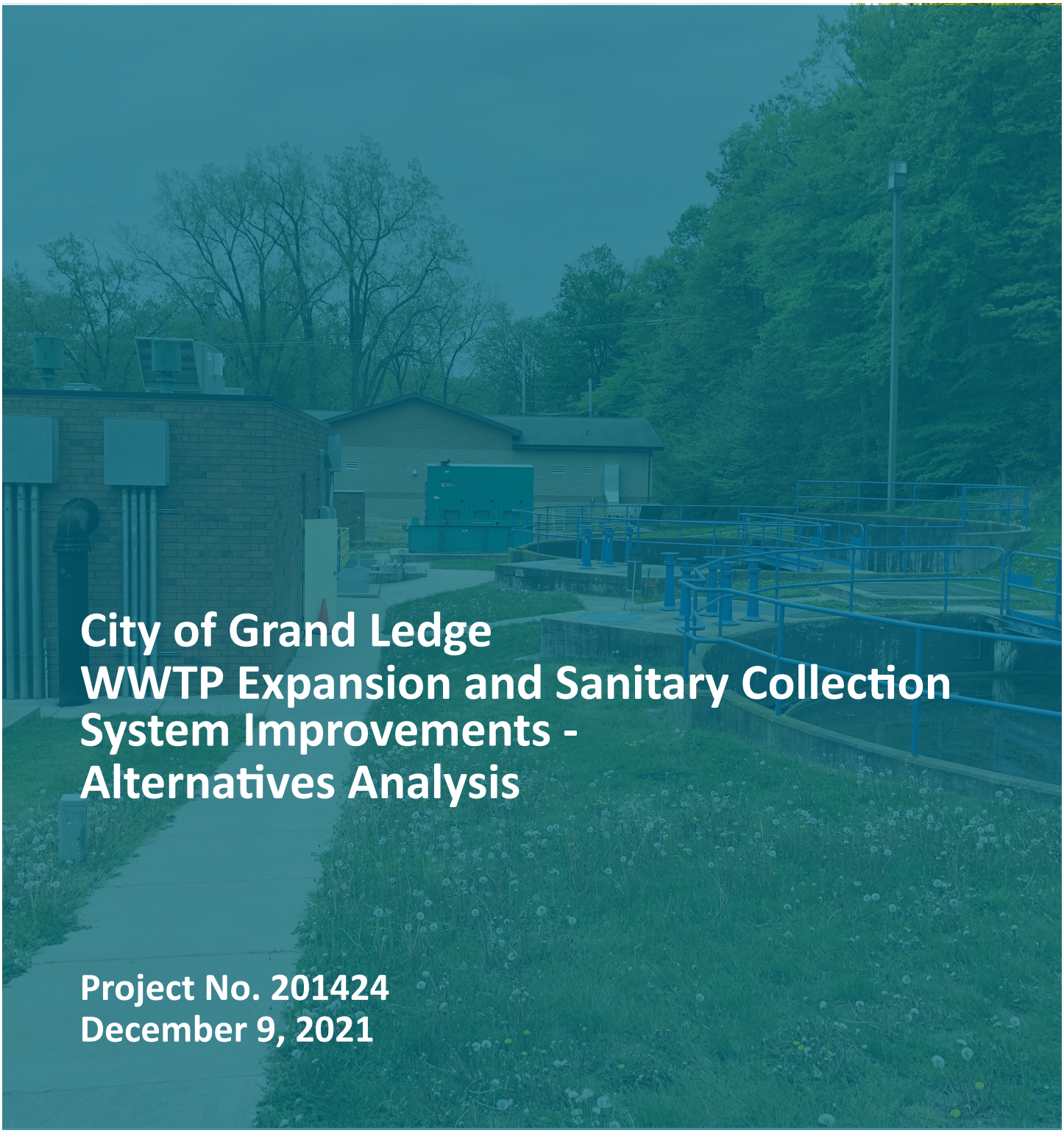

City of Grand Ledge
WWTP Expansion and Sanitary Collection System Improvements - Alternatives Analysis

Project No. 201424
December 9, 2021

FINAL DRAFT

fishbeck
Engineers | Architects | Scientists | Constructors

fishbeck
Engineers | Architects | Scientists | Constructors

1515 Arboretum Drive, SE
Grand Rapids, Michigan 49546

616.575.3824 | fishbeck.com

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Prepared For:
City of Grand Ledge
Grand Ledge, Michigan

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Final Draft

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List of Abbreviations/Acronyms

$CBOD_5$	five-day carbonaceous biochemical oxygen demand
City	City of Grand Ledge
EGLE	Michigan Department of Environment, Great Lakes, and Energy
gpd	gallons per day
I/I	inflow and infiltration
lbs	pounds
MBR	membrane bioreactor
mgd	million gallons per day
mg/L	milligrams per liter
NH_3-N	ammoniacal nitrogen
NPDES	National Pollutant Discharge Elimination System
OM&R	operation, maintenance and replacement
RAS	return activated sludge
REU	residential equivalent unit
SCCUMA	Southern Clinton County Municipal Utility Authority
SESC	soil erosion and sedimentation control
SIU	significant industrial user
SSO	sanitary sewer overflow
Total-P	total phosphorus
TSS	total suspended solids
UV	ultraviolet
WAS	waste activated sludge
WTP	water treatment plant
WWTP	wastewater treatment plant

1.0 Introduction

1.1 Overview

The City of Grand Ledge (City) wastewater treatment plant (WWTP) requires expansion to provide additional capacity to the service area's residents, businesses, and industries. There is currently demand for capacity from residential and commercial developments and the potential for future demand from industrial park growth.

An evaluation of the wastewater treatment system capacity was conducted by Fishbeck in 2017. This study determined that the WWTP was at 73% of its current 1.5 million gallon per day (mgd) hydraulic capacity and was exceeding its biological treatment capacity; therefore, it lacks capacity for future growth and development.

Fishbeck completed an evaluation of existing and projected sanitary flow and load. These findings were presented in the City of Grand Ledge WWTP Expansion and Sanitary Collection System Improvements – Basis of Design report dated May 24, 2021 (2021 Basis of Design Report). This report confirmed the earlier findings that sanitary system improvements are required to meet current and future treatment requirements. This report also noted that the annual average influent concentrations for five-day carbonaceous biochemical oxygen demand ($CBOD_5$) and total suspended solids (TSS) are both above the sewer use ordinance limit and recommended confirming the influent waste strength.

The collection system may also have hydraulic bottlenecks and issues with inflow and infiltration (I/I) that limit its capacity and ability to transport the flow to the WWTP. Collection system improvements will most likely be required in conjunction with WWTP improvements.

1.2 Purpose

The purpose of this report is to confirm the influent loading to the WWTP and to determine the preferred improvements to meet projected treatment requirements as defined in the 2021 Basis of Design Report. This report has been prepared to present the findings from the collection system sampling, present alternative WWTP improvement options and present the selected WWTP improvement alternative. This report, along with the 2021 Basis of Design Report, may ultimately be expanded to prepare a project plan to apply for project funding.

Improvements to the collection system and to the WWTP are required to meet current and projected capacity requirements. Collection system improvements will be required to reduce inflow and infiltration (I/I) and to transport wastewater to the treatment plant. For planning purposes, we have assumed that collection system improvements will allow for the collection and transportation of the 25-year, 24-hour storm event to the WWTP.

The focus of this alternatives analysis is on WWTP improvements. Treatment expansion can include relocation of existing treatment cells, construction of new cells within the existing footprint, and acquisition of new land depending on the selected alternative. The existing WWTP and the associated Solids Storage Area are located within Fitzgerald Park, with the WWTP also bordered by the Grand River to the north. Figure 1 shows the existing WWTP site plan and Fitzgerald Park's public access areas.

2.0 Confirmation of Influent Waste Strength

To confirm the influent loading to the WWTP, Fishbeck installed composite samplers in three locations in the collection system. Two composite samples were collected from each location. The selected locations are identified in Figure 2 and include:

- Site 1: Eaton Highway Pump Station
- Site 2: West Main Gravity Sewer
- Site 3: West River Street Pump Station

Laboratory analysis results from these samples are presented in Table 1. Sample Site 1 was intended to capture higher strength waste from potential industrial sources. The analytical results from Site 1 confirm that higher strength waste is present at the Eaton Highway Pump Station. Sample Site 2 was intended to confirm the domestic background waste strength. The analytical results from Site 2 are typical for a predominantly residential neighborhood. Sample Site 3 was intended to replicate the composite influent waste to the WWTP. The analytical results from Site 3 are consistent with average influent waste strength to the WWTP.

Table 1 – WWTP Influent Annual Average Flow Characteristics

Site	Date	BOD_5 (mg/L)	TSS (mg/L)	Total-P (mg/L)	Ammonia (mg/L)
Site 1	8/18/2021	616	168	5.1	9.6
	8/20/2021	550	212	5.8	10.0
Site 2	8/18/2021	193	164	4.3	27.7
	8/20/2021	238	236	4.8	28.5
Site 3	8/18/2021	240	258	64.0	23.4
	8/20/2021	308	250	5.2	23.8

BOD_5 five-day biochemical oxygen demand
mg/L milligrams per liter
TSS total suspended solids
Total-P total phosphorus

Overall, these sample results imply that there are sources of higher strength waste within the collection system and that these sources do impact the overall waste strength to the WWTP. This limited sampling analysis supports the influent waste strength values presented in the 2021 Basis of Design Report.

3.0 Design Criteria

Design criteria for current and future needs were developed in the 2021 Basis of Design Report. The findings of this report are presented in Table 2. The projected annual average flows and loads represent the ultimate buildout within the area.

Table 2 – Projected Annual Average Flows and Loads

Flow Source	Flow (mgd)	$CBOD_5$ (mg/L)	$CBOD_5$ (lbs/day)	TSS (mg/L)	TSS (lbs/day)	NH_3-N (mg/L)	NH_3-N (lbs/day)	Total-P (mg/L)	Total-P (lbs/day)
Existing Average	1.06	291	2,395	228	2,258	25	221	4.9	39
Additional Residential & Commercial Average	1.40	190	2,211	210	2,453	25	292	4.9	57
Additional Industrial Average	1.20	183	1,834	234	2,282	36	351	5	49
WTP Average	0.28	0	0	144	340	0	0	0	0
Total Projected Average	3.9	198	6,449	225	7,332	26	864	4.4	145

To continue to serve the community in a cost-effective manner that allows for continue residential, commercial, and industrial growth in the area, these projections have been refined into phases. Phase 1a accounts for 20 years of residential growth, the addition of one significant industrial user (as defined in the 2021 Basis of Design Report) and additional flow from the Water Treatment Plant (WTP) resulting from ion exchange softening. Phase 1b accounts for the addition of a second significant industrial user. Phase 2 accounts for the remaining residential growth to achieve ultimate buildout within the projected service area. Flow projections for each Phase are identified in Table 3.

Table 3 – Phased Flow Projections

Parameter	Units	Current Design	Actual	Phase 1a	Phase 1b	Phase 2
Average Day	mgd	1.5	1.06	2.2	2.8	3.9
Maximum Day	mgd	3.0	4.66	5.4	5.6	7.9
Peak Hour Flow	mgd	-	10*	13.1	13.7	14.3
Equalized Peak Hour	mgd	-	10*	5.4	5.6	7.9

**Estimated based on overflow events*

4.0 Treatment Alternatives for Improvement

4.1 Description

The following treatment alternatives were developed considering this design criteria:

- Alternative 1 – No Action
- Alternative 2 – Regional Alternative
- Alternative 3 – Expansion of Conventional Activated Sludge
- Alternative 4 – Conversion to Extended Aeration
- Alternative 5 – Conversion to Membrane Bioreactors (MBRs)
- Alternative 6 – Maintain Existing Facility and Construct a Remote Facility

Current improvements are based on meeting the Phase 1a treatment requirements. Consideration has been given to each alternative's ability to expand to meet the Phase 1b and Phase 2 treatment requirements.

4.1.1 Alternative 1 – No Action

The no action alternative was considered as making no improvements to the WWTP and continuing with current maintenance schedules. This would not involve capital expenditure and would eliminate additional construction impacts to Fitzgerald Park. However, due to the WWTP capacity limitations, this option is not considered a viable option.

4.1.2 Alternative 2 – Regional Alternative

The most practical regional alternative could be provided by connecting to either the Southern Clinton County Municipal Utility Authority (SCCUMA) WWTP in DeWitt or the Delta Township WWTP.

The SCCUMA WWTP is located approximately 9.5 miles from the Grand Ledge WWTP. Based on a potential route, a 12.4-mile force main could be required to make this regional connection. Additional improvements within the SCCUMA sanitary collection system may be required to route flow to the SCCUMA WWTP. The existing SCCUMA WWTP has a rated capacity of 5.0 mgd. This rated capacity is anticipated to serve the growing needs of Bath Township, DeWitt Township, Watertown Township, and the City of Dewitt past the year 2030. Adding flow from Grand Ledge could necessitate improvements to the SCCUMA WWTP sooner than currently anticipated. Given the distance and capacity limitations, connection to the SCCUMA WWTP is a not a viable alternative.

The Delta Township WWTP is located approximately 5.5 miles from the Grand Ledge WWTP and the Delta Township sanitary collection system is located such that an approximate 3.3-mile force main would be required to make this regional connection. Additional improvements within the Delta Township sanitary collection system may be required to route flow to the Delta Township WWTP. The Delta Township WWTP is currently in the process of expanding their facility. The existing facility has a rated capacity of 6.0 mgd, while the proposed improvements are intended to expand the capacity to 8.0 mgd. Currently, the Delta Township WWTP receives an annual average flow of 4.9 mgd. The increase in the Delta Township WWTP rated capacity is to accommodate the projected 30-year growth within their existing service area and does not include accommodations for additional flow from Grand Ledge.

Considerations beyond the physical limitations of connecting to a regional alternative must be considered. By connecting to a regional alternative, Grand Ledge would not be able to control the future cost of treatment, or the rates assessed to users withing the Grand Ledge service area. Additionally, future connections to or expansions of the Grand Ledge service area may need to be approved by the regional authority. If treatment

capacity is limited, future connections could be denied. This could limit growth within Grand Ledge. Maintaining autonomy and control over future costs are important factors in creating a prosperous future in Grand Ledge. Given the distance, limited capacity, and the potentially restrictive nature of regional approach, Alternative 2 is not considered a principal alternative and will not be evaluated further.

4.1.3 Alternative 3 – Expansion of Conventional Activated Sludge

Alternative 3 was developed with the intention of expanding the treatment capacity while maintaining the current mode of conventional activated sludge biological treatment.

Under Alternative 3, the following improvements would be required to provide capacity to meet the Phase 1a design criteria:

Flow Retention

- 150-foot long by 80-foot wide concrete basin with 25-foot sidewalls near solids storage area.
- Force main connecting raw influent to retention basin.
- Pumps to transfer raw influent through force main.
- Gravity sewer connecting retention basin to headworks.

Preliminary Treatment

- Demolish existing aerated grit system and building.
- Relocate new vortex grit to south side of site.

Primary Clarification

- Demolish existing primary clarifier mechanical equipment.
- Construct two 70-foot-long by 20-foot-wide rectangular primary clarifiers on east side of site.

Aeration System

- Convert existing primary clarifiers to aeration tanks.
- 50-foot long by 25-foot wide aeration tank over demolished final clarifier.
- Process and sludge piping.
- Blowers in Process Building.

Final Clarifiers

- Demolish existing final clarifiers.
- Two 60-foot diameter clarifiers in Fitzgerald Park.

Disinfection and Outfall

- Decommission existing chlorine disinfection system.
- Ultra Violet (UV) disinfection system on west end of the site.
- Construct new plant effluent pipe to discharge downstream of the fall in the Grand River.
- New outfall to be permitted by the Michigan Department of Environment, Great Lakes, and Energy (EGLE).

Solids Handling

- Two rotary drum thickeners and associated piping and equipment modifications to reduce biosolids volume.
- Bulk lime storage and lime handling equipment for biosolids stabilization.

In addition to the improvements identified above, the following improvements would be required to provide capacity to meet the Phase 1b design criteria:

Aeration System

- One additional 50-foot-long by 25-foot-wide aeration tank constructed in place of demolished final clarifiers-
- Blowers and aeration equipment as needed in the Process Building-

In addition to the improvements identified above, the following improvements would be required to provide capacity to meet the Phase 2 design criteria:

Aeration System

- Two additional 50-foot-long by 25-foot-wide aeration tanks constructed in place of demolished final clarifiers.
- Blowers and aeration equipment as needed in the Process Building.

Alternative 3 improvements are identified in Figure 3 with Phase 1a improvements identified in red. Phase 1b and Phase 2 ultimate buildout improvements are identified in green and blue respectively. While the Phase 2 improvements would not be implemented at this time, the areas identified in Figure 3 should be reserved for future treatment capacity. Ultimate buildout for Alternative 3 would require utilization of approximately 1.3 acres of Fitzgerald Park.

4.1.4 Alternative 4 – Conversion to Extended Aeration

Alternative 4 was developed with the intention of expanding the treatment capacity by converting the treatment process to provide extended aeration biological treatment. While this treatment is very similar to the current conventional activated sludge treatment, an extended hydraulic retention time in the treatment tanks allows for nitrification treatment.

Under Alternative 4, the following improvements would be required to provide capacity to meet the Phase 1a design criteria:

Flow Retention

- 150-foot-long by 80-foot-wide concrete basin with 25-foot sidewalls near the solids storage area.
- New force main connecting raw influent to retention basin.
- Pumps to transfer raw influent through force main.
- New gravity sewer connecting retention basin to headworks.

Grit Removal

- Demolish existing aerated grit system and building.
- Build new vortex grit system.

Primary Clarification

- Demolish existing primary clarifier mechanical equipment.
- Convert to aeration tanks upstream of new extended aeration tanks.

Aeration System

- Convert existing primary clarifiers to aeration tanks.
- Build two 100-foot-long by 50-foot-wide extended aeration tanks with 24-foot sidewalls in Fitzgerald Park.

Disinfection and Outfall

- Decommission existing chlorine disinfection system.
- Build new UV disinfection system on west end of the site.
- Construct new plant effluent pipe to discharge downstream of the fall in the Grand River.
- New outfall to be permitted by EGLE.

Solids Handling

- Two rotary drum thickeners and associated piping and equipment modifications to reduce biosolids volume.
- Bulk lime storage and lime handling equipment for biosolids stabilization.

To meet Phase 1b design criteria, the following improvements would be required:

Final Clarifier

- Build one new 65-foot-diameter clarifier in WWTP site.
- Site piping modifications for flow split between clarifiers.

In addition to the improvements identified above, the following improvements would be required to provide capacity to meet the Phase 2 design criteria:

Aeration System

- Build an additional 100-foot long by 50-foot-wide extended aeration tank with 24-foot sidewalls adjacent to the existing biosolids storage tank in the biosolids handling area.
- Piping to and from the third extended air tank with associated pumps.

Alternative 4 improvements are identified in Figure 4 with Phase 1a improvements identified in red. Phase 1b and 2 ultimate buildout improvements identified in green and blue respectively. While the Phase 2 improvements would not be implemented at this time, the areas identified in Figure 4 should be reserved for future treatment capacity. Ultimate buildout for Alternative 4 would require approximately 1.4 acres of additional space within Fitzgerald Park and will entail some area disturbed for new piping to and from the new flow retention basin near the current solids storage area.

4.1.5 Alternative 5 – Conversion to MBR

Alternative 5 was developed with the intention of expanding the treatment capacity by converting the treatment process to provide primary sludge removal by replacing the primary clarifiers with microscreens and converting the existing conventional activated sludge secondary treatment system into an MBR treatment system. This is a significant change to the treatment process, but these progressive technologies can produce a very high-quality effluent in a reduced footprint.

Under Alternative 5, the following improvements would be required to provide treatment capacity that meets that Phase 1a flow and loading criteria:

Flow Retention

- 150-foot-long by 80-foot-wide concrete basin with 25-foot sidewalls in Fitzgerald Park.
- New force main connecting raw influent to retention basin.
- Pumps to transfer raw influent through force main.
- New gravity sewer connecting retention basin to headworks.

Preliminary Treatment

- Demolish existing aerated grit system and building.
- Relocate new vortex grit to south side of site.
- Construct a 30-foot by 40-foot building addition to the headworks building.

Primary Treatment

- Demolish existing primary clarifiers.
- Install microscreens for MBR protection and to replace primary clarifiers.

MBR System

- Three trains of membranes in existing final clarifiers.
- Update aeration system as needed for MBR biological treatment.
- Decommission existing final clarifiers and demolish mechanisms.

Disinfection

- Decommission existing chlorine disinfection system.
- Build new UV disinfection system within the existing chlorine contact tanks.

Solids Handling

- Two rotary drum thickeners and associated piping and equipment modifications to reduce biosolids volume.
- Bulk lime storage and lime handling equipment for biosolids stabilization.

Minimal additional improvements would be required to meet the Phase 1b design criteria. Additional membrane modules would be installed in the MBR system as required to provide necessary treatment capacity.

In addition to the improvements identified above, the following improvements would be required to provide capacity to meet the Phase 2 design criteria:

- Additional microscreening equipment.
- Additional membrane train and associated equipment.

Alternative 5 improvements are identified in Figure 5 with Phase 1a improvements identified in red. Phase 1b improvements will include additional membrane modules within the original three trains in the existing primary clarifier tanks. Phase 2 improvements will include a fourth membrane train in the existing primary clarifier and screening equipment within the same Phase 1a footprint. Ultimate buildout for Alternative 5 would require less than 1 acre of Fitzgerald Park and will entail that some area be disturbed by new piping to and from the new flow retention basin.

4.1.6 Alternative 6 – Maintain Existing Facility and Construct a Remote Facility

Alternative 6 would maintain the capacity of the existing WWTP and provides additional capacity at a second remote WWTP located near the anticipated growth within the industrial park. While significant improvements would not be required currently at the existing WWTP, substantial collection system improvements would be required to redirect flow to the remote WWTP site. In addition, loading to the remote WWTP would be very low until growth within the industrial park is realized. Once growth within the industrial park is realized, the remote

facility would be highly dependent upon loading from a small number of industrial users. This underloading and potential future variable loading would create significant operational difficulties.

This remote facility could potentially discharge to the Whitney Drain, a small tributary of the Grand River. Given this potential discharge location, the effluent limits for the remote facility would be very restrictive and necessitate a high degree of reliable treatment. Providing a facility able to meet such treatment requirements may be cost prohibitive.

By introducing a remote facility, the City would need to maintain compliance with their existing National Pollutant Discharge Elimination System (NPDES) permit at the current WWTP and would also need to maintain compliance with a new NPDES permit at the remote facility. Maintenance costs and system reliability would also be a concern in maintaining two WWTPs.

Given the loading concerns, the restrictive treatment requirements, the cost of construction, and the cost and logistical concerns associated with maintenance multiple facilities, Alternative 6 is not considered further at this time.

4.2 Cost Estimates

Total preliminary opinions of probable construction cost for Alternatives 3, 4, and 5 are presented in Table 4.

Table 4 – Preliminary Principal Alternative Opinion of Probable Construction Cost Comparison

Work Items	Alternate 3: Conventional Activated Sludge Expansion	Alternate 4: Extended Aeration	Alternate 5: MBRs
Mobilization	$923,000	$1,004,000	$778,000
Flow Retention	$8,214,000	$8,214,000	$8,214,000
Preliminary Treatment	$1,129,000	$1,129,000	$1,129,000
Primary Clarification	$2,201,000	$162,000	$834,000
Biological Treatment	$1,770,000	$6,860,000	$3,506,000
Final Clarification	$3,060,000	$1,635,000	$150,000
Disinfection	$1,172,000	$1,172,000	$812,000
Solids Handling	$900,000	$900,000	$900,000
Construction Subtotal	**$19,369,000**	**$21,076,000**	**$15,423,000**
Estimate Contingency	$1,937,000	$2,108,000	$1,633,000
Design Contingency	$1,937,000	$2,108,000	$1,633,000
Cost Escalation	$2,906,000	$3,162,000	$2,449,000
Construction Contingency	$1,937,000	$2,108,000	$1,633,000
Construction and Contingency Subtotal	**$28,086,000**	**$30,562,000**	**$22,771,000**
General Conditions, Overhead & Profit	$1,562,000	$1,612,000	$1,474,000
Total Construction Estimate	**$29,648,000**	**$32,174,000**	**$24,245,000**
Engineering and Inspection Services	$4,448,000	$4,827,000	$3,772,000
Total Estimated Project Cost	**$34,096,000**	**$37,001,000**	**$28,017,000**

Detailed cost estimates are presented in Appendix 1. These costs represent WWTP improvements required to meet the Phase 1a flow and loading criteria. Costs have been prepared using current construction pricing; an escalation factor has been applied to account for the current volatility in the bidding climate.

4.3 Net Present Worth Analysis

A present worth analysis evaluates the total cost of treatment of each principal alternative by evaluating their 20-year life cycle costs. This net present worth analysis includes an evaluation of the capital cost for construction, the operation, maintenance, and replacement (OM&R) costs and the salvage value for the proposed improvements.

OM&R costs account for labor costs, supply and chemical costs, utility costs, maintenance costs and additional expenses required to operate and maintain the proposed facility. The present worth for 20 years of OM&R costs are included in the analysis. An interest rate of 0.5% has been assumed for this analysis.

Salvage values for the proposed improvements are included in the net present worth analysis. Items included in the current project will retain value at the end of the design life of the project and may continue to provide value. The present worth of the salvage value is included in the net present worth analysis, again assuming an interest rate of 0.5%.

In general, the alternative with the lowest net present worth can be viewed as the alternative that provides the lowest cost of treatment. All principal alternatives are intended to meet the current treatment requirements. Table 5 presents the results of the net present worth analysis.

Table 5 – Net Present Worth Analysis

Items	Alternate 3: Conventional Activated Sludge Expansion	Alternate 4: Extended Aeration	Alternate 5: MBRs
Total Estimated Project Cost	$34,096,000	$37,001,000	$28,017,000
Present Worth of 20 Years of OM&R Costs	$17,042,000	$19,406,000	$21,210,000
Present Worth of Salvage Value	$5,579,000	$6,349,000	$4,228,000
Total Net Present Worth	$45,559,000	$50,058,000	$44,999,000

4.4 Additional Monetary Considerations

The future expandability of the proposed alternative is an important consideration. The site constraints observed at the existing location necessitate an efficient use of available space. Expanding Alternate 3 or Alternate 4 beyond the Phase 1a improvements will require additional land for treatment plant use. Alternate 5 can continue to expand to meet the Phase 1b and Phase 2 flow and load projections while maintaining the existing treatment plant footprint. Cost estimate for Phase 1b and Phase 2 improvements have been developed for Alternate 3, Alternate 4, and Alternate 5, and are presented in Appendix A. A summary of these future costs is presented in Table 6. Because it is unknown when these improvements may be implemented, they have not been incorporated into the net present worth analysis.

Table 6 – Future Expansion Costs

Items	Alternate 3: Conventional Activated Sludge Expansion	Alternate 4: Extended Aeration	Alternate 5: MBRs
Phase 1b	$3,447,000	$4,329,000	$1,896,400
Phase 2	$9,211,000	$5,805,000	$3,238,600

Expanding the existing WWTP to the full buildout capacity as a single project may offer construction cost efficiencies. Costs to achieve Phase 2 capacities in a single WWTP expansion project are presented in Table 7.

Table 7 – Phase 1a, Phase 1b and Phase 2 as a Single Construction Project

	Alternate 3: Conventional Activated Sludge Expansion	Alternate 4: Extended Aeration	Alternate 5: MBRs
Total Estimated Project Cost	$42,961,000	$45,039,000	$32,052,000

4.5 Environmental Impacts

4.5.1 Phase 1a Short-Term Impacts

Phase 1a construction for Alternative 3 involves expansion of the WWTP into Fitzgerald Park, which will involve excavation of grass covered area to construct new treatment cells with between 5- and 10-feet of excavation below the existing grade. Alternative 3 will require excavation of a large portion of the solids handling area to construct the new retention basin. Alternative 3 will also include excavation at the existing WWTP site for construction of new primary clarifiers. As these areas have been disturbed previously, there is no impact to threatened or endangered species anticipated.

Phase 1a construction for Alternative 4 proposes further expansion into Fitzgerald Park than necessary for Alternatives 3 and 5. Alternative 4 involves excavation of grass covered area to a deeper excavation between 10- and 20-feet below existing grade. Room in the solids handing facility for Phase 2 improvements and construction of the new retention basin will be required. Alternative 4 will include upgrades to final clarification capacity which will disturb the WWTP site as well. As these areas have been disturbed previously, no impacts to threatened or endangered species are anticipated.

Phase 1a construction for Alternative 5 will require excavation of a portion of Fitzgerald Park to construct the new retention basin. As this area has been disturbed previously, no impacts to threatened or endangered species are anticipated.

Soil erosion and sedimentation control (SESC) will be used to mitigate impacts of excavation and construction vehicle traffic to the Grand River. Excavation will not affect the sandstone ledges.

4.5.2 Phases 1b and 2 - Short-Term Impacts

Alternative 3 will involve additional excavation of the existing WWTP for Phase 1b and Phase 2, and in the grass area of Fitzgerald Park during to construct additional aeration tanks. As with Phase 1a, proper SESC will be utilized to minimize impacts to the river.

Alternative 4 will involve additional excavation of the solids storage area and piping through Fitzgerald Park for Phase 2. In addition, a third new final clarifier will be constructed in the existing WWTP area. Traffic control in the park during construction and SESC will be needed during Phase 2 construction.

Alternative 5 will require additional excavation causing limited environmental impacts during Phases 1b and 2. Treatment capacity increases will be accomplished by adding additional screens to the headworks building addition constructed in Phase 1a and adding membranes to the converted primary clarifier tanks.

The sandstone ledges will not be disturbed during Phases 1b or 2 for any of the alternatives considered.

4.5.3 Long-Term Environmental Impacts

Impacts to the Grand River depend on the treatment alternative chosen. Alternative 5 produces a higher quality effluent than the other treatment alternatives, but treatment improvements for any alternative will be sized to meet the effluent discharge quality requirements to the Grand River as required by EGLE.

4.6 Land Requirements

Each of the remaining alternatives will require additional land for construction within Fitzgerald Park area.

Alternative 3 will require approximately 1.3 acres for additional treatment area and will disturb an additional 0.3 acres for buried piping modifications.

Alternative 4 will require approximately 1.4 acres for additional treatment area and will disturb an additional 0.3 acres for buried piping modifications. The steep slope of the area south of the WWTP and the size of the proposed extended air tanks requires the Phase 2 tank to be constructed adjacent to the existing biosolids storage tank in the biosolids handling area. This would require further air piping, process water piping, and sludge piping. This alternative requires the largest expansion footprint.

Alternative 5 will require less than 1 acre for additional treatment area, including the grass hill and the gravel parking lot west of the WWTP.

4.7 Potential Construction Problems

Continuing existing WWTP operation is the main concern when decommissioning or demolishing treatment cells. To remove a tank, the replacement tank and process piping or a temporary bypass must already be in place. Phase 1a construction for all alternatives will need to be coordinated to allow for uninterrupted treatment. Yard piping protection when converting and constructing treatment tanks will be essential to uninterrupted service. A detailed survey of yard piping is needed during design to determine the allowable footprint of new tanks and the alignments of new piping.

There will be natural factors to contend with during construction such as the steep grade across the site and Fitzgerald Park, as well as the bedrock that exists close to grade. The steep grade will necessitate the need for pumps to reach treatment that is built uphill and necessitates some of the extended aeration tanks in Alternative 4 to be built further into Fitzgerald Park. Increased difficulty of excavation into bedrock for tanks, building additions, or piping must be considered during cost and schedule estimation. These factors will dictate the future site plan and impact the construction cost.

With the current supply chain issues, volatile material pricing, and uncertain labor availability experienced across the country, the estimates provided in this report are less certain than before the Covid-19 pandemic. It is unclear if these issues will have resolved or worsened by the time construction of Phase 1a would begin.

4.8 Sustainability Considerations

Energy and chemical use efficiency of the main treatment processes will be considered to lessen the long-term environmental impact of the WWTP operation. On average, the energy consumption of the alternatives is less with conventional activated sludge, and the most with the MBR system, with extended aeration consumption

falling between the two. If the lowest overall energy consumption is the main concern, then Alternative 3 would be the recommended upgrade. However, this does not consider the sustainability impacts of reduced chemical use for solids stabilization and disinfection with Alternative 5. It also does not consider the increased ammonia removal that is associated with Alternative 5. Each principal alternative has a sustainable benefit for implementation.

4.9 Future Treatment Requirements

State and federal treatment requirements continue to become more stringent. While future treatment requirements are not known, the City may see more restrictive phosphorus and ammonia limits in the future. Alternate 3, Alternate 4, and Alternate 5 are able to provide treatment that can reliably meet the current effluent criteria. Of the alternatives investigated, MBR treatment is best suited to provide a superior quality effluent that is likely able to meet more restrictive future effluent limits.

5.0 Conclusions and Recommendations

Collection system sampling has been used to validate the projected flows and loads presented in the 2021 Basis of Design Report. Alternate 3, Alternate 4, and Alternate 5 are all able to provide treatment for these projected flows and loads. Alternate 5 has the lowest total estimated project cost of the viable alternatives. This relatively lower projected project cost is directly related to the MBR treatment equipment being able to fit within footprint of the existing tanks. While the operating costs for Alternate 5 are higher than those associated with Alternate 3 or Alternate 4, a higher level of treatment better suited to meet potential future effluent limits is provided by the MBR technology included in Alternate 5. Additionally, when the alternatives are evaluated on a net present worth basis, Alternate 5 remains the lowest cost option. Alternate 5 is the recommended alternative because of the relatively lower projected initial capital cost and net present worth, the high level of treatment provided, and the efficient land use.

Figures

PLOT INFO: Z:\2020\201424\CAD_FIGURES\PROPOSED WWTP SITE MAP.DWG LAYOUT: FIG02-LARGE SITE MAP DATE: 12/9/2021 TIME: 5:02:50 PM USER: JREDNER

NORTH

EXISTING WWTP SITE MAP

SCALE: 1" = 50'

0 25 50 100

City of Grand Ledge
Eaton County, Michigan

Grand Ledge WWTP Expansion and Sanitary Collection System Improvements - Basis of Design

PROJECT NO. 201424

FIGURE NO. 2

Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

fishbeck
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PLOT INFO: Z:\191425 Grand Ledge\GIS\MapDoc\201424 - WWTP Expansion\Wastewater Project Planning Area - Existing Service Area.mxd Date: 3/4/2021 3:55:55 PM User: prbaskins

SITE 1

SITE 2

SITE 3

COLLECTION SYSTEM SAMPLING LOCATIONS

NORTH

0 1,000 2,000 FEET

LEGEND

Existing Service Area

City Limits

Data Source: Base map reproduced with permission granted by the County of Eaton, Michigan. Some information has been provided subject to a non-exclusive, limited, and revocable license granted by the County of Eaton, Michigan.

FIGURE NO. 2

PROJECT NO. 201424

City of Grand Ledge

Eaton County, Michigan

WWTP Expansion

Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

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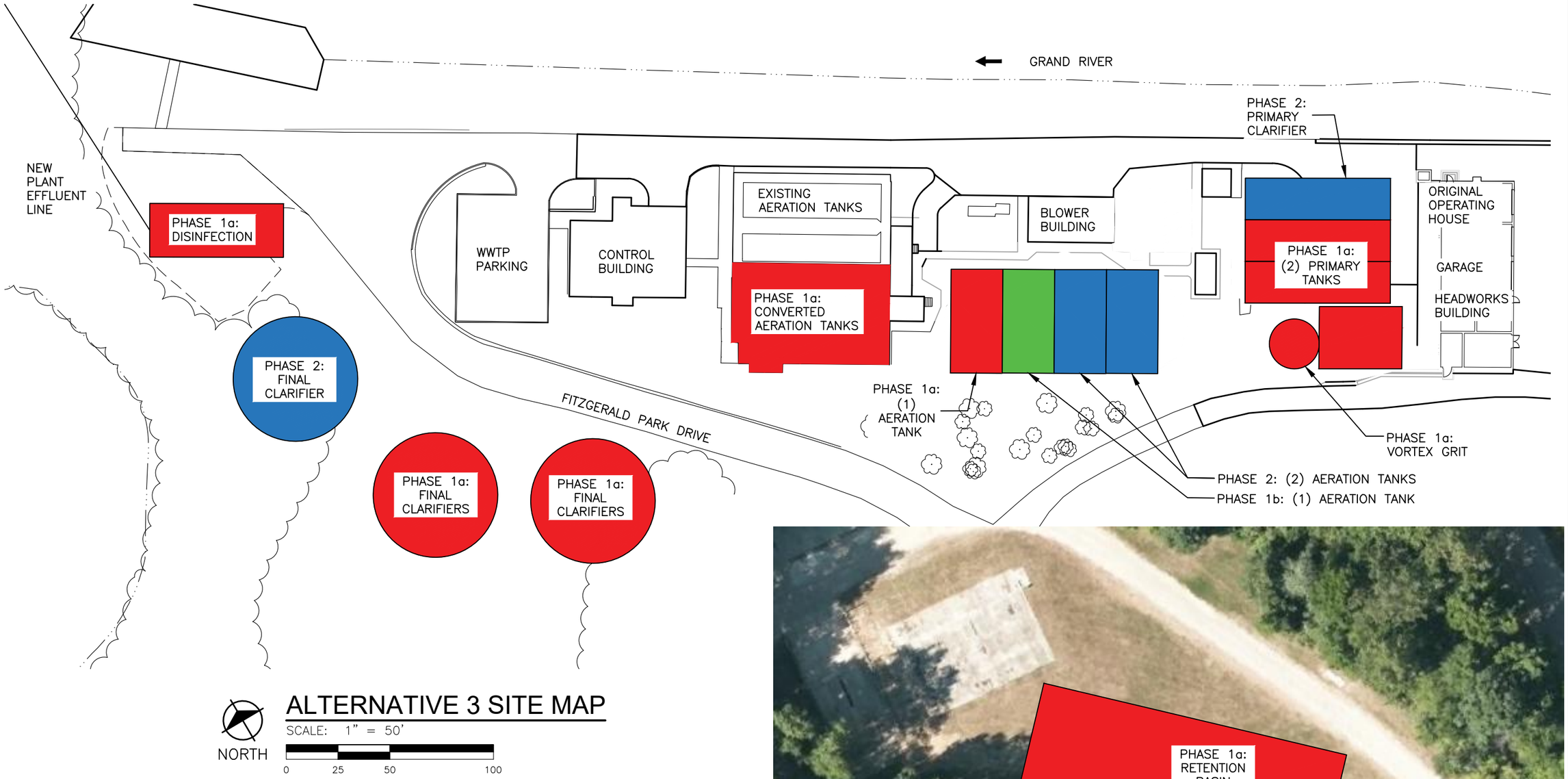

ALTERNATIVE 3 SITE MAP

SCALE: 1" = 50'

LEGEND

EDGE OF WATER		LIGHT		GRAVEL SURFACE	
SHRUBS		GUY ANCHOR		PAVED SURFACE	
DECIDUOUS TREE		UTILITY POLE		CURB & GUTTER	
HEDGE EDGE OF WOODS		SIGN		FENCE	

SOLIDS STORAGE AREA - SEE FIGURE 2

SCALE: 1" = 50'

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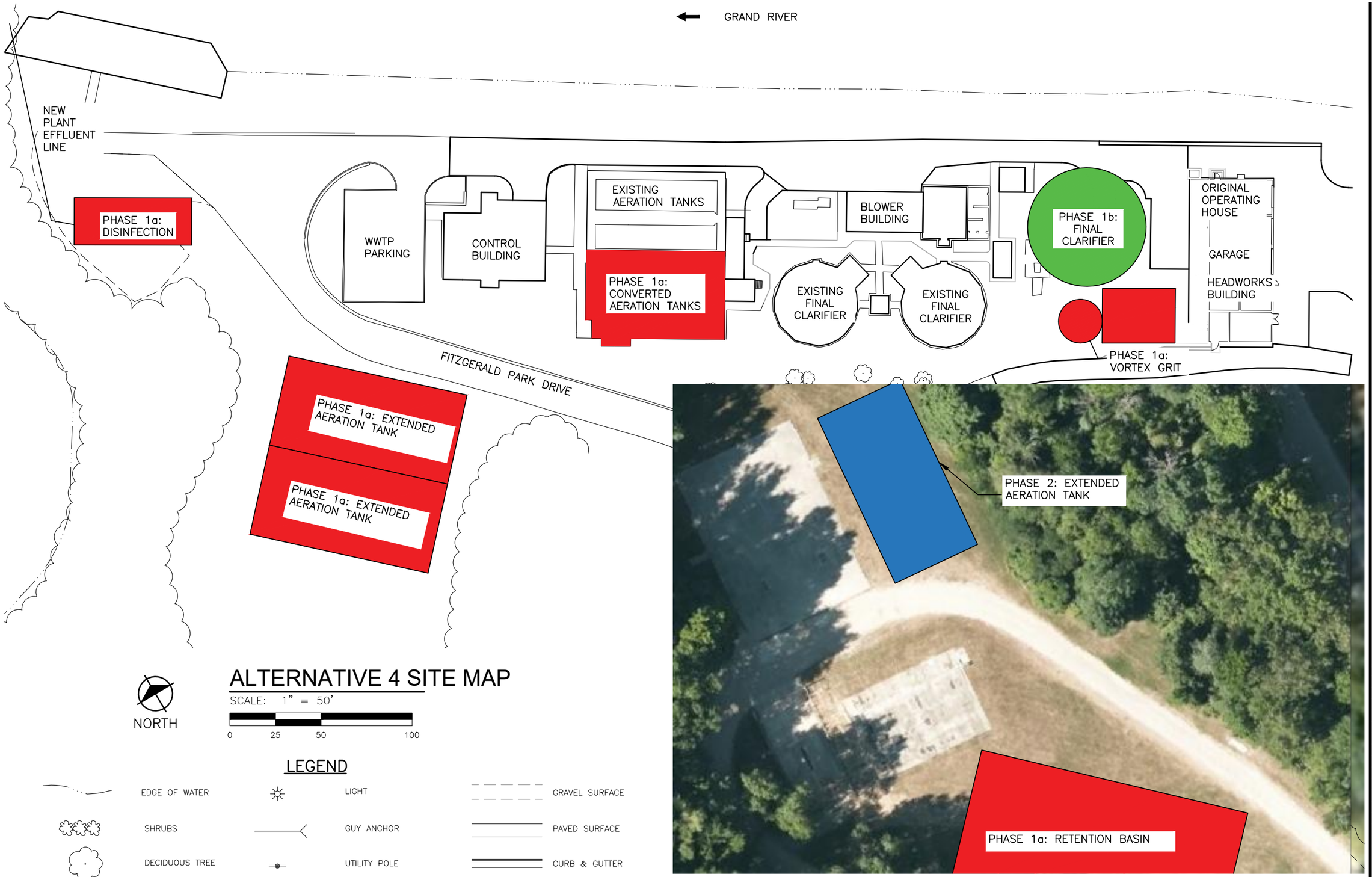
Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

City of Grand Ledge
Eaton County, Michigan

Grand Ledge WWTP Expansion and Sanitary Collection System Improvements - Basis of Design

PROJECT NO.
201424

FIGURE NO.
3



ALTERNATIVE 4 SITE MAP

SCALE: 1" = 50'

NORTH

0 25 50 100

LEGEND

- EDGE OF WATER
- SHRUBS
- DECIDUOUS TREE
- HEDGE / EDGE OF WOODS
- LIGHT
- GUY ANCHOR
- UTILITY POLE
- SIGN
- GRAVEL SURFACE
- PAVED SURFACE
- CURB & GUTTER
- FENCE

SOLIDS STORAGE AREA - SEE FIGURE 2

SCALE: 1" = 50'

PLOT INFO: Z:\2020\201424\CAD_FIGURES\PROPOSED WWTP SITE MAP.DWG LAYOUT: FIG04-ALTERNATIVE 4 DATE: 12/9/2021 TIME: 5:07:17 PM USER: JREDNER

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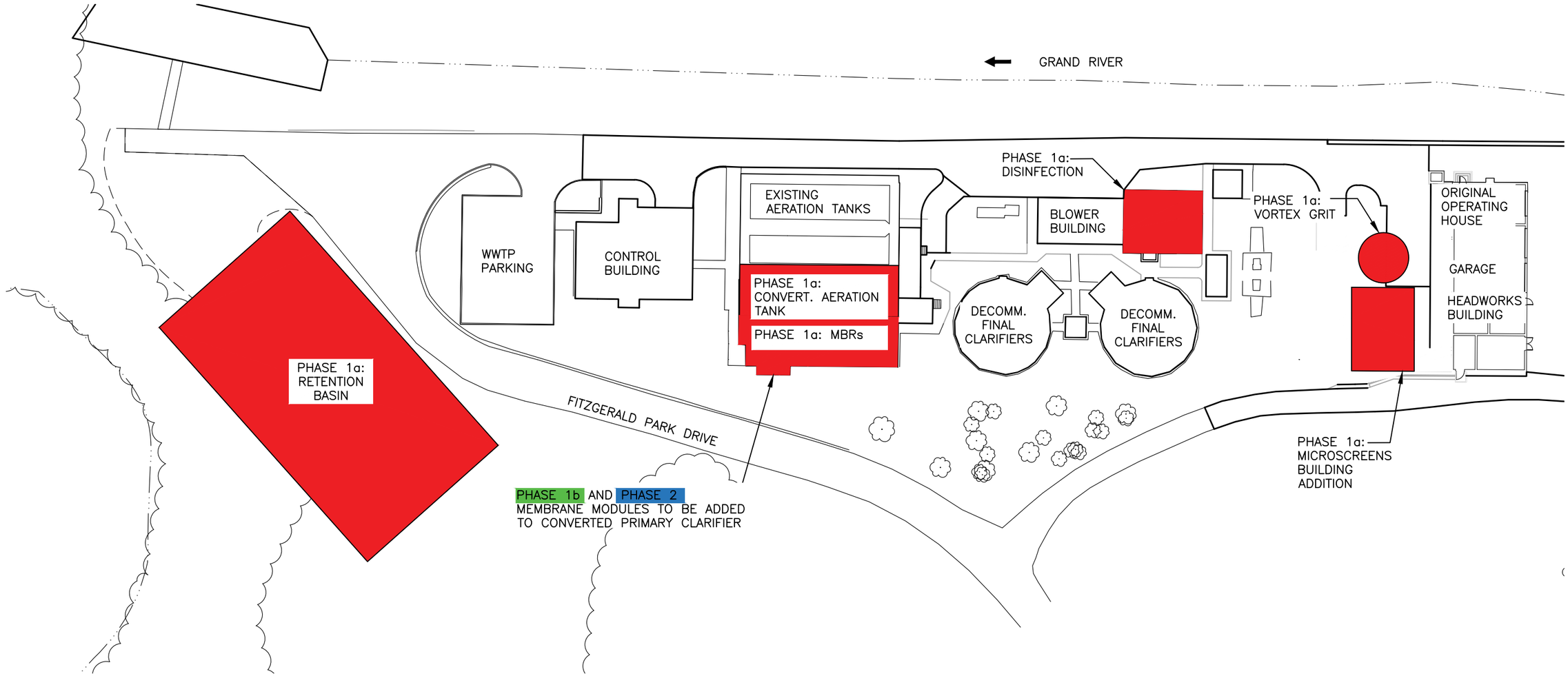
City of Grand Ledge
Eaton County, Michigan

Grand Ledge WWTP Expansion and Sanitary Collection System Improvements - Basis of Design

PROJECT NO.
201424

FIGURE NO.
4



NORTH

ALTERNATIVE 5 SITE MAP

SCALE: 1" = 50'

0 25 50 100

LEGEND

EDGE OF WATER		LIGHT		GRAVEL SURFACE	
SHRUBS		GUY ANCHOR		PAVED SURFACE	
DECIDUOUS TREE		UTILITY POLE		CURB & GUTTER	
HEDGE EDGE OF WOODS		SIGN		FENCE	

PLOT INFO: Z:\2020\201424\CAD_FIGURES\PROPOSED WWTP SITE MAP.DWG LAYOUT: FIG05-ALTERNATIVE 5 DATE: 12/9/2021 TIME: 5:11:06 PM USER: JREDNER

fishbeck
Engineers | Architects | Scientists | Constructors

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City of Grand Ledge
Eaton County, Michigan

Grand Ledge WWTP Expansion and Sanitary Collection System Improvements - Basis of Design

PROJECT NO.
201424

FIGURE NO.
5

Appendix 1

City of Grand Ledge WWTP Improvements

Net Present Worth Analysis

Work Items	Alternate 3: Conventional Activated Sludge Expansion	Alternate 4: Extended Aeration without Primary Clarifiers	Alternate 5: Microscreens and MBRs without Primary or Final Clarifiers
Mobilization	$923,000	$1,004,000	$778,000
Flow Retention	$8,214,000	$8,214,000	$8,214,000
Preliminary Treatment	$1,129,000	$1,129,000	$1,129,000
Primary Clarification	$2,201,000	$162,000	$834,000
Biological Treatment	$1,770,000	$6,860,000	$3,506,000
Final Clarification	$3,060,000	$1,635,000	$150,000
Disinfection	$1,172,000	$1,172,000	$812,000
Solids Handling	$900,000	$900,000	$900,000
Construction Subtotal	**$19,369,000**	**$21,076,000**	**$15,423,000**
Estimate Contingency	$1,937,000	$2,108,000	$1,633,000
Design Contingency	$1,937,000	$2,108,000	$1,633,000
Cost Escalation	$2,906,000	$3,162,000	$2,449,000
Construction Contingency	$1,937,000	$2,108,000	$1,633,000
Construction and Contingency Subtotal	**$28,086,000**	**$30,562,000**	**$22,771,000**
General Conditions, Overhead & Profit	$1,562,000	$1,612,000	$1,474,000
Total Construction Estimate	**$29,648,000**	**$32,174,000**	**$24,245,000**
Engineering and Inspection Services	$4,448,000	$4,827,000	$3,772,000
Total Estimated Project Cost	**$34,096,000**	**$37,001,000**	**$28,017,000**
Present Worth of 20 Years of OM&R Costs	**$17,042,000**	**$19,406,000**	**$21,210,000**
Present Worth of Salvage Value	**$5,579,000**	**$6,349,000**	**$4,228,000**
Total Net Present Worth	**$45,559,000**	**$50,058,000**	**$44,999,000**

Future Expansion Opinion of Probable Project Cost

Phase 1b	**$3,447,000**	**$4,329,000**	**$1,896,400**
Phase 2	**$9,211,000**	**$5,805,000**	**$3,238,600**

Phase 1a, Phase 1b and Phase 2 as a Single Construction Project

Total Estimated Project Cost	**$42,961,000**	**$45,039,000**	**$32,052,000**

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 3 - Expansion of Conventional Activated Sludge, Phase 1a

Total Design Life (years)	20
Interest Rate	0.50%

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost	Useful Life (Years)	Future Salvage Value	Present Worth of Salvage Value
General										
Mobilization	LS	1	$ 923,000	$ 923,000	$ -	$ -	$ 923,000	0	$ -	$ -
Flow Retention										
Excavation and Backfill	CYD	12,000	$ -	$ -	$ 100	$ 1,200,000	$ 1,200,000	0	$ -	$ -
Concrete	CYD	3,450	$ 1,250	$ 4,312,500	$ -	$ -	$ 4,313,000	50	$ 2,587,800	$ 2,342,122
Access Hatch	EA	2	$ 20,000	$ 40,000	$ 6,000	$ 12,000	$ 52,000	50	$ 31,200	$ 28,238
Flushing System	LS	1	$ 500,000	$ 500,000	$ 150,000	$ 150,000	$ 650,000	30	$ 216,667	$ 196,097
Pumps	EA	2	$ 90,500	$ 181,000	$ 27,150	$ 54,300	$ 236,000	20	$ -	$ -
Site Piping Force Main	LF	1,290	$ 500	$ 645,000	$ 150	$ 193,500	$ 839,000	50	$ 503,400	$ 455,609
Site Piping Gravity Sewer	LF	1,310	$ 500	$ 655,000	$ 150	$ 196,500	$ 852,000	50	$ 511,200	$ 462,668
Electrical, Instrumentation, and Controls	LS	1	$ 55,000	$ 55,000	$ 17,000	$ 17,000	$ 72,000	15	$ -	$ -
Preliminary Treatment										
Demolition of Existing Grit and Site Piping	LS	1	$ -	$ -	$ 132,500	$ 132,500	$ 133,000	0	$ -	$ -
Screen	LS	1	$ 195,000	$ 195,000	$ 58,500	$ 58,500	$ 254,000	20	$ -	$ -
Vortex Grit Removal	LS	1	$ 192,000	$ 192,000	$ 57,600	$ 57,600	$ 250,000	30	$ 83,333	$ 75,422
Conveyor	LS	1	$ 40,000	$ 40,000	$ 12,000	$ 12,000	$ 52,000	20	$ -	$ -
Site Piping	LF	130	$ 400	$ 52,000	$ -	$ -	$ 52,000	50	$ 31,200	$ 28,238
Building Addition	SQFT	1,200	$ 160	$ 192,000	$ -	$ -	$ 192,000	30	$ 64,000	$ 57,924
Site Restoration	LS	1	$ 15,000	$ 15,000	$ 4,500	$ 4,500	$ 20,000	0	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 135,000	$ 135,000	$ 41,000	$ 41,000	$ 176,000	15	$ -	$ -
Primary Clarification										
Digester Demolition	LS	1	$ -	$ -	$ 100,000	$ 100,000	$ 100,000	0	$ -	$ -
Primary Clarifier Mechanisms Demolition	LS	1	$ -	$ -	$ 50,000	$ 50,000	$ 50,000	0	$ -	$ -
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 2,000	$ 2,000	$ 12,000	0	$ -	$ -
Excavation and Backfill	CYD	1,260	$ -	$ -	$ 100	$ 126,000	$ 126,000	0	$ -	$ -
Concrete	CYD	630	$ 1,250	$ 787,500	$ -	$ -	$ 788,000	50	$ 472,800	$ 427,914
Site Piping	LF	285	$ 400	$ 114,000	$ -	$ -	$ 114,000	50	$ 68,400	$ 61,906
Clarifier Mechanism and Drive	EA	2	$ 160,000	$ 320,000	$ 64,000	$ 128,000	$ 448,000	20	$ -	$ -
Sludge Pump	EA	2	$ 15,840	$ 31,680	$ 4,760	$ 9,520	$ 42,000	20	$ -	$ -
Sludge Piping	LF	340	$ 200	$ 68,000	$ -	$ -	$ 68,000	50	$ 40,800	$ 36,927
Handrail and Grating	LS	1	$ 50,000	$ 50,000	$ 15,000	$ 15,000	$ 65,000	30	$ 21,667	$ 19,610
Electrical, Instrumentation, and Controls	LS	1	$ 277,000	$ 277,000	$ 111,000	$ 111,000	$ 388,000	15	$ -	$ -
Biological Treatment										
Modification to Existing Primary Clarifiers	LS	1	$ -	$ -	$ 200,000	$ 200,000	$ 200,000	50	$ 120,000	$ 108,608
Excavation & Fill	CYD	300	$ -	$ -	$ 100	$ 30,000	$ 30,000	0	$ -	$ -
Concrete	CYD	200	$ 1,250	$ 250,000	$ -	$ -	$ 250,000	50	$ 150,000	$ 135,759
Site Piping	LF	400	$ 500	$ 200,000	$ -	$ -	$ 200,000	50	$ 120,000	$ 108,608
Diffusers and Aeration Equipment	EA	2	$ 150,000	$ 300,000	$ 45,000	$ 90,000	$ 390,000	20	$ -	$ -
Blower	EA	2	$ 150,000	$ 300,000	$ 45,000	$ 90,000	$ 390,000	20	$ -	$ -
Blower VFD	EA	2	$ 35,000	$ 70,000	$ 10,500	$ 21,000	$ 91,000	15	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 168,000	$ 168,000	$ 50,400	$ 50,400	$ 219,000	15	$ -	$ -

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 3 - Expansion of Conventional Activated Sludge, Phase 1a

Total Design Life (years)	20
Interest Rate	0.50%

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost	Useful Life (Years)	Future Salvage Value	Present Worth of Salvage Value
Final Clarification										
Demolition of Existing Finals	LS	1	$ -	$ -	$ 265,000	$ 265,000	$ 265,000	0	$ -	$ -
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 3,000	$ 3,000	$ 13,000	0	$ -	$ -
Excavation and Backfill	CYD	2,630	$ -	$ -	$ 100	$ 263,000	$ 263,000	0	$ -	$ -
Concrete	CYD	920	$ 1,250	$ 1,150,000	$ -	$ -	$ 1,150,000	50	$ 690,000	$ 624,493
Site Piping	LS	85	$ 400	$ 34,000	$ -	$ -	$ 34,000	50	$ 20,400	$ 18,463
Final Clarifier Internal Mechanism	EA	2	$ 300,000	$ 600,000	$ 30,000	$ 60,000	$ 660,000	20	$ -	$ -
Sludge Pump	EA	2	$ 15,840	$ 31,680	$ 4,752	$ 9,504	$ 42,000	20	$ -	$ -
RAS Pipe	LF	120	$ 200	$ 24,000	$ -	$ -	$ 24,000	50	$ 14,400	$ 13,033
WAS Pipe	LF	120	$ 200	$ 24,000	$ -	$ -	$ 24,000	50	$ 14,400	$ 13,033
Tank Coating	LS	2	$ 10,000	$ 20,000	$ 3,000	$ 6,000	$ 26,000	15	$ -	$ -
Handrail and Grating	SQFT	658	$ 80	$ 52,650	$ 24	$ 15,795	$ 69,000	30	$ 23,000	$ 20,816
Launder Cover	EA	2	$ 36,700	$ 73,400	$ 11,010	$ 22,020	$ 96,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 303,000	$ 303,000	$ 91,000	$ 91,000	$ 394,000	15	$ -	$ -
Disinfection										
Excavation and Backfill	CYD	100	$ -	$ -	$ 100	$ 10,000	$ 10,000	0	$ -	$ -
Concrete	CYD	40	$ 1,250	$ 50,000	$ 375	$ 15,000	$ 65,000	50	$ 39,000	$ 35,297
UV Equipment	LS	1	$ 600,000	$ 600,000	$ 180,000	$ 180,000	$ 780,000	20	$ -	$ -
Site Piping	LF	210	$ 450	$ 94,500	$ 135	$ 28,350	$ 123,000	50	$ 73,800	$ 66,794
Electrical, Instrumentation, and Controls	LS	1	$ 149,000	$ 149,000	$ 45,000	$ 45,000	$ 194,000	15	$ -	$ -
Solids Handling										
Process Piping Modifications	LS	1	$ 250,000	$ 250,000	$ -	$ -	$ 250,000	50	$ 150,000	$ 135,759
Dewatering Equipment	EA	2	$ 75,000	$ 150,000	$ 22,500	$ 45,000	$ 195,000	20	$ -	$ -
Polymer Feed Equipment	LS	1	$ 20,000	$ 20,000	$ 6,000	$ 6,000	$ 26,000	20	$ -	$ -
Lime Storage	LS	1	$ 150,000	$ 150,000	$ 45,000	$ 45,000	$ 195,000	50	$ 117,000	$ 105,892
Lime Feed Equipment	LS	1	$ 100,000	$ 100,000	$ 30,000	$ 30,000	$ 130,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 80,000	$ 80,000	$ 24,000	$ 24,000	$ 104,000	15	$ -	$ -
SUBTOTAL DIRECT CONSTRUCTION COST							**$ 19,369,000**			**$ 5,579,000**
Estimate Contingency	Percentage of Subtotal			10%			$ 1,937,000			
Design Contingency	Percentage of Subtotal			10%			$ 1,937,000			
Cost Escalation	Percentage of Subtotal			15%			$ 2,906,000			
Construction Contingency	Percentage of Subtotal			10%			$ 1,937,000			
SUBTOTAL DIRECT CONSTRUCTION WITH CONTINGENCIES							**$ 28,086,000**			
General Conditions, Overhead & Profit							$ 1,562,000			
TOTAL CONSTRUCTION ESTIMATE							**$ 29,648,000**			
Engineering and Inspection Services	Percentage of Subtotal			15%			$ 4,448,000			
TOTAL ESTIMATED PROJECT COST							**$ 34,096,000**			

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 4 - Conversion to Extended Aeration, Phase 1a

Total Design Life (years)	20
Interest Rate	0.50%

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost	Useful Life (Years)	Future Salvage Value	Present Worth of Salvage Value
General										
Mobilization	LS	1	$ 1,004,000	$ 1,004,000	$ -	$ -	$ 1,004,000	0	$ -	$ -
Flow Retention										
Excavation and Backfill	CYD	12,000	$ -	$ -	$ 100	$ 1,200,000	$ 1,200,000	0	$ -	$ -
Concrete	CYD	3,450	$ 1,250	$ 4,312,500	$ -	$ -	$ 4,313,000	50	$ 2,587,800	$ 2,342,122
Access Hatch	EA	2	$ 20,000	$ 40,000	$ 6,000	$ 12,000	$ 52,000	50	$ 31,200	$ 28,238
Flushing System	LS	1	$ 500,000	$ 500,000	$ 150,000	$ 150,000	$ 650,000	30	$ 216,667	$ 196,097
Pumps	EA	2	$ 90,500	$ 181,000	$ 27,150	$ 54,300	$ 236,000	20	$ -	$ -
Site Piping Force Main	LF	1,290	$ 500	$ 645,000	$ 150	$ 193,500	$ 839,000	50	$ 503,400	$ 455,609
Site Piping Gravity Sewer	LF	1,310	$ 500	$ 655,000	$ 150	$ 196,500	$ 852,000	50	$ 511,200	$ 462,668
Electrical, Instrumentation, and Controls	LS	1	$ 55,000	$ 55,000	$ 17,000	$ 17,000	$ 72,000	15	$ -	$ -
Preliminary Treatment										
Demolition of Existing Grit and Site Piping	LS	1	$ -	$ -	$ 132,500	$ 132,500	$ 133,000	0	$ -	$ -
Screen	LS	1	$ 195,000	$ 195,000	$ 58,500	$ 58,500	$ 254,000	20	$ -	$ -
Vortex Grit Removal	LS	1	$ 192,000	$ 192,000	$ 57,600	$ 57,600	$ 250,000	30	$ 83,333	$ 75,422
Conveyor	LS	1	$ 40,000	$ 40,000	$ 12,000	$ 12,000	$ 52,000	20	$ -	$ -
Site Piping	LF	130	$ 400	$ 52,000	$ -	$ -	$ 52,000	50	$ 31,200	$ 28,238
Building Addition	SQFT	1,200	$ 160	$ 192,000	$ -	$ -	$ 192,000	30	$ 64,000	$ 57,924
Site Restoration	LS	1	$ 15,000	$ 15,000	$ 4,500	$ 4,500	$ 20,000	0	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 135,000	$ 135,000	$ 41,000	$ 41,000	$ 176,000	15	$ -	$ -
Primary Clarification										
Digester Demolition	LS	1	$ -	$ -	$ 100,000	$ 100,000	$ 100,000	0	$ -	$ -
Primary Clarifier Mechanisms Demolition	LS	1	$ -	$ -	$ 50,000	$ 50,000	$ 50,000	0	$ -	$ -
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 2,000	$ 2,000	$ 12,000	0	$ -	$ -
Biological Treatment										
Modifications to Existing Aeration and Primary Tanks	LS	1	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 200,000	50	$ 120,000	$ 108,608
Site Work	LS	1	$ 15,000	$ 15,000	$ 4,500	$ 4,500	$ 20,000	0	$ -	$ -
Excavation and Backfill	CYD	5,560	$ -	$ -	$ 150	$ 834,000	$ 834,000	0	$ -	$ -
Concrete	CYD	2,270	$ 1,250	$ 2,837,500	$ -	$ -	$ 2,838,000	50	$ 1,702,800	$ 1,541,141
Site Piping	LF	1,395	$ 400	$ 558,000	$ -	$ -	$ 558,000	50	$ 334,800	$ 303,015
Aeration Equipment	EA	2	$ 500,000	$ 1,000,000	$ 125,000	$ 250,000	$ 1,250,000	20	$ -	$ -
WAS Pipe	LF	400	$ 200	$ 80,000	$ -	$ -	$ 80,000	50	$ 48,000	$ 43,443
Sludge Pump	EA	3	$ 15,840	$ 47,520	$ 4,752	$ 14,256	$ 62,000	20	$ -	$ -
Sludge Meter	EA	3	$ 5,000	$ 15,000	$ 1,500	$ 4,500	$ 20,000	20	$ -	$ -
Sampler	EA	3	$ 20,000	$ 60,000	$ 6,000	$ 18,000	$ 78,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 707,000	$ 707,000	$ 213,000	$ 213,000	$ 920,000	15	$ -	$ -

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 4 - Conversion to Extended Aeration, Phase 1a

Total Design Life (years)	20
Interest Rate	0.50%

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost	Useful Life (Years)	Future Salvage Value	Present Worth of Salvage Value
Final Clarification										
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 3,000	$ 3,000	$ 13,000	0	$ -	$ -
Excavation and Backfill	CYD	1,315	$ -	$ -	$ 100	$ 131,500	$ 132,000	0	$ -	$ -
Concrete	CYD	460	$ 1,250	$ 575,000	$ -	$ -	$ 575,000	50	$ 345,000	$ 312,247
Site Piping	LS	85	$ 400	$ 34,000	$ -	$ -	$ 34,000	50	$ 20,400	$ 18,463
Final Clarifier Internal Mechanism	EA	1	$ 300,000	$ 300,000	$ 30,000	$ 30,000	$ 330,000	20	$ -	$ -
Sludge Pump	EA	1	$ 15,840	$ 15,840	$ 4,752	$ 4,752	$ 21,000	20	$ -	$ -
RAS Pipe	LF	100	$ 200	$ 20,000	$ -	$ -	$ 20,000	50	$ 12,000	$ 10,861
WAS Pipe	LF	100	$ 200	$ 20,000	$ -	$ -	$ 20,000	50	$ 12,000	$ 10,861
Tank Coating	LS	1	$ 10,000	$ 10,000	$ 3,000	$ 3,000	$ 13,000	15	$ -	$ -
Handrail and Grating	SQFT	329	$ 80	$ 26,325	$ 24	$ 7,897	$ 35,000	30	$ 11,667	$ 10,559
Launder Cover	EA	1	$ 36,700	$ 36,700	$ 11,010	$ 11,010	$ 48,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 303,000	$ 303,000	$ 91,000	$ 91,000	$ 394,000	15	$ -	$ -
Disinfection										
Excavation and Backfill	CYD	100	$ -	$ -	$ 100	$ 10,000	$ 10,000	0	$ -	$ -
Concrete	CYD	40	$ 1,250	$ 50,000	$ 375	$ 15,000	$ 65,000	50	$ 39,000	$ 35,297
UV Equipment	LS	1	$ 600,000	$ 600,000	$ 180,000	$ 180,000	$ 780,000	20	$ -	$ -
Site Piping	LF	210	$ 450	$ 94,500	$ 135	$ 28,350	$ 123,000	50	$ 73,800	$ 66,794
Electrical, Instrumentation, and Controls	LS	1	$ 149,000	$ 149,000	$ 45,000	$ 45,000	$ 194,000	15	$ -	$ -
Solids Handling										
Process Piping Modifications	LS	1	$ 250,000	$ 250,000	$ -	$ -	$ 250,000	50	$ 150,000	$ 135,759
Dewatering Equipment	EA	2	$ 75,000	$ 150,000	$ 22,500	$ 45,000	$ 195,000	20	$ -	$ -
Polymer Feed Equipment	LS	1	$ 20,000	$ 20,000	$ 6,000	$ 6,000	$ 26,000	20	$ -	$ -
Lime Storage	LS	1	$ 150,000	$ 150,000	$ 45,000	$ 45,000	$ 195,000	50	$ 117,000	$ 105,892
Lime Feed Equipment	LS	1	$ 100,000	$ 100,000	$ 30,000	$ 30,000	$ 130,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 80,000	$ 80,000	$ 24,000	$ 24,000	$ 104,000	15	$ -	$ -
SUBTOTAL DIRECT CONSTRUCTION COST							**$ 21,076,000**			**$ 6,349,000**
Estimate Contingency	Percentage of Subtotal			10%			$ 2,108,000			
Design Contingency	Percentage of Subtotal			10%			$ 2,108,000			
Cost Escalation	Percentage of Subtotal			15%			$ 3,162,000			
Construction Contingency	Percentage of Subtotal			10%			$ 2,108,000			
SUBTOTAL DIRECT CONSTRUCTION WITH CONTINGENCIES							**$ 30,562,000**			
General Conditions, Overhead & Profit							$ 1,612,000			
TOTAL CONSTRUCTION ESTIMATE							**$ 32,174,000**			
Engineering and Inspection Services	Percentage of Subtotal			15%			$ 4,827,000			
TOTAL ESTIMATED PROJECT COST							**$ 37,001,000**			

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 5 - Conversion to MBR, Phase 1a

Total Design Life (years)	20
Interest Rate	0.50%

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost	Useful Life (Years)	Future Salvage Value	Present Worth of Salvage Value
General										
Mobilization	LS	1	$ 778,000	$ 778,000	$ -	$ -	$ 778,000	0	$ -	$ -
Flow Retention										
Excavation and Backfill	CYD	12,000	$ -	$ -	$ 100	$ 1,200,000	$ 1,200,000	0	$ -	$ -
Concrete	CYD	3,450	$ 1,250	$ 4,312,500	$ -	$ -	$ 4,313,000	50	$ 2,587,800	$ 2,342,122
Access Hatch	EA	2	$ 20,000	$ 40,000	$ 6,000	$ 12,000	$ 52,000	50	$ 31,200	$ 28,238
Flushing System	LS	1	$ 500,000	$ 500,000	$ 150,000	$ 150,000	$ 650,000	30	$ 216,667	$ 196,097
Pumps	EA	2	$ 90,500	$ 181,000	$ 27,150	$ 54,300	$ 236,000	20	$ -	$ -
Site Piping Force Main	LF	1,290	$ 500	$ 645,000	$ 150	$ 193,500	$ 839,000	50	$ 503,400	$ 455,609
Site Piping Gravity Sewer	LF	1,310	$ 500	$ 655,000	$ 150	$ 196,500	$ 852,000	50	$ 511,200	$ 462,668
Electrical, Instrumentation, and Controls	LS	1	$ 55,000	$ 55,000	$ 17,000	$ 17,000	$ 72,000	15	$ -	$ -
Preliminary Treatment										
Demolition of Existing Grit and Site Piping	LS	1	$ -	$ -	$ 132,500	$ 132,500	$ 133,000	0	$ -	$ -
Screen	LS	1	$ 195,000	$ 195,000	$ 58,500	$ 58,500	$ 254,000	20	$ -	$ -
Vortex Grit Removal	LS	1	$ 192,000	$ 192,000	$ 57,600	$ 57,600	$ 250,000	30	$ 83,333	$ 75,422
Conveyor	LS	1	$ 40,000	$ 40,000	$ 12,000	$ 12,000	$ 52,000	20	$ -	$ -
Site Piping	LF	130	$ 400	$ 52,000	$ -	$ -	$ 52,000	50	$ 31,200	$ 28,238
Building Addition	SQFT	1,200	$ 160	$ 192,000	$ -	$ -	$ 192,000	30	$ 64,000	$ 57,924
Site Restoration	LS	1	$ 15,000	$ 15,000	$ 4,500	$ 4,500	$ 20,000	0	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 135,000	$ 135,000	$ 41,000	$ 41,000	$ 176,000	15	$ -	$ -
Primary Clarification										
Digester Demolition	LS	1	$ -	$ -	$ 100,000	$ 100,000	$ 100,000	0	$ -	$ -
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 2,000	$ 2,000	$ 12,000	0	$ -	$ -
Microscreen	EA	3	$ 185,000	$ 555,000	$ 55,500	$ 166,500	$ 722,000	20	$ -	$ -
Biological Treatment										
Demolition of Primary and Final Clarifier Equipment	LS	1	$ -	$ -	$ 200,000	$ 200,000	$ 200,000	0	$ -	$ -
Modification of North Primary to Aeration	LS	1	$ 150,000	$ 150,000	$ 45,000	$ 45,000	$ 195,000	50	$ 117,000	$ 105,892
Influent Channel from Aeration to MBRs	LS	1	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 200,000	50	$ 120,000	$ 108,608
Aeration Equipment	LS	1	$ 435,500	$ 435,500	$ -	$ -	$ 436,000	20	$ -	$ -
Site Piping	LF	500	$ 400	$ 200,000	$ -	$ -	$ 200,000	50	$ 120,000	$ 108,608
Membranes and Associated Equipment	LS	1	$ 1,270,000	$ 1,270,000	$ 508,000	$ 508,000	$ 1,778,000	20	$ -	$ -
Level Sensor	EA	3	$ 10,000	$ 30,000	$ 3,000	$ 9,000	$ 39,000	15	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 344,000	$ 344,000	$ 114,000	$ 114,000	$ 458,000	15	$ -	$ -

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 5 - Conversion to MBR, Phase 1a

Total Design Life (years)	20
Interest Rate	0.50%

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost	Useful Life (Years)	Future Salvage Value	Present Worth of Salvage Value
Final Clarification										
Demolish Exiting Final Clarifier Mechanisms	EA	2	$ -	$ -	$ 75,000	$ 150,000	$ 150,000	0	$ -	$ -
Disinfection										
Concrete	CYD	20	$ 1,250	$ 25,000	$ 375	$ 7,500	$ 33,000	50	$ 19,800	$ 17,920
UV Equipment	LS	1	$ 450,000	$ 450,000	$ 135,000	$ 135,000	$ 585,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 149,000	$ 149,000	$ 45,000	$ 45,000	$ 194,000	15	$ -	$ -
Solids Handling										
Process Piping Modifications	LS	1	$ 250,000	$ 250,000	$ -	$ -	$ 250,000	50	$ 150,000	$ 135,759
Dewatering Equipment	EA	2	$ 75,000	$ 150,000	$ 22,500	$ 45,000	$ 195,000	20	$ -	$ -
Polymer Feed Equipment	LS	1	$ 20,000	$ 20,000	$ 6,000	$ 6,000	$ 26,000	20	$ -	$ -
Lime Storage	LS	1	$ 150,000	$ 150,000	$ 45,000	$ 45,000	$ 195,000	50	$ 117,000	$ 105,892
Lime Feed Equipment	LS	1	$ 100,000	$ 100,000	$ 30,000	$ 30,000	$ 130,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 80,000	$ 80,000	$ 24,000	$ 24,000	$ 104,000	15	$ -	$ -
SUBTOTAL DIRECT CONSTRUCTION COST							**$ 16,323,000**			**$ 4,228,000**
Estimate Contingency	Percentage of Subtotal			10%			$ 1,633,000			
Design Contingency	Percentage of Subtotal			10%			$ 1,633,000			
Cost Escalation	Percentage of Subtotal			15%			$ 2,449,000			
Construction Contingency	Percentage of Subtotal			10%			$ 1,633,000			
SUBTOTAL DIRECT CONSTRUCTION WITH CONTINGENCIES							**$ 23,671,000**			
General Conditions, Overhead & Profit							$ 1,474,000			
TOTAL CONSTRUCTION ESTIMATE							**$ 25,145,000**			
Engineering and Inspection Services	Percentage of Subtotal			15%			$ 3,772,000			
TOTAL ESTIMATED PROJECT COST							**$ 28,917,000**			

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 3 - Expansion of Conventional Activated Sludge, Phase 1b

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost
General							
Mobilization	LS	1	$ 65,000	$ 65,000	$ -	$ -	$ 65,000
Biological Treatment							
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 3,000	$ 3,000	$ 13,000
Excavation and Backfill	CYD	300	$ -	$ -	$ 100	$ 30,000	$ 30,000
Concrete	CYD	200	$ 1,250	$ 250,000	$ -	$ -	$ 250,000
Site Piping	LF	150	$ 500	$ 75,000	$ -	$ -	$ 75,000
Diffusers and Aeration Equipment	EA	1	$ 150,000	$ 150,000	$ 45,000	$ 45,000	$ 195,000
Blower	EA	1	$ 150,000	$ 150,000	$ 45,000	$ 45,000	$ 195,000
Blower VFD	EA	1	$ 35,000	$ 35,000	$ 10,500	$ 10,500	$ 46,000
RAS Pipe	LF	200	$ 200	$ 40,000	$ -	$ -	$ 40,000
WAS Pipe	LF	200	$ 200	$ 40,000	$ -	$ -	$ 40,000
Sludge Pump	EA	2	$ 15,840	$ 31,680	$ 4,752	$ 9,504	$ 42,000
Sludge Meter	EA	2	$ 5,000	$ 10,000	$ 1,500	$ 3,000	$ 13,000
DO and Level Sensor	EA	2	$ 35,000	$ 70,000	$ 10,500	$ 21,000	$ 91,000
Grating For Aeration Basins	SQFT	400	$ 80	$ 32,000	$ 26	$ 10,560	$ 43,000
Sampler	EA	1	$ 20,000	$ 20,000	$ 6,600	$ 6,600	$ 27,000
Electrical, Instrumentation, and Controls	LS	1	$ 138,000	$ 138,000	$ 46,000	$ 46,000	$ 184,000
SUBTOTAL DIRECT CONSTRUCTION COST							**$ 1,349,000**
Estimate Contingency	Percentage of Subtotal			10%			$ 135,000
Design Contingency	Percentage of Subtotal			10%			$ 135,000
Cost Escalation	Percentage of Subtotal			15%			$ 203,000
Construction Contingency	Percentage of Subtotal			10%			$ 135,000
SUBTOTAL DIRECT CONSTRUCTION WITH CONTINGENCIES							**$ 1,957,000**
General Conditions, Overhead & Profit							$ 1,040,000
TOTAL CONSTRUCTION ESTIMATE							**$ 2,997,000**
Engineering and Inspection Services	Percentage of Subtotal			15%			$ 450,000
TOTAL ESTIMATED PROJECT COST							**$ 3,447,000**

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 4 - Conversion to Extended Aeration, Phase 1b

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost
General							
Mobilization	LS	1	$ 89,000	$ 89,000	$ -	$ -	$ 89,000
Final Clarification							
Digester Demolition	LS	1	$ -	$ -	$ 100,000	$ 100,000	$ 100,000
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 3,000	$ 3,000	$ 13,000
Excavation and Backfill	CYD	1,320	$ -	$ -	$ 100	$ 132,000	$ 132,000
Concrete	CYD	460	$ 1,250	$ 575,000	$ -	$ -	$ 575,000
Site Piping	LS	600	$ 400	$ 240,000	$ -	$ -	$ 240,000
Final Clarifier Internal Mechanism	EA	1	$ 300,000	$ 300,000	$ 30,000	$ 30,000	$ 330,000
Sludge Pump	EA	1	$ -	$ -	$ -	$ -	$ -
RAS Pipe	LF	120	$ 200	$ 24,000	$ -	$ -	$ 24,000
WAS Pipe	LF	120	$ 200	$ 24,000	$ -	$ -	$ 24,000
Tank Coating	LS	1	$ 10,000	$ 10,000	$ 3,000	$ 3,000	$ 13,000
Handrail and Grating	SQFT	329	$ 80	$ 26,325	$ 24	$ 7,897	$ 35,000
Launder Cover	EA	1	$ 36,700	$ 36,700	$ 11,010	$ 11,010	$ 48,000
Electrical, Instrumentation, and Controls	LS	1	$ 187,000	$ 187,000	$ 57,000	$ 57,000	$ 244,000
SUBTOTAL DIRECT CONSTRUCTION COST							**$ 1,867,000**
Estimate Contingency	Percentage of Subtotal			10%			$ 187,000
Design Contingency	Percentage of Subtotal			10%			$ 187,000
Cost Escalation	Percentage of Subtotal			15%			$ 281,000
Construction Contingency	Percentage of Subtotal			10%			$ 187,000
SUBTOTAL DIRECT CONSTRUCTION WITH CONTINGENCIES							**$ 2,709,000**
General Conditions, Overhead & Profit							$ 1,055,000
TOTAL CONSTRUCTION ESTIMATE							**$ 3,764,000**
Engineering and Inspection Services	Percentage of Subtotal			15%			$ 565,000
TOTAL ESTIMATED PROJECT COST							**$ 4,329,000**

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 5 - Conversion to MBR, Phase 1b

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost
General							
Mobilization	LS	1	$ 21,000	$ 21,000	$ -	$ -	$ 21,000
Biological Treatment							
Membranes and Associated Equipment	LS	1	$ 347,000	$ 347,000	$ 69,400	$ 69,400	$ 416,400
SUBTOTAL DIRECT CONSTRUCTION COST							**$ 437,400**
Estimate Contingency	Percentage of Subtotal			10%			$ 44,000
Design Contingency	Percentage of Subtotal			10%			$ 44,000
Cost Escalation	Percentage of Subtotal			15%			$ 66,000
Construction Contingency	Percentage of Subtotal			10%			$ 44,000
SUBTOTAL DIRECT CONSTRUCTION WITH CONTINGENCIES							**$ 635,400**
General Conditions, Overhead & Profit							$ 1,013,000
TOTAL CONSTRUCTION ESTIMATE							**$ 1,648,400**
Engineering and Inspection Services	Percentage of Subtotal			15%			$ 248,000
TOTAL ESTIMATED PROJECT COST							**$ 1,896,400**

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 3 - Expansion of Conventional Activated Sludge, Phase 2

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost
General							
Mobilization	LS	1	$ 226,000	$ 226,000	$ -	$ -	$ 226,000
Primary Clarification							
Excavation and Backfill	CYD	640	$ -	$ -	$ 100	$ 64,000	$ 64,000
Concrete	CYD	310	$ 1,250	$ 387,500	$ -	$ -	$ 388,000
Site Piping	LF	285	$ 400	$ 114,000	$ -	$ -	$ 114,000
Clarifier Mechanism and Drive	EA	1	$ 160,000	$ 160,000	$ -	$ -	$ 160,000
Sludge Pump	EA	1	$ 15,840	$ 15,840	$ 4,752	$ 4,752	$ 21,000
Handrail and Grating	LS	1	$ 25,000	$ 25,000	$ 7,500	$ 7,500	$ 33,000
Electrical, Instrumentation, and Controls	LS	1	$ 141,000	$ 141,000	$ 43,000	$ 43,000	$ 184,000
Biological Treatment							
Site Work	LS	1	$ 10,000	$ 10,000	$ 3,000	$ 3,000	$ 13,000
Excavation and Backfill	CYD	745	$ -	$ -	$ 100	$ 74,500	$ 75,000
Concrete	CYD	440	$ 1,250	$ 550,000	$ -	$ -	$ 550,000
Site Piping	LF	100	$ 500	$ 50,000	$ -	$ -	$ 50,000
Diffusers and Aeration Equipment	EA	2	$ 150,000	$ 300,000	$ 45,000	$ 90,000	$ 390,000
Blower	EA	2	$ 150,000	$ 300,000	$ 45,000	$ 90,000	$ 390,000
Blower VFD	EA	2	$ 35,000	$ 70,000	$ 10,500	$ 21,000	$ 91,000
RAS Pipe	LF	120	$ 200	$ 24,000	$ -	$ -	$ 24,000
WAS Pipe	LF	120	$ 200	$ 24,000	$ -	$ -	$ 24,000
Sludge Pump	EA	4	$ 15,840	$ 63,360	$ 4,752	$ 19,008	$ 83,000
Sludge Meter	EA	2	$ 5,000	$ 10,000	$ 1,500	$ 3,000	$ 13,000
DO and Level Sensor	EA	2	$ 35,000	$ 70,000	$ 10,500	$ 21,000	$ 91,000
Grating For Aeration Basins	SQFT	800	$ 80	$ 64,000	$ 24	$ 19,200	$ 84,000
Electrical, Instrumentation, and Controls	LS	1	$ 231,000	$ 231,000	$ 70,000	$ 70,000	$ 301,000

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 3 - Expansion of Conventional Activated Sludge, Phase 2

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost
Final Clarification							
Excavation and Backfill	CYD	1,313	$ -	$ -	$ 100	$ 131,333	$ 132,000
Concrete	CYD	460	$ 1,250	$ 575,000	$ -	$ -	$ 575,000
Site Restoration	LS	1	$ 10,000	$ 10,000	$ -	$ -	$ 10,000
Final Clarifier Internal Mechanism	EA	1	$ 300,000	$ 300,000	$ 30,000	$ 30,000	$ 330,000
Sludge Pump	EA	1	$ 15,840	$ 15,840	$ 3,960	$ 3,960	$ 20,000
RAS Pipe	LF	50	$ 200	$ 10,000	$ -	$ -	$ 10,000
WAS Pipe	LF	50	$ 200	$ 10,000	$ -	$ -	$ 10,000
Tank Coating	LS	1	$ 10,000	$ 10,000	$ -	$ -	$ 10,000
Handrail and Grating	SQFT	329	$ 80	$ 26,325	$ 16	$ 5,265	$ 32,000
Launder Cover	EA	1	$ 36,700	$ 36,700	$ 7,340	$ 7,340	$ 45,000
Electrical, Instrumentation, and Controls	LS	1	$ 150,000	$ 150,000	$ 45,000	$ 45,000	$ 195,000
SUBTOTAL DIRECT CONSTRUCTION COST							**$ 4,738,000**
Estimate Contingency	Percentage of Subtotal			10%			$ 474,000
Design Contingency	Percentage of Subtotal			10%			$ 474,000
Cost Escalation	Percentage of Subtotal			15%			$ 711,000
Construction Contingency	Percentage of Subtotal			10%			$ 474,000
SUBTOTAL DIRECT CONSTRUCTION WITH CONTINGENCIES							**$ 6,871,000**
General Conditions, Overhead & Profit							$ 1,138,000
TOTAL CONSTRUCTION ESTIMATE							**$ 8,009,000**
Engineering and Inspection Services	Percentage of Subtotal			15%			$ 1,202,000
TOTAL ESTIMATED PROJECT COST							**$ 9,211,000**

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 4 - Conversion to Extended Aeration, Phase 2

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost
General							
Mobilization	LS	1	$ 131,000	$ 131,000	$ -	$ -	$ 131,000
Biological Treatment							
Site Work	LS	1	$ 10,000	$ 10,000	$ 3,000	$ 3,000	$ 13,000
Excavation and Backfill	CYD	2,223	$ -	$ -	$ 150	$ 333,500	$ 334,000
Concrete	CYD	907	$ 1,250	$ 1,133,333	$ -	$ -	$ 1,134,000
Site Piping	LF	85	$ 400	$ 34,000	$ -	$ -	$ 34,000
Aeration Equipment	EA	1	$ 500,000	$ 500,000	$ 125,000	$ 125,000	$ 625,000
WAS Pipe	LF	200	$ 200	$ 40,000	$ -	$ -	$ 40,000
Sludge Pump	EA	2	$ 15,840	$ 31,680	$ 4,752	$ 9,504	$ 42,000
Sludge Meter	EA	1	$ 5,000	$ 5,000	$ 1,500	$ 1,500	$ 7,000
Sampler	EA	1	$ 20,000	$ 20,000	$ 6,000	$ 6,000	$ 26,000
Electrical, Instrumentation, and Controls	LS	1	$ 267,000	$ 267,000	$ 81,000	$ 81,000	$ 348,000
SUBTOTAL DIRECT CONSTRUCTION COST							**$ 2,734,000**
Estimate Contingency	Percentage of Subtotal			10%			$ 274,000
Design Contingency	Percentage of Subtotal			10%			$ 274,000
Cost Escalation	Percentage of Subtotal			15%			$ 411,000
Construction Contingency	Percentage of Subtotal			10%			$ 274,000
SUBTOTAL DIRECT CONSTRUCTION WITH CONTINGENCIES							**$ 3,967,000**
General Conditions, Overhead & Profit							$ 1,080,000
TOTAL CONSTRUCTION ESTIMATE							**$ 5,047,000**
Engineering and Inspection Services	Percentage of Subtotal			15%			$ 758,000
TOTAL ESTIMATED PROJECT COST							**$ 5,805,000**

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 5 - Conversion to MBR, phase 2

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost
General							
Mobilization	LS	1	$ 59,000	$ 59,000	$ -	$ -	$ 59,000
Primary Clarification							
Microscreen	EA	1	$ 185,000	$ 185,000	$ -	$ -	$ 185,000
Biological Treatment							
Site Piping	LF	30	$ 400	$ 12,000	$ -	$ -	$ 12,000
Membranes and Associated Equipment	LS	1	$ 633,000	$ 633,000	$ 126,600	$ 126,600	$ 759,600
Level Sensor	EA	3	$ 10,000	$ 30,000	$ 3,000	$ 9,000	$ 39,000
Electrical, Instrumentation, and Controls	LS	1	$ 129,000	$ 129,000	$ 43,000	$ 43,000	$ 172,000
SUBTOTAL DIRECT CONSTRUCTION COST							**$ 1,226,600**
Estimate Contingency	Percentage of Subtotal			10%			$ 123,000
Design Contingency	Percentage of Subtotal			10%			$ 123,000
Cost Escalation	Percentage of Subtotal			15%			$ 184,000
Construction Contingency	Percentage of Subtotal			10%			$ 123,000
SUBTOTAL DIRECT CONSTRUCTION WITH CONTINGENCIES							**$ 1,779,600**
General Conditions, Overhead & Profit							$ 1,036,000
TOTAL CONSTRUCTION ESTIMATE							**$ 2,815,600**
Engineering and Inspection Services	Percentage of Subtotal			15%			$ 423,000
TOTAL ESTIMATED PROJECT COST							**$ 3,238,600**

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 3 - Expansion of Conventional Activated Sludge, Full Buildout as Single Project

Total Design Life (years)	20
Interest Rate	0.50%

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost	Useful Life (Years)	Future Salvage Value	Present Worth of Salvage Value
General										
Mobilization	LS	1	$ 1,165,000	$ 1,165,000	$ -	$ -	$ 1,165,000	0	$ -	$ -
Flow Retention										
Excavation and Backfill	CYD	12,000	$ -	$ -	$ 100	$ 1,200,000	$ 1,200,000	0	$ -	$ -
Concrete	CYD	3,450	$ 1,250	$ 4,312,500	$ -	$ -	$ 4,313,000	50	$ 2,587,800	$ 2,342,122
Access Hatch	EA	2	$ 20,000	$ 40,000	$ 6,000	$ 12,000	$ 52,000	50	$ 31,200	$ 28,238
Flushing System	LS	1	$ 500,000	$ 500,000	$ 150,000	$ 150,000	$ 650,000	30	$ 216,667	$ 196,097
Pumps	EA	2	$ 90,500	$ 181,000	$ 27,150	$ 54,300	$ 236,000	20	$ -	$ -
Site Piping Force Main	LF	1,290	$ 500	$ 645,000	$ 150	$ 193,500	$ 839,000	50	$ 503,400	$ 455,609
Site Piping Gravity Sewer	LF	1,310	$ 500	$ 655,000	$ 150	$ 196,500	$ 852,000	50	$ 511,200	$ 462,668
Electrical, Instrumentation, and Controls	LS	1	$ 55,000	$ 55,000	$ 17,000	$ 17,000	$ 72,000	15	$ -	$ -
Preliminary Treatment										
Demolition of Existing Grit and Site Piping	LS	1	$ -	$ -	$ 132,500	$ 132,500	$ 133,000	0	$ -	$ -
Screen	LS	1	$ 195,000	$ 195,000	$ 58,500	$ 58,500	$ 254,000	20	$ -	$ -
Vortex Grit Removal	LS	1	$ 192,000	$ 192,000	$ 57,600	$ 57,600	$ 250,000	30	$ 83,333	$ 75,422
Conveyor	LS	1	$ 40,000	$ 40,000	$ 12,000	$ 12,000	$ 52,000	20	$ -	$ -
Site Piping	LF	130	$ 400	$ 52,000	$ -	$ -	$ 52,000	50	$ 31,200	$ 28,238
Building Addition	SQFT	1,200	$ 160	$ 192,000	$ -	$ -	$ 192,000	30	$ 64,000	$ 57,924
Site Restoration	LS	1	$ 15,000	$ 15,000	$ 4,500	$ 4,500	$ 20,000	0	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 135,000	$ 135,000	$ 41,000	$ 41,000	$ 176,000	15	$ -	$ -
Primary Clarification										
Digester Demolition	LS	1	$ -	$ -	$ 100,000	$ 100,000	$ 100,000	0	$ -	$ -
Primary Clarifier Mechanisms Demolition	LS	1	$ -	$ -	$ 50,000	$ 50,000	$ 50,000	0	$ -	$ -
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 2,000	$ 2,000	$ 12,000	0	$ -	$ -
Excavation and Backfill	CYD	1,900	$ -	$ -	$ 100	$ 190,000	$ 190,000	0	$ -	$ -
Concrete	CYD	940	$ 1,250	$ 1,175,000	$ -	$ -	$ 1,175,000	50	$ 705,000	$ 638,069
Site Piping	LF	570	$ 400	$ 228,000	$ -	$ -	$ 228,000	50	$ 136,800	$ 123,813
Clarifier Mechanism and Drive	EA	3	$ 160,000	$ 480,000	$ 64,000	$ 192,000	$ 672,000	20	$ -	$ -
Sludge Pump	EA	3	$ 15,840	$ 47,520	$ 4,760	$ 14,280	$ 62,000	20	$ -	$ -
Sludge Piping	LF	340	$ 200	$ 68,000	$ -	$ -	$ 68,000	50	$ 40,800	$ 36,927
Handrail and Grating	LS	1	$ 75,000	$ 75,000	$ 22,500	$ 22,500	$ 98,000	30	$ 32,667	$ 29,565
Electrical, Instrumentation, and Controls	LS	1	$ 418,000	$ 418,000	$ 154,000	$ 154,000	$ 572,000	15	$ -	$ -
Biological Treatment										
Modification to Existing Primary Clarifiers	LS	1	$ -	$ -	$ 200,000	$ 200,000	$ 200,000	50	$ 120,000	$ 108,608
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 3,000	$ 3,000	$ 13,000	0	$ -	$ -
Excavation & Fill	CYD	1,345	$ -	$ -	$ 100	$ 30,000	$ 30,000	0	$ -	$ -
Concrete	CYD	840	$ 1,250	$ 250,000	$ -	$ -	$ 250,000	50	$ 150,000	$ 135,759
Site Piping	LF	650	$ 500	$ 325,000	$ -	$ -	$ 325,000	50	$ 195,000	$ 176,487
Diffusers and Aeration Equipment	EA	5	$ 150,000	$ 750,000	$ 45,000	$ 225,000	$ 975,000	20	$ -	$ -
Blower	EA	5	$ 150,000	$ 750,000	$ 45,000	$ 225,000	$ 975,000	20	$ -	$ -
Blower VFD	EA	5	$ 35,000	$ 175,000	$ 10,500	$ 52,500	$ 228,000	15	$ -	$ -
DO and Level Sensor	EA	4	$ 35,000	$ 140,000	$ 10,500	$ 42,000	$ 182,000	15	$ -	$ -
Grating For Aeration Basins	SQFT	1,200	$ 80	$ 96,000	$ 26	$ 31,680	$ 128,000	20	$ -	$ -
Sampler	EA	1	$ 20,000	$ 20,000	$ 6,600	$ 6,600	$ 27,000	15	$ -	$ -

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 3 - Expansion of Conventional Activated Sludge, Full Buildout as Single Project

Total Design Life (years)	20
Interest Rate	0.50%

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost	Useful Life (Years)	Future Salvage Value	Present Worth of Salvage Value
Electrical, Instrumentation, and Controls	LS	1	$ 537,000	$ 537,000	$ 166,400	$ 166,400	$ 704,000	15	$ -	$ -
Final Clarification										
Demolition of Existing Finals	LS	1	$ -	$ -	$ 265,000	$ 265,000	$ 265,000	0	$ -	$ -
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 3,000	$ 3,000	$ 13,000	0	$ -	$ -
Excavation and Backfill	CYD	3,943	$ -	$ -	$ 100	$ 394,333	$ 395,000	0	$ -	$ -
Concrete	CYD	1,380	$ 1,250	$ 1,725,000	$ -	$ -	$ 1,725,000	50	$ 1,035,000	$ 936,740
Site Piping	LS	85	$ 400	$ 34,000	$ -	$ -	$ 34,000	50	$ 20,400	$ 18,463
Final Clarifier Internal Mechanism	EA	3	$ 300,000	$ 900,000	$ 30,000	$ 90,000	$ 990,000	20	$ -	$ -
Sludge Pump	EA	4	$ 15,840	$ 63,360	$ 4,752	$ 19,008	$ 83,000	20	$ -	$ -
Sludge Meter	EA	4	$ 5,000	$ 20,000	$ 1,500	$ 6,000	$ 26,000	20	$ -	$ -
RAS Pipe	LF	490	$ 200	$ 98,000	$ -	$ -	$ 98,000	50	$ 58,800	$ 53,218
WAS Pipe	LF	490	$ 200	$ 98,000	$ -	$ -	$ 98,000	50	$ 58,800	$ 53,218
Tank Coating	EA	3	$ 10,000	$ 30,000	$ 3,000	$ 9,000	$ 39,000	15	$ -	$ -
Handrail and Grating	SQFT	987	$ 80	$ 78,975	$ 24	$ 23,692	$ 103,000	30	$ 34,333	$ 31,074
Launder Cover	EA	3	$ 36,700	$ 110,100	$ 11,010	$ 33,030	$ 144,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 453,000	$ 453,000	$ 136,000	$ 136,000	$ 589,000	15	$ -	$ -
Disinfection										
Excavation and Backfill	CYD	100	$ -	$ -	$ 100	$ 10,000	$ 10,000	0	$ -	$ -
Concrete	CYD	40	$ 1,250	$ 50,000	$ 375	$ 15,000	$ 65,000	50	$ 39,000	$ 35,297
UV Equipment	LS	1	$ 600,000	$ 600,000	$ 180,000	$ 180,000	$ 780,000	20	$ -	$ -
Site Piping	LF	210	$ 450	$ 94,500	$ 135	$ 28,350	$ 123,000	50	$ 73,800	$ 66,794
Electrical, Instrumentation, and Controls	LS	1	$ 149,000	$ 149,000	$ 45,000	$ 45,000	$ 194,000	15	$ -	$ -
Solids Handling										
Process Piping Modifications	LS	1	$ 250,000	$ 250,000	$ -	$ -	$ 250,000	50	$ 150,000	$ 135,759
Dewatering Equipment	EA	2	$ 75,000	$ 150,000	$ 22,500	$ 45,000	$ 195,000	20	$ -	$ -
Polymer Feed Equipment	LS	1	$ 20,000	$ 20,000	$ 6,000	$ 6,000	$ 26,000	20	$ -	$ -
Lime Storage	LS	1	$ 150,000	$ 150,000	$ 45,000	$ 45,000	$ 195,000	50	$ 117,000	$ 105,892
Lime Feed Equipment	LS	1	$ 100,000	$ 100,000	$ 30,000	$ 30,000	$ 130,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 80,000	$ 80,000	$ 24,000	$ 24,000	$ 104,000	15	$ -	$ -
SUBTOTAL DIRECT CONSTRUCTION COST							**$ 24,446,000**			**$ 6,332,000**
Estimate Contingency	Percentage of Subtotal			10%			$ 2,445,000			
Design Contingency	Percentage of Subtotal			10%			$ 2,445,000			
Cost Escalation	Percentage of Subtotal			15%			$ 3,667,000			
Construction Contingency	Percentage of Subtotal			10%			$ 2,445,000			
SUBTOTAL DIRECT CONSTRUCTION WITH CONTINGENCIES							**$ 35,448,000**			
General Conditions, Overhead & Profit							$ 1,909,000			
TOTAL CONSTRUCTION ESTIMATE							**$ 37,357,000**			
Engineering and Inspection Services	Percentage of Subtotal			15%			$ 5,604,000			
TOTAL ESTIMATED PROJECT COST							**$ 42,961,000**			

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 4 - Conversion to Extended Aeration, Full Buildout as Single Project

Total Design Life (years)	20
Interest Rate	0.50%

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost	Useful Life (Years)	Future Salvage Value	Present Worth of Salvage Value
General										
Mobilization	LS	1	$ 1,223,000	$ 1,223,000	$ -	$ -	$ 1,223,000	0	$ -	$ -
Flow Retention										
Excavation and Backfill	CYD	12,000	$ -	$ -	$ 100	$ 1,200,000	$ 1,200,000	0	$ -	$ -
Concrete	CYD	3,450	$ 1,250	$ 4,312,500	$ -	$ -	$ 4,313,000	50	$ 2,587,800	$ 2,342,122
Access Hatch	EA	2	$ 20,000	$ 40,000	$ 6,000	$ 12,000	$ 52,000	50	$ 31,200	$ 28,238
Flushing System	LS	1	$ 500,000	$ 500,000	$ 150,000	$ 150,000	$ 650,000	30	$ 216,667	$ 196,097
Pumps	EA	2	$ 90,500	$ 181,000	$ 27,150	$ 54,300	$ 236,000	20	$ -	$ -
Site Piping Force Main	LF	1,290	$ 500	$ 645,000	$ 150	$ 193,500	$ 839,000	50	$ 503,400	$ 455,609
Site Piping Gravity Sewer	LF	1,310	$ 500	$ 655,000	$ 150	$ 196,500	$ 852,000	50	$ 511,200	$ 462,668
Electrical, Instrumentation, and Controls	LS	1	$ 55,000	$ 55,000	$ 17,000	$ 17,000	$ 72,000	15	$ -	$ -
Preliminary Treatment										
Demolition of Existing Grit and Site Piping	LS	1	$ -	$ -	$ 132,500	$ 132,500	$ 133,000	0	$ -	$ -
Screen	LS	1	$ 195,000	$ 195,000	$ 58,500	$ 58,500	$ 254,000	20	$ -	$ -
Vortex Grit Removal	LS	1	$ 192,000	$ 192,000	$ 57,600	$ 57,600	$ 250,000	30	$ 83,333	$ 75,422
Conveyor	LS	1	$ 40,000	$ 40,000	$ 12,000	$ 12,000	$ 52,000	20	$ -	$ -
Site Piping	LF	130	$ 400	$ 52,000	$ -	$ -	$ 52,000	50	$ 31,200	$ 28,238
Building Addition	SQFT	1,200	$ 160	$ 192,000	$ -	$ -	$ 192,000	30	$ 64,000	$ 57,924
Site Restoration	LS	1	$ 15,000	$ 15,000	$ 4,500	$ 4,500	$ 20,000	0	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 135,000	$ 135,000	$ 41,000	$ 41,000	$ 176,000	15	$ -	$ -
Primary Clarification										
Digester Demolition	LS	1	$ -	$ -	$ 100,000	$ 100,000	$ 100,000	0	$ -	$ -
Primary Clarifier Mechanisms Demolition	LS	1	$ -	$ -	$ 50,000	$ 50,000	$ 50,000	0	$ -	$ -
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 2,000	$ 2,000	$ 12,000	0	$ -	$ -
Biological Treatment										
Modifications to Existing Aeration and Primary Tanks	LS	1	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 200,000	50	$ 120,000	$ 108,608
Site Work	LS	1	$ 15,000	$ 15,000	$ 4,500	$ 4,500	$ 20,000	0	$ -	$ -
Excavation and Backfill	CYD	7,783	$ -	$ -	$ 150	$ 1,167,500	$ 1,168,000	0	$ -	$ -
Concrete	CYD	3,177	$ 1,250	$ 3,970,833	$ -	$ -	$ 3,971,000	50	$ 2,382,600	$ 2,156,403
Site Piping	LF	1,480	$ 400	$ 592,000	$ -	$ -	$ 592,000	50	$ 355,200	$ 321,478
Aeration Equipment	EA	3	$ 500,000	$ 1,500,000	$ 125,000	$ 375,000	$ 1,875,000	20	$ -	$ -
WAS Pipe	LF	600	$ 200	$ 120,000	$ -	$ -	$ 120,000	50	$ 72,000	$ 65,165
Sludge Pump	EA	5	$ 15,840	$ 79,200	$ 4,752	$ 23,760	$ 103,000	20	$ -	$ -
Sludge Meter	EA	4	$ 5,000	$ 20,000	$ 1,500	$ 6,000	$ 26,000	20	$ -	$ -
Sampler	EA	4	$ 20,000	$ 80,000	$ 6,000	$ 24,000	$ 104,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 974,000	$ 974,000	$ 294,000	$ 294,000	$ 1,268,000	15	$ -	$ -

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 4 - Conversion to Extended Aeration, Full Buildout as Single Project

Total Design Life (years)	20
Interest Rate	0.50%

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost	Useful Life (Years)	Future Salvage Value	Present Worth of Salvage Value
Final Clarification										
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 3,000	$ 3,000	$ 13,000	0	$ -	$ -
Digester Demolition	LS	1	$ -	$ -	$ 100,000	$ 100,000	$ 100,000	0	$ -	$ -
Excavation and Backfill	CYD	2,635	$ -	$ -	$ 100	$ 263,500	$ 264,000	0	$ -	$ -
Concrete	CYD	920	$ 1,250	$ 1,150,000	$ -	$ -	$ 1,150,000	50	$ 690,000	$ 624,493
Site Piping	LS	685	$ 400	$ 274,000	$ -	$ -	$ 274,000	50	$ 164,400	$ 148,792
Final Clarifier Internal Mechanism	EA	2	$ 300,000	$ 600,000	$ 30,000	$ 60,000	$ 660,000	20	$ -	$ -
Sludge Pump	EA	2	$ 15,840	$ 31,680	$ 4,752	$ 9,504	$ 42,000	20	$ -	$ -
RAS Pipe	LF	220	$ 200	$ 44,000	$ -	$ -	$ 44,000	50	$ 26,400	$ 23,894
WAS Pipe	LF	220	$ 200	$ 44,000	$ -	$ -	$ 44,000	50	$ 26,400	$ 23,894
Tank Coating	LS	2	$ 10,000	$ 20,000	$ 3,000	$ 6,000	$ 26,000	15	$ -	$ -
Handrail and Grating	SQFT	658	$ 80	$ 52,650	$ 24	$ 15,795	$ 69,000	30	$ 23,000	$ 20,816
Launder Cover	EA	2	$ 36,700	$ 73,400	$ 11,010	$ 22,020	$ 96,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 490,000	$ 490,000	$ 148,000	$ 148,000	$ 638,000	15	$ -	$ -
Disinfection										
Excavation and Backfill	CYD	100	$ -	$ -	$ 100	$ 10,000	$ 10,000	0	$ -	$ -
Concrete	CYD	40	$ 1,250	$ 50,000	$ 375	$ 15,000	$ 65,000	50	$ 39,000	$ 35,297
UV Equipment	LS	1	$ 600,000	$ 600,000	$ 180,000	$ 180,000	$ 780,000	20	$ -	$ -
Site Piping	LF	210	$ 450	$ 94,500	$ 135	$ 28,350	$ 123,000	50	$ 73,800	$ 66,794
Electrical, Instrumentation, and Controls	LS	1	$ 149,000	$ 149,000	$ 45,000	$ 45,000	$ 194,000	15	$ -	$ -
Solids Handling										
Process Piping Modifications	LS	1	$ 250,000	$ 250,000	$ -	$ -	$ 250,000	50	$ 150,000	$ 135,759
Dewatering Equipment	EA	2	$ 75,000	$ 150,000	$ 22,500	$ 45,000	$ 195,000	20	$ -	$ -
Polymer Feed Equipment	LS	1	$ 20,000	$ 20,000	$ 6,000	$ 6,000	$ 26,000	20	$ -	$ -
Lime Storage	LS	1	$ 150,000	$ 150,000	$ 45,000	$ 45,000	$ 195,000	50	$ 117,000	$ 105,892
Lime Feed Equipment	LS	1	$ 100,000	$ 100,000	$ 30,000	$ 30,000	$ 130,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 80,000	$ 80,000	$ 24,000	$ 24,000	$ 104,000	15	$ -	$ -
SUBTOTAL DIRECT CONSTRUCTION COST							**$ 25,667,000**			**$ 7,483,000**
Estimate Contingency	Percentage of Subtotal			10%			$ 2,567,000			
Design Contingency	Percentage of Subtotal			10%			$ 2,567,000			
Cost Escalation	Percentage of Subtotal			15%			$ 3,851,000			
Construction Contingency	Percentage of Subtotal			10%			$ 2,567,000			
SUBTOTAL DIRECT CONSTRUCTION WITH CONTINGENCIES							**$ 37,219,000**			
General Conditions, Overhead & Profit							$ 1,945,000			
TOTAL CONSTRUCTION ESTIMATE							**$ 39,164,000**			
Engineering and Inspection Services	Percentage of Subtotal			15%			$ 5,875,000			
TOTAL ESTIMATED PROJECT COST							**$ 45,039,000**			

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 5 - Conversion to MBR, Full Buildout as Single Project

Total Design Life (years)	20
Interest Rate	0.50%

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost	Useful Life (Years)	Future Salvage Value	Present Worth of Salvage Value
General										
Mobilization	LS	1	$ 859,000	$ 859,000	$ -	$ -	$ 859,000	0	$ -	$ -
Flow Retention										
Excavation and Backfill	CYD	12,000	$ -	$ -	$ 100	$ 1,200,000	$ 1,200,000	0	$ -	$ -
Concrete	CYD	3,450	$ 1,250	$ 4,312,500	$ -	$ -	$ 4,313,000	50	$ 2,587,800	$ 2,342,122
Access Hatch	EA	2	$ 20,000	$ 40,000	$ 6,000	$ 12,000	$ 52,000	50	$ 31,200	$ 28,238
Flushing System	LS	1	$ 500,000	$ 500,000	$ 150,000	$ 150,000	$ 650,000	30	$ 216,667	$ 196,097
Pumps	EA	2	$ 90,500	$ 181,000	$ 27,150	$ 54,300	$ 236,000	20	$ -	$ -
Site Piping Force Main	LF	1,290	$ 500	$ 645,000	$ 150	$ 193,500	$ 839,000	50	$ 503,400	$ 455,609
Site Piping Gravity Sewer	LF	1,310	$ 500	$ 655,000	$ 150	$ 196,500	$ 852,000	50	$ 511,200	$ 462,668
Electrical, Instrumentation, and Controls	LS	1	$ 55,000	$ 55,000	$ 17,000	$ 17,000	$ 72,000	15	$ -	$ -
Preliminary Treatment										
Demolition of Existing Grit and Site Piping	LS	1	$ -	$ -	$ 132,500	$ 132,500	$ 133,000	0	$ -	$ -
Screen	LS	1	$ 195,000	$ 195,000	$ 58,500	$ 58,500	$ 254,000	20	$ -	$ -
Vortex Grit Removal	LS	1	$ 192,000	$ 192,000	$ 57,600	$ 57,600	$ 250,000	30	$ 83,333	$ 75,422
Conveyor	LS	1	$ 40,000	$ 40,000	$ 12,000	$ 12,000	$ 52,000	20	$ -	$ -
Site Piping	LF	130	$ 400	$ 52,000	$ -	$ -	$ 52,000	50	$ 31,200	$ 28,238
Building Addition	SQFT	1,200	$ 160	$ 192,000	$ -	$ -	$ 192,000	30	$ 64,000	$ 57,924
Site Restoration	LS	1	$ 15,000	$ 15,000	$ 4,500	$ 4,500	$ 20,000	0	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 135,000	$ 135,000	$ 41,000	$ 41,000	$ 176,000	15	$ -	$ -
Primary Clarification										
Digester Demolition	LS	1	$ -	$ -	$ 100,000	$ 100,000	$ 100,000	0	$ -	$ -
Site Restoration	LS	1	$ 10,000	$ 10,000	$ 2,000	$ 2,000	$ 12,000	0	$ -	$ -
Microscreen	EA	4	$ 185,000	$ 740,000	$ 55,500	$ 222,000	$ 962,000	20	$ -	$ -
Biological Treatment										
Demolition of Primary and Final Clarifier Equipment	LS	1	$ -	$ -	$ 200,000	$ 200,000	$ 200,000	0	$ -	$ -
Modification of North Primary to Aeration	LS	1	$ 150,000	$ 150,000	$ 45,000	$ 45,000	$ 195,000	50	$ 117,000	$ 105,892
Influent Channel from Aeration to MBRs	LS	1	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 200,000	50	$ 120,000	$ 108,608
Aeration Equipment	LS	1	$ 435,500	$ 435,500	$ -	$ -	$ 436,000	20	$ -	$ -
Site Piping	LF	500	$ 400	$ 200,000	$ -	$ -	$ 200,000	50	$ 120,000	$ 108,608
Membranes and Associated Equipment	LS	1	$ 2,250,000	$ 2,250,000	$ 704,000	$ 704,000	$ 2,954,000	20	$ -	$ -
Level Sensor	EA	3	$ 20,000	$ 60,000	$ 6,000	$ 18,000	$ 78,000	21	$ 3,714	$ 3,362
Electrical, Instrumentation, and Controls	LS	1	$ 473,000	$ 473,000	$ 157,000	$ 157,000	$ 630,000	15	$ -	$ -

City of Grand Ledge WWTP Improvements

Opinion of Probable Construction Cost: Alternative 5 - Conversion to MBR, Full Buildout as Single Project

Total Design Life (years)	20
Interest Rate	0.50%

Item	Unit	Quantity	Material Unit Cost	Material Subtotal	Install Unit Cost	Install Subtotal	Dec. 2021 Construction Cost	Useful Life (Years)	Future Salvage Value	Present Worth of Salvage Value
Final Clarification										
Demolish Exiting Final Clarifier Mechanisms	EA	2	$ -	$ -	$ 75,000	$ 150,000	$ 150,000	0	$ -	$ -
Disinfection										
Concrete	CYD	20	$ 1,250	$ 25,000	$ 375	$ 7,500	$ 33,000	50	$ 19,800	$ 17,920
UV Equipment	LS	1	$ 450,000	$ 450,000	$ 135,000	$ 135,000	$ 585,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 149,000	$ 149,000	$ 45,000	$ 45,000	$ 194,000	15	$ -	$ -
Solids Handling										
Process Piping Modifications	LS	1	$ 250,000	$ 250,000	$ -	$ -	$ 250,000	50	$ 150,000	$ 135,759
Dewatering Equipment	EA	2	$ 75,000	$ 150,000	$ 22,500	$ 45,000	$ 195,000	20	$ -	$ -
Polymer Feed Equipment	LS	1	$ 20,000	$ 20,000	$ 6,000	$ 6,000	$ 26,000	20	$ -	$ -
Lime Storage	LS	1	$ 150,000	$ 150,000	$ 45,000	$ 45,000	$ 195,000	50	$ 117,000	$ 105,892
Lime Feed Equipment	LS	1	$ 100,000	$ 100,000	$ 30,000	$ 30,000	$ 130,000	20	$ -	$ -
Electrical, Instrumentation, and Controls	LS	1	$ 80,000	$ 80,000	$ 24,000	$ 24,000	$ 104,000	15	$ -	$ -
SUBTOTAL DIRECT CONSTRUCTION COST							**$ 18,031,000**			**$ 4,232,000**
Estimate Contingency	Percentage of Subtotal			10%			$ 1,804,000			
Design Contingency	Percentage of Subtotal			10%			$ 1,804,000			
Cost Escalation	Percentage of Subtotal			15%			$ 2,705,000			
Construction Contingency	Percentage of Subtotal			10%			$ 1,804,000			
SUBTOTAL DIRECT CONSTRUCTION WITH CONTINGENCIES							**$ 26,148,000**			
General Conditions, Overhead & Profit							$ 1,723,000			
TOTAL CONSTRUCTION ESTIMATE							**$ 27,871,000**			
Engineering and Inspection Services	Percentage of Subtotal			15%			$ 4,181,000			
TOTAL ESTIMATED PROJECT COST							**$ 32,052,000**			

City of Grand Ledge WWTP Improvements

Opinion of Operation, Maintenance and Replacement Costs

Total Design Life (years)	20
Interest Rate	0.50%

	Budget 2021-2022	Alternative 3	Alternative 4	Alternative 5
Labor	**$ 356,189**	**$ 458,398**	**$ 458,398**	**$ 458,398**
Salaries/Wages	$ 219,019	$ 321,228	$ 321,228	$ 321,228
Overtime	$ 12,011	$ 12,011	$ 12,011	$ 12,011
Fringe Benefits	$ 125,159	$ 125,159	$ 125,159	$ 125,159
OPEB Adjustment	$ -	$ -	$ -	$ -
Compensated Absences Adjustment	$ -	$ -	$ -	$ -
Maintenance Supplies	**$ 42,500**	**$ 53,669**	**$ 62,381**	**$ 54,569**
Flow Retention	$ 2,125	$ 4,250	$ 4,250	$ 4,250
Screening	$ 7,438	$ 7,438	$ 7,438	$ 18,538
Grit Removal	$ 5,313	$ 2,656	$ 2,656	$ 2,656
Primary Clarification	$ 4,250	$ 4,250	$ -	$ -
Biological Treatment	$ 12,750	$ 18,700	$ 32,725	$ 22,750
Final Clarification	$ 2,125	$ 2,125	$ 2,125	$ -
Disinfection	$ 4,250	$ 10,000	$ 10,000	$ 4,250
Solids Handling	$ 4,250	$ 4,250	$ 3,188	$ 2,125
Chemicals	**$ 55,000**	**$ 53,778**	**$ 53,778**	**$ 19,167**
Biological Treatment	$ 18,333	$ 26,889	$ 26,889	$ 10,000
Disinfection	$ 18,333	$ -	$ -	$ -
Solids Handling	$ 18,333	$ 26,889	$ 26,889	$ 9,167
Contractual	**$ 80,000**	**$ 80,000**	**$ 80,000**	**$ 80,000**
Utilities	**$ 105,000**	**$ 160,663**	**$ 243,438**	**$ 363,916**
Flow Retention	$ 2,625	$ 4,263	$ 4,263	$ 4,263
Screening	$ 2,625	$ 2,625	$ 2,625	$ 2,625
Grit Removal	$ 5,250	$ 5,250	$ 5,250	$ 5,250
Primary Clarification	$ 2,625	$ 3,850	$ -	$ 9,110
Biological Treatment	$ 78,750	$ 115,500	$ 202,125	$ 334,980
Final Clarification	$ 2,625	$ 2,625	$ 2,625	$ -
Disinfection	$ 2,625	$ 15,000	$ 15,000	$ 3,750
Solids Handling	$ 7,875	$ 11,550	$ 11,550	$ 3,938
Maintenance	**$ 72,500**	**$ 88,500**	**$ 121,500**	**$ 138,500**
Grounds Maintenance	$ 6,000	$ 6,000	$ 6,000	$ 6,000
Building Maintenance	$ 25,000	$ 25,000	$ 25,000	$ 25,000
Vehicle Maintenance	$ 7,500	$ 7,500	$ 7,500	$ 7,500
Structure Maintenance	$ 4,000	$ 6,000	$ 6,000	$ 4,000
Equipment Maintenance	$ 30,000	$ 44,000	$ 77,000	$ 96,000
Equipment Rental	**$ -**	**$ -**	**$ -**	**$ -**
Transfer to Parks & Rec	**$ 2,500**	**$ 2,500**	**$ 2,500**	**$ 2,500**
TOTAL	**$ 713,689**	**$ 897,507**	**$ 1,021,995**	**$ 1,117,049**
PRESENT WORTH OF 20 YEARS OF O&M COSTS	**$ 13,552,000**	**$ 17,042,000**	**$ 19,406,000**	**$ 21,210,000**