City of Marquette
Marquette, MI | 300 W Baraga Ave, MI 49855

City of Marquette

Wastewater and Water System Improvements
State Revolving Fund (SRF)
Amendment No. 1 to Project Plan

March 2020

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STATE OF MICHIGAN
CRAIG
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ENGINEER
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LICENSED PROFESSIONAL ENGINEER

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1. INTRODUCTION

The City of Marquette Water & Sewer Utility (Utility), submitted a State Revolving Fund (SRF)/Drinking Water Revolving Fund (DWRF) Project Plan in April, 2019. The Utility routinely reviews capital planning and improvement needs and funding obligations as part of the asset management process. This Amendment to the SRF/DWRF addresses changes to the Wastewater Treatment Plant Solids Handling Improvements project.

1.1 PROPOSED PROJECTS

The project plan provides an overview, evaluates alternatives and makes recommendations for projects eligible for SRF funding. This document provides updates to the Wastewater Treatment Plant Solids Handling Improvements Project. The updated costs for the solids handling improvements is $5,667,000.

1.1.1 WASTEWATER TREATMENT FACILITY

The Utility is planning improvements to the solids handling system as follows:

- Receive and process septage, high strength waste (HSW) and fats, oils and grease (FOG)
- Produce additional biogas
- Utilize additional biogas in existing engine generators to produce electricity
- Reduce sludge volume, solids disposal costs and environmental impact through dewatering
- Improve system reliability by providing biosolids processing flexibility

A business case for Green Project Reserve is included as a separate document.

1.1.2 FLOODPLAINS

Figure 1-1 provides 2017 FEMA 100 year floodplain mapping for the Marquette service area. The map can be accessed through the following web address and searching for Marquette, MI: https://msc.fema.gov/portal/search#searchresultsanchor.

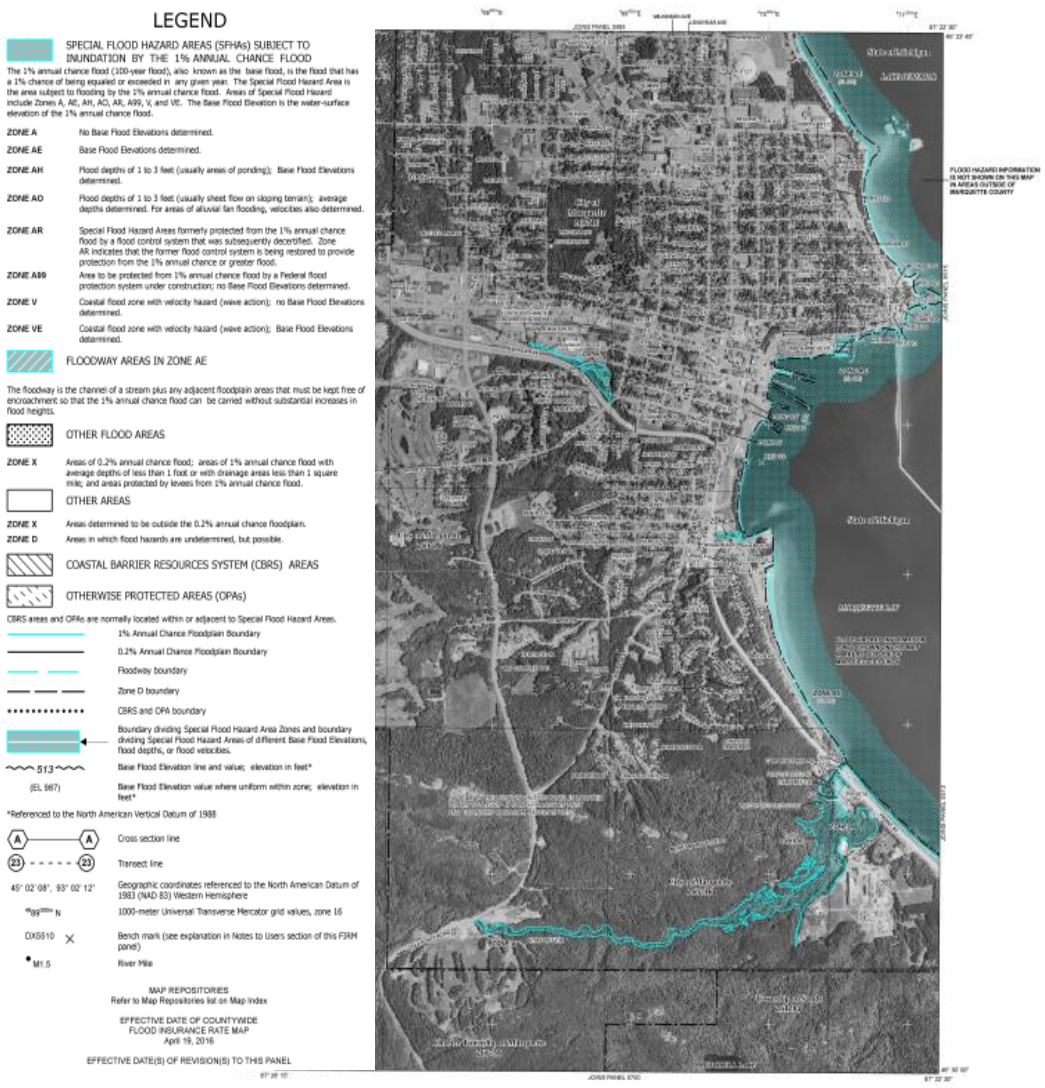

Figure 1-1 Large-Scale FEMA 100-Year Floodplain

The wasteater treatment plant solids handling improvements include structural additions to the WWTP site. The site is adjacent to US 41 Highway and the Carp River. The property map, floodplain map and wetland delineation map were reviewed to identify preferred locations for new facilities.

Figure 1-2 illustrates the FEMA 100-year floodplain mapping for the treatment facility along with the proposed improvements. As part of the 2008 construction, a berm was provided that protects the existing secondary clarifiers, aeration, cake storage and other assets from a 100-year flood.

The wetland delineation map from 2006 was also reviewed. The delineation did not include the entire site. The project proposes to complete a wetland delineation for the proposed construction area as part of the project.

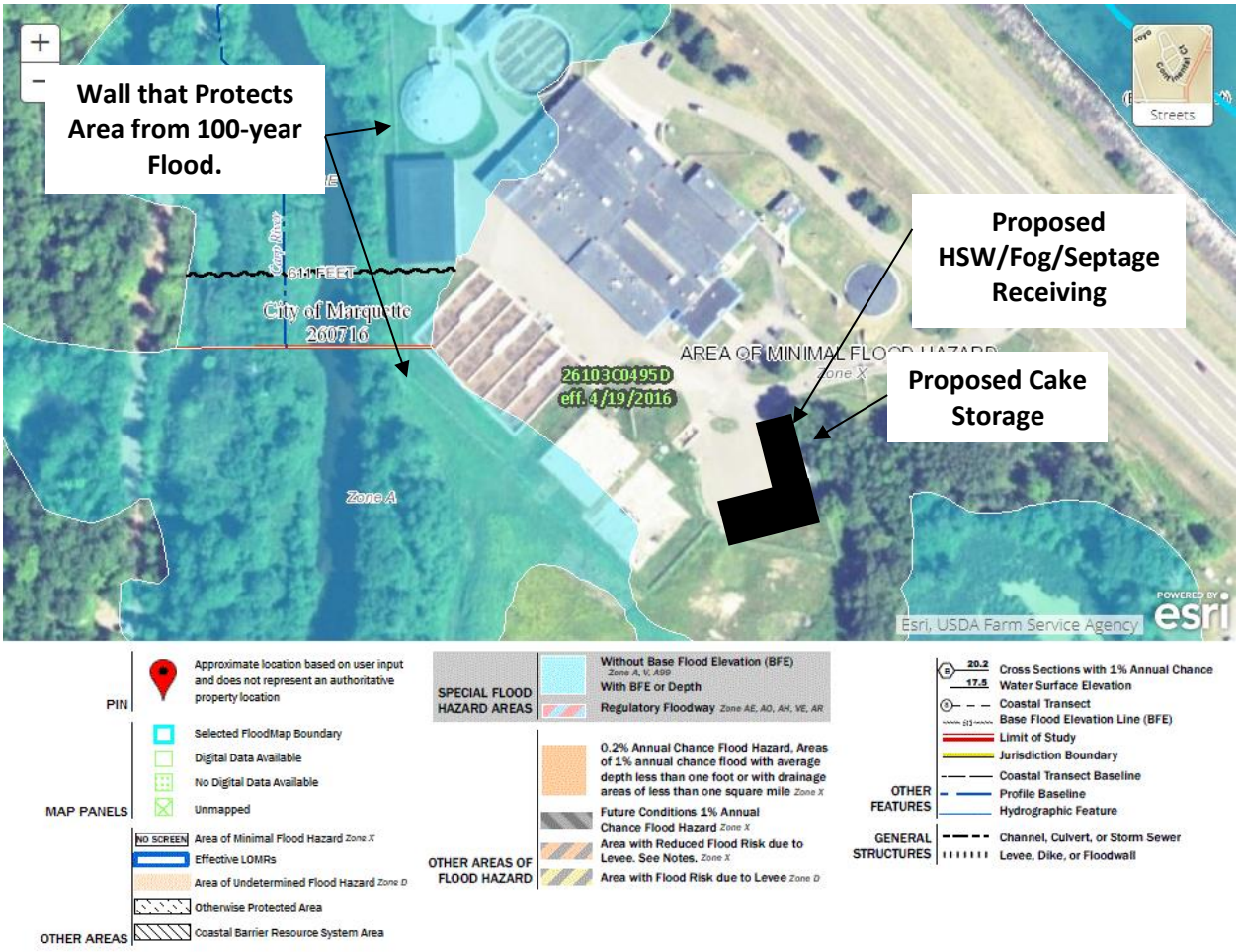

Figure 1-2 Wastewater Treatment Facility - 100-Year Floodplain

1.2 PROJECT NEEDS

An updated project needs form for the solids handling project is included in **Appendix A**.

2. ANALYSIS OF ALTERNATIVES

2.1 WASTEWATER TREATMENT SOLIDS HANDLING IMPROVEMENTS (CONSIDERED FOR GREEN PROJECT RESERVE)

Removal of solids from the wastewater treatment process is essential for NPDES permit compliance and process efficiency. The Utility evaluated long-term biosolids processing, storage and disposal alternatives to improve the system including:

- Provide system redundancy – a single piece of equipment performs both thickening and dewatering.
- Increase biosolids storage capacity (currently less than 180 days of storage)
- Support beneficial reuse of solids
- Reduce the cost of biosolids disposal
- Receive septage and high strength waste
- Increase energy production to leverage utilization of existing dual fuel generators.

This amendment addresses the analysis of an additional alternative (Alternative No. 4) to the Project Plan. Alternative 4 includes the following major elements:

- New Dewatering Facility with a single belt filter press and room for a second
- Sludge cake storage
- Sludge cake transfer and storage
- Septage, high strength waste and fats oil and grease receiving

2.1.1 ALTERNATIVE 4 - NEW CAKE STORAGE, NEW DEWATERING BUILDING AND SEPTAGE/HSW/FOG RECEIVING (ELIGIBLE FOR GREEN PROJECT RESERVE)

This alternative includes a new dewatering building and cake storage building. The buildings are located on the south end of the site adjacent to each other. Pavement is added to the north side of the building for truck loading access, chemical delivery and equipment removal. The cake structure is similar to the existing cake storage building with concrete walls, a pole shed cover and multiple bays. A CMU wall building is constructed for the dewatering equipment. The roof is flat, constructed of pre-cast concrete with an EPDM roofing system.

One new BFP is installed in the dewatering building with space for a second. The building is split into three rooms: dewatering room, electrical room and polymer room. Overhead doors are provided adjacent to the driveway for the polymer room and dewatering room. A booster pump is required in the dewatering room for belt washing. A conveyor, common to both BFPs, transfers dewatered cake to a cake storage pad. A front end loader is used to move cake from the cake storage pad to the cake storage building. Cake handling options that could be provided at additional cost include:

1. Loadout conveyor to truck located within dewatering building.
2. Loadout conveyor to Cake Storage Bay No. 3. Loadout conveyor includes heat tracing to prevent freezing.

3. Inclined conveyor to distributing conveyor. Distributing conveyor has drop point in all three cake storage bays. All conveyor components exterior to the dewatering building include heat tracing to prevent freezing.

The new BFP is sized to match the capacity of the existing combination BFP/GBT. The BFP is intended for normal service. The combination BFP is available for a backup unit and space is provided for a future unit in the new Dewatering Building. The existing combination BFP/GBT is utilized for thickening under normal operations. There is no backup GBT in this alternative. See Table 2-1 for the Alternative 4 design basis.

Table 2-1 Thickening and Dewatering Loading Alternative 3

Thickening (Existing GBT/BFP)		Average	Max Month
Operation	Days/week	4	5
Operation	Hours/day	7	7
Flow Capacity*	gpm	440	440
Flow Rate	gpm	185	180
Solids Capacity*	lb/hr	1,100	1,100
Solids Loading	lb/hr	780	760
Dewatering (New BFP)			
Operation	Days/week	1	2
Operation	Hours/day	8	8
Flow Capacity*	gpm	140	140
Flow Rate	gpm	133	128
Solids Capacity*	lb/hr	2,100	2,100
Solids Loading	lb/hr	1,880	1,658

* Per manufacturers design basis recommendations

A new cake biosolids storage building is proposed in this alternative. The new storage building holds 700 cubic yards of dewatered bisolids to provide a total of 180 days combined storage time. The building is a pole shed installed on concrete walls with approximate overall dimensions of 50 feet by 120 feet. The building is split into three bays.

Septage, FOG and HSW facilities consist of the following:

- Septage receiving equipment
- Storage tanks (two tanks)
- Positive displacement pumps
- Waste receiving structure
- Electrical, controls and HVAC

Key elements of each alternative are provided in Table 2-2 (key elements for Alternatives 1 – 3 are provided for reference).

Table 2-2 Alternatives Summary Table (Average Day)

Parameter	Units	Original Project Plan			Project Plan Amendment
		Alternative No. 1	Alternative No. 2	Alternative No. 3	**Alternative No. 4**
Thickening Equipment	----	(1) New GBT (2) Existing GBT/BFP	(1) New GBT (2) Existing GBT/BFP	(1) Existing GBT/BFP	(1) Existing GBT/BFP
Dewatering Equipment	----	(1) Existing GBT/BFP	(1) Existing GBT/BFP	(1) New BFP No. 1 (2) Existing GBT/BFP	(1) New BFP No. 1 (2) Existing GBT/BFP
Cake Disposal	dtpy	258	399	399	531
Liquid Disposal	dtpy	218	77	77	73
Biosolids Cake Storage Volume	Cubic yards	890	1,600	1,600	1,600
Septage Receiving	gal/yr	0	0	0	1,000,000
FOG and HSW Receiving	gal/yr	0	0	0	365,000
Digester Gas Production	Cubic Feet per day	41,000	41,000	41,000	55,000
Electrical Energy Production	kw	105	105	105	141
Heat Production	MMBTU/d	7.4	7.4	7.4	9.9
Digester Loading	Lb Vs/kcf/d	39	39	39	53
Digester SRT	days	57	57	57	45

2.2 SUMMARY AND RECOMMENDATION

The key considerations for each alternative are:

- Providing additional solids handling redundancy and operational flexibility
- Increasing disposal of cake biosolids to reduce annual expenses
- Provide at least 180 days of biosolids storage
- Capital and life cycle cost.

Life cycle cost for Alternative No. 4 is summarized in Table 2-3 (highlighted in **bold**). The table also includes Alternative Nos. 1 – 3 included in the SRF/DWRF Project Plan for reference.

Table 2-3 Alternatives Cost Summary Table

Alternative and Description	Initial Cost	Annual O&M	20-Year PW	Salvage Value
Alternative 1: New Liquids Storage & New GBT in Existing Building	2,565,000	182,000	6,300,000	0
Alternative 2: New Cake Storage and New GBT in Existing Building	2,211,000	147,000	5,231,000	0
Alternative 3: New Cake Storage and New Dewatering Building	4,006,000	147,000	7,026,000	0
Alternative 4: New Cake Storage and New Dewatering Building, Septage/HSW and FOG Receiving	**5,667,000**	**(21,000)**	**5,230,000**	**0**

Advantages and disadvantages for each alternative are summarized in Table 2-4. The table highlights Alternative No. 4 in **bold**.

Table 2-4 Alternatives Cost Summary Table

Alternative No. and Description	Advantages	Disadvantages
Alternative 1: New Liquids Storage & New GBT in Existing Building	• Provides thickening and dewatering redundancy • Exceeds 180 day biosolids storage requirement	• Does not provide flexibility for biosolids disposal • Highest biosolids disposal cost with reliance on liquid hauling
Alternative 2: New Cake Storage and New GBT in Existing Building	• Provides thickening redundancy • Exceeds 180 day biosolids storage requirement • Increases biosolids disposal flexibility with cake disposal opportunities • Lowers disposal cost and operations time to manage cake • Lowest capital cost	• No dewatering redundancy. • Limited flexibility for dewatering without additional cake storage (more reliance on liquid hauling) • Stormwater management issues with hauling biosolids around site
Alternative 3: New Cake Storage, New Dewatering Building	• Provides dewatering redundancy • Exceeds 180 day biosolids storage requirement • Increases biosolids disposal flexibility with cake disposal opportunities • Lowers disposal cost and operations time to manage cake	• Highest capital cost • Highest lifecycle cost • No thickening redundancy
Alternative 4: New Cake Storage, New Dewatering Building and Septage/HSW/FOG Processing	• **Provides dewatering redundancy and additional cake storage** • **Provides lowest life cycle costs.** • **Leverages existing CHP infrastructure and digester capacity** • **Increases digester gas production and utilization** • **Provides septage/HSW/FOG disposal service to area.** • **Increases revenues**	• **Highest capital cost.** • **Relies on market for septage, HSW and FOG** • **Results in more challenging operation** • **No thickening redundancy**

The costs for each alternative are summarized in Table 2-2. A detailed cost review for Alternative No. 4 is includes in **Appendix B**.

3. SELECTED ALTERNATIVES

3.1.1 DESCRIPTION OF SELECTED ALTERNATIVES

Based on a review of both economic and non-economic factors, it is recommended that Alternate No. 4 for the WWTP Solids Handling Project is constructed. The City will re-evaluate this plan on a year-by-year basis, during the normal annual budgeting process.

3.1.2 PROJECT SCHEDULE

The anticipated project schedule is presented in Figure 3-1. The project considers a Q3 loan closing.

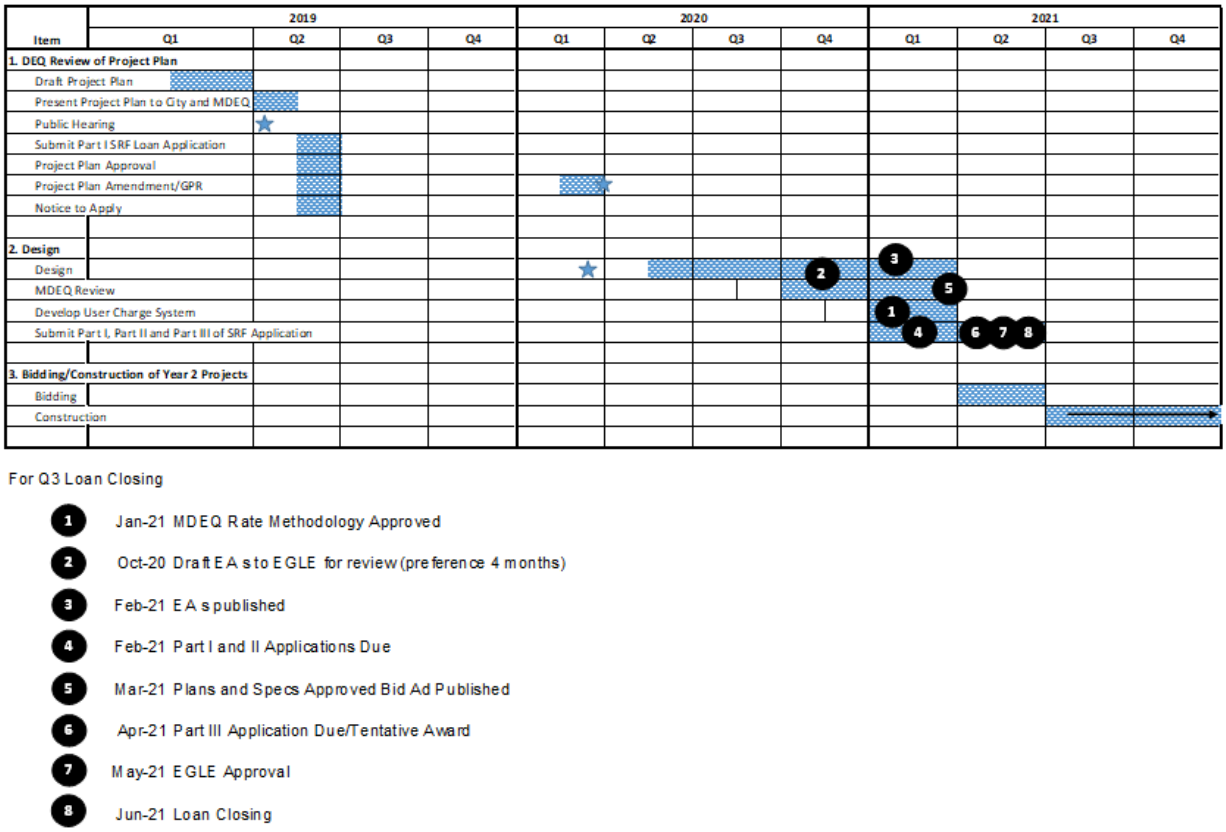

Figure 3-1 Project Schedule

3.1.3 AUTHORITY TO IMPLEMENT THE SELECTED ALTERNATIVES

For the wastewater plant upgrades, the cost share amongst the city and the townships would be based on the terms of the current inter-municipal agreement. Under that agreement, the City of Marquette would be responsible for 84% of those project components' cost, Marquette Township would be responsible for 9% of those costs, and Chocolay Township would be responsible for 7% of the project cost. The City of Marquette has agreed to operate the wastewater treatment facility and the contract

communities are charged operating costs based on usage. The wastewater treatment facility is managed by an Advisory Board made up of representatives of the three contract communities.

3.1.4 USER COSTS

The funding strategy and user costs for the WWTP Solids Handling Project are summarized in Table 3-1. The plan assumes the project components are eligible for financing from a Michigan EGLE State Revolving Fund low interest loan. The loan amount assumes a 20 year loan at 2.25% interest rate. The costs does not include estimates for possible Green Project Reserve principle forgiveness. The costs also do not include estimates for revenue or operational costs savings resulting from the project.

Table 3-1 Funding Strategy and User Costs (2021)

Impact of Debt Repayment	Sewer Fund
Impact of Debt Repayment on City of Marquette	
Total Year 1 Project Cost (WWTP Solids Handling Project)	$5,667,000
EGLE SRF normal interest rate	2.25%
Annual Debt Payment Related to Project	$355,000
Annual City of Marquette Share (assumes 84%)	$298,200
Impact of Debt Repayment on Users	
Number of Water & Sewer Customers	6,141
Average Debt Retirement Cost Per Customer/yr	$57.80
Average Debt Retirement Cost Per Customer/mo	$4.80

4. PUBLIC PARTICIPATION

4.1.1 PUBLIC HEARING

The formal public hearing for the amendment is scheduled for April, 2020. A copy of the public hearing transcript, advertisement for the public hearing, presentation and resolution will be incorporated into the final Project Plan

5. GREEN PROJECT RESERVE BUSINESS PLAN

The Solids Handling Project meets the Green Project Reserve eligibility requirements for Energy Efficiency and Environmentally Innovative. The business case for Green Project Reserve is provided as a separate document.

APPENDICES

Appendix A – Project Need Request Form

2017 -2022 CAPITAL IMPROVEMENT PROGRAM – 2021 PROJECT REQUEST FORM I.D. #_____

DEPARTMENT CONTACT INFORMATION

	Date: 1/27/2020	Department Priority: Low, Medium, High High
	Department: Water & Wastewater	Project Location: Wastewater Facility- 1930 U.S. 41 South
	Project Title: Solids Handling Storage Facility	Estimate Funding Request: $5,667,000
	Contact: Curt Goodman	Estimate Useful Life of Asset (Years): 30

SYSTEM CATEGORY:

☐ Street System	☐ Sidewalk/Pathway System
☒ Sanitary Sewer System	☐ Public Buildings
☐ Water System	☐ Public Parks/Grounds
☐ Storm Sewer/Drainage System	☐ Marinas
☐ Bridge System	☐ Motor Pool/Fleet/Major Equipment
☐ Transportation Safety	☐ Public Safety

PURPOSE OF PROJECT:

☒ Regulatory or Ordinance Requirement	☒ Expanded Service
☒ Conforms to Adopted Plan	☒ New Operation
☐ Upgrade/Replace Existing Asset	☐ Scheduled Replacement
☒ New Asset	☐ Extend Asset Useful Service Life
☐ Health and Safety Issue	☐ Other
☐ Economic Development	

PROJECT DESCRIPTION

Provide a new dewatering building and cake storage building. The buildings are located on the south end of the site adjacent to each other. Pavement is added to the north side of the building for truck loading access, chemical delivery and equipment removal. The cake structure is similar to the existing cake storage building with concrete walls, a pole shed cover and multiple bays. A CMU wall building is constructed for the dewatering equipment. Details include:

- New Dewatering Facility (2 Belt Filter Presses – one relocated existing, one new)
- Relocate existing BFP/Thickener to Dewatering
- Provide new thickener (gravity belt thickener or rotary drum thickener)
- Sludge cake transfer and storage
- Septage and high strength waste (HSW) receiving
    a. Consider utilization and value of septage and HSW for tipping fees and gas production/heat for existing CHP systems

Picture Title: Proposed Site Layout

PROJECT PLANNING AND FINANCING

Proposed Fiscal Year Planned: 2021	Estimate New Effect on Operating Cost, Revenues, Staffing, etc.? $ 150,000 - $200,000
Name of Account Funding: MAWTF	*Explain: Lower Biosolids annual disposal cost, revenue from septic and extra strength waste, Increase digester gas production for co-gen operation.*
Outside Funding Sources: Yes State Revolving Fund-principle forgiveness Amount: $2,000,000	*Total reduced biosolids disposal costs, increase revenues and increase in biogas production and electrical production:*
Does Asset Have a Salvage Value? No Amount: $	*Preliminary estimate: $150,000 - $200,000*
Estimate Asset Useful Life Extension (Years): 30	

APPENDICES

Appendix B – WWTP Solids Handling Project Cost Worksheets

City of Marquette
Solids Handling Study
Marquette, MI

Alternative 4: New Cake Storage and New Dewatering Building, Septage/HSW and FOG Receiving

INITIAL COST ESTIMATE

General Description

This alternative includes one new BFP in a new Dewatering Building and a new cake storage building adjacent to liquid storage tank no. 2. The Dewatering Building is a CMU block building with metal siding and a flat precast roof with an EPDM roofing system. The new cake storage structure is similar to the existing cake storage structure. There is a conveyor that transfers cake from the Dewatering Building to Cake Storage. This alternative also includes a septage and FOG receiving station. The cost estimate does not include modifications to the FEW system, decant pumping system or improvements to the existing liquid storage tanks.

ITEM	Units	Quantity	Unit Cost ($)	Initial Cost ($)
Architectural/Structural				
Earthwork	See Worksheet for Detailed Cost Breakdown			115,000
Concrete	See Worksheet for Detailed Cost Breakdown			890,066
Metals	See Worksheet for Detailed Cost Breakdown			34,660
Buildings	See Worksheet for Detailed Cost Breakdown			319,000
Demolition	See Worksheet for Detailed Cost Breakdown			0
Belt Filter Presses	EA	**1**	**310,000**	310,000
Polymer Systems	EA	**2**	**10,000**	20,000
Conveyors	LS	**1**	**75,000**	75,000
Booster Pumps	LS	**1**	**9,000**	9,000
Electrical	LS	**1**	**300,000**	300,000
Instrumentation and Control	LS	**1**	**50,000**	50,000
HVAC	LS	**1**	**100,000**	100,000
Plumbing	LS	**1**	**50,000**	50,000
HW Rotary Lobe Pump	EA	**2**	**19,500**	39,000
HW Septage Receiving System	LS	**1**	**304,850**	304,850
HW Recirculation Pumps	EA	**2**	**26,000**	52,000
HW Heat Exchangers and Pumps	EA	**2**	**25,000**	50,000
Buried Piping	LS	**1**	**116,903**	116,903
Building Process-Mechanical Piping and Valves	LS	**1**	**194,838**	194,838
Subtotal				*3,031,000*
Contingency			**30%**	*910,000*
Subtotal				3,941,000
Contractor Overhead & Profit			**25%**	*986,000*
Total Construction Cost				**4,927,000**
Engineering			**15%**	740,000
Total Initial Cost				**5,667,000**

City of Marquette
Solids Handling Study
Marquette, MI

Alternative 4: New Cake Storage and New Dewatering Building, Septage/HSW and FOG Receiving

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Quantity	Unit Cost ($)	Initial Cost ($)
Earthwork: Site Excavation	lump sum	1	100,000	100,000
Earthwork: Dewatering	gal	300	50	15,000
Earthwork:				
Earthwork:				
Earthwork:				
Earthwork:				
Earthwork:				
Earthwork				**115,000**
Concrete: Cake Storage Building	lump sum	1	120,000	120,000
Concrete: Dewatering Building	lump sum	1	480,000	480,000
Concrete: Septage Receiving Base Slab	cu yd	45	1,108	49,842
Concrete: Septage Receiving Walls	cu yd	174	1,381	240,224
Concrete:				
Concrete:				
Concrete:				
Concrete:				
Concrete				**890,066**
Metals: Aluminum Bar Grating	sq ft	400	31	12,400
Metals: Aluminum Handrail	ft	60	86	5,160
Metals: Aluminum Stairway	risers	20	455	9,100
Metals: Structural steel	lbs	2,000	4	8,000
Metals:				
Metals				**34,660**
Building: Cake storage pre-engineered metal canopy	LS	1	195,000	195,000
Building: Overhead doors	each	2	9,000	18,000
Building: Mandoors	each	3	2,000	6,000
Building: Septage Receiving	sq. ft	500	200	100,000
Building:				
Building:				
Buildings				**319,000**
Demolition: Liquid Storage Tank No. 1				
Demolition:				
Demolition:				
Demolition:				
Demolition				**0**

City of Marquette
Solids Handling Study
Marquette, MI

Alternative 4: New Cake Storage and New Dewatering Building, Septage/HSW and FOG Receiving

INITIAL ANNUAL O&M COST ESTIMATE

Biosolids Disposal

ITEM	Units	Annual Quantity	Unit Cost ($)	Annual Cost ($)
Liquid Biosolids Disposal	$/gal	**400,000**	**0.10**	40,000
Cake Biosolids Disposal	$/cubic yard	**4,700**	**25.00**	117,500
Cake Processing	$/dry ton	**531**	**50.000**	26,550
Septage Tipping fee	gal	**1,007,400**	**0.110**	-110,814
FOG Tipping fee	gal	**365,000**	**0.220**	-80,300
Digester Gas Production	MMBTU	**3,030**	**4.700**	-14,239
Ferric Chloride	gal	**7,461**	**1.50**	0
Electricity	kw	285,120	0.00	
Heat (capture from CHP)	MMBTU	913	**0.000**	
O&M Sum				-21,303

APPENDICES

Appendix C – Public Hearing and Resolution Information

Information will be provided once hearing is held and resolution is completed.