Macon Municipal Utilities Wastewater and Combined Sewer Integrated Plan

Macon Municipal Utilities
Integrated Plan

Revision FINAL
6/21/2022

Macon Municipal Utilities Wastewater and Combined Sewer Integrated Plan

prepared for

Macon Municipal Utilities
Integrated Plan
Macon, Missouri

Project No. 130292

Revision FINAL
6/21/2022

prepared by

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St. Louis, Missouri

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
Burns & McDonnell	Burns & McDonnell Engineering Company, Inc.
City	City of Macon, Missouri
CIPP	Cured in place pipe
CCTV	Closed-Circuit Television
CWA	Clean Water Act
CSO	Combined Sewer Overflows
CSS	Combined Sewer System
EPA	United States Environmental Protection Agency
I/I	Inflow and Infiltration
IP	Integrated Plan
Integrated Plan Framework	Integrated Municipal Stormwater and Wastewater Planning Approach Framework
LTCP	Long Term Control Plan
MDNR	Missouri Department of Natural Resources
MHI	Median Household Income
MMU	Macon Municipal Utilities
MPUA	Missouri Public Utility Alliance
NMC	Nine Minimum Controls
RDII	Rainfall Derived Inflow and Infiltration
TMDL	Total Maximum Daily Load
UV	Ultraviolet Light
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA) developed the *Integrated Municipal Stormwater and Wastewater Planning Approach Framework* to assist municipalities with prioritizing projects to meet Clean Water Act (CWA) compliance requirements in such a way that avoids disproportionate burdens of affordability on rate payers while protecting, prioritizing, and sequencing of project and technologies to address human health and water quality related challenges. Development of an Integrated Plan is a voluntary path for municipalities to take to comply with the CWA.

The following guidance was set forth in *EPA's Integrated Municipal Stormwater and Wastewater Planning Approach Framework (Integrated Plan Framework)*:

1. Element 1: Description of water quality, human health and regulatory issues to be addressed.

2. Element 2: Description of existing wastewater and stormwater systems under consideration and summary information describing the systems' current performance.

3. Element 3: Process which opens and maintains channels of communication with relevant Community Stakeholders to give full consideration of the views of others in the planning process and during implementation of the plan.

4. Element 4: Process for identifying, evaluating, and selecting alternatives and proposing implementation schedules.

5. Element 5: Process for evaluating the performance of projects identified in a plan, which may include evaluation of monitoring data, information developed by pilot studies and other studies.

6. Element 6: Process for identifying, evaluating, and selecting proposed new projects or modifications to ongoing or planned projects and implementation schedules based on changing circumstance.

Macon Municipal Utilities (MMU) provides customers in Macon, Missouri with electric, water, wastewater, and natural gas services. Macon, Missouri is in northern central Missouri and has a population of 5,457 people according to the 2020 Census. The median household income (MHI) per the 2016-2020 U.S. Census Bureau is $37,974. Macon is one of five communities in the State of Missouri with a combined sewer system (CSS). The combined sewer system was constructed in the late 1800's.

MMU began its Integrated Planning effort in 2020 to prioritize large capital improvement projects associated with the wastewater and combined sewer collection systems, and the wastewater treatment plant. The collection system is divided into three main categories within this Integrated Plan: stormwater, the combined and separate sewer collection systems. Figure 1-1 below illustrates these key components of the Integrated Plan.

Figure 1-1: Key Components of the MMU Integrated Plan

MMU has studied each aspect of the separate and combined sewer collection systems and WWTP to understand existing condition of these systems, current water quality initiatives and identify proposed improvements to achieve CWA compliance. MMU's Integrated Plan (IP) has considered the following reports:

- "Systemwide Collection System Flow and Rainfall Analysis" report. Prepared by Burns & McDonnell. Dated October 2018. (Flow Analysis Report)
- "Hydraulic Analysis of Long-Term Control Plan (LTCP): Existing Conditions and Future Alternatives" report. Prepared by Burns & McDonnell. Dated July 2019. (Hydraulic Analysis Report)
- "Macon Sewer Separation" report. Prepared by McClure. Dated October 2019. (Sewer Separation Report)

- "Wastewater System Facility Plan" report. Prepared by Benton & Associates, Inc. In Association with CDM Smith. Dated April 2014. (Facility Plan)

MMU chose to pursue an IP to support prioritization of capital spending challenges and prioritization of improvements to achieve water quality compliance. A total of approximately $50M in improvements in the separate and combined sewer systems and the wastewater treatment plant has been identified as part of this IP. The improvements outlined herein are based on the evaluation of the existing system needs as evaluated in the above referenced reports, regulatory requirements, and community outreach feedback.

2.0 DRIVERS FOR INTEGRATED PLANNING

Element 1 of the EPA's *Integrated Plan Framework* is to describe the water quality, human health and regulatory issues to be addressed. For MMU, water quality and human health concerns are associated discharges from three (3) permitted combined sewer overflows (CSOs) and anticipated compliance initiatives at the wastewater treatment plant (WWTP). MMU's WWTP and three (3) permitted CSOs discharge into Sewer Creek, which is located within the South Fork Salt River/Mark Twain Lake watershed that drains to the Mississippi River.

MMU chose to pursue an Integrated Plan to support prioritization of capital spending challenges and prioritization of control technologies including sewer separation, wet weather conveyance, Rainfall Derived Inflow and Infiltration (RDII) reduction and WWTP improvements to achieve water quality compliance. Documents related to MMU regulatory compliance requirements are as follows:

- "State of Missouri Department of Natural Resources – Missouri Clean Water Commission. Missouri State Operating Permit" (NPDES Permit). Permit No. MO-0023221. Dated July 2017.
- "The Combined Sewer Overflow Long-Term Control Plan for The City of Macon, Missouri" document. Prepared by Shafer, Kline & Warren, Inc. Dated June 2008. Adopted January 2009.

MMU developed The Combined Sewer Overflow Long-Term Control Plan (LTCP) in 2009 to outline a plan for controlling, eliminating, and reducing the discharge of CSOs. Coupled with the Nine Minimum Controls (NMC), the LTCP outlines a three phased approach.

Phase 1 was aimed at removing high strength wastewater from the CSS to improve the quality of water discharged from the CSOs. Phase 1 was completed in 2005.

Phase 2 of the LTCP included construction of an Ultraviolet Light (UV) Disinfection system. Per Phase 2, MMU invested approximately $1M in 2011 to construct UV Disinfection to disinfect the WWTP effluent during the recreational season; April 1 through October 31.

Phase 3 included modifications to the headworks at the wastewater treatment plant. MMU constructed a new headworks facility at the WWTP in 2021 for approximately $5M. Phase 3 also proposed construction of a 36-inch sewer from the grit chamber CSO to the WWTP. The LTCP indicated that 3 MGD would be sent to the WWTP, and excess combined sewer flow would be diverted to the WWTP wet weather storage facility, which would be retrofitted to prevent discharge of floatable materials.

MMU contracted Burns & McDonnell in 2018 to complete flow monitoring and develop a hydraulic model to evaluate Phase 3 of the LTCP. Based on the Hydraulic Analysis report, referenced in Section 1 of this IP, the 36-inch pipe was determined to be undersized to convey sufficient wet weather flows and the WWTP and existing wet weather storage basin capacities are undersized to meet the LTCP goals.

3.0 EXISTING SYSTEM EVALUATION

MMU operates and maintains the electric, water, separate and combined sewer collection, and natural gas systems. This Integrated Plan document is focused solely on the wastewater collection and treatment systems, including the impacts of stormwater management. MMU has completed various studies, referenced in Section 1, on the collection system and wastewater treatment plant to evaluate and understand the existing system and limitations. Figure 3-2, shown below, illustrates the CSS, SSS, CSOs, and the WWTP.

3.1 Collection System

MMU's collection system includes a portion of combined sewer and separate sewer systems. The CSS was constructed in the late 1800's and conveys rainwater runoff, domestic wastewater, and industrial wastewater, including flow from ConAgra's poultry processing plant. Figure 3-1 indicates that approximately two-thirds of the wet weather volume in MMU's collection system is from the combined sewer system. However, based on the Hydraulic Analysis report, one-third of the wet weather volume is from the separate sewer collection system. Therefore, improvements to both the CSS and SSS are described in the following sections.

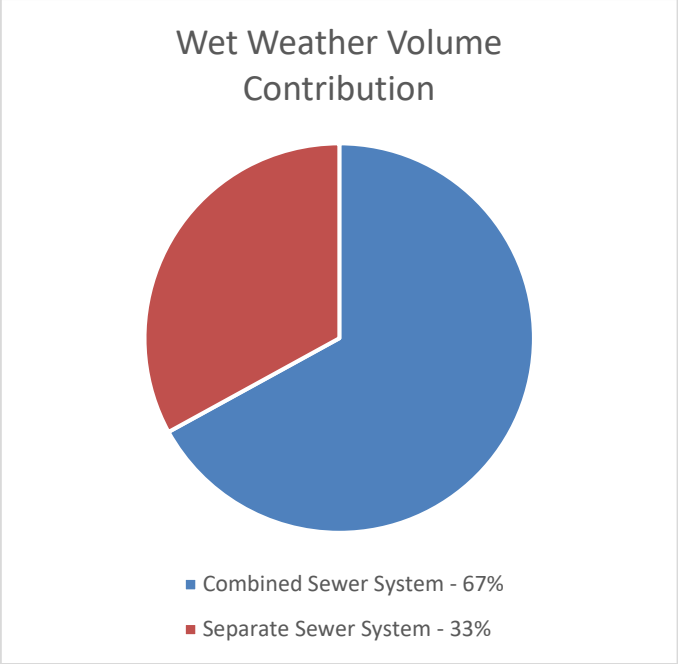
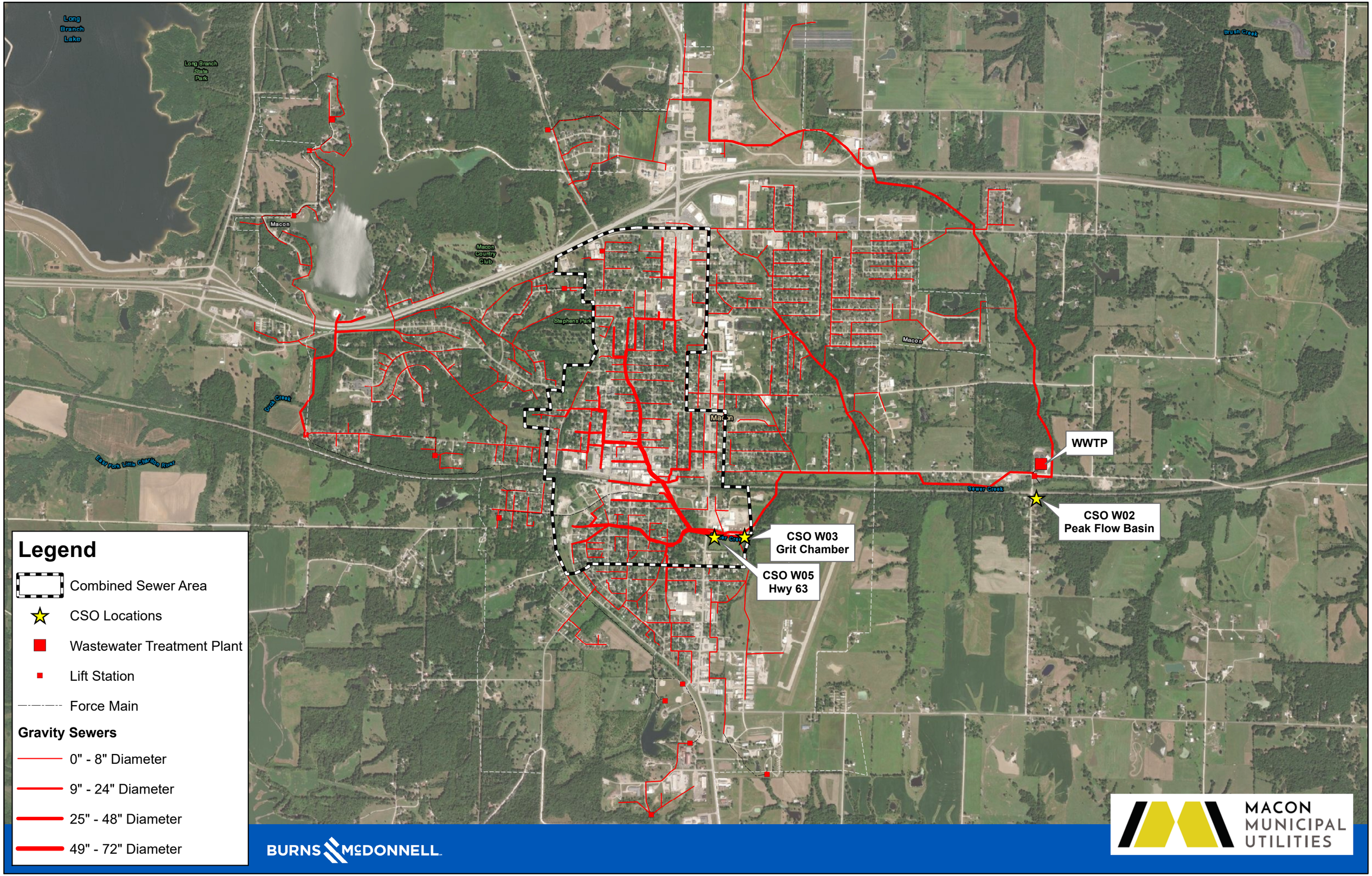


Figure 3-1: Wet Weather Volume Contribution


Long Branch Lake
Long Branch State Park
Macon
Macon Country Club
Stephens Park
Macon
Macon
Brush Creek
Sewer Creek
Deer Creek
East Fork Little Chariton River
WWTP
CSO W02
Peak Flow Basin
CSO W03
Grit Chamber
CSO W05
Hwy 63
Legend
Combined Sewer Area
CSO Locations
Wastewater Treatment Plant
Lift Station
Force Main
Gravity Sewers
0" - 8" Diameter
9" - 24" Diameter
25" - 48" Diameter
49" - 72" Diameter
BURNS McDONNELL
MACON MUNICIPAL UTILITIES

3.1.1 Combined Sewer System

The CSS consists of approximately 250 manholes and 80,000 linear feet of combined sewer collection system piping ranging from 6-inch to 72-inch. Much of the combined sewer system was constructed in the late 1800's. A Closed-Circuit Television (CCTV) inspection of the main 6' brick sewer through the heart of the CSS completed in 2016 and is in fair shape. When excess flows exceed the capacity of this sewer, one of the three permitted CSOs activates to discharge combined sewage into Sewer Creek. Table 3-1, below lists the three permitted combined sewer outfalls.

Table 3-1: Permitted Combined Sewer Outfalls

Combined Sewer Overflows	
Outfall W05	Highway 63
Outfall W03	Grit Chamber – East of Highway 63
Outfall W02	Holding Basin at Wastewater Treatment Plant

MMU's LTCP adopted in 2009 outlines the CSO goals to align with the CWA as follows:

- Reduce overflow events to less than an average of four events per year
- Capture at least 85% by volume of the combined sewage collected in the combined sewage system during precipitation events for treatment, equivalent to primary clarification, on a system-wide annual average basis

Based on the Hydraulic Analysis report, referenced in Section 1 of this IP, the 36-inch pipe was determined to be undersized to convey sufficient wet weather flows and the WWTP and existing wet weather storage basin capacities are undersized to meet the prescribed CSO activation goals in the LTCP.

3.1.2 Stormwater System

Stormwater in the separate sewer areas is conveyed away from the city into surrounding watersheds through various storm sewers, culverts, ditches, and creeks. Stormwater in the CSS is conveyed by the main 6' diameter brick sewer to the WWTP. There are approximately 200 stormwater inlets that discharge directly into the CSS. The storm system assets are owned and maintained by the City of Macon.

3.1.3 Separate Sanitary Sewer System

The newer portions of the collection system were constructed as separate sanitary sewer system (SSS). The SSS consists of approximately 750 manholes and 215,000 linear feet of collection system piping ranging from 6-inch to 24-inch. MMU has focused on cured-in-place pipe (CIPP) lining and manhole rehabilitation in the SSS since 2009. Table 3-2 summarizes the annual capital spend MMU has made since 2009 toward inflow and infiltration (I/I) reduction and system rehabilitation.

Table 3-2: Wastewater Collection Main Cured-In-Place-Pipe Projects

Year	Approximate Investment
2009	$70,000.00
2010	$100,000.00
2011	$90,000.00
2012	$80,000.00
2013	$100,000.00
2014	$90,000.00
2015	$100,000.00
2016	$110,000.00
2017	$100,000.00
2018	$90,000.00
2019	$110,000.00
2020	$120,000.00
2021	$120,000.00
Total	**$1,280,000**

3.2 Wastewater Treatment Plant

The existing wastewater treatment plant is located one mile east of Macon and is designed to treat a peak hourly flow of 2.5 MGD.

The original wastewater treatment plant was constructed in 1959 as a trickling filter plant, which consisted of a comminutor and bar rack, a primary sedimentation basin, two rock-media trickling filters, and two final clarifiers. During the first plant expansion in 1985, a second-stage tower-style trickling filter with plastic media was added. In 1988, the headworks was replaced with new comminutors, a second primary sedimentation basin was added, and an excess flow holding basin was constructed that provided a storage capacity of approximately 929,000 gallons. In 2011, UV Disinfection was added to the WWTP processes. A new sludge screw press was installed in 2016. Construction of a new headworks facility including influent screening, grit removal, and an influent pump station was completed in 2021. The new headworks facility has a hydraulic capacity of 10 MGD.

The trickling filters and second-stage tower-style trickling filters struggle meeting current ammonia compliance in the bitter cold. The hydraulic and organic treatment capacity at the existing WWTP has limited remaining capacity. This limited remaining capacity could restrict the opportunity for residential growth and for expansion of current businesses or new businesses in town. Aging infrastructure at the WWTP is also a concern.

4.0 COMMUNITY OUTREACH

MMU has put significant effort into education and community outreach related to utility maintenance and system improvement projects. MMU maintains an active website and social media accounts on Facebook and Instagram to engage the public.

4.1 Stakeholder Involvement

As part of the development of this Integrated Plan, MMU hosted four public outreach events, listed below in Table 4-1.

Table 4-1: Summary of Public Meetings

July 19, 2021	Macon City Council and Macon Municipal Utilities Board of Public Works Bus Tour
August 17, 2021	Chamber of Commerce Coffee & Chat
September 8, 2021	Rotary Club / Public Meeting 1
September 21, 2021	Economic Development / Public Meeting 2

Figure 4-1: July 19, 2021 Bus Tour Photo

MMU hosts monthly Board of Public Works meetings which are open to the public. The Utility Board meeting minutes are posted to the MMU website and in the weekly newspaper. MMU also maintains Facebook and Instagram pages. MMU utilizes these social media pages to share necessary project information, job postings, and educational information.

4.2 Outreach Results

MMU requested feedback at each of the public meetings described in Figure 4-2. As the collection system and wastewater treatment plant was described, the stakeholders and public were asked to rank three categories based on order of importance: environmental, social, and financial impacts. The environmental impacts as presented were specific to the water quality impacts from the CSOs and WWTP effluent discharges. The social impacts are directly related to economic growth and town expansion. Lastly, the financial impacts are related to rate increases for community members and the potential impacts on regulatory compliance. Table 4-2, below, lists the results of the public outreach efforts. The three categories were ranked from 1 to 3; where 1 is the most important and 3 is the least important.

Figure 4-2: Public Engagement Feedback Form

Table 4-2: Public Outreach Feedback Results

ALL FEEDBACK COMPILED					
	OVERALL	Board of Public Works / City Council Bus Tour	Chamber of Commerce Coffee & Chat	Rotary Club / Public Meeting 1	Economic Development / Public Meeting 2
ENVIRONMENTAL	2.2	2.8	1.9	2.1	2.2
SOCIAL	1.8	1.9	1.8	1.8	1.2
FINANCIAL	2.0	1.3	2.4	2.1	2.6

Figure 4-3: August 17, 2021 Chamber of Commerce Coffee & Chat

5.0 SYSTEM IMPROVEMENTS ANALYSIS

MMU has studied each aspect of the wastewater collection system and wastewater treatment plant to identify necessary improvements. These alternatives have been outlined in the following sections of the IP and prioritized and sequenced based on the needs of the system, public feedback, and the financial capabilities of the community.

5.1 Identifying Alternatives

5.1.1 Collection System

Based on the Hydraulic Analysis report, the three CSOs activate more than the prescribed goals in the LTCP, prior to implementation of phase 3 of the LTCP. The hydraulic model developed in 2018 predicts that the proposed 36" CSS interceptor sewer as defined in the current LTCP would not provide adequate conveyance of CSS flows the necessary combined flows to the wastewater treatment plant overflow basin.

Based on this information, the following improvements to both the separate and combined sewer systems are proposed to reduce the inflow of stormwater into the combined sewer system. I/I Reduction and partial sewer separation programs are suggested to make incremental reductions to the volumes of combined wastewater in the system.

5.1.1.1 Separate Sewer System – I/I Reduction

MMU has allocated resources annually, since 2009, for I/I Reduction efforts. These efforts have included CIPP lining and manhole rehabilitation in the separate sanitary sewer system. An expansion of these I/I Reduction efforts has been given a high priority in this integrated plan. The I/I Reduction program is centered around I/I Assessment and Reduction in various parts of the separate sewer collection system, as prioritized in the Hydraulic Analysis report completed in 2018.

5.1.1.2 Storm Sewer System – Partial Separation

The Sewer Separation report outlines various sewer separation opportunities in the combined sewer system. This integrated plan prioritizes pursuing partial sewer separation, when feasible, to reduce the volume of combined flow in the system.

5.1.1.3 Combined Sewer System – Interceptor Sewer

Following progress of the I/I Reduction and partial sewer separation programs, post construction flow monitoring and a hydraulic model update will measure the success of these programs. This data will be

utilized to evaluate the need and/or sizing, ranging from 24-inch to 48-inches in diameter, of the approximately 1.5-mile CSS interceptor sewer as laid out in the LTCP.

5.1.2 Wastewater Treatment Plant

The trickling filters and second-stage tower-style trickling filters struggle meeting current ammonia compliance during extreme cold weather conditions. In addition, a total phosphorus limit will likely be implemented in Macon in 2033. A total nitrogen limit is likely to be implemented in the future as well. Additional processes at the plant to meet this new limit will be required. The hydraulic and organic treatment capacity at the existing WWTP has limited remaining capacity for expansion of current businesses or new businesses in town. Aging infrastructure at the WWTP is also a concern. A new activated sludge wastewater treatment plant will be necessary within the next 10-20 years to meet future effluent limits, add hydraulic and organic capacity and mitigate aging infrastructure concerns. A new activated sludge wastewater treatment plant process would also provide an increased peaking factor to allow additional wet weather flow to receive treatment.

5.2 Project Sequencing

Five (5) major project initiatives have been considered as part of this IP:

- New WWTP
- Interceptor Sewer
- SSS I/I Reduction Program
- CSS Partial Sewer Separation Program
- Adaptive management

I/I Reduction in the SSS and partial sewer separation in the CSS will be followed by post-construction flow monitoring and a hydraulic model update to evaluate the success of this program, referred to as adaptive management. Post-construction metering will support hydraulic model updates during execution of the IP to evaluate current condition performance and impacts to the large capital projects considered within the IP including the CSS interceptor sewer and WWTP improvements.

Three project sequencing scenarios have been evaluated as shown in Table 5-1, Table 5-2, and Table 5-3 below. Scenario 1, shown in Table 5-1, is focused on a more aggressive 5-year Partial Sewer Separation program and 10-year I/I Reduction program with the need for a new WWTP capacity expansion and Interceptor Sewer sequenced after execution of these programs. Scenario 2, as shown in Table 5-2, illustrates an extended 10-year Partial Sewer Separation program and 20-year I/I Reduction program. In this scenario, a new WWTP is projected in the next 10 years and the Interceptor Sewer is extended out into

2046. Table 5-3 represents Scenario 3. This scenario evaluates project sequencing if a new WWTP is needed in the immediate future.

Table 5-1: Project Sequencing - Scenario 1

SCENARIO 1	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
New WWTP																				✓				
Interceptor Sewer															✓									
I/I Reduction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓														
Partial Sewer Separation	✓	✓	✓	✓	✓																			
Adaptive Management						✓					✓													

Table 5-2: Project Sequencing - Scenario 2

SCENARIO 2	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
New WWTP										✓														
Interceptor Sewer																								✓
I/I Reduction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Partial Sewer Separation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓														
Adaptive Management											✓										✓			

Table 5-3: Project Sequencing - Scenario 3

SCENARIO 3	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046
New WWTP	✓																							
Interceptor Sewer																								✓
I/I Reduction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Partial Sewer Separation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓														
Adaptive Management											✓										✓			

5.3 Rate Impact

Figure 5-1 illustrates the opinion of probable cost in 2022 dollars for each of the project initiatives identified in this IP. A total of approximately $50M in improvements in the separate and combined sewer systems and the wastewater treatment plant has been identified as part of this IP.

Figure 5-1: Cost Opinion of Integrated Plan Initiatives

Table 5-4 below summarizes the MHI and residential sewer rates in towns neighboring Macon in Northern Missouri. Per the EPA's Combined Sewer Overflows-Guidance for Financial Capability Assessment and Schedule Development documented dated February 1997, residential sewer rates are considered a "high" financial impact when they exceed 2% of the communities MHI. For Macon, the current sewer rates are approximately 1.3% of the MHI. At 2% of the MHI, the monthly residential sewer rate for a 5,000-gallon user for Macon would be $63.29.

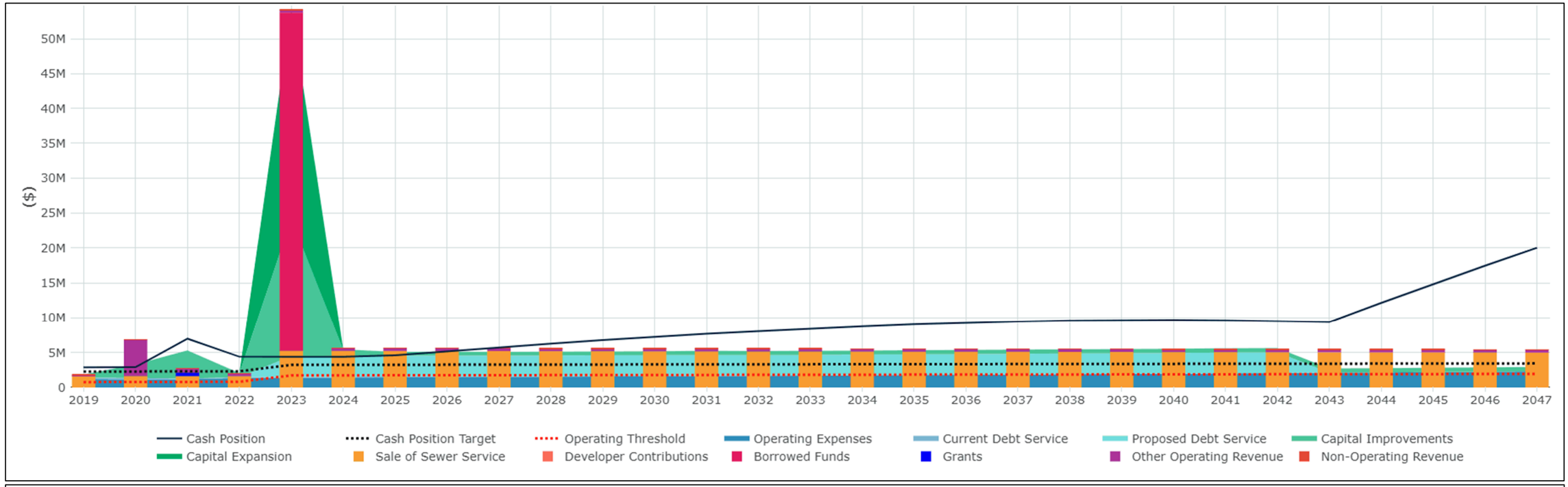
Table 5-4: Northern Missouri Cities MHI and Residential Sewer Rate Survey

Northern Missouri Cities MHI and Residential Sewer Rate Survey		
Town	**MHI (US Census, Bureau, 2016-2020, in 2020 Dollars)**	**Residential Sewer Rates, 5,000 Gallons per Month**
Macon	$37,974	$40.91
Chillicothe	$40,822	$25.50
Marshall	$42,584	$47.75
Hannibal	$42,906	$43.00
Kirksville	$33,575	$49.86
Trenton	$40,881	$67.99
Moberly	$37,021	$64.70

Figure 5-2, Figure 5-3, Figure 5-4, and Figure 5-5 have been developed by MMU to outline the project sequencing scenarios for impacts on community sewer rates. Figure 5-2 lists a baseline scenario evaluating the impact on rates if all projects identified are completed immediately. This is meant to illustrate the need for prioritizing projects and phasing of the cost impacts. Figure 5-3 illustrates Scenario 1, which is a more aggressive 10-year I/I Reduction program and a 5-year Partial Sewer Separation program with the need for a new WWTP sequenced after execution of these programs. Figure 5-4 is Scenario 2, which shows a new WWTP in the next 10 years, with a 20-year I/I Reduction and 10-year Partial Sewer Separation program. Figure 5-5 represents Scenario 3, which is the impact on rates if the new WWTP is constructed in the immediate future.

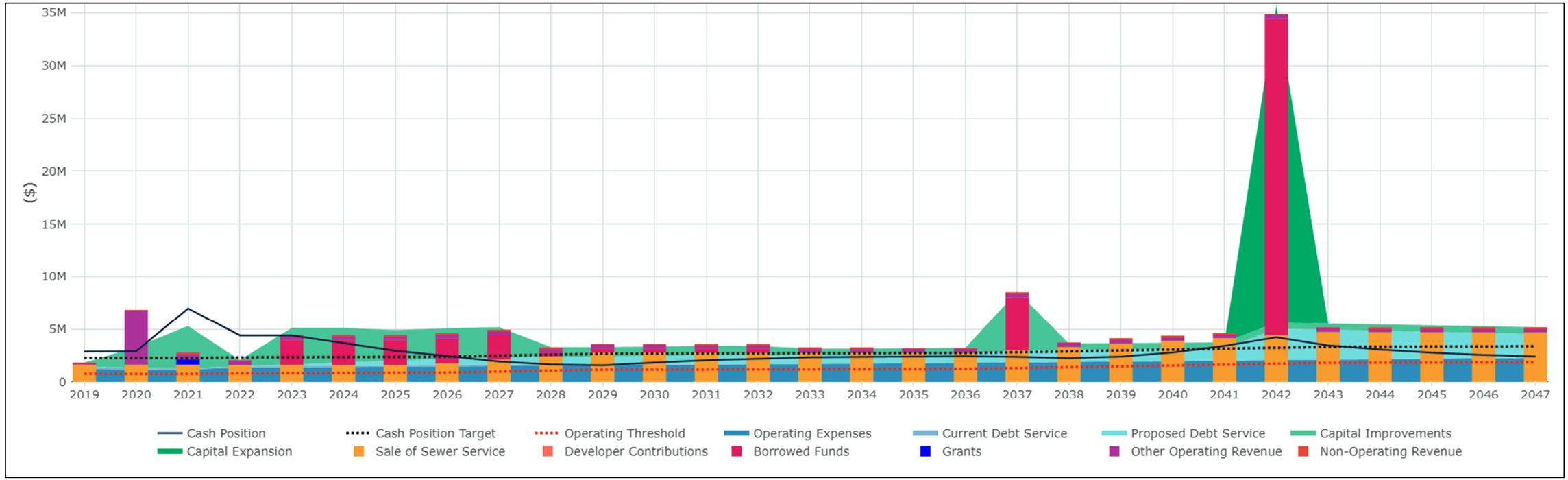
The residential sewer rates outlined in the following figures are based on the 5,000-gallon user. The rates are highlighted red when they exceed the EPA's 2% MHI threshold and become a high burden on rate payers.

Figure 5-2: MDNR Integrated Plan Base Scenario



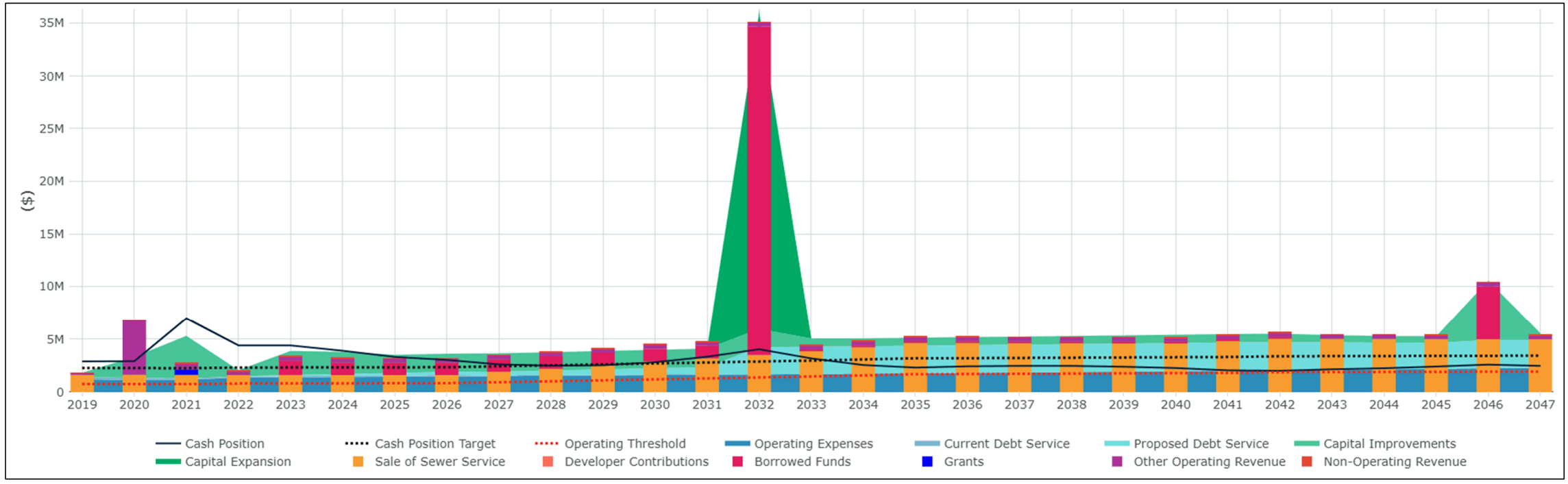
Base Scenario																									
Year	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**	**2046**
New Plant		30,000,000																							
Interceptor Sewer		5,000,000																							
I&I Reduction		3,500,000																							
Storm Sewer		10,000,000																							
Monitoring		100,000																							
Sales Increase		225%																							
Residential	40.91	132.97	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96	132.96
Commercial	72.48	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56	235.56
ConAgra	35,213.74	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66	114,444.66

Figure 5-3: MDNR Integrated Plan Scenario 1



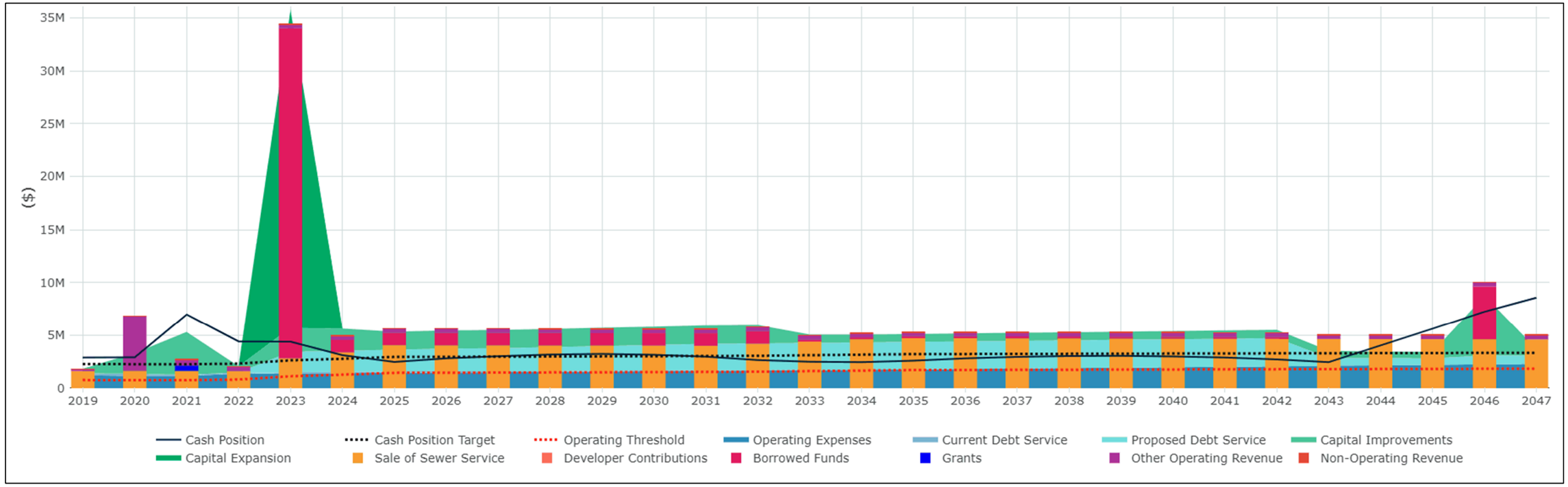
Scenario 1																								
Year	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**	**2046**
New Plant																					30,000,000				
Interceptor Sewer																5,000,000									
I&I Reduction		350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000														
Storm Sewer		2,000,000	2,000,000	2,000,000	2,000,000	2,000,000																			
Monitoring							50,000					50,000													
Sales Increase					10%	20%	15%	15%								10%	10%	10%	7%	7%	7%	7%			
Residential	40.91	40.91	40.91	40.91	45.00	54.00	62.10	71.42	71.42	71.42	71.42	71.42	71.42	71.42	71.42	78.56	86.41	95.06	101.71	108.83	116.45	124.60	124.60	124.60	124.60
Commercial	72.48	72.48	72.48	72.48	79.73	95.67	110.02	126.53	126.53	126.53	126.53	126.53	126.53	126.53	126.53	139.18	153.10	168.41	180.20	192.81	206.31	220.75	220.75	220.75	220.75
ConAgra	35,213.74	35,213.74	35,213.74	35,213.74	38,735.11	46,482.14	53,454.46	61,472.63	61,472.63	61,472.63	61,472.63	61,472.63	61,472.63	61,472.63	61,472.63	67,619.89	74,381.88	81,820.07	87,547.47	93,675.79	100,233.10	107,249.41	107,249.41	107,249.41	107,249.41

Figure 5-4: MDNR Integrated Plan Scenario 2



Scenario 2																								
Year	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**	**2046**
New Plant											30,000,000														
Interceptor Sewer																									5,000,000
I&I Reduction		175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000				
Storm Sewer		1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000														
Monitoring												50,000										50,000			
Sales Increase						20%	15%	15%	15%	10%	10%	10%	10%	10%						5%	5%				
Residential	40.91	40.91	40.91	40.91	40.91	49.09	56.46	64.92	74.66	82.13	90.34	99.38	109.31	120.25	120.25	120.25	120.25	120.25	120.25	126.26	132.57	132.57	132.57	132.57	132.57
Commercial	72.48	72.48	72.48	72.48	72.48	86.98	100.02	115.03	132.28	145.51	160.06	176.06	193.67	213.04	213.04	213.04	213.04	213.04	213.04	223.69	234.87	234.87	234.87	234.87	234.87
ConAgra	35,213.74	35,213.74	35,213.74	35,213.74	35,213.74	42,256.49	48,594.96	55,884.21	64,266.84	70,693.52	77,762.87	85,539.16	94,093.07	103,502.38	103,502.38	103,502.38	103,502.38	103,502.38	103,502.38	108,677.50	114,111.38	114,111.38	114,111.38	114,111.38	114,111.38

Figure 5-5: MDNR Integrated Plan Scenario 3



Scenario 3																									
Year	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**	**2046**
New Plant		30,000,000																							
Interceptor Sewer																									5,000,000
I&I Reduction		175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000				
Storm Sewer		1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000														
Monitoring												50,000										50,000			
Sales Increase		75%	20%	20%							5%	5%	2.5%												
Residential	40.91	71.59	85.91	103.09	103.09	103.09	103.09	103.09	103.09	103.09	108.25	113.66	116.50	116.50	116.50	116.50	116.50	116.50	116.50	116.50	116.50	116.50	116.50	116.50	116.50
Commercial	72.48	126.84	152.21	182.65	182.65	182.65	182.65	182.65	182.65	182.65	191.78	201.37	206.41	206.41	206.41	206.41	206.41	206.41	206.41	206.41	206.41	206.41	206.41	206.41	206.41
ConAgra	35,213.74	61,624.05	73,948.85	88,738.62	88,738.62	88,738.62	88,738.62	88,738.62	88,738.62	88,738.62	93,175.56	97,834.33	100,280.19	100,280.19	100,280.19	100,280.19	100,280.19	100,280.19	100,280.19	100,280.19	100,280.19	100,280.19	100,280.19	100,280.19	100,280.19

5.4 System Improvement Conclusion

The recommended sequencing based on system needs and community priorities is Scenario 2. Scenario 2 includes a 20-year I/I Reduction program along with a 10-year partial sewer separation program. This allows MMU to prioritize a new WWTP in the next 10 years. In the recommended Scenario 2, the CSS interceptor sewer project is phased following completion of all other improvements.

Scenario 2 exceeds the EPA's 2% of the 2020 MHI threshold and becomes a high burden on rate payers in 2029. Per the U.S. Census Bureau between 2010 and 2020, Macon's annual growth rate in MHI is about 1.6%. When a 1.6% annual growth rate in MHI is considered, Scenario 2 would become a high burden on rate payers in 2030. Regardless of Scenario selection, grant funding opportunities are key in mitigating the burden of system improvement costs on the rate payers in Macon.

6.0 MEASURING SUCCESS

The I/I Reduction and partial sewer separation programs would provide incremental water quality and system improvements tracking toward LTCP compliance. Construction of a new WWTP helps meet upcoming regulatory compliance requirements for WWTP effluent while aligning with community outreach goals of economic growth and town expansion.

Post construction flow monitoring and a hydraulic model update should be completed periodically with the I/I Reduction and partial sewer separation programs to measure the volume of stormwater removed from the collection system. The post construction flow monitoring and a hydraulic model update should be utilized to re-evaluate the interceptor sewer project as outlined in Phase 3 of the LTCP.

7.0 ADAPTIVE MANAGEMENT

Measuring success, as described in the previous section, can be accomplished by systematically completing post construction flow monitoring as I/I Reduction and Partial Sewer Separations projects are complete. Following completion of the post construction flow monitoring and hydraulic model updates, MMU can review and make any necessary updates to the project sequencing described herein.

MMU can review this IP on a biennial basis to determine if changes are necessary to budget or schedule. It is during this time that the addition of any new project would be considered. Funding opportunities, new regulatory requirements and development are examples of potential impacts to the projects and schedule identified in this IP. MMU has invested time and money into developing a GIS system and hydraulic model to use as tools to support this process. Any changes to the Integrated Plan would be identified and submitted to MDNR at this time for review.

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