



CITY OF
St. Joseph

**Clean Water Revolving Fund
Project Plan Update**

March 15, 2026 DRAFT

Purpose

The purpose of this CWSRF Project Plan Update is to provide the scope of work proposed for funding through the CWSRF FY2027 loan process, and notify City of St. Joseph rate payers of the potential rate increase needed to fund the projects. This updates the City's CWSRF Project Plan dated June 1, 2022, and provides additional background on the subsequent Combined Sewer Overflow (CSO) Storage Project alternatives selection process, and the Hawthorne Lift Station Project.

Phase 2 - CSO Storage Project

Background

When the City of St. Joseph was first developed, it was common to install a single pipe to convey both stormwater and wastewater directly to the St. Joseph River and Morrison Channel through the same collection system. In the early 1950's, the Benton Harbor-St. Joseph Joint Wastewater Treatment Plant (JWWTP) was built to address water quality issues in the St. Joseph River, Morrison Channel, and Lake Michigan. It was not economical or practical to build sufficient capacity at the JWWTP to treat both wastewater (sanitary) and stormwater flows. Instead, the practice at that time was to install CSO overflow chambers to act as relief points during periods where heavy rainfall events contributed excess stormwater to the collection system. The enactment of the Clean Water Act (CWA) in 1972 (Also known as the Federal Water Pollution Control Act) put in place the initial regulations to eliminate CSO discharges from most rainfall events.

The City of St. Joseph is nearing the end of its decades-long CSO compliance program that has included separating combined sewers, replacing and rehabilitating sanitary sewers, and most recently, construction of a new diversion chamber at Public Works to control wet-weather flows. Several rounds of flow monitoring and hydraulic modeling have been completed at various stages of the program to determine the effectiveness of removing inflow and infiltration (I&I) from the sanitary sewer collection system.

In order to comply with the City's National Pollutant Discharge Elimination System (NPDES) permit, overflows from most events must be eliminated. The deadline for the CSO Storage Project has been extended multiple times to allow the City to pursue cost-effective I&I Removal Projects. Hydraulic modeling that followed the most recent I & I Removal Project concluded that it was time to build a CSO Storage tank as the final corrective measure. Once the tank is completed, the City will no longer be eligible to discharge under a CSO NPDES Permit, and overflow events will be limited to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Sanitary Sewer Overflow (SSO) guidance requirements.

Alternatives Analysis and Selected Alternative Review

A public meeting for the alternatives analysis and the selected alternative for the CSO Storage Project was held on June 28, 2023, in City Commission Chambers. Links to a recording of the public meeting and the presentation slides were posted on the City Engineer webpage following the meeting. The public input period remained open from June 2023 to November 2023.

On September 29, 2023, the City submitted the Final CSO Compliance Report to EGLE via the MiEnviro portal as required by the City's CSO NPDES permit. The compliance report provided very detailed information on the status of the CSO program and the basis for the selected alternative.

The selected alternative, which included locating the CSO Storage Tank at the Public Works location, was authorized by the City Commission at a public meeting held on November 13, 2023. The City was initially informed that the project did not score within the fundable range for FY2024 CWSRF funding in the late summer of 2023. However, EGLE Water Infrastructure Finance Section (WIFS) staff contacted City staff on October 23, 2023, with news that funding had become available. City staff and Wade Trim acted quickly to obtain City Commission approval for design services to meet a Quarter 3.5 CWSRF schedule. The Quarter 3.5 schedule was critical to meet the deadline of the CSO Storage Early Action Project option offered in the City's CSO NPDES permit.

A finding of no significant impact (FNSI) and an environmental assessment (EA) were published in March 2024 for the CSO Storage Early Action Project at the Public Works site. Construction on the CSO Storage Early Action Project commenced in November 2024 and was substantially complete in May 2025.

Appendix A includes the presentation from the June 28, 2023 public meeting, the September 29, 2023 CSO Final Compliance Report, and the FNSI and EA for the CSO Storage Early Action Project published in March 2024.

Hawthorne Lift Station Project

The June 1, 2022, project plan amendment also called for replacing the Hawthorne Lift Station in its current location. In August of 2023, the City, with assistance from Abonmarche, secured a United States Department of Agriculture (USDA) grant to defray a portion of the design costs. The design for the Hawthorne Lift Station Project is complete, and Permit Number P410053878 v.1 was issued on June 30, 2025. A copy of the EGLE permit is included in Appendix B of this update.

Summary of Costs

November 2025 construction estimates for the CSO Storage Tank range between \$14,344,000 to \$17,747,000, predominantly based on the size of the tank. Wade Trim is conducting flow monitoring and hydraulic modeling to finalize the storage tank size.

The City and Wade Trim have also been coordinating with the Benton Harbor – St. Joseph Joint Wastewater Treatment Plant staff to ensure that flows sent to the plant will not have an adverse impact on operations.

The Hawthorne Lift Station Project is estimated at \$1,378,000 based upon a November 2024 Engineer’s Estimate adjusted for inflation.

The following table provides the cost summary of the CWSRF FY27 low-interest loan request.

FY27 CWSRF Loan Estimate		
Project/Task	Cost	Remarks
Project: CSO Storage		
Design services	\$ 1,486,000	Flow Monitoring & Hydraulic Modeling plus Design Services
Construction Services	\$ 1,750,000	
Construction	\$ 17,474,000	Upper Range of Construction Estimate
CSO Project Sub-Total	\$ 20,710,000	
Project: Hawthorne Lift Station		
Design Services	\$ -	No CWSRF requested - USDA Grant Covered 74% of Design
Construction Services	\$ 190,000	
Construction	\$ 1,378,000	
Hawthorne Lift Station Sub-Total	\$ 1,568,000	
Sub-Total FY27 CWSRF Projects	\$ 22,278,000	
Bond Origination Costs	\$ 322,000	
Total FY27 CWSRF Request	\$22,600,000	

The costs for both projects are anticipated to be 100% eligible for CWSRF funding given the scope of the work. Therefore, no alternative justifiable expenditures (AJE) should be required.

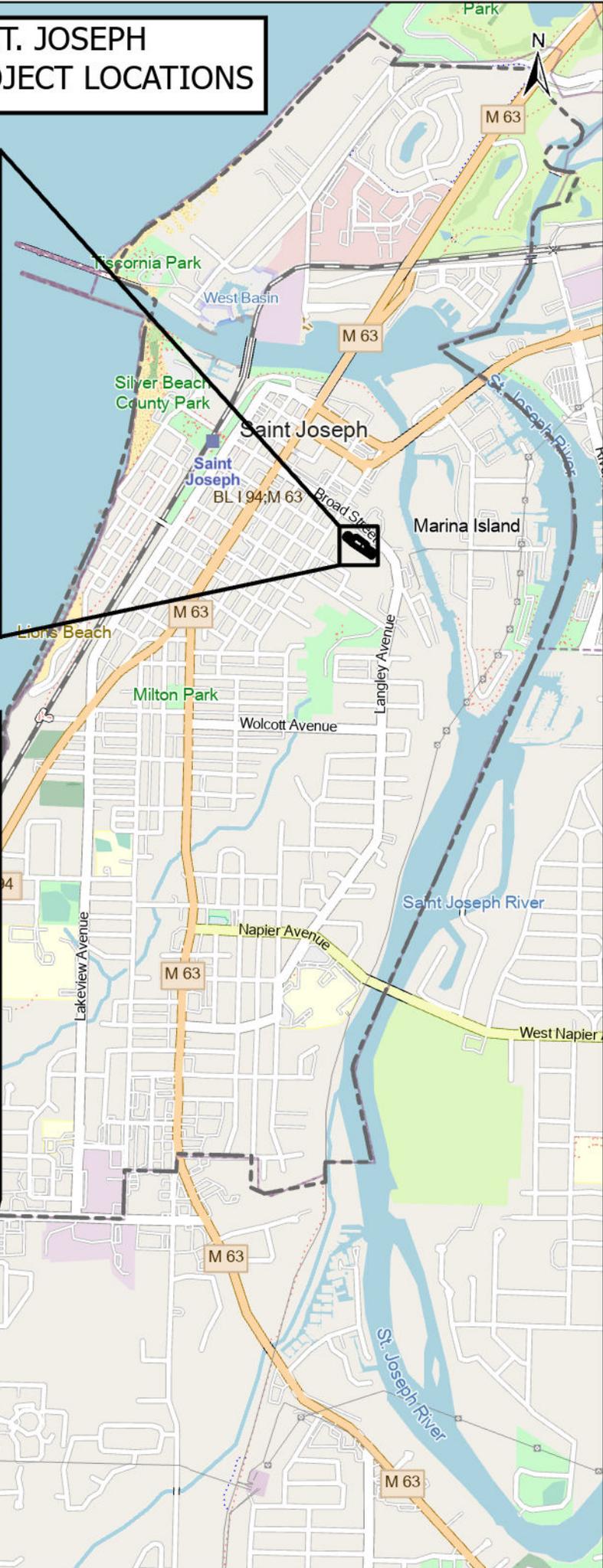
Costs to Users

The expected annual debt repayment for the FY2027 loan is \$89,981 per month for 30 years. With 4,664 users (based upon residential equivalent units) in the City system, it is expected that the necessary rate increase, to finance the debt service will be on average of \$19.29 per a typical City residential user.

Public Involvement

A public hearing is scheduled on April 6, 2026, as part of the regular City Commission Meeting commencing at 6 PM.

CITY OF ST. JOSEPH FY27 CWSRF PROJECT LOCATIONS

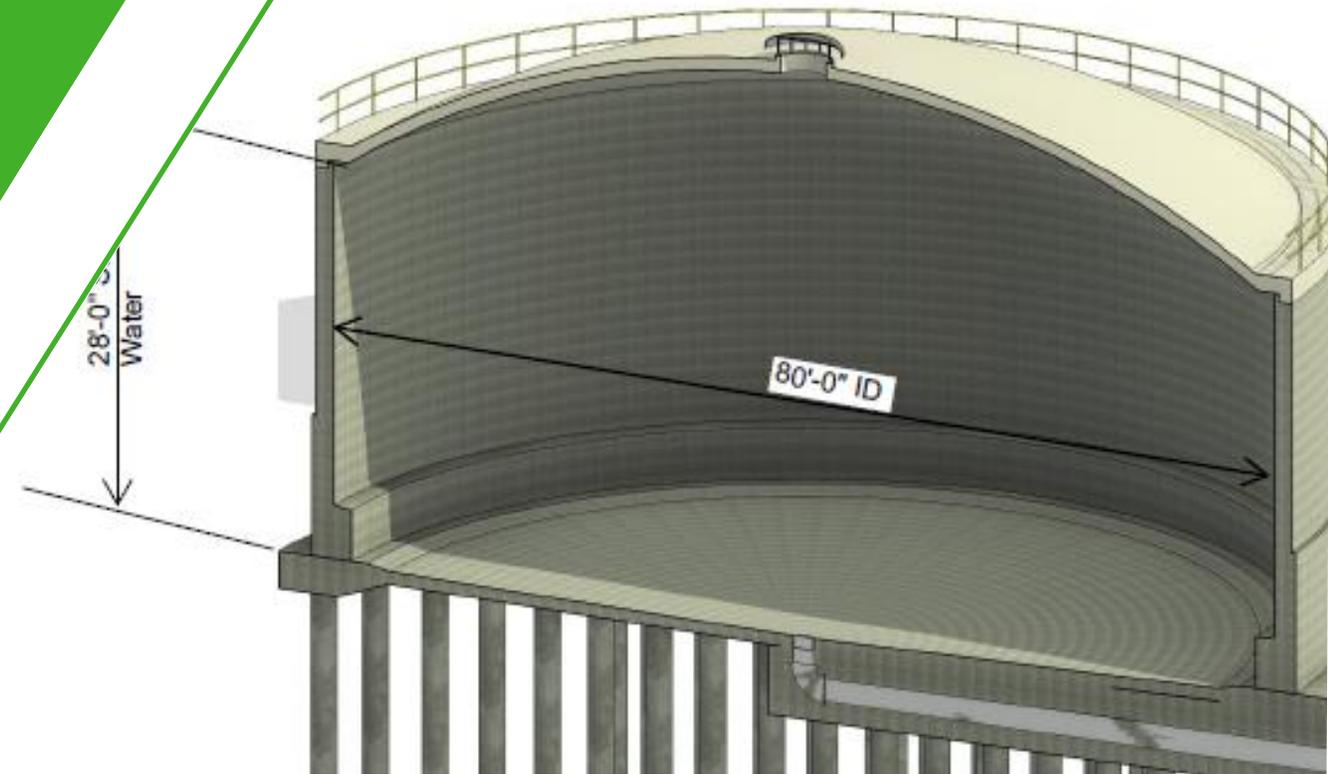


Appendix A



St. Joseph CSO Compliance Program Public Meeting

June 28, 2023



St. Joseph CSO Compliance Program - Agenda

1. System Overview
2. What is a Combined Sewer Overflow (CSO)
3. Why do we need to address CSO control at this time
4. Preliminary screening of storage options
5. Feasible options evaluated
6. Early action project
7. Overall project schedule
8. Project cost summary
9. Pursuing matching funding from the State of Michigan

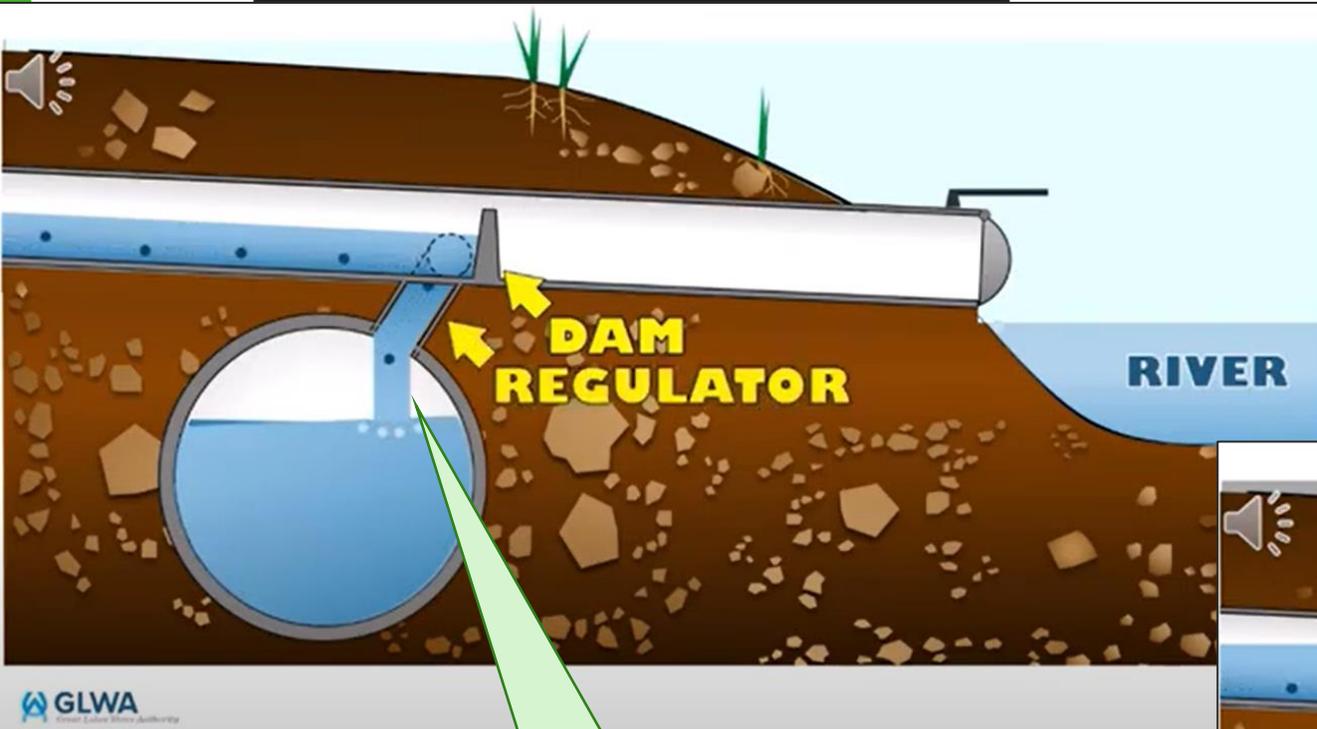
St. Joseph Sewer System Overview

1. Collection system sewers
2. Combined sewer overflows (CSO)
3. Waste Water Treatment Plant (WWTP)

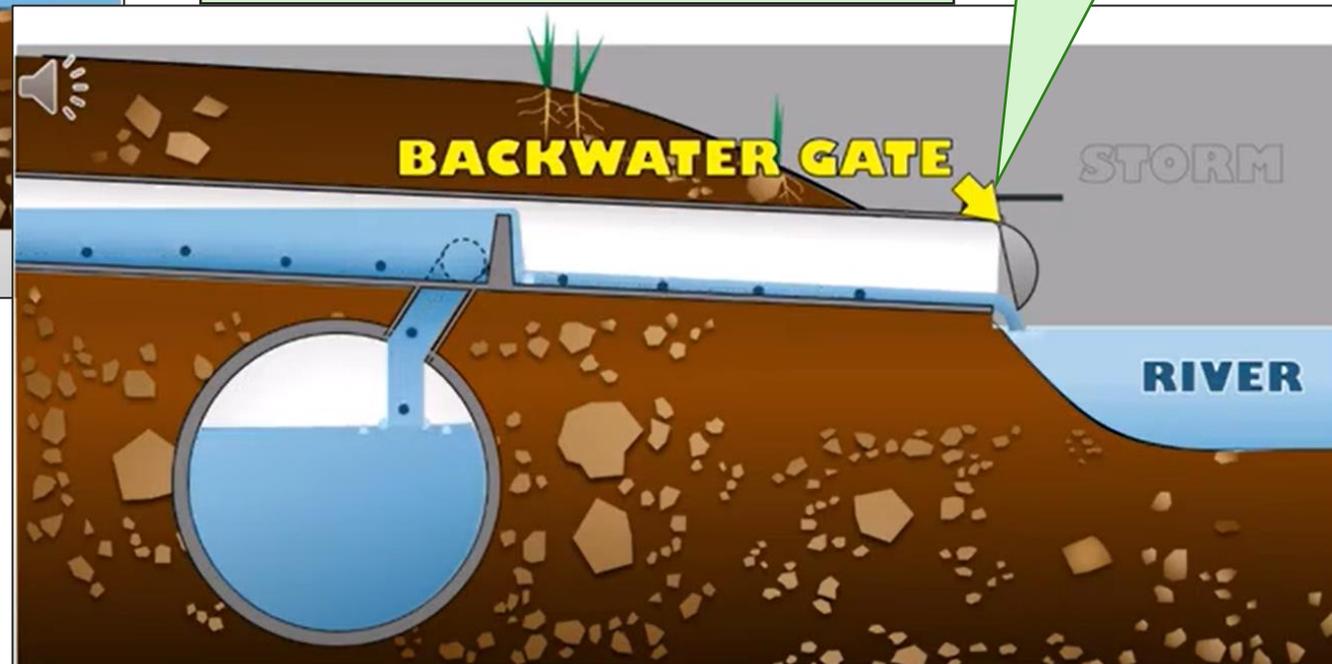


What is a Combined Sewer Overflow?

Dry Weather Flow Conditions



Wet Weather Flow Conditions



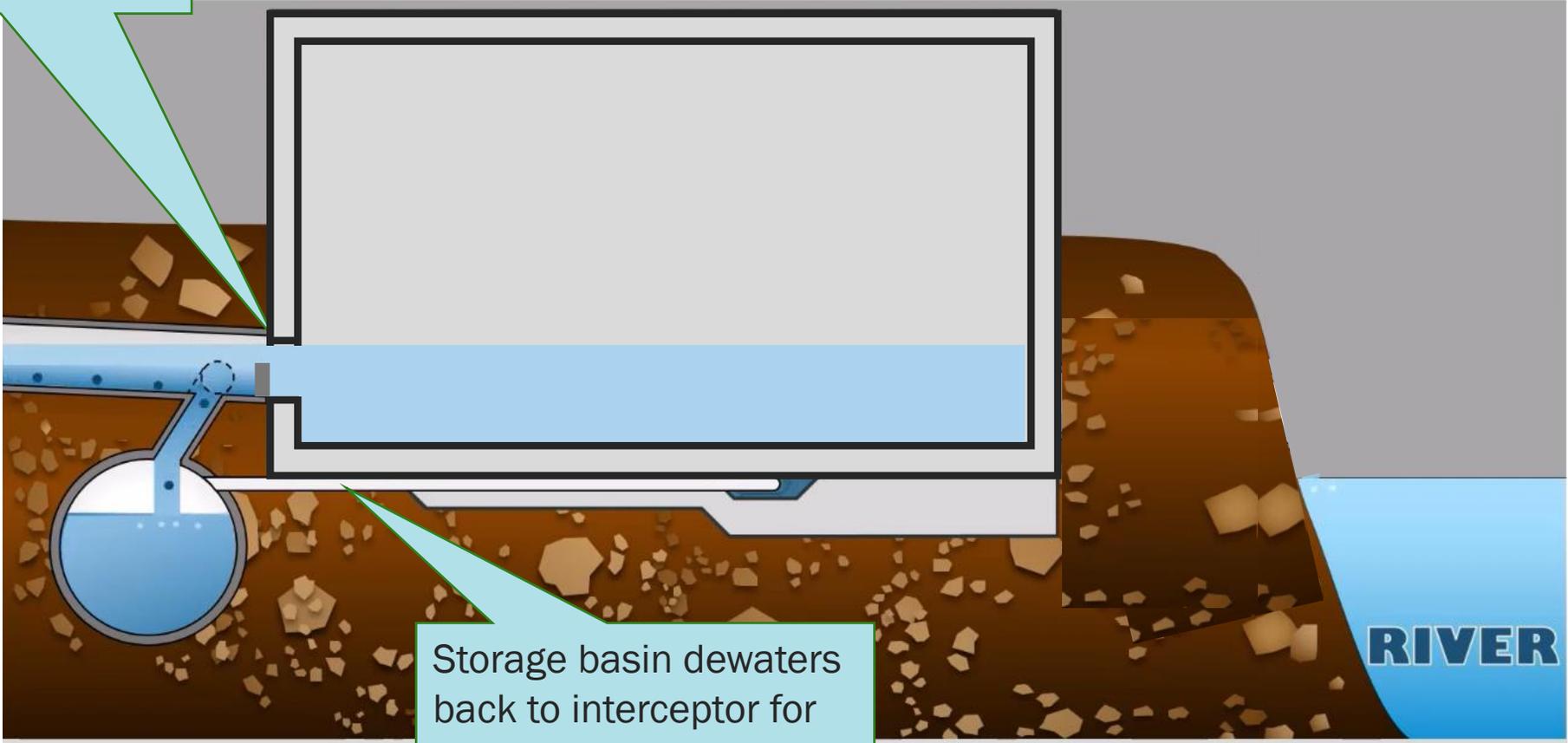
During wet weather, flow exceeds regulator capacity and a mix of sanitary and stormwater discharge to environment

All Sanitary flow is Diverted to Interceptor

Combined Sewer Overflow Control

Construction of Storage Basin

Storage basin intercepts overflow



Why is CSO Control Being Addressed at this Time?

1. CSO control is mandated by the State of Michigan (EGLE)
2. St. Joseph has been working toward CSO control for over 20-years
 - a. Improvements have included
 - Sewer separation of combined sewers areas
 - Sewer rehabilitation in areas with high infiltration and inflow
 - Implementation of flow and rainfall monitoring program
 - Development of a computer model of the system
 - b. Final stage of CSO control is construction of a storage basin
 - Storage basin will intercept flow prior to discharge to river
 - Post event, captured flow will be dewatered back to the interceptor for treatment at the WWTP
 - Flow optimization toward the WWTP will be incorporated into design

Preliminary Review of Basin Storage Options

DPW
Options

Kiwanis Park
Options

Above ground
circular tank

Below grade
deep shaft

Above ground
circular tank

Rectangular
below grade tank

Rectangular
below grade tank

Below grade
linear storage

Rectangular tank
partially buried in
hillside



Preliminary Storage Basin Options – Below Grade Tank

Pros

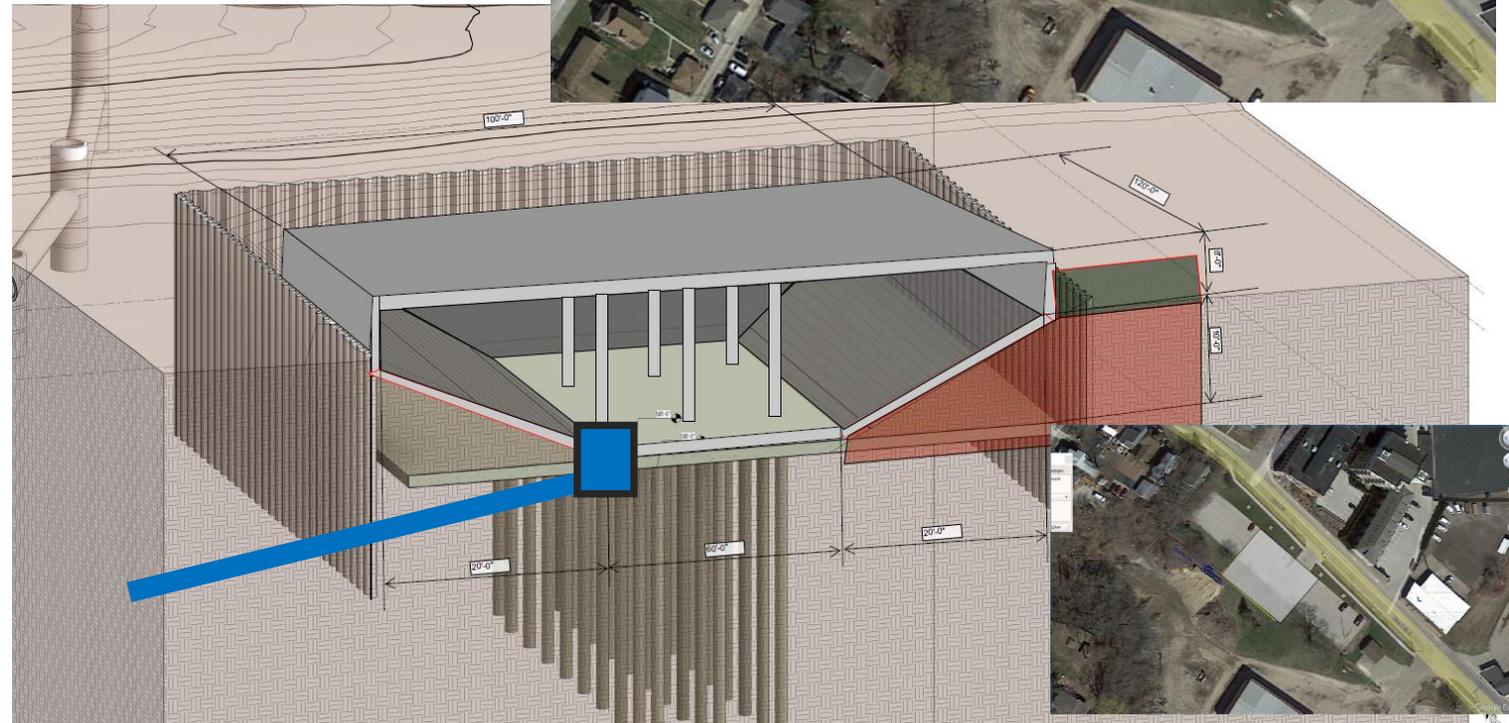
1. Less visual impact
2. Portion of footprint can be used for other activities
3. Gravity dewatering

Cons

1. Higher construction cost

Outcome

1. Option was carried forward for preliminary design



Preliminary Storage Basin Options Above Grade Circular Tank

Pros

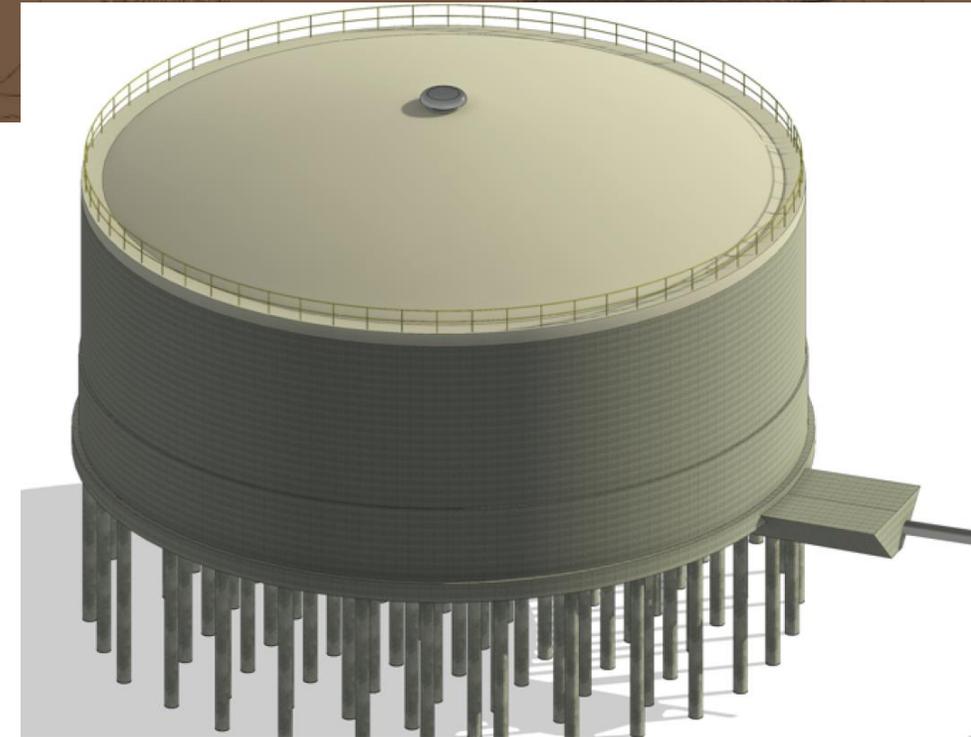
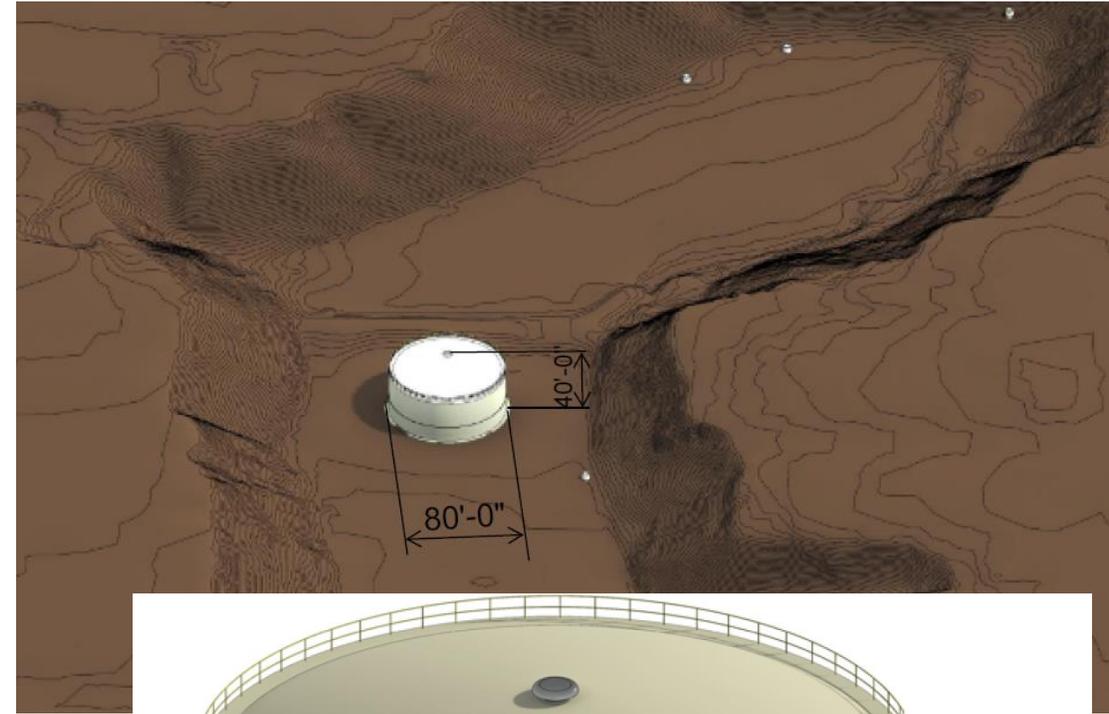
1. Lower construction cost

Cons

1. More visible

Outcome

1. Option was carried forward for preliminary design



Preliminary Storage Basin Options – Deep Shaft

Pros

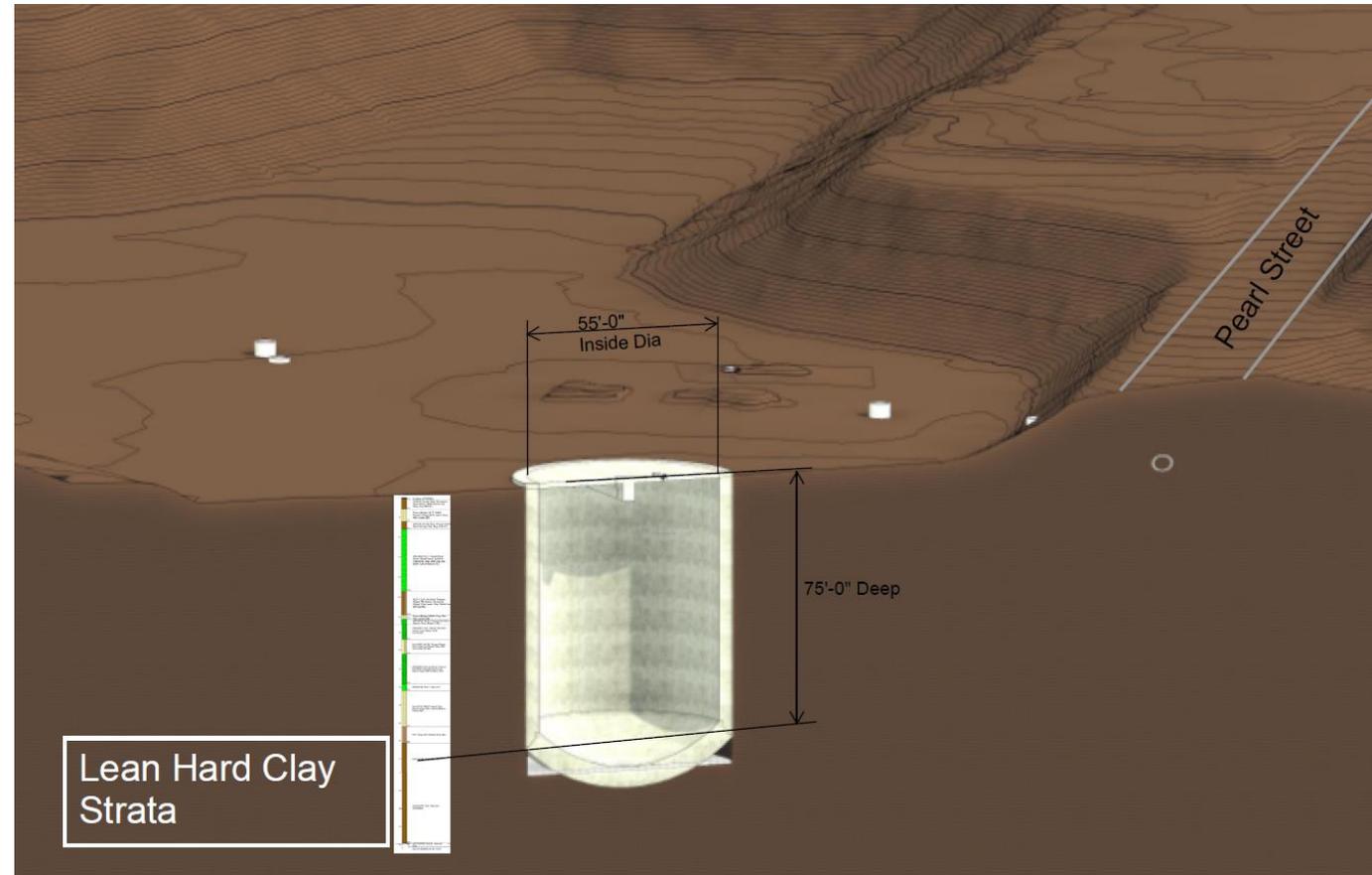
1. Small footprint
2. Less visual impact
3. Portion of footprint can be used for other activities

Cons

1. Higher construction cost
2. Riskier construction
3. Higher operating cost

Outcome

1. Option not carried forward



Preliminary Storage Basin Options – Linear Storage (Large Storage Pipes)

Pros

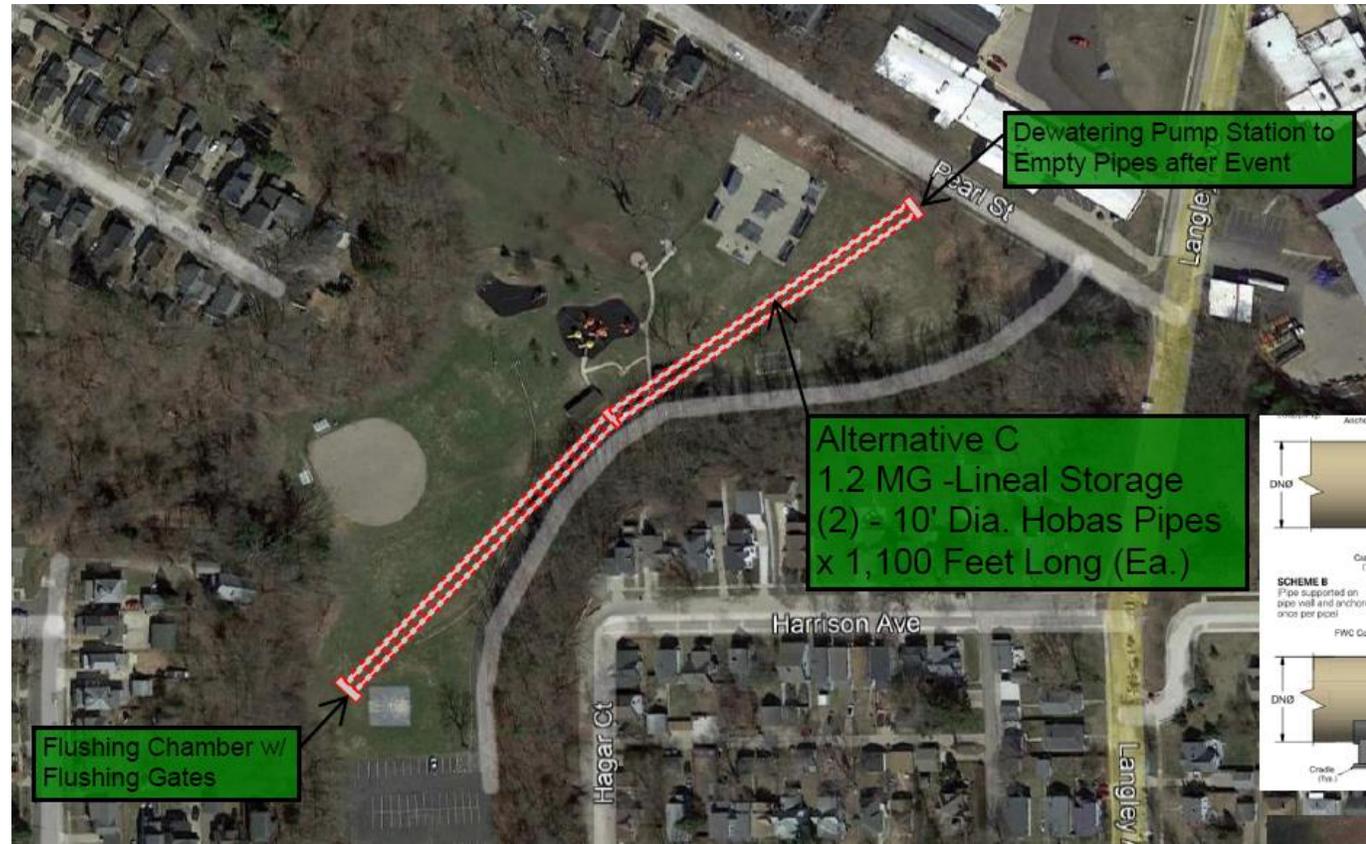
1. Less visual impact
2. Portion of footprint can be used for other activities

Cons

1. Higher construction cost
2. Larger area of disruption during construction
3. More impact with local utilities

Outcome

1. Option not carried forward



Preliminary Storage Basin Options

Rectangular Tank in Hillside

Pros

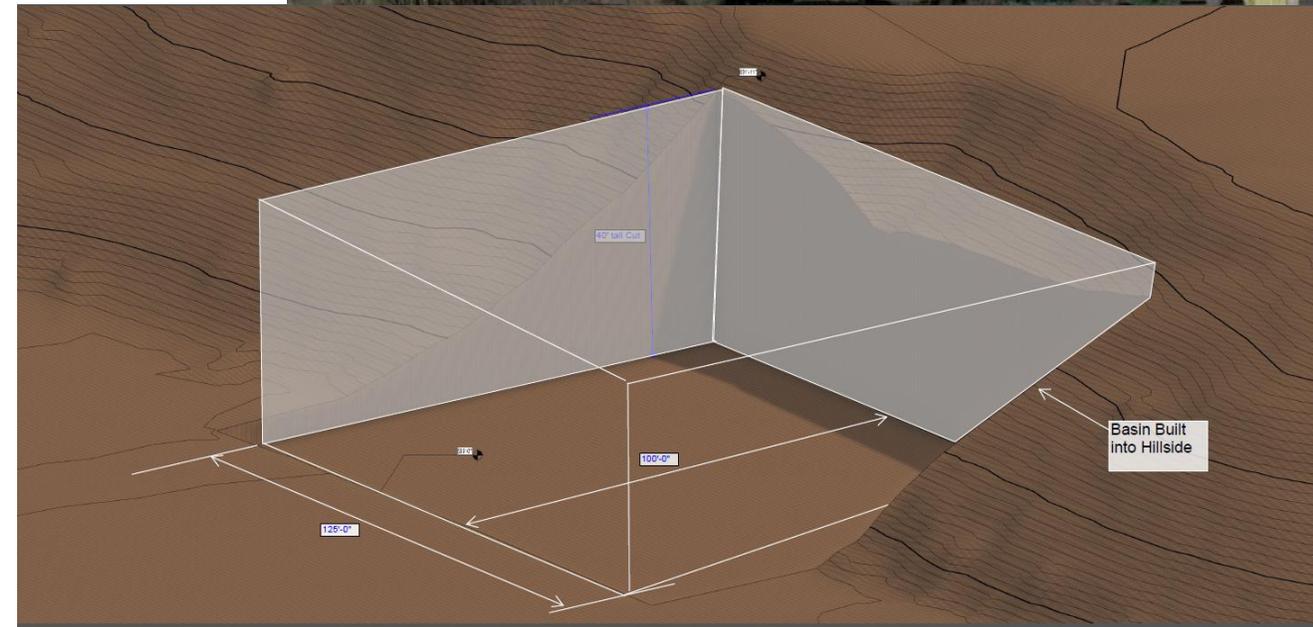
1. Reduced visual impact

Cons

1. Higher construction cost
2. Risky construction

Outcome

1. Option not carried forward



Evaluation of Feasible Options – Basin Siting

1. Preliminary screening of potential options identified the following storage options as a good fit for the St. Joseph system
 - a. Below ground storage tank
 - b. Above ground circular storage tank

2. Using these options, three site locations were identified
 - a. DPW yard on Broad Street
 - b. North end of Kiwanis Park
 - c. South end of Kiwanis Park

Evaluation of Feasible Options – Basin Siting

Above ground circular tank within DPW yard

Rectangular below grade tank under box factory parking lot

Above ground circular tank at South end of Kiwanis Park

Rectangular below grade tank at North end of Kiwanis Park

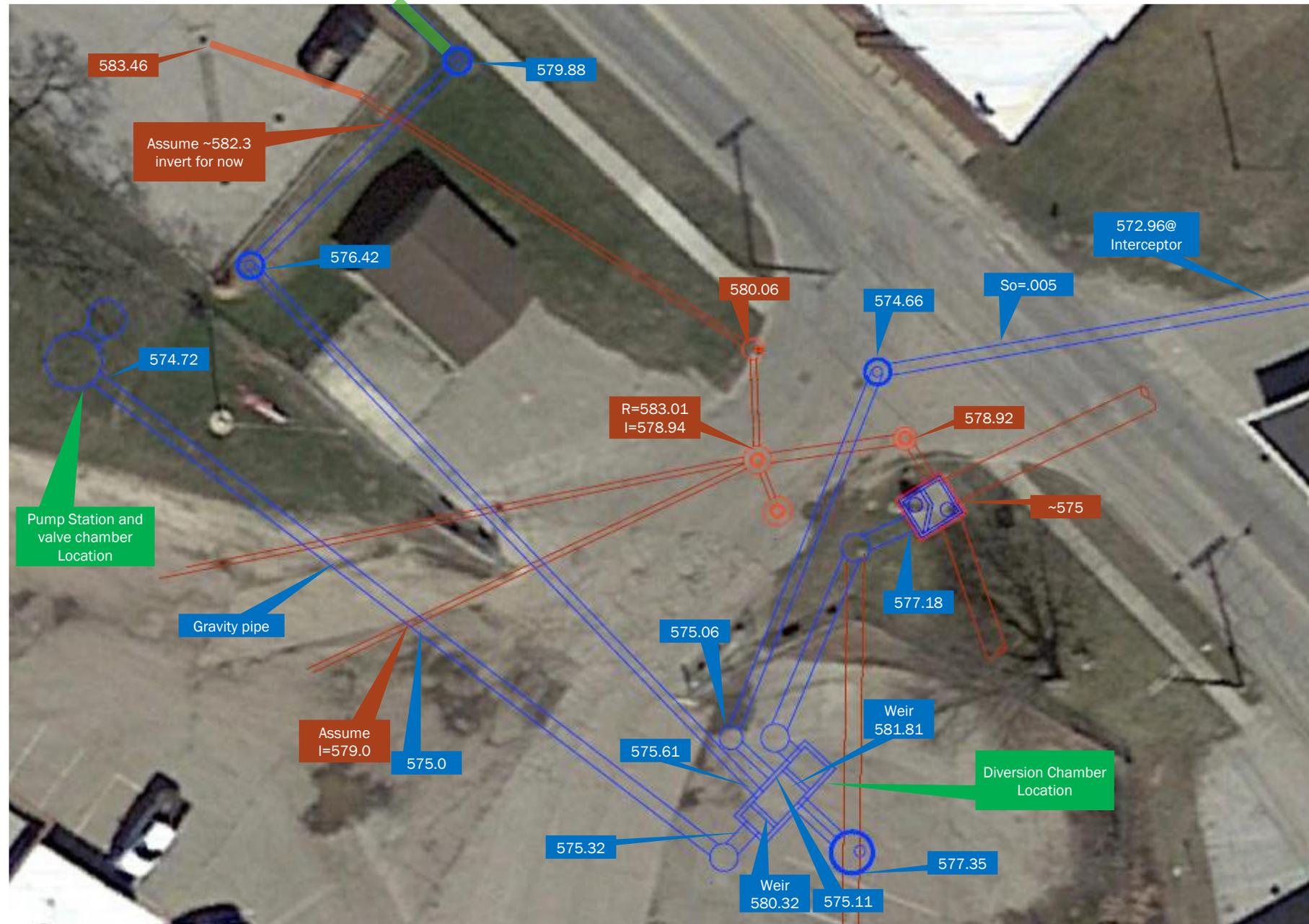


Diversion Chamber and Pump Station

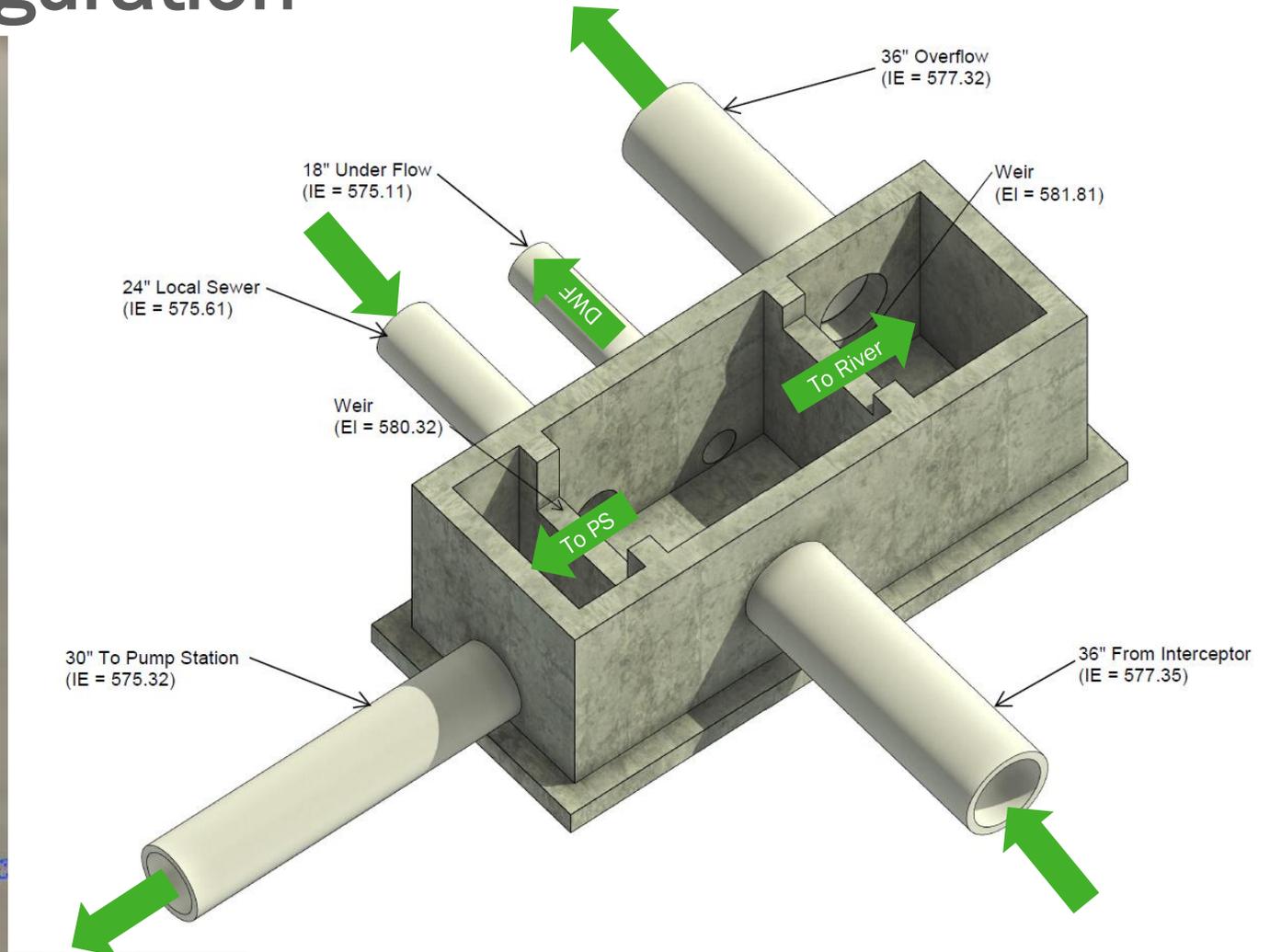
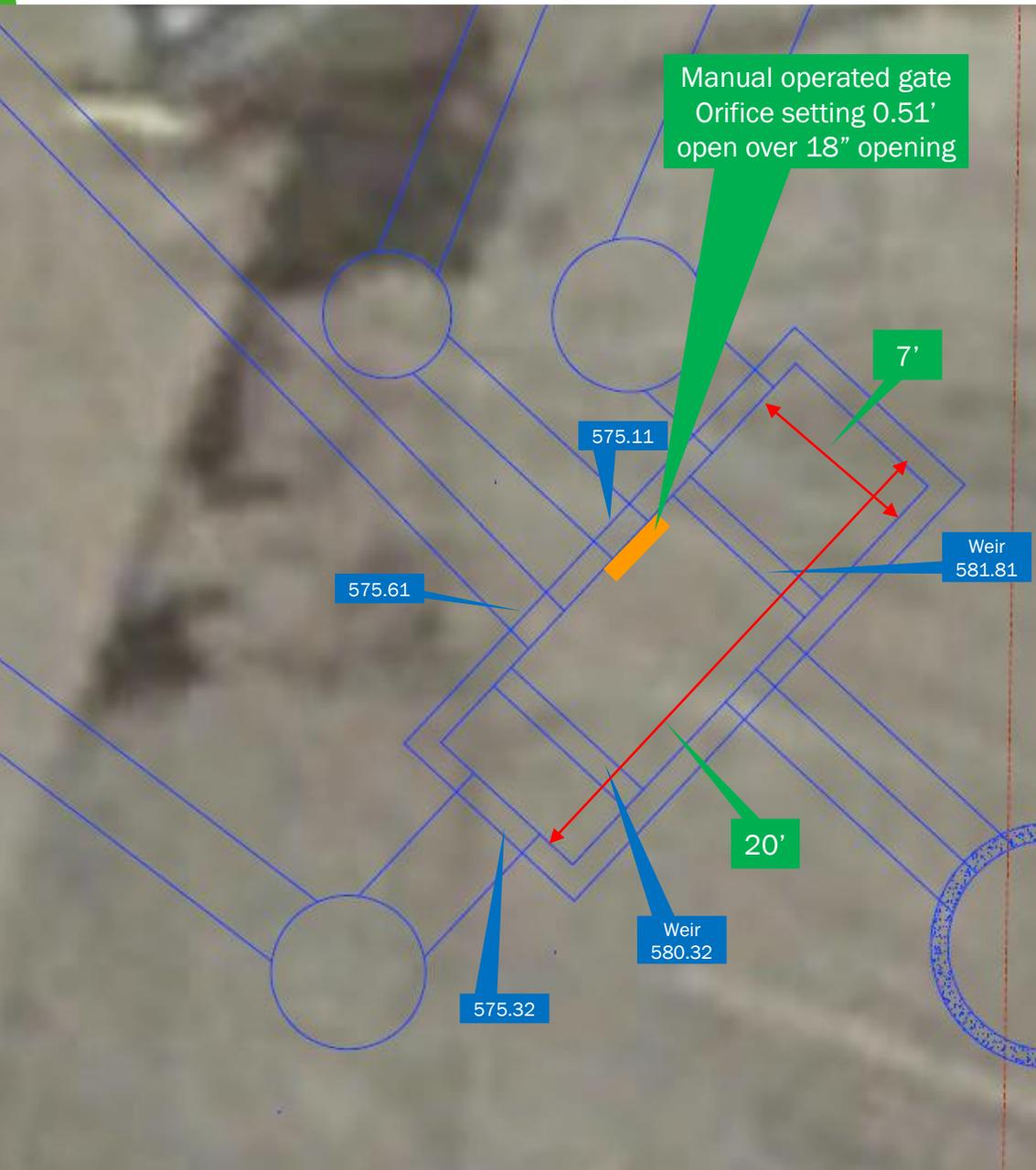
1. The optimal location for diversion to the basin storage is at the existing CSO-005 diversion chamber
2. This location intercepts all flow from the CSO-005 district and minimizes the size of the required storage basin
3. From this location, flow can be pumped to any of the storage site locations

Diversion Chamber and Pump Station Locations

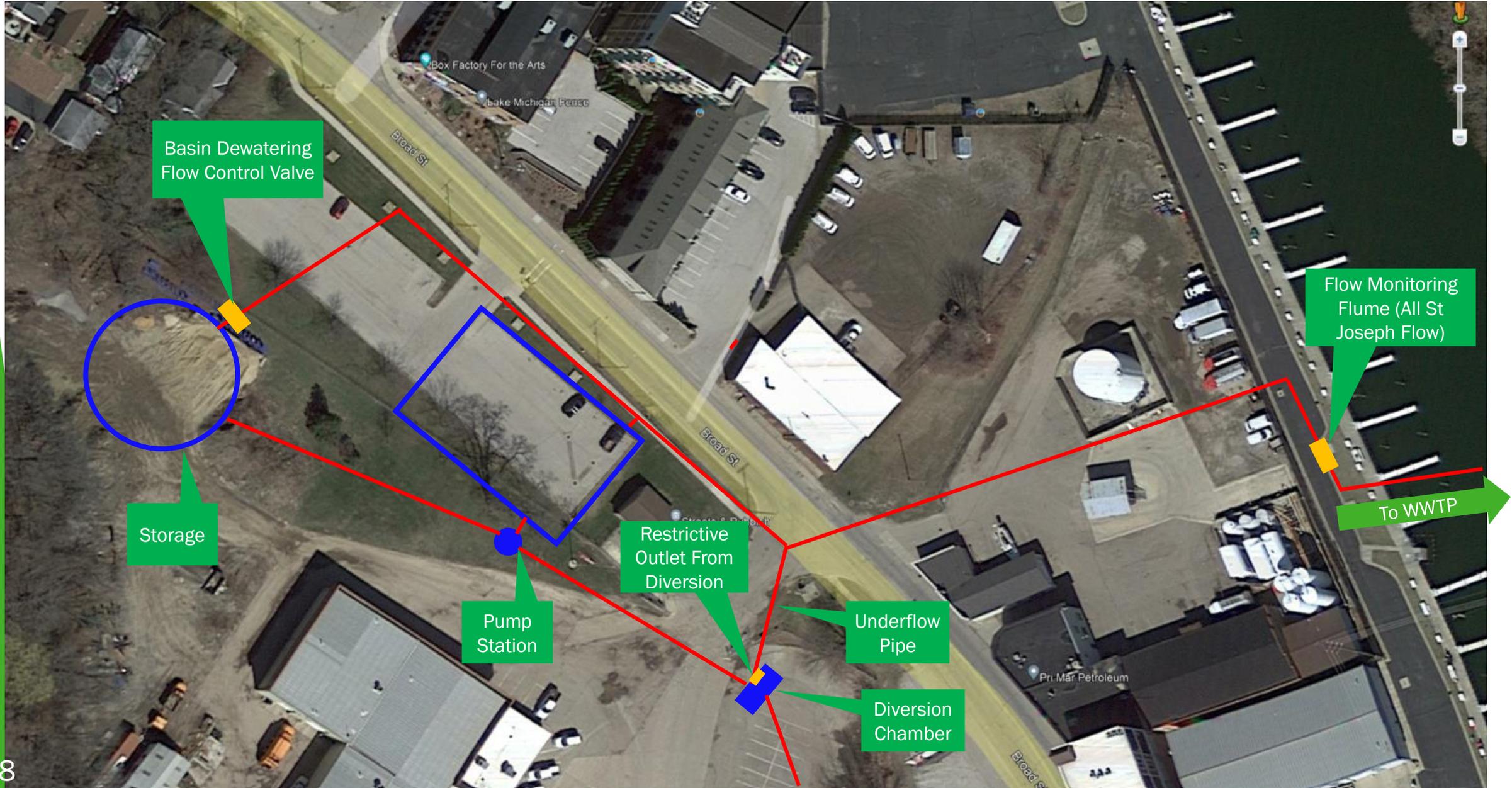
- Pump station is located away from parking lot out of floodplain
- All infrastructure in parking lot can be flush with ground surface
- No interference with parking lot



Diversion Chamber Configuration



DPW Inlet and Outlet Sewers



Kiwanis Park Inlet and Outlet Sewer Routes



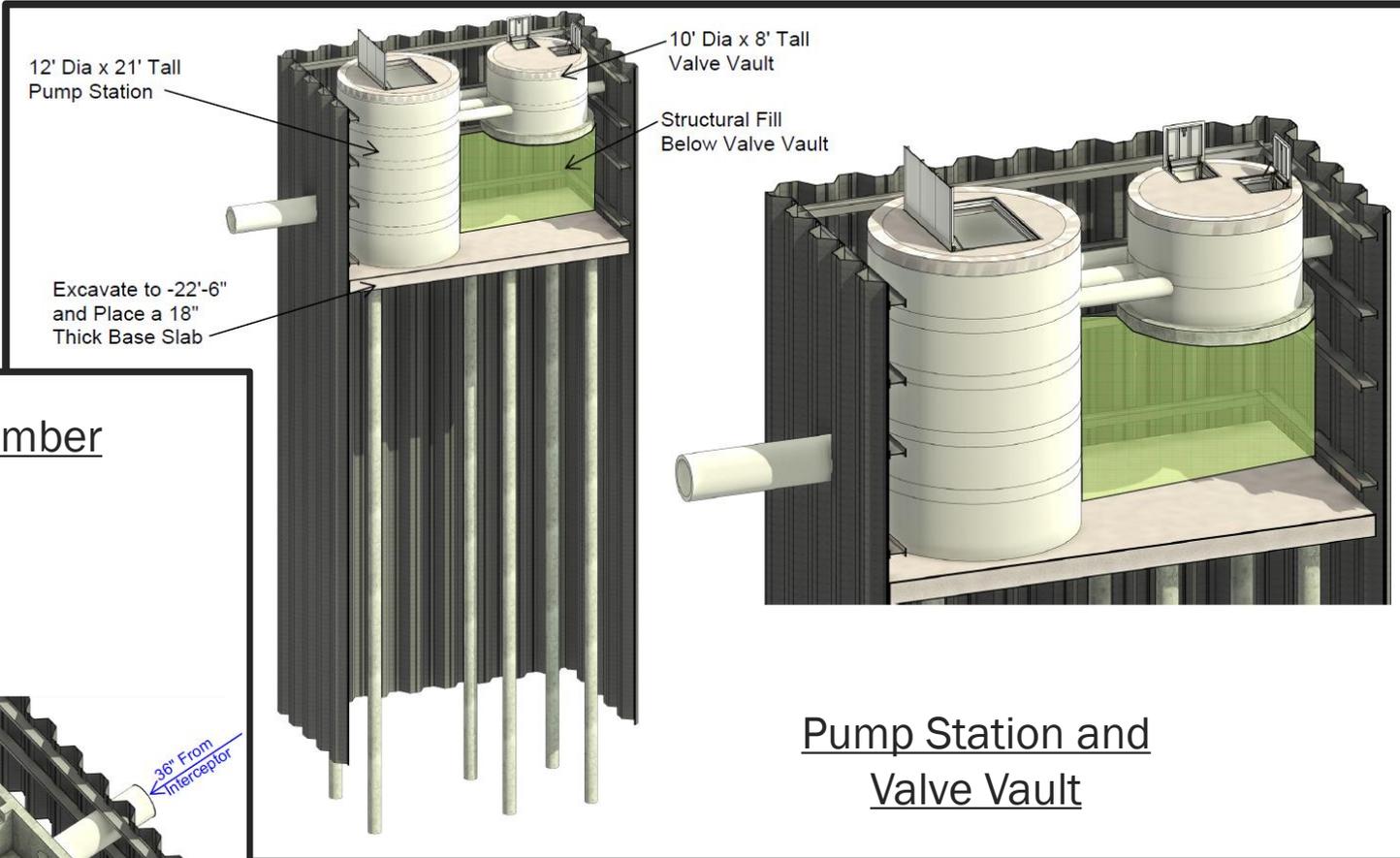
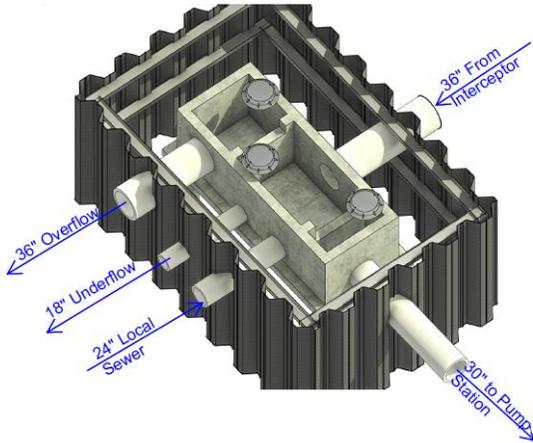
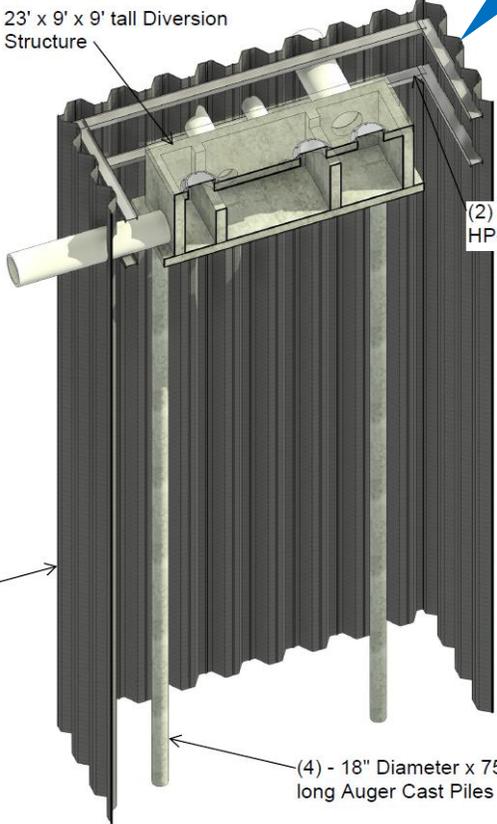
Rectangular below grade tank at North end of Kiwanis Park

Above ground circular tank at South end of Kiwanis Park

Diversion Chamber and Pump Station Configurations

Support of Excavation (SOE)

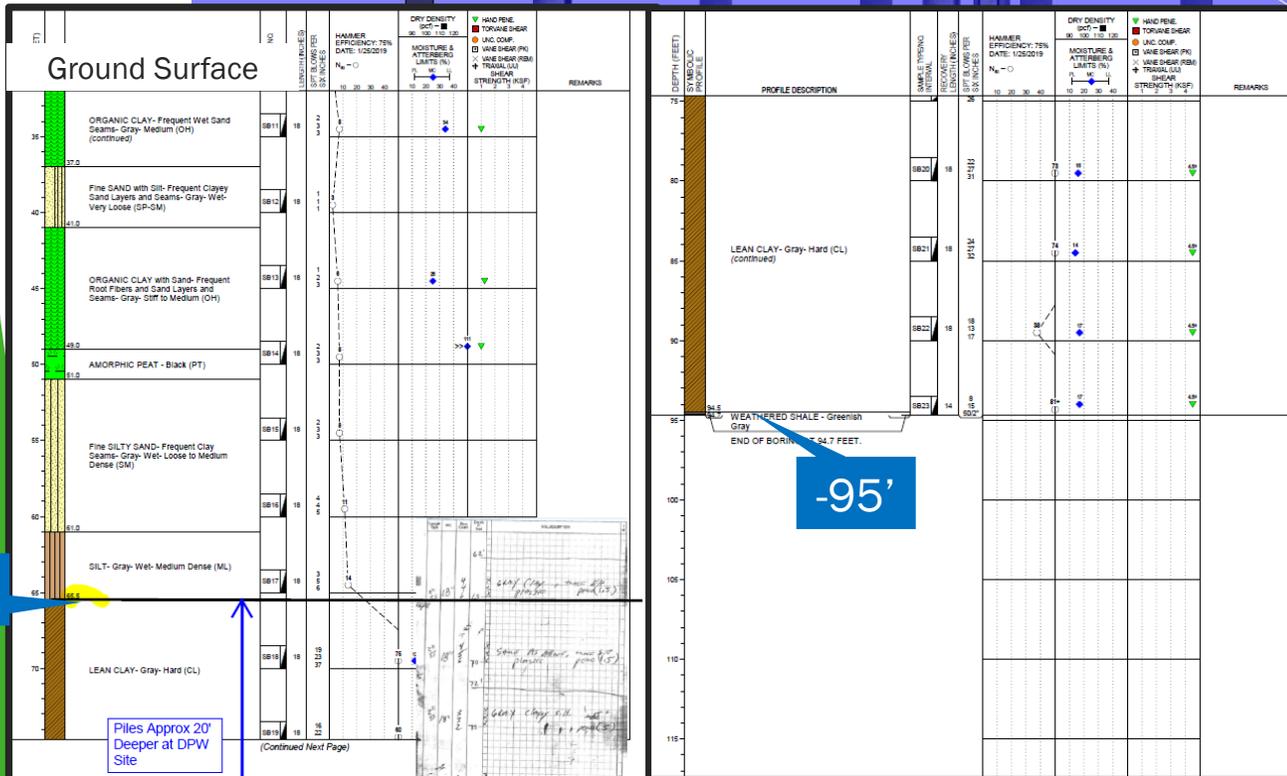
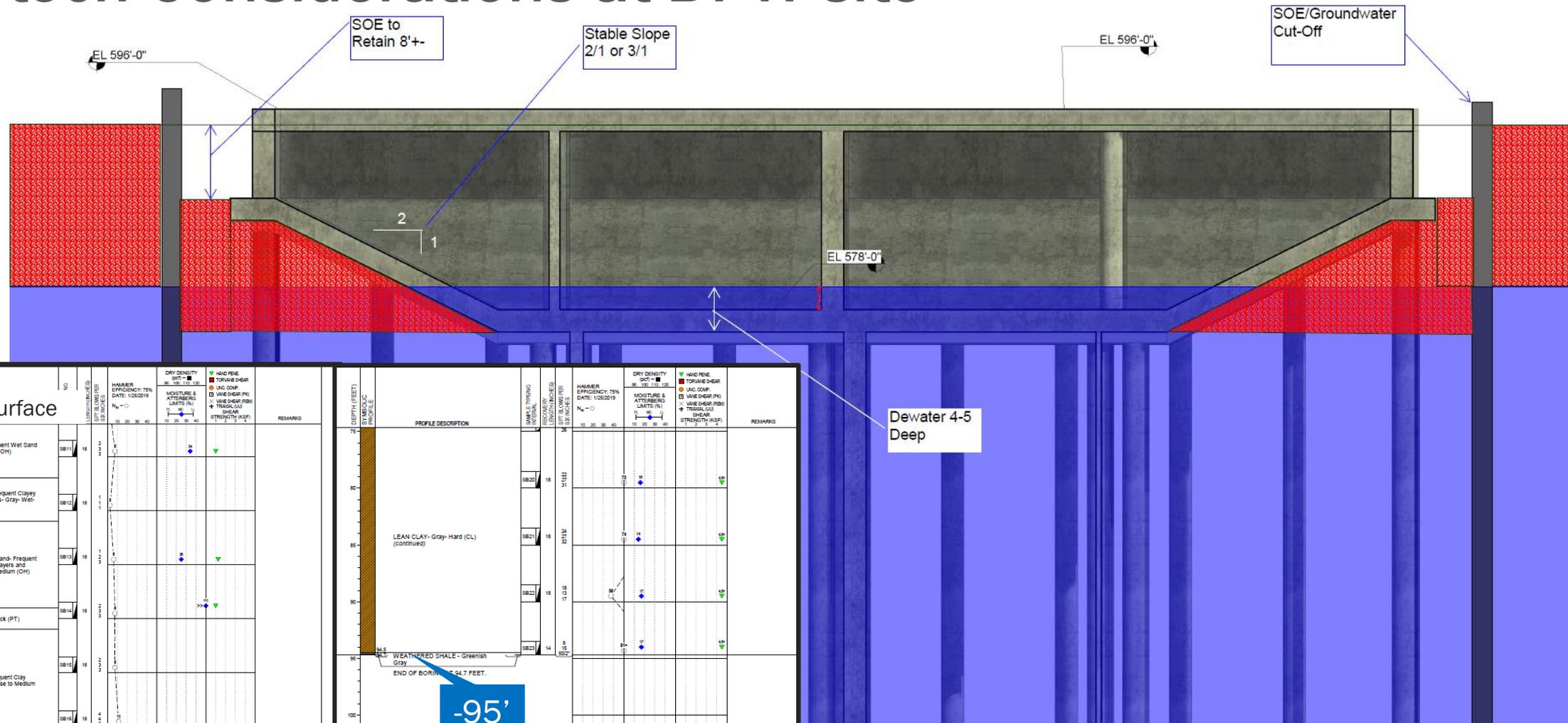
Diversion Chamber



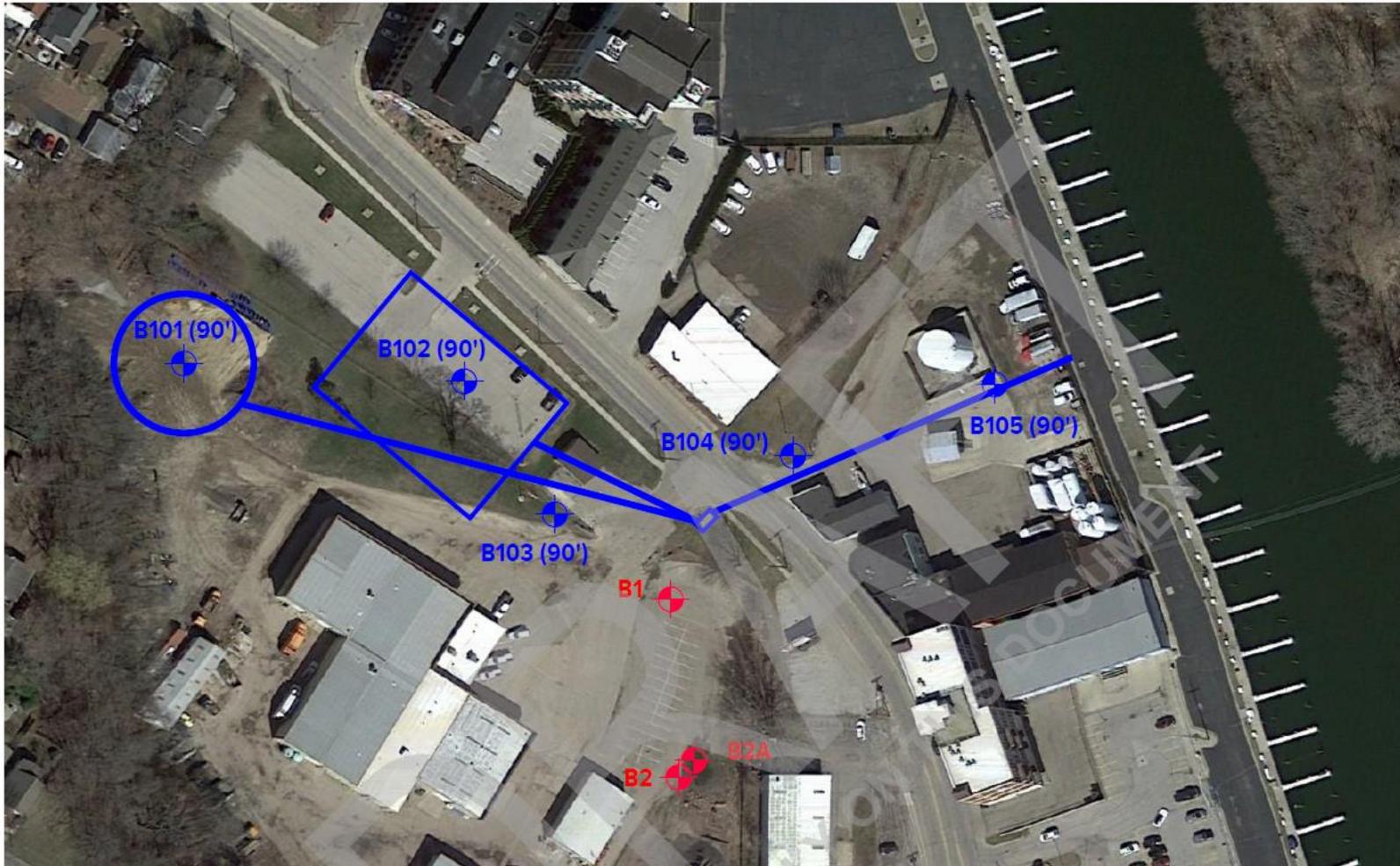
Geotechnical Considerations

1. Site specific soil bores taken at Kiwanis Park site
2. Historical soil bores available at low end of DPW site
3. Additional soil bores were collected at DPW basin and pump station locations
4. Based on soil bore information at DPW, tanks will require
 - Deeper pile supports
 - More robust support of excavation to control groundwater during construction

Geotech Considerations at DPW site



Geotech Considerations at DPW site



LEGEND

-  APPROXIMATE BORING LOCATION (SME PROJECT NO 075169.01)
-  Recent BORING LOCATION (PROPOSED BORING DEPTH)

NOTES: BORING LOCATIONS AND DEPTHS SUBJECT TO CHANGE DEPENDING ON FINAL DESIGN AND ENCOUNTERED SOIL CONDITIONS.



Cost Estimate – Cost Comparison (current June 2023)

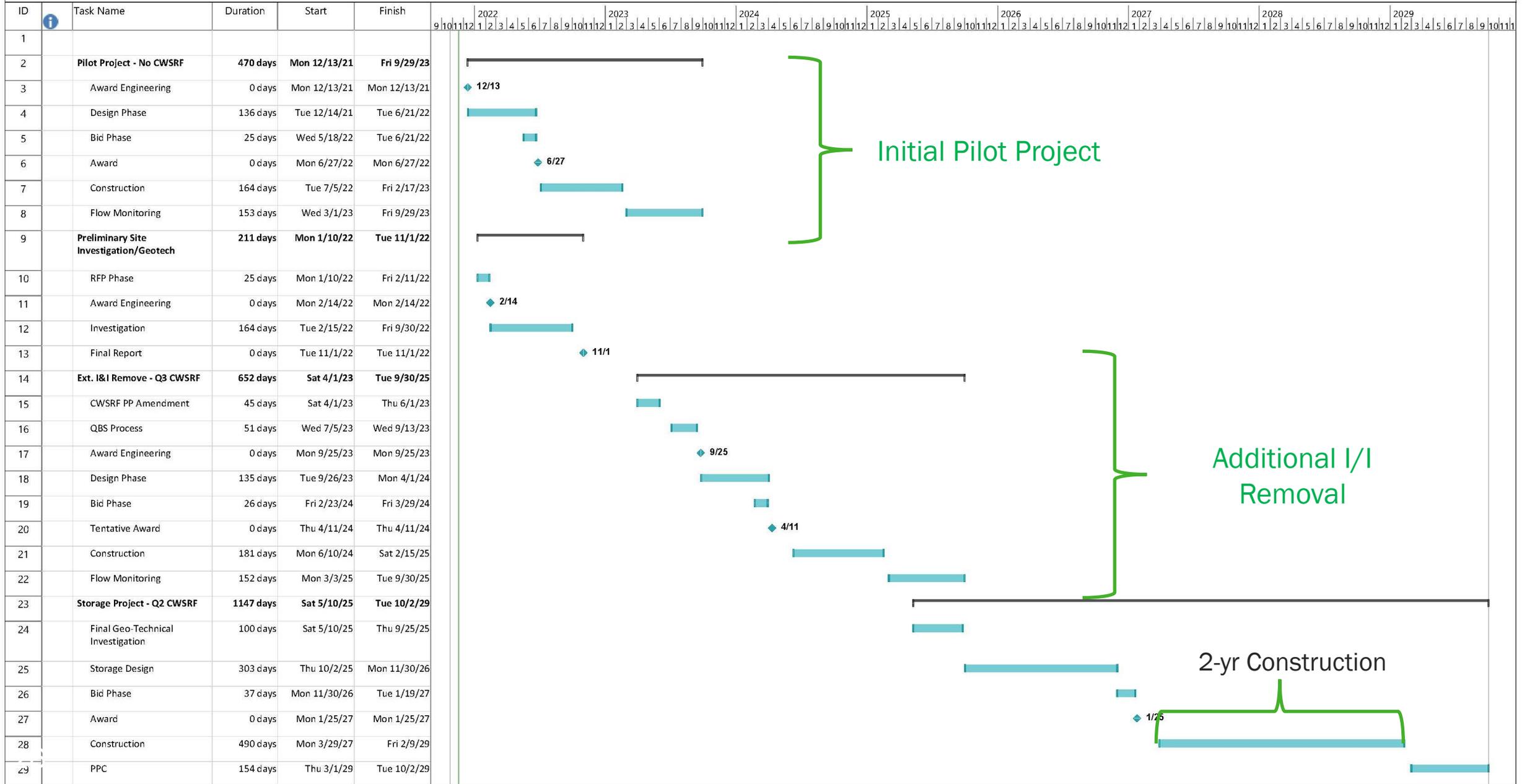
Location	DPW Site Option A	DPW Site Option B	Kiwanis Park Option A	Kiwanis Park Option B
Storage Option	Above Grade Tank	Below Grade Tank	Above Grade Tank	Below Grade Tank
Project Component				
Storage Tank				
Structure only (includes excavation, structure, deep piles, support of excavation)	\$4,000,000	\$17,500,000	\$3,370,000	\$12,100,000
Tank Process Items (Flushing System , odor control, ventilation)	\$700,000	\$500,000	\$700,000	\$500,000
Pump Station with Inlet/Outlet connections				
Structural	\$1,754,000	\$1,754,000	\$1,754,000	\$1,754,000
Process	\$1,100,000	\$1,100,000	\$1,100,000	\$1,100,000
Force main/Dewatering from DPW PS to Tank	\$631,000	\$148,000	\$2,542,000	\$1,732,000
Diversion Chamber and Connections				
Underflow Pipe	\$685,000	\$685,000	\$685,000	\$685,000
Diversion Chamber	\$941,000	\$941,000	\$941,000	\$941,000
Gravity pipes in/out of New Diversion Chamber	\$525,000	\$525,000	\$525,000	\$525,000
Construction Cost Subtotal	\$10,336,000	\$23,153,000	\$11,617,000	\$19,337,000
Construction Contingencies (25%)	\$2,584,000	\$5,788,000	\$2,904,000	\$4,834,000
Engineering , Legal, and Administration (30%)	\$3,101,000	\$6,946,000	\$3,485,000	\$5,801,000
Total Project Cost	\$16,021,000	\$35,887,000	\$18,006,000	\$29,972,000

Above Grade Tank at DPW Site



Schedule - Long Term

CSO Pilot-Ext-Storage Project.mpp



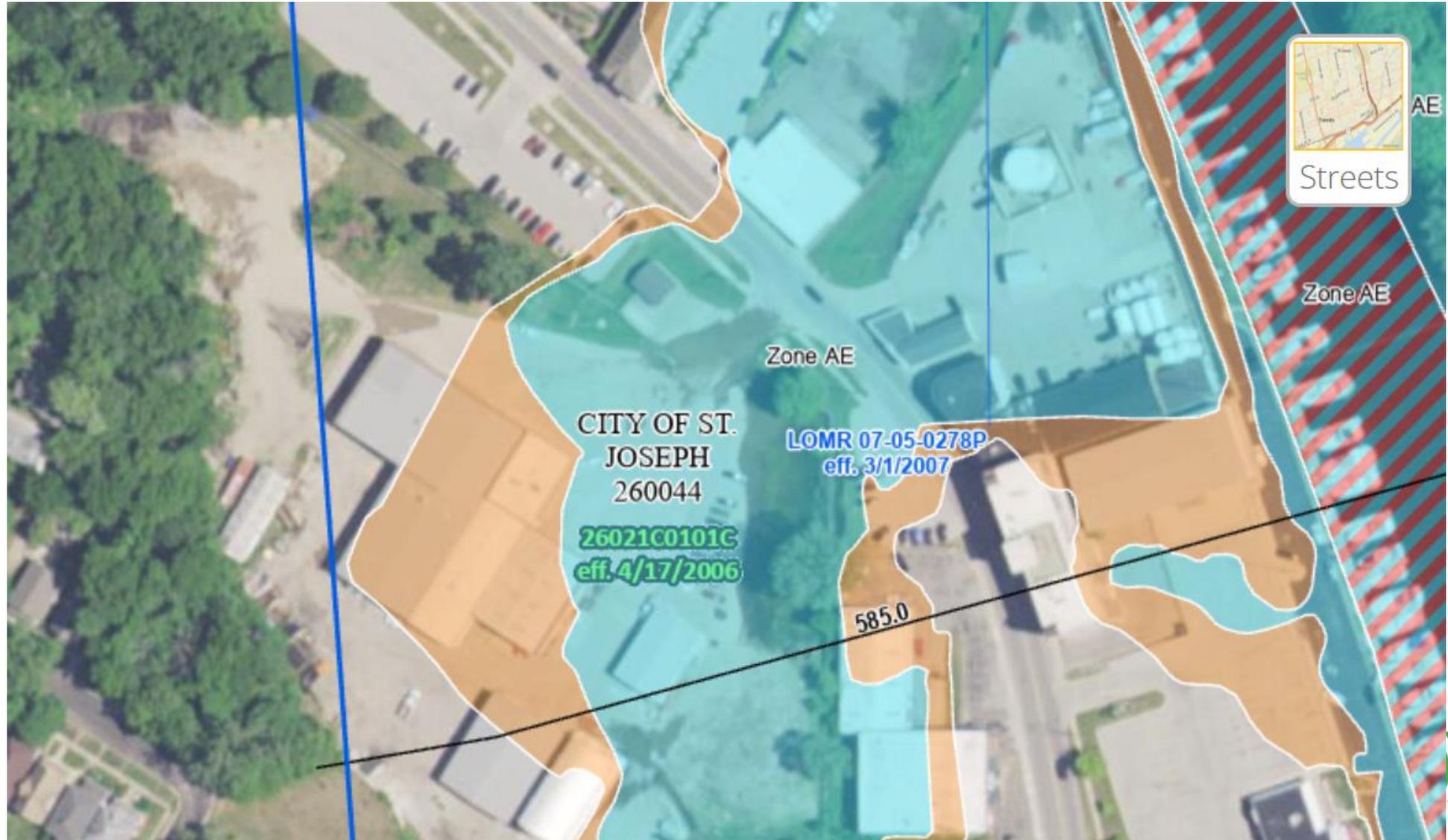
Thank you for attending!

Questions

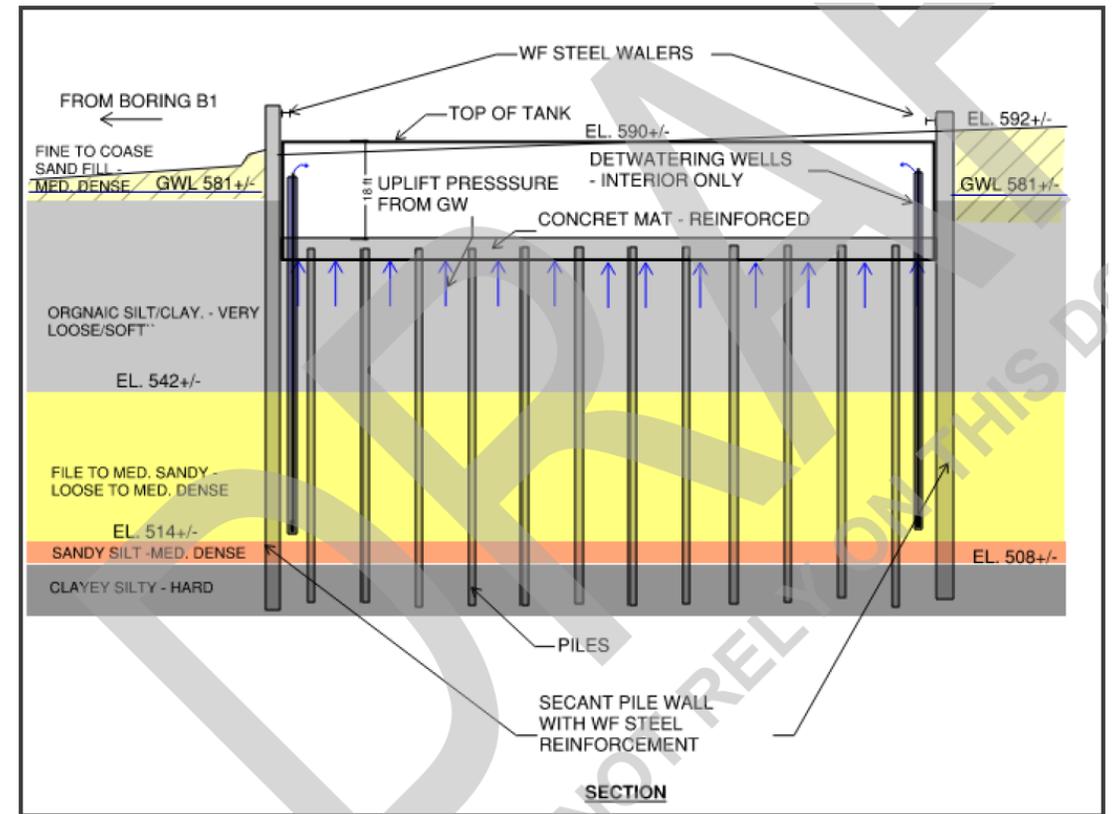
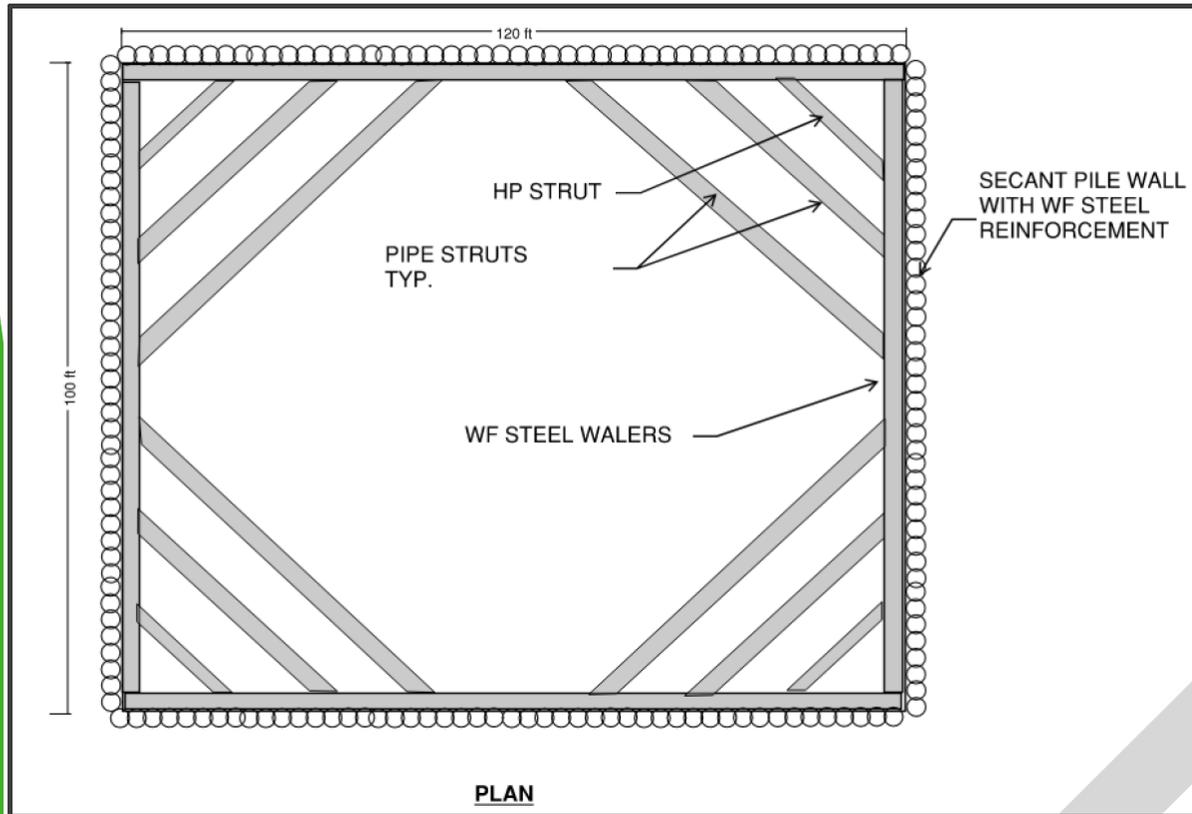


Extras

Federal Emergency Management Association (FEMA) Floodplain Map



Geotech Considerations at DPW site





City of St. Joseph CSO Compliance

FINAL CSO STORAGE PROJECT CONCEPT DESIGN REPORT

September 29, 2023



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Appendix A. NPDES Permit No. MI00026735 Issued 9/26/2022

EXECUTIVE SUMMARY

This Concept Design Report presents the current status and recommendations for the City of St. Joseph CSO Compliance project mandated by EGLE under NPDES Permit No. MI 0026735. The report includes analysis results based on additional engineering review and evaluations conducted for the following items:

1. Introduction and Historical Background (Section 1.0) for CSO Separation Compliance Program requirements
2. Hydraulic Model Updates and Analysis (Section 2.0)
3. Pilot I/I Removal Project Effectiveness Analysis based on 2023 Post-Project Flow Monitoring (Section 3.0)
4. Recommendations for CSO Modifications (Section 4.0)
5. Review of Design Considerations for CSO 005 Storage Facility (Section 4), focusing on:
 - Potential siting locations at City owned Kiwanis Park and DPW properties
 - Hydraulic requirements for basin sizing and system optimization
 - Operational features for storage tank, diversion chamber and pump station
 - Review of applicable storage technologies based on site specific geotechnical evaluations and historical environmental conditions
6. Preliminary Screening of Storage Options (Section 5.0) based on preliminary cost estimates and pro's and con's review
7. Final Evaluation and Recommendations for Short-listed Options (Section 6.0)
8. Public Meeting Input (Section 7.0) and Summary of Recommended Option (Section 8.0)

A summary of the findings and recommendations are as follows:

1. The updated model of the St. Joseph system was used to develop a storage alternative in accordance with EGLE's performance criteria standard that limits post project discharges to no more than 1 overflow every 10 years. The alternative included a 1.2 MG storage basin and real time control that optimized basin dewatering to the JWWTP.
2. Flow and rainfall data from 2022 (prior to I/I rehab) and 2023 (post I/I rehab) was analyzed to determine effectiveness of I/I mitigation withing the St. Joseph system. This analysis showed mitigation of non-point source inflows had limited effectiveness in reducing peak wet weather inflow rates and volumes. Based on this analysis, no additional I/I rehabilitation projects are recommended prior to proceeding with the CSO 005 Storage Project.
3. The recommended alternative for the storage basin is an above grade D-110 circular tank located at the DPW facility with an estimated project cost of \$16.1 million dollars. Details for the components of the recommended project are presented in Section 8.0 Summary of Recommended Option.

4. It is recommended that this report be submitted to EGLE for their review as an update of the current project status, and to satisfy the NPDES Permit compliance schedule date of October 1, 2023, for submittal of the pilot I/I removal project results. It is also recommended that the City authorize detailed design activities to begin for the recommended storage alternative to meet the next permit compliance date for submittal of the storage project Part 41 Permit application by March 1, 2025, and allow bidding and contract award in June 2025, with construction to occur in July 2025 through March 2027.

1.0 INTRODUCTION/BACKGROUND

The City of St. Joseph is entering the final phases for completion of their long-term combined sewer separation program to address uncontrolled CSO discharges as required under NPDES permit No. MI0026735 issued by the Michigan Department of Environment, Great Lakes, and Energy (EGLE). There are three remaining CSO outfalls to be addressed as part of the combined sewer separation work to control the outfall discharges at CSO 003, 005, and 011.

Previous planning studies identified that an approximate 1.2 MG storage facility may be necessary to adequately control the remaining CSO discharges and meet the EGLE CSO compliance requirements. Previous reports also recommended that the City investigate the potential for additional sewer system rehabilitation for infiltration /inflow reduction, as well as consider options for optimizing flow delivered to the Benton Harbor/St. Joseph Joint Wastewater Treatment Plant (JWWTP) as a means of potentially reducing the required storage volume.

This Concept Design report presents the results of those additional evaluations which include updates and refinements to the sewer system hydraulic model, results of the post project flow monitoring analysis to assess the effectiveness of the pilot I/I rehabilitation project, review of design considerations and potential alternative storage options, evaluation of the feasible storage alternatives, and concept design recommendations for the proposed storage project location, configuration, and sizing, including the proposed project implementation schedule to comply with the NPDES Permit requirements.

1.1 CSO Separation Program

Over the past 20 years the City of St. Joseph has been implementing combined sewer separation projects in a fiscally responsible manner that have been prioritized and coordinated with other necessary City capital improvement projects for the sanitary sewers, storm drainage system, road improvements, and the water supply and distribution system infrastructure needs. The City also initiated an Asset Management program in 2017 that is in the process of being updated to identify the existing system conditions, prioritize the various infrastructure improvements needed, and assess the financial requirements for budgeting and implementing capital improvement projects. While the CSO compliance projects are considered a high priority, they are also the most costly, and the City must continue to establish implementation schedules for coordinated and phased projects that are affordable within the overall financial constraints of the City budgets for funding the needed improvements.

There are 3 remaining CSO outfalls to be controlled for the combined sewer separation program. The general location of the outfall locations in relation to the collection system major interceptor sewers is shown in **Figure 1-1**.

Figure 1-1 City of St. Joseph Interceptor Sewers and CSO Locations



Previous studies were conducted to evaluate the post-separation sanitary sewer conveyance system using a sewer system hydraulic model to assess existing system performance and identify the improvements to meet the regulatory requirements for a separated sewer system. These previous studies included:

1. 2016 State Revolving Fund (SRF) Project Plan dated March 11, 2016.
2. 2020 City of St. Joseph CSO Control Program Hydraulic Report and Storage Basis of Design dated August 1, 2020
3. City of St. Joseph CSO Storage Basin SRF Budget Development Technical Memorandum dated August 18, 2020

4. St. Joseph Infiltration and Inflow Mitigation-Monitoring and Modeling Analysis (Micro-metering) dated November 16, 2021
5. City of St. Joseph Clean Water State Revolving Fund (CWSRF) Project Plan dated June 1, 2022

The previous studies and reports have been submitted to EGLE for their review and comment and discussed with EGLE staff in ongoing coordination meetings to keep them informed of the City's progress and obtain concurrence with the projects proposed to meet the regulatory requirements of the CSO Compliance Program.

1.2 Regulatory Requirements

The City of St. Joseph's three remaining combined sewer system outfalls are regulated by EGLE under NPDES Permit No, MI 0026735. The current permit was issued on September 26, 2022, and remains in effect until October 1, 2027. A copy of the current permit is included in Appendix A. Because there are remaining uncontrolled CSO outfalls, the City's sewers are currently classified as a combined sewer system subject to the NPDES discharge requirements set forth in the permit.

Based on the previous studies, the current permit identifies the need for a corrective action storage project. In accordance with current EGLE guidelines for separated sanitary sewer systems, the required storage volume must be sized to meet the following criteria as listed in the current NPDES Permit Project Performance Certification Requirements for the completed project as summarized in **Figure 1-2**.

Figure 1-2 Excerpt from NPDES Permit

The PPC shall certify, based upon use of a properly calibrated hydraulic model, that:

(1) all sewers 15" in diameter and larger transporting sanitary sewage have sufficient capacity to transport the flows generated as a result of a 25-year, 24-hour storm event using growth conditions (April – October) and normal soil moisture without discharging raw sewage, including storm-related basement flooding/back-ups. Alternatively, the permittee may choose a performance standard, instead of the remedial design standard defined above, that is predicted to cause no more than one (1) discharge event every ten (10) years (during growth conditions, April through October); and

(2) all sewers 15" in diameter and larger transporting sanitary sewage have adequate volume to store flows generated as a result of a 25-year, 24-hour storm event using growth conditions (April – October) and normal soil moisture without discharging raw sewage, including storm related basement flooding/back-ups. Alternatively, the permittee may choose a performance standard, instead of the remedial design standard defined above, that is predicted to cause no more than one (1) discharge event every ten (10) years (during growth conditions, April through October).

Based on the modeling evaluations completed to date, the City has selected the alternate performance standard rather than the remedial standard for the storage project sizing criteria.

Acknowledging that the final sizing of the storage tank is dependent on the additional I/I removal efforts and optimization of flows delivered to the JWWTP for treatment, the current NPDES permit allows phasing of an additional round of sewer improvements if determined to provide cost benefits for reducing the required storage tank size. This schedule flexibility was negotiated with and approved by EGLE to allow the City additional time to evaluate system flows after the pilot area I/I rehabilitation work was completed and evaluated and determine if additional I/I reduction projects or other system improvements should be implemented before proceeding with the storage tank. If it is demonstrated that additional projects are cost effective to optimize system performance, then an additional 2-year period would be allowed to complete the recommended work and re-assess system requirements prior to proceeding with final design and construction of the storage project. The compliance schedule dates listed in the current NPDES permit is presented in **Table 1-1**.

Table 1-1 NPDES Permit CSO Compliance Schedule Dates

Compliance Date	Activity
Oct 1, 2023	Submit Report on Effectiveness of I/I Pilot (Part of Concept Design Report)
Schedule Additional I/I Rehabilitation Removal Project (if I/I Pilot is cost effective):	
April 1, 2024	Submit Part 41 for Additional I/I Removal
July 1, 2024	Start Construction
March 1, 2025	Complete Construction
Jan 1, 2025	Submit Post Rehab Flow Monitoring and Hydraulic Modeling Report
Storage Construction (if I/I Pilot Mitigation is cost effective):	
March 1, 2027	Submit Part 41 for Storage Project
July 1, 2027	Start Construction
Dec 1, 2028	Submit PPC Work Plan
March 1, 2029	Complete Construction
April 1, 2029	Commence PPC Flow Monitoring
Jan 1, 2030	Submit PPC Report
Storage Construction (if I/I Mitigation is not cost effective):	
March 1, 2025	Submit Part 41 for Storage Project
July 1, 2025	Start Construction
Dec 1, 2026	Submit PPC Work Plan
March 1, 2027	Complete Construction
April 1, 2027	Commence PPC Flow Monitoring
Jan 1, 2028	Submit PPC Report

The next milestone date in the current NPDES permit requires a post project submittal to EGLE for the I/I pilot project post monitoring results and recommendations by October 1, 2023. Since the I/I rehabilitation results directly impact the modeling evaluations necessary for the final storage sizing, it needs to be coordinated with the ongoing project work for the preliminary concept design options for the storage tank. It therefore was suggested in discussions with St. Joseph that the I/I pilot area findings submittal be compiled into one comprehensive report that incorporates both the I/I removal effectiveness analysis with the updated existing system performance and storage design concept sizing evaluations. This Concept Design report will therefore satisfy the NPDES schedule submittal milestone requirements as well as serve as a preliminary basis of design for the recommended proposed storage project resulting from the additional evaluations.

1.3 CWSRF Funding Applications

Concurrent with the initiatives to comply with the NPDES Permit requirements, the City has also coordinated with EGLE and submitted applications to secure low interest loans for funding the necessary CSO control projects from the EGLE Clean Water State Revolving Funds (CWSRF) loan program, and also qualify for other potential funding that may be available from State or Federal

programs. The City of St. Joseph Clean Water State Revolving Fund Project Plan dated June 1, 2022, was submitted and approved by EGLE and describes the various project components that are being pursued for SRF funding within the current 5-year cycle that the Project Plan covers. In addition to the storage project, this includes funding for ongoing FY 2023 projects currently awarded, and potential FY 2024 projects associated with the CSO Compliance program that have been identified and submitted for potential funding. The availability of funding assistance provided through these programs is critical for St. Joseph to implement the necessary projects.

2.0 HYDRAULIC MODEL UPDATES AND ANALYSIS

A planning level SWMM hydraulic model of the St. Joseph sanitary sewer system was initially prepared in 2020 to evaluate performance of the City of St. Joseph combined sewer separation program and identify additional improvements necessary to bring the City into CSO compliance in accordance with the NPDES permit requirements. The 2020 model was calibrated based to flow and rainfall data collected in 2018, 2019, and 2020. The existing 2020 model was used as a starting point for alternative evaluations as described in this section.

2.1 Existing Model Update

Several model refinements were required to accurately represent the system and to generate statistically accurate model results. These improvements included additional areas in the downstream portion of the CSO-005 system and updates to the long-term rainfall data inputs. The following sections describe these updates in detail.

2.1.1 Long-Term Rainfall Record Update

The 50-years of long-term historic rainfall data used for the St. Joseph existing and proposed system performance evaluation was reviewed for accuracy. This review included rainfall data from 2006-2020 that was obtained from the National Oceanic and Atmospheric Administration (NOAA) gauge in Benton Harbor and rain data from 1960-1995 from the NOAA gauge at Detroit Metro Airport. Data from these gauges had been disaggregated from 1-hour data into synthetic 15-minute data for use in the model. Disaggregation of the rainfall data provides more realistic peak flows from the St. Joseph model.

A review of the rainfall data previously disaggregated for the 2020 model identified some peak event rainfall rates that were not properly represented in the 15-minute data. An example of an event where the peak rainfall was not properly disaggregated is shown in **Figure 2-1** for the 10/14/2017 event. To improve the rainfall data disaggregation for the refined model, Wade Trim used a disaggregation methodology that was originally published in “Development of Long-Term Precipitation and Infiltration Records for the Performance Evaluation of a Proposed Regional Tunnel.” The updated disaggregation methodology did a better job of disaggregating the peak of each event compared to the previous disaggregation. The updated disaggregation for the 10/14/2017 event is shown in **Figure 2-2**. While many events were unchanged by the updated disaggregation, some events had higher or lower peaks, which led to different flow responses in the system for those events.

Figure 2-1 Original Rainfall Disaggregation

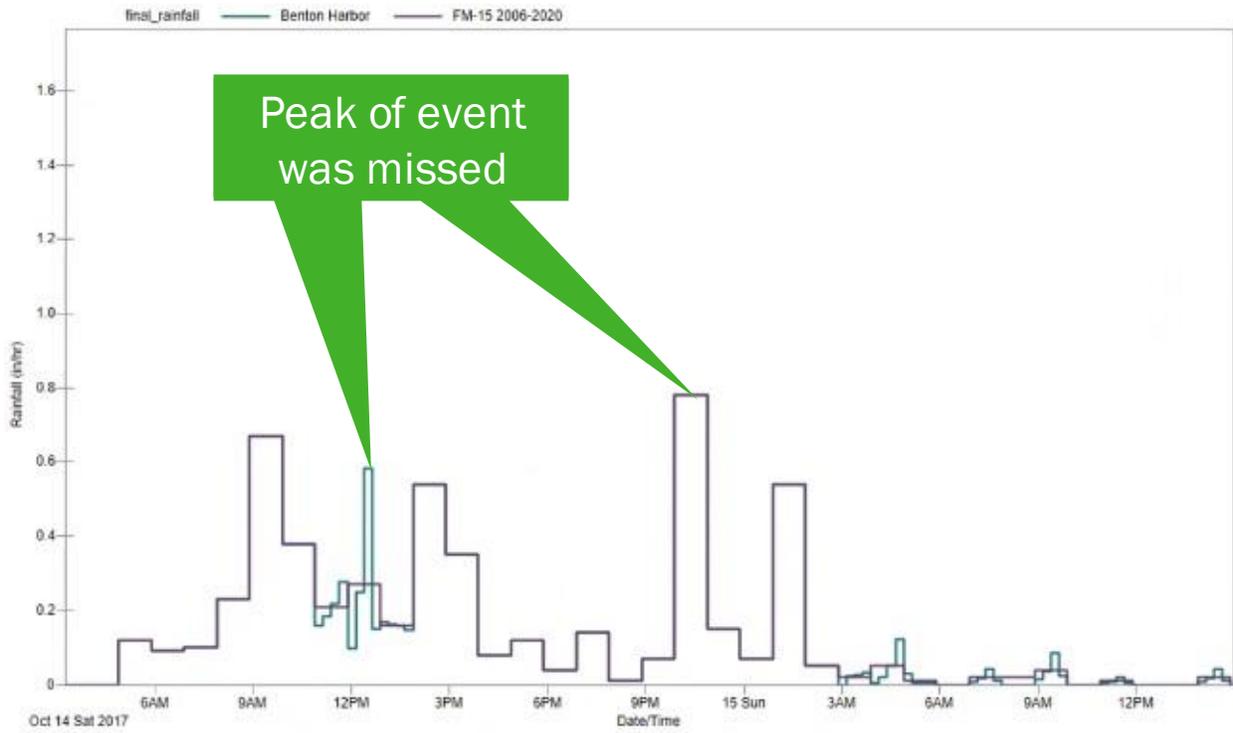
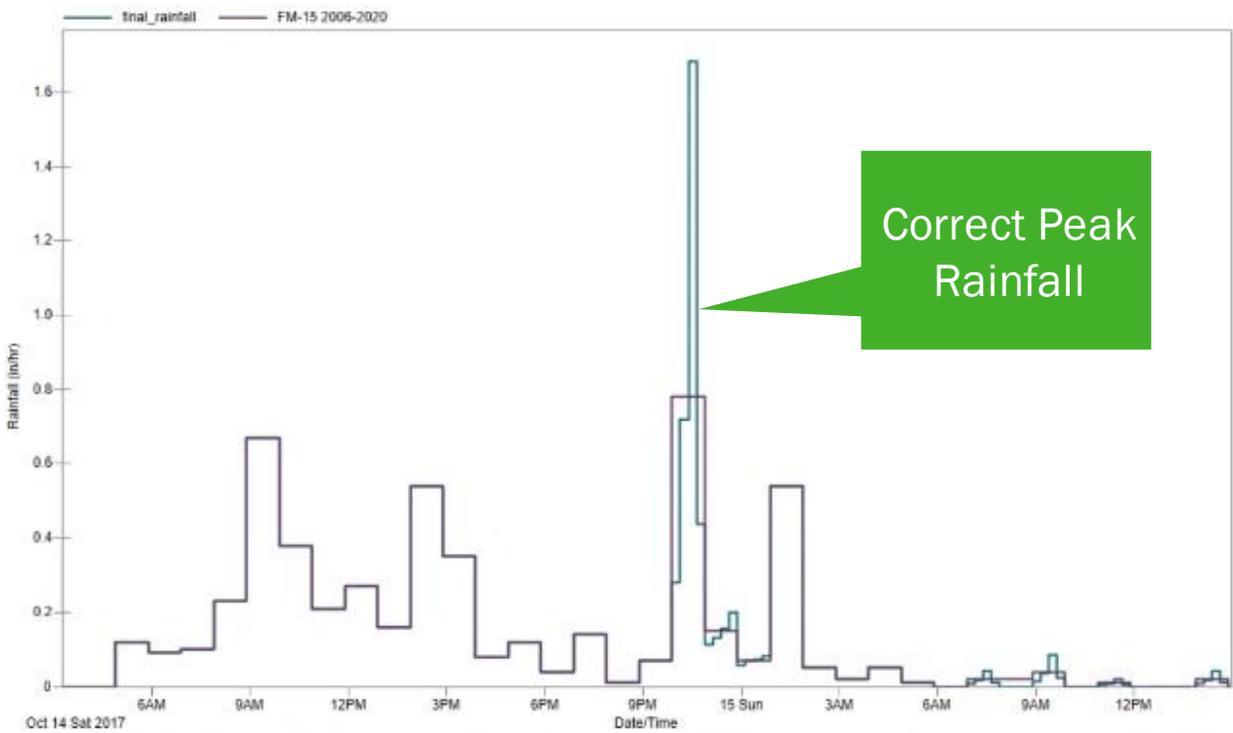


Figure 2-2 Updated Rainfall Disaggregation



2.1.2 Model Subarea Review

The model subarea representation was reviewed to confirm all areas tributary to the CSO-005 system were included in the model. This review focused primarily on a comparison of model drainage areas to area delineations developed in the GIS environment. This review identified 83 acres of additional service area tributary to CSO-005 that was not previously included in the model. The inlet points for these additional areas were downstream of any flow meters that had been used for model calibration and therefore did not affect calibration of other areas of the model. However, these areas contribute additional flow to the system that was not included in the 2020 model. Since historical flow data for these areas was not available, dry weather flows and wet weather responses for this part of the system were assumed to be similar to surrounding areas of the system. This assumed hydrology was reasonable based on available information about sewer age, condition, and land use. The additional service areas that were added to the model are shown in **Figure 2-3**.

Figure 2-3 Areas Added to Model



2.2 Alternative Development Model Updates

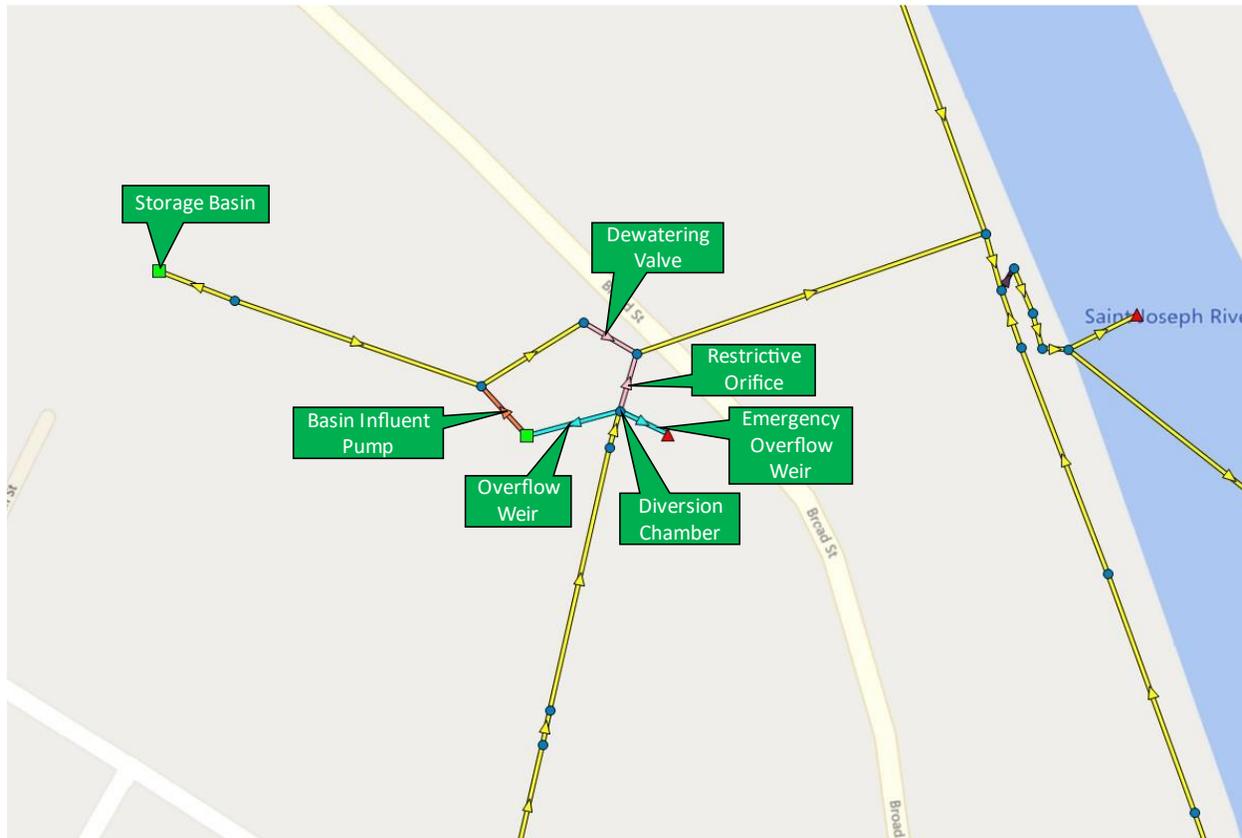
The updated existing conditions model was used as a starting point for alternatives development. The current selected alternative described below assumes a circular above ground storage at the DPW yard on Broad Street. The alternatives included incorporation of the following additional elements into the model:

1. Diversion Chamber – A new diversion chamber was added to the model to divert flow from the Ravine interceptor to the proposed basin. This diversion chamber replaces the existing chamber. The new diversion chamber includes the following elements:

- *Underflow orifice* – The underflow orifice allows dry weather flow and a portion of wet weather flow to discharge directly to the WWTP for treatment. The orifice restricts flow to approximately 2,800 gpm prior to overflowing to the basin. The orifice will be constructed as a gate to allow for fine tuning the capacity in the field.
 - *Basin Overflow Weir* – Flow that exceeds the capacity of the underflow orifice will be diverted to the basin over the overflow weir. This weir is 5 feet long and has a crest elevation of 580.32 feet.
 - *Emergency Overflow Weir* – Approximately one event in ten years will have sufficient volume to exceed the capacity of the storage basin. The excess flow from these events will be diverted to the existing stormwater system over the emergency overflow weir. This weir is 3.1 feet long and has a crest elevation of 581.81 feet.
2. Storage Basin – The storage basin is currently sized for 1.0 MG of storage. The basin is assumed to be an above ground tank with an influent pumping. The basin is dewatered via gravity with a dewatering control valve. The 1.0 MG storage is the minimum required volume and assumes full optimization of the influent and discharge flow from the basin. To account for potential flexibility of the dewatering controls as the final design moves forward, a 20% safety factor has been included to increase the recommended basin volume to 1.2 MG.
 3. Pump Station – A new pump station will be required to pump flow into the proposed basin. The current model representation assumes an idealized pump capable of pumping a maximum flow rate of 5,300 gpm.
 4. Real Time Dewatering Controls – The required basin volume was optimized by assuming real time control of the basin dewatering. This real time control tracks the total flow from the St. Joseph system to the JWWTP. The basin dewatering gate is modulated automatically to maintain a not to exceed flow rate of 4,500 gpm to the JWWTP. There is more discussion of this dewatering rate in subsequent sections of this report.

The general representation of the above-described model components is shown in **Figure 2-4**. This concept includes a new diversion chamber which restricts flows to the JWWTP and diverts excess wet weather flows over a weir that leads to a pump station. The flow is then pumped into the storage basin. As capacity in the system becomes available, the storage basin is dewatered back into the system downstream of the new CSO-005 diversion chamber.

Figure 2-4 Model Representation of DPW Storage Basin



The updated existing and proposed alternative models were used to evaluate basin storage requirements based on the criteria of no more than 1 overflow occurring in 10 years. To meet this criteria, 50 years of historical rainfall data (1960-1995 and 2006-2020) was run through the models and the event with the fifth highest volume in the proposed basin was used to determine the required basin size. All events smaller than this would be captured by the basin and only the four largest events would cause overflows during the 50 years of simulation. Only events occurring during the growing season (April-October) were included in this analysis to meet the EGLE SSO performance criteria for basin sizing. The model was not calibrated to non-growing season events and model results outside the growing season are unreliable. Multiple proposed alternative models were run when evaluating possible configurations for the system. Details of which elements were found to have the most impact on hydraulic performance and basin size are discussed below.

2.3 Basin Sizing and System Optimization

The location of the proposed diversion chamber is important to the hydraulic performance of the system and directly impacts the size of the required basin. Locating the diversion chamber at the downstream end of the system allows it to control flow more efficiently than if the diversion chamber is further upstream. Any flow that enters the system downstream of the diversion chamber is not restricted and has potential to cause an overflow during wet weather events. To maximize

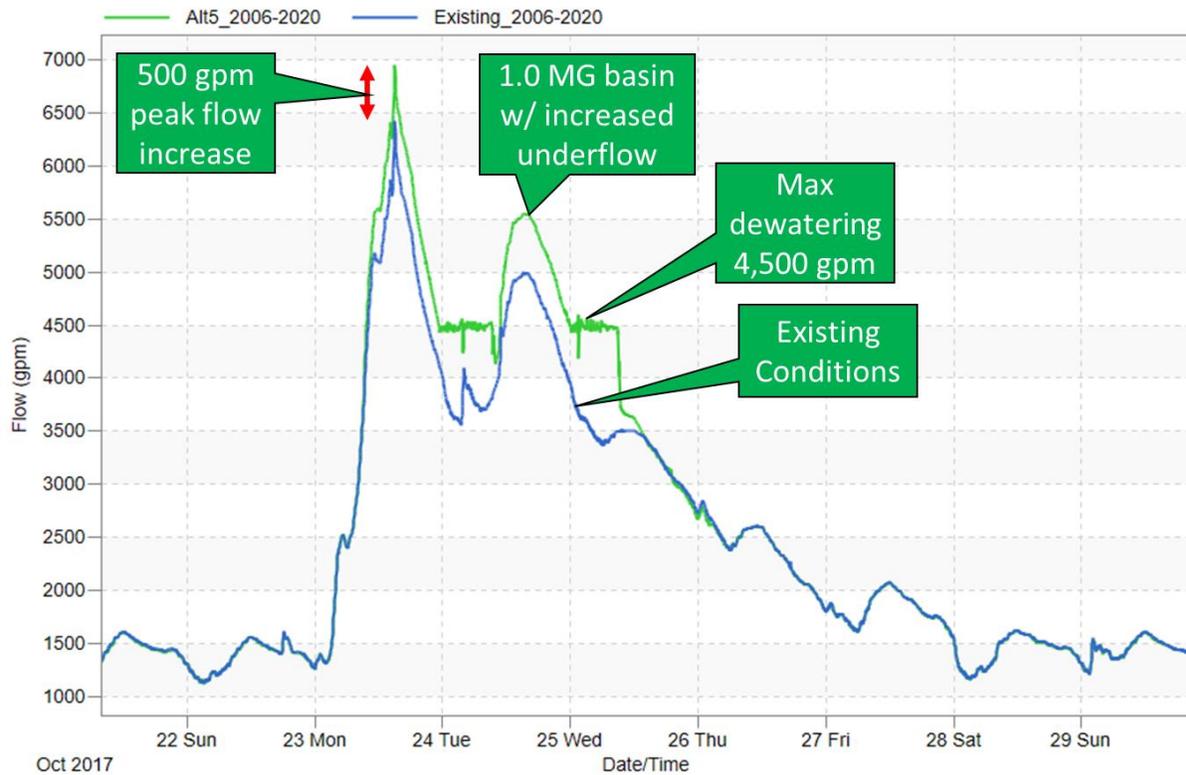
effectiveness, the proposed diversion chamber should be located near the existing CSO-005 diversion chamber at the downstream end of the Ravine Interceptor.

The location of the proposed basin does not have a large impact on the hydraulic performance of the system. As stated above, the hydraulic control for basin sizing is the location of the diversion chamber. However, the location of the basin relative to the diversion chamber will impact the required length of force main from the diversion chamber to the basin and the length of gravity basin dewatering pipe from the basin back to the collection system.

A limitation of the existing system that impacts the basin size is the capacity of the existing 330-foot, 12-inch underflow pipe from the existing CSO-005 diversion chamber to the interceptor. This pipe currently has a capacity of 2,400 gpm prior to overflow to the river at CSO-005 outfall structure. Under proposed conditions the capacity of the underflow pipe must be increased to accommodate underflow from the proposed diversion chamber and the dewatering flow from the proposed basin. The current preliminary design increases the diameter of the underflow pipe from 12-inches to 24-inches. Flow from the new diversion chamber to the underflow pipe will be limited by an adjustable orifice gate. This orifice gate is intended to remain in a fixed position but can be adjusted to fine tune the outlet flow rate in the field. Dewatering flow from the basin will be controlled by an automated valve that tracks total flow from the St. Joseph system to the JWWTP. These flow controls are necessary to prevent the total St. Joseph flow from overwhelming the JWWTP during wet weather.

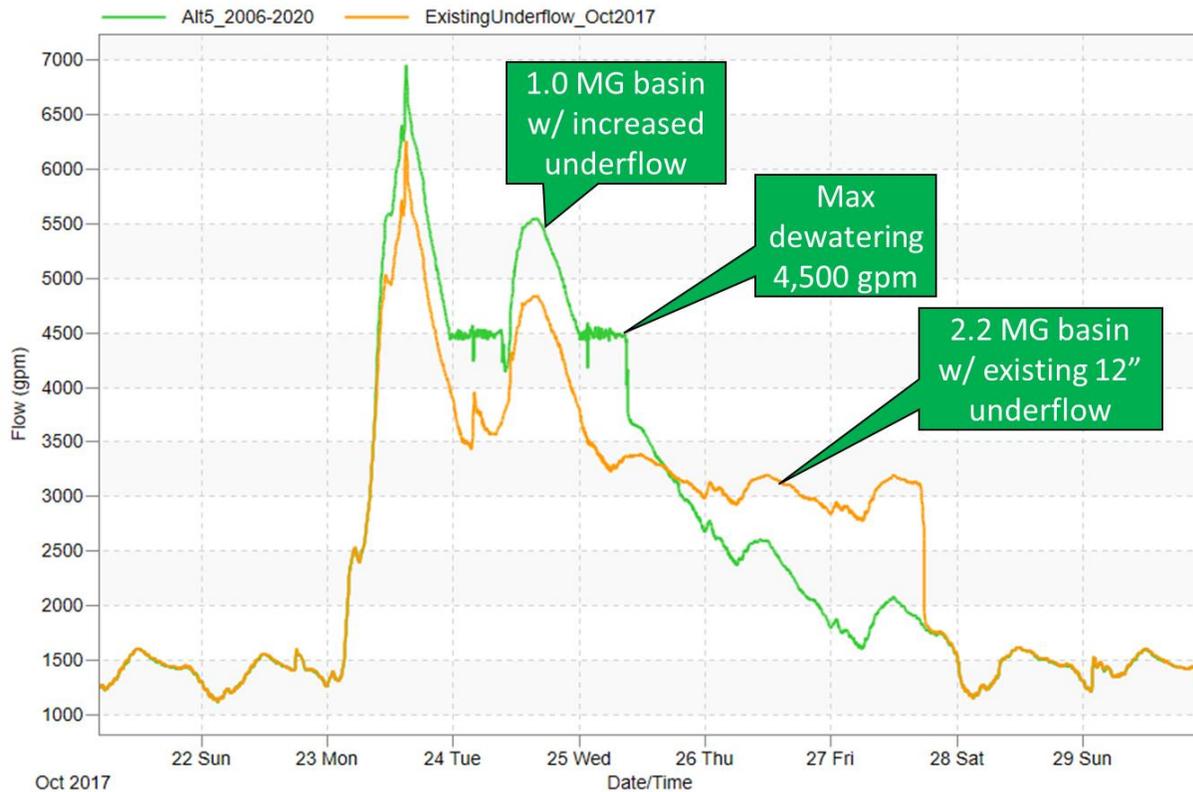
Dewatering of the basin must be optimized to maximize flow to the JWWTP without overwhelming process and capacity of the JWWTP. To meet this goal, real time control (RTC) logic was incorporated into the model to track total flow from the St. Joseph system to the JWWTP. With the RTC in place, the dewatering valve from the basin is modulated to achieve a specific rate of flow to the JWWTP during basin dewatering. The dewatering valve is assumed to be controlled based on measured flow at the exiting St. Joseph flume located just West of the Morrison Channel. As the total flow hydrograph begins to recede, the dewatering valve is modulated. An example of this valve modulation assuming a set point of 4,500 gpm is shown in **Figure 2-5**. The blue line shows the total flow from the St. Joseph system to the JWWTP under existing conditions. The green line shows the total flow to the JWWTP with the larger underflow pipe and a RTC basin dewatering valve that modulates to maintain a maximum flow rate of 4,500 gpm to the JWWTP. The plot shows the benefit of RTC logic that allows portions of the basin to be dewatered during intermediate lags in the flow. This intermediate dewatering optimizes the use of the basin volume and reduces the overall required basin volume. Under this this proposed configuration, the required basin volume is 1.0 MG. The larger underflow pipe does slightly increase the peak flow to the JWWTP by 500 gpm. During the preliminary design process, staff from the JWWTP were included in a review of the results from this proposed system configuration. JWWTP staff indicated the slight increase in peak flow and the overall increase in event volume during basin dewatering toward the JWWTP can be accommodated without impacting the effectiveness of treatment at the JWWTP.

Figure 2-5 Flow to WWTP with Increased Underflow



A separate sensitivity analysis was performed to show the impact of maintaining the existing 12-inch underflow pipe. Under this configuration, RTC logic of the basin dewatering valve tracks the level in the CSO-005 chamber. The basin dewatering valve is modulated to maintain a level in the CSO-005 chamber that is 6-inches below the overflow to the river weir crest. Under this configuration, the required basin volume is approximately 2.2 MG. A comparison of the total flow to the JWWTP with and without increasing the underflow pipe is shown in **Figure 2-6**.

Figure 2-6 Sensitivity of Increasing Underflow Pipe Size



Using the larger underflow pipe and RTC logic that maintains a maximum flow from the St. Joseph system to the JWWTP of 4,500 gpm, a continuous 50-year model simulation was run to develop overflow statistics. The results of this simulation are shown in **Table 2-1**. The results show a 1.0 MG storage basin will fully capture all but the two largest storms in a 50-year period. Although the basin could be reduced in size to a 0.95 MG basin, the additional 0.05 MG of storage significantly improves the long-term performance of the system. Although 1.0 MG is the idealize design volume, the final design should assume 1.2 MG to account for a 20% safety factor. It should be noted that the 9/13/2008 event was excluded from the statistics due to the extreme rainfall volume of 8.45-inches which approaches a 1,000-year, 24-hour storm volume.

Table 2-1 Required Basin Sizing Statistics – Selected Alternative

Rank	Overflow Event Date	Total Rainfall (in)	Proposed Conditions Stored Volume (gal)
--	9/13/2008	8.45	1,000,076*
1	10/14/2017	5.40	1,000,076*
2	10/30/2009	3.07	1,000,076*
3	9/6/1990	3.51	967,164
4	10/24/2010	3.00	949,960
5	10/31/2013	3.37	943,976
6	5/26/1968	3.73	890,868
7	6/7/1986	2.23	806,344
8	10/19/1985	2.57	682,999
9	4/18/2013	2.86	674,920
10	9/4/2008	3.04	497,046

* Basin volume completely fills for these events

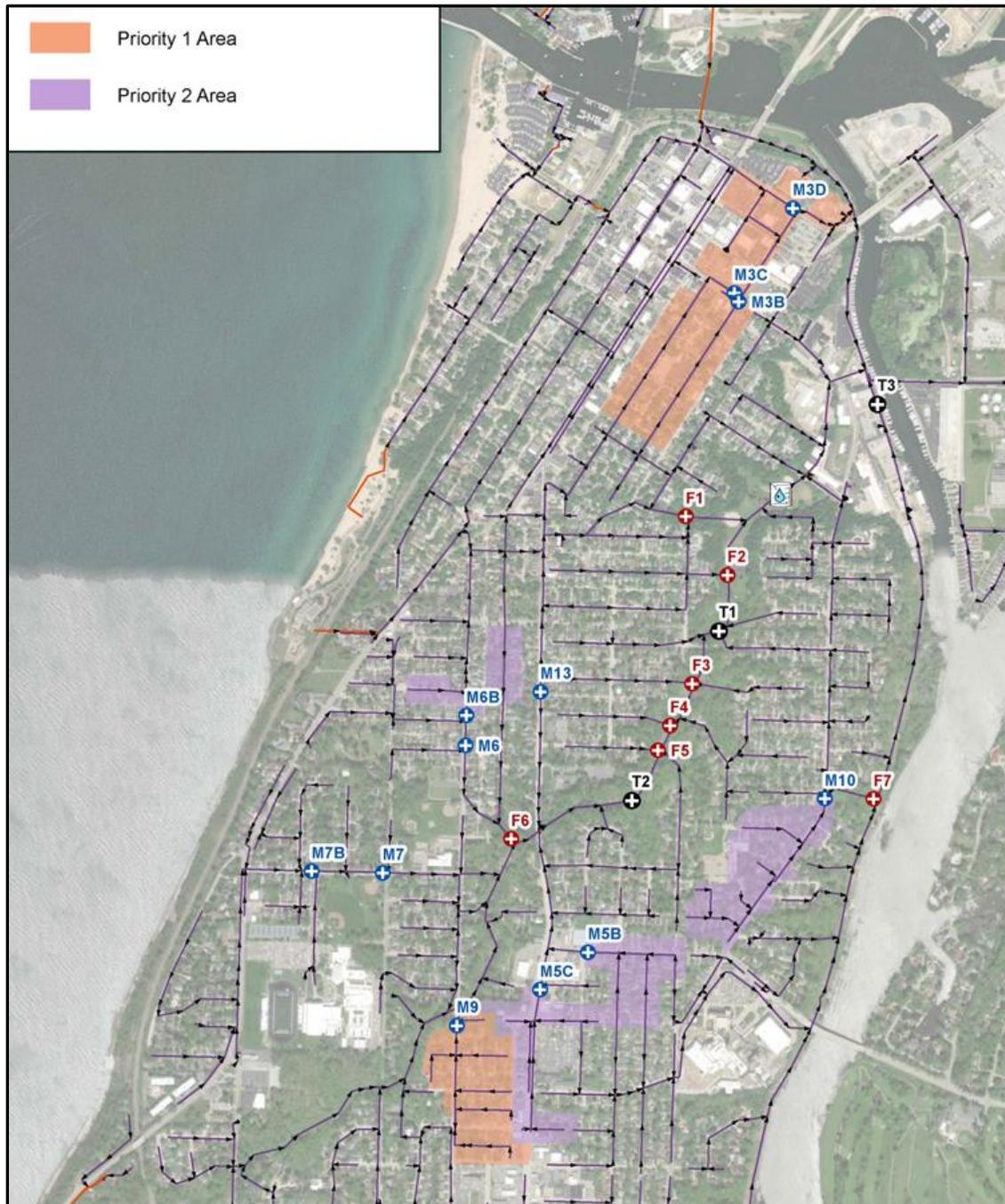
For this system configuration the required peak pumping rate from the diversion chamber to the storage basin is approximately 5,300 gpm. This pumping rate reflects the highest pumping rate in the model for the 50-years of continuous model simulation prior to the basin becoming completely full.

3.0 FLOW AND LEVEL DATA ANALYSIS

In 2021, a micro-flow metering program was implemented within the St. Joseph system. The purpose of the flow monitoring program was to identify areas with high infiltration and inflow (I/I). Any areas that were identified as having high I/I would be flagged for possible rehabilitation to reduce I/I which would in-turn reduce the required basin size. The concept of micro-metering is to install flow meters in area that are suspected to have high I/I. After confirming high I/I areas, the flow meters are moved upstream to isolate any problem areas allowing for a more focused rehabilitation. The results of the 2021 micro-metering program identified two high priority area for rehabilitation which are shown in **Figure 3-1**.

Since 2021, improvements to the system have been made in areas M3, M9, and M10. In the M3 area, directly connected impervious areas were identified in the field and most were disconnected from the system in 2022 and 2023. Sewer lining projects were also performed in the system in the M9 and M10 areas in 2022. The M9 and M10 areas were selected as pilot areas to evaluate the effectiveness of rehabilitation on I/I reduction. If effective, the I/I reduction efforts could potentially be expanded to other parts of the system which would reduce excess flow in the system and reduce the required basin size.

Figure 3-1 Areas with High I/I in 2021



After the rehabilitation of M3, M9, and M10 areas, another round of flow monitoring was performed. A map identifying the 2023 flow meter locations is shown in **Figure 3-2**. The goals of the 2023 flow monitoring were:

1. Determine the effectiveness of the I/I mitigation in the M3, M9, and M10 areas.

2. Verify the hydrology selected for the 85-acre T5 area at the downstream end of the ravine interceptor.
3. Verify the overall calibration of the ravine interceptor system up to meter Site-11.
4. Determine if high Great Lakes levels had an impact on I/I in the St. Joseph system.
5. Determine potential backwater impacts from the JWWTP at T6.

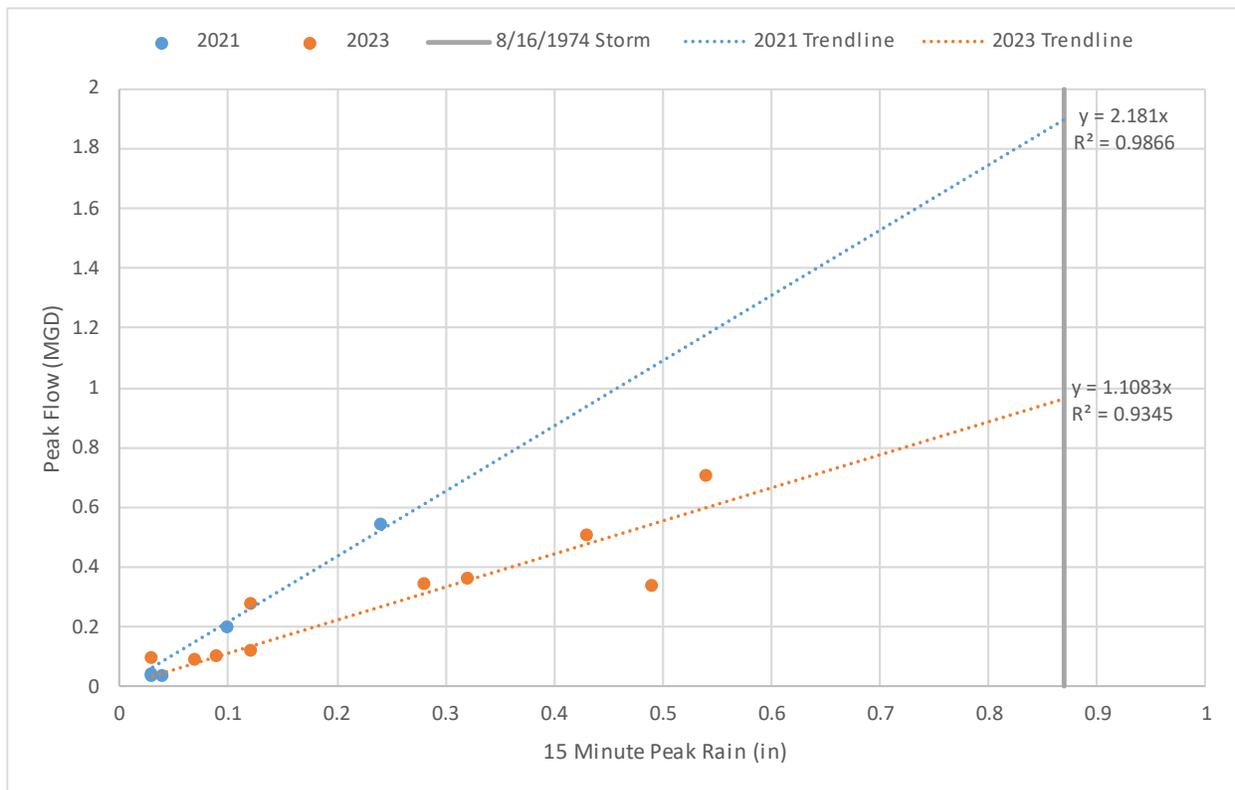
Figure 3-2 2023 Flow Monitoring Locations



3.2 Area M3

Flow monitoring in 2021 showed very high and very abrupt peak flows in the M3 area. The shape of the measured inflow hydrographs indicated directly connected impervious surfaces to the sanitary system. Field investigations located these direct connections, and a portion of the connections were removed. The flow data in 2023 shows significantly lower peaks flows than in 2021. Peaks flows from 2021 and 2023 were compared by plotting the peak 15-minute rainfall against the corresponding peak flow for each event. A plot of the peak flow comparison at meter M3 between 2021 and 2023 is shown in **Figure 3-3**. The regression lines for 2021 and 2023 were extended to 0.87 in/15min to reflect the peak intensity from the largest overflow event at CSO-003 in 50-years. This significance of this point of line extension is discussed in the CSO-003 section of this report. Based on this extension of the regression line, the peak flow is expected to be reduced by approximately 0.94 MGD from this area. This effectiveness of this reduction in peak flow is due to a direct disconnect of point source inflows to the system. This is in contrast to the difficulties of identifying and removing non-point source inflows associated with I/I.

Figure 3-3 Meter M3 Peak Flows 2021 vs. 2023



3.3 Area M9

The M9 area showed a higher than average I/I response to wet weather during the 2021 monitoring period. To mitigate this high I/I, a lining project of the public sewers and manholes was performed in 2022. A set of peak flow vs. 15 min rainfall regression lines were developed based on the 2021 and

2023 data as shown in **Figure 3-4**. These regression lines show a 14% reduction in peak flow from 2021 to 2023. However, the highest peak flow measured in 2021 occurred on extremely wet soil following 2-days of prior rain totaling 2.81-inches (red arrow). Eliminating this event from the data set lowers the slope of the 2021 regression line resulting in a 14% increase in flow from 2021 to 2023. A similar analysis was performed for total wet weather volume in the M9 area as shown in **Figure 3-5**. The slope of the regression lines translates to an average capture coefficient of 14.9% in 2021 and 10.8% in 2023. The volume regression plot shows a 37% reduction in wet weather inflow from 2021 to 2023. Again, if the volume from the outlier event is eliminated from the 2021 data set, the 2023 wet weather volume actually increases by 17% (red arrow). Based on the sensitivity of this single data point, the conclusion is that the I/I mitigation in the M9 area did not significantly reduce wet weather inflow peak or volume to the system. Based on this conclusion, further rehabilitation of additional areas within the system to mitigation I/I and recalibration of the M9 area is not recommended.

Figure 3-4 Meter M9 Peak Flows 2021 vs. 2023

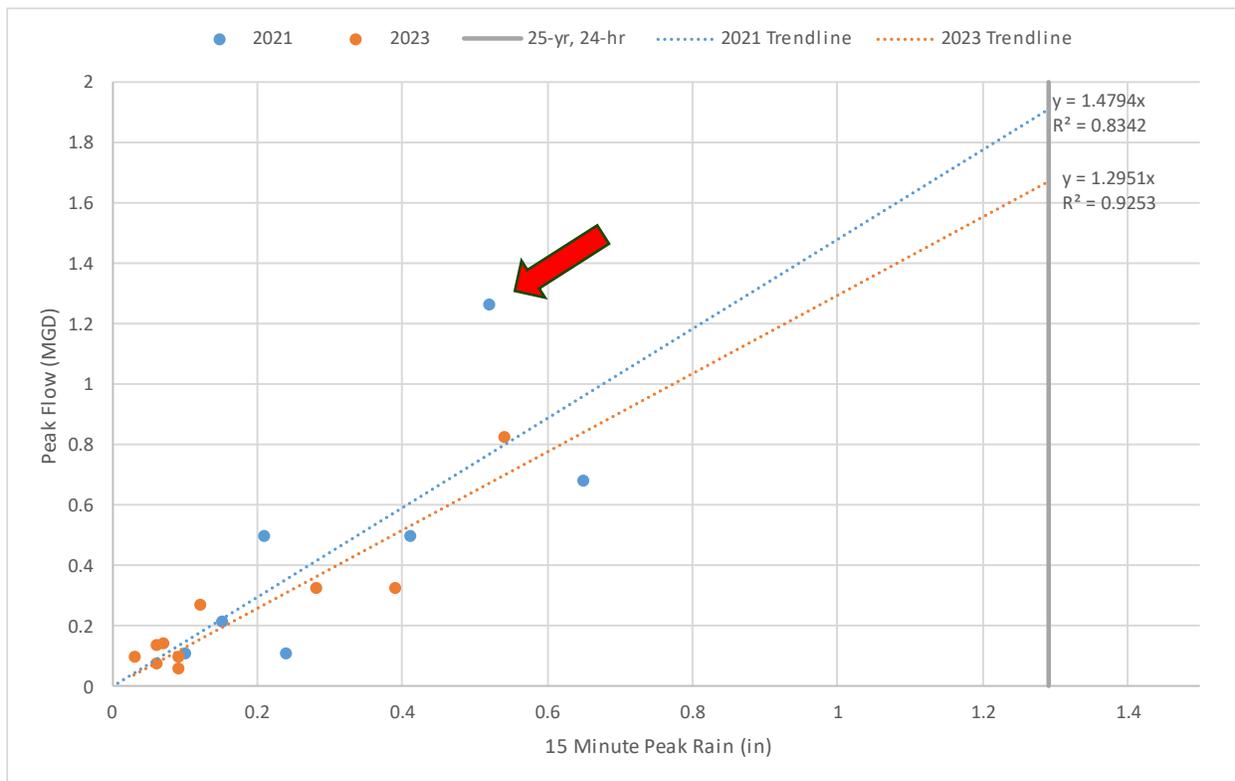
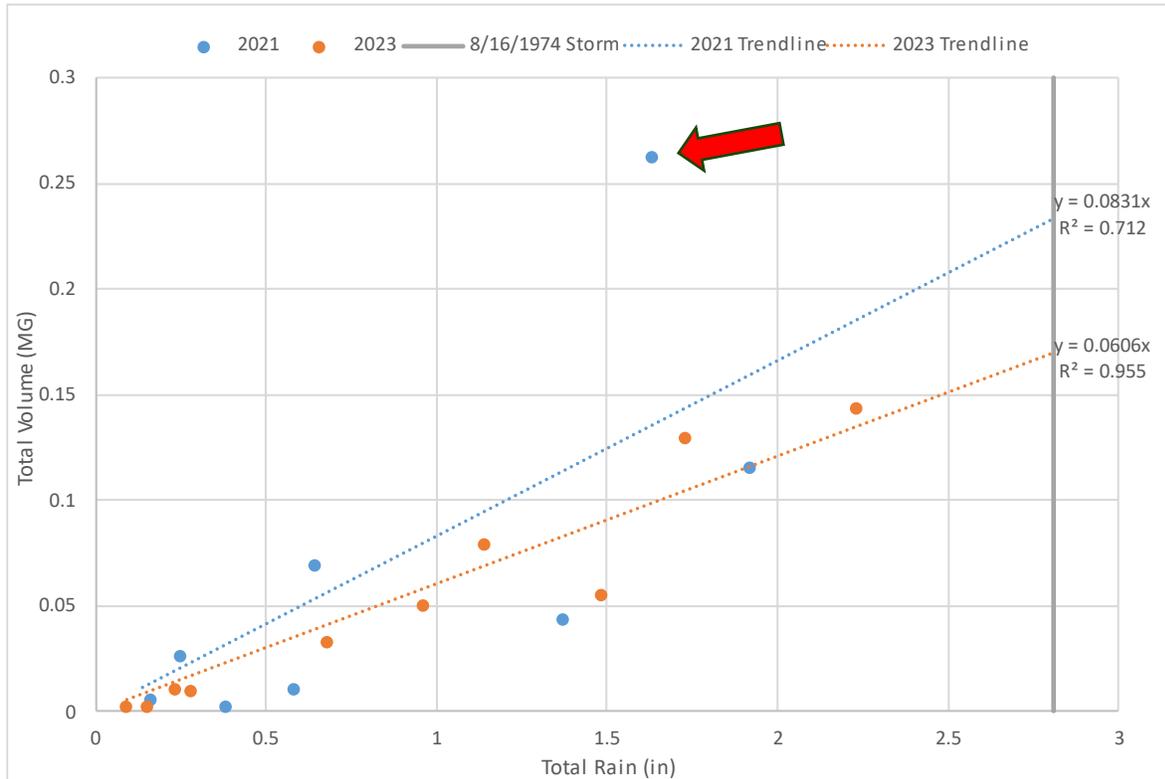


Figure 3-5 Meter M9 Volume 2021 vs. 2023



3.4 Area M10

Sewer rehabilitation was also performed in 2022 within the M10 area due to known issues with the condition of the sewer. Wet weather peak flow and volume regression plots were developed for the M10 area as shown in **Figure 3-6** and **Figure 3-7**. Although the plots suggest an increase in peak flow and volume from 2012 to 2023, there is a significant amount of scatter in the 2023 data and limited data from 2021. The results of the data analysis from this site are assumed to be inconclusive.

Figure 3-6 Meter M10 Peak Flow 2021 vs. 2023

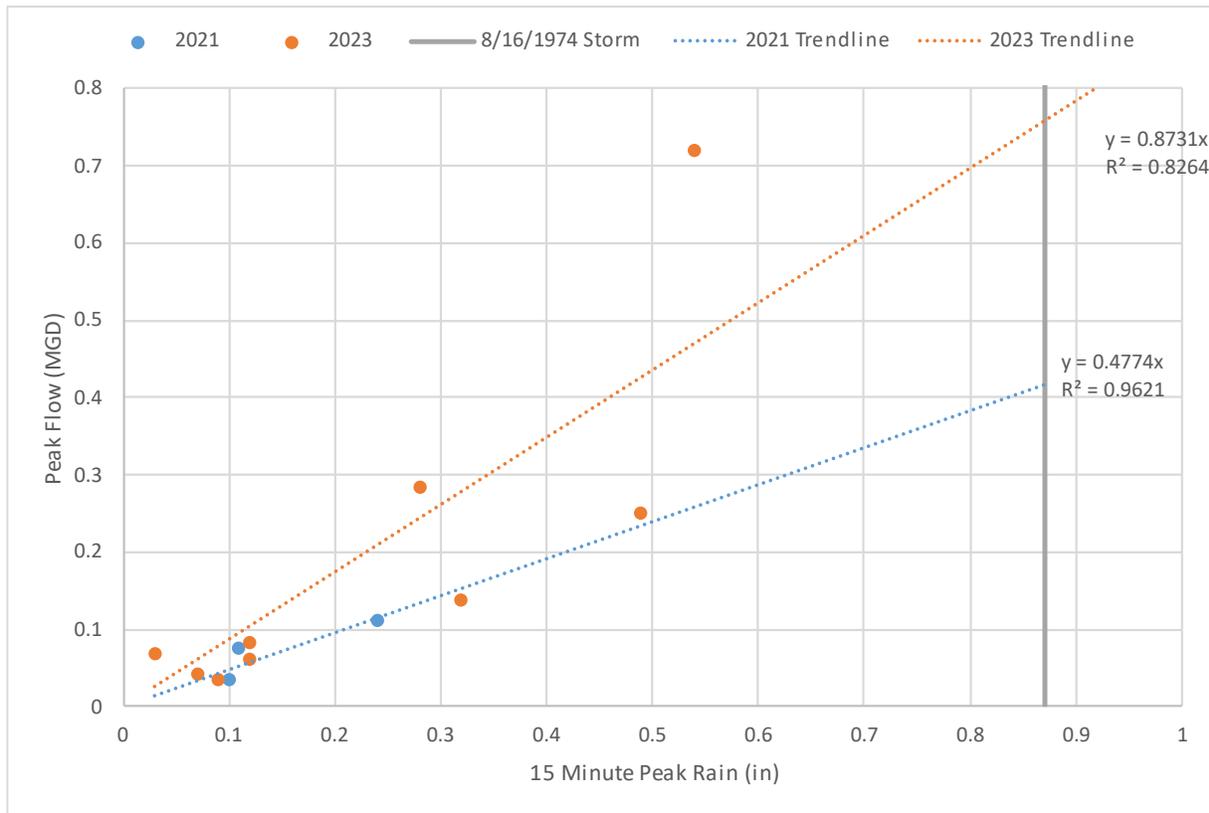
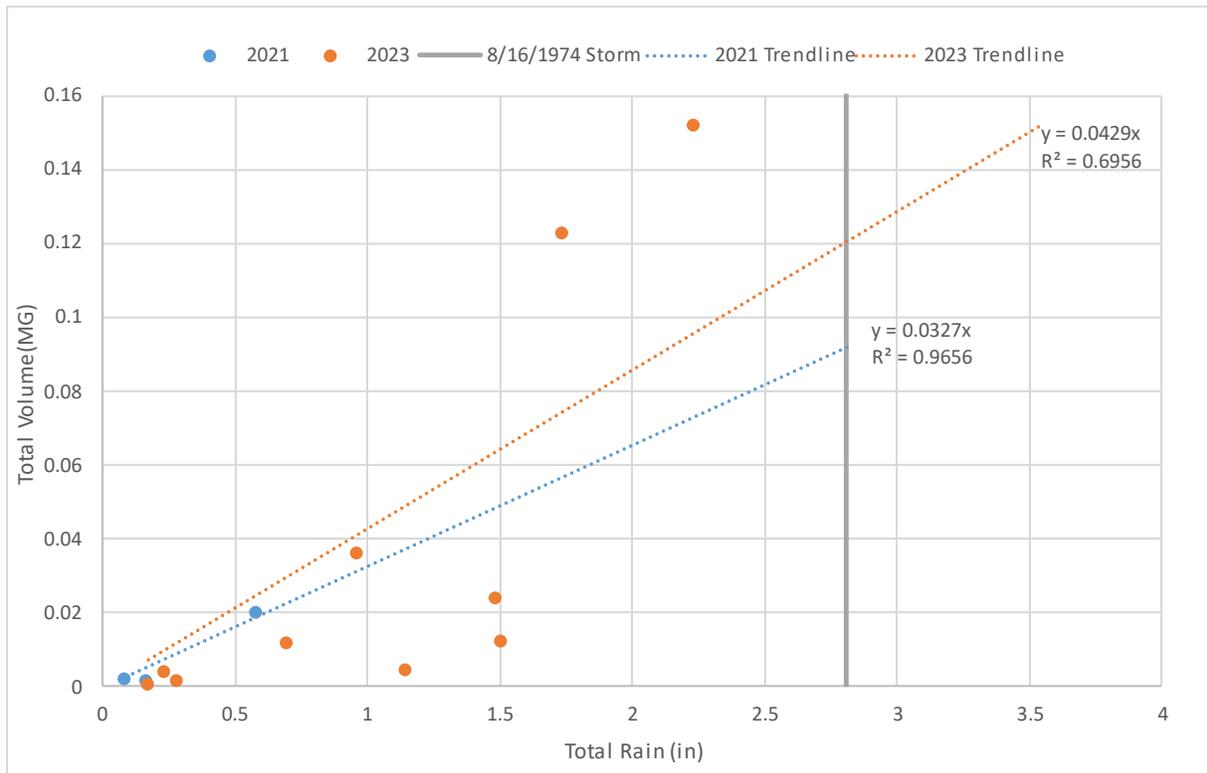


Figure 3-7 Meter M10 Volume 2021 vs. 2023



3.5 Additional T5 Areas

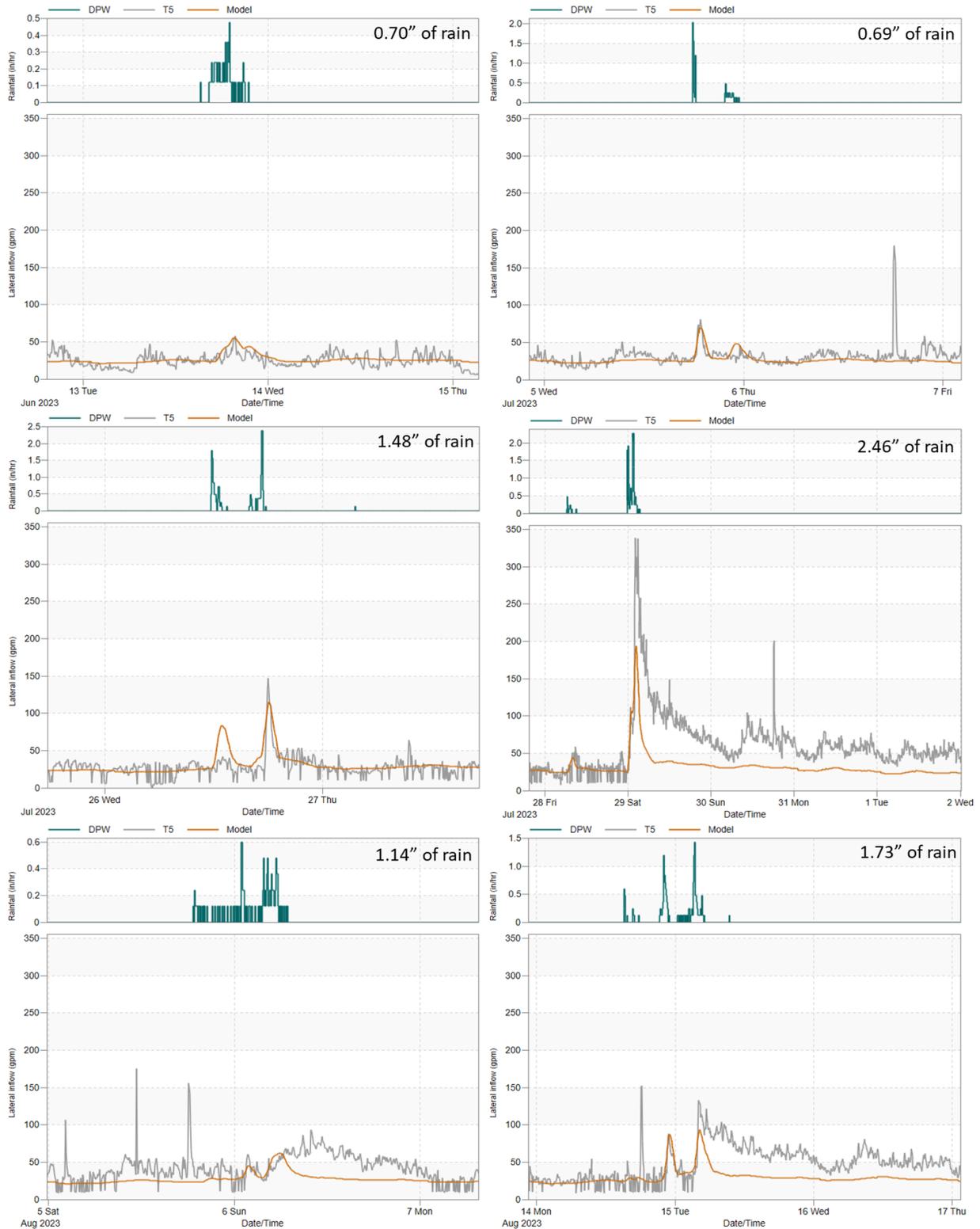
A flow meter was installed within the T5 area on one of the incoming branched toward the downstream end of the Ravine Interceptor. The purpose of this flow meter was to verify the assumed hydrology for the additional 83-acres that were added to the model. The location of the T5 flow is shown in **Figure 3-8**.

Figure 3-8 Meter T5 Location



Using rainfall data collected as part of the 2023 monitoring program, the model was run for the monitoring period. The results from this model simulation were compared to the measured data at meter T5. This comparison of model vs. measured flow is presented for six events as a series of hydrographs in **Figure 3-9**.

Figure 3-9 Model Vs. Measured Flow – Meter T5

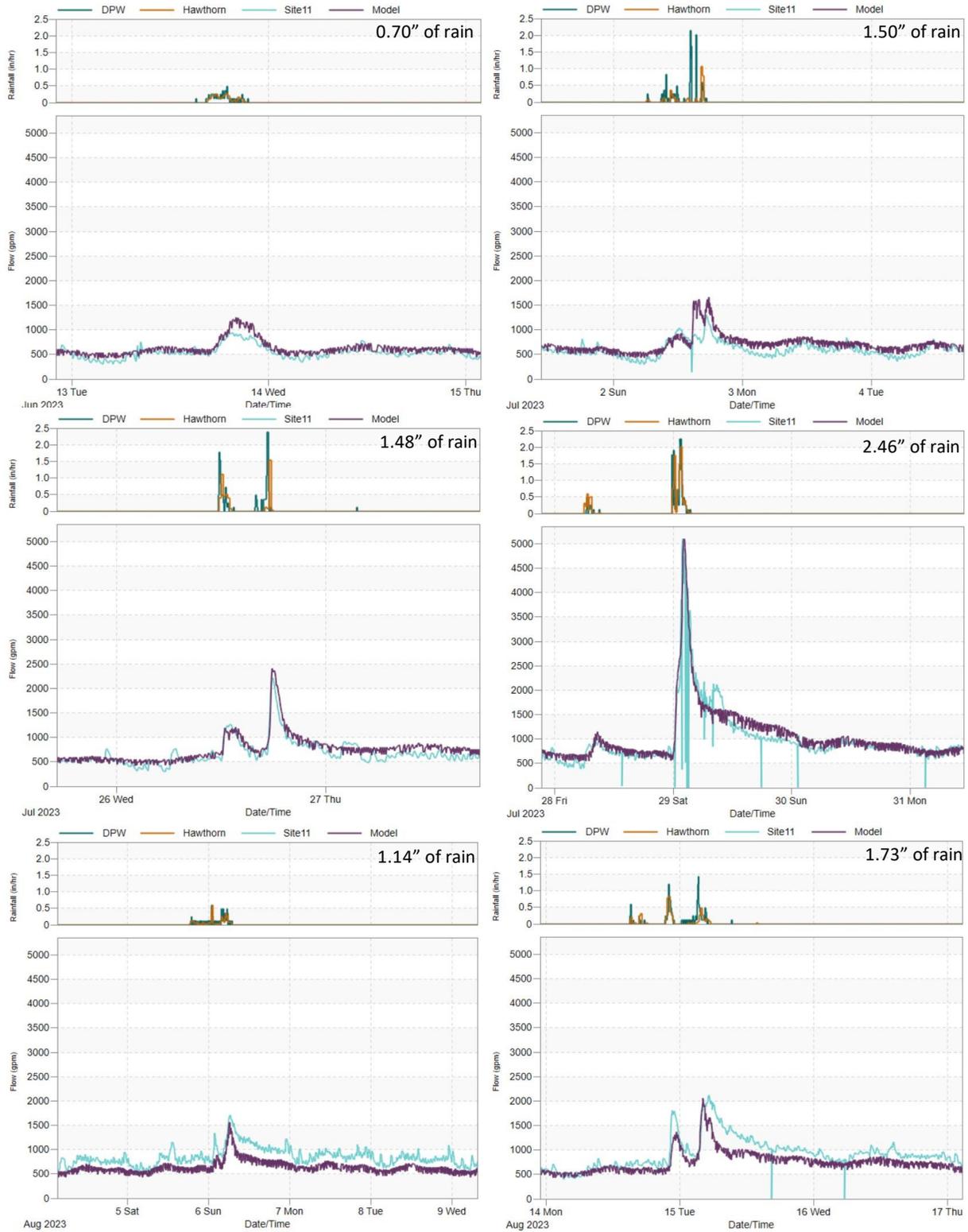


A review of the model vs. measured comparison shows good agreement for smaller events. However, the large July 29, 2023, event shows a significant underprediction of both peak flow and volume by the model. The subsequent events in August also underpredict peak flow and volume. This underprediction will likely impact the total runoff volume for large historic events within the 50-year continuous simulation that are used for basin sizing. Based on these results, it is recommended that the hydrologic model representation within the T5 meter area be calibrated to the T5 meter data. The other tributary areas at the downstream portion of the CSO-005 district should be evaluated for land use, sewer age, etc. to determine if they should be adjusted for T5 hydrology parameters or continue to use previously selected hydrology from other adjacent areas. This model calibration and model update should be performed at the start of the final design of the basin. The updated model can then be used to develop a final basin volume.

3.6 Ravine Interceptor Calibration Validation

Flow meter Site 11 was installed during the 2023 flow monitoring period to validate the model performance for the majority of the area tributary to the ravine interceptor. The model was run as a continuous model simulation for the entire monitoring period. The model results were compared to the measured data for select events as a series of hydrographs as shown in **Figure 3-10**. The model shows very good correlation to the measured data especially for the largest 2.46-inch event that occurred on July 29, 2023. Based on these results, further calibration of the areas tributary to the ravine interceptor is not required.

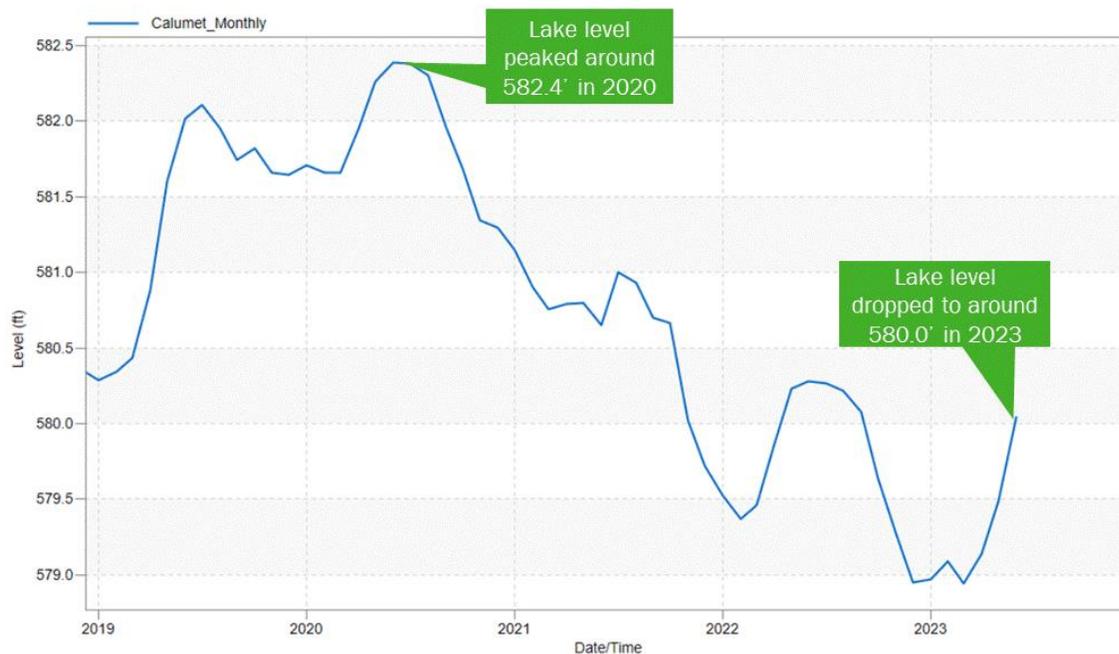
Figure 3-10 Model Vs. Measured Flow – Site 11



3.7 Potential High Great Lakes Impact on St. Joseph

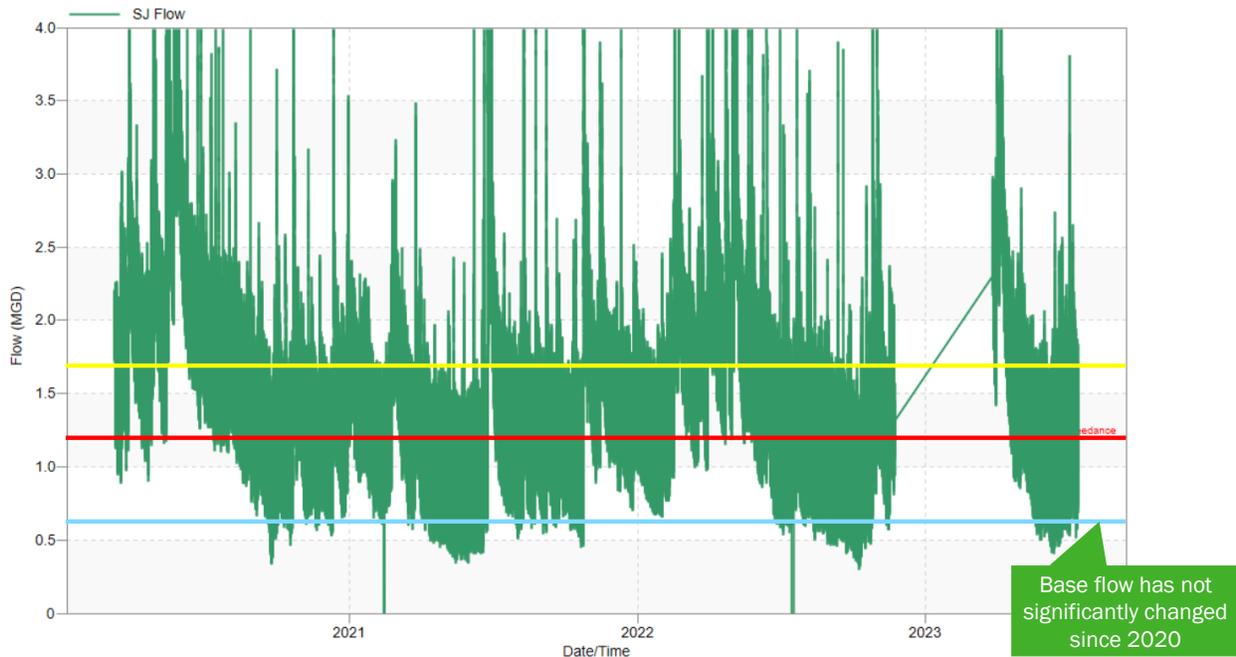
The most recent comprehensive calibration of the St. Joseph model was performed using data collected 2018, 2019, and 2020. The 2019 and 2020 monitoring period corresponded with record high great Lake levels as shown in **Figure 3-11**. A separate analysis was performed to determine if the high Great Lake levels were biasing the measured flow from the St. Joseph by increasing the I/I into the system from other sources unrelated to rainfall. This analysis focused on the total flow to the JWWTP measured at the flume. The analysis assumed the portion of the flow record that would be most impacted is the base flow measurement.

Figure 3-11 Lake Michigan Historic Levels



The measured baseflow from 2020 through 2023 was reviewed to identify any changes in the baseflow trend as shown in **Figure 3-12**. Three trendlines were added to the plot to represent the bottom of the baseflow (blue), average baseflow (red), and top of the baseflow (yellow). All three trendlines show a horizontal line indicating no significant change in baseflow during a period when the lake level dropped by approximately 3-feet. The bottom of the baseflow holds at 0.6 MGD for the entire duration. Based on this analysis, the St. Joseph system is not impacted by the Great Lakes levels.

Figure 3-12 Changes in Base Flow Infiltration



3.8 Backwater Impact from the JWWTP

A flow meter was installed on the 36-inch interceptor to the JWWTP located on Marina Island just East of the Morrison Channel. The purpose of this flow meter was to track potential backwater from the JWWTP. The monitoring data shows periodic spikes in level data measurement. The majority of these spikes are 2 to 4-feet above the invert of the 36-inch interceptor. However, on July 5, 2023, the spike exceeded the invert of the St. Joseph flume. On July 29, 2023, an even larger spike submerged to flume by almost 5-feet. The spikes for the entire monitoring period are shown in **Figure 3-13**. Zooming in on the July 29, 2023, event provides an understanding of the duration of this backwater as shown in **Figure 3-14**. The detail also shows how close the backwater came to causing an overflow at the CSO-011 outfall structure.

Figure 3-13 JWWTP Backwater Impacts

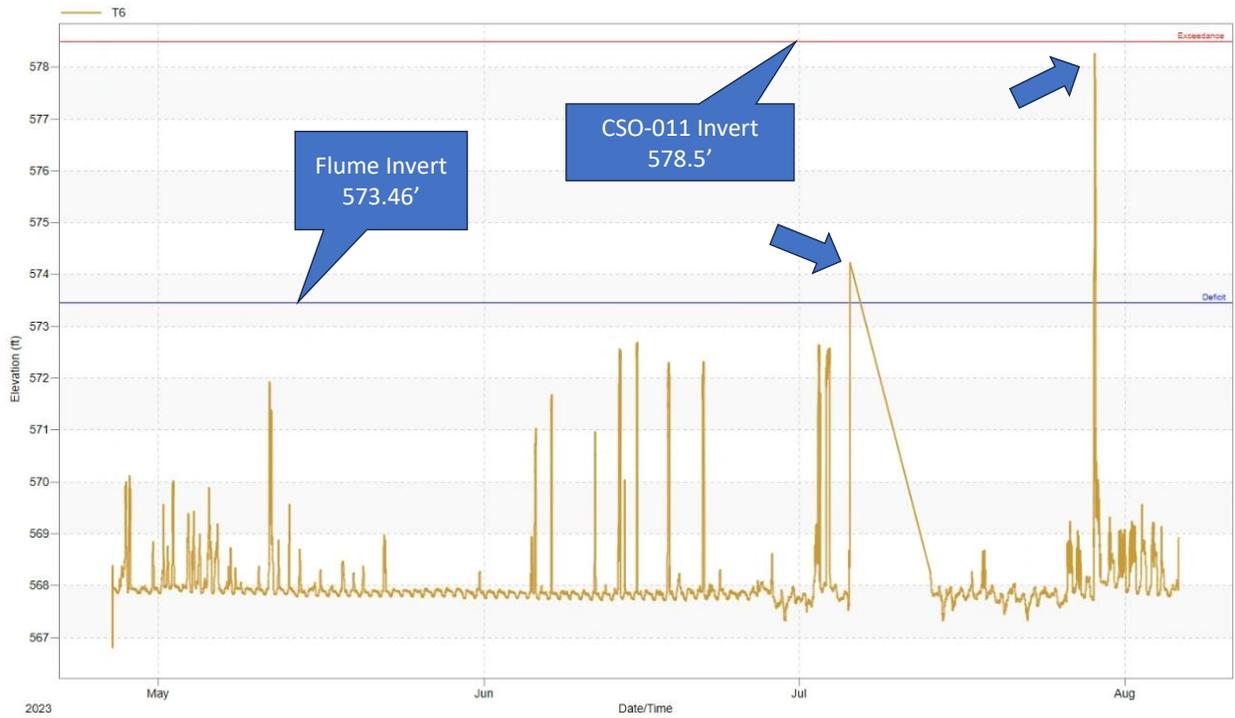
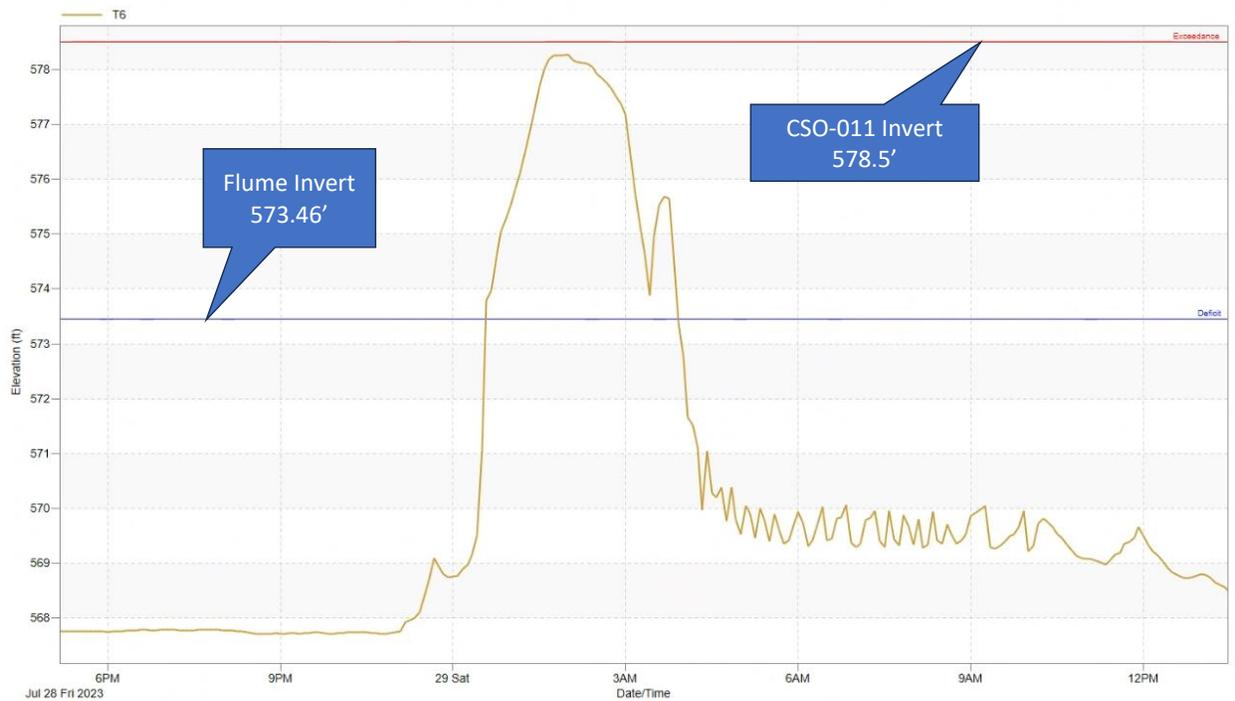


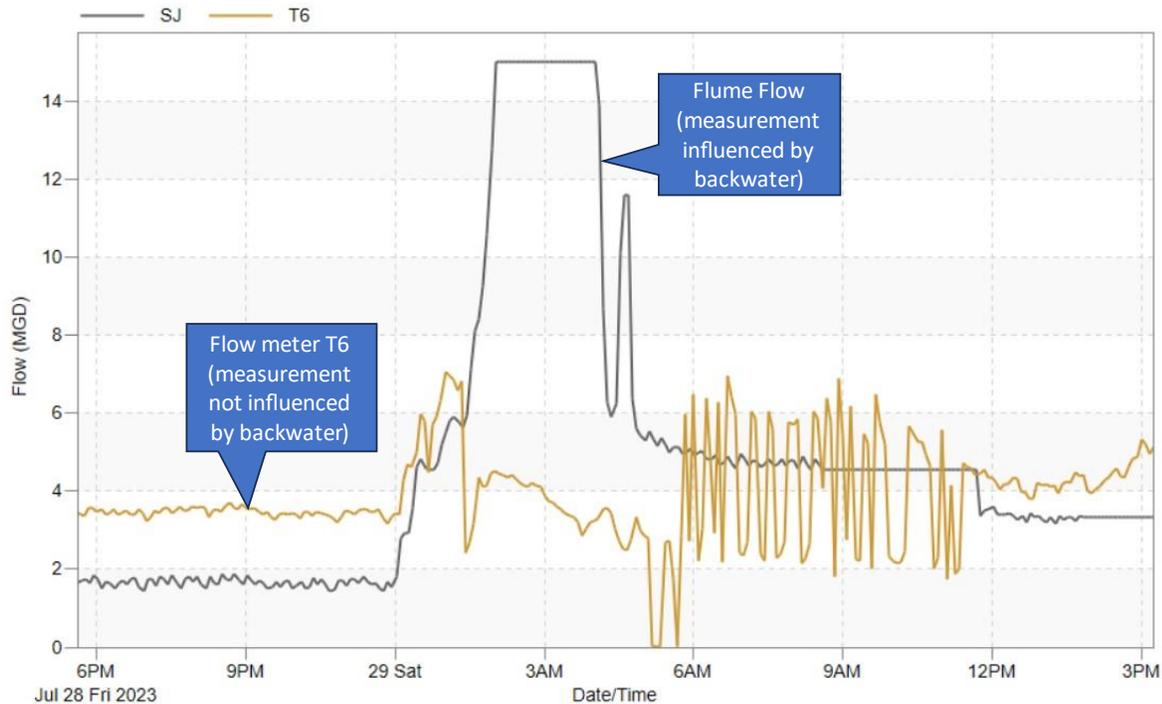
Figure 3-14 July 29, 2023, Backwater Impacts



The St. Joseph flume is used to measure all of the flow from St. Joseph West of the Morrison Channel to the JWWTP. A flume is a proven accurate flow measurement device, but it does rely on very

specific hydraulic conditions. If a flume is backwater effected, the conversion from depth to flow will overestimate the total flow rate. A comparison of the measured flow rate at the flume to the measured flow rate at Meter T6 is shown in **Figure 3-15**.

Figure 3-15 July 29, 2023, Flume vs Meter T6 Measured flow



This backwater impact was presented to the JWWTP staff. The staff recognized that they had problems getting one of the large pumps started at the plant which led to the large increase in level upstream of the JWWTP. Also, prior to the start of the event, one of the pumps had been taken out of service for motor rewinding. They also indicated that they have a project underway to replace several of the pump motors that have been in service since the 1950's. After these motors are replaced, they expect to have more reliable service.

4.0 RECOMMENDATIONS FOR CSO MODIFICATIONS

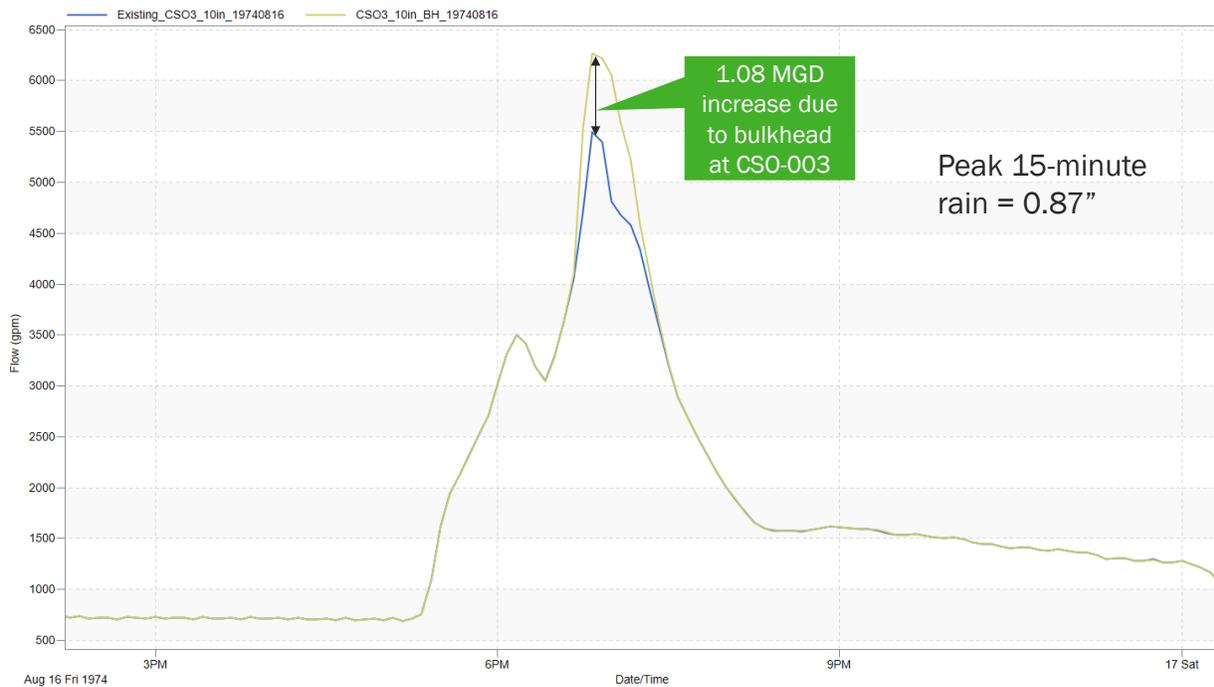
The overall goal of the St. Joseph CSO control program is to bring St. Joseph in compliance with the State of Michigan CSO and SSO control policy. One aspect of this control is complete removal of the CSO outfalls from service through the installation of a bulkhead. Although a bulkhead prevents a CSO from occurring, it does remove a point of relief from the system that can be used in the event of extreme wet weather or do to some other operational problem within the system. Below is a discussion of the three remaining CSO's in the St. Joseph system and our recommendations for future modifications.

4.1 CSO-003

Structural improvements describe below for CSO-003 have already been approved by EGLE (Permit No. P41004331 v.1, issued on June 16, 2023) and is currently planned for construction as part of the Upton Drive Reconstruction Project. The discussion below represents the supporting information and analysis for these changes.

As part of the CSO-003 performance certification CSO-003 was found to overflow infrequently and with limited overflow volume. The model results showed that 0.015 MG of storage was all that would be required to bring CSO-003 into CSO control compliance. The concept at CSO-003 is to install a bulkhead within the CSO structure and increase the 40-foot-long underflow pipe from a 10-inch pipe to a 24-inch pipe. A 24-inch pipe was selected to match the upstream pipe within the CSO-003 collection system and the downstream 24-inch North interceptor. The flow that would have previously gone to the overflow will now be directed toward the interceptor thereby increasing the peak flow toward the JWWTP. To understand the magnitude of this flow increase, the 50-years of continuous model results were reviewed to identify the largest CSO-003 overflow event in 50-years. The peak event was identified as the August 16, 1974, event. This event was run for existing conditions and for proposed conditions with the CSO-003 bulkhead in-place. A comparison of these hydrographs is shown in **Figure 4-1**. The result of this comparison shows that for the largest event in 50-years, the peak flow is expected to increase by 1.08 MGD. This increase in peak flow will be offset by improvements to the system in the Meter M3 district as describe in Section 3.2. The Meter M3 Regression plot shows a 0.94 MGD reduction in peak flow in the area immediately downstream of the CSO-003 bulkhead. Based on these results, it is recommended to move forward with increasing the CSO-003 underflow pipe and placing a bulkhead in the CSO-003 outfall structure.

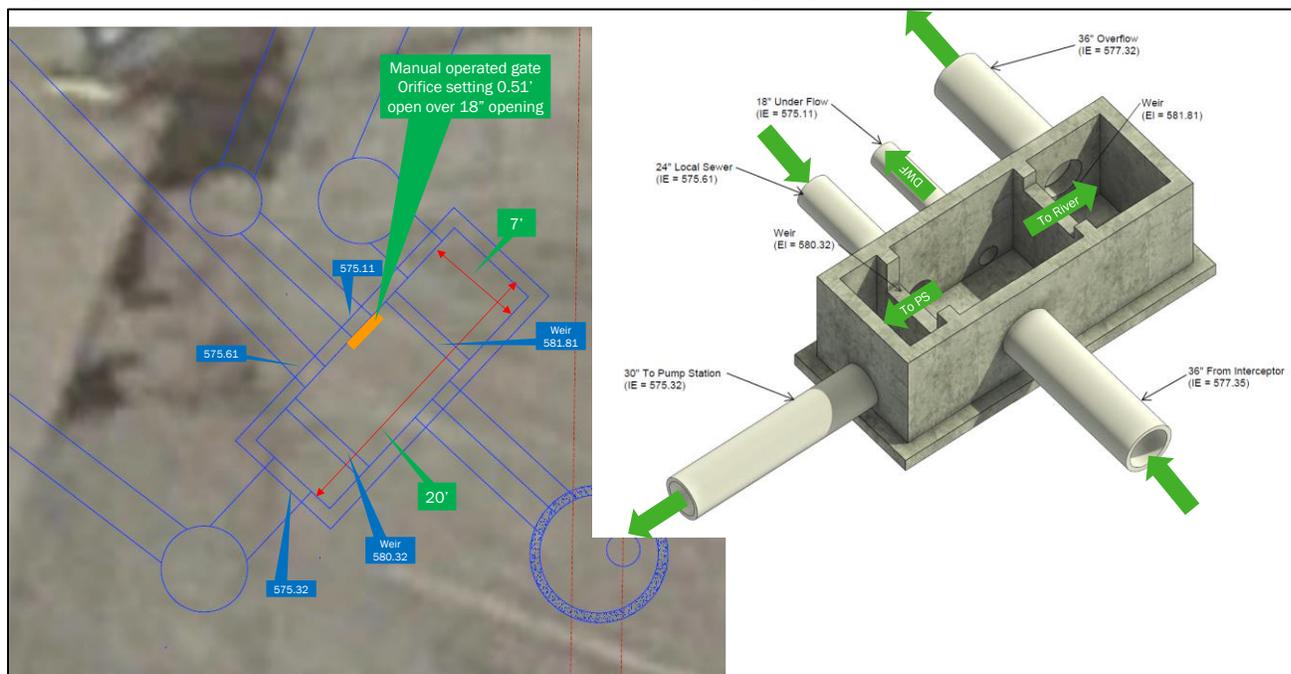
Figure 4-1 August 16, 1974, Existing and Proposed Inflow Hydrographs



4.2 CSO-005

The CSO-005 diversion chamber and overflow weir are planned to be completely rebuilt as part of CSO-005 basin construction project. This new chamber will have an underflow orifice with slightly more capacity than the existing 12-inch pipe, an overflow to the basin pump station, and an emergency overflow to the local stormwater system. This emergency overflow weir is only expected to operate under extreme conditions that are expected to occur less than once every 10-years. This emergency overflow will reduce the flooding risk of system and basement backups during extreme events. A permanent level sensor will be installed at the emergency overflow weir to monitor the overflow and continuously verify the infrequent use of the overflow. A conceptual layout of the proposed CSO-005 diversion chamber and emergency overflow is shown in **Figure 4-2**.

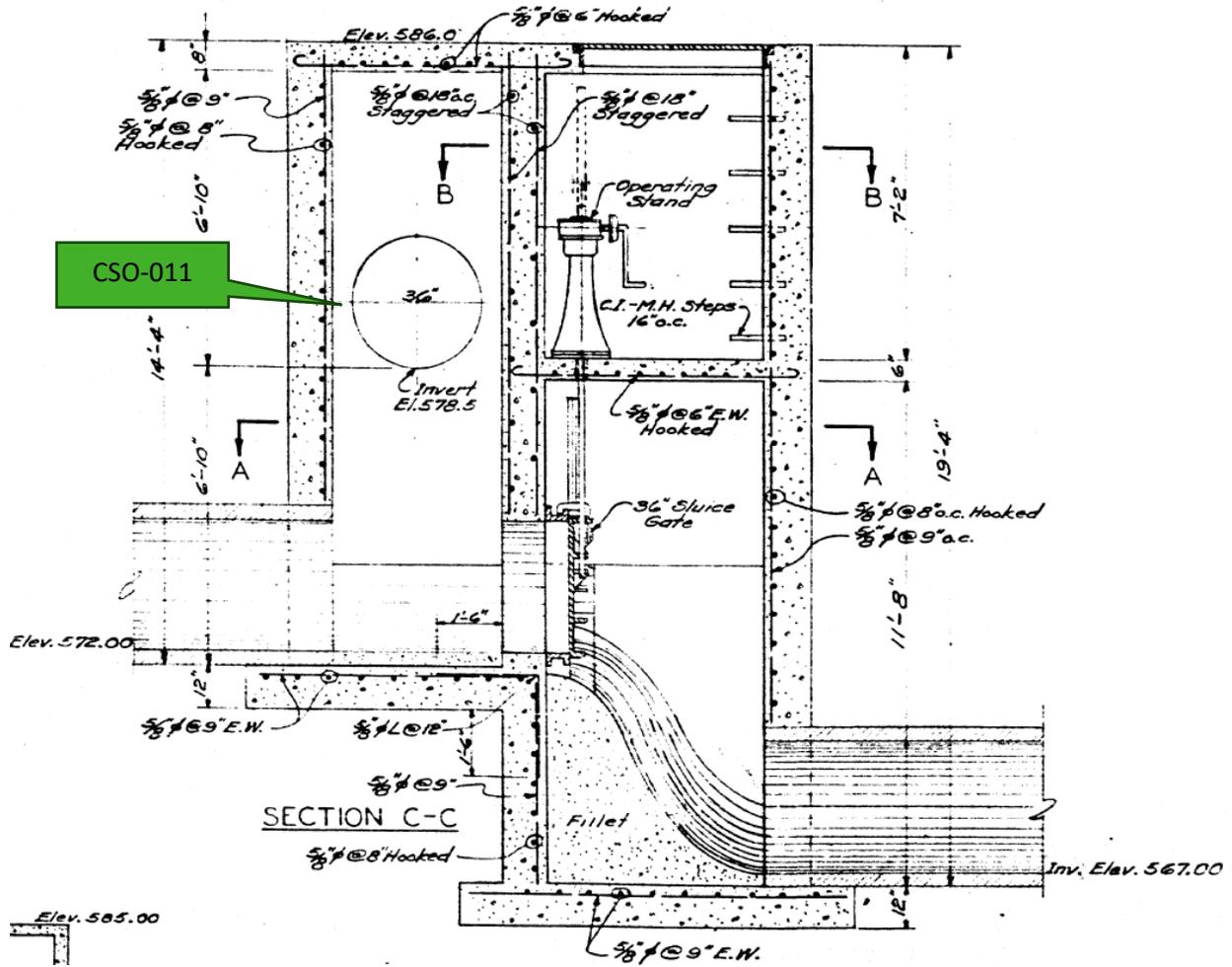
Figure 4-2 Proposed CSO-005 Diversion Chamber and Emergency Overflow



4.3 CSO-011

CSO-011 is situated 6.5-feet above the invert of the 36-inch interceptor just West of the Morrison Channel as shown in **Figure 4-3**. During the 50-year continuous model simulation, the 36-inch interceptor at CSO-011 remains in an open channel condition and does not surcharge. It appears that the only condition that would cause an activation of CSO-011 is a backup from the JWWTP. Although backups from the JWWTP can occur, near term improvements to the influent pump station motors will make these backwater event less frequent. Although backups from JWWTP are expected to occur less frequently in the future, the risk still remains, and we recommend that CSO-011 outfall structure remain in place to protect the St. Joseph system. A permanent level sensor will be installed upstream of the CSO-011 outfall structure to monitor the overflow and continuously verify the infrequent use of the overflow.

Figure 4-3 CSO-011 Overview



5.0 DESIGN CONSIDERATIONS FOR NEW STORAGE FACILITY

This section presents the preliminary design evaluations conducted to establish the potential feasible options and locations for the proposed storage facility. The Design Considerations are organized for the following major categories:

1. Potential Site Locations
2. Hydraulic Requirements
3. Operational Features
4. Geotechnical and Environmental Considerations
5. Structure Types for Storage

5.1 Potential Site Locations

Two different City owned properties were evaluated as potential locations for the required storage facilities. Initially the Kiwanis Park property was examined for five different types of potential storage options that included both above grade and below grade storage methods. After additional hydraulic analysis, it was determined that the required storage volume could be reduced by optimizing flow delivered to the WWTP during wet weather events. This strategy required the diversion chamber to be located and controlled at the downstream end of the Ravine Interceptor in the vicinity of the DPW site. For this reason, vacant property within the City owned DPW facility located was also examined for potential storage locations. The two property locations are shown in **Figure 5-1**.

Figure 5-1 Basin Site Property Location Map



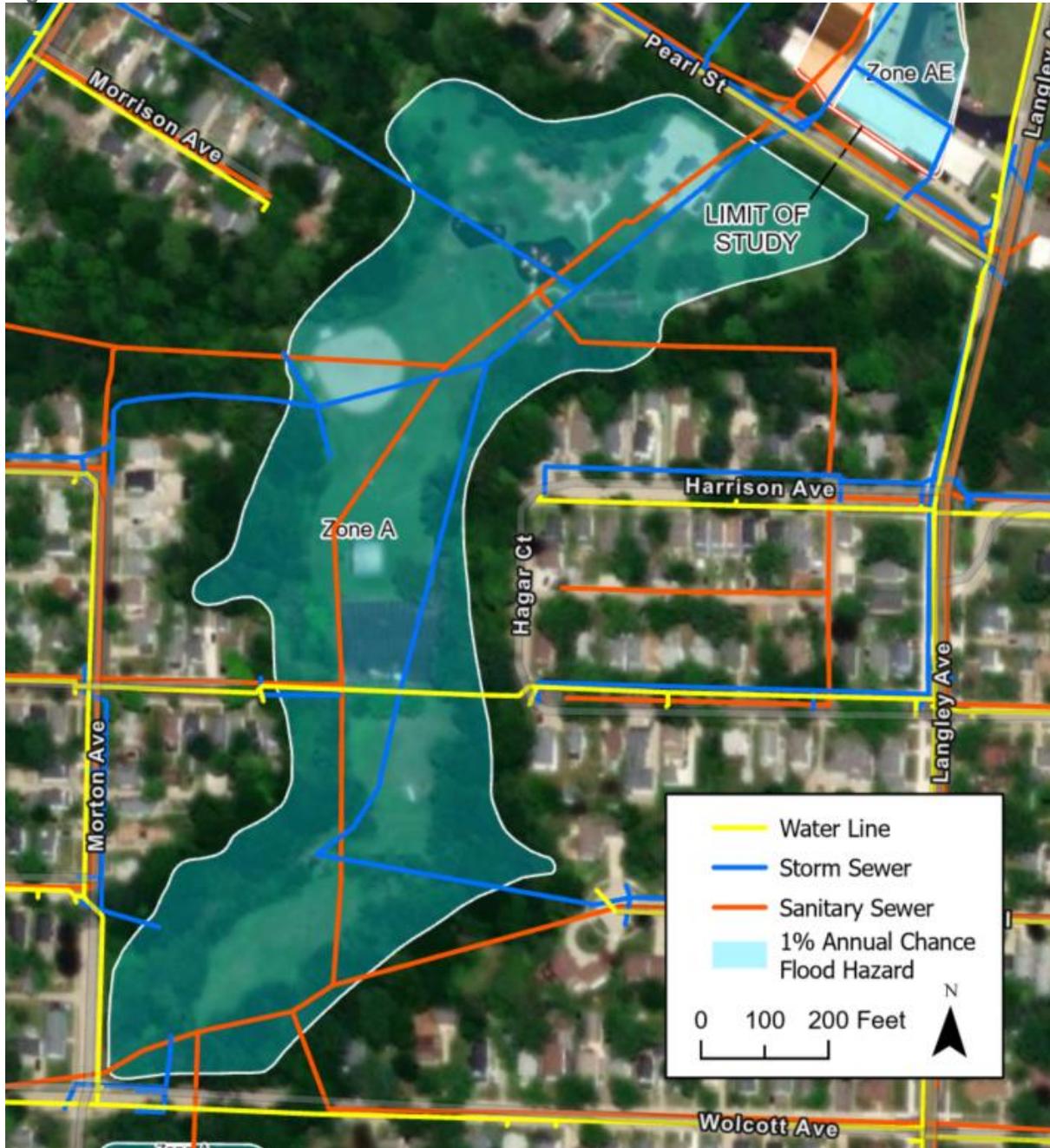
5.1.1 Kiwanis Park Site

The Kiwanis Park site was the original site considered in the FY 2022 Project Plan for either a below grade or above grade storage tank. The existing park property has multiple active City park features including a Comfort Station, outdoor pavilion, playscape, baseball fields, basketball courts, skateboard track, pickle ball court, and sledding hill.

The park is located within a drainage ravine surrounded by residential areas at higher elevations ranging approximately 55-feet higher than the park along the west and east boundaries. Most of the park area lies within a FEMA flood hazard area. The south end of the park has a storm drainage retention area constructed as part of the 2004 Sewer Separation Project Interceptor Renovation Project to help alleviate surface flooding within the park and downstream areas. There are also multiple underground utilities that extend the length of the park, including the 30-inch Ravine Interceptor and 48-inch enclosed storm drain flowing south to north, with various connections from

the residential areas adjacent to the park. There is also an existing 6-inch watermain serving to loop the residential areas that crosses the site. These Kiwanis Park local utilities are shown in **Figure 5-2**.

Figure 5-2 Kiwanis Park Local Utilities



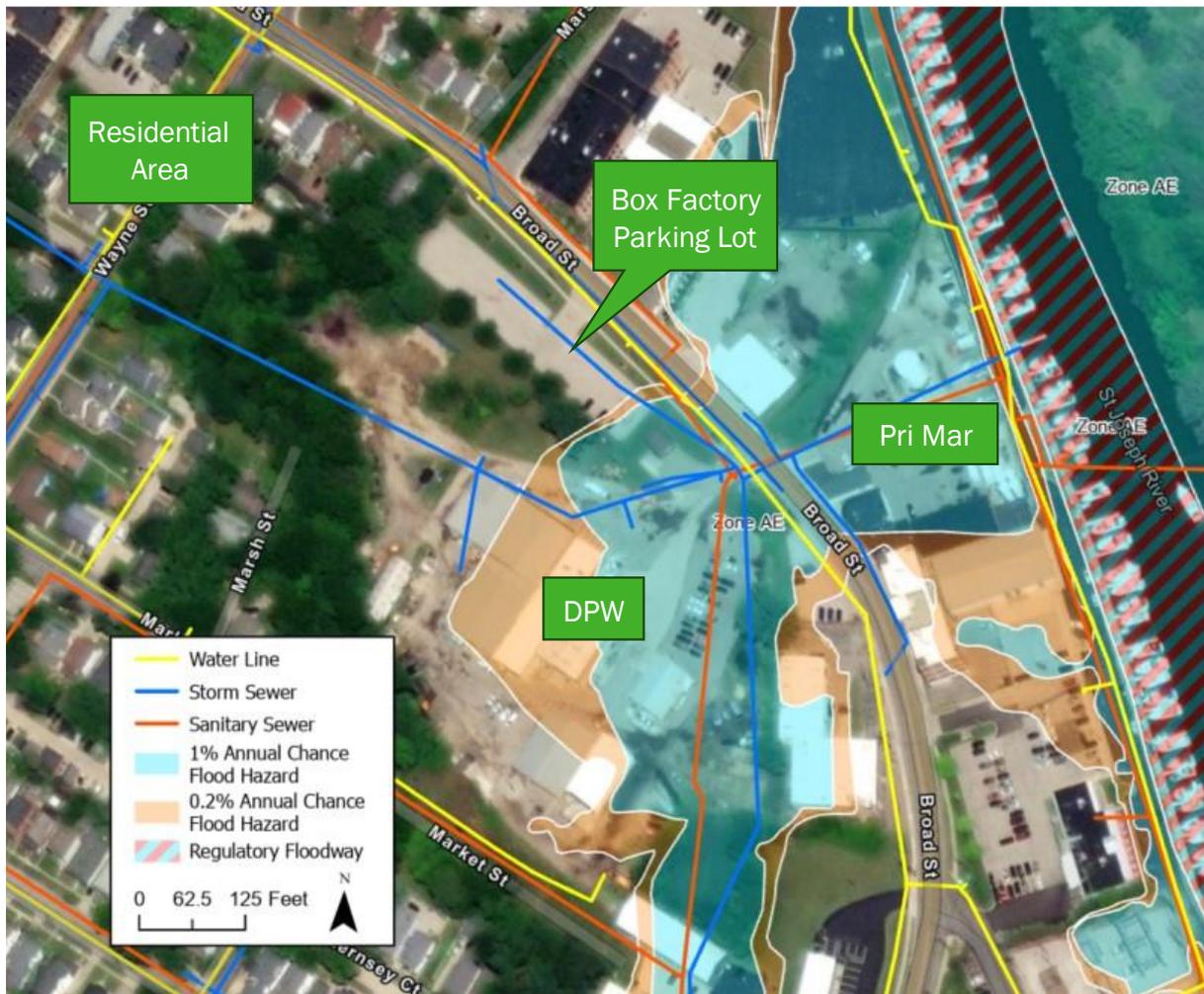
5.1.2 DPW Site

The DPW site is a City owned parcel that is located south and west of where Broad Street ends and turns south to begin Langley Avenue. The DPW facilities are contained within the fenced portion of

the property that currently serves as the DPW main administration building and maintenance facility for various DPW vehicles, employee parking, miscellaneous storage buildings and vehicle storage, as well as material storage within the open area on the west end of the parcel.

The north side of the property outside of the fenced DPW yard along Broad Street is used as a City parking lot primarily for the Box Factory for the Arts. Residential areas at higher elevations border the DPW property to the west and southwest at a higher elevation approximately 45-feet above the DPW. The sloped areas are densely covered with trees that help screen the residential area from view of the DPW facility below. Site access is through the main access gate located where Broad Street turns to Langley Avenue directly across the street from the Pri-Mar property entrance. These DPW local utilities are shown in **Figure 5-3**.

Figure 5-3 DPW and Surrounding Areas Local Utilities



5.2 Hydraulic Requirements

As discussed in Section 2, the basin was sized to meet the State of Michigan SSO performance criteria of less than one overflow in ten years during the growing season. The basin volume was optimized through the selection of the diversion chamber location and the inclusion of real time control of the basin dewatering valve. A list of the key components developed as part of the hydraulic analysis are listed below.

1. Diversion Chamber – An additional diversion chamber was added to the model to divert flow from the Ravine interceptor to the proposed basin. The diversion chamber includes the following elements:
 - Underflow orifice – The underflow orifice allows dry weather flow and a portion of wet weather flow to discharge directly to the WWTP for treatment. The orifice restricts flow to approximately 2,800 gpm prior to overflowing to the basin.
 - Basin Overflow Weir – Flow that exceeds the capacity of the underflow orifice will be diverted to the basin over the overflow weir. This weir is 5 feet long and has a crest elevation of 580.32 feet.
 - Emergency Overflow Weir – Approximately one event in ten years will have sufficient volume to exceed the capacity of the storage basin. The excess flow from these events will be diverted to the existing stormwater system over the emergency overflow weir. This weir is 3.1 feet long and has a crest elevation of 581.81 feet.
2. Storage Basin – The storage basin is currently sized for 1.0 MG of storage. The basin is assumed to be an above ground tank with influent pumping. The basin is dewatered via gravity with a dewatering control gate. The 1.0 MG storage is the minimum required volume and assumes full optimization of the influent and discharge flow from the basin. To account for potential flexibility of the dewatering controls as the final design moves forward, a 20% safety factor has been included to increase the recommended basin volume to 1.2 MG.
3. Pump Station – A new pump station will be required to pump flow into the proposed basin. The current model representation assumes an idealized pump capable of pumping a maximum flow rate of 5,300 gpm.
4. Real Time Dewatering Controls – The required basin volume was optimized by assuming real time control of the basin dewatering. This real time control tracks the total flow from the St. Joseph system to the WWTP. The basin dewatering gate is modulated automatically to maintain and not to exceed flow rate of 4,500 gpm to the WWTP. There is more discussion of this dewatering rate in subsequent sections of this report.

5.3 Operational Features

The main function of the storage facility is to provide the necessary flow volume that satisfies the EGLE regulatory requirement to effectively reduce the potential for a wet weather sanitary overflow to occur no more than once every 10 years. After a wet weather event, the stored flow is then

dewatered back to the sanitary system and conveyed to the JWWTP for treatment as system capacity becomes available.

In addition to the storage tank volume, the following process equipment may also be necessary for the storage facility.

5.3.1 Pump Station

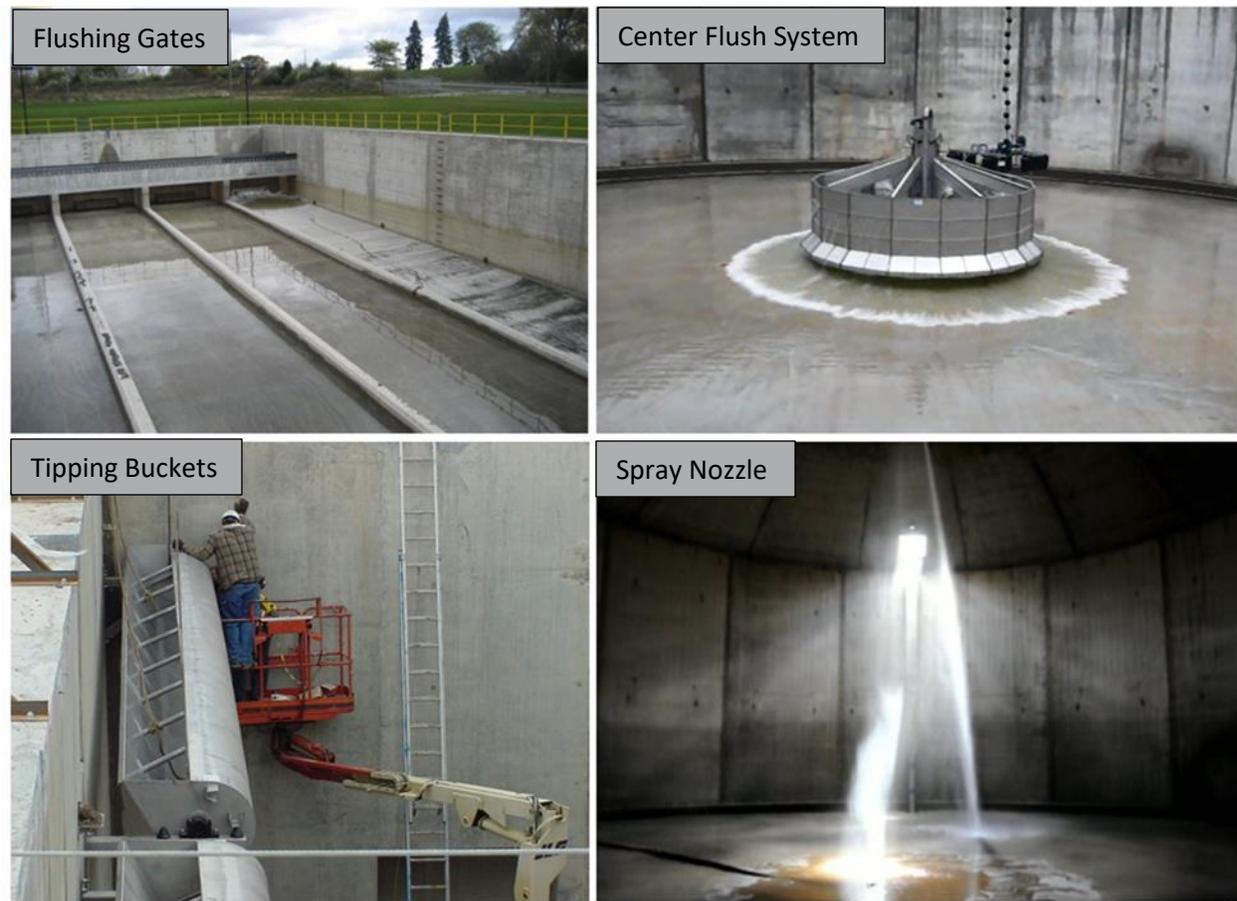
Typical storage tanks will require a pump station for either inlet or outlet flow discharge, or in some instances a combination of both. The pumping requirements for a specific storage option is dictated by the hydraulic elevations for the existing inlet/outlet sewers, the proposed diversion chamber control weir elevations, and proposed configuration for the storage option hydraulic elevations. Typically, above grade tanks require inlet pumping and are designed for gravity dewatering, while below grade tanks are designed to be either gravity in with pumped outflow or pumped in with gravity outflow.

5.3.2 Flushing

During the periods that excess wet weather sanitary flows are being held in the storage tank prior to dewatering, the potential exists for solids deposition to occur within the tank. These solids need to be flushed out of the tank after dewatering is completed to restore the full storage capacity of the tank for the next event. Flushing after each use also helps to mitigate odors that may occur if debris and settled solids are not removed.

There are various types of flushing systems utilized that are dependent on the shape and configuration of the storage tank. Typical flushing systems used for wastewater storage tanks are shown in **Figure 5-4**. The specific flushing system to be used for the selected storage option will be determined during final design.

Figure 5-4 Typical Flushing Systems for Storage Tanks



5.3.3 Optional Odor Control

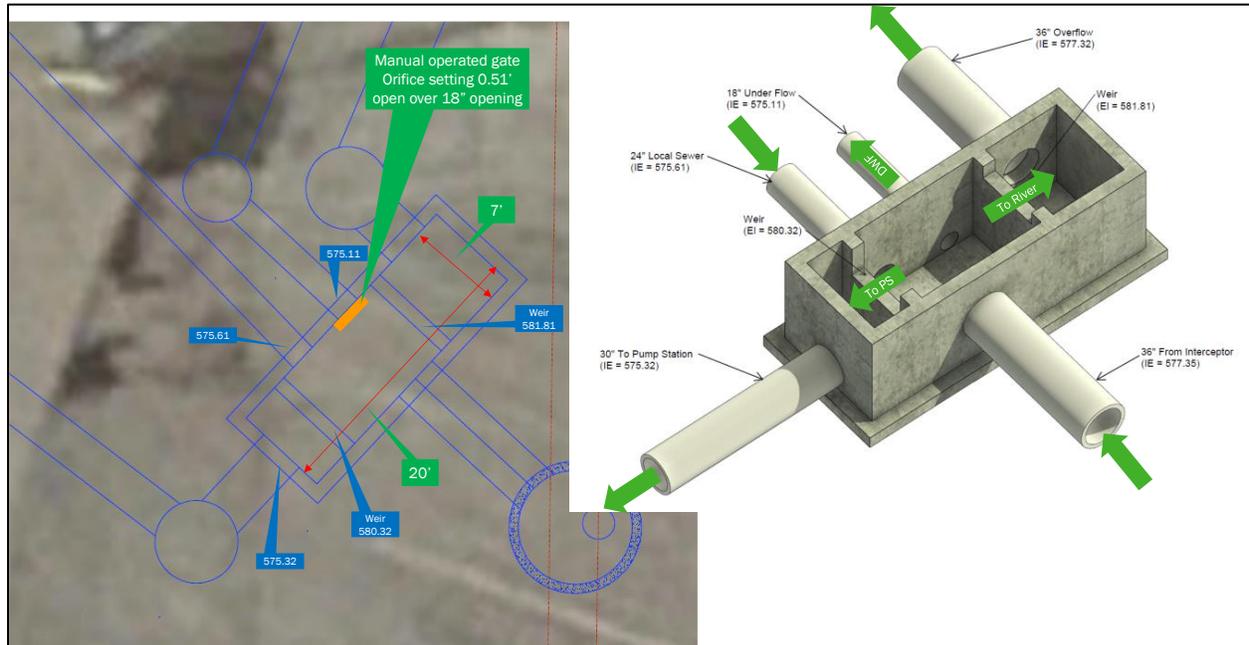
In some cases, odor control equipment may need to be provided for the storage facility as a regulatory requirement or to address Owner concerns on potential impact to the surrounding area. There are a number of equipment technologies available to mitigate odors that can be installed with the new tank or retrofit after the fact if odors become an issue. Typical systems utilize a ventilation fan to create a negative pressure to channel air flow through an activated carbon system or some other chemical process. Many installed systems are not used in practice and therefore may be best to defer for future consideration only if needed. Specific requirements for odor control for the selected St. Joseph storage tank option will be evaluated during final design and either added to the project or addressed by identifying a proposed location with adequate space for future retrofit if necessary.

5.3.4 Control Gates and Weirs

Flow diversion to the storage tank and dewatering after a storage event is controlled by diversion weirs and control gates. Ideally these hydraulic features are designed to the extent possible as

passive systems to avoid operational requirements during the wet weather event. The proposed concept for the CSO 005 diversion structure is shown in **Figure 5-5**.

Figure 5-5 Concept Design for CSO-005 Diversion Chamber



The use of passive diversion weirs set at varying heights with control gates for the treatment outlet and tank dewatering discharge allows normal dry weather flow to be routed to the underflow outlet pipe through a specified control gate setting to appropriately restrict the flow to the desired outlet discharge rate. As wet weather flows increase, flow will overtop the lower diversion weir toward the pump station and be pumped to the storage tank. When the tank is full as indicated by a level sensor in the tank, the pumps will be programmed to automatically shut down, which under the alternate performance criteria sizing should statistically occur no more frequently than once every ten years. Under emergency conditions for extreme events, the higher diversion weir will be overtopped with passive overflow control toward the emergency bypass.

5.4 Geotechnical and Environmental Considerations

A major design consideration for developing and evaluating feasible storage options is the existing geotechnical and environmental conditions that can impact short term construction and long-term performance of the installed structure. Since these factors can have significant cost impacts on the project, it is important to identify and evaluate these conditions from soil bore information available from historical projects, and also obtain site specific investigations. For this concept design report, the following information was obtained and reviewed:

1. Historical Soil Bores available from the following previous projects:

- 2004 Combined Sewer Project for the Ravine Interceptor Renovation that included the Kiwanis Park Site
 - 2017 CSO Project for the Ravine Interceptor improvements at the DPW Site, including Environmental Reports for the DPW site and adjacent properties.
2. SME Geotechnical Investigations for the Kiwanis Park Storage Options dated September 23, 2022
 3. SME Geotechnical Investigations for the DPW Site Storage Options dated June 29, 2023

The following is an overview summary of the existing geotechnical conditions at the two potential storage site locations, and the design considerations to be addressed for evaluating the various storage options. Additional details for the soil bore logs and preliminary geotechnical analysis conducted can be found in the referenced reports.

5.4.1 Subsurface Conditions

A generalized summary of the soils encountered in the preliminary series of borings is summarized as follows:

Stratum 1: Surface Materials. About 4 to 12 inches of topsoil or asphalt pavement was encountered at the surface of the borings.

Stratum 2: Natural Clays and Sands. Natural sands and clays were encountered below the surficial materials and extended to depths ranging from about 6 to 8 feet below the existing ground surface.

Stratum 3: Organic Silt. Organic silt (also called “marl”) was encountered below Stratum 2 and extended to depths ranging from 16 to 23 feet below the existing ground surface.

Stratum 4: Organic Clays, Sands, and Peat. Below Stratum 3, alternating strata of organic clays, sands and peats extended to a depth of 51 feet below the existing ground surface.

Stratum 5: Natural Clays, Sands, and Silts. Below Stratum 4 alternating strata of natural clays, sands, and silts were encountered either to the termination depth of the borings, or to the depth at which rock was encountered.

Stratum 6: Weathered Shale. Weathered shale was encountered at a depth of about 67.5 to 94.5 feet.

5.4.2 Groundwater Conditions

Groundwater was observed during drilling at depths ranging from about 3 to 22 feet below the existing ground surface. Groundwater was observed upon completion drilling of borings depths

ranging from about 4 to 7 feet below the existing ground surface. In general, the overall site groundwater levels are expected to be controlled by Lake Michigan and the St. Joseph River at about elevation 580 feet, however, higher groundwater levels are expected inland as the groundwater will be higher away from the river and lake. In any event, short- and long-term groundwater levels within Kiwanis Park and the DPW site are relatively shallow, with groundwater levels at or above the ground surface during flooding events.

5.4.3 Excavation, Dewatering, and Subgrade Considerations

Excavations of varying size and depth will be required for each of the proposed storage options. For critical utilities that convey fluids by gravity, settlement over time could lead to reduced or compromised hydraulic efficiency, and failures could occur at pipe joints if differential settlements occur over a relatively short distance. Due to the critical nature of the proposed structures, we recommend the proposed tank alternatives, and the proposed linear storage pipe alternative situated over organic soils be supported by a deep foundation pile system whereby the piles provide support for either the tank or pipes, and the piles transfer loads from these supported elements to suitable strata below the organic soils. For the linear storage option, consideration could also be given to undercut removal of organic soils and replacement with engineered fill to minimize potential settlements.

5.4.4 Pile Support Capacities

Based on the geotechnical investigations performed there are two deep foundation types determined to be appropriate for this project. The first foundation type utilizes auger cast piles. This method consisted of temporary steel casings through the organic materials. When the auger reaches a suitable soil strata concrete or grout is pumped through a hollow stem continuous flight auger. As the auger is extracted, removing a column of soil, this displaced soil is replaced with concrete, this method results in a large amount of spoils that need to be removed, but there is limited vibrations impacting surrounding structures and utilities. The capacities for the auger cast piles are given in **Table 5-1**.

The second deep foundation system consists of driven steel “H” -piles. For this type of foundation, a pile driving rig is used to drive, or hammer steel piles through the organic soils and into more competent soil strata, beneath the organic soils. This method has no spoils as the piles are driven through the soils, displacing the soils outward, instead of pulling the soils out of the ground. This method results in larger vibrations, though which need to be considered as possible impacts to surrounding structures and utilities. The capacities for drive steel “H” piles are given in **Table 5-2**.

Table 5-1 Preliminary ACIP Pile Working Capacities (B1)

PILE DIAMETER (INCHES)	ALLOWABLE WORKING CAPACITY IN COMPRESSION (KIPS)	ALLOWABLE WORKING CAPACITY IN TENSION (KIPS)
18	190	90
24	280	120
30	390	160
36	500	190

NOTES:

1. Capacities are based on a pile length of 50 feet and a top of pile elevation of 567 feet.
2. Capacities are based on using a minimum design spacing of at least three pile diameters between adjacent piles (center-to-center) within a group. The use of closer pile spacing would require additional evaluation of the group effect.
3. The allowable capacity in compression is based on a factor-of-safety of about 2 applied to the calculated ultimate pile capacity in compression.
4. The allowable capacity in tension is based on a factor-of-safety of about 3 applied to the calculated ultimate pile capacity in tension.

Table 5-2 Preliminary H-Pile Working Capacities (B1)

PILE SIZE	ALLOWABLE WORKING CAPACITY IN COMPRESSION (KIPS)	ALLOWABLE WORKING CAPACITY IN TENSION (KIPS)
HP12x53	160	80
HP14x73	200	100

NOTES:

1. Capacities are based on a pile length of 57 feet and a top of pile elevation of 567 feet.
2. The piles must be spaced a minimum of 3 pile diameters from center of pile to center of pile to achieve the factor driving resistance without a small group reduction.
3. The allowable capacity in compression is based on a factor-of-safety of about 2 applied to the calculated ultimate pile capacity in compression.
4. The allowable capacity in tension is based on a factor-of-safety of about 3 applied to the calculated ultimate pile capacity in tension.

5.5 Evaluation of Applicable Storage Technologies

Several construction technologies were identified and evaluated taking into consideration the required size of the storage tank, the hydraulic parameters of the project, and the anticipated subsurface conditions at the available property locations, A total of five different technologies were identified as potential options to provide the required storage volume. The five storage options evaluated for this project are as follows:

- A cast-in-place, below grade concrete structure
- An above ground wire and strand-wound circular prestressed concrete structure
- A large diameter Hobas Pipe linear storage system
- A circular, below grade, cast-in-place deep shaft
- A cast-in-place concrete structure constructed into the Kiwanis Park hillside

All five alternatives are technically feasible and can be constructed with common construction practices. However, various geotechnical considerations must be addressed when considering each

of the five alternatives as described below. These considerations include, but are not limited to, excavation support, groundwater control, the presence of organic soils, foundation support methods, and buoyancy of below-grade structures.

5.5.1 Below Ground Cast-in-Place Concrete Structure

The first storage technology evaluated was the construction of a below ground cast-in-place concrete tank. A conceptual design for this type of storage structure is shown in **Figure 5-6** and an example of what this type of structure looks like is shown in **Figure 5-7**. There are several features of this type of facility that could be beneficial for this project. Because the structure can be constructed where the storage volume is at a lower elevation than the influent hydraulic grade line, the facility can fill passively by gravity. As the flows in the sewer system increase, a portion of the flow is passively diverted to the storage tank by overtopping a weir and flowing by gravity into the below grade structure. This approach eliminates the need for a large pump station capable of pumping peak flows into the structure during wet weather events. In this arrangement a small, dewatering pump station would be required to dewater the contents of the tank after the wet weather event has subsided. Typically the size of a dewatering pump station would be much smaller than an influent pump station as it can dewater over a longer period of time.

Another benefit of this type of facility is that the completed facility is below the ground surface. The major benefit of being below the ground surface is that the structure is not visible to the public, and other site uses can be programmed for the site. One of the proposed locations for the equalization tank is in Kiwanis Park. If a below ground structure is selected at this location, other public facilities could be installed above the structure such as tennis courts, a parking lot, a skate park or other normal park amenities.

Figure 5-6 Concept Design for a Below Ground Cast-in-Place Concrete Storage Tank

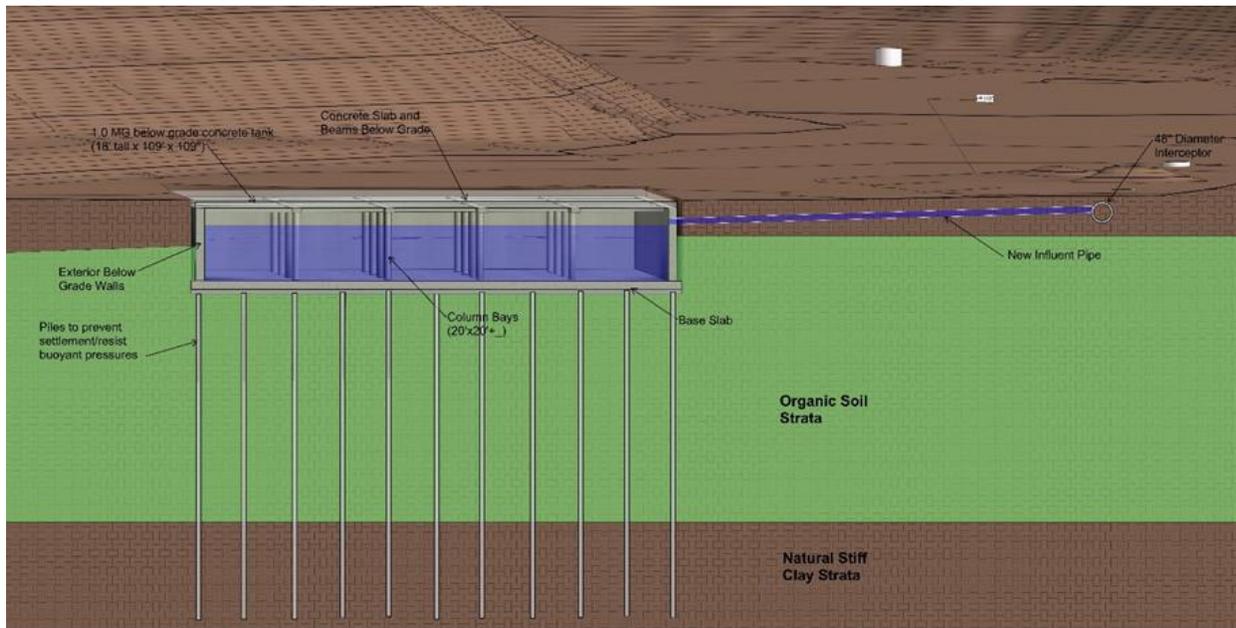


Figure 5-7 Example of a Below Ground Cast-in-Place Concrete Storage Tank



One of the downsides of this type of construction is potentially high construction costs. The major construction challenges that effect the construction cost of a below grade structure include the following:

- Excavation and backfilling for the structure
- Groundwater dewatering
- Deep foundations required to minimize settlements and to counter buoyant forces
- Temporary support of excavation systems required to facilitate the tank construction
- Robust concrete walls and slabs required to retain soil and hydrostatic forces

To construct a below ground structure a large volume of excavation is required. The volume of the storage facility, overburden soils above the tank, and soils beyond the structures' walls need to be removed to facilitate the structure's construction.

At the properties being considered for this project, the groundwater levels are high (similar in elevation to the adjacent waterways). To construct a below ground structure, the groundwater table at the project site would need to be lowered below the proposed excavation depth. As the soils in these locations consist of organic and granular layers to a relatively deep level, a water cut-off system would be required to cut-off the groundwater facilitating local dewatering.

For a below ground structure constructed in an area with a high-water table, there are large buoyant forces on the structure during the times when the structure is empty. These buoyant forces are typically resisted with a deep, pile foundation system, which is typically expensive.

The soils encountered at the proposed project sites consist of very weak, organic soils. To safely retain these soils during construction and to cut off groundwater in these soils a deep support of excavation system is required. This system would consist of a robust, braced sheeted, or augered concrete pile system, which at these depths can be very costly.

Finally, to resist the large below ground soil pressures, the structural system would need thicker, more heavily reinforced elements than an above grade structure.

5.5.2 Above Ground Wire-and Strand-Wound, Circular, Prestressed Concrete Structure (AWWA D110)

An above ground wire-and strand wound, circular, prestressed concrete structure is another construction technology that was evaluated for this project. A conceptual design for this type of storage structure is shown in **Figure 5-8** and an example of what this type of structure looks like is shown in **Figure 5-9**. There are several features of this type of facility that could be beneficial for this project. One of the key benefits of this type of facility is that historically this type of construction is considerably less expensive than other options. The key reasons these facilities are less expensive than other technologies include the following:

- Little or no excavation is required
- No support of excavation systems required

- Lowering the groundwater table during construction is typically not required
- Forces imposed on the structure are low, and the circular configuration is an efficient structural system

Figure 5-8 Concept Design for an Above Ground Circular Storage Tank

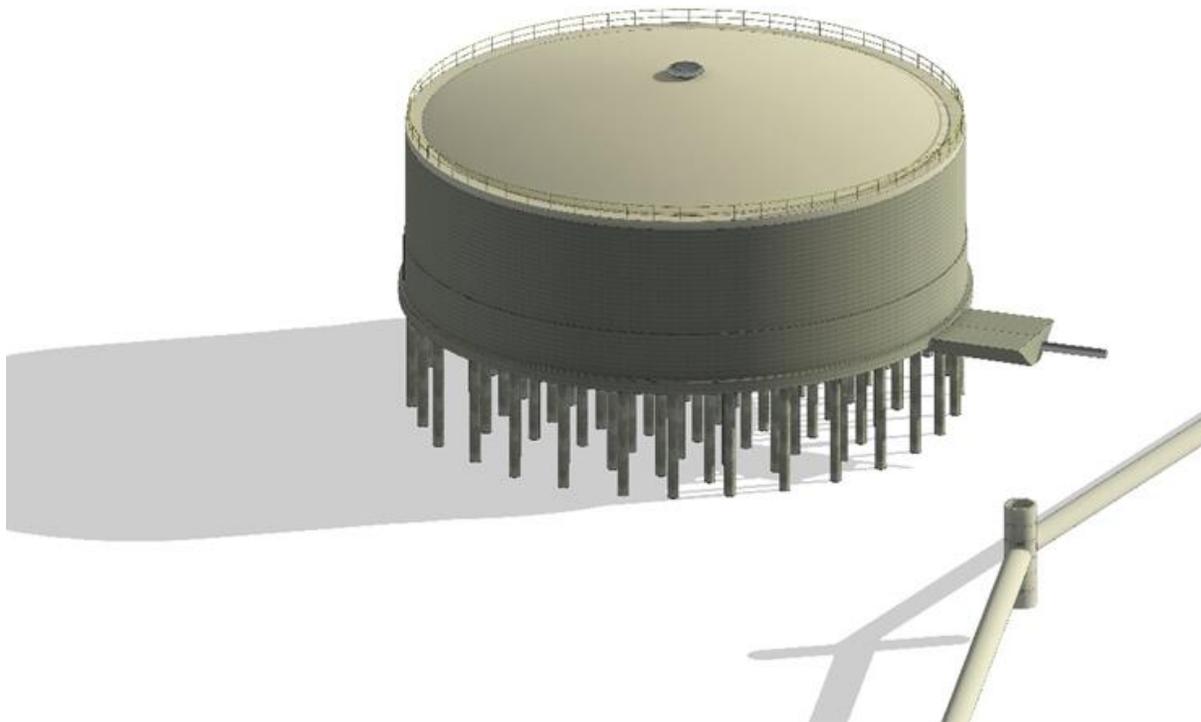


Figure 5-9 Example of an Above Ground Circular Storage Tank



The sites being considered for the project typically have very poor soils consisting of deep pockets of organic materials with a very high groundwater table. The above ground storage tank concept avoids most of the high costs associated with these soil related challenges. Because the structure is primarily constructed above the ground surface, little excavation or groundwater control will be required, and therefore no temporary support of excavation systems will be required.

The new structure and proposed CSO contents, however, will surcharge the site. These increased loads, constructed over the organic soils, will require a deep, pile foundation system.

Another benefit of the circular configuration of the structure is that the walls of the structure are primarily placed on tension. These tension forces are efficiently resisted by the high strength, wire windings. This approach utilizes concrete primarily as a method of covering and protecting the wire strands, reducing the volume of concrete required, thereby reducing the overall cost of the structure.

The two major downsides of this storage technology are as follows:

- The storage structure is above the ground surface, which to many, is considered an eyesore to the community, which occupies space that cannot be used for other public use or recreation

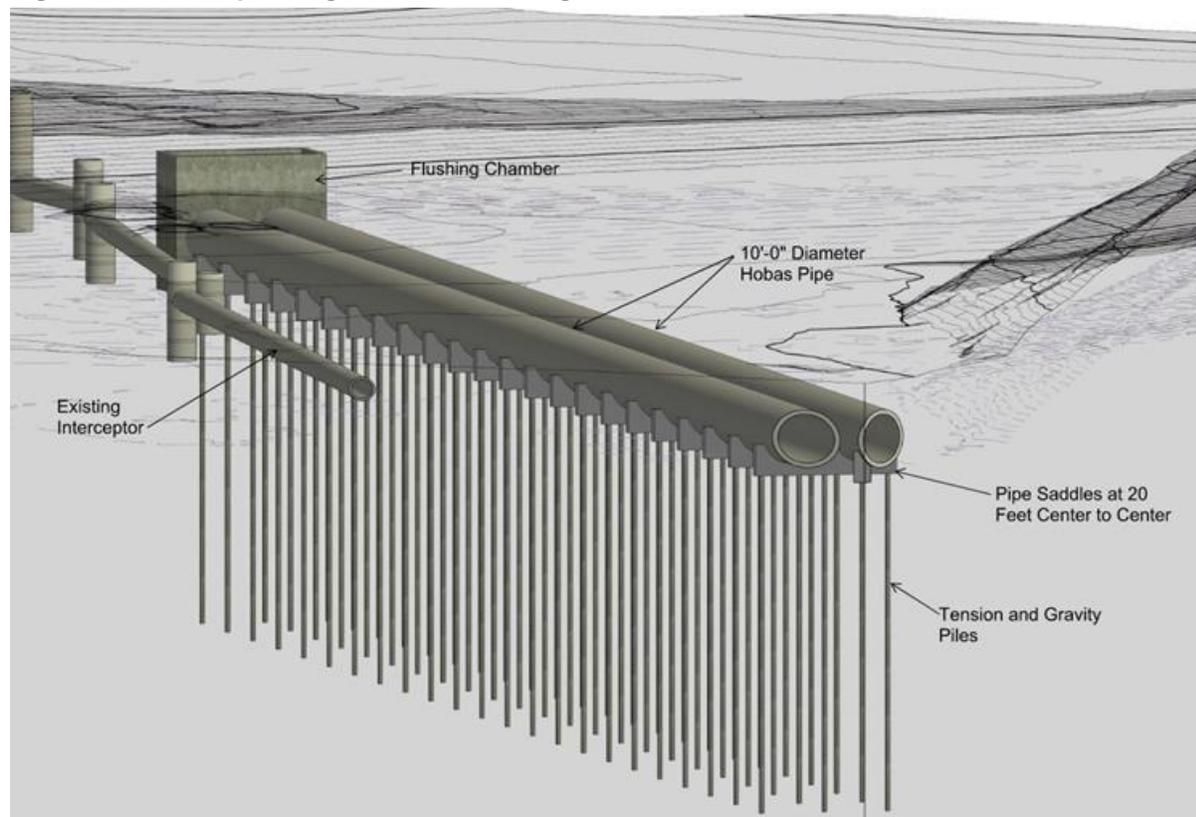
- An influent pump station capable of pumping peak flows during a wet weather event is required to pump flow into the structure

The proposed structure will be approximately 80 feet in diameter, with an overall height of the approximately 35 feet, so the structure will be very visible to the surrounding community. One of the proposed sites for the storage tank is in the south end of Kiwanis Park. This park is surrounded by residential neighborhoods located on the top of the surrounding hillsides. The proposed tank would be very visible to people visiting the park and would be visible to the surrounding residents in the winter when the leaves are off the trees between the storage tank and the surrounding neighbors. The proposed structure would occupy space that is currently a greenspace in the park. The visual impacts at the alternative DPW site would be less and would not diminish the footprint of the public park.

5.5.3 Large Diameter Hobas Pipe – Linear Storage

A third storage technology evaluated was the construction of large-diameter linear storage pipes. This system would run parallel to the existing interceptor sewers in the Kiwanis Park. As wet weather events occur, flows would be diverted into this parallel system for temporary storage, which would be dewatered back into the sewers after the wet weather event subsides. A concept design for this type of storage is shown in **Figure 5-10**. The benefits of this system are similar to the benefits of a below ground concrete tank.

Figure 5-10 Concept Design for Linear Storage



First the facility would fill during a wet weather event by gravity. As the flows in the sewer system increase a portion of the flow is passively diverted to the storage pipes by overtopping a weir and flowing by gravity into the below grade system. Because the structure can be constructed where the storage volume is at a lower elevation than the influent hydraulic grade line, the facility can fill passively by gravity. This approach eliminates the need for a large pump station capable of pumping peak flows into the structure during wet weather events. In this arrangement a small, dewatering pump station would be required to dewater the contents of the tank after the wet weather event has subsided. Typically, the size of a dewatering pump station would be much smaller than an influent pump station as it can dewater over a longer period of time.

Another benefit of this type of facility is that the completed facility is below the ground surface. The major benefit of being below the ground surface is that the structure is not visible to the public, and other site uses can be programmed for the site. One of the proposed locations for the equalization tank is in Kiwanis Park. If a below ground structure is selected at this location, other public facilities could be installed above the structure such as tennis courts, a parking lot, a skate park or other normal park amenities.

The downsides of this type of construction are potentially high construction cost and a large disruption requiring closure of the park during construction. The major construction challenges that effect the construction cost of a below grade structure include the following:

- Excavation and backfilling for the structure
- Groundwater dewatering
- Deep foundations required to minimize settlements and to counter buoyant forces
- Temporary support of excavation systems required to facilitate the tank construction
- Disruption of the majority of Kiwanis Park during construction

To construct a linear storage system, a large volume of excavation is required. The volume of the pipes, the space between the pipes, and the overburden above the pipes would need to be excavated and backfilled. To perform these excavations, the groundwater table at the project site would need to be lowered below the proposed excavation depth. As the soils in these locations consist of organic and granular layers to a relatively deep level, a water cut-off system would be required to cut-off the groundwater facilitating local dewatering.

For a linear storage system constructed in an area with a high-water table, there are large buoyant forces on the pipes when they are empty. These buoyant forces are typically resisted with saddles and a deep pile foundation system, which is typically expensive.

The soils encountered at the proposed project sites consist of very weak, organic soils. To safely retain these soils during construction and to cut off groundwater in these soils, a deep support of excavation system is required. This system would consist of a robust, braced sheeted, or augured concrete pile system, which at these depths can be very costly.

5.5.4 Circular, Cast-in-Place, Below Grade Deep Shaft

Another storage technology that was considered for this project was a circular, cast-in-place concrete deep shaft. The conceptual design for this type of storage is shown in **Figure 5-11**. This construction technology can be an efficient method of constructing below grade structures at sites with the proper sub-surface soil conditions. The circular configuration is an efficient structural system, and in certain soil types, the structure can be constructed as a “sinking caisson”. A sinking caisson is constructed from the ground surface, and the weight of the structure as it is being constructed causes the entire structure to sink as additional weight is being added. As the newly poured concrete walls cure, the soils inside the structure are excavated, reducing the friction of the walls, allowing the structure to continue to “sink” to its final bearing elevation. This approach can be cost effective because in the right soils, the structure walls act as the support of excavation, eliminating the need for a separate temporary system. Also, in cohesive soils, the structure can act as a groundwater cutoff, simplifying the groundwater dewatering system requirements. An example of this type of storage tank during

construction is shown in **Figure 5-12**. This option has the other benefits of the below grade, cast-in-place concrete structure including the following benefits:

- The facility fills passively, by gravity, minimizing the pump station requirements.
- The finished structure is below grade, eliminating negative visual impacts on to the surrounding community
- The real-estate above the facility can be utilized as recreational facilities

Figure 5-11 Concept Design for Circular Deep Shaft

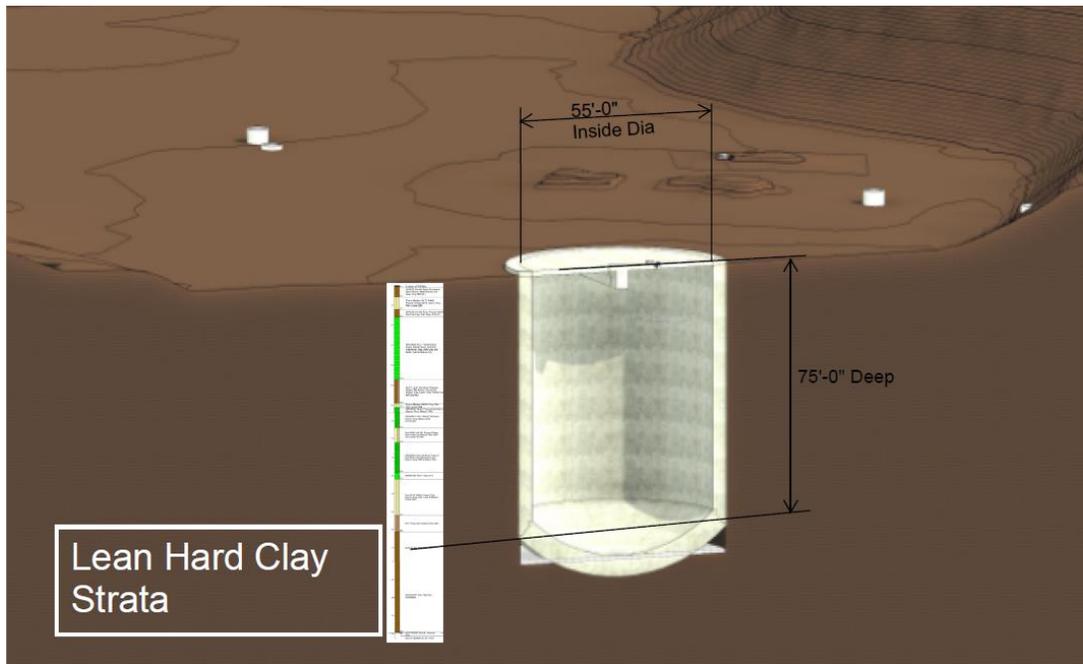
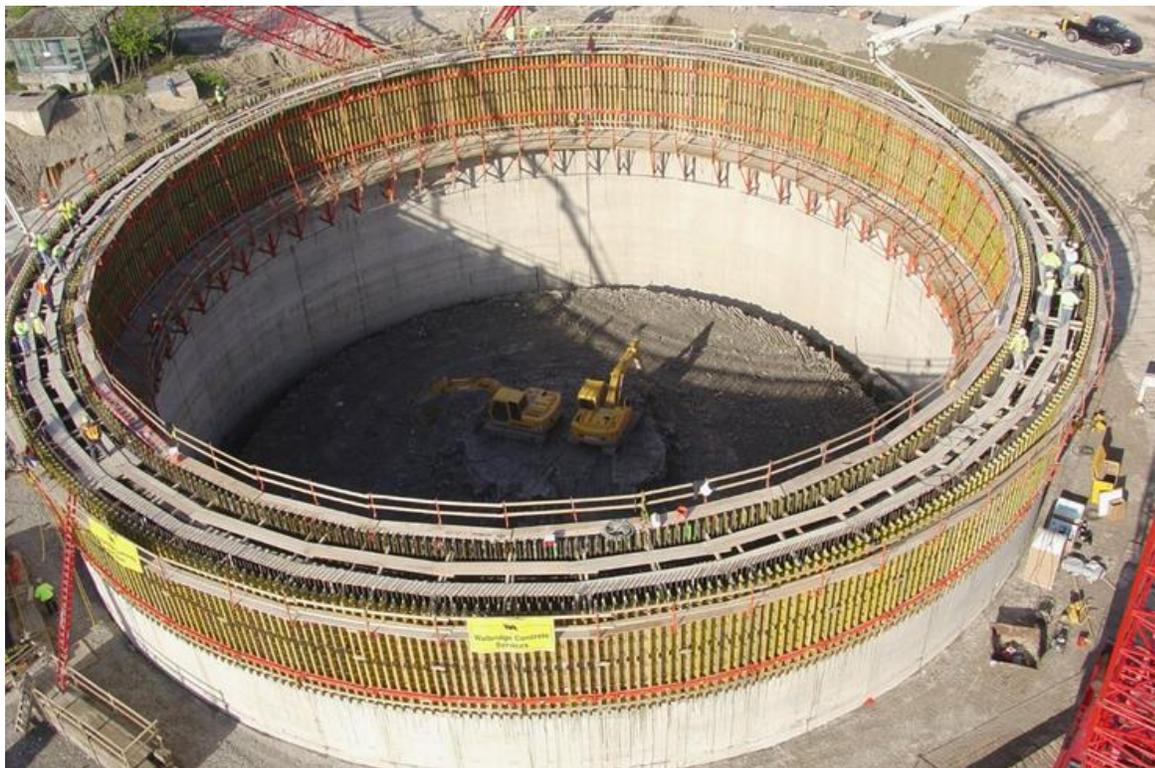


Figure 5-12 Example of Circular Deep Shaft Construction

Unfortunately, the subsurface conditions at the proposed facility locations do not support the “sinking caisson” technology. Due to the variable conditions and the extremely soft organic layers of soils at the site, controlling the rate of sinking and alignment of the structure during construction would be extremely risky. At these sites, constructing a deep shaft structure would require an independent support of excavation system to safely excavate and dewater the site during construction.

5.5.5 Cast-in-Place Concrete Structure Constructed into Hillside

The final storage technology evaluated was the construction of a cast-in-place concrete tank built into the Kiwanis Park hillside. This concept has some of the benefits and downsides of both the above grade structures and the below grade, cast-in-place concrete options. An example of construction of a tank in the hillside is shown in **Figure 5-13**. The benefits of this type of construction include the following:

- The completed structure is largely concealed from view as it is mostly covered on three sides
- The structure is located above the groundwater table
- Minimal impact on the usable footprint of the park for recreational purposes

Figure 5-13 Example of Hillside Storage Tank Construction



The downside of this concept includes the following:

- An influent pump station capable of pumping peak storm flows is required
- The support of excavation system required to stabilize the hillside during construction (risk to impacts on residential properties at the top of the hill)
- Constructing a foundation system to resist the lateral soil pressures from the hillside excavation

6.0 PRELIMINARY SCREENING OF STORAGE OPTIONS

The original plan was to provide a storage facility at the Kiwanis Park Site. A preliminary design of each of the five storage technologies described in Section 5.5 was performed for each option. These preliminary designs were then evaluated based on several relevant criteria. These criteria include the following:

- Capital Cost of Construction Focusing on the Structure Cost
- Visual Impact on the surrounding residents and visual impacts on the park.
- Constructability impacts and construction risk
- Future operational and maintenance impacts

As the preliminary designs were evaluated for the Kiwanis Park site, the DPW Yard was identified as a second potential site for the storage facility, and as the preferred location for the proposed diversion structure and pump station for the project. As the preliminary design progressed, an evaluation was performed to determine which technology was appropriate for each of the two site locations. The results of this preliminary screening process are described in this section.

6.1 Initial Alternatives Considered

Based on the review of the potential storage structure technologies and land availability within the two City owned properties, a total of 7 initial alternatives were initially identified as potential options to provide the required 1 MG of storage volume identified from the hydraulic model analysis performance criteria evaluation. The location for these seven storage options are shown in **Figure 6-1** and listed below.

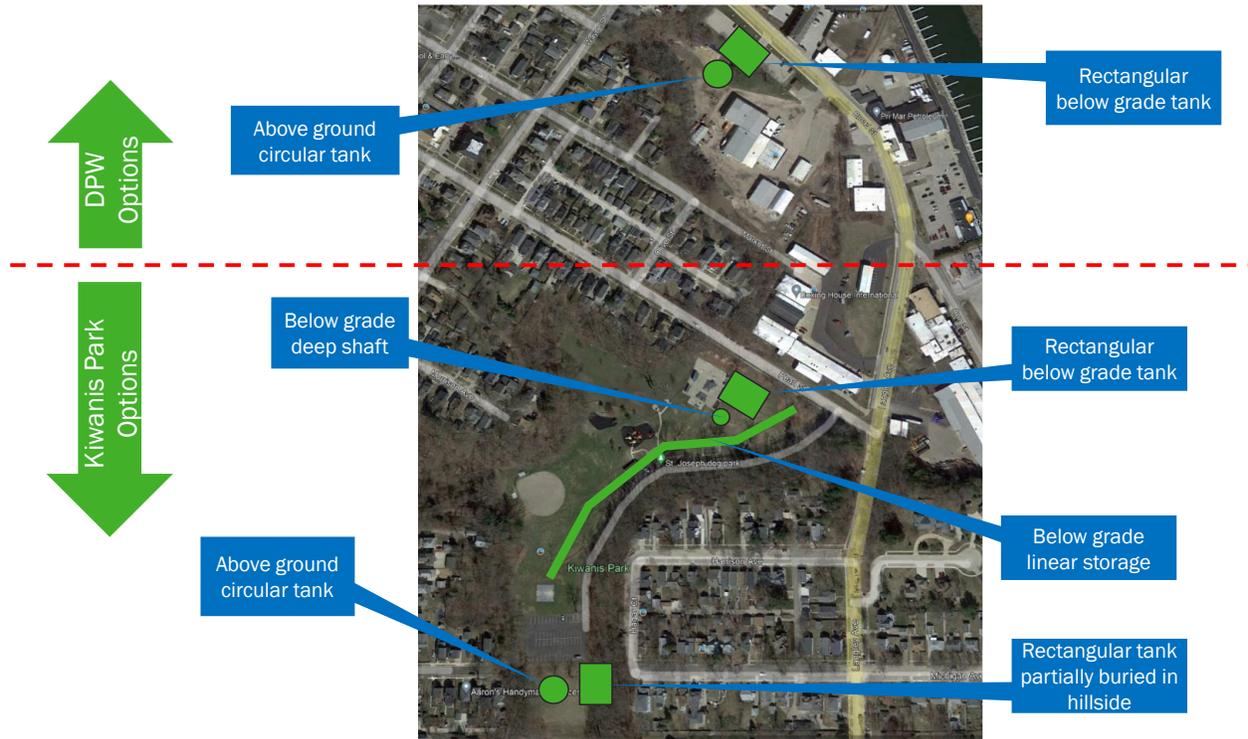
Kiwanis Park Site:

1. Above ground circular storage tank located at the South end of Kiwanis Park
2. Linear storage extending through 1,000-feet of the park starting at the North end of the park
3. Rectangular below grade storage located at the North end of Kiwanis Park
4. Deep Shaft located at the North end of Kiwanis Park
5. Rectangular storage tank partially embedded in the hillsides at the South end of Kiwanis Park

DPW Site:

6. Above ground circular storage located in the Northwest portion of the DPW yard.
7. Below grade rectangular storage under the Box Factory parking lot. This location is outside of the DPW yard fence line.

Figure 6-1 Preliminary Alternative Options



6.2 Preliminary Screening

The potential storage options identified at each site were evaluated by comparing the pros and cons for each option, with review of initial cost comparisons focusing on the major cost component related to the storage structure only. The alternatives were based on the design considerations presented in the Section 5.0 and addressed the site-specific information gathered for local geotechnical conditions at each of the storage sites for review of siting impacts for short term constructability requirements, visual impact after construction, and the long-term operations and maintenance of the storage facility.

The following narratives discuss the comparison of the key features and conclusions of the preliminary screening evaluation for the various storage options considered.

6.2.1 Below Grade Storage

Below Grade Storage was selected for further consideration as having the least long-term visual impact after construction as the sites could be restored for their current use. Portions of the basin footprint can also be used for other activities. Locations for consideration include the open area at the north end of Kiwanis Park that could remain available for park activities and at the DPW site under the existing Box Factory parking lot. Both locations however will have moderate construction

impacts during construction, and high costs for the buried structure and support of excavation. This option had the potential to offset the higher construction cost with an overall better public acceptance due to reduced visual impact.

This option was assumed to be viable and was carried forward for more detailed evaluation.

6.2.2 Above Grade Storage

Above Grade Circular Storage was determined to be the lowest cost option. Because this is an above grade basin, it has a higher visual impact than the other options. The Kiwanis Park location will have moderate visual impact if placed in the open area south of the existing parking lot. The visual impacts are considered moderate at the DPW site as it can be constructed in the open area along the far west end of the existing site and screened from adjacent neighborhoods by the existing trees on the slope to the west and south of the proposed location. Both the Kiwanis Park and DPW basin site options will have the diversion chamber and influent pump station located at the DPW. This option had the potential to offset the higher visual impact with lower overall cost.

This option was assumed to be viable and was carried forward for more detailed evaluation.

6.2.3 Linear Pipe Storage

Linear Pipe Storage is constructed entirely below grade virtually eliminating the visual impact of the storage. Portions of the basin footprint can also be used for other activities after construction. In most applications, linear storage can be a very cost effected storage solution. However, due to poor soil conditions, pile supports will be required along the entire length of the linear storage which significantly increases the cost for construction. Installation of the pile supports will impact the surrounding neighborhood during installation. The linear storage will impact a larger portion of the park during construction and will have the largest impact on existing structures and infrastructure. This option is not applicable to the DPW site due to property constraints.

Due to higher construction costs and increased impacts to the park during construction, this option was assumed not to be viable and was not carried forward for more detailed evaluation.

6.2.4 Deep Shaft Storage

Deep Shaft storage has a small overall footprint and is constructed entirely below grade virtually eliminating the visual impact of the storage. Portions of the basin footprint can also be used for other activities. Due to its depth, pile supports will likely not be required for construction. However, the poor soil conditions require very expensive support of excavation. This option is assumed to have high construction risks relative to the other options considered. The depth of the structure also increases the long-term operation and maintenance including the post event dewatering pumping and flushing systems for sediment removal.

Based on the above considerations, this option was not carried forward for more detailed evaluation.

6.2.5 Hillside Storage

Partially embedding a storage tank within the hillside is intended to reduce the overall visual impact of the basin. Due to poor soil conditions, this option was assumed to have the highest risk for potential impacts to the residents due to concerns of slope stability during construction, and the excessive cost for hillside support of excavation and tree clearing necessary for construction. To minimize these risks significantly drives up the cost for construction.

Due to high construction risks and costs, this option was not carried forward for more detailed evaluation.

6.2.6 Summary of Options Selected for Detailed Evaluation

Based on the initial screening described above, a summary of the preliminary screening categories is presented in **Table 6-1**. This preliminary screening was based on the minimum storage requirement of 1.0 MG.

Table 6-1 Preliminary Screening Categories – Assuming 1.0 MG Storage Volume

	Alternative									
	A		B		C		D		E	
Storage Technology Type	Above Ground D-110 Circular Tank		Below Ground EQ Tank		Lineal Storage (Round or Circular Culverts)		Deep Shaft		Hillside - Partially Buried Concrete Tank	
Location	Kiwanis	DPW	Kiwanis	DPW	Kiwanis	DPW	Kiwanis	DPW	Kiwanis	DPW
Dimensions	80' Dia x 35' Tall	80' Dia x 35' Tall	110'x65'x 21' Tall	120'x100'x 14' Tall	(2)-10' Dia x 1,000 Feet Long	NA	55' Dia x 75 Feet Deep	55' Dia x 75 Feet Deep	80' x 100' x 22.5' Tall	NA
Capital Cost * (Main Structure Only)	\$3,370,000	\$4,800,000	\$12,100,000	\$17,500,000	\$16,375,000	NA	\$6,500,000	\$6,500,000	\$10,450,000	NA
Visual Impact	Moderate	Moderate	Low	Low	High During Construction	NA	Low	Low	Moderate	NA
Construction Risk	Low	Low	Moderate	Moderate	Moderate	NA	High	High	High	NA
Future O & M Impacts	Moderate	Low	Moderate	Low	Moderate	NA	High	High	Moderate	NA

Based on these results the options selected to be carried forward for more detailed evaluation include:

1. Option A – Above grade circular storage location within the DPW yard.
2. Option B – Rectangular below grade storage located under the Box Factory parking lot
3. Option C – Above grade circular storage located at the South end of Kiwanis Park
4. Option D – Rectangular below grade storage located at the North end of Kiwanis Park

7.0 FINAL EVALUATION OF SHORT-LISTED OPTIONS

The four storage options identified for detailed evaluation were further evaluated for refined cost evaluation of the full project components. This included the storage tanks, diversion chamber, inlet and outlet sewers, and other necessary features. This section presents the results of the final evaluation for selecting the preferred option.

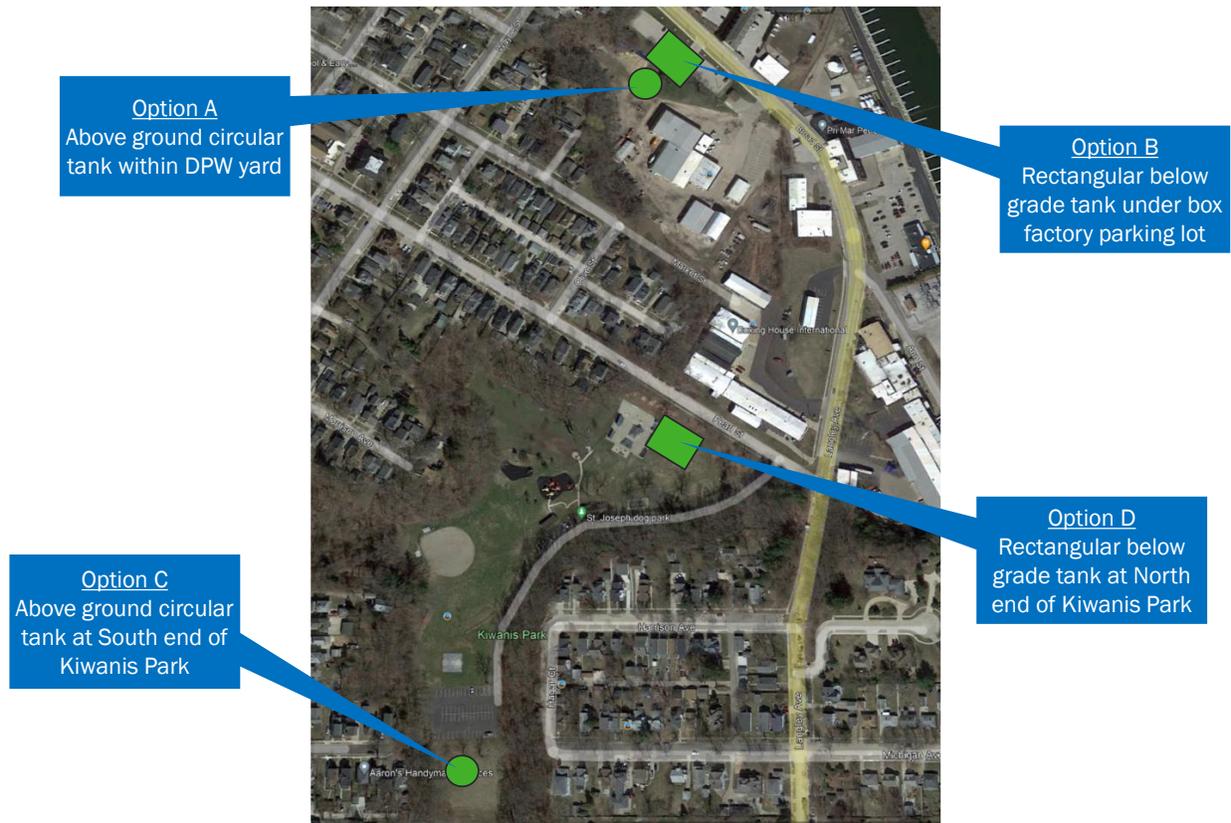
For the final cost comparisons of the short-listed options, it was decided that an additional 20% factor of safety would be added to the storage volume requirement. This additional 20% storage volume provides flexibility for addressing details of the storage basin control system that will be necessary for optimizing flow delivered to the JWWTP in conjunction with the new underflow pipe. The 1.2 MG storage volume is consistent with the anticipated storage tank sizing identified in previous Project Plan evaluations and will be further refined and confirmed as needed during final design. Also, due to the proximity of portions of the new sewer work within the Pri Mar Petroleum property and adjacent Broad Street right-of way, contingency costs were added to both the underflow pipe, Broad Street sewer work, and force mains. This additional cost addresses potential treatment of sewer construction dewatering that may be necessary in these areas.

7.1 Description of Final Alternatives

7.1.1 Basin Structure Type and Location

The four options carried forwarded for final analysis are identified by the type of storage structure and proposed site configuration footprint required for short term construction and long-term O & M access. The proposed locations are shown in **Figure 7-1**. All options assumed a total required storage volume of 1.2 MG.

Figure 7-1 Final Alternative Storage Option Locations



Option A: Above Ground Tank at DPW Site

This option consists of a D-110 Storage tank constructed within the open area within the west side of the DPW site currently used for material storage. The storage will be 80-feet in diameter and will measure 40-feet to the crown of the dome.

Option B: Below Grade Tank at DPW Site

The proposed location for an underground tank option at the DPW site would be under a portion of the existing parking lot along Broad Street on the north end of the City DPW property. The underground tank would be a cast in place concrete structure that would be configured to allow the parking lot to be reconstructed over the buried tank. The dimensions of the storage will be 100-foot wide, 144-foot long, and an average structure height of 14-feet.

Option C: Above Grade Tank at Kiwanis Park Site

This option consists of a D-110 Storage tank constructed within the open area within the west side of the DPW site currently used for material storage. The storage will be 80-feet in diameter and will measure 40-feet to the crown of the dome.

Option D: Below Grade Tank at Kiwanis Park Site

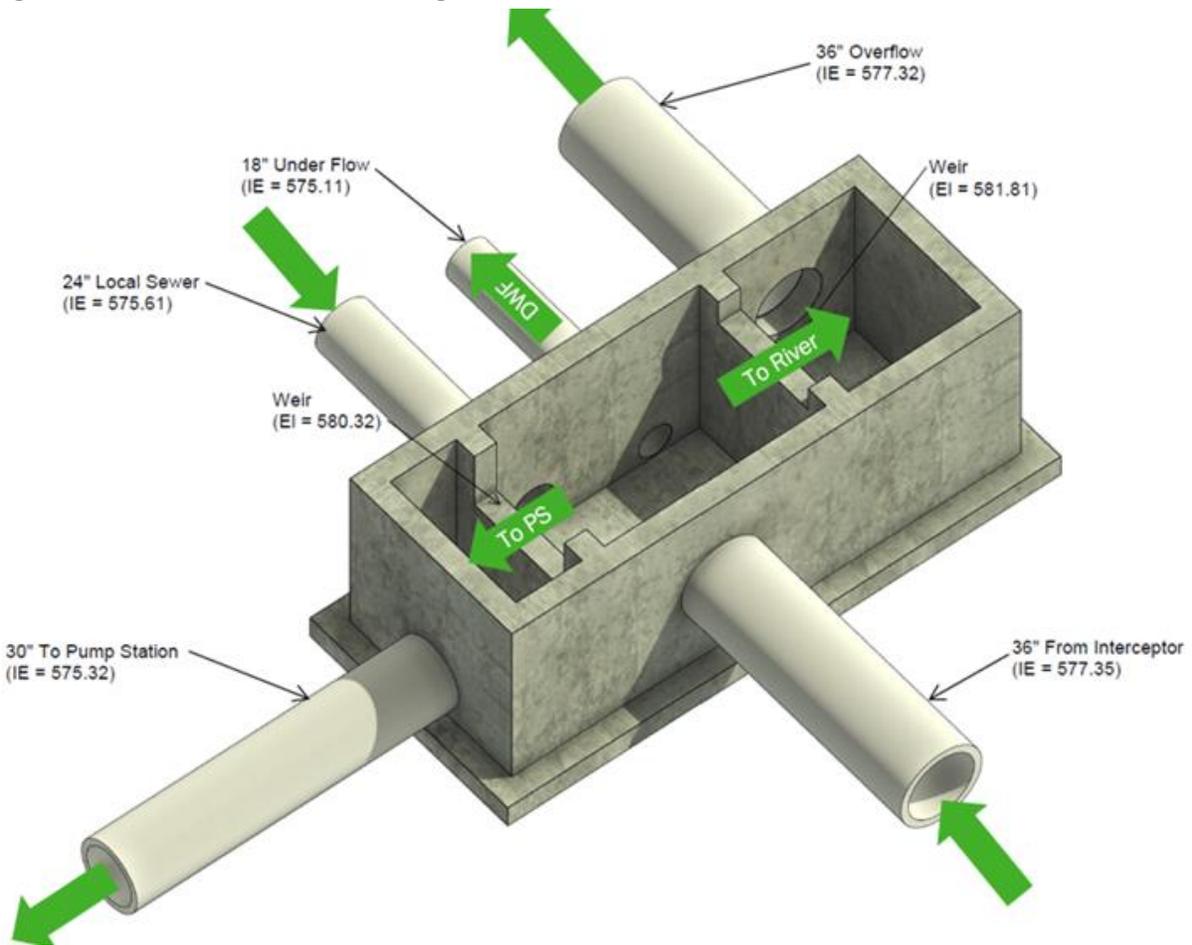
The underground tank option at the Kiwanis Park site would be located within the open area at the north end of the park west of the entrance road along Pearl Street. The underground tank would be a cast in place concrete structure. The dimensions of the storage will be 65-feet wide, 132-feet long, and an average height of 21-feet. This location would allow the site to be restored for future park use on top of the buried tank.

7.1.2 Diversion Chamber and Pump Station

The hydraulic analysis evaluations identified that the optimal location for the new diversion chamber was near the existing CSO-005 chamber at the DPW site. This location provides several advantages to minimize required storage volume, maximize use of available interceptor capacity, and provide increased ability to maintain acceptable hydraulic control of flow in and out of the storage tank, as well as control dewatering to optimize flow delivered to the JWWTP. This area was also identified as the best location for siting the pump station for convenience and reliability of operations by DPW staff.

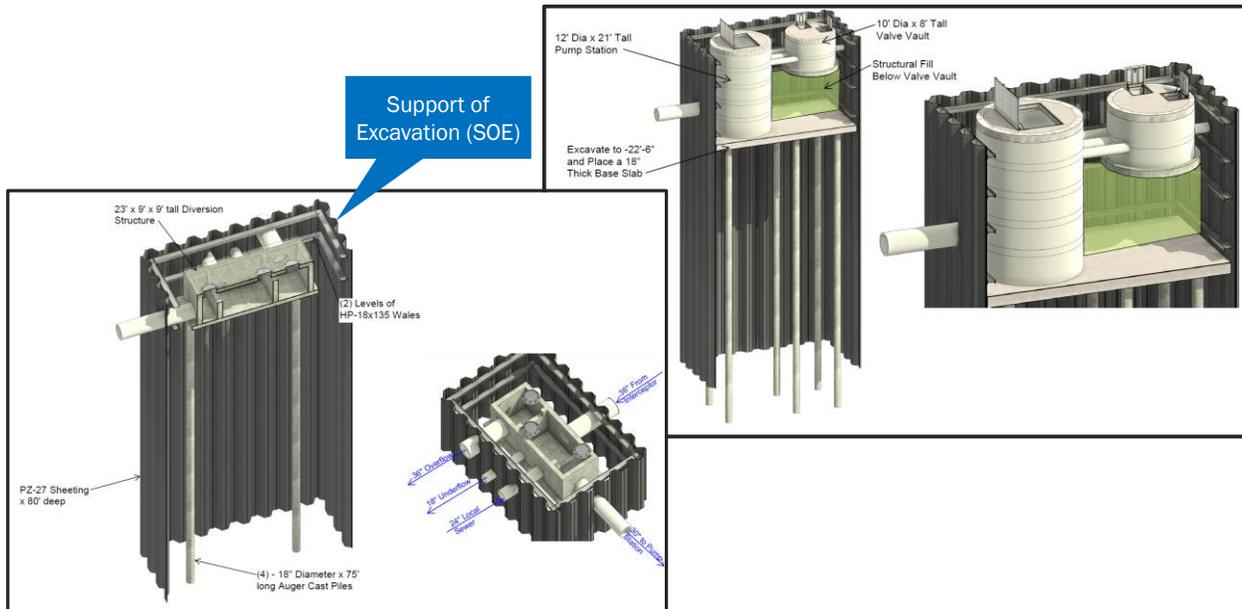
The proposed locations for the new diversion chamber and pump station in relation to existing sanitary and storm sewers is shown in **Figure 7-2**. The proposed configuration for the new diversion chamber, with the associated connecting sewers to the pump station, underflow pipe, and existing CSO-005 chamber, are shown in blue. This configuration allows the existing separated storm sewers (shown in orange) to be left in place, and discharge to the existing 60-inch storm sewer flowing east to the Morrison Channel. The new diversion chamber also provides an emergency overflow for extreme storm events beyond the EGLE performance criteria requirements for the separated system storage tank. Additional details for the new diversion chamber are shown in **Figure 7-3**.

Figure 7-3 Diversion Chamber Configuration



Due to the poor soil conditions at the DPW, an extensive support of excavation (SOE) will be required. The preliminary SOE design includes steel sheeting and pile supports as shown in **Figure 7-4**.

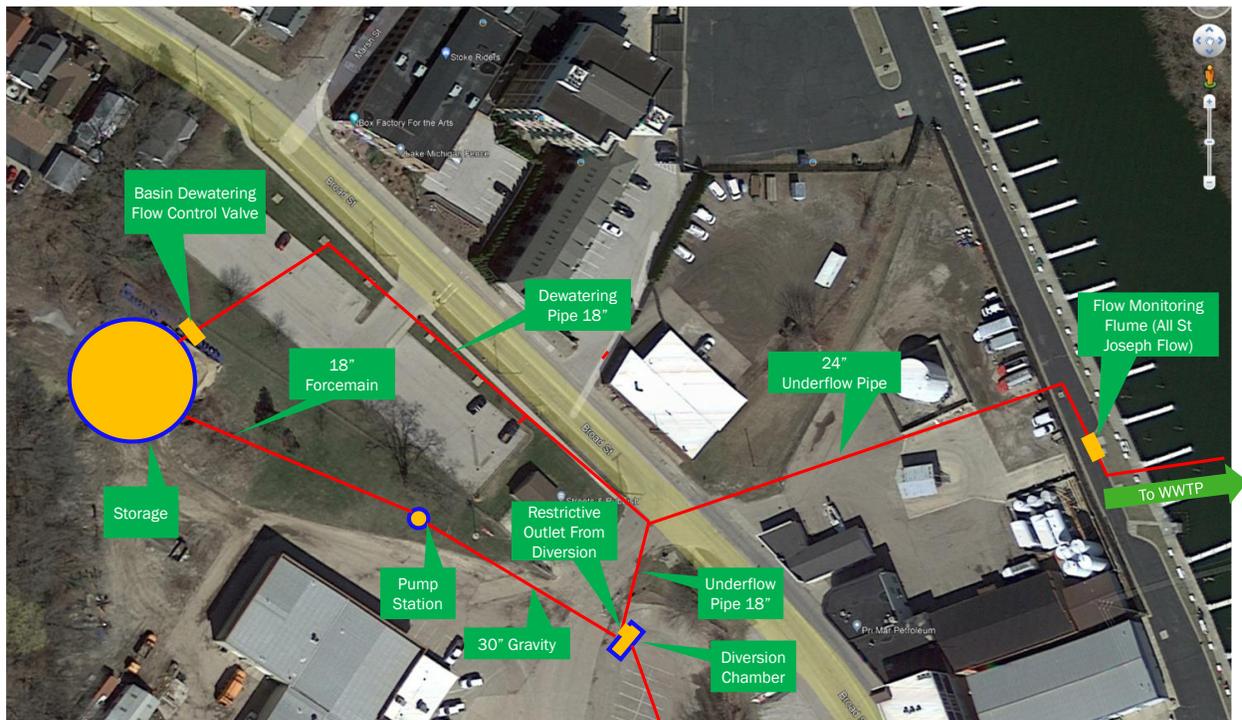
Figure 7-4 Diversion Chamber and Pump Station SOE



7.1.3 DPW Site Inlet and Outlet Sewers

The proposed inlet and outlet sewers for the two DPW site storage options are shown in **Figure 7-5**. Both DPW tank options require an 18-inch force main connection from the pump station to the storage tank, and an 18-inch inch dewatering sewer from the storage tank to the junction manhole for the underflow pipe outlet. The existing 12-inch underflow pipe from the existing diversion chamber to the North interceptor will be replaced with an 18-inch sewer to the dewatering line outlet connection, and a new 24-inch sewer from the junction manhole downstream through the Primar property to the existing interceptor.

Figure 7-5 DPW Site Inlet and Outlet Sewers

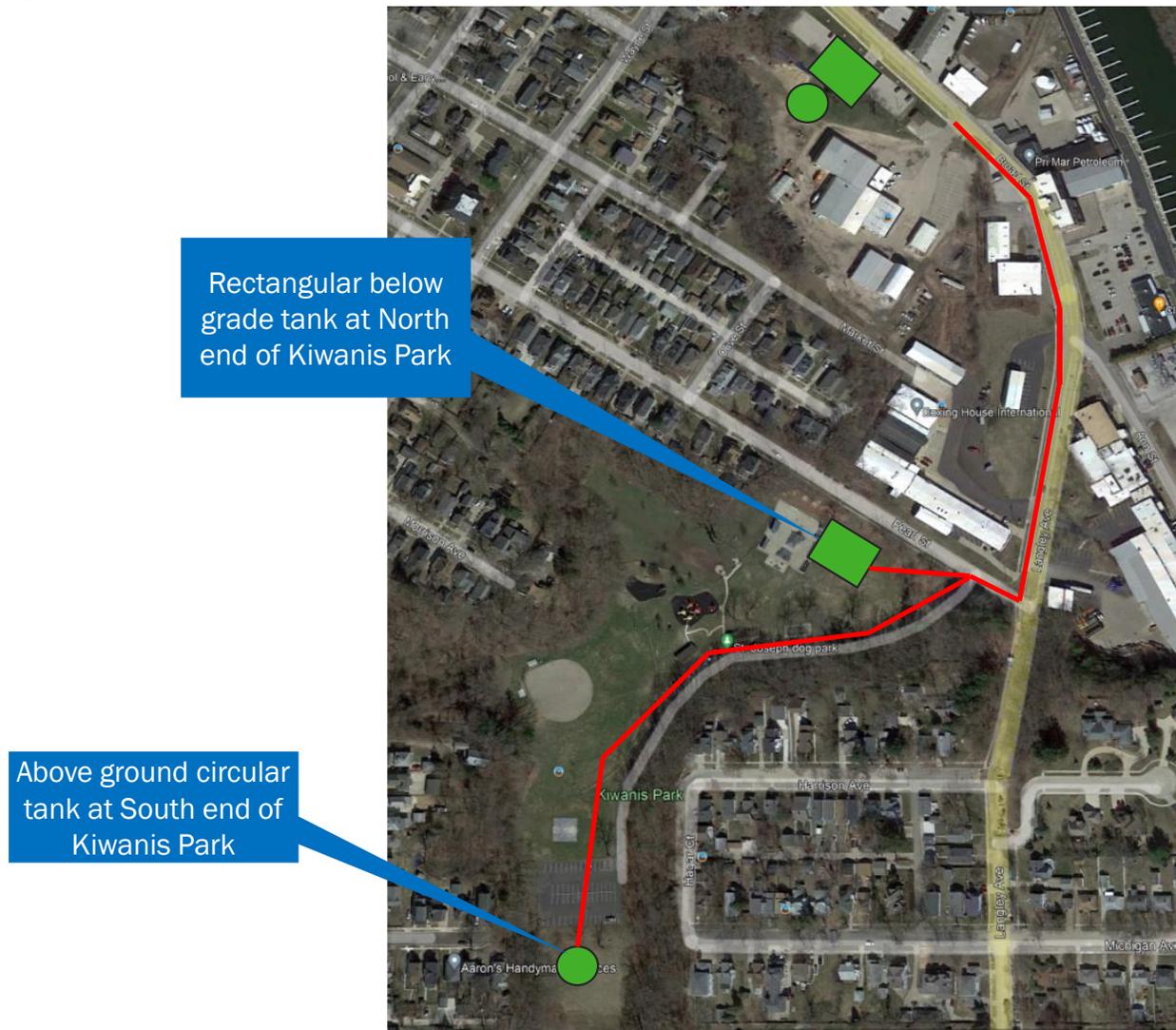


7.1.4 Kiwanis Park Inlet and Outlet Sewers Routes

To maintain the hydraulic and operational efficiencies for minimizing storage volume required and optimizing flow delivered to the JWWTP, the Kiwanis Park options will utilize the same components and locations previously described at the DPW site for the new diversion chamber, pump station, underflow sewer, and associated connecting sewers. However, a longer route will be required to transport flow to and from the upstream Kiwanis Park storage tank locations.

Due to the existing ground topography and routing conflicts with existing developed properties, the route location for the inlet/outlet sewers will need to follow the existing road right of way along Langley Avenue and Pearl Street to the entrance of Kiwanis Park as shown in **Figure 7-6**. This route will require road closures to install the new sewers with roadway replacement after construction is complete. The route within the park will generally follow the entrance road or be aligned within open areas of the park if not in conflict with other existing underground utilities in the park.

Figure 7-6 Kiwanis Park Inlet and Outlet Sewers



7.2 Final Evaluation and Cost Comparison of Alternatives

Refined cost estimates were developed for each of the four final alternative options that included the tank structure and other necessary project components. These estimates are based on the proposed site-specific tank locations and preliminary concept design details developed to meet the hydraulic requirements performance sizing criteria of a 1.2 MG storage tank. The estimates also consider the poor soils and groundwater conditions for support of excavation during construction. These conditions require additional support to prevent long term settlement of the tank and associated structures. A summary of the cost for the four options is presented in **Table 7-1**.

Table 7-1 Cost Comparison of Final Alternatives (June 2023) – Assuming 1.2 MG Storage Volume

Location	DPW Site Option A	DPW Site Option B	Kiwanis Park Option C	Kiwanis Park Option D
Storage Option	Above Grade Tank	Below Grade Tank	Above Grade Tank	Below Grade Tank
Project Component				
Storage Tank				
Structure only (includes excavation, structure, deep piles, support of excavation)	\$5,400,000	\$19,700,000	\$3,800,000	\$13,700,000
Tank Process Items (Flushing System , odor control, ventilation)	\$700,000	\$500,000	\$700,000	\$500,000
Pump Station with Inlet/Outlet connections				
Structural	\$1,754,000	\$1,754,000	\$1,754,000	\$1,754,000
Process	\$1,100,000	\$1,100,000	\$1,100,000	\$1,100,000
Force main/Dewatering from DPW PS to Tank	\$631,000	\$148,000	\$3,042,000	\$2,232,000
Diversion Chamber and Connections				
Underflow Pipe	\$1,185,000	\$1,185,000	\$1,185,000	\$1,185,000
Diversion Chamber	\$941,000	\$941,000	\$941,000	\$941,000
Gravity pipes in/out of New Diversion Chamber	\$525,000	\$525,000	\$525,000	\$525,000
Construction Cost Subtotal	\$12,236,000	\$25,853,000	\$13,047,000	\$21,937,000
Construction Contingencies (25%)	\$3,059,000	\$6,463,000	\$3,262,000	\$5,484,000
Engineering , Legal, and Administration (30%)	\$3,671,000	\$7,756,000	\$3,914,000	\$6,581,000
Total Project Cost*	\$18,966,000	\$40,072,000	\$20,223,000	\$34,002,000

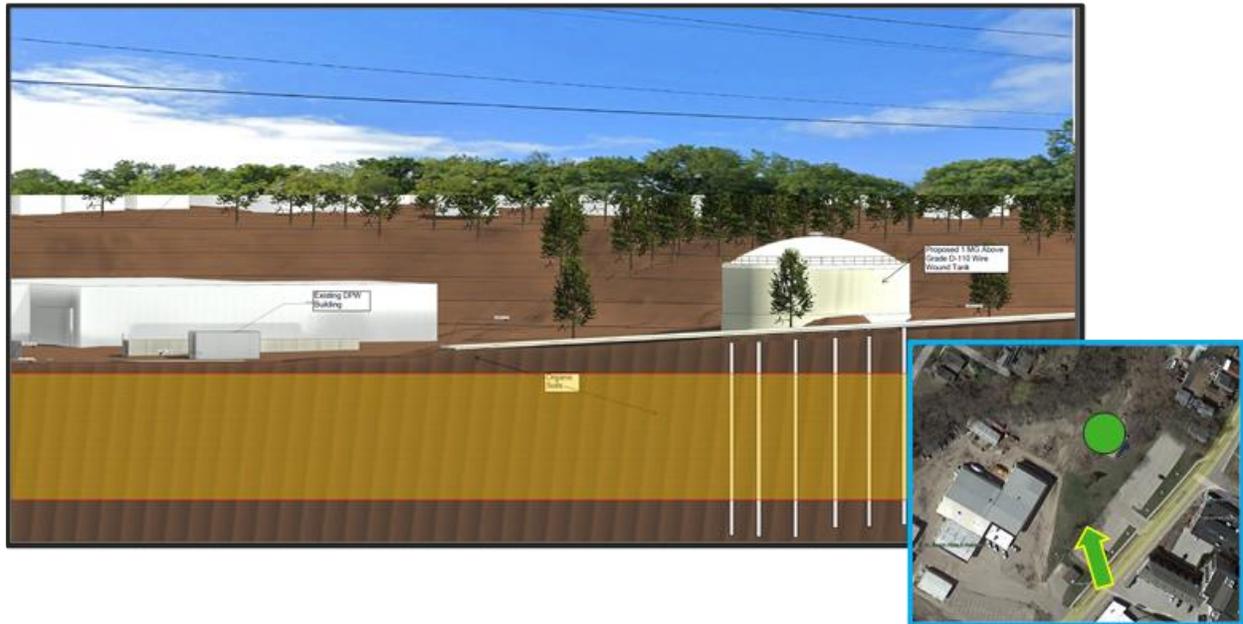
* Total project cost could be impacted by current market uncertainty.

The construction cost estimates are based on June 2023 pricing, and include a 25% construction contingency, and 30% for Engineering, Legal, and Administration expenses. The resulting Total Project Cost estimate clearly shows that the above ground storage options are the most cost-effective, primarily due to the poor soil conditions and high groundwater that result in more significant cost impacts for the below ground tank options. An above grade tank located at the DPW site provides an approximate \$1.2 million dollar cost savings over the Kiwanis Park site. The DPW site is also the preferred option as compared with the Kiwanis Park location as it keeps the tank in close proximity to the diversion chamber, pump station, and emergency outlet for operation and maintenance considerations. It also fits in better with the use of the existing DPW property which has less visual impact to the public as compared with the Kiwanis Park site.

7.3 Preferred Option for Final Design (Above Grade Tank at DPW)

Based on the detailed cost estimate, the most cost-effective option is the construction of an above grade tank at the DPW property with an estimated total project cost of \$16.1 million dollars. This site also has the added benefit of having a lower visual impact and is more convenient for operation and maintenance of the system. A 3D rendering of the proposed above grade tank located in the DPW is shown in **Figure 7-7**.

Figure 7-7 Above Grade Tank at DPW Site



8.0 PUBLIC INPUT

A Public Meeting was held on June 30, 2023, to review background information on the regulatory requirements for the St. Joseph Combined Sewer Overflow Compliance Program, discuss design considerations and options evaluated for the proposed storage project, and solicit public input on the results of the cost comparisons. The meeting date was advertised in the local paper and the City website in advance of the meeting. Both the PowerPoint presentation and meeting recording were posted to the City website after the meeting. Based on questions and comments received, there were no objections raised regarding selection of Option A for the Above Grade tank at the DPW site as the preferred alternative.

9.0 CONCLUSIONS AND RECOMMENDATIONS

The computer model of the St. Joseph collection system was updated to reflect the most current representation of the collection system. This model was used in the development of a range of storage alternatives to meet the EGLE NPDES permit requirement of less than one overflow per 10-years. The final alternative included 1.0 MG of storage with a diversion chamber and influent pump station located at the DPW. This system also includes real time control of the basin dewatering to optimize the use of the JWWTP and minimize the required storage volume.

To meet the above storage requirement, a range of storage technologies and storage locations were considered. Selection of a final storage configuration was heavily weighted on cost although, visual impacts, ease of operation, and long-term operation and maintenance costs were also considered. Based on this analysis and public input, the final selected alternative includes the construction of a 1.0 MG above grade D-110 circular tank located at the DPW facility.

The tank is currently configured to be 80-foot in diameter and 35-feet tall. A separate diversion chamber and influent pump station will also be constructed at the DPW facility. The storage will be dewatered via gravity back to the JWWTP for treatment. The basin dewatering valve will throttle flow toward the JWWTP using real time control that tracks total flow from the St. Joseph system with the goal of maintaining a minimum flow of 4,500 gpm. The estimated total project cost for the selected alternative is \$16.1 million dollars. An overview of selected alternative is shown in **Figure 9-1**. A separate detail of the proposed diversion chamber is shown in **Figure 9-2**. A 3D rendering of the above grade tank is shown in **Figure 9-3**.

Figure 9-1 Selected Alternative Overview

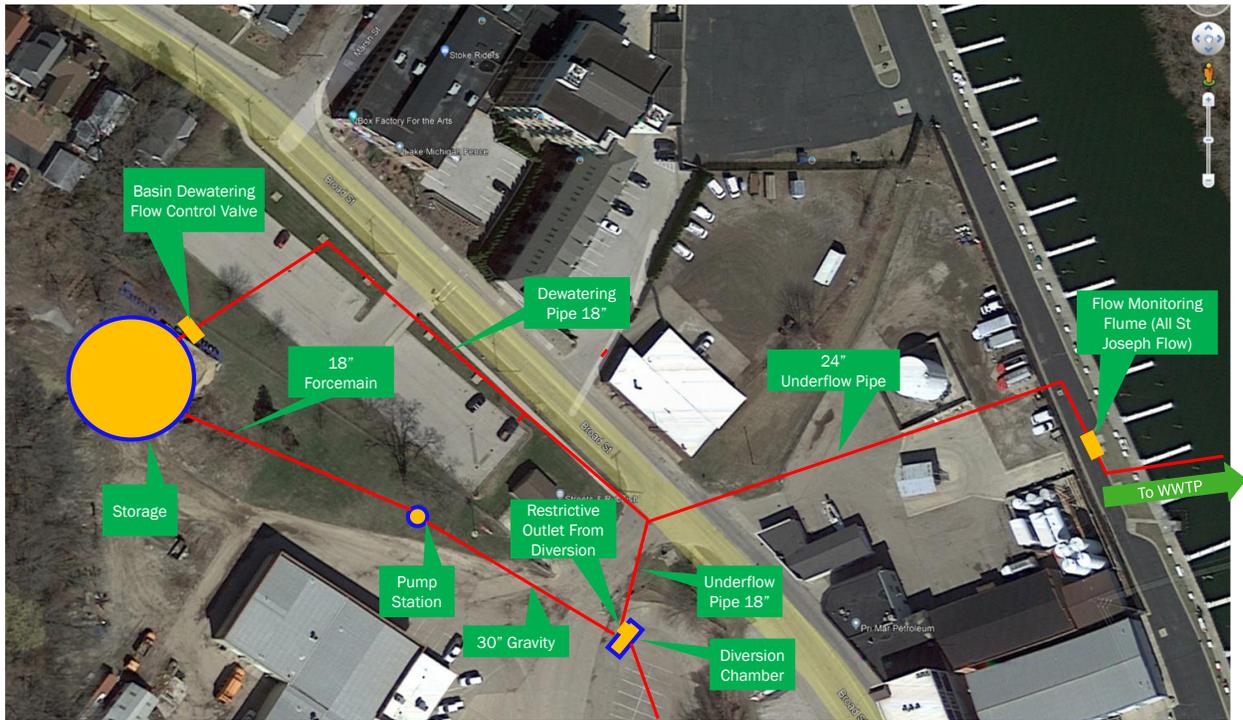


Figure 9-2 Diversion Chamber Configuration

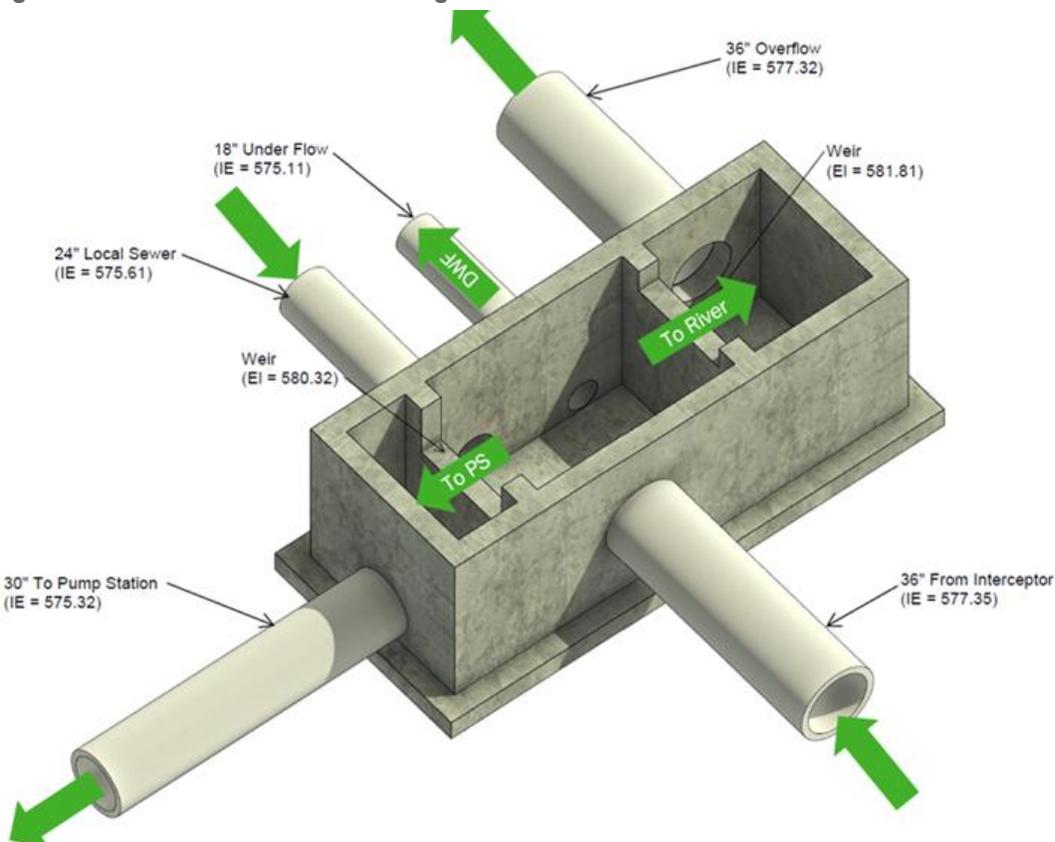
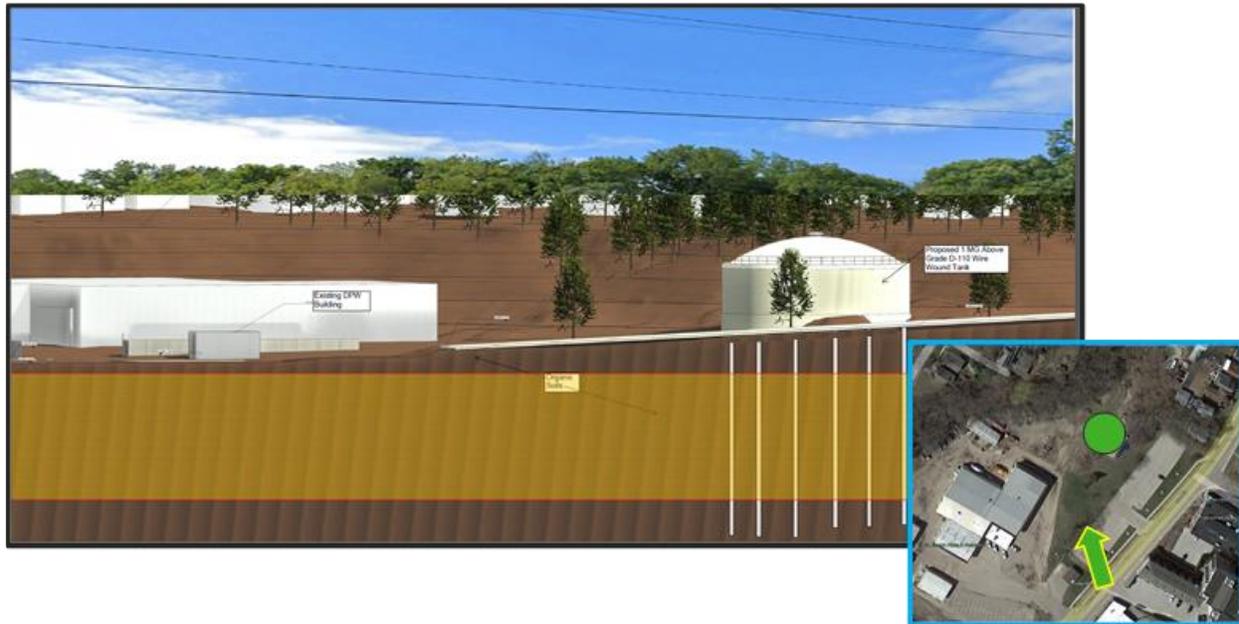


Figure 9-3 Above Grade Tank at DPW Site



A separate flow and rainfall analysis of the system was also performed to identify the effectiveness of I/I mitigation within the system. The goal of the I/I mitigation was to reduce wet weather inflow and thereby reduce the required basin storage volume. Flow and rainfall data collected from 2022 and 2023 were used to compare the wet weather response pre and post I/I rehab projects. The results of this analysis showed limited effectiveness of sewer and manhole lining project in reducing wet weather peak inflow and volume to the system. Based on this analysis, the recommendation is to move forward with construction of the storage basin without any additional effort for I/I mitigation.

The three remaining CSO's within the St. Joseph were also evaluated to determine final structural changes to each of these outfalls. Based on this analysis, the following recommendations should be implemented.

CSO-003 – This system was found to have sufficient capacity for the to accommodate the remaining wet weather inflow to the system. A bulkhead should be placed in the outfall and the underflow pipe should be increased from a 10-inch pipe to a 24-inch pipe. This work has been approved by EGLE (Permit No. P41004331 v.1, issued on June 16, 2023) and is currently planned for construction as part of the Upton Drive Reconstruction Project.

CSO-005 – A 1.0 MG basin should be constructed to intercept excess wet weather flow and limit the frequency of overflow to less that one overflow in 10-years. A new diversion chamber should be constructed to distributed flow between the JWWTP and the new basin. This diversion chamber should include a high-level emergency overflow to divert flow from extreme events to the existing stormwater system to protect the system from backups and basement flooding. This emergency

overflow will be used less than once every 10-years. Permanent level monitoring equipment should be installed at this location to document the frequency of use of this outfall.

CSO-011 - A continuous 50-year model simulation of this CSO shows the system continuously operates in an open channel condition and does not overflow. However, monitoring data does show the potential for system backups originating from the JWWTP due to operational and equipment problems can cause significant backups at this location. To protect the St. Joseph system from these backups, it is recommended to keep this CSO open. Permanent level monitoring equipment should be installed at this location to document the frequency of use of this outfall.

In accordance with the current NPDES compliance schedule requirements, the recommended storage project that incorporates the CSO 005 and 011 recommendation is to proceed according to the implementation schedule shown in **Table 9-1**.

Table 9-1 Storage Project NPDES Compliance Schedule

Storage Construction (if I/I Mitigation is not cost effective):	
March 1, 2025	Submit Part 41 for Storage Project
July 1, 2025	Start Construction
Dec 1, 2026	Submit PPC Work Plan
March 1, 2027	Complete Construction
April 1, 2027	Commence PPC Flow Monitoring
Jan 1, 2028	Submit PPC Report

To meet this schedule, it is recommended that this report be submitted to EGLE for their review as an update of the current project status, and to satisfy the NPDES Permit compliance schedule date of October 1, 2023, for submittal of the pilot I/I removal project results. It is also recommended that the City authorize detailed design activities to begin for the recommended storage alternative to meet the next permit compliance date for submittal of the storage project Part 41 Permit application by March 1, 2025, and allow bidding and contract award in June 2025, with construction to occur in July 2025 through March 2027.



GRETCHEN WHITMER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY
LANSING



PHILLIP D. ROOS
DIRECTOR

March 6, 2024

TO: All Interested Citizens, Organizations, and Government Agencies

SUBJECT: FINDING OF NO SIGNIFICANT IMPACT
City of St. Joseph, Berrien County
Combined Sewer Overflow Storage Phase 1
Clean Water State Revolving Fund Project Number 5775-01

The purpose of this notice is to seek public input and comment on a preliminary decision by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) that an Environmental Impact Statement (EIS) is not required to implement recommendations discussed in the attached Environmental Assessment of a wastewater project planning document submitted by the applicant mentioned above.

HOW WERE ENVIRONMENTAL ISSUES CONSIDERED?

Part 53, Clean Water Assistance, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, being Sections 324.5301 to 324.5316 of the Michigan Compiled Laws Annotated, requires EGLE to evaluate all environmental implications of a proposed wastewater project. EGLE has done this by incorporating a detailed analysis of the environmental effects of the proposed alternatives in its review and approval process. A project planning document containing information on environmental impacts was prepared by the municipality and reviewed by the State. EGLE has prepared the attached Environmental Assessment and found that the proposed project does not require the preparation of an EIS.

WHY IS AN EIS NOT REQUIRED?

Our environmental review concluded that no significant environmental impacts would result from the proposed action. Any adverse impacts have either been eliminated by changes in the project planning document or will be reduced by the implementation of the mitigative measures discussed in the attached Environmental Assessment.

HOW DO I GET MORE INFORMATION?

A map depicting the location of the proposed project is attached. This information is also available on our website at Michigan.gov/CWSRF under "Additional Links." The Environmental Assessment presents additional information on the project, alternatives that were considered, impacts of the proposed action, and the basis for our decision. Further information can be obtained by calling or writing one of the contact people listed below.

HOW DO I SUBMIT COMMENTS?

Any comments supporting or disagreeing with this preliminary decision should be submitted to me at EGLE, P.O. Box 30457, Lansing, Michigan 48909-4957. We will not

Finding of No Significant Impact

Page 2

March 6, 2024

take any action on this project planning document for 30 calendar days from the date of this notice in order to receive and consider any comments.

WHAT HAPPENS NEXT?

In the absence of substantive comments during this period, our preliminary decision will become final. The applicant will then be eligible to receive loan assistance from this Agency to construct the proposed project.

Any information you feel should be considered by EGLE should be brought to our attention. If you have any questions, please contact Lance Wood, the project manager, at 517-388-5780; WoodL8@Michigan.gov; or you may contact me. Your interest in this process and the environment is appreciated.

Sincerely,

Dan Beauchamp

Dan Beauchamp, Section Manager
Water Infrastructure Funding and Financing Section
Finance Division
517-388-3380

Attachment

DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
Clean Water State Revolving Fund (CWSRF)
City of St. Joseph, Berrien County
Environmental Assessment
March 2024

PROJECT IDENTIFICATION

Applicant: City of St. Joseph

Address: 700 Broad Street
St. Joseph, Michigan 49085

Authorized Representative: Tim Zebell, City Engineer

Project Number: 5775-01

PROJECT OVERVIEW

The city of St. Joseph (St. Joseph) is applying for a low-interest CWSRF loan administered by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) to finance the installation of a new diversion chamber and underflow pipe. The proposed project provides additional storage capacity necessary for St. Joseph to reduce combined sewer overflows (CSO) within the system. The project is estimated to cost \$5,000,000 and will be financed by a 30-year low-interest CWSRF loan. As a result of the project, the average residential user would see a rate increase of approximately \$4.48 per month.

St. Joseph is in Berrien County in southwest Michigan along the shore of Lake Michigan. St. Joseph is surrounded by the St. Joseph River and Paw Paw River on the east side and the St. Joseph River also flows through the northern portion of St. Joseph. As of the 2020 United States Census, St. Joseph's population was 7,856, down 6 percent from 2010. Based on data from the Southwestern Michigan Planning Commission, St. Joseph's population is expected to decrease slightly by 2040 with average daily flows remaining steady.

PROJECT BACKGROUND

St. Joseph owns and operates the wastewater collection system that is comprised of separate sanitary and storm water sewers and a few combined sewer areas. Much of the sanitary sewer collection system was originally constructed in the late 1800s through mid-1900s. These areas include clay pipes with brick manholes. Portions of the system have been replaced as part of CSO work or roadway reconstruction. In these areas, the system utilizes polyvinyl chloride pipe and precast concrete manholes.

St. Joseph has three permitted CSO discharge outfalls: 003, 005, and 011. During wet weather, flows that exceed the Benton Harbor–St. Joseph Joint Wastewater Treatment Plant (JWWTP) capacity are discharged as untreated CSOs from CSO-005. CSO-005 is located on Broad Street (Broad) near the Department of Public Works (DPW) and discharges to the Morrison Channel. As part of CWSRF project 5647-02 financed in fiscal year 2023, the CSO outfall 003 was able to be closed with a revised structure to eliminate discharges except during extreme weather events.

The wastewater from the collection system is sent to the JWWTP located on Marina Island. The JWWTP is co-owned by St. Joseph and the city of Benton Harbor and serves the two cities

along with four surrounding townships and two villages. The JWWTP has a capacity of 15.3 million gallons per day (mgd) and has the necessary capacity to serve the system. Two 7-mgd submersible pumps and an electrical substation were replaced in 2010 to help the plant better handle influent flows and reduce the likelihood of sanitary sewer overflows to the St. Joseph River.

PROPOSED PROJECT

A. Project Need

St. Joseph has National Pollutant Discharge Elimination System (NPDES) Permit MI0026735 that was issued September 26, 2022. The NPDES permit regulates the CSO outfalls and requires a Final CSO Control Program Update to work towards eliminating overflow discharges from CSO Outfalls 005 and 011. As part of the permit, St. Joseph was required to conduct an infiltration and inflow (I/I) removal pilot program and cost-effective analysis to determine if any cost-effective I/I removal projects exist.

The I/I removal pilot program was completed in 2022 within three areas of the collection system. This work consisted of disconnection of impervious areas and sewer lining. Flow and rainfall data was collected in 2023 and was used to compare with the pre-I/I removal data. The results showed that while there was some reduction in I/I flows in the system, the peak flows were not significantly reduced. The main reductions in I/I flows were the result of the disconnection of impervious areas. Since the sewer lining was not successful, it was not recommended to be implemented in other parts of the system.

Since the I/I removal projects were not successful, St. Joseph needs to construct storage to accommodate the wet weather flows at CSO-005. As part of the CSO storage project, the work is divided into Phases 1 and 2 which both work towards achieving the requirements of the NPDES permit. The early action Phase 1 CSO project will be constructed before the storage basin design is finalized to allow flow studies to be completed and assist in storage basin design. Additionally, the existing 12-inch diameter underflow pipe that flows from the current chamber to the interceptor is undersized and should be upgraded to accommodate the additional flow from the new diversion chamber and the necessary dewatering of the future storage basin.

B. Alternatives Considered

No-action Alternative

The no-action alternative is not a viable option as continued operation of the system without improvements would result in continued CSO discharges which involve risks to public health. Additionally, the no-action alternative would not meet the requirements of the NPDES permit and cause St. Joseph to be in non-compliance. Therefore, this alternative will not be evaluated as a principal alternative.

Regional Alternative

The collection system already sends wastewater to the JWWTP which serves as a regional treatment plant for the area. I/I removal efforts are not able to be accomplished through a regional alternative with another system. The CSO outfalls and collection system require upgrades within the existing system that a regional alternative cannot provide. CSO storage is not feasible through the connection with a regional system. This alternative will not be evaluated further.

Optimization of Existing System

Optimization of the existing system would consist of further I/I removal projects to help reduce flows in the system. This alternative was determined to not be a viable option as St. Joseph has conducted various I/I removal projects over the years and have only achieved small reduction in flows. St. Joseph is unable to remove I/I flows to the point where storage would not be required. The JWWTP currently does not have operation issues and optimization of the JWWTP would not address the flows within the system.

CSO Storage

This alternative consists of building additional storage designed to handle the overflow volumes associated with CSO-005. As part of the CSO storage project, upgrades to the associated infrastructure at CSO-005 will be necessary to accommodate the storage tank. Locations for the proposed storage tank and design of either an above ground or below ground tank were considered. It was compared to build the tank at the DPW site or nearby Kiwanis Park. Additionally, it was compared whether the tank should be constructed above or below ground and the necessary sizing to accommodate flows. The tank designs were compared based on construction costs, operations costs, and the footprint impact.

It was determined that a new diversion chamber would best be suited to be constructed at the existing CSO-005 diversion chamber. This location was selected as it captures all flows from the CSO-005 district and allows for flows to be sent to the future storage tank. The new diversion chamber would be designed to send flows to the JWWTP, storage tank, or overflow to the river in extreme events. To optimize flows to the JWWTP, upsizing of the underflow pipe from the diversion chamber is necessary. The proposed underflow pipe is a 24-inch diameter pipe that flows are controlled by the orifice plate on the outflow from the diversion chamber.

C. Selected Alternative

The proposed project focuses on improvements to reduce CSO overflows at outfall 005. St. Joseph has chosen to complete the 'early action' project which is Phase 1 towards addressing CSO outfall 005. This project includes a new diversion chamber, overflow pipe, replacement of the underflow pipe that flows to the JWWTP, and an outlet orifice plate from the diversion chamber to the underflow pipe. The location of the project is near the existing chamber at CSO-005 at the DPW. The project location can be seen in Figure 1 and the specific site plan can be seen in Figure 2.

The new diversion chamber will be constructed adjacent to the existing CSO-005 chamber. This project also includes the associated piping to and from the diversion chamber. A 30-inch diameter gravity sewer from the diversion chamber will be constructed to connect to the future pumping station to send flow to the storage tank. A new overflow pipe will also be constructed to connect to the existing diversion chamber which will be modified with backflow prevention. The existing 12-inch diameter underflow pipe to the JWWTP will be replaced with a 24-inch diameter pipe that is better designed to handle the flows and will accommodate the dewatering of the future storage tank.

D. Project Cost and Implementation

St. Joseph will finance the Phase 1 project with a \$5,000,000 CWSRF loan for 30 years at 2.75 percent interest. Based on the \$5,000,000 CWSRF loan, it is estimated that user rates will increase by approximately \$4.48 per month. Costs for the Phase 2 project will be finalized during design with future rate increases determined at that time.

The proposed project is expected to start construction in the fall of 2024 and will conclude in May 2025. Flow monitoring will be completed following the construction of this project to guide the design of the future storage tank. The Phase 2 portion of the proposed project which includes construction of the storage tank is planned to begin in 2027 and will be covered in a future environmental assessment if financed through the CWSRF.

PROJECT IMPACTS

A. Water Quality Impacts

The proposed project is not expected to have any short-term or long-term adverse impacts to water quality. During construction, proper soil erosion and sedimentation practices will be utilized to mitigate any impacts on nearby waters. The project will provide beneficial impacts to water quality by working to eliminate CSO-005. With the reduction in CSO outfalls, there will be decreased likelihood of public health impacts associated with sewage discharges. By reducing the CSO outfalls, it will also reduce the adverse impacts to aquatic life and human contact with surface waters.

B. Construction Impacts

There will be short-term adverse impacts associated with project construction. These impacts will be minor and limited to the construction site. Construction will take place at the DPW building, across Broad, and the neighboring property that exists through a public easement. Construction impacts include increased noise and dust associated with the project. These impacts will be mitigated by utilizing standard construction practices that include dust control, muffling of work equipment, and limiting the approved work hours.

Since the construction will take place on city property and within existing rights-of-way, there are no impacts expected to cultural or historic resources and endangered species. In the event tree removals are necessary, they will be completed between October 1 and March 31 to mitigate impacts to bat species. All disturbed sites will be restored to previous conditions to mitigate any environmental impacts.

A portion of the 24-inch diameter underflow pipe will be located in an area of known soil and groundwater contamination. Sampling was completed at the property that identified non-hazardous contamination with low levels of various metals and volatile organic compounds. The trench used for utility construction will be limited in width to reduce the amount of contaminated soil disturbed. Any excavated contaminated soils will be properly disposed at a Type II landfill. The contaminated groundwater is non-hazardous and has been reviewed by JWWTP staff. Any dewatering that occurs during the project will be sent to the JWWTP for proper treatment in the normal treatment system.

C. Floodplains

Much of the work at CSO-005 is located in the 100-year floodplain. Impacts within the floodplain are only expected to be temporary during construction and will be mitigated to the fullest extent possible. A Joint Permit Application from EGLE and the United States Army Corps of Engineers is being developed and will be submitted once full design is completed. There are no long-term adverse impacts to the floodplain expected and St. Joseph will comply with all permit requirements.

PUBLIC PARTICIPATION

A formal public hearing for the proposed project was held at 6:00pm on May 9, 2022, at St. Joseph City Hall. Notice was posted in the *Herald Palladium* on April 6, 2022, and the project plan was made publicly available for viewing. During the public hearing, the project was presented including the project need, alternative analysis, environmental evaluation, and user cost impacts. The only comments were from City Commission members regarding project logistics. No comments were submitted by members of the public. A resolution to adopt the project plan was adopted by the St. Joseph City Commission on May 9, 2022, after the conclusion of the public hearing.

REASONS FOR CONCLUDING NO SIGNIFICANT IMPACTS

The short-term construction impacts of the proposed project are outweighed by the water quality and public health benefits. The project will help reduce public health impacts by limiting the frequency of CSO overflows to waters of the state. Minor construction impacts will be temporary and localized to the work zones. These impacts will be mitigated with sound construction practices and adherence to permit requirements.

Questions regarding this Environmental Assessment should be directed to:

Lance Wood, Project Manager
Water Infrastructure Funding and Financing Section
Finance Division
Michigan Department of Environment, Great Lakes, and Energy
P.O. Box 30457
Lansing, Michigan 48909-4957
Telephone: 517-388-5780
Email: WoodL8@Michigan.gov

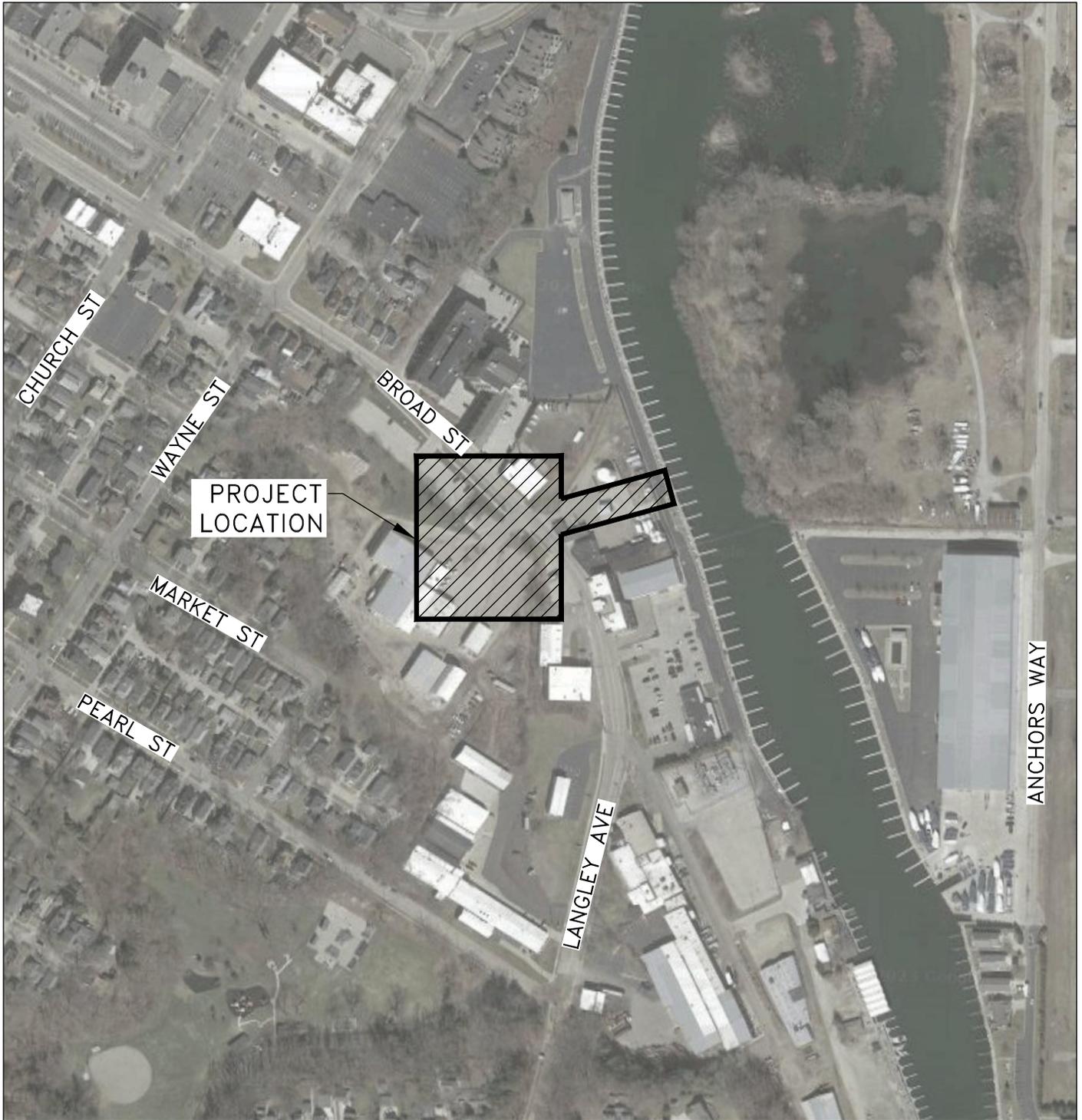


Figure 1



2851 Charlevoix Drive SE, Suite 108
Grand Rapids, MI 49546
616.956.3304
www.wadetrim.com

CITY OF ST. JOSEPH
BERRIEN COUNTY, MI 49085

LOCATION MAP

Appendix B

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
WATER RESOURCES DIVISION
PERMIT FOR CONSTRUCTION OF WASTEWATER SYSTEMS

SITE NAME:	St Joseph CM
CONTACT NAME:	Tim Zebell
CONTACT PHONE:	269-983-5541
CONTACT EMAIL:	tzebell@sjcity.com
PROJECT COUNTY:	Berrien

PERMIT NUMBER:	P41005387 v. 1
ISSUED DATE:	June 30, 2025
ISSUED TO:	City of St. Joseph
PROJECT NAME:	Hawthorne Avenue Lift Station
PROJECT LOCATION:	City of St. Joseph

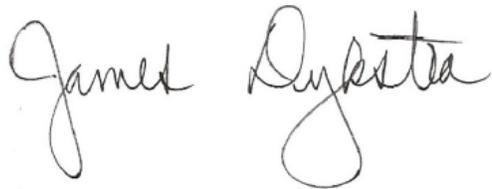
APPLICATION SUBMISSION ID: HQ9-06SG-DV3NS
REQUIRED NOTIFICATIONS: The permittee shall submit a Construction Startup Notification (just prior to excavation) and a Construction Completion Notification (upon project completion) using the permit schedules in MiEnviro Portal.
<input type="checkbox"/> If this box is checked, please see the SPECIAL CONDITIONS on page 2.

**ISSUED UNDER THE AUTHORITY OF THE DIRECTOR OF
THE DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY (EGLE)**

Issued By:


Marcus J. Tironi, P.E. Senior Environmental Engineer

Reviewed By:


James Dykstra Environmental Engineer

cc: Nick Margaritis, Berrien County Health Department
Tim Drews, Abonmarche
Charles Thompson, Abonmarche
Jacob Manzo, Abonmarche

GENERAL CONDITIONS

- a. This PERMIT only authorizes the construction, alteration, addition, or improvement of the wastewater system as described herein and is issued solely under the authority of Part 41, Sewerage Systems, of Act 451.
- b. This PERMIT expires two (2) years after the above date of issuance unless construction starts prior to the expiration date in accordance with R 299.2939(2) of the Part 41 Administrative Rules.
- c. Any portion of the herein-described proposed wastewater project constructed prior to the date of issuance is not authorized by this PERMIT and is a violation of Part 41 of Act 451.
- d. No sewer shall be placed into service unless and until the outlet sewer has been constructed, tested, and placed into service.
- e. Failure to meet any condition of this PERMIT or any requirement of Act 451 constitutes a violation of Act 451.
- f. Issuance of this PERMIT does not authorize any violation of federal, state, or local laws or regulations, nor does it obviate the need to obtain other permits or approvals from EGLE or other units of government as required by law.
- g. The applicant must provide notice of impending construction to public utilities and comply with the requirements of the Underground Facility Damage Prevention and Safety Act, PA 174 of 2013, as amended (MISS DIG).
- h. All earth-changing activities must be conducted in accordance with Part 91, Soil Erosion and Sedimentation Control, of Act 451.
- i. All construction activity, including groundwater dewatering, impacting wetlands shall be conducted in accordance with Part 303, Wetlands Protection, of Act 451.
- j. If water withdrawal, via dewatering activities, is associated with this project, authorization under Part 327, Great Lakes Preservation, of Act 451, is required for new or increased large quantity withdrawals over 100,000 gallons per day (70 gallons per minute). A Part 327 permit is required for new or increased large quantity withdrawals over 2,000,000 gallons per day.

SPECIAL CONDITIONS

1. This permit does not have any special conditions in addition to the General Conditions listed above.

PROPOSED WASTEWATER PROJECT DESCRIPTION

Improvements to the Hawthorn Avenue Lift Station, including structural, mechanical, electrical, pump replacement, sanitary sewer replacement, site piping, and related site improvements on the subject parcel of land and adjacent right-of-way of Hawthorn Avenue and Kerth Street. There will be approximately 21 feet of 12-inch DI sanitary sewer replaced and one structure installed to connect new and existing pipe.