

October 2023



DESIGN REPORT

CITY OF MEQUON

Lift Station E Improvements



PN6555

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LIFT STATION E REPLACEMENT

DESIGN REPORT

October 2023

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PN6555

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Chapter 1

EXECUTIVE SUMMARY

Lift Station E (LS E), located on W. Ranch Road, is owned and operated by the City of Mequon. It was constructed in the mid-1960s and includes the service areas for Stations F, G, H and T, which ultimately discharge into the collection system to LS E. Based on the 2021 Condition Assessment, LS E is a source of concern for several reasons:

- During periods of wet weather, the tributary service area has experienced multiple Sanitary Sewer Overflows (SSOs).
- The current pumping and electrical equipment have reached the end of their design lives.
- The restrictive site does not have sufficient space for expansion.

The purpose of this project is to replace the station to handle expected flow conditions, ensure its continued reliable operation, restore the service lives of the equipment, upgrade the station's functionality, decrease operation and maintenance costs, and increase energy efficiency.

TM 1: DESIGN FLOWS

Technical Memorandum (TM) 1 evaluated the historical and future flows of LSE, ultimately recommending that the new LS E be designed with a firm capacity of 9,000 gpm. The basin area is nearly fully developed and not expected to experience significant population increases. Based on the reported pumping rate during the August 8, 2021 SSO, the station would have been capable of conveying the firm capacity had this upgrade been in place.

All pumps can be operated during extreme flow events to pump more than 9,000 gpm through the force mains. The wet well will be sized with physical space consideration for larger pumps, allowing the station to be upgraded in the future to handle increased flows from LS F and G and/or additional unplanned development from the north.

Additional upgrades to the discharge force mains, or other upgrades like another relief sewer or in-line storage solutions, will be required if peak hour flows to the station increase above 9,000 gpm.

TM 2: SITE SELECTION AND SEWER ROUTES

Site B, located at the north terminus of N. Laguna Drive, was the site selected for the new LS E. While Site A was less costly, the DNR's Practical Alternative Analysis (PAA) determined that Site B should be selected because it offers less permanent wetland impacts than other alternatives.

A new sewer will be constructed to convey flow from the existing confluence manhole southwest to the new station site, where it will discharge into the new wet well. The collector sewers that discharge into the confluence manhole will also be redirected to the new LS location. Two sewer route alternatives were identified and evaluated, and Route D was selected because it will require less new sewer.

TM 2 also included hydraulic modeling of the City's sanitary system to verify the benefits of upsizing the lift station capacity and provide insight into other possible improvements or issues in the collection system. The model confirmed that the improvements of Phases 1-4 will eliminate most of the sewer surcharging conditions in the LS E basin.

TM 3: WEST FORCE MAIN DISCHARGE IMPROVEMENTS

TM 3 determined the improvements necessary to adequately convey the increased force main discharge of LS E through the Hidden Reserve. The West Force Main is the shorter of the two 16-inch diameter force mains discharging from LS E, and it discharges into the gravity sewer at a manhole immediately adjacent to The Hidden Reserve. To continue using the two-force main system, improvements to the gravity sewer system or an extension of the West Force Main are necessary to provide adequate capacity for the upgraded station discharge. The least intrusive option was determined to be relaying and upgrading the gravity sewer between Manhole Nos. 0430-017 and 0430-105 from 18-inch to 21-inch diameter. In addition, the gravity sewer between Manhole Nos. 0430-011 and 0430-106 must be upgraded from 18- to 24-inch diameter.

DESIGN REPORT

Conclusions and Recommendations

This design report includes all previous technical memoranda and outlines the recommended features of the new LS E.

LIFT STATION

Building

The architecture of the building will blend with the surrounding properties, similar to lift station depicted in Figure 1-1. It will feature a slab on grade foundation with frost footings, concrete block walls with rigid board insulation and finish brick exterior, and a standing seam metal roof.

Interior Configuration

The building's interior will be configured into three areas: a generator room, valve room and mechanical room.

Wet Well

The wet well for the station will be 28 feet long by 16 feet wide constructed of cast in place concrete with a depth of 39 feet. Entrance to the wet well will be through either:

1) Five pump access hatches sized for removal and installation of the submersible pumps from the valve room, or 2) Three access hatches from the building exterior. Fall-through protection will ensure that the access hatches can be safely opened for observation of the wet well interior.

Pumps

The wet well will contain five Flygt NP 3231 submersible pumps, each rated at 2,250 GPM to provide a firm capacity of 9,000 GPM with the largest pump out of service. Three of the five pumps will be 250 hp rated at 2,250 gpm to serve the East Force Main. The other two pumps will be 150 hp rated for 2,250 gpm to serve the West Force Main. All pumps will be operated with variable frequency drives to allow varied pumping rates to match influent flows and ease pump startup under standby power.

Location and Sitework

The new LS E will be accessed from the nearby multi-use trail, and pavement along the building will provide direct access to the valve, generator and mechanical rooms.

FIGURE 1-1
South Milwaukee North Chicago Lift Station



Controls and SCADA

A control panel housing the controls and SCADA system will be located in the generator room. An uninterruptible power supply will be included to maintain PLC operation and SCADA monitoring during power failures. A local control panel will also be located in the valve room, allowing line of sight operation of the pumps to verify operation. Flow meters will be installed on each force main in the valve room.

Standby Power

A 750 kW natural gas emergency generator and automatic transfer switch will allow the station to remain operational in the event of an electrical service outage.

Ventilation

- The wet well will be continuously ventilated through an odor control system located in the mechanical room. Portable mechanical ventilation equipment will allow for confined space entry into the wet well.
- The valve room will be mechanically ventilated.
- Space heating will provide intermittent ventilation during occupancy of the mechanical room.
- The generator room will be ventilated using the emergency generator's radiator fan and opening of the damper if the room temperature exceeds 90°F. A unit heater will be employed during cold weather.

FORCE MAIN AND SEWERS

New twin 16-inch diameter force mains, spanning approximately 690 LF, will connect the new station site to the point of reconnection near the existing driveway. They will be C-900 PVC pipes that match the existing force mains.

Two influent sewers will connect to the wet well in the new station to convey all flows from the existing LS E to the new LS E: a 36-inch diameter sewer from the north and a 24-inch diameter sewer from the south.

COST ESTIMATE

Based on the estimates contained within the Technical Memoranda and this Design Report, the work necessary to relocate the station from the present site to the new site will be approximately \$10,937,000.

Chapter 2

PURPOSE

This design report summarizes the design details for the Lift Station E Improvements, incorporating the findings of Technical Memoranda (TM) 1 through 3 and expanding on station design, building configuration, and site development. TM 1 determined the design flows for the new station, TM 2 discussed preliminary site selection and rerouting the gravity sewers and force mains to the new site, and TM 3 evaluated the discharge force main and downstream conditions near Hidden Reserve.

PROJECT BACKGROUND & PAST RECOMMENDATIONS

The City of Mequon (City) owns and operates Lift Station E (LS E), which is located in the southeastern portion of the City on the north side of W. Ranch Road. It is situated in a residential neighborhood near the Milwaukee River’s flood fringe. An existing site plan for the lift station is shown in Figure 2-1. LS E serves a large portion of the eastern half of the City and is the largest City-owned sanitary lift station. There are four other lift stations tributary to LS E.



Existing dry pit pumps

The lift station was originally constructed in 1965 and had a major upgrade in the 1980s. The building is a combination of brick and concrete block. There is a cast-in-place concrete wet well and dry well.

As shown in Figure 2-1, the wet well receives flow from a confluence manhole (MH# 0119-034) with three influent sewers: a 30-inch diameter to the north, an 18-inch diameter to the west, and a 10-inch diameter from the south. Further discussion on the service area is contained in TM-1.



Existing building

The existing conditions of the station were evaluated in detail in ATI’s 2021 *Lift Station E Evaluation Report*. The condition assessment identified that the existing station needs to be replaced. There is not enough physical space

in the dry pit or wet well to add significant additional pumping capacity while the building structure is in relatively good condition.

The existing lift station's wet well, dry well, and building are in relatively good condition. However, the size and layout of the station makes maintaining the pumping equipment difficult and hazardous. The existing dry pit pumps do not provide enough pumping capacity to keep up with peak flows to the lift station. Some sections of the collection system that contribute to LS E are in poor condition and currently contribute to significant infiltration and inflow. The combined rainfall from August 6-8, 2021, which resulted in the most recent sanitary sewer overflow (SSO), indicated that the station capacity is insufficient for wet weather peak flows.

Without its replacement, LS E's lack of adequate capacity will likely result in continued SSO events. The station has already experienced multiple recent SSOs, such as the August, 2021 SSO of over 1-million gallons. LS E is a critical component of the City's wastewater collection system and its reliable operation and upgraded capacity is critical to preventing SSOs and ensuring smooth collection system operation .

CONSTRUCTION OF A NEW LIFT STATION

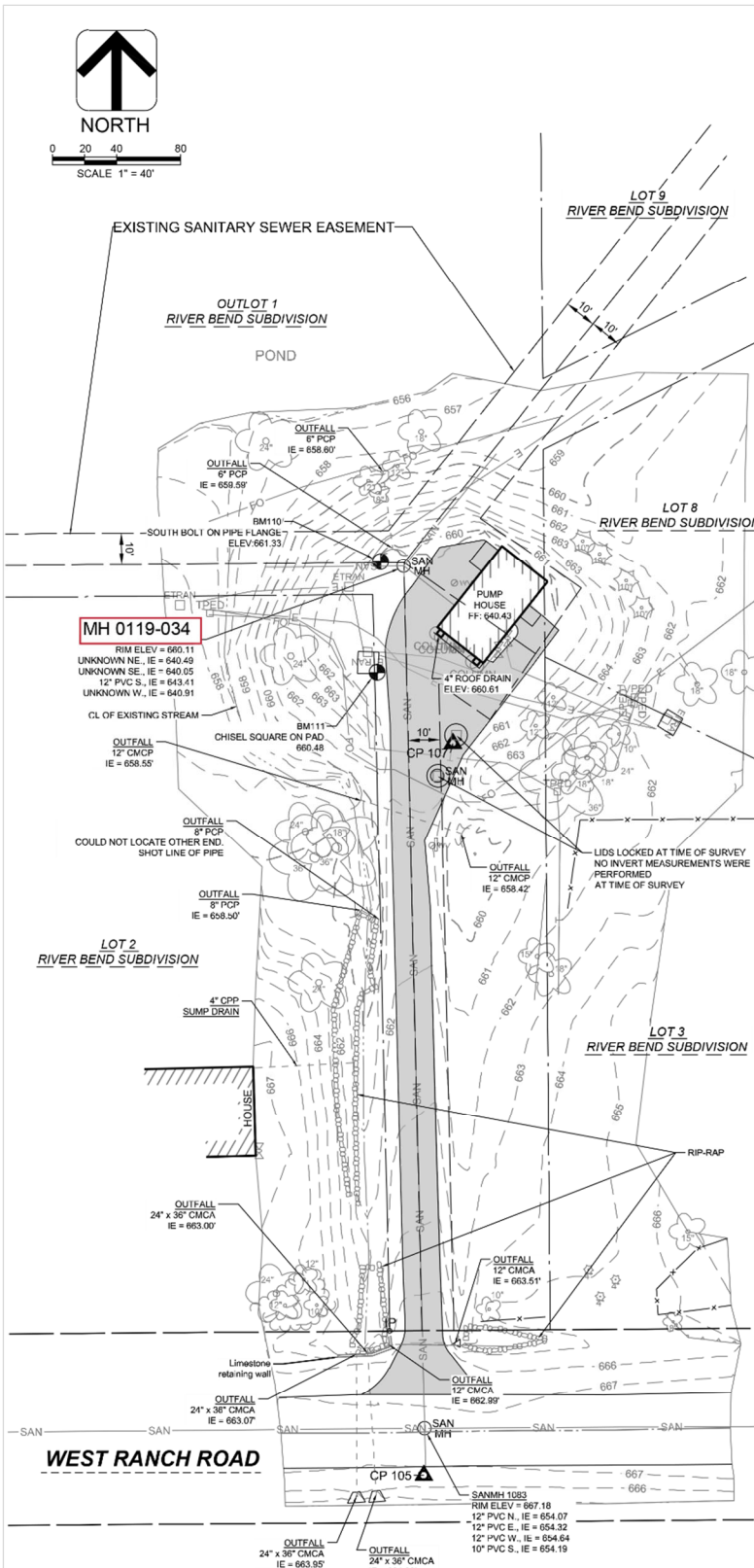
The Lift Station E condition assessment recommended constructing a new lift station near the existing station and reconnecting it to the existing dual force mains. TM 1 established the design flow requirements of the new lift station and determined that the existing dual 16-inch diameter force mains could convey the increased design peak flows. TM 2 identified alternatives for the new station site and gravity sewer and force main reconnection. The existing station property is narrow, contains several large utilities, and is located near the flood fringe.

TM 2 recommended constructing the new lift station approximately 700 feet southwest of the existing station at the north end of N. Laguna Drive. This station site is located in a 60-foot wide platted right-of-way (ROW). The gravity collector sewer will be re-routed to the new station site through the old station driveway and the W. Ranch Road ROW. This site offers the best combination of constructability and cost-effectiveness when considering utility and building costs. Additional discussion of the new station site is included in TM 2 in Appendix B.



LS E service area (red border)

FIGURE 2-1
Existing Lift Station E Site Plan



CONTROL / BENCHMARK POINT DATA				
POINT NO.	FEATURE	NORTHING	EASTING	DESCRIPTION
105	CP	454876.933	2518816.712	666.83 REBAR WCAP
107	CP	455105.625	2518825.772	660.96 X IN CONC. MH LID
101	CP	454640.005	2519092.794	674.007 SEC CORNER, BRASS MON
110	BM	455162.429	2518803.225	661.34 SOUTH BOLT ON PIPE FLANGE
111	BM	455127.791	2518802.156	660.49 CHISELED SQUARE ON PAD

GENERAL NOTES:

- Survey was completed on 09-18-2020
- Survey was performed in NAD83, State Plane Coordinate System, Wisconsin South Zone
- Elevations are referenced to NAVD 88 Vertical Datum in which the Center of Section 19, T9N, R22E, (point 101), has an elevation of 674.007'
- Due to the heavy flow at San MH 1268 unable to determine pipe diameters in field.
- Trees locations are center of tree at ground elevations.

Diggers Hotline, Inc. (Wisconsin)		Locate Request for AUTOEMAIL	
Ticket #:	20203806055	Seq #:	4
Ticket Type:	Planning-Prints	Previous Ticket:	
Call Date:	09/14/2020 06:00:32 PM	Start Date:	09/25/2020 06:00:00 AM
Contact Information			
Caller:	Nick Schramer	Phone:	(262) 522-4912
Company:	Ayres	Cell:	(262) 522-4912
Address:	N17W24222 Riverwood Dr Suite 310		
	Waukesha		
	WI 53188	Working For:	AYRES
Email:	SchramerN@ayresassociates.com		
Field Rep:	Nick Schramer	Phone:	(262) 409-1654 Ext
Work Information			
County:	OZAUKEE		
Place:	MEQUON CITY		
Address:			
Street:	RANCH RD		
Intersection 1:	N ORIOLE LN		
On the side of the road approximately 250 FT EAST OF INTERSECTION OF N ORIOLE LN			
Type of Work:	SURVEY WORK		
Explosives:	N	Overhead:	N
Boring Equipment:	N		
Pre-Marked:	N		
Marking Instructions			
SHOW A 200 FT WIDE PATH ALONG THE PRIVATE DRIVE OF LIFT STATION GOING NORTH FOR 400 FT.			
Remarks			
CALL NICK SCHRAMER FOR QUESTION ON MARKING INSTRUCTIONS.			
Members Notified			
NOWGB	WE ENERGIES-ELE AND WG GAS-NOWGB	(262) 446-9821	
SBC01	AT&T DISTRIBUTION SBC01	(262) 446-9821	
TWC30	TIME WARNER CABLE - TWC30	(262) 446-9821	
Work Site Polygon (NE/SW)			
Latitude:	43.229389	Longitude:	-87.935216
Secondary Latitude:	43.230503	Secondary Longitude:	-87.934417

Diggers Hotline, Inc. (Wisconsin)		Locate Request for AUTOEMAIL	
Ticket #:	20203806054	Seq #:	3
Ticket Type:	Standard	Previous Ticket:	
Call Date:	09/14/2020 06:00:11 PM	Start Date:	09/18/2020 06:00:00 PM
Contact Information			
Caller:	Nick Schramer	Phone:	(262) 522-4912
Company:	Ayres	Cell:	(262) 522-4912
Address:	N17W24222 Riverwood Dr Suite 310		
	Waukesha		
	WI 53188	Working For:	AYRES
Email:	SchramerN@ayresassociates.com		
Field Rep:	Nick Schramer	Phone:	(262) 409-1654 Ext
Work Information			
County:	OZAUKEE		
Place:	MEQUON CITY		
Address:			
Street:	RANCH RD		
Intersection 1:	N ORIOLE LN		
On the side of the road approximately 250 FT EAST OF INTERSECTION OF N ORIOLE LN			
Type of Work:	SURVEY WORK		
Explosives:	N	Overhead:	N
Boring Equipment:	N		
Pre-Marked:	N		
Marking Instructions			
MARK A 200 FT WIDE PATH ALONG THE PRIVATE DRIVE OF LIFT STATION GOING NORTH FOR 400 FT.			
Remarks			
CALL NICK SCHRAMER FOR QUESTION ON MARKING INSTRUCTIONS.			
Members Notified			
NOWGB	WE ENERGIES-ELE AND WG GAS-NOWGB	(262) 446-9821	
SBC01	AT&T DISTRIBUTION SBC01	(262) 446-9821	
TWC30	TIME WARNER CABLE - TWC30	(262) 446-9821	
Work Site Polygon (NE/SW)			
Latitude:	43.229389	Longitude:	-87.935216
Secondary Latitude:	43.230503	Secondary Longitude:	-87.934417

LEGEND	
	SANITARY MANHOLE
	STORM/SAN. MANHOLE
	INLET
	CATCH BASIN
	WATER VALVE
	GAS VALVE
	FIRE HYDRANT
	FLAG POLE
	GUY WIRE
	BOLLARD
	RECORDED AS (100.00)
	FIBER OPTICS MANHOLE
	ELECTRIC MANHOLE
	GENERAL MANHOLE
	UTILITY POLE
	ELECTRIC PEDESTAL
	TELEPHONE PED
	CABLE TV PED
	ELECTRIC METER/ GAS METER
	ELECTRIC PULLBOX
	LIGHT POLE
	SIGN
	YARD LIGHT
	PROPERTY LINE
	R/W LINE
	R/W CENTERLINE
	CHAINLINK FENCE
	UNDERGROUND TELEPHONE
	UNDERGROUND ELECTRIC
	UNDERGROUND SANITARY
	UNDERGROUND GAS
	UNDERGROUND STORM SEWER
	WATERMAIN
	LANDSCAPED AREA
	CONCRETE
	ASPHALT
	FOUND MONUMENT (TYPE/SIZE NOTED)

Chapter 3

ENVIRONMENTAL ISSUES

ENDANGERED RESOURCES

The DNR provided an Endangered Resources Review for the project planning area, included in Appendix D. The endangered resources recorded from within the project area and surrounding area included:

- Rusty Patched Bumble Bee
- Little Brown Bat (*Myotis lucifugus*)
- Forked Aster (*Eurybia furcata*)
- Hairy Beardtongue (*Penstemon hirsutus*)

RUSTY PATCHED BUMBLE BEE (BEE)

The project site is located within a high potential zone of the Rusty Patched Bumble Bee. Take of the bee is prohibited by the federal Endangered Species Act, and it was suggested that the project team implement one or more of the USFWS's recommended conservation measures.

LITTLE BROWN BAT (MAMMAL)

The Little Brown Bat, a threatened species in Wisconsin, has been recorded in the vicinity of the project area. It was recommended that a time-of-year restriction be included with special consideration to protecting snags or dying trees, particularly from June 1st to August 15th while bats may have flightless pups at the roost.

FORKED ASTER (PLANT)

The Forked Aster, a Wisconsin special threatened plant, may be impacted by this project as well. Various avoidance and minimization efforts were recommended, including site surveys to confirm the presence/absence of species, fencing off areas of occupied habitat, and submitting the survey results to the Endangered Resources Review Program.

HAIRY BEARDTONGUE (PLANT)

The Hairy Beardtongue, a Wisconsin special concern species, may be impacted by this project. As with the Forked Aster, various avoidance and minimization efforts were recommended, including site surveys to confirm the presence/absence of species, fencing off areas of occupied habitat, and submitting the survey results to the Endangered Resources Review Program.

ADDITIONAL RECOMMENDATIONS

Additional actions will be taken to conserve endangered resources, including use of the recommended erosion control matting.

ARCHEOLOGICAL AND HISTORICAL SITES

The DNR's review of the Wisconsin Historic Preservation Database (WHPD) and the National Register of Historic Places (NRHP) GIS databases, included in Appendix E, indicated that no previously reported archaeological sites are coincident with or immediately adjacent to the project area for the LS E Phase 1 project site. These findings were confirmed by a cultural resource review, conducted by UW-Milwaukee.

Chapter 4

DESIGN FLOWS

Technical Memorandum 1 – Lift Station E Design Flows, contained in Appendix A, evaluated the service area and established design flows for the LS E replacement project.

SERVICE AREA

The LS E service area generally lies in the northeastern portion of the City and serves a significant portion of the City of Mequon. It encompasses approximately 3,800 acres, including the service areas for Stations F, G, H and T, which ultimately discharge into the collection system to LS E (refer to Figure 1). The current basin area is mainly comprised of residential neighborhoods and includes commercial, public, institutional and park land. It is nearly fully developed and not expected to experience significant population increases, though the service area could be expanded to the north and include some excluded areas to the east in the future. However, given the topography and cost required to expand the collection system to the north, the City’s Community Development Department determined that any growth to the north, such as the Ulao Creek Development (formerly known as “East Growth Area”), will utilize private on-site sewer systems.

HISTORICAL FLOWS

The City monitors and records the flows pumped from LS E using two ultrasonic doppler flow meters. The station’s average daily flows appear to have grown steadily since 2013, ranging from 1.222 MGD (849 gpm) in 2015 to 2.485 MGD (1,726 gpm) in 2019. During the August 8, 2021 storm event, the station metered a peak hour flow of 5,950 gpm, which is beyond the station’s firm capacity of 5,250 gpm.

SANITARY SEWER OVERFLOWS

There has been a history of SSO events resulting from severe weather-related conditions, such as large or successive precipitation events, saturated soil, and/or heavy snowmelt. The August 8, 2021 SSO resulted in a 1,080,000 gallon overflow from L SE’s service area at a pumping rate of 3,000 gpm. This reportedly occurred while the L SE was operating at its firm capacity.

PROJECTED GROWTH

With the City Community Development Department determining that any growth to the north, such as the Ulao Creek Development (formerly known as East Growth Area), will be with private on-site sewer systems, no significant growth is expected in the LS E service area by 2050 based on the Milwaukee Metropolitan Sewerage District (MMSD)'s 2050 Facilities Plan and land use information from the City of Mequon.

NEW LIFT STATION E CAPACITY

As discussed in TM 1, LS E will be designed for a firm capacity of 9,000 gpm (13 MGD), roughly a 70% increase over the station's existing firm capacity of 5,250 gpm. This is based on minimal expected growth in the LS E service area by 2050 and observed peak hour and SSO flows from LS E.

Chapter 5

PROPOSED LIFT STATION E

LIFT STATION BUILDING

A new lift station building will be constructed on the new site. It will contain separate valve and generator rooms and house the lift station power distribution and control equipment. The new building will be constructed in place and will include the following features:

- Foundation: Slab on grade with frost footings.
- Walls: Concrete block with rigid board insulation and finish brick exterior.
- Roof: Standing seam metal roof.

ARCHITECTURAL FEATURES

The architecture of the building is intended to blend with the surrounding development. Its appearance will be similar to South Milwaukee's North Chicago Lift Station (Figure 5-1). The site can be landscaped with various plantings, including ornamental trees and shrubs if desired by City staff.

Additional architectural details could be added to enhance this cohesion. Building elevations of the proposed lift station building can be seen in Figure 5-2.

INTERIOR CONFIGURATION

The building will be configured into three rooms, as depicted in Figure 5-3:

- Generator Room: 750 kW generator and transfer switch, power distribution, variable frequency drives for the pumps, pump controls, control panel.
- Valve Room: Discharge piping and check and isolation valves from the pumps.
- Mechanical Room: Odor control equipment.

Water service is not currently available in this area, so no wash sinks or restrooms are being considered for this facility.

FIGURE 5-1
South Milwaukee North Chicago Lift Station



FIGURE 5-2
Proposed LS E Building Elevations

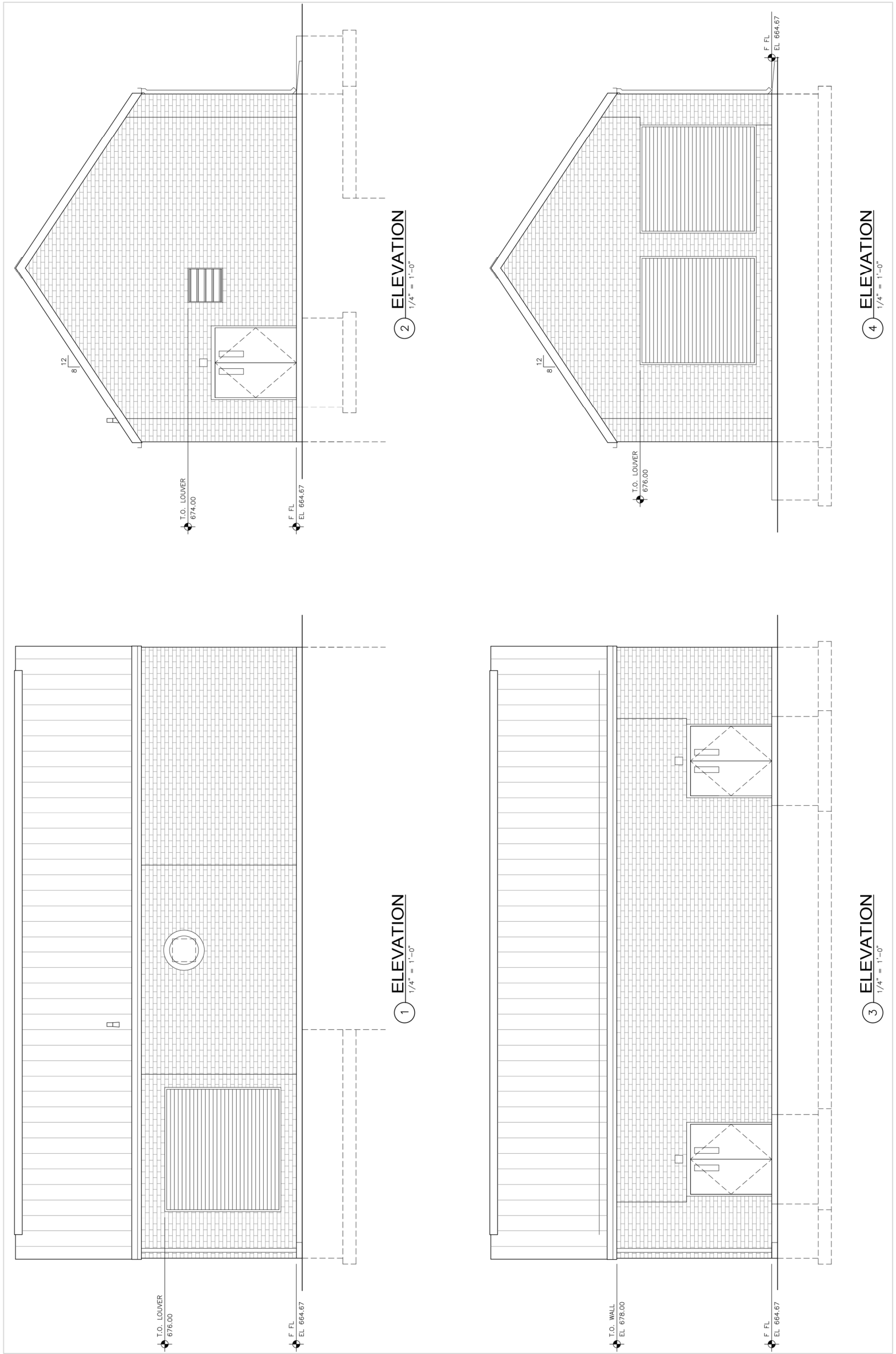
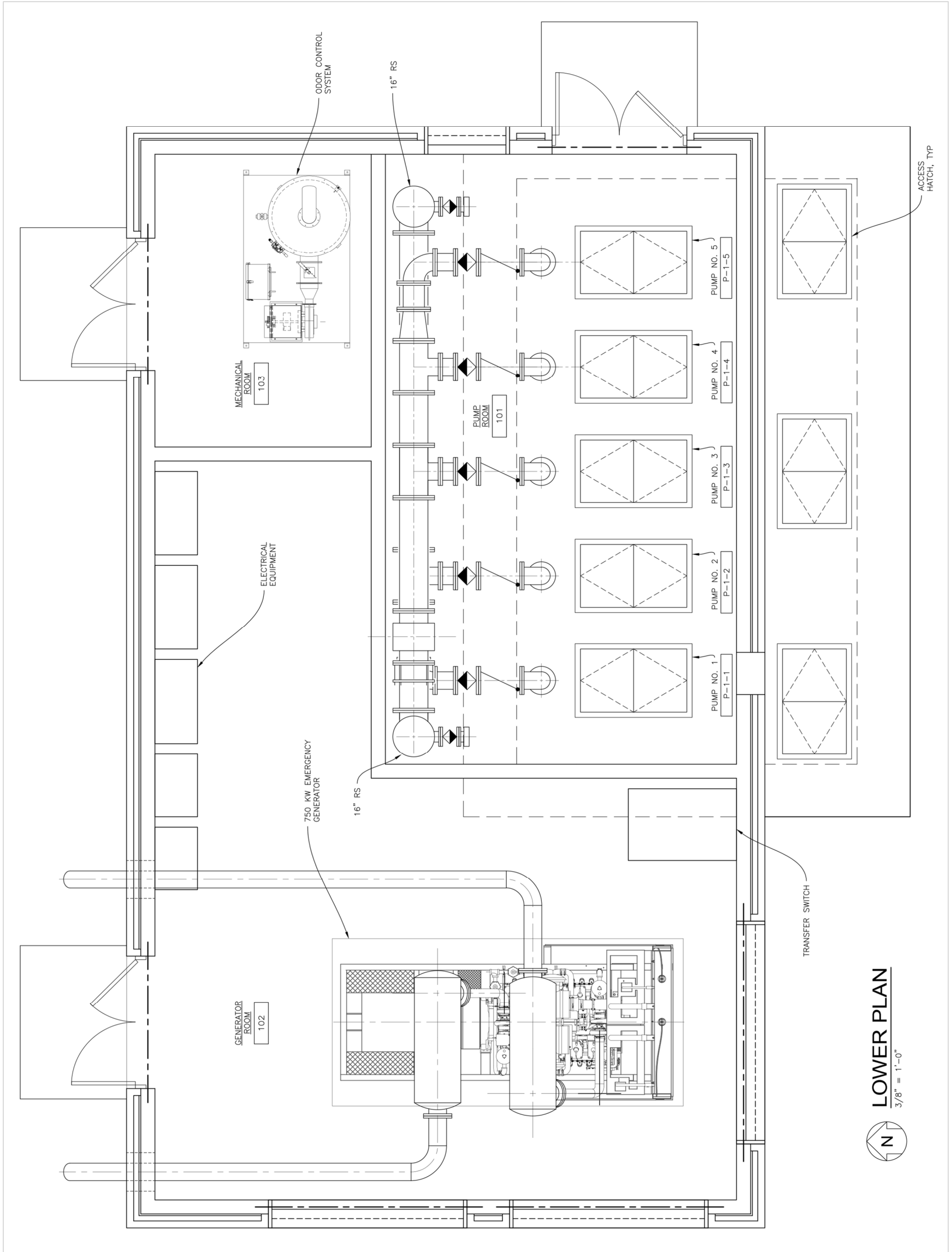


FIGURE 5-3
Proposed LS E Ground Plan



LOWER PLAN
3/8" = 1'-0"



WET WELL

The wet well for the lift station will be 28 feet long by 16 feet wide cast in place concrete rectangular structure with a depth of 39 feet. (See Figure 5-4.) The lift station building will be constructed partially over the wet well so the discharge header assembly is located inside the pump room. A 36-inch diameter interceptor sanitary sewer from the existing LS E site and the Phase 24-inch diameter interceptor sanitary sewer from Phase 2 will both discharge into the wet well at an approximate invert elevation 637.70.

Entrance to the wet well will be through either: 1) Five pump access hatches sized for removal and installation of the submersible pumps from the valve room, or 2) Three access hatches from the building exterior. Fall-through protection will ensure that the access hatches can be safely opened for observation of the wet well interior.

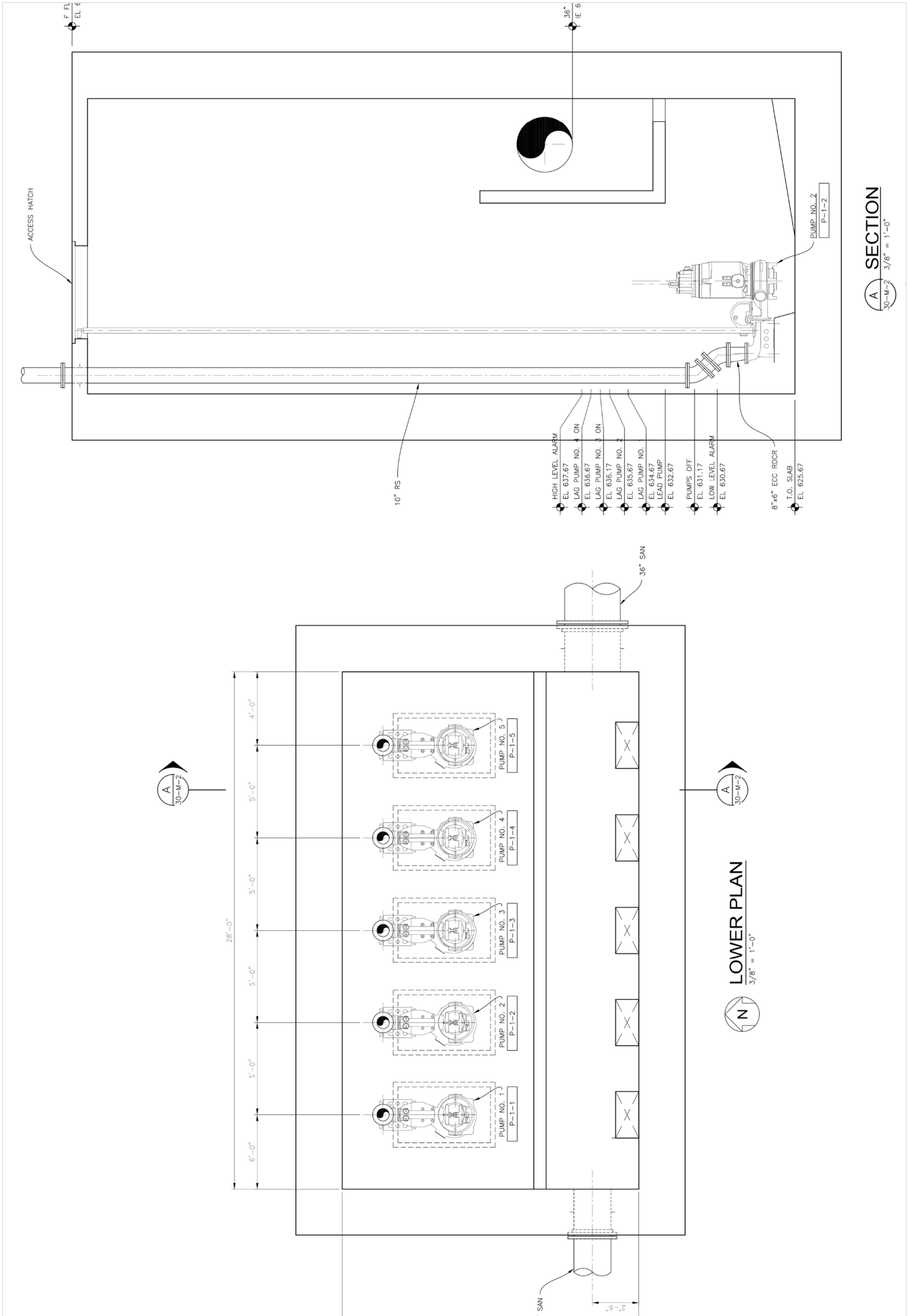
PUMPS

The City has preliminarily selected Flygt N-Series submersible pumps for the new lift station. The N-pump uses a proprietary hydraulic end design to reduce the risk of clogging while maintaining pump efficiency.

Per TM 1, the new station will be designed for a peak hour pumping capacity of 9,000 gpm. The discharge will be evenly split between the two 16-inch diameter discharge force mains. To achieve this, the station will feature five Flygt NP 3231 submersible pumps, each with a rated capacity of 2,250 gpm and detailed in Appendix F. Three of the five pumps will be 250 hp rated at 2,250 gpm at 217 feet of total dynamic head (TDH) sized to serve the East force main. The other two pumps will be 150 hp rated for 2,250 gpm at 154 feet TDH sized to serve the West force main. The higher TDH value in the East force main is due to the longer force main length which results in more friction loss. Premium efficiency motors will be considered to minimize pump operation costs. With one of the largest pumps out of service, LS E will be able to pump the full peak flow, equal to a firm capacity of 9,000 gpm.

The pumps will utilize variable frequency drives to allow a varied pumping rate to match influent flows and ease pump startup under standby power. Utilizing the variable frequency drives to ramp up pump speed at startup greatly reduces the starting current as compared to an across the line starter. This is especially true for large pumps.

FIGURE 5-4
LS E Wet Well Plan and Section



LOCATION AND SITEWORK

The new LS will be located southwest of the current LS, as shown in Figure 5-5. The site is partially wooded with a multi-use trail running through it to connect N. Laguna Drive and W. Ranch Road. The LS will be accessed from the multi-use trail, and pavement along the building will provide direct access to the valve, generator and mechanical rooms. The site plan also shows the proposed reconfiguration of sanitary sewers to the station, as well as the two new 16-inch diameter force mains.

Relocating the LS to a new site will allow the new LS to be constructed while the existing LS remains in service. The existing LS will be demolished once the new LS is operational. The structure will be removed above grade and to a depth of 36-inches below grade, and the remaining wet well and dry well structures will be filled with stone. Holes will be drilled through the base slab to allow for drainage. Both sites and adjacent areas will be graded and restored.

CONTROLS AND SCADA

A control panel housing the controls and SCADA system will be provided in the generator room. The control panel will utilize an Allen-Bradley CompactLogix Programmable Logic Controller (PLC) and a local Maple Systems Operator Interface Terminal (OIT) touch screen. Its touch screen and front of panels switches will be similar to those in the existing LS E. An uninterruptible power supply will be included to maintain PLC operation and SCADA monitoring during power failures. A local control panel will also be located in the valve room, allowing line of sight operation of the pumps to verify operation.

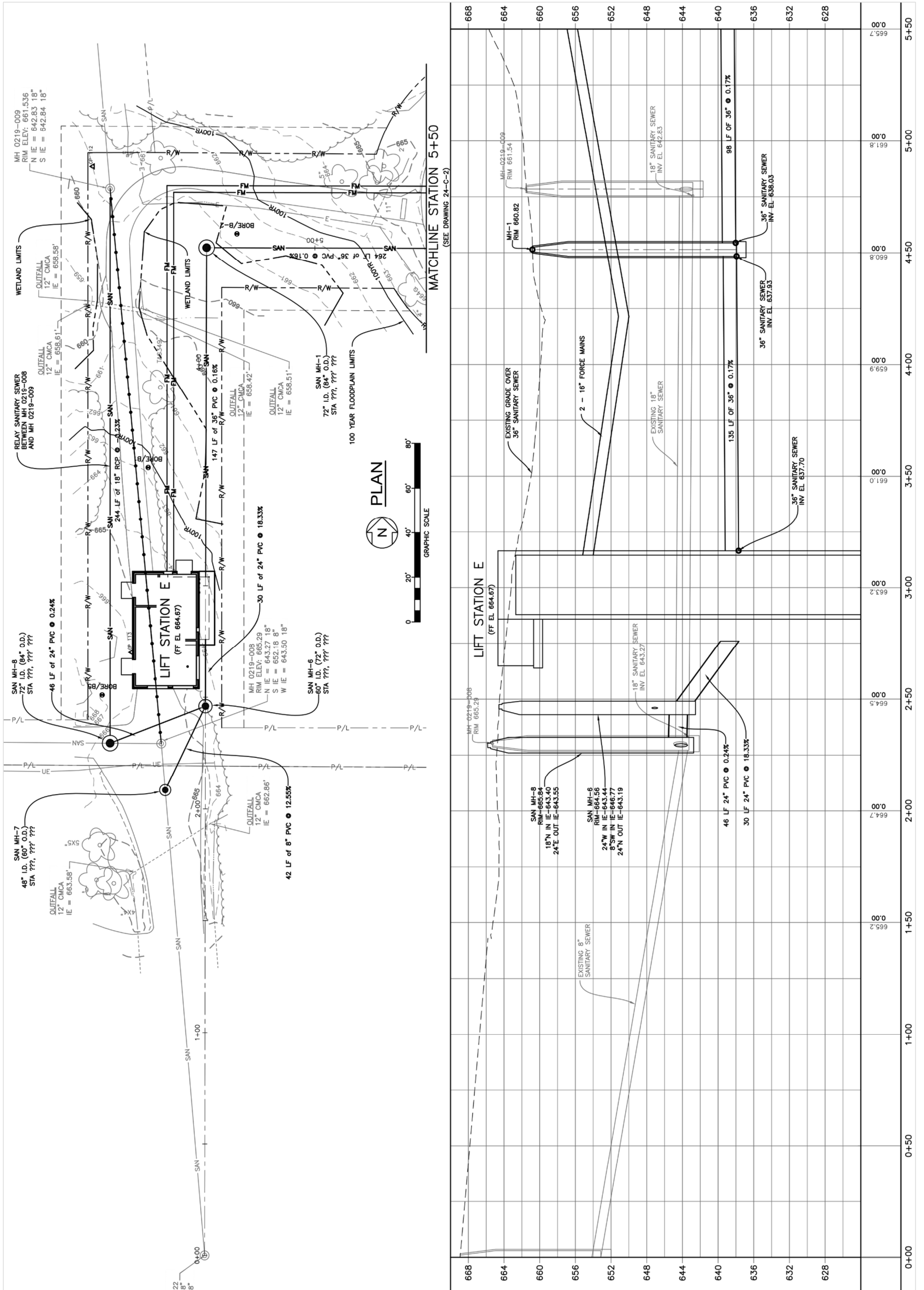
The primary level control system will be a submersible pressure transmitter that provides continuous level indication and pump control through the PLC. A backup float system will provide full pump control in the event of a level transmitter or PLC failure.

Since flow monitoring allows for easy monitoring of lift stations, a flow meter will be installed on each force main in the valve room of the lift station building.



Existing LS E control panel

FIGURE 5-5
LS E Site Plan



STANDBY POWER

An emergency generator and automatic transfer switch (ATS) will allow the station to remain operational in the event of an electrical service outage. The generator will be a 750 kW unit sized for operation of the four pumps and other electrical demands of the station. (See Figure 5-6.)

Standby generators of this size can be either natural gas or diesel powered, depending on preference or application. Natural gas generators are fueled by the local natural gas utility. They can be impractical when the natural gas service is not nearby or for larger sized units where the natural gas generator requires a significantly larger engine than a diesel unit. In general terms, a natural gas fueled engine produces less power than a diesel engine for a given displacement.

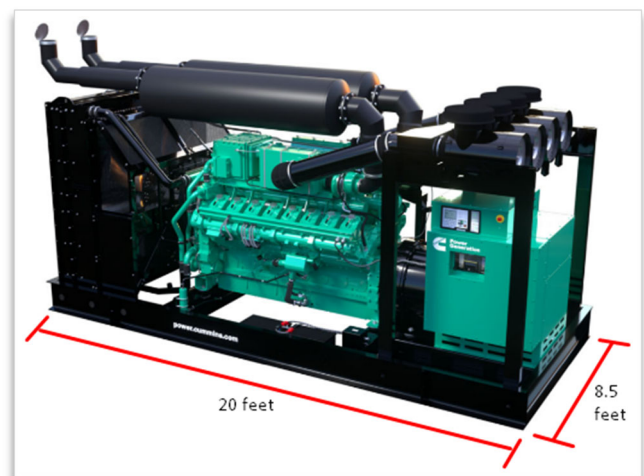
Although diesel generators require smaller displacement engines, they require onsite diesel fuel storage (typically 24 hours of fuel). Diesel fuel storage requires periodic monitoring to ensure it is kept fresh and that an adequate supply is available for any outage. The LS E diesel generator would include a base tank to store 2,000 gallons of fuel to meet this requirement.

Diesel generators also can experience wet stacking, which occurs when the diesel engine runs below its designed operating temperature for extended periods. Unburned fuel is exhausted and a black sludge is present at the exhaust manifold. Over time, the unburnt fuel build-up in the exhaust side of the engine can result in fouled injectors and a buildup of carbon on the exhaust valves, turbo charger and exhaust. This can cause a loss of engine performance and the scaring and erosion of key engine surfaces.

WE-Energies indicated that natural gas service is available at the current LS E site and can be delivered to the proposed LS E. Based on the ability to deliver natural gas to the site, the maintenance issues of diesel engines, and the City's preference for natural gas generators, a natural gas generator is recommended for the new LS E. Figure 5-6 depicts the approximate dimensions for a typical natural gas generator.

Transfer from normal utility power to generator power will be automatic through the use of a 480-volt ATS. The ATS will continually monitor the utility power source, transferring power should

FIGURE 5-6
750 kW Natural Gas Generator



one or more phases drop out. To ensure that utility power is stable, the ATS will include user-adjustable time delays to ignore momentary outages and prevent retransfer to utility power.

VENTILATION

To maintain the air quality within and around the station, ventilation of the various rooms and wet well is required. The current Wisconsin Administrative Code NR 110 Sewerage Systems requires that adequate ventilation of a lift station be provided either continuously or intermittently. Additionally, NFPA 820 Standards for Fire Protection in Wastewater Treatment and Collection Facilities establishes a standard to provide for fire and explosion protection.

WET WELL

A permanent mechanical ventilation system for the wet well is not required under NR 110, as routine entrance into the wet well is not required to inspect or maintain equipment. The new station will be configured to allow for the removal of pumps and level elements for service and repair without requiring a person to enter the wet well.

Although a permanent mechanical ventilation system is not required for the station's wet well, the wet well will be continuously ventilated at a rate of 2 air changes per hour (ACH), through an odor control system. The odor control system will be a skid-mounted packaged carbon odor scrubber system, similar to the system in use at the existing LS E. It features a drum containing granular carbon filtration media specifically designed to remove sewage odors, a blower, electrical control panel, and associated process equipment. The blower will be mounted adjacent to the carbon drum to facilitate replacement of the carbon media. The blower fan will be constructed of corrosion resistant material with a wheel fabricated from nonsparking material, as required for ventilating areas. The odor control system will be located in the Mechanical Room.

Portable mechanical ventilation equipment will be required to allow for confined space entry into the wet well.

Based on the requirements of NFPA 820, this area will be rated as a Class I Division 1, Group D NEC hazardous location.

VALVE ROOM

The valve room will provide access to the pumps and valves for operation, inspection, and maintenance. To conform with the requirements of NR 110, the valve room will be mechanically ventilated. The space will be heated to prevent freezing during cold weather, though continuous ventilation at 12 ACH of outside air will result in higher heating costs. The space will typically be

ventilated at less than 12 ACH of outside air and intermittently ventilated at 30 ACH whenever occupied to comply with NR 110 requirements. During unoccupied periods, the valve room will be ventilated continuously at 2 to 3 ACH to maintain air quality and minimize odors and corrosion.

This space will be rated as a Class I Division 1, Group D NEC hazardous location, conforming to the requirements of NFPA 820.

MECHANICAL ROOM

The mechanical room will house the wet well's odor control equipment. Ventilation of the mechanical room is not dictated by NR 110 requirements. However, odor control and ventilation systems serving classified locations are covered under NFPA 820, which requires that the entire area be rated as a Class I Division 2 Group D NEC hazardous location if the space is not continuously ventilated at six or more ACH. For spaces continuously ventilated at six or more ACH or areas located within 3 feet of leakage sources (e.g., fans, dampers, flexible connections, flanges, pressurized unwelded ductwork, odor-control vessels), a Class I Division 2, Group D NEC hazardous location classification is required, though the areas beyond can remain unclassified. Given the small size of the room and the odor control equipment, most of the room will need to be classified even if ventilated above 6 ACH. Therefore, there is no need to continuously ventilate at 6 or more ACH since the entire mechanical room will be classified. Instead, space heating will provide intermittent ventilation during occupancy.

GENERATOR ROOM

Ventilation in the generator room is not dictated by NR 110 requirements, since the generator room will be physically separated from the the wet well with no personnel access to the wet well. It is an unclassified space based on NFPA 820 requirements. The room has three louvers with motorized dampers. It will be ventilated with the emergency generator using the generator's radiator fan and opening of the damper if the room temperature exceeds 90°F. The room will be heated with a unit heater during cold weather.

Chapter 6

FORCE MAIN AND SEWERS

FORCE MAIN

At the new firm station capacity, 4,500 gpm will discharge into each force main with a fluid velocity of approximately 7.8 ft/s (within force main guideline velocities of <8 ft/s). The station will be designed to pump 9,000 gpm with the largest pump out of service.

The two existing 16-inch diameter force mains, composed of PVC with ductile iron fittings, were constructed in 2001 to replace the original 10-inch and 14-inch diameter force mains. The original force mains were abandoned in place and will need to be crossed twice by the new force mains near the station's driveway entrance.

New twin 16-inch diameter force mains will be constructed from the new station to the connection point. They will be C-900 PVC pipes that match the existing force mains. The new station will be reconnected to the existing force mains immediately east of the existing station driveway. At this point, the existing force mains continue to the east in the W. Ranch Road ROW before turning south into the N. Oriole Lane ROW. The elevation of the force main reconnection near the station driveway will be approximately 656.1.

The new 16-inch diameter force mains will run approximately 690 LF between the new station site and the point of reconnection near the existing driveway. The new force main will discharge at the station at approximate elevation 657.0.

INFLUENT SEWER

Two influent sewers will connect to the wet well in the new station: a 36-inch diameter sewer from the north and a 24-inch diameter sewer from the south. They will convey all flows from the existing LS E to the new LS E.

36-INCH DIAMETER SANITARY SEWER

A new 36-inch diameter influent sewer will convey flows from the existing 10-inch and 30-inch diameter sewers to the new lift station. The existing 30-inch diameter sewer collects wastewater flows from north of the existing station, which is a large portion of the City's flows. The existing 10-inch diameter sanitary sewer collects flows from W. Ranch Road to the south of the existing station. The 36-inch diameter sewer will be constructed between the existing confluence manhole

MH# 0119-034, following Route D along the existing driveway, crossing W. Ranch Road, and following the W. Ranch Road ROW to the west, before turning south in the N. Laguna Drive easement and terminating at the new wet well. Four new manholes are expected to be constructed along the 36-inch diameter sewer route.

24-INCH DIAMETER SANITARY SEWER

A new 24-inch diameter influent sewer will convey the flows from the existing 18-inch diameter sewers located in N. Laguna Drive and the portion of W. Ranch Road located southwest of the new lift station site. A 70-foot portion of the 24-inch diameter sewer will be constructed between the wet well and a new manhole installed near existing manhole MH#0219-008 at the northern terminus of N. Laguna Dr. to convey sewage from the south to the new station.

Chapter 7

UTILITIES SITEWORK

As discussed in TM 2, the selected utility corridor is Route D with an estimated cost of \$2,123,000.

Chapter 8

COST ESTIMATE

METHODOLOGY

Construction costs were developed for this project using the following methodology:

- Unit costs were applied to the quantity takeoffs determined for each aspect of the project. Unit costs were obtained from cost estimating references, recent bid tabs, vendor quotations, and recent past experience with midwestern municipal projects.
- Quantity takeoffs were made for the major items shown on the predesign drawings:
 - Excavation and backfill
 - Underground piping
 - Building architectural/structural components
 - Major process equipment items
- Equipment quotations and installation labor requirements were provided by manufacturers.
- A construction cost contingency has been included to account for undefined design details that may arise during final design and items that were not identified in the current estimate.
- A line item for general conditions is included to account for the following items:
 - Mobilization/demobilization
 - Bonds and insurance
 - Overhead and profit

This preliminary design cost estimate is intended to be a budgetary level estimate to provide a check on the project's financial status at this point in the design. An estimate of this type is typically accurate to within +30% to -15% of anticipated bids for construction. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors. As a result, the final project costs will typically vary from the estimates presented.

CONSTRUCTION COST ESTIMATE

The estimated construction cost for the Mequon Lift Station E improvements is \$8,814,000, as detailed in Table 8-1. Appendix G provides a breakdown of the quantity takeoffs and unit prices used to create this estimate.

PROJECT COST ESTIMATE

The estimated total project cost of \$10,937,000 includes the construction costs and engineering fees necessary to construct the new station and associated utilities.

TABLE 8-1
Lift Station E Project Cost Estimate

Item	Cost
Lift Station	
Excavation and Backfilling	\$766,000
Dewatering	\$250,000
Cast in Place Concrete Wet Well	\$269,000
Lift Station Building	\$738,000
Submersible Pumps	\$1,598,000
Odor Control Unit	\$105,000
Generator & ATS	\$808,000
Sitework	\$137,000
Mechanical	\$753,000
Electrical	\$603,000
Instrumentation and Controls	\$251,000
Subtotal Construction Cost	\$6,278,000
Contingencies (30%)	\$1,883,000
General Conditions, Bonds and Insurance (8%)	\$653,000
Total Lift Station Cost	\$8,814,000
Total Utility Cost*	\$2,123,000
TOTAL PROJECT COST	\$10,937,000

* Utility costs are detailed in Table 4 of TM 2.

FUNDING METHODS AND RATE IMPACTS

The capital cost for the LS E project will be funded through the City's budget process.

APPENDIX A

Technical Memorandum 1: Design Flows

Date: July 19, 2023 (Original: May 18, 2023)

Project #: 6555

To: Kevin Driscoll, P.E. (City of Mequon)

From: Alan Labisch, (ATI) Will Hein (ATI), Paul Traeger (ATI)

cc:

Regarding: Technical Memorandum 1 – Lift Station E Design Flows Revised

PURPOSE

This technical memorandum evaluates the service area and establishes design flows for the Lift Station (LS) E replacement project. On October 27, 2022, the City Sewer Utility District agreed to proceed with designing and constructing a new Lift Station E (LSE) in the 60-foot public right-of-way located at the north end of Laguna Drive southwest of the existing station.

SERVICE AREA

The service area for the LSE generally lies in the northeastern portion of the City and serves a significant portion of the City of Mequon. The service area currently includes approximately 4,400 acres, including the service areas for Stations F, G, H and T which ultimately discharge into the collection system to station E (refer to Figure 1). The basin area is nearly fully developed and not expected to have significant population increases. It is made up of primarily residential neighborhoods and includes commercial, public, institutional and park land. Potentially the service area could be expanded to the north and include some excluded areas to the east in the future. However, the topography and cost required to expand the collection system to the north has resulted in the City Community Development Department determining that any growth to the north, such as the Ulao Creek Development (formerly known as East Growth Area), will be with private on-site sewer systems.

Anticipated Land Use

The City's 2035 Land Use Plan was finalized in 2019. The plan confirms that land use will not significantly change in the LSE service area, and that LSE will primarily serve residential neighborhoods.

FLOWS – CURRENT AND FUTURE

Historical Flows

The City of Mequon has two ultrasonic doppler flow meters to monitor and record the flows pumped from LSE. Over the period from January 1, 2013 through December 31, 2019, the station's daily flows have averaged from 1.222 MGD (849 gpm) for 2015 to 2.485 MGD (1,726 gpm) for 2019 and appear to have steadily grown since 2013. Over this period, the station experienced a maximum daily flow of 5.148 MGD (3,575 gpm) on April 1, 2016. A detailed summary of historical flows is contained in Chapter 5 of the 2021 Lift Station E Condition Assessment. The report indicated some concerns over the reliability and accuracy of the reported data, however the flow meters were recently installed and calibrated to within 2% accuracy.

Sanitary Sewer Overflows

There has been a history of Sanitary Sewer Overflow (SSO) events resulting from severe weather-related conditions such as large or successive precipitation events, saturated soil and/or heavy snowmelt. These SSOs were initiated to prevent basement backups and severe property damage. The 2021 Lift Station E Condition Assessment summarized the SSO events indicating that nine separate periods of heavy precipitation and/or flooding led to 25 SSOs being reported to the DNR for the years 2007 through 2020 with the data showing an apparent trend that SSO events are increasing in magnitude.

Since the 2021 Lift Station E Condition Assessment was completed another SSO has occurred that was documented in the "Riverdale Park LS F Hydraulic Analysis" prepared by SEH, Inc. The SSO occurred on August 8th, 2021, and resulted in a 1,080,000 gallon overflow from LSE's service area. SEH reported that LSE was operating at its firm capacity of 5,250 gpm of flow and had a SSO of 1,080,000 gallons at a pumping rate of 3,000 gpm. City staff have confirmed that there were two bypass/trash pumps running during the LSE SSO that totaled 3,000 gpm.

During the August 8th storm event, the station's ultrasonic flow meters measured a peak hour flow of 5,950 gpm, which is beyond the station's firm capacity of 5,250 gpm. Based on the measured peak hour flow (5,950 gpm) and the SSO pumping rate (3,000 gpm) just upstream of LSE, LSE would have been capable of handling the August 8th storm event if it was capable of pumping 8,950 gpm.

Projected Growth

The 2021 LSE Condition Assessment used the Milwaukee Metropolitan Sewerage District (MMSD)'s 2050 Facilities Plan to estimate sewer shed flows for 2050. The assessment established that little-to-no growth in flow will occur in the LSE service area by 2050. To verify the findings of the condition assessment, subdivision-based growth projections from Mequon-Thiensville School District were assessed. For reference, Figure 1 shows the existing LSE service area and the other MMSD sewer shed areas.

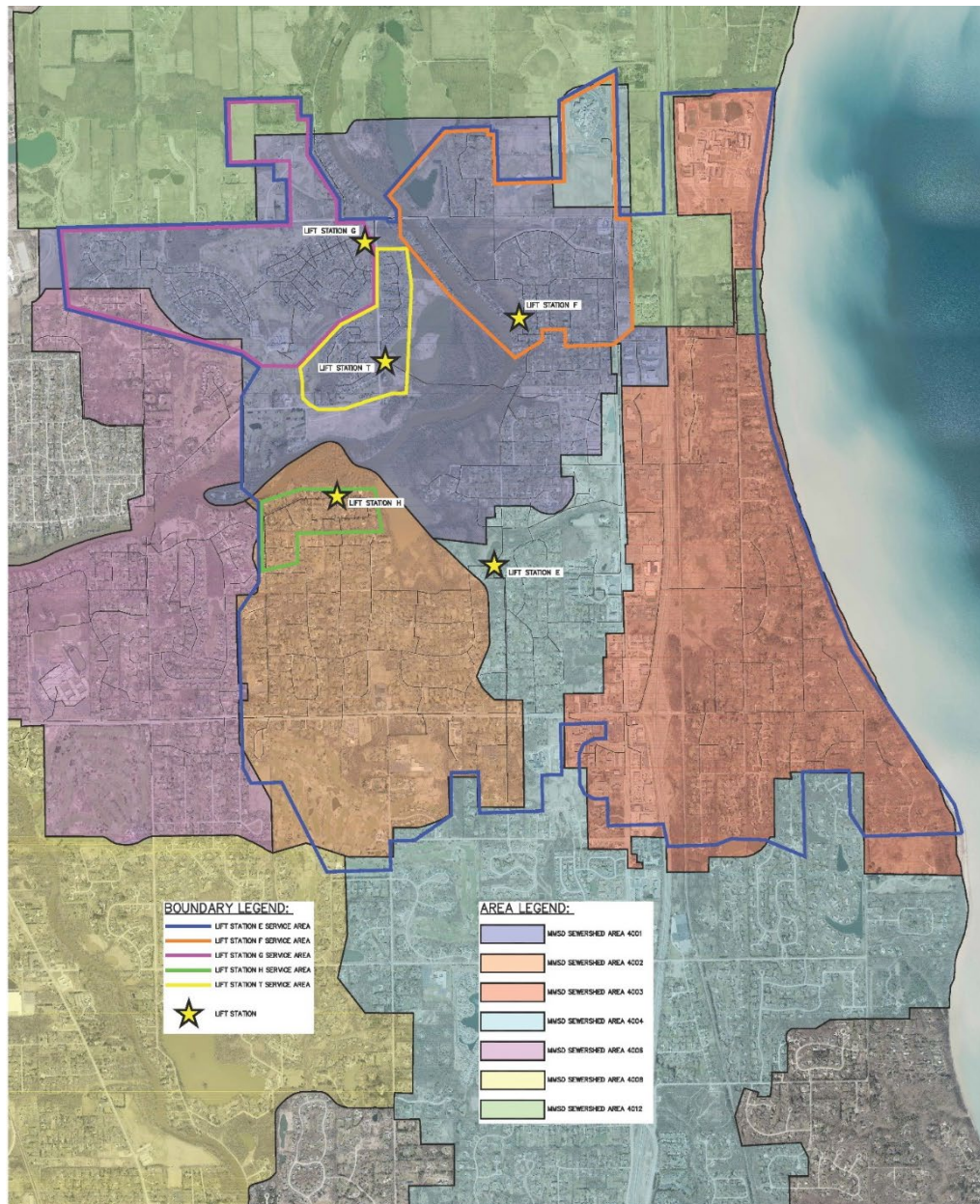


FIGURE 1 – MMSD SEWERSHED AREAS IN THE CITY

Land use information from the City of Mequon was analyzed and reviewed along with the subdivision growth projections completed by the Mequon-Thiensville School District (MTSD) in 2021 which included a detailed map of *Unit Growth by Neighborhood between 2019 and 2030*.

Figure 2 shows MTSD’s subdivision growth map with the LSE service area overlaid onto it. Most of the land in the service area is green, corresponding to “no significant growth”. Only a fraction of MTSD subdivision #62, located in the northernmost region of the LSE service area, is expected to have growth. The orange color corresponds to medium growth (80-179 new housing units by 2030). No areas of high growth (180+ new housing units by 2030) are projected inside the LSE service area. This confirms that significant growth is not expected in the LSE service area.



FIGURE 2

LSE Service Area (Solid Red Border) and Neighborhood Growth
Green=No Significant Growth Yellow = Low Growth Orange = Medium Growth

Note: Neighborhood growth data is sourced from Mequon Thiensville School District

New Lift Station E Capacity

Considering no significant growth is expected in the LSE service area by 2050, the new LSE should be sized for the peak hour observed flow plus the LSE SSO flow, rounded up. The resulting proposed station capacity is 9,000 gpm.

$$5,950 \text{ gpm} + 3,000 \text{ gpm} = 8,950 \approx 9,000 \text{ gpm}$$

This value will be used as the station's design firm capacity, which is the station capacity with the largest pump out of service.

RECOMMENDATION

LSE should be designed for a firm capacity of 9,000 gpm (13 MGD). This is roughly a 70% increase over the station's existing firm capacity of 5,250 gpm. At the new firm station capacity, 4,500 gpm could flow in each discharge force main, with a fluid velocity of approximately 7.8 ft/s (within force main guideline velocities of <8 ft/s). The station will be designed to pump 9,000 gpm with the largest pump out of service. All pumps will be capable of being operated during extreme flow events to pump more than 9,000 gpm through the force mains. The wet well will be sized with physical space consideration for larger pumps. This will allow the station to be upgraded in the future to handle increased flows from LS F and G and/or additional unplanned development from the north.

Additional upgrades to the discharge force mains, or other upgrades such as an additional relief sewer, or in-line storage solutions will most likely be required if peak hour flows to the station increase above 9,000 gpm. The proposed firm capacity will allow LSE to handle future peak flows without surcharging, while maintaining an acceptable velocity in the discharge force mains at peak flow.

Following this recommendation, future technical memos #2 through #4 will discuss in further detail the proposed sewer modifications, selection of the lift station site, and building/wet well size and layout.

APPENDIX B

Technical Memorandum 2: Site Selection & Sewer Routes

Date: October 17, 2023

Project #: 6555

To: Kristen Lundeen, P.E. (City of Mequon)

From: Alan Labisch, (ATI) Will Hein, (ATI) Paul Traeger (ATI)

cc:

Technical Memorandum 2 – Site Selection and Sewer Routes for Lift Station E and Hydraulic Modeling Summary

Regarding: *Revision 2 based on City comments*

PURPOSE

This design memorandum discusses the corridors of the existing sewers that discharge to existing Lift Station E (LS E) and evaluate options for connecting these sewers to the new station site (Phase 1 Sewer Improvements). Alternatives for the sewer corridor and the new station location have been evaluated, and methods for sewer replacement are discussed. In addition, the findings of the PCSWMM hydraulic modeling are summarized for the new lift station, force mains, re-routed sewer and other Phase 1, 2, 3 and 4 sewer improvements.

EXISTING CONFIGURATION

LS E collects wastewater from approximately 6 square miles (3,841 acres) in a confluence manhole (MH #0119-034) immediately north of the station. The majority of the flow enters the confluence manhole from the northeast through an existing 30-inch diameter sanitary sewer. The flow in the 30-inch sewer includes the discharge from Lift Stations F and G as well as the northern portion of LS E's service area. The second influent sewer is an 18-inch sewer from the West, which is located within a 20-foot wide utility easement. The third and final influent sewer is a 10-inch sewer from the South. All influent sewers need to be conveyed to the new station site.

Figures 1 and 2 both depict the existing LS E layout with the 30-inch, 18-inch, and 10-inch influent sewers at the confluence manhole (MH #0119-034).

NEW LIFT STATION LOCATION

The new location for LS E will be located in a City owned 60-foot-wide right-of-way, as defined on the Ranch Court subdivision plat. The location is near several privately owned residential properties further described below. This section of right-of-way contains areas of both flood fringe and wetlands. Considering the environmental impact of the new LS E, careful evaluation of LS E site in relation to both the wetlands and flood fringe in accordance with the regulatory standards contained within the Wisconsin Administrative Code (WAC) is one of the factors in determining the new station site. Other factors include constructability, cost, and function.

NEW STATION SITES

Based on the above criteria, two sites have been identified for further evaluation as the new location for LS E. We note that the work on the site required to implement the future phase 2 sewer improvements is included with both site options. Constructing the station at either site will require provisions for maintaining pedestrian and sewer access throughout construction and after construction is completed.

Site A

Site A is located at the west end of the cul-de-sac on W. Ranch Road west of the home located at 2145 W. Ranch Road. Three homes (2042, 2145 & 2205 W Ranch Road) are located within 250-feet of the proposed lift station. [Figure 1](#) shows new LS E site A in relation to the existing LS E and possible sewer routes to the new LS E from the existing LS E, while [Figure 2](#) is a site plan of the new LS E at Site A.

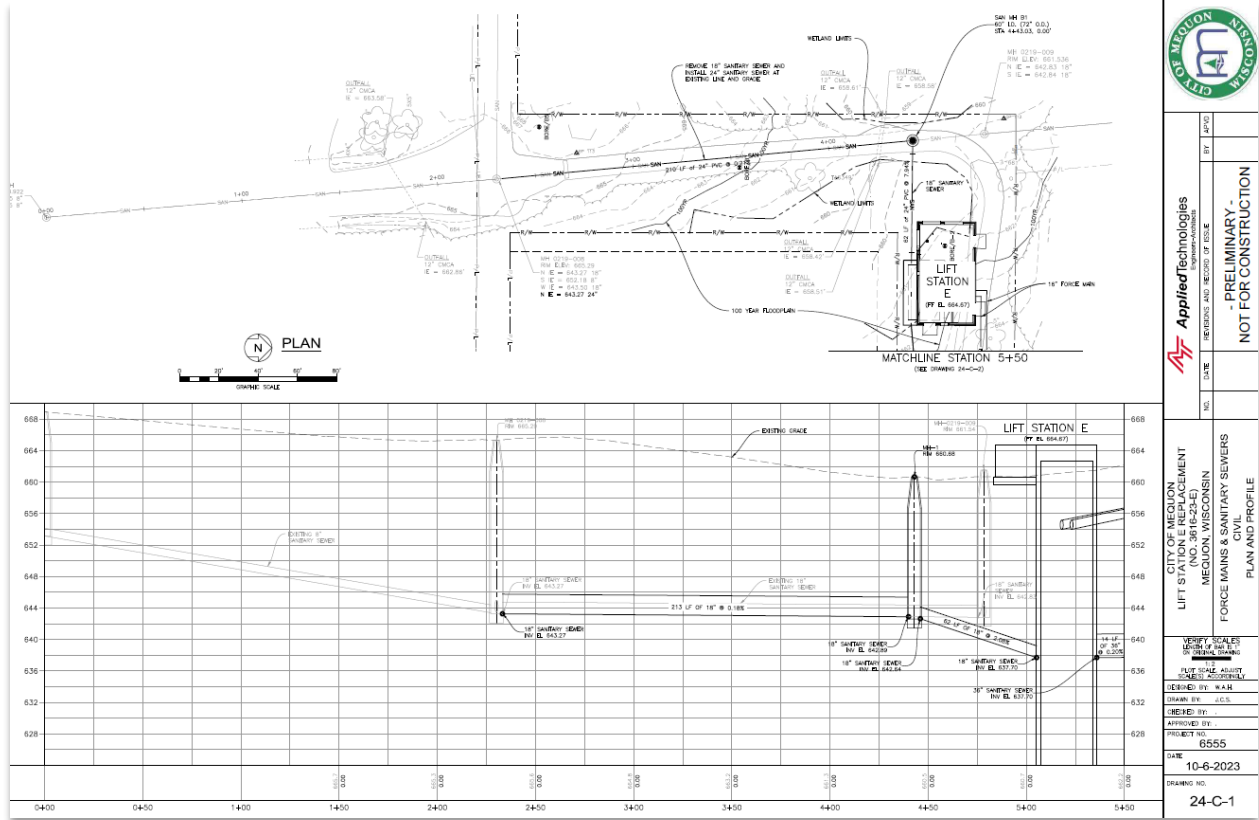
Notable features of this site include a buried electric utility line which passes through this portion of the right-of-way that will require relocation to construct at this location. No other utilities were picked up in this area during the recent site survey. Connecting the station to the existing collection system will involve the construction of a short section of 24-inch sewer from the west to the existing sewer from the south. In addition, the remainder of the existing sewer to the south will be re-laid as 24-inch to facilitate the future phase 2 improvements, along with constructing a new sewer from the confluence manhole (MH #0119-034) at the existing LS E site to Site A. Site A is closer to the existing station. Consequently, less sewer and force main will need to be constructed to tie into the existing gravity collection system and force mains. Locating the new LS at this site will also incur relaying and upsizing approximately 150-feet of additional 18-inch sewer to 24-inch sewer for Phase 2 work versus Site B as described.

Areas of wetland and flood fringe will be affected by the construction of the station at this site. If deemed necessary by City staff, compensatory storage for fill added within the flood fringe can be provided at the existing LS E site following the abandonment and removal of the existing station

Figure 1 – LS E Site A & Routes



Figure 2 – LS E Site A Plan & Profile



		AppfectTechnologies ENGINEERS AND ARCHITECTS 1000 W. WISCONSIN ST. SUITE 200 MEQUON, WI 53151 PHONE: 414.224.8800 FAX: 414.224.8801 WWW.AFFECTTECH.COM	BY: JAPD
			DATE: 10-6-2023
CITY OF MEQUON LIFT STATION E REPLACEMENT (NO. 36-18-23-4E) MEQUON, WISCONSIN FORCE MAINS & SANITARY SEWERS CIVIL PLAN AND PROFILE		NOT FOR CONSTRUCTION PRELIMINARY	DATE: 10-6-2023
VERIFY SCALES BY: J.C.S. DATE: 10-6-2023 LIFT SCALE: AS SHOWN PLAN SCALE: AS SHOWN DESIGNED BY: W.A.H. DRAWN BY: J.C.S. CHECKED BY: APPROVED BY: PROJECT NO. 6555			DRAWING NO. 24-C-1

and berms. Compensatory storage is at the discretion of the City Zoning Administrator unless the City requests input from the Department of Natural Resources or FEMA. Based on a review of Article IX of Chapter 58.75, modification to the base flood elevation requires the approval of the DNR and FEMA. Limited fill within the flood fringe will have no impact on the base flood elevation and as such, may be reviewed and approved on a case by case basis by the City. Portions of Site A lie within the flood fringe and will need to be elevated to provide the necessary floodproofing required under WAC Section NR 116 (i.e., the building floor must be 2-feet above the 100-year flood elevation among other things). Based on the existing elevations in the area, it is estimated that this site will need approximately 600 CY of imported structural fill will be needed to floodproof Site A. Due to existing elevations at Site A, the grade will need to be raised approximately 3-feet.

In addition to flood fringe, development at Site A will involve the filling of wetlands mapped by Wetland and Waterway Consulting LLC to construct the new station.

The right-of-way is currently being used for pedestrian access and maintenance of the sanitary sewer. The station located at Site A is “offline” of the existing sewer system. As such, there is virtually no impact on the existing 18-inch diameter sewer traversing the right of way. In order to provide a safe work area, we anticipate the closure of the pedestrian path at least until the station is up to grade.

If Site A is selected, the lift station building will be constructed at a finish floor elevation of 664.67. The 18-inch sewer in the N. Laguna Drive easement would be intercepted and re-laid with 24-inch diameter pipe and a new manhole, directing flow towards the wet well and entering the wet well from the west [Figure 1](#). The station would have a driveway off of Ranch Ct, which would tie in to the pedestrian path where it turns from Ranch Ct to N. Laguna Dr. The building would have an exposed foundation wall on the south side. It does not appear that retaining walls will be required.

Site B

Site B, shown on [Figure 2](#), is located at the north terminus of N. Laguna Drive and is adjacent to properties located at 11547 and 11548 N. Laguna Drive. Four homes (2145 W Ranch Road, 11541, 11547 and 11548 N. Laguna Drive) are located within 250-feet of the proposed lift station. [Figure 1](#) shows new LS E site B in relation to the existing LS E and possible sewer routes to the new LS E from the existing LS E, while [Figure 4](#) is a site plan of the new LS E at Site B.

Notable features of this site include the 18-inch sewer that passes through this portion of the right-of-way. The existing 18-inch sewer conflicts with the excavation and shoring necessary to build the new station at site B. The diversion of this 18-inch sewer can either be accomplished through relay, or temporary bypass pumping of the sewer flow around the new LS building throughout construction outside of the building’s construction footprint. No other utilities were picked up in

this area during the recent site survey. Connecting the station to the existing collection system will involve the construction of a short section of 24-inch sewer from the existing 18-inch sewer from the south, north of MH #0219-008 (at the northern terminus of N. Laguna Drive) and constructing

Figure 3 – LS E Site B & Routes

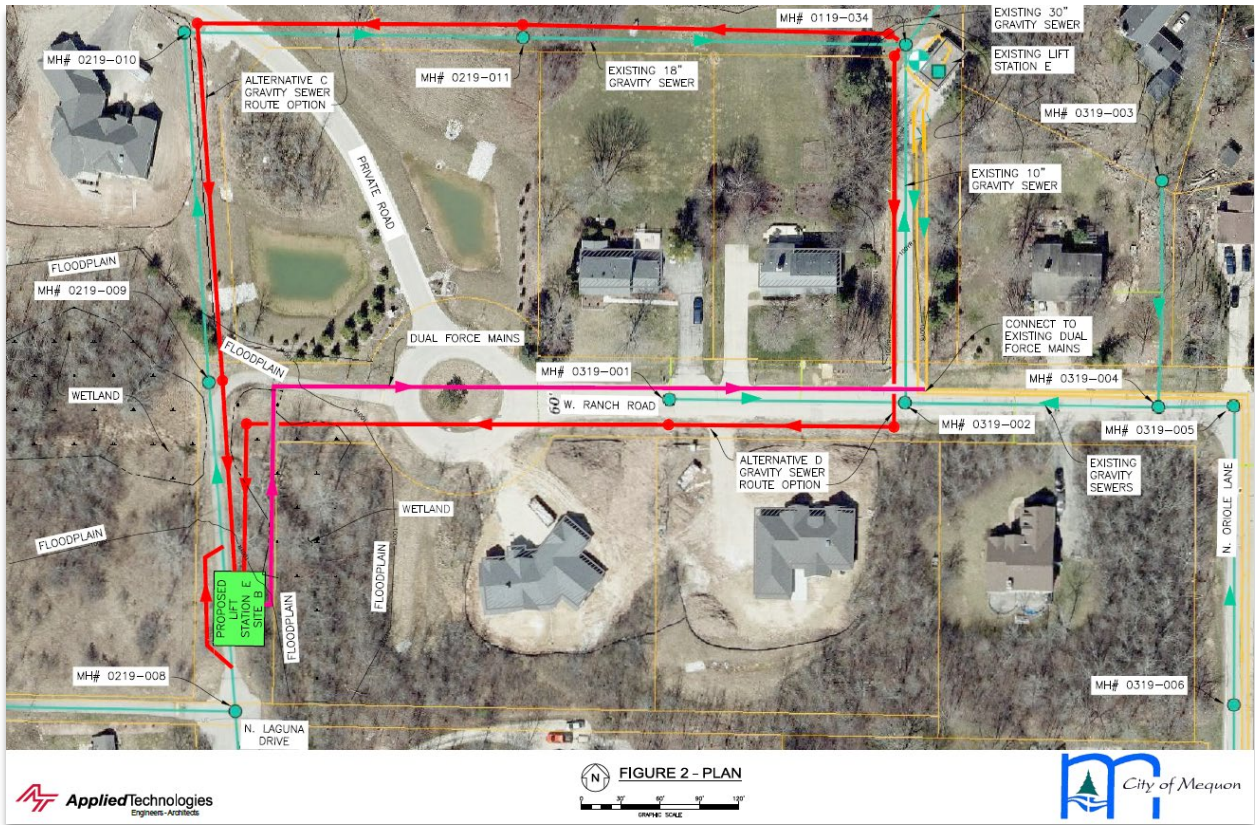
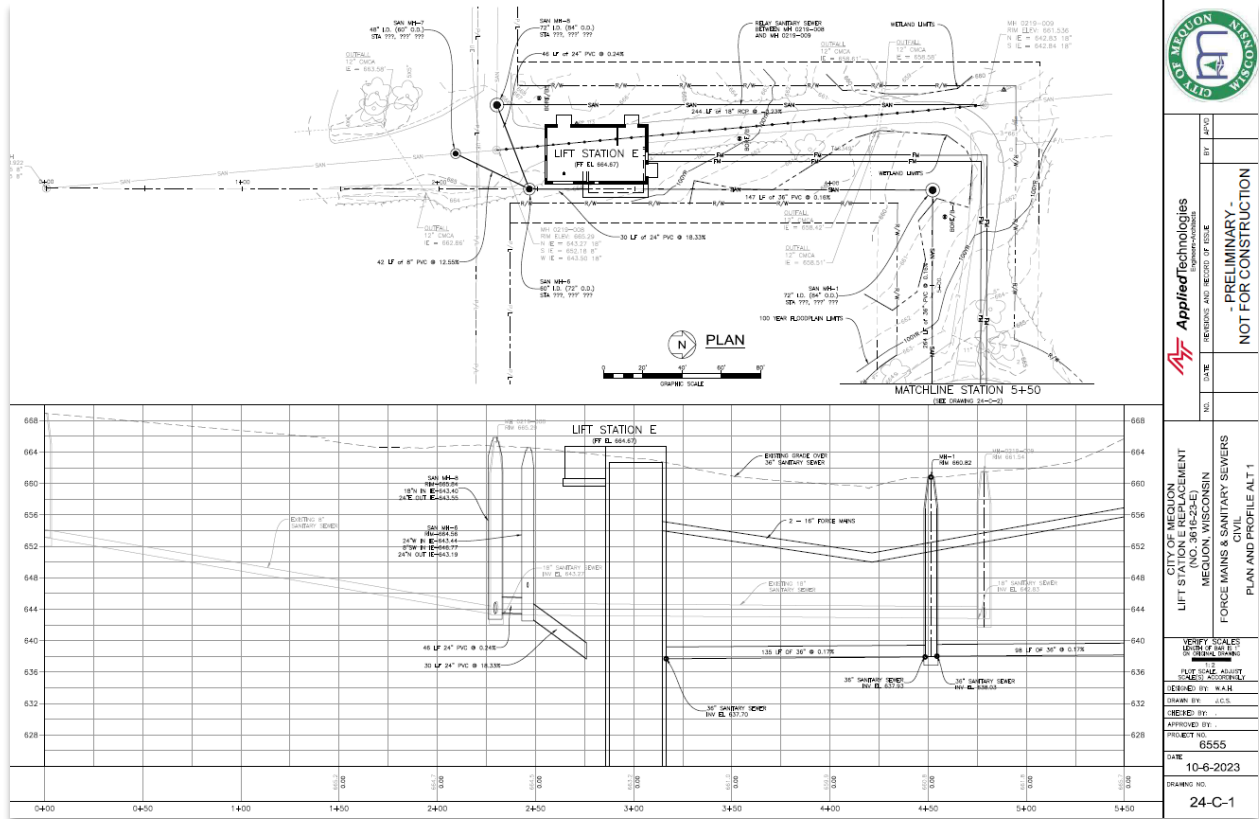


Figure 4 – LS E Site B – Plan and Profile



a new sewer from the confluence manhole (MH #0119-034) at the existing LS E site to the new LS site. Site B is further from the existing station consequently more sewer and force main will need to be constructed to tie into the existing gravity collection system and force mains.

Construction of the station at this site will have no impact on the wetland or flood fringe. Some of the sewer and force main work will impact the wetland and flood fringe, but the building construction will not. As with Site A, if deemed necessary, compensatory storage for required fill added within the flood plain can be met at the existing LS E site. Floodproofing of the new LS will not be necessary, but we anticipate constructing the station with the same floor elevation as at site A. Less fill is required at Site B when compared to Site A as the existing elevations are higher. Less than 100 CY of structural fill will be required to bring Site A up to grade.

The station being located at Site B will require that the first task completed will be the 18-inch diameter sewer relay/bypass. In order to perform this work, the pedestrian path will be inaccessible during construction of the relay/bypass and the new building. Ultimately, the path will be reconstructed adjacent to the new station driveway that would be built off N. Laguna Drive.

If Site B is selected, the lift station building would be constructed at a finish floor elevation of 664.67. As with Site A, it does not appear that retaining walls will be needed. The 18-inch sewer in the N. Laguna Drive easement would be temporarily relayed or bypass pumped, and later permanently relayed after LS E wet well and building construction to connect into the wet well.

REPLACEMENT SEWER ROUTES

As a part of the relocation of LS E, the collector sewers that discharge into the confluence manhole must be redirected to the new LS location. Specifically, a new sewer will need to be constructed to convey flow from the existing confluence manhole southwest to the new station site, where it will discharge into the new wet well. Two sewer route alternatives were identified and evaluated for routing the sewer from the existing confluence manhole (MH #0119-034) to the new station site.

Sewer Route C

Sewer route C, as shown on [Figure 1](#) (Site A) and [Figure 3](#) (Site B), follows the route of the existing 18-inch diameter from N. Laguna Drive to the confluence manhole (MH #0119-034) at the existing LS E site. However, the flow direction of the new sewer would be reversed, flowing to the southwest from the confluence manhole (MH #0119-034) at the existing LS E site to the new LS E. Much of sewer route C is in the existing 20-ft wide sanitary sewer easement granted by the River Bend Homes Association, Inc. and Ranch Court, LLC for the existing 18-inch sewer. The remainder of this route is in Mequon's right-of-way.

The new sewer within the existing easement would need to be deeper than the existing sewer to convey the sewage from the confluence manhole to the new station site. Using standard open cut construction methods, the new sanitary sewer would need to be installed at a design slope of approximately 0.1% grade to provide adequate capacity to convey the design flow. This would disturb the private road where the sanitary sewer crosses and would disturb the adjacent retention pond. Constructing the sewer along Route C would result in a new sewer depth approximately 2.5-feet deeper than current at MH #0219-010 and 4-feet deeper than current at MH #0219-008. Based on this, the east-west portion (MH #0119-034 to MH #0219-010) of the sewer route would be between 16 and 26-feet deep. This section would be partially located within the flood fringe, primary environmental corridor and hydric soils (likely representative of wetlands). The north-south portion (MH #0219-010 to MH #0219-008) would be between 24 and 26-feet deep and also partially affected by flood fringe, wetland and environmental corridor. This route requires 870 lineal feet of sewer to Site A and 960 lineal feet to Site B.

Construction of the new sewer using the same 20-foot wide easement corridor as the existing 18-inch diameter collector sewer would be very challenging given the limited easement width and the need to drain the sewer in the opposite direction. The only practical means of doing this would be to construct the new sewer in place of the existing sewer. To do this, careful construction sequencing would be required to ensure continued operation of Mequon's collection system and service to all users. The first step would involve placing the new LS in service while maintaining the existing LS in service with the 18-inch sewer from the south diverted to the new LS and each LS connected to one of the two force mains. This would allow the 18-inch sewer to be removed from service for the most part from the new LS to the existing LS site with only the need to provide service for the four parcels that are part of the Ranch Court Subdivision and are served by the private sewer on Ranch Court. This could be achieved by constructing the section of sewer that is south of MH #0219-010 first and routing the flow from the private sewer south to the new LS through this new section of sewer. Once this is done the remaining east-west section of sewer could be constructed (MH #0219-010 to MH #0119-034) and all flow can be redirected to the new LS.

Sewer Route D

Sewer route D, as shown on [Figure 1](#) (Site A) and [Figure 3](#) (Site B), runs southwest from the confluence manhole (MH #0119-034) to the new LS E site. The first section runs south following the route of the existing 10-inch sewer along the access drive to the existing LS E and is located in Outlot 1 of River Bend Homes Association from the confluence manhole (MH #0119-034) to W. Ranch Road near manhole #0319-002. The second section of sewer route D runs west down the right-of-way for W. Ranch Road to the new LS E site. This portion of the route is located entirely in either an outlot or existing Mequon right-of-way.

The new sewer within the existing outlot will need to be deeper than the existing 10-inch sewer to convey the sewage from the confluence manhole to the new station site. Using standard open cut construction methods, the new sewer would need to be installed at a design slope of approximately 0.1% grade to provide adequate capacity to convey the design flow. This would result in a new sewer depth of approximately 15-feet deeper near MH #0319-002 at a depth of approximately 26-feet. The east-west portion (MH #0319-002 to the New LS) of the sewer route will be approximately 26-feet deep. The route is also partially affected by flood fringe, wetland and environmental corridor. This route will require approximately 725 lineal feet of sewer to Site A and 900 lineal feet to Site B.

Construction of most of the sewer will be in 60-foot wide right-of-way. Its alignment and construction will need to be coordinated with existing buried utilities (sewer, gas and electric). Construction of the new sewer through the 50-foot wide outlot corridor will be very challenging given the limited width and the need to install the sewer while maintaining access to the existing LS E site as well as the 10-inch sewer and two 16-inch diameter force mains. This corridor also contains an abandoned 12-inch diameter force main and an abandoned 14-inch diameter force main. Careful construction sequencing will be required to ensure continued operation of Mequon's collection system and service to all users. The section of sewer that runs to the west, in the right-of-way, will likely need to be constructed and placed in service before the section located in the outlot. This would allow construction to proceed without the need to maintain the 10-inch sewer that runs in the opposite direction in service. Once this is done, all flow can be redirected to the new LS.

COST-EFFECTIVENESS ANALYSIS AND ALTERNATIVE SELECTION

Both monetary costs and non-monetary criteria are used in the alternative evaluation to select both the site and sewer route.

MONETARY COSTS

A monetary cost evaluation of the site and sewer route alternatives was done as part of the selection process. This is a simple cost evaluation based on preliminary capital cost of the major components of the site and sewer routes. This evaluation is not intended to provide a cost estimate of the project, but as a comparison to evaluate which alternative has a monetary advantage over the other alternative. A cost summary for each alternative's major work items is presented in Table 1 through Table 4.

TABLE 1
Site A – Sewer Route C
Cost Summary

Description	Quantity	Unit	Unit Cost	Cost
Buried Electrical Power Transmission Relocation	1	Lot	\$25,000	\$25,000
36" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration)	870	LF	\$550	\$479,000
24" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration)	70	LF	\$400	\$28,000
24" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration)	250	LF	\$400	\$100,000
16" C900 Force Main, Bedding Slurry Backfill (Excludes Surface Restoration)	860	LF	\$350	\$301,000
Sanitary Sewer Manholes	100	VF	\$500	\$50,000
Surface Restoration - Turf	6,500	SY	\$10	\$65,000
Surface Restoration – Pavement	2,800	SY	\$100	\$280,000
Surface Restoration - Stone	500	SY	\$20	\$10,000
Easement Appraisal	3	Ea	\$5,000	\$15,000
Easement Acquisition	14,500	SF	\$5	\$73,000
Traffic Control	1	Lot	\$40,000	\$40,000
Environmental Corridor Restoration and Native Planting	1	Lot	\$100,000	\$100,000
Dewatering	1	Lot	\$75,000	\$75,000
Subtotal				\$1,641,000
Contingencies (20%)				\$328,000
General Conditions, Bonds and Insurance (8%)				\$158,000
Total Construction Cost				\$2,127,000

Notes:

- Relay of existing 18" gravity sewer, upsized to 24 in. (Phase II)

TABLE 2
Site A – Sewer Route D
Cost Summary

Description	Quantity	Unit	Unit Cost	Cost
Buried Electrical Power Transmission Relocation	1	Lot	\$25,000	\$25,000
36" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration)	720	LF	\$550	\$396,000
24" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration)	70	LF	\$400	\$28,000
24" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration) ¹	250	LF	\$400	\$100,000
16" C900 Force Main, Bedding Slurry Backfill (Excludes Surface Restoration)	860	LF	\$350	\$301,000
Sanitary Sewer Manholes	100	VF	\$500	\$50,000
Surface Restoration - Turf	4,600	SY	\$10	\$46,000
Surface Restoration – Pavement	2,800	SY	\$100	\$280,000
Surface Restoration - Stone	500	SY	\$20	\$10,000
Traffic Control	1	Lot	\$40,000	\$40,000
Environmental Corridor Restoration and Native Planting	1	Lot	\$25,000	\$25,000
Dewatering	1	Lot	\$25,000	\$25,000
Subtotal				\$1,326,000
Contingencies (20%)				\$265,000
General Conditions, Bonds and Insurance (8%)				\$127,000
Total Construction Cost				\$1,718,000

Notes:

- Relay of existing 18" gravity sewer, upsized to 24 in. (Phase II)

TABLE 3
Site B – Sewer Route C
Cost Summary

Description	Quantity	Unit	Unit Cost	Cost
36" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration)	960	LF	\$550	\$528,000
24" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration)	85	LF	\$400	\$34,000
18" PVC SDR 21, Bedding, Slurry Backfill (Excludes Surface Restoration) ¹	250	LF	\$375	\$94,000
16" C900 Force Main, Bedding Slurry Backfill (Excludes Surface Restoration)	1,340	LF	\$350	\$469,000
8" PVC SDR 21, Bedding, Slurry Backfill (Excludes Surface Restoration)	40	LF	\$250	\$10,000
Sanitary Sewer Manholes	200	VF	\$500	\$100,000
Surface Restoration - Turf	6,500	SY	\$10	\$65,000
Surface Restoration – Pavement	2,800	SY	\$100	\$280,000
Surface Restoration - Stone	500	SY	\$20	\$10,000
Easement Appraisal	3	Ea	\$5,000	\$15,000
Easement Acquisition	14,500	SF	\$5	\$73,000
Traffic Control	1	Lot	\$40,000	\$40,000
Environmental Corridor Restoration and Native Planting	1	Lot	\$100,000	\$100,000
Dewatering	1	Lot	\$100,000	\$100,000
Subtotal				\$1,918,000
Contingencies (20%)				\$384,000
General Conditions, Bonds and Insurance (8%)				\$184,000
Total Construction Cost				\$2,486,000

Notes:

1. Construction of 18" gravity sewer bypass to allow construction of new LS E.

TABLE 4
Site B – Sewer Route D
Cost Summary

Description	Quantity	Unit	Unit Cost	Cost
36" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration)	900	LF	\$550	\$495,000
24" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration)	85	LF	\$400	\$34,000
18" PVC SDR 21, Bedding, Slurry Backfill (Excludes Surface Restoration) ¹	250	LF	\$375	\$94,000
16" C900 Force Main, Bedding Slurry Backfill (Excludes Surface Restoration)	1,340	LF	\$350	469,000
8" PVC SDR 21, Bedding, Slurry Backfill (Excludes Surface Restoration)	40	LF	\$250	\$10,000
Sanitary Sewer Manholes	200	VF	\$500	\$100,000
Surface Restoration - Turf	4,600	SY	\$10	\$46,000
Surface Restoration – Pavement	2,800	SY	\$100	\$280,000
Surface Restoration - Stone	500	SY	\$20	\$10,000
Traffic Control	1	Lot	\$40,000	\$40,000
Environmental Corridor Restoration and Native Planting	1	Lot	\$25,000	\$25,000
Dewatering	1	Lot	\$35,000	\$35,000
Subtotal				\$1,638,000
Contingencies (20%)				\$328,000
General Conditions, Bonds and Insurance (8%)				\$157,000
Total Construction Cost				\$2,123,000

Notes:

1. Construction of 18" gravity sewer bypass to allow construction of new LS E.

ADDITIONAL CONSIDERATIONS

In addition to the wetlands, flood fringe and environmental corridor described earlier, a detailed tree inventory was prepared for the project area. The City has a Tree Preservation Ordinance which identifies eighteen species of trees which are considered old growth when the proper diameter is present. The benefits of old growth trees include reduction of storm water runoff, preservation of wildlife habitat, enhancement of air quality and additional aesthetic benefits. Two trees were identified within the project area which are considered specimen trees based on tree diameter and species. Both were American Basswood trees and will not be impacted by the project. In addition, there were four White Pine and four Black Walnut trees identified which do not meet the diameter necessary to qualify as specimen trees located within the proposed project corridor.

Additional construction methods for the installation of the piping would include horizontal directional drilling (HDD), horizontal auger boring (jack and bore) and micro-tunnelling.

HDD consists of the drilling of a small pilot hole, enlarging (reaming) the pilot hole in preparation of the installation of the pipe and finally pulling the pipe into the reamed hole. Because of the uncertainty of the ground conditions, HDD contractors generally request a design slope not less than 2% which will result in a station depth at least 17.5 feet deeper than when compared to open cutting. Based on this factor alone, we have not seriously considered HDD to install the sewer.

Jack and bore consists of pushing a larger carrier (casing) pipe through the soil and removing the soil within the casing pipe using a suitably sized auger to clear the soil from the carrier pipe. While this appears to be a feasible option, it will likely require the addition of an intermediate manhole in the east-west section of new sewer due to the length of the pipe sections.

And finally, micro-tunnelling consists of a remotely guided and controlled boring machine while simultaneously installing and advancing a tunnel lining (carrier or casing pipe).

Given the large diameter of the sewer, there are limited similar installations which makes estimating the cost of these alternative construction methods difficult. Discussion with local contractors has led to preliminary budget level estimates for these installation methods.

Installing new sewer with HDD is expected to cost 2x as much as open cut. Jack and bore will be 3x the cost of open cut, and micro-tunneling will be 4x-5x the cost of open cut.

RECOMMENDATIONS

Site B with Route D is the preferred alternative. While Site A is less costly, the development of Site A results in the filling of mapped wetland to facilitate the building construction. One of the important aspects of the DNR permitting is the preparation of a practical alternative analysis (PAA). Because there is an alternative which impacts wetland to a lesser extent, it is expected that

the DNR would select Site B due to the fact it permanently impacts no wetland as a result of the building construction. Route D involves less new sewer.

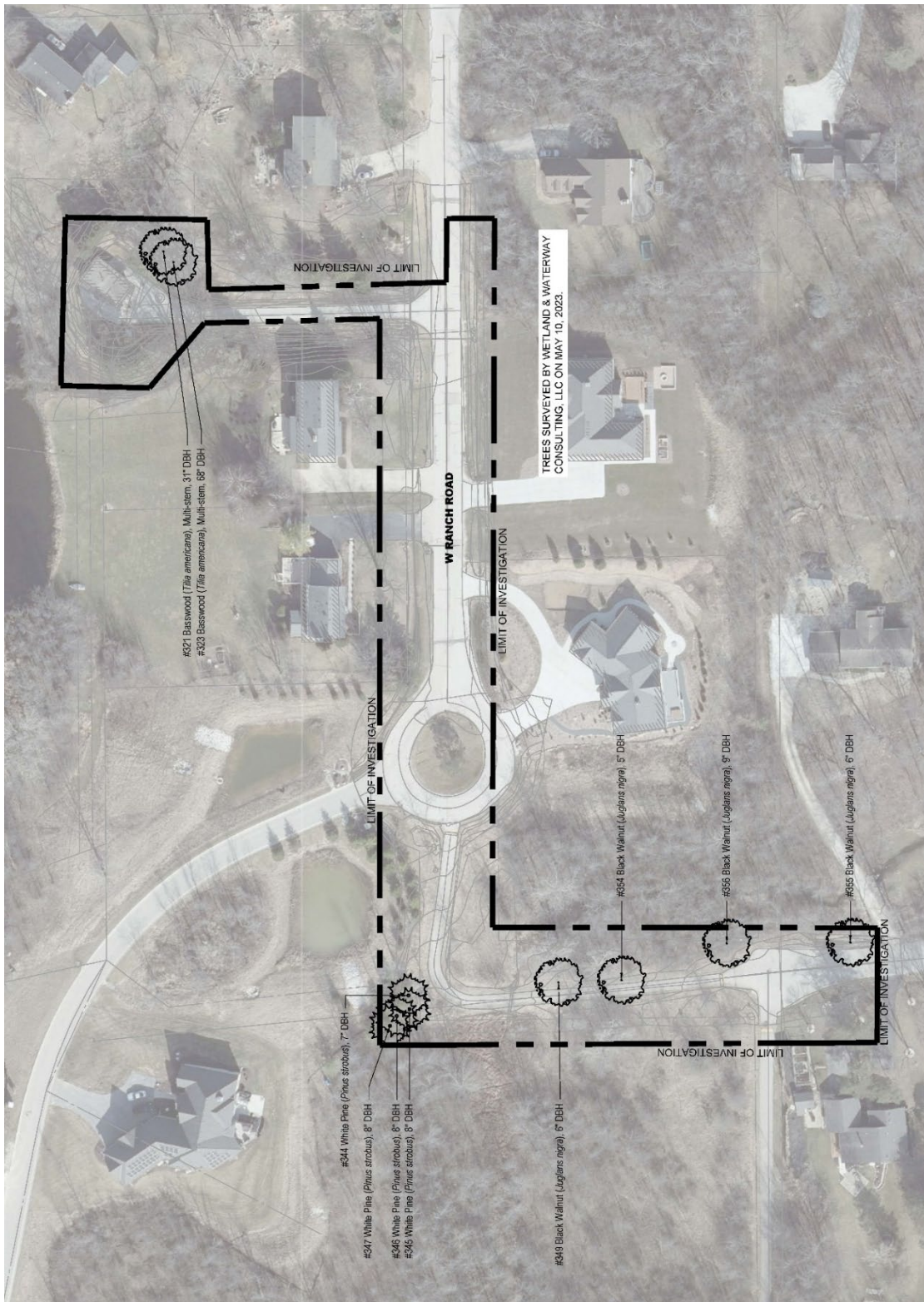


Figure 5 – Tree Survey Map

The new sewer would be constructed, from the confluence manhole at existing LS E to the new LS E wet well along the selected route. This route minimizes complications with private property owners and the described environmental concerns associated with the sewer route. The impact to wetlands, flood fringe and environmental corridor for sewer route D are reduced when compared to those described in sewer route C. In addition, there are fewer private property disturbances necessary which makes sewer route D a more favorable alternative.

In tandem with the development of station site and sewer route recommendations, the City's sanitary system was hydraulically modeled to verify the benefits of upsizing the lift station capacity, and to provide insight into other possible improvements in the collection system.

HYDRAULIC MODELING

A hydraulic analysis of Mequon's existing collection system was completed under this project to determine the effects of the phase 1, 2, 3 and 4 improvements in addressing capacity and surcharging issues in the collection system. Review of the East Trunk Sewer Area Relief Recommendations – Draft prepared for City of Mequon by Brown and Caldwell and the hydraulic model in PCSWMM was completed. Mequon's existing PCSWMM comprehensive system model was updated used and modified to reflect the existing collection system, and the existing collection system with phase 1, 2, 3 and 4 improvements. For this evaluation, the model does not include the proposed force main extension through Hidden Reserve subdivision to address surcharging issues in this area, this work is covered in TM-3 – Lift Station E Replacement Force Main.

MODEL ASSUMPTIONS

The following model assumptions were made:

1. Model conditions - 10-year recurrence interval rainfall event with future flow conditions (2035 development with Ulaos A growth area), see TM-1 – Lift Station E Design Flows.
2. Sanitary sewer system conditions-existing pipe conditions, no system improvements near the LS F, LS E, LS H and Fire Station #2 areas with the following model input for the following lift stations:
 - a. LS F (LS capacity 600 gpm) - 600 gpm
 - b. LS G (LS capacity 660 gpm) – 764 gpm
 - c. LS H (LS capacity 264 gpm) - 264 gpm
 - d. LS T (LS capacity 300 gpm) - 300 gpm

3. Projected future flow from Ulao Creek growth area (ME 4012 per MMSD 2050 facility plan) - 0.746 MGD
4. LS E west force main limited to convey only 3,800 gpm to avoid downstream sewer surcharging

BASE MODEL

Using the above assumptions, Mequon's existing PCSWMM comprehensive system model was modified to model Mequon's existing collection system without any of the planned improvements. The results of this modeling is presented on Figure 6 which shows sewers that are surcharging and undersized.

The results of this base modeling identified the following issues with Mequon's existing collection system. These are summarized by the area in which they occur.

LS E Area

This is the gravity collection system that is directly upstream of lift station E (LS E). The issues observed in this area is summarized as follows:

- The 10-inch sewer running east down West Ranch Road (MH #0219.056 to MH #0219.003) is restricted by the sewer capacity of the downstream 18-inch sewer (MH #0219.003 to MH #0219.008).
- The trunk sewer running south down St James Lane from Grace Avenue and east down West Ranch Road to N. Laguna Drive (MH #0224.051 to MH #0219.008) is undersized and restricted by the LS E's capacity.
- I-43 system made up of the 24" and 18" trunk sewers that run north along the west edge of the I-43 right-of-way and runs west across the I-43 right-of-way near Mequon's Fire Station 2 flowing to MH #0119.006 are restricted by the downstream capacity.
- The 24-inch diameter trunk sewer running southwest from the discharge point of Ulao Creek Area on Port Washington Road to the south end of Oriole Lane (MH #0119.006 to MH #0119.038) is undersized.
- The 8-inch and 10-inch diameter section of sewer running south down North Oriole Lane from North Valley Drive and west down West Ranch Road to the existing LS E site (MH #0319.008 to MH #0319.002) is undersized.

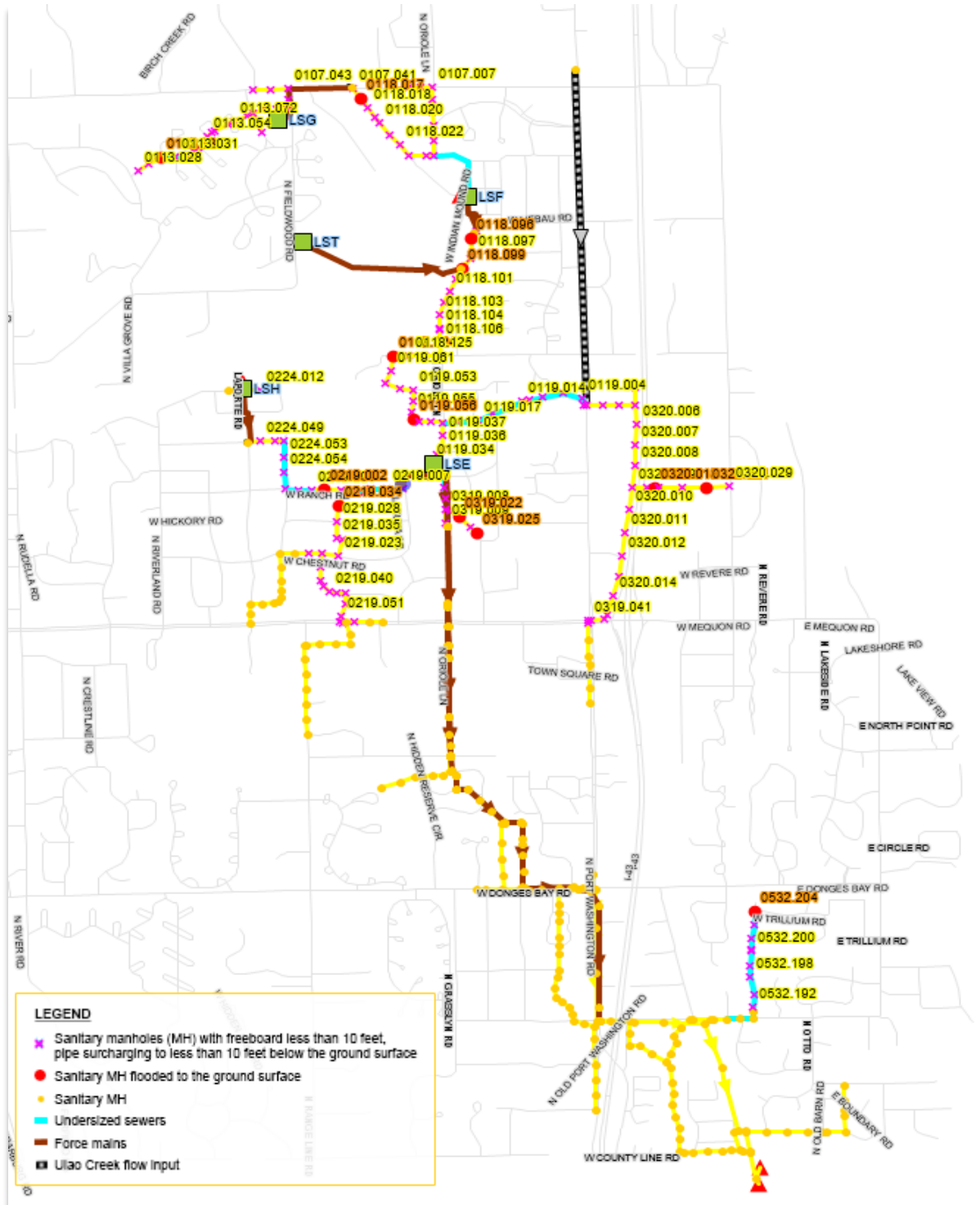


Figure 6 – Base Model

Pipe surcharging Conditions in the 10-year recurrence interval rainfall event future flow conditions (Existing Pipe System)

- The trunk sewer (10-inch, 12-inch and 18-inch diameter) that runs east down West Ranch Road to North Laguna Drive (MH #0224.051 to MH #0219.008) is undersized.

LSs Upstream of LS E

These are the portions of LS E's service area that are collected by lift stations that contribute to LS E's service area. The issues observed in these areas are the result of limitations with either the contributing LS's capacity and/or sewer capacity. These issues are not being addressed by this project and are summarized as follows:

LS F Area

The following issues were identified within LS F's service area that cause sewer surcharging from MH #0107.041 to MH #0118.025:

- The trunk sewer on Circle Drive from River Forest to LS F (MH #0118.025 to MH #0118.064) is undersized.
- The pump capacity of LS F is restricting the flow from LS F's service area.

LS G Area

The following issues were identified within LS G's service area that cause sewer surcharging along Fleur De Lis Drive from MH #0113.028 to LS G:

- The 8-inch sewer on Fleu De Lis Drive from Colette Courte to Jacqueline Court (MH #0113.030 to MH #0113.037) is undersized.
- The pump capacity of LS G is restricting the flow from LS G's service area.

LS H Area

The following issues were identified within LS H's service area that cause sewer surcharging near LS H (MH #0224.012 to LS H):

- The 8-inch sewer from Riverland Drive to LS H (MH #0224.015 to LS H) is undersized.
- The pump capacity of LS H is restricting the flow from LS H's service area.

Downstream of LS E

This area of Mequon's collection system is not part of the LS E service area and phase 1, 2, 3 and 4 improvements. The current base model is limiting the flow from LS E's west force main to 3,800 gpm to avoid downstream sewer surcharging. During the future evaluation of the west force main discharge the flow will be equally split between the two force mains and the model will be updated

for the proposed force main alignment. Consequently, the model output does not show the surcharging issues that have been observed at Hidden Valley Reserve. The model does show an issue with surcharging due to an undersized 15-inch sewer that runs south down North Waterleaf Drive and west down West Zedler Lane (MH #0532.204 to MH #0532.185). The model also indicates that the peak flow entering the MIS at MS0409 is 18.40 MGD and is less than the maximum allowable peak flow of 19.3 MGD.

PHASE 1 SEWER IMPROVEMENTS

The Phase 1 sewer improvements to Mequon's collections system are as follows:

- Construct a new LS E on the right-of-way just north of N. Laguna Drive and decommission the existing LS E.
- Increase LS E's firm capacity to 9,000 gpm (12.76 MGD).
- Connect the two existing 16-inch diameter force main sewers to the new LS E.
- Construct approximately 1,000 LF 36-inch sewer from the existing LS E to the relocated LS E.

Using the assumptions made above, Mequon's base model of the existing PCSWMM comprehensive system model was modified to model Mequon's existing collection system with the Phase 1 sewer improvements. The result of this modeling is presented on Figure 6 Figure 7 which shows sewers that are surcharging and undersized. These are summarized by the area in which they occur.

LS E Area

The Phase 1 improvements reduce the sewer surcharging along the Valley Drive and Oriole Lane area, and Robin Lane area.

LSs Upstream of LS E

These are the portions of LS E's service area that are collected by lift stations that contribute to LS E's service area. The issues observed in the base model remain and the Phase 1 improvements do nothing to address issues in this portion of the collection system.

Downstream of LS E

This area of Mequon's collection system is not part of the LS E service area and phase 1, 2, 3 and 4 improvements. The findings are similar to those observed in the base model, however the peak flow entering the MIS at MS0409 is 20.63 MGD which exceeds the maximum allowable peak flow of 19.3 MGD to the MIS.

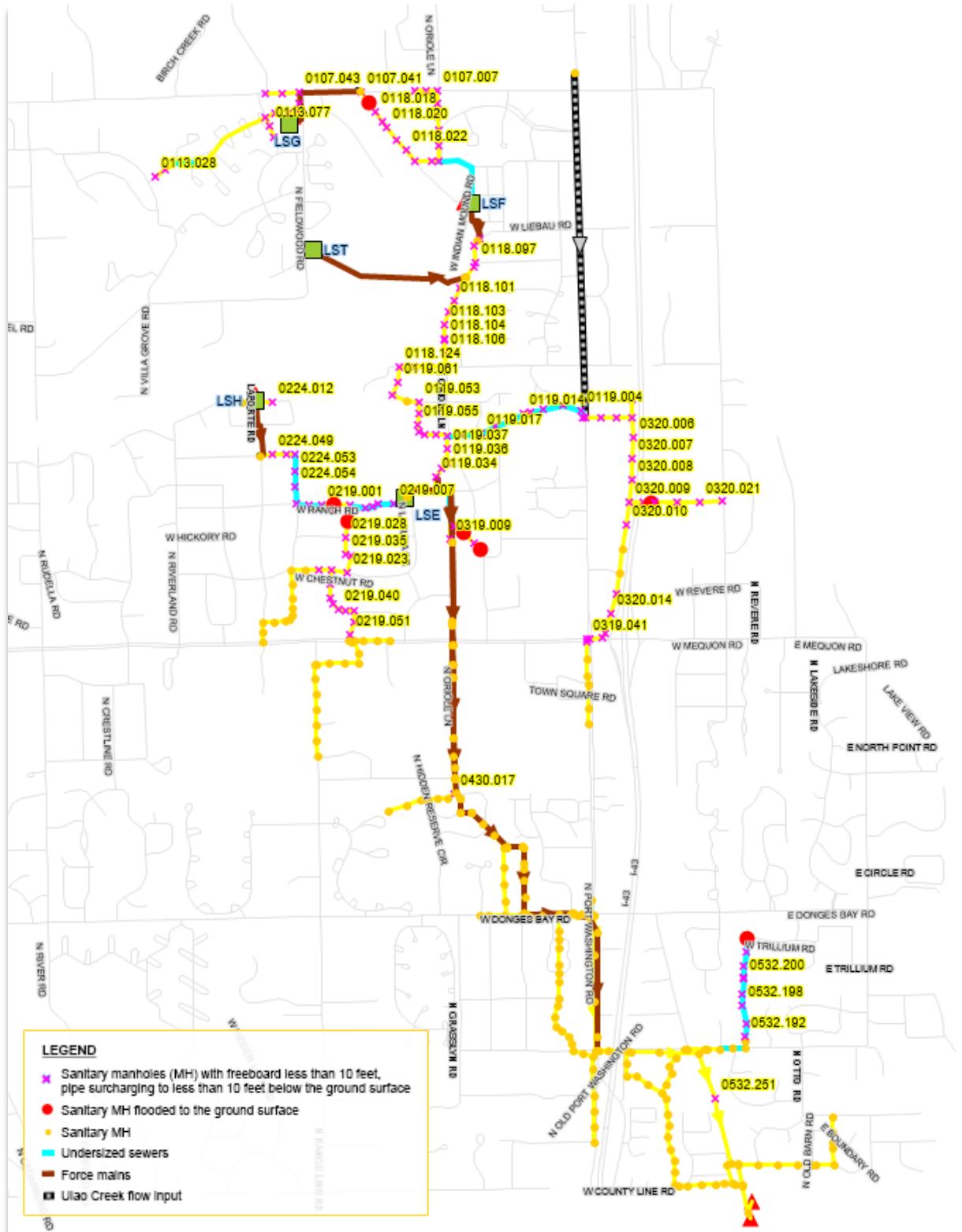


Figure 7 – Phase 1 Sewer Improvements

Pipe surcharging Conditions for a 10-year recurrence interval rainfall event future flow conditions (Phase 1 Improvements with New LS E of 9000 gpm)

PHASE 1 SEWER IMPROVEMENTS WITH NEW LS CAPACITY UNRESTRICTED

The Phase 1 model as described above was rerun with the LS E's pumping capacity set to 10,900 gpm (15.70 MGD), matching the peak flow conveyed to the lift station. The result of this modeling is presented on Figure 8 which shows sewers that are surcharging and undersized. These are summarized by the area in which they occur.

LS E Area

The Phase 1 improvements with new LS capacity unrestricted eliminate sewer surcharging in the following areas:

- The collection system between the LS F discharging point on East Shoreland Drive (MH #0118.094) to LS E inflow point.
- The 24-inch trunk sewer that runs southwest from Port Washington Road near Mequon's Fire Station 2, discharge point of Ulao A, to the intersection of Wildwood Drive and Oriole Lane (MH #0119.006 to MH #0119.038).
- The 10-inch trunk sewer runs north from Mequon Road to Glenbrook Lane and the 15-inch trunk sewer runs north from Robin Lane to Chestnut Road.

LSs Upstream of LS E

These are the portions of LS E's service area that are collected by lift stations that contribute to LS E's service area. The issues observed in the base model remain and the Phase 1 improvements do nothing to address issues in this portion of the collection system.

Downstream of LS E

This area of Mequon's collection system is not part of the LS E service area and phase 1, 2, 3 and 4 improvements. The findings are similar to those observed in the base model, however the peak flow entering the MIS at MS0409 is 21.97 MGD which exceeds the maximum allowable peak flow of 19.3 MGD to the MIS.

PHASE 1 AND PHASE 2 SEWER IMPROVEMENTS WITH NEW LS CAPACITY OF 9,000 GPM

The Phase 1 as listed above and the Phase 2 sewer improvements to Mequon's collections system that relays and upsizes approximately 1,400 LF 18-inch sewer that runs east down West Ranch Road to N. Laguna Drive (MH #0219.003 to MH #0219.008) and to the new LS E.

Using the assumptions made above, Mequon's base model of the existing PCSWMM comprehensive system model with the Phase 1 sewer improvements was modified to model Mequon's existing collection system with Phase 1 and Phase 2 Sewer Improvements. The result

of this modeling is presented on Figure 9 which shows sewers that are surcharging and undersized. These are summarized by the area in which they occur.

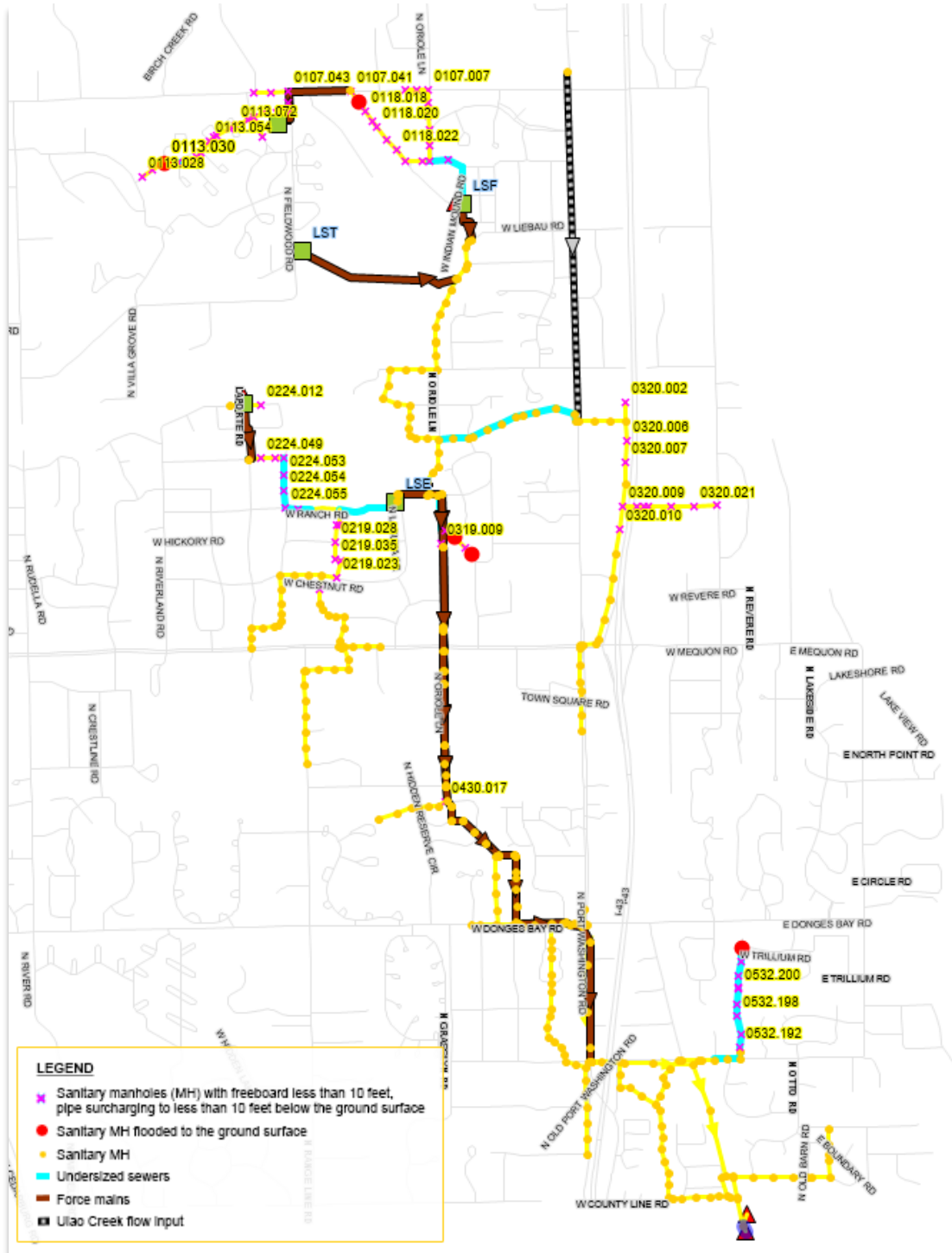


Figure 8 – Phase 1 Sewer Improvements with New LS E Capacity Unrestricted

Pipe surcharging Conditions in the 10-year recurrence interval rainfall event future flow conditions (Phase 1 Improvements with New LS E of 10,900 gpm)

LS E Area

The Phase 1 and Phase 2 improvements eliminate sewer surcharging conditions in the following locations:

- The 10-inch trunk sewer that runs north from Mequon Road to Glenbrook Lane and the 15-inch trunk sewer that runs north from Robin Lane to Chestnut Road, (see Figure 11).
- The trunk sewer (10-inch and 18-inch diameter) that runs east down West Ranch Road to North Laguna Drive (MH #0219.001 to MH #0219.008). However, the model continues to show that the 10-inch and 12-inch trunk sewer that runs from MH #0224-048 at the intersection of Grace Avenue and Bobolink Lane southeast to MH #0219.003 on West Ranch Road is undersized and continues to have surcharging, see Figure 10. The section is beyond the current scope of this project.

LSs Upstream of LS E

These are the portions of LS E's service area that are collected by lift stations that contribute to LS E's service area. The issues observed in the base model remain and the Phase 1 improvements do nothing to address issues in this portion of the collection system.

Downstream of LS E

This area of Mequon's collection system is not part of the LS E service area and phase 1, 2, 3 and 4 improvements. The findings are similar to those observed in the base model, however the peak flow entering the MIS at MS0409 is 20.71 MGD which exceeds the maximum allowable peak flow of 19.3 MGD to the MIS.

PHASES 1, 2, 3 AND 4 SEWER IMPROVEMENTS WITH NEW LS CAPACITY OF 9,000 GPM

The Phase 1 and Phase 2 improvements as listed above. The Phase 3 improvements adds approximately 1,200 LF of 36-inch relief sewer that runs south from the intersection of Oriole Lane and Wildwood Drive from MH #0119.038 to Ranch Road. The Phase 4 improvements add approximately 1,300 LF of 12-inch relief sewer that runs south from Glen Oaks Lane down Oriole Lane to Wildwood Drive (MH #0119.038 to MH #0119.038).

Using the assumptions made above, Mequon's base model of the existing PCSWMM comprehensive system model with the Phase 1 and Phase 2 sewer improvements was modified to model Mequon's existing collection system with Phase 3 and Phase 4 Sewer Improvements. The result of this modeling is presented on Figure 12 which shows sewers that are surcharging and undersized. These are summarized by the area in which they occur.

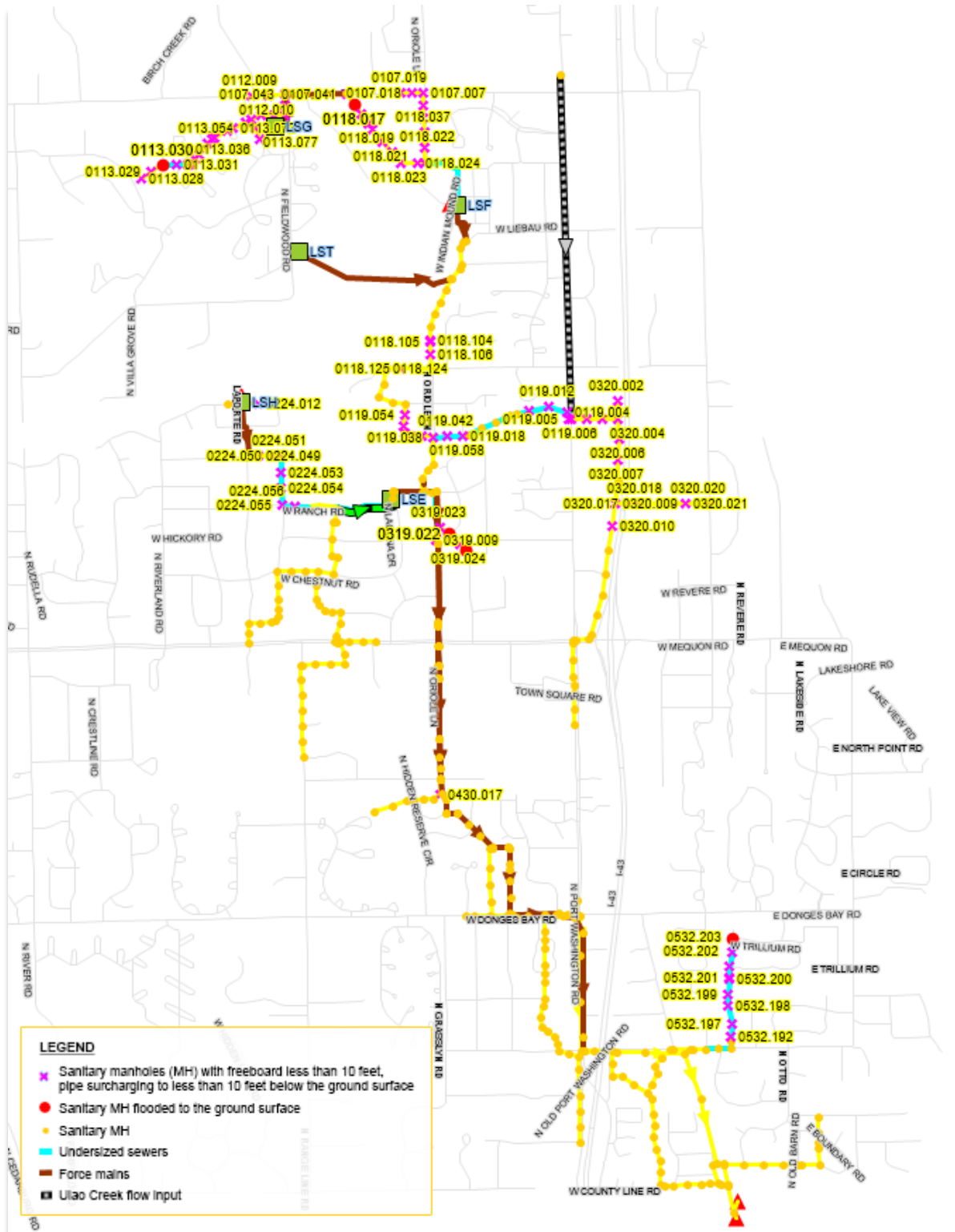


Figure 9 – Phase 1 and Phase 2 Sewer Improvements with New LS Capacity of 9,000 gpm

Pipe surcharging Conditions in the 10-year recurrence interval rainfall event future flow conditions (Phases 1 and 2 Improvements with New LS E of 9,000 gpm)

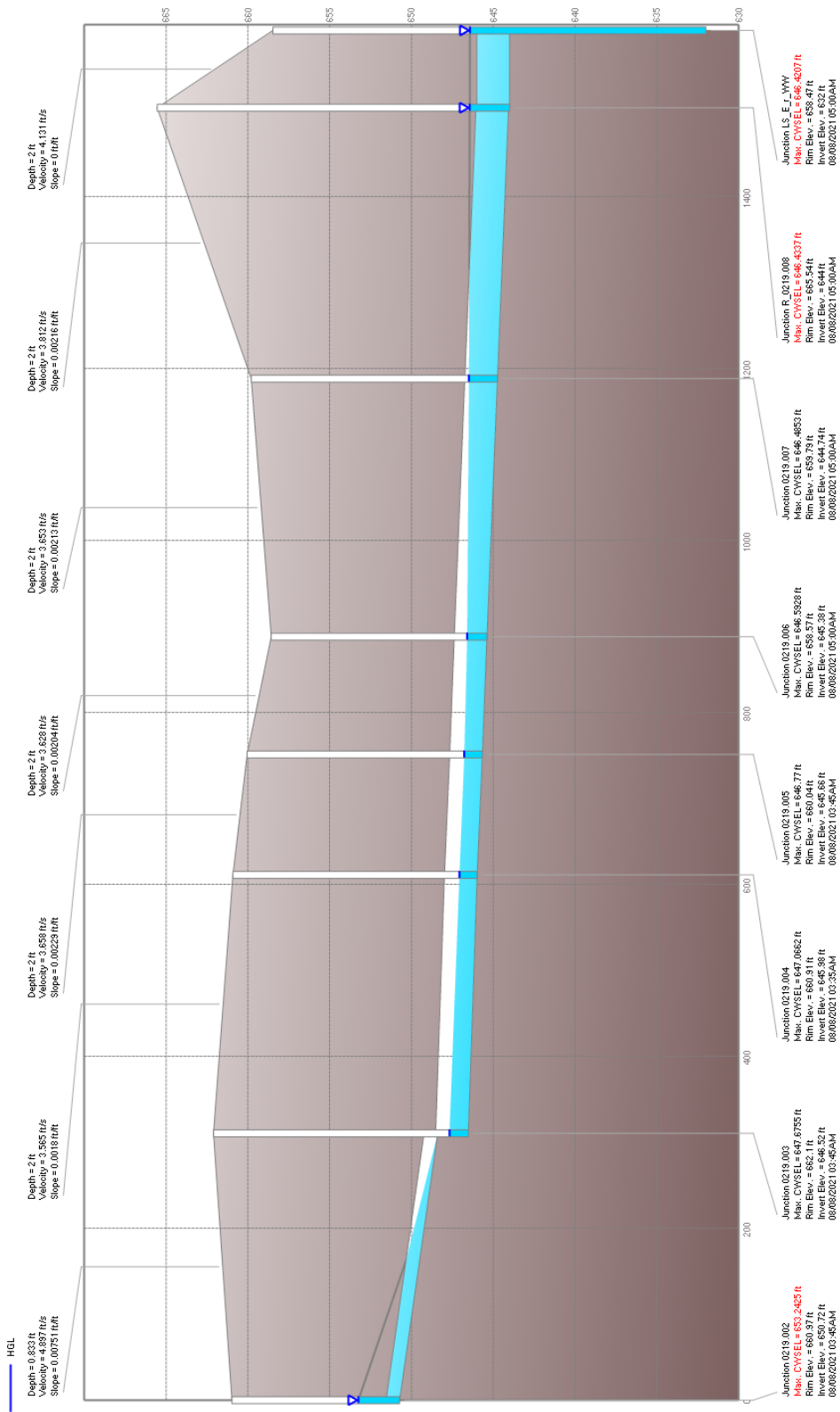


Figure 10
 Hydraulic profile of 24-inch W. Ranch Rd Sewer (Phase 2) from MH #0219-003 to LS E
 (Phases 1 and 2 Improvements with New LSE of 9,000 gpm)

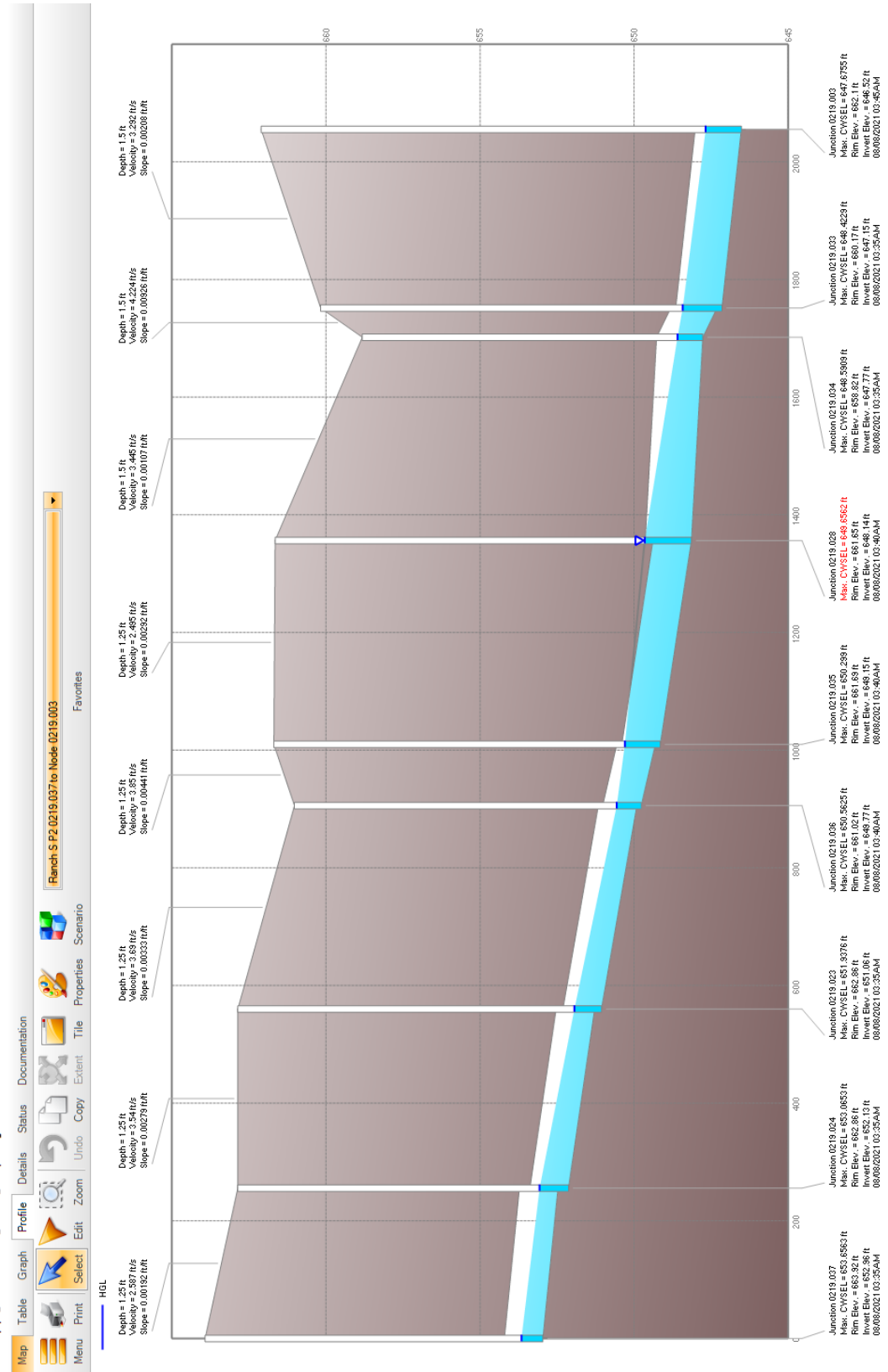


Figure 11

*Hydraulic profile of trunk sewer from the south 15-inch sewer form MH #0219-037 on N. Glenbrook Lane to MH #0219-028 on Hickory Lane where the trunk sewer increased to 18-inch from MH #0219-028 to MH #0219-003 on W. Ranch Road (see Figure 10)
(Phases 1 and 2 Improvements with New LS E of 9,000 gpm)*

LS E Area

The Phase 3 and 4 improvements further eliminate sewer surcharging conditions north and east of LS E in the following locations:

- The collection system between the LS F discharging point on East Shoreland Drive (MH #0118.094) to LS E inflow point.
- The 24-inch trunk sewer that runs southwest from Port Washington Road near Mequon's Fire Station 2, discharge point of Ulaos A, to the intersection of Wildwood Drive and Oriole Lane (MH #0119.006 to MH #0119.038).

These improvements achieve similar benefits of eliminating pipe surcharging conditions as upsizing LS E pumps to a total of 10,900 gpm.

LSs Upstream of LS E

These are the portions of LS E's service area that are collected by lift stations that contribute to LS E's service area. The issues observed in the base model remain and the Phase 1 improvements do nothing to address issues in this portion of the collection system.

Downstream of LS E

This area of Mequon's collection system is not part of the LS E service area and phase 1, 2, 3 and 4 improvements. The findings are similar to those observed in the base model, however the peak flow entering the MIS at MS0409 is 20.71 MGD which exceeds the maximum allowable peak flow of 19.3 MGD to the MIS.

PHASE 1 AND 2 SEWER IMPROVEMENTS WITH NEW LS CAPACITY UNRESTRICTED

The Phase 1 and 2 model as described above was rerun with the LS E's pumping capacity set to 10,900 gpm (15.70 MGD), matching the peak flow conveyed to the lift station. The result of this modeling is presented on Figure 13 Figure 6 which shows sewers that are surcharging and undersized. These are summarized by the area in which they occur.

LS E Area

The Phase 1 and 2 improvements with new LS capacity unrestricted eliminate sewer surcharging with similar benefits as the Phase 3 and 4 improvements.

LSs Upstream of LS E

These are the portions of LS E's service area that are collected by lift stations that contribute to LS E's service area. The issues observed in the base model remain and the Phase 1 improvements do nothing to address issues in this portion of the collection system.

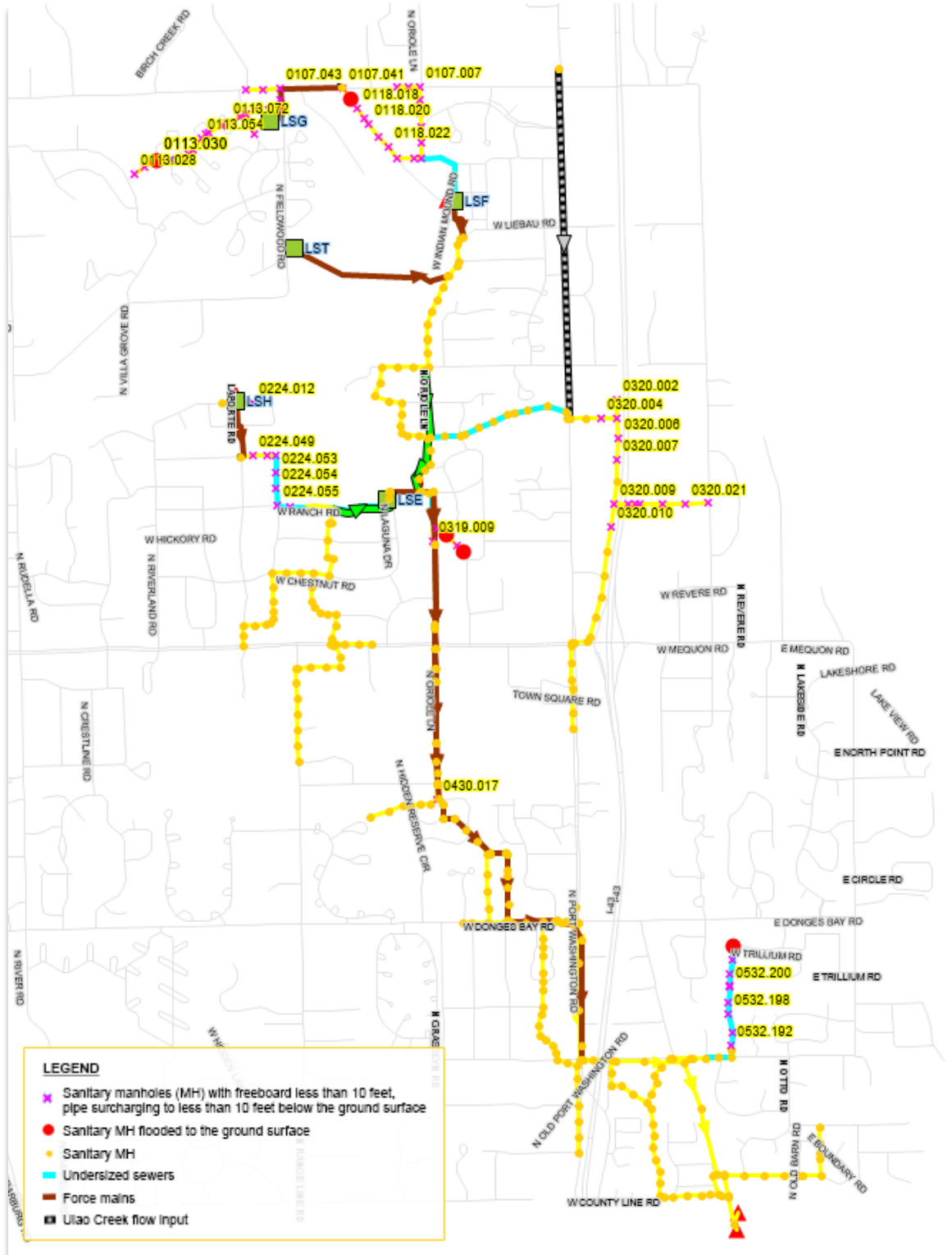


Figure 12 – Phases 1, 2, 3 and 4 Sewer Improvements with New LS Capacity of 9,000 gpm

Pipe surcharging Conditions in the 10-year recurrence interval rainfall event future flow conditions (Phases 1, 2, 3 and 4 Improvements with New LS E of 9,000 gpm)

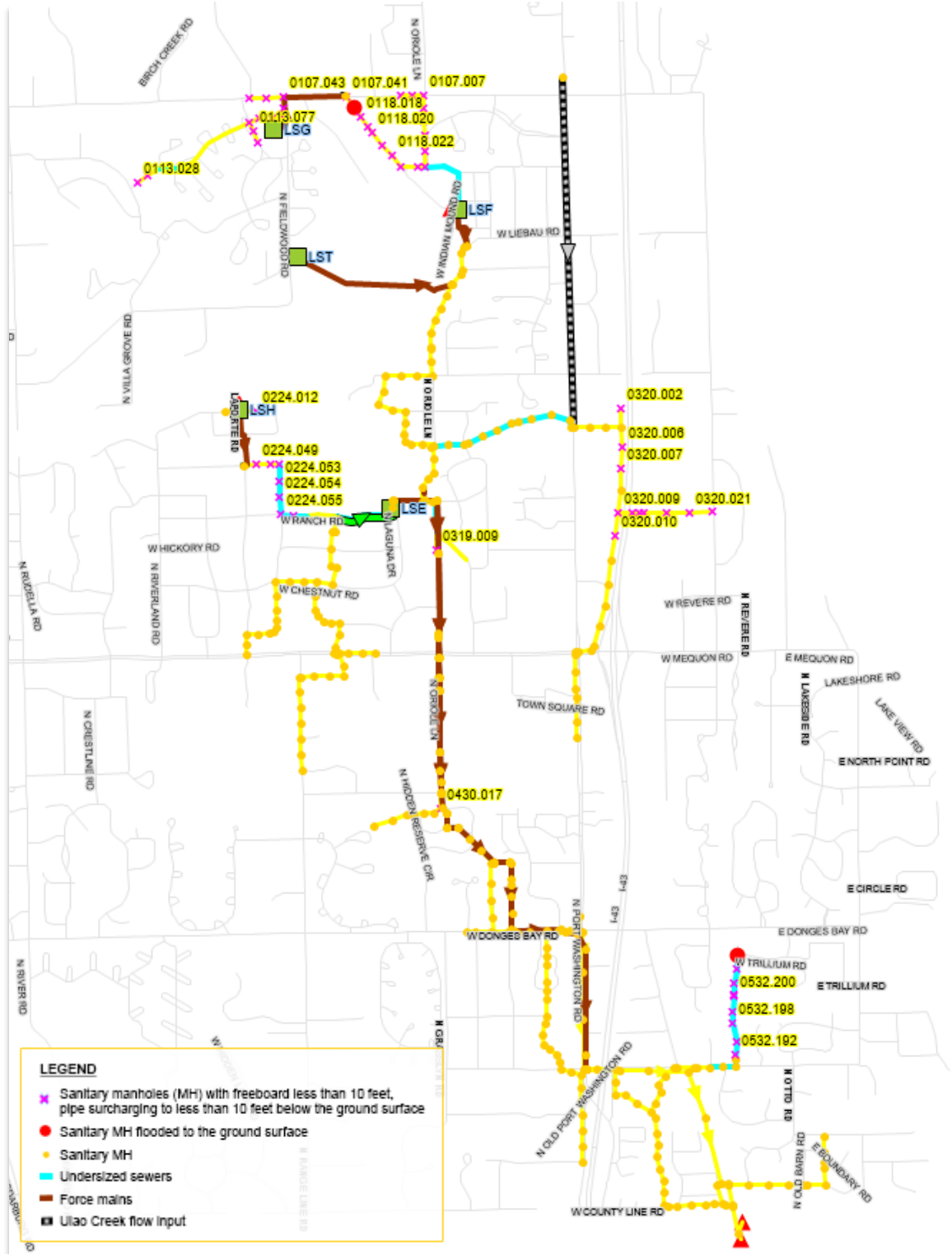


Figure 13 – Phases 1 and 2 Sewer Improvements with New LS Capacity of 10,900 gpm

Pipe surcharging Conditions in the 10-year recurrence interval rainfall event future flow conditions (Phases 1 and 2 Improvements with New LS E of 10,900 gpm)

Downstream of LS E

This area of Mequon's collection system is not part of the LS E service area and phase 1, 2, 3 and 4 improvements. The findings are similar to those observed in the base model, however the peak flow entering the MIS at MS0409 is 22.05 MGD which exceeds the maximum allowable peak flow of 19.3 MGD to the MIS. This produces the highest discharge rate to the MIS of the six scenarios modeled.

PHASE 1 SEWER IMPROVEMENTS WITHOUT ULAO CREEK

Model Assumptions

The model assumptions are the same as outlined in the base model with exception of the flow that is contributed to the service area by Ulaio Creek growth area which is assumed not to be contributing any flow to LS E's service area. Mequon's PCSWMM comprehensive system model for Phase 1 Sewer Improvements was modified to eliminate any flow contribution from Ulaio Creek growth area. The result of this modeling is presented on Figure 14 which shows sewers that are surcharging and undersized. These are summarized by the area in which they occur.

LS E Area

The Phase 1 improvements without Ulaio Creek growth area is able to relieve the pipe surcharging except for the segments that are restricted by sewer capacity or undersized sewers.

LSs Upstream of LS E

These are the portions of LS E's service area that are collected by lift stations that contribute to LS E's service area. The issues observed in the base model remain and the Phase 1 improvements do nothing to address issues in this portion of the collection system.

Downstream of LS E

This area of Mequon's collection system is not part of the LS E service area and phase 1, 2, 3 and 4 improvements. The findings are similar to those observed in the base model, however the peak flow entering the MIS at MS0409 is 20.63 MGD which exceeds the maximum allowable peak flow of 19.3 MGD to the MIS.

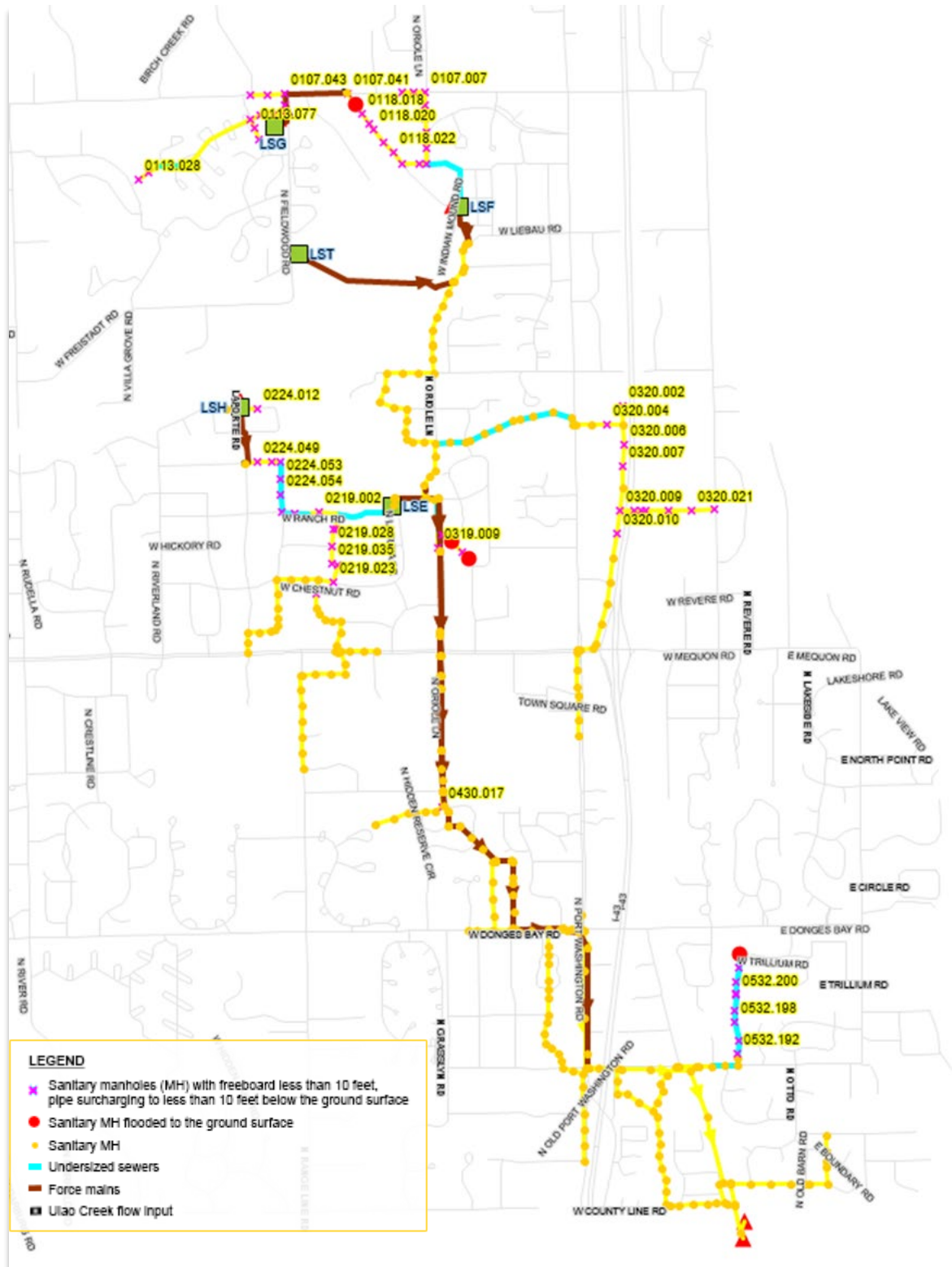


Figure 14 – Phase 1 Sewer Improvements without Ulaio Creek

Pipe surcharging Conditions in the 10-year recurrence interval rainfall event future flow, no Ulaio Creek growth area contributions (Phase 1 Improvements with New LS E of 9000 gpm)

FINDINGS AND CONCLUSIONS

Based on this PCSSWMM system modeling, the following findings and conclusions were made from the modeling of Phases 1, 2, 3 and 4:

- Upsizing the LS E pumps to a total of 9,000 gpm alone is able to relieve the pipe surcharging along the Valley Drive and Oriole Lane area, and Robin Lane area.
- The Phase 2 sewer work that upsizes the 18-inch sewer extending along Ranch Road to 24-inch is able to further reduce the pipe surcharging along the Ranch Road segments east of Glenbrook Lane (extended) and the pipe segments between Ranch Road and Chestnut Road.
- The 36-inch Phase 3 (extending along near Oriole Lane and Wildwood Drive) and Phase 4 (extending north to MH118.127 near Oriole Lane and Glen Oaks Lane) relief sewers combined can eliminate pipe surcharging conditions along three systems: between LS F discharging point to LS E inflow point, system from the east downstream of MH #0119.006, from the Fire Station on Port Washington Road and west.
- Implementing all four phases of improvements can eliminate most of the modeled pipe surcharging in the East Trunk Sewer system except the surcharging caused by the downstream pump or sewer capacity restrictions. Mequon currently has begun planning on addressing some of these identified problems in future project such as the planned improvements for LS G and LS F.
- If the LS E capacity is increased to match the maximum inflow to the LS (10,900 gpm), no Phases 3 and 4 improvements are required. Constructing LS E with a capacity of 10,900 gpm and the Phase 2 sewer work extending along Ranch Road can eliminate most of the pipe surcharging in the East Trunk Sewer system. Increasing the capacity of LS E to the maximum inflow capacity will require increasing the existing force main capacity through either upsizing the current force mains or adding a third force main.
- Upsizing the LS E's capacity results in increasing the peak flow entering the MIS at MS0409 to exceed the maximum allowable peak flow of 19.3 MGD.
- Implementing Phase 1 improvements without Ulao Creek growth area is able to relieve the pipe surcharging except for the segments that are restricted by sewer capacity or undersized sewers.

APPENDIX C

Technical Memorandum 3: Force Main

Date: October 13, 2023

Project No.: 6555

To: Kristen Lundeen, P.E. (City of Mequon)

From: Will Hein (ATI), Paul Traeger (ATI), Alan Labisch (ATI)

cc:

Regarding: Technical Memorandum 3 – Lift Station E Force Main

Purpose

As a result of the increase in design flows expected from the new Lift Station E, staff has further evaluated the downstream receiving sewer system to determine the necessary improvements required to adequately convey the force main discharge through The Hidden Reserve. Based on the results of Technical Memorandum No.1, the new facility described as Lift Station E will have a firm capacity of 9,000 GPM with the ability to expand to 11,400 GPM if upstream and downstream improvements are made to the sewer system.

Existing Conditions

As described in the Lift Station “E” Condition Assessment, the existing discharge from the station consists of two 16-inch diameter force mains. These force mains have been identified as the east force main and west force main. The west force main is the shorter of the two, and it discharges into the gravity sewer at manhole No. 0430-011 near the intersection of Sunnydale Lane and Oriole Lane immediately adjacent to The Hidden Reserve. The City intends to continue utilizing the two force-main system for the foreseeable future. The goal of this technical memo is to identify areas downstream of the existing west force main discharge which are not capable of conveying half of the firm capacity of the new station (4,500 GPM), and recommend an alternative.

The west force main discharges into the sewer system at the intersection of Sunnydale Lane and Oriole Lane at Manhole No. 0430-011 and proceeds southerly and easterly through The Hidden Reserve to Manhole No. 0430-110. The route consists of approximately 714 lineal feet of 18-inch diameter gravity sewer from Manhole No. 0430-011 to No. 0430-106 followed by approximately 1,155 lineal feet of 24-inch diameter gravity sewer down to Manhole No. 0430-110.

Portions of the existing 18-inch diameter gravity sewer downstream of this discharge point do not provide sufficient capacity to convey a portion of the expected design flow from the new station. PCSWMM modelling indicates that there are two limiting sections of sewer. The first is the section between manhole no. 0430-017 and manhole no. 0430-105. The second is the section between manhole 0430-105 and

manhole 0430-106. When increasing the discharge from the force main to half of the station firm capacity, PCSWMM modelling indicates that the section of sewer between manhole 0430-017 and manhole 0430-105 needs to be upgraded from 18-inch diameter to 21-inch diameter. Additionally, the section between manhole 0430-105 and manhole 0430-106 needs to be upgraded from 18-inch diameter to 24-inch diameter to eliminate the surcharging in the area.

Manhole No. 0430-110 is the location of a diversion structure near Stone Creek Drive. At this location, there is a 24-inch diameter gravity sewer flowing to the east, with a weir located in the diversion manhole which allows high flows to be directed to the south in an additional 24-inch diameter relief sewer installed as part of the East Trunk Relief Sewer project in 2018. Due to a shallow slope, the relief sewer between Manhole No. 0430-196 and manhole no. 0430-195 has a calculated capacity of 4,567 GPM and represents the maximum available flow presently in the relief sewer. Conversely, a review of the system maps and GIS data appears to indicate that the sewer section from Manhole No. 0430-115 and manhole no. 0430-085 would represent the limiting section with a calculated capacity of 3,364 GPM. When coupled with the limiting section of the relief sewer, the combination of these 24-inch diameter sewers provides sufficient capacity to convey half of the station discharge.

To continue using the two-force main system, improvements to the gravity sewer system or an extension of the west force main is necessary to provide adequate capacity for the upgraded station discharge. Options available include increasing the capacity of the gravity sewer system as described previously or the extension of the force main through The Hidden Reserve to discharge at the diversion manhole no. 0430-110.

Improvements to the gravity sewer system will require increasing the diameter of approximately 149 lineal feet of sewer from manhole no. 0430-017 to manhole no. 0430-105 from 18-inch diameter to 21-inch diameter. Additionally, the existing gravity sewer from manhole no. 0430-105 to manhole no. 0430-106 (approximately 272 lineal feet) will need to be increased from 18-inch diameter to 24-inch diameter.

Alternatively, the west force main can be extended from manhole no. 0430-011 to manhole no. 0430-110. This option would not require improvements to the gravity sewer system within The Hidden Reserve, as it would eliminate the force main discharge upstream of The Hidden Reserve and instead discharge further south into diversion manhole 0430-110.

It is the intent of the design to put the other half of the discharge from the station into the longer (east) force main which discharges into manhole no. 0432-006 near the intersection of Zedler Lane and Port Washington Road.

Options for Force Main Extension

The first option is the upgrading of the 18-inch gravity sewer as described.

ATI staff visited the area and walked several corridors considered for the extension of the force main to the diversion structure if that is ultimately selected as the best course of action. A brief description of each is noted in the following paragraphs.

Corridor 1 would follow the route of the existing gravity sewer and the east force main through The Hidden Reserve. This route is approximately 1,870 lineal feet in length as measured along the existing gravity sewer route. Refer to Figure 1 for a sketch of the route described.

Corridor 2 would consist of running east in the Sunnydale Lane Right of Way approximately 1,000 feet and then turning south. This route is approximately 2,320 lineal feet. Refer to Figure 2 for a sketch of the route described.

Corridor 3 would consist of running south in Oriole Lane then running east and south in Hidden Reserve Court to a point near manhole No.0430-108 where the route would then follow the existing sewer and force main route described in corridor 1. This route in total is approximately 2,075 lineal feet in length and is shown on Figure 3.

Corridor 4 would be a slightly different route than described in corridor 2. This route would run east in Sunnydale Lane to a point approximately 650 feet. At this point, the route would run southeasterly behind the homes located at 1802W to 1850W Hidden Reserve Court then connect at manhole No.0430-110. This route in total is approximately 2,000 lineal feet in length and is shown on Figure 4.

Discussion of Force Main Routes

The shortest route is Corridor 1, whereas the longest route is Corridor 2. Corridors 2 and 4 will have to contend with mapped wetland areas. Corridors 1 and 3 avoid these wetland areas. Lands subject to regulatory floodplains are not present in the corridor areas. Corridor 1 is likely the easiest from a regulatory perspective. The sewer corridor is located within a 20-foot wide sanitary sewer and force main easement and within portions of Hidden Reserve Circle, a public 60-foot wide right of way. While there are mapped wetland areas present at various points within the route, the route has been disturbed previously when installing the sanitary sewer and force main. The existing easements already in place would be helpful during the design and construction. If additional space is needed outside the existing easement, the presence of the existing easement will likely assist when negotiating additional easement space.

Corridor 2 consists of construction beneath or immediately adjacent to several storm water ponds located in the Concord Place Condominium development. In addition, several mapped wetland areas will need to be traversed and easements obtained.

Corridor 3 is located within the aforesaid 60-foot wide street right of way for Hidden Reserve Circle for the first portion of the route and then transitioning to follow the aforesaid existing 20-foot wide easement down toward N. Stone Creek Drive.

Corridor 4 is impacted by the mapped wetland areas which will limit the ability to install the pipe using open-cut construction methods. It is noted that the majority of corridor 4 would require the acquisition of new easements as none are presently available. Corridor 4 would involve the least amount of disturbance to property owners since the ground surface disturbance would be limited to the south right-of-way along Sunnydale Road. The remainder of the corridor could be installed utilizing trenchless methods.

Depending on the corridor, it is apparent that trenchless installation of the new force main will be utilized to some extent to limit the impact and inconvenience to private property owners. Corridor 3 could be open-cut due to a majority of its route occurring in the right of way but not near waterways. All corridors affect properties owned by private individuals or associations, making impact to private property a significant challenge when proceeding with the design.

In terms of project costs, we estimate that the pipe replacement can be completed for an estimated cost of \$513,000, including the upsizing the undersized sections of pipes to meet 4500 gpm capacity through the sewer. Compared to pipe replacement, extending the force main would be approximately \$2,000,000 for the preferred Corridor 4, or \$1,570,000 for Corridor 3. In addition to the estimated fiscal impact, easement acquisition may ultimately dictate the replacement method more so than the cost. Corridor 4 may minimize the disturbances to residents of The Hidden Reserve, but it requires easement acquisition that cannot be guaranteed. Corridor 3 requires disturbing the Hidden Reserve Circle right-of-way and several resident's driveways in the Circle to extend the force main. Foregoing a force main extension and instead relaying an upsized gravity sewer through The Hidden Reserve is cheaper than extending the force main and requires much less linear feet of utility work than extending the force main.

Conclusion

Based on our review of the available options, the least intrusive option to meet necessary sewer capacity through The Hidden Reserve is to relay the gravity sewer, upsizing from an 18-inch diameter to a 21-inch diameter between no. 0430-011 and manhole no. 0430-106 (approximately 149 lineal feet). This option also involves upsizing the gravity sewer from 24-inch diameter to 27-inch diameter between manhole no. 0430-107 and manhole no. 0430-110 (approximately 272 lineal feet).

If instead the force main extension through the subdivision is chosen, it is our conclusion that the corridor with the least impact on the property owners in the Hidden Reserve development would be Corridor 4. As described, this corridor would require the negotiation and acquisition of new easements but would minimize construction challenges such as utility crossings, pavement restoration, and disturbing resident's driveways as compared to Corridors 1,2, and 3. Corridor 4 would be able to best utilize trenchless installation of the force main between Sunnydale Ln and Stonecreek Drive. Despite the greater cost relative to the other corridors, Corridor 4 has the advantage of minimal disturbance to residents and fewer construction conflicts with installation of the new force main.

Appendix A

Hidden Reserve Cost Tables

Table 10
Hidden Reserve Force Main Route 1 (MH 430-017 **Relay to 430-106 (420 LF, 18" -> 21"))**
Cost Summary

Description	Quantity	Unit	Unit Cost	Amount
21" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration)	149	LF	\$400	\$59,600
27" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration)	272	LF	\$425	\$115,600
Sanitary Sewer Manholes	100	VF	\$500	\$50,000
Surface Restoration				
Turf Restoration	3100	SY	\$10	\$31,000
Crushed Aggregate Base Course	620	CY	\$35	\$21,700
2" HMA Binder Course	215	Ton	\$100	\$21,500
Tack Coat	95	Gal	\$3	\$285
2" HMA Surface Course	215	Ton	\$100	\$21,500
Traffic Control	1	Lot	\$40,000	\$40,000
Environmental Corridor Restoration and Native Planting	1	Lot	\$10,000	\$10,000
Dewatering	1	Lot	\$25,000	\$25,000
Subtotal				\$396,000
Contingencies (20%)				\$79,000
General Conditions, Bonds and Insurance (8%)				\$38,000
Total Construction Cost				\$513,000

Table 11
Hidden Reserve (Force Main Extension Corridor 4, South of Sunnydale portion HDD)
Cost Summary

Description	Quantity	Unit	Unit Cost	Amount
Easement Appraisal	1	EA	\$5,000	\$5,000
Easement Acquisition	1	Lot	\$50,000	\$50,000
Power Pole Protection (5 utility poles in area of open cut)	5	EA	\$5,000	\$25,000
16" C900 Force Main, Bedding Slurry Backfill (Excludes Surface Restoration)	700	LF	\$400	\$280,000
16" (fPVC) HDD Force Main	1400	LF	\$700	\$980,000
Clearing and Grubbing for Drill Rig Staging Area	1	Lot	\$20,000	\$20,000
Core Hole and Tie-in Force Main @ Diversion Structure	1	EA	\$5,000	\$5,000
Surface Restoration				
Turf Restoration	1889	SY	\$10	\$18,889
Pavement Restoration	259	SY	\$100	\$25,889
Stone	500	SY	\$20	\$10,000
Traffic Control	1	Lot	\$40,000	\$40,000
Environmental Corridor Restoration and Native Planting	1	Lot	\$10,000	\$10,000
Dewatering	1	Lot	\$75,000	\$75,000
Subtotal				\$1,544,778
Contingencies (20%)				\$309,000
General Conditions, Bonds and Insurance (8%)				\$148,000
Total Construction Cost				\$2,001,778

Table 12
Hidden Reserve (Force Main Extension **Corridor 3, Follow hidden reserve Circle until MH0430-108)**
Cost Summary

Description	Quantity	Unit	Unit Cost	Amount
18" RSCP, Bedding, Slurry Backfill (Excludes Surface Restoration)	0	LF	\$375	\$0
16" C900 Force Main, Bedding Slurry Backfill (Excludes Surface Restoration)	2075	LF	\$400	\$830,000
Widening of Exst Easement from 20 to 30-feet (City Code-Required for 2+ Utilities)	1	Lot	\$25,000	\$25,000
Core Hole and Tie-in Force Main @ Diversion Structure	1	EA	\$5,000	\$5,000
Surface Restoration				
Turf Restoration	4222.222	SY	\$10	\$42,222
Pavement Restoration	1111.111	SY	\$100	\$111,111
Stone	500	SY	\$20	\$10,000
Traffic Control	1	Lot	\$40,000	\$40,000
Environmental Corridor Restoration and Native Planting	1	Lot	\$25,000	\$25,000
Storm Culvert Replacement along force main route	4	EA	\$5,000	\$20,000
Dewatering	1	Lot	\$100,000	\$100,000
Subtotal				\$1,208,333
Contingencies (20%)				\$242,000
General Conditions, Bonds and Insurance (8%)				\$116,000
Total Construction Cost				\$1,566,333

Appendix B

Force Main Corridor Alternatives

Figures 1 - 4



FIGURE 1



FIGURE 2



FIGURE 3



FIGURE 4

APPENDIX D

Endangered Resources Review



State of Wisconsin / DEPARTMENT OF NATURAL RESOURCES

Tony Evers, Governor
Preston D. Cole, Secretary
Telephone 608-266-2621
Toll Free 1-888-936-7463
TTY Access via relay - 711

101 S. Webster St.
Box 7921
Madison, WI 53707-7921

September 9, 2022

William Hein
Applied Technologies, Inc.
13400 Bishops Lane Suite 270
Brookfield, WI 53005

SUBJECT: Endangered Resources Review (ERR Log # 22-632)
Proposed Mequon Lift Station E, Ozaukee County, WI (T09N R22E S19)

Dear William Hein,

The Bureau of Natural Heritage Conservation has reviewed the proposed project described in the Endangered Resources (ER) Review Request received August 22, 2022. The complete ER Review for this proposed project is attached and follow-up actions are summarized below:

Required Actions: 0 species

Recommended Actions: 4 species

No Follow-Up Actions: 0 species

Additional Recommendations Specified: Yes

This ER Review may contain Natural Heritage Inventory data (<http://dnr.wi.gov/topic/NHI>), including specific locations of endangered resources, which are considered sensitive and are not subject to Wisconsin's Open Records Law. Information contained in this ER Review may be shared with individuals who need this information in order to carry out specific roles in the planning, permitting, and implementation of the proposed project. **Specific locations of endangered resources may not be released or reproduced in any publicly disseminated documents.**

The attached ER Review is for informational purposes and only addresses endangered resources issues. **This ER Review does not constitute DNR authorization of the proposed project and does not exempt the project from securing necessary permits and approvals from the DNR and/or other permitting authorities.** Please contact the ER Review Program whenever the project plans change, new details become available, or more than a year has passed to confirm if results of this ER Review are still valid.

Please contact me at 608-264-8968 or via email at anna.rossler@wi.gov if you have any questions about this ER Review.

Sincerely,

Anna Rossler
Endangered Resources Review Program

cc:

**Endangered Resources Review for the Proposed Mequon Lift Station E, Ozaukee County
(ER Log # 22-632)**

Section A. Location and brief description of the proposed project

Based on information provided by the ER Review Request form and attached materials, the proposed project consists of the following:

Location	Ozaukee County - T09N R22E S19
Project Description	The City wishes to reconstruct Lift Station E on this property. The parcel will be 20,000 square feet in size and lie outside previously delineated floodplain, wetland and environmental corridor. It is likely that the entire lot will be disturbed as part of the construction
Project Timing	Sept 2023- Dec 2024
Current Habitat	Area appears to be grass land with some trees and brush
Impacts to Wetlands or Waterbodies	Wetland, environmental corridor and floodplain shown on the Ranch Court Subdivision plat
Property Type	Public, Private
Federal Nexus	No

It is best to request ER Reviews early in the project planning process. However, some important project details may not be known at that time. Details related to project location, design, and timing of disturbance are important for determining both the endangered resources that may be impacted by the project and any necessary follow-up actions. Please contact the ER Review Program whenever the project plans change, new details become available, or more than a year has passed to confirm if results of this ER Review are still valid.

Section B. Endangered resources recorded from within the project area and surrounding area

	Group	State Status	Federal Status
Rusty Patched Bumble Bee Federal High Potential Zone	Bee	NA	HPZ
Little Brown Bat (<i>Myotis lucifugus</i>)	Mammal~	THR	
Forked Aster (<i>Eurybia furcata</i>)	Plant	THR	
Hairy Beardtongue (<i>Penstemon hirsutus</i>)	Plant	SC	

For additional information on the rare species, high-quality natural communities, and other endangered resources listed above, please visit our Biodiversity (<http://dnr.wi.gov/topic/EndangeredResources/biodiversity.html>) page. For further definitions of state and federal statuses (END=Endangered, THR=Threatened, SC=Special Concern), please refer to the Natural Heritage Inventory (NHI) Working List (<http://dnr.wi.gov/topic/nhi/wlist.html>).

Section C. Follow-up actions

Actions that need to be taken to comply with state and/or federal endangered species laws: None

Actions recommended to help conserve Wisconsin's Endangered Resources:

• Rusty Patched Bumble Bee Federal High Potential Zone - Bee

State Status: NAFederal Status: HPZ

Impact Type	Impact possible
Recommended Measures	Other
Description of Recommended Measures	<p>This project occurs within the Rusty Patched Bumble Bee Federal High Potential Zone and may contain suitable habitat for the bee. Take of the bee is prohibited per the federal Endangered Species Act. However, because this project has no federal nexus, follow-up actions are recommended and not required.</p> <p>Recommended follow-up actions for the Rusty patched bumble bee include following one or more of the USFWS' recommended conservation measures below outlined in the Conservation Management Guidelines for the Rusty Patched Bumble Bee (<i>Bombus affinis</i>) document (https://www.fws.gov/sites/default/files/documents/ConservationGuidanceRPBBv1_27Feb2018_0.pdf). Actions include but are not limited to:</p> <p>For tree clearing/thinning:</p> <ul style="list-style-type: none"> • Implement best management practices (BMPs), especially those that serve to minimize the spread of invasive species and to avoid or minimize soil compaction. Visit (https://www.stateforesters.org/newsroom/state-forestry-bmps/) for up to date information about BMP recommendations by state. • Avoid or minimize soil disturbance and heavy equipment operation during overwintering (mid October- mid March) • Avoid or minimize forest management that may destroy spring blooming flowers during their bloom periods. • Consider thinning or single tree selection and dense invasive shrub removal that may improve overwintering and spring foraging habitat. <p>For all other activities:</p> <ul style="list-style-type: none"> • use native trees, shrubs and flowering plants in landscaping, • provide plants that bloom from spring through fall (refer to the USFWS RPBB Midwest Plant Guide), • remove and control invasive plants in any habitat used for foraging, nesting, or overwintering <p>If suitable habitat is present and none of the above conservation measures can be followed, contact the USFWS Bloomington Field Office at (952) 252-0092 or TwinCities@fws.gov for further consultation.</p>

• Little Brown Bat (*Myotis lucifugus*) - Mammal-

State Status: THR

Impact Type	Impact possible
Recommended Measures	Time of year restriction
Description of Recommended Measures	<p>Little Brown Bat has been recorded in the vicinity of the project area. While the known roost will not be impacted, bats can use trees as roosts. Tree removal occurring as part of this project is covered for take by the Cave Bat Broad Incidental Take Permit and there are no required actions for this species. However, it is recommended that special consideration be given to protecting snags or dying trees, particularly from June 1 – August 15 while bats may have flightless pups at the roost.</p> <p>Little Brown Bat (<i>Myotis lucifugus</i>) is a Threatened species in Wisconsin. Its dorsal fur is a glossy dark-brown to olive-brown color with a lighter ventral side. The little brown bat is insectivorous and feeds on aquatic soft-bodied insects and is found roosting in warm microclimates provided by tree snags, bat houses, and buildings during the summer. It forages primarily over open water and along edge habitat. Little Brown Bats hibernate in caves and mines from October through April. Mating occurs in the fall, and females store sperm until emergence in the spring. Usually one pup is born in early June and matures in six weeks.</p>

• Forked Aster (*Eurybia furcata*) - Plant

State Status: THR

Impact Type	Impact possible
Recommended Measures	Surveys, Other
Description of Recommended Measures	<p>Suitable habitat for the Forked Aster may be impacted by this project. Although not required because utilities are exempt from plant requirements, we recommend that you avoid or minimize take of the Forked Aster. Avoidance and minimization efforts may include site surveys to confirm presence/absence of species and fencing off areas of occupied habitat. Survey results should be submitted to the Endangered Resources Review Program.</p> <p>Forked Aster (<i>Eurybia furcata</i>), a Wisconsin Threatened plant, is found in dry-mesic to mesic hardwoods, often adjacent to lakes or streams, or on slopes with dolomite near the surface. Blooming occurs early August through early October; fruiting occurs late August through early October. The optimal identification period for this species is late August through late September.</p>

Impact Type	Impact possible
Recommended Measures	Surveys,Other
Description of Recommended Measures	<p>Suitable habitat for the Hairy Beardtongue may be impacted by this project. Although not required because Special Concern species are not legally protected, we recommend that you avoid or minimize take of the Hairy Beardtongue. Avoidance and minimization efforts may include site surveys to confirm presence/absence of species and fencing off areas of occupied habitat. Survey results should be submitted to the Endangered Resources Review Program.</p> <p>Hairy Beardtongue (<i>Penstemon hirsutus</i>), a Wisconsin Special Concern plant, is found on dry gravelly and sandy prairies, or in hillside oak woodlands. It is also naturalized on roadsides. Blooming occurs late May through late June; fruiting occurs late July through late August. The optimal identification period for this species is late May through late June.</p>

Remember that although these actions are not required by state or federal endangered species laws, they may be required by other laws, permits, granting programs, or policies of this or another agency. Examples include the federal Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, State Natural Areas law, DNR Chapter 30 Wetland and Waterway permits, DNR Stormwater permits, and Forest Certification.

Additional Recommendations

Please note that erosion control netting (also known as erosion control blankets, erosion mats or erosion mesh netting) used to prevent erosion during the establishment of vegetation can have detrimental effects on local snake and other wildlife populations. Plastic netting without independent movement of strands can easily entrap snakes moving through the area, leading to dehydration, desiccation, and eventually mortality. Netting that contains biodegradable thread with the "leno" or "gauze" weave (contains strands that are able to move independently) appears to have the least impact on snakes and should be used in areas adjacent to or near any waterbody.

If erosion matting will be used for this project, use the following matting (or something similar): American Excelsior "FibreNet" or "NetFree" products; East Coast Erosion biodegradable jute products; Erosion Tech biodegradable jute products; ErosionControlBlanket.com biodegradable leno weave products; North American Green S75BN, S150BN, SC150BN or C125BN; or Western Excelsior "All Natural" products.

No actions are required or recommended for the following endangered resources: None

Section D. Next Steps

1. Evaluate whether the '**Location and brief description of the proposed project**' is still accurate. All recommendations in this ER Review are based on the information supplied in the ER Review Request. If the proposed project has changed or more than a year has passed and you would like your letter renewed, please contact the ER Review Program to determine if the information in this ER Review is still valid.
2. Determine whether the project can incorporate and implement the '**Follow-up actions**' identified above:
 - o 'Actions that need to be taken to comply with state and/or federal endangered species laws' represent the Department's best available guidance for complying with state and federal endangered species laws based on the project information that you provided and the endangered resources information and data available to us. If the proposed project has not changed from the description that you provided us and you are able to implement all of the 'Actions that need to be taken to comply with state and/or federal endangered species laws', your project should comply with state and federal endangered species laws. Please remember that if a violation occurs, the person responsible for the taking is the liable party. Generally this is the landowner or project proponent. For questions or concerns about individual responsibilities related to Wisconsin's Endangered Species Law, please contact the ER Review Program.
 - o If the project is unable to incorporate and implement one or more of the 'Actions that need to be taken to comply with state and/or federal endangered species laws' identified above, the project may potentially violate one or more of these laws. Please contact the ER Review Program immediately to assist in identifying potential options that may allow the project to proceed in compliance with state and federal endangered species laws.
 - o 'Actions recommended to help conserve Wisconsin's Endangered Resources' may be required by another law, a policy of this or another Department, agency or program; or as part of another permitting, approval or granting process. Please make sure to carefully read all permits and approvals for the project to determine whether these or other measures may be required. Even if these actions are not required by another program or entity for the proposed project to proceed, the Department strongly encourages the implementation of these conservation measures on a voluntary basis to help prevent future listings and protect Wisconsin's biodiversity for future generations.

3. If federally-protected species or habitats are involved and the project involves federal funds, technical assistance or authorization (e.g., permit) and there are likely to be any impacts (positive or negative) to them, consultation with USFWS will need to occur prior to the project being able to proceed. If no federal funding, assistance or authorization is involved with the project and there are likely to be adverse impacts to the species, contact the USFWS Twin Cities Ecological Services Field Office at 612-725-3548 (x2201) for further information and guidance.

Section E. Standard Information to help you better understand this ER Review

Endangered Resources (ER) Reviews are conducted according to the protocols in the guidance document Conducting Proposed Endangered Resources Reviews: A Step-by-Step Guide for Wisconsin DNR Staff.

How endangered resources searches are conducted for the proposed project area: An endangered resources search is performed as part of all ER Reviews. A search consists of querying the Wisconsin Natural Heritage Inventory (NHI) database for endangered resources records for the proposed project area. The project area evaluated consists of both the specific project site and a buffer area surrounding the site. A 1 mile buffer is considered for terrestrial and wetland species, and a 2 mile buffer for aquatic species. Endangered resources records from the buffer area are considered because most lands and waters in the state, especially private lands, have not been surveyed. Considering records from the entire project area (also sometimes referred to as the search area) provides the best picture of species and communities that may be present on your specific site if suitable habitat for those species or communities is present.

Categories of endangered resources considered in ER Reviews and protections for each: Endangered resources records from the NHI database fall into one of the following categories:

- Federally-protected species include those federally listed as Endangered or Threatened and Designated Critical Habitats. Federally-protected animals are protected on all lands; federally-protected plants are protected only on federal lands and in the course of projects that include federal funding (see Federal Endangered Species Act of 1973 as amended).
- Animals (vertebrate and invertebrate) listed as Endangered or Threatened in Wisconsin are protected by Wisconsin's Endangered Species Law on all lands and waters of the state (s. 29.604, Wis. Stats.).
- Plants listed as Endangered or Threatened in Wisconsin are protected by Wisconsin's Endangered Species Law on public lands and on land that the person does not own or lease, except in the course of forestry, agriculture, utility, or bulk sampling actions (s. 29.604, Wis. Stats.).
- Special Concern species, high-quality examples of natural communities (sometimes called High Conservation Value areas), and natural features (e.g., caves and animal aggregation sites) are also included in the NHI database. These endangered resources are not legally protected by state or federal endangered species laws. However, other laws, policies (e.g., related to Forest Certification), or granting/permitting processes may require or strongly encourage protection of these resources. The main purpose of the Special Concern classification is to focus attention on species about which some problem of abundance or distribution is suspected before they become endangered or threatened.
- State Natural Areas (SNAs) are also included in the NHI database. SNAs protect outstanding examples of Wisconsin's native landscape of natural communities, significant geological formations, and archeological sites. Endangered species are often found within SNAs. SNAs are protected by law from any use that is inconsistent with or injurious to their natural values (s. 23.28, Wis. Stats.).

Please remember the following:

1. This ER Review is provided as information to comply with state and federal endangered species laws. By following the protocols and methodologies described above, the best information currently available about endangered resources that may be present in the proposed project area has been provided. However, the NHI database is not all inclusive; systematic surveys of most public lands have not been conducted, and the majority of private lands have not been surveyed. As a result, NHI data for the project area may be incomplete. Occurrences of endangered resources are only in the NHI database if the site has been previously surveyed for that species or group during the appropriate season, and an observation was reported to and entered into the NHI database. As such, absence of a record in the NHI database for a specific area should not be used to infer that no endangered resources are present in that area. Similarly, the presence of one species does not imply that surveys have been conducted for other species. Evaluations of the possible presence of rare species on the project site should always be based on whether suitable habitat exists on site for that species.
2. This ER Review provides an assessment of endangered resources that may be impacted by the project and measures that can be taken to avoid negatively impacting those resources based on the information that has been provided to ER Review Program at this time. Incomplete information, changes in the project, or subsequent survey results may affect our assessment and indicate the need for additional or different measures to avoid impacts to endangered resources.
3. This ER Review does not exempt the project from actions that may be required by Department permits or approvals for the project. Information contained in this ER Review may be shared with individuals who need this information in order to carry out specific roles in the planning, permitting, and implementation of the proposed project.

APPENDIX E

Historical Information

From: [Will Hein](#)
To: [Will Hein](#)
Subject: FW: OZ-9-22-19...WM...Historical Site Review
Date: Tuesday, October 17, 2023 7:49:35 AM
Attachments: [image001.png](#)
[Ranch Court.pdf](#)
[20220809123721.pdf](#)
[Figure 1-1.pdf](#)

From: Kubicek, Richard H - DNR <richard.kubicek@wisconsin.gov>
Sent: Tuesday, September 13, 2022 8:52 AM
To: Will Hein <wahein@ati-ae.com>
Subject: OZ-9-22-19...WM...Historical Site Review

DNR has completed a cultural resource review of the above project.

No recorded historic properties are reported to occur within the proposed project location.

Please forward this correspondence to other parties, as needed, and retain a copy (including your correspondence and the provided maps) for your project files.

In future, I need only the following: T/R/S info, a brief project description, and a USGS topo map with project disturbance footprint clearly delineated thereon.

Do not hesitate to get in touch for additional information or clarification.

Richard H. Kubicek
Departmental Archaeologist/
Departmental Historic Preservation Officer
Pronouns: He/Him

Historic Preservation Unit
Bureau of Environmental Analysis & Sustainability
Wisconsin Department of Natural Resources –
1027 W. St Paul Ave,
Milwaukee , WI 53233
Cell Phone: 608-445-8395
Richard.kubicek@wisconsin.gov



We are committed to service excellence.

Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

From: Will Hein <wahein@ati-ae.com>
Sent: Tuesday, September 13, 2022 7:36 AM

To: Kubicek, Richard H - DNR <richard.kubicek@wisconsin.gov>

Subject: Historical Site Review

**CAUTION: This email originated from outside the organization.
Do not click links or open attachments unless you recognize the sender and know the content is safe.**

Good Morning

In the past you have assisted our office in providing reviews on properties for historical sites. This site is located in the City of Mequon and was platted as part lot 3 of the Ranch Court subdivision back in 2018. The City is looking to obtain a portion of lot 3 in order to relocate one of their sanitary sewer lift stations.

I am attaching a copy of the subdivision plat, a general sketch of the proposed site and a proposed site plan for the project for your consideration.

Please review and contact our office if additional information is necessary to complete the review.

Thank you in advance for your consideration

William A. (Will) Hein, PE, PLS
CAS DEPARTMENT MANAGER

Direct-(262) 785-7326
Cell- (262) 352-2460

APPLIED TECHNOLOGIES, Inc.

13400 Bishops Lane-Suite 270 | Brookfield, WI 53005 | (262) 784-7690 | <http://www.ati-ae.com/>



July 9, 2023

Will Hein
Applied Technologies, Inc.
13400 Bishop's Lane, Suite 270
Brookfield, WI 53005
Direct-(262) 785-7326
Cell- (262) 352-2460
Email: wahein@ati-ae.com

Sabin Hall, Rm 290
PO Box 413
Milwaukee, WI
53201-0413
414 229-3078
www.uwm.edu
www.uwm.edu/archaeology-
laboratory/

RE: Lift Station Rehabilitation TM#2023-0294
Applied Technologies, Inc.
City of Mequon, Ozaukee County
UWM-CRM Project 2022-1140

Dear Mr. Heim,

The following presents the results of the cultural resources review for the above referenced project located in the City of Mequon, Ozaukee County, Wisconsin (Attachments 1 and 2).

Project Description

The project is for a lift station rehabilitation project in the City of Mequon, Ozaukee County. The methods and techniques used during the study will follow those standards promulgated in the Secretary of Interior's Standards and Guidelines for Archeology and Historic Preservation, the Architecture-History Survey Manual, and the Guide for Public Archaeology in Wisconsin. The use of these documents as guides for historic preservation planning is endorsed by the Wisconsin State Historic Preservation Office (SHPO).

Archaeological Review

As part of this review, the Wisconsin Historic Preservation Database (WHPD) and the National Register of Historic Places (NRHP) were consulted, as well as relevant previous reporting and archival materials, to assess the presence of previously reported archaeological and/or burial sites within the proposed project area. No previously reported archaeological sites are coincident with or immediately adjacent to the project area. The review identified two previously reported cemetery/burial sites reported within one mile of the project area (Table 1; Attachment 3 and 4). The closest previously recorded archaeological site, burial site

47BOZ-0009, is located roughly two thirds of a mile to the east/southeast (WHPD 2023b). No further work is recommended.

Archival investigations also included a review of the WHPD database and historic aerial photos and plat maps. A review of the WHPD database identified one previous archaeological investigations along Ranch Road the partially overlaps with the current project area. Results of these investigations also did not find any evidence of intact cultural deposits with the project area (Attachment 6). Other sources reviewed include historic aerials and plat maps (Attachments 7 and 8).

Recommendations

1. Relative to archaeological resources and Wisconsin Statutes §44.40 and §157.70, there are no previously recorded archaeological burial or non-burial sites coincident with or immediately adjacent to the proposed project area. Therefore, no further investigations are required or recommended.
2. Additionally, no further work is recommended pursuant to Section 106 of the National Historic Preservation Act (NHPA).

Please contact Brian Nicholls, at nicholls@uwm.edu or at (414) 251-5680, with any questions and/or concerns.

Sincerely,



Brian D. Nicholls MS, RPA
Principal Investigator

References Cited

Christensen, George W.

2005 WDOT Archaeological Survey Field Report: Ranch Road, Mequon Road and Grace Avenue Connectors, Ozaukee County, Wisconsin. Great Lakes Archaeological Research Center, Inc. Milwaukee, Wisconsin

WHPD

2023a *Architecture and History Inventory*. Electronic document, <https://www.wisahrd.org/AHI/Properties/Primary.aspx?id=9937>, accessed May 2023.

2023b *Archaeological Site Inventory*. Electronic document, <https://www.wisahrd.org/ASI/Sites/Primary.aspx?id=9663>, accessed May 2023.

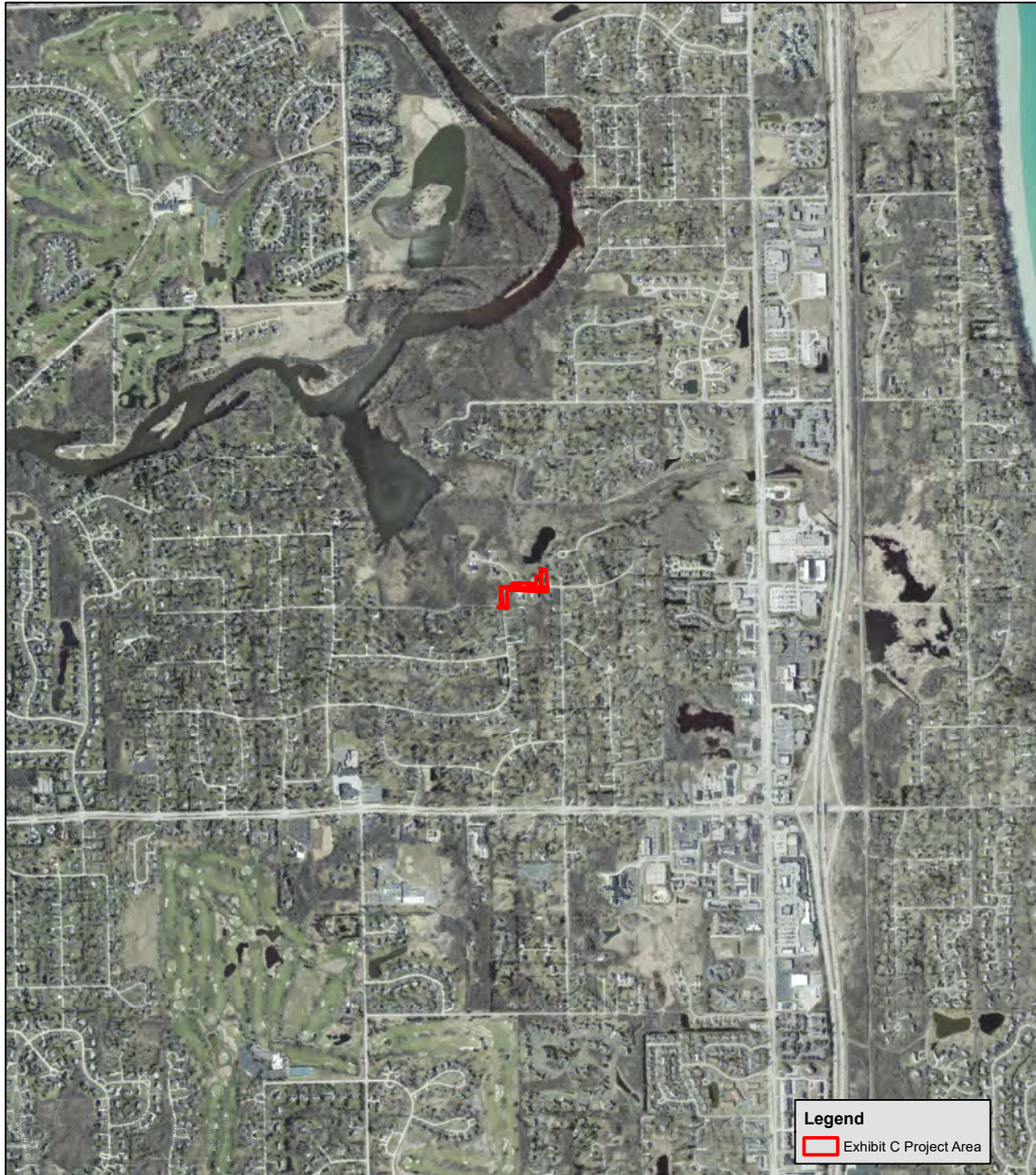
Table 1. Previously Recorded Archaeological Sites within One Mile of the Project Location.

State Site	Burial Site	Site name	Site Type	Culture
	BOZ-0005	St. James Chatholic Cemetery	Cemetery	Historic Euro-american
	BOZ-0016	St. John's Evangelical Lutheran Church Cemetery	Cemetery	Historic Euro-american

List of Attachments

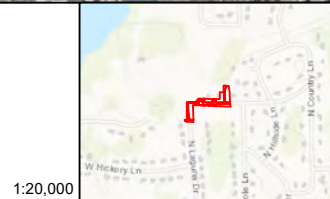
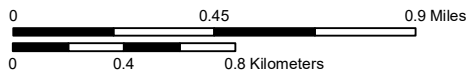
Attachment 1. Project location (topographic)..... 5
Attachment 2. Project location (aerial). 6
Attachment 3. Previously surveyed historic properties 7
Attachment 4. Previously recorded archaeological (Topo) 8
Attachment 5. Previously recorded archaeological sites (Aerial). 9
Attachment 6. Project location relative to previous archaeological survey. 10
Attachment 7. 1937 aerial imagery of the project location 11
Attachment 8. Historic plat maps. 12
Attachment 9. WHS Archaeological Reports Inventory Form 13

Attachment 2. Project location (aerial).



Map Details: UWM-CRM 2022-1140
Coordinate System: NAD 1983 HARN Transverse Mercator
Projection: Transverse Mercator
Datum: North American 1983 HARN
Created by: UWM-CRM 7/10/2023

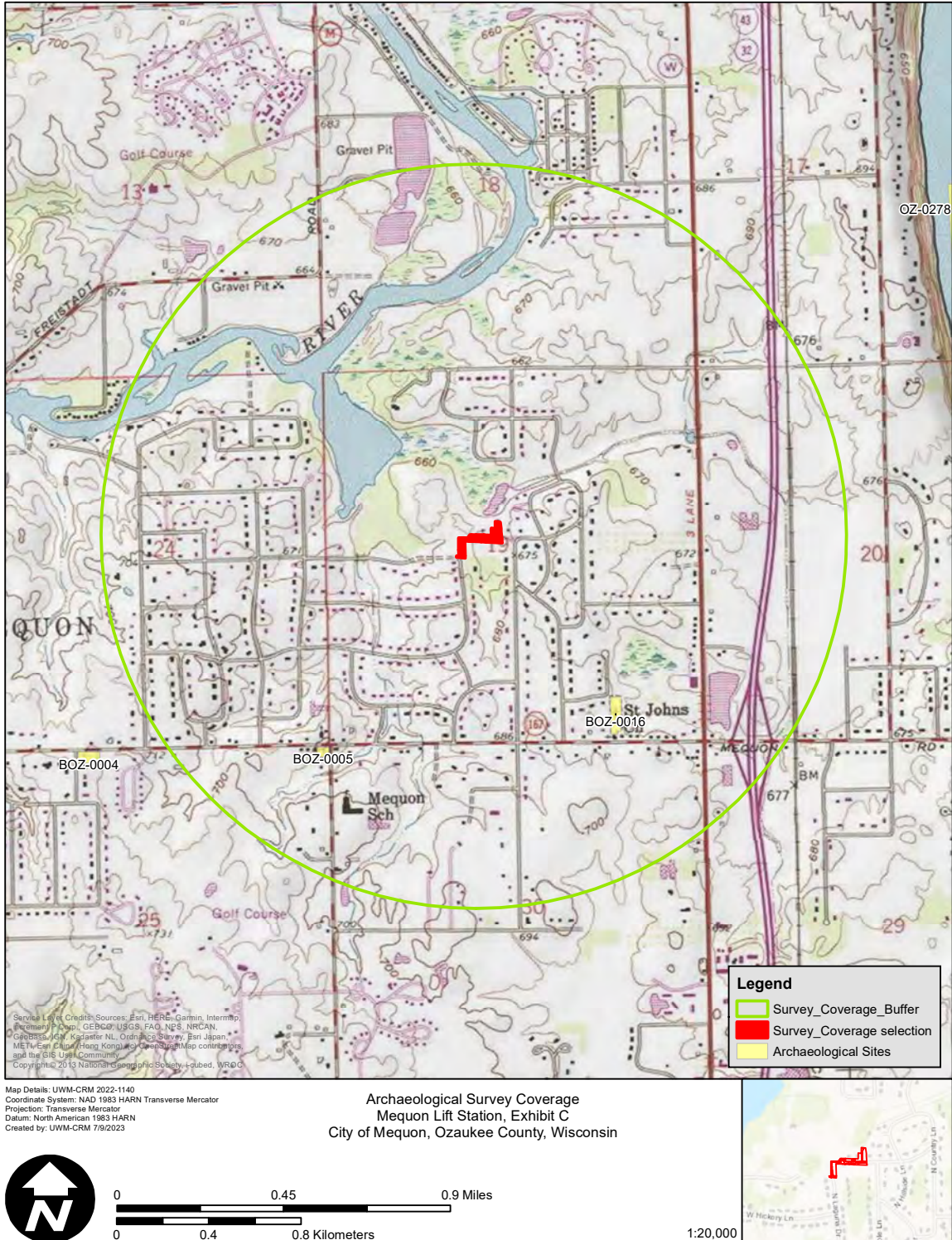
Archaeological Survey Coverage
Mequon Lift Station, Exhibit C
City of Mequon, Ozaukee County, Wisconsin



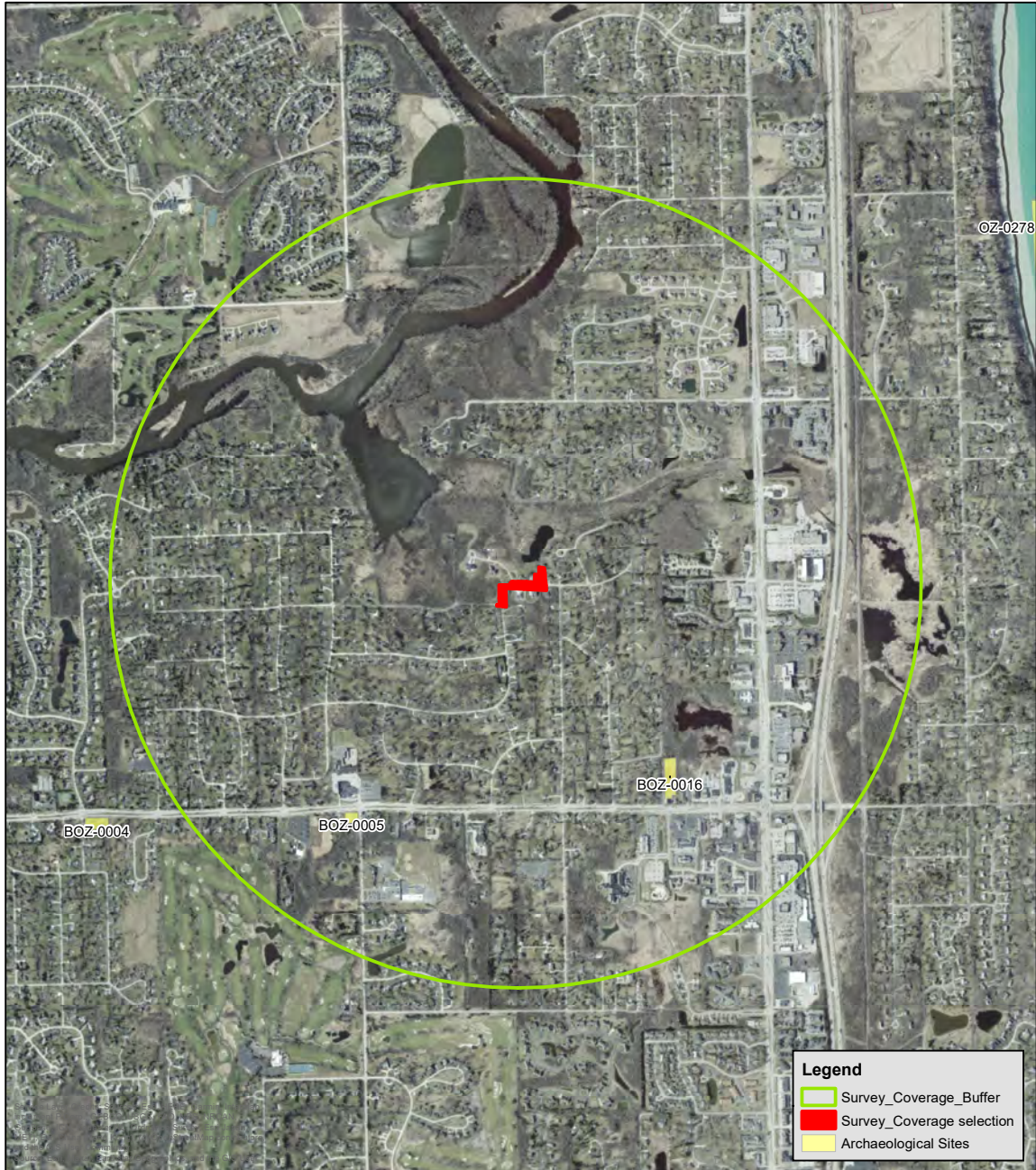
Attachment 3. Previously surveyed historic properties relative to the project location (aerial).



Attachment 4. Previously recorded archaeological sites within one mile of the project location (topographic).



Attachment 5. Project location relative to previously recorded archaeological sites (aerial).

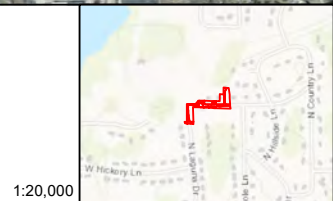
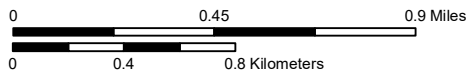


Map Details: UWM-CRM 2022-1140
 Coordinate System: NAD 1983 HARN Transverse Mercator
 Projection: Transverse Mercator
 Datum: North American 1983 HARN
 Created by: UWM-CRM 7/9/2023

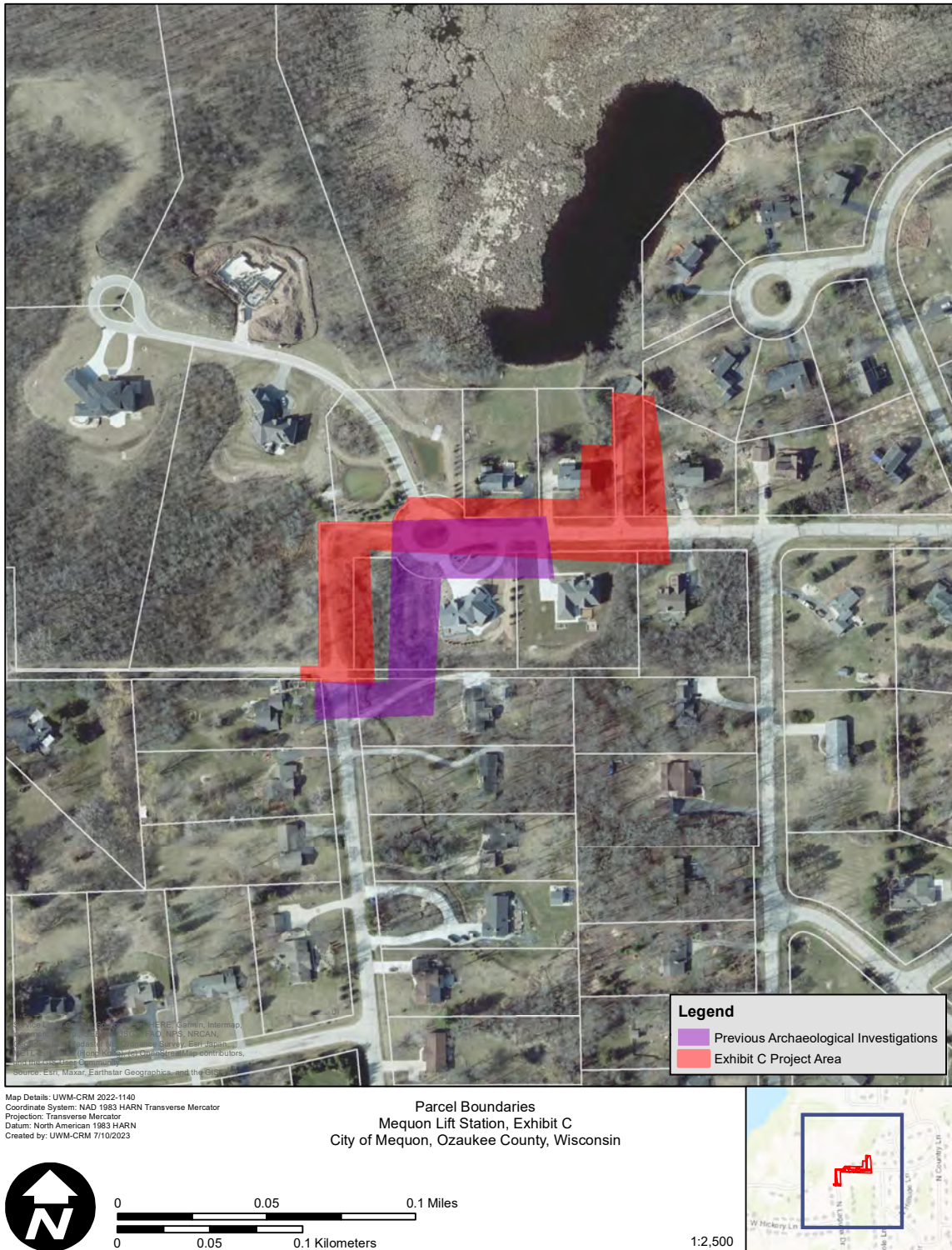
Archaeological Survey Coverage
 Mequon Lift Station, Exhibit C
 City of Mequon, Ozaukee County, Wisconsin

Legend

- Survey_Coverage_Buffer
- Survey_Coverage selection
- Archaeological Sites



Attachment 6. Project location relative to previous archaeological survey (aerial).



Attachment 7. 1937 aerial imagery of the project location (aerial)
<https://geodata.wisc.edu/catalog/555cdf33-541e-4f36-bd6d-3d568fa4572f>



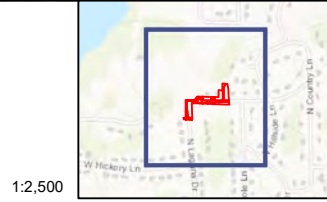
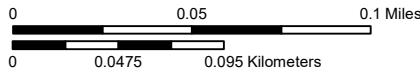
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, swisstopo, DeLorme, GeoBC, USGS, IGN, CHRS, NGA, Swisstopo, © 2019, IGN, Kadaster, NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), © OpenStreetMap contributors, and the GIS User Community, WROCC imagery.

Legend

- Exhibit C Project Area

Map Details: UWM-CRM 2022-1140
 Coordinate System: NAD 1983 HARN Transverse Mercator
 Projection: Transverse Mercator
 Datum: North American 1983 HARN
 Created by: UWM-CRM 7/10/2023

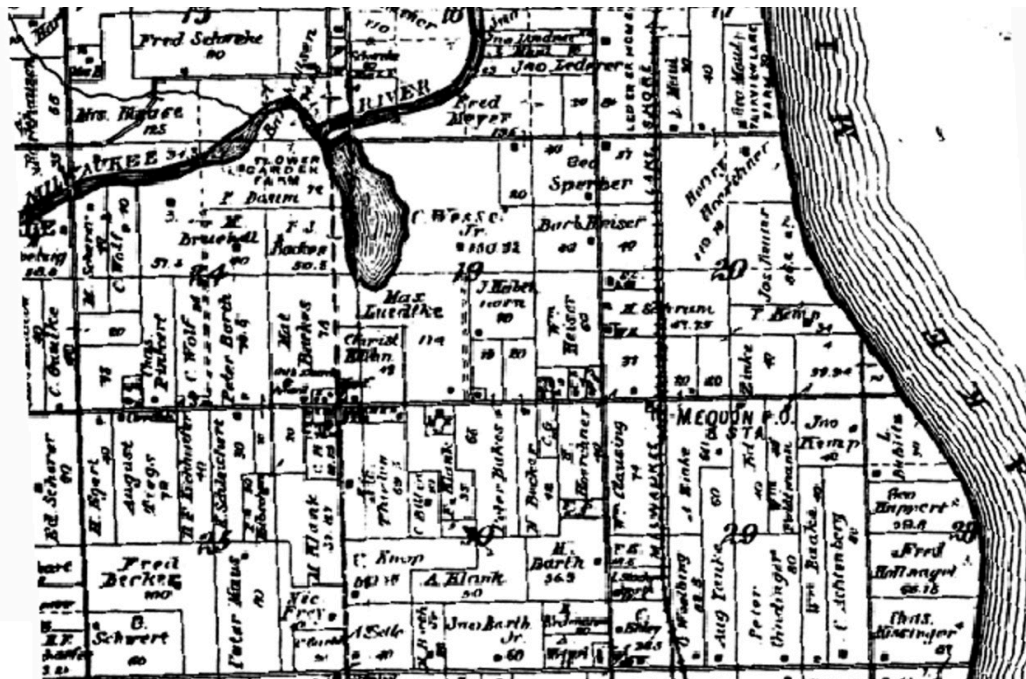
Project Area
 Mequon Lift Station, Exhibit C
 City of Mequon, Ozaukee County, Wisconsin



Attachment 8. Historic plat maps.



Plat Map T9N R22E Section 19 (Albert Volk, North West Publishing Co. - 1915)
<https://www.loc.gov/resource/g4123wm.gla00199/?sp=34&r=0.364,0.198,0.552,0.314,0>



Mequon T9N R22E Section 19 (Western Historical Co. - 1892)
<https://sites.rootsweb.com/~wiozauke/maps/1892.Mequon.jpg>

Attachment 9. Wisconsin Historical Society Archaeological Reports Inventory Form

ARCHAEOLOGICAL REPORTS INVENTORY FORM

WHS PROJECT #

COUNTY Ozaukee

AUTHORS: Brian Nicholls

REPORT TITLE: Phase I Archaeological Investigations for the City of Mequon Lift Rehabilitation Station, Ozaukee County, Wisconsin

DATE OF REPORT (MONTH AND YEAR): July 2023

SERIES/NUMBER: CRM-TM 2023-0294

PLACE OF PUBLICATION: UW-Milwaukee Archaeological Research Laboratory Center

LOCATIONAL INFORMATION [LEGAL DESCRIPTION OF SURVEY AREA (T-R-S)]
Township 9 North, Range 22 East, Section 19

U.S.G.S. QUAD MAP(S): Thiensville

SITE(S) INVESTIGATED: None

ACRES INVESTIGATED: ~ 1

AGENCY # n/a

INVESTIGATION TECHNIQUES COMPLETED (Check all that apply.)

- | | | |
|--|---|--|
| <input type="checkbox"/> Historical Research | <input type="checkbox"/> Surface Survey | <input type="checkbox"/> Geomorphology |
| <input type="checkbox"/> Interview/Informant | <input type="checkbox"/> Soil Core | <input type="checkbox"/> Underwater |
| <input type="checkbox"/> Records/Background | <input checked="" type="checkbox"/> Walk Over/Visual Inspection | <input type="checkbox"/> Avocational Survey |
| <input checked="" type="checkbox"/> Literature Background Research | <input type="checkbox"/> Mechanical Stripping | <input type="checkbox"/> Chance Encounter |
| <input type="checkbox"/> Traditional Knowledge | <input type="checkbox"/> Test Excavation/Phase II | <input type="checkbox"/> Osteological Analysis |
| <input type="checkbox"/> Monitoring | <input type="checkbox"/> Major Excavation/Phase III | <input type="checkbox"/> Faunal Analysis |
| <input checked="" type="checkbox"/> Shovel Testing/Probing | <input type="checkbox"/> Remote Sensing | <input type="checkbox"/> Floral Analysis |

ABSTRACT: Included in report Written in space below

In the spring of 2023, staff from UWM-CRM conducted a phase I archaeological survey of parcels that will be impacted by the City of Mequon Lift Rehabilitation project in Ozaukee county, Wisconsin. The entire project area was subjected to a visual inspection followed by shovel testing in all areas. Shovel test excavation profiles revealed areas with A/Ap horizon present while others produced disturbed soils. Results of the phase I survey failed to produced any cultural material or evidence of intact subsurface deposits. Based on the lack of intact cultural deposits, UWM-CRM recommends no additional investigations are required.

Office of the State Archaeologist ARI # _____

APPENDIX F

Equipment

NP 3231/746 3~ 480

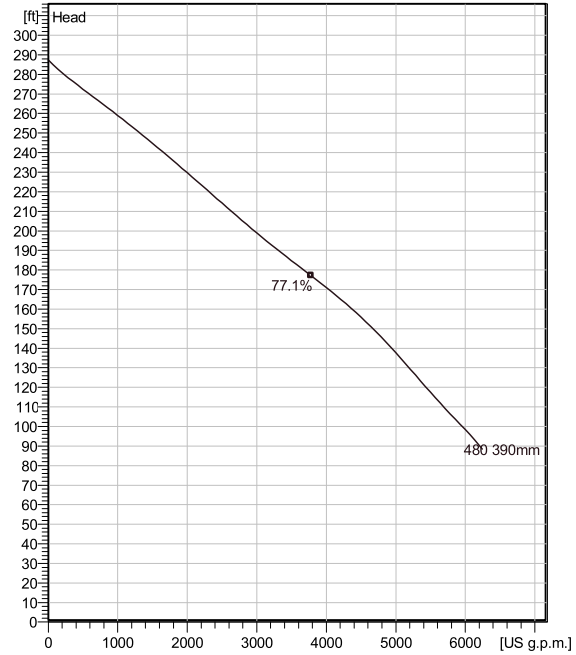
Patented self cleaning semi-open channel impeller, ideal for pumping in most waste water applications. Modular based design with high adaptation grade.



Technical specification



Curves according to: Water, pure Water, pure [100%], 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number N0746.000 43-44-41D-W IE3 250hp	Installation type P - Semi permanent, Wet
Impeller diameter 390 mm	Discharge diameter 8 inch

Configuration

Pump information

Impeller diameter 390 mm
Discharge diameter 8 inch
Inlet diameter 250 mm
Maximum operating speed 1785 rpm
Number of blades 3
Max. fluid temperature 40 °C

Material

Impeller Grey cast iron

Project	6555 Mequon LS E - East	Created by	Paul Traeger
Block	0	Created on	9/15/2023
		Last update	9/15/2023

NP 3231/746 3~ 480

Technical specification



Motor - General

Motor number N0746.000 43-44-41D-W IE3 250hp	Phases 3~	Rated speed 1785 rpm	Rated power 250 hp
Approval FM	Number of poles 4	Rated current 276 A	Stator variant 1
Frequency 60 Hz	Rated voltage 460 V	Insulation class H	Type of Duty S1
Version code 000	Closed loop cooling system		

Motor - Technical

Power factor - 1/1 Load 0.88	Motor efficiency - 1/1 Load 96.4 %	Total moment of inertia 63.1 lb ft ²	Starts per hour max. 10
Power factor - 3/4 Load 0.85	Motor efficiency - 3/4 Load 96.6 %	Starting current, direct starting 1800 A	
Power factor - 1/2 Load 0.77	Motor efficiency - 1/2 Load 96.5 %	Starting current, star-delta 600 A	

Project	6555 Mequon LS E - East	Created by	Paul Traeger		
Block	0	Created on	9/15/2023	Last update	9/15/2023

NP 3231/746 3~ 480

Performance curve

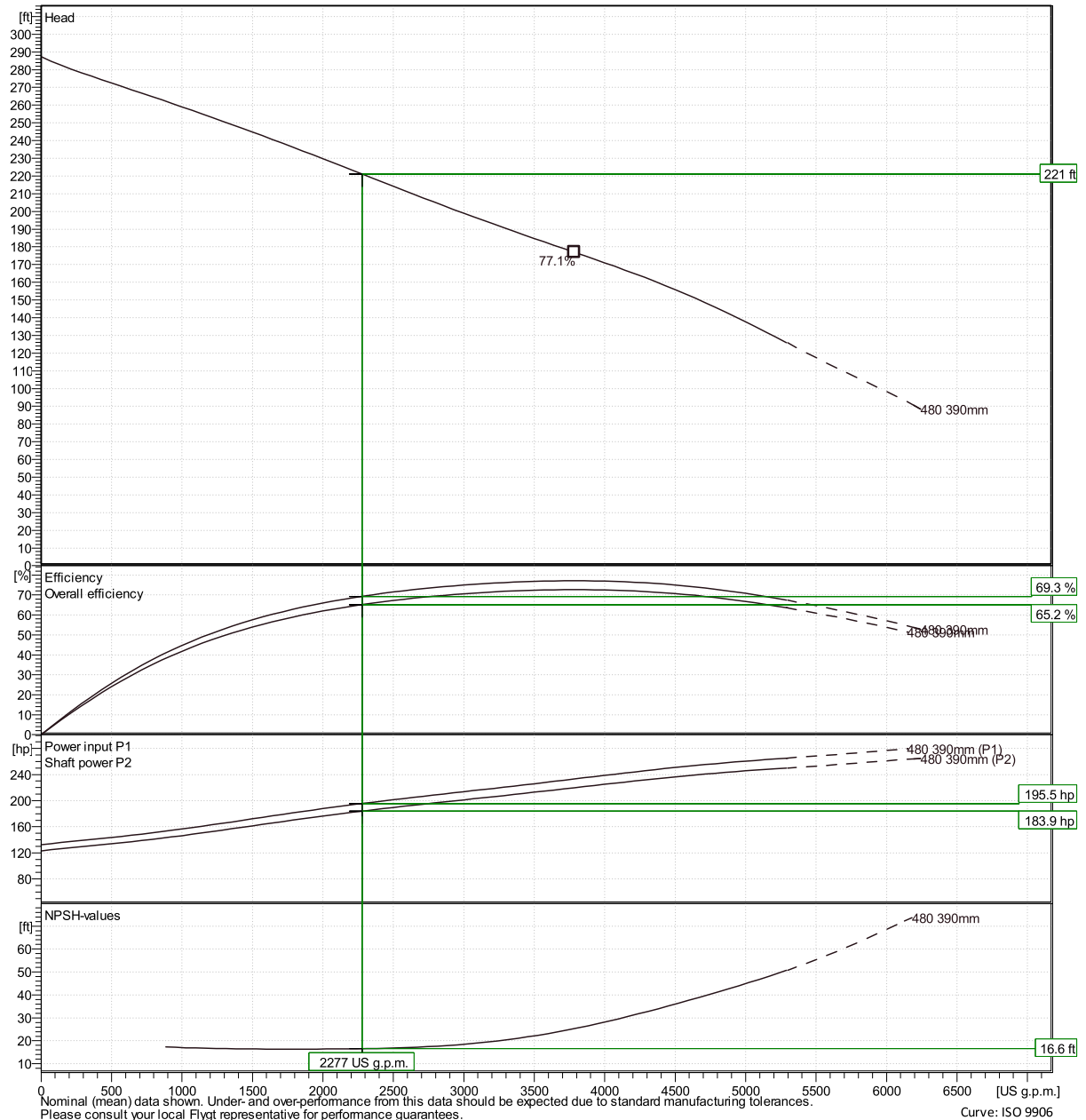


Duty point

Flow
2280 US g.p.m.

Head
221 ft

Curves according to: Water, pure [100%], 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s



6555 Mequon LS E - East
0

Paul Traeger
Created on 9/15/2023 Last update 9/15/2023

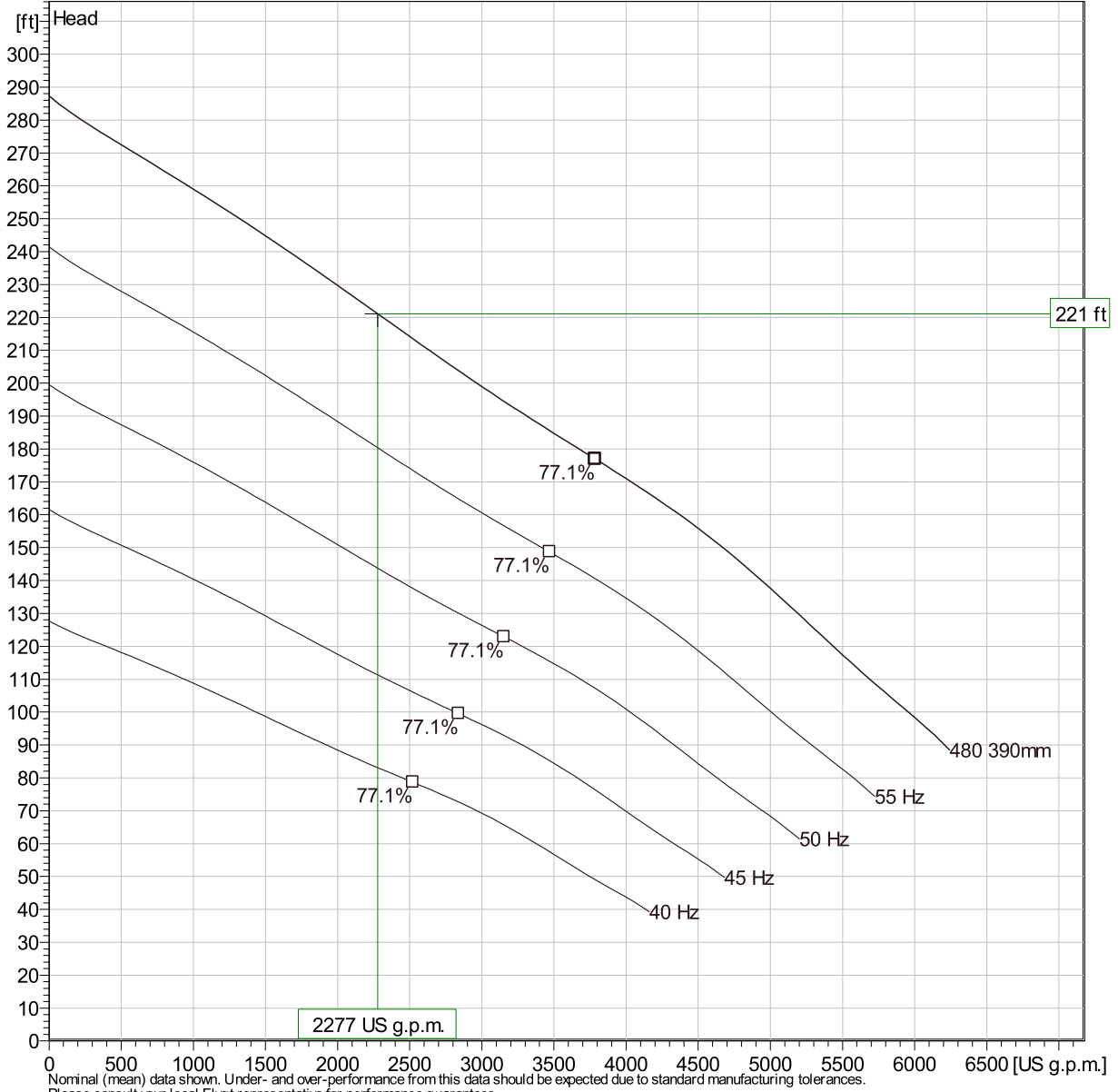
Curve: ISO 9906

NP 3231/746 3~ 480

Duty Analysis



Curves according to: Water, pure [100%]; 39.2°F; 62.42lb/ft³; 1.6891E-5ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees.

Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr. eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	2280	221	184	2280	221	184	69.3 %	1070	16.6

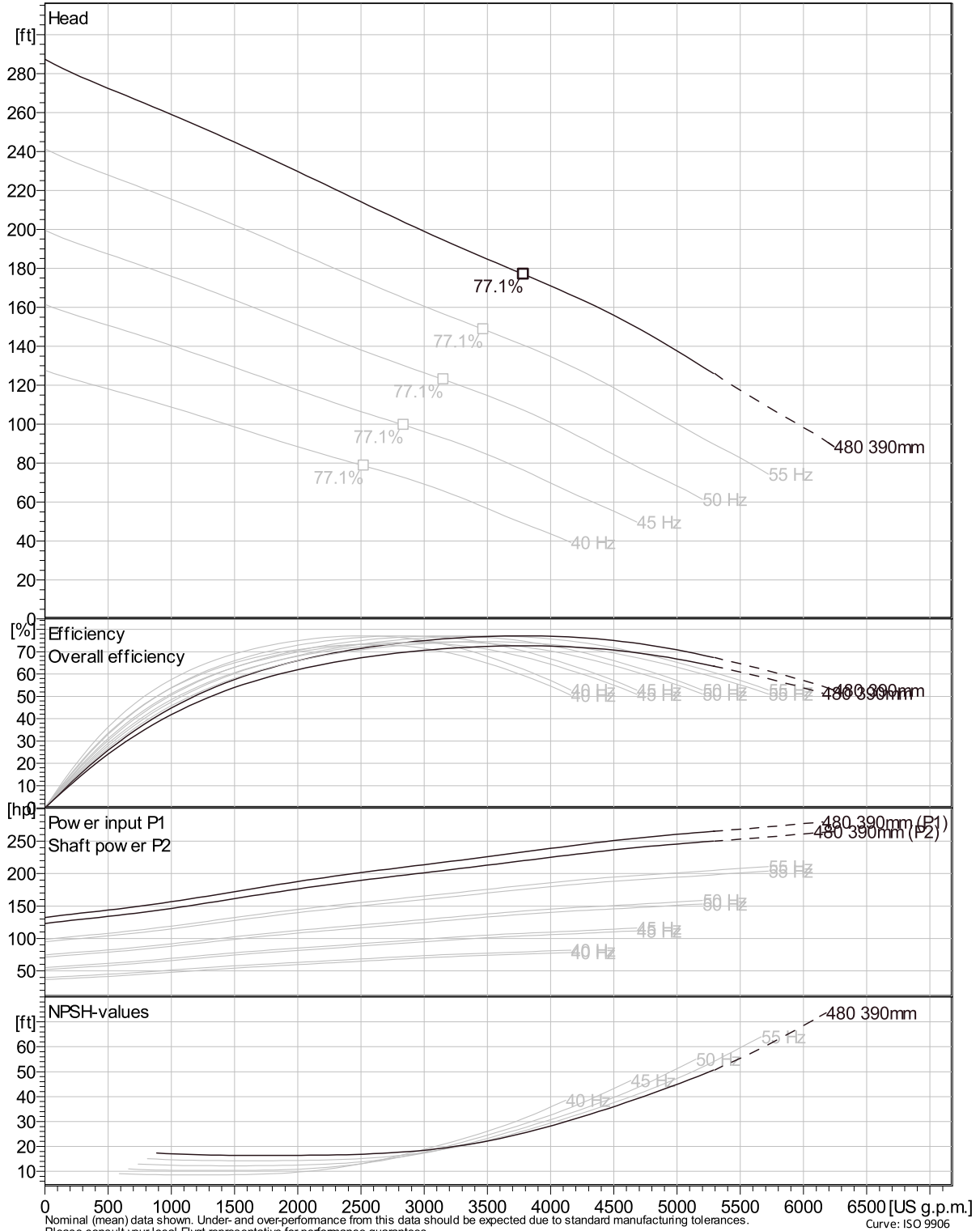
Project		Created by	Paul Traeger
Block	6555 Mequon LS E - East	Created on	9/15/2023
		Last update	9/15/2023

NP 3231/746 3~ 480

VFD Curve



Curves according to: Water, pure, 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s

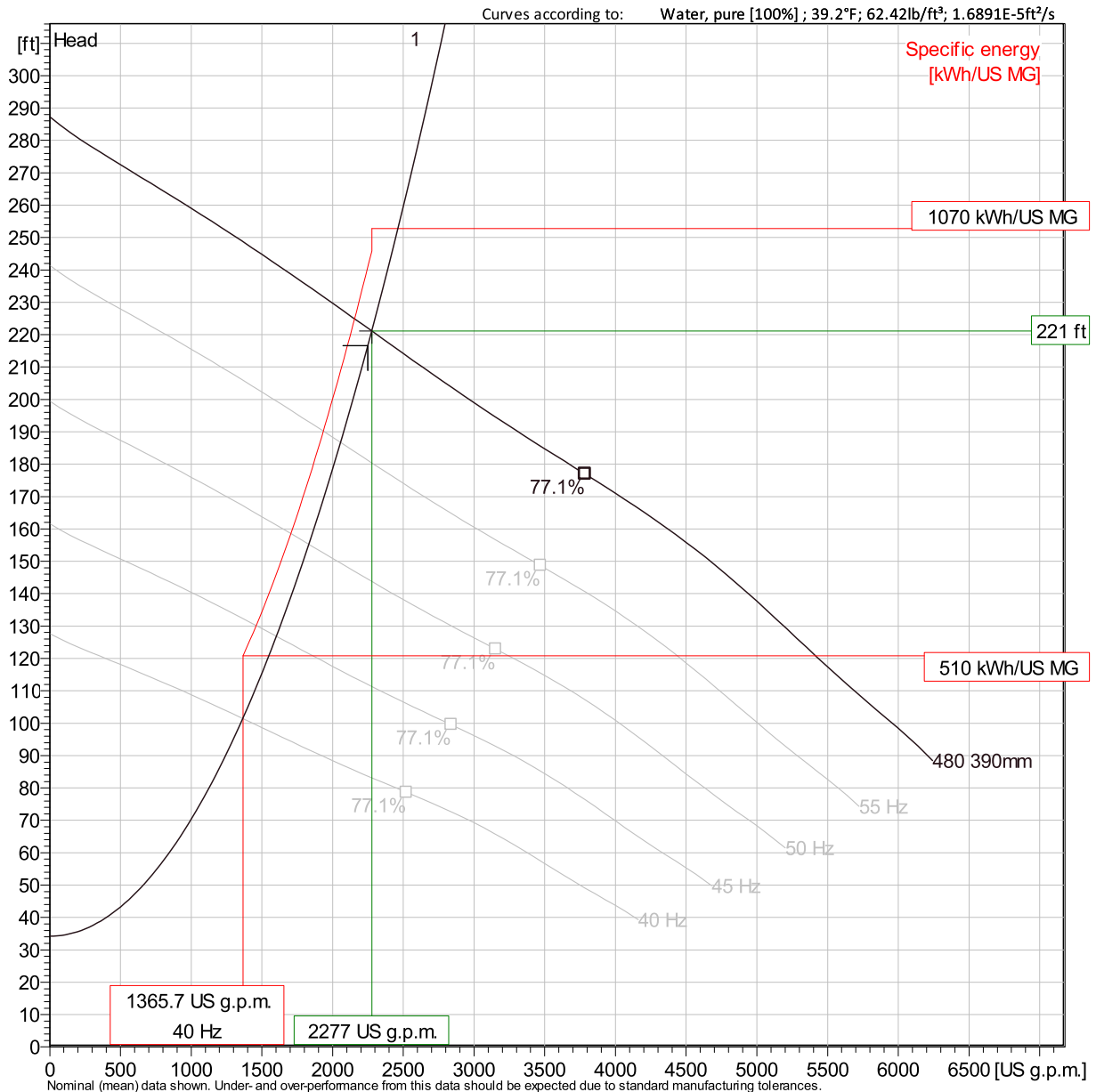


Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees. Curve: ISO 9906

Project	6555 Mequon LS E - East	Created by	Paul Traeger
Block	0	Created on	9/15/2023
		Last update	9/15/2023

NP 3231/746 3~ 480

VFD Analysis



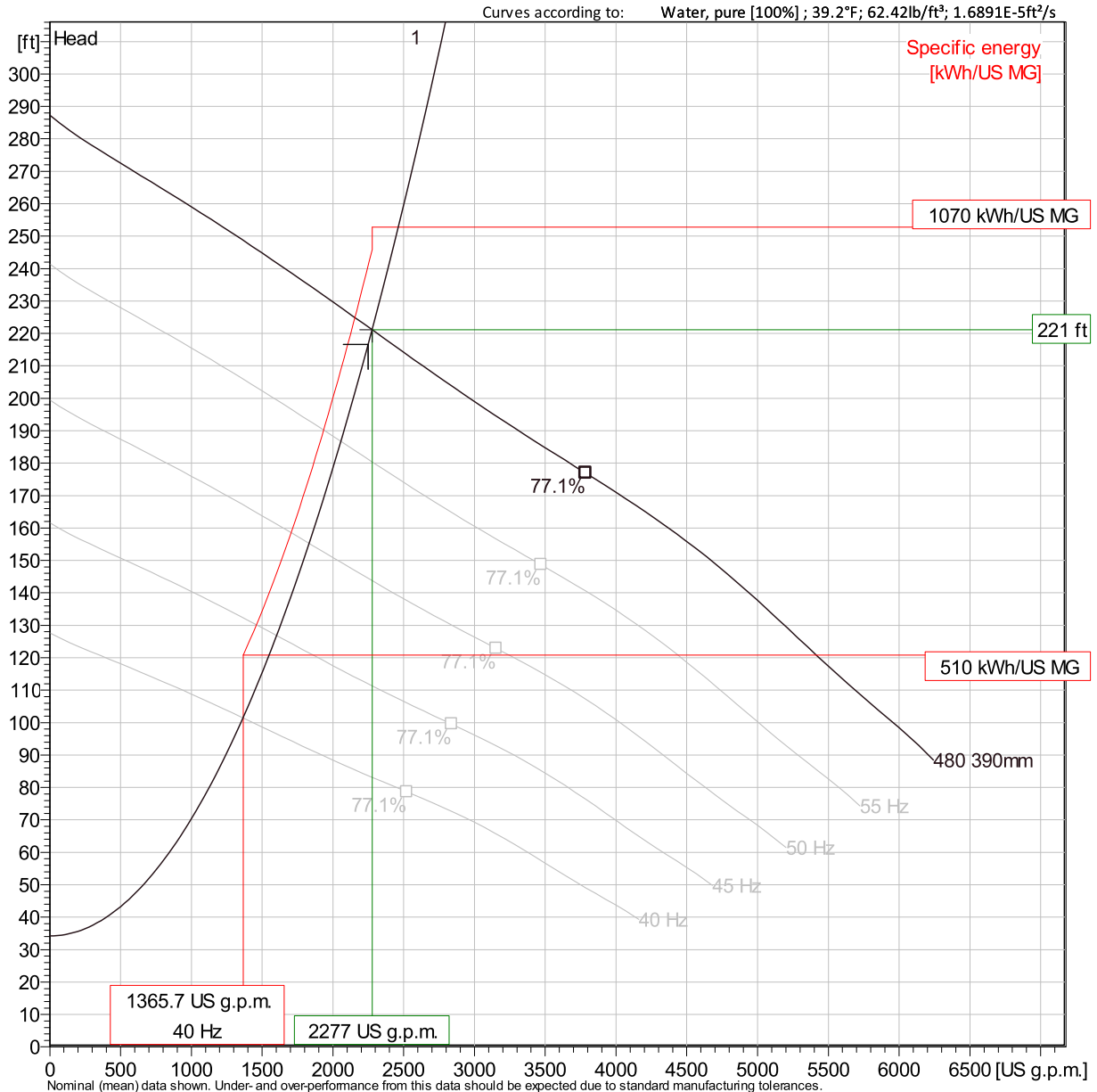
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr. eff.	Specific energy	NPSH _{re}
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	
1	60 Hz	2280	221	184	2280	221	184	69.3 %	1070	16.6
1	55 Hz	2060	187	141	2060	187	141	69 %	882	14.4
1	50 Hz	1830	155	105	1830	155	105	68.5 %	741	12.3
1	45 Hz	1600	127	76	1600	127	76	67.7 %	616	10.4

Project	6555 Mequon LS E - East	Created by	Paul Traeger
Block	0	Created on	9/15/2023
		Last update	9/15/2023

NP 3231/746 3~ 480

VFD Analysis



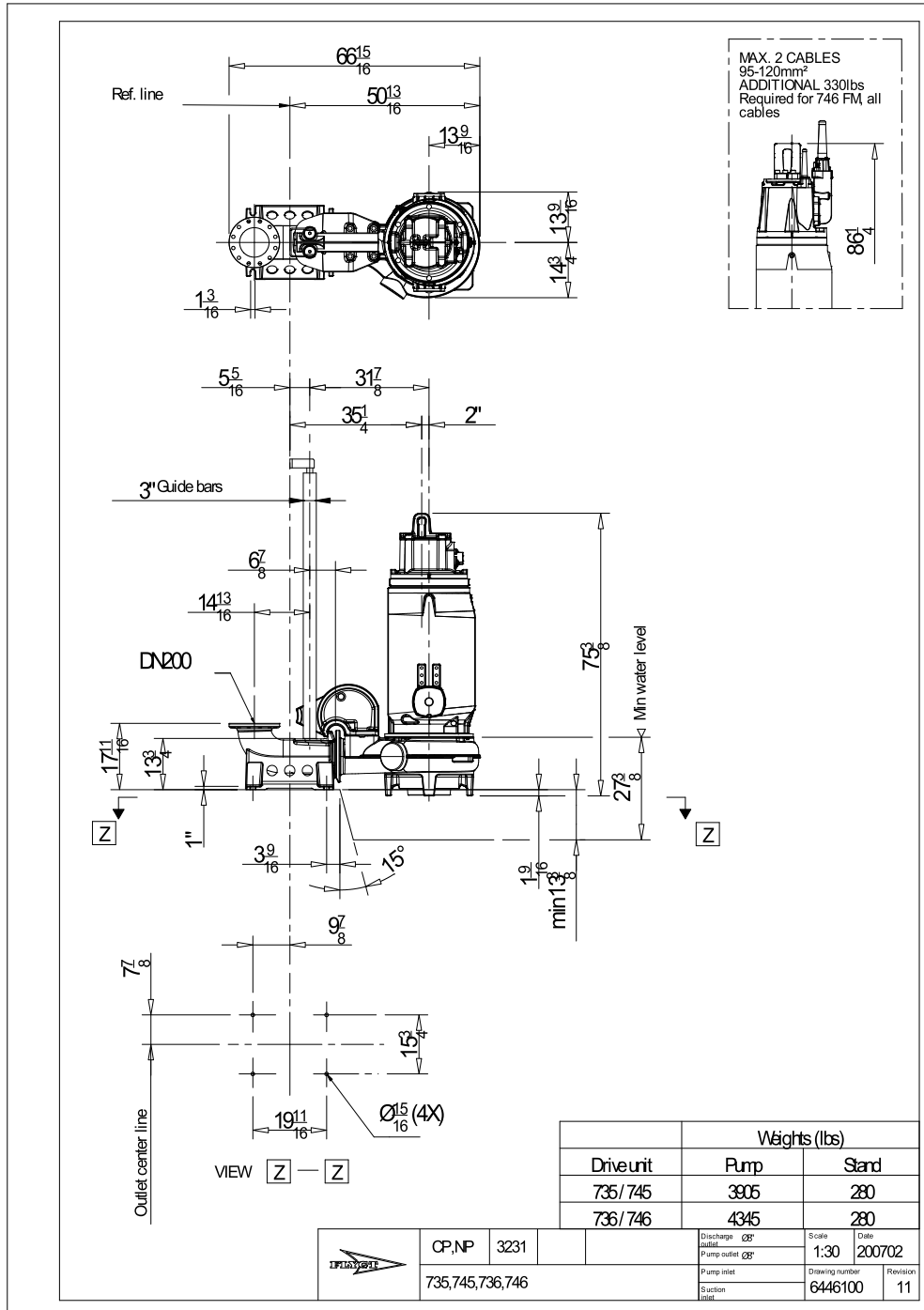
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr. eff.	Specific energy	NPSH _{re}
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	
1	40 Hz	1370	101	52.7	1370	101	52.7	66.6 %	510	8.59

Project	6555 Mequon LS E - East	Created by	Paul Traeger
Block	0	Created on	9/15/2023
		Last update	9/15/2023

NP 3231/746 3~ 480

Dimensional drawing



Project 6555 Mequon LS E - East
Block 0

Created by Paul Traeger
Created on 9/15/2023 Last update

9/15/2023

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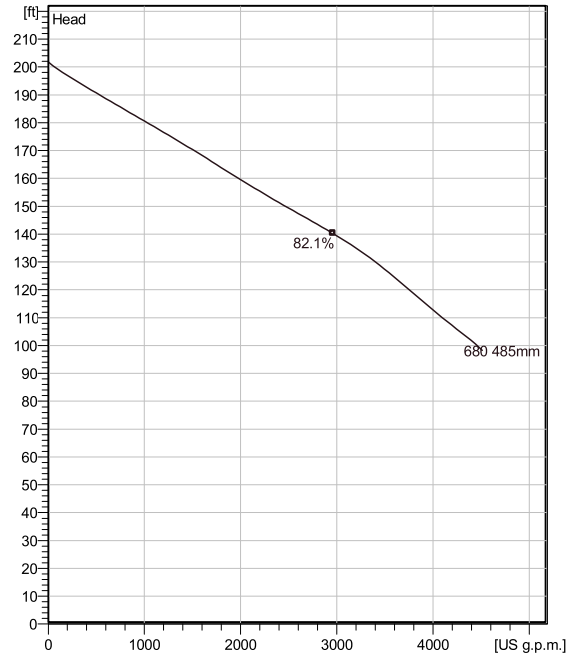
Patented self cleaning semi-open channel impeller, ideal for pumping in most waste water applications. Modular based design with high adaptation grade.



Technical specification



Curves according to: Water, pure Water, pure [100%], 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number N0716.000 43-30-61D-W IE3 150hp	Installation type P - Semi permanent, Wet
Impeller diameter 485 mm	Discharge diameter 8 inch

Configuration

Pump information

Impeller diameter 485 mm
Discharge diameter 8 inch
Inlet diameter 250 mm
Maximum operating speed 1185 rpm
Number of blades 3
Max. fluid temperature 40 °C

Material

Impeller Grey cast iron

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Technical specification



Motor - General

Motor number N0716.000 43-30-61D-W IE3 150hp	Phases 3~	Rated speed 1185 rpm	Rated power 150 hp
Approval FM	Number of poles 6	Rated current 188 A	Stator variant 1
Frequency 60 Hz	Rated voltage 460 V	Insulation class H	Type of Duty S1
Version code 000	Closed loop cooling system		

Motor - Technical

Power factor - 1/1 Load 0.78	Motor efficiency - 1/1 Load 96.0 %	Total moment of inertia 65.7 lb ft ²	Starts per hour max. 10
Power factor - 3/4 Load 0.71	Motor efficiency - 3/4 Load 96.5 %	Starting current, direct starting 1110 A	
Power factor - 1/2 Load 0.59	Motor efficiency - 1/2 Load 96.5 %	Starting current, star-delta 368 A	

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Performance curve

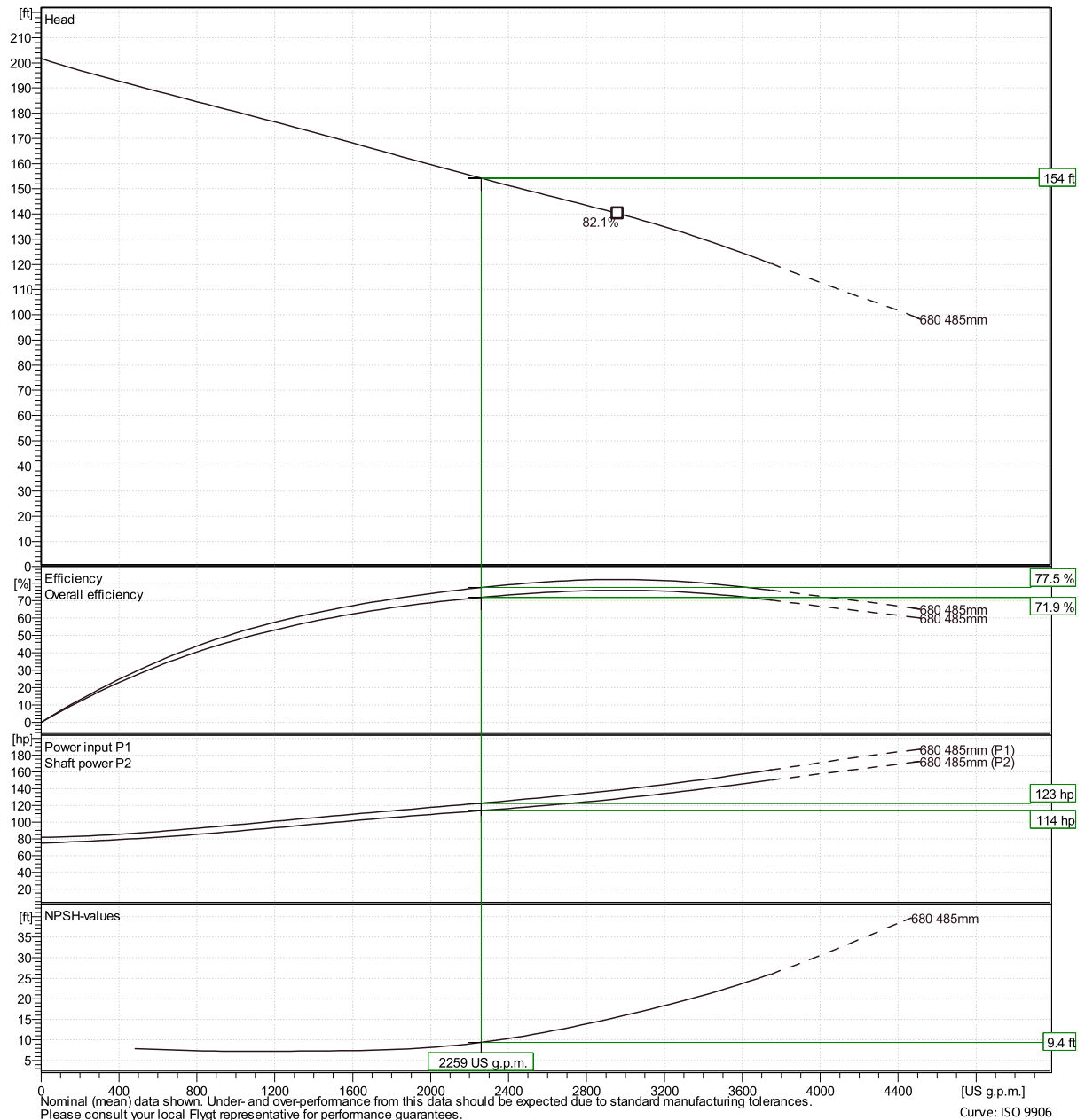


Duty point

Flow
2260 US g.p.m.

Head
154 ft

Curves according to: Water, pure Water, pure [100%], 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s



6555 Mequon LS E - West
0

Paul Traeger
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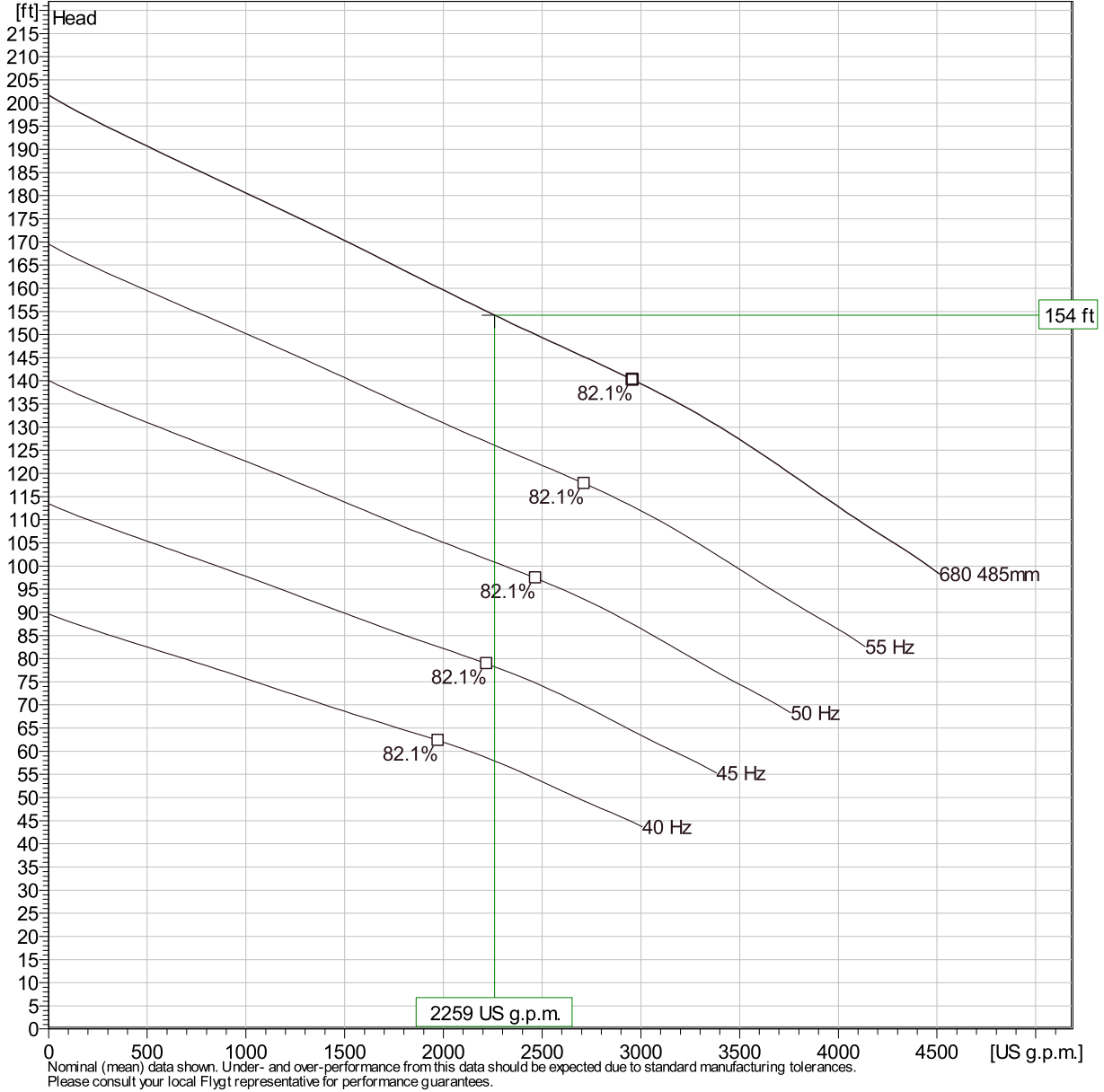
Curve: ISO 9906

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Duty Analysis



Curves according to: Water, pure [100%]; 39.2°F; 62.42lb/ft³; 1.6891E-5ft²/s



Operating characteristics

Pumps / Systems	Flow US g.p.m.	Head ft	Shaft power hp	Flow US g.p.m.	Head ft	Shaft power hp	Hydr.eff.	Spec. Energy kWh/US MG	NPSHre ft
1	2260	154	114	2260	154	114	77.5 %	675	9.4

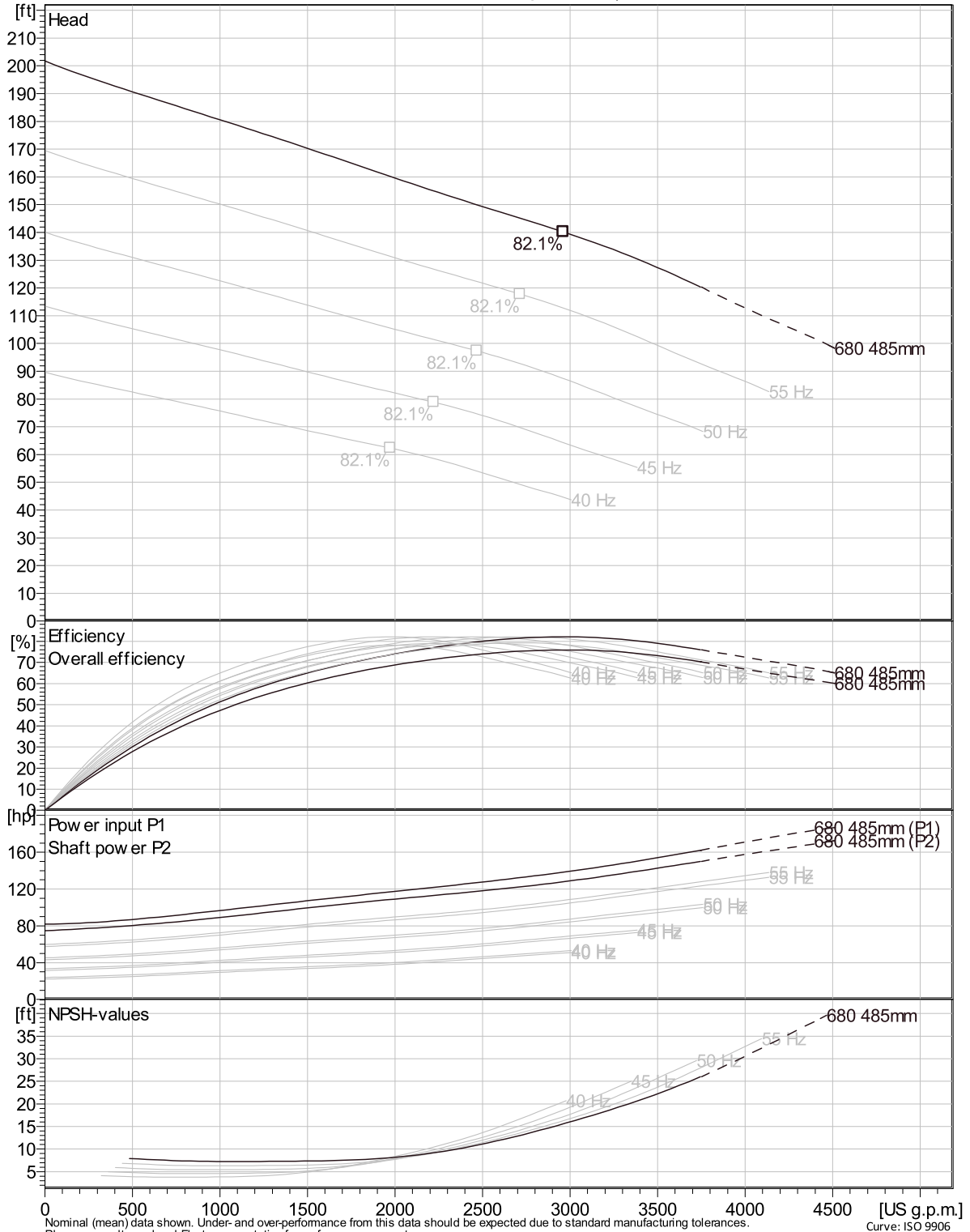
Project		Created by	Paul Traeger
Block	6555 Mequon LS E - West	Created on	9/15/2023
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VFD Curve



Curves according to: Water, pure, 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees.

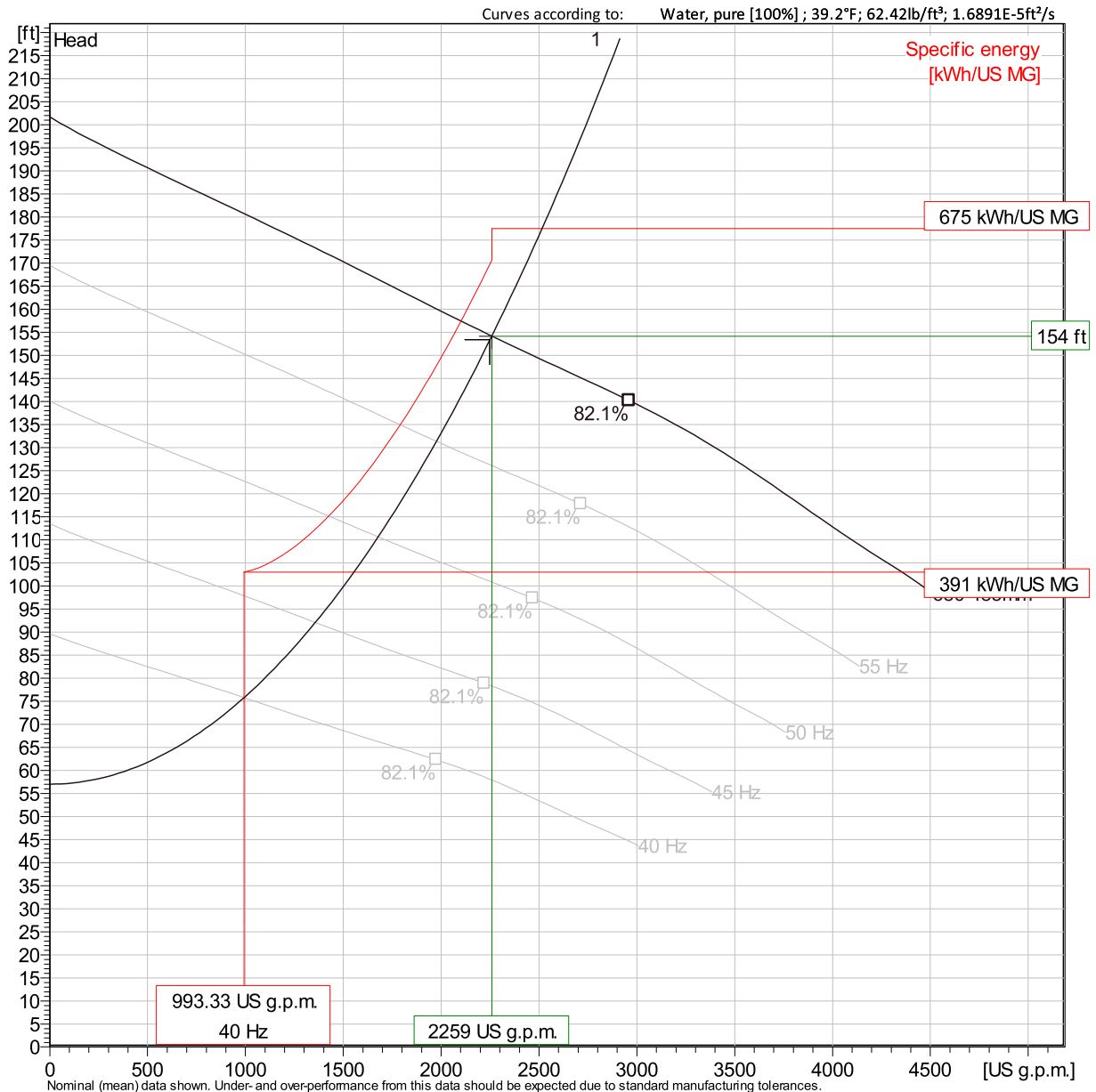
Curve: ISO 9906

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VFD Analysis



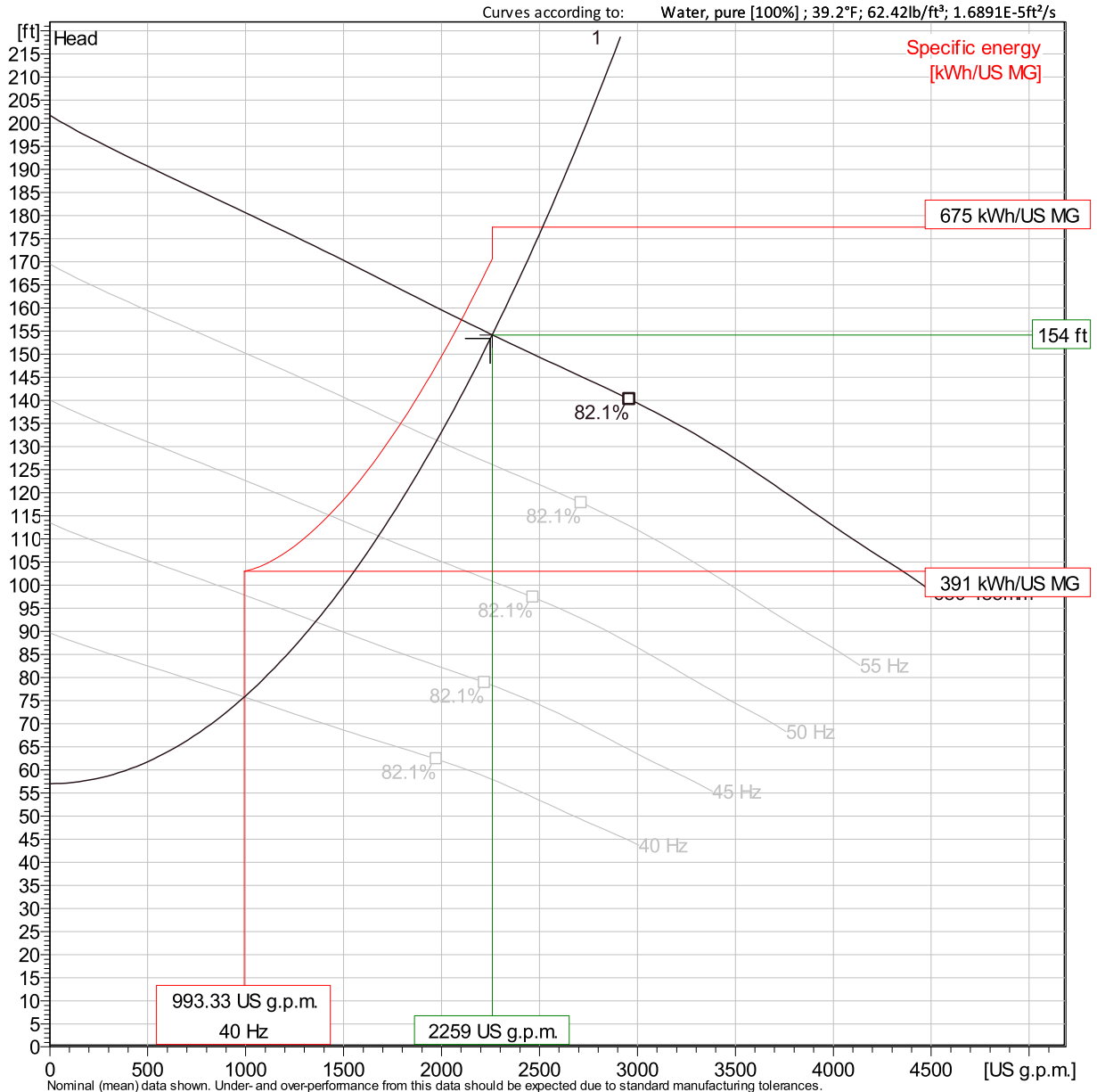
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr. eff.	Specific energy	NPSH _{re}
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	
1	60 Hz	2260	154	114	2260	154	114	77.5 %	675	9.4
1	55 Hz	1980	131	86.2	1980	131	86.2	76.2 %	561	7.68
1	50 Hz	1680	111	63.3	1680	111	63.3	74.2 %	486	6.15
1	45 Hz	1360	92.1	44.5	1360	92.1	44.5	71 %	427	4.85

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VFD Analysis



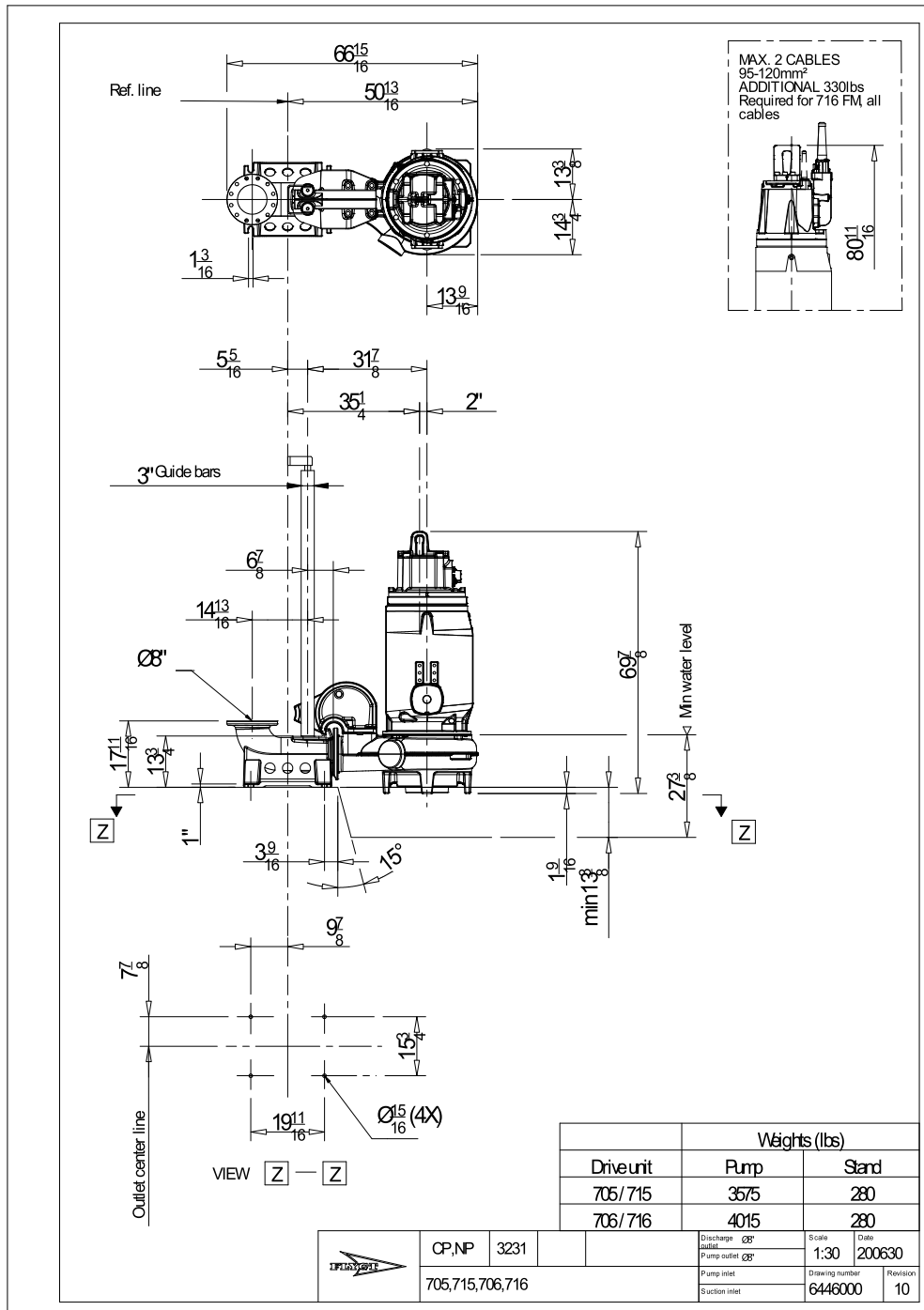
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr. eff.	Specific energy	NPSH _{re}
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	
1	40 Hz	993	75.8	29.4	993	75.8	29.4	64.8 %	391	3.84

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Dimensional drawing



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9/15/2023

APPENDIX G

Construction Cost Estimate

FACILITY:
 NUMBER: 30 MEQUON LS E
 TYPE: Prelim Design

PROJECT NAME: MEQUON LIFT STATION 3
 PROJECT NO.: 6555
 FILE: C:\Users\wahein\AppData\Local\Microsoft\Windows\NetCache\Content.Outlook\H6LDW3WE\Mequon D

SPEC SECTION	DESCRIPTION	DIMENSION	QUANTITY	UNIT	MATERIALS		LABOR		TOTAL
					Unit Cost	Amount	Unit Cost	Amount	
DIVISION 2	SITework AND DEMOLITION MEQUON LIFT STATION E Grubbing Clearing Silt Fence Dewatering for new station Excavation for new station Site Grading Export excavated material Granular Backfill for new station Access limiting multi-use trail SUBTOTAL								
			1	lot	\$3,000	\$3,000			
			1	lot	\$10,000	\$10,000			
			300	lf	\$3	\$900			
			1	lot	\$250,000	\$250,000			
			1	lot	\$750,000	\$750,000			
			750	sy	\$60	\$45,000			
			1,500	cy	\$32	\$48,000			
			500	cy	\$32	\$16,000			
			300	lf	\$100	\$30,000			
						\$1,152,900		\$0	\$1,153,000
DIVISION 3	CONCRETE Cast in Place Concrete Elevated slab on grade WW walls WW floor SUBTOTAL								
			168	cy	\$1,000	\$168,000			
			177	cy	\$500	\$88,500			
			42	cy	\$300	\$12,600			
						\$269,100		\$0	\$269,000
DIVISION 4	MASONRY Standard Building Cost SUBTOTAL	52'-8" x 30'-0"	1580	sf	\$400	\$631,920		\$0	
						\$631,920		\$0	\$632,000
DIVISION 5	METALS SUBTOTAL					\$0		\$0	\$0
DIVISION 6	WOOD AND PLASTIC SUBTOTAL					\$0		\$0	\$0
DIVISION 7	THERMAL AND MOISTURE CONTROL SUBTOTAL					\$0		\$0	\$0
DIVISION 8	DOORS AND WINDOWS Floor Hatches SUBTOTAL			8	ea	\$2,000	\$16,000	\$800	\$6,400
						\$16,000		\$6,400	\$22,000
DIVISION 9	FINISHES SUBTOTAL					\$0		\$0	\$0
DIVISION 10	SPECIALTIES SUBTOTAL					\$0		\$0	\$0
DIVISION 11	EQUIPMENT Flygt NP 3231 (250 Hp and 185 Hp Submersible) Odor Control Unit 16" Magnetic Flow Meter (forcemain) Automatic Transfer Switch 750 kW Natural Gas Generator SUBTOTAL								
			1	lot	\$1,100,000	\$1,100,000	\$440,000	\$440,000	
			1	lot	\$75,000	\$75,000	\$30,000	\$30,000	
			2	ea	\$16,000	\$32,000	\$12,800	\$25,600	
			2	ea	\$69,000	\$138,000	\$55,200	\$110,400	
			1	lot	\$400,000	\$400,000	\$160,000	\$160,000	
						\$1,745,000	\$766,000	\$766,000	\$2,511,000
DIVISION 12	FURNISHINGS SUBTOTAL					\$0		\$0	\$0
DIVISION 13	SPECIAL CONSTRUCTION I&C SUBTOTAL	Eqpt Costs	10%			\$251,100		\$0	\$251,000
						\$251,100		\$0	\$251,000
DIVISION 14	CONVEYING SYSTEMS Trolley and Hoist SUBTOTAL			1	ea	\$60,000	\$60,000	\$24,000	\$24,000
						\$60,000		\$24,000	\$84,000
DIVISION 15	MECHANICAL Mechanical LIFT STATION 16" Force Main 10" Force Main HVAC SUBTOTAL	Eqpt Costs	20%				\$502,200		
			50	lf	\$350	\$17,500			
			200	lf	\$250	\$50,000			
			1	lot	\$183,000	\$183,000			
						\$752,700		\$0	\$753,000
DIVISION 16	ELECTRICAL Electrical Submersible pump VFDs Submersible pump VFDs SUBTOTAL	Eqpt Costs	12%				\$301,320		
		2 x 185 hp	2	ea	\$40,000	\$80,000	\$16,000	\$32,000	
		3 x 250 hp	3	ea	\$50,000	\$150,000	\$20,000	\$40,000	
						\$531,320		\$72,000	\$603,000
TOTAL									\$6,278,000

CONTINGENCIES 30% \$1,883,400
 GENERAL CONDITIONS, BONDS AND INSURANCE 8% \$652,900
 GRAND TOTAL FOR FACILITY **\$8,814,000**