Report

Facilities Plan for the Central Lift Station and Attenuation Basin

Caledonia Utility District
Racine, County, Wisconsin

December 2021

Project I.D.: 19C030.06

Solving our clients' toughest science and engineering challenges.

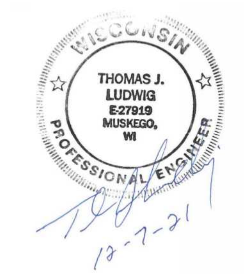
Facilities Plan for the Central Lift Station and Attenuation Basin

Project ID: 19C030.06

Prepared for
Caledonia Utility District
333 4 ½ Mile Road
Racine, WI 53402

Prepared by
Foth Infrastructure & Environment, LLC

December 2021



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Facilities Plan for the
Central Lift Station and Attenuation Basin
Caledonia Utility District

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Project Summary
Foth Infrastructure & Environment, LLC (Foth) was retained by the Caledonia Utility District (CUD) to prepare a facilities plan for the Central Lift Station and Attenuation Basin. The Central Lift Station was installed in 1987 and serves the eastern portion of the CUD, generally bounded by 3 Mile Road to the south, 7 Mile Road to the north, Lake Michigan to the east, and the Union Pacific Railroad and STH 31 to the west. The lift station pumps wastewater through a 30-inch force main to the Racine Water and Wastewater Utility (RWWU) collection system for further conveyance and treatment. Future growth within the Central Lift Station Sewer Service Area (SSA) will increase wastewater flows to the lift station, however, flow allocations to the RWWU remain unchanged. Additionally, elements of the lift station have reached the end of their service life. A facilities plan must be approved by the Wisconsin Department of Natural Resources (WDNR) prior to completing design.

Purpose
The purpose of the facilities plan is to identify components of the existing lift station that are in need of rehabilitation and to recommend designs for flow attenuation and safety site conveyance. Flow attenuation involves on-site storage of wastewater flows in excess of the allowable flow to the RWWU collection system, and is commensurate with the findings of the current RWWU Facilities Plan. Safety site conveyance involves routing flow above the allowable flow to the RWWU to a surface water outfall once the storage system is full or filling at capacity. This document facilitates a review by the WDNR with respect to applicable sections of the Wisconsin Administrative Code.

Scope
The following tasks were completed as a part of this facilities plan and are necessary to evaluate potential alternatives and develop a summary of the recommended improvements:

- Review historical flow data.
- Review current land use and development within the sewer service area.
- Summarize current flows for average and peak hour conditions.
- Provide a general description of the sewer service area.
- Perform endangered species and historical/archeological reviews of the site.
- Summarize design criteria for the existing lift station.
- Estimate future growth within the sewer service area.
- Develop future flow projections for average and peak hour conditions.
- Use a computer model of the sewer system to determine design storm hydrographs.

- Analyze the capacity of existing infrastructure with respect to future flows.
- Evaluate lift station, attenuation basin, and safety site system alternatives.
- Perform a total present worth analysis for the proposed alternatives.
- Provide recommendations for rehabilitation of the existing lift station.
- Develop a capital cost estimate for recommended improvements.
- Prepare an implementation schedule for the project.
- Determine the parallel cost percentage for the Clean Water Fund loan.

Conclusions

Based on the findings of this report, the following is a summary of conclusions for the Central Lift Station and Attenuation Basin:

- No endangered resources were found within the site boundaries that required follow-up actions.
- The existing lift station site was not found to be an area of historical or archeological significance.
- Wastewater flows are anticipated from primarily residential development in the sewer service area, with some minor contributions from commercial and governmental and institutional development.
- The projected design average annual flow rate is 4.5 MGD.
- The projected design peak hour flow rate is 27.3 MGD.
- The modeled 2040 5-Year 6-Hour Storm peak instantaneous flow rate is 27.9 MGD.
- The modeled 2040 5-Year 12-Hour Storm produces the greatest required storage volume, which is 3.6 MG.
- The modeled 2040 100-Year 24-Hour Storm peak instantaneous flow rate is 35.0 MGD.
- The existing north 36-inch sewer is of adequate size for continued use with 2040 flows, however the existing south 21-inch sewer will surcharge under the same conditions.
- The existing lift station wet well is of adequate size for continued use with 2040 flows.
- The existing wastewater pumps are suitable for continued use during 2040 flows.
- The existing force main is of adequate size for continued use during 2040 flows.
- The existing storm sewer does not have sufficient available capacity for use as a safety site conveyance pipe.
- The most cost effective attenuation basin design is a covered concrete basin with consecutive channels and an above grade, pumped in, gravity out layout.
- The most cost effective combined alternative is Alternative B, which consists of a new attenuation basin and reconfiguration of the existing lift station to address all pumping operations. However, Alternative A2, which consists of a new attenuation basin and attenuation pumping station with no modifications to the existing lift station pumps, is within 10-percent of Alternative B on a 20-year total present worth basis and can therefore be considered of equal cost.

- The most cost effective safety site alternative is the Pressure Conveyance Alternative.
- The total capital cost of the recommended improvements is estimated to be $22,460,000.
- The RWWU WWTP will receive flows from the Central Lift Station. It is capable of treating the type of wastewater that is expected. Flow allocations to the WWTP will not change through the year 2040.
- The project may be funded through the Clean Water Fund loan program, with payments made using user charge system revenue.
- The parallel cost percentage for the recommended improvements is 100%.

Recommendations

In accordance with the previously identified conclusions, the following is a summary of recommendations for the Central Lift Station and Attenuation Basin:

- The 21-inch interceptor discharging into the lift station from the south catchment should be evaluated for I/I and upsized for future flows.
- The recommended global alternative is the Existing Lift Station Rehabilitation and On-Site Storage Alternative.
- The recommended on-site storage alternative is the Covered Concrete Attenuation Basin Alternative.
- The recommended attenuation basin channel configuration alternative is the Consecutive Channel Alternative.
- The recommended attenuation basin layout alternative is the Above Grade, Pumped In, Gravity Out Layout Alternative.
- The recommended combined alternative is Alternative A2, which consists of a new attenuation basin and attenuation pumping station with no modifications to the existing lift station pumps.
- The recommended safety site conveyance alternative is the Pressure Conveyance Alternative.
- The existing lift station pumps and piping should be retained for continued use.
- The existing lift station structure should be retained for continued use.
- The new attenuation basin and pumping station should be constructed on the existing lift station site.
- Do not phase construction of the attenuation basin or attenuation pumping station.
- Phase construction of the safety site force main according to future trends in peak flow.
- Perform a condition assessment and capacity analysis for the existing large pumps.
- The existing lift station should be rehabilitated to facilitate continued use, including replacement of the electrical and controls systems and standby generator.
- Provide miscellaneous repairs to the existing lift station building and support systems as needed based on the condition of items to be retained.

- Submit the facilities plan to the WDNR for review and approval in December 2021.
- Hold a public hearing for the project in February 2022.
- Start design of the Central Lift Station and Attenuation Basin improvements in March 2022.
- Start construction of the Central Lift Station and Attenuation Basin improvements in March 2023.
- Complete construction of the Central Lift Station and Attenuation Basin improvements by September 2024.

Facilities Plan for the
Central Lift Station and Attenuation Basin
List of Abbreviations, Acronyms, and Symbols

ac	acre
ATL	across-the-line
cfs	cubic feet per second
CUD	Caledonia Utility District
CWF	Clean Water Fund
District	Caledonia Utility District
DU	dwelling unit
FEMA	Federal Emergency Management Agency
Foth	Foth Infrastructure & Environment, LLC
FRPMP	fiberglass-reinforced polymer mortar pipe
ft	feet
ft/s	feet per second
gal	gallons
GIS	geographic information system
gpcd	gallons per capita per day
HP	horsepower
I/I	infiltration and inflow
in	inch
kW	kilowatt
kWh	kilowatt-hour
MG	million gallons
MGD	million gallons per day
MH	manhole
mi	miles
NOAA	National Oceanic and Atmospheric Association
NR110	Wisconsin Administrative Code Chapter NR110
O&M	operation and maintenance
PVC	polyvinyl chloride
RCP	reinforced concrete pipe
RDII	rainfall-derived infiltration and inflow
rpm	revolutions per minute
RWWU	Racine Water and Wastewater Utility
scfm	standard cubic feet per minute
SEWRPC	Southeastern Wisconsin Regional Planning Commission
SSA	sewer service area
SSRV	solid state non-reversing starter (soft starter)
TID	tax incremental financing district
TDH	total developed head
Village	Village of Caledonia
WDNR	Wisconsin Department of Natural Resources
WWTP	wastewater treatment plant

Facilities Plan for the

Central Lift Station and Attenuation Basin

Acknowledgements

Caledonia Sewer & Water Utility District Commission & Staff

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1 Introduction

1.1 Purpose

The purpose of this facilities plan is to review existing conditions, evaluate long-term needs, and develop a plan to provide economical and reliable wastewater collection, storage, and conveyance to the customers of the Caledonia Utility District (CUD) Central Lift Station Sewer Service Area (SSA). A 20-year design period was used in this facilities plan, with the design period extending through the year 2040.

1.2 Project Description

The Central Lift Station is located in the Village of Caledonia on 4 ½ Mile Road near the border with the Village of Wind Point. The lift station pumps wastewater from the Central Lift Station Sewer Service Area (SSA) through a 30-inch force main to the Racine Water and Wastewater Utility (RWWU) collection system for treatment at the RWWU Wastewater Treatment Plant (WWTP).

This facilities plan effort was undertaken to identify components of the existing lift station that are in need of rehabilitation and to recommend designs for flow attenuation and safety site conveyance. Flow attenuation involves on-site storage of wastewater flows in excess of the allocated flow to the RWWU collection system. Safety site conveyance involves routing flow above the allocated flow to the RWWU to a surface water outfall once the storage system is full or filling at the design peak flow rate. To accomplish the latter goals, flow rates will be projected for the year 2040 and the sewer system will be modeled to generate storm hydrographs for use in determining storage requirements and peak flows.

1.3 Scope of Work

The scope of work for this facilities plan includes the following major tasks:

- Review historical flow data.
- Review current land use and development within the sewer service area.
- Summarize current flows for average and peak hour conditions.
- Provide a general description of the sewer service area.
- Perform endangered species and historical/archeological reviews of the site.
- Summarize design criteria for the existing lift station.
- Estimate future growth within the sewer service area.
- Develop future flow projections for average and peak hour conditions.
- Use a computer model of the sewer system to determine design storm hydrographs.
- Analyze the capacity of existing infrastructure with respect to future flows.
- Evaluate lift station, attenuation basin, and safety site system alternatives.
- Perform a total present worth analysis for the proposed alternatives.
- Provide recommendations for rehabilitation of the existing lift station.
- Develop a capital cost estimate for recommended improvements.

- Prepare an implementation schedule for the project.
- Determine the parallel cost percentage for the Clean Water Fund loan.

1.4 Regulatory Requirements

This report has been prepared and is being submitted pursuant to the general requirements of Chapter NR110 of the Wisconsin Administrative Code. Sections 110.10 and 110.11 provide requirements for facilities plans for municipally-owned sewage collection and pumping systems. Section 110.09 provides requirements for municipally-owned wastewater treatment plants and applies to attenuation facilities.

2 Existing Conditions

2.1 Project Background

The Central Lift Station is located in the Village of Caledonia on 4 ½ Mile Road near the border with the Village of Wind Point. The lift station pumps wastewater from the Central Lift Station Sewer Service Area (SSA) through a 30-inch force main to the Racine Water and Wastewater Utility (RWWU) collection system for treatment at the RWWU Wastewater Treatment Plant (WWTP). The lift station, interceptor system, and force main were constructed in 1987 following the decommissioning of the North Park WWTP. The Central Lift Station was constructed at the site of the old WWTP.

The proposed project consists of three components: rehabilitation of the existing lift station, construction of an attenuation facility for temporary storage of peak wastewater flows, and installation of safety site infrastructure to divert wastewater that the system cannot contain to a surface water outfall. As a part of a 2002 intergovernmental agreement between the RWWU and surrounding communities, including the Village of Caledonia, the Central Lift Station was assigned flow allocations for pumping to the RWWU collection system. The flow allocations address average day, peak month, peak day, and peak hour flows and have triggers at 80-percent, 90-percent, 95-pecent, and over 100-percent of allocated capacity for each duration. Over the last several years, the Central Lift Station has exceeded some of these allocation thresholds, including on one occasion the 100-percent peak hour allocation. These exceedances have triggered the need for facilities planning for the Central Lift Station.

In addition to the recent flow allocation exceedances, the development of a new facilities plan for the RWWU WWTP has provided impetus for this facilities planning effort. The facilities plan analyzed the RWWU collection system and that of the surrounding communities tributary to it. This analysis led to the recommendation that a 3.5 MG storage facility be constructed at the Central Lift Station site. The storage facility capacity was based upon addressing future flows up to the design year of 2040. Additionally, it was based upon direction from the WDNR to provide a 5-year level of service for wastewater bypass events within the region. In other words, all flows generated by storm events up to and including a 5-year recurrence interval must be contained within the system and cannot be bypassed to surface waters through a safety site.

The current RWWU WWTP facilities plan did not address updating the 2002 intergovernmental agreement flow allocations for the member communities due to growth within the region. Therefore, the original flow allocations will apply to the facilities planning period of 2020 – 2040 addressed herein. The Central Lift Station peak hour allocation of 13.07 MGD will remain unchanged, and flows above this up to the 2040 5-year storm event must be stored in the collection system. For flows that exceed the 2040 5-year event, a safety site will be utilized to discharge wastewater to a surface water outfall in order to protect customers from basement backups. It is understood that if systems are in place to limit pumping to the RWWU to 100-percent of the peak flow allocation, to store additional flow up to the 2040 5-year storm, and to route any remaining flow through a safety site, the 80-percent, 90-percent, and 95-percent allocation triggers will be relaxed by the RWWU.

The purpose of this facilities plan is to identify components of the existing lift station that are in need of rehabilitation and to recommend designs for flow attenuation and safety site conveyance. To accomplish the latter goals, flow rates will be projected for the year 2040 and the sewer system will be modeled to generate storm hydrographs for use in determining storage requirements and peak flows.

2.2 Location

The Central Lift Station SSA is located in the Village of Caledonia along the shore of Lake Michigan north of the City of Racine. The SSA is generally bounded by 3 Mile Road to the south, 7 Mile Road to the north, and the Union Pacific Railroad and STH 31 to the west. The Village of Wind Point is included in the SSA. The lift station is located on 4 ½ Mile Road at the same site as the CUD central office.

Refer to Figure 2-1 for a location map of the area.

2.3 Sewer Service Area

Land use in the Central Lift Station SSA consists of primarily single family residential, with some multi-family residential lots as well as commercial, governmental, and industrial land use.

Refer to Figure 2-2 for a map showing current land use within the Central Lift Station SSA.

2.4 Wastewater Flows

2.4.1 Existing Flow Data

Measurement of pumped flow at the Central Lift Station is achieved with a magnetic flow meter on the discharge force main. The flow meter is calibrated annually and accurate records are kept as the lift station is a point of discharge to the RWWU. Annual average flow rates over the three years preceding this facilities planning effort are summarized below in Table 2-1.

Table 2-1
Historical Flow Rates 2018-2020
Central Lift Station

Year	Annual Average Flow Rate (MGD)
2018	2.244
2019	2.393
2020	2.172
Average	2.270

Over the record period of 2018 – 2020, a storm event on August 10, 2020 produced a peak hour flow rate of 15.106 MGD. This equates to a peak hour factor of approximately 6.7.

2.4.2 Existing Estimated Flows

Existing flows were estimated for the Central Lift Station SSA using the same techniques that will be used for projecting future flows. The population of the SSA was first calculated by totaling the number of existing sewered dwelling units (DUs) and multiplying by a factor of 2.5 people per DU, based on current US Census data for the Village of Caledonia, to obtain an estimated population. A per capita average flow rate of 167 gpcd was applied to the estimated population to determine the average annual residential flow. To estimate flows associated with commercial, government and institutional, and industrial land use, per-acre flow factors were assigned to each: 1,200 gpd/ac for commercial areas, 625 gpd/ac for government and institutional areas, and 2,000 gpd/ac for industrial areas. A peak hour factor of 6.0 was applied to the average annual design flow to obtain the peak hour design flow. The per capita average flow rate, land use-based flow rates, and peak hour factor were selected to match the values used in the 1998 Racine WWTP facilities plan, which are in alignment with historical flow data from the Village. The calculated annual average flow rate is 3.247 MGD (2,256 gpm) and the calculated peak hour flow rate is 19.482 MGD (13,529 gpm).

Refer to Table 2-2 for estimated existing flows.

Estimated existing flows for the Central Lift Station SSA are higher than existing flow data. However, the estimated flows will be used to develop future total flows as the method of calculation is consistent for both and the estimated flows are more conservative. In the future these flows may also prove to be more representative of an aging collection system.

Table 2-2
Estimated Existing Flows
Central Lift Station

Land Use	Actual Area (ac)	Dwelling Units	Population [1]	Average Annual Flow (MGD) [2]	Peak Hour Flow (MGD) [3]
Single-Family Residential [4]	-	5,553	13,883	2.318	13.910
Multi-Family Residential [4]	-	807	2,018	0.337	2.022
Senior Housing [4]	-	181	453	0.076	0.456
Parks and Recreation	-	91	228	0.038	0.228
Commercial [5]	221	-	-	0.265	1.590
Government and Institutional [6]	175	-	-	0.109	0.654
Industrial [7]	52	-	-	0.104	0.624
Total	-	6,632 [8]	16,582 [8]	3.247	19.482

Notes:

1. Population is calculated using 2.5 people/DU and rounded up to the nearest person, then totaled.
2. Average annual flow is based on a per capita flow rate of 167 gpcd, after RWWU's 1998 Wastewater Treatment Facility Plan.
3. A peaking factor of 6.0 was used to determine the peak hour flow rate, after RWWU's 1998 Wastewater Treatment Plant Facilities Plan.
4. Residential land use area was not calculated because dwelling units are existing and can be counted directly.
5. A flow rate of 1,200 gpd/ac was used for commercial land use.
6. A flow rate of 625 gpd/ac was used for government and institutional land use.
7. A flow rate of 2,000 gpd/ac was used for industrial land use.
8. Note that the SEWRPC 2010 dwelling unit total is 6,269 and the population total is 16,102. The values listed in Table 2-2 are estimates by the Village for 2021.

Figure 2-1
Location Map

Client: Caledonia Utility District

Project ID: 19C030.06

Project: Facilities Plan for Central Lift Station

Date: July 2021

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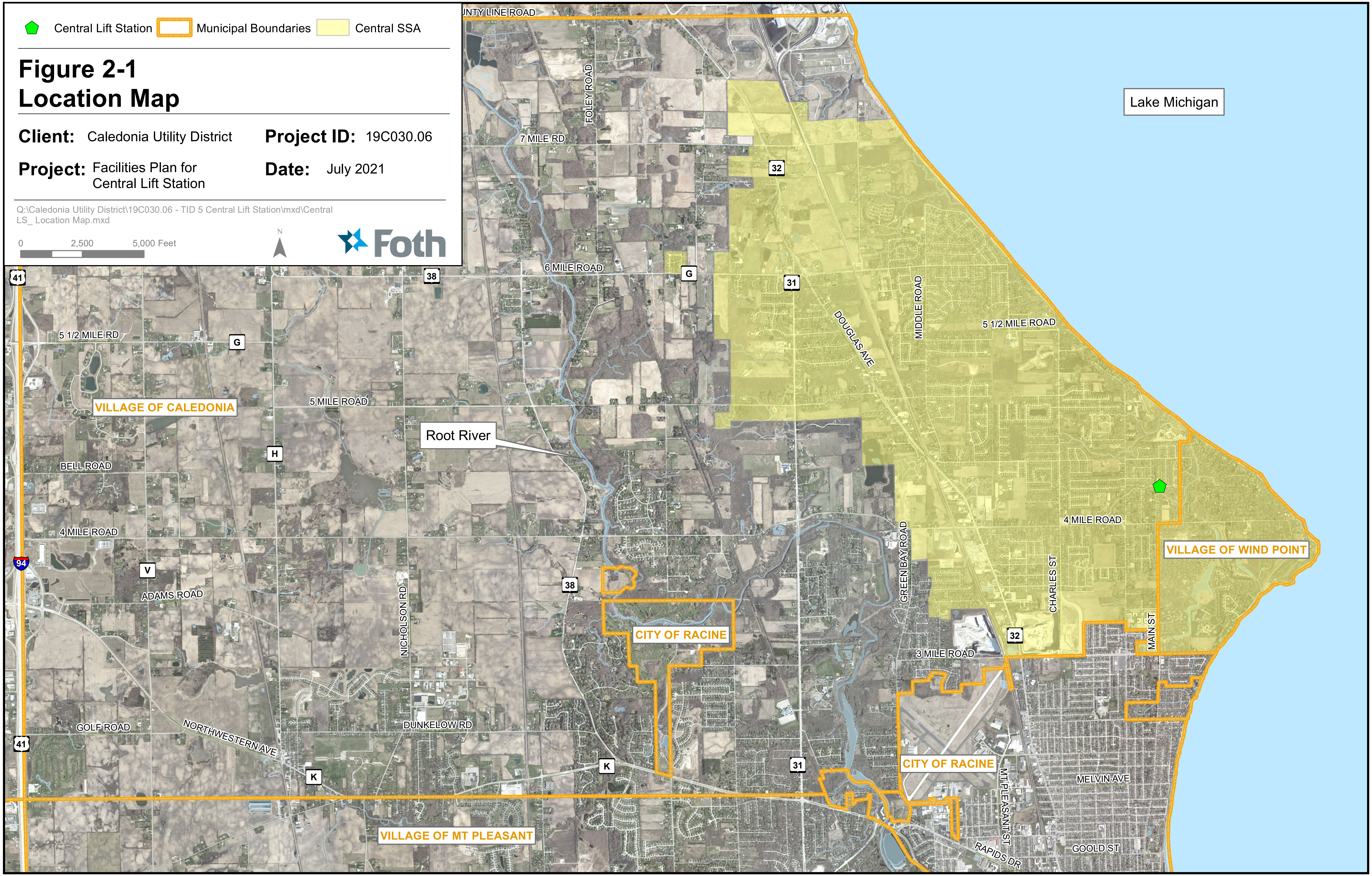

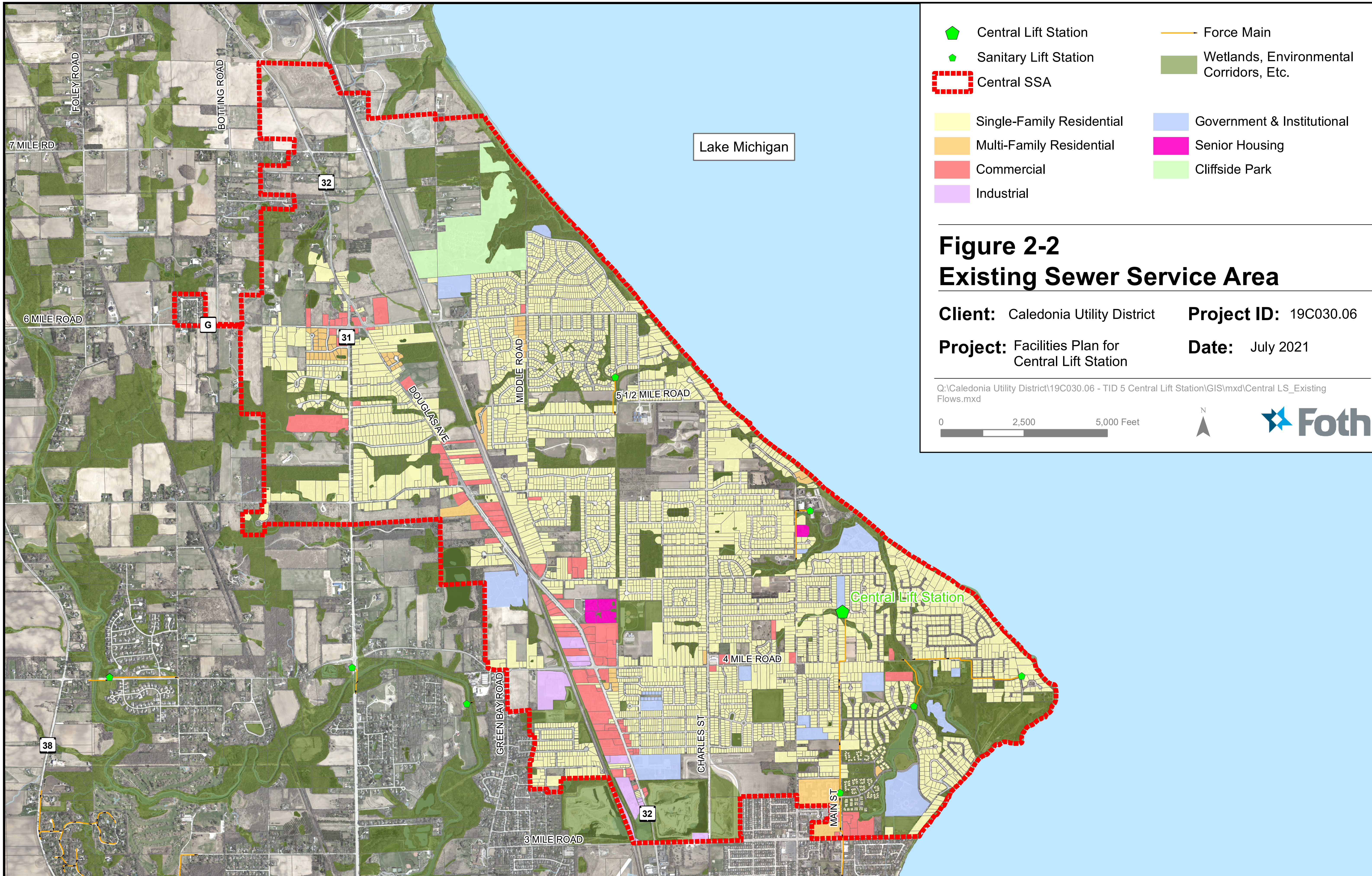
Central Lift Station
Sanitary Lift Station
Central SSA
Force Main
Wetlands, Environmental Corridors, Etc.
Single-Family Residential
Multi-Family Residential
Commercial
Industrial
Government & Institutional
Senior Housing
Cliffside Park
Figure 2-2
Existing Sewer Service Area
Client: Caledonia Utility District
Project ID: 19C030.06
Project: Facilities Plan for Central Lift Station
Date: July 2021
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0
2,500
5,000 Feet
N
Foth
Lake Michigan
7 MILE RD
6 MILE ROAD
5 1/2 MILE ROAD
4 MILE ROAD
3 MILE ROAD
FOLEY ROAD
BOTTING ROAD
MIDDLE ROAD
DOUGLAS AVE
GREEN BAY ROAD
CHARLES ST
MAIN ST
32
31
G
38
Central Lift Station

2.5 Lift Station Description

The Central Lift Station was constructed in 1987 and consists of a screening chamber, two wet wells, a separate dry well, and five wastewater pumps. In addition to these items, the lift station building also includes a garage, office space, and meeting rooms as it serves as the main office for CUD staff.

Wastewater flows into the screening chamber from two interceptor sewers. A manual bar screen is used to keep large solids out of the wet well; the screen is cleaned regularly by hand. From the screening chamber, wastewater enters the large pump wet well. Three large pumps draw from this wet well during periods of high flow. Adjacent to this wet well is the small pump wet well. Two small pumps draw from this wet well under average flow conditions. Gates can be closed to shut off flow to the large pump and small pump wet wells. A bypass pipe can be used to route flow from the screening chamber around the large pump wet well to the small pump wet well.

Refer to Figure 2-3 for an overview of the existing lift station property and Figure 2-4 for a plan view of the lift station building and immediate surroundings. Relevant design parameters for the overall lift station are provided below in Table 2-3.

Table 2-3
Existing Lift Station Design Parameters
Central Lift Station

Parameter	Value
Wet Well Dimensions (L x W)	
Screening Chamber	10’-0” x 6’-0”
Large Pump Wet Well	22’-8” x 8’-0”
Small Pump Wet Well	11’-0” x 8’-0”
Depth [1]	3’-6”
Number of Pumps	5
Generator Size, kW	400

[1] Measured from low water level to high water level. Actual operating band is shorter and can be adjusted.

The wastewater pumps are vertical centrifugal non-clog style pumps with line-shaft driven motors. The small pumps operate on VFDs. The large pumps share a VFD but typically operate at constant speed. The pumps are controlled with a pressure transducer, which is backed up by float switches. The pumps discharge to a common 20-inch header, which increases to a 30-inch force main outside the building. A magnetic flow meter is located in a manhole outside the building and is used for metering wastewater flow to the RWWU. Odor control chemical is added to the wet well seasonally to reduce wet well and force main odors. A standby generator is located inside the lift station building and provides power to the pumps and controls in the event that utility power is lost.

Relevant design parameters for the existing wastewater pumps are provided in Table 2-4.

Table 2-4
Existing Pump Design Parameters
Central Lift Station

Parameter	Small Pumps	Large Pumps
Manufacturer	Fairbanks	Fairbanks
Model	8” 5424	10” 5425
Design Capacity, gpm (ea.)	3,100	4,150
TDH at Design Capacity, ft	62	70
Speed, rpm	1,200	900
Motor Size, HP	60	100
Motor Control	VFD	Constant Speed

The design firm capacity of the lift station is approximately 12 MGD, which involves running two large pumps simultaneously. The design intent is that small pumps and large pumps are not operated together. The 100-percent peak hour flow allocation for the lift station is 13.07 MGD. At present this flow rate can nearly be met by operating only two large pumps. Operating all three large pumps exceeds the flow allocation. It may be necessary to install full trim impellers and larger motors or to over-speed the motors slightly to fully match the peak hour flow allocation.

The lift station was installed in 1987 and has been providing reliable service since then. The lift station does not experience issues relating to odors or grease. Ragging of the pumps is a semi-regular occurrence, but staff prefer removing rags from the pumps to the use of a grinder. All pumps appear to be in good working order and suitable for continued use, however, prior to design a condition assessment will be conducted for the large pumps; the condition assessment will also investigate the capacity of the pumps to determine if larger impellers and motors or over-speeding are needed for future use. Water hammer has not been an issue but a surge relief valve will be installed as a safeguard. The electrical system is in need of an upgrade and the generator is reaching the end of its service life. VFDs will be installed for all large pumps. The building is in good condition, but CUD staff have expressed interest in expanding office space at the lift station. Miscellaneous building systems upgrades will also be included in the final project scope.

2.6 Flooding and Wetlands

The lift station site is not within the Federal Emergency Management Agency (FEMA) 100-year flood zone. The only areas classified as wetlands on the lift station site are along the southern property line, which is an area that will not be disturbed by construction activity. Refer to the map in Appendix A for floodplain and wetland limits.

2.7 WDNR Environmental Site Requirements

2.7.1 Endangered Resources Review

The Central Lift Station is located at the southern end of a parcel of land owned by the District that is approximately 250 ft wide by 1,200 ft long. Most of the site consists of a grass lawn and is kept in a mowed condition. Up to 1987, when the current lift station was constructed, the majority of the site was a WWTP. After the lift station was constructed the WWTP was decommissioned and the existing structures were removed or buried. The site is located in a residential neighborhood and all parcels surrounding the property have been developed.

An endangered resources review was performed for the Central Lift Station site (ERR Log No. 21-381). The review found no species present that require follow-up actions. Three species of plant were found that are of special concern; however, improvements proposed for this site are all located in landscaped areas of the site and therefore would not affect these plant species. Consequently, further action is not deemed necessary.

2.7.2 Historical and Archeological Site Review

The Wisconsin Historical Society Archeological Reports Inventory and the Wisconsin Architecture and History Inventory were searched for historical and archeological site impacts at the Central Lift Station. The search found no areas of interest that would impact construction at the site. The reports can be found in Appendix B.

2.7.3 WWTP Separation Requirements

The Central Lift Station and Attenuation Basin project consists of constructing a new lift station and attenuation basin. NR 110 does not require physical separation from surrounding commercial or residential properties for lift stations. For WWTPs, separation distances are identified under 110.15(3)(d). The attenuation basin will be located within 100 ft of existing residences along the east and west property boundaries of the site. However, the basins will be used only during storm events that lead to flows in excess of the flow allocation for the lift station. This flow rate is approximately three times the 2040 design average flow rate. Thus, use of the system will be infrequent. Additionally, the attenuation basin will be buried below grade and covered with grass turf. The wastewater entering the basin will be highly diluted and therefore not likely to generate noticeable odors. The basin will be equipped with a hydraulic flushing system to clean sediment from the basins that could otherwise lead to odor formation. A vapor-phase odor control system is not proposed as a part of this project, as the site does not currently receive odor complaints, however provisions will be made for the addition of an odor control system in the future if deemed necessary. For these reasons, the site is considered suitable for construction of the attenuation basin.

FACILITIES PLAN FOR CENTRAL LIFT STATION AND ATTENUATION BASIN

CALEDONIA UTILITY DISTRICT

RACINE COUNTY — VILLAGE OF CALEDONIA, WISCONSIN

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RECORD DRAWINGS OF COMPLETED CONSTRUCTION CONFORMING TO CONTRACTOR AND/OR OWNERS RECORDS.

BY: ________ DATE: ________

DATE OF PREPARATION	BY	DATE
SURVEYED		
DRAWN	PCG	8/13/2021
DESIGNED	MJE	8/13/2021
CHECKED	-	-

EXISTING SITE PLAN OVERVIEW

0 60 120
scale feet

PROJECT ID 20C030.09

FIGURE 2-3

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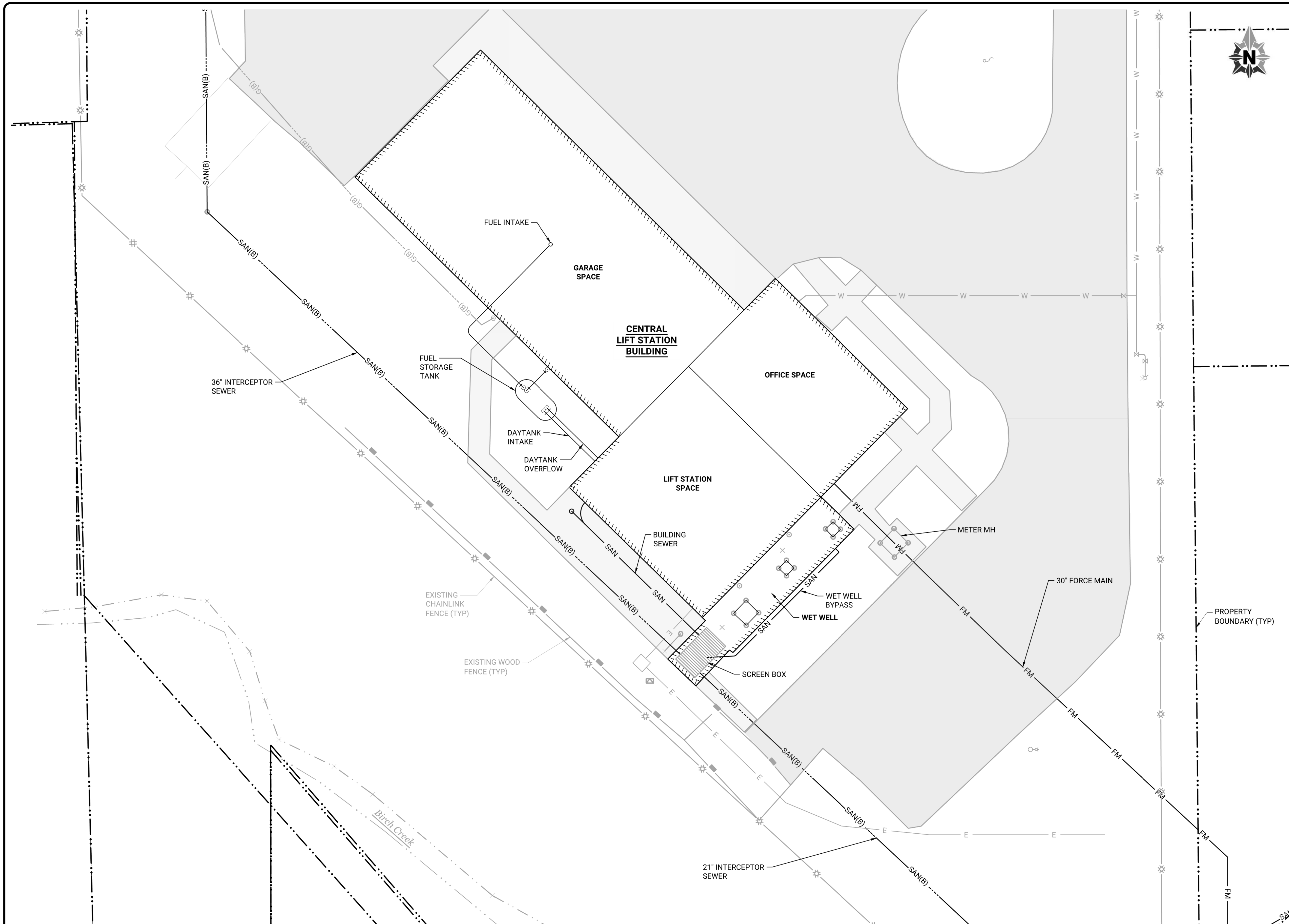

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FACILITIES PLAN FOR CENTRAL LIFT STATION AND ATTENUATION BASIN

CALEDONIA UTILITY DISTRICT

VILLAGE OF CALEDONIA, WISCONSIN

RACINE COUNTY

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SURVEYED		
DRAWN	PCG	8/13/2021
DESIGNED	MJE	8/13/2021
CHECKED	.	.

EXISTING SITE PLAN LIFT STATION

0 10 20
scale feet

PROJECT ID 20C030.09

FIGURE 2-4

Aug 13, 2021 - 9:29am pcg C:\pw_workdir\pw_ie\fvd_pcg\d0453654\Figure 2-4.dwg

3 Future Conditions

3.1 Sewer Service Area

The Central Lift Station SSA boundary will not change as a result of the facilities planning process, however, the population density will increase. Growth in the SSA is primarily attributed to the development of farmland into residential housing. Some future commercial and government and institutional developments are also planned.

Refer to Figure 3-1 for a map showing current and future land use within the Central Lift Station SSA.

3.2 Design Period

The design period for the planning area is 20 years. Within this period of time, nearly all of the remaining undeveloped areas will be filled in with single family homes, multi-family housing, commercial properties, and governmental and institutional facilities. These developments will bring the SSA nearly to its expected maximum density, which represents the ultimate build-out condition for wastewater flows. Only several small parcels on the north edge of the SSA are not projected for development within the design period.

3.3 Design Flows

3.3.1 Population Projections

Population projections for residential growth within the Central Lift Station SSA were developed using estimates for dwelling units per acre and population per dwelling unit. The areas zoned as future residential were divided into three land use categories: single-family residential at 2.2 DU/ac, multi-family residential at 4.0 DU/ac, and multi-family residential at 4.6 DU/ac. For each category, the total area was calculated. These areas were then reduced by 15-percent to account for land used for streets. For each area, the respective number of dwelling units per acre was applied to the total area to estimate the projected number of dwelling units. Note that in addition to these areas, one planned condominium development totaling 280 DUs was included. Based on current US Census data for the Village of Caledonia, a factor of 2.5 people per dwelling unit was used to determine the increase in population within the SSA for residential areas.

Using the methods described above, the total increase in population to the Central Lift Station SSA during the 20 year design period is estimated to be 7,201 people. Adding this to the existing population estimate, along with183 people from currently unsewered areas, yields a total population of 23,966 people. Refer to Table 3-1 for the projected population.

3.3.2 Residential Flow Projections

The total increase in population to the Central Lift Station SSA during the 20 year design period is estimated to be 7,201 people. To calculate an average annual flow rate for residential growth, a per capita flow rate of 167 gpcd was applied to the total additional population. The per capita average flow was selected to match the value used in the 1998 RWWU WWTP facilities plan. In addition, 73 existing single family residential units will be connected to the sewer system, adding an estimated 183 people and 0.030 MGD of average annual flow. The calculated total increase in average annual residential flow rate due to future development and new sewer connections within the SSA is 1.232 MGD. Refer to Table 3-1 for projected residential flows.

3.3.3 Commercial and Government and Institutional Flow Projections

In addition to residential growth, some commercial and government and institutional growth is expected in the Central Lift Station SSA. Land areas for these two categories were totaled and per acre flow rates were used to determine projected flows. For commercial land use a flow rate of 1,200 gpd/ac was used and for government and institutional land use a flow rate of 625 gpd/ac was used; these rates match typical values observed in the District over the last several decades. The calculated increase in average annual commercial and government and institutional flow rate due to future development within the SSA is 0.074 MGD. Refer to Table 3-1 for projected commercial and government and institutional flows.

3.3.4 Industrial Contributions

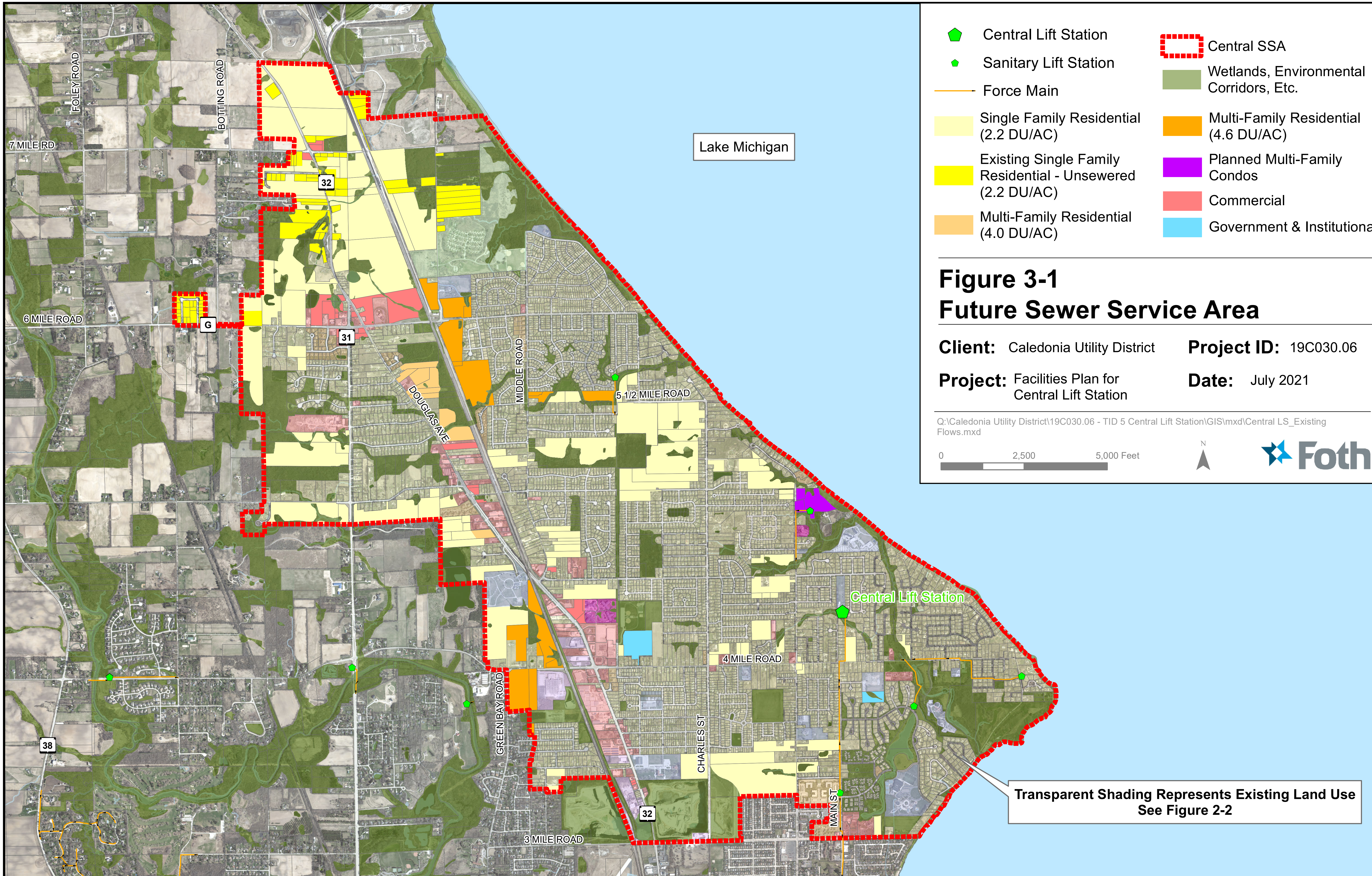
Approximately 52 acres of the Central Lift Station SSA has been developed for industrial use. No future industrial areas are planned within the Central Lift Station SSA. The flows associated with this area are presented in Table 2-2.

3.3.5 Infiltration and Inflow

Infiltration is defined as water that enters a pipeline through cracks in the pipe wall or at pipe joints. It is often caused by saturated soil conditions surrounding the pipe. Infiltration is typically seen as prolonged periods of higher than expected flow. Inflow is defined as water that enters a pipeline through a manhole or a hole in the pipe. It is often caused by surface runoff during a storm event. Inflow is typically seen as a short period of extremely high flow during a storm event.

Per capita flow rates used herein for flow development account for contributions to the total flow by infiltration and inflow (I/I) under average flow conditions. The majority of the SSA utilizes existing sewers, which are typically subject to higher I/I rates. However, there is evidence that these per capita flow rates are typical even for sewers constructed in Southeast Wisconsin with more modern methods. This is due in part to high groundwater and corrosive soils in the region.

Infiltration and inflow are typically highest during a storm event. To address this, a peak hour flow factor of 6.0 was applied to the average annual flows developed in Table 3-1. This peaking factor is typical for communities located in Southeast Wisconsin. Both the peak hour factor and per capita flow rate values match those used in the 1998 RWWU WWTP facilities plan, which are in alignment with historical flow data from the Village.


Central Lift Station
Sanitary Lift Station
Force Main
Single Family Residential (2.2 DU/AC)
Existing Single Family Residential - Unsewered (2.2 DU/AC)
Multi-Family Residential (4.0 DU/AC)
Central SSA
Wetlands, Environmental Corridors, Etc.
Multi-Family Residential (4.6 DU/AC)
Planned Multi-Family Condos
Commercial
Government & Institutional
Figure 3-1
Future Sewer Service Area
Client: Caledonia Utility District
Project ID: 19C030.06
Project: Facilities Plan for Central Lift Station
Date: July 2021
Q:\Caledonia Utility District\19C030.06 - TID 5 Central Lift Station\GIS\mxd\Central LS_Existing Flows.mxd
0
2,500
5,000 Feet
N
Foth
Lake Michigan
FOLEY ROAD
BOTTING ROAD
7 MILE RD
6 MILE ROAD
32
G
31
MIDDLE ROAD
DOUGLAS AVE
5 1/2 MILE ROAD
Central Lift Station
4 MILE ROAD
GREEN BAY ROAD
CHARLES ST
MAIN ST
38
3 MILE ROAD
Transparent Shading Represents Existing Land Use
See Figure 2-2

3.3.6 Other Communities

The Village of Wind Point is included in the Central Lift Station SSA. Wastewater flow from other communities does not enter the Central Lift Station SSA. Additionally, there are no nearby communities that it would be cost-effective to connect to the SSA or for the Central Lift Station to discharge to. The Central Lift Station currently discharges to the RWWU collection system. Therefore, no other communities were contacted as a part of the facilities planning process.

3.3.7 Design Flow Rates

The 20-year projected design flows for the Central Lift Station SSA were calculated by combining the existing and future projected flows. These flows account for I/I into the collection system. No flows are attributed to industrial growth or adjacent communities. Design flow rates are summarized below in Table 3-1.

Based on the flow projections described above, the flow in the Central Lift Station SSA is projected to increase by approximately 40-percent during the 20-year design period. The majority of this increase in flow is attributed to residential development. If all of this development is realized, the SSA will be almost fully built out and thus the flows generated herein would represent ultimate design flows for the lift station.

Table 3-1
Projected Design Flows
Central Lift Station

Land Use	Area (ac)	Reduced Area (ac) [1]	Dwelling Units	Population [2]	Average Annual Flow (MGD) [3]	Peak Hour Flow (MGD) [4]
Future Projected Flows						
Residential – Existing Unsewered [5]	-	-	73	183	0.030	0.183
Single-Family Residential (2.2 DU/ac)	1,031	875	1925	4,813	0.804	4.824
Multi-Family Residential (4.0 DU/ac)	39	34	135	338	0.056	0.336
Planned Multi-Family Condos [6]	24	-	280	700	0.117	0.702
Multi-Family Residential (4.6 DU/ac)	138	117	540	1,350	0.225	1.350
Commercial [7]	63	53	-	-	0.063	0.378
Government and Institutional [8]	20	17	-	-	0.011	0.066
Total	-	-	2,880	7,384	1.306	7.836
Existing Estimated Flows						
Total	-	-	6,632	16,582	3.247	19.482
Projected Design Flows						
Total	-	-	9,512 [9]	23,966 [9]	4.553	27.321

Notes:

1. Total area reduced by 15% to account for streets.
2. Population is calculated using 2.5 people/DU and rounded up to the nearest person, then totaled.
3. Average annual flow is based on a per capita flow rate of 167 gpcd, after RWWU's 1998 Wastewater Treatment Plant Facilities Plan.
4. A peaking factor of 6.0 was used to determine the peak hour flow rate, after RWWU's 1998 Wastewater Treatment Plant Facilities Plan.
5. Flows for providing sewer service to previously unsewered existing dwellings. Assume 2.5 people/DU and 167 gpcd.
6. Dwelling units provided by developer for planned condominiums.
7. A flow rate of 1,200 gpd/ac was used for commercial land use.
8. A flow rate of 625 gpd/ac was used for government and institutional land use.
9. Note that the SEWRPC 2050 dwelling unit total is 8,098 and the population total is 19,400, thus the values listed in Table 3-1 are more than 10-percent higher than the SEWRPC 2050 values. The dwelling units and population listed in Table 3-1 are based on a land use map adopted by the Village in 2018 and therefore supersedes the Village's 2035 comprehensive plan map. The 2018 land use map was submitted to SEWRPC in November 2021 and it is anticipated to be used in future updates of SEWRPC's regional land use plan for dwelling unit and population estimates for the Village of Caledonia.

3.4 Sewer Modeling

3.4.1 Background

The Central Lift Station sanitary sewer model (Model) was developed using Bentley SewerGEMS CONNECT (SewerGEMS) modeling software, which is a software product specifically designed for sanitary and combined sewer modeling. The focus of the Model was to evaluate the existing system flows, analyze the capacity of existing infrastructure with respect to future flows, model rainfall derived inflow and infiltration (RDII) for various storm events, determine the capacity of the proposed attenuation basin at the Central Lift Station, and develop the design for a safety site to convey flows that exceed the proposed storage capacity. The intent of these actions was to facilitate the design of infrastructure that will allow the District to comply with the level of service requirements identified by the WDNR, prevent discharges to the RWWU that exceed flow allocations, and protect customers from basement backups during extreme flow events.

3.4.2 Model Development

The Central Lift Station sanitary sewer model was constructed using the ArcGIS interface in SewerGEMS. The elements and attributes in ArcGIS were imported to SewerGEMS and any incomplete or missing data was manually input using collection system record drawings. The Model was then evaluated using the connectivity review tools in SewerGEMS to ensure a hydraulically coherent model. The completed Model consists of approximately 1,790 manholes, 1,800 conduits, and five lift stations and encompasses the entire Central Lift Station SSA.

Base flows were determined by developing area-based flow estimates and calibrating these flows to measured data. Existing residential flows were estimated by determining the number of existing dwelling units, determining a total population, and assigning a per capita flow rate to this population. In order to be consistent with preceding methods of flow estimation, 2.5 people per dwelling unit and 167 gpcd were used to generate the flows. Future flows were developed by applying the same parameters to areas of future development. Future development areas were assigned a dwelling unit density consistent with the area-based method: 2.2 DU/ac, 4.0 DU/ac, or 4.6 DU/ac. Future commercial and government and institutional flows used the previously identified per acre flows rates of 1,200 gpd/ac and 625 gpd/ac respectively.

Calibration of the Model focused on matching modeled loading patterns with flows based on flow metering data. Meters were installed in two manholes, located immediately north and south of the Central Lift Station. These two metered manholes were the basis of both the dry-weather and rainfall derived infiltration and inflow calibrations. The dry-weather flows were calibrated to match the typical diurnal flow variation for the SSA; the calibration was based on the flow metering data from the period of January 1 – 8, 2021.

Wet weather flows were modeled using the RTK method to convert rainfall to sewer flow, which combines flows from rapid inflow, moderate infiltration, and slow infiltration components to produce a single hydrograph shape specific to the area being modeled. "R" is the fraction of precipitation that enters the collection system for that component, "T" is the time from the precipitation pulse to the peak of rapid inflow of the hydrograph, and "K" is the ratio of the time to the peak flow to the time to the end of the hydrograph. RDII sources in the system include inflow at services, sump pumps and manholes as well as infiltration at manholes and through cracks in the sewer pipes and joints. These sources are not metered or specifically known and therefore the RTK method is used to determine a hydrograph that simulates the system's rain events. T and K parameters were based on a storm event that took place from July 9 – 10, 2020 and produced approximately 3.8 inches of rain over a 12-hour period. This storm resulted in surcharging of the metering manholes and thus did not present a good data set for calibrating the R value. The R value was calibrated using the August 2, 2020 storm event, a small storm with a total of 0.92 inches of rain over 10 hours. The Model was then run using this storm event to confirm that all RTK parameters were properly calibrated.

The Model was calibrated based on depth, or level of water in the metered manholes. The depth component was used to calibrate the Model since the meters were found to measure depth more accurately than flow rate. Depth could then be used within the Model to generate flow rates. Following the successful depth-based calibration of the Model, design storms were input into the Model to generate the required storm flow hydrographs for future conditions.

3.4.3 Model Output

The ultimate goal of the Model was to determine the storage volume required to meet all 2040 storm events with a level of service of five years and to determine the 2040 peak flow for development of a safety site design. To develop hydrographs for these events, the precipitation depth for various storm durations was determined using the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Data Server for the Racine weather station. The NOAA precipitation-frequency estimates were analyzed using SEWRPC recommended rainfall distribution and modeled in SewerGEMS. The peak flow allocation for the Central Lift Station to the RWWU is 13.07 MGD. The resulting storage volumes required to meet a five year level of service for various storm durations are summarized below. Refer to Figure 3-2 for a graphical comparison of hydrographs for these storm events.

Figure 3-2
Flow Storage Analysis - 5-yr Storm (2040)
Central Lift Station

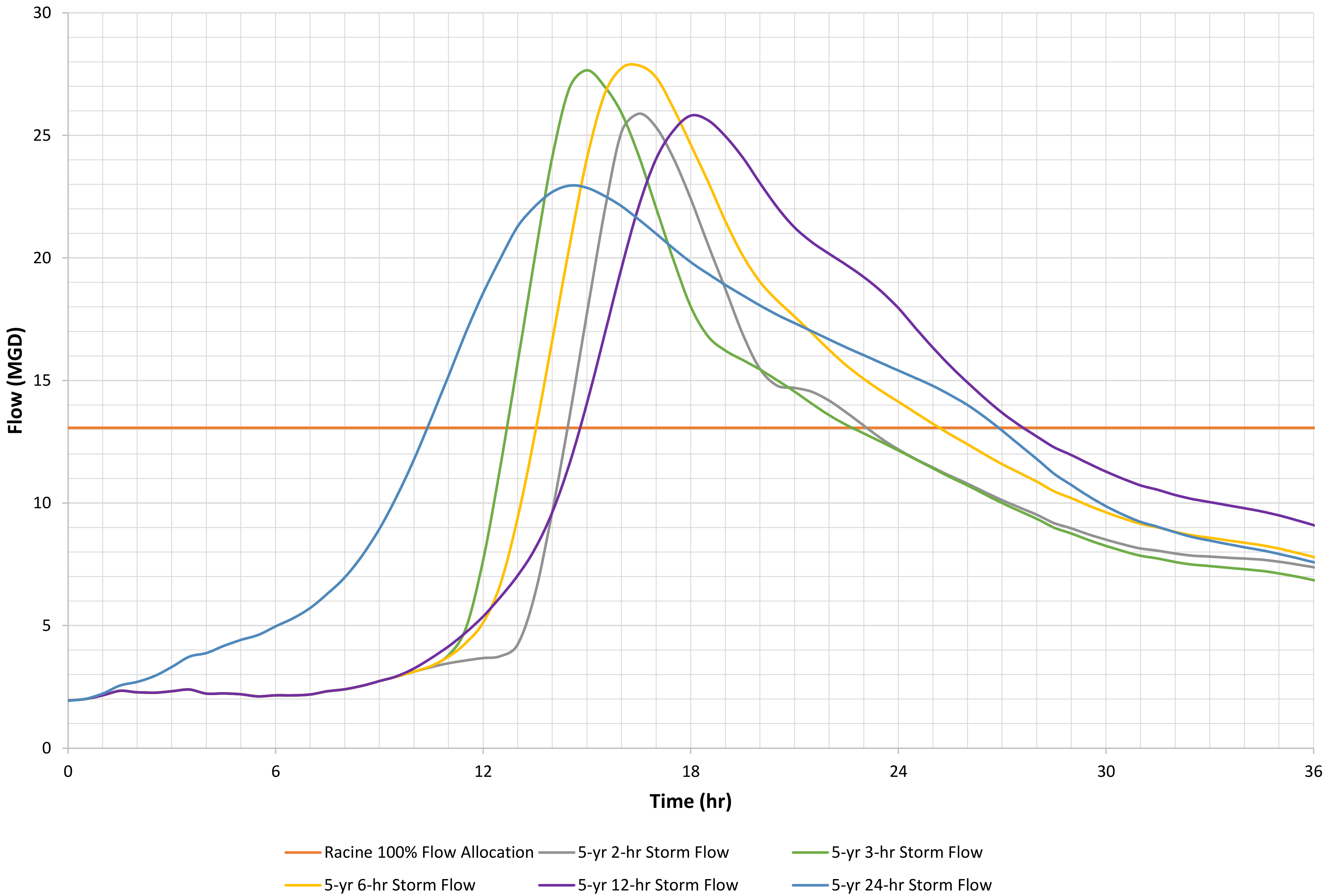


Table 3-2
Flow Storage Analysis
Central Lift Station

Rain Event	Rain Depth (in)	Peak Hour Flow (MGD)	Volume Stored (MG)
5 Year 2 Hour	2.01	25.9	2.0
5 Year 3 Hour	2.24	27.7	2.0
5 Year 6 Hour	2.59	27.9	3.2
5 Year 12 Hour	2.87	25.8	3.6
5 Year 24 Hour	3.22	23.0	2.5

As demonstrated in Table 3-2, the design storm for storage of a five year level of service is the 12-hour event. This storm requires a storage facility with a capacity of 3.6 MG. Note also that the pumping system that conveys excess flow into the basin must be designed for the 6-hour event peak flow rate of 27.9 MGD minus the flow rate to the RWWU of 13.0 MGD. Figures 3-3 and 3-4 present the influent hydrographs for the year 2040 5-year 12-hour and 5-year 6-hour storms.

The Model was also used to determine the 2040 peak instantaneous flow for development of the safety site design. For this flow, the 100-year 24-hour storm was modeled. The resulting peak instantaneous flow rate was 35.0 MGD. The Central Lift Station and Attenuation Basin facility will accommodate this storm as follows: a continuous flow of 13.0 MGD will be maintained to the RWWU collection system throughout; the 3.6 MG attenuation basin will be filled at a rate up to the attenuation pump capacity of 14.9 MGD, for a total output matching flow up to the 5-year level of service peak flow of 27.9 MGD; flows in excess of this and up to 35.0 MGD will be pumped to the safety site; once the attenuation basin is full, at approximately hour 16, the expected influent flow rate will be 32.5 MGD; the system must be capable of conveying the remaining flow, up to 19.5 MGD, to the safety site. This sequence and the 100-year 24-hour storm hydrograph are depicted in Figure 3-5.

Modeled flow rates are summarized below in Table 3-3.

Table 3-3
Modeled Flow Rates
Central Lift Station

Parameter	Value
Existing Annual Average Flow Rate, MGD	3.12
Projected Design Annual Average Flow Rate, MGD	4.27
2040 5-Year 12-Hour Storm Peak Instantaneous Flow, MGD	25.80
2040 5-Year 6-Hour Storm Peak Instantaneous Flow, MGD	27.90
100-Year 24-Hour Storm Peak Instantaneous Flow, MGD	35.00

The modeled flow rates were compared to projected design flows in the previous subsection. The existing and projected 2040 annual average modeled flow rates closely match projected flow rates developed using the area-based method outlined in the previous subsection. The peak hour flow calculated using the area-based method is 27.3 MGD, which approximately matches the 2040 5-year 6-hour storm. The modeled peak instantaneous design storm exceeds the calculated peak hour flow by approximately 8 MGD.

The 100-year 24-hour storm peak instantaneous flow will be used to size the safety site system. The purpose of the safety site system is to protect customers' basements from sewer backups, and therefore a more conservative approach is warranted. Additionally, the peak instantaneous flow is a modeled flow and therefore should be more accurate than the desktop method of multiplying a peaking factor to an average flow.

Figure 3-3
5-yr 12-hr Storm Influent Hydrograph (2040)
Central Lift Station

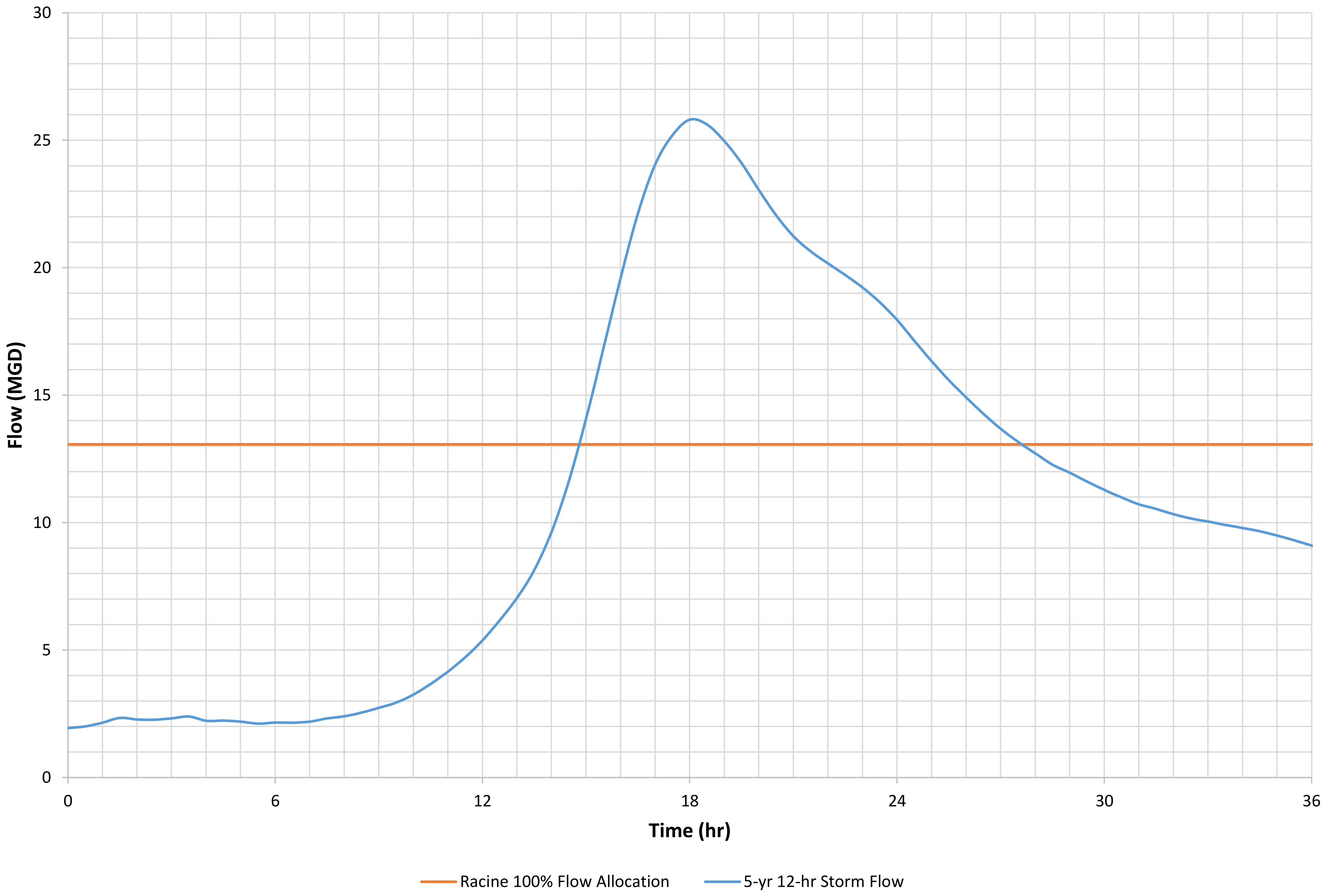


Figure 3-4
5-yr 6-hr Storm Influent Hydrograph (2040)
Central Lift Station

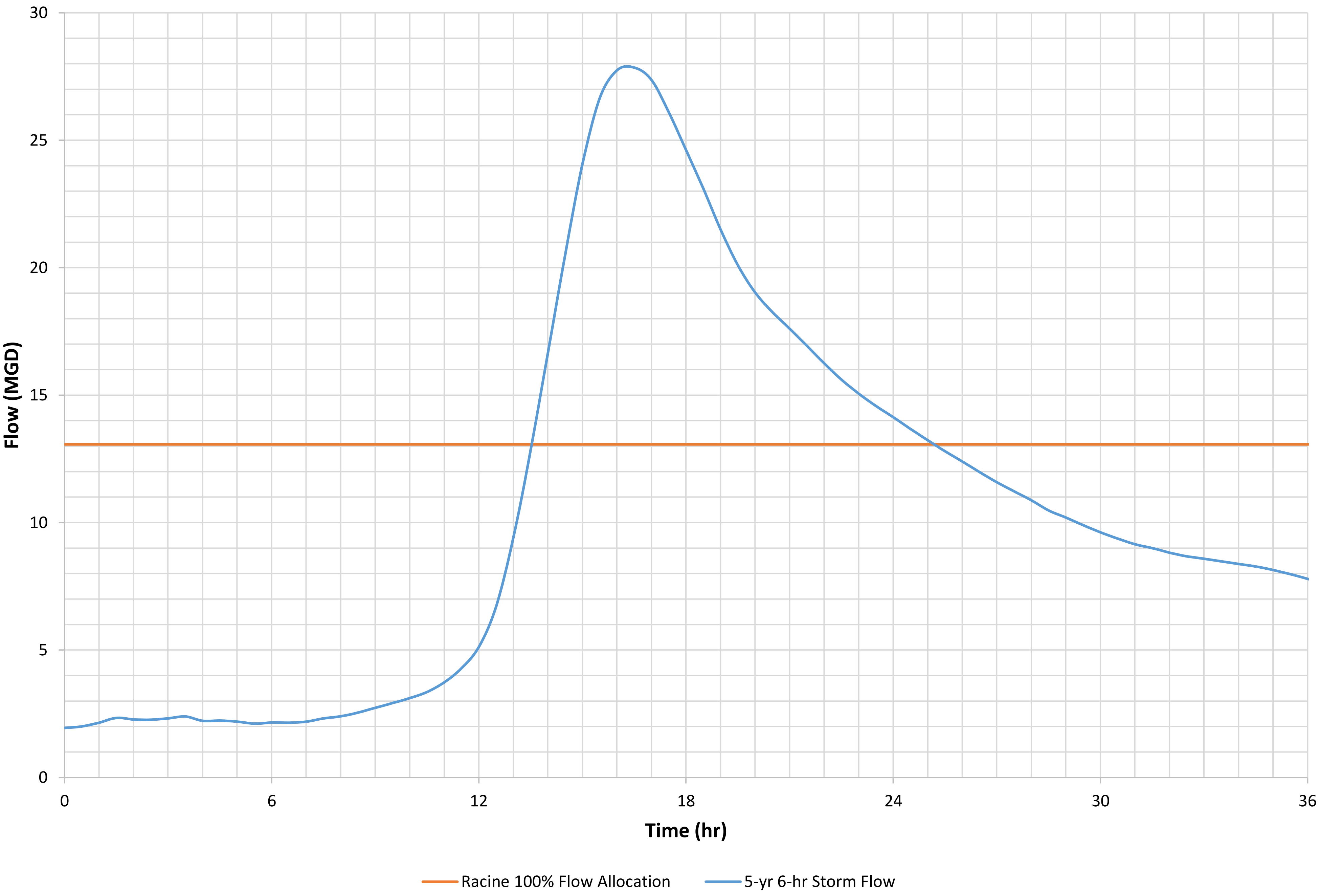
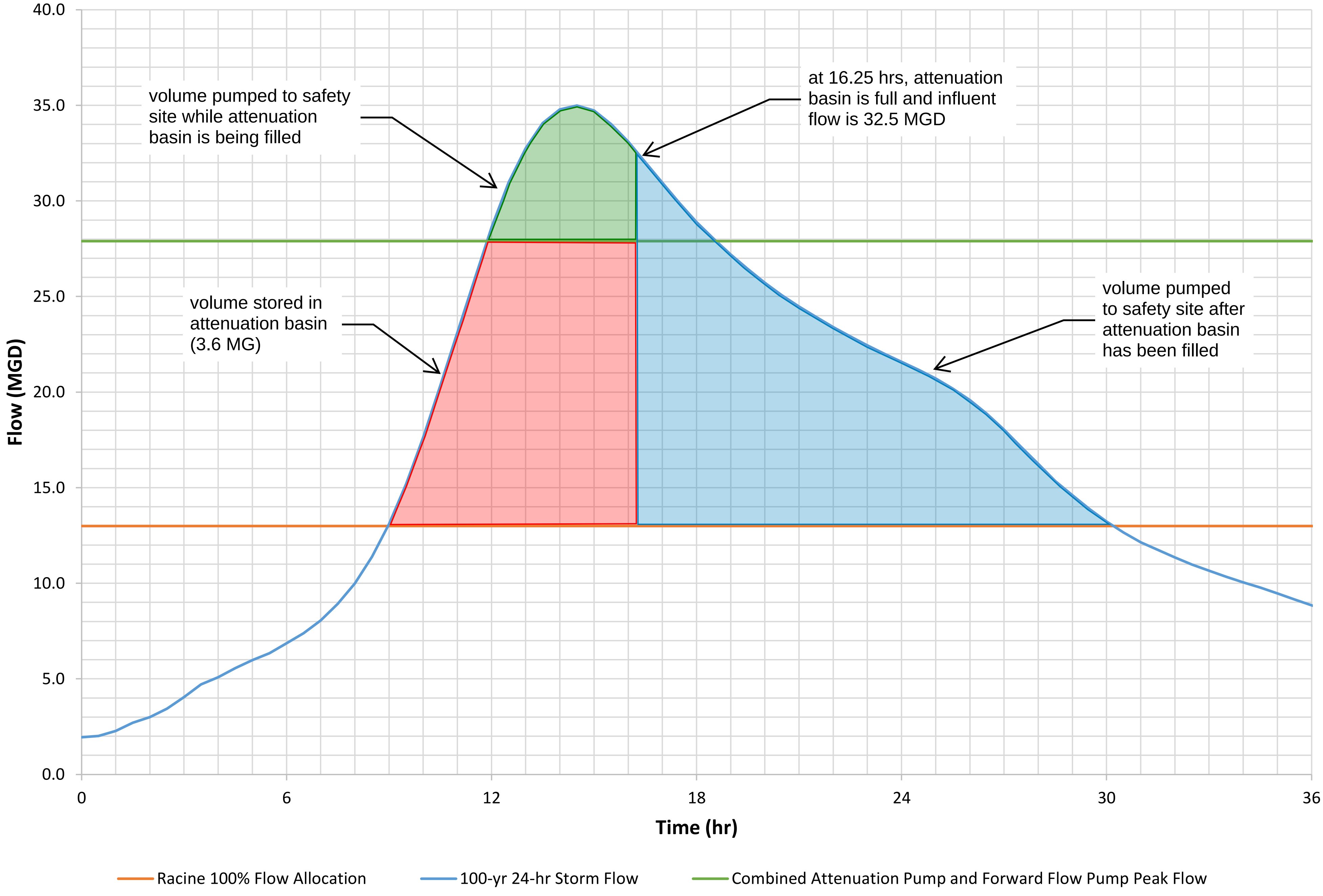


Figure 3-5
100-yr 24-hr Influent Hydrograph (2040) with Storage and Safety Site Discharge
Central Lift Station



4 Alternatives Analysis

4.1 Capacity Analysis

The projected 2040 peak instantaneous flow rate to the Central Lift Station is 35.0 MGD. The lift station must convey this flow rate without surcharging the collection system. The level of service required by the WDNR is represented by the 2040 5-year storm; the 6-hour duration event produces the peak flow rate, 27.9 MGD, and the 12-hour duration event generates the maximum storage volume, 3.6 MG. The lift station must not allow these storms to result in safety site discharges or to surcharge the collection system. The flow allocation to the RWWU over the 20-year planning period remains unchanged at 13.07 MGD. The 2040 design average flow rate is 4.553 MGD. The existing lift station, force main, and collection system were evaluated using these flows to determine if a capacity increase is required.

4.1.1 Lift Station

4.1.1.1 Wastewater Pumps

As the flow allocation for the Central Lift Station is not changing over the planning period, higher peak flows do not change the amount of flow that can be routed to the RWWU collection system. Therefore, the existing large pumps are of adequate capacity for future use. The capacity of the small pumps is 3,100 gpm (4.46 MGD) each. These pumps operate on VFDs and can be turned down below this flow rate. The 2040 design average flow rate is 4.553 MGD. Therefore, the existing small pumps are of adequate capacity for future flows. Two pumps may be required at times to convey average flows, but this does not affect the lift station's firm capacity. If one small pump is out of service, one larger pump can be used at a variable speed to serve as a redundant unit.

4.1.1.2 Wet Well

The existing wet well is composed of three interconnected chambers: a screening box, a large pump wet well, and a small pump wet well. Flow enters the screening box, then flows into the large pump wet well. A gate controls flow from the large pump wet well into the small pump wet well. Under normal operation, all three chambers are hydraulically connected and share the same water level. The collective volume per foot of depth for the wet well is 2,464 gal/ft. The vertical distance between the low water level and the high water level is 3.5 ft. The small pumps operate on VFDs, whereas the large pumps are constant speed. The pump "on" and "off" levels are controlled by a submersible level transducer and are adjustable. The 2040 design average flow rate is 4.553 MGD.

Wisconsin Administrative Code Chapter NR 110 has two criteria for lift station wet wells: a maximum hydraulic detention time of 30 minutes at the design average flow rate for the LEAD pump stage and a minimum pump cycle time of five minutes. The design average flow rate is 3,162 gpm, which yields a maximum lead pump stage volume of 95,000 gal. A wet well volume that large is not realistic. Regarding pump cycle time, the pumps will operate on VFDs under normal conditions and are therefore not at risk for motor overheating due to frequent starting and stopping. If both small pumps are operating on backup controls, a stage 1 volume of 3,952 gal is required to achieve a pump cycle time of 5 minutes. This is approximately 1.5 ft of wet well level, which is compatible with the operating range of 3.5 ft. Therefore, the wet well is of adequate capacity for future use.

The high water level in the wet well is EL 587.00. All alternatives require operating height above this level, either for overflowing a weir or operating additional pumps. An additional 2 ft of height, or EL 589.00, should prove sufficient for all operations. A water level of 589.00 would just surcharge the 21-inch interceptor at MH 10, which is approximately 120 ft upstream of where the interceptor enters the lift station property boundary and prior to the first lateral connection. A water level of 589.00 would just surcharge the 36-inch interceptor at MH 1, which is on the lift station property near the building. Thus, the wet well and collection system are suitable for increased water levels associated with attenuation and safety site processes.

4.1.2 Force Main

The existing force main that carries forward flow to the RWWU collection system is constructed of 30-inch ductile iron pipe. For the 20-year peak hour flow rate, the maximum allowable velocity through this pipe is 10 ft/s. In the RWWU force main, this corresponds to a flow rate of 23,500 gpm (33.8 MGD). Thus, the force main nearly has capacity to pass the 2040 peak instantaneous flow rate. However, the Central Lift Station flow allocation to the RWWU is limited to 13.07 MGD and will not discharge more flow than this during the planning period. Therefore, the existing force main is of adequate size for future use. Note that a redundant force main will be considered in the future and if selected would be constructed in conjunction with the replacement of Main Street.

4.1.3 Sanitary Sewer System

Two interceptor sewers discharge into the Central Lift Station wet well: a 36-inch sewer from the north and a 21-inch sewer from the south. Both pipelines are constructed of RCP, and both sewers are sloped more steeply from the first manhole upstream into the lift station than they are further upstream. In other words, the last section of pipe before the lift station wet well is sloped the steepest. The capacity of these sewers was evaluated for both the 5-year 6-hour storm and the 100-year 24-hour storm using Manning's Equation, with a Manning's "n" of 0.015 for old concrete. The degree to which the sewers surcharge for the various flows was evaluated using the Darcy-Weisbach equation as well as the SewerGEMS Model. The split in flow between the north and south pipe sewer sheds was based on Model output. Sewer capacity calculations are summarized below in Table 4-1.

Table 4-1
Sewer Capacity Analysis
Central Lift Station

Storm Event	North Sewer (36 in)	South Sewer (21 in)
Flows		
2040 5-Year 6-Hour (MGD)	14.55	13.35
2040 100-Year 24-Hour (MGD)	16.47	18.53
Sewer Capacity (per Manning's Equation)		
First Pipe Segment Upstream of Lift Station (MGD)	42.65	6.05
Third Pipe Segment Upstream of Lift Station (MGD)	13.96	3.32
Sewer Surcharge (per Darcy-Weisbach Equation)		
First MH Upstream of Lift Station – 5-Year 6-Hour (ft)	–	3.56
Third MH Upstream of Lift Station – 5-Year 6-Hour (ft)	1.67	15.71
First MH Upstream of Lift Station – 100-Year 24-Hour (ft)	–	6.85
Third MH Upstream of Lift Station – 100-Year 24-Hour (ft)	2.14	30.22
Sewer Surcharge (per SewerGEMS Model)		
First MH Upstream of Lift Station – 5-Year 6-Hour (ft)	–	1.00
Third MH Upstream of Lift Station – 5-Year 6-Hour (ft)	–	9.50
First MH Upstream of Lift Station – 100-Year 24-Hour (ft)	–	3.50
Third MH Upstream of Lift Station – 100-Year 24-Hour (ft)	–	23.50

The calculations summarized in Table 4-1 show that the 36-inch sewer is of adequate capacity for 2040 design flows. The capacity of the sewer as calculated by Manning's Equation is slightly below the 5-Year 6-Hour and 100-Year 24-Hour model flow rates. Desktop calculation using the Darcy-Weisbach equation shows only a small amount of surcharging in the sewer. Model output for these events shows no surcharging in the sewer, although it is nearly at capacity. Therefore, it is not expected that this condition will impact sewer connections upstream and the 36-inch sewer is considered to be of adequate capacity for continued use.

Conversely, the calculations summarized in Table 4-1 show that the 21-inch sewer is undersized for future flows. The Manning's Equation capacity of the sewer is well below Model flow rates, and both desktop and Model results show extreme surcharging during the 5-Year 6-Hour and 100-Year 24-Hour events. According to the Model, surcharged conditions develop more than a half mile upstream of the lift station and persist for hours. Existing flow monitoring data, including for the August 10, 2020 storm, which generated 3.87 inches of rain in 2 hours, showed manholes immediately upstream of the lift station surcharging by as much as 10 feet. Surcharged conditions have been corroborated by CUD staff inspections. Replacing the sewer with larger pipe, likely at least 36-inch, will be required to accommodate the 2040 design flows. However, as the south catchment is smaller than the north catchment but generates higher flows during storms, an I/I evaluation of the system is recommended prior to designing a new interceptor. Further analysis of the sewer system is outside the scope of this investigation.

4.1.4 Storm Sewer System for Safety Site

SewerGEMS was also used to develop a model of the existing storm sewer system tributary to the 30-inch outfall located in the area of the proposed safety site. SewerGEMS uses land cover, rainfall depth and intensity, and drain time to calculate stormwater flow in storm sewer systems. Profiles of the storm sewer system can also be generated to determine if surcharging of the pipes and structures is occurring. The storm sewer model was run for the 5-, 10-, 25-, and 100-year 6-hour storm events.

The results of the model indicate that the 30-inch storm sewer draining to, and located within, the proposed safety site area has adequate capacity during the 5-year 6-hour event, is close to capacity during the 10-year 6-hour event, and is over capacity during the 25- and 100-year 6-hour events. Table 4-1 summarizes the water surface elevations at the upstream and downstream ends of the storm sewer system relative to the top of the pipe.

Table 4-2
Storm Sewer Water Level Summary
Central Lift Station

Storm Event	Top of Pipe Elevation (ft) US / DS	Water Surface Elevation (ft) US / DS
5-Year 6-Hour	603.40 / 585.00	602.20 / 584.00
10-Year 6-Hour	603.40 / 585.00	602.45 / 584.15
25-Year 6-Hour	603.40 / 585.00	603.30 / 584.75
100-Year 6-Hour	603.40 / 585.00	608.30 / 585.30

Consequently, this storm sewer cannot be used to convey safety site flows to the outfall.

4.2 Preliminary Alternatives Analysis

4.2.1 Global Alternatives

Four global alternatives were identified and are discussed below. The global alternatives address the overall solution to the issues impacting the Central Lift Station.

4.2.1.1 No Action Alternative

The projected 2040 5-year storm flow exceeds CUD's flow allocation to the RWWU. No on-site storage is currently available. A safety site has not been established at the lift station. The No Action Alternative does not address these considerations. Therefore, the No Action Alternative is not applicable to this project.

4.2.1.2 Redirection of Flow Alternative

The Central Lift Station SSA is one of three large SSAs in the Village of Caledonia and a point of discharge to the RWWU collection system. Redirecting flow would require other collection system infrastructure to be upsized to handle this additional flow. Additionally, the existing lift station and force main are sized for the allocated flow from the Central SSA and have service life remaining. Therefore, the Redirection of Flow Alternative is not applicable to this project.

4.2.1.3 New Lift Station Alternative

The major structural components of the existing Central Lift Station are of sufficient size and in adequate condition for continued service. No changes to the existing sewer system or force main are required to incorporate additional flows. Therefore, construction of a new lift station would not be cost-effective compared to retaining and rehabilitating the existing lift station. Thus the New Lift Station Alternative is not relevant to this project.

4.2.1.4 Existing Lift Station Rehabilitation and On-Site Storage Alternative

The existing lift station is suitable for continued use and the lift station property is of sufficient size to incorporate on-site storage alternatives. As the RWWU flow allocation will not change over the planning period and the required level of service exceeds this allocation, storage is required. Therefore, the Existing Lift Station Rehabilitation and On-Site Storage Alternative will be developed further as a part of this facilities plan.

Regarding the location of the storage facility, the existing site has sufficient room for on-site storage. The SSA is largely developed and no other suitable locations for a storage facility were found. In addition, the two major interceptors within the Central Lift Station SSA converge at the Central Lift Station site. Therefore, if storage were located off-site, two facilities would likely be needed. Consequently, the Central Lift Station site was selected as the location for wastewater storage.

4.2.2 On-Site Storage Alternatives

Four alternatives for on-site storage were evaluated for further development in this plan. These alternatives are discussed below.

4.2.2.1 Above-Ground Steel Tank Alternative

The Above-Ground Steel Tank Alternative consists of installing four circular glass-lined bolted steel tanks at grade north of the lift station on the same property. The tanks, estimated to be approximately 20 ft tall, would rest on concrete slabs and be covered. Pumps would route flow into the tanks and they would drain by gravity to the wet well.

The Above-Ground Steel Tank Alternative would not be acceptable to adjacent property owners on account of the detrimental aesthetic impacts it would cause to the neighborhood. Even with screening vegetation, these tanks would be visible throughout the neighborhood. Therefore, this alternative will not be considered further.

4.2.2.2 Buried Pipe Storage Alternative

The Buried Pipe Storage Alternative consists of a grid of large HDPE pipes buried underground and used to store wastewater during an attenuation event. Pumps would route flow into the pipes. The pipes would drain to a secondary lift station that would route flow to the Central Lift Station wet well. The pipes would be on the order of 6 feet in diameter and connected at the ends by header pipes. It is likely that two layers of pipes would need to be installed to store flow from the 2040 5-year 12-hour event.

The Buried Pipe Storage Alternative is not compatible with automated cleaning of the basins. During an attenuation event, solids will settle in the pipes and gravity drainage will not completely remove this material. The settled material will likely generate odors following an event. In addition, the pipes do not use the available space as efficiently as a rectangular tank and therefore no room for future expansion would be available with this alternative. Therefore, this alternative will not be considered further.

4.2.2.3 Collection System Storage Alternative

The Collection System Storage Alternative consists of replacing upstream sewer pipe with oversized segments capable of storing flow during a storm event. This alternative was not developed further for several reasons. Replacement of existing sewers, and the associated roadway restoration, would be inordinately expensive. The sewers would need to be replaced with at least 60-inch pipe, which may not fit in the existing alignment. In excess of five miles of sewer would need to be replaced if 60-inch pipe were used. Storage would not be controlled by CUD staff and it would be difficult to detect when the approximate volume of storage is reached. Therefore, this alternative will not be considered further.

4.2.2.4 Covered Concrete Attenuation Basin Alternative

The Covered Concrete Attenuation Basin Alternative consists of buried rectangular concrete channels in series. Once each basin channel fills with wastewater, it overflows into the next one upstream. Flushing water storage tanks at the head of each channel are used to store water that is used for flushing. After the basin has been drained, the flushing water in each channel is rapidly released from the tanks by opening a hydraulic gate. This creates a wave of water that flushes solids from the channel floors and back to the lift station wet well. Clean water is available for use in a second flush. The system is automatically operated via a control panel.

The Covered Concrete Attenuation Basin Alternative is able to be buried and therefore will not create aesthetic issues. The system can be cleaned easily, which will reduce odor impacts. Storage and flushing can be automated, making the system user-friendly and more flexible. The District currently operates a similar system, the Hoods Creek Attenuation Basin Facility. For these reasons, the Covered Concrete Attenuation Basin Alternative will be further evaluated in this plan.

4.2.3 Attenuation Basin Channel Configuration Alternatives

The selected alternative for storing wastewater is a covered concrete basin. A basin consists of multiple channels in series. Each channel is 32 feet wide and includes two flushing gates and associated flushing water storage areas. A total of six channels are required to achieve the necessary storage volume. Three different configurations were evaluated for the channels in the basin: consecutive, non-consecutive, and separate. These configurations were evaluated in order to determine which was most cost effective, all other considerations being equal.

4.2.3.1 Consecutive Channels

The Consecutive Channel Configuration consists of all six channels overflowing and draining from one into another, with the channel at the beginning discharging to the lift station. As the channels drain consecutively, the drain sumps must be progressively deeper. This limits the storage depth of the channels. However, construction is simplified. Given the required number of channels and site constraints for this project, the Consecutive and Non-Consecutive Channel Configurations are approximately equal in cost. Due to the simplified layout and construction of the Consecutive Channels Configuration, it was selected for use in the subsequent total present worth analysis.

4.2.3.2 Non-Consecutive Channels

The Non-Consecutive Channels Configuration consists of the channels arranged roughly in a “V” shape, with two channels being deeper than the remaining four. The deeper two channels would fill first, and all channels would drain to the center of the structure rather than to one end. This configuration is more efficient when the number of channels exceeds six, as more volume can be used at the same excavation depth – in other words, the channels have greater volume for their surface area. However, construction is complicated by this arrangement. Given the required number of channels and site constraints for this project, the Consecutive and Non-Consecutive Channel Configurations are approximately equal in cost. Due to a more complicated layout and construction, the Non-Consecutive Channels Alternative will not be considered further.

4.2.3.3 Separate Channels

The Separate Channels Configuration consists of constructing two separate basins with three channels each. This configuration allows for taking an entire basin out of service for cleaning or maintenance without losing the capacity to store some flow. It may also simplify future expansion. However, compared to the other two configurations, it is not cost effective for this project and will not be considered further.

4.2.4 Attenuation Basin Layout Alternatives

Four layout alternatives were evaluated using the Consecutive Channel Configuration described above. The purpose of evaluating different layouts was to determine which ones resulted in the most cost-effective attenuation basin dimensions for the subsequent combined alternatives analysis. For each layout, the following considerations were made: is the top of the basin above grade or below, is flow pumped into the basin or does it enter by gravity, and does flow drain from the basin by gravity or is it pumped out.

4.2.4.1 Above Grade, Pumped In, Gravity Out Layout Alternative

The Above Grade, Pumped In, Gravity Out Layout Alternative consists of an attenuation basin with the top slab located above the surrounding grade, covered by 18 inches of soil, and surrounded with a 3:1 sloped berm. Attenuation pumps route flow from the existing lift station wet well into the basin, but the bottom of the basin is elevated enough that it can drain back into the existing wet well above the normal wet well high water level. This alternative is constrained by both the available width of the site, and thus the ability of the berm to fit, and the elevation of the high water level in the wet well. For all combined alternatives that this layout applies to, it is the most cost-effective.

4.2.4.2 Below Grade, Pumped In, Gravity Out Layout Alternative

The Below Grade, Pumped In, Gravity Out Layout Alternative consists of an attenuation basin with the top slab located 18 inches below existing grade. Attenuation pumps route flow from the existing lift station wet well into the basin, but the bottom of the basin is elevated enough that it can drain back into the existing wet well above the normal wet well high water level. This alternative is constrained by the available width on the site, the elevation of the existing grade, and the elevation of the high water level in the wet well. As a result, the basin dimensions lead to a flatter overall shape, and thus it is less cost-effective.

4.2.4.3 Below Grade, Pumped In, Pumped Out Layout Alternative

The Below Grade, Pumped In, Pumped Out Layout Alternative consists of an attenuation basin with the top slab located 18 inches below existing grade. Attenuation pumps route flow from the existing lift station wet well into the basin, but the bottom of the basin is allowed to be lower than the existing wet well normal high water level. A deep submersible pumping station is used to drain the basin and pump flow back into the existing wet well. This alternative is constrained by the available width on the site and the elevation of the existing grade. Although it results in a more cost-effective basin shape, the depth of excavation and resulting thicker walls, as well as the additional pumping station, cause this layout to not be cost-effective.

4.2.4.4 Below Grade, Gravity In, Pumped Out Layout Alternative

The Below Grade, Gravity In, Pumped Out Layout Alternative consists of an attenuation basin with the top slab located approximately 20 feet below existing grade. Wastewater flows through the existing lift station wet well, over a weir, and into the basin by gravity. The high water level in the basin must be below the weir to avoid surcharging the collection system, thus leading to the extreme depth. A deep submersible pumping station is used to drain the basin and pump flow back into the existing wet well. This alternative is constrained by the available width of the site, due to soil stabilization requirements, and the elevation of the high water level in the wet well. The primary advantage of this alternative is that no mechanical equipment is needed to initiate a storage event – it happens automatically as the water level rises in the wet well. The great depth of the basin prevents this layout from being cost effective, and is not considered further except where this layout is inherent in the alternative being evaluated.

4.3 Combined Alternatives Analysis

Section 4.2 evaluated preliminary alternatives related to basin configuration and layout in order to determine which were the most cost-effective. These selected alternatives were then utilized below as a part of the combined alternatives analysis. This analysis develops complete solutions for handling 2040 5-year and peak hour flows at the Central Lift Station.

4.3.1 Alternative A1

Alternative A1 involves replacing the large pumps in the existing lift station, adding an attenuation pumping station, and adding an attenuation basin. Wastewater overflows from the existing wet well into the attenuation pumping station wet well. The attenuation pumping station consists of two horizontal centrifugal wastewater pumps, one duty and one standby. The pumps route flow into an attenuation basin with six consecutive channels. The basin would be constructed with the top slab above grade, with flow pumped in and draining by gravity back to the existing wet well. Excess flow would be pumped using a combination of the new large pumps and the attenuation pumps through the safety site pipeline.

At flows up to 3,100 gpm (4.5 MGD), the lift station would utilize the existing small pumps. As flow into the existing lift station increases beyond 3,100 gpm, pumping transitions to the new large pumps. Each large pump can deliver 7,000 gpm (10.1 MGD) to Racine, and as incoming flow rises above this a second pump will be called to run. The two pumps combined would produce approximately 9,000 gpm (13.0 MGD), which is just under the CUD's capacity allocation for the Central Lift Station.

As flows increase beyond 13.0 MGD, wastewater overflows into the attenuation pumping station wet well. One attenuation pump can deliver up to 10,400 gpm (14.9 MGD) to the attenuation basin for storage. With the attenuation pump operating at capacity, the total flow rate to the Central Lift Station is 27.9 MGD, which is just above the 2040 5-year storm peak flow – occurring during a storm with a duration of six hours. Under this scenario, and for the 12-hour storm (the design storm for basin storage), the level of service is met.

If flow increases beyond 27.9 MGD, the safety site would be activated. Through the use of motorized valves, the third large pump in the existing lift station would be used to pump up to an additional 5,000 gpm (7.1 MGD) through the safety site force main. The total flow at this point would be 35.0 MGD, which is the design peak instantaneous flow rate. Note that if flows exceed this, the third large pump can produce additional flow beyond design capacity. The second attenuation pump serves as the redundant pump, as it can produce the necessary flow to the safety site as well. This pump is connected to the safety site force main through the use of motorized valves.

If flows remain above 13.0 MGD once the attenuation basin is full, the safety site would remain active. The worst case scenario is for the 2040 peak instantaneous event, in which the attenuation basin fills after seven hours and the influent flow is approximately 32.5 MGD. Under this condition, one large pump in the existing lift station and one attenuation pump would combine to produce up to 13,500 gpm (19.5 MGD) to the safety site. This would be accomplished using a modulating flow control valve. As flow receded, one pump would shut down followed by the other below 13.0 MGD influent flow. Once the event passes, the attenuation basin would be drained and cleaned.

Figure 4-1 shows the process schematic for Alternative A1 and Figure 4-2 shows the proposed site plan for Alternative A1. Refer to Appendix C for sample pump curves.

4.3.2 Alternative A2

Alternative A2 involves retaining all pumps in the existing lift station, adding an attenuation pumping station, and adding an attenuation basin. Wastewater overflows from the existing wet well into the attenuation pumping station wet well. The attenuation pumping station consists of three horizontal centrifugal wastewater pumps, two duty and one standby. The pumps would route flow into an attenuation basin with six consecutive channels. The basin would be constructed with the top slab above grade, with flow pumped in and draining by gravity back to the existing wet well. Excess flow would be pumped using another attenuation pump through the safety site pipeline.

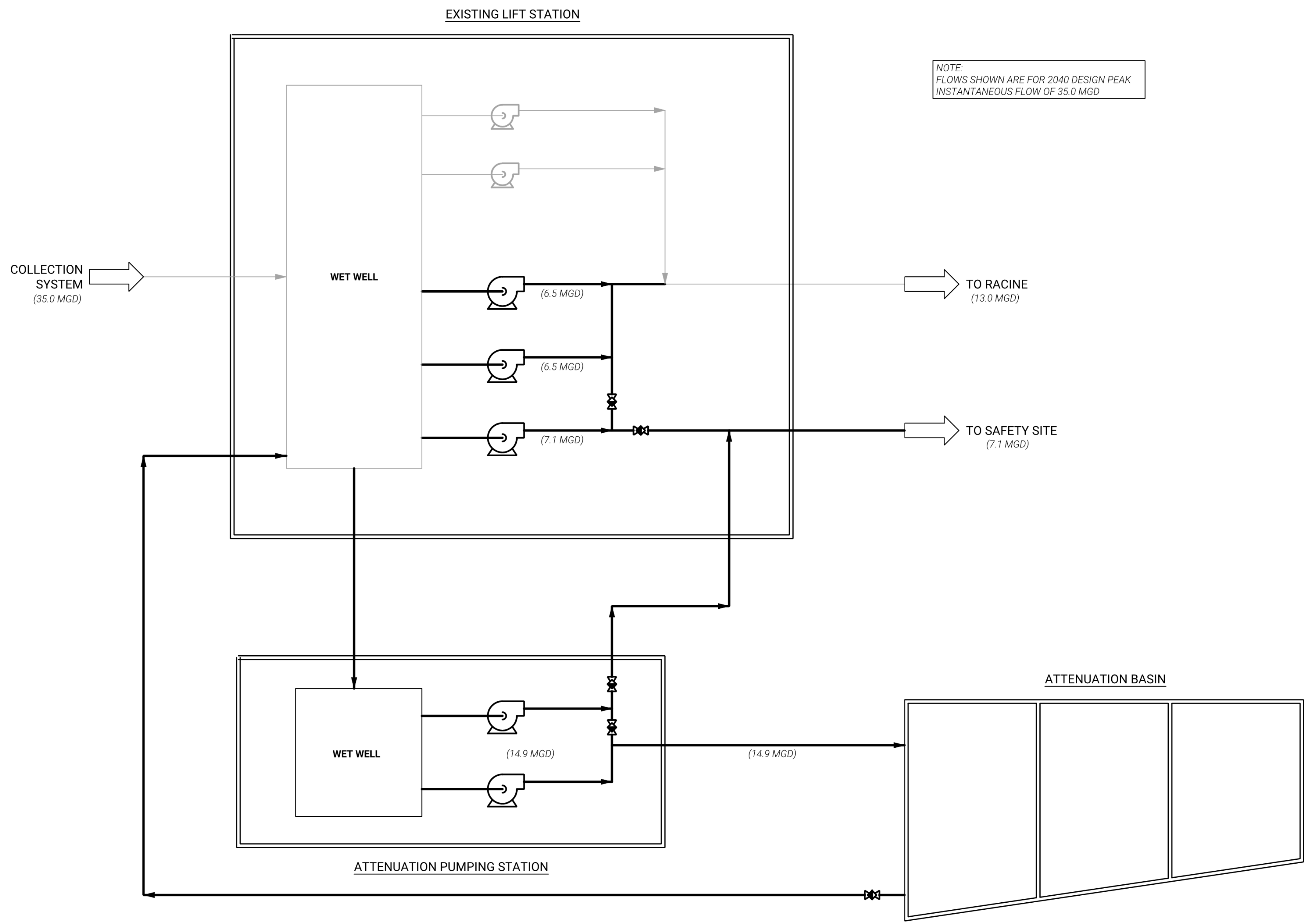
At flows up to 3,100 gpm (4.5 MGD), the lift station would utilize the existing small pumps As flow into the existing lift station increases beyond 3,100 gpm, pumping transitions to the existing large pumps. Two large pumps operating in parallel can deliver 9,000 gpm (13.0 MGD) to Racine, which is just under the CUD's capacity allocation for the Central Lift Station.

As flows increase beyond 13.0 MGD, wastewater overflows into the attenuation pumping station wet well. One attenuation pump can deliver up to 10,400 gpm (14.9 MGD) to the attenuation basin for storage. With the attenuation pump operating at capacity, the total flow rate to the Central Lift Station is 27.9 MGD, which is just above the 2040 5-year storm peak flow – occurring during a storm with a duration of six hours. Under this scenario, and for the 12-hour storm (the design storm for basin storage), the level of service is met.

If flow increases beyond 27.9 MGD, the safety site would be activated. Through the use of motorized valves, a second attenuation pump would be used to pump up to an additional 5,000 gpm (7.1 MGD) through the safety site force main. The total flow at this point will be 35.0 MGD, which is the design peak instantaneous flow rate. Note that if flows exceed this, the attenuation large pump can produce additional flow beyond design capacity. At the peak instantaneous flow rate, both the forward flow and attenuation/safety site pumping systems have redundant units.

If flows remain above 13.0 MGD once the attenuation basin is full, the safety site would remain active. The worst case scenario is for the 2040 peak instantaneous event, in which the attenuation basin fills after seven hours and the influent flow is approximately 32.5 MGD. Under this condition, two attenuation pumps would combine to produce up to 13,500 gpm (19.5 MGD) to the safety site. As flow receded, one pump would shut down followed by the other below 13.0 MGD influent flow. Once the event passes, the attenuation basin would be drained and cleaned.

Figure 4-3 shows the process schematic for Alternative A2 and Figure 4-4 shows the proposed site plan for Alternative A2. Refer to Appendix C for sample pump curves.



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FACILITIES PLAN FOR CENTRAL LIFT STATION AND ATTENUATION BASIN

CALEDONIA UTILITY DISTRICT

RACINE COUNTY — VILLAGE OF CALEDONIA, WISCONSIN

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PROCESS SCHEMATIC ALTERNATIVE A1

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FIGURE 4-1

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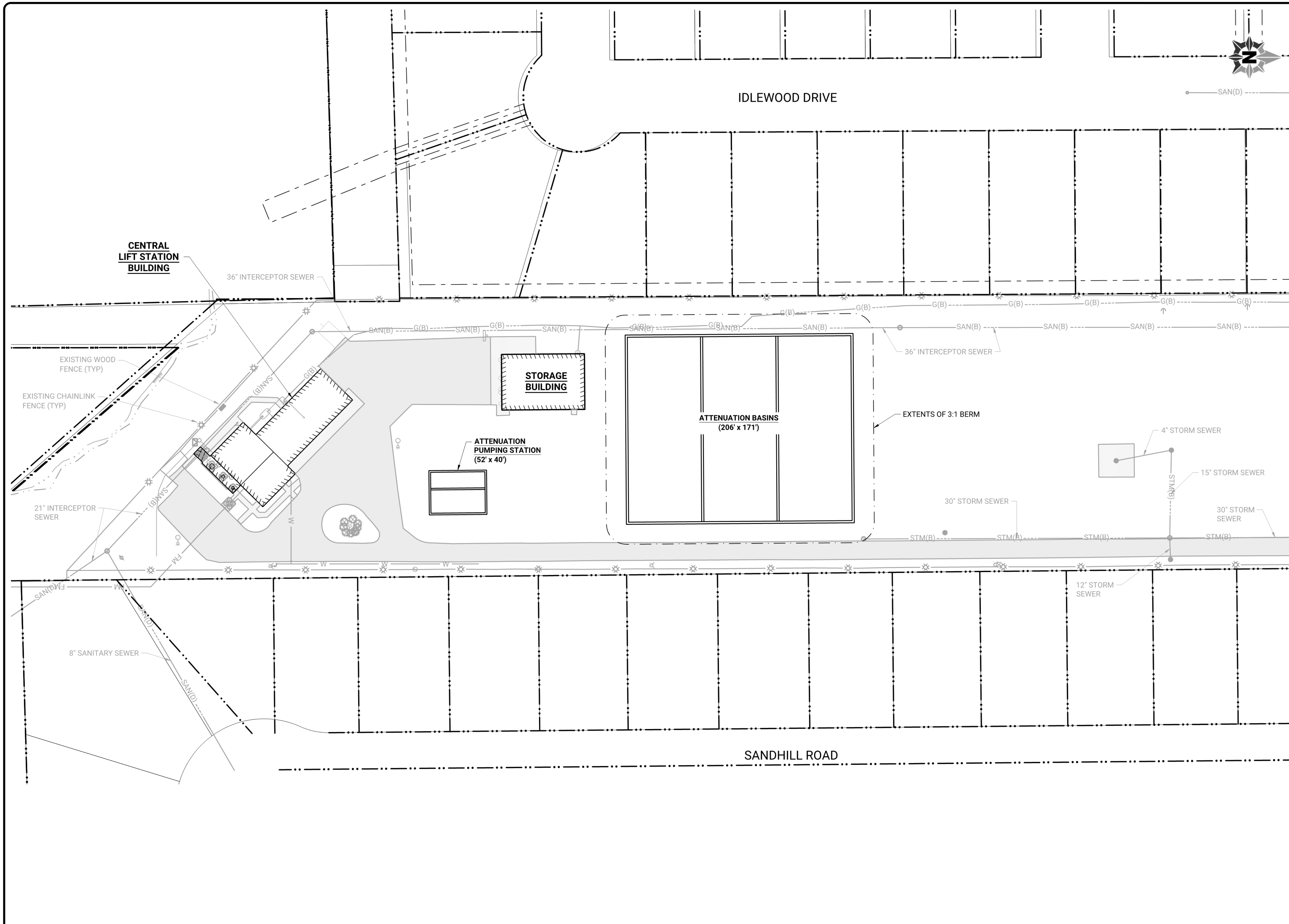

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PROPOSED SITE PLAN ALTERNATIVE A1

scale 0 40 80 feet

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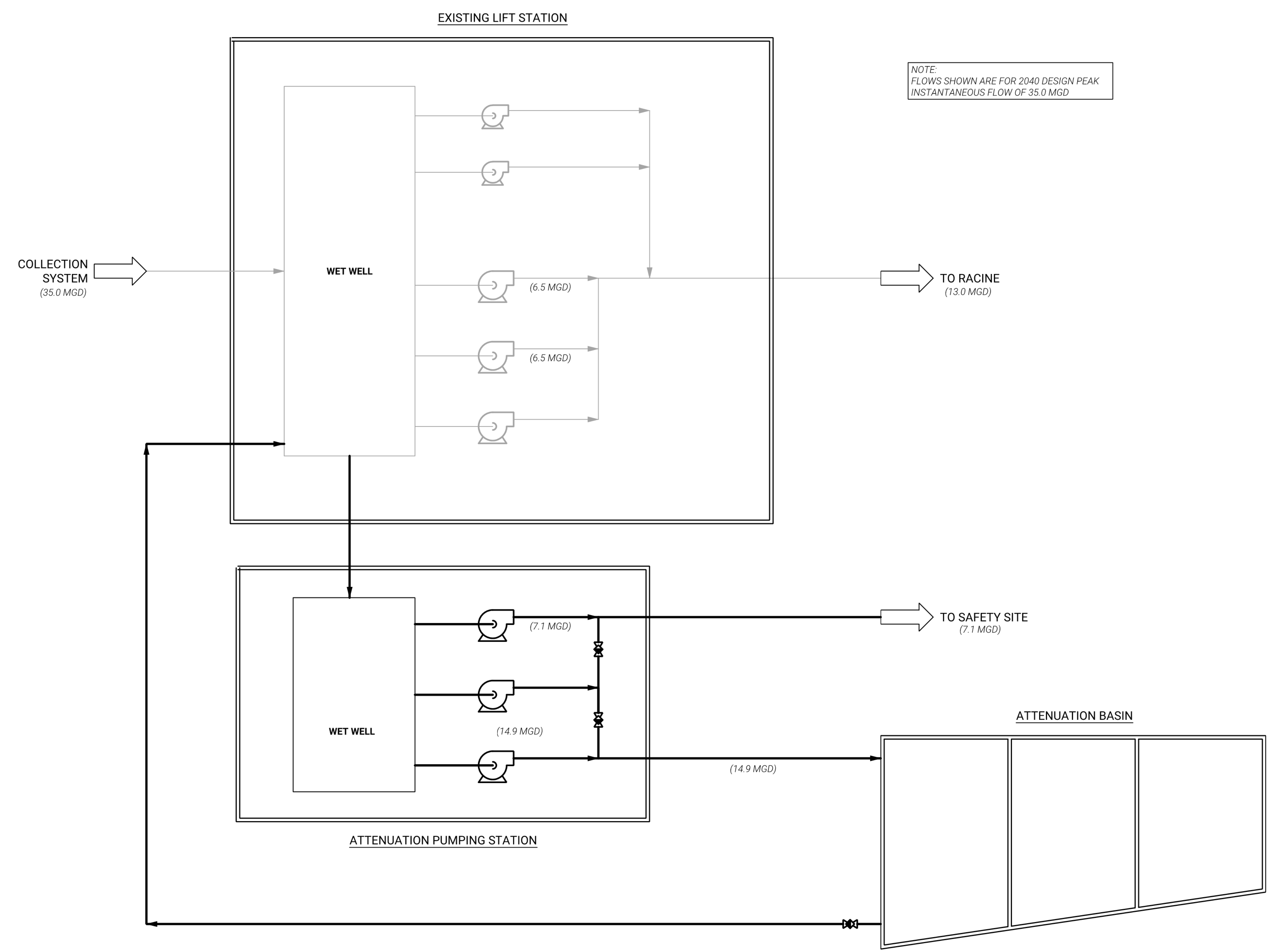
FIGURE 4-2



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PROCESS SCHEMATIC ALTERNATIVE A2

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FIGURE 4-3

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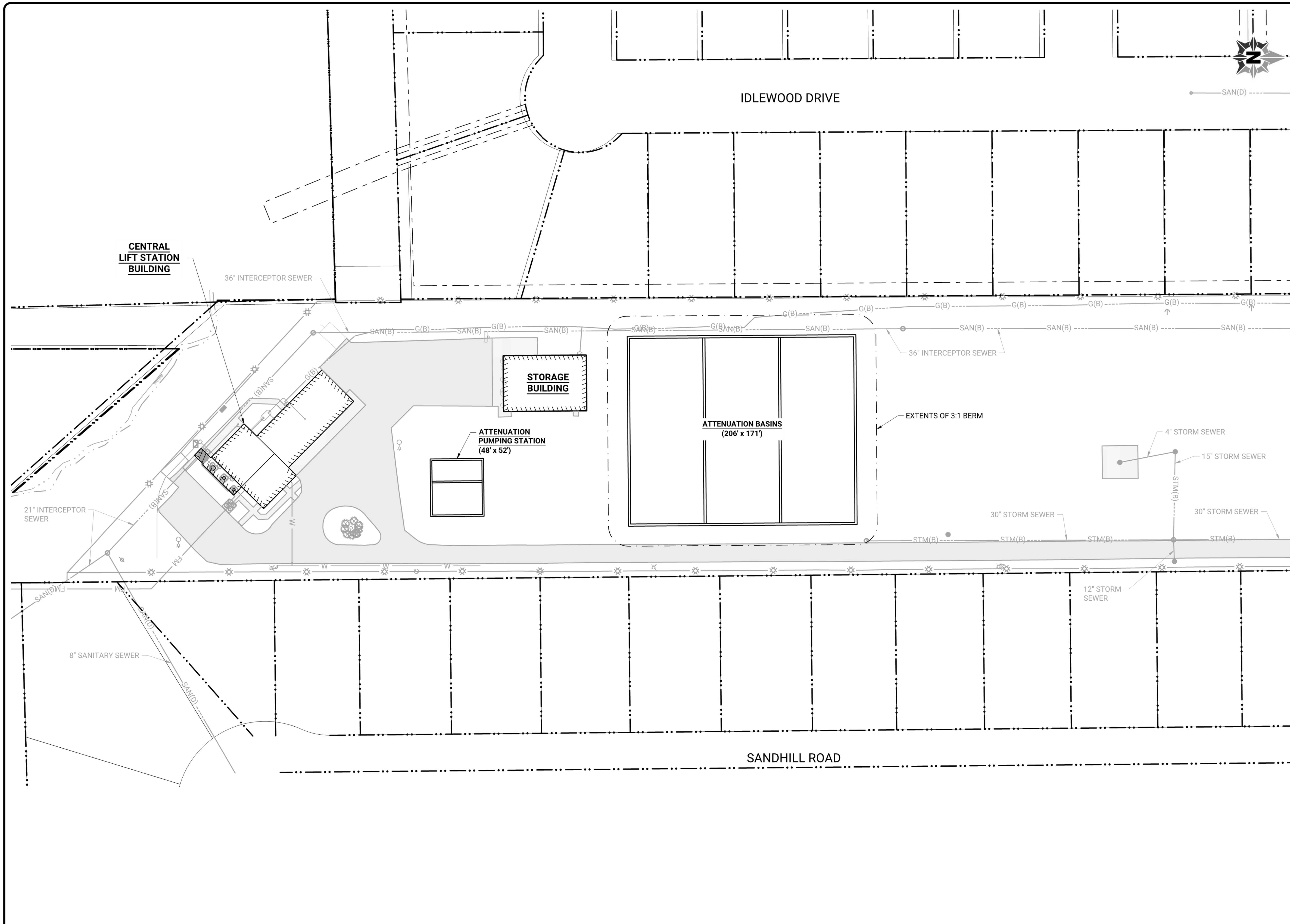

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PROPOSED SITE PLAN ALTERNATIVE A2

0 40 80
scale feet

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FIGURE 4-4

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4.3.3 Alternative B

Alternative B involves replacing the small pumps and the large pumps in the existing lift station with two sets of two new large pumps and adding an attenuation basin. One set of pumps would be designed around forward flow to Racine, and the other set would be designed around attenuation flow. The attenuation pumps would route flow into an attenuation basin with six consecutive channels. The basin would be constructed with the top slab above grade, with flow pumped in and draining by gravity back to the existing wet well. Excess flow would be pumped using either of the two types of pumps, or both if flows dictate, through the safety site pipeline.

The two forward flow pumps would be able to deliver 9,000 gpm (13.0 MGD) each to Racine when operating alone, which is just under the CUD's capacity allocation for the Central Lift Station. Thus, one would act as a duty pump and one as a standby. The forward flow pumps are theoretically able to turn down to 1,000 gpm (1.4 MGD) and the lift station will cycle on and off below that flow rate. However, this flow produces a velocity of less than 0.5 ft/s in the force main and therefore it is not ideal to operate this low.

As flows increase beyond 13.0 MGD, the attenuation pumps would be activated to pump from the existing lift station wet well to the attenuation basin. One attenuation pump can deliver up to 10,400 gpm (14.9 MGD) to the attenuation basin for storage. With the attenuation pump operating at capacity, the total flow rate to the Central Lift Station is 27.9 MGD, which is just above the 2040 5-year storm peak flow – occurring during a storm with a duration of six hours. Under this scenario, and for the 12-hour storm (the design storm for basin storage), the level of service is met.

If flow increases beyond 27.9 MGD, the safety site would be activated. Through the use of motorized valves, the second attenuation pump would be used to pump up to an additional 5,000 gpm (7.1 MGD) through the safety site force main. The total flow at this point would be 35.0 MGD, which is the design peak instantaneous flow rate. Note that if flows exceed this, the second forward flow pump can produce additional flow beyond design capacity. At the peak instantaneous flow rate, the second forward flow pump serves as the redundant pump, as it can produce the necessary flow to the safety site as well. All pumps operate from a common header and are separated by motorized valves.

If flows remain above 13.0 MGD once the attenuation basin is full, the safety site would remain active. The worst case scenario is for the 2040 peak instantaneous event, in which the attenuation basin fills after seven hours and the influent flow is approximately 32.5 MGD. Under this condition, two attenuation pumps would combine to produce up to 13,500 gpm (19.5 MGD) to the safety site. Note that one forward flow pump can operate in parallel with one attenuation pump to the safety site in the event that one attenuation pump is out of service. As flow receded, one pump would shut down followed by the other below 13.0 MGD influent flow. Once the event passes, the attenuation basin would be drained and cleaned.

Figure 4-5 shows the process schematic for Alternative B and Figure 4-6 shows the proposed site plan for Alternative B. Refer to Appendix C for sample pump curves.

4.3.4 Alternative C

Alternative C involves replacing the large pumps in the existing lift station with three unique large pumps and adding an attenuation basin. One pump would be designed around forward flow to Racine, one pump would be designed around safety site flow, and one pump would be capable of either service. Wastewater would flow by gravity from the existing lift station wet well into an attenuation basin with six consecutive channels. The basin would be constructed with the top slab well below grade, with flow entering by gravity and being pumped back to the existing wet well by a separate pumping station.

At flows up to 3,100 gpm (4.5 MGD), the lift station would utilize the existing small pumps. As flow into the existing lift station increases beyond 3,100 gpm, pumping would transition to the new forward flow pump. The forward flow pump can deliver 9,000 gpm (13.0 MGD) to Racine, which is just under the CUD's capacity allocation for the Central Lift Station.

As flows increase beyond 13.0 MGD, wastewater would overtop a weir and flow by gravity from the existing lift station wet well to the attenuation basin. As this flow is not pumped, the rate is irrelevant with respect to the conveyance system.

Once the attenuation basin is full, the safety site would become active. The worst case scenario is for the 2040 peak instantaneous event, in which the attenuation basin fills after seven hours and the influent flow is approximately 32.5 MGD. Under this condition, the safety site pump would produce up to 13,500 gpm (19.5 MGD) to the safety site. As flow receded below 13.0 MGD influent flow, the safety site pump would shut down. Once the event passes, the attenuation basin would be drained and cleaned.

A swing pump would be installed that could pump either to Racine or to the safety site. Motorized valves on the common header would facilitate the use of this pump. Thus, if either duty pump is out of service, the capacity of the lift station for all services can be maintained.

Figure 4-7 shows the process schematic for Alternative C and Figure 4-8 shows the proposed site plan for Alternative C. Refer to Appendix C for sample pump curves.

4.4 Safety Site Conveyance Alternatives Analysis

The rehabilitated Central Lift Station will include a safety site to accommodate flows in excess of the level of service established by the WDNR. Four alternatives were evaluated: discharge to a new outfall immediately behind the lift station, discharge through the existing 30-inch storm sewer at the lift station site to the existing outfall on a natural drainage ditch tributary to Lake Michigan, and new pressure and gravity conveyance along a route parallel to, and within the right-of-way of, the existing 30-inch storm sewer. The alternative of discharging to an outfall immediately behind the lift station was rejected due to its proximity to the adjacent residential properties. The capacity of the existing storm sewer was analyzed in subsection 4.1 and determined to be inadequate for conveying both stormwater and safety site discharge simultaneously, and thus this alternative is not viable. The two alternatives selected for further evaluation are the gravity and pressure conveyance alternatives, which both use new pipe, follow the alignment of the existing storm sewer, and discharge near the storm sewer outfall.

Figure 4-9 shows the safety site conveyance route, which is the same for both alternatives.

4.4.1 Gravity Conveyance Alternative

The Gravity Conveyance Alternative involves using lift station or attenuation pumps to discharge safety site flow to a gravity sewer system that runs from the Central Lift Station site to the outfall as shown on Figure 4-9. The lift station would pump to a manhole at the beginning of the route, and the sewer would terminate at a cast-in-place discharge structure located along the drainage ditch. The sewer would be installed by open cut, with the bury depth dictated by grade along the route and the minimum self-cleaning slope for the selected pipe size.

4.4.2 Pressure Conveyance Alternative

The Pressure Conveyance Alternative involves using lift station or attenuation pumps to discharge safety site flow through a force main that runs from the Central Lift Station site to the outfall as shown on Figure 4-9. The lift station would pump flow through the force main to a manhole located at the high point of the route, which is within 250 ft of the drainage ditch. From the discharge manhole, a gravity sewer would carry flow to a cast-in-place discharge structure located along the drainage ditch. The force main would be installed by directional drilling and would be routed such that no air release valves would be required.

4.5 Cost Effective Analysis

4.5.1 General Cost Effective Analysis Information

This section of the facilities plan provides an evaluation of the cost effectiveness of the various alternatives identified in Sections 4.3 and 4.4. In order to make a cost-effective comparison between selected alternatives, it is necessary to prepare preliminary designs. These preliminary designs are based on consideration of future design wastewater flows, standard wastewater engineering practices, and Wisconsin Administrative Code requirements.

Chapter NR110 of the Wisconsin Administrative Code indicates that the cost effective analysis for attenuation basins should include an evaluation of the potential for staging of the proposed upgrades. For design flows greater than 1.8 times the initial flow, NR110 indicates that a maximum initial staging period of 10 years should be used.

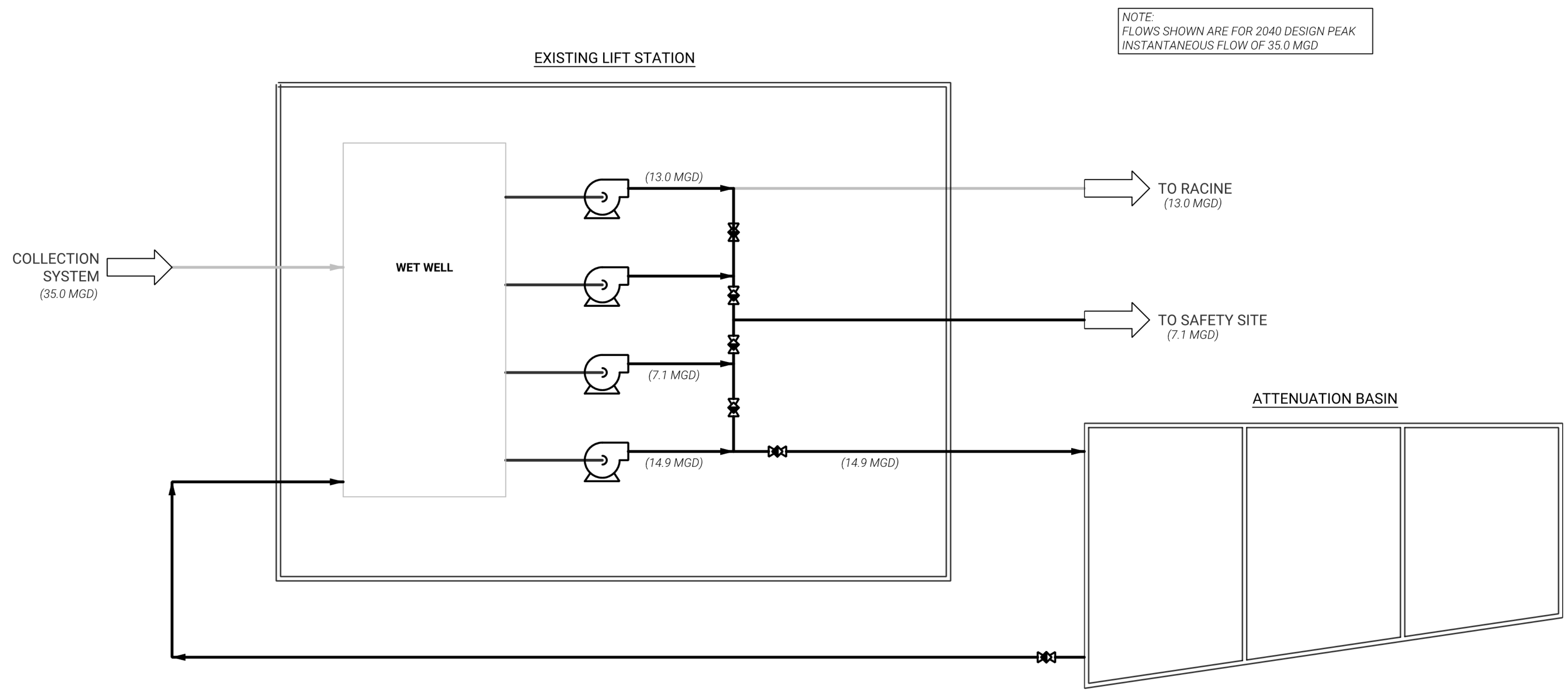

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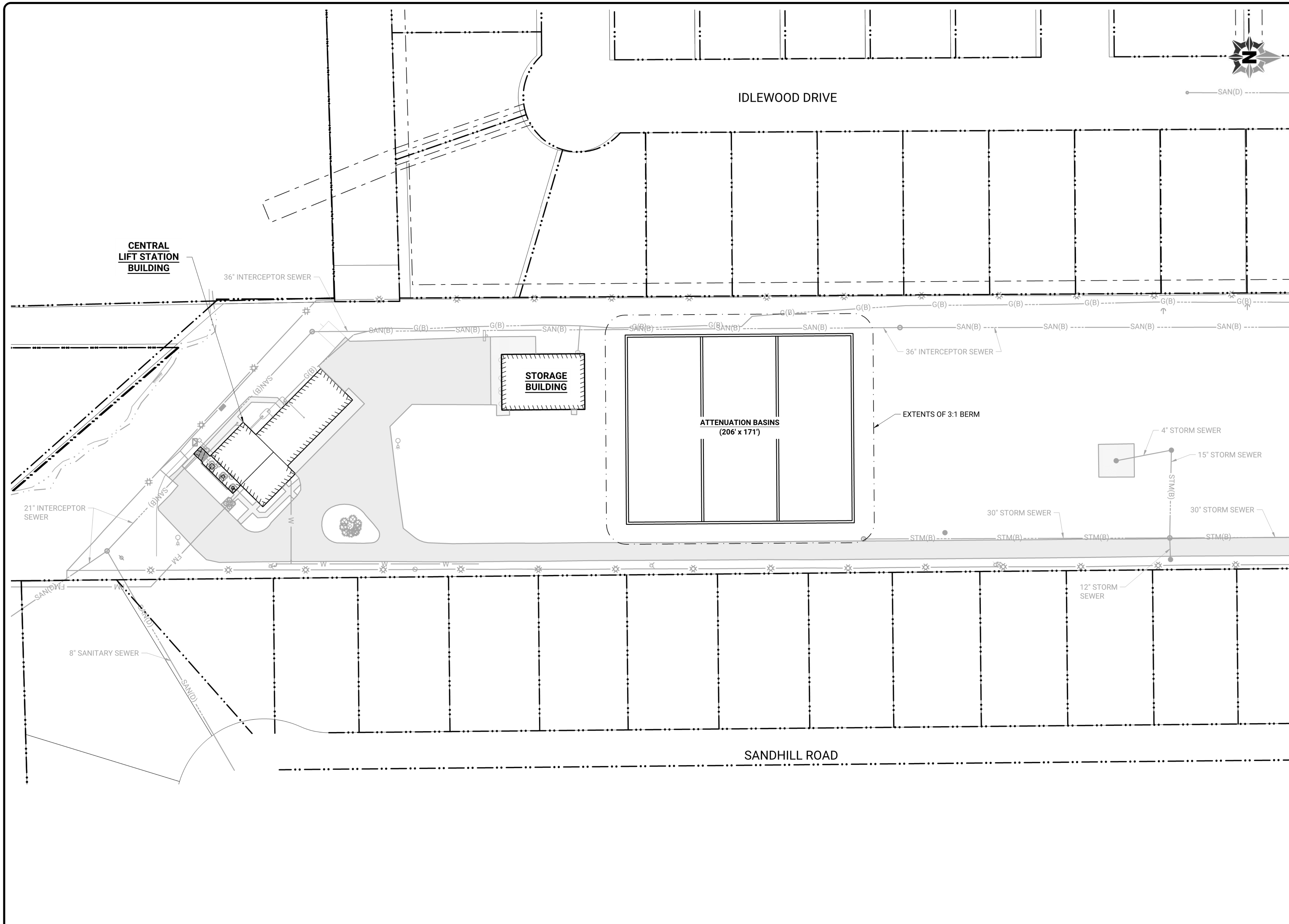
FIGURE 4-5



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BY ______ DATE ______

DATE OF PREPARATION

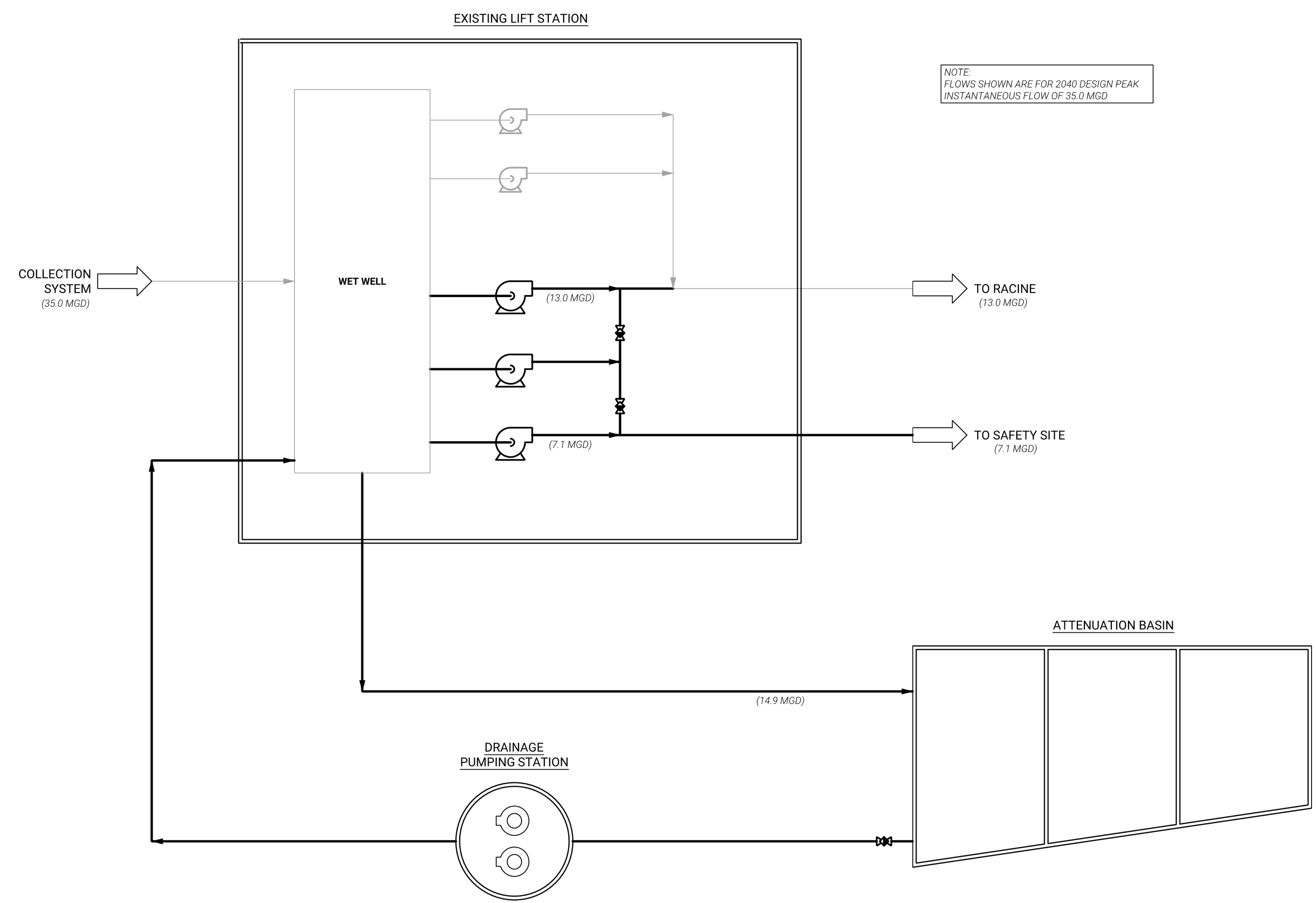
	BY	DATE
SURVEYED		
DRAWN	PCG	8/13/2021
DESIGNED	MJE	8/13/2021
CHECKED	.	.

PROPOSED SITE PLAN ALTERNATIVE B

0 40 80
scale feet

PROJECT ID 20C030.09

FIGURE 4-6



Foth Infrastructure & Environment, LLC
7044 S. Ballpark Drive, Suite 200
Franklin, WI 53132
Phone: 414-336-7900 Fax: 414-336-7901

FACILITIES PLAN FOR CENTRAL LIFT STATION AND ATTENUATION BASIN

CALEDONIA UTILITY DISTRICT

VILLAGE OF CALEDONIA, WISCONSIN

RACINE COUNTY

REVISION / ISSUE

NO.	BY	DATE	DESCRIPTION
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DATE OF PREPARATION

	BY	DATE
SURVEYED		
DRAWN	PCG	8/13/2021
DESIGNED	MJE	8/13/2021
CHECKED	.	.

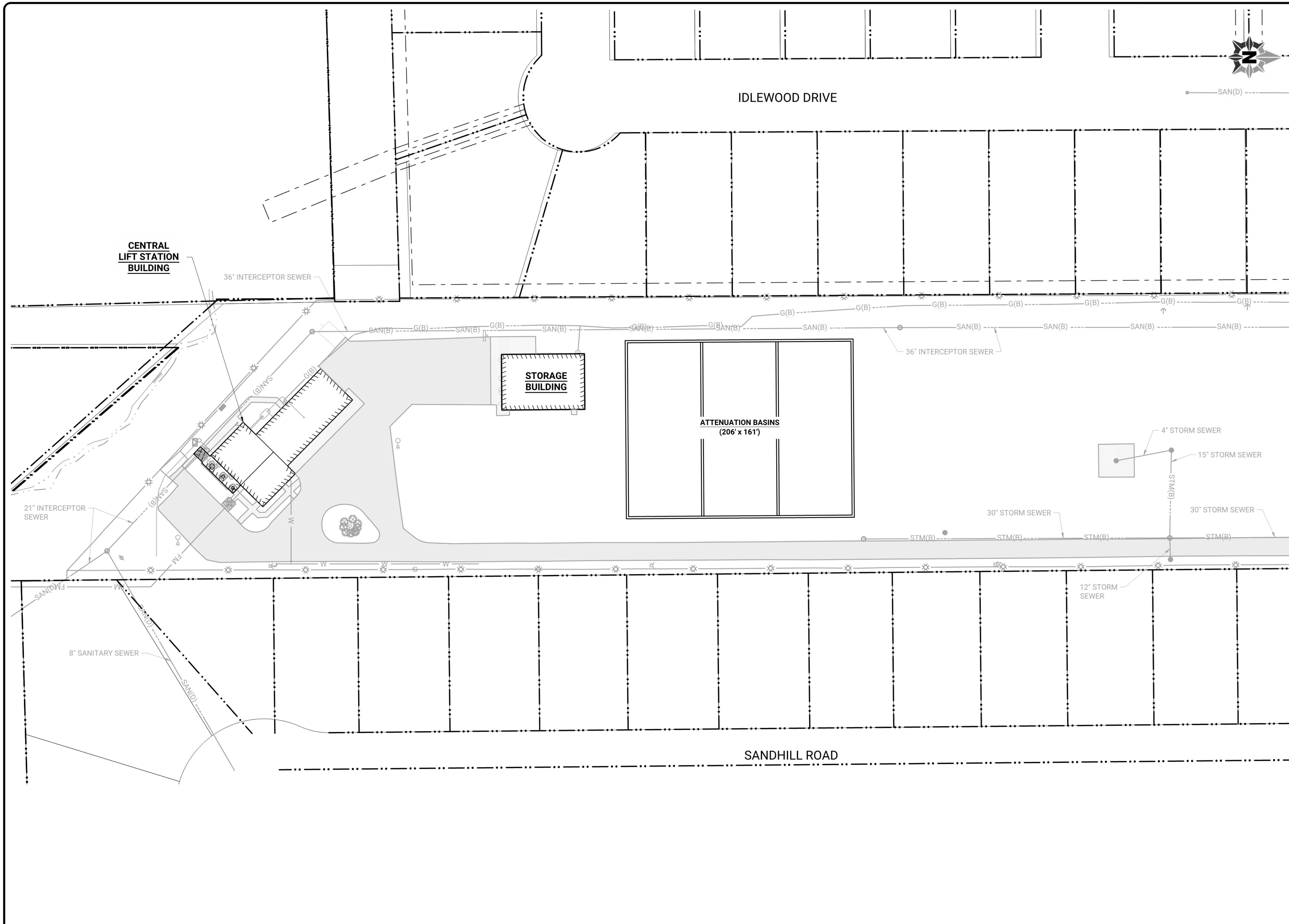
PROCESS SCHEMATIC ALTERNATIVE C

.

PROJECT ID 20C030.09

FIGURE 4-7

Aug 13, 2021 - 10:17am pcg C:\pw_workdir\pw_ie\fvd_pcg\d0453654\Figure 4-7.dwg



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FACILITIES PLAN FOR CENTRAL LIFT STATION AND ATTENUATION BASIN

CALEDONIA UTILITY DISTRICT

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DATE OF PREPARATION

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DRAWN	PCG	8/13/2021
DESIGNED	MJE	8/13/2021
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PROPOSED SITE PLAN ALTERNATIVE C

.

0 40 80
scale feet

PROJECT ID 20C030.09

FIGURE 4-8

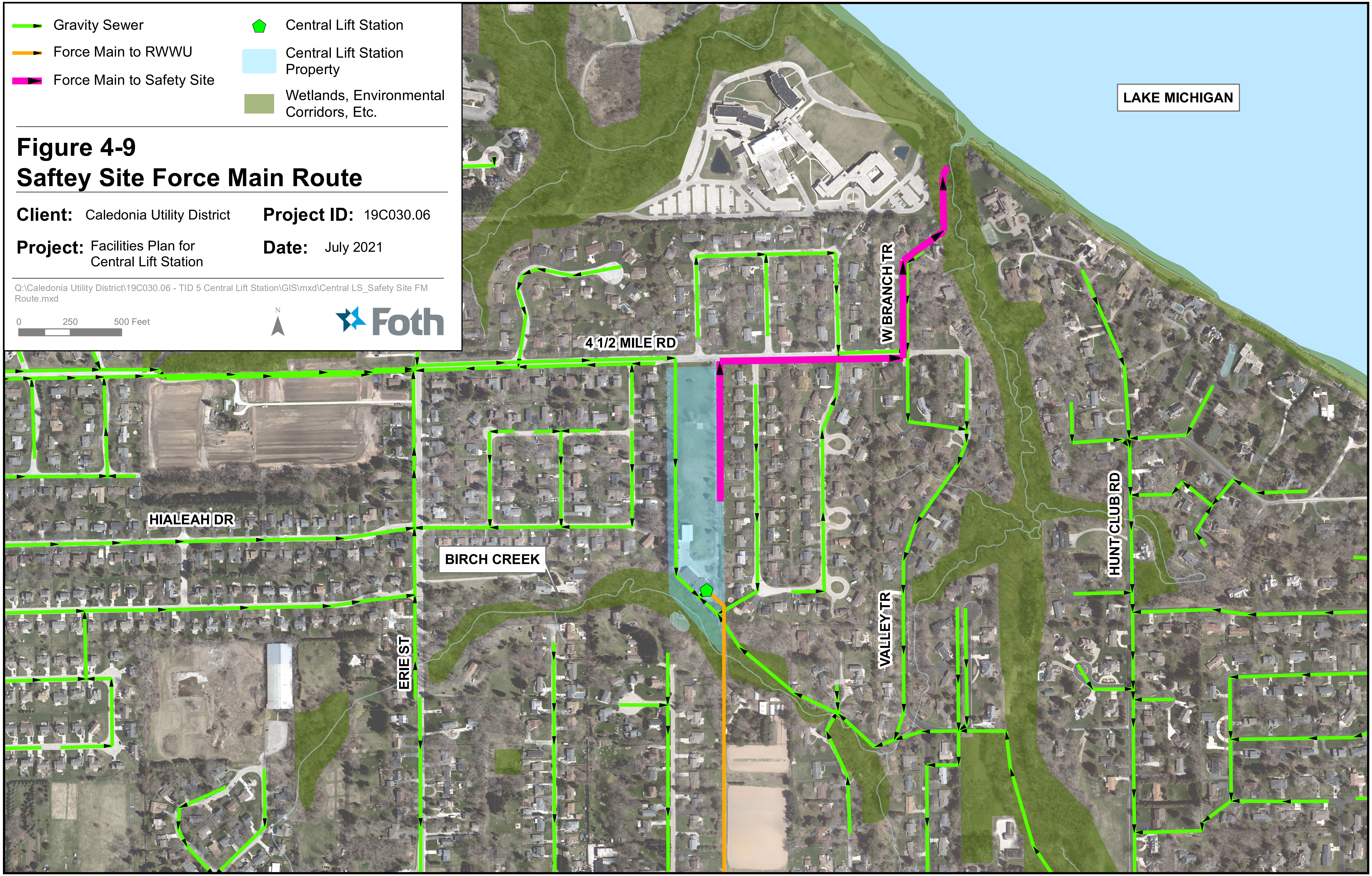


Figure 4-9
Saftey Site Force Main Route

Client: Caledonia Utility District **Project ID:** 19C030.06

Project: Facilities Plan for Central Lift Station **Date:** July 2021

Q:\Caledonia Utility District\19C030.06 - TID 5 Central Lift Station\GIS\mxd\Central LS_Safety Site FM Route.mxd

4.5.2 Total Present Worth Cost Analysis

Specific alternatives were evaluated using the total present worth analysis (TPW) method to compare total costs over a 20-year design period. The interest rate used in this evaluation was 3.125-pecent; this is the current discount rate for wastewater system facilities planning as published on the WDNR website for the 2021 fiscal year.

A detailed cost effectiveness analysis is provided for each alternative evaluated. The detailed cost estimate analyses are located in Appendix D. The analyses include capital costs, replacement costs, salvage values and operation and maintenance costs. Capital costs were estimated based on budget quotes from equipment vendors, installation costs, quantity take-offs using typical unit prices, and miscellaneous bid costs as seen on previous projects. Replacement costs reflect replacement of mechanical portions or components of a particular process that will require replacement within the design life of the project. Salvage value costs reflect the portion of useful life which will remain at the end of the 20-year design period. Operation and maintenance costs include power, labor, and O&M. These were estimated based on vendor information, wastewater industry experience, and other guidelines.

The present worth of the replacement, salvage value, and operation and maintenance costs were calculated using a 3.125-percent discount rate. These present worth costs were then added to the estimated capital, legal, engineering, administrative, and contingency costs to provide the total present worth of each alternative for the 20-year design period. This format and methodology was used for all cost-effective comparisons presented in this facilities plan.

The following sections of this facilities plan provide the cost effectiveness analyses for the various alternatives evaluated. Note that a cost effective analysis was conducted only where more than one alternative was identified in Sections 4.3 and 4.4 of this facilities plan.

Additional lift station upgrades, which will be recommended in this facilities plan but for which practical alternatives were not available or considered, are identified in Section 5.2.

4.5.2.1 Combined Alternatives Evaluation

The four combined alternatives for pumping and storage were evaluated based on a 20-year total present worth cost basis. The summarized totals for each alternative are shown in Table 4-3. The cost estimate worksheets for each alternative are located in Appendix D.

Alternative A1 evaluated constructing a new attenuation basin and pumping station as well as modifications to the existing lift station, including to the wastewater pumping system. The attenuation pumping station consists of a 52 ft x 24 ft x 34 ft deep wet well/dry well, an electrical room, a generator room, and a mechanical room. The standby generator was estimated to be 165 kW. Two attenuation pumps are included, each designed for 10,400 gpm at 39 ft with 150 HP motors. Other components include pump valves, motorized actuators, magnetic flow meters, and a bridge crane. The attenuation basin is above grade with pumped flow in and gravity flow out. The configuration is consecutive channels, with a total of six 32-foot wide channels and twelve flushing gates. The approximate inner dimensions of the basin are 167 ft long x 202 ft wide x 21 ft deep. The bury depth is six feet above surrounding grade with 18 inches of soil cover; a 3:1 berm surrounds the tanks. In the existing lift station, the small pumps will be retained and the large pumps will be replaced by three pumps each designed for 7,000 gpm at 99 ft TDH with 250 HP motors. The piping system will be replaced and a new bridge crane will be added. A new 550 kW generator will also be installed. Modifications to the existing building and wet well will be required to facilitate large pump replacement. Modifications to the building and support systems are included as well. Operation and maintenance costs include forward flow pump energy usage and attenuation pump O&M and labor.

Alternative A2 evaluated constructing a new attenuation basin and pumping station as well as modifications to the existing lift station, although none relating to wastewater pumping. The attenuation pumping station consists of a 48 ft x 32 ft x 34 ft deep wet well/dry well, an electrical room, a generator room, and a mechanical room. The standby generator was estimated to be 330 kW. Three attenuation pumps are included, each designed for 10,400 gpm at 39 ft TDH with 150 HP motors. Other components include pump valves, motorized actuators, magnetic flow meters, and a bridge crane. The attenuation basin is above grade with pumped flow in and gravity flow out. The configuration is consecutive channels, with a total of six 32-foot wide channels and twelve flushing gates. The approximate inner dimensions of the basin are 167 ft long x 202 ft wide x 21 ft deep. The bury depth is six feet above surrounding grade with 18 inches of soil cover; a 3:1 berm surrounds the tanks. In the existing lift station, all wastewater pumps and piping will be retained. A new 330 kW generator will be installed. Modifications to the building and support systems are included as well. Operation and maintenance costs include forward flow pump energy usage and attenuation pump O&M and labor.

Alternative B evaluated constructing a new attenuation basin as well as modifications to the existing lift station, including to the wastewater pumping system. The attenuation basin is above grade with pumped flow in and gravity flow out. The configuration is consecutive channels, with a total of six 32-foot wide channels and twelve flushing gates. The approximate inner dimensions of the basin are 167 ft long x 202 ft wide x 21 ft deep. The bury depth is six feet above surrounding grade with 18 inches of soil cover; a 3:1 berm surrounds the tanks. In the existing lift station, all wastewater pumps will be replaced: two forward flow pumps will be designed for 9,000 gpm at 119 ft TDH with 400 HP motors and two attenuation pumps will be designed for 10,400 gpm at 39 ft TDH with 150 HP motors. The piping system will be replaced and a new bridge crane will be added. A new 770 kW generator will also be installed. Modifications to the existing building and wet well will be required to facilitate large pump replacement. Modifications to the building and support systems are included as well. Operation and maintenance costs include forward flow pump energy usage only.

Alternative C evaluated constructing a new attenuation basin and drainage pumping station as well as modifications to the existing lift station, including to the wastewater pumping system. The attenuation basin is below grade with gravity flow in and pumped flow out. The configuration is consecutive channels, with a total of six 32-foot wide channels and twelve flushing gates. The approximate inner dimensions of the basin are 157 ft long x 202 ft wide x 20 ft deep. The bury depth is 20.5 feet below surrounding grade to the top slab. The drainage pumping station is a 12-foot diameter precast concrete structure that is 56 feet deep. Two submersible pumps are installed in the station, each capable of 1,400 gpm. In the existing lift station, the small pumps will be retained and the large pumps will be replaced by three unique pumps: the forward flow pump will be designed for 9,000 gpm at 119 ft TDH with a 400 HP motor, the safety site pump will be designed for 13,500 gpm at 29 ft TDH with a 125 HP motor, and the swing pump will be designed for both conditions and because of that require a 600 HP motor. The piping system will be replaced and a new bridge crane will be added. A new 800 kW generator will also be installed. Modifications to the existing building and wet well will be required to facilitate large pump replacement. Modifications to the building and support systems are included as well. Operation and maintenance costs include forward flow pump energy usage only.

Table 4-3
Combined Alternatives Total Present Worth
Central Lift Station

Alternative	Capital Cost	Annual O&M Cost	Total Present Worth
Alternative B	$22,720,000	$69,700	$22,630,000
Alternative A2	$23,020,000	$83,600	$22,850,000
Alternative A1	$25,450,000	$78,600	$25,290,000
Alternative C	$31,140,000	$58,200	$30,330,000

Table 4-3 is arranged by total present worth, from least to most value. The most cost-effective option was estimated to be Alternative B. Conclusions and discussions for the recommended alternative are included in Section 5.1.1.

4.5.2.2 Safety Site Conveyance Alternatives Evaluation

Two methods of safety site flow conveyance were evaluated based on total capital cost. Total present worth was not used as a basis of comparison as operation and maintenance and salvage costs for both alternatives would be approximately equal. Due to the infrequent use of this system, O&M considerations such as cleaning, odor control chemical feed, if any, and pump power usage do not factor in to the analysis. The total costs for each alternative are shown in Table 4-4. The cost estimate worksheets for each alternative are located in Appendix D.

The Gravity Conveyance Alternative evaluated constructing a gravity sewer system from the Central Lift Station to the outfall. The sewer size is 54-inch and the material is fiberglass reinforced polymer mortar pipe (FRPMP). Bury depths range up to 20 ft. The route includes nine manholes ranging from 84 – 108 inches in diameter.

The Pressure Conveyance Alternative evaluated constructing a force main from the Central Lift Station to a manhole just upstream of the outfall, with gravity conveyance for the final segment. The force main size is 24-inch and the material is HDPE. The bury depth was estimated to be constant at 8 ft and the route length is approximately 2,000 ft. The first 700 ft of the route is on site and will be open-cut. A 1,300 ft segment of directional drilling through the neighborhood follows. The force main terminates at a 60-inch manhole at the route high point and transitions to gravity sewer for the final 250 ft. The gravity sewer size is 54-inch and the material is FRPMP. The route highpoint is located at the edge of the drainage ditch and the grade falls steeply to the discharge structure location.

Table 4-4
Safety Site Conveyance Alternatives Total Capital Cost
Central Lift Station

Alternative	Total Capital Cost
Pressure Conveyance Alternative	$1,520,000
Gravity Conveyance Alternative	$2,840,000

The most cost-effective option shown in Table 4-4 is the Pressure Conveyance Alternative. Conclusions and discussions for the recommended alternative are included in Section 5.1.2.

5 Recommendations

5.1 Cost Effective Analysis

The following section provides conclusions for the recommended alternatives, based in part on the total present worth cost analysis from Section 4.5. The present worth of the replacement, salvage value and operation and maintenance costs were calculated using a 3.125-percent discount rate for the 20-year design period. This format and methodology was used for all cost-effective comparisons presented in this facilities plan. Note that a cost effective analysis was conducted only where more than one alternative was identified in Section 4 of this facilities plan.

Additional lift station upgrades recommended in this facilities plan, but for which practical alternatives were not available or considered, are discussed in Section 5.2.

5.1.1 Combined Alternatives Analysis Conclusions

Table 4-3 is arranged by total present worth, from least to most value. The least expensive option was estimated to be Alternative B, however, Alternatives B and A2 were within 10-percent of each other, and for cost estimation purposes can be considered equal. Alternatives A1 and C were in excess of 10-percent of the lowest TPW alternative and will not be considered further.

The preferred alternative is Alternative A2, which includes a new three-pump attenuation pumping station, an above-grade, pumped in, gravity out attenuation basin, and no changes to the existing wastewater pumping system in the existing lift station. The primary advantage of Alternative A2 is that the District can retain the existing wastewater pumps, which have years of service life remaining. Of all the alternatives, A2 requires the least complicated operating sequence and generally has as much or more pumping redundancy than the other alternatives. Construction will be simplified as well, as the existing lift station does not need to be taken out of service except to connect the transfer pipe between the existing and attenuation wet wells. The only significant disadvantage of Alternative A2 is that O&M and labor will increase as a new lift station is being added. However, these values are not comparable to a lift station that is operating continuously.

Alternative B has the lowest total present worth of all the alternatives, but in fact is only lower than Alternative A2 by 0.5-percent. The primary advantage of this alternative is that a second lift station does not need to be constructed. However, retrofitting the existing lift station to house four larger pumps will involve a complicated and expensive construction sequence that may result in unexpected costs. The true cost of this process can only be fully evaluated during a detailed design. For example, the existing bridge crane would need to be replaced and the floor openings cut larger to remove the pumps. Yet it is possible that the existing floor cannot hold the heavier components of the new pumps or would not withstand larger openings being cut into it. For these reasons, Alternative B is not recommended.

Alternative A1 is the next lowest in total present worth. This alternative is similar to Alternative A2 but requires some of the existing lift station modifications required of Alternative B, thus driving up the cost. It is a viable alternative but involves a complicated sequence of operation. Alternative C is not cost effective and may not be feasible to construct on the site. Gravity flow into the basins is ideal as the system could activate even during loss of power, however, it would be difficult to determine the portion of the influent flow that needs to be routed to the safety site during the peak flow event; this would require an influent flow meter or larger pumps than presented herein. For these reasons, Alternatives A1 and C are not recommended.

5.1.2 Safety Site Conveyance Alternatives Analysis Conclusions

The least expensive option was estimated to be the Pressure Conveyance Alternative, which is significantly less in cost than the Gravity Conveyance Alternative. This is due primarily to the pipe size and bury depth required for the Gravity Conveyance Alternative, as well as associated restoration costs. As mentioned previously, typical O&M considerations that would disproportionately impact force mains, such as cleaning, odor control chemical feed, and pump power usage were not considered here due to the infrequent use of the safety site conveyance system.

5.2 Construction Phasing

The recommended upgrades include a 3.6 MG attenuation basin, an attenuation and safety site pumping station, and a force main to the safety site outfall. The planning period is 20 years, to approximately the year 2040, at which time the Central Lift Station SSA is expected to near ultimate build-out. It is recommended that the proposed project involve construction of the attenuation lift station and full attenuation basin. Phasing construction of the attenuation basin would create losses in economy of scale, and the design period is only 20 years. However, the attenuation basin consists of six channels and could be constructed in two or three phases if funding is not available for the full project. The lift station structure cannot be phased, and two attenuation pumps are required for redundancy. The attenuation basin is needed to meet level of service requirement established by the WDNR.

The safety site components of the proposed design include the force main, outfall, and third attenuation pump. The current peak hour flow at the lift station is approximately 15 MGD. The attenuation pumping station will be designed for a peak flow rate of approximately 28 MGD, or nearly double the measured current peak hour flow rate. The ultimate design flow for the safety site is 35 MGD. It is unlikely that peak flows will approach 28 MGD sooner than 10 years from now, or that volumes in excess of 3.6 MG will need to be stored, and up until that time the attenuation basin can be used to capture all flow exceeding the current flow allocation. Adding the force main, outfall, and third pump in the future would not pose phasing or construction challenges. It is therefore recommended that the safety site components be constructed in the future once observed peak flows demonstrate the need for safety site improvements. If the full attenuation basin is not constructed with the initial project, however, the safety site force main should be reconsidered for inclusion in the initial project.

5.3 Future Expansion

The attenuation and safety site processes were sized based on 2040 projected flow rates. Based on current development within the SSA and projected growth, it is estimated that the SSA will reach ultimate build-out around the year 2040. Therefore, it is not anticipated that future expansion of the attenuation and safety site processes will be needed to meet the required level of service. However, the proposed project will be designed such that an additional attenuation basin will fit on the site. The proposed basin would overflow through a pipe to the future basin. A future basin of the same size and capacity as the proposed basin would fit on the site, although it would need to be drained with a separate pipe.

To accommodate increased storage, it is likely that the attenuation pumping station capacity would need to be increased. If the station has been expanded to three pumps, that should be sufficient for future peak flows. A third lift station could then be constructed for safety site flows. Alternatively, the capacities of the pumps could be increased to match future demand or additional pumps could be added. Due to the low probability that this second expansion would ever be needed, the proposed attenuation pumping station layout will not provide space for future pumps. The structure will be designed such that additional wet well and dry well space could be added in the future.

As mentioned previously, an odor control system will not be included with the recommended upgrades. However, provisions will be made for the addition of an odor control system in the future if deemed necessary. The odor control system is expected to be a vertical bed, horizontal flow unit or a radial flow unit; both systems would utilize vapor phase treatment with activated carbon. The unit would consist of a pre-filter, fan, and media vessel and would be located outside adjacent to the lift station. The capacity of the system is estimated to be approximately 10,000 scfm.

Refer to Figure 5-1 for a site plan showing the recommended upgrades along with potential future expansion.

5.4 Lift Station Recommended Upgrades

5.4.1 Existing Facilities to Remain in Service

The existing wet well and lift station structure will be retained for continued use. The wet well is of adequate size and in good condition. The building is well maintained and in good condition, and as the pumps are not being replaced no changes to the building layout are required. Additionally, water and gas service to the building are adequate for future needs. The lift station site, including pavement, sidewalks, and landscaping, is in good condition and not in need of rehabilitation at this time.

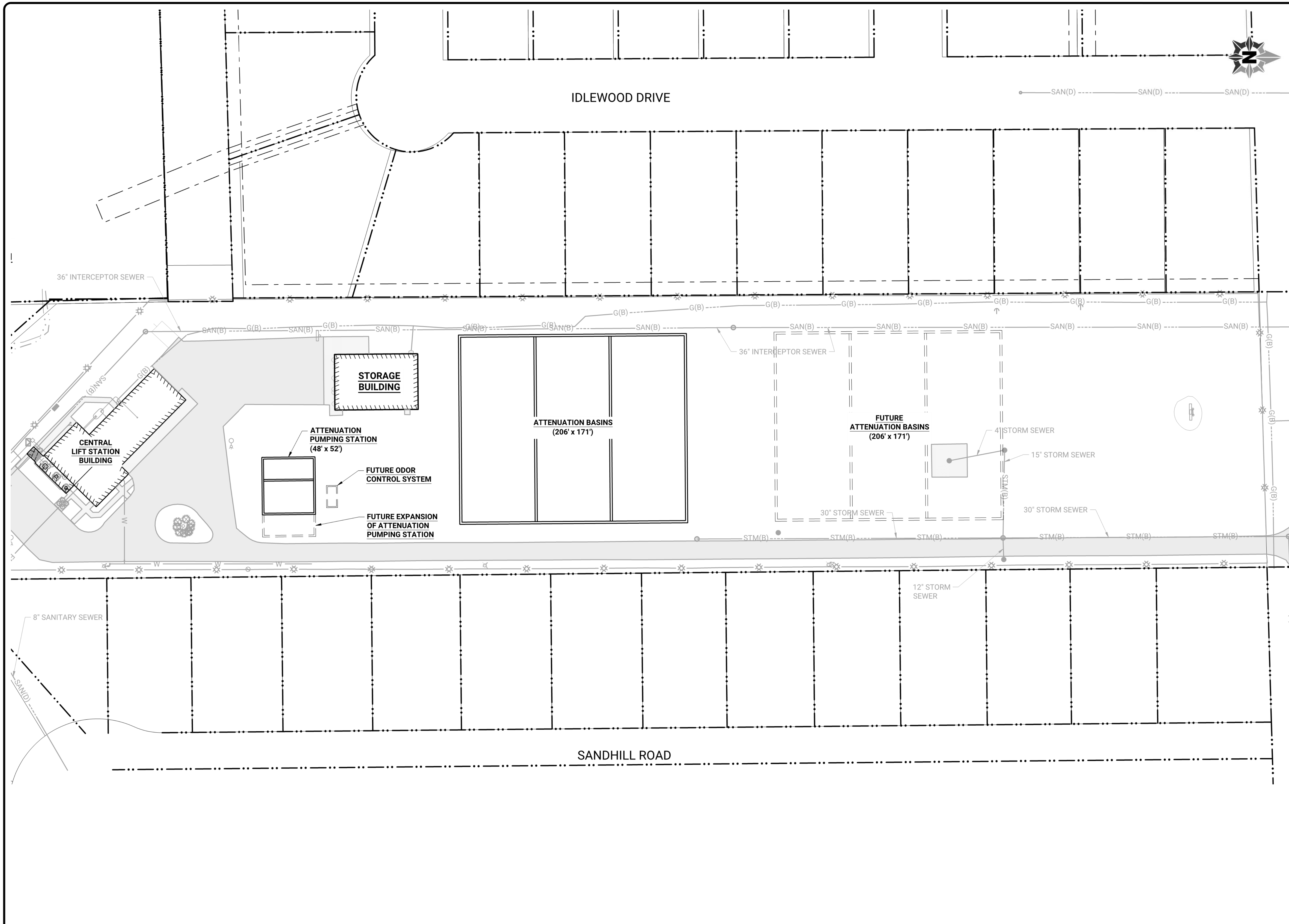
5.4.2 Recommended Rehabilitation

As a part of the rehabilitation, the lift station will receive new electrical controls and a new standby generator. The existing controls and generator have reached the end of their service life and will be replaced with current technology. The large pumps will be operated on VFDs. In addition, miscellaneous upgrades to the lighting, mechanical, and plumbing systems are accounted for.

Regarding the structure, approximately 450 ft^2 of office space will be added to the lift station building to provide staff with more administrative space. Miscellaneous architectural and structural upgrades are also accounted for. Access to the wet well is currently via manhole steps in the exterior wall. Costs were included for upgrading access to improve safety.

5.5 Environmental Analysis

An environmental analysis was not performed for the Central Lift Station site. All modifications proposed by this facilities plan will be within the existing structures, inside the site boundary, or within currently paved and landscaped areas. Additionally, this lift station does not meet the criteria outlined in Chapter NR 110.11(1)(g) for an environmental analysis.



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FACILITIES PLAN FOR CENTRAL LIFT STATION AND ATTENUATION BASIN

CALEDONIA UTILITY DISTRICT

VILLAGE OF CALEDONIA, WISCONSIN

RACINE COUNTY

REVISION / ISSUE

NO.	BY	DATE	DESCRIPTION
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BY: ______ DATE: ______

DATE OF PREPARATION

	BY	DATE
SURVEYED		
DRAWN	PCG	8/13/2021
DESIGNED	MJE	8/13/2021
CHECKED	.	.

RECOMMENDED ALTERNATIVE SITE PLAN WITH FUTURE EXPANSION

0 40 80
scale feet

PROJECT ID 20C030.09

FIGURE 5-1

6 Recommendations

6.1 Recommended Upgrades

The following upgrades are recommended as a part of the proposed project:

- Construct a new 3.6 MG buried concrete attenuation basin with automatic flushing gates.
- Construct a new 2,000 ft^2 attenuation pumping station building, including a wet well, pump room, electrical room, generator room, and mechanical room.
- Install two 10,400 gpm, 150 HP attenuation pumps.
- Install a 330 kW standby generator for the attenuation pumping station.
- Construct a 450 ft^2 addition to the existing lift station building for office space.
- Perform a condition assessment and capacity analysis for the existing large pumps.
- Replace the existing lift station electrical and controls systems and standby generator.
- Perform miscellaneous upgrades to the building and electrical, mechanical, and plumbing systems.
- Improve access to the existing wet well.

Figures 4-3 and 4-4 show a schematic representation and a site plan of the selected alternative, respectively. Raw wastewater flows into the lift station wet well and when flows exceed the allocated capacity, wastewater would overflow into the attenuation pumping station wet well. Attenuation pumps would be used to fill the attenuation basin, which would drain back to the lift station wet well by gravity after the storm event passes. Automatic flushing gates would be used to clean the attenuation basin after use. Note that Figure 4-3 includes a depiction of safety site infrastructure, which is not recommended for construction at this time.

6.2 Existing Facilities Retained for Continued Use

The following facilities are recommended to be retained for continued use in the 20-year design period:

- Wet well
- Wastewater piping
- Wastewater pumps
    - Expected to be replaced during the design period
- Bridge crane
- Lift station building
- Site features, including paving, fencing, and landscaping

6.3 Recommended Construction

The recommended project includes construction of a new attenuation pumping station and attenuation basin. The attenuation pumping station consists of a cast-in-place structure with a wet well, dry well, and two horizontal centrifugal pumps. The building includes a standby generator, as well as a generator room, electrical room, and mechanical room. The attenuation basin consists of six storage channels, each containing two flushing gates. The structure will be constructed of cast-in-place concrete and will rise above surrounding grade but be covered with soil. A berm will be use to blend the top of the tank into surrounding grade. No process modifications to the existing lift station will be made, however, the electrical, mechanical, and plumbing systems will be upgraded and additional office space will be added. The proposed site layout is provided in Figure 4-4.

6.4 Project Cost

Based on the cost evaluation performed as part of this facilities plan, the estimated total capital cost for the recommended project is $22,460,000. This is composed of costs for the attenuation basin, attenuation pumping station, and modifications to the existing lift station. The estimated construction cost, without contingency, is $16,040,000. Future projects would include the installation of the safety site outfall force main and the addition of a third attenuation pump, which would be used for safety site flows. A total present worth breakdown for the recommended project is provided in Appendix D.

7 Implementation of Recommended Plan

7.1 Implementation Schedule

The following schedule for implementation of the project is recommended:

♦ Submit Facilities Plan to RWWU and SEWRPC	October 2021
♦ Submit Facilities Plan to WDNR	December 2021
♦ Receive WDNR Approval of Facilities Plan	February 2022
♦ Conduct Facilities Plan Public Hearing	February 2022
♦ Begin Design	March 2022
♦ Submit Plans and Specifications to WDNR	October 2022
♦ Submit Clean Water Fund Application	October 2022
♦ Advertise for Bids	December 2022
♦ Receive WDNR Approval of Plans and Specifications	January 2023
♦ Open Bids	January 2023
♦ Award Contract	February 2023
♦ Begin Construction	March 2023
♦ Achieve Substantial Completion	July 2024
♦ Achieve Final Completion	September 2024

The current Racine RWWU Facilities Plan identifies numerous conveyance improvement projects and categorizes them as “near-term”, “mid-term”, and “long-term”. Wastewater storage at the Central Lift Station is Priority No. 4 in the conveyance system improvements recommendations and falls under “midterm”, which is indicated as being completed and in service between 2025 and 2030. However, the plan also notes that due to May 2020 storm events, which produced high flows from this SSA, the project may be considered a higher priority. The proposed schedule is in alignment with the recommendations in the current RWWU facilities plan.

7.2 Funding Source

The Caledonia Utility District may apply for a State of Wisconsin Clean Water Fund loan to finance the Central Lift Station and Attenuation Basin project. The project is eligible for a subsidized loan. The loan will be repaid through the Caledonia Utility District’s user charge system.

7.3 Parallel Cost Summary

A parallel cost percentage analysis was prepared for the Central Lift Station and Attenuation Basin project to determine what percentage of the project is eligible for a subsidized interest rate through the Clean Water Fund Loan Program. Flows attributable to the following sources are subtracted from the total lift station capacity to determine the portion of the project costs that are eligible for subsidy: reserve capacity in an unsewered municipality, reserve capacity at a WWTP for flows and loads projected beyond the first 10 years of the design life, capacity allocated for industrial users, and capacity allocated for state and federal facilities. Based on these criteria, a parallel cost percentage reduced flow for the peak hour condition was calculated to be 23.62 MGD, compared to a calculated 2040 peak hour flow of 27.32 MGD. There are no industrial, state, or federal facilities within the SSA that exceed the flow thresholds. The flow reduction was based on flow projected beyond the first 10 years of operation using straight line population growth, as well as connecting an existing 73 dwelling units that are currently unsewered.

To calculate the parallel cost percentage, the major components of the full lift station and attenuation basin project were evaluated to determine if they could be phased to accommodate the reduced flow of 23.62 MGD. The attenuation pumping station cannot be phased to accommodate a flow reduction as the building and pumps are not modular. The attenuation basin, which consists of six identical channels, is modular. However, the reduced flow is 86-percent of the design flow, whereas five of the six channels would only provide 83-percent of the design capacity of the basin. Consequently, as no criteria for reduced capacity are met, the parallel cost percentage is determined to be 100% and the project is eligible for full funding with a subsidized interest rate.

Parallel cost percentage calculations are included in Appendix E.

7.4 Public Hearing

A public hearing is anticipated to be scheduled in January 2022 at the Caledonia Utility District office. The date will be subject to receipt of facilities plan review comments from the WDNR.

7.5 Regulatory Agencies

The facilities plan was submitted to the Racine Water and Wastewater Utility (RWWU) Commission and the Southeastern Wisconsin Regional Planning Commission (SEWRPC) for review. Copies of the RWWU Commission and SEWRPC approval letters are included in Appendix F.

Appendix A Wetlands and Floodplain Map

Gravity Sewer
Force Main
Central Lift Station
Central Lift Station Property Boundary
100 Year Floodplain
Wetlands, Environmental Corridors, Etc.

Appendix A
Wetlands and Floodplain Map

Client: Caledonia Utility District

Project ID: 19C030.06

Project: Facilities Plan for Central Lift Station

Date: July 2021

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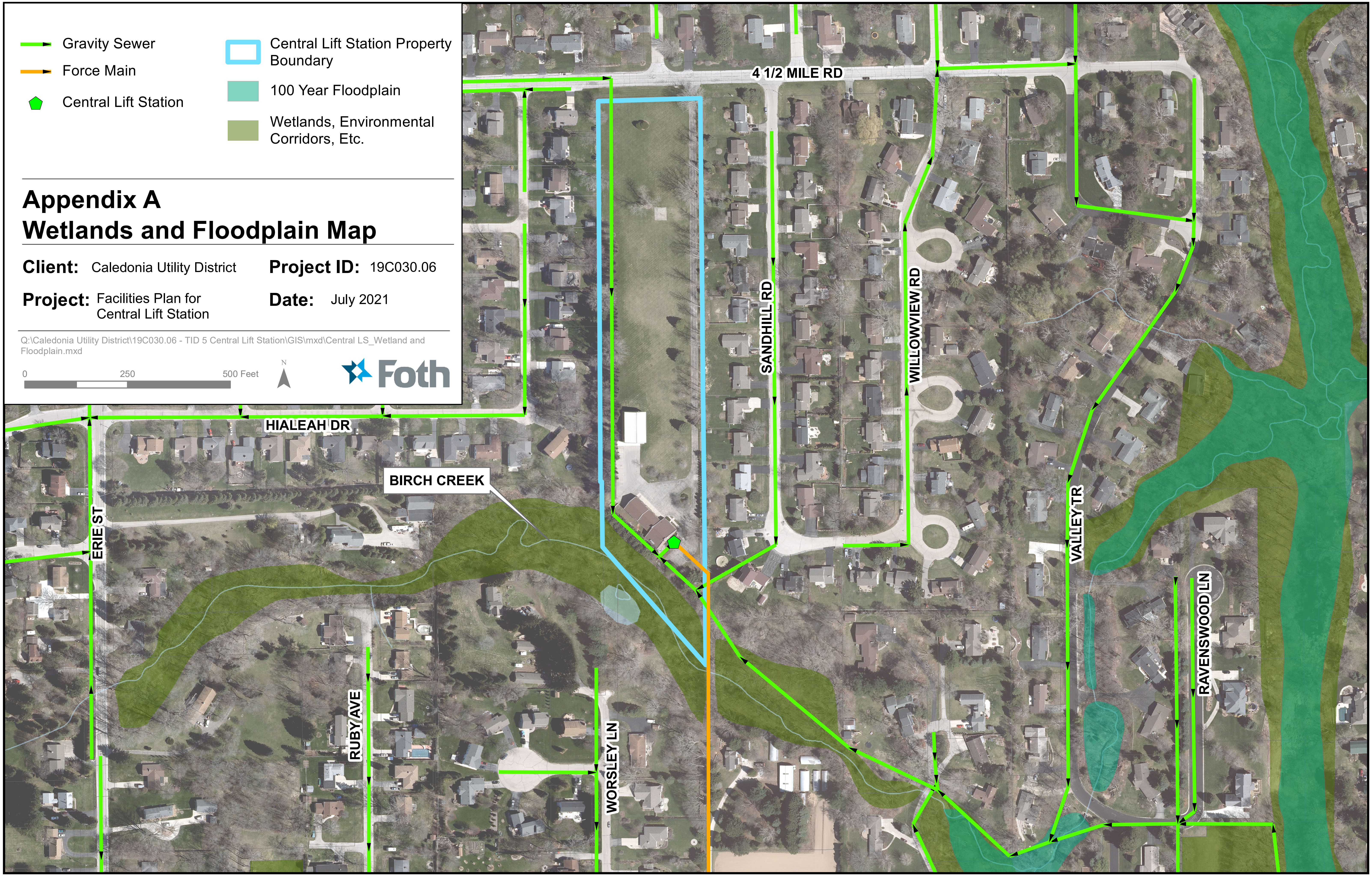


Appendix B Historical and Archeological Site Report

2 reports found where:
Township = 4
Range = 23
Direction = East
Section = 21

Refine Search

Year Published	Report Title	Authors	WHS #
1979	Cultural Resource Reconnaissance Of Proposed Emergency Shoreline Protection, Lake Michigan, In Racine County,Wiconsin	Ryder, Keith G.	79-0619
2008	Archaeological Investigations of Site 47RA0007, WE Energies Six Mile/Erie SS Relief Project, Racine County, Wisconsin	Watson, Robert	08-0175

2 reports found

Primary Info	
WHS Project #	08-0175
ARI #	21849
Report Title	Archaeological Investigations of Site 47RA0007, WE Energies Six Mile/Erie SS Relief Project, Racine County, Wisconsin
Author	Watson, Robert
Report Location	Archives Box #160

Location Info	
County	Racine
USGS 7.5' Quad Info	RACINE NORTH
PLSS	Township: 4; Range: 23; Direction: E; Section: 21; French Lot:

Township	Range	Direction	Section	French Lot
4	23	E	21	

Investigation Info	
Investigation Type	Shovel Testing/Probing, Walk Over/Visual Inspection

Reports	
Report Type	Phase I/Survey

Other Info	
Abstract	In April 2008 GLARC conducted testing within the reported boundaries of RA-0007 prior to a proposed utility project. Shovel testing at proposed pole locations failed to produce evidence of artifacts or cultural materials. GLARC recommends that the project be cleared to proceed.
Series Type	
Series Number	2008-9
Series Investigator	Great Lakes Archaeological Research Center
Sites Investigated	RA-0007
Map Description	Map in Project Report
Acreage Covered	0.10
Place Published	Milwaukee, WI
Month Published	May
Year Published	2008
Is Report On File	Yes
Date Filed	05/22/2008
Date Entered	09/28/2009
Date Modified	01/22/2015


16
RA-0006
TWP4 RNG23 E SEC16
view Sch
N Point Dr
Daily Double Ln
608
10924
Riva Ridge Dr
Winners Dr
Arabian Dr
Silent Sunday Ct
Erie St
Horner Dr
RA-0007
College
79-0619
Richwood Ln
Marwood Dr
TWP4 RNG23 E SEC21
Northway Dr
Kaywood Dr
Point Ridge Dr
Kentwood Dr
600
RA-0218
Northwood Dr
College Point Ct
600ft

Primary Info	
WHS Project #	79-0619
ARI #	1055
Report Title	Cultural Resource Reconnaissance Of Proposed Emergency Shoreline Protection, Lake Michigan, In Racine County,Wiconsin
Author	Ryder, Keith G.
Report Location	Archives - Box #59

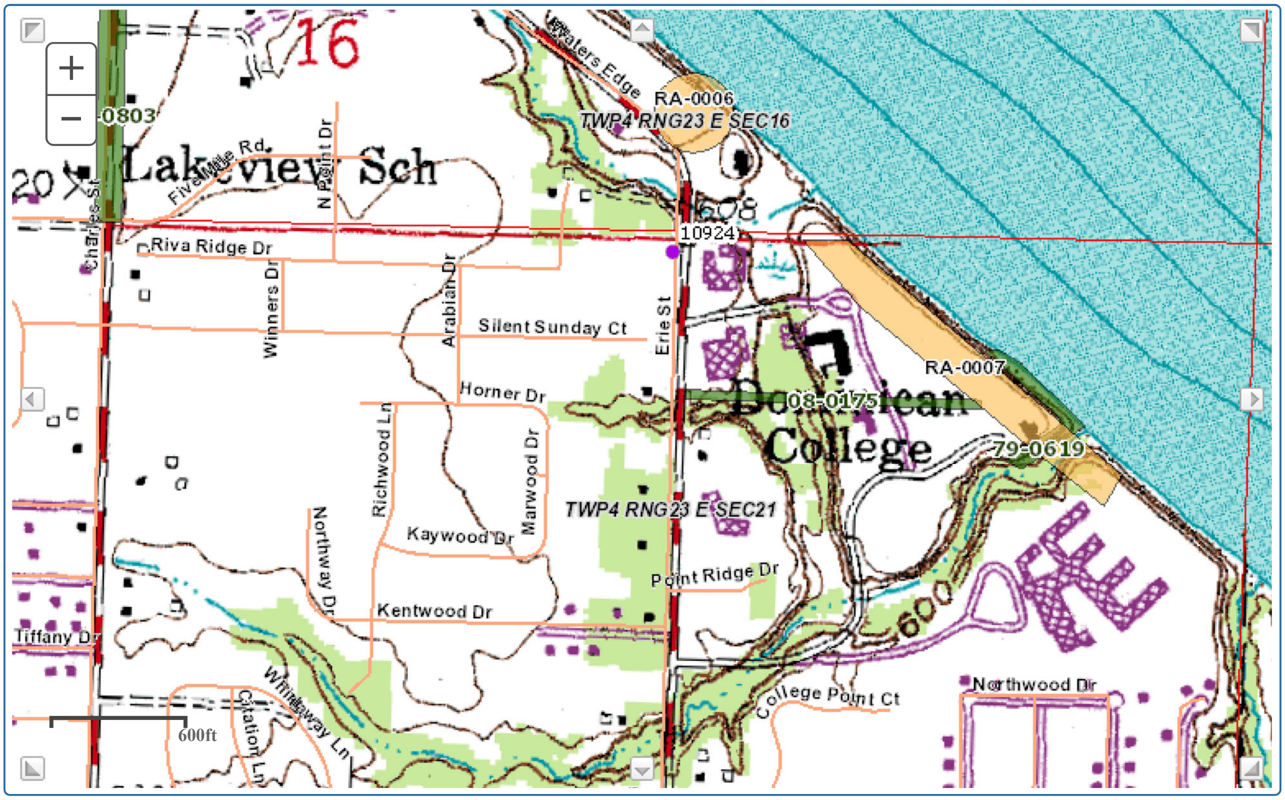
Location Info	
County	Racine
USGS 7.5' Quad Info	RACINE NORTH
PLSS	

Township	Range	Direction	Section	French Lot
3	23	E	4	
4	23	E	21	

Investigation Info	
Investigation Type	Shovel Testing/Probing

Reports	
Report Type	

Other Info	
Abstract	SURVEY OF 450' AND 800' OF SHORELINE.
Series Type	
Series Number	
Series Investigator	United States Army Corps of Engineers
Sites Investigated	
Map Description	
Acreage Covered	
Place Published	Chicago, IL
Month Published	
Year Published	1979
Is Report On File	No
Date Filed	
Date Entered	01/29/2014
Date Modified	03/13/2003



RA-0006
TWP4 RNG23 E SEC16
Waters Edge
16
0803
Lakeview Sch
Fivemile Rd.
N Point Dr
Charles St
10924
Riva Ridge Dr
Winners Dr
Arabian Dr
Silent Sunday Ct
Erie St
Horner Dr
RA-0007
08-0175
Dominican
College
79-0619
Richwood Ln
Marwood Dr
Northway Dr
Kaywood Dr
TWP4 RNG23 E SEC21
Point Ridge Dr
Kentwood Dr
Tiffany Dr
600
College Point Ct
Northwood Dr
Whiteway Ln
Citation Ln
600ft

0 properties found where:
Township = 4
Range = 23
Direction = East
Section = 21

Refine Search

No Properties were found. **Search again**

1 sites found where:
Township = 4
Range = 23
Direction = East
Section = 21

Refine Search

	State Site #	Burial Site #	Site Name	Site Type	Culture	TRS
Photo Not Available	RA-0007	BRA-0068	Tabor Cemetery	Cemetery/burial	Unknown Prehistoric	4-23-E-21

1 sites found

Primary Info

State Site #	RA-0007
Name	Tabor Cemetery
Other Name	
Field #	
ASI #	8044

Location Information

County	Racine
Municipality	
Civil Town	Caledonia
Location Description	This site is on the banks of Lake Michigan northeast of Wind Point. It is on the grounds of the Dominican College, east of Erie Drive and north of 4 1/2 mile drive.
PLSS	(see below)
UTM Info	
USGS 7.5' Quad Info	RACINE NORTH
Parcel ID	

PLSS:

Township	Range	Direction	Section	QSection	Grid Alignment	French Lot	Gov. Lot
4	23	E	21	NW, NE			

Site Description

Site Description	This site consists of a cemetery found in the late 1800's by local residents. 'Many human bones' were observed. A 'large quantity' of stone tools and ornaments were found in the graves. The site has since eroded away into Lake Michigan. A box of artifacts was supposedly collected from this site and sent to a museum in 'Bohemia' (modern Czech Republic). Update 2008: Shovel testing within a portion of the reported site failed to produce evidence of burials. GLARC confirms that site has probably been destroyed by erosion.		
Site Dimensions (feet)		**Site Area (acres)**	
Site Dimensions (meters)		**Site Area (hectares)**	
Site Type	Cemetery/burial		
Cultural Info	(see below)		
Investigation Type	Avocational Survey, Shovel Testing/Probing		
Archaeological Phase/Complex			
Tribe/Ethnic Group			
Site Status	This human burial site is protected under Wis. Stats 157.70. Consultation with the Wisconsin Historical Society is required. See burial page.		
Covenant	No - None of site		

Cultural Info:

Culture	Certainty
Unknown Prehistoric	Definite

Site Characteristics

Modern Landuse	Submerged
Degree of Disturbance	Heavy
Impacts to Sites	Natural Threats

Burial Site Info

Burial Number	BRA-0068	**Burial Status**	Not Catalogued
Date Catalogued		**Cemetery Type**	Inactive/Unmarked
Earliest Grave Date	Precontact	**Latest Grave Date**	Precontact
Disposition Activity		**Date of Disposition**	
Cataloging Comments			

National Register Info

Other Eligibility Evaluation

Individual Eligibility Evaluation	
Proposed Historic District	
Contributing	
Evaluation Date	
Eligibility Comments	

Ownership

Artifact Info

Artifact Repository	
Material Class	
Artifact List	'Stone implements and ornaments'.
Date of Site	
Dating Method	

Investigator Info

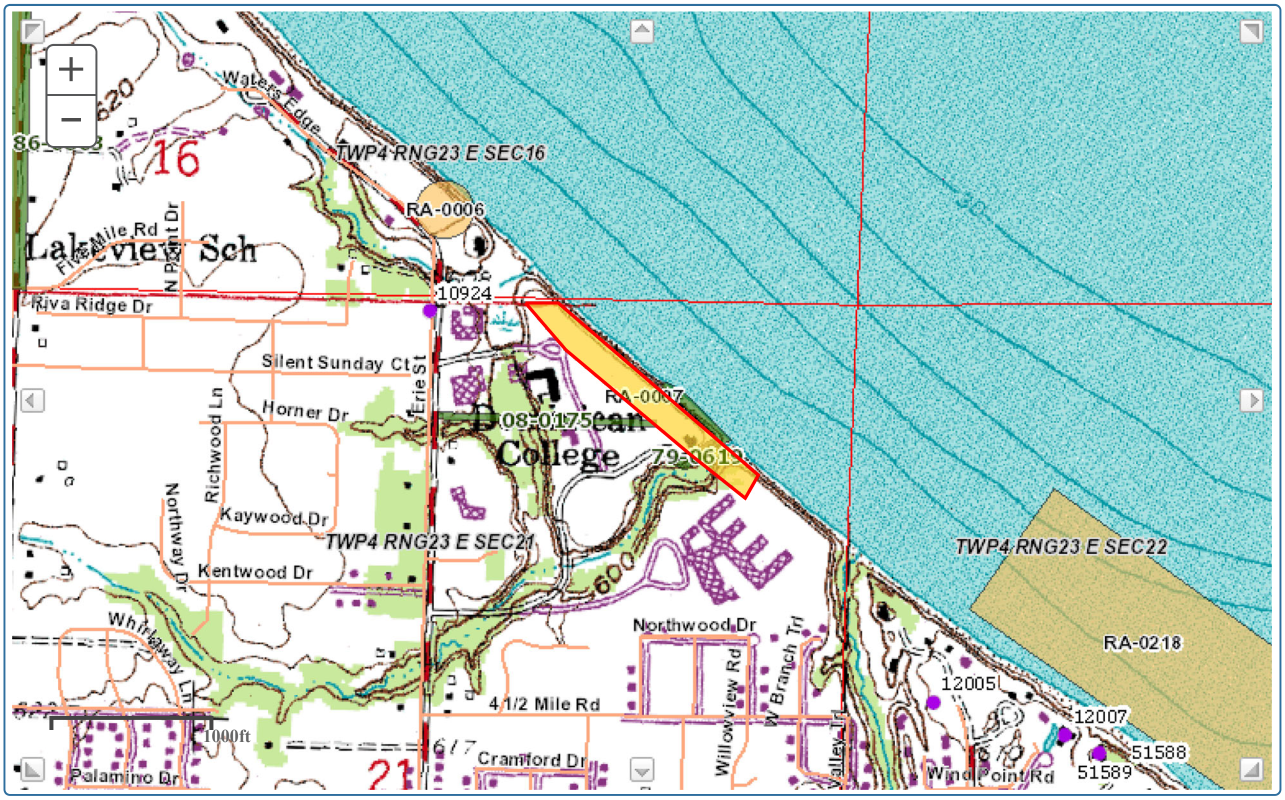
Investigator	Organization	Date	Recommendation	
Robert Watson	Great Lakes Archaeological Research Center	4/1/2008		
George West	Wisconsin Archeological Society	1/1/1903		

Site Reporter Info

Reporter	George West
Organization	Wisconsin Archeological Society
Date Reported	1/1/1903
Bibliography	West, George, 1903, Summary of the Archaeology of Racine County, WA (OS) 3(1):28. Brown, Charles E., 1906, Record of Wisconsin Antiquities, WA (OS) 5(3-4):369. Watson, Robert, 2008, Archaeological Investigations of Site 47RA0007, WE Energies Six Mmile/Erie SS Relief Project, Racine County, Wisconsin, GLARC 2008-9, Milwaukee, WI.

Tracking

WHS Project #	ARI #	Reason For Reporting	
08-7795	21849	Personal/Private Site Investigation	



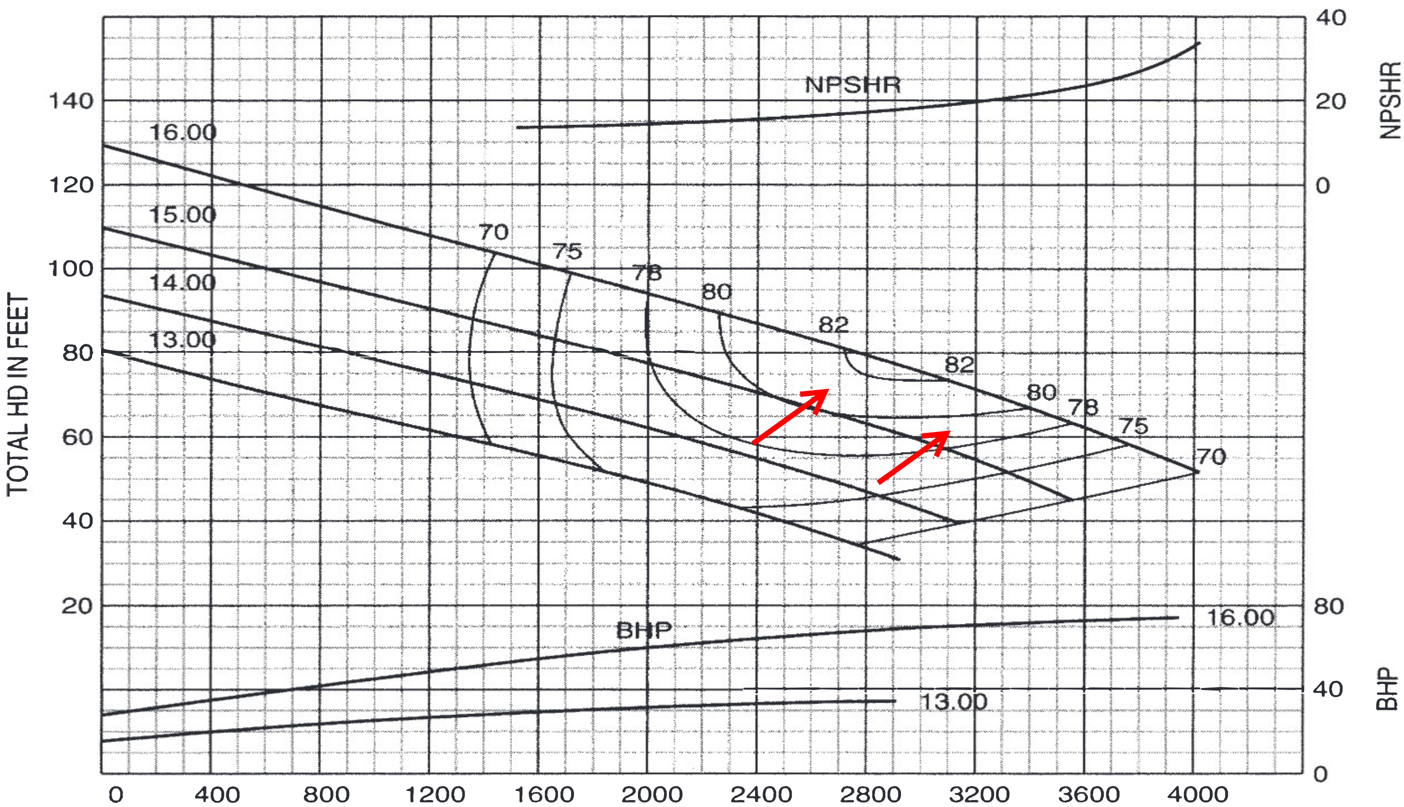
TWP4 RNG23 E SEC16
RA-0006
Lakeview Sch
Five Mile Rd
N Point Dr
Riva Ridge Dr
10924
Silent Sunday Ct
Erie St
Horner Dr
Richwood Ln
RA-0007
08-0175
College
79-0619
Northway Dr
Kaywood Dr
TWP4 RNG23 E SEC21
Kentwood Dr
TWP4 RNG23 E SEC22
RA-0218
Whirlaway Ln
Northwood Dr
Willowview Rd
W Branch Trl
Valley Trl
12005
12007
51588
51589
4 1/2 Mile Rd
1000ft
Cramford Dr
Palamino Dr
Wind Point Rd
16
21

Appendix C Sample Pump Curves

Existing Small Pumps - Alternatives A1, A2, and C

Performance Curve – 8" 5414L, 5424L, 5434L, 5434ML&WL, 5444L RPM: **1185** SOLIDS: **4"**

IMPELLER: **T8D1D** SUCTION: **5424 -8" (OTHER: 10")** INLET: **72.94 in²**

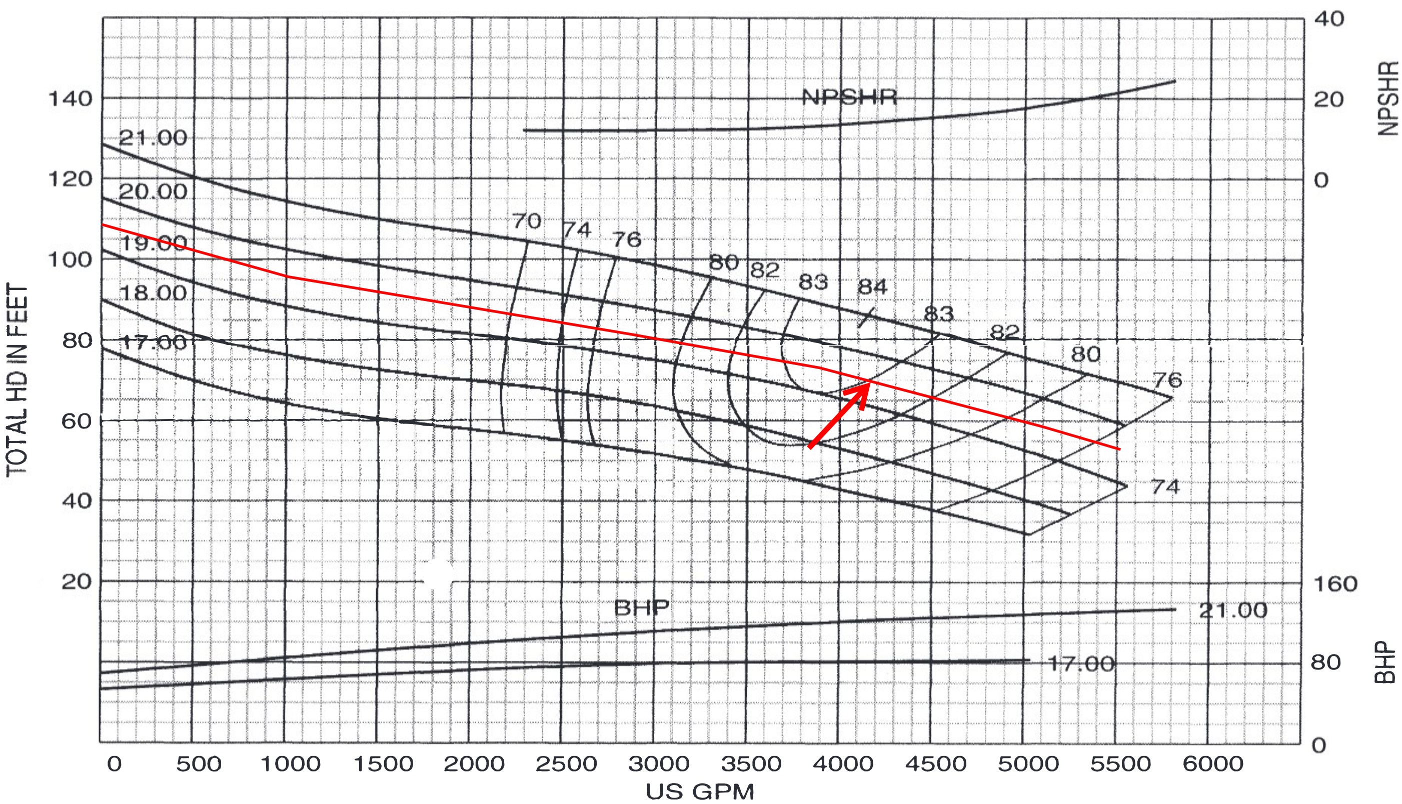


Existing Large Pumps - Alternative A2

Performance Curve – 10" 5415, 5425, 5435, 5435M&W, 5445

RPM: **890** SOLIDS: **6"**

IMPELLER: **TALE5A** SUCTION: **5425 -10" (OTHER: 10" or 12")** INLET: **127.43 in²**



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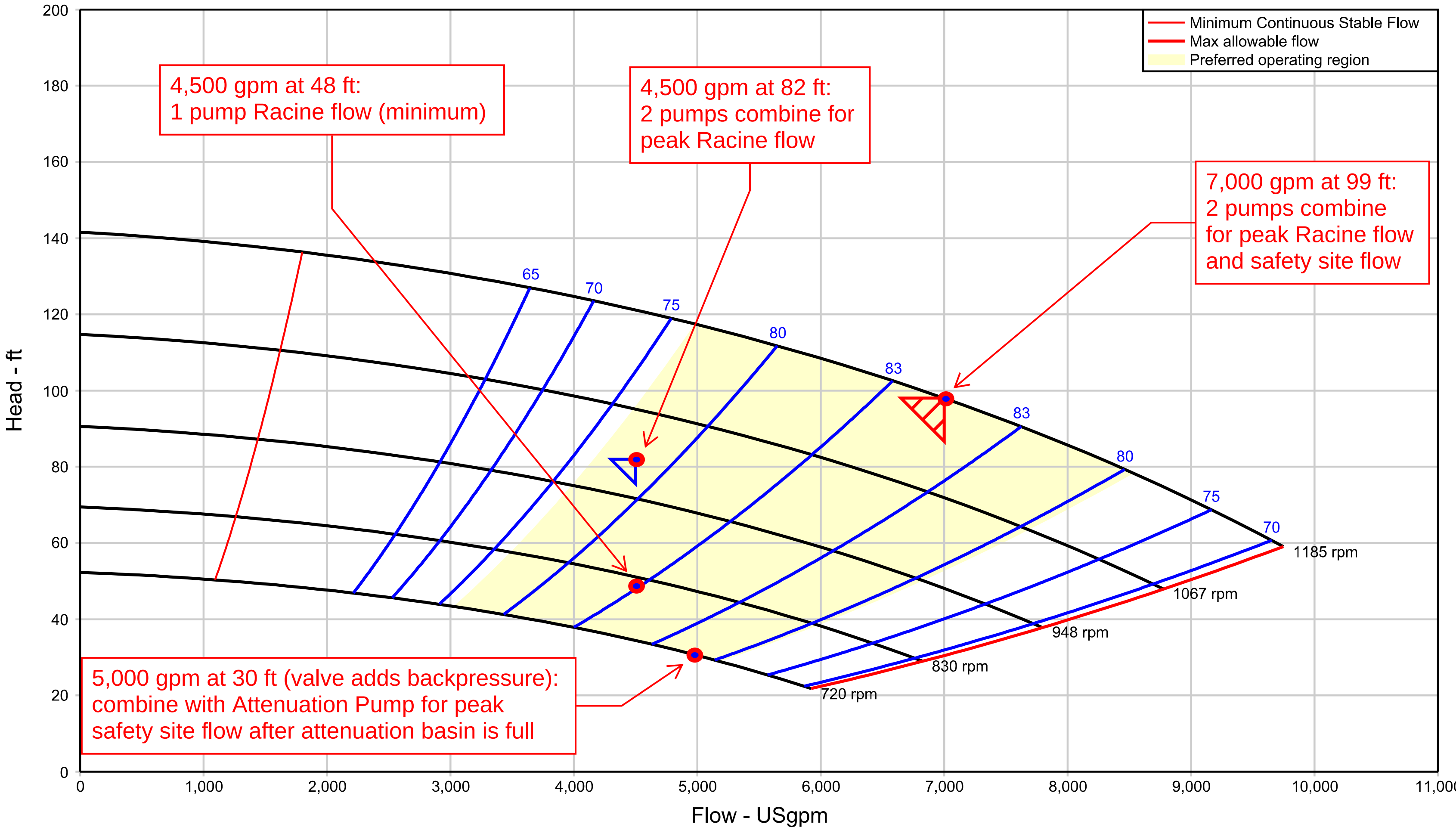
PENTAIR

Racine Flow Pumps - Alternative A1

Multi-Speed Performance Curve

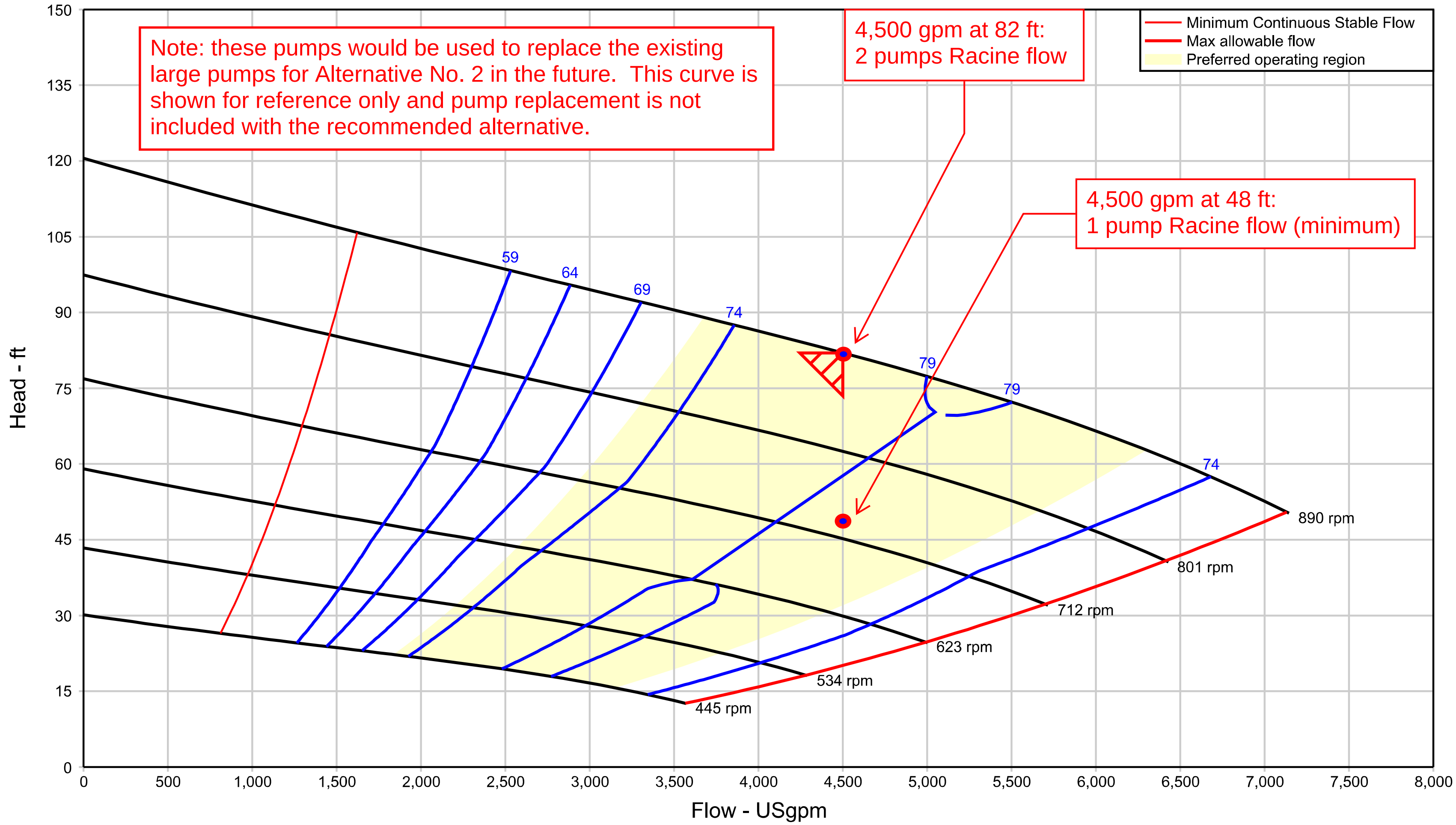
Encompass 2.0 - 21.0.4



Item number	: 001	Size	: 12" 24X4	Flow, rated	: 7,000.0 USgpm
Service	:	Stages	: 1	Differential head / pressure, rated	: 98.00 ft
Quantity	: 1	Efficiency	: 83.45 %	Speed, rated	: 1185 rpm
Quote number	: 315502	Power, rated	: 208 hp	Impeller diameter, rated	: 17.38 in
Based on curve number	: 12-2414-1185-L12E1A	NPSH required	: 22.55 ft	Fluid density, rated / max	: 1.000 / 1.000 SG
		Site Supply Frequency	: 60 Hz	Viscosity	: 1.00 cP
Date last saved	: 07 Apr 2021 3:18 PM	Nominal speed	: 1180 rpm	Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00

Racine Flow Pumps - Alternative A2

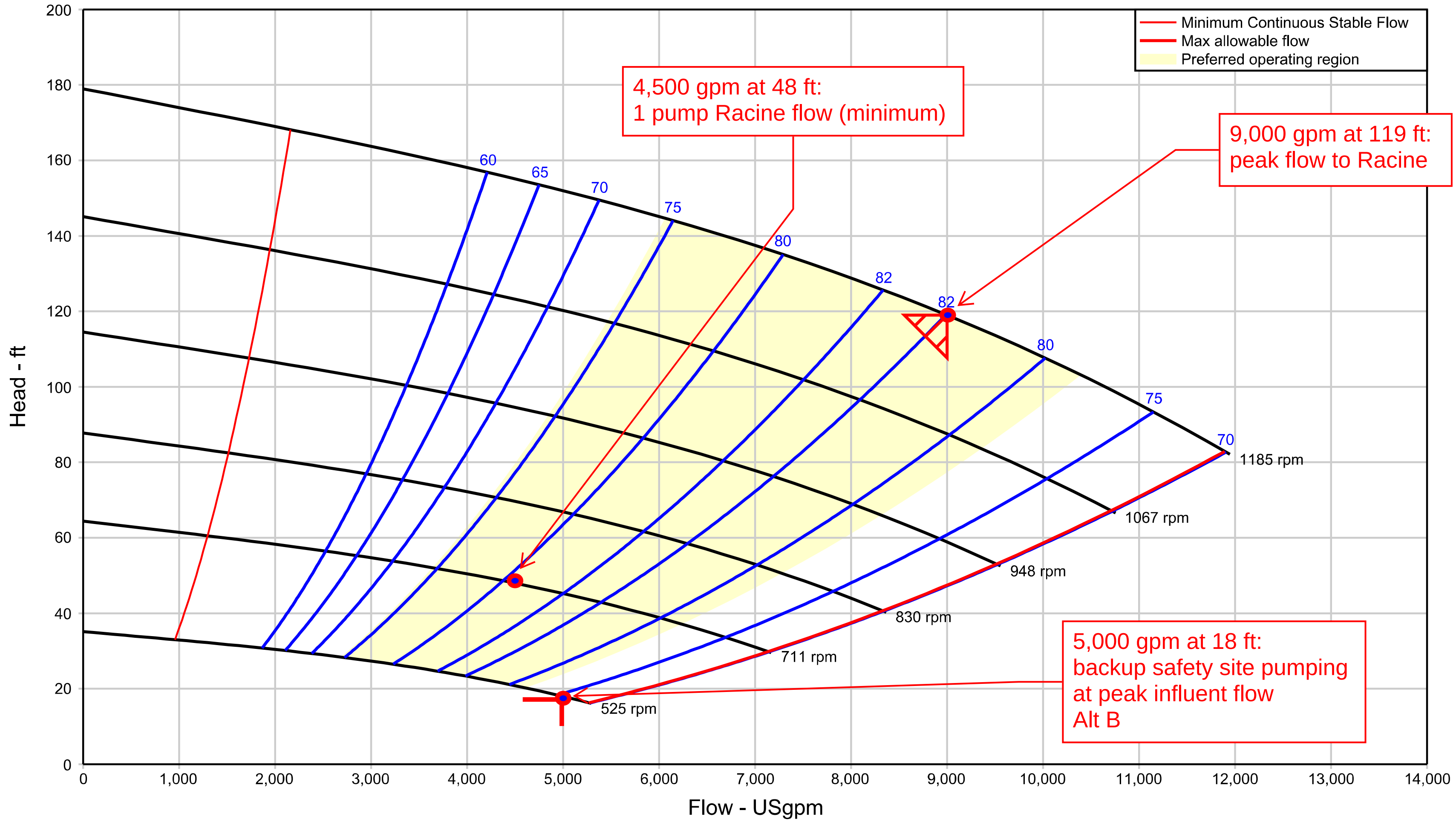
Multi-Speed Performance Curve
Encompass 2.0 - 21.1.2



Item number	: 001	Size	: 12" 24X6 (L12F1G)	Flow, rated	: 4,500.0 USgpm
Service	:	Stages	: 1	Differential head / pressure, rated	: 82.00 ft
Quantity	: 1	Efficiency	: 77.69 %	Speed, rated	: 890 rpm
Quote number	: 315502	Power, rated	: 120 hp	Impeller diameter, rated	: 21.72 in
Based on curve number	: 12-2416-1185-L12F1G	NPSH required	: 13.03 ft	Fluid density, rated / max	: 1.000 / 1.000 SG
		Site Supply Frequency	: 60 Hz	Viscosity	: 1.00 cP
Date last saved	: 27 Apr 2021 4:48 PM	Nominal speed	: 880 rpm	Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00

Racine Flow Pumps - Alternatives B and C

Multi-Speed Performance Curve
Encompass 2.0 - 21.1.0



Item number	: 001	Size	: 12" 24X5	Flow, rated	: 9,000.0 USgpm
Service	:	Stages	: 1	Differential head / pressure, rated	: 119.0 ft
Quantity	: 1	Efficiency	: 81.99 %	Speed, rated	: 1185 rpm
Quote number	: 315502	Power, rated	: 330 hp	Impeller diameter, rated	: 20.11 in
Based on curve number	: 12-2415-1185-L12E1C	NPSH required	: 27.02 ft	Fluid density, rated / max	: 1.000 / 1.000 SG
		Site Supply Frequency	: 60 Hz	Viscosity	: 1.00 cP
Date last saved	: 14 Apr 2021 4:24 PM	Nominal speed	: 1180 rpm	Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00

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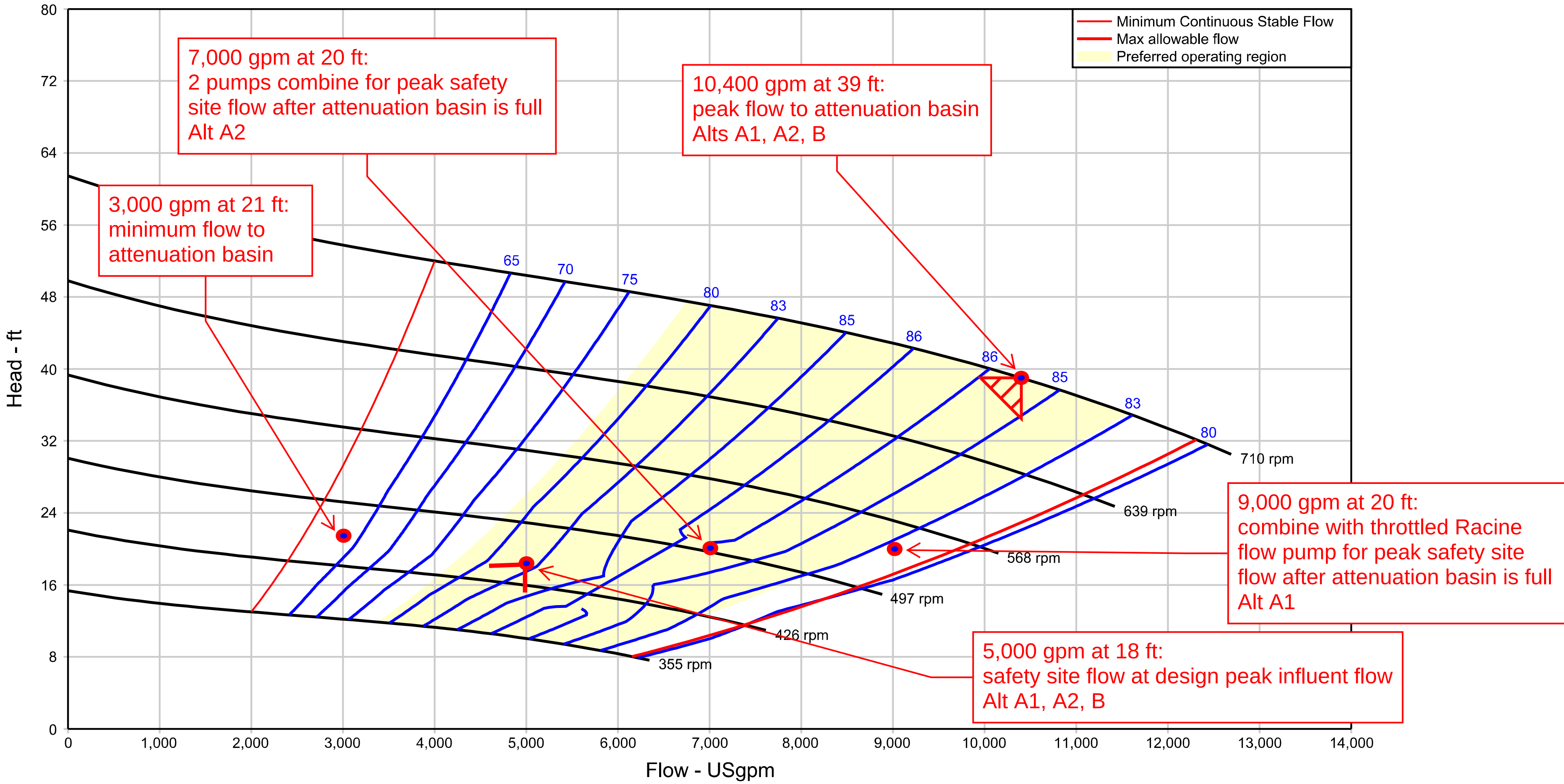
Attenuation Pumps - Alternatives A1, A2, and B

Multi-Speed Performance Curve

Encompass 2.0 - 21.1.0

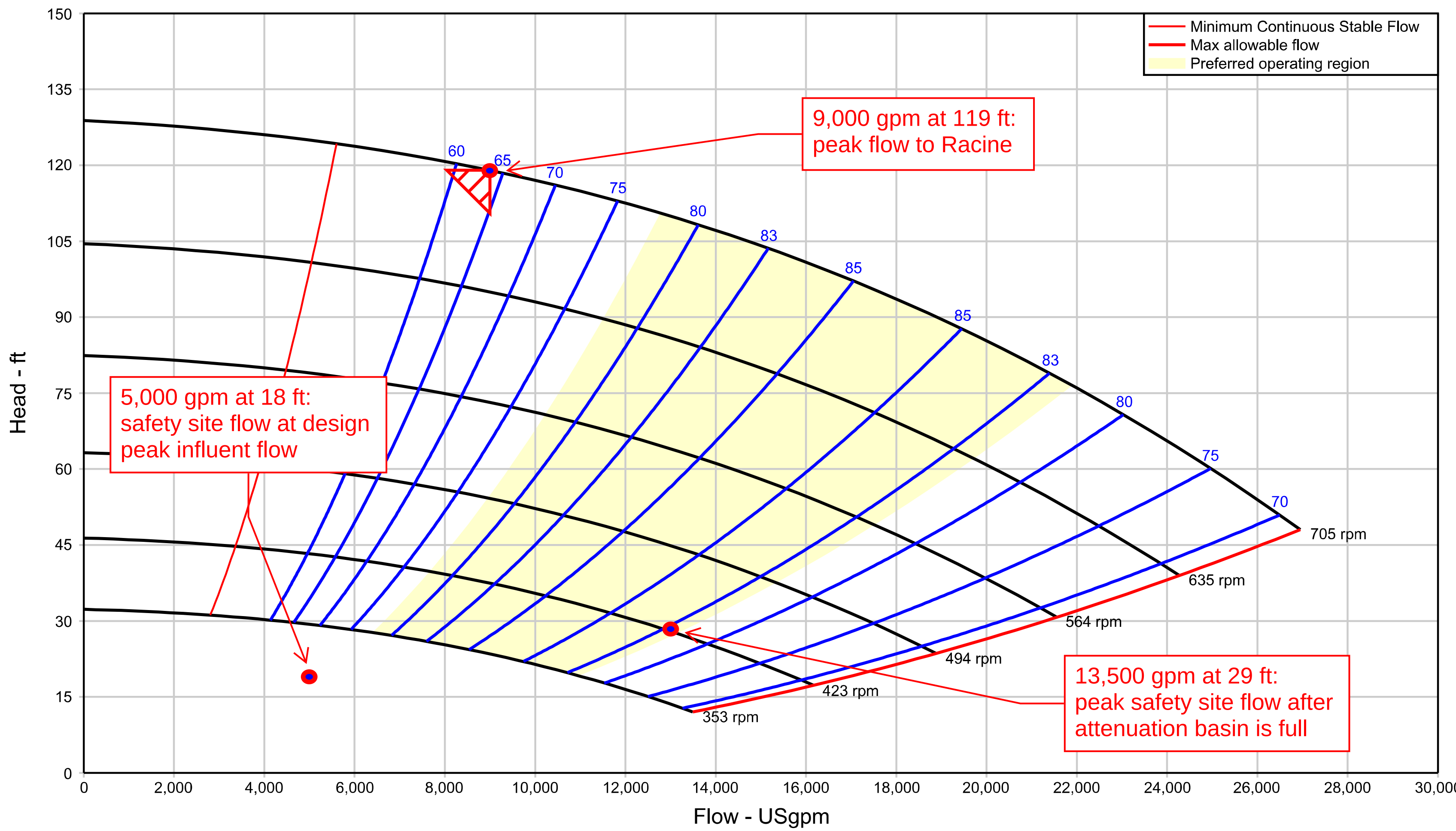


Item number	: 001	Size	: 18" 57X1 (L18A1M)	Flow, rated	: 10,400.0 USgpm
Service	:	Stages	: 1	Differential head / pressure, rated	: 39.00 ft
Quantity	: 1	Efficiency	: 85.66 %	Speed, rated	: 710 rpm
Quote number	: 315502	Power, rated	: 120 hp	Impeller diameter, rated	: 20.28 in
Based on curve number	: 18-57x1-720-L18A1M	NPSH required	: 22.66 ft	Fluid density, rated / max	: 1.000 / 1.000 SG
		Site Supply Frequency	: 60 Hz	Viscosity	: 1.00 cP
Date last saved	: 14 Apr 2021 4:35 PM	Nominal speed	: 700 rpm	Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00

Swing Pump - Alternative C

Multi-Speed Performance Curve

Encompass 2.0 - 21.1.0



Item number	: 001	Size	: 20" 24X4	Flow, rated	: 9,000.0 USgpm
Service	:	Stages	: 1	Differential head / pressure, rated	: 119.0 ft
Quantity	: 1	Efficiency	: 63.67 %	Speed, rated	: 705 rpm
Quote number	: 315502	Power, rated	: 425 hp	Impeller diameter, rated	: 29.19 in
Based on curve number	: 20-2414-705-L20E1A	NPSH required	: 18.95 ft	Fluid density, rated / max	: 1.000 / 1.000 SG
		Site Supply Frequency	: 60 Hz	Viscosity	: 1.00 cP
Date last saved	: 14 Apr 2021 5:03 PM	Nominal speed	: 700 rpm	Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00

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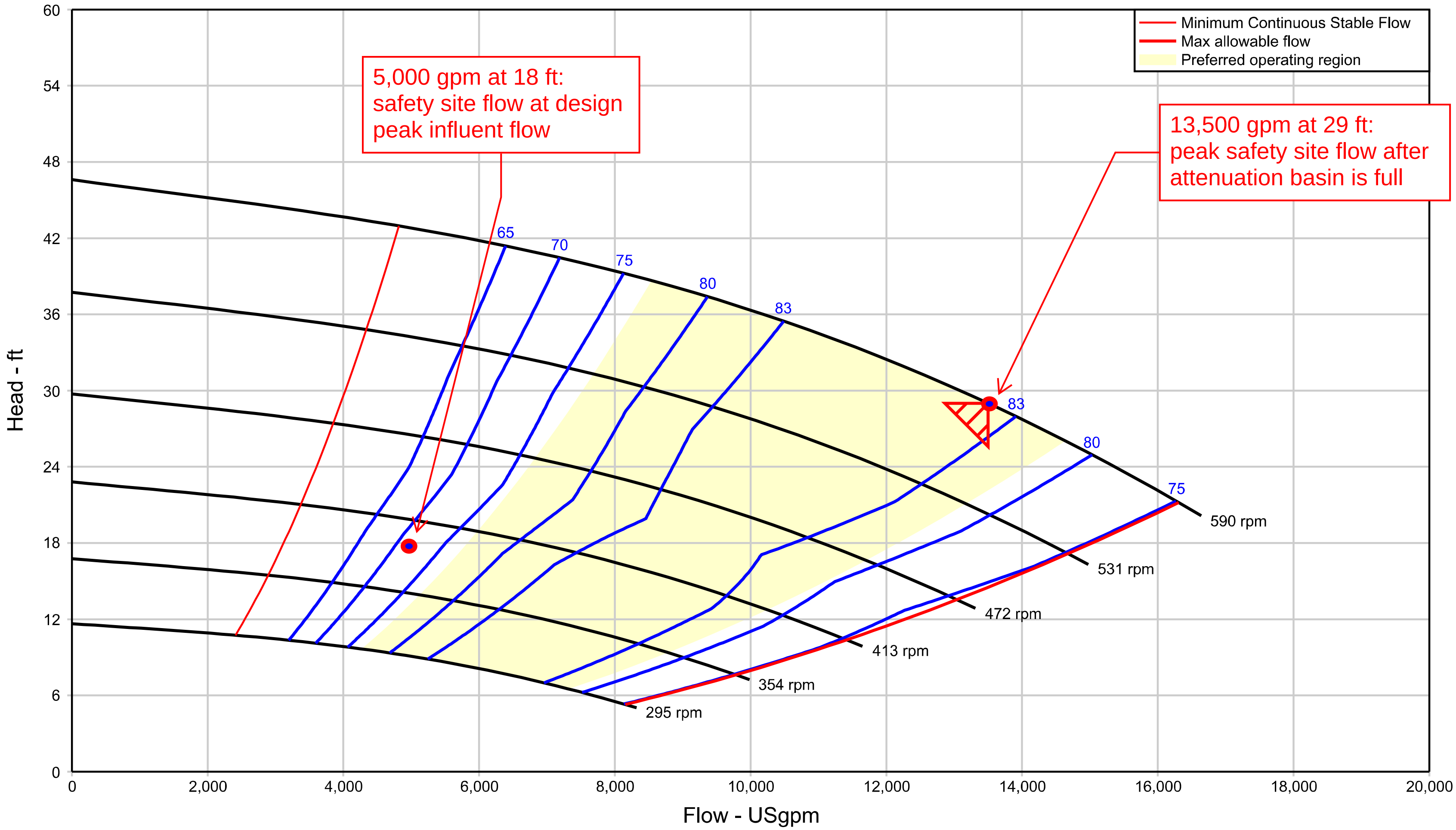
Safety Site Pump - Alternative C

Multi-Speed Performance Curve

Encompass 2.0 - 21.1.0



Item number	: 001	Size	: 20" 57X1L (L20A1AU)	Flow, rated	: 13,500.0 USgpm
Service	:	Stages	: 1	Differential head / pressure, rated	: 29.00 ft
Quantity	: 1	Efficiency	: 83.73 %	Speed, rated	: 590 rpm
Quote number	: 315502	Power, rated	: 118 hp	Impeller diameter, rated	: 21.72 in
Based on curve number	: 20-57x1-720-L20A1AU	NPSH required	: 15.06 ft	Fluid density, rated / max	: 1.000 / 1.000 SG
		Site Supply Frequency	: 60 Hz	Viscosity	: 1.00 cP
Date last saved	: 14 Apr 2021 4:43 PM	Nominal speed	: 580 rpm	Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00

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Appendix D Total Present Worth and Capital Cost Estimate Calculations

Central Lift Station and Attenuation Basin Facilities Plan
Capital Cost Estimate
Recommended Project

Prepared By: MJE
Checked By: TJL

1) Captital Costs

Item	Quantity	Unit	Unit Price	Installation	Capital Costs
Attenuation Basins					
Earthwork					
Excavation	31,176	CY	$ 20		$ 623,520
Backfill	8,344	CY	$ 50		$ 417,200
Temporary Shoring	16,263	SF	$ 50		$ 813,150
Tank Concrete					
Base Slabs	3,403	CY	$ 500		$ 1,701,500
Walls	2,108	CY	$ 500		$ 1,054,000
Elevated Slabs	1,957	CY	$ 600		$ 1,174,200
Fillets	33	CY	$ 400		$ 13,200
Flushing Sump Concrete					
Walls	56	CY	$ 500		$ 28,000
Fillets	104	CY	$ 400		$ 41,600
Collection Sump Concrete					
Walls	191	CY	$ 500		$ 95,500
Fillets	36	CY	$ 400		$ 14,400
Equipment					
Flushing Gates	12	EA	$ 20,000	15%	$ 276,000
Check Valves	5	EA	$ 3,000	30%	$ 19,500
Plug Valves	1	EA	$ 10,000	30%	$ 13,000
Hatches	19	EA	$ 6,000	25%	$ 142,500
Attenuation Pumping Station					
Earthwork					
Excavation	4,324	CY	$ 20		$ 86,480
Backfill	2,162	CY	$ 50		$ 108,100
Temporary Shoring	8,512	SF	$ 50		$ 425,600
Concrete					
Base Slabs	208	CY	$ 500		$ 104,000
Walls	454	CY	$ 500		$ 227,000
Elevated Slabs	44	CY	$ 600		$ 26,400
Wet Well Trough	6	CY	$ 3,000		$ 18,000
Fillets	37	CY	$ 400		$ 14,800
Building					
Pump Room (Lower Level)	868	SF	$ 100		$ 86,800
Pump Room (First Floor)	1,088	SF	$ 250		$ 272,000
Electrical Room	350	SF	$ 300		$ 105,000
Generator Room	462	SF	$ 300		$ 138,600
Mechanical Room	150	SF	$ 300		$ 45,000
Overhead Door	1	EA	$ 10,000	25%	$ 12,500
Stairs	1	LS	$ 50,000		$ 50,000
Grating	488	SF	$ 100		$ 48,800

Central Lift Station and Attenuation Basin Facilities Plan
Capital Cost Estimate
Recommended Project

Equipment					
Attenuation Pumps	2	EA	$ 295,000	5%	$ 619,500
24" Plug Valves	2	EA	$ 23,000	10%	$ 50,600
20" Plug Valves	2	EA	$ 15,000	10%	$ 33,000
20" Check Valves	2	EA	$ 36,000	10%	$ 79,200
20" Magnetic Flow Meter	1	EA	$ 20,000	10%	$ 22,000
Bridge Crane	1	LS	$ 80,000	30%	$ 104,000
Lower Level Monorail and Hoist	1	LS	$ 15,000	50%	$ 22,500
Generator	1	EA	$ 115,000	20%	$ 138,000
Existing Lift Station					
Equipment					
16" Surge Relief Valve	1	EA	$ 42,000	10%	$ 46,200
20" Magnetic Flow Meter	1	EA	$ 20,000	10%	$ 22,000
Generator	1	EA	$ 115,000	20%	$ 138,000
Building					
Enhance Access to Wet Well	1	LS	$ 30,000		$ 30,000
Additional Office Space	450	SF	$ 300		$ 135,000
Misc Architectural/Structural Upgrades	1	LS	$ 20,000		$ 20,000
Mechanical/Electrical/Plumbing					
Misc Electrical and Lighting Upgrades	1	LS	$ 15,000		$ 15,000
Misc Mechanical/HVAC Upgrades	1	LS	$ 25,000		$ 25,000
Misc Plumbing Upgrades	1	LS	$ 5,000		$ 5,000
Electrical and Controls Upgrade	1	LS	$ 100,000		$ 100,000
Piping					$ 1,374,900
Electrical					$ 729,900
Misc. Metals					$ 168,800
Site Work					$ 84,300
Buried Concrete Removal					$ 300,000
Dewatering					$ 142,016
Overhead and Profit				15%	$ 1,890,190
Mobilization, Bonding, and Insurance				5%	$ 630,064
Escalation				3%	$ 453,700
Allowances				3%	$ 467,300
Subtotal					$ 16,042,520
Design Engineering				12%	$ 1,925,200
Construction Engineering				12%	$ 1,925,200
Legal/Admin/Contingency				16%	$ 2,566,900
Total Capital Cost					$ 22,459,820

Central Lift Station and Attenuation Basin Facilities Plan
Total Present Worth Analysis
Alternative A1 - New Attenuation Pumping Station with Existing Pump Replacement

Prepared By: MJE
Checked By: TJL

1) Captital Costs

Item	Quantity	Unit	Unit Price	Installation	Capital Costs	Service Life	Salvage Value
Attenuation Basins							
Earthwork							
Excavation	31,176	CY	$ 20		$ 623,520	20	$ -
Backfill	8,344	CY	$ 50		$ 417,200	20	$ -
Temporary Shoring	16,263	SF	$ 50		$ 813,150	20	$ -
Tank Concrete							
Base Slabs	3,403	CY	$ 500		$ 1,701,500	40	$ 850,800
Walls	2,108	CY	$ 500		$ 1,054,000	40	$ 527,000
Elevated Slabs	1,957	CY	$ 600		$ 1,174,200	40	$ 587,100
Fillets	33	CY	$ 400		$ 13,200	40	$ 6,600
Flushing Sump Concrete							
Walls	56	CY	$ 500		$ 28,000	40	$ 14,000
Fillets	104	CY	$ 400		$ 41,600	40	$ 20,800
Collection Sump Concrete							
Walls	191	CY	$ 500		$ 95,500	40	$ 47,800
Fillets	36	CY	$ 400		$ 14,400	40	$ 7,200
Equipment							
Flushing Gates	12	EA	$ 20,000	15%	$ 276,000	20	$ -
Check Valves	5	EA	$ 3,000	30%	$ 19,500	20	$ -
Plug Valves	1	EA	$ 10,000	30%	$ 13,000	20	$ -
Hatches	19	EA	$ 6,000	25%	$ 142,500	20	$ -
Attenuation Pumping Station							
Earthwork							
Excavation	3,828	CY	$ 20		$ 76,560	20	$ -
Backfill	2,072	CY	$ 50		$ 103,600	20	$ -
Temporary Shoring	8,202	SF	$ 50		$ 410,100	20	$ -
Concrete							
Base Slabs	175	CY	$ 500		$ 87,500	40	$ 43,800
Walls	413	CY	$ 500		$ 206,500	40	$ 103,300
Elevated Slabs	34	CY	$ 600		$ 20,400	40	$ 10,200
Wet Well Trough	4	CY	$ 3,000		$ 12,000	40	$ 6,000
Fillets	25	CY	$ 400		$ 10,000	40	$ 5,000
Building							
Pump Room (Lower Level)	620	SF	$ 100		$ 62,000	30	$ 20,700
Pump Room (First Floor)	840	SF	$ 250		$ 210,000	30	$ 70,000
Electrical Room	280	SF	$ 300		$ 84,000	30	$ 28,000
Generator Room	300	SF	$ 300		$ 90,000	30	$ 30,000
Mechanical Room	150	SF	$ 300		$ 45,000	30	$ 15,000
Overhead Door	1	EA	$ 10,000	25%	$ 12,500	20	$ -
Stairs	1	LS	$ 50,000		$ 50,000	40	$ 25,000
Grating	420	SF	$ 100		$ 42,000	40	$ 21,000
Equipment							
Attenuation Pumps	2	EA	$ 295,000	5%	$ 619,500	20	$ -
24" Plug Valves	2	EA	$ 23,000	10%	$ 50,600	20	$ -
20" Plug Valves	4	EA	$ 15,000	10%	$ 66,000	20	$ -
20" Check Valves	2	EA	$ 36,000	10%	$ 79,200	20	$ -
Electric Actuators	2	EA	$ 5,000	20%	$ 12,000	20	$ -
20" Magnetic Flow Meters	2	EA	$ 20,000	10%	$ 44,000	20	$ -
Bridge Crane	1	LS	$ 80,000	30%	$ 104,000	20	$ -
Lower Level Monorail and Hoist	1	LS	$ 15,000	50%	$ 22,500	20	$ -
Generator	1	EA	$ 75,000	30%	$ 97,500	20	$ -

Central Lift Station and Attenuation Basin Facilities Plan
Total Present Worth Analysis
Alternative A1 - New Attenuation Pumping Station with Existing Pump Replacement

Existing Lift Station							
Equipment							
Forward Flow Pumps	3	EA	$ 255,000	5%	$ 803,250	20	$ -
20" Plug Valves	6	EA	$ 15,000	10%	$ 99,000	20	$ -
18" Plug Valves	6	EA	$ 11,000	10%	$ 72,600	20	$ -
18" Check Valves	3	EA	$ 20,000	10%	$ 66,000	20	$ -
16" Surge Relief Valve	1	EA	$ 42,000	10%	$ 46,200	20	$ -
Electric Actuators	2	EA	$ 5,000	20%	$ 12,000	20	$ -
24" Magnetic Flow Meter	1	EA	$ 24,000	10%	$ 26,400	20	$ -
20" Magnetic Flow Meter	1	EA	$ 20,000	10%	$ 22,000	20	$ -
Equipment Removals	1	LS	$ 60,000		$ 60,000	20	$ -
Generator	1	EA	$ 154,000	20%	$ 184,800	20	$ -
Bridge Crane	1	LS	$ 80,000	30%	$ 104,000	20	$ -
Building							
Reconfigure Wet Well and Pump Suction	1	LS	$ 50,000		$ 50,000	20	$ -
Building Modifications for Pump Removal	1	LS	$ 100,000		$ 100,000	20	$ -
Expand Existing Generator Room	374	SF	$ 300		$ 112,200	20	$ -
Piping					$ 1,670,200	20	$ -
Electrical					$ 842,700	20	$ -
Misc. Metals					$ 240,700	20	$ -
Site Work					$ 84,300	20	$ -
Buried Concrete Removal					$ 300,000		
Dewatering					$ 140,032		
Temporary Conveyance					$ 200,000		
Overhead and Profit				15%	$ 2,142,167		
Mobilization, Bonding, and Insurance				5%	$ 714,056		
Escalation				3%	$ 514,200		
Allowances				3%	$ 529,600		
Subtotal					$ 18,181,135		$ 2,439,300
Design Engineering				12%	$ 2,181,800		
Construction Engineering				12%	$ 2,181,800		
Legal/Admin/Contingency				16%	$ 2,909,000		
Total Capital Cost					$ 25,453,735		

2) Annual Operation and Maintenance Costs

Item	**Annual O&M Cost ($/yr)**
Forward Flow Pump Energy Usage	$ 58,213
Additional General O&M for Attenuation PS	$ 10,000
Additional Labor for Attenuation PS	$ 10,400
Total	$ 78,613

3) Total Present Worth

Capital Cost	$ 25,453,735
O&M Cost	$ 1,156,158
Salvage Value	$ (1,318,215)
Total Present Worth	$ 25,291,678

Note:

Present worth factors based on discount rate of:	3.125%
Design Period, years	20
P/F (Present Worth Factor)	0.5404
P/A (Series Present Worth Factor)	14.7070

Central Lift Station and Attenuation Basin Facilities Plan
Total Present Worth Analysis
Alternative A2 - New Attenuation Pumping Station with No Existing Pump Replacement

Prepared By: MJE
Checked By: TJL

1) Captial Costs

Item	Quantity	Unit	Unit Price	Installation	Capital Costs	Service Life	Salvage Value
Attenuation Basins							
Earthwork							
Excavation	31,176	CY	$ 20		$ 623,520	20	$ -
Backfill	8,344	CY	$ 50		$ 417,200	20	$ -
Temporary Shoring	16,263	SF	$ 50		$ 813,150	20	$ -
Tank Concrete							
Base Slabs	3,403	CY	$ 500		$ 1,701,500	40	$ 850,800
Walls	2,108	CY	$ 500		$ 1,054,000	40	$ 527,000
Elevated Slabs	1,957	CY	$ 600		$ 1,174,200	40	$ 587,100
Fillets	33	CY	$ 400		$ 13,200	40	$ 6,600
Flushing Sump Concrete							
Walls	56	CY	$ 500		$ 28,000	40	$ 14,000
Fillets	104	CY	$ 400		$ 41,600	40	$ 20,800
Collection Sump Concrete							
Walls	191	CY	$ 500		$ 95,500	40	$ 47,800
Fillets	36	CY	$ 400		$ 14,400	40	$ 7,200
Equipment							
Flushing Gates	12	EA	$ 20,000	15%	$ 276,000	20	$ -
Check Valves	5	EA	$ 3,000	30%	$ 19,500	20	$ -
Plug Valves	1	EA	$ 10,000	30%	$ 13,000	20	$ -
Hatches	19	EA	$ 6,000	25%	$ 142,500	20	$ -
Attenuation Pumping Station							
Earthwork							
Excavation	4,324	CY	$ 20		$ 86,480	20	$ -
Backfill	2,162	CY	$ 50		$ 108,100	20	$ -
Temporary Shoring	8,512	SF	$ 50		$ 425,600	20	$ -
Concrete							
Base Slabs	208	CY	$ 500		$ 104,000	40	$ 52,000
Walls	454	CY	$ 500		$ 227,000	40	$ 113,500
Elevated Slabs	44	CY	$ 600		$ 26,400	40	$ 13,200
Wet Well Trough	6	CY	$ 3,000		$ 18,000	40	$ 9,000
Fillets	37	CY	$ 400		$ 14,800	40	$ 7,400
Building							
Pump Room (Lower Level)	868	SF	$ 100		$ 86,800	30	$ 29,000
Pump Room (First Floor)	1,088	SF	$ 250		$ 272,000	30	$ 90,700
Electrical Room	350	SF	$ 300		$ 105,000	30	$ 35,000
Generator Room	462	SF	$ 300		$ 138,600	30	$ 46,200
Mechanical Room	150	SF	$ 300		$ 45,000	30	$ 15,000
Overhead Door	1	EA	$ 10,000	25%	$ 12,500	20	$ -
Stairs	1	LS	$ 50,000		$ 50,000	40	$ 25,000
Grating	488	SF	$ 100		$ 48,800	40	$ 24,400
Equipment							
Attenuation Pumps	3	EA	$ 295,000	5%	$ 929,250	20	$ -
24" Plug Valves	4	EA	$ 23,000	10%	$ 101,200	20	$ -
20" Plug Valves	4	EA	$ 15,000	10%	$ 66,000	20	$ -
20" Check Valves	3	EA	$ 36,000	10%	$ 118,800	20	$ -
Electric Actuators	2	EA	$ 5,000	20%	$ 12,000	20	$ -
24" Magnetic Flow Meters	1	EA	$ 24,000	10%	$ 26,400	20	$ -
20" Magnetic Flow Meters	1	EA	$ 20,000	10%	$ 22,000	20	$ -
Bridge Crane	1	LS	$ 80,000	30%	$ 104,000	20	$ -
Lower Level Monorail and Hoist	1	LS	$ 15,000	50%	$ 22,500	20	$ -
Generator	1	EA	$ 115,000	20%	$ 138,000	20	$ -
Existing Lift Station							
Equipment							
16" Surge Relief Valve	1	EA	$ 42,000	10%	$ 46,200	20	$ 46,200
20" Magnetic Flow Meters	1	EA	$ 20,000	10%	$ 22,000	20	$ 22,000
Generator	1	EA	$ 115,000	20%	$ 138,000	20	$ -

Central Lift Station and Attenuation Basin Facilities Plan
Total Present Worth Analysis
Alternative A2 - New Attenuation Pumping Station with No Existing Pump Replacement

Piping					$ 1,427,100	20	$ -
Electrical					$ 828,400	20	$ -
Misc. Metals					$ 193,400	20	$ -
Site Work					$ 84,300	20	$ -
Buried Concrete Removal					$ 300,000		
Dewatering					$ 142,016		
Overhead and Profit				15%	$ 1,937,688		
Mobilization, Bonding, and Insurance				5%	$ 645,896		
Escalation				3%	$ 465,100		
Allowances				3%	$ 479,000		
Subtotal					$ 16,445,600		$ 2,589,900
Design Engineering				12%	$ 1,973,500		
Construction Engineering				12%	$ 1,973,500		
Legal/Admin/Contingency				16%	$ 2,631,300		
Total Capital Cost					$ 23,023,900		

2) Annual Operation and Maintenance Costs

Item	Annual O&M Cost ($/yr)
Forward Flow Pump Energy Usage	$ 58,213
Additional General O&M for Attenuation PS	$ 15,000
Additional Labor for Attenuation PS	$ 10,400
Total	$ 83,613

3) Total Present Worth

Capital Cost	$ 23,023,900
O&M Cost	$ 1,229,693
Salvage Value	$ (1,399,600)
Total Present Worth	$ 22,853,993

Note:

Present worth factors based on discount rate of:	3.125%
Design Period, years	20
P/F (Present Worth Factor)	0.5404
P/A (Series Present Worth Factor)	14.7070

Central Lift Station and Attenuation Basin Facilities Plan
Total Present Worth Analysis
Alternative B - Rehab Existing Lift Station for Attenuation Pumping

Prepared By: MJE
Checked By: TJL

1) Captital Costs

Item	Quantity	Unit	Unit Price	Installation	Capital Costs	Service Life	Salvage Value
Attenuation Basins							
Earthwork							
Excavation	31,176	CY	$ 20		$ 623,520	20	$ -
Backfill	8,344	CY	$ 50		$ 417,200	20	$ -
Temporary Shoring	16,263	SF	$ 50		$ 813,150	20	$ -
Tank Concrete							
Base Slabs	3,403	CY	$ 500		$ 1,701,500	40	$ 850,800
Walls	2,108	CY	$ 500		$ 1,054,000	40	$ 527,000
Elevated Slabs	1,957	CY	$ 600		$ 1,174,200	40	$ 587,100
Fillets	33	CY	$ 400		$ 13,200	40	$ 6,600
Flushing Sump Concrete							
Walls	56	CY	$ 500		$ 28,000	40	$ 14,000
Fillets	104	CY	$ 400		$ 41,600	40	$ 20,800
Collection Sump Concrete							
Walls	191	CY	$ 500		$ 95,500	40	$ 47,800
Fillets	36	CY	$ 400		$ 14,400	40	$ 7,200
Equipment							
Flushing Gates	12	EA	$ 20,000	15%	$ 276,000	20	$ -
Check Valves	5	EA	$ 3,000	30%	$ 19,500	20	$ -
Plug Valves	1	EA	$ 10,000	30%	$ 13,000	20	$ -
Hatches	19	EA	$ 6,000	25%	$ 142,500	20	$ -
Existing Lift Station							
Equipment							
Forward Flow Pumps	2	EA	$ 315,000	5%	$ 661,500	20	$ -
Attenuation Pumps	2	EA	$ 295,000	5%	$ 619,500	20	$ -
24" Plug Valves	4	EA	$ 23,000	10%	$ 101,200	20	$ -
20" Plug Valves	13	EA	$ 15,000	10%	$ 214,500	20	$ -
20" Check Valves	3	EA	$ 36,000	10%	$ 118,800	20	$ -
16" Surge Relief Valve	1	EA	$ 42,000	10%	$ 46,200	20	$ -
Electric Actuators	5	EA	$ 5,000	20%	$ 30,000	20	$ -
24" Magnetic Flow Meters	1	EA	$ 24,000	10%	$ 26,400	20	$ -
20" Magnetic Flow Meters	2	EA	$ 20,000	10%	$ 44,000	20	$ -
Bridge Crane	1	LS	$ 100,000	30%	$ 130,000	20	$ -
Lower Level Monorail and Hoist	1	LS	$ 25,000	50%	$ 37,500	20	$ -
Generator	1	EA	$ 190,000	20%	$ 228,000	20	$ -
Equipment Removals	1	LS	$ 75,000		$ 75,000	20	$ -
Building							
Reconfigure Wet Well and Pump Suction	1	LS	$ 100,000		$ 100,000	20	$ -
Building Modifications for Pump Removal	1	LS	$ 150,000		$ 150,000	20	$ -
Expand Existing Generator Room	510	SF	$ 300		$ 153,000	20	$ -
Piping					$ 1,517,200	20	$ -
Electrical					$ 670,600	20	$ -
Misc. Metals					$ 153,200	20	$ -
Site Work					$ 69,300	20	$ -
Buried Concrete Removal					$ 300,000		
Dewatering					$ 124,720		
Temporary Conveyance					$ 750,000		
Overhead and Profit				15%	$ 1,912,184		
Mobilization, Bonding, and Insurance				5%	$ 637,395		
Escalation				3%	$ 459,000		
Allowances				3%	$ 472,700		
Subtotal					$ 16,229,169		$ 2,061,300
Design Engineering				12%	$ 1,947,600		
Construction Engineering				12%	$ 1,947,600		
Legal/Admin/Contingency				16%	$ 2,596,700		
Total Capital Cost					$ 22,721,069		

Central Lift Station and Attenuation Basin Facilities Plan
Total Present Worth Analysis
Alternative B - Rehab Existing Lift Station for Attenuation Pumping

2) Annual Operation and Maintenance Costs

Item	Annual O&M Cost ($/yr)
Forward Flow Pump Energy Usage	$ 69,679
Total	$ 69,679

3) Total Present Worth

Capital Cost	$ 22,721,069
O&M Cost	$ 1,024,768
Salvage Value	$ (1,113,941)
Total Present Worth	$ 22,631,896

Note:

Present worth factors based on discount rate of:	3.125%
Design Period, years	20
P/F (Present Worth Factor)	0.5404
P/A (Series Present Worth Factor)	14.7070

Central Lift Station and Attenuation Basin Facilities Plan
Total Present Worth Analysis
Alternative C - Gravity Flow into Attenuation Basins

Prepared By: MJE
Checked By: TJL

1) Captital Costs

Item	Quantity	Unit	Unit Price	Installation	Capital Costs	Service Life	Salvage Value
Attenuation Basins							
Earthwork							
Excavation	72,709	CY	$ 20		$ 1,454,180	20	$ -
Backfill	16,144	CY	$ 50		$ 807,200	20	$ -
Temporary Shoring	38,681	SF	$ 50		$ 1,934,050	20	$ -
Tank Concrete							
Base Slabs	5,251	CY	$ 500		$ 2,625,500	40	$ 1,312,800
Walls	2,530	CY	$ 500		$ 1,265,000	40	$ 632,500
Elevated Slabs	3,143	CY	$ 600		$ 1,885,800	40	$ 942,900
Fillets	31	CY	$ 400		$ 12,400	40	$ 6,200
Flushing Sump Concrete							
Walls	56	CY	$ 500		$ 28,000	40	$ 14,000
Fillets	104	CY	$ 400		$ 41,600	40	$ 20,800
Collection Sump Concrete							
Walls	242	CY	$ 500		$ 121,000	40	$ 60,500
Fillets	36	CY	$ 400		$ 14,400	40	$ 7,200
Equipment							
Flushing Gates	12	EA	$ 20,000	15%	$ 276,000	20	$ -
Check Valves	5	EA	$ 3,000	30%	$ 19,500	20	$ -
Plug Valves	1	EA	$ 10,000	30%	$ 13,000	20	$ -
Hatches	19	EA	$ 13,000	25%	$ 308,750	20	$ -
Drainage Pumping Station							
Earthwork							
Excavation	1,519	CY	$ 20		$ 30,380	20	$ -
Backfill	1,188	CY	$ 50		$ 59,400	20	$ -
Temporary Shoring	5,467	SF	$ 50		$ 273,350	20	$ -
Structure							
Wet Well Structure	56	LF	$ 2,000	25%	$ 140,000	40	$ 70,000
Valve Vault	1	LS	$ 15,000	25%	$ 18,750	40	$ 9,400
Hatches	2	EA	$ 3,000	25%	$ 7,500	40	$ 3,800
Fillets	10	CY	$ 500		$ 5,000	40	$ 2,500
Equipment							
Drainage Pumps	2	EA	$ 20,000	30%	$ 52,000	20	$ -
Plug Valves	2	EA	$ 3,000	20%	$ 7,200	20	$ -
Check Valves	2	EA	$ 3,000	20%	$ 7,200	20	$ -
Existing Lift Station							
Equipment							
Forward Flow Pump	1	EA	$ 315,000	5%	$ 330,750	20	$ -
Safety Site Pump	1	EA	$ 300,000	5%	$ 315,000	20	$ -
Swing Pump	1	EA	$ 415,000	5%	$ 435,750	20	$ -
30" Plug Valves	2	EA	$ 40,000	10%	$ 88,000	20	$ -
24" Plug Valves	4	EA	$ 23,000	10%	$ 101,200	20	$ -
20" Plug Valves	7	EA	$ 15,000	10%	$ 115,500	20	$ -
24" Check Valves	2	EA	$ 52,000	10%	$ 114,400	20	$ -
20" Check Valves	1	EA	$ 36,000	10%	$ 39,600	20	$ -
16" Surge Relief Valve	1	EA	$ 42,000	10%	$ 46,200	20	$ -
Electric Actuators	2	EA	$ 5,000	20%	$ 12,000	20	$ -
24" Magnetic Flow Meters	1	EA	$ 24,000	10%	$ 26,400	20	$ -
20" Magnetic Flow Meters	1	EA	$ 20,000	10%	$ 22,000	20	$ -
Bridge Crane	1	LS	$ 120,000	30%	$ 156,000	20	$ -
Lower Level Monorail and Hoist	1	LS	$ 30,000	50%	$ 45,000	20	$ -
Generator	1	EA	$ 194,000	20%	$ 232,800	20	$ -
Equipment Removals	1	LS	$ 75,000		$ 75,000	20	$ -
Building							
Reconfigure Wet Well and Pump Suction	1	LS	$ 50,000		$ 50,000	20	$ -
Building Modifications for Pump Removal	1	LS	$ 150,000		$ 150,000	20	$ -
Expand Existing Generator Room	540	SF	$ 300		$ 162,000	20	$ -

Central Lift Station and Attenuation Basin Facilities Plan

Total Present Worth Analysis

Alternative C - Gravity Flow into Attenuation Basins

Piping					$ 1,724,700	20	$ -
Electrical					$ 741,100	20	$ -
Misc. Metals					$ 171,600	20	$ -
Site Work					$ 113,100	20	$ -
Buried Concrete Removal					$ 300,000		
Dewatering					$ 296,916		
Temporary Conveyance					$ 200,000		
Overhead and Profit				15%	$ 2,620,827		
Mobilization, Bonding, and Insurance				5%	$ 873,609		
Escalation				3%	$ 629,000		
Allowances				3%	$ 647,900		
Subtotal					$ 22,243,512		$ 3,082,600
Design Engineering				12%	$ 2,669,300		
Construction Engineering				12%	$ 2,669,300		
Legal/Admin/Contingency				16%	$ 3,559,000		
Total Capital Cost					$ 31,141,112		

2) Annual Operation and Maintenance Costs

Item	Annual O&M Cost ($/yr)
Forward Flow Pump Energy Usage	$ 58,213
Total	$ 58,213

3) Total Present Worth

Capital Cost	$ 31,141,112
O&M Cost	$ 856,135
Salvage Value	$ (1,665,858)
Total Present Worth	$ 30,331,389

Note:

Present worth factors based on discount rate of:	3.125%
Design Period, years	20
P/F (Present Worth Factor)	0.5404
P/A (Series Present Worth Factor)	14.7070

Central Lift Station and Attenuation Basin Facilities Plan
Safety Site Conveyance Cost Estimate
Pressure Conveyance Alternative

Prepared By: TJM
Checked By: AMS

1) Captital Costs

Item	Quantity	Unit	Unit Price	Capital Costs
24' HDPE Force Main, Open Cut-Granular Backfill	1,300	LF	$ 275	$ 357,500
24' HDPE Force Main, Trenchless Installation	700	LF	$ 600	$ 420,000
54" Gravity (<10 ft bury), Spoil Backfill	250	EA	$ 540	$ 135,000
60" Manhole (<10 ft' depth)	1	EA	$ 6,000	$ 6,000
Discharge Structure	1	EA	$ 50,000	$ 50,000
Restoration			8%	$ 77,500
Mobilization			4%	$ 38,800
Subtotal				$ 1,084,800
Design Engineering			12%	$ 130,200
Construction Engineering			12%	$ 130,200
Legal/Admin/Contingency			16%	$ 173,600
Total Capital Cost				$ 1,518,800

Central Lift Station and Attenuation Basin Facilities Plan
Safety Site Conveyance Cost Estimate
Gravity Conveyance Alternative

Prepared By: TJM
Checked By: AMS

1) Captital Costs

Item	**Quantity**	**Unit**	**Unit Price**	**Capital Costs**
54" HOBAS (<10 ft bury)	500	LF	$ 665	$ 332,500
54" HOBAS (10-15 ft bury)	1,700	LF	$ 725	$ 1,232,500
54" HOBAS (15-20 ft bury)	50	LF	$ 800	$ 40,000
108" Manhole	5	EA	$ 20,000	$ 100,000
84" Manhole	4	EA	$ 14,000	$ 56,000
Discharge Structure	1	EA	$ 50,000	$ 50,000
Restoration			8%	$ 144,900
Mobilization			4%	$ 72,500
Subtotal				$ 2,028,400
Design Engineering			12%	$ 243,500
Construction Engineering			12%	$ 243,500
Legal/Admin/Contingency			16%	$ 324,600
Total Capital Cost				$ 2,840,000

Appendix E Parallel Cost Percentage Calculations

Caledonia Utility District
Central Lift Station and Attenuation Basin Facilities Plan
Parallel Cost Percentage Calculation

Prepared By:	MJE
Checked By:	TJL

Parallel Cost Percentage Calculations

Data	
WDNR CWF Loan Annual Market Interest Rate:	2.700%
WDNR CWF Loan Annual Reduced Interest Rate:	1.485%
WDNR CWF Loan Discount Rate:	3.125%
WDNR CWF Loan Period (years):	20
Parallel Cost Percentage	
2021 Estimated Population	16,582
2030 Estimated Population	20,274
2040 Estimated Design Population	23,966
2021 Estimated Annual Average Flow Rate (gpd)	3,247,000
2021 Estimated Peak Hour Flow Rate (gpd)	19,482,000
2030 Additional Residential Flow (gpd)	616,000
2030 Additional Commercial Flow (gpd)	63,000
2030 Additional Industrial Flow Under 25,000 gpd (gpd)	0
2030 Additional Government and Institutional Flow Under 5% (gpd)	11,000
2030 Estimated Annual Average Flow Rate (gpd)	3,937,000
2030 Estimated Peak Hour Flow Rate (gpd)	23,622,000
Projected 2040 Average Annual Flow (gpd):	4,553,000
Projected 2040 Peak Hour Flow (gpd):	27,321,000
Parallel Cost Percentage Reduced Flow (gpd):	23,622,000
Total Project 2040 Capital Cost:	$ 21,657,420
Reduced Project Capital Cost:	$ 21,657,420
Parallel Cost Percentage:	100.0%

Appendix F Regulatory Approval Letters

Racine Water and Wastewater Utilities

Keith E. Haas, P.E.
General Manager

RACINE ON THE LAKE
City of Racine, Wisconsin

Michael L. Gitter, P.E.
Chief of Operations

Kenneth M. Scolaro, C.P.A.
Administrative Manager

Chad W. Regalia, P.E.
Chief Engineer

October 21, 2021

Anthony Bunkelman
Utility Director
Village of Caledonia
5043 Chester Lane
Racine, WI 53402

SUBJECT: Caledonia Utility District Sanitary Sewer Project – Central Lift Station and Attenuation Basin Facilities Plan

Dear Mr Bunkelman:

This letter serves as a reply to your request for a letter of acknowledgement for the plan entitled, Central Lift Station and Attenuation Basin facilities plan as provided by Matt Eberhardt of Foth Engineering for the Village of Caledonia Utility District ("Village"). It is noted that the Village has experienced past peak flow capacity exceedance under terms of the Intergovernmental Sanitary Sewer Service, Revenue Sharing, Cooperation and Settlement Agreement ("Agreement") and that the proposed facilities plan is a component of the Village draft Peak Flow Mitigation Plan required under the Agreement.

Upon my review of the Agreement and consultation with legal counsel, this project does not require formal Racine Wastewater Utility Commission ("Wastewater Commission") approval. The project seeks to maintain the Village's existing allocations under the Agreement and is therefore not an Unplanned *Expansion* Sewer Service Facility. In addition, the Village is not seeking to have the Wastewater Commission fund an Unplanned *Upgraded* Sewer Service Facility. Rather, it is wholly within the confines of Village jurisdiction and will be completely funded locally to enable the Village to stay within the allocations within the Agreement. As such, this project does not require Agreement party notice nor a Cost of Service Study for formal Wastewater Commission approval. This conclusion is consistent with project approvals for the Village first phase attenuation basin construction at the Hoods Creek station per correspondence dated July 1, 2011 from then Utility General Manager, Keith Haas.

Although we have not reviewed the technical specifications of this project and the Wastewater Commission will not be formally approving this plan, we acknowledge receipt of this plan and agree that this project is generally consistent with the Village Hoods Creek Attenuation Basin Facility Plan, and the draft Racine Wastewater Utility Facility Plan regarding level of protection storm event protocols administered by WDNR.

Please let me know if there are questions or additional concerns.

Sincerely,

Michael Gitter

Michael Gitter, P.E.
Interim General Manager
Cc: P. Kent (Stafford Rosenbaum LLP)

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION
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December 6, 2021

Matthew J. Eberhardt, P.E.
Foth Infrastructure & Environment, LLC
5117 West Terrace Drive, Suite 401
Madison, WI 53718

Dear Mr. Eberhardt:

We are writing in response to your electronic mail of October 7, 2021, to the Wisconsin Department of Natural Resources, requesting that the Commission staff review and comment on the document entitled *Facilities Plan for the Central Lift Station and Attenuation Basin*, dated December 2021. That document, which was prepared by your firm for the Caledonia Utility District, sets forth recommendations to rehabilitate the existing wastewater lift station, construct an attenuation basin, and install an overflow diversion system.

Pursuant to your request, the Commission staff has reviewed the report and offers the following comments for your consideration:

1. The report indicates that the population forecast to the Central Lift Station sanitary sewer service area would approximate 23,966 persons in 2040, which is considered full buildout conditions. This population forecast is based on a 2035 land use map approved by the Village in 2018. This population forecast significantly exceeds the future population projection developed by the Commission and utilized in the regional land use and transportation plan (VISION 2050), and therefore is inconsistent with the Commission's regional plans including the Areawide Water Quality Management Plan (AWQMP). It can be noted however, that as the sanitary sewer service area boundary set forth in the Central Lift Station facilities plan is consistent with the AWQMP, and the population forecast utilized in the Central Lift Station facilities plan is consistent with the Village of Caledonia's adopted comprehensive plan, the design based on this population projection would provide a higher level of protection to the service area.

2. The sanitary sewer service area for the Central Lift Station is shown in Figure 3-1 of the report. This map matches the adopted sanitary sewer service area identified in the March 2018 SEWRPC *Amendment to the Regional Water Quality Management Plan – City of Racine and Environs, Community Assistance Planning Report No. 147.*

3. The estimated year 2040 average annual and peak hourly wastewater flows to this lift station are 4.55 million gallons per day (mgd) and 27.32 mgd, respectively. These flows were developed using per capita and peak hour factors from the 1998 Racine Water and Wastewater Utility (RWWU) WWTP facilities plan, which match historical flow data and were the most current data available during plan development. The current lift station pump capacity is 5.98 mgd for each of the three large pumps, which is sufficient to fully meet the 13.07 mgd peak flow allocation to the RWWU. As the existing peak flow allocation for the Central Lift Station to the RWWU is not changing, the existing pumps have adequate capacity for future use to design year 2040. The proposed attenuation basin was sized to meet the 2040 5-year level of service requirement.

4. The report presents costs for rehabilitating the existing lift station, constructing an attenuation basin, and constructing a safety site conveyance system to convey flows in excess of the attenuation basin capacity to an outfall at a ravine to Lake Michigan. The preferred attenuation basin design was a covered concrete attenuation basin with buried rectangular concrete channels, with the top slab being above existing grade and covered by 18 inches of soil. Flows would be pumped into the basin and then gravity drained out, and the preferred attenuation basin has a present worth cost of $22,850,000. Two alternatives were considered for the safety site conveyance analysis: pressure conveyance and gravity conveyance. The pressure conveyance alternative was the most cost effective, and thus the preferred alternative, with a total capital cost of $1,520,000, which includes approximately 2,000 linear feet of 24-inch HDPE force main. This outfall is parallel with the existing sanitary sewer outfall and the design will include erosion control to protect the ravine.

Based on the foregoing, the Commission staff finds that the recommendations of the *Facilities Plan for the Central Lift Station and Attenuation Basin,* dated December 2021, are not inconsistent with, and would serve to implement, the adopted regional water quality management plan subject to the following considerations: that the Village of Caledonia review this facility plan, and any subsequent amendments or updates, for consistency with the Village's comprehensive plan, particularly as the content of the comprehensive plan pertains to the Village's projected growth, utilities, community facilities, and services and their related goals, objectives, and policies; that the adopted 2018 full buildout map be incorporated into the next update of the Village's comprehensive plan; and that this information also be incorporated into the next update of the regional land use and transportation plan.

We trust the foregoing comments and recommendations will be helpful to you. If we may be of further assistance to you in this matter, please do not hesitate to contact Ms. Laura K. Herrick, Chief Environmental Engineer, at (262) 953-3224, or *lherrick@sewrpc.org*.

Sincerely,

Kevin J. Muhs, PE, AICP
Executive Director

LKH/JED/JMM/cp
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cc: Mr. Robert J. Lui, General Manager, Caledonia Utility District
Ms. Kathy Kasper, Administrator, Village of Caledonia
Mr. Andrew Dutcher, Wastewater Engineer, Wisconsin Department of Natural Resources