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WATER RESOURCE ENGINEERS

MORRISVILLE WATER & LIGHT DEPARTMENT

Jersey Heights Pump Station Upgrade Study

Preliminary Engineering Report

April 2023

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APPENDICES

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1. PROJECT PLANNING

1.1. Introduction

The Morrisville Water & Light's (MW&L) Sewer System serves residential, commercial, and industrial users in and around the downtown Morrisville and Morristown areas in Lamoille County. The sewer system consists of gravity collection sewers, several pump stations, including the Jersey Heights pump station, and a wastewater treatment facility that treats wastewater before discharging it to the Lamoille River.

The purpose of this project is to evaluate alternatives for upgrade and expansion of the aging and undersized Jersey Heights Pump Station (JHPS).

1.2. Location

The Town of Morristown is located in Lamoille County in the north-central portion of the State of Vermont, approximately 10 miles north of Stowe. The proposed Jersey Heights Pump Station Upgrade project will take place at the site of the existing sewage pump station located on Route 100, just west of the Feline Loop intersection. The site is located between the Boardman Brook and 330 Historic VT-100. A site location map is shown in **Figure 1 of Appendix A**.

1.3. Environmental Resources Present

The following environmental resources are noted to exist in the project area.

- The site is in State-mapped river corridor, but is not in the flood plain for the Boardman Brook or the Lamoille River.
- There are no mapped rare, threatened, or endangered species within approximately a half-mile of the project area.

The project area is in Zone X and is therefore determined to be outside the 500-year flood plain.

1.4. Population Trends

Census data combines the data from the Village of Morrisville and the Town of Morristown together under the Town of Morristown. The 2020 census population estimate for the Town of Morristown was 5,434 and the 2010 census population estimate was 5,227. This census data shows an approximate 4.0% increase in the population over that decade. Population data and projections for the Town are included in Table 1.1, below.

Table 1.1
Town of Morristown's Population

	1990 Census[1]	2000 Census[1]	2010 Census[1]	2020 Census[1]	2030 Projection[2]
Town of Morristown	4,733	5,139	5,227	5,434	6,305

Notes:
1. US Census Data
2. Vermont Population Projections – 2010 – 2030, Jones & Schwarz, August 2013, State of Vermont Agency of Commerce and Community Development.

The median household income in the Town of Morristown from the 2021 American Community Survey 5-year Estimate is $58,621.

1.5. Community Engagement

Public engagement for MW&LD is accomplished through publicly warned Board of Trustee meetings and public votes. As part of the bond vote process, the project will be discussed at warned Board meetings, as well as at a public informational meeting prior to the bond vote. Documents relating to the bond vote will be available from MW&L.

2. EXISTING CONDITIONS

2.1. Location Map

Figure 1 in **Appendix A** shows a project location map and **Figure 3** in **Appendix A** shows a more detailed map of the existing Jersey Heights Pump Station site.

2.2. History

In Morristown and Morrisville, a large wastewater collection system expansion was constructed circa 1974, though portions of the collection system are older. Since then, periodic expansions of the sewer service area have been completed, building further from the Village and Town centers and especially in the area of the Jersey Heights pump station. In 2007, MW&L completed a major upgrade project to the wastewater treatment facility which increased the design flow of the facility to 0.550 mgd.

The Jersey Heights Pump Station is believed to have been constructed with most of the collection system circa 1970. Periodic maintenance and replacement of failed equipment has been performed at the site since then. In 2018, MW&L upgraded the pump station by installing a new standby generator to the facility.

2.3. Condition of Existing Facilities

2.3.1 Introduction

MW&L owns and operates its own collection system and pump stations. MW&L owns the wastewater treatment facility, but contracts out the operation of the wastewater treatment facility to H2O Innovation. The sewer collection system serves the downtown areas of Morrisville and Morristown on either side of the Lamoille River.

2.3.2 Wastewater Collection System

The wastewater collection system consists primarily of asbestos cement pipe, though some older vitrified clay (VC) pipe is still in use, which were mostly installed prior to the 1970's. More recent expansions and improvements have made use of polyvinyl chloride (PVC) pipe since the 1980's. The wastewater collection system was not evaluated as part of this project.

The Jersey Heights Pump Station service area is mostly the western side of the Village and Town and also services everything south of Union Street. **Figure 2** in **Appendix A** illustrates the sewer service area of the pump station.

2.3.3 Wastewater Treatment

MW&L owns and H20 Innovation operates the wastewater treatment facility under Discharge Permit No. 3-1155 that treats wastewater prior to discharge into the Lamoille River. In 2007, MW&L completed an upgrade of the existing wastewater treatment facility at the permitted flow of 0.550 mgd. The upgrade included the conversion of two aeration tanks to a sequential batch reactor (SBR) tank, as well as, an additional SBR tank built. Within this upgrade project, treatment components were built for a capacity of 660,000 gpd, but the Discharge Permit was not amended to this higher flow. The wastewater treatment facility provides wastewater treatment capacity for both existing residential and commercial properties and for new development, in areas that lie within the existing sewer service area.

2.3.4 Jersey Heights Pump Station

The JHPS is located in the western portion of Morrisville and just to the west of the downtown area. The pump station is located adjacent to where Broadman Brook and the Lamoille River meet each other. It is a below-grade duplex pump station with a cast-in-place concrete wet well and a steel dry pit. The Jersey Heights Pump Station service area is most of the western side of the Village and Town, and everything south of Union Street. Morristown's sewer service area as well as the sub-area served by the Jersey Heights Pump Station is shown on **Figure 2** in **Appendix A**, and the existing pump station plan and sections are shown on **Figure 3** and **Figure 4** in **Appendix A.**

The cast-in-place concrete wet well contains a JWC sewage grinder installed in 2016 and a wet well compartment with an active volume of 500 gallons, which is undersized for the current pumping capacity. This structure is equipped with 4" vent with a ship's ladder leading down into the structure. The ground elevation at the wet well is approximately 604.5 feet with a base slab elevation of 582 feet, which means the top of this structure sits well above the 100-year and 500-year flood elevations. A new 50KW Generac standby generator and automatic transfer switch were installed in 2018 and is located next to wet well structure. On-site power is supplied as 120V/208V, 3 phase.

The ground elevation at the dry pit is approximately 604.5 feet with a bottom elevation of 582.08 feet. The dry pit is a steel structure with an internal dimension of 7'-0" by 10'-6". Electrical equipment, pump motors, pumps, and control panel are located at the bottom of the structure. The dry pit is equipped with lighting and mechanical ventilation. Access to the equipment at the bottom of the dry pit is accessed via an electrically operated manlift with an integral ladder through a 4' wide access tube. Since the pump station dry pit is technically a public building under a utility occupancy, annual inspection of this device is required.

There are two (2) 40-HP non-clog horizontal centrifugal pumps manufactured by Cornell. The pumps have a nominal capacity of 250 gallons per minute (gpm) each at 72 feet total dynamic head.

The pump station is in a grass clearing that is located between a residential home at 330 Jersey Heights, Broadman Brook, the Lamoille River, and Route 100 (Jersey Heights). The pump station parcel is roughly 0.35-acre large and is MW&L-owned, while only 0.16-acres of 0.35-acre lot is actually cleared of trees. Access to the site is provided from a stair adjacent to the roadway parking area or down a gravel drive near the existing home driveway.

The pump station is fed via a single influent manhole, located west of the pump station. This manhole is very deep, with the 16-foot-deep controlling inlet invert being the 10-inch sewer that crosses the under route 100/Jersey Heights.

The Jersey Heights Pump Station discharges through a 6-inch PVC force-main that runs north under the Boardman Brook to Feline Loop, then up Feline Loop and connects into the gravity sewer system. This force-main is reported by MW&L is to be in fine condition, however, there was a break in the force-main in the past 10 years.

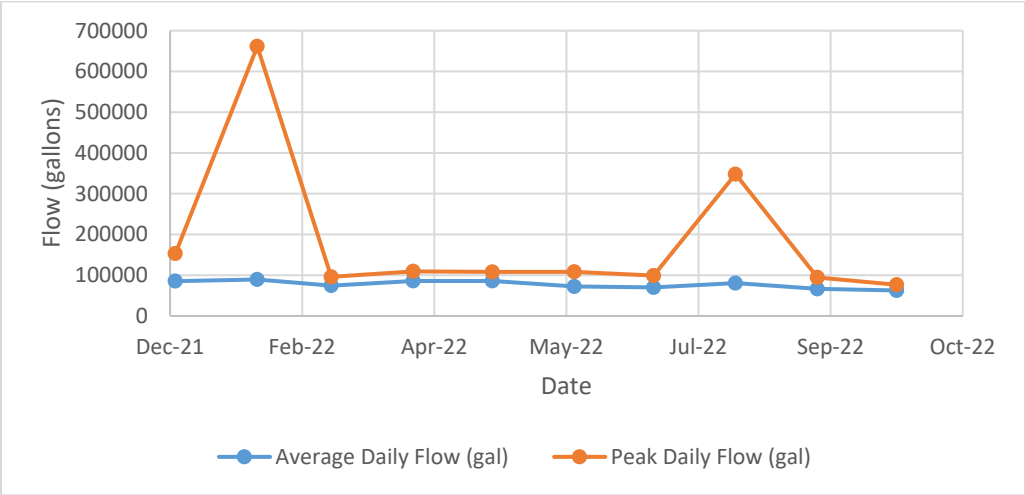
JHPS Control Panel, Wet Well, and Dry Pit

JHPS Pumps

2.4. Jersey Heights Pump Station Flows

MW&L collects daily run-time data for both pumps at the JHPS and periodically measures pump output. This data is then used to estimate daily flows at this site. Based on daily flow data provided by MW&L for 10 months of 2022, the average daily flow (ADF) at this site is 77,000 gallons per day (gpd). The maximum daily flow (MDF) over this time was on February 14, 2022, with a flow of 661,500 gallons. In Figure 2.1 below is the monthly average and peak daily flows for the evaluation period.

Figure 2.1
Jersey Heights Pump Station Flow Data (2022)



Flow monitoring is not available at this pump station, but based on a typical peaking factor of 3.8 at the average daily flow, a peak hourly flow of 227 gpm is estimated, which is approximately 90% of the 250-gpm pump capacity.

2.5. Financial Status of Existing Facilities

MW&L has metered sewer accounts. The current residential sewer rate structure includes a base monthly charge of between $42.83 per month up to $1,914 depending on the size of the meter. There is an additional user fee of $0.007653 per gallon less than 10,000 gallons and $0.009797 for any gallon greater than 10,000 gallons. Table 2.1 breaks down the wastewater billing rates for different meter sizes, which can also be found in **Appendix B**.

Table 2.1
Wastewater Rates

Meter Size	Customer Charge	Usage Rate per Gallon Less than or Equal to 10,000 Gallons	Usage Rate per Gallon Greater than 10,000 Gallons
5/8"-3/4"	$42.83	$0.007653	$0.009787
1"	$82.03	$0.007653	$0.009787
1 1/2"	$173.16	$0.007653	$0.009787
2"	$319.00	$0.007653	$0.009787
3"	$455.71	$0.007653	$0.009787
4"	$1,914.00	$0.007653	$0.009787
Non-metered	$78.80	$0.007653	$0.009787

MW&L maintains a separate enterprise fund for their wastewater department. Wastewater department revenues and expenses are shown in **Appendix C** and summarized in Table 2.2, below. A typical residential household using 60,000 gallons per year pays approximately $575 per year or $48 per month.

Table 2.2
Wastewater Department Budget

	2020	2021
Sales & Other Operating Revenues	$ 1,089,256	$ 1,145,984
Operating Expenses	$ (942,507)	$ (949,355)
Operating Income (loss)	$ 146,749	$ 196,629
Non-operating Income (expense)	$ (55,497)	$ 10,620
Net Position	**$ 91,252**	**$ 207,249**
Utility Plant & Equipment	$ 8,282,186	$ 8,042,074
Current Assets	$ 1,523,637	$ 1,751,317
Deferred Outflows of Resources	$ 13,177	$ 20,667
Total Assets and Deferred Outflows	**$ 9,819,000**	**$ 9,814,058**
Long-term Liabilities	$ 3,671,372	$ 3,427,243
Current Liabilities	$ 297,484	$ 329,979
Deferred Inflows of Rouses	$ 6,178	$ 5,621
Total Liabilities and Deferred Inflows	**$ 3,975,034**	**$ 3,762,843**
Net Position		
Net Investment in Capital Asset	$ 4,387,062	$ 4,403,582
Restricted	$ 801,688	$ 896,282
Unreserved	$ 655,216	$ 751,351
Total Net Position	**$ 5,843,966**	**$ 6,051,215**
Total Liabilities, De. Inflows and Net Positions.	**$ 9,819,000**	**$ 9,814,058**

The system has a reserve fund that contains approximately $751,351 as of FY2021.

The Wastewater Department had an increase to its net position during 2021 of approximately $207,000 compared to $91,000 in 2020 based on operating expenses of $949,355. Operating revenues increased approximately $50,000, expenses were down slightly and interest expense was lower by $75,000.

2.6. Water/Energy/Waste Audits

The MW&LD has completed water, energy, or waste audits for their wastewater system by Weston & Sampson, but has not completed an audit for their sewer pump stations.

3. NEED FOR PROJECT

3.1. Health, Sanitation, and Security

The purpose of this project is to upgrade an aging pump station with a modern pump station with increased capacity. Improving the reliability of this infrastructure will reduce the potential for health or sanitation issues associated with this site. Specific health, sanitation, and security-related needs at this site include:

- Antiquated manlift
- Aging process, mechanical and electrical
- Original steel dry pit
- Undersized pumping capacity

3.2. Aging Infrastructure

This pump station was installed circa 1970 and while some major components such the pumps have been replaced since then, any equipment that has not been replaced will have reached the end of its expected useful life. Specific age-related needs at the site include:

- Aging mechanical & electrical equipment
- Undersized dry pit makes maintenance difficult
- Antiquated manlift and ladder makes safe access difficult
- Undersized wet well compartments causing rapid pump cycling

Inside of the dry pit there is a manlift that is old and likely in need of being inspected and is not up to code with the Vermont Fire and Safety regulations. The pump station was completely reconditioned in 2006, which included rewiring both the electric motors and replacing the impellers and bearings on the pumps and new electric controllers. The pump station's wet well and dry pit are both very small and makes maintenance and inspection of the facility difficult.

Table 3.1
Jersey Heights Pump Station Condition Assessment

Item	Rank of Existing Condition					Year Installed	Projected Remaining Life (Years)	Notes
	Poor		Fair	Good				
	1	2	3	4	5			
Control Panel	X					1970	<2	
Wet Well Structure			X			1970	10+	
Pumps	X					1970	<2	One pump reconditioned last year and the other in 2006
Grinder				X		2016	<10	
Generator					X	2018	20+	
Dry Pit		X				1970	10+	
Manlift Elevator	X					1970	<2	Is not always functional

3.3. Reasonable Growth

The purpose of this project is to improve redundancy of critical infrastructure and is also intended to increase the pump station capacity. However, the proposed infrastructure will have a very long useful life (over 40 years in the case of wet wells and subsurface piping), so the proposed improvements should be designed to meet MW&L's growing needs throughout that time period.

As discussed in Section 1.4, the Town of Morristown will see a projected 16% increase in population over the next 10 years, as well as, significant residential and commercial development within this sewer service area, with expansion of the sewer collection system.

Key reasonable growth aspects that the new pump station will need to support include:

- Input from the Town's Planning Director/Zoning Administrator indicate that there are been two approved developments in the Jersey Heights Pump Station's service area. Table 3.1 breaks down the two developments and the expected size of the developments. One of the developments, Jersey Heights Apartments, is currently under construction. Projected flows from these approved developments are 53,340 gpd.
- The Town's Planning Director/Zoning Administrator provided information on two other major developments that are currently in planning, but have not yet been approved. The two future developments are listed below in Table 3.2 and could require an additional 151,200 gpd.

Table 3.2
Jersey Heights PS Service Area
Approved Development

Development	Units	Flow (gpd)
Jersey Heights Apartments	200	42,000
HA Manosh – Jersey Way & Cottage Street	54	11,340
Total		53,340

Table 3.3
Jersey Heights PS Service Area
Possible Future Development

Development	Units	Flow (gpd)
Cheng Property	520	109,200
Heanue's House Property	200	42,000
Total		151,200

As mentioned in the report in Section 2.3.3, the wastewater treatment facility is currently permitted for 550,000 gpd and the average daily flow is roughly 380,000 gpd. Once the actual wastewater flows approach 80% of the permitted threshold, a plan for expansion of the capacity is required. As mentioned previously, the upgraded facility is capable of a permitted flow of 0.660 mgd, so this expansion capacity can be used in the future if needed.

Based on the approved developments in the Jersey Height service area, an approximately 70% increase in flows is projected at the Jersey Heights Pump Station over the next few years. Current flows are approximately 77,300 gpd, so the recommended design flow is at least 131,000 gpd and would require a pumping capacity of 350 gpm. Expansion of the pumping capacity is required, but it is important not to oversize the pumps. As these new units are built and connected, the actual flows will be less than the design flows until some of these developments have been built, which may take many years to build out and therefore could be outside the 20-year design life of the new equipment. Also, the existing force-main size will be a limiting factor in the capacity increase for this pump station.

4. ALTERNATIVES CONSIDERED

4.1. Description

The objective of this project is to refurbish or replace an existing pump station to improve safety and long-term reliability as well as allow reasonable growth in the service area. Design criteria for the pump station, including pump type, design flow, and are reviewed and developed in Section 4.2. Using these design criteria, three upgrade alternatives are described in more detail in Section 4.3.

4.2. Preliminary Design Criteria

Guidelines for the design of pump stations are provided in TR-16 and the 10 States Standards.

For this project, the following design criteria were used in the evaluation and development of the pump station alternatives:

Design Flow

As described in Section 3.3, the recommended design-year average daily flow (ADF) for this pump station is 131,100 gpd. For flows between 100,000 and 500,000 gpd, a peaking factor of 3.8 is recommended, for a design-year peak hourly flow (PHF) of 350 gpm.

A minimum flow velocity of 2 feet per second is recommended to prevent solids deposition in the force-main. Since the Jersey Heights Pump Station uses a 6-inch diameter force-main, a minimum flow rate of 180 gpm is recommended. The proposed 350-gpm design flow is enough to provide a velocity of approximately 4 feet per second.

While issues with pipe erosion generally do not occur at velocities of less than approximately 8 feet per second, a velocity of 4 feet per second imposes additional headloss and energy usage that will be necessary only when the pump station is operating at peak flow, which will be relatively infrequent even during the design year. Therefore, it is recommended that both pumps be run on variable frequency drives (VFD's) to allow pump output to be reduced during times of low flow.

Wet Well Sizing

The total wet well size varies depending on the type of pump and associated suction or submergence requirements, but a normal working storage range should limit pump cycles to no less than 5 minutes (to prevent damage to the pumps or motors) or greater than 30 minutes (to prevent odor and corrosion issues). This is equal to approximately two minutes of pumping capacity, since shorter pump cycle times can cause excessive pump or motor wear or other reliability issues, though some pump manufacturers may allow a shorter cycle time. Since the

design-year pumping capacity of the Jersey Heights Pump Station is 350 gpm, a minimum active operating volume of at least 700 gallons is recommended.

Typically, wet wells with an exterior width larger than 12 feet are constructed from cast-in-place concrete, while smaller wet wells are constructed from precast concrete segments. Precast concrete reduces construction cost due to the efficiency of off-site fabrication, but structures wider than 12 feet cannot be cost-effectively transported to the site due to oversize/overweight load requirements.

Additionally, structures deeper than approximately 20 feet generally present greater constructability challenges and higher construction costs due to the need for more involved dewatering and shoring measures.

Preliminary Treatment

Preliminary treatment at pump stations can include screening and grit removal and is intended to protect downstream equipment and infrastructure such as the pumps or force-mains from damage due to fouling, plugging, or solids accumulation. For a pump station of this size, no preliminary treatment is required, though as issues with non-disposable wipes and other non-degradable consumer goods have become more common, installation of preliminary treatment at small- and medium-sized pump stations is becoming more common. Preliminary treatment at pump stations can range from simple trash baskets to full screening and grit removal, and can include (in order of cost and complexity)

- Trash baskets
- Sewage grinders
- Vertical rotary screens
- Inclined rotary or multi-rake fine screens, possibly combined with grit removal

Manually-cleaned screens are generally no longer used as primary screening devices in pump stations, since they require regular visits by operators to clean and require construction of a very costly occupiable below-grade space with lighting, ventilation, stair access, etc.

The existing force-main and proposed pumps will be capable of handling spherical solids up to 3 inches in diameter, there is already fine screening installed at the WWTF, and the SBR process in use at the WWTF is well-suited for handling the high intermittent pump station discharges necessary to keep the force-main clear of solids, so installation of fine screening and/or grit removal at this site is not recommended. Rather, the purpose of any preliminary treatment at this site would be to prevent fouling of the pumps by non-degradable rags or wipes. As a minimum, continued use of the existing sewage grinder or installation of a new unit is recommended.

Pumps

Types of pumps typically used in wastewater pump stations include:

- Submersible solids-handling, chopper, or grinder pumps

- Centrifugal solids-handling or chopper pumps located in an adjacent dry-pit
- Vacuum-primed centrifugal suction pumps located above-grade.

Submersible pumps used in wastewater applications are typically either solids-handling pumps or grinder/chopper pumps. Grinder/chopper pumps break solids in the wastewater into smaller pieces that are less likely to plug the pump or force-main. The cutting units on these pumps wear out and require periodic service, and may have particular difficulty with inorganic rags and pieces of plastic. Solids-handling pumps have specially-designed impellers and volutes that can pass solids with less likelihood of plugging, though the downstream force-main must be larger, typically at least four (4) inches in diameter.

Since a six-inch diameter force-main is already installed and will remain in use, the added maintenance of grinder pumps is not necessary. Therefore, the proposed pump station should make use of submersible solids-handling pumps.

4.3. Alternatives Considered

4.3.1 – Alternative No. 1 – Re-use Existing Pump Station Structure

This alternative would include the following:

- Duplex 40-HP horizontal centrifugal solids-handling pumps.
- Refurbishment of the existing steel dry pit
- Upgrades to the man lift in the dry pit
- Above-grade space to house controls and electrical equipment.
- New duplex control panel, telemetry system, and appurtenances.

A 2-minute minimum pump run time is recommended for dry-pit centrifugal pumps, and dry-pit centrifugal pumps should still be operated with flooded suction to prevent priming issues. Accounting for clearance around the pump intake piping, some additional wet well depth is required below the pump elevation, so the total interior depth of this structure would be approximately 24 feet, similar in depth to the top-mounted pump station option, though the amount of excavation will be significantly larger since the pump station substructure is larger.

A map showing this alternative is included in **Figure 5 in Appendix A**. A technical evaluation of this alternative is included in Table 4.1, below:

Table 4.1
Alternative No. 1
Technical Evaluation

Advantages	Disadvantages
• Reuse existing precast wet well and sewage grinder. • Reuse original dry pit • Addition of an above grade structure to house the pump controls • Existing generator can be used with one pump running	• Shorter remaining useful life for the steel dry pit since it is being refurbished and used • Pumps aren't very well accessible in existing dry pit and requires confined space entry • May not be possible to upgrade the existing man lift to improve reliability and compliance with current regulations • Have to bypass flow while construction takes place

4.3.2 - Alternative No. 2 – Submersible Pump Station

This alternative would include the following:

- New circular, precast concrete wet well with an interior diameter of 8 feet and an interior depth of approximately 22 feet.
- Duplex 40-HP solids-handling submersible pumps, 350 gpm each, mounted on lift-out brackets and rails.
- Continued use of existing wet well and sewage grinder
- At grade control building that will house the pump control panel and all other electrical equipment.
- Precast concrete valve vault
- New 10-inch sewer connections to the existing influent manhole and inlet sewers
- Extension of the existing 6-inch diameter force-main to the new pump station location
- Decommissioning of the existing pump station

The pump station will consist of a new circular, precast concrete wet well with an interior diameter of 8 feet and an interior depth of 22 feet, equipped with duplex submersible pumps. The pumps would be mounted on lift-out brackets and slide rails, which will allow removal of the pumps for maintenance or repair without confined space entry into the wet well. Submersible pump stations generally do not include separate wet well compartments, so only a single wet well compartment will be included.

Submersible pumps generally must remain submerged (or mostly submerged) while running so that the surrounding liquid can cool the pump motor. Additionally, the 8-foot inner diameter available from local precast suppliers results in an additional four feet of depth necessary to hold

the recommended 1,700-gallon storage volume. Consequently, this pump station will be relatively deep, with an interior depth of approximately 22 feet, likely requiring an excavation at least 25 feet deep. Equipment information for a typical submersible pump station package is included in **Appendix D.**

The pumps will need to be fully removed as a unit from the wet well for any type of maintenance or repair, and the pumps will likely weight nearly 1,200 pounds each. Therefore, removal of the pumps will require access with a portable crane or boom truck with a minimum 1,200-pound capacity.

A figure showing this alternative is included in **Figure 6 in Appendix A**. A technical evaluation of this alternative is included in Table 4.2, below:

Table 4.2
Alternative No. 2 Technical Evaluation

Advantages	Disadvantages
• Mechanical simplicity. • Use of precast concrete structures. • Submersible pump stations are familiar to W&L's operations staff • Reuse existing precast wet well and sewage grinder. • Eliminates original dry pit and confined space entry for access of pump controls and pump maintenance. • Existing generator can be used.	• Very deep excavation will require extensive shoring and dewatering. • Pumps are very heavy and will require removal for any type of maintenance or repair. • Submersible pumps susceptible to moisture damage due to seal failure. • Submersible pumps tend to be less reliable than dry pit pumps.

Submersible pumps are mechanically relatively simple, do not have to be primed, are self-cooling, and do not require a separate dry-pit space, so have become very popular for municipal pump stations, especially small- to medium-sized pump stations with design flows of less than 50,000 gallons per day. For larger pump stations, the size and weight of the pumps and the need to remove them for most maintenance or repair tasks limits their advantages. Additionally, the pumps are continuously submerged, so eventual failure of the seals will require periodic refurbishment of the pumps.

4.3.3 – Alternative No. 3 – Rectangular Recessed Pump Station

This alternative would include the following:

- New circular, precast concrete wet well with an interior diameter of 8 feet and an interior depth of approximately 19 feet
- A rectangular recessed pump station (either vacuum- or self-priming) with 40-HP solids-handling pumps.
- Continued use of existing wet well and sewage grinder.
- New pump house to hold the pumping equipment and controls.
- New control panel, telemetry system, and appurtenances.
- New 10-inch sewer connections to the existing influent manhole and inlet sewers
- Extension of the existing 6-inch diameter force-main to the new pump station location
- Decommissioning of the existing pump station

The pump station will consist of a precast concrete wet well with an interior diameter of 8 feet and an interior depth of 19 feet, equipped with a rectangular recessed pump station package.

Rectangular recessed pump station packages have pumps that are mounted at- or near-grade on top of the wet well, and operate in suction. Priming of the pumps is accomplished using either self-priming pumps or ancillary vacuum pumps, with the specific choice of priming system largely driven by operator preference. Isolation and check valves for each pump are included as part of the pump package, so a separate valve pit is not typically used. Equipment information for a typical rectangular recessed pump station package is included in **Appendix E.**

With a top-mounted pump station, submergence of the pumps is not an issue, and a 1-minute pump run time is typically allowed by the manufacturer, so this alternative will be shallower, with an interior depth of approximately 19 feet and a total excavation up to approximately 22 feet. This is still relatively deep and will require shoring and dewatering.

A map showing this alternative is included in **Figure 7 in Appendix A**. A technical evaluation of this alternative is included in Table 4.3, below:

Table 4.3
Alternative No. 3
Technical Evaluation

Advantages	Disadvantages
• Pumps readily accessible for maintenance and repair. • Reuse existing precast wet well and sewage grinder. • Use of precast concrete structures. • Excavation not as deep as submersible alternative.	• Mechanically more complex. • Access to recessed structure is a confined space

The additional priming equipment needed for rectangular recessed pump station packages increases the complexity of this type of pump package. However, the pumps and related equipment are mounted just blow grade, so they are more readily accessible for maintenance and repair, and can be more easily disassembled, with the heaviest components generally weighing less than 500 pounds.

4.4. Conceptual Plans

Appendix A includes conceptual drawings for each alternative.

4.5. Environmental Impacts

Most construction activity under any of the alternatives will be limited to mowed areas, with limited impacts to vegetation.

4.6. Land Requirements

There aren't any additional land requirements required, because the MW&L-owned parcel is large enough for all three of the alternatives. An off-site staging and stockpile area will possibly be necessary during construction.

4.7. Potential Construction Problems

All of the alternatives considered include relatively deep excavations, approaching or exceeding 20 feet in depth. Excavations this deep typically require either extensive shoring or sloped sides (thereby greatly increasing the required volume of the excavation). The particular method of stabilizing excavations is typically selected and designed by the contractor.

However, the overall layout of the site and available land area should allow the cost-effective implementation of any of these alternatives. Additionally, the proposed pump station will allow

the existing station to remain in-place and operational during construction to avoid the need for temporary pumping.

Assuming that the excavation will need to be at least 15 feet deep with sides at a maximum 1.5H:1V slope (a value recommended by OSHA for sandy or gravelly soils), the excavation for the proposed pump station would be nearly 60 feet wide and have a volume of at least 1,000 cubic yards. While there is adequate space on the site to achieve this (with additional temporary construction easements), constructability issues with this include the need to temporarily transport and stockpile a large volume of earth, as well as the need for a larger crane to set the wet well structure.

Deep excavations can also be difficult where groundwater is encountered. Assuming the groundwater elevation on the site is roughly equal to that of the Broadman Brook, any excavation below an elevation of approximately 605 feet MSL may require additional dewatering methods, which would increase the cost of the project.

4.8. Sustainability Considerations

The purpose of this project is to replace aging wastewater collection system infrastructure, so there are limited sustainability considerations. By using VFD's, head loss in the force-main can be limited to only that necessary to meet inflow and velocity requirements in the force-main, thereby reducing energy consumption.

4.9. Cost Estimates

The opinion of probable construction costs for the Jersey Heights Station Upgrade alternatives are shown in Table 4.4. Detailed breakdowns of construction cost estimates for each alternative can be found in **Appendix F.**

Table 4.4
Estimated Construction Costs

Alt. No.	Description	Total Opinion of Probable Cost (ENR 13175)[(1)]
1	Re-use Existing Pump Station Structure	$585,000
2	Submersible Pump Station	$705,000
3	Rectangular Recessed Package Pump Station	$695,000

Notes:
1. Costs are based on ENR 13175 (April 2023)

Operation and maintenance costs will be limited to electrical usage, periodic cleaning and/or other maintenance, and periodic maintenance or replacement of pumps and electrical controls, and are not expected to vary between these alternatives.

5. SELECTION OF AN ALTERNATIVE

5.1. Life Cycle Cost Analysis

Lifecycle costs for the alternatives differ due to variability in useful life and construction costs. A lifecycle cost analysis is shown in **Appendix G**. Alternative No.1 has the lowest construction cost, but only has a useful life at 20 years. Alternative No.2 has a useful life of 60 years and the largest construction cost, due to the large capital cost of the long-lived building structure. Lastly, Alternative No.3 has a shorter useful life as Alternative No.2 at 50 years, but is similar to Alternative No.2. A comparison of the lifecycle costs is shown in Table 5.1

Table 5.1
Estimated Lifecycle Costs

Alt. No.	Description	Estimated Lifecycle Cost (Net Present Value)
1	Re-use Existing Pump Station Structure	$1,141,338
2	Submersible Pump Station	$721,926
3	Rectangular Recessed Package Pump Station	$722,458

Alternative No. 1 has the highest lifecycle cost because of the alternative's such short life span. Alternative No.2 and Alternative No.3 have a similar lifecycle cost demonstrating that no alternative offers a clear advantage in lifecycle cost between Alternative No.2 and Alternative No.3.

5.2. Non-Monetary Factors

Alternative No.1 – Reuse Existing Pump Station Structure is the cheapest option, but has many constructability issues such as building the stations while continuing operation of the pump station and also modifying the existing wet well to fit the new pumps. Another challenge for Alternative No.1 is the difficulty in repairing the manlift as this technology is outdated and is hard to come by. Alternative No.2 – Submersible Pump Station is what the operators of MW&L are most familiar with, but is the more expensive because of the new building. Alternative No.3 – Rectangular Recessed Package Pump Station and Alternative No.2 both have similar excavation required, but the top-mount pump station packages are mechanically more complex than submersible pump stations.

5.3. Recommended Alternative

Alternative No.2 has a similar lifecycle cost to Alternative No.3, but there are several non-monetary advantages over the other alternatives. Alternative No.1 has the non-monetary

downside of constructability issues and short useful lifespan and Alternative No.3 will be too technically complex. Therefore, Alternative No.2 is the recommended alternative because of its technical simplicity and overall useful lifespan of the pump station.

6. PROPOSED PROJECT

6.1. Project Description

This new pump station will include the following:

- New circular, precast concrete wet well with an interior diameter of 8 feet and an interior depth of approximately 22 feet.
- Duplex 40-HP solids-handling submersible pumps, 350 gpm each, mounted on lift-out brackets and rails.
- Continued use of existing wet well and sewage grinder
- At grade control building that will house the pump control panel and all other electrical equipment.
- Precast concrete valve vault
- New 10-inch sewer connections to the existing influent manhole and inlet sewers
- Extension of the existing 6-inch diameter force-main to the new pump station location
- Decommissioning of the existing pump station

The pump station will consist of a new circular, precast concrete wet well with an interior diameter of 8 feet and an interior depth of 22 feet, equipped with duplex submersible pumps. The pumps would be mounted on lift-out brackets and slide rails, which will allow removal of the pumps for maintenance or repair without confined space entry into the wet well. Submersible pump stations generally do not include separate wet well compartments, but the existing wet well will continue to be used. The site plan of the proposed project is included in **Figure 8 in Appendix A**.

The existing dry pit will be decommissioned. The dry pit will have the equipment removed, demolition of structures to 5 feet below grade, and filled with granular backfill. The standby generator will be salvaged and re-used for the new pump station. The existing wet well will stay in commission and the flow will be diverted to the existing wet well to the new wet well.

The proposed project described above is based off of the preliminary design criteria in Section 4.2. Current flows are approximately 77,300 gpd, which is approximately 90% of the 250-gpm pump capacity with the peaking factor inchluded. Based off of the population growth in the Jersey Heights Pump Station sewage area, the recommended design-year average daily flow (ADF) for this pump station is 131,100 gpd.

The sizing for the new wet well was based off of the design-year pumping capacity, which is 350 gpm. A minimum active operating volume of at least 700-gallons is recommended. The 700-gallon recommendation is calculated under normal working storage range which limit pump cycles to no less than 5 minutes (to prevent damage to the pumps or motors) or greater than 30 minutes (to prevent odor and corrosion issues).

6.2. Project Schedule

A tentative schedule for the proposed project is shown in Table 6.1

Table 6.1
SRF Funded Implementation Schedule

Projected Date		Task
2023	April	Finalize Preliminary Engineering Study
	July	Start Final Design
	October	Prepare Bond Documents Hold Public Informational Meeting
	November	Hold Bond Vote for Project
2024	January	Complete Final Design DBE Mailing Advertisement
	February	Bid Advertisement
	March	Bid Opening & Recommendation to Award
	August	Start Construction
2025	July	Substantial Completion

6.3. Permit Requirements

The following permits are potentially required for this project:

- Environmental Report – An Environmental Information Document (EID) will need to be prepared and submitted for approval to the State of Vermont Water Investment Division. This document will need to be approved during final design.
- Archeological and Historic Preservation – Review of archeological and historic properties in the project area by the State Historic Preservation Office will be required for NEPA compliance if federally-funded programs like CWSRF are used. The project is located in the vicinity of a river, so further archeological evaluation is likely needed, though impacts to archeological or historical resources are not anticipated due to construction occurring within previously-disturbed areas.
- Act 250 – The district Act 250 coordinator will be contacted to determine whether an Act 250 permit is required. It appears that there is no Act 250 jurisdiction on the surrounding parcels, so it is anticipated that the project will not require an Act 250 permit.
- Flood Hazard Area & River Corridor – This project is not located within a flood hazard area, but is located in a river corridor. Since the Town of Morristown's zoning regulations do not address river corridors, a permit from the State of Vermont will be required. Since the project does not involve further encroachment into the river corrido than what currently

exists at the site, it is anticipated that this project could be permitted under the No Adverse Impact standard.

- Division of Fire Safety (DFS) – This project involves new construction of a public building and will require a DFS permit.

6.4. Sustainability Considerations

The selected alternative will have the greatest environmental impact due to the increased excavation and earth disturbance. However, construction will be limited to mowed areas with limited impacts to vegetation. Sustainability measures able to integrated are limited due to the nature of the project, but one consideration is proper pump selection to help reduce overall electrical costs.

6.5. Land Requirements

The current pump station is located on a parcel that is roughly 0.35-acre large and is MW&L-owned, while only 0.16-acres of 0.35-acre lot is actually cleared of trees. Access is provided down a stair adjacent to the roadway parking area or down a gravel drive near the existing home driveway.

The MW&L owned parcel is a large enough site of the new pump station, therefore additional easements will not be necessary for this project, but off-site staging may be required during construction.

6.6. Estimated Costs

6.6.1 Estimated Construction Costs

Current estimated construction costs and construction costs projected for the proposed construction started in April 2024 are in Table 6.2, below.

Table 6.2
Estimated Construction Costs

Description	Estimated Construction Cost	
	ENR(1)	ENR(2)
Submersible Pump Station	$705,000	$750,000

Notes:

1. Costs are based on ENR 13175 (March 2023)
2. Costs are based on ENR 14000 (Projected for April 2024)

6.6.2 Total Project Costs

The estimated total project cost of $1,070,000 is summarized in Table 6.3, below. The total project cost includes: construction, 15% construction contingency, engineering, permit feed, and other related project costs.

Table 6.3
Total Project Cost Summary

Item Description	Total Estimated Cost
Construction [1]	
Jersey Heights Pump Station Replacement	$750,000
Construction Subtotal	$750,000
Construction Contingency	
Construction Contingency (15%)	$112,500
Construction Contingency Subtotal	$112,500
Step I – Preliminary Engineering	
Environmental Report	$3,000
Step I Subtotal	$3,000
Step II - Final Design and Permitting	
Final Design Basic Services	$53,700
Subsurface Investigation	$5,000
Special Services	$5,000
Step II Subtotal	$63,700
Step III - Construction Phase Services [2]	
Bid & Construction Services	$98,450
Special Services	$10,000
Step III Subtotal	$108,450
Other Costs	
Administrative	$2,500
Bond Vote Assistance	$3,000
Permit Fees	$5,000
Archeological/Historic Properties Assessment	$3,500
Legal & Fiscal	$5,000
Short Term Interest	$10,000
Other Subtotal	$29,000
Total Project Cost	$1,066,650
Use	**$1,070,000**

Table Notes:
1. Construction cost based upon ENR 14000 (projected for April 2024)
2. Based upon State of Vermont Water Investment Division fee curves.

6.7. Funding Options

6.7.1 State of Vermont CWSRF

The State of Vermont provides funding for planning, design, and construction of water infrastructure projects through the Clean Water State Revolving Fund (CWSRF). The CWSRF program offers loans with a 2% administrative fee for 100% of eligible costs. To qualify for a CWSRF loan, the project must be listed in the fundable range of the CWSRF priority list. A priority list application is required each year for which funding is sought.

The CWSRF program offers subsidies for some projects and costs. While these subsidies very from year to year, subsidies currently available include:

- Loan subsidy up to 50% (as of 2022) for the preliminary (Step I) and final design (Step II) engineering services, capped at $100,000 per project for each fiscal year. If MW&L would like to make use of these funds for final design, MW&L will need to complete a qualifications-based selection (QBS) process to select a final design consultant
- PC grants of up to 25% of total project cost are issued using a points-based scoring system that considers factors such as affordability, effects on public health and water quality, as well as other factors. Preliminary scoring based on the current PC program rule suggests that, since the State of Vermont has elected to not prioritize proactive replacement of aging wastewater infrastructure, this project may not be eligible for a PC grant under the current scoring system.
- Disadvantaged-System and Additional Subsidy are available based on economic conditions in the area and year-to-year funding allocations in the CWSRF IUP. These subsidies can be up to approximately 50% of the total project cost. The Town of Morristown would qualify for Disadvantaged System subsidy, and as of 2022 no Additional Subsidy had been allocated in the most recent CWSRF IUP.

6.7.2 USDA Rural Development (RD)

The United States Department of Agriculture (USDA) Rural Development (RD) program includes both grants and loans for infrastructure projects in communities with a population of less than 10,000.

Grant amounts and loan terms are dependent on economic conditions in the community. As of 2021, the Town of Morristown's median household income (MHI) was below the statewide MHI and therefore would be eligible for a grant or reduced interest rates through this program. As of January 1, 2023, the market rate is 3.75%.

6.8. Bond Amount

The recommended bond amount for the project is $1,070,000. MW&L will need to vote on

this full bond amount, with any subsidies being accounted for after voter approval of the bond.

6.9. Annual Operating Budget

6.9.1 Income

The project is not intended or expected to increase system revenues. Post-project system revenue is expected to remain fairly close to the $1,145,984 from FY21.

6.9.2 Annual O&M Costs

The project is not intended or expected to have an impact on annual operation & maintenance costs, though the improved reliability of the Jersey Heights Pump Station may reduce operation & maintenance costs slightly. Post-project operation & maintenance costs are expected to remain fairly close to the $949,355 expenses from FY2021.

6.9.3 Debt Repayments

Based on a loan term of 30 years and an administrative/interest rate of 2%, annual debt payments for the project will be $46,354. In FY 2021 the operating expenditures were $949,355, with a debt principal payment of $329,979, which gives a total of $1,279,334 for the annual sewer budget. The additional debt payment corresponds to an increase in the annual budget of 4.0%. As of 2022, the typical residential household using 60,000 gallons per year would pay a projected rate increase of $24 per year or $2.00 per month for this project.

Table 6.4
Loan Repayment Estimation

Item	Jersey Heights Pump Station
Funding Source	CWSRF
Loan Terms	30 years @ 2%(1)
Initial Repayment Year	2026
Total Amount	$ 1,070,000
Anticipated Total Available Subsidy	$ 31,850
Remaining Loan Amount	$ 1,038,150
Projected Annual Loan Payment	$ 46,354

Notes:
1. Standard CWSRF “Administrative Fee” for all construction loans.

6.9.4 Reserves

As of 2021, the MW&L had approximately $751,351 in reserves designated for sewer capital projects. While a portion of this could be used to fund the project, it would only have a minor impact on the amount of debt required. Additionally, MW&L has other uses for sewer capital funds for projects that are too small to cost-effectively fund through programs such as the CWSRF.

Short-term assets have a lifespan (either to replacement or refurbishment) shorter than the loan term. These include the pumps, VFD's, telemetry, and controls. The total cost of refurbishing or replacing these items over 20 years is approximately $120,000, so the MW&L should allocate about $6,000 per year in reserves to cover major maintenance tasks on the new pump station.

Since MW&L has such a large amount of sewer capital funds for this project, depending on the funding package from the State; MW&L may decide to fund the project internally and not use State funding.

7. CONCLUSIONS AND RECOMMENDATIONS

The most favorable approach to replacement of the Jersey Heights Pump Station is to construct a new submersible pump station adjacent to the existing pump station. The estimated total project cost for the project is $1,070,000, with a recommended bond amount of $1,070,000 or less depending on any local American Rescue Plan Act (ARPA) or capital funds used.

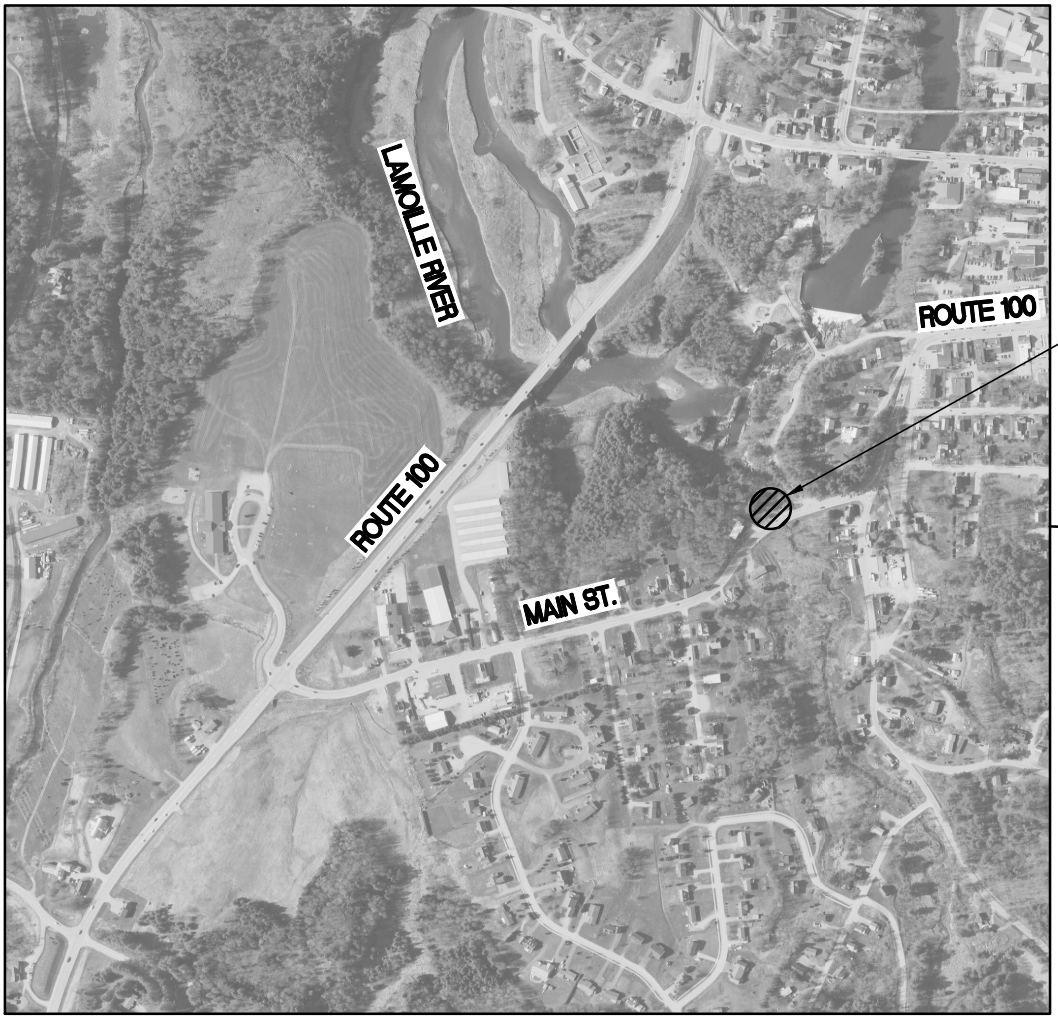
The State of Vermont CWSRF program currently offers loan funding for this type of project, so the MW&L will need to hold and pass a bond vote prior to construction. Construction would tentatively be scheduled for the 2024 construction season.

Next steps for this project include:

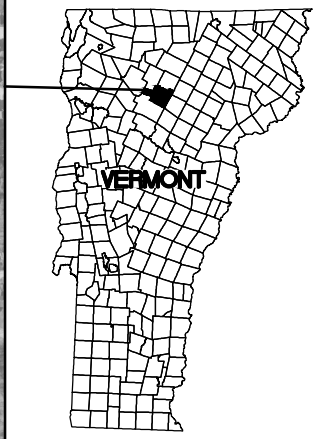
- An Environmental Information Document (EID) should be prepared and submitted to the State of Vermont CWSRF Program. Environmental review has become very time consuming and as of 2022 has to be completed prior to final design for CWSRF projects, so it is recommended that this begins soon. This work is typically completed by MW&L's engineering consultant.
- A CWSRF priority list application for the project should be submitted to the State of Vermont annually in February until construction is complete. There is no cost for this application, and projects must be listed on the CWSRF priority list to receive funding.
- If MW&L would like to make use of CWSRF funds for final design, a final design consultant will need to be selected using the Qualifications-Based Selection (QBS) process.

APPENDIX A

FIGURES



PROJECT LOCATION



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LOCATION MAP

SCALE: 1"=800'

GRAPHIC SCALE

0 800 1200 1600

(IN FEET)

Aldrich + Elliott
WATER RESOURCE ENGINEERS

6 Market Place, Suite 2
Essex Jct., VT 05452

P: 802.879.7733
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PROJECT LOCATION PLAN

JERSEY HEIGHTS PUMP STATION STUDY

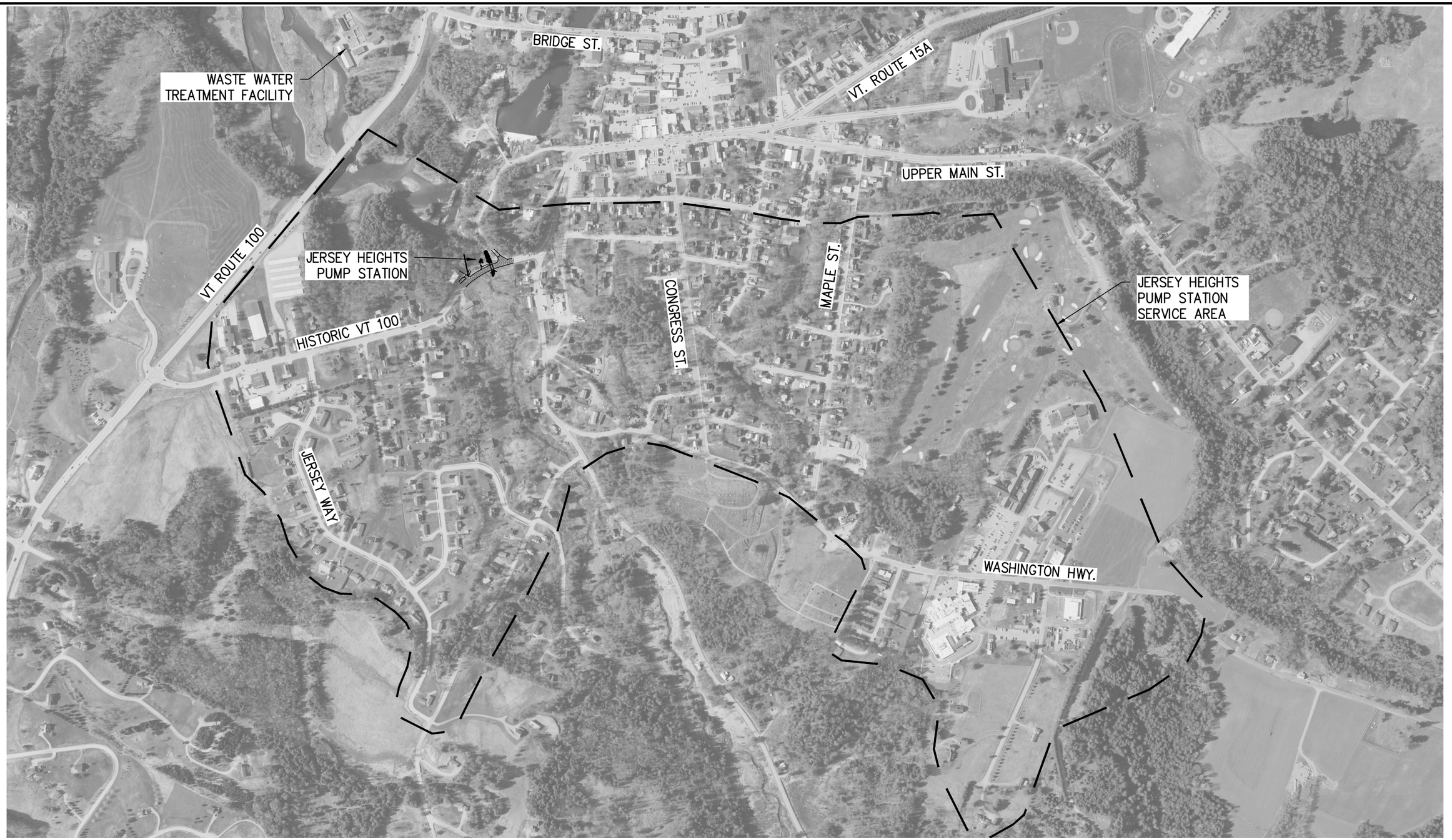
MORRISVILLE WATER AND LIGHT DEPARTMENT

MORRISVILLE VERMONT

DESIGNED	RW
DRAWN	JEB
CHECKED (PM)	JAB
CHECKED (PE)	WAE
SCALE	AS NOTED
DATE	MAR. 2023

PROJECT NO. 22030

FIGURE NO. 1



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PLAN
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GRAPHIC SCALE

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(IN FEET)

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SEWER SERVICE AREA MAP

JERSEY HEIGHTS PUMP STATION STUDY

MORRISVILLE WATER AND LIGHT DEPARTMENT

MORRISVILLE VERMONT

DESIGNED	RW
DRAWN	WAE
CHECKED (PM)	JAB
CHECKED (PE)	WAE
SCALE	AS NOTED
DATE	MAR. 2023
PROJECT NO.	22030
FIGURE NO.	2

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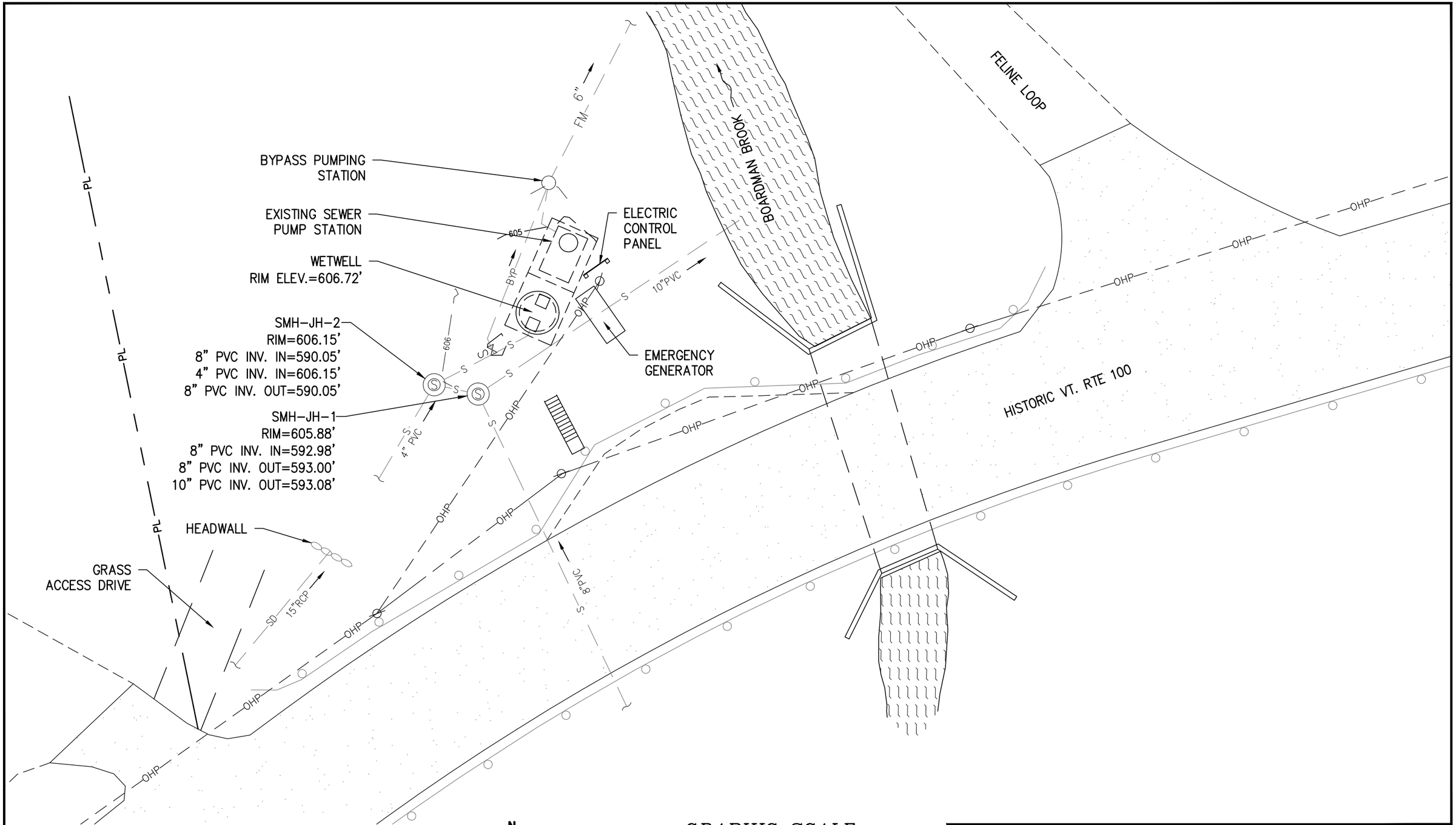

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PLAN
SCALE: 1"=20'

GRAPHIC SCALE

0 20 30 40

(IN FEET)

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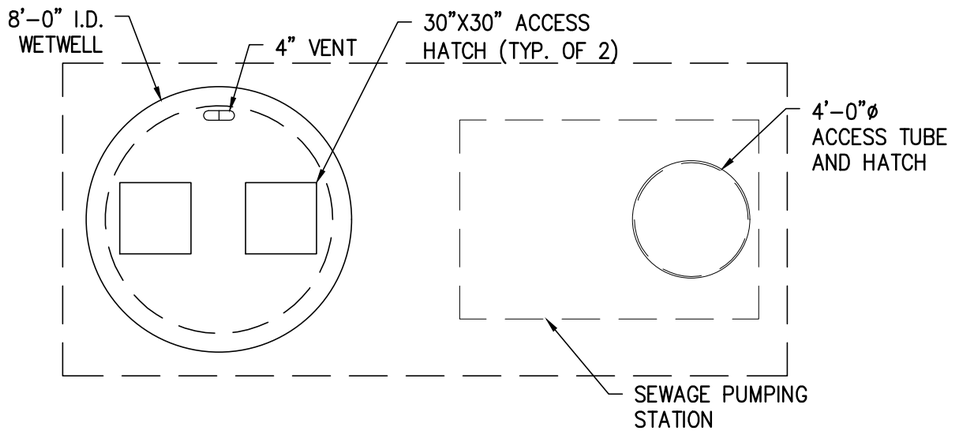
EXISTING SITE PLAN

JERSEY HEIGHTS PUMP STATION STUDY

MORRISVILLE WATER AND LIGHT DEPARTMENT

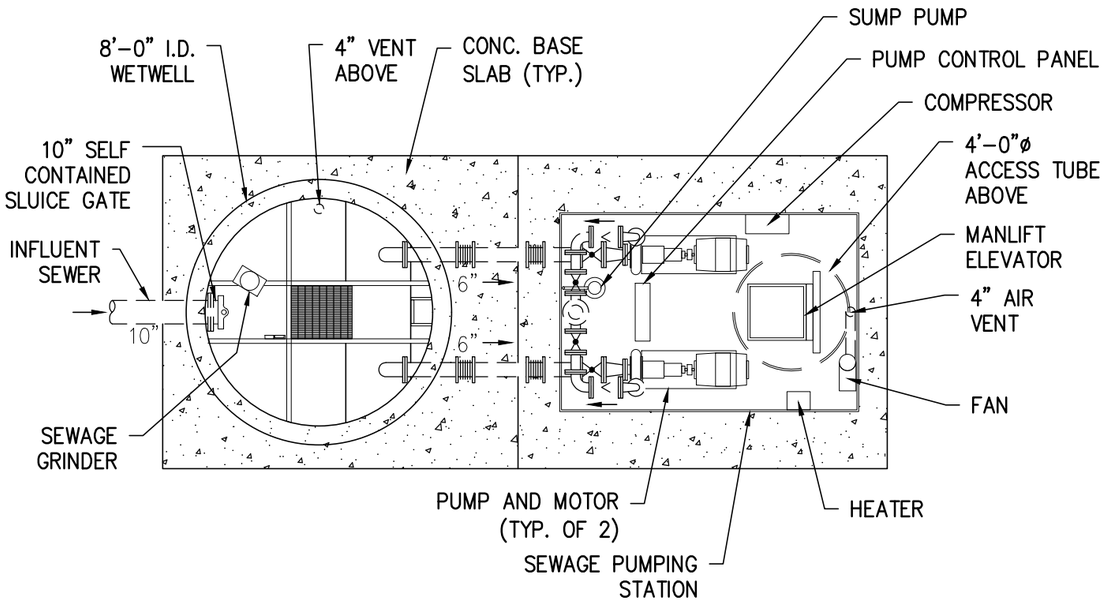
MORRISVILLE SITE PLAN

DESIGNED	RW
DRAWN	JEB
CHECKED (PM)	JAB
CHECKED (PE)	WAE
SCALE	AS NOTED
DATE	MAR. 2023
PROJECT NO.	22030
FIGURE NO.	3



PLAN - GROUND LEVEL

SCALE: 3/16"=1'-0"



PLAN - LOWER LEVEL

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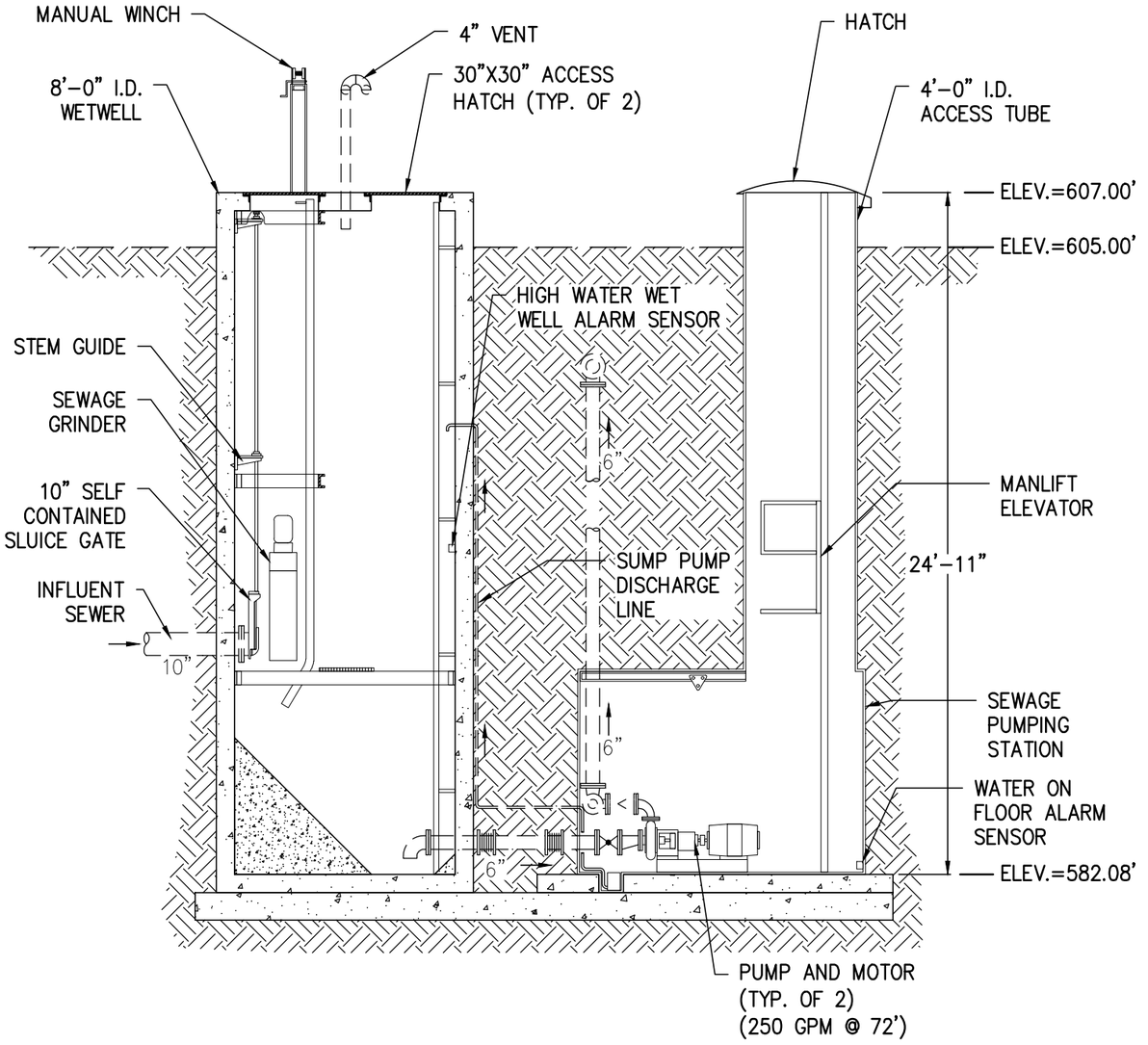

SECTION

SCALE: 3/16"=1'-0"

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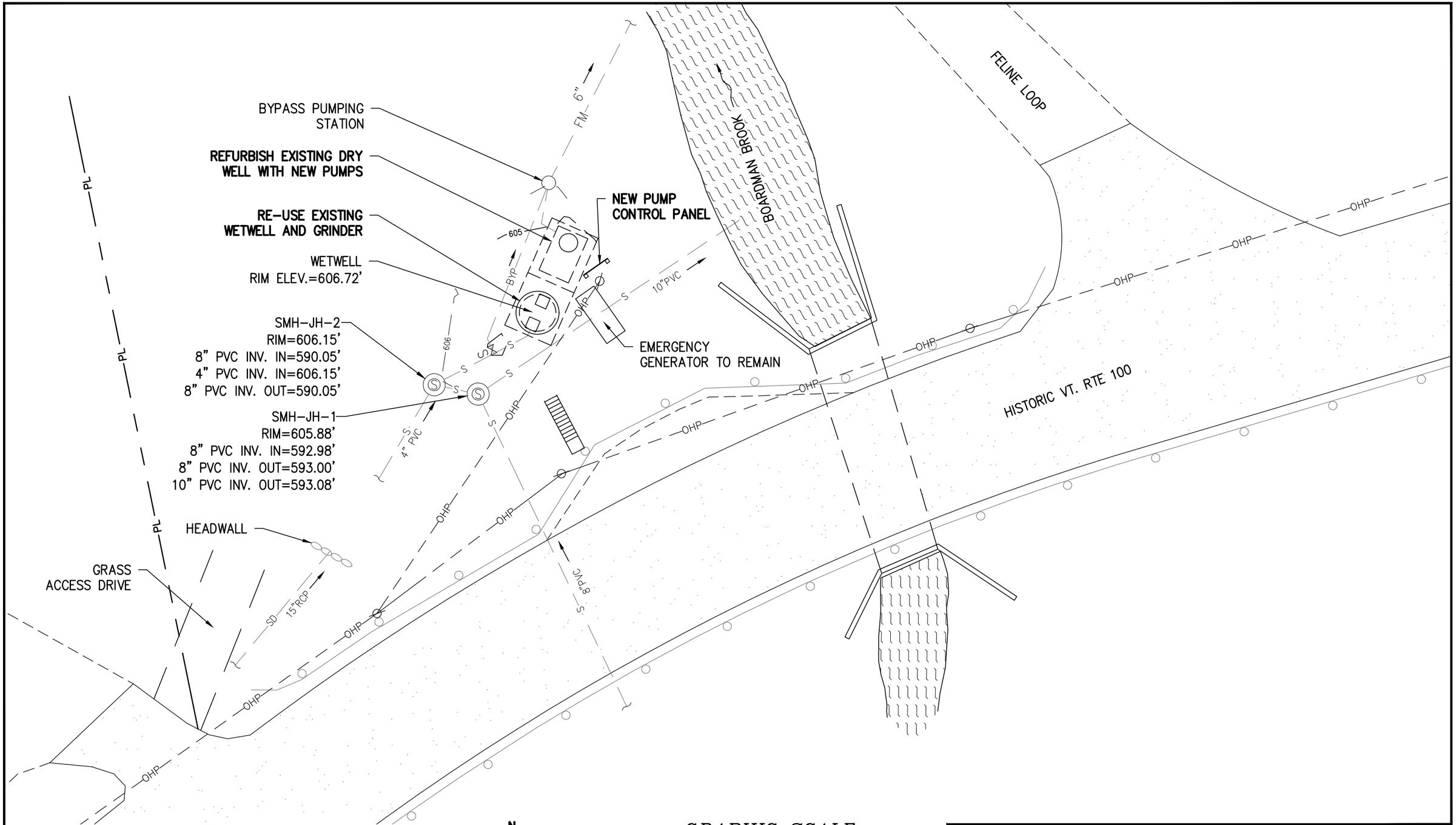
EXISTING PUMP STATION PLANS AND SECTION

JERSEY HEIGHTS PUMP STATION STUDY

MORRISVILLE WATER AND LIGHT DEPARTMENT

MORRISVILLE VERMONT

DESIGNED RW	PROJECT NO. 22030
DRAWN JEB	
CHECKED (PM) JAB	
CHECKED (PE) WAE	FIGURE NO. 4
SCALE AS NOTED	
DATE MAR. 2023	



N

PLAN
SCALE: 1"=20'

GRAPHIC SCALE

0 20 30 40

(IN FEET)

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ALTERNATIVE NO.1
RE-USE EXIST. PUMP STATION
SITE PLAN

JERSEY HEIGHTS PUMP STATION STUDY

MORRISVILLE WATER AND LIGHT DEPARTMENT

MORRISVILLE VERMONT

DESIGNED	RW
DRAWN	JEB
CHECKED (PM)	JAB
CHECKED (PE)	WAE
SCALE	AS NOTED
DATE	MAR. 2023
PROJECT NO.	22030
FIGURE NO.	5

BYPASS PUMPING STATION

EXISTING SEWER PUMP STATION TO BE DECOMMISSIONED

NEW VALVE VAULT

NEW WET WELL (ALT.2)
RIM=604.00'±
10" PVC IN=589.95'±
10" PVC OUT=589.95'±
BASE=581.70±

BUILDING HOUSING ELECTRICAL EQUIPMENT

SMH-JH-2
RIM=606.15'
8" PVC INV. IN=590.05'
4" PVC INV. IN=606.15'
8" PVC INV. OUT=590.05'

SMH-JH-1
RIM=605.88'
8" PVC INV. IN=592.98'
8" PVC INV. OUT=593.00'
10" PVC INV. OUT=593.08'

GRASS ACCESS DRIVE

HEADWALL

ELECTRIC CONTROL PANEL

EMERGENCY GENERATOR

EXISTING WETWELL
RIM ELEV.=606.72'

BOARDMAN BROOK

FELINE LOOP

HISTORIC VT. RTE 100

FM 6"

10"PVC

4" PVC

8"PVC

SD 15"RCP

PL

OHP

S

BYP

605

606

N

PLAN
SCALE: 1"=20'

GRAPHIC SCALE
0 20 30 40
(IN FEET)

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ALTERNATIVE NO.2
SUBMERSIBLE PUMP STATION
SITE PLAN

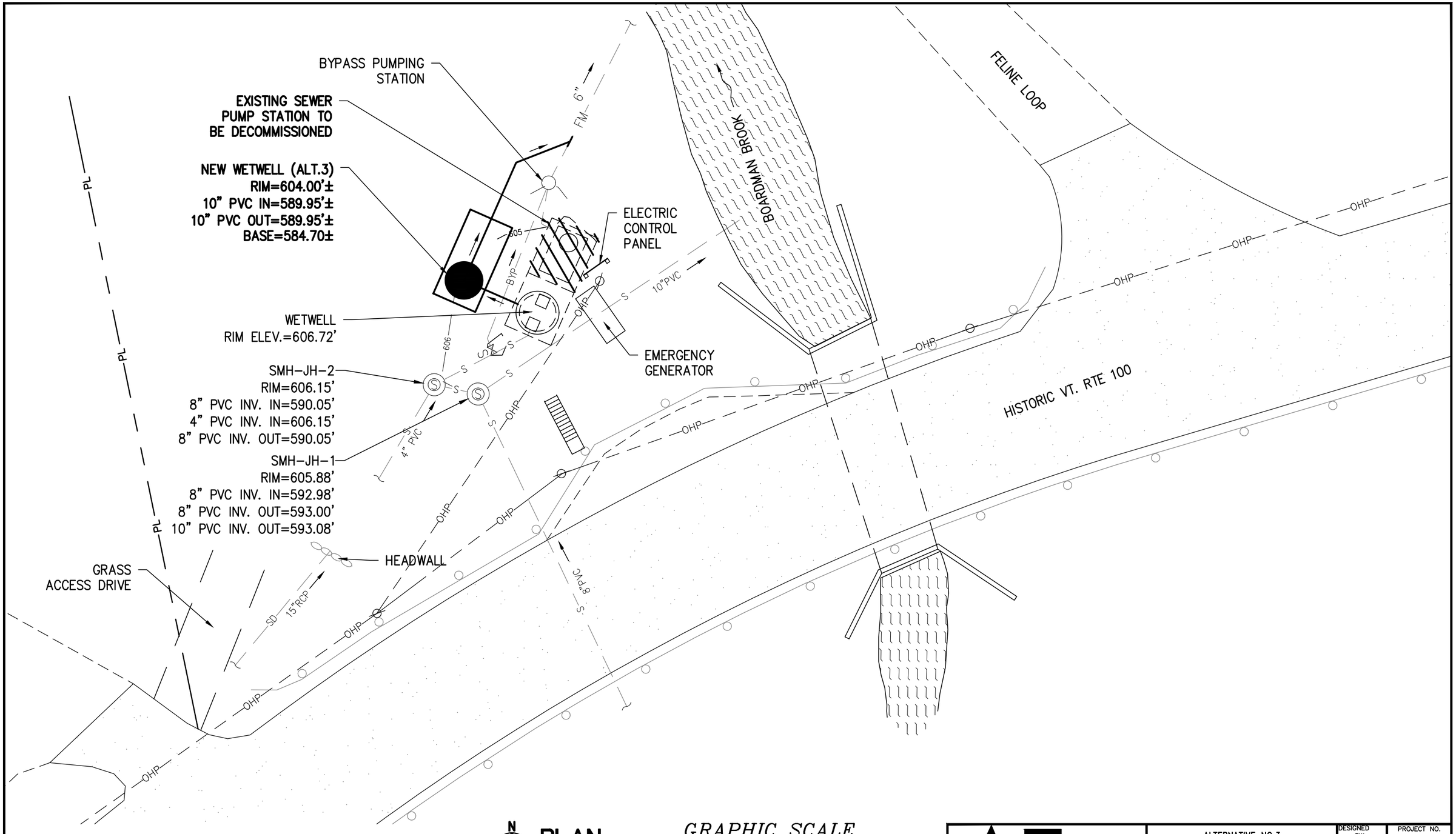
JERSEY HEIGHTS PUMP STATION
STUDY

MORRISVILLE WATER AND LIGHT DEPARTMENT
MORRISVILLE VERMONT

DESIGNED	RW
DRAWN	JEB
CHECKED (PM)	JAB
CHECKED (PE)	WAE
SCALE	AS NOTED
DATE	MAR. 2023

PROJECT NO. 22030

FIGURE NO. 6



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PLAN
SCALE: 1"=20'

GRAPHIC SCALE

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(IN FEET)

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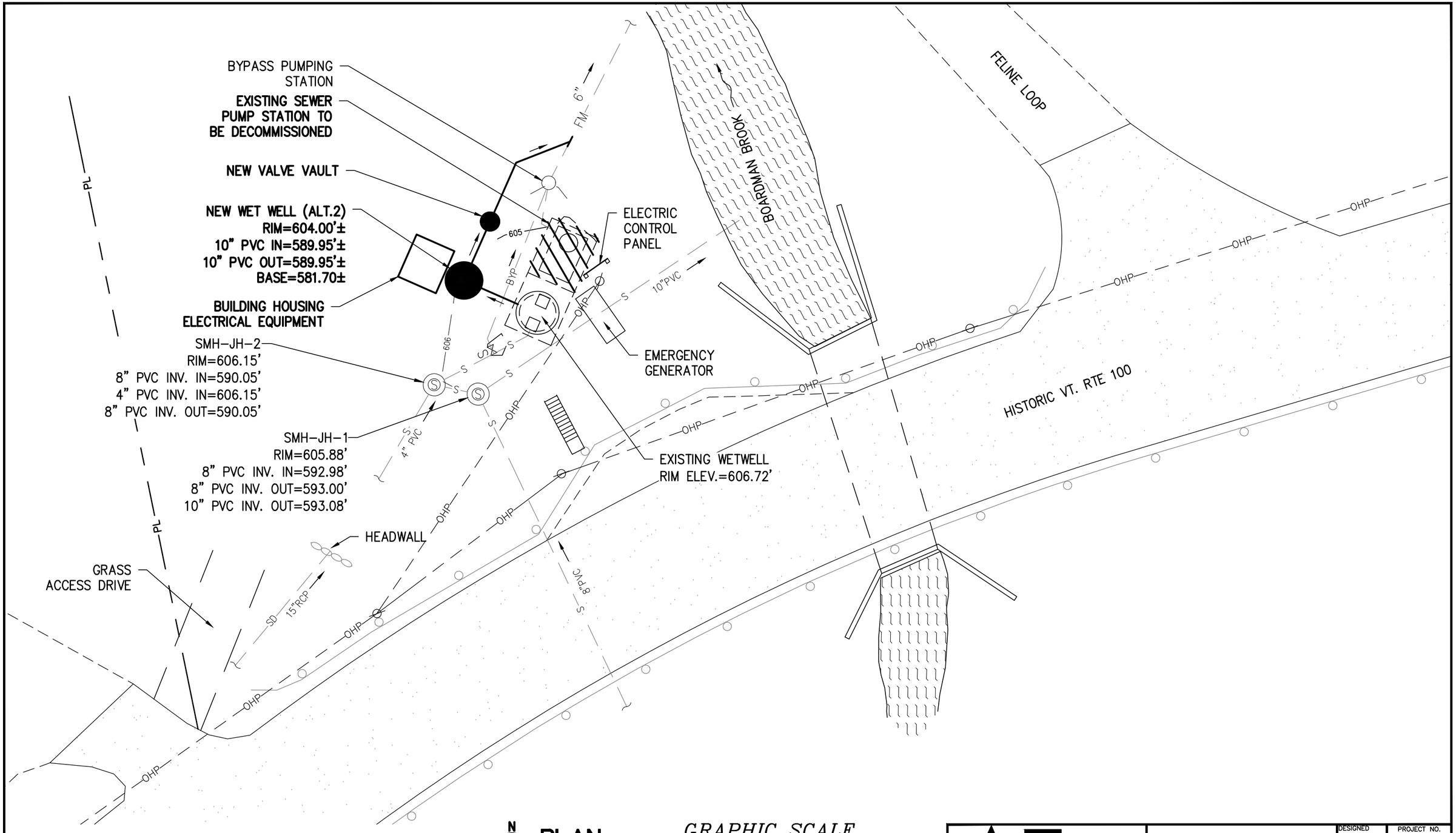
ALTERNATIVE NO.3
RECTANGULAR RECESSED PUMP STATION
SITE PLAN

JERSEY HEIGHTS PUMP STATION
STUDY

MORRISVILLE WATER AND LIGHT DEPARTMENT
MORRISVILLE VERMONT

DESIGNED	RW
DRAWN	JEB
CHECKED (PM)	JAB
CHECKED (PE)	WAE
SCALE	AS NOTED
DATE	MAR. 2023
PROJECT NO.	22030
FIGURE NO.	7



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PLAN
SCALE: 1"=20'

GRAPHIC SCALE

0 20 30 40

(IN FEET)

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WATER RESOURCE ENGINEERS

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PROPOSED PROJECT SITE PLAN

JERSEY HEIGHTS PUMP STATION STUDY

MORRISVILLE WATER AND LIGHT DEPARTMENT

MORRISVILLE VERMONT

DESIGNED RW	PROJECT NO. 22030
DRAWN JEB	
CHECKED (PM) JAB	
CHECKED (PE) WAE	FIGURE NO. 8
SCALE AS NOTED	
DATE MAR. 2023	

APPENDIX B

SEWER RATES

WASTE WATER RATES

Meter Size	Customer Charge	Usage Rate per Gallon Less than or equal to 10,000 gallons	Usage Rate per Gallon greater than 10,000 gallons
5/8 - 3/4"	$ 42.83	0.007653	0.009787
1"	$ 82.03	0.007653	0.009787
1 1/2"	$ 173.16	0.007653	0.009787
2"	$ 319.00	0.007653	0.009787
3"	$ 455.71	0.007653	0.009787
4"	$ 1,914.00	0.007653	0.009787
Non-metered	$ 78.80	0.007653	0.009787

APPENDIX C

SEWER DEPARTMENT BUDGET

Morrisville Water & Light Sewer Department Budget Information

	2020	2021
Sales & Other Operating Revenues	$ 1,089,256	$ 1,145,984
Operating Expenses	$ (942,507)	$ (949,355)
Operating Income (loss)	$ 146,749	$ 196,629
Non-operating Income (expense)	$ (55,497)	$ 10,620
Net Position	$ 91,252	$ 207,249
Utility Plant & Equipment	$ 8,282,186	$ 8,042,074
Current Assets	$ 1,523,637	$ 1,751,317
Defereed Outflows of Resources	$ 13,177	$ 20,667
Total Assets and Deffered Outflows	$ 9,819,000	$ 9,814,058
Long-term Liabilities	$ 3,671,372	$ 3,427,243
Current Liabilities	$ 297,484	$ 329,979
Defered Inflows of Rouses	$ 6,178	$ 5,621
Total Liabilities and Defered Inflows	$ 3,975,034	$ 3,762,843
Net Position		
Net Investment in Capital Asset	$ 4,387,062	$ 4,403,582
Restricted	$ 801,688	$ 896,282
Unreserved	$ 655,216	$ 751,351
Total Net Position	$ 5,843,966	$ 6,051,215
Total Liabilities, De. Inflows and Net Positions.	$ 9,819,000	$ 9,814,058

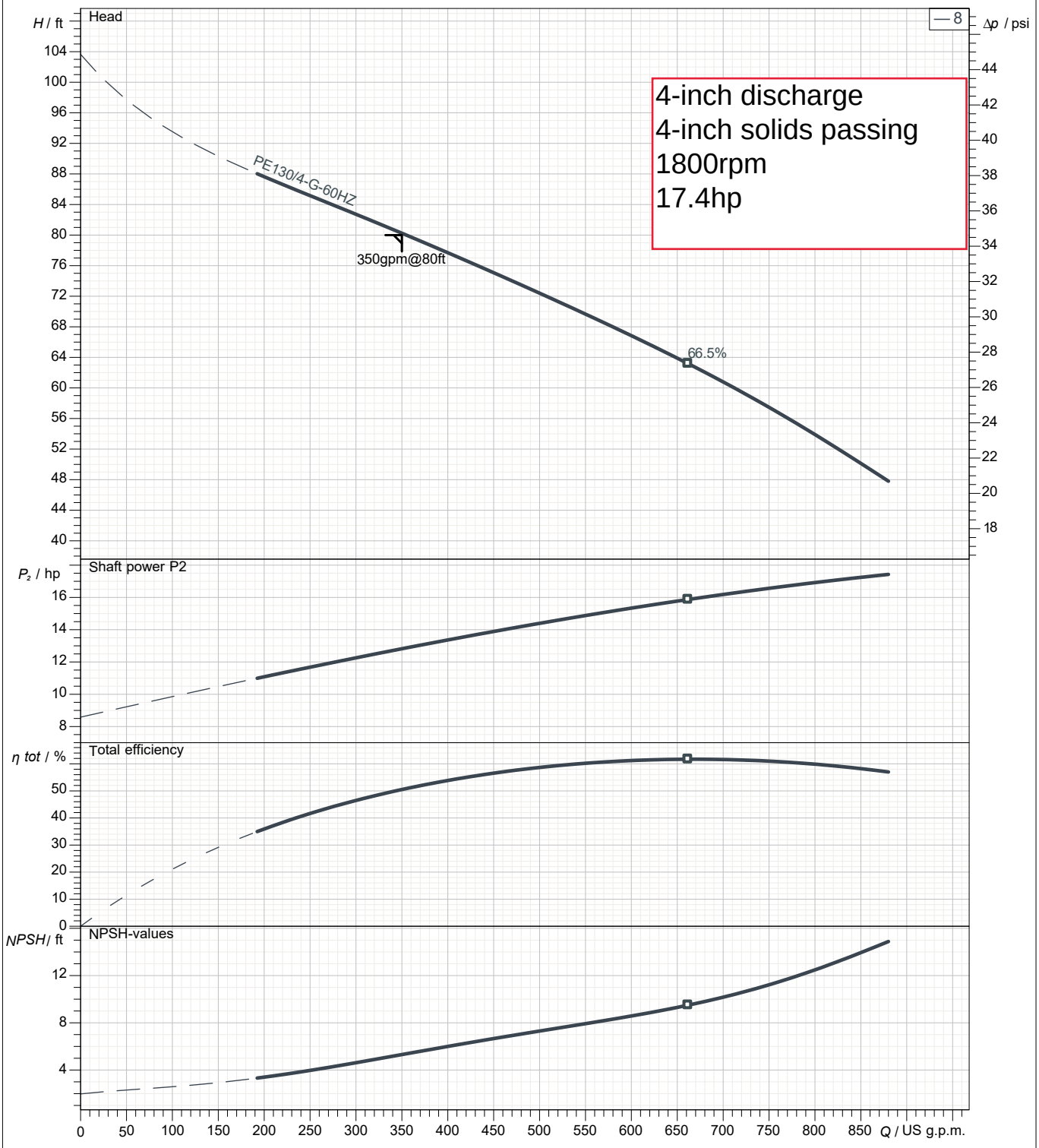
APPENDIX D

EQUIPMENT INFORMATION

SUBMERSIBLE PACKAGE

Curve number	Pump performance curves	
Reference curve XFP100G CB1 60HZ	**XFP100G CB1 60HZ (wet pit/dry pit)**	SULZER

			Discharge	Frequency
			DN100	60 Hz
Density	Viscosity	Test Standard	Rated speed	Date
62.31 lb/ft³	1.077E-5 ft²/s	ISO 9906, HI 11.6/14.6 Gr 2B	1786 rpm	2023-01-24



Wet Well installation with pedestal (without cooling jacket)

Impeller size	N° of vanes	Impeller	Solid size	Revision
240 mm	1	Contrablock Plus impeller, 1 vane	100 mm	

SULZER

Submersible Sewage Pump Type ABS XFP

XFP 100G-CB1 | 4", 4 Pole, 3-Phase, 60 Hz, PE3

Submersible Motor Specifications, PE3 Frame

Motor Design		NEMA design B, squirrel cage induction
Motor Type		Fully enclosed Premium Efficiency submersible, IP68 protection rating
Motor Efficiency Standard and Rating		IEC 60034-30, IE3 rating
Motor Efficiency Test Protocol		IEC 60034-2-1
Insulation Material		Class H, 180ºC (356ºF), copper windings
Motor Filling Medium		Air
Temperature Rise		Class A
Maximum Fluid Temperature		40ºC (104ºF) continuous, 50ºC (122ºF) intermittent
Cooling System	**OPT**	Closed-loop, non-toxic glycol/water mixture (⅓ / ⅔)
Motor Protection	**Thermal**	Normally closed bimetallic switch in each phase, connected in series, 140ºC (284ºF) +/- 5ºC (41ºF) opening temperature
	Leakage	Moisture detection probe in seal sensing chamber (for use with appropriate relay)
Sensing Chamber Filling Medium		Air
Bearing Type	**Upper**	Single row deep groove ball bearing, permanently lubricated
	Lower	Double row angular contact ball bearing, permanently lubricated
Motor Starter Types		Suitable for use with direct-on-line (DOL), electronic soft starters, and PWM type Variable Frequency Drives [1]
Maximum Starts per Hour		15, evenly spaced
Inverter Duty Rating		Motors meet NEMA MG1, part 31 requirements
Maximum Submergence		20 meters (65 feet)
Available Voltages		208, 230, 460, 600 (consult factory for other voltages)
Voltage Tolerance from Rated		+/-10%
Agency Approvals		Factory Mutual, CSA
Explosion Proof Rating		NEC 500 Class 1, Division 1, Group C & D, Class T3C max surface temp

The picture above may differ from the actual product.
For illustrative purposes only.

[1] Output filters may be required on VFDs. See document **DS-E00-001** for details.

Motor Ratings, PE3 Frame

Motor Model	Input Power (P1)	Rated Power Output (P2)	Nominal RPM	Rated Voltage	Full Load Amps	Locked Rotor Amps	NEMA Code Letter	NEMA Service Factor	Motor Efficiency at % Load			Power Factor at % Load		
									100	75	50	100	75	50
PE 130/4	14.0 kW	13 kW 17 HP	1781	208	51.3	595	P	1.3	93.1	91.6	85.8	.757	.672	.552
				230	46.4	538								
				460	23.2	269								
				600	17.8	206								
PE 150/4	16.2 kW	15 kW 20 HP	1777	208	56.4	655	N	1.3	92.9	92.7	88.4	.794	.715	.592
				230	51.0	592								
				460	25.5	296								
				600	19.6	227								
PE 185/4	19.8 kW	19 kW 25 HP	1777	208	71.4	686	L	1.3	93.7	92.4	88.5	.768	.691	.566
				230	64.6	620								
				460	32.3	310								
				600	24.8	238								
PE 210/4	22.5 kW	21 kW 28 HP	1774	208	78.2	687	K	1.3	93.6	93.0	90.0	.797	.728	.605
				230	70.7	621								
				460	35.4	311								
				600	27.1	238								
PE 250/4	26.7 kW	25 kW 34 HP	1757	208	90.3	696	J	1.3	93.6	93.5	92.8	.821	.762	.631
				230	81.7	629								
				460	40.8	315								
				600	31.3	241								

DS-E01-033 REV: 4 DATE: 10/16 Specifications Subject to Change Without Notice

Scan For More Info

Cable Data, PE3 Frame

	Motor	Motor Voltage	Cable Qty	Cable Type [3]	Cable Nominal Outside Diameter +/- .5mm (.02")	
					Power	Ground
Power Cable	PE 130/4	208 volt	1	G-GC 6-3	26.7mm (1.05")	Integrated w/ Power
		230 volt	1	G-GC 6-3	26.7mm (1.05")	Integrated w/ Power
		460 volt	1	SOOW 8/4+16/3	24.4mm (0.96")	Integrated w/ Power
		600 volt	1	SOOW 10/7	20.7mm (0.82")	Integrated w/ Power
	PE 150/4	208 volt	1	G-GC 6-3	26.7mm (1.05")	Integrated w/ Power
		230 volt	1	G-GC 6-3	26.7mm (1.05")	Integrated w/ Power
		460 volt	1	SOOW 8/4+16/3	24.4mm (0.96")	Integrated w/ Power
		600 volt	1	SOOW 10/7	20.7mm (0.82")	Integrated w/ Power
	PE 185/4	208 volt	1	G-GC 4-3	30.2mm (1.19")	Integrated w/ Power
		230 volt	1	G-GC 6-3	26.7mm (1.05")	Integrated w/ Power
		460 volt	1	SOOW 8/4+16/3	24.4mm (0.96")	Integrated w/ Power
		600 volt	1	SOOW 8/4+16/3	24.4mm (0.96")	Integrated w/ Power
	PE 210/4	208 volt	1	G-GC 4-3	30.2mm (1.19")	Integrated w/ Power
		230 volt	1	G-GC 4-3	30.2mm (1.19")	Integrated w/ Power
		460 volt	1	SOOW 8/4+16/3	24.4mm (0.96")	Integrated w/ Power
		600 volt	1	SOOW 8/4+16/3	24.4mm (0.96")	Integrated w/ Power
	PE 250/4	208 volt	1	G-GC 2-3	34.0mm (1.34")	Integrated w/ Power
		230 volt	1	G-GC 2-3	34.0mm (1.34")	Integrated w/ Power
		460 volt	1	SOOW 8/4+16/3	24.4mm (0.96")	Integrated w/ Power
		600 volt	1	SOOW 8/4+16/3	24.4mm (0.96")	Integrated w/ Power

	Motor Monitoring Type [4]	Cable Qty	Cable Type	Cable Nominal Outside Diameter +/- .5mm (.02")
Control Cable	Std monitoring w/ SOOW Power Cable	N/A	Integrated w/ Power	Integrated w/ Power
	Std monitoring w/ G-GC Power Cable	1	SOOW 16/4	10.6mm (0.42")
Cable Length	Standard: 15m (49 feet)	Optional: 20m (65 feet), 30m (98 feet); Consult Factory for longer lengths		

[3] Type SOOW power cables have integrated control wires. [4] See motor protection on page 1.

Pump Data

Discharge Size	4" flanged, compatible with 4" class 125 ANSI flanges									
Suction Size (Wet-Pit / Dry-Pit)	4" flanged / 4" flanged, compatible with 4" class 125 ANSI flanges, threaded for 8x5/8-11 UNC screws, 30mm (1.2") deep									
Volute Pressure Rating	16 bar (232 psi)									
Impeller Type	Semi-Open, 1-vane, Contrablock Plus, w/ Seal Protection System									
Impeller Code	.9	.8	.7	.6	.5	.4				
Impeller Diameter, mm (in.)	230 (9.1)	240 (9.5)	250 (9.8)	260 (10.2)	270 (10.6)	280 (11.0)				
Solids Passage Size, mm (in.)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)	100 (3.94)				
Min. Recommended Flow, GPM [5]	290	330	360	400	400	400				

[5] Recommend minimum continuous flow. Consult factory for applications below this flow rate.

Materials of Construction

		Standard	Optional
Power/Control Cable Jacket		Chlorinated Polyethylene (CPE)	
Lifting Hoop		Stainless Steel 1.4401 (AISI 316)	
Cable Connection Chamber		Cast Iron EN-GJL-250 (ASTM A-48, Class 35B)	
Motor Housing		Cast Iron EN-GJL-250 (ASTM A-48, Class 35B)	
Cooling Jacket		Cast Iron EN-GJL-250 (ASTM A-48, Class 35B)	
Intermediate Housing		Cast Iron EN-GJL-250 (ASTM A-48, Class 35B)	
Seal Plate/Cooling Chamber		Cast Iron EN-GJL-250 (ASTM A-48, Class 35B)	
Pump and Motor Shaft		Stainless Steel 1.4021 (AISI 420)	
Impeller		Cast Iron EN-GJL-250 (ASTM A-48, Class 35B) [6]	Duplex Stainless Steel 1.4470 (ASTM A890, CD3MN Grade 4A)
Wear Parts	Bottom/Wear Plate	Cast Iron EN-GJL-250 (ASTM A-48, Class 35B) [6]	Duplex Stainless Steel 1.4470 (ASTM A890, CD3MN Grade 4A)
Volute		Cast Iron EN-GJL-250 (ASTM A-48, Class 35B)	
External Hardware		Stainless Steel 1.4401 (AISI 316)	
O-Rings and Cable Glands		Nitrile (Buna-N)	Viton®
Mechanical Seals	Lower	Silicon Carbide / Silicon Carbide, Nitrile, 316 SS	Silicon Carbide / Silicon Carbide, Viton®, 316 SS
	Upper	Silicon Carbide / Silicon Carbide, Nitrile, 316 SS	
Coating/Protection		Two-part epoxy, blue, 120µm (4.7 mil) DFT	Two-part epoxy, blue, 400µm (15.7 mil); Wet-end liquid ceramic coating, 500µm (19.7 mil); Zinc Anodes

[6] Hardening of bottom edge of impeller vane and wear plate surface available. Consult factory for details.

General Data (Standard Materials of Construction & Cable Length)

	PE 130/4	PE 150/4	PE 185/4	PE 210/4	PE 250/4
Overall Height	1282mm (50.5")	1282mm (50.5")	1282mm (50.5")	1282mm (50.5")	1321mm (52.0")
≈ Pump Weight (Non-Cooled)	351 kg (774 lb)	351 kg (774 lb)	371 kg (818 lb)	381 kg (840 lb)	400 kg (882 lb)

DS-E01-033 REV: 4 DATE: 10/16 Specifications Subject to Change Without Notice

APPENDIX E

EQUIPMENT INFORMATION

RECTANGULAR RECESSED PACKAGE

Smith & Loveless, Inc.

14040 Santa Fe Trail Dr.
Lenexa, KS 66215-1284
Phone: (913) 888-5201
Fax: (913) 888-2173

EVERLAST™

EVERLAST™ Budget Proposal:

EVERLAST™ Rectangular Recessed Wet Well Mounted Pump Station
S&L Proposal #JS9874
1/11/2023

Prepared For:

Morrisville, VT

Represented by:

Russell Resources, Inc.

Proposal Table of Contents

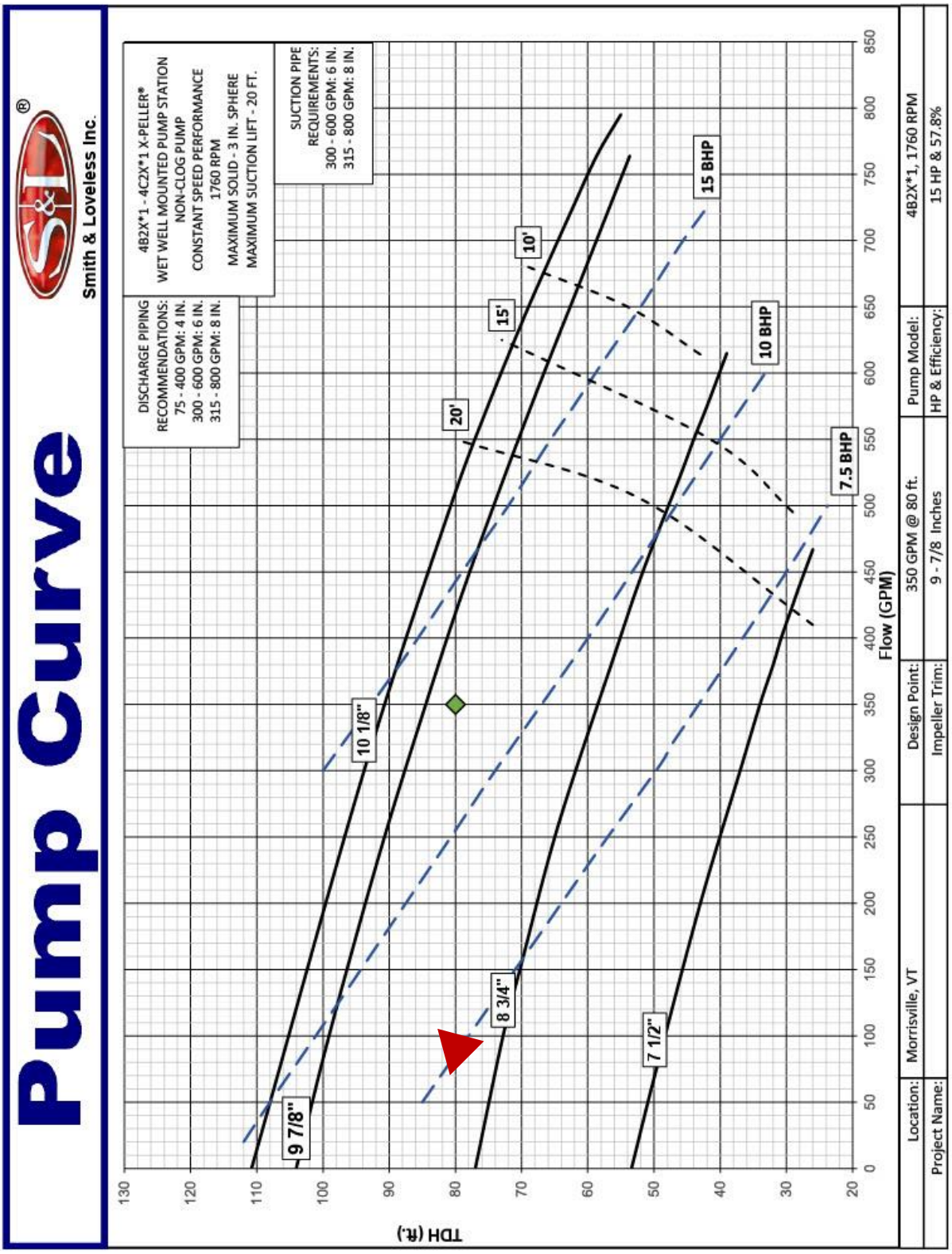
Proposal Introduction

For 75 years, Smith & Loveless' pre-engineered water and wastewater treatment and pumping systems have paved the way for municipalities, developments, industry, governmental, and military facilities. Smith & Loveless' energy-efficient and durable pumping systems deliver unrivaled life-cycle cost savings and the safest lift station O&M without confined space entry. Smith & Loveless has shipped more than one pump station per day during its history, and backed by the longest warranty protection in the industry, the first pump stations ever installed are still running today! Smith & Loveless serves Municipal, Industrial, International, Real Estate Development, Military / Government, Native America / 1st Nations, Disaster Relief.

Smith & Loveless Pumping Station feature:

- robust construction
- efficient performance
- long service life
- operator-safe maintenance
- single-source solutions
- easy installation
- maintenance savings
- lift station access safety

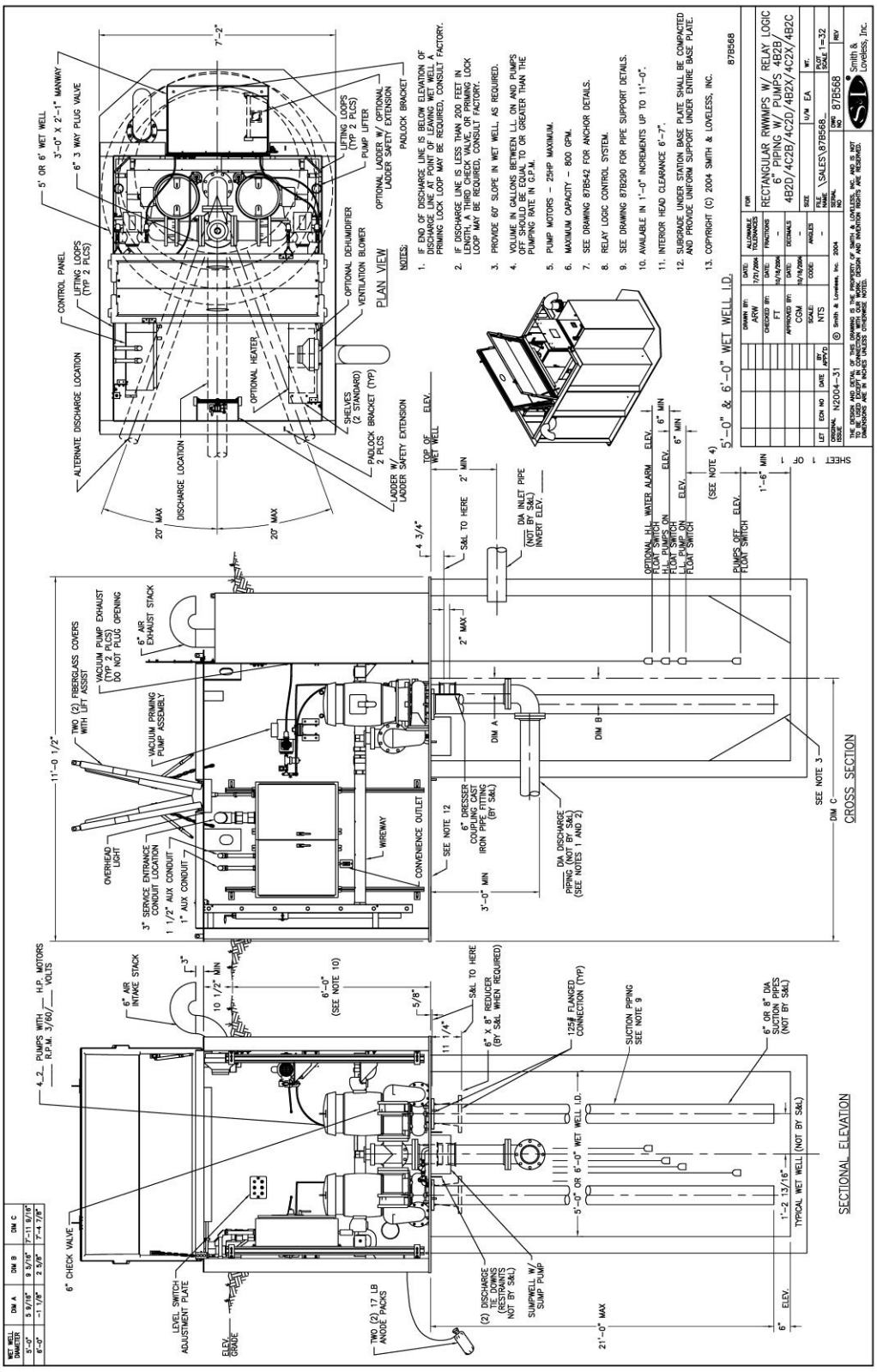
Pump Curve



Design Conditions: 350 GPM @ 80’ TDH

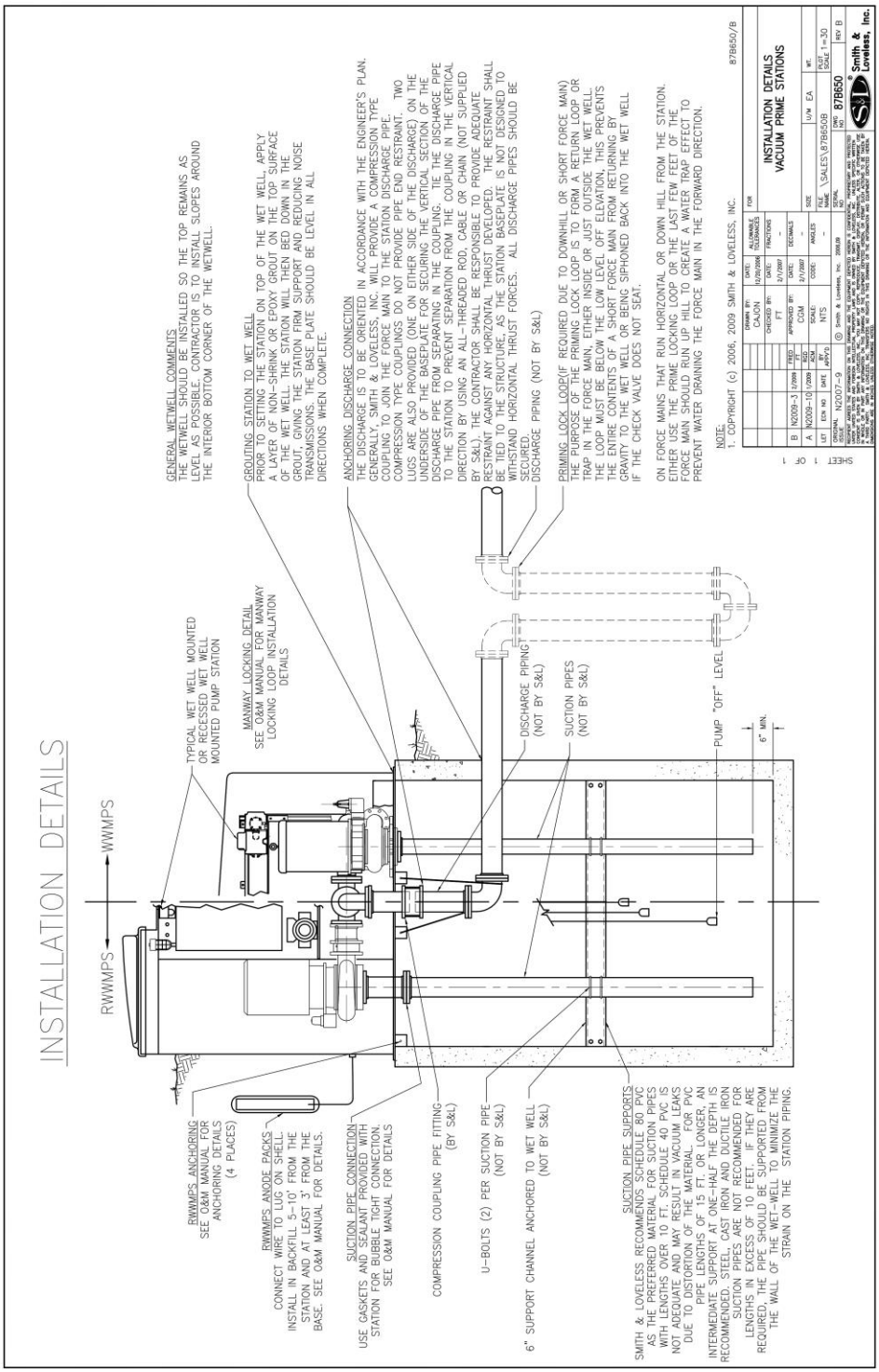
Online: smithandloveless.com • Phone: 913.888.5201 • FAX: 913.888.2173

Station Outline Drawing

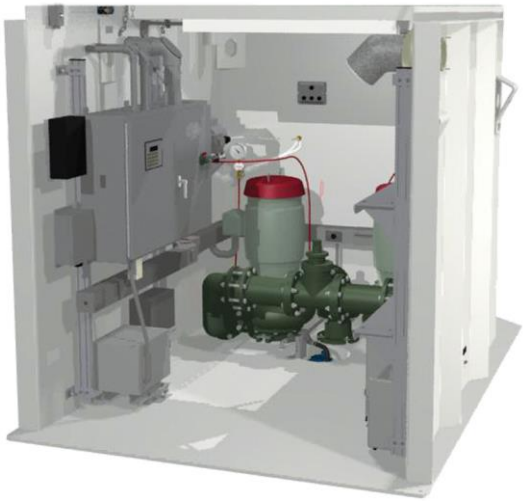


Online: smithandloveless.com • Phone: 913.888.5201 • FAX: 913.888.2173

Installation Details Drawing



EVERLAST™ Rectangular Recessed Overview:



EVERLAST™

Rectangular Recessed

Ground-Level, Dual Hatch

Allows for Deeper Wet Well

Maintains Low Profile

System Model:	**EVERLAST™** Rectangular Recessed
Wet Well Diameter:	6’-0”
Discharge / Suction Piping:	4” with compression coupling
Static Suction Lift:	20’
No. of Pumps:	2
Pump Size:	4”
Pump Model:	4B2X*1
Design Conditions:	350 GPM @ 80’ TDH
Pump Power:	15 HP
Pump Speed:	1760 RPM
Electrical Info:	3 Phase, 60 Cycle, 230 Volt motor

Price and Timeline Details:

Budget Price:	$225,000
Submittal Timeline:	6-8 Weeks (after receipt of complete details)
Mfg. Timeline:	26-30 Weeks (after receipt in Seller's office of approved Submittal Data)

Additional Price Details:

The estimated cost of this budget proposal constitutes a non-binding estimate for certain goods and/or services and is exclusive of applicable taxes.

F.O.B. factory plus any taxes, which may apply. Truck/Rail freight allowed to the job site, rail siding or nearest unloading area-unloading to be by Buyer. Due to the spike in gas prices, which is beyond the control of Smith & Loveless at the time of our quotation/bid, a fuel surcharge may need to be assessed at time of shipment.

One day supervision of initial operation over one trip is included. If additional days are required, Seller will furnish a factory-trained supervisor for $925 per day including travel time, plus actual travel expenses.

Smith & Loveless, Inc. will provide one electronic copy of the O&M on CD in PDF format and four hard copies of the O&M. Additional copies can be provided for $50 per copy.

Standard EVERLAST™ Rectangular Recessed Features:

✓ **STAR ONE™** Non-Clog Pumps

Vertical, close-coupled design featuring oversized, stainless steel shafts and bearings, delivering leading efficiencies and a 20+ year service life.

Learn More:
https://smithandloveless.com/energy-efficiency-reuse-sl-systems

✓ **WaveStart™** Prime Sensing System

Employing **Multi-Variable Sensing**™ and minimal connections, virtually eliminates O&M in applications with flushables and other debris.

Learn More:
https://smithandloveless.com/sl-pumping-advantage

✓ **2-Piece Hinged Enclosure**

Quick access 2-piece hinged enclosure with newly redesigned S&L style

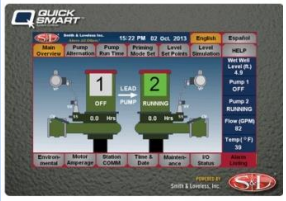
✓ **1" Baseplate**

Carbon steel baseplate comes standard

✓ **QUICKSMART™** or **Relay Logic** System Controls

Choice of **QUICKSMART™** PLC Touchscreen (7" 65K-Color TFT LCD HMI) or Relay Logic controls.

Learn More:
http://files.smithandloveless.com/documents/QuickSmart_Pumping_interactive_e.pdf



✓ **10 Year Warranty Protection**

The industry's longest service life and warranty protection, including 10-year protection for pump, baseplate and enclosure components.

Standard EVERLAST™ Rectangular Recessed Features (continued):

- ✓ Submersible Level Transducer
- ✓ 24v Control Circuits
- ✓ Back-up Float Control System - 3 Floats
- ✓ Prime Mode Selector - Constant or On-Demand Prime
- ✓ Selectable Alternation - Timed or Sequential
- ✓ High Water Alarm
- ✓ Pump Fail / Prime Fail Sensors
- ✓ Compound Pressure Gauges
- ✓ Running Time Indication - Individual & Totalizing
- ✓ Aluminum Manway Cover
- ✓ Spare Mechanical Seal
- ✓ Spare 24V Power Supply
- ✓ Surge Protection Device

Optional EVERLAST™ Rectangular Recessed Features (included if checked):

Available	**DURO-LAST®** Stainless Steel Baseplate 316 and/or lean duplex series 2100 stainless steel baseplate for superior pump station protection, backed by 25-year warranty protection.	
✓	**X-PELLER®** Clog-Fighting Impeller Features a mono-port design, which allows it to pass 3” solids, including consumer flushable wipes, rags or other trashy items. *Learn More:* https://www.youtube.com/watch?v=mW3bLAxVX7E	
✓	**RAPIDJACK™** Quick Clean Check Valve Wafer check valve design simplifies access for clearing blockages or obstructions, requiring removal of only 4 bolts and approx. 15 min. *Learn More:* https://www.youtube.com/watch?v=xK6d8l0Xh58	
✓	3KVA Transformer	
Available	Transducer Signal Splitter	
✓	Dialer Interface / Dialer Not Included	
Available	Generator Interlock	
Available	Panel Mounted Automatic Silence Switch	
Available	Non-Mercury Float Switches	
✓	QuickSmart PLC	
✓	Cold Climate Package	

Aldrich + Elliott
WATER RESOURCE ENGINEERS

APPENDIX F

ESTIMATED CONSTRUCTION COSTS

ESTIMATED BUDGET WORKSHEET

PROJECT: **Morrisville Water & Light**
ITEM: **Jersey Heights Pump Station - Alternative No.1 - Reuse Existing Structures**
DATE: **Apr-23**

CATEGORY	ITEM		QUANTITY	UNIT COST	UNIT	SUBTOTAL	USE (ENR 13175)
General Requirements (10%)							$40,950
Demolition							
	Pumps, and Controls		1	$10,000	L.S.	$10,000	
	Bypass Pumping		1	$7,500	L.S.	$7,500	
		Subtotal				$17,500	$17,500
Sitework/Yard Piping							
	Misc		1	$10,000	Allowance	$10,000	
		Subtotal				$10,000	$10,000
Concrete							
	Misc. Concrete		5	$1,000	C.Y.	$5,000	
		Subtotal				$5,000	$5,000
Misc. Metals							
	Misc.		1	$2,000	Allowance	$2,000	
		Subtotal				$2,000	$2,000
Painting							
	Dry Pit Refurbishment/Repairs		1	$50,000	Allowance	$50,000	
		Subtotal				$50,000	$50,000
Equipment							
	Pumps						
		Equipment:	2	$35,000	Each	$70,000	
		Installation:	2	$10,000	Each	$20,000	
	Control Panel						
		Equipment:	1	$50,000	Each	$50,000	
		Installation:	1	$5,000	Each	$5,000	
	VFDs						
		Equipment:	2	$12,000	Each	$24,000	
		Installation:	2	$5,000	Each	$10,000	
		Subtotal				$179,000	$179,000
Special Construction							
	Man Lift Replacement		1	$50,000	Each	$50,000	
		Subtotal				$50,000	$50,000
Instrumentation							
	Telemetry		1	$15,000	Each	$15,000	
		Subtotal				$15,000	$15,000
Process Piping							
	6" DI interior piping		40	$150	L.F.	$6,000	
	6" Plug Valves		3	$4,000	Each	$12,000	
	6" Check Valves		2	$4,000	Each	$8,000	
	Misc. Fittings & Parts		1	$5,000	Allowance	$5,000	
						$31,000	$31,000
Electrical							
	Misc. Electrical		1	$50,000	Allowance	$50,000	
		Subtotal				$50,000	$50,000
					Subtotal		$450,450
					8% OH&P		$36,036
					20% Contingency		$97,297
					Total		$583,783
					Use		$585,000

Notes:
1. ENR 13175 = April 2023

ESTIMATED BUDGET WORKSHEET

PROJECT: Morrisville Water & Light
ITEM: Jersey Heights Pump Station - Alternative No.2 - Submersible Traditional
DATE: Apr-23

CATEGORY	ITEM		QUANTITY	UNIT COST	UNIT	SUBTOTAL	USE (ENR 13175)
General Requirements (10%)							$59,000
Demolition							
	Equipment Removal		1	$10,000	L.S.	$10,000	
	Demo to 6' Below Grade		20	$950	C.Y.	$19,000	
	Fill with Low Strength Concrete		60	$500	C.Y.	$30,000	
		Subtotal				$59,000	$60,000
Sitework							
	Excavation		1000	$50	C.Y.	$50,000	
	Shoring						
	Drive & Extract		900	$40	S.F.	$36,000	
	Sheet Piling Rental		900	$7	S.F./1-mo.	$6,300	
	Bracing		1	$10,000	L.S.	$10,000	
	Conduit		50	$100	L.F.	$5,000	
	Crushed Stone		10	$40	C.Y.	$400	
	Structural Backfill		100	$75	C.Y.	$7,500	
	New Valve Pit		1	$10,000	Each	$10,000	
	New Wet Well		1	$70,000	Each	$70,000	
		Subtotal				$195,200	$200,000
Yard Piping							
	6" PVC Force Main		35	$180	L.F.	$6,300	
	10" PVC Gravity Sewer		25	$360	L.F.	$9,000	
		Subtotal				$15,300	$20,000
Concrete							
	Building Foundation		1	$12,500	L.S.	$12,500	
	Misc. Concrete		5	$1,000	C.Y.	$5,000	
		Subtotal				$17,500	$17,500
Building							
	Building		150	$200	S.F.	$30,000	
		Subtotal				$30,000	$30,000
Misc. Metals							
	Misc.		1	$2,000	Allowance	$2,000	
		Subtotal				$2,000	$2,000
Equipment							
	Pumps						
		Equipment:	2	$25,000	Each	$50,000	
		Installation:	2	$10,000	Each	$20,000	
	Control Panel						
		Equipment:	1	$45,000	Each	$45,000	
		Installation:	1	$5,000	Each	$5,000	
	VFDs						
		Equipment:	2	$10,000	Each	$20,000	
		Installation:	2	$5,000	Each	$10,000	
		Subtotal				$150,000	$150,000
Instrumentation							
	Telemetry		1	$15,000	Each	$15,000	
		Subtotal				$15,000	$15,000
Process Piping							
	6" DI interior piping		40	$150	L.F.	$6,000	
	6" Gate Valves		2	$4,000	Each	$8,000	
	6" Check Valves		2	$4,000	Each	$8,000	
	Misc. Fittings & Parts		1	$10,000	Allowance	$10,000	
						$32,000	$35,000
Mechanical							
	Heating & Ventilation		1	$10,000	L.S.	$10,000	
		Subtotal				$10,000	$10,000
Electrical							
	Misc. Electrical		1	$50,000	Allowance	$50,000	
		Subtotal				$50,000	$50,000
					Subtotal		$648,500
					8% OH&P		$51,880
					Total		$700,380
					Use		$705,000

Notes:
1. ENR 13175 = April 2023

ESTIMATED BUDGET WORKSHEET

PROJECT: **Morrisville Water & Light**
ITEM: **Jersey Heights Pump Station - Alternative No.3 - Rectnagular Recessed**
DATE: **Apr-23**

CATEGORY	ITEM		QUANTITY	UNIT COST	UNIT	SUBTOTAL	USE (ENR 13175)
General Requirements (10%)							$58,300
Demolition							
	Equipment Removal		1	$20,000	L.S.	$10,000	
	Demo to 6' Below Grade		20	$950	C.Y.	$19,000	
	Fill with Low Strength Concrete		60	$500	C.Y.	$30,000	
		Subtotal				$59,000	$60,000
Sitework							
	Excavation		1000	$50	C.Y.	$50,000	
	Shoring						
	Drive & Extract		900	$40	S.F.	$36,000	
	Sheet Piling Rental		900	$7	S.F./1-mo.	$6,300	
	Bracing		1	$10,000	L.S.	$10,000	
	Conduit		50	$100	L.F.	$5,000	
	Crushed Stone		10	$40	C.Y.	$400	
	Structural Backfill		100	$75	C.Y.	$7,500	
	New Wet Well		1	$50,000	Each	$50,000	
		Subtotal				$165,200	$170,000
Yard Piping							
	6" PVC Force Main		35	$180	L.F.	$6,300	
	10" PVC Gravity Sewer		25	$360	L.F.	$9,000	
		Subtotal				$15,300	$20,000
Concrete							
	Misc. Concrete		5	$1,000	C.Y.	$5,000	
		Subtotal				$5,000	$5,000
Misc. Metals							
	Misc.		1	$2,000	Allowance	$2,000	
		Subtotal				$2,000	$2,000
Equipment							
	Pump Package						
	Equipment:		1	$250,000	Each	$250,000	
	New Control Panel					Included in Pump Package	
		Subtotal				$250,000	$250,000
Instrumentation							
	Telemetry		1	$15,000	Each	$15,000	
		Subtotal				$15,000	$15,000
Process Piping							
	6" DI interior piping		20	$150	L.F.	$3,000	
	Misc. Fittings & Parts		1	$7,500	Allowance	$7,500	
						$10,500	$10,500
Electrical							
	Misc. Electrical		1	$50,000	Allowance	$50,000	
		Subtotal				$50,000	$50,000
					Subtotal		$640,800
					8% OH&P		$51,264
					Total		$692,064
					Use		$695,000

Notes:
1. ENR 13175 = April 2023

APPENDIX G

LIFE CYCLE COST ANALYSIS

Morrisville Water & Light
Jersey Heights Pump Station Replacement
Net Present Worth/Lifecycle Cost Analysis
A+E Project No. 22030
April 24, 2023

	Alternative No. 1 Re-use Existing Pump Station Structure	Alternative No. 2 Submersible Pump Station	Alternative No. 3 Rectangular Recessed Pump Station
Captial Costs			
Construction Cost	**$ 585,000**	**$ 705,000**	**$ 695,000**
Operation & Maintenance Costs			
Electrical Usage	$ 9,000	$ 9,000	$ 9,000
Pump Refurbishment	$ 10,000	$ 4,500	$ 2,500
Other Maintenance	$ 10,000	$ 10,000	$ 10,000
Total Present Worth O&M Costs	**$556,338**	**$450,826**	**$412,458**
Salvage Value			
Lifespan (years)	20	60	50
Depriciation	$ 585,000	$ 235,000	$ 278,000
Salvage Value at Lifespan	$ -	$ 470,000	$ 417,000
Present Worth Salvage Value	**$ -**	**$ 433,900**	**$ 385,000**
Net Present Cost	**$ 1,141,338**	**$ 721,926**	**$ 722,458**

Analysis Term:	20
Real Discount Rate	0.40%

Notes:

1. O&M costs assume a base $10,000 for general pump station monitoring/maintenance, $9,000 for electrical usage, pump refurbishment at $20,000 every 2 years for submersible pumps, $10,000 every 5 years and $25,000 every 10 years for vacuum-prime pumps, and $25,000 every 10 years for dry-pit pumps.