Bayshore Pumping Station Rehabilitation

Final Preliminary Engineering Report

August 23, 2022

Prepared for:

City of Tampa

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Abbreviations

ANSI	American National Standards Institute
City	City of Tampa Wastewater Department
DI	Ductile Iron
ESCP	Erosion and Sediment Control Plan
FDEP	Florida Department of Environmental Protection
gpm	gallons per minute
GIS	Geographic Information System
HOA	Hand/off/auto
HFC AWTP	Howard F. Curren Advanced Wastewater Treatment Plant
HP	Horsepower
HVAC	Heating, Ventilation, Air Conditioning
HMI	Human Machine Interface
HI	Hydraulic Institute
H_2S	Hydrogen Sulfide
MCC	Motor Control Center
MGD	million gallons per day
NPDES	National Pollutant Discharge Elimination System
NOI	Notice of Intent
NOT	Notice of Termination
OIT	Operator Interface Terminal
PER	Preliminary Engineering Report
PLC	Programmable Logic Controller
PS	Pumping Station
PVC	Polyvinyl Chloride
RTU	Remote Telemetry Unit
ROW	Right-of-Way
SWPPP	Stormwater Pollution Prevention Plan
SCADA	Supervisory Control and Data Acquisition
TECO	Tampa Electrical Company
TDH	Total Dynamic Head
VFD	Variable Frequency Drive

Executive Summary

The existing pumps at the Bayshore Pump Station (PS) are coming close to the end of their useful life and they have also seen their discharge forcemain conditions changed recently with the upgrades implemented to the San Carlos PS, which discharges into the same forcemain. As a result of that, the City of Tampa Wastewater Department (the City) hired PCL Construction, Inc. as the Design-Builder to develop the design and later perform the construction of the refurbishment of this PS.

This document describes the efforts performed during the Preliminary Design Phase, to identify the modifications to the existing infrastructure and define the design criteria to be used in Detailed Design, to accommodate the current and projected operating conditions for this PS, along with meeting current construction codes and revised flood elevation at this site.

Out of the different elements used to define the improvements to this PS, the initial efforts were concentrated on defining the required capacity for the new pumps to be installed. A review of historical data, along with potential for future developments, resulted in a selection of 6,500 gallons per minute (gpm) as the combined capacity of the duty pumps.

Following the selection of the PS's firm capacity, a study was conducted to evaluate the alternatives for modifications to the existing infrastructure to accommodate this capacity and the operating conditions, which are mainly driven by the operation of the San Carlos PS. As a result of the evaluation of the alternatives proposed, it was agreed that the detailed design would proceed with the modification of the PS to be converted into a wet well, and designed with 3 duty pumps and 1 standby pump, to provide it with a firm capacity of 6,500 gpm when the San Carlos PS is pumping 40 million gallons per day (MGD), which creates a need for each submersible non-clog pump to be sized for 2,167 gpm @ 88-ft total dynamic head (TDH). The PS will be also suited to operate at a minimum 1,000 gpm and average 1,800 gpm with a single pump in service, with low head conditions and the use of their variable frequency drives (VFDs). Along with that, operating conditions for the wet well were agreed, establishing that to keep enough submergence of the pumps, but not create overflows upstream, the normal wet well levels would range between EL -10.6 ft and EL -7.5 ft.

Once the characteristics of the required pumps, operating levels, and reconfiguration of the infrastructure to be converted into a wet well were defined, a detailed review of the required modifications to house the necessary electrical and instrumentation and control gear was conducted, along with a review of the ability to reuse the existing backup generator. As a result of the evaluations and conversation with the City, it was agreed that a new electrical building would be built adjacent to the existing PS, along the median in Bayshore Blvd. It was also agreed that understanding the prominence of Bayshore Blvd. within the City, this new building will have a low profile, and will be partially recessed into the ground. The new building will be designed not only to house all new electrical and control equipment that's not required to be inside the wet well or its proximity, but also to meet the requirements of a new building in the vicinity of the bay, including the revised flood elevation. Additionally, a new generator will be installed within the existing enclosure to replace the existing one, and modifications will be completed to the existing PS building to

remove the aboveground section of the structure and allow adequate access for maintenance of the new pumping equipment.

With a good definition of the changes to the existing structure, along with an understanding of the requirements for new installation, and given the high profile of this location within the City, a thorough evaluation of the Heating, Ventilation, Air Conditioning (HVAC), architectural and landscape architectural updates were conducted, which concluded with the preparation of representative renderings which depict the proposed style and general configuration of the project, once implemented. Figure 11-1 through Figure 11-6 reflect the proposed approach.

1 INTRODUCTION

1.1 BACKGROUND

The Bayshore PS was placed into service in 1955 and is located in the median of Bayshore Blvd, near West Mason St. The Bayshore PS has a drywell/wetwell configuration, with most of the structure below grade. The flow from the Bayshore PS is discharged using a 24-inch forcemain, connecting to the 48-inch forcemain from the San Carlos PS, which ultimately directs all its flows to the Howard F. Curren Advanced Wastewater Treatment Plant (HFC AWTP).

Currently, the Bayshore PS houses two (2) VFD, 200 horsepower (HP) Fairbanks Morse (Pentair) pumps, both rated at 6,000 gpm at approximately 80-ft of head, that were designed to operate on a duty/standby basis but actually operate in a duty/assist configuration during high wet weather flows. The PS has been rehabilitated since its original construction, and while the existing equipment in the PS is considered operable, several components have reached the end of their useful life, resulting in failures that have required repairs to sustain the PS's reliability. In addition, the recent upgrade to the San Carlos PS has the potential to increase the pressure on the 48-inch forcemain to the HFC AWTP. The increased pressures during rain events can affect the Bayshore PS performance by reducing the capacity of the Bayshore pumps, to the point that they would not be able to maintain adequate flows required by the service area and potentially creating a surcharge condition and overflows into the Hillsborough Bay or further upstream at Coachman Avenue. As the Bayshore PS frequently operates with both pumps in service during high wet weather flows, the PS does not have adequate capacity if one pump is out of service as there is no redundancy. Considering the criticality of this PS, the age and condition of the infrastructure/equipment, the risk of overflows and the impacts on the reliability of the existing electrical equipment due to the new site flood level rehabilitating the Bayshore PS is critical for the health and safety of the served communities.

When originally constructed, the sewage from Bayshore PS was pumped approximately 500-ft in an 18-inch forcemain to a manhole at Santiago Street where it flowed by gravity to the Krause PS and was then pumped directly to the HFC AWTP. That forcemain was abandoned when Bayshore PS was connected to the San Carlos 48-inch forcemain. As part of this project, the City requested the replacement of the existing 18-inch forcemain to be used as an emergency backup. Due to the age and the existing conditions of the forcemain, it is recommended to replace it. A new PVC forcemain is recommended as a replacement to be able to accommodate the design flows. The new force main will be sized to restrict flow to the downstream gravity system based on hydraulic limitations provided by the City.

1.2 REPORT OBJECTIVES

This Preliminary Engineering Report (PER) summarizes the requirements for rehabilitating the Bayshore PS. The improvements will provide more reliability, redundancy, and flexibility to the PS overall. The PER for the Bayshore PS rehabilitation consists of the following:

- Project Data Collection
- Performed Evaluations, including:
  - PS Capacity
  - PS Alternatives Configurations
  - Electrical and Control Systems Improvements
  - PS Ancillary Systems and Aesthetics
- Detail Design Criteria for each discipline, including:
  - Process Mechanical
  - Civil
  - Structural
  - Electrical
  - Instrumentation and Control
  - HVAC
  - Architectural
  - Landscape Architecture
- Permitting requirements
- Opinion of Probable Construction Cost
- Preliminary Construction Approach/Sequence of Construction

2 PROJECT DATA COLLECTION

The City provided SCADA data (time of day, pumped flow rate, water depth, pump(s) on/off, pump(s) failed) for the Bayshore PS from 2010 to 2021 and five years of data for the pumping stations feeding to it, including:

- Clark Pump Station
- Coachman Pump Station
- Interbay Pump Station and
- Knights Pump Station.

Previous studies/reports provided by the City included:

- Coachman Avenue Overflow Elimination Study
- Corrective Active Plan of the West River and Bayshore Basins Final Report February 2008
- Final Modeling Report – January 19, 2018
- Final Perry Model Report 2012
- Sanitary Sewer Evaluation Study West River to Bayshore (analysis of existing data)
- Sewer System Evaluation Study of the West River and Bayshore Intercepting Systems and Tributary Pipelines Task 2 – Project Planning and Existing Data Evaluation
- SSES Bayshore and West River Basins Final Sewage Pumping Stations Review Memo

A growth evaluation desktop study was undertaken to determine the number of parcels of land within Bayshore basin that were vacant and could potentially be developed.

3 PERFORMED EVALUATIONS

Several evaluations were undertaken to determine the upgrades required at the Bayshore PS to handle the increased pressures on the discharge forcemain from San Carlos PS, future growth in Bayshore basin area and average/peak historical flows from Bayshore PS. The purpose of this project is to determine the requirements for the rehabilitation of the City's Bayshore PS. As part of the scope of work for this project, the three (3) evaluations described below were performed. Each subsection summarizes the findings and recommendations/outcomes from each evaluation, discussions with the City, and the decisions agreed upon.

3.1 PUMP STATION CAPACITY

Engineer was tasked with evaluating the Bayshore PS capacity and impacts of the new San Carlos pumps in order to determine the modifications required for the PS. Engineer reviewed the historical SCADA flow data documenting flow at fifteen-minute intervals going to the Bayshore PS from January 2010 to February 2021, as well as previous reports and studies, in order to determine the average and peak flows leaving the PS. In addition, Engineer evaluated the City's hydraulic model of the receiving forcemain to analyze the system pressure impacts from the San Carlos PS on the Bayshore PS. Engineer also performed a growth evaluation of the Bayshore basin to identify any future growth requirements that will need to be considered.

3.1.1 Summary of Findings

Flow Data Evaluation

Historical data from January 2010 to November 2018 was utilized to determine the average and peak flows from the PS. Data from December 2018 through February 2021 was excluded due to the flow meter being out of service since December 17, 2018. This historical data was graphed, and a trendline was added to evaluate the change in flows over time which included wet weather flow during storm events. The trendline, shown in Figure 3-1, indicates that the average flow has remained constant during the years evaluated.

The majority of the flows during this period (84%) were between 500 gpm to 2,000 gpm. Average flow was calculated to be 1,320 gpm.

Over the same period evaluated, three peak flow events were identified, all above 5,500 gpm, with the highest flow (7,522 gpm) occurring in August 2015. However, these events had a very short durations (approximately 30 minutes) and infrequent enough (0.004%) to not be considered representative of peak flow conditions and they were excluded from the peak flow evaluation. Review of the data for longer duration events (1 hour or more), revealed that the peak flows at the PS ranged from 5,500 to 6,100 gpm. The review of the peak events is included in Appendix A.

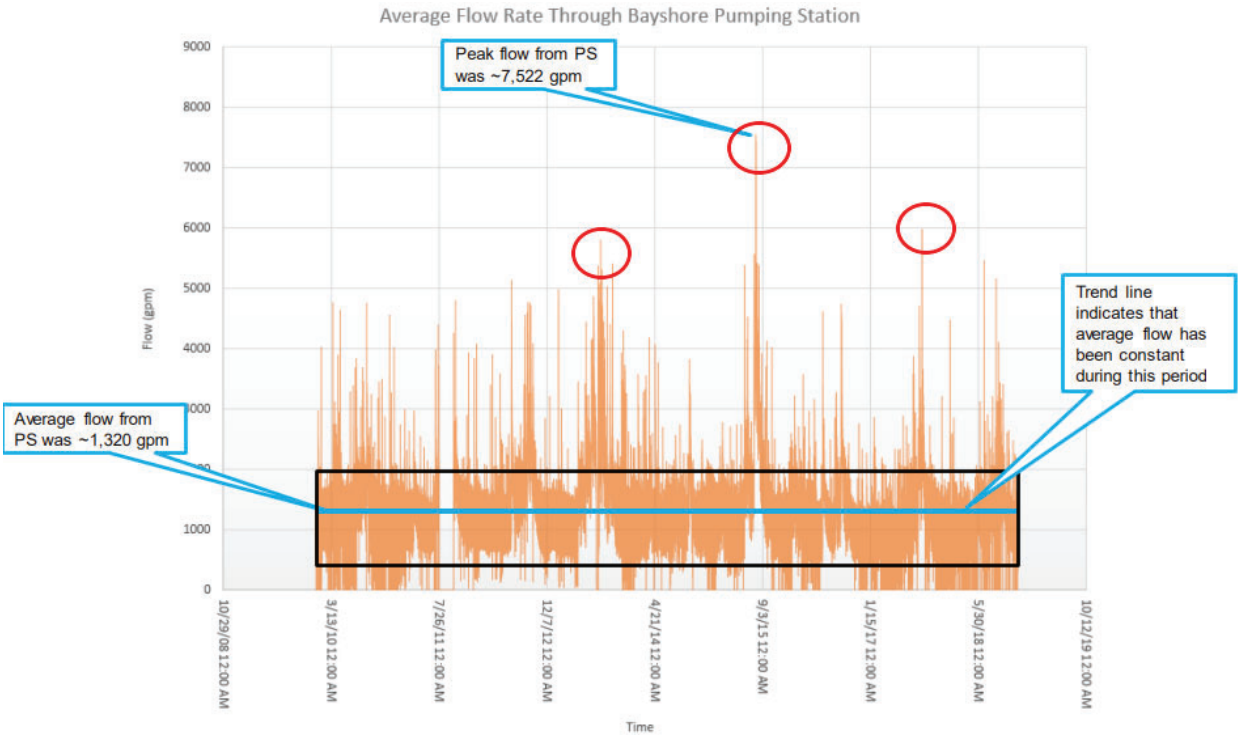

Figure 3-1: Flows at Bayshore PS Jan 2010 through November 2018

Pressure Evaluation

As previously mentioned, the Bayshore PS discharges into the San Carlos PS forcemain. The Bayshore PS is the next downstream PS that discharges into the San Carlos forcemain. Downstream from Bayshore, the forcemain also receives flows from the TGH Private PS, the Columbia PS, and the Davis Island PS prior to discharging into the HFC AWTP. Therefore, the recent upgrade to the San Carlos PS affects the pumped flows from Bayshore PS. To determine the extent of the effects, Engineer performed an analysis of the City's forcemain hydraulic model to evaluate the pressure impacts to the Bayshore PS from the recently rehabilitated San Carlos PS. The City's hydraulic model was revised and the model was evaluated at peak conditions for Bayshore (6,500 gpm) and for flow conditions at the San Carlos PS of 55 MGD, 50 MGD, 45 MGD, 40 MGD, and 3 MGD, with 55 MGD representing the peak flow and 3 MGD representing the minimum flow. Subsequent to this evaluation, direction was provided by the City to assume a peak flow of 40 MGD from the San Carlos PS as a limiting factor (worst-case scenario). The model results indicated that when San Carlos is pumping at 40 MGD, and three of the selected Bayshore pumps are operating in parallel, the historical peak flow of approximately 7,600 gpm can be achieved at approximately 94% speed. The resulting pressures at the Bayshore PS operating at the target design flow of 6,500 gpm at different operation flows from San Carlos are presented on Table 3-1.

Table 3-1: Hydraulic Model Evaluation Results

Flow, MGD	Pressure, ft	No. of Bayshore Pumps
55	118	3
50	106	3
45	98	2 or 3
40	88	2 or 3
30	71	2 or 3
20	67	1, 2, or 3
10	56	1, 2, or 3
3	50	1

According to the pump curves for the existing pumps, the shut-off head of the pumps is approximately 100-feet. Therefore, in the event that San Carlos PS is pumping the maximum expected flows, the Bayshore PS would not be able to pump against the pressure generated in the forcemain. This creates the possibility of surcharging the Bayshore wetwell and collection system upstream of the Bayshore PS, leading to sewage overflows into the Hillsborough Bay or at the Coachman Avenue manhole. Therefore, new pumps with sufficient capacity to match the discharge pressure created by San Carlos PS (88-ft) at 40 MGD are required and recommended for the Bayshore PS.

In addition to evaluating the pressures in the forcemain system when San Carlos operates at maximum expected flow conditions (40 MGD), the engineer evaluated the pressures in the forcemain system when San Carlos PS is at low flow conditions (3 MGD). At that condition, the Bayshore PS will see pressures of approximately 50-ft of head. The pumps selected for the Bayshore PS will need to be able to safely operate with discharge pressures between 50 and 88-ft of head when the Bayshore PS is pumping 6,500 gpm. This is a significant range of pressures for the centrifugal pumps requiring VFDs to be provided.

Growth Evaluation

Engineer performed a growth evaluation using the available information on the geographic information system (GIS). Within the Bayshore basin, 6,767 parcels were identified. At the time of the Pumping Station Capacity workshop with the City in March 2021, there were only 61 vacant parcels, of which 6 are owned by the City, 21 are owned by Hillsborough County Express Authority, and 31 are privately owned, which are shown in Figure 3-2.

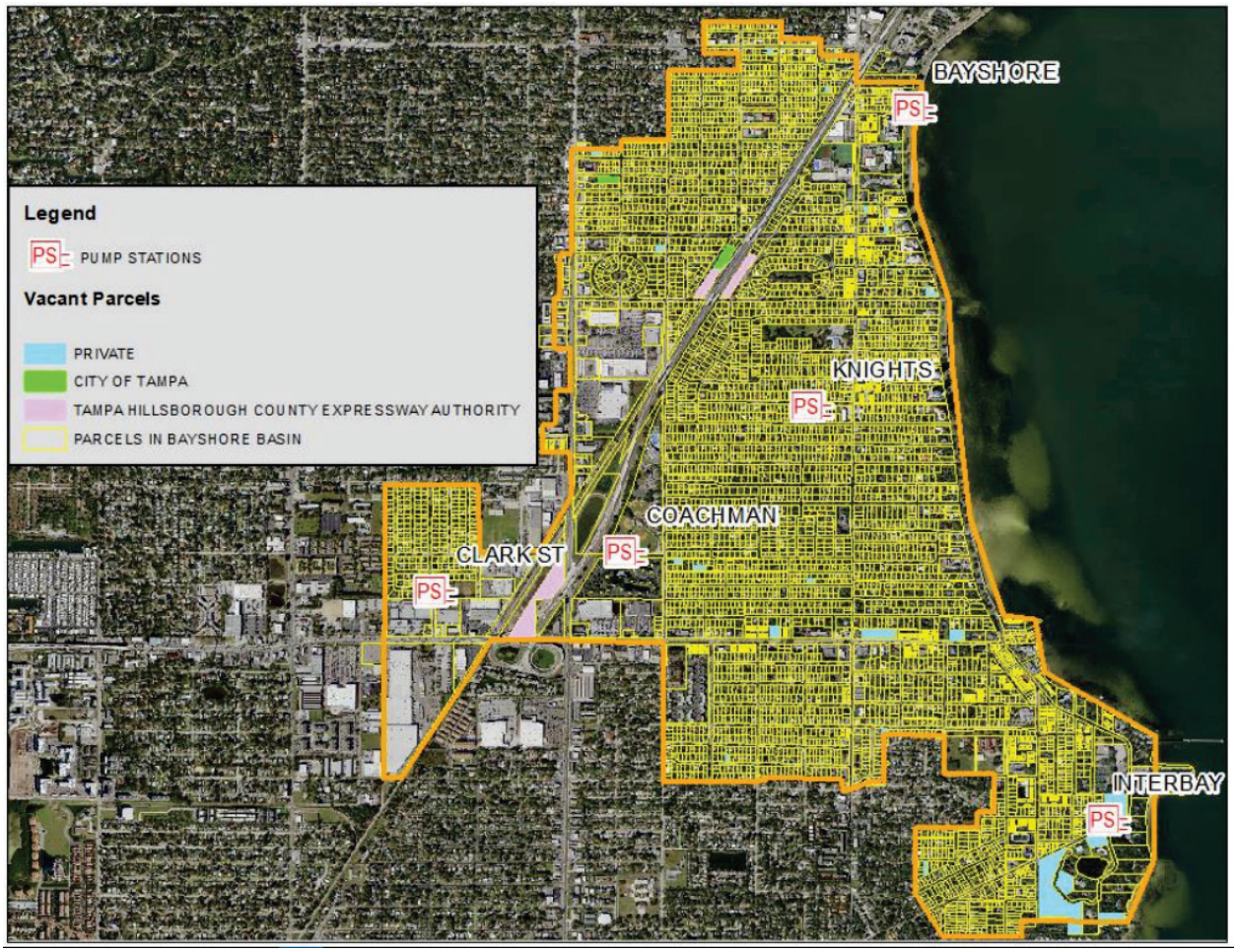

Figure 3-2: Potential Future Growth

Engineer performed a site visit of some of the larger vacant parcels in the basin and held discussions with the City's Development and Growth Management Department to confirm results of the growth evaluation.

The results of the evaluation determined the following:

- The vast majority of Planned Development zones in the Bayshore basin have already been developed.
- The general area north of MacDill Airforce Base is limited to 10 housing units per acre, and as such this area will not have any more high-rise development.
- There is approximately $13 Billion in proposed future real estate development in Tampa, but no major projects are planned on the Interbay Peninsula.

Based on the growth evaluation and discussions with the City's Development and Growth Department, it was determined that there should be no significant increase in the population base of the Bayshore PS

service area, as such, a significant increase in sewage is not expected for the Bayshore PS. Therefore, based on the findings from both the flow and the future growth evaluation, it is recommended to design the Bayshore PS for an average flow of 1,800 gpm and a peak flow of 6,500 gpm which include an allowance of 500 gpm for potential growth in excess of what is expected in the short and medium term.

3.1.2 Agreed Path Forward

The Bayshore PS pumps will be designed for an average flow of 1,800 gpm and a peak flow of 6,500 gpm, with design TDH between 50 and 88-ft for when San Carlos is pumping between 3 and 40 MGD.

3.2 PUMPING STATION ALTERNATIVES CONFIGURATIONS

This section describes the pumping station design alternatives and recommendations to provide increased reliability and redundancy of the equipment and infrastructure at the Bayshore PS.

The Bayshore PS is configured as a below grade, 37-ft x 21.75-ft rectangular, wet pit/dry pit configuration. The wet pit portion of the station originally included a 30-inch influent isolation sluice gate, 4.4-ft x 6.3-ft manual bar screen, and metal grating to access the screen. The screen offered some level of protection to the pumps from large debris; however, the City was forced to remove the screen from service due to the screen corroding from high levels of hydrogen sulfide (H_2S) and unsafe operating condition due to infrastructure deterioration. As of the date this report was written, the City has installed a new screen.

Figure 3-3, Figure 3-4, and Figure 3-5 depict the original PS configuration and dimensions.

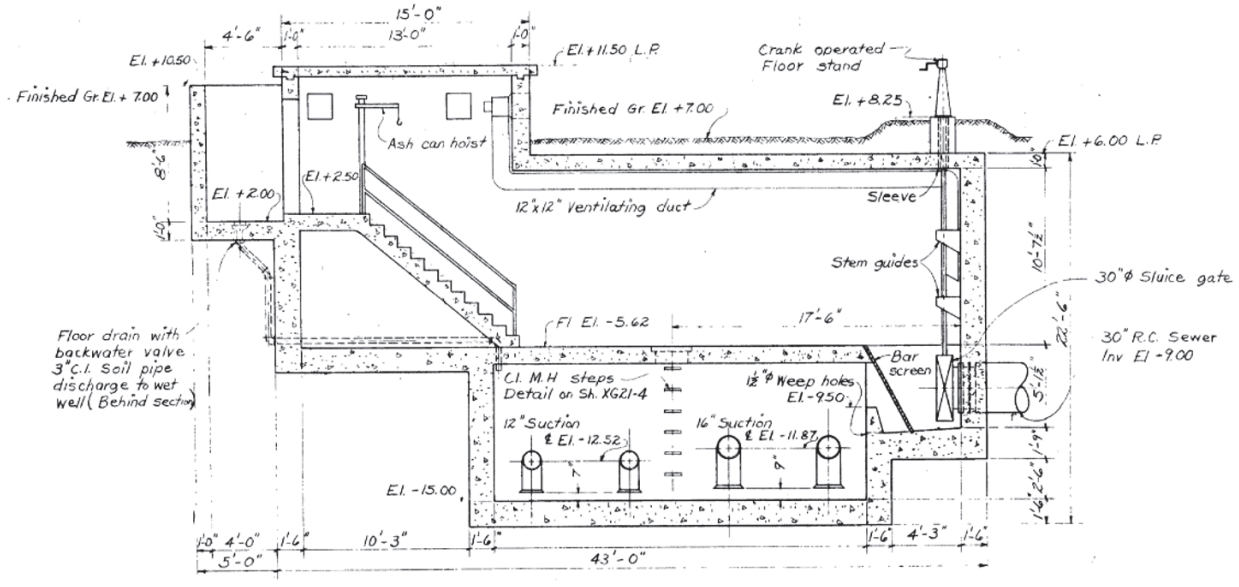

Figure 3-3: Existing PS Section View Configuration

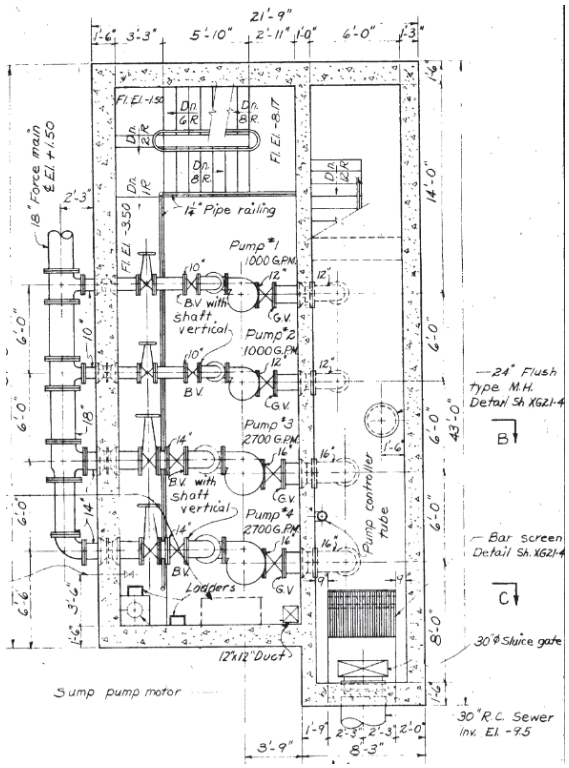

Figure 3-4: Existing PS Plan View Configuration

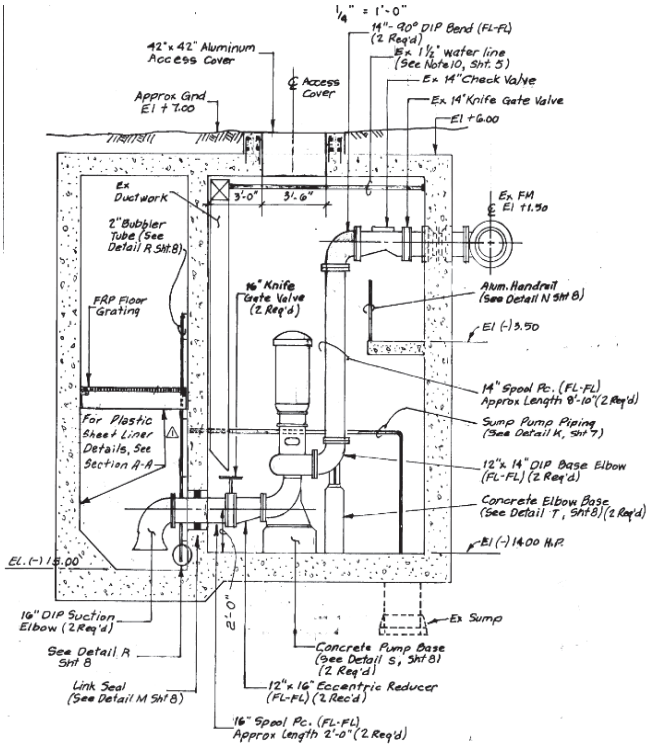

Figure 3-5: Existing PS Pump Configuration

The dry pit portion of the PS originally housed four pumps; however, the PS was modified over the years and currently has two centrifugal pumps, 16-inch suction pipes with 16-inch knife gate isolation valves, 14-inch discharge pipes with 14-inch knife gate isolation valves and 14-inch check valves. In addition, the electrical and control panels for the pumps are located on the first story of the station which is below ground level. The dry pit configuration maintains the pumps and valves outside of the sewage, allowing for maintenance to be performed without exposing personnel to sewage. However, the location of the pumps in the basement of the station and the arrangement of the discharge piping do not facilitate, and in some cases, hinders maintenance work. The City's maintenance personnel expressed their preference for a different configuration, which would allow for pump maintenance outside of the structure and shared some features that they liked on some of the City's other PSs.

Engineer evaluated 3 PS configurations for the rehabilitation of the Bayshore facility. The configurations included wet/dry pit, wetwell and self-cleaning trench type. Engineer utilized industry best practices, collaborated with multiple pump manufacturers and City personnel when evaluating the different configurations. In addition, Engineer utilized the Hydraulic Institute standard (HI) for pump intake design (ANSI/HI 9.8-2018), Appendix E (Aspects of design for rectangular wetwell for solids bearing liquids) to determine the minimum dimensions for the structure in order to prevent the excessive presence of unwanted hydraulic phenomena and the accumulation of sediments and/or scum, and to provide the proper flow approach for solids-bearing liquids.

Wet/Dry Pit Pump Station

The wet/dry pit configuration is similar to the existing facility, where the pumps are isolated from the sewage by a wall. In general, a wet/dry pit configuration has a larger footprint than a submersible or self-cleaning type PS's. Although the City expressed their preference to not utilize this configuration, Engineer performed the evaluation as this configuration was likely to be the lowest capital cost option.

As mentioned above, the dimensions of the wet pit sump are based on individual pump flow, while submergence requirements are based on flow and intake diameter. Section 3.1.2 determined that the design PS flows should be 6,500-gpm for peak flows. The pumps were evaluated in a 1 duty, 1 standby configuration (6,500-gpm per pump) and 2 duty, 1 standby configuration (3,250-gpm per pump).

The 6,500-gpm pump would require approximately 5.7-ft minimum wet pit water depth and approximately 10.7-ft between wet pit wall and intake bell to meet HI standards.

The 3,250-gpm pumps would require approximately 4.3-ft minimum wet pit water depth and approximately 7.6-ft between wet pit wall and intake bell to meet HI standards.

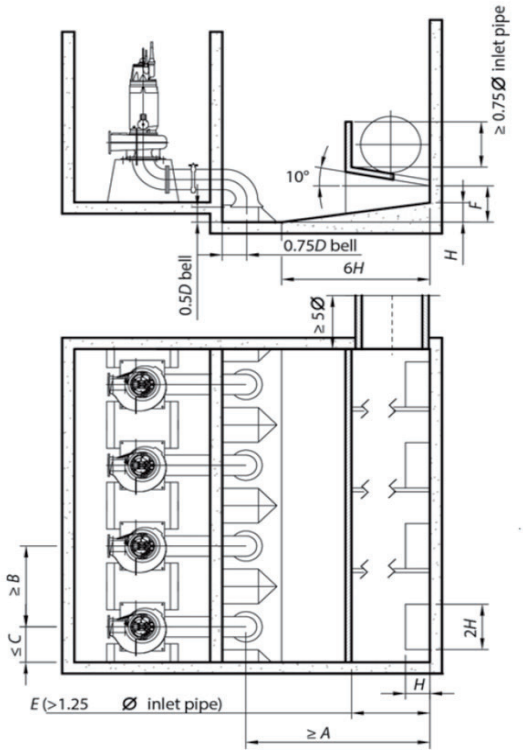

Figure 3-6: Dry Well Configuration

The existing wet pit sump is approximately 6-ft wide and a total height of 6-ft from finished floor to influent pipe invert. Both pump size options would require substantial modifications (such as wet pit wall relocation, external pipe installation, or internal flow diversion) to meet HI standards. Because of this and the City's preference to not use a dry pit configuration, a wet/dry pit PS is not recommended.

Submersible Pump Station

A submersible PS has the pumps submerged in the sewage. This allows for a more compact footprint than the wet/dry pit configuration.

As mentioned above, the dimensions of the wet well are based on individual pump flow, while submergence requirements are based on flow and intake diameter. Section 3.1 determined that the design PS flows should be 6,500-gpm for peak flows. The pumps were evaluated in a 1 duty, 1 standby configuration (6,500-gpm per pump), 2 duty, 1 standby configuration (3,250-gpm per pump) and 3 duty, 1 standby (2,167-gpm per pump).

The 6,500-gpm pump would require approximately 8.2-ft minimum water depth and approximately 10.7-ft between wet well wall and pump intake to meet HI standards.

The 3,250-gpm pumps would require approximately 5.7-ft minimum water depth and approximately 7.6-ft between wet well wall and pump intake to meet HI standards.

The 2,167-gpm pumps would require approximately 5.7-ft minimum water depth and distance of approximately 6.2-ft between wet well wall and pump intake to meet HI standards.

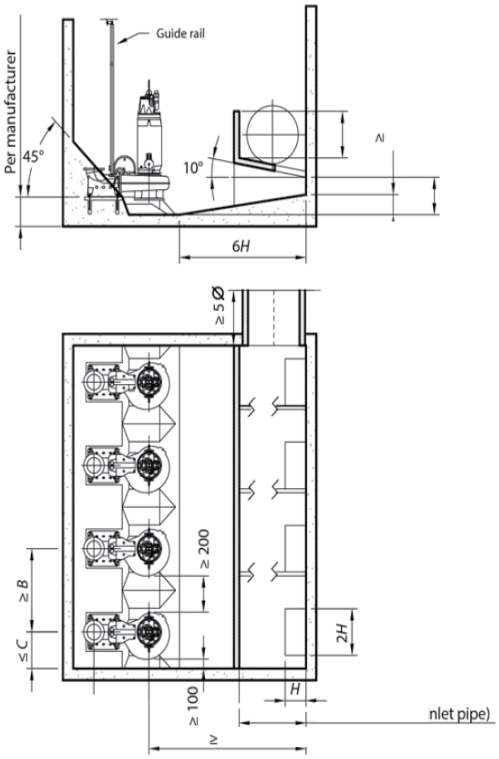

Figure 3-7 Submersible Configuration

The existing PS is approximately 21.75-ft wide and can easily accommodate the dimension required to meet HI standards. However, the existing dry pit finished floor elevation provides 5.6-ft distance to the pipe invert. The minimum water level requirement for the 6,500-gpm alternative, would not allow for free discharge from the gravity main to the PS, therefore it would adversely affect the upstream collection system. The 3,250 and 2,167-gpm alternative would allow for free discharge from the gravity main to the PS wet well and provide 0.7-ft of operating level before adversely affecting the upstream collection system. Lowering the PS floor would provide more operating height, but it would come at a significant cost. Another alternative, although not ideal, is to manage the small operating level using multiple pumps with VFDs. Modifications to the dividing wall between the wet/dry pits will be required to convert the PS into a single wet well. These modifications should be carefully planned to maintain structural integrity, minimize clogging, while still providing optimal flow distribution to each pump. During construction, the Bayshore PS can remain offline while the structural modifications are being completed by using temporary diesel pumps with the permanent buried 18-inch PVC bypass pipe located near the existing gravity manhole on the south side of the PS. The permanent 18-inch PVC bypass pipe connects approximately 170 ft north to the existing 24-inch PVC forcemain. Refer to Section 4.6 for additional details.

Further analysis of the historical data showed that during approximately 25% of the time, the Bayshore PS received flows under 1,000 gpm. Under these conditions and using only the available storage capacity of the modified wet well, any pump would need to start every 45 minutes. The operating conditions during low flows offer a reasonable cycle frequency. If the pumps are operated with the normal level at the center of the gravity main, the added storage volume will minimize or possibly eliminate the need for pump cycling.

Self-Cleaning Trench Pump Station

A self-cleaning trench utilizes a modified wet/dry pit configuration, where the wet pit is narrow (only 2 times the pump intake diameter) multiple finished floor elevations and a contoured intake to create a hydraulic jump for the incoming sewage. With low submergence requirements and minimal horizontal surfaces outside of the area of influence of the pumps, this configuration minimizes solids accumulation. This configuration has very low retention time and should be carefully sized to ensure that excessive cycling does not occur.

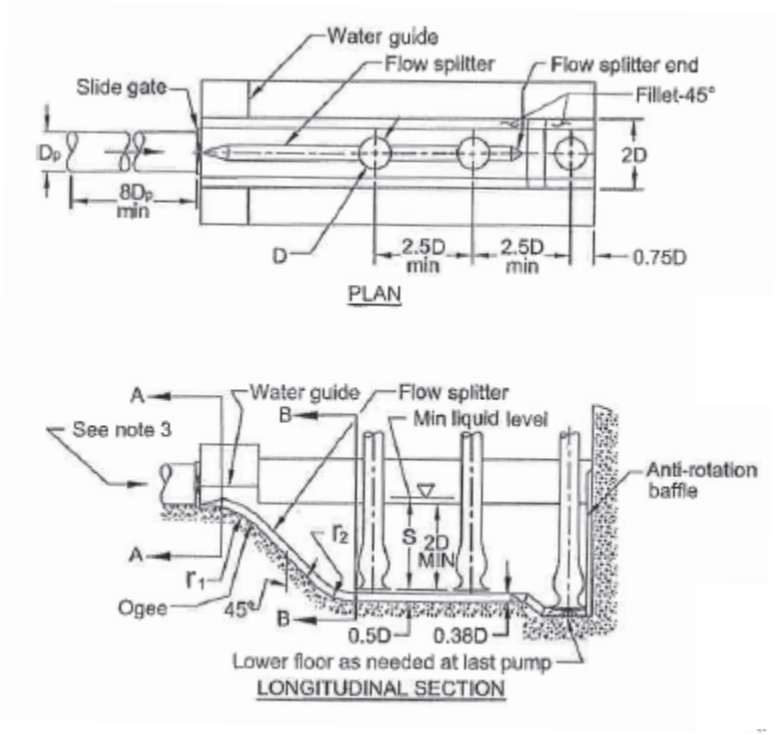

Figure 3-8: Self-Cleaning Trench Configuration

The trench type PS dimensions are governed solely by the diameter of the pump intake. As part of the evaluation, Engineer obtained preliminary cutsheets for the 6,500 and 3,500 gpm pumps, which were used to develop the trench type PS dimension requirements. All three pumps include a 16-inch bell intake in their dry pit configuration, as such, the trench would only be required to be approximately 47-inch wide, and 132-inch long (excluding the transition ramp). This would fit well within the existing dry pit dimensions. Modifications to the wet pit floor would be limited to the 47-inch width and a small lower floor section to accommodate the last pump. Due to the required modification to the wet pit floor, the reduction in storage time and the City's preference to not use a dry pit configuration, the self-cleaning trench type PS is not recommended.

The hydraulic analysis was based on the use of a submersible PS with the pumps located in the existing wet well (floor elevation -15.0-feet City of Tampa Datum).

3.2.1 Discussions with the City

Larger pumps will likely be subject to frequent, short pump cycles during normal flow conditions at the Bayshore PS. For this reason the number of duty pumps increased from two to three pumps in order to improve PS turndown, as well as to allow for operation of the pumps past the inlet gravity main invert up to the centerline of pipe.

The recent rehabilitation of the San Carlos PS was also discussed during the workshop. When the flow from San Carlos is 3 MGD (min flow), the maximum combined flow from a single Bayshore pump is greater than 6,500 gpm, and if the San Carlos flow ever reaches 55 MGD (since San Carlos is now capable of pumping that flow), all three Bayshore pumps would only be able to pump approximately 4,500 gpm. The historical flow analysis showed that the flows for the Bayshore PS exceeded 4,500 gpm only 0.2% of the

time. Direction was provided by the City to assume a flow of 40 MGD from the San Carlos PS as a limiting factor (worst-case scenario) to the Bayshore PS.

Another topic of discussion during the workshop was the requirement to replace the abandoned 18-inch forcemain that connects to a manhole at Santiago Street which would enable sewage from the Bayshore PS to go by a gravity main to the Krause PS. The City confirmed that the forcemain will be operated manually under emergency conditions and the Bayshore pumps do not need to be sized for this very low head condition.

3.2.2 Site Visit

During the site visit held on March 11, 2021, spacing limitations, such as for equipment installation and/or maintenance, were observed, along with concrete damage in the wet well and some corrosion on the pumps.

The City currently injects odor control products upstream of the Bayshore PS. During the site visit no evidence of odor issues was identified. With the rehabilitation of the PS and the construction of a new electrical building in the median, it is unlikely that an odor control unit can be accommodated due to space constraints, among other concerns.

3.2.3 Agreed Path Forward

During the Bayshore PS configuration evaluation workshop with the City, the City expressed their preference to have a submersible PS without lowering the invert of the existing PS.

To meet the capacity requirements established during the PS capacity workshop, and taking into account the City's preference for using submersible pumps, it was agreed that the most optimal pump configuration to meet all requirements is to use three (3) duty pumps and one (1) standby, each one having a minimum flow of approximately 1,000 gpm and a combined flow of approximately 6,500 gpm with three (3) pumps in service when the flow from the San Carlos PS is 40 MGD (88-ft of head). Per discussions with the City, the PS design will be based on the use of Flygt NP 3312 pumps.

The City also provided direction to assume liquid level beyond the invert of the inlet pipe to approximately EL 7.5' (half of pipe) to the wet well should be allowed and that no odor control will be required.

3.3 ELECTRICAL AND CONTROL SYSTEMS IMPROVEMENTS

This section describes the proposed electrical distribution system and potential safety measures/configurations for the Bayshore PS Rehabilitation project. Electrical distribution one-line diagrams, conceptual load calculations, and equipment recommendations are described in this section. The design criteria and equipment recommendations presented herein will be the basis for the detailed design of the electrical distribution system.

3.3.1 Summary of Electrical Findings and Recommendation

3.3.1.1 Codes and Standards

The codes and standards listed below will be used in development of the detailed design. The most stringent standards or code requirements will be used in case of conflict or discrepancy between current and latest versions of the following standards and codes:

- NFPA 70, National Electrical Code (NEC)
- NFPA 101, Life Safety Code
- NFPA 780, Standard for the installation of Lightning Protection Systems
- NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities
- Appropriate National Electrical Manufacturer's Association (NEMA) standards for the environments where equipment is installed
- Underwriter Laboratories (UL)
- Telecommunications Building Wiring Standards (American Nationals Standards Institute [ANSI]/TIA/EIA)
- Appropriate Institute of Electrical and Electronic Engineers (IEEE) standards for design and equipment specifications
- Federal Occupational Safety and Health Act (OSHA)
- Local Building Code
- Design Criteria Package for RFQ: 20-C-00015 Design-Build Services (City of Tampa)

3.3.1.2 Safety and Protection

The primary consideration in the design and installation of a power system is the safety of personnel and the protection of property. To accomplish this, several aspects of the power system will be evaluated as follows:

A load study will be conducted to tabulate all electrical loads. Electrical loads will consist of electric motor driven pumps, accessory systems, HVAC equipment, interior and exterior lighting, etc. The surge in current from starting electric motors will be factored into the load study and motor starting voltage drops will be estimated. Equipment, such as switchboard, buses, and conductors, will be selected with sufficient capacity to carry the design loads without overheating. Estimated demand factors will apply to this study.

A preliminary fault current study will be performed before the procurement of the equipment to evaluate the potential magnitude of the available current in the event of a short-circuit. The electric utility will provide the fault current that is available at its service transformer, and the contribution of electric motors will be added to determine the total available fault current. Breakers, fuses, and protective switches will be selected with sufficient capacity to safely interrupt the maximum available fault current. A final fault current study will be performed based on actual confirmed cable lengths and installed equipment and protective devices.

The detailed design will require the Engineer to perform a protective device coordination study to be completed before the procurement of equipment. The study will determine the trip point and time delay settings, which will allow a fault to be isolated to only the affected area and allow continued operation of the

remainder of the unaffected electrical system. Fault current study and protective device coordination will be computed and evaluated using up-to-date computer software. An Arc Flash Analysis will be included with the Power Distribution Study. The study will be performed by the Electrical Contractor and will be submitted for approval.

Consideration will be given to the arrangement of the power system to allow for maintenance work to be accomplished with the particular circuits and equipment de-energized and grounded. Equipment will be selected with provisions for locking out circuits or equipment for maintenance.

As a minimum, the dedicated space clearances around equipment will be maintained per code requirements. Additional clearances to benefit maintenance and repair work will be considered for some equipment as needed. Required exits from the electrical equipment dedicated spaces will be provided in accordance with code requirements.

Consideration will be given to selecting equipment and installation methods that simplify and minimize the amount of work required to maintain the electrical equipment.

3.3.1.3 Area Classifications

Some areas to be included at the Bayshore PS will have high temperature, wet, corrosive, or hazardous environments due to location of the processes and materials involved. All materials and methods used will be rated for use in such areas.

Enclosure Classifications are as follows:

- Electrical and control equipment installed in dry, non-hazardous condition areas will be in NEMA 1A enclosures with gasketed covers. The switchboard, panelboards, etc. will be specified with tin-plated copper buses.
- All conduits will be sealed where they enter or exit corrosive or hazardous areas to prevent the migration of corrosive or hazardous gases.
- All equipment installed in areas identified as wet, non-hazardous, and non-corrosive will be specified with NEMA 4X enclosures.
- All equipment installed in areas identified as corrosive, whether wet or dry, will be specified with NEMA 4X stainless steel enclosures with corrosion inhibitors inside the enclosure.
- All equipment installed in areas identified as hazardous will be specified with NEMA 7 or NEMA 8 explosion-proof enclosures.

3.3.1.4 Electrical Distribution

3.3.1.4.1 Electrical Distribution Criteria

To meet requirements for Class I Reliability as required by EPA's Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability (EPA-430-99-74-001), the lineup will consist of a main-tie-main configuration with provisions for both a permanent standby generator and portable unit via generator docking station. Reference drawing E-02 for the proposed One-Line Diagram.

The electrical distribution design will include considerations for reliability, maintainability, and safety. To provide for a reliable distribution, the system will be designed with two independent sources of power and protection from common mode failure. This will consist of a single utility service feed and sufficient standby power to allow for complete operation of the PS in order to meet firm capacity requirements.

The anticipated cumulative loads per phase are as shown in Table 3-2.

Table 3-2: Anticipated Loads

Description	Connected Load (kVA)	Demand Load (kVA)
Pump No. 1	236	133
Pump No. 2	236	133
Pump No. 3	236	133
Pump No. 4	236	133
Misc Loads	85	68
Total	**1029**	**600**
Ampacity		
480 volts	1238	722
Note: kVA = kilovolt-ampere		

The intent is to locate all electrical equipment in an air-conditioned electrical building. The initial installation will be based on a combined load of approximately 1,029 kVA connected. Utilizing a demand factor as provided by Flygt on duty equipment, the electrical system is based on load of approximately 600 kVA. The main switchboard will allow for 40 percent plant expansion up to an ultimate loading of 1000 kVA.

3.3.1.5 Electrical Service

The Bayshore PS currently receives power from Tampa Electrical Company (TECO) via an existing 300kVA pad-mounted transformer, located on the north side of the PS wet well. The existing service equipment will support a 360A, 480Y/277V, 3-phase, 4-wire, 60 Hz service. This will not adequately support the proposed PS capacity requirements.

In order to accommodate the proposed PS configuration, we propose to upsize the existing facility service through TECO to a minimum 750kVA pad-mounted transformer, or roughly a 900A, 480Y/277V, 3-phase, 4-wire, 60 Hz service. The new pad-mounted transformer will be located further south within the project median to avoid potential damage from oncoming traffic.

3.3.1.6 Standby Power System Improvements

Similar to the existing utility service, the existing emergency generator, currently sized at 250 kW, 480Y/277V, 3-phase, 4-wire, is too small to accommodate our proposed loads. Approximately 600 kW of

emergency power capacity is required to run the PS at firm capacity. The generator will provide power to the PS during occasions when TECO service is unavailable. The new generator will be located within a modified footprint of the existing generator space with its own sound attenuated, weatherproof enclosure. The generator design will be based on Caterpillar.

In addition to the permanent emergency generator, provisions will include available hook-up for a portable generator via a generator docking station. Should utility service be lost, the main utility breaker will open and the main generator breaker will close. To accomplish this, electrically operated main protective devices will be used. The tie breaker shall be normally closed and only opened when maintenance is required on one side of the switchboard. If for whatever reason the permanent emergency generator fails, the City will be able to manually switch over to a portable generator via the generator docking station. The docking station design will be based on Trystar, Series GDS-3.

3.3.1.7 Standby Generator Fuel

The generator will be mounted on a 2,400-gallon, dual wall, sub-base diesel fuel tank sized to maintain operation of the facility for 72 hours following a utility power failure. The sub-base diesel fuel tank will be constructed with heavy gauge steel and will include a reinforced steel box channel for generator support. The sub-base tank package will include pre-wired fuel pump and controls, low and high fuel level switches, and a rupture basin. Table 3-3 provides a summary of the fuel storage system.

Table 3-3: Standby Generator

Parameter	Feeder Type
Generator Size	600kW / 750kVA
Quantity of Generators	1
Fuel Type	Diesel
Fuel Consumption at 75% load	33.0 gph
Fuel Backup Run Time	72.7 hrs
Proposed Sub-base Tank Size	2400 gal

3.3.1.8 Concrete-Encased Ductbank

Ductbanks will be concrete encased. Interlocking polyvinyl chloride (PVC) spacers will provide spacing between ducts and 3-inch minimum cover of concrete for the outer ducts, spaced 5-ft on center. Rebar will be placed in the ductbank with longitudinal rebar tied to the spacers. Direct burial PVC duct will be placed in the spacers and joined with PVC cement.

3.3.1.9 480-Volt Power Distribution

The 480-V distribution system will consist of a dead front type, low voltage metal-enclosed switchboard. The switchboard described herein will be designed for operation on a 480Y/277V, 3-phase, 4-wire, 60-Hz

system. The switchboard main bus will be rated based on the loads served and constructed so that all buses, bus supports, and connections withstand stresses that would be produced by fault currents equal to the close and latch rating of the circuit breakers.

The assembly will be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of 25,000 amperes symmetrical at rated voltage. The bus system will have a minimum ANSI short-circuit withstand rating of 65,000 amperes symmetrical. The electrical distribution equipment will be designed based on Eaton, Pow-R-Line Xpert Switchboards.

3.3.1.10 Distribution System Protection

The following types of protective devices will be used for the low voltage distribution systems:

- 480-V switchboard – 100 percent rated insulated case circuit breaker with solid-state trip for mains and feeders 400A and larger. Smaller feeders will be accommodated via local 480-V panelboards.
- 480-V feeder circuit breakers in panelboards, 400A and larger – 100 percent rated, molded case with solid state trip.
- 480-volt feeder circuit breakers in panelboards, smaller than 400A (other than for combination motor starters) – Molded case, thermal magnetic type.

All electrical equipment will have adequate momentary and interrupting capacity to withstand fault currents that may occur at the point in the system where the equipment will be applied. Ground fault protection on main breakers and feeder breakers will be equipped with time delay setting and restraint systems, unless indicated otherwise on the design drawings.

3.3.1.11 Surge Suppression

High-performance SPDs will provide effective high-energy transient voltage surge suppression, surge current diversion, and high-frequency noise attenuation in all electrical modes for equipment connected downstream from the facility's meter or load side of the main over current device. The unit will be connected in parallel with the facility's wiring system.

SPDs for each switchboard, panelboard, and control panel will be provided, mounted either internally or externally to all equipment it serves. Surge protection devices will also be provided for each signal wire entering or leaving a device or control panel.

Systems will be designed, manufactured, tested, and installed in accordance with the following applicable documents and standards:

- UL 1449 4th Addition and UL 1283
- ANSI/IEEE C62.41
- National Electric Code
- UL 248

3.3.1.12 Variable Frequency Drives

VFDs can help save motor energy by allowing for variable flow based on the demands and needs of the facility. This is accomplished by converting the fixed frequency of incoming AC voltage to DC — and then reconverting it back to AC voltage by varying the frequency at which the insulated gate bipolar transistors (IGBTs) are gated on and off.

Basic operation is summarized below:

A VFD operates by converting the input sinusoidal AC voltage to DC voltage and then back to AC voltage. This conversion occurs by using either silicon control rectifiers (SCRs) or IGBTs. The DC voltage is switched using IGBTs to create an AC output voltage (called the inverter). The IGBT can switch on and off to create an AC voltage waveform that delivers power to the motor. The IGBTs create an AC waveform by using pulse width modulation switching. The frequency at which the switching occurs is called “carrier frequency.”

A typical 6-pulse VFD has six diodes as a front-end bridge rectifier that converts AC to DC. VFDs can also have 12 diodes — two sets per phase (2 × 2 × 3 = 12 pulse) — or 18 diodes — three sets per phase (3 × 2 × 3 = 18 pulse). One set of diodes is supplied by a Delta-Y transformer to create a phase shift on the AC side between the two rectifiers to reduce harmonics reflected back to the source.

The VFDs will be designed based on Yaskawa, Model IQ1000 as provided by Icon Technologies.

3.3.1.13 Panelboards

Lighting panels will be surface-mounted, 208Y/120-V, three-phase, four-wire type, with the main circuit breaker sized to match the lighting transformer capacity. Transformers to supply 208Y/120-V requirements will be dry type and suitable for the area in which they are to be located. Separate panelboards will be provided to supply power to instruments and control panels where the equipment to be supplied requires a conditioned power supply. Each panelboard will be provided with a minimum of 20 percent spare breakers with spaces, bus work, and terminations to complete the standard size panel. Panelboard schedules will show the circuit description, protective device trip rating, number of poles, and rating of main lugs or main circuit breaker. Where multiple instruments are connected to a single-branch circuit, a toggle switch will be provided at each tap to allow each individual instrument to be disconnected from the branch circuit.

3.3.1.14 Convenience Receptacles

Convenience receptacles for general service will be spaced not more than 40 feet apart inside all buildings and 75 feet apart in outside process areas. They will be located on the surface of walls or columns. Receptacles will be provided at air conditioning units and air handling units as required by NEC. Where wash-down is expected, outlets will be located 48 inches above the floor.

3.3.1.15 Raceways

Specific types of raceways will be chosen for use in various locations in the facility, based on moisture, temperature, exposure to damage, corrosion, voltage, and cost:

- Exterior, exposed conduit will be aluminum.
- In exterior, corrosive areas, PVC-coated aluminum will be used.
- Exterior, underground, direct-buried conduit will be schedule 80 PVC.
- Exterior, underground, concrete-encased conduit will be schedule 80 PVC.
- Interior, exposed conduit in dry areas will be aluminum.
- Interior, exposed conduit in corrosive areas will be PVC coated aluminum.
- Interior, concealed conduit will be schedule 40 PVC.
- PVC conduit runs will use PVC coated aluminum elbows.
- The minimum diameter of conduit will be ¾ inch.

3.3.1.16 Low Voltage Cable

Copper conductors will be used throughout. Solid conductors will be permitted for lighting and receptacle circuits. All other applications will employ stranded conductors. Wire and cable will be specified with moisture and heat-resistant insulation, type XHHW-2 with XLPE insulation. Wire and cables will be rated for 600-V, 90°C in wet or dry locations. Power conductors will not be smaller than #12 AWG stranded copper. Discrete control circuits will use individual #14 AWG stranded copper conductors, unless it is practical to use multi-conductor cables to group control circuits. Twisted, shielded pair control cable #16 AWG with an aluminum Mylar tape shield will be used for analog signals.

3.3.1.17 Grounding

The grounding system will be designed and installed for “single point grounding” by ensuring that all equipment has only a single ground path, and that all equipment grounds in a particular structure are connected at a single common grounding point. External counterpoise ground rings will be connected to building grounds at the single common grounding point.

Proper grounding is essential with the addition of microprocessor-based controls and computers. All grounds will be brought back to the service in accordance with NEC. All grounds will consist of ground conductors to ground rods and building structures. To ensure proper grounding, multiple stainless steel 5/8 inch minimum diameter ground rods of 10 feet in depth or more will be used to achieve a maximum of 2 ohms measured resistance to ground.

3.3.1.18 Lighting

Lighting levels in all areas of the Bayshore PS will be calculated following the procedures recommended in the Illumination Engineering Society handbook. In addition to normal lighting, emergency lighting will be provided in select locations for life safety during a blackout. In general, the minimum foot-candle levels and types of light source identified in Table 3-4 will be used:

Table 3-4: Lighting Criteria

Area	Foot-Candles	Light Source
Electrical Bldg, inside (to 15’ ceiling)	30 – 50	LED

Electrical Bldg, outside	5	LED

3.3.1.19 Lightning Protection

Lightning protection systems will be provided and installed for all buildings as well as for all structures greater than 5 feet above grade level. The system will follow provisions of Code for Lightning Protection Systems as adopted by the NFPA and Lightning Protection Institute.

Lightning protection cable will be Class I copper. Grounding counterpoise will be utilized. Fittings and straps will be cast copper. Air terminals will be copper as required to match roof conductors, will have proper base support for the surface on which they are attached, and will be securely anchored to this surface. Terminals will project a minimum of 10 inches above the top of object to which attached.

Roof conductors will consist of copper complying with the weight and construction requirements of the Code for Lightning Protection Systems, and will be coursed to interconnect with air terminals, and in general, provide a two-way minimum path to the ground. Down conductors will be copper, concealed within the structure.

Ground connections will be made in accordance with requirements of all applicable codes. Ground rods will be placed in a minimum of 2 feet from building foundations. In addition to above artificial grounds, one down conductor of each two-path system will be connected to the water piping system with an approved water pipe type strap connector. All ground rods will be ¾ inches in diameter, with a minimum length of 20 feet, made up of 10 foot sections, and be solid stainless steel type.

3.3.2 Summary of Instrumentation and Control Findings

This section describes the proposed instrumentation and control upgrades for the Bayshore Pumping Station Rehabilitation project. The proposed upgrades include a new pump control panel, wet well level sensors, magnetic flowmeter, and station communication equipment. The PS will operate as a standalone system and will operate in automatic mode under normal conditions. Remote monitoring and control will be available at the HFC AWTP.

3.3.2.1 Codes and Standards

The instrumentation and control design will be governed by the following codes and applicable standards of the listed agencies:

- IEEE 802.3, Standards Defining Physical Layer and Data Link Layer Media Access Control (MAC) Sublayer of Wired Ethernet
- ISA 5.1, Instrumentation Symbols and Identification
- ISA 5.4, Instrument Loop Diagrams
- ISA 20, Specification Forms for Process Measurement & Control Instruments, Primary Elements & Control Valves
- NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum)
- NFPA 79, Electrical Standard for Industrial Machinery

- UL 50, Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
- UL 508A, Industrial Control Panels
- UL 698A, Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations
- UL 2062, Enclosures for Use in Hazardous (Classified) Locations

3.3.2.2 Design Approach

3.3.2.2.1 Pump Station Control Panel

A new PS control panel will be provided to replace the existing control panel for monitoring and control of the Bayshore PS. The new panel will be located in the new electrical building and will include an Emerson Rx3i programmable logic controller (PLC) and a 15" Maple Systems operator interface terminal (OIT) with human machine interface (HMI) graphic displays for primary control and monitoring of the PS. The OIT will allow the operators to monitor equipment status, analytical values, as well as to control equipment and adjust setpoints. A Motorola ACE3600 remote telemetry unit (RTU) will also be provided for backup monitoring of select signals to be determined during detailed design. An uninterruptible power supply will be provided for the new panel.

The City has standardized on Emerson RX3i PLCs and Motorola ACE3600 RTUs, and Maple Systems OITs. Therefore, these will serve as the basis of design and will be the only named PLC vendors in the specifications. The configuration of the PLCs and OIT will be performed by Rocha Controls. There are two existing Supervisory Control and Data Acquisition (SCADA) systems in the AWTP running in parallel, HSQ and VTSCADA. The system integration of the new PLCs into the existing HSQ and VTSCADA systems will be performed by the City.

3.3.2.2.2 Communication

The Bayshore PS upgrades also include providing cable internet service by Spectrum. The PS will communicate to the existing HSQ SCADA system at the AWTP using a new modem connected to the Emerson RX3i PLC. A cellular modem will be provided for backup communication of the Motorola ACE3600 RTU with the existing VTSCADA system at the AWTP. Both the cable internet and cellular modems will communicate with existing communication hardware at the AWTP.

3.3.2.2.3 Control Narrative

Each pump's VFD will have hand/off/auto (HOA) selector switches and a keypad for establishing speed setpoints for hand mode operation.

When the respective VFD's HOA selector switch is in the Hand position, pump will start and speed control of that pump will be from the VFD keypad. When the HOA selector switch is in the Auto position, start/stop and speed control of the pump will be from the signals received from the RX3i PLC.

When the HOA selector switch is in the Auto position, the operator has the option of choosing manual or fully automatic mode for pump control, using the OIT or SCADA workstation. If the operator chooses fully automatic mode, the four pumps will operate in a Lead/Lag-1/Lag-2/Standby configuration based on the levels shown in Table 3-5 below. These levels are estimated and will be refined during design and

construction. Pump speed shall be controlled by a single level setpoint input by the operator. This level setpoint will be determined during detailed design.

Table 3-5: Level Setpoints

Level Setpoint	Elevation
High Level Alarm	El. -7.2
Lag-2 Pump On	El. -7.5
Lag-1 Pump On	El. -8.0
Lead Pump On / Influent Pipe Invert	El. -9.0
All Pumps Off	El. -10.6
Low Level Alarm	El. -10.9

Operation of the PLC will be continuously monitored, and in the event of a controller and/or level transducer failure, a back-up level control system will sequentially start the pumps when the high-water alarm is reached. The back-up level control system will only start pumps that have their mode switch in the “auto” position.

3.3.2.2.4 Equipment and Instrumentation

See the process and instrumentation diagram (P&ID), I-02, attached, for an overview of the PS equipment and instrumentation. A new level sensor and backup flow switches will be provided for wet well level monitoring. A magnetic flowmeter with manual bypass will be provided on the common discharge header of the pumps.

As a minimum, the following parameters will be monitored.

- Wet well level
- PS discharge flow
- Pump discharge pressure (Locally)
- Pump run status
- Pump overload/malfunction status
- Pump local/remote selector switch position
- Pump runtime
- Discharge check valve limit switch position

3.3.2.2.5 Manufacturer Selection

The following manufacturers and models are preferred by the City and will be specified during detailed design:

- Ultrasonic Level Transmitter – Pulsar Measurement
- Strap On Flowmeter – Greyline Portable Ultrasonic Doppler Flowmeter

Flow meter technology to be used at Bayshore PS will be determined during detailed design, but expectation is to use a strap-on meter.

3.3.3 Discussions with the City

The City noted that a conditioned building is preferred over exterior rated and conditioned gear, especially given the size of the potential pumps and heat conditions.

Multiple layout/location considerations were reviewed with the City including where to locate the electrical systems. Offsite locations were considered for the electrical systems and were found to be unsuitable due to the size and length of cable needed as well as the potential for loss of signal or power disruption. Additionally, an alternative site location for a new PS was considered and deem not feasible due to the difficulty to get gravity flows to evaluated location. It was concluded that a long rectangular building might be better fit for equipment arrangement.

The selected location for the new electrical building was in the median, north of the existing PS. Limitations for the installation for a new electrical building at this location are the need to comply with the updated FEMA Flood Map Base Flood Elevation of EL 13.0 NAVD 88, within Zone VE, and a preference to limit the height of this building to minimize visual obstructions at this location. To manage these limitations, the electrical building would need to be raised such that the lowest horizontal structural element is 1-foot above the Base Flood Elevation, or 14.0 NAVD 88 (approximate floor elevation of 16.0 NAVD 88) or use a partly buried structure with a water retaining wall around it that protects up to at least EL 15.0 NAVD88.

Discussions with the City indicated their preference for the use of the partly buried structure with a water retaining wall, but a request was made to validate this concept with the City's Construction Services Department. After meeting with the Construction Services Department representatives, it was determined that they would accept this design concept.

Additionally, it was established that the electrical building will need to have provisions for access during a high-water event.

Finally, in discussions regarding the existing generator it was established that the generator requires replacement as it was determined to be approximately 12-13 years old and not sized appropriately to power the upgraded PS configuration. The City's preference is to base the design on the use of Caterpillar equipment for the new generator.

3.3.4 Discussions with Tampa Electric Company

Due to the location of PS within the middle of Bayshore Blvd., the location and style of transformer required was given considerable attention. The team worked closely with TECO to ensure that the agreed upon solution would meet TECO standards and would be allowed to move forward.

3.3.5 Agreed Path Forward

The electrical and instrumentation equipment is to be installed in a new building to be located adjacent to the existing PS. The building will be constructed in such a way that it will provide sufficient space for the proposed equipment and adequate access for staff to work on and replace equipment as needed. Understanding the prominence of Bayshore Blvd within the City, the building shall have a low profile and will be partially recessed into the ground to blend in with the existing Bayshore Blvd character.

All proposed equipment types were selected based on interactions with City staff and current City design standards. Every effort will be made to maintain consistency with current system standards and guidelines with continuous input from the City during detailed design.

3.4 PUMPING STATION ANCILLARY SYSTEM AND AESTHETICS

3.4.1 Summary of Findings and Recommendation

3.4.1.1 HVAC

This section describes the HVAC system options and recommendations for air conditioning the PS electrical building to maintain an acceptable space temperature for the electrical equipment. The electrical building houses electrical equipment including VFDs, switch gear, control cabinets and transformers which liberate heat that needs to be removed in order to maintain a suitable operating environment to support equipment operation. Due to the critical nature of the HVAC system to maintain the required environment for electrical equipment it is recommended that a redundant system be included in the design.

3.4.1.1.1 Cooling Load

Based on the anticipated electrical equipment load, approximately 40 KW of heat is generated in the electrical room which needs to be removed. We estimate that approximately 15 -18 tons of cooling will be required to offset heat from the electrical equipment and from envelope losses associated with outside air temperatures and solar loads. Cooling load calculations will be developed during detailed design based on final building size to accommodate electrical equipment and HVAC equipment.

3.4.1.1.2 HVAC Equipment Options

There are four (4) options that can be considered for cooling this facility. Each option is described below along with advantages and disadvantages:

1. **Ducted Split System Air Conditioning Units –** These units include an indoor air handling unit and an outdoor air-cooled condensing unit. The indoor unit adsorbs heat from the space and the heat is rejected by the outdoor unit. The outdoor units house the condenser coil and refrigerant compressors. The indoor unit is floor mounted and requires access to be provided around the unit for service and maintenance. The air handing unit can have a simple top mounted ductwork plenum with supply registers or more extensive ductwork if needed for better air distribution in larger rooms. Refrigerant piping between the indoor and

outdoor units is required. These units are available with a capacity starting around 2 tons of cooling up to about 25 tons in a single air handling unit. These units are available as a heat pump or cooling only unit. Heat pumps incorporate a refrigerant reversing valve to supply cooling or heating depending on whether the unit is in the cooling or heating mode.

Figure 3-9: Ducted Split System Air Conditioning Unit

Advantages:

Available in higher capacities so less units can be used to meet required cooling capacity.
Air handling unit is mounted indoors so less equipment is visible from outdoors.
More air distribution options using simple or complex ductwork layouts to suit application.

Disadvantages:

Indoor unit takes up floor space and must be accommodated in overall building size.

2. **Ductless Split System Air Conditioning Units –** These units include an indoor compact ceiling hung air handling unit (cassette) and an outdoor air-cooled condensing unit. The ceiling cassette has an integral return air grille in the center and perimeter integral supply grilles on each of the four sides that effectively deliver air to the space without the need for ductwork. The air handling units is also available in a wall mounted version. Refrigerant piping between the indoor and outdoor units is required. These units are available with a capacity starting around 1 ton of cooling up to about 4 tons in a single air handling unit. These units are available as a heat pump, cooling only, or variable refrigerant flow (VRF) unit. VRF units can have multiple air handling units coupled to a single air-cooled condensing unit or heat pump. Refrigerant is metered to the air handling units as needed to meet the required capacity which is variable.

Advantages:

Air handling unit is mounted indoors so less equipment is visible from outdoors.

Air handling unit is ceiling suspended and does not take up floor space.
No ductwork required for air distribution.
Multiple units are required to meet the total cooling capacity and if one unit fails there are a number of units still available to cool the space.
Outdoor condensing unit is available with a factory wall mounting bracket for mounting the unit close to the wall above grade if flooding is a concern or it's preferred to just keep the equipment off the ground.

Disadvantages:

Available in limited capacities so more units and associated refrigerant piping is required to meet higher cooling capacity and to provide adequate air distribution.
Units are more expensive than other options presented because more are needed to meet higher cooling capacity.

Figure 3-10: Ductless Split System AC Unit with Ceiling Cassette

3. **Packaged Wall Mounted Air Conditioning Units –** These units are similar to the packaged roof mounted units described above except that they are mounted on an exterior wall and have a capacity between 1.5 and 6 tons of cooling. These units are typically used on small modular buildings associated with telecommunications stations or small prefabricated buildings but can be used on many other applications as well.

   Advantages:

   Available in limited capacities so more units are required to meet higher cooling capacity.
   Units are wall mounted on the outside of the building and do not take up indoor floor space.
   Supply and return air registers mounted flush with the inside surface of the building wall provides air distribution without the need for ductwork.
   More options are available to suit application.

   Disadvantages:

Unit is mounted outdoors on the wall and is more visible and harder to screen.
Unit is more accessible to vandalism.
Because the building is partially below grade, less available vertical space on exterior wall is available to mount units.
Clear space on the interior side of the building wall at the unit's location needs to be provided so the supply and return registers are not blocked by indoor wall mounted electrical equipment.
Flood elevation makes this option problematic.

Figure 3-11: Packaged Wall Mounted AC Unit

4. **Packaged Roof Mounted Air Conditioning Units –** These units include a supply fan, evaporator coil (cooling coil), condenser coil (heat rejection coil), and compressors all in one packaged unit. The unit can be placed on the roof or at grade and ducted to the space. No external refrigerant piping is required only internal refrigerant piping. These units are available as a heat pump or cooling only unit. They are also available with a host of options including an air side economizer, different filtration options, and different types of heating options. When the outside air temperature is cool and has low humidity, an economizer can be used to cool the space without the need to turn on the compressors. The economizer mode is sometimes referred to as the "free cooling" mode because of the energy saved during cooling without energizing compressors. Since the unit is located outdoors, it utilizes an intake hood to draw air for the economizer mode or to bring in some outdoor air for ventilating the space. These units are available with a capacity starting around 3 tons of cooling up to about 25 tons.

   Advantages:

Available in higher capacities so less units can be used to meet required cooling capacity.
More air distribution options using simple or complex ductwork layouts to suit application.
More options are available to suit application needs.

Disadvantages:

Unit is mounted outdoors and takes up more space than the other options presented.
Units are more visible from surrounding buildings and harder to screen.
If mounted on the roof, either a parapet or adequate clearance to the edge of the roof must be maintained for servicing equipment.

Figure 3-12: Packaged Rooftop AC Unit

Table 3-6: Outdoor Design Weather Data

Location	Elevation (ft.)	Cooling Criteria (ASHRAE 0.4%)		Heating Criteria (ASHRAE 99.6%)
Tampa Florida (1)	19	DB (°F)	MCWB (°F)	DB (°F)
		92.5	76.8	39.8

Table Notes:

(1) Tampa International weather station No. 72210

Table Abbreviations:

ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers, 2021 Fundamentals

DB – Dry Bulb Temperature

MCWB – Mean Coincident Wet Bulb Temperature

3.4.1.1.3 Recommendations

Engineer recommends that Option 1 or 2 be implemented depending on the owner's preference and which characteristics are most important. Actual cooling load requirements prepared during detail design will weigh into selecting the most appropriate option based on the number and size of AC units needed to cool the space. Option 1 may be a better choice if the additional floor space needed to install the equipment is not a concern and fewer units are more desirable. Options 1 and 2 are better choices If aesthetics is an important consideration due to the high visibility of the structure and equipment mounted on it. Option 2 may be a better choice if multiple smaller units are desired to give better part load cooling and to minimize impacts to the overall building size.

Engineer recommends that the electrical building be designed to maintain 75° F when the outside air temperature is 95° F. Arcadis also recommends that additional capacity be factored into the equipment sizing to provide adequate cooling to maintain the space at an acceptable higher indoor temperature that minimizes impacts to electrical equipment operation should one of the cooling units fail.

Although weather data indicates wintertime low temperatures in the high 30's, no heating will be provided unless requested by the owner. The wintertime space temperature will therefore fluctuate based on the amount of heat generated in the space from the electrical equipment and the outdoor air temperature. Cooling is available in the winter should the space exceed its temperature set point.

3.4.1.2 Architectural

The above ground portion of the existing building will be demolished, and a new Electrical Building will be designed and constructed to enable the PS to continue to operate during a flood event. Due to the new flood elevations at the site, it has been determined that the Electrical Building will be designed and constructed below the flood elevation but will incorporate a flood wall around the perimeter of the building to protect the electrical equipment inside it. Designing the building at ground level will allow the neighboring residences to maintain views and minimize the aesthetic impact along Bayshore Blvd. The flood wall will incorporate landscaping around the perimeter to create visual appeal and to conceal the flood wall and Electrical Building.

3.4.1.3 Landscaping

The existing landscape plant material is in good condition; There are four existing Oak trees and one Palm tree, and the equipment is screened by layered shrubs (primarily Viburnum and Ixora) with some accent annual planting. The beds are mulched brown surrounded by sod.

3.4.2 Discussions with the City and Agreed Path Forward

As the location of the pump station infrastructure is on a very prominent part of the City, right in the median of Bayshore Boulevard, it was agreed with the City that a critical piece of the design would be to continue to use landscaping to blend all pump station related infrastructure with the adjacent existing vegetation, using landscaping features similar to what's already existing on site, while meeting the current City code, and introducing additional features, such as the use of living walls around the most visible sides of the new electrical building.

4 PROCESS-MECHANICAL DESIGN CRITERIA

This section describes the design requirements for the process mechanical discipline. The design requirements include equipment sizing criteria, pipe sizing criteria, standards and testing, valve selection criteria, and acceptable materials for the project. Appendix B includes preliminary equipment cut sheets for the Bayshore PS pumps discussed in this section.

This section will also describe the recommended improvements for the following equipment:

- Pumps selection
- Bar screen
- Discharge piping and valves
- Flowmeter
- Wet well inlet sluice gate
- Bypass system
- Pump station configuration

4.1 PUMP SELECTION

Pump selections are based on industry best practice guidelines for the specific pumping application, with consideration given to the City's preferences and experience with the existing pump equipment at the facility, and as recommended by the respective manufacturers for this application. As previously described, the pumps are used to transfer sewage collected from the Bayshore basin into the 48-inch San Carlos PS forcemain which discharges at HFC AWTP.

As described in Section 3, Bayshore PS's capacity was evaluated to determine the flows and pressures that the new pumps should be designed to handle. The recommended design criteria for the new pumps is 6,500 gpm at 88-ft of head. The new pumps will be required to handle the following operating conditions:

- Flow range of 1,800 gpm (average) to 6,500 gpm (peak)
- Discharge pressures between 50-ft and 88-ft when the Bayshore PS is pumping 6,500 gpm and San Carlos flows of 3.0 to 40.0-mgd.

As mentioned in Section 3.2, it was established that the Bayshore PS will be designed as a submersible PS with three (3) duty and one (1) standby submersible solids handling centrifugal pumps. The pumps will be able to handle solids up to 3-inches in diameter. Per discussions with the City, the PS design will be based on the use of Flygt NP 3312 pumps. The pumps will be mounted on guide rails to facilitate easy removal of the pumps from the wet well for maintenance without the need for an operator to enter the wet well.

As graphically depicted on Figure 4-1, the Flygt NP 3312 pump performance curve was superimposed on the system curves graph. The performance curve shows that the three duty pumps will be able to meet the 6,500 gpm flow requirement at 100% speed with high head conditions, as well as handling a minimum flow rate of approximately 1,000 gpm at low head conditions. Flygt's pump performance curve is shown in Figure

4-2. Please note that the flow can vary greatly due to the effect of the San Carlos PS flows in the discharging forcemain, which will affect the number (and flow for each) pump in operation at the Bayshore PS. The effect of these flow/pressure variations as well as the controls required to keep the facility operating within manufacturers' recommendations will be completed during the detailed design stage.

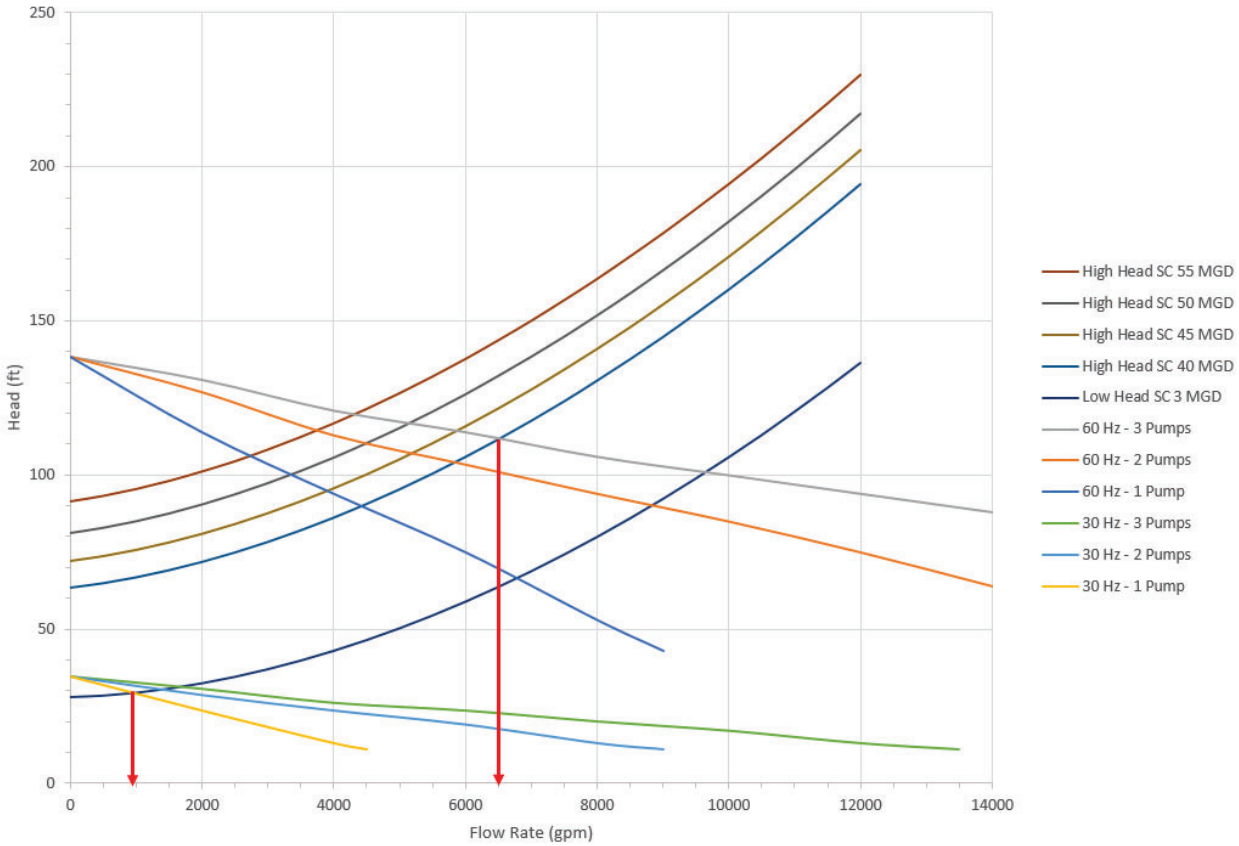

Figure 4-1: System Curves and Flygt NP 3312 Pump Curve

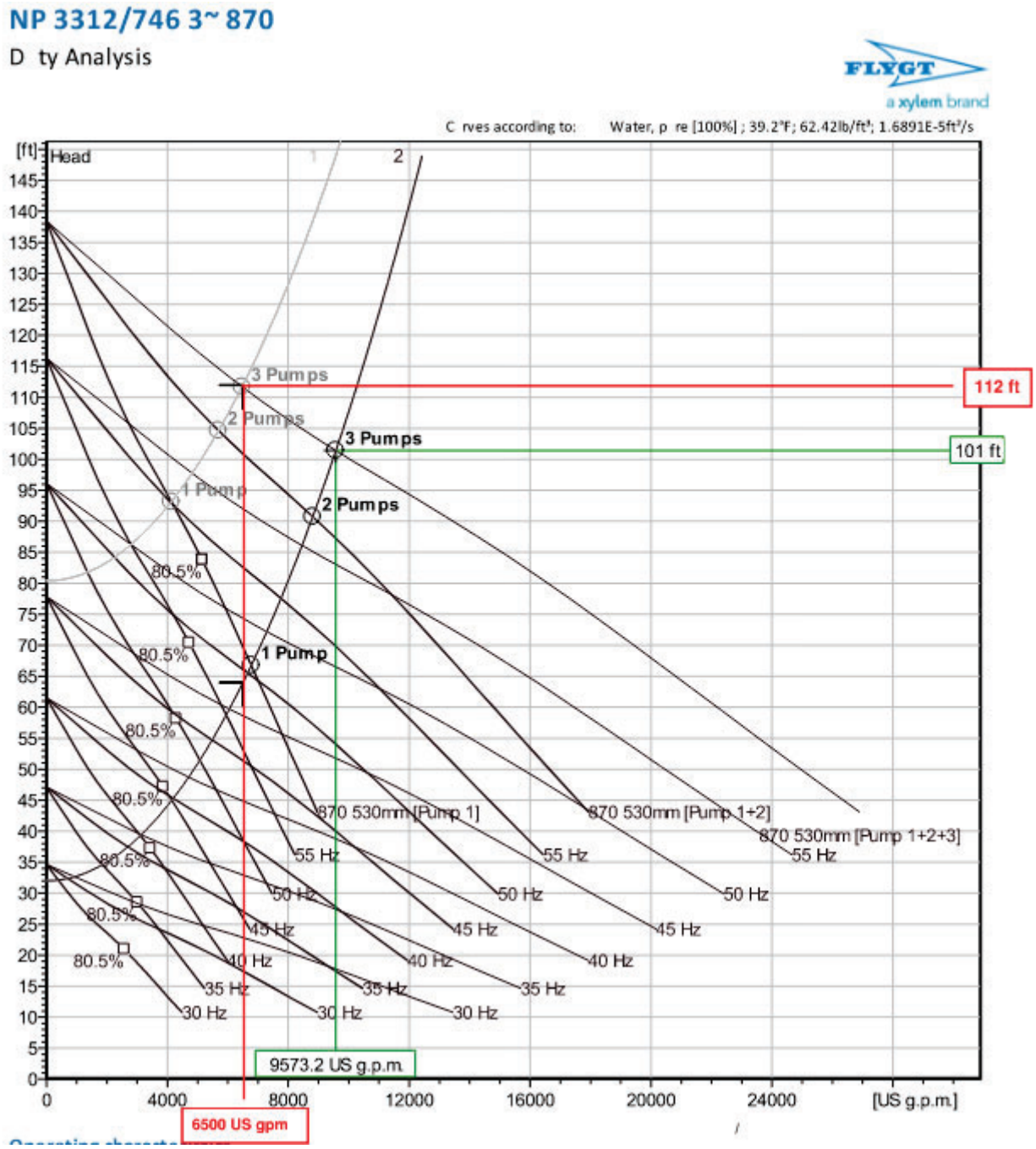

Figure 4-2: Flygt NT 3312/746 Pump Curve

4.2 BAR SCREEN

The existing bar screen corroded and was not replaced. With the conversion of the pumping station to a submersible style wet well it would be difficult to access for maintenance and regular cleaning. If not

cleaned on a regular basis it could bind and result in flow backups in the influent line. For these reasons a screen will not be provided at the pumping station. The new pumps will be submersible solids handling pumps capable of passing a solid up to 3-inches in diameter.

4.3 DISCHARGE PIPING AND VALVES

The design criteria for the submersible pump discharge piping and main header/manifold are to install the piping in areas where they can be properly supported and to provide easy access for maintenance or repairs. In general, the pipes are sized to maintain velocities of 10 fps or less at maximum flow conditions, with the exception of the flow meter assembly. The pumps individual discharge pipes were sized to match the pump discharge diameter (14-inch) and will be vertically supported off the wet well's west wall. The discharge pipes will exit the wet well below grade entering into a vault. The vault will house an 18-inch main discharge header/manifold which all the 14-inch individual pump discharge pipes will connect to. There will be 14-inch isolation knife gates and 14-inch check valves inside the vault to allow for individual pump isolation and the check valves will prevent any flow recirculation back into the wet well shown in Figure 4-3 and Figure 4-4.

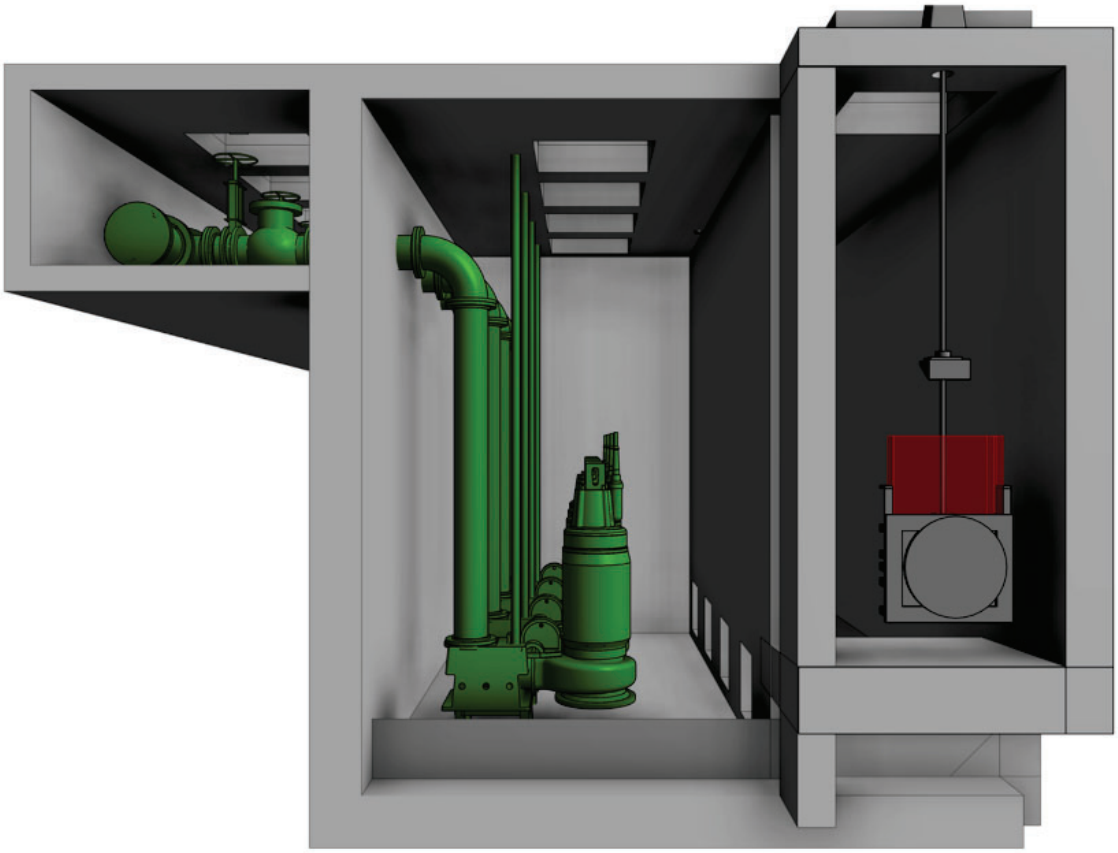

Figure 4-3: Proposed Pump Discharge Configuration

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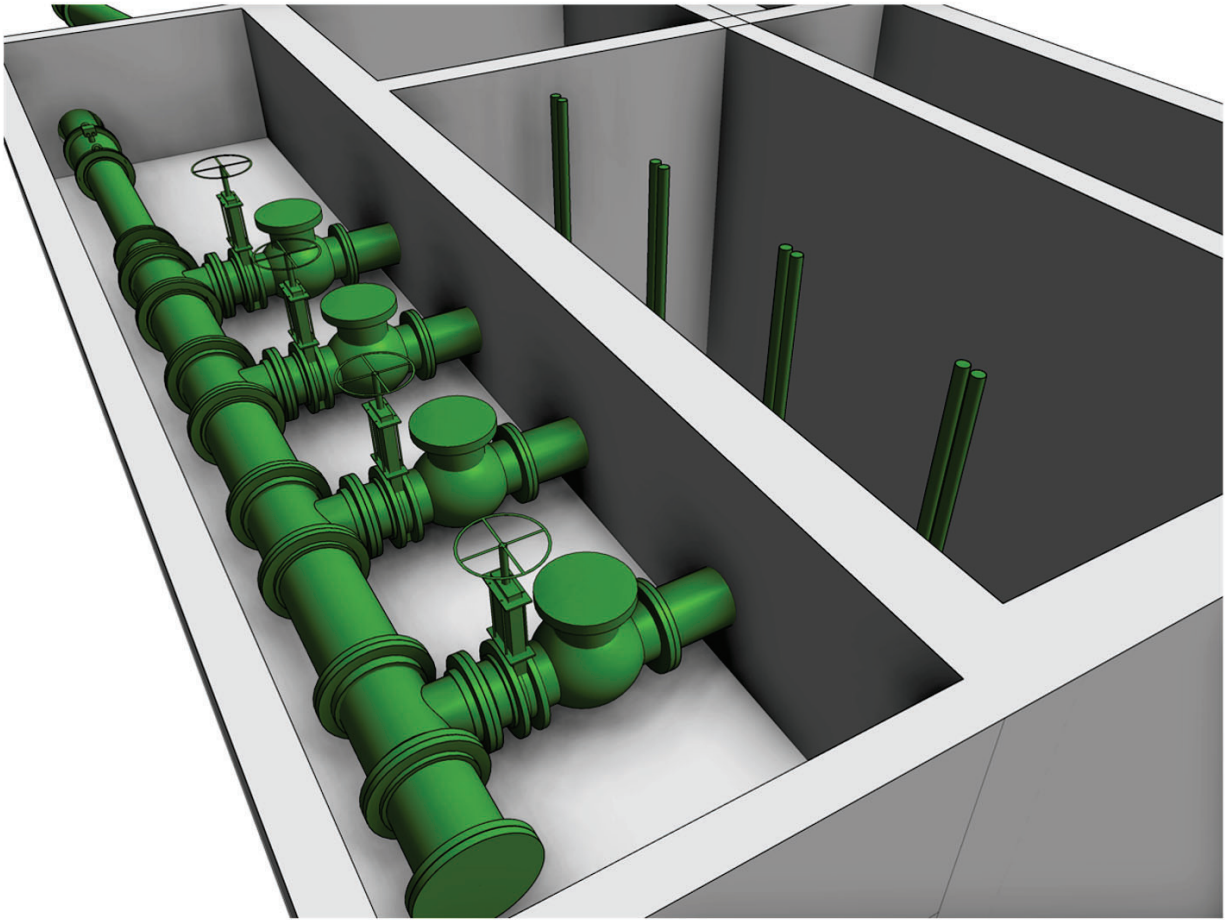


Figure 4-4: Proposed Main Header/Manifold and Valves Configuration

All the valves will be accessible for maintenance or replacement with access hatches above them, and they will all be located outside of the wet well to prevent H_2S exposure to prolong their lifespan. They will be located inside a vault to hide them from public view and to enable them to be placed below ground to be less intrusive for the Bayshore residents. Refer to Figure 4-4 for details.

The discharge piping and fittings will be designed with ductile iron pipe lined with Protecto 401 (ceramic epoxy coating) with flanged joints. The entire discharge piping, fittings, and valves from the submersible pumps to the main header manifold will be flanged joints.

Isolation valves will be designed to be knife gate valves, which are typically used in wastewater applications to provide bubble tight shutoff in either direction on dead end service.

One air release valve will be provided in the common discharge header (high points) and its drain pipe will be routed to the wet well during detailed design.

4.4 FLOW METER

A flow meter will be located on the common main discharge header to measure the total flow from the Bayshore PS. Magnetic flow meters are typically recommended since they are suitable for measuring wastewater flowrates. However, due to the City's preference, a strap-on/clamp-on doppler flow meter will be provided during detailed design, as shown in Figure 4-5, since they are also suitable for wastewater and sewage applications. These flow meters allow more flexibility, easy maintenance, and replacement without interfering with the operation of the PS or the need for a bypass. The flow meter will include a remote digital display adjacent to the flow meter location. Also, the flow meter information will be displayed at the PLC in the MCC building. The strap-on doppler flow meter will be added during detailed design. The pipework will be designed to meet the flow meter manufacturer's recommended upstream and downstream lengths of pipe to achieve accurate readings. Reducers will be used on both sides of the flow meter to achieve the flow meter's minimum velocity during low flows in the forcemain.

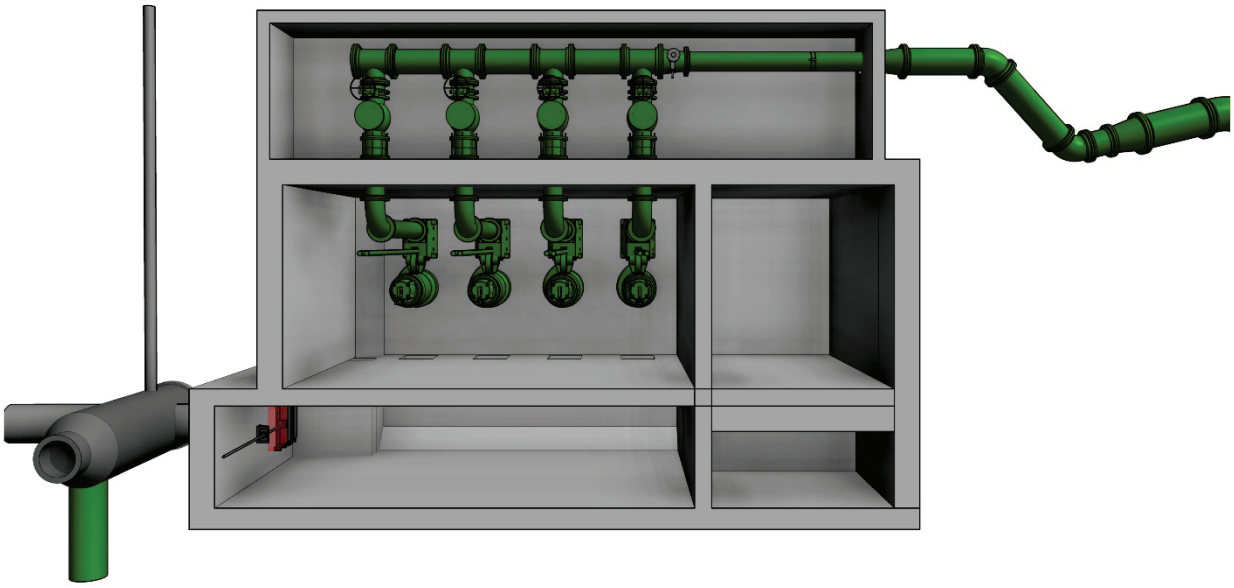


Figure 4-5: Proposed Flow Meter Location

4.5 WET WELL INLET SLUICE GATE

The Bayshore PS originally had a 30-inch sluice gate on the influent gravity main connection to the existing wet well located on the south side of the Bayshore PS, as shown on Figure 4-6. A new sluice gate is required to isolate the entire wet well for any future maintenance, wet well cleanup or repairs, pump base replacement, or submersible pump discharge pipe replacement.

The sluice gate will be approximately 15-ft deep, and it will require stem guides and supports. The design intent is not to use a crank-operated floor stand, so it is not visible to the public. It will be operated with a valve key embedded into the wet well top slab.

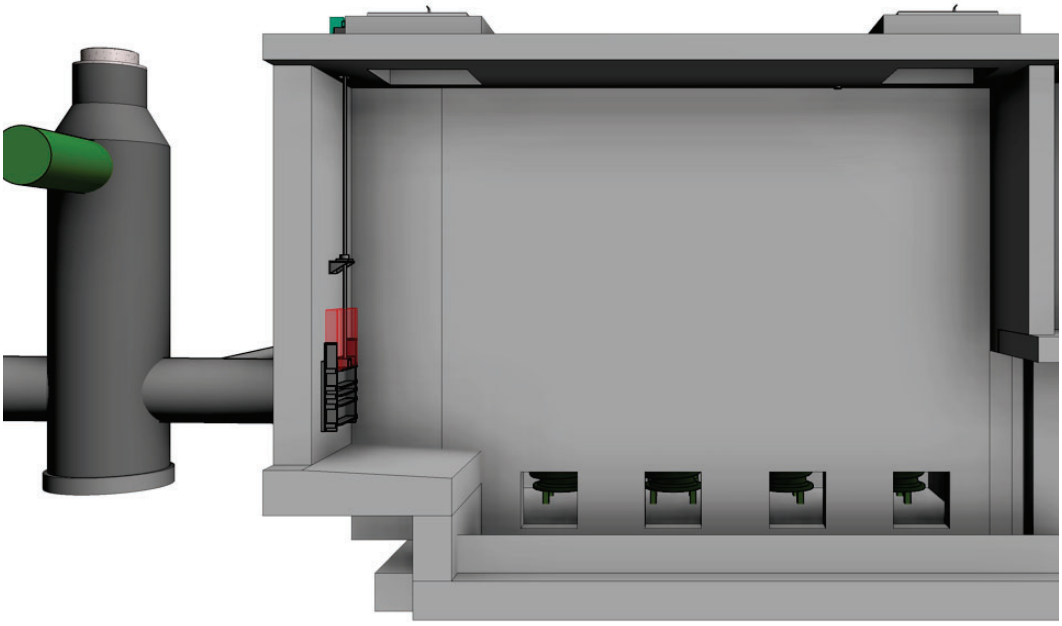


Figure 4-6: Influent Sluice Gate Location

4.6 BYPASS SYSTEM

The City has bypassed the entire Bayshore PS in the past by installing temporary pumps in the gravity manhole immediately upstream of the Bayshore PS and connecting a temporary discharge pipe to a permanent bypass hot tap connection on the north side of Mason St. However, the City recently installed a permanent buried 18-inch PVC bypass pipe with an 18-inch blind flange connection at finished grade in a meter box by the existing gravity manhole on the south side of the PS. The permanent 18-inch PVC bypass pipe connects approximately 170-ft north to the existing 24-inch PVC forcemain with a 12” isolation plug valve and 12-inch tapping valve.

The design criteria assumes the permanent 18-inch PVC pipe will be used to bypass the Bayshore PS entirely during construction. The permanent bypass is buried under Mason St which allows the street to remain open for traffic unless other construction activities required it to be shutdown. There is an existing 24-inch plug valve upstream of permanent bypass connection that will allow the isolation of the existing Bayshore PS discharge main header for the construction of the proposed modification. Figure 4-7 shows the permanent bypass pipe and isolations valves mentioned above.

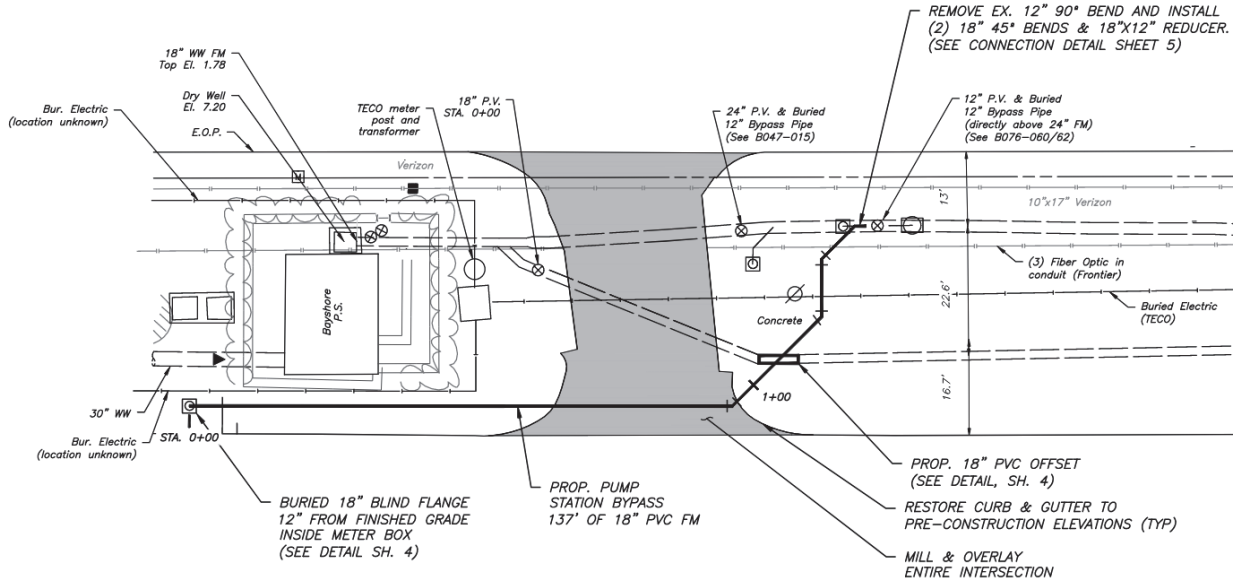


Figure 4-7: Permanent Bypass Piping, Point of Connections, and Isolation Valves

4.7 SELECTED PUMP STATION CONFIGURATION

As described in Section 3, to avoid the expense of making the PS deeper or extensive modifications on the existing wet pit, and in collaboration with the City, it was decided to convert the Bayshore PS into a wet well type PS with submersible pumps. A portion of the existing dry pit will become part of the proposed wet well and the existing wet pit will be maintained. The dividing wall between the existing dry pit and wet pit cannot be removed (see structural section for details), so it will be modified to allow the sewage to enter the proposed new wet well and into the pump suctions, as shown on Figure 4-8.

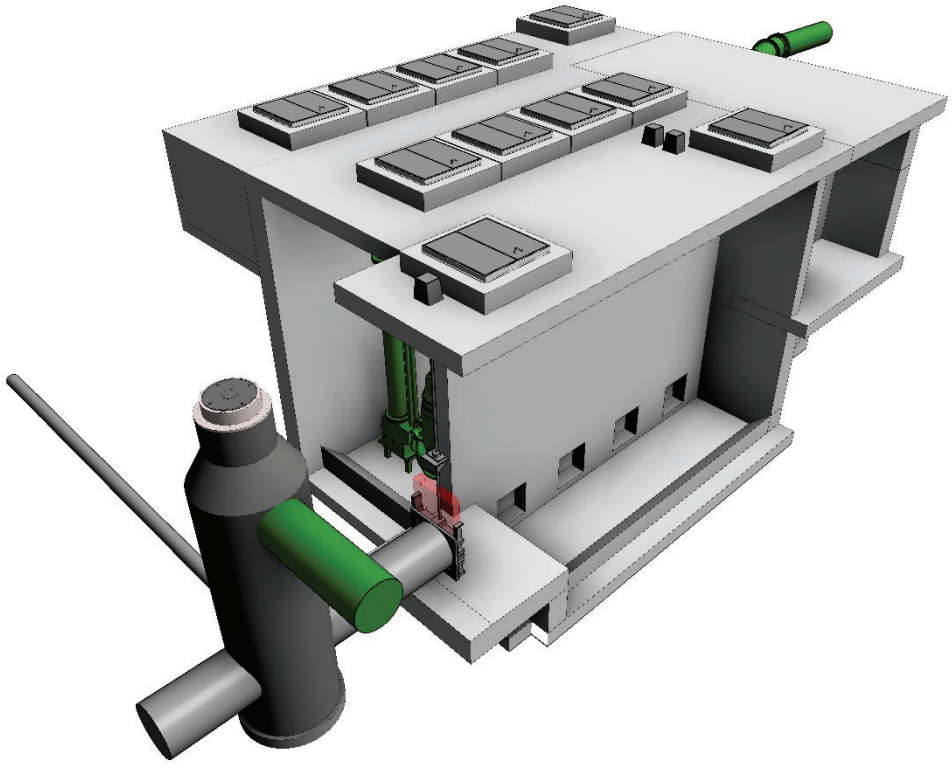


Figure 4-8: Proposed Opening on Existing Wet/Dry Dividing Wall to Convert the PS into a Wet Well

All four pumps will have sealed access hatches to allow for the removal of the pumps. Pumps guide rails will be supported off the wet well's west wall and on the top slab. Two additional sealed hatches will be installed on the existing wet pit, one of the south side by the isolation sluice gate to provide access to the gate and one on the north side of the wet pit to provide access to the wet pit and allow access for cleaning. The north side will have an access driveway for vac-truck or service trucks.

Four sealed hatches will be installed at the valve vault to provide access to the pumps. Additionally, a hatch will be provided for the flow meter.

Figure 4-9 through Figure 4-12 depict conceptual renderings of the proposed PS configuration.

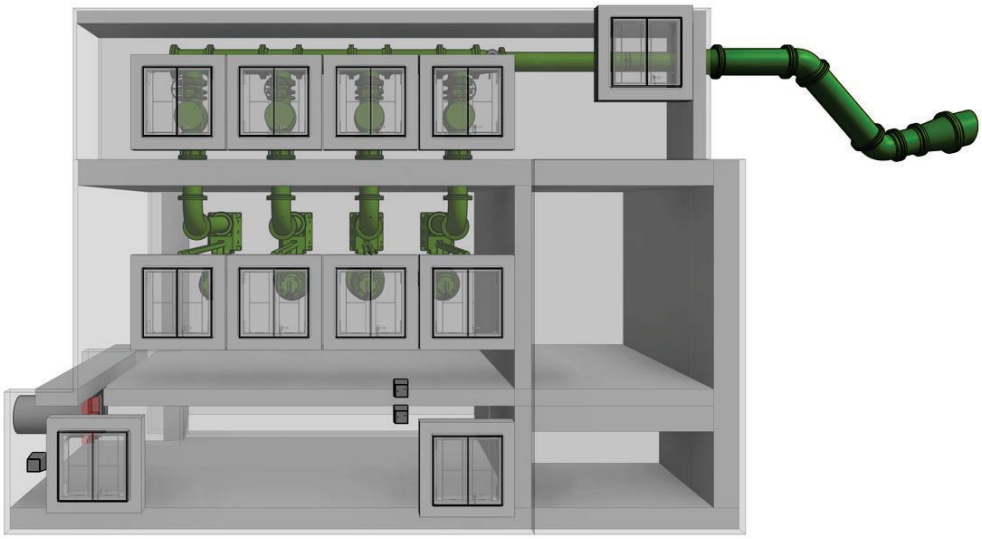


Figure 4-9: Proposed Access Hatches Layout

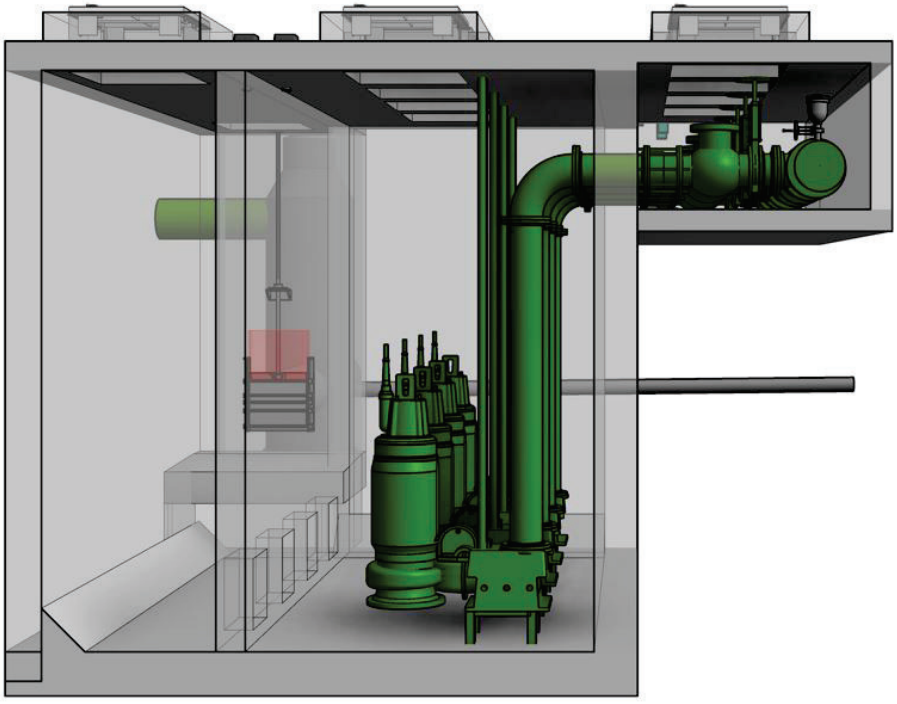


Figure 4-10: Submersible Pumps, Wet Well, and Discharge Piping Configuration

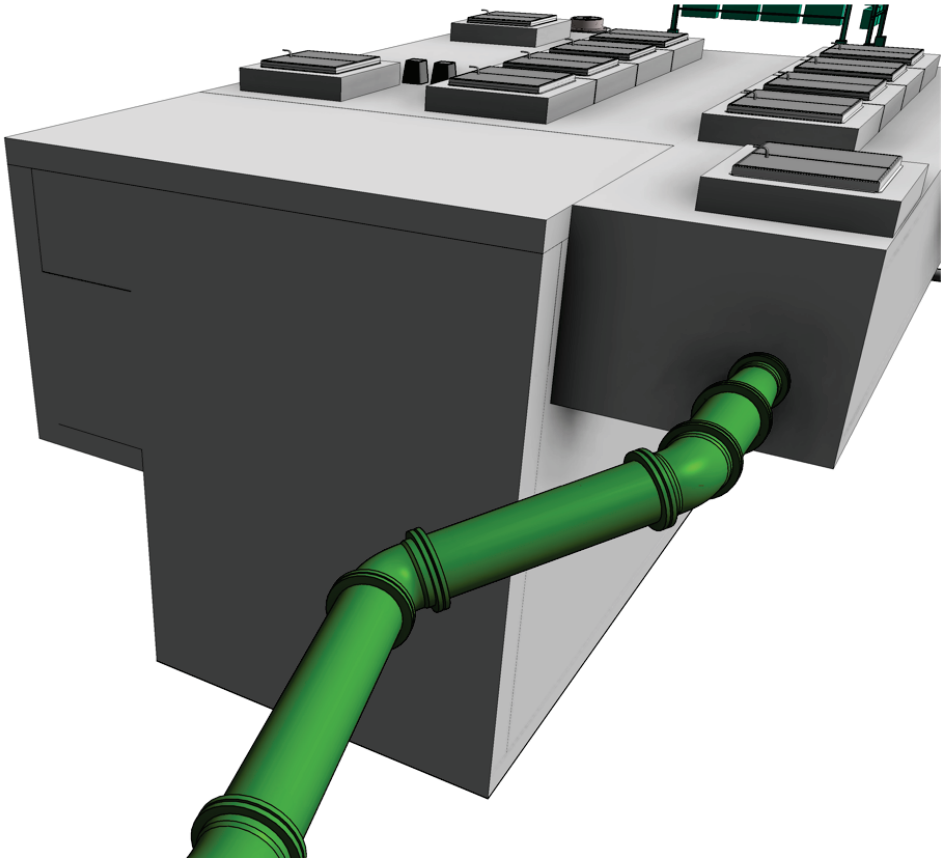


Figure 4-11: Propose Connection to the Existing Forcemain

There is a portion of the existing dry/wet pit area that will no longer be needed and hence divided to create the proposed wet well. This will be addressed during detailed design.

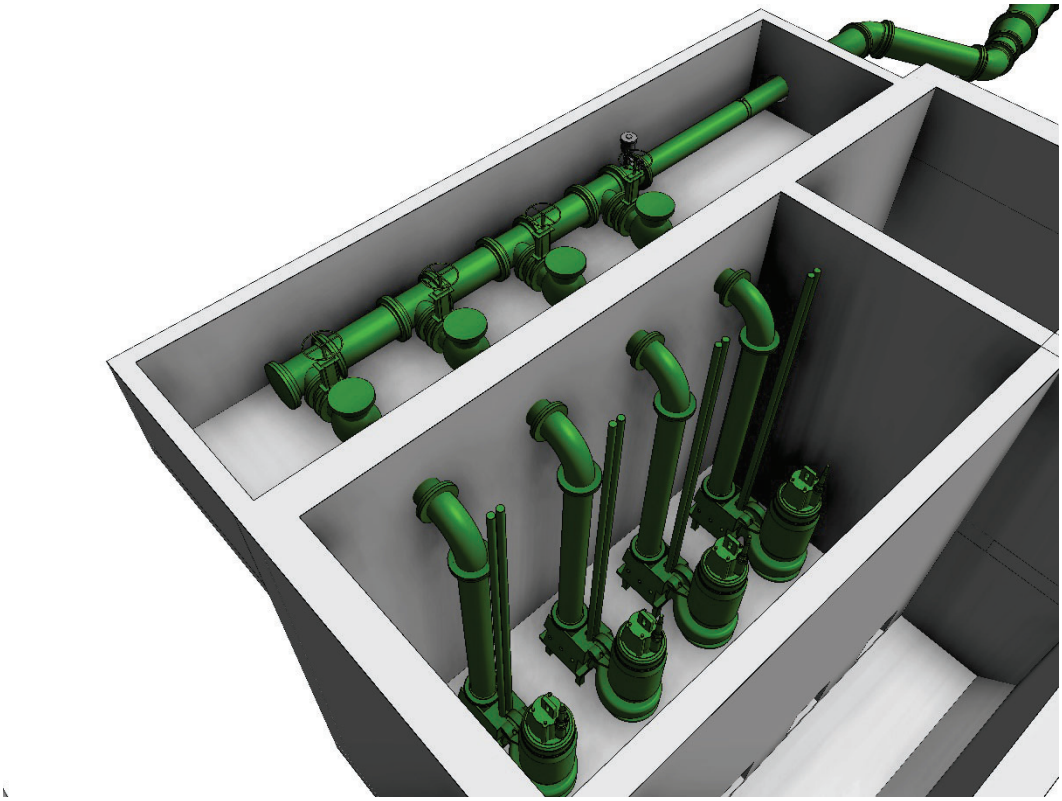


Figure 4-12: Proposed PS Layout and Areas to be Filled Out

Refer to Appendix C for the preliminary drawings of the proposed Bayshore PS configuration.

5 CIVIL DESIGN CRITERIA

When originally constructed the Bayshore pump station discharged to the downstream gravity system in Bayshore Blvd through an 18-inch cast iron forcemain that runs approximately 500 feet down the west side of the Bayshore median to a discharge manhole at Santiago Street. This forcemain was disconnected in 2005 and flow from Bayshore was redirected to the San Carlos Forcemain System and now discharges directly to the HFC AWTP.

As a part of this project the City has requested that the ability to discharge to the Bayshore gravity system be reestablished as a backup measure during high flows or other emergency situations. A survey of the existing area was conducted, and it was determined that there was adequate space along the eastern edge of the Bayshore Blvd median to construct a new PVC forcemain. Force main will be sized to restrict flows based on the capacity of the downstream gravity system as provided by the City.

5.1 SURVEY AND SUBSURFACE UTILITY INVESTIGATION

In June of 2021 a SUE survey of existing utilities around the station and along Bayshore Blvd was completed. This was done to field located existing sewer pipelines, crossing utilities and potential conflicts for new installations. Based on this survey, the route for the new proposed 20” forcemain along the eastern edge of the Bayshore median as described in Section 6.2.2 was found to be the most favorable. Additional survey of the route will be required during detail design to ensure proper force main alignment.

5.2 18-INCH FORCEMAIN REPLACEMENT

The existing 18” cast iron forcemain was built in 1955 with the station. It is now 67 years old and it has been left open and exposed to sewer gases from the manhole in Santiago St. As a result, it is not recommended that this pipeline be placed back into service.

A new 20” PVC forcemain is recommended as a replacement. The new pipe is to be installed via open cut along the eastern side of the Bayshore Blvd median with a new connection to the existing manhole in Santiago St. the proposed Bayshore Pumps will be operating at a discharge head of 3.4’ and would be operating off of their curve in this proposed scenario. Operating strategies, including the use of a throttling valve, will be evaluated during the detailed design process.

5.2.1 Pipe Material and Size

The proposed forcemain would be constructed of PVC or HDPE to protect against sewer gasses in the system and have an inside diameter of 20”. This will provide for adequate capacity from the station without overwhelming the downstream system.

5.2.2 Pipe Alignment

The proposed forcemain will be interconnected using a new wye connection upstream of the bypass flange using plug valves for isolation into the existing 24" PVC forcemain at the discharge of the station. It will then shift to the eastern side of the existing median of Bayshore Blvd. and eventually tie into the existing manhole at Santiago. The condition of the existing manhole will be evaluated due to its age and it may be advisable to construct a new discharge manhole upstream of the existing manhole. Flow from the new manhole would then flow by gravity to the existing system.

Figure 6-1 shows the existing gravity system in green, the existing in service forcemain in red and the proposed forcemain in yellow. The existing out of service forcemain is not shown.

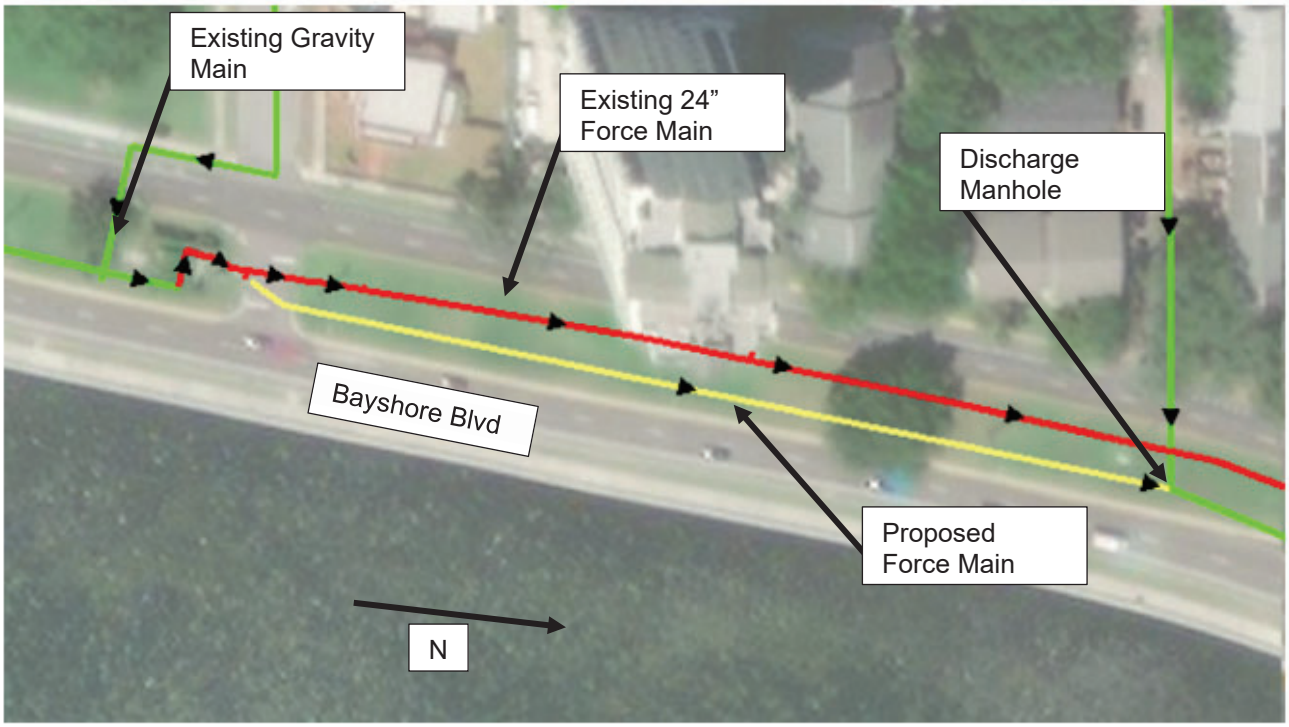


Figure 5-1: Existing Gravity System, Existing FM, and Proposed FM

6 STRUCTURAL DESIGN CRITERIA

This section presents a summary of the structural codes and design criteria that will be used for the project. These requirements will be incorporated on all new structures and for the repair, alteration, change of occupancy, and/or addition of existing structures. All elevations presented are based on NAVD 88.

6.1 GEOTECHNICAL INVESTIGATION

A geotechnical investigation was deemed required as part of the project and such investigation was completed during this design phase. A Geotechnical Engineering Services Report with the findings dated April 30, 2021, has been provided as part of the appendices.

6.2 LEAD AND ASBESTOS SURVEY

Engineer performed an asbestos and lead-based paint survey of the existing Bayshore Boulevard Pumping Station. The asbestos and lead-based paint survey was conducted on April 8, 2021 and provided a report summarizing their findings. In accordance with the report dated April 28, 2021, the samples of paint and suspect asbestos containing material collected were tested in a laboratory. The report concludes that the sampled paint is not considered lead-based paint and the sampled suspect asbestos containing material do not contain asbestos fibers. Lead was found during the paint laboratory testing but was below the limits required to be considered hazardous waste. Worker safety may still be applicable when activities disturb the paint.

6.3 APPLICABLE BUILDING CODE

6.3.1 Governing Codes and Design Standards

Structural design will be performed in accordance with the 7th Edition (2020) Florida Building Code except where other applicable codes are more restrictive.

6.3.2 Design References and Standards

Structural design will be in accordance with the following references and standards. Where the version is not listed, use the version listed under Referenced Standards in 7th Edition (2020) FBC.

- American Society of Civil Engineers (ASCE) 7-16 - Minimum Design Loads for Buildings and Other Structures
- ASCE 24-14 - Flood Resistant Design and Construction
- American Concrete Institute (ACI) 318-14 - Building Code Requirements for Structural Concrete
- ACI 350-20 – Code Requirements for Environmental Engineering Concrete Structures
- ACI 350.1-10 – Tightness Testing of Environmental Engineering Concrete Structures
- ACI 350.4R-04 – Design Considerations for Environmental Engineering Concrete Structures

- American Institute of Steel Construction 325-17 (AISC) – Steel Construction Manual, 15th Edition (includes AISC 360-16 Specification for Structural Steel Buildings and AISC 303-16 Code of Standard Practice for Steel Buildings and Bridges)
- American Welding Society (AWS) D1.1-15 – Structural Welding Code – Steel
- AWS D1.2-14 – Structural Welding Code – Aluminum
- American Iron and Steel Institute (AISI) S220-15 – North American Standards for Cold-formed Steel Framing
- Aluminum Association Aluminum Design Manual (AA ADM) 2015
- American Society of Testing and Materials (ASTM) – Standards and Specifications
- Steel Deck Institute (SDI) 2017 – Standard Specifications for Steel Roof Deck and Steel Floor Deck
- Steel Joist Institute (SJI) 2015 – Standard Specifications for Steel Joists and Joist Girders
- TMS 402/602-16 – Building Code and Specification for Masonry Structures
- U.S. Army Corps of Engineers (USACE) Engineer Manuals (EM) 1110-2-2100 – Stability Analysis of Concrete Structures
- USACE EM 1110-2-2502 – Retaining and Flood Walls
- USACE EM 1110-2-2504 – Design of Sheet Pile Retaining Walls
- USACE EM 1110-2-2906 – Design of Pile Foundations
- American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications Ninth Edition
- Moody/U.S. Department of the Interior, Bureau of Reclamation (USBR) – Moments and Reactions for Rectangular Plates – Engineering Monograph No. 27, W.T. Moody – Reprinted 1986
- Portland Cement Association (PCA) – Rectangular Concrete Tanks
- PCA – Circular Concrete Tanks without Prestressing

6.4 DESIGN LOADS

Design loads for the structures are summarized in the following paragraphs.

6.4.1 Risk Category

The Risk Category for the structures will be determined in accordance with the FBC. Design all structures for Risk Category III.

6.4.2 Dead Loads (D)

Includes the weight of the structure and all fixed equipment.

Table 6-1: Dead Loads

Weights of materials:	
Reinforced concrete	150 pcf
Steel	490 pcf
Aluminum	170 pcf
Concrete masonry unit (normal weight)	125 pcf
Soil (above groundwater)	**112 pcf**

6.4.3 Soil Loads (H)

Design buried structures for lateral loads due to soil and groundwater. Design buried structures for hydrostatic uplift loads due to groundwater. Use buoyant weight of soil counteracting uplift loads. The information below is based on a Geotechnical Engineering Services Report dated April 30, 2021. The information will be updated as the project design progresses.

Table 6-2: Soil Loads

DEPTH, FT	TOTAL WEIGHT	AT-REST UNIT WEIGHT (SATURATED)	FRICTION ANGLE	COHESION
0 - 4	**105 pcf**	**43 pcf**	**28**	**0 psf**
4 – 13.5	**112 pcf**	**50 pcf**	**30**	**0 psf**
13.5 – 18.5	**110 pcf**	**44 pcf**	**0**	**250 psf**
18.5 – 70	**135 pcf**	**73 pcf**	**0**	**15000 psf**
0 - 6	**102 pcf**	**45 pcf**	**28**	**0 psf**
6 – 23.5	**110 pcf**	**48 pcf**	**0**	**250 psf**
23.5 – 28.5	**115 pcf**	**46 pcf**	**0**	**0 psf**
28.5 – 30	**135 pcf**	**44 pcf**	**0**	**15000 psf**

6.4.4 Fluid Loads (F)

Consider unbalanced fluid loads wherever they can occur. Design for maximum operating fluid levels for hydrostatic and earthquake induced hydrodynamic loads. Design for maximum possible fluid level (flooded) based on a worst-case scenario (see load combinations).

Table 6-3: Fluid Loads

Common Fluids	Unit Weights
Water	62.4 pcf
Seawater	64 pcf

6.4.5 Live Loads (L)

Table 6-4: Live Loads

Building Roof Live	**20 psf**
Floor Live Loads (uniform)	
Concrete Roof Deck	**100 psf**
Process Area, typical UNO	**250 psf**
Heavy Equipment Rooms	**250 psf**
Platforms and Stairs (uniform)	**100 psf**
Traffic Areas HL-93 Lane Load Designation	**0.64 k/ft**
Live Loads (concentrated):	
Typical (unless noted otherwise)	**3000 lbs**
Heavy Equipment Rooms	**3000 lbs**
Traffic Areas Truck Load Designation	**32,000 lbs axle**

6.4.6 Flood Loads (F_a)

Flood forces and groundwater level will be based on the FEMA Flood Map Number 12057C0361J. The project is located at an area designated Zone VE, Coastal Area with a 1% or greater chance of flooding and an additional hazard associated with storm waves. The FEMA Flood Map shows that the existing Bayshore PS is within the Limit of Moderate Wave Action (LiMWA). The requirements of ASCE 24 Chapters 4, 5, 7, 8, and 9 are evaluated as part of the flood design loads. The project has been given preliminary approval to deviate from the requirements of ASCE 24 for the structures protected by a flood wall designed as part of the project.

As part of the flood loading, a hydraulic analysis will be performed to determine the wave forces that will need to be included in the design of the structure. The analysis will also include expected scour depth that will need to be accounted for in the design of the structure.

Table 6-5: Fload Loads

Flood Design Class	**3**
Zone	**VE**
Base Flood Elevation	**13.0**
Design Flood Elevation (Electrical Building Flood Wall)	**14.0**[1]
Design Flood Elevation (Existing Pump Station)	**14.0**
Attendant Utilities and Equipment Minimum Elevation	**15.0**[2]

NOTES:

1. electrical building will be protected by a flood wall and interior of the flood wall will be provided with rainwater collection and pumping systems to allow electrical building floor elevations below the design flood elevation.

2. equipment not protected by flood wall

6.4.7 Snow Loads (S)

Snow loads are not applicable for Florida in accordance with Section 101.2 Exceptions.

6.4.8 Rain Load (R):

Rain loads will be applied to each portion of the roof with the assumption that the primary drainage system is blocked and an additional surcharge above the inlet of the secondary drainage system will be applied. The primary drainage and secondary drainage system shall be designed for a rainfall intensity equal to or greater than the 60-minute duration 100-year return period storm. The following parameters will be used to calculate the rain loads based on The National Oceanic and Atmospheric Administration (NOAA's) National Weather Service Precipitation Frequency Data Server, Hydrometeorological Design Studies Center (http://hdsc.nws.noaa.gov/hdsc/pfds/index.html):

Table 6-6: Rain Load

Description	Parameter	Value
Design Rainfall Intensity (60-minute duration, in/hr)	i	**4.5**

6.4.9 Seismic Load Criteria (E):

Seismic loads are not applicable for Florida in accordance with Section 101.2 Exceptions.

6.4.10 Wind Load (W)

Wind loads for design of main wind force resisting systems and components and cladding will be determined per the requirements of FBC and ASCE 7, Chapters 26 through 31.

Use the following parameters to calculate the wind loads:

Table 6-7: Wind Load

Description	Parameter	Value
Ultimate design wind speed (3-second gust)	V_{ULT}	**165** mph
Nominal design wind speed (3-second gust)	V_{ASD}	**128** mph
Exposure Category		**D**
Internal pressure coefficient	$G_{C\ pi}$	**+/- 0.18**

6.4.11 Temperature Loads (T)

The cumulative effects of self-restraining forces and effects arising from contraction or expansion resulting from environmental or operational temperature changes, shrinkage, moisture changes, creep in component materials, movement caused by differential settlement, or a combination thereof shall be accounted for.

6.5 STRUCTURAL DESIGN METHODS AND ASSUMPTIONS

There are two basic type of structures, water bearing or hydraulic structures that are buried or partially buried, and buildings or above grade structures. Each has different design considerations.

6.5.1 Hydraulic Concrete and Buried Structures

Concrete environment/hydraulic structures will be designed considering an environmental durability factor (S_d) in accordance with ACI-350, which results in lower concrete stresses to reduce cracking.

Apply hydrostatic loads to walls without considering passive soil pressure resistance. Apply soil active loads without considering resisting loads from hydrostatic loads.

The below grade hydraulic structures will be designed according to ACI 350, with the following load combinations considering dead load (D), live load (L), soil backfill load (H), liquid load (F), and wind (W):

1. U = 1.4 (D + F)
2. U = 1.2 (D + F + T) + 1.6 (L + H) + 0.5 (L_r or R)
3. U = 1.2 D + 1.6 (L_r or R) + 1.0L or 0.5W
4. U = 1.2 D + 1.0 W + 1.0L + 0.5 (L_r or R)
5. U = 1.2 D + 1.2F + 1.6H + 1.0L
6. U = 0.9 D + 1.2F + 1.0 W + 1.6H

Where fluid loads (F) are present, they will be included with the same load factor as dead load (D) in load combinations 1-4. Where H loads are present, use a factor of 0.9 where the effect of H resists the primary load and 1.6 where H adds to the primary load. Where flood loads (Fa) are present, 1.0W in combinations 4 and 6 shall be replaced by 1.0W + 2.0Fa

6.5.2 Buildings and Above-Grade Structures

The above-grade building structures will be designed according to FBC requirements. Above ground non hydraulic structures do not require consideration of the environmental durability factor (S_d).

The non-hydraulic building structures will be designed according to ASCE 7, with the following load combinations considering dead load (D), live load (L), soil backfill load (H), liquid load (F), and wind (W):

7. U = 1.4 D
8. U = 1.2 D + 1.6 L + 0.5 (L_r or R)
9. U = 1.2 D + 1.6 (L_r or R) + 1.0 (L or 0.5W)
10. U = 1.2 D + 1.0 W + 1.0L + 0.5 (L_r or R)
11. U = 0.9 D + 1.0 W

Where fluid loads (F) are present, they will be included with the same load factor as dead load (D) in load combinations 1-4. Where H loads are present, use a factor of 0.9 where the effect of H resists the primary load and 1.6 where H adds to the primary load. Where flood loads (Fa) are present, 1.0W in combinations 4 and 5 shall be replaced by 1.0W + 2.0Fa

The design strength reduction factors are given for concrete building structures in ACI 318, and for environmental/hydraulic structures in ACI 350, and are equal to:

- Φ = 0.90 Tension Only Controlled Sections
- Φ = 0.75 Compression Controlled Sections with Spiral reinforcing
- Φ = 0.65 Compression Controlled Sections with other reinforcing
- Φ = 0.75 Shear and Torsion
- Φ = 0.65 Bearing on Concrete

6.5.3 Stability

Design structures to resist sliding, overturning, and flotation using the following criteria and factors of safety:

Table 6-8: Stability

Factors of safety:	
Against sliding	
Normal	FS = 1.5
Seismic/Wind	FS = 1.1
Against overturning	
Normal	FS = 1.5
Seismic/Wind	FS = 1.1
Against flotation	
Extreme (100-year flood water level)	FS = 1.1
Operation (design ground water level)	FS = 1.5

Keep resultant force within the middle third of the foundation base if possible.

Use concrete weight of 145 pcf for dead loads resisting flotation.

Resistance to uplift of structures due to high groundwater levels will be provided by the dead load of the structure and the weight of soil within a wedge 10-degrees from vertical extending upward from the footing extensions (use buoyant weight below design groundwater elevation). At structures supported by drilled shafts, resistance to uplift can be provided by the drilled shafts. The connection between the shafts and the foundation slab will need to be designed for tension.

Resistance to lateral seismic loads will be provided by the following: friction between foundation mat or footing, passive soil pressure, friction between backfill and side walls, and lateral loads carried by drilled piers into soil. Combinations of these used will be in accordance with the geotechnical report.

6.5.4 Deflection Criteria

The following maximum deflection criteria, under service live load only, will be used:

Table 6-9: Deflection Criteria

Floors	**L/360**
Roofs Top Slabs	L/240
Floor plates and gratings	L/180, 1/4 – inch maximum

6.5.5 Vibration

Centrifugal pumps, fans, centrifuges, compressors, and engine generators most often cause vibration problems. Special precautions to reduce vibration effects on the structures will be included for designing supports for this machinery.

The natural frequency of the support structure must significantly differ from the frequency of the disturbing force. To minimize resonant frequencies, the ratio of the natural frequency of the structure will be set to the frequency of the equipment at either less than 0.5 (low-tuned) or greater than 1.5 (high-tuned), preferably the latter. A stiff support system will prevent the machinery from passing through the resonant frequency during startup and shutdown.

Refer to the ACI 350.4R for more information on natural frequencies of beams and recommended maximum structural deflection for given equipment operating speeds.

Use the following guidelines when designing supports for equipment:

- Consult with the equipment manufacturer to obtain recommendations, frequencies, and unbalanced loads.
- Mount large rotating and reciprocating machinery on concrete foundations, preferably isolated from the floor slab.
- Provide a concrete foundation weighing a minimum of ten times the weight of the rotating parts of the equipment, or three times the total weight of the equipment, whichever is greater.
- Use embedded anchor bolts (with sleeves for adjustment), rather than drilled anchors.
- Add bracing as required to stiffen the structure to ensure a natural frequency greater than 1.5 times the equipment speed.

- Use vibration isolators or inertia pads, as recommended by the manufacturer.
- Ensure all bolted connections are slip-critical high-strength bolted connections.

6.5.6 Hydraulic Concrete Structures

Hydraulic concrete structures will be designed for maximum durability and water-tightness following the design methodology of ACI 350. Distribute flexural reinforcement to control crack width according for severe environmental exposure.

Shrinkage cracking will be controlled using low-shrinkage concrete, movement joints and minimum shrinkage and temperature reinforcement. Provide construction joints at 20 foot spacing where possible. Provide expansion joints in long structures, at 120-foot maximum spacing, or where abrupt changes in configuration or support occur. Refer to ACI 350.4R for more information about movement joints. Provide shrinkage and temperature reinforcement per ACI 350. Adjust reinforcement ratio as noted when partial contraction joints are used.

Provide 6-inch flat strip PVC waterstops in all wall and slab construction and contraction joints. Provide 9-inch PVC waterstops with center bulb at wall and slab expansion joints. Provide hydrophilic or PVC retrofit waterstops where new construction abuts existing construction.

6.5.7 Corrosion Protection

Soil corrosivity testing should be performed to determine the corrosivity of the existing soils and recommend additional protections against corrosion.

Protective coating will be applied to protect various materials against elements and chemical exposure from process water exposure on the inside of the structures.

6.5.8 Anchoring To Concrete

Cast-in anchors and post-installed anchors will be designed to meet the requirements of ACI 318, except for special anchor types not covered by ACI 318.

6.5.9 Existing Structures

Existing structures and structural elements that will be repaired, altered, or added to or will undergo a change of occupancy will be designed in accordance with the requirements of the Code for Existing Buildings.

6.6 MATERIALS OF CONSTRUCTION

Structures in this project will be reinforced concrete, masonry, and steel structures.

6.6.1 Reinforced Concrete

The reinforced concrete used on this project will be designed for strength, durability, shrinkage reduction, sulfate resistance and aesthetics. The project is located adjacent to Hillsborough Bay and will be exposed to seawater spray and mist. The concrete requirements will be specified to increase resistance to damage associated with sea water exposure. See cast-in-place concrete specification for slump, aggregate sizes, and water/cement ratios for different mixes.

Table 6-10: Reinforced Concrete

Cement	**ASTM C150 Type II, unless noted otherwise.**
Pozzolans	No pozzolans (including flyash) will be used in concrete for hydraulic concrete structures.
Admixtures	A combination of water-reducing admixtures may be used in all concrete mixes for ease of pumping and placement, to achieve the lowest possible water/cement ratios to minimize shrinkage and control cracking. Admixtures containing calcium chloride will not be used.
Reinforcement	ASTM A615 Grade 60 unless otherwise noted ASTM A706 Grade 60, if welded. Carbon Equivalent will not exceed 0.55 percent. Welded wire reinforcement - ASTM A1064
Concrete	Structural Concrete (all structural applications) = 4,500 psi Sitework Concrete (civil and sitework applications) = 3,000 psi Lean Concrete (unreinforced applications) = 2,000 psi

6.6.2 Structural Steel

Steel may be used for the primary structural system for buildings as well as for roof and miscellaneous framing, pipe supports, and grating in vehicular areas. Protective coatings for steel will be specified as required.

Table 6-11: Structural Steel

Wide flange shapes and WT shapes	**ASTM A992**
Structural pipe	ASTM A53, Type E or S, Grade B standard weight
Hollow structural sections	ASTM A500 Grade B
Other shapes, plates, bars	ASTM A36
Bolts	ASTM F3125
Anchors rods	ASTM A307, Grade A or B, hot-dip galvanized, or ASTM F1554, GR36, hot-dip galvanized

6.6.3 Stainless Steel

Table 6-12: Stainless Steel

Submerged or corrosive areas	**Type 316**

6.6.4 Aluminum

Table 6-13: Aluminum

All applications, except as noted	**Alloy 6061 T6**
Railing and grating	Alloy 6061 or 6063

6.6.5 Post-Installed Concrete and Masonry Anchors

Post-installed concrete and masonry anchors will be adhesive, screw in, or expansion type and will have an approved International Code Council – Engineering Services (ICC ES) or International Association of Plumbing and Mechanical Officials (IAPMO UES) evaluation report. Material will be stainless steel. Determination of type and material will depend on use, temperature, corrosivity, design loads and concrete dimensions. Only cast-in-place “headed” anchor bolts will be used for anchorage of vibratory equipment.

6.6.6 Concrete Masonry

The reinforced masonry used on this project will be designed for strength, durability, sulfate resistance and aesthetics.

Table 6-14: Concrete Masonry

Cement	**ASTM C150 Type I or II, low alkali unless noted otherwise.**
Flyash	ASTM C618
Admixtures	Water-repellant and efflorescence control admixture will be provided in exterior walls and retaining walls
Reinforcement	ASTM A615 Grade 60 unless otherwise noted ASTM A706 Grade 60, if welded. Carbon Equivalent will not exceed 0.55 percent.

	Masonry Joint Reinforcement - ASTM A951
Concrete Masonry Units	ASTM C90 Compressive Strength, f'm = 2,000 psi
Mortar	ASTM C270 Type S, with minimum 28-day compressive strength of 1800 psi
Grout	ASTM C476 with minimum 28-day compressive strength of 2000 psi

6.6.7 Waterstops

Table 6-15: Waterstops

New construction	Polyvinyl chloride (PVC) flat strip waterstops, unless noted otherwise. Use center-bulb-type waterstop at movement/expansion joints.
Retrofit	PVC or preformed hydrophilic waterstops.

6.7 STRUCTURE DESCRIPTIONS

Bayshore PS is located in the median of Bayshore Boulevard. Bayshore Boulevard runs parallel to the shoreline of Hillsborough Bay. The existing PS is a wet well/dry well configuration PS. Separate entrances to the dry well and wet well side of the PS are located along the north end of the PS. The entrances extend approximately 4.5-feet above finished grade with the door thresholds recessed below existing grade approximately 5-feet. The drywell side of the PS occurs on the west side of the PS and the wet well side of the PS occurs on the east side of the PS. The overall PS size is approximately 39-feet by 22-feet in plan view with the bottom of the wet well approximately 22-feet below finished grade and the dry well approximately 21-feet below finished grade.

6.7.1 Electrical Building

The Electrical Building will be constructed approximately **100** feet south of the existing PS, in the median of Bayshore Boulevard. Bayshore Boulevard is adjacent to the Hillsborough Bay and separates residential property from the waterfront. Visibility from the residential properties is a concern expressed by the City. ASCE 24-14 would require the new electrical building to be constructed with the lowest supporting horizontal structural member of the lowest floor to be located 2-feet above the Base Flood Elevation. To meet this requirement, the Electrical Building would have to be designed and constructed with a proposed floor at approximately 9-feet[1] above existing finished grade and a roof approximately 24-feet[2] above existing finished grade. These heights would dramatically increase the visual impact for residential

[1] Based on existing grade approximately EL 6.00 NAVD 88 and approximate structure support overall height approximately 2-feet (15.0 ft - 6.0 ft = 9.0 ft)

[2] Based on an interior height of 12-feet and roof structure height of approximately 2-feet (9.0 ft + 12.0 ft + 2.0 ft = 23.0 ft)

properties with a view of Tampa Bay. Dry flood proofing provisions of ASCE 24 Chapter 6 are not permitted for structures constructed in Flood Zone VE.

To reduce the visual impact, discussions with the City occurred to determine whether an alternative approach would be acceptable to the Authority Having Jurisdiction (AHJ). Specifically, the concept of designing a flood wall structure around the Electrical Building and incorporated into the Electrical Building superstructure was considered. The AHJ has given approval to design a flood wall around the Electrical Building, allowing the Electrical Building finished floor and equipment to be located below the Design Flood Elevation, with protection against flooding provided by flood walls designed to resist applicable flood loads and wave loads exceeding the Design Flood Elevation. The Design Flood Elevation for this location and Flood Design Class is taken as EL 14.0 based on ASCE 24-14 Chapter 4.

The concept for the Electrical Building is to design a pile supported concrete flood resistant structure to keep flood water out. Refer to Appendix C for conceptual arrangement. The bottom slab and walls will be reinforced concrete. Within the perimeter of the flood-resistant structure, the electrical equipment will be located both inside and outside of an Electrical Building. The Electrical Building will use the bottom slab of the flood-resistant structure as the foundation of the building. Common walls of the flood-resistant structure and Electrical Building will be used where practical based on the Electrical Building layout within the flood-resistant structure. Nuisance water from rain and wave crashing around the perimeter will be handled by a sump pit and sump pumps pumping this nuisance water over the flood wall.

6.7.2 Existing Pump Station

Existing structures are required to be evaluated based on the extent of work performed. 7th Edition FBC (2020) defines the classification of work. As the expected repairs, modification, alteration, or addition become more extensive, the compliance with current Code requirements becomes more stringent. The modifications and alterations defined in this PER are expected to require every aspect of the Existing Bayshore Pump Station (Existing PS) to comply with the current Code. This is primarily a result of conversion of the dry well into a wet well, which results in additional loading. Additionally, modifications to the structure and increased design flood elevation as defined in this document results in alterations and additional loading that would exceed the threshold requirements that allow the existing structure to not have an evaluation for the current Code.

The Existing PS will be converted into a wet well PS. The dry well portion of the Existing PS will be modified to allow sewage to fill the entire PS through limited removal of the existing divider wall that separates the wet well from the dry well. Refer to Appendix C for conceptual structure arrangement. The extent of wall removal will be evaluated during detailed design, but the entire wall cannot be removed without adversely affecting the bottom and top slabs of the existing structure since the interior wall acts as support for the bottom slab and top slab. The elevated entrance to the existing wet well and dry well will be demolished to make the PS a submerged PS, with access through hatches and manholes in the top slab of the converted wet well.

The Existing PS will be evaluated for the design flood elevation of 14.0. It is expected that the exterior walls will require strengthening to support the additional lateral forces from elevated groundwater. A concept to

consider for strengthening the exterior walls is the installation of struts across the PS. It is expected that the entire top slab will be replaced. Since a portion of the top slab is removed as part of the entrance removal, additional openings for access would be required in the top slab, and the additional loads associated with a higher design flood elevation need to be accounted for, the top slab of the wet well is expected to be entirely removed and replaced. A new, more robust top slab will be designed in the detailed design to accommodate the modifications and to entirely support occasional truck traffic loading.. It is expected that the bottom slab does not have adequate uplift capacity resulting from increased groundwater as the flood elevation increases. Additionally, the overall buoyancy of the existing PS is not expected to resist increased buoyancy from elevated flood water. It is expected that the bottom slab will need to be strengthened and additional resistance to buoyancy is necessary. It is expected that some of the additional resistance can come from a thick top slab but additional capacity plus strengthening of the bottom slab is expected to come from the addition of hold-down anchors. Based on record drawings, the PS is founded on bedrock, and the hold down anchors will be drilled into the bedrock for a distance to provide the required capacity and engage enough bedrock mass to resist buoyancy.

7 HVAC DESIGN CRITERIA

Based on the anticipated electrical equipment load, approximately 40 KW of heat is generated in the electrical room which needs to be removed. We estimate that approximately 15 -18 tons of cooling will be required to offset heat from the electrical equipment and from envelope losses associated with outside air temperatures and solar loads. Cooling load calculations will be developed during detailed design based on final building size to accommodate electrical equipment and HVAC equipment.

Table 9-1: HVAC Design Criteria

Location	Elevation (ft.)	Cooling Criteria (ASHRAE 0.4%)		Heating Criteria (ASHRAE 99.6%)
Tampa Florida (1)	19	DB (°F)	MCWB (°F)	DB (°F)
		92.5	76.8	39.8

Table Notes:

(1) Tampa International weather station No. 72210

Table Abbreviations:

ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers, 2021 Fundamentals

DB – Dry Bulb Temperature

MCWB – Mean Coincident Wet Bulb Temperature

8 ARCHITECTURAL DESIGN CRITERIA

8.1 CODES, STANDARDS, AND REGULATIONS

The following codes apply to the design of this project:

- Florida Building Code, 7th Edition (2020) Building
- Florida Building Code, 7th Edition (2020) Energy Conservation
- Florida Fire Prevention Code, 7th Edition (2020)
- Florida Energy Conservation Code
- Life Safety Code (NFPA 101)
- Occupational Safety and Health Administration (OSHA)
- Americans with Disabilities Act Accessibility Guidelines (ADAAG)
- Accessible and Usable Buildings and Facilities ICC A117.1-2009
- Florida Hurricane product approvals

8.2 CODE EVALUATION

Based on FBC 506, the allowable floor area of a building shall be determined based on:

- Occupancy classification,
- The type of construction,
- Whether there is an automatic sprinkler system installed throughout the building, and
- The amount of building frontage on a public way or open space.

8.2.1 Occupancy Classification

The Electrical Building will have an F-2 Low-Hazard Factory Industrial occupancy.

8.2.2 Construction Type

The construction type will be type II-B.

8.2.3 Sprinkler Requirements

The building will not require an automatic fire suppression system based on the F-2 building occupancy.

8.2.4 Allowable Area

Per FBC 506.2, this building will have an allowable areas requirement of 23,000 sq ft.

8.2.5 Allowable Height

Per FBC 504.3a, this building will have an allowable height requirement of 55 feet.

8.2.6 Fire Separation

Per Table 602 of the FBC, there will not be any fire rating resistance requirements for this building. There will not be any other buildings within 10 feet of this building.

8.2.7 Egress

Two means of egress are the minimum requirement. Per Table 1017.2 Exit Access Travel Distance is 300 feet without a fire suppression system. The design shall provide at least two egress doors at each end of the building.

8.2.8 ADA Requirements

The Electrical Building is exempt from Americans with Disabilities Act (ADA) based on 2010 ADA Standards for Accessible Design, Section 203: “General Exceptions; Machinery Spaces; Spaces frequented only by service personnel for maintenance, repair or occasional monitoring or equipment shall not be required to comply with these requirements or to be on an accessible route. Machinery spaces include, but are not limited to, water or sewage treatment Pump Rooms and stations; electrical substations and transformer vaults; and …” FBC 1103.9 also indicates “Equipment spaces, Spaces frequented only by service personnel for maintenance, repair, or occasional monitoring or equipment shall not be required to comply with this chapter”.

Except for regular monitoring and maintenance of equipment, the Electrical Building is not intended for human occupancy for extended periods of time. The primary purpose of the building is to house electrical equipment for wastewater conveyance.

8.2.9 Energy Requirements

The Electrical Building is exempt from the energy code requirements based on the Florida Building Code, 7th Edition (2020) Energy Conservation, Section C101.4.2.4 Buildings designed for purposes other than general space comfort conditioning.

8.3 GENERAL STANDARDS

8.3.1 Program

The Electrical Building shall be designed as a one room Electrical Building that will provide an area and clearances required for the electrical equipment.

8.3.2 Exterior Walls

The exterior walls shall have cast-in-place concrete backup wall for structural support. The exterior veneer will be a combination of masonry over rigid insulation.

8.3.3 Roof Construction

The roof system shall be a white single-ply membrane over polyisocyanurate rigid insulation on concrete deck. Drainage shall be provided by sloping the insulation to roof scuppers and downspouts. Access ot the roof shall be provided with an exterior fixed ladder.

8.3.4 Moisture Protection

Building insulation shall be provided on the roof, in the wall systems, and below grade where applicable. Waterproofing and/or damp proofing shall be provided below grade to prevent water infiltration through the walls and foundation.

8.3.5 Doors, Frames, and Finish Hardware

Exterior doors and their frames shall be flush steel, insulated, and field painted. Doors will provide flood protection for the building.

All door hardware shall be heavy-duty locksets, and latch sets, as required. The function of such hardware shall be appropriate for each door's use. Panic hardware shall be used where required.

8.3.6 Louvers

Louvers shall be painted or anodized aluminum finish, and provided with acoustical baffles, as required. Final location shall be determined in conjunction with the mechanical design engineers.

8.3.7 Interior Finishes

Flooring:

- Flooring shall be trowel finished exposed concrete with sealer for protection.

Walls:

- Interior walls shall be cast-in-place concrete with a rubbed finish.

Ceilings:

- Ceilings shall be unpainted exposed structure.

8.3.8 Specialties

Fire extinguishers shall be provided.

8.3.9 Exterior Lighting

Lighting shall satisfy functional and security needs while not creating light pollution in the form of point sources of direct glare, which are visible from a distance. Fixtures shall be low-level, directional light fixtures, which illuminate immediate areas, carefully selected for efficiency.

9 LANDSCAPE ARCHITECTURE DESIGN CRITERIA

9.1 LANDSCAPE PLANTING MATERIALS

Proposed plant materials and function (plant material is subject to change):

- Street trees – Live Oak (*Quercus virginiana*) *avoid planting oaks near structures or buried pipes
- Hedges – Japanese Privet (*Ligustrum japonicum*), Podocarpus (*Podocarpus macrophyllus*), and Walter's Viburnum (*Viburnum obovatum*)
- Small shrubs – Indian Hawthorne (*Raphiolepis indica*) and Dwarf ixora (*Ixora chinensis*)
- Groundcover – Green Island Ficus (*Ficus microcarpa 'Green Island'*) and Parson's Juniper (*Juniperus parsonii*)
- Vines – Star Jasmine (*Trachelospermum jasminoides 'Star'*) and Climbing Fig (*Ficus pumila*)
- Sod – Floratam St. Augustine Grass (*Stenotaphrum secundatum 'Floratam'*)
- Mulch – Hardwood Shredded mulch - color to match existing

9.2 PLANTING AND IRRIGATION REQUIREMENTS

9.2.1 Planting Requirements

9.2.1.1 City of Tampa Landscape and Tree Planting Standards

1. Recommended trees shall be used to meet the requirements of Chapter 27, Section 285, and as specified in the technical standards, be at least two (2) inches in diameter when measured at six (6) inches above grade and shall be selected from the recommended tree list set forth in Schedule C. At least fifty (50) percent of the recommended trees planted on a parcel shall be shade trees. At least sixty (60) percent of the recommended trees planted on a parcel shall be native trees. Palm trees shall be replaced one (1) for one (1) with a recommended tree.
2. An existing or relocated protected tree which meets the standards of this section shall be credited toward the planting requirements contained in section 27-285.1 for recommended trees on a parcel, in accordance with the tree equivalency table set forth in table 284.4.1.A.
3. Any person may request that the department may approve a tree as a replacement tree that is not included on the recommended tree list if the tree is similar in character and function to a tree on the recommended tree list.
4. A pervious area with an effective minimum radius of six (6) feet from the trunk of a recommended tree shall be maintained around all recommended trees.
5. Paving base may extend to within six (6) feet from the trunk of a protected tree, provided an effective pervious area radius of ten (10) feet is created through the use of turf block, pavement aeration devices or similar products.
6. Structural foundations may be located at a radius of six (6) feet from the trunk of a protected tree, provided an effective pervious area radius is extended proportionally in three (3) other directions to allow six hundred (600) square feet of pervious area.
7. All recommended trees and plant material shall be planted in accordance with the specifications described in the State Department of Agriculture and Consumer Services, Division of Forestry, Tree Protection Manual for Builders and Developers, October 1980, as revised from time to time.

8. All recommended trees and plant material used shall be vigorous, well shaped, branched and foliated and shall be graded State Department of Agriculture Nursery Grade No. 1 or better as outlined by the state division of Plant Industry Grades and Standards for Nursery Plants, Fifth Edition, 2015, as revised from time to time.
9. Landscape areas shall consist of at least sixty (60) percent native plant material and/or plant material adapted to local climatic. Recommended trees, protected trees and plant material shall be planted in such a way as to conserve, preserve and enhance land uses, natural land features, and natural and aesthetic values. Nonliving natural material which permits percolation may also be used as necessary material in landscaping.
10. A layer of mulch to a minimum depth of three (3) inches shall be specified on the site plan in plant beds and around individual trees in turf areas. Organic mulches are preferred. The mulch should not be placed directly against the plant stem or tree trunk. Mulch shall not be required in annual beds.
11. Soil testing shall be performed in all planting areas (including sodded areas) prior to construction with results submitted to landscape architect. Samples shall be taken from each different planting area, from soil which is to remain. Soil amendments shall be added as necessary to meet the following parameters:

pH Range	6.0 - 7.0
Organic Matter	4 - 10%
Calcium	60 - 70%
Magnesium	10 - 20%
Phosphorus	Equal to Potassium
Potassium	3 - 5%
Soluble Salts/ Conductivity	less than 2 mmho/cm

12. If a hedge or other screen is used, it must be at least two (2) feet in height at time of planting.
13. Turf and grass sod shall be clean and free of weeds, pests, and disease. Grass seed shall be delivered to the job site in bags with the state department of agriculture tags attached.
14. All landscape areas must allow for access to public and private utility facilities for maintenance purposes.
15. All staking and guying of trees shall be removed after one growing season.

9.2.1.2 Tree Protection Standards

16. Protective barricades shall be placed around all protected trees and grand trees during site clearing to create a protective radius and shall remain in place until land alteration, site clearing and construction activities are complete. Barricades for the protective radius shall be erected at a minimum distance of ten (10) feet from the edge of trunk of protected trees and twenty (20) feet from the edge of trunk of grand trees. Barricades shall meet City of Tampa standards as outlined in Chapter 27-284.1.1.
17. A minimum distance of ten (10) feet from all protected trees, 15' from specimen trees (24"-31"), and twenty (20) feet from all grand trees shall be maintained when installing underground utilities. If this results in unreasonable hardship, a soil auger shall be used to tunnel under the root systems.

18. Installation of artificial barriers such as protective barricades, fences, posts or walls shall not destroy or irreversibly harm the root system of protected trees and grand trees. Footers for walls shall end at the point where larger roots are encountered, and the roots shall be bridged. Post holes and trenches located close to protected trees or grand trees shall be adjusted to avoid damage to major roots.
19. All roots to be removed during the site clearing phase shall be severed clean at the perimeter of the designated protective radius.
20. A two-inch layer of mulch shall be applied over the surface of exposed roots of protected trees and grand trees during the site clearing phase.
21. A protective dry well and drainage / aeration system shall be provided where protected trees or grand trees will be adversely affected by raising the grade.
22. A protective retaining wall shall be constructed at the perimeter of the protective radius around a protected tree or grand tree where the protected tree or grand tree will be adversely affected by lowering the grade.
23. All trimming of protected trees and grand trees during development shall be done by a qualified, certified arborist.

9.2.1.3 Tree Barricade Requirements

Protective barriers are used during land alteration and construction activities to protect trees and natural areas to be retained on a site. Protective barriers must be erected around trees to be retained within an area where land alteration and construction activities will occur as well as along natural areas where such areas are adjacent to permitted land alteration or construction activities. A protective barrier must remain in place until the land alteration and construction activities are completed or until commencement of grade finishing, sodding, and landscaping. No ground disturbance shall occur within the barricaded area. The following represents the City's minimum protection barrier specifications:

1. Trees - Chain link (6' - 8') is required for barricade of all grand trees with a 8-1/2" x 11" sign every 50' stating: "keep out tree protection area". Tree Barricades; 27-284.1.1 & Tech Manual A.2, Provide tree protection for Grand trees (32”+) (20' from edge of trunk to closest edge of improvement, Specimen trees (24”-31”) (15' from edge of trunk to closest edge of improvement; and protected trees (23” and less) (10' from edge of trunk to closest edge of improvement).
2. Natural Areas - To restrict access into areas where land alteration and construction activities are not authorized, a physical structure not less than 3 feet in height is placed along the perimeter of such areas. Upright stakes of no less than 2" x 2" lumber spaced no more than 25' apart and connected by extra strength filter fabric at 6' maximum spacing without wire support fence. Other methods of demarcation will be considered depending upon the characteristics of the site.

9.2.2 Irrigation Requirements

Proposed irrigation components, to be tied into existing system:

- Trees – 2 bubblers per tree
- Hedges, Shrubs, Groundcovers, Vines – drip irrigation for all shrub areas
- Sod – Spray heads, to not over-throw onto hardscape or equipment

9.2.2.1 City of Tampa Irrigation Standards

All irrigation installation shall conform to City of Tampa, Division 4 Irrigation Regulations, Section 27-284.3.2.c.

1. All required landscaping, as described in 27-284.3.3, shall be equipped with an irrigation system except as specified below:
   a. Retained native plant habitat is not required to have an irrigation system.
   b. Single and two-family dwellings are not required to have an irrigation system. However, the addition of synthetic water absorbing polymers to topsoil prior to planting or sodding to increase water-holding capacity is encouraged.
   c. Drought-tolerant landscape material (see the University of Florida IFAS Extension Florida Yards and Neighborhoods Florida-Friendly Plant List 2006, as may subsequently be revised) planted in specific zones or beds is only required to be irrigated during establishment (minimum thirty (30) days) and protracted drought periods. Irrigation shall be a low-volume irrigation system.
2. The landscape and tree planting plan shall illustrate the proposed irrigation zones, delineating low-volume irrigation zones and areas utilizing irrigation techniques other than low-volume irrigation.
3. Irrigated turf areas shall utilize irrigation techniques other than low-volume irrigation. Turf areas shall be on separate irrigation zones from other landscape plant zones. In the case of expansion of an existing development, this limitation will apply to the area of new landscape, only.
4. In addition, in order to promote water conservation in the community, Florida Friendly Yards are strongly encouraged. A maximum of fifty (50) percent green space may be planted with turfgrass configured with a permanent irrigation system (the maximum allowable new turf grass percentage will be reduced to forty-five (45) percent in 2009, forty (40) percent in 2010, thirty-five (35) percent in 2011, thirty (30) percent in 2012 and twenty-five (25) percent in 2013 and thereafter.) Turf grass in excess of this limitation shall not be allowed to have a permanent or temporary irrigation system. In the case of expansion of an existing development or the completion or continuation of a phased development, limitations identified for allowable new turf grass percentages, will apply to the area of new landscaping only.
5. Turf zone head spacing shall achieve head to head coverage.
6. Sprays and rotors shall not be combined on the same control valve circuit. Sprays and rotors shall have matching application rates within each irrigation zone.
7. All irrigation systems shall be designed to avoid over spray, runoff, low head drainage, or other similar conditions where water flows onto or over adjacent property, non-irrigated areas, walkways, roadways, structures, or water features. Emitters and sprinkler heads are encouraged to be located at least two (2) feet from buildings and water should not hit the building while operating. Narrow areas (four (4) feet wide or less) shall not be irrigated unless low-volume irrigation is utilized.
8. Irrigation control equipment shall include an automatic irrigation controller having program flexibility such as repeat cycles and multiple program capabilities. Automatic irrigation controller(s) shall have battery back-up or nonvolatile memory to retain the irrigation program(s). Automatic control systems shall be equipped with an operable rain sensor or other devices, such as soil moisture sensors, to prevent unnecessary irrigation.
9. The irrigation system shall be designed to "Standards and Specifications for Turf and Landscape Irrigation Systems, " Fifth Edition, 2005, Florida Irrigation Society, as may subsequently be revised.
10. All installations of new irrigation systems shall connect to the city's reclaimed water system if that system is available, as required by Tampa City Code, Chapter 26 and subsequent amendments.
11. Sports fields, golf courses, cemeteries, and storm water management systems are exempt from the turf area limitation and low-volume irrigation requirements of this ordinance where functional need for turf is demonstrated. All other irrigation and landscape requirements of this article apply.

9.2.2.2 General Irrigation Notes:

1. Refer to the landscape plans when trenching to avoid tree and shrub locations.
2. All mainline piping shall be buried to a minimum depth of 18" of cover and all lateral piping shall be buried to a minimum depth of 12" of cover.
3. All pop-up rotor and spray heads shall be installed using an 18" PVC flex pipe or swing joint connection. Contractor shall not use funny pipe.
4. Pipe sizes shall conform to those shown on the drawings. The smallest lateral pipe size to a single spray or rotor head shall be 3/4".
5. All risers shall be staked with a 1" wood dowel and secured with UV-resistant plastic cable ties. Risers and dowel shall be painted flat black.
6. All remote-control valves, gate valves and quick couplers shall be installed in valve boxes.
7. All risers shall be installed 12" from any wall and a minimum of 36" from any sidewalk, patio, or road.
8. The exact height of any 12" pop-up that is shown in a shrub bed shall be determined by the landscape architect in the field.
9. Control wire shall be 14-1 UF direct burial, colored red for control wires and white for common wires. No cross connection between controllers shall be allowed. Wire splices shall be made only in valve boxes using rainbird 'snap-tite' connectors.
10. Any piping or valves shown outside the property line or outside of a landscape area are shown there for design clarity only. all piping and valves shall be installed on the property and within landscape areas.
11. It is the responsibility of the irrigation contractor to familiarize themself with, and exercise care so as to not damage any existing berms, walls, structures, plant materials, and utilities. The irrigation contractor shall be responsible for the immediate repair or replacement of all items damaged by their work. They shall coordinate their work with other contractors for the location and installation of sleeves and piping through walls, under roadways and paving, etc.
12. Do not willfully install the sprinkler system as shown on the drawings when it is obvious in the field that unknown obstructions, grade differences or differences in area dimensions exist that might not have been considered in the engineering. Such obstructions or differences should be brought to the attention of the owner's authorized representative. In the event this notification is not performed, the irrigation contractor shall assume full responsibility for any revisions.
13. Final location of the automatic controller(s) shall be approved by the owner.
14. Electrical service to all equipment shall be provided to a junction box at the equipment location.
15. The irrigation contractor shall flush and adjust all sprinkler heads and valves to provide optimum coverage with minimal overspray onto walks, streets, walls, etc. In order to accomplish this, the contractor may substitute variable arc nozzles in place of the specified fixed arc nozzles where necessary. Pressure compensating screens may also be used to reduce spray distance.
16. The contractor shall complete all work in accordance with all applicable laws, codes, ordinances and regulations.
17. All sprinkler equipment not otherwise detailed or specified shall be installed as per manufacturer's recommendations and specifications.
18. The contractor shall prepare an as-built drawing on a reproducible mylar showing all irrigation installation. A mylar of the original plan may be obtained from the landscape architect for a fee. The as-built drawing shall locate all mainline and valves by showing exact measurements from hard surfaces.
19. All work shall be guaranteed for one year from the date of final acceptance against all defects in equipment and workmanship.
20. Sleeves shall be placed under pavement as shown on plans and shall be a minimum of 2x the size of the irrigation pipe.
21. All spray heads in the ROW shall be either 6" or 12" pop-up as indicated on the plans.

22. Contractor shall perform pressure and volume test on irrigation water source over a continuous 24-hour period prior to the commencement of any construction work. Should the available supply not be adequate to meet the demands of the irrigation system as designed the contractor shall contact the landscape architect prior to construction for design modifications.
23. In the event that a well is used as the water source for the irrigation system, the landscape contractor shall be responsible for obtaining water samples from the well. At the landscape contractor's expense, they shall have a certified lab analyze the water quality. The landscape contractor shall report to the landscape architect or owner's project manager, any potential issues that may affect the health of the plant material or potential staining to sidewalks and buildings. Reporting shall occur before the system is in operation. Failure to report shall place liability on the landscape contractor.
24. Ground all electrical equipment per all applicable codes, laws, and ordinances, and per all manufacturer's recommendations and specifications and industry best practices.

9.3 DESIGN AESTHETIC ILLUSTRATION

The intent of the proposed landscape design is to screen all utilities and equipment (generator enclosure, transformer, electrical building, control panels, and PS access hatches) while maintaining safety and visibility on Bayshore Boulevard. The materials are to closely match the existing palette and incorporate the new equipment in the median.

Plant material aesthetics:

- Street trees – Maintain the existing tree spacing to extend the existing oak canopy.
- Hedges – Large shrubs screen the above-ground utilities while still maintaining their and not obstructing critical views for safety on Bayshore.
- Small shrubs and groundcover – Provide accent planting and colors planted in front of the hedges in key locations to provide lush interest and a 'tiered' aesthetic.
- Vines – Planted 3' on center at the base of the wire screens around the electrical building for additional screening.

Views especially considered are the following:

- Southeast on the intersection of Bayshore & Stovall – visibility is improved by removing any obstructions: the PSs (moving underground) and the screening landscape material). Crossing Bayshore becomes much safer for vehicles and pedestrians.
- East from the western sidewalk – the proposed electrical building is screened and trees are added to maintain the existing tree spacing on Bayshore
- Down from the Monte Carlo Towers - proposed electrical building is screened by the proposed tree canopy so that the views are focused on the bay and not utility equipment.

As seen in Figure 11-1 through Figure 11-6, landscape material will screen equipment and provide a lush aesthetic to the Bayshore median with extended tree canopies, hedges, accent shrubs, vines, and new sod.

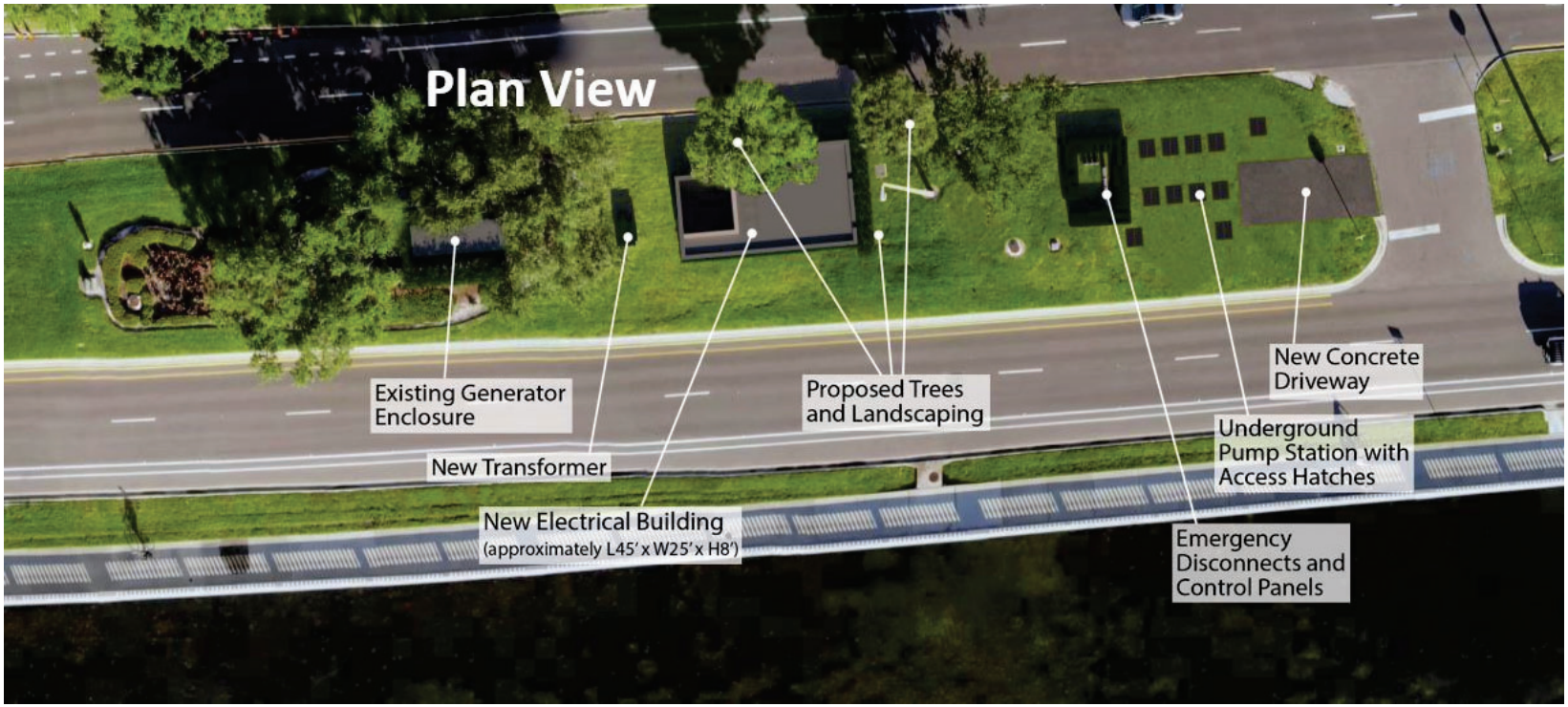


Figure 9-1: Plan View Rendering

Figure 9-2: Aerial View

Figure 9-3: Street View Looking West

Figure 9-4: Street View Looking East

Figure 9-5: Southwest View

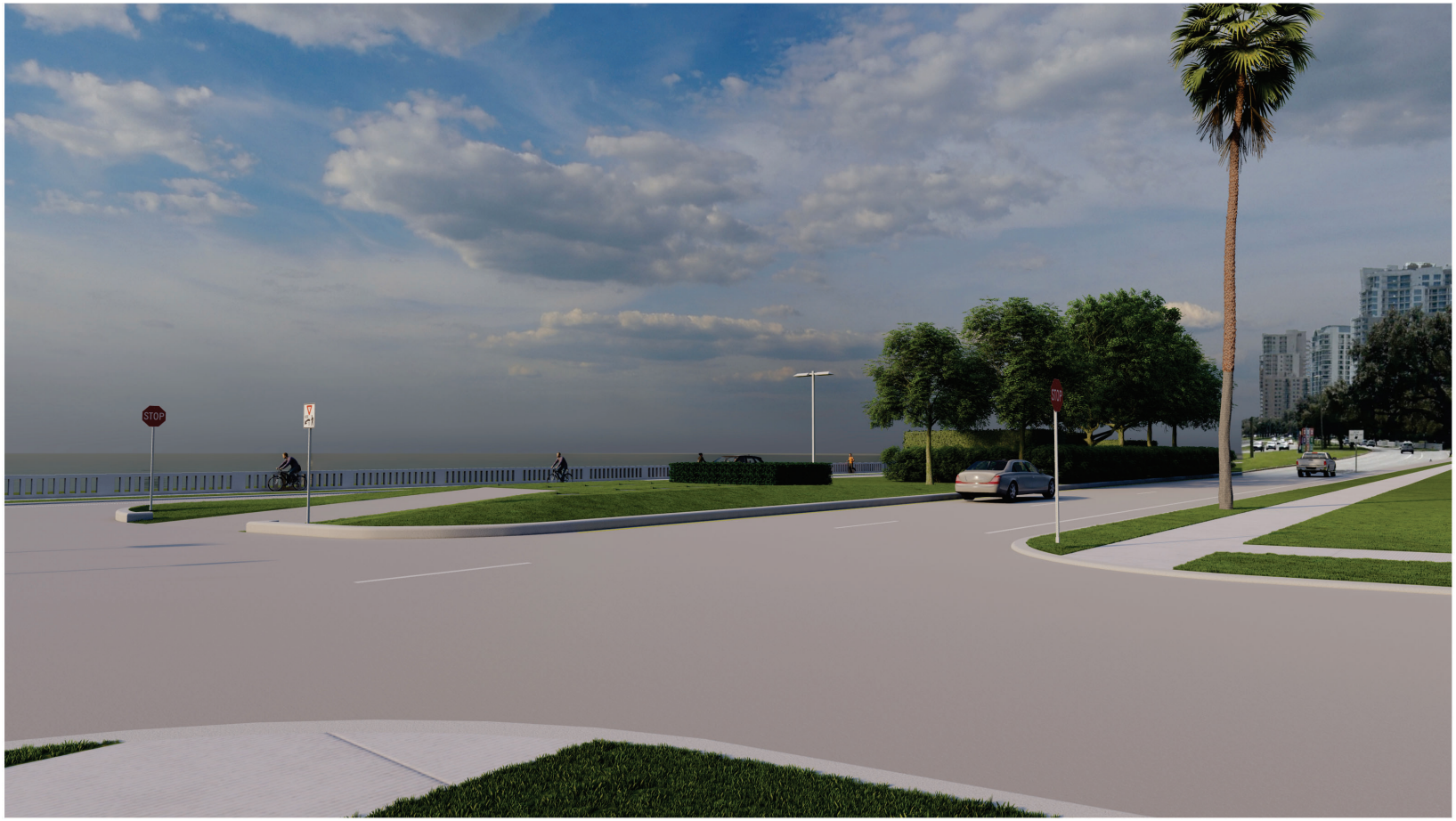


Figure 9-6: Southeast View

10 PRELIMINARY DESIGN DRAWINGS

This section contains the preliminary design drawings developed during this design phase. These drawings reflect the current level of progress in the design, and will continue to be developed during detailed design, along with the rest of the drawings identified in the scope of work.

The following preliminary design drawings are included in Appendix C of this PER:

I-01 INSTRUMENTATION SYMBOLS AND LEGEND

I-02 INSTRUMENTATION PUMP STATION P&ID

M-003 WET WELL 2+2 ALTERNATIVE 4A

M-101 PLAN

M-102 SECTIONS

M-103 ISOMETRICS 1

M-104 ISOMETRICS 2

M-105 ISOMETRICS 3

E-01 ELECTRICAL NOTES, LEGEND, AND ABBREVIATIONS

E-02 ELECTRICAL ONE-LINE DIAGRAM

E-04 ELECTRICAL BUILDING PLAN VIEW

11 DETAILED DESIGN DRAWINGS AND SPECIFICATIONS

11.1 ANTICIPATED FINAL DRAWING LIST

GENERAL SHEETS

G-01 COVER SHEET/LOCATION PLAN
G-02 SHEET INDEX
G-03 LEGENDS AND ABBREVIATIONS
G-04 GENERAL NOTES
G-05 GENERAL COMMON SYMBOLS
G-06 GENERAL ABBREVIATIONS
G-07 GENERAL PIPE SCHEDULE FLUID ABBREVIATIONS
G-08 GENERAL PIPE SCHEDULE PIPE MATERIAL

CIVIL

GC-01 CIVIL NOTES, ABBREVIATIONS AND SYMBOLS
C-01 OVERALL SITE PLAN
C-02 PLAN/PROFILE VIEW
C-03 MANHOLE CONNECTION DETAIL
C-04 FORCE MAIN CONNECTION DETAIL
C-05 TRENCH AND BACKFILL DETAIL, PAVEMENT RESTORATION
C-06 DRIVEWAY DETAIL

INSTRUMENTATION AND CONTROLS

I-01 SYMBOLS AND LEGEND
I-02 PUMP STATION P&ID
I-03 NETWORK DIAGRAM
I-04 INSTALLATION DETAILS
I-05 PANEL LAYOUT I
I-06 PANEL LAYOUT II

ARCHITECTURAL

GA-01 GENERAL NOTES AND SYMBOLS
GA-02 DOOR, WINDOW AND ROOM FINISH SCHEDULES
GA-03 STANDARD DETAILS-I
GA-04 STANDARD DETAILS-II
A-01 BUILDING CODE SUMMARY AND LIFE SAFETY PLAN
A-02 ELECTRICAL BUILDING FLOOR PLAN
A-03 ELECTRICAL BUILDING ROOF PLAN
A-04 ELECTRICAL BUILDING EXTERIOR ELEVATIONS - II

A-05 ELECTRICAL BUILDING EXTERIOR ELEVATIONS - II
A-06 ELECTRICAL BUILDING SECTIONS
A-07 ELECTRICAL BUILDING DETAILS
A-08 PUMP STATION FLOOR PLAN

STRUCTURAL
GS-01 GENERAL NOTES AND DESIGN CRITERIA
GS-02 STANDARD DETAILS - I
GS-03 STANDARD DETAILS - II
GS-04 STANDARD DETAILS - III
GS-05 STANDARD DETAILS - IV
GS-06 STANDARD DETAILS - V
GS-07 STANDARD DETAILS - VI
GS-08 STANDARD DETAILS - VII
GS-09 STANDARD DETAILS - VIII
GS-10 STANDARD DETAILS - X
SD-01 DEMOLITION BOTTOM PLAN
SD-02 DEMOLITION TOP PLAN
SD-03 DEMOLITION SECTION AND DETAILS - I
SD-04 DEMOLITION SECTION AND DETAILS - II
S-01 PUMP STATION BOTTOM PLAN
S-02 PUMP STATION INTERMEDIATE PLAN
S-03 PUMP STATION TOP PLAN
S-04 PUMP STATION SECTIONS AND DETAILS - I
S-05 PUMP STATION SECTIONS AND DETAILS - II
S-06 PUMP STATION SECTIONS AND DETAILS - III
S-07 ELECTRICAL BUILDING FOUNDATION PLAN
S-08 ELECTRICAL BUILDING ROOF PLAN
S-09 ELECTRICAL BUILDING SECTIONS AND DETAILS - I
S-10 ELECTRICAL BUILDING SECTIONS AND DETAILS - II
S-11 ELECTRICAL BUILDING SECTIONS AND DETAILS - III
S-12 ELECTRICAL BUILDING SECTIONS AND DETAILS - IV

PROCESS MECHANICAL
GM-01 GENERAL NOTES
M-01 PUMP STATION PLAN
M-02 PUMP STATION ELEVATION A.A-FT DEMOLITION PLAN - I
M-03 PUMP STATION ELEVATION B.B-FT DEMOLITION PLAN - II
M-04 PUMP STATION DEMOLITION SECTIONS - I
M-05 PUMP STATION DEMOLITION SECTIONS - II
M-06 PUMP STATION PLAN - ELEVATION A.A FT PARTIAL PLAN - I

M-07 PUMP STATION PLAN - ELEVATION B.B FT PARTIAL PLAN - II
M-08 PUMP STATION SECTION AND DETAILS SHEET I
M-09 PUMP STATION SECTION AND DETAILS SHEET II

HVAC AND PLUMBING
H-01 ABBREVIATIONS, SYMBOLS AND NOTES
H-02 ELECTRICAL BUILDING FLOORPLAN AND SECTION
H-03 EQUIPMENT SCHEDULES AND DETAILS

ELECTRICAL
E-01 ELECTRICAL NOTES, LEGEND, AND ABBREVIATIONS
E-02 SITE PLAN - DEMOLITION
E-03 SITE PLAN - PROPOSED
E-04 PUMP STATION PLAN
E-05 PUMP STATION HAZARDOUS LOCATION PLAN
E-06 ONE-LINE DIAGRAM
E-07 INTERCONNECT WIRING DIAGRAM
E-08 TYPICAL PUMP CONTROL WIRING SCHEMATIC
E-09 SCHEDULES
E-10 DETAILS I
E-11 DETAILS II

LANDSCAPE ARCHITECTURE
L-01 LANDSCAPE NOTES
L-02 LANDSCAPE DEMOLITION
L-03 PLANTING PLAN, DETAILS, SCHEDULE
L-04 IRRIGATION PLAN, SCHEDULE
L-05 IRRIGATION DETAILS

11.2 ANTICIPATED FINAL SPECIFICATION LIST

CITY OF TAMPA SPECIFICATIONS

W-1 EXCAVATION
W-2 BACKFILLING
W-8 METAL CASTINGS
W-10 DUCTILE IRON PIPE AND FITTINGS
W-11 PVC PIPE
W-17 SODDING
W-18 LEAKAGE TESTS
W-27 DEMOLITION
W-30 MISCELLANEOUS PIPE AND FITTINGS
W-31 HANGERS AND SUPPORTS
W-35 MAGNETIC FLOW METER
W-36 PAINTING
W-45 ELECTRICAL
W-63 CONCRETE REPAIR
W-67 STEEL PIPE AND FITTINGS
W-73 RESTRAINING DEVICES
W-76 CONDUIT, WIRING AND GROUNDING
W-85 FLOOR GRATING AND PLATE
W-86 DOORS AND FRAMES
W-87 HARDWARE
W-88 CAULKING AND SEALING
W-89 PIPE RAILINGS
W-113 DISPOSAL OF DEBRIS
W-800 HDPE PIPE

01-GENERAL REQUIREMENTS

01 33 17 STRUCTURAL DESIGN, SUPPORT, AND ANCHORAGE
01 74 40 CONCRETE STRUCTURE TESTING

03-CONCRETE

03 01 30 CONCRETE REPAIR AND REHABILITATION
03 11 00 CONCRETE FORMING
03 21 00 REINFORCEMENT STEEL
03 31 00 CAST IN PLACE CONCRETE
03 32 00 JOINTS IN CONCRETE
03 34 00 CONTROLLED LOW STRENGTH MATERIAL
03 60 00 GROUTING

04-MASONRY

04 05 19.29 POST INSTALLED ANCHORS IN MASONRY

04 20 00 REINFORCED CONCRETE BLOCK MASONRY

05-METALS

05 05 19 POST INSTALLED ANCHORS IN CONCRETE

05 50 00 MISCELLANEOUS METALWORK

05 52 00 ALUMINUM RAILINGS

07-THERMAL & MOISTURE PROTECTION

07 14 00 FLUID APPLIED WATERPROOFING

07 19 00 SURFACE APPLIED WATER REPELLENTS

07 22 16 ROOF INSULATION

07 54 19 MEMBRANE ROOFING

07 92 13 SEALANTS AND CAULKING

08-OPENINGS

08 11 13 STEEL DOORS AND FRAMES

08 71 00 DOOR HARDWARE

08 91 00 LOUVERS

09-FINISHES

09 96 00 PROTECTIVE COATING

10-SPECIALTIES

10 14 00 BUILDING SIGNAGE

10 44 00 FIRE EXTINGUISHERS

23-HEATING, VENTILATING & AIR CONDITIONING

23 05 29 - HANGERS AND SUPPORTS FOR HVAC DUCTWORK, PIPING AND EQUIPMENT

23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC

23 31 13 - METAL DUCTWORK

23 81 26 - SPLIT-SYSTEM AIR CONDITIONERS

26-ELECTRICAL

26 05 05 GENERAL PROVISIONS FOR ELECTRICAL SYSTEMS

26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

26 05 23 INSTRUMENTATION AND COMMUNICATION CABLE

26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

26 05 33.13 RIGID CONDUITS

26 05 33.16 FLEXIBLE CONDUITS

26 05 33.23 SEALED FITTINGS

26 05 33.26 EXPANSION/DEFLECTION FITTINGS
26 05 33.33 PULL, JUNCTION, AND TERMINAL BOXES
26 05 33.36 OUTLET BOXES
26 05 43.13 UNDERGROUND DUCTBANKS FOR ELECTRICAL SYSTEMS
26 05 43.23 MANHOLES AND HANDHOLES FOR ELECTRICAL SYSTEMS
26 05 45 UTILITY SERVICES FOR ELECTRICAL SYSTEMS
26 05 53 IDENTIFICATIONS FOR ELECTRICAL SYSTEMS
26 05 73 ELECTRICAL POWER DISTRIBUTION STUDIES
26 22 14 DRY-TYPE LOW-VOLTAGE DISTRIBUTION TRANSFORMERS
26 23 23 METAL-CLAD LOW-VOLTAGE SWITCHGEAR
26 24 16 PANELBOARDS
26 27 26.13 LOW-VOLTAGE RECEPTACLES
26 27 26.23 SNAP SWITCHES
26 28 16.33 DISCONNECT SWITCHES
26 29 23 LOW-VOLTAGE VARIABLE FREQUENCY DRIVES
26 32 13 ENGINE GENERATORS
26 33 00 BATTERY EQUIPMENT
26 36 23 AUTOMATIC TRANSFER SWITCHES
26 41 13 LIGHTNING PROTECTION FOR STRUCTURES
26 43 00 SURGE PROTECTIVE DEVICES
26 50 00 LIGHTING

32-EXTERIOR IMPROVEMENTS
32 12 16 ASPHALT PAVING
32 84 00 LANDSCAPE IRRIGATION SYSTEMS
32 90 00 LANDSCAPE WORK
32 92 23 LANDSCAPE SODDING
33-UTILITIES

40-PROCESS INTERCONNECTIONS
40 60 05 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

43-MATERIAL HANDLING EQUIPMENT
43 20 00 PUMPS GENERAL
43 25 06 SUBMERSIBLE SOLIDS HANDLING PUMPS
43 30 16 CHECK VALVES
43 30 18 BALL VALVES
43 30 22 GATE VALVES
43 30 24 PLUG VALVES
43 30 52 MISCELLANEOUS VALVES
43 30 56 HYDRAULIC GATES GENERAL

43 30 60 CAST IRON SLIDE AND SHEAR GATES

46-WATER & WASTEWATER EQUIPMENT
46 01 00 EQUIPMENT GENERAL

12 PERMITTING

This section outlines the permit requirements involved in the design build process for this project.

12.1 DESIGN PHASE PERMITTING REQUIREMENTS

Florida Department of Environmental Protection (FDEP) Form 62-604.300(8)(a) Notification for Constructing a Domestic Wastewater Collection/Transmission System

A pre-application meeting or direct communication will be held with the FDEP to determine the appropriate permit application / submittal requirements and to identify specific concerns of the FDEP to be addressed in the design build process. It is anticipated that form 62-604.300(8)(a) to be submitted at least 30 days prior to initiating construction. However, FDEP may allow this project to proceed as a maintenance activity and may not require an application. The general permit requires that the design be compliant with the design/performance criteria in FAC 62.604.400, which include property ownership/rights, setbacks from potable water supply wells, emergency pumping capability, surge protection, odor control, noise control, fencing, flood protection, valving, crossing requirements. This application can be submitted at 90% design and the expected fee for the application would be $500.

12.2 CONSTRUCTION PHASE PERMITTING REQUIREMENTS

FDEP Form 62-621.300(4)(b) Notice of Intent (NOI) to Use Generic Permit for Stormwater Discharge From Large and Small Construction Activities

PCL will be required to submit a NOI to the FDEP to comply with the terms of the National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges of Storm Water Runoff Associated with Construction Activity. A $250 processing fee is associated with the NOI. The NOI process must occur prior to commencement of construction. A Storm Water Pollution Prevention Plan (SWPPP) and an Erosion and Sediment Control Plan (ESCP) are required to be completed as part of this effort. The NOI, SWPPP and ESCP shall be in accordance with the contract documents. The contract documents will require PCL to submit the SWPPP and ESCP to PCL for review and approval prior to submitting the NOI to FDEP. The fee for a Small Construction project is $250. PCL will file a NPDES Stormwater Notice of Termination (NOT), Form 62-621.300(6) once the project is complete. The NOT must be filed within 14 days of the final stabilization of the site. There is not an additional for the NOT.

FDEP Form 62-620.910(12) Notification of Completion of Construction for Wastewater Facilities or Activities

FDEP Form 62-620.910(12) Notification of Completion of Construction for Wastewater Facilities or Activities should be filed prior to placing the newly modified infrastructure into operation.

FDEP Form 62-620.910(13) Notification of Availability of Record Drawings and Final Operation and Maintenance Manuals

PCL will file FDEP Form 62-620.910(13) Notification of Availability of Record Drawings and Final Operation and Maintenance Manuals within six months after placing the newly modified portion of the existing facility into operation.

City of Tampa Right-of-Way Permitting

The Bayshore PS is located in the median of Bayshore Boulevard. Right-of-Way (ROW) permitting would be needed to mobilize in that location. ROW permits need to be obtained prior to mobilizing onsite. Permit review takes approximately 15 business days. Permit fees are estimated to range from $100 - $1000, depending on in and how many sidewalks or lane closures will be needed during construction.

City of Tampa Building Permit

A Building Permit will be needed for the proposed PS modifications. The building permit will be required prior to starting the PS modification construction. The building permit fee is estimated to be $2000. PCL will schedule any inspections and complete permit closeout as required per the permit.

13 OPINION OF PROBABLE CONSTRUCTION COST

PCL Constructors Inc.
PCL Constructors Inc.

City of Tampa - Bayshore Pump Station - Summary Report

Opinion of Probable Construction Cost based on the Preliminary Engineering Report developed in the Initial Design Phase

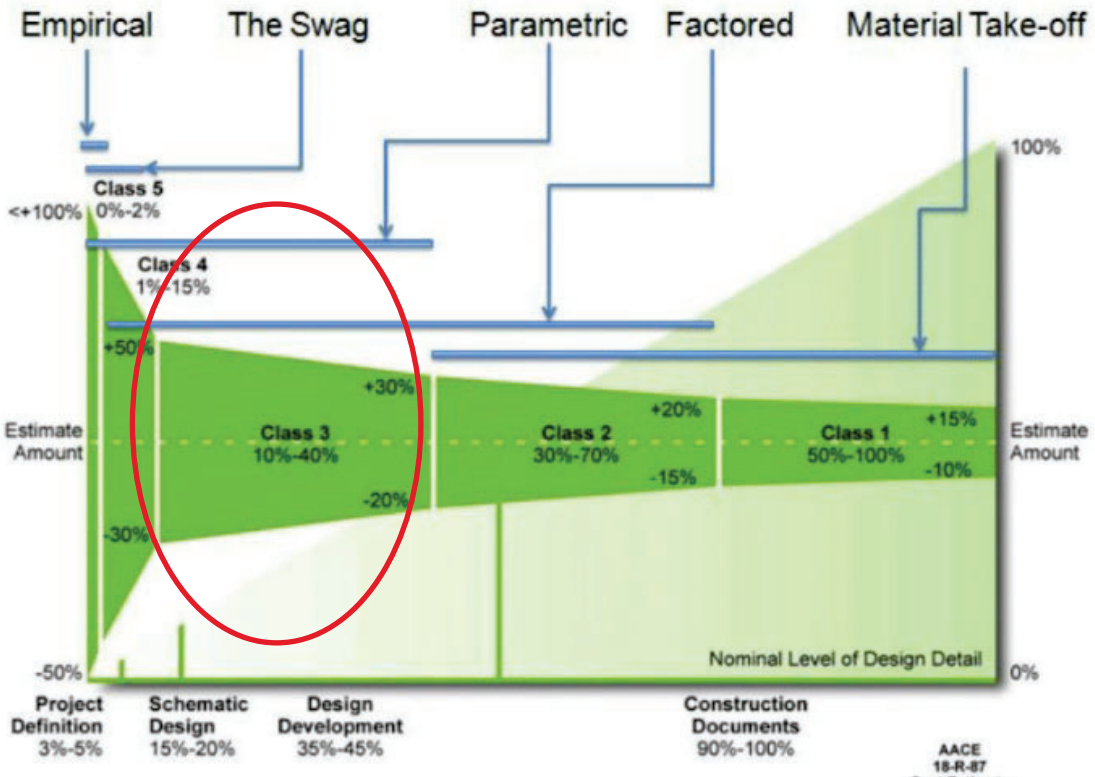
Project	**City of Tampa - Bayshore Pump Station Design-Build**	Functional Units	
Location	**Tampa, FL, USA**	Area	**830 SF**
Owner	**City of Tampa**		
Designer	**Stantec Inc.**		

Summary Item Description	Quantity	UOM	Total Cost
DIRECT COSTS			
General Conditions	1	LS	1,603,943
General Requirements	1	LS	1,114,690
Site Construction - Includes Deep Foundations, MOPO, MOT and Demolition	1	LS	3,619,553
Site Construction - 18" Diameter Pipe	1	LS	700,000
Concrete	1	LS	728,464
Metals	1	LS	111,651
Thermal and Moisture Protection - Includes Roof System	1	LS	124,653
Doors and Windows - Includes Waterproof Doors	1	LS	58,480
Finishes - Includes Wetwell Coatings	1	LS	336,782
Equipment - Includes Submersible Pumps and Gates	1	LS	1,055,605
Mechanical - Includes Above Ground Pipe and HVAC	1	LS	555,511
Electrical and Generator	1	LS	1,336,738
I&C	1	LS	200,000
DIRECT COSTS			11,546,070
TOTAL COST			11,546,070
Fee 7%			808,225
TOTAL BID			12,354,295

Opinion of Probable Construction Cost (OPCC) based on AACE Class 4/3 Estimate for Feasibility Study/Budgeting Purposes with a project definition level of 15 -30% based on the Preliminary Engineering Report (PER) developed in the Initial Design Phase.

TABLE 1: Summary of AACE International Cost Classifications and Expected Ranges of Accuracy

AACE Class	ANSI Classification	Typical Use	Project Definition	Expected Range of Accuracy: Low Expected Actual Cost	Expected Range of Accuracy: High Expected Actual Cost	Other Terms
Class 5	Order-of-Magnitude	Strategic Planning; Concept Screening	0% to 2%	-50% to -20%	+30% to +100%	ROM; Ballpark; Blue Sky; Ratio
Class 4		Feasibility Study	1% to 15%	-30% to -15%	+20% to +50%	Feasibility; Top-down; Screening; Pre-design
Class 3	Budgetary	Budgeting	10% to 40%	-20% to -10%	+10% to +30%	Budget; Basic Engineering Phase; Semi-detailed
Class 2	Definitive	Bidding; Project Controls; Change Management	30% to 75%	-15% to -5%	+5% to +20%	Engineering; Bid; Detailed Control; Forced Detail
Class 1		Bidding; Project Controls; Change Management	65% to 100%	-10% to -3%	+3% to +15%	Bottoms Up; Full Detail; Firm Price



Construction Cost Estimate Accuracy Ranges

14 CONSTRUCTION APPROACH AND SEQUENCE OF CONSTRUCTION

The construction approach and sequence follow a similar strategy as the design characteristics of the planned upgrades; which is to minimize impacts to the surrounding community while building a robust and resilient project. This includes MOT planning, site boundaries, and the general construction sequence.

The primary focus *at* the onset of the construction phase will be to establish a safe and effective work area. This includes protecting the construction workforce, City inspectors and staff, as well as the general public. An MOT plan will be submitted and modified as required to get approval and will incorporate several key items. These items include approach signage, as well as traffic barricades to be placed on the median around the work area. A fence screening system is envisioned as well to help shield the project site and help prevent windborne debris. This barricade and screening system may also incorporate traffic lighting, as the existing light pole which is currently south of the existing pump station, may need to be temporarily removed to allow for construction activities. It is also likely that the cross street at Mason Ave. in the Bayshore median will be incorporated into the construction site and become part of the barricaded area to provide adequate construction access.

The construction sequence, further outlined within the “preliminary” construction phase schedule within section 15, is based on the following key approaches:

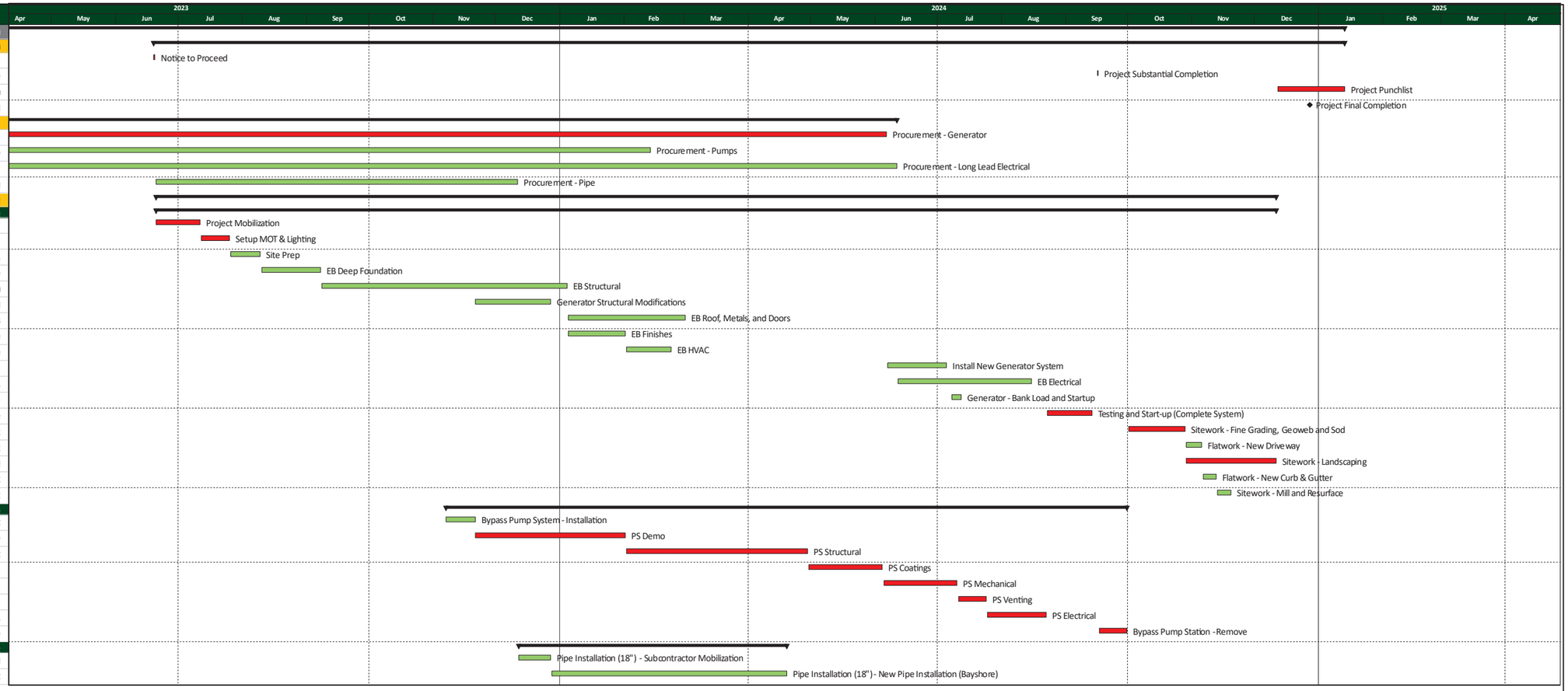
1. Utilize early procurement of long lead equipment to mitigate schedule impacts – The electrical gear, pumps, and generator are all currently projected to have longer than typical lead times due to market volatility and supply chain issues. It is planned that these items will be ordered following the design completion and before the final Guaranteed Maximum Price (GMP) has been approved to help mitigate any schedule impacts during construction.

2. Minimize the Bypass Pumping Duration – In order to mitigate the risks and cost impacts associated with bypass pumping, the planned construction sequence begins first with the electrical building improvements. The new electrical building will not require bypass pumping during construction of that scope. The pump station work will begin later which will be planned in a manner that aligns completion of the pump station with completion of the electrical building.

3. Coordination with City events (Gasparilla) – Given the location of the pump station upgrades, it is anticipated that construction work will overlap with several high-profile community events and parades. Construction work will be coordinated with City needs before, during, and after these events to allow for City access or reduced construction traffic when access may be limited.

15 UPDATED PROJECT SCHEDULE

Activity ID	Activity Name	Planned Duration	Start	Finish
Bayshore Pumping Station Rehabilitation Design Build		446	31-Mar-23	13-Jan
Milestones		395	19-Jun-23	13-Jan
MILE.100	Notice to Proceed	1	19-Jun-23	19-Ju
MILE.120	Project Substantial Completion	1	16-Sep-24	16-Se
MILE.130	Project Punchlist	20	12-Dec-24	13-Jan
MILE.140	Project Final Completion	0		27-De
Procurement		300	31-Mar-23	11-Ju
PROCURE.	Procurement - Generator	300	31-Mar-23	06-Ju
PROCURE.	Procurement - Pumps	220	31-Mar-23	13-Fe
PROCURE.	Procurement - Long Lead Electrical	300	31-Mar-23	11-Ju
PROCURE.	Procurement - Pipe	120	20-Jun-23	11-De
Construction		371	20-Jun-23	11-De
Electrical Building Systems		371	20-Jun-23	11-De
EB1000	Project Mobilization	15	20-Jun-23	11-Ju
EB1010	Setup MOT & Lighting	10	12-Jul-23	25-Ju
EB1020	Site Prep	10	26-Jul-23	09-Au
EB1030	EB Deep Foundation	20	10-Aug-23	07-Se
EB1040	EB Structural	80	08-Sep-23	04-Jan
EB1050	Generator Structural Modifications	25	21-Nov-23	27-De
EB1060	EB Roof, Metals, and Doors	40	05-Jan-24	01-M
EB1070	EB Finishes	20	05-Jan-24	01-Fe
EB1080	EB HVAC	15	02-Feb-24	23-Fe
EB1090	Install New Generator System	20	07-Jun-24	05-Ju
EB1100	EB Electrical	45	12-Jun-24	15-Au
EB1110	Generator - Bank Load and Startup	5	08-Jul-24	12-Ju
EB1120	Testing and Start-up (Complete System)	15	23-Aug-24	13-Se
EB1130	Sitework - Fine Grading, Geoweb and Sod	20	01-Oct-24	28-Oc
EB1140	Flatwork - New Driveway	6	29-Oct-24	05-No
EB1150	Sitework - Landscaping	30	29-Oct-24	11-De
EB1160	Flatwork - New Curb & Gutter	5	06-Nov-24	12-No
EB1170	Sitework - Mill and Resurface	5	13-Nov-24	19-No
Pump Station		225	07-Nov-23	30-Se
PS1000	Bypass Pump System - Installation	10	07-Nov-23	21-No
PS1010	PS Demo	50	21-Nov-23	01-Fe
PS1020	PS Structural	60	02-Feb-24	29-Ap
PS1030	PS Coatings	25	30-Apr-24	04-Ju
PS1040	PS Mechanical	25	05-Jun-24	10-Ju
PS1050	PS Venting	10	11-Jul-24	24-Ju
PS1060	PS Electrical	20	25-Jul-24	22-Au
PS1070	Bypass Pump Station - Remove	10	17-Sep-24	30-Se
18" Forcemain		90	12-Dec-23	19-Ap
PIPE.100	Pipe Installation (18") - Subcontractor Mobilization	10	12-Dec-23	27-De
PIPE.110	Pipe Installation (18") - New Pipe Installation (Bayshc	80	28-Dec-23	19-Ap



PCL Construction

Bayshore Pumping Station Rehabilitation Design Build

Data Date: 31-Mar-23
Print Date: 31-Mar-22

Actual Work
Remaining Work
Critical Remaining Work
Remaining Level of Effort
Actual Level of Effort
Milestone

PUMP STATION CAPACITY

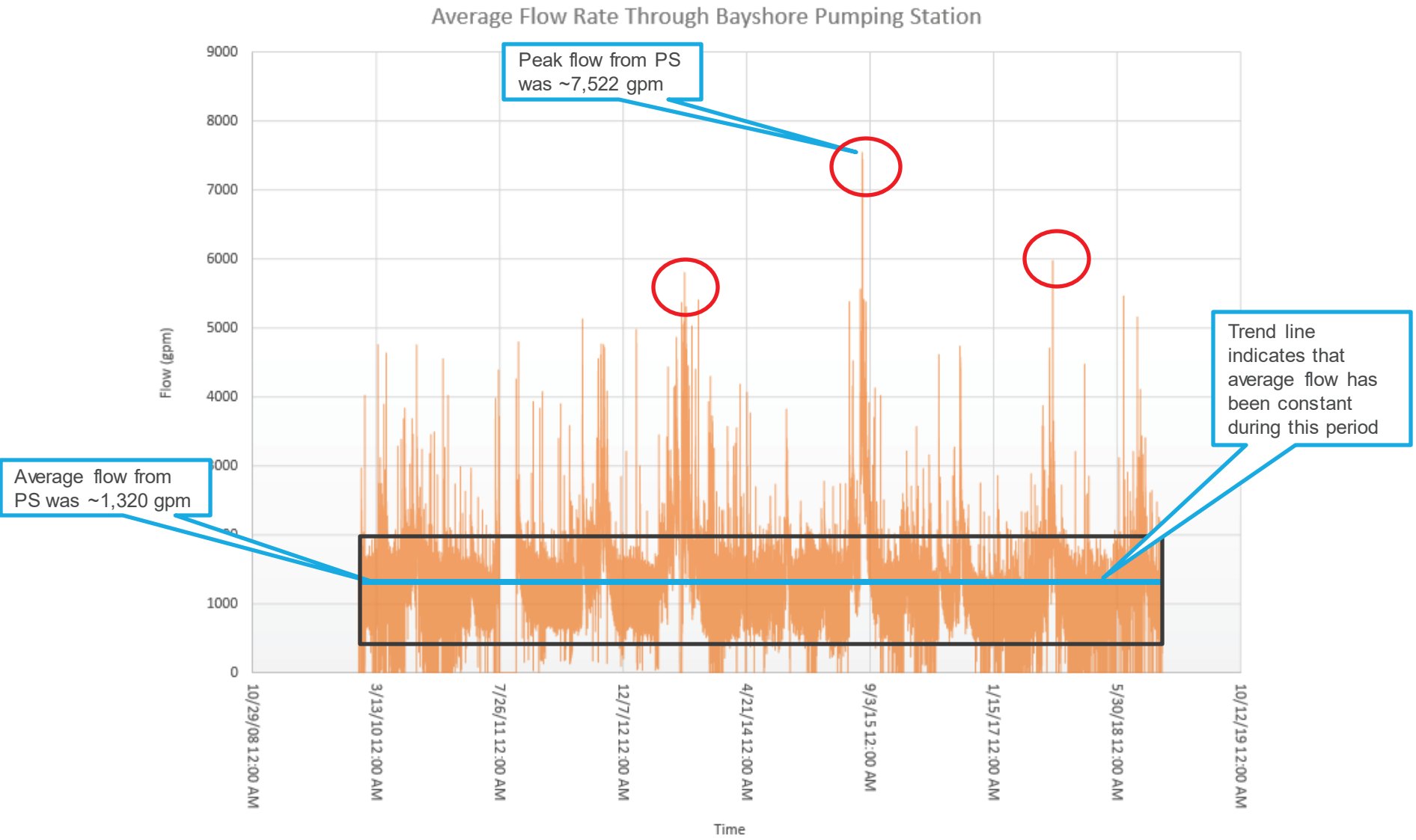
Appendix A

Flow Data Review

Approach – Data Review

- Review of the Bayshore Pumping Station (PS) historical SCADA flow data from January 2010 to February 2021 provided by The City of Tampa (COT).
- Review of previous reports/studies provided by COT.
- Average flow from the Bayshore PS was calculated from January 2010 to November 2018.
  - Data from Dec. 2018 to Feb. 2021 excluded (flow meter out of service since Dec 17, 2018).

Historical Data



Historical Data – Change Over Time

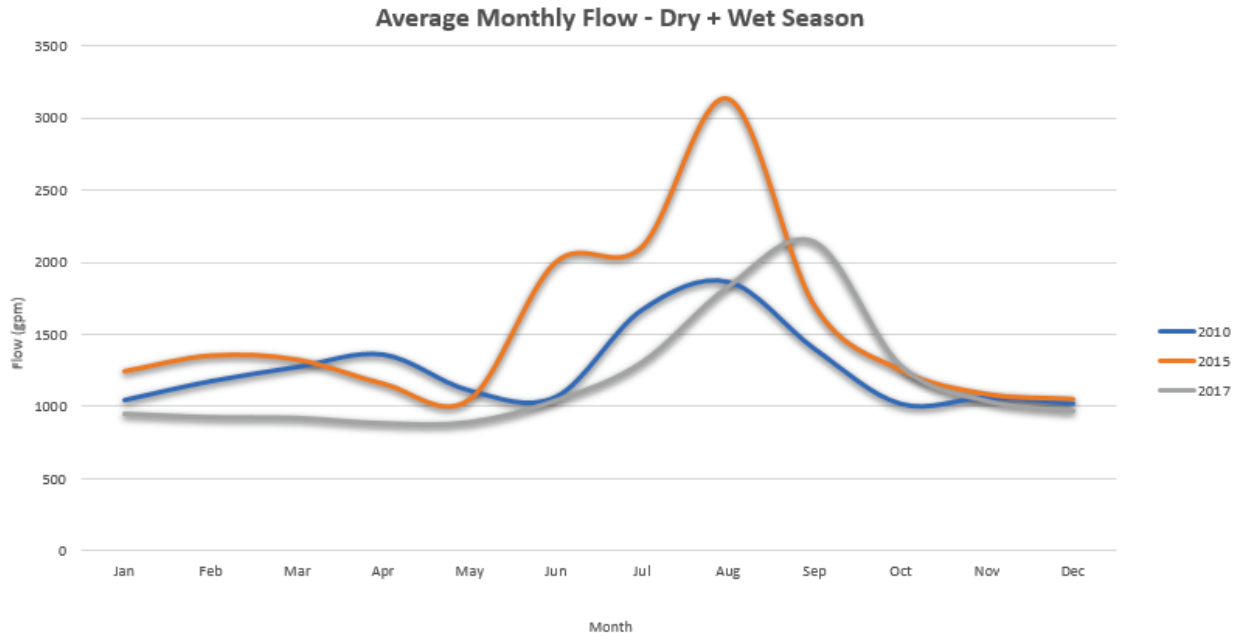
2010	
Month	Avg Flow (gpm)
Jan	1044
Feb	1175
Mar	1273
Apr	1359
May	1110
Jun	1066
Jul	1668
Aug	1862
Sep	1399
Oct	1018
Nov	1060
Dec	1021
Annual Avg.	1254

2015	
Month	Avg Flow (gpm)
Jan	1246
Feb	1354
Mar	1327
Apr	1159
May	1049
Jun	2002
Jul	2108
Aug	3135
Sep	1701
Oct	1254
Nov	1088
Dec	1053
Annual Avg.	1540

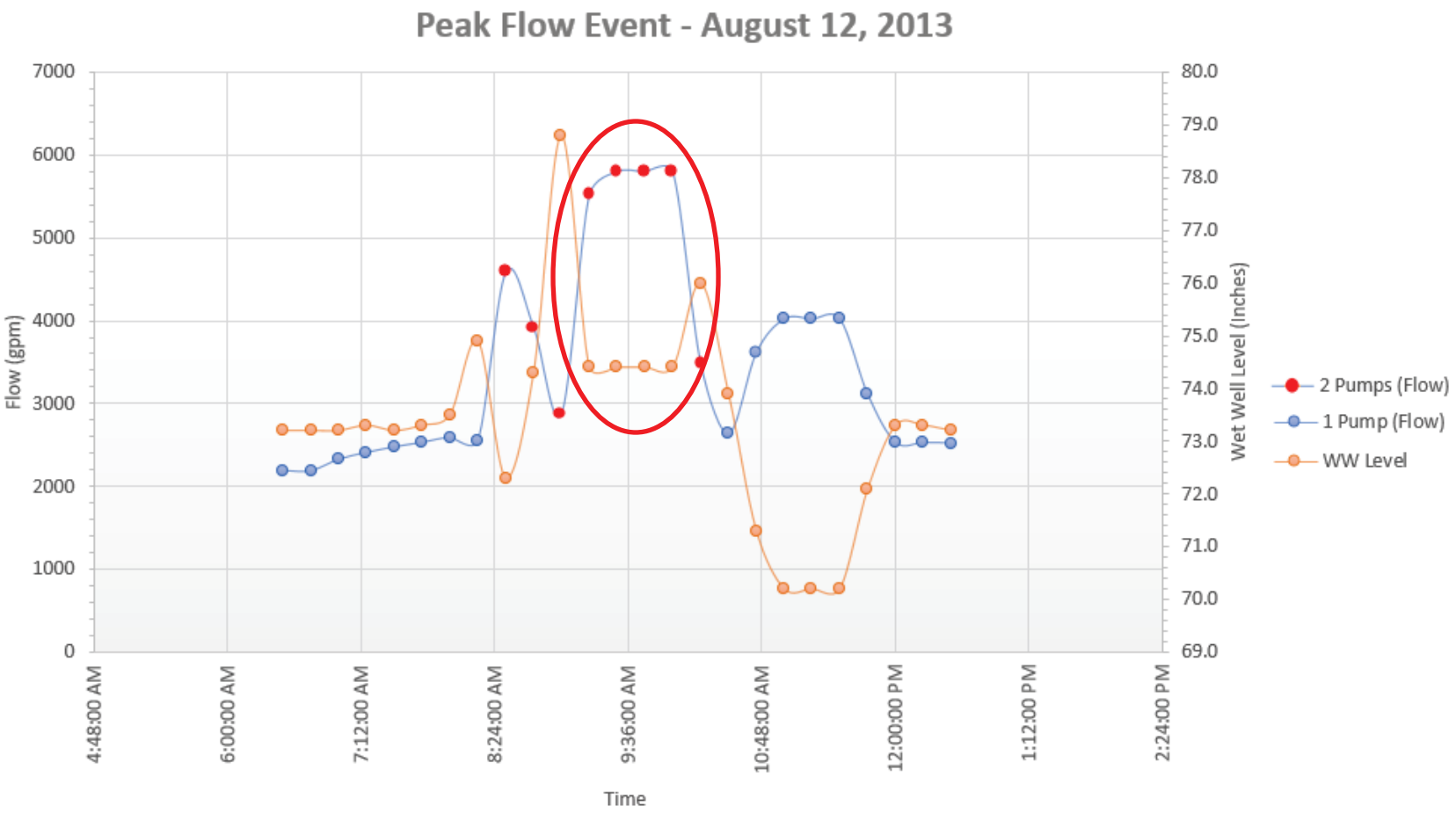
2017	
Month	Avg Flow (gpm)
Jan	944
Feb	921
Mar	915
Apr	878
May	886
Jun	1037
Jul	1302
Aug	1831
Sep	2144
Oct	1281
Nov	1034
Dec	964
Annual Avg.	1178

2010 compared to 2015: + 25%

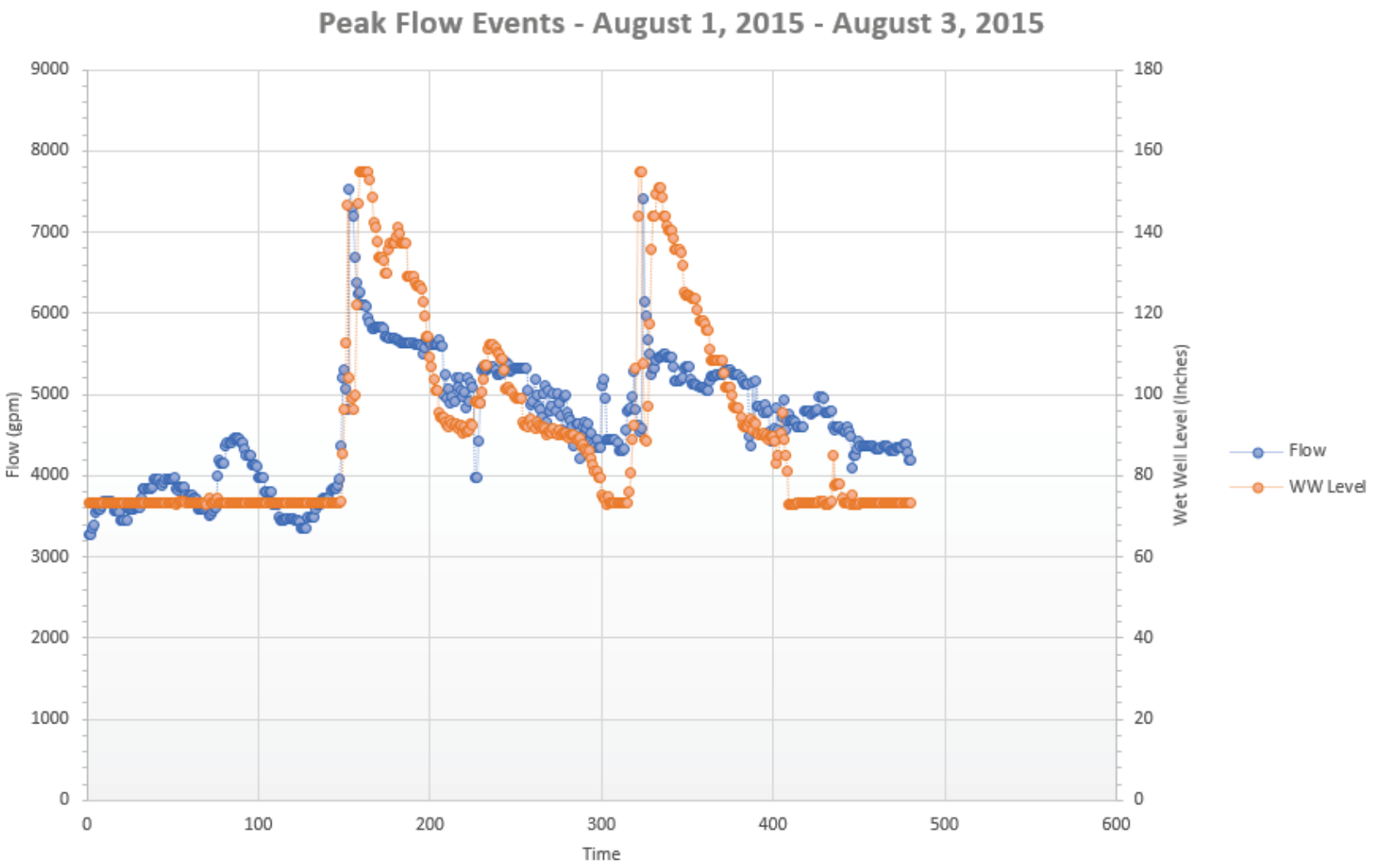
2015 compared to 2017: - 25%



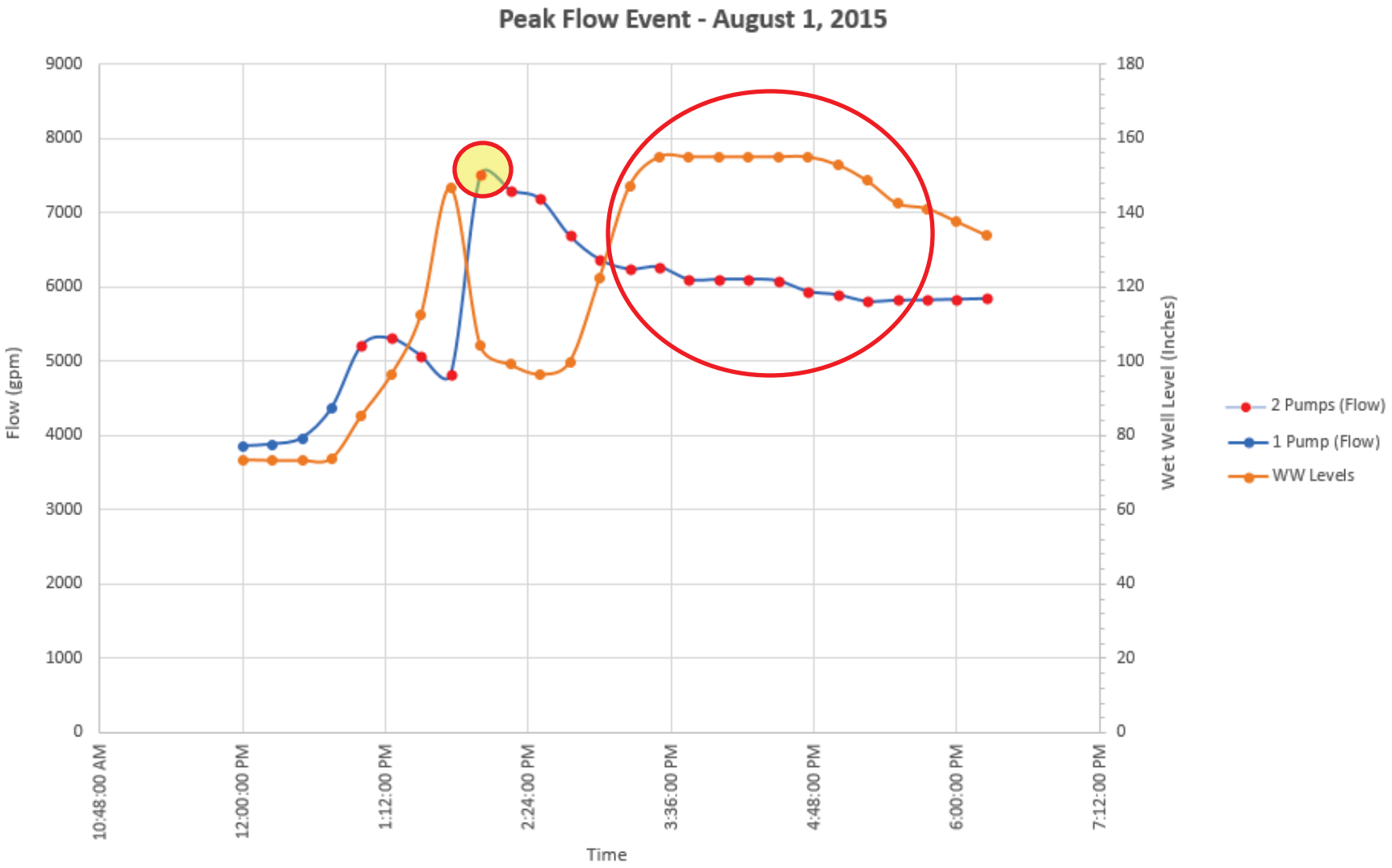
Peak Flow Event 1



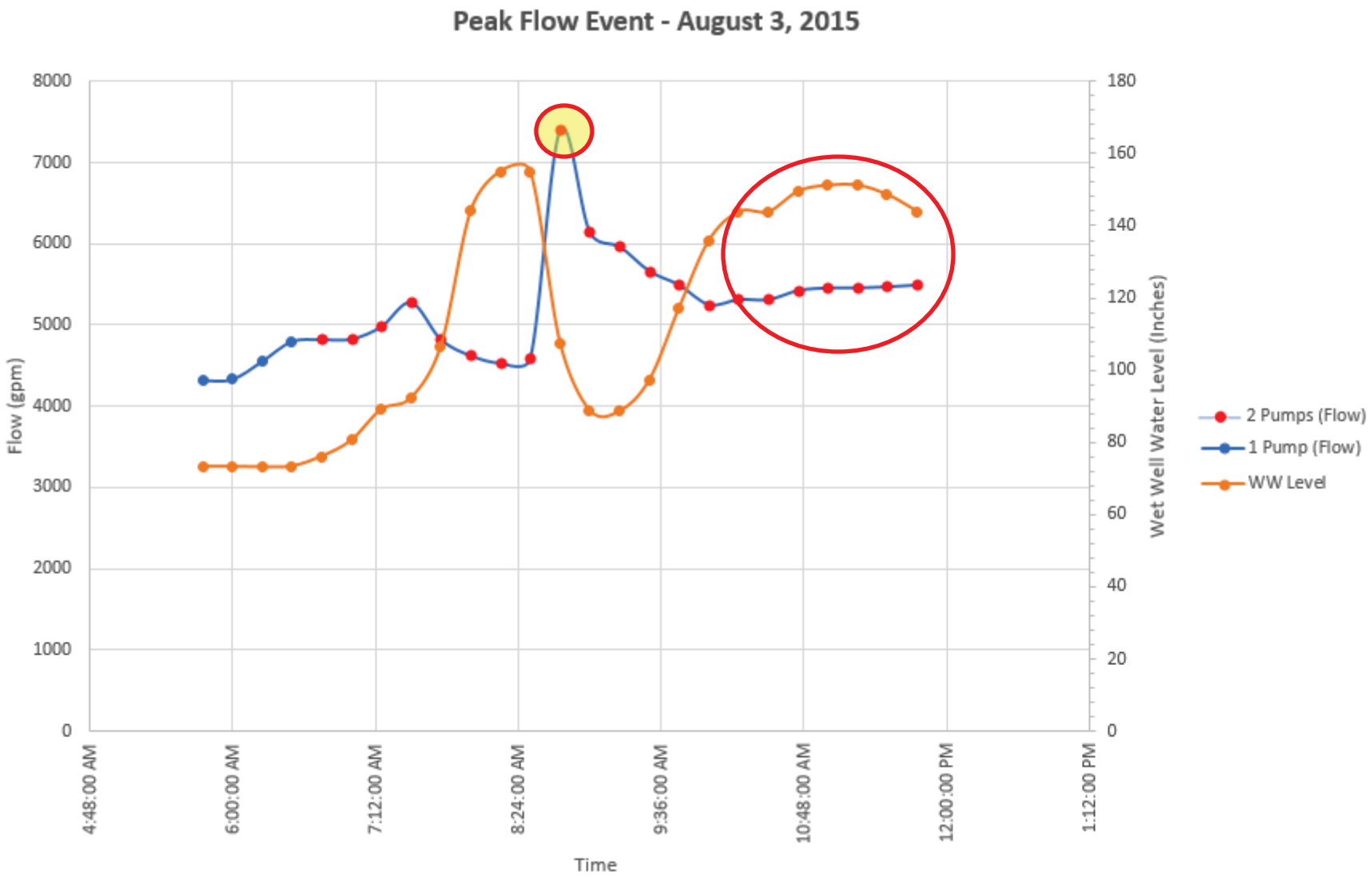
Peak Flow Event(s) 2



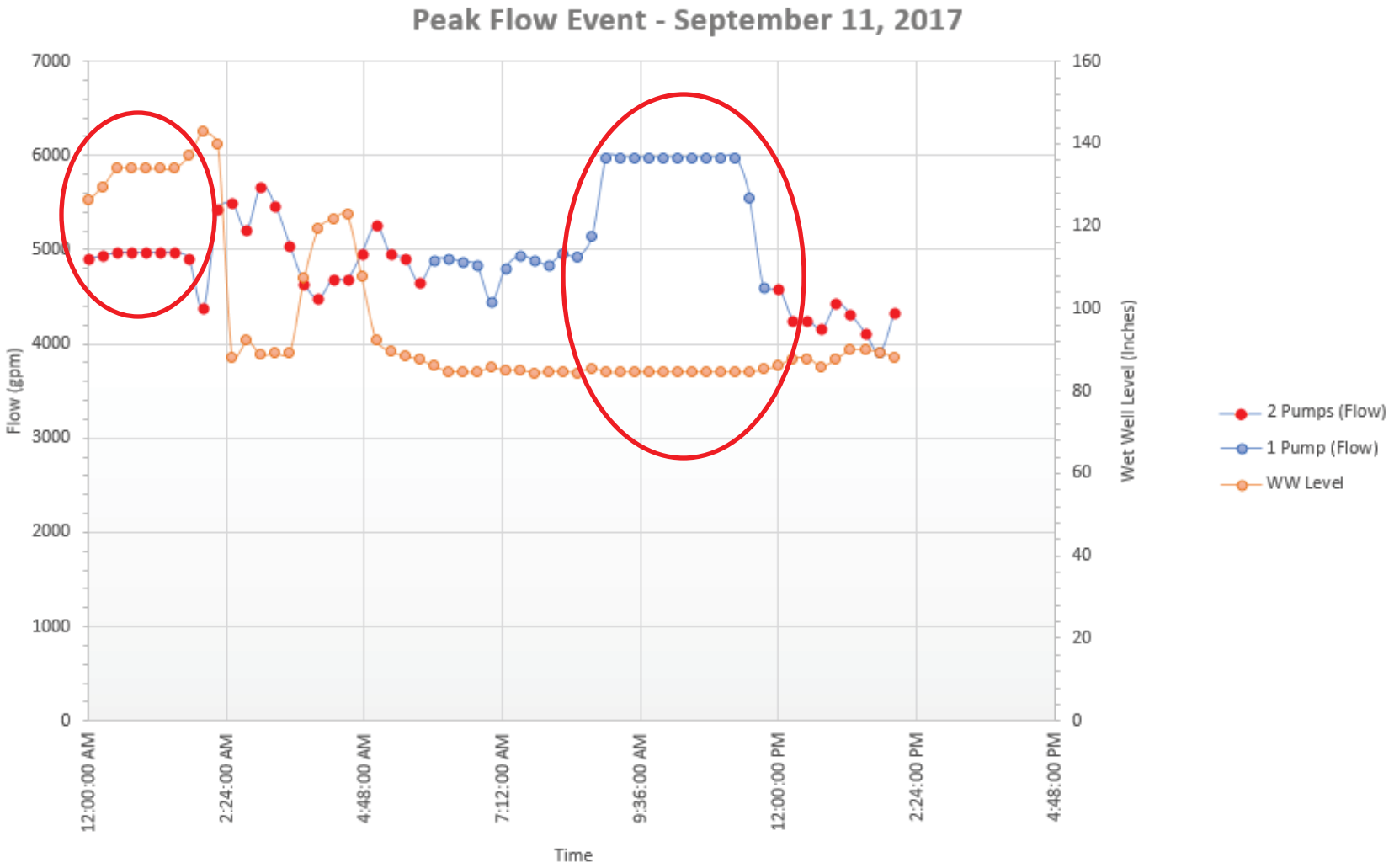
Peak Flow Event 2A – Aug. 1, 2015



Peak Flow Event 2B – Aug. 3, 2015



Peak Flow Event 3



VENDOR INFORMATION

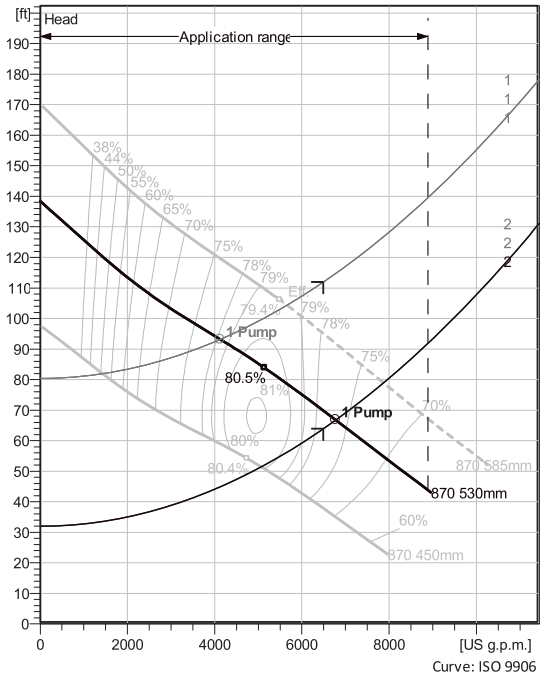
Appendix B

NP 3312/746 3~ 870

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

Technical specification

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



Configuration

Motor number
N0746.000 43-44-8ID-W 185hp

Installation type
P - Semi permanent, Wet

Impeller diameter
530 mm

Discharge diameter
12 inch

Pump information

Impeller diameter
530 mm

Discharge diameter
12 inch

Inlet diameter
350 mm

Maximum operating speed
880 rpm

Number of blades
3

Max. fluid temperature
40 °C

Materials

Impeller
Hard-Iron ™

Project		**Created by**	STEPHEN DENNIS
Block		**Created on**	2/16/2022 **Last update** 2/16/2022

NP 3312/746 3~ 870

Technical specification

Motor - General

Motor number N0746.000 43-44-8ID-W 185hp	**Phases** 3~	**Rated speed** 880 rpm	**Rated power** 185 hp
ATEX approved FM	**Number of poles** 8	**Rated current** 225 A	**Stator variant** 1
Frequency 60 Hz	**Rated voltage** 480 V	**Insulation class** H	**Type of Duty**
Version code 000			

Motor - Technical

Power factor - 1/1 Load 0.78	**Motor efficiency - 1/1 Load** 94.2 %	**Total moment of inertia** 97.2 lb ft²	**Starts per hour max.** 0
Power factor - 3/4 Load 0.74	**Motor efficiency - 3/4 Load** 94.8 %	**Starting current, direct starting** 1040 A	
Power factor - 1/2 Load 0.63	**Motor efficiency - 1/2 Load** 94.7 %	**Starting current, star-delta** 348 A	

Project	**Created by**	STEPHEN DENNIS	
Block	**Created on**	2/16/2022	**Last update** 2/16/2022

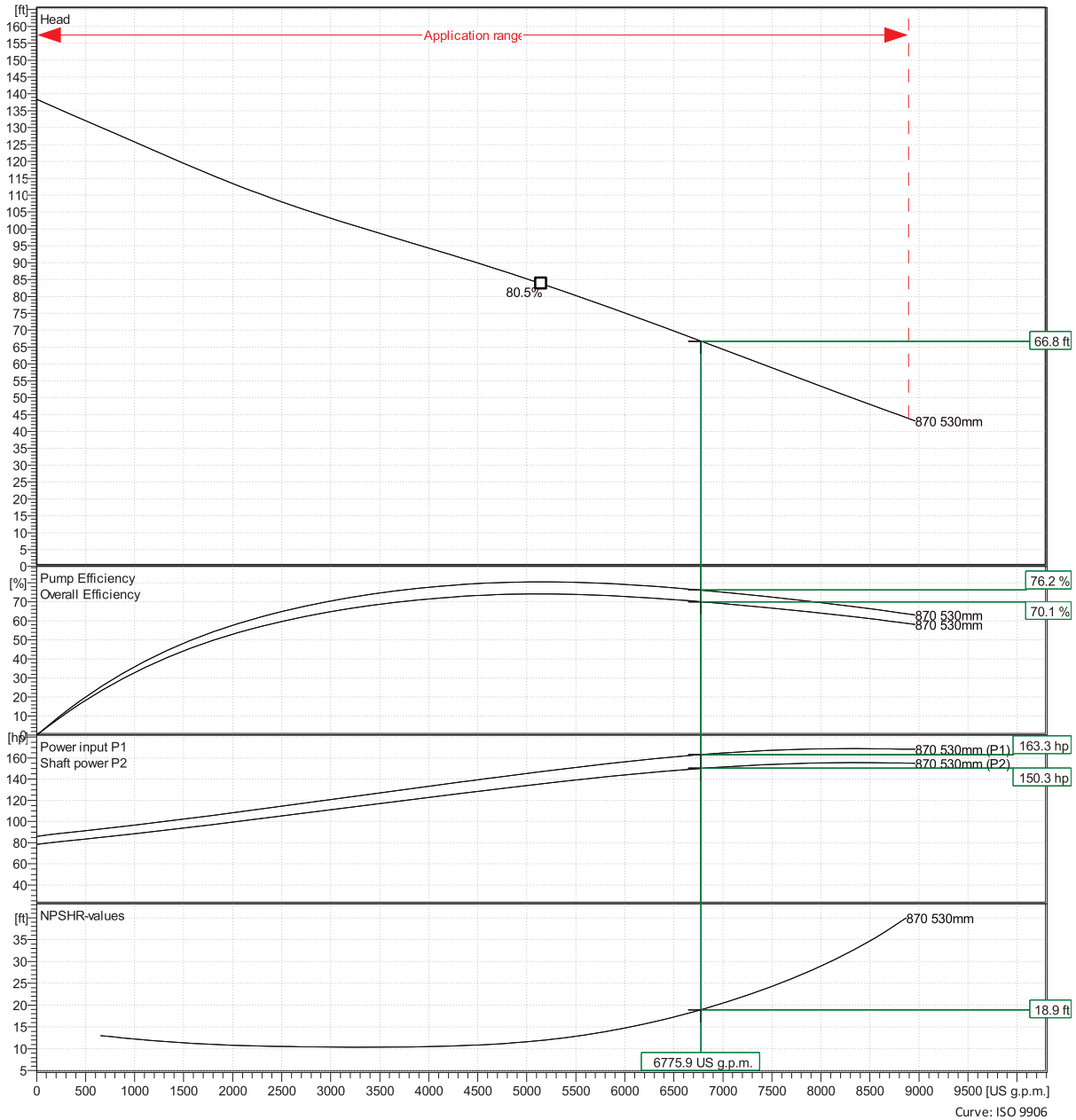
NP 3312/746 3~ 870

Performance curve

Duty point

Flow	Head
6780 US g.p.m.	66.8 ft

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



Curve: ISO 9906

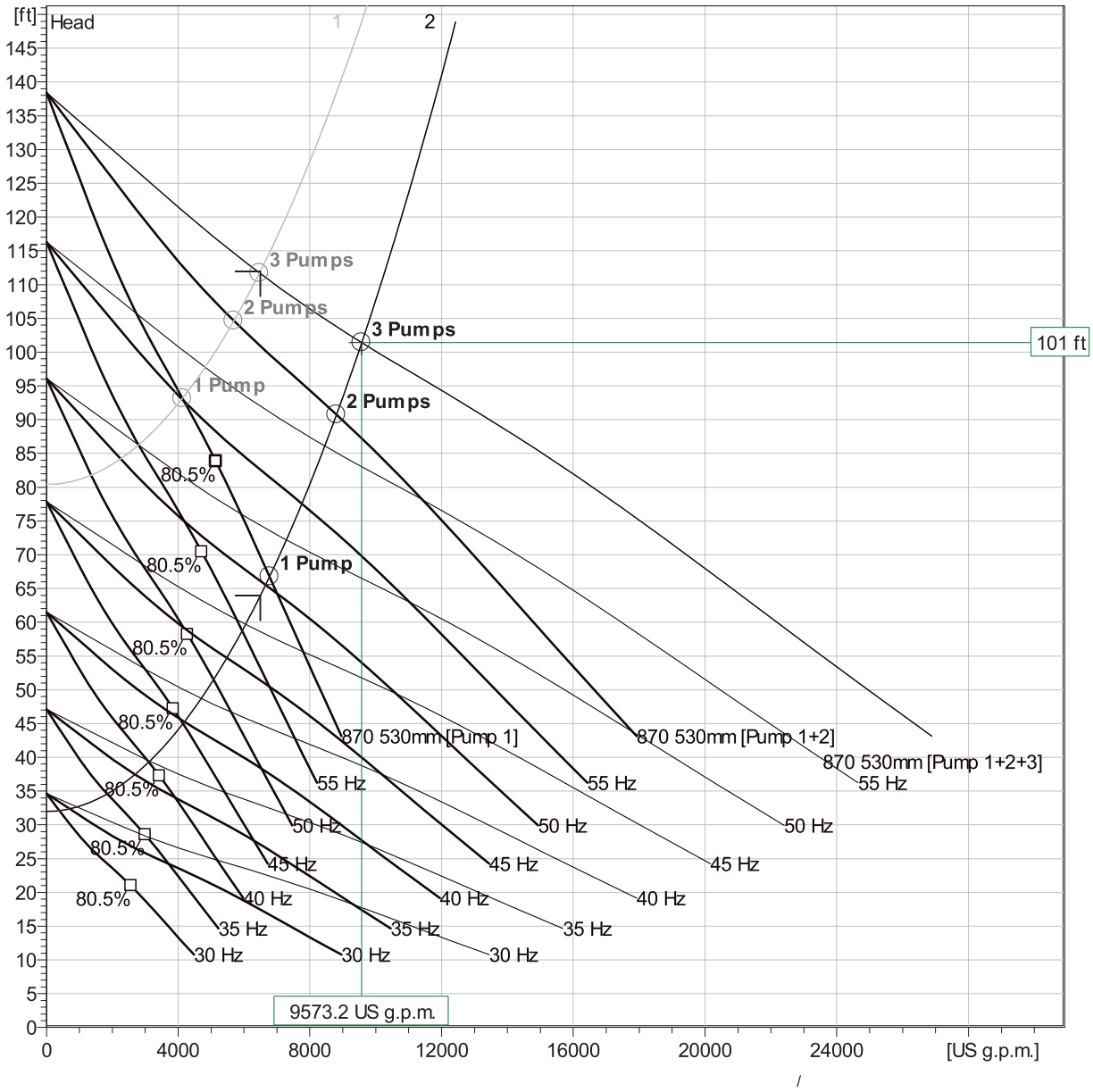
STEPHEN DENNIS

Created on 2/16/2022 **Last update** 2/16/2022

NP 3312/746 3~ 870

Duty Analysis

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



Operating characteristics

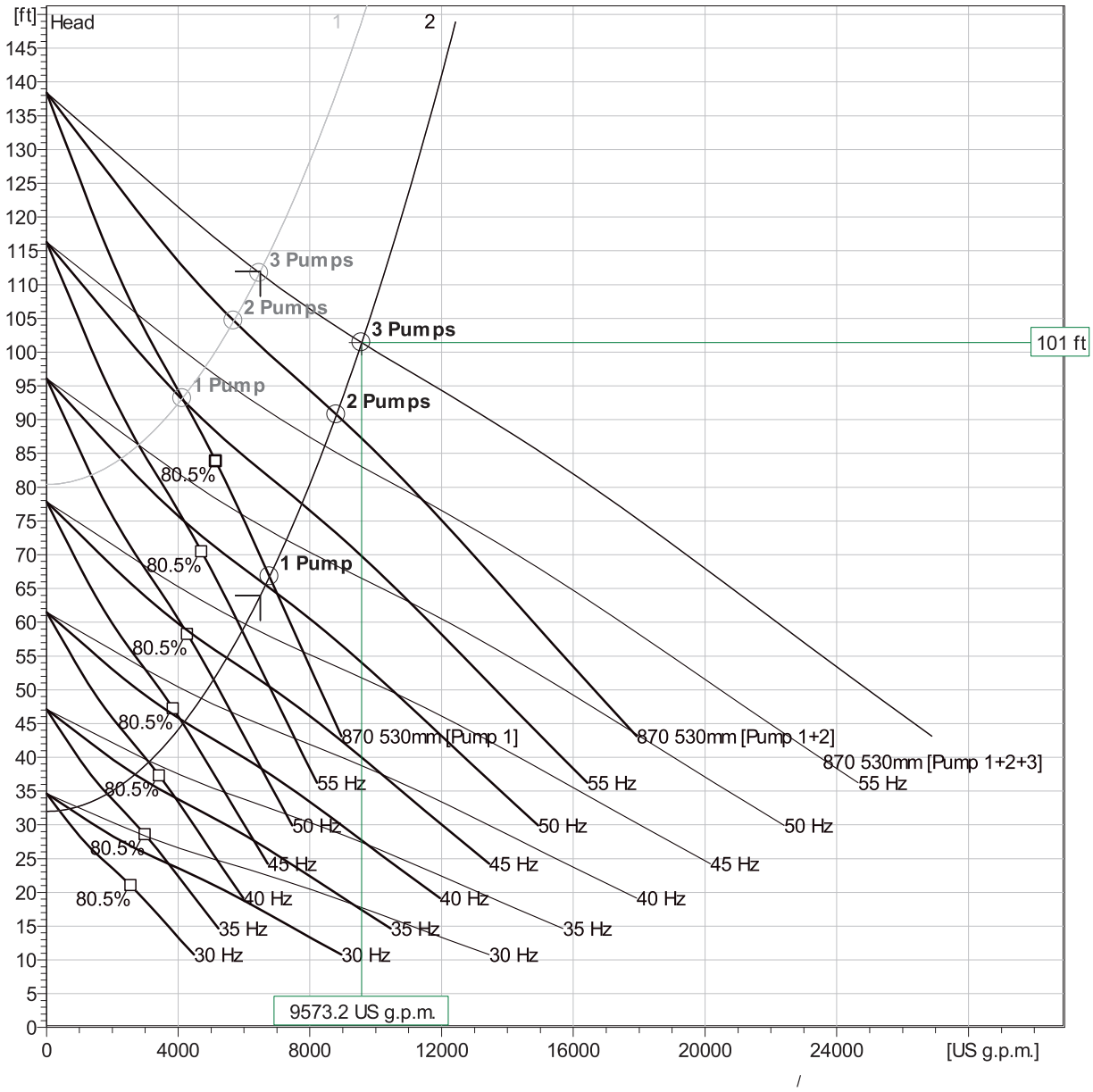
Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
3 / 2	3190	101	113	9570	101	340	72.2 %	480	10.4

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

Duty Analysis

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



Operating characteristics

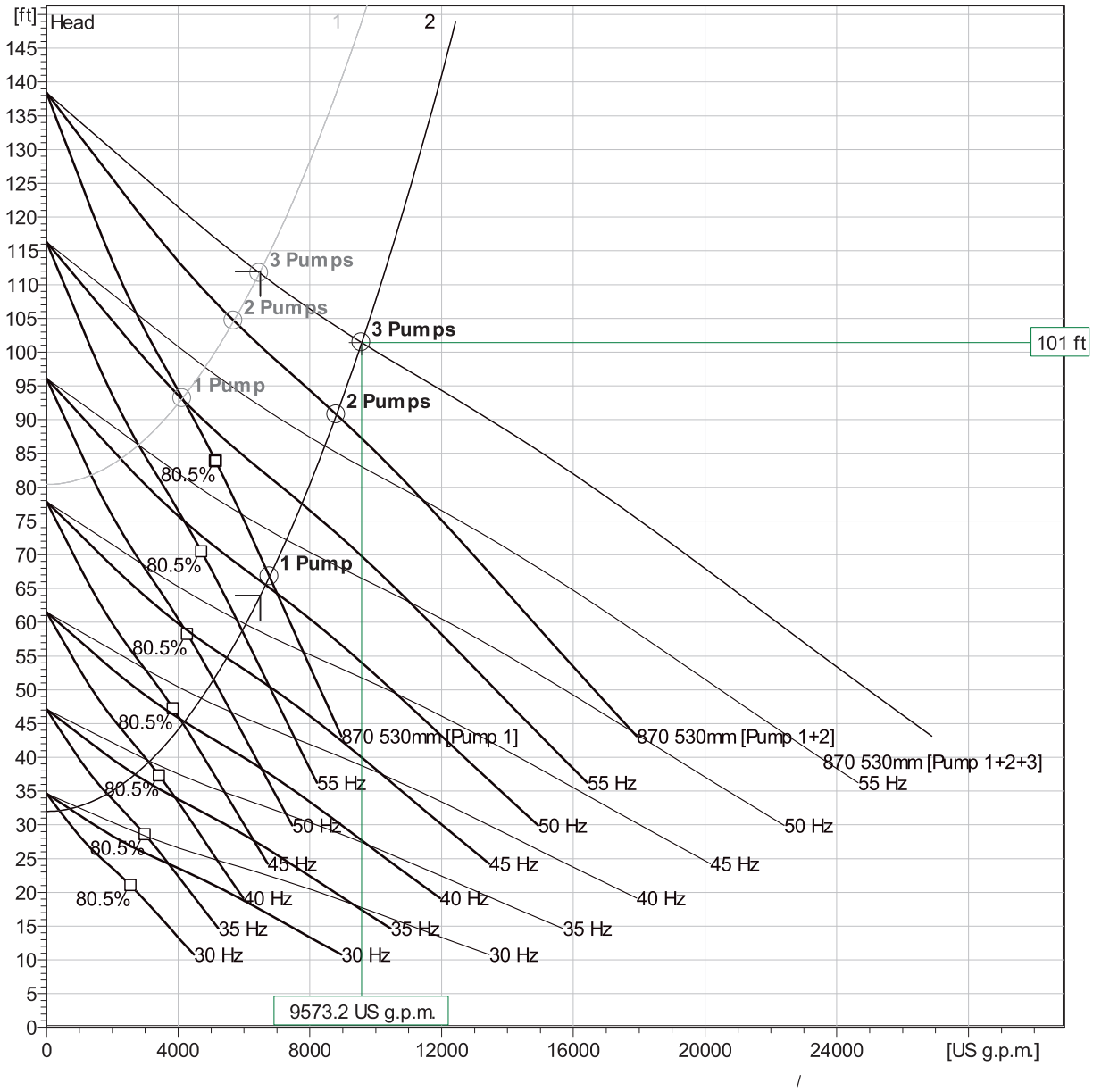
Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
2 / 2	4400	90.7	127	8810	90.7	255	79.3 %	390	10.8

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

Duty Analysis

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



Operating characteristics

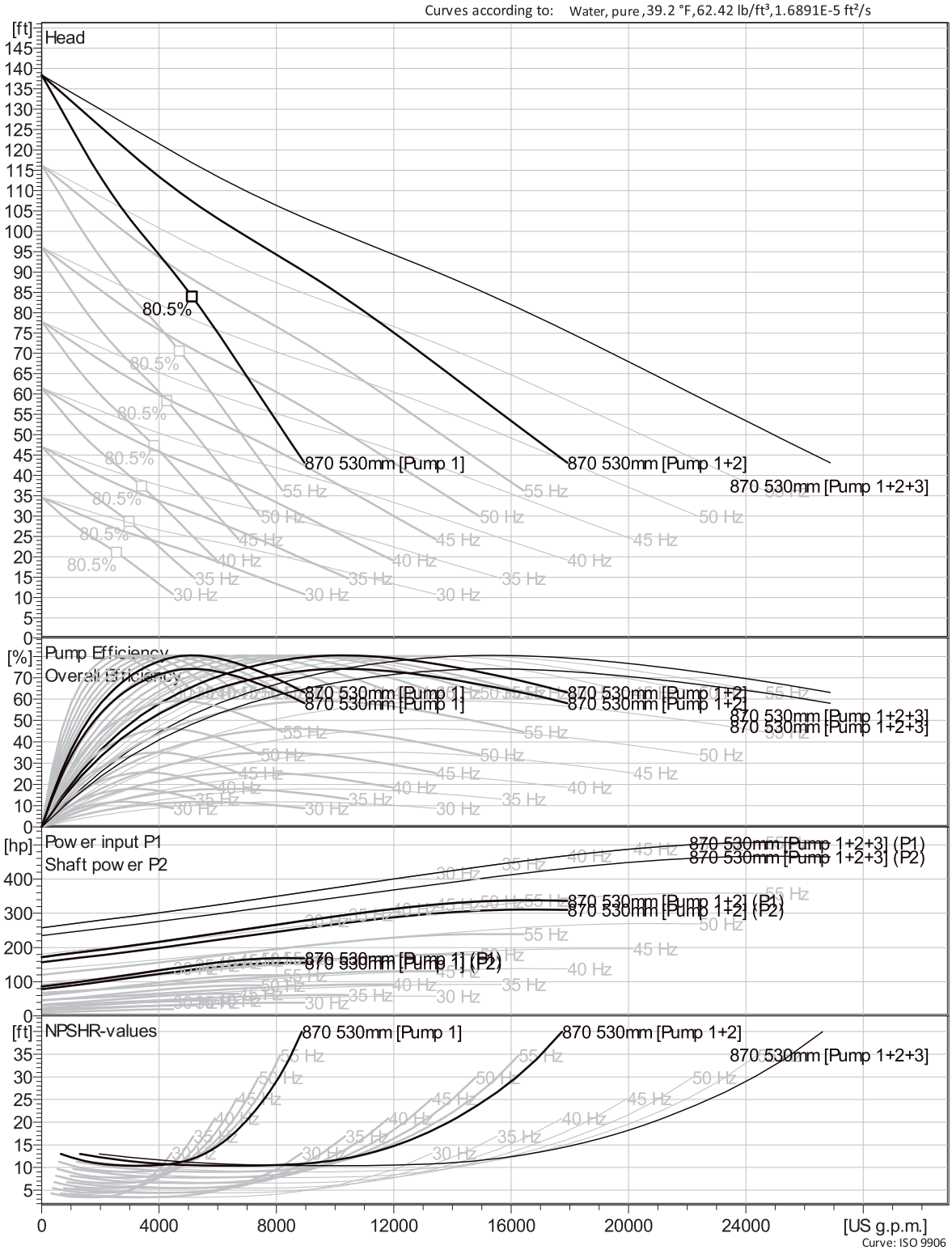
Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1 / 2	6780	66.8	150	6780	66.8	150	76.2 %	299	18.9

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

VFD Curve

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

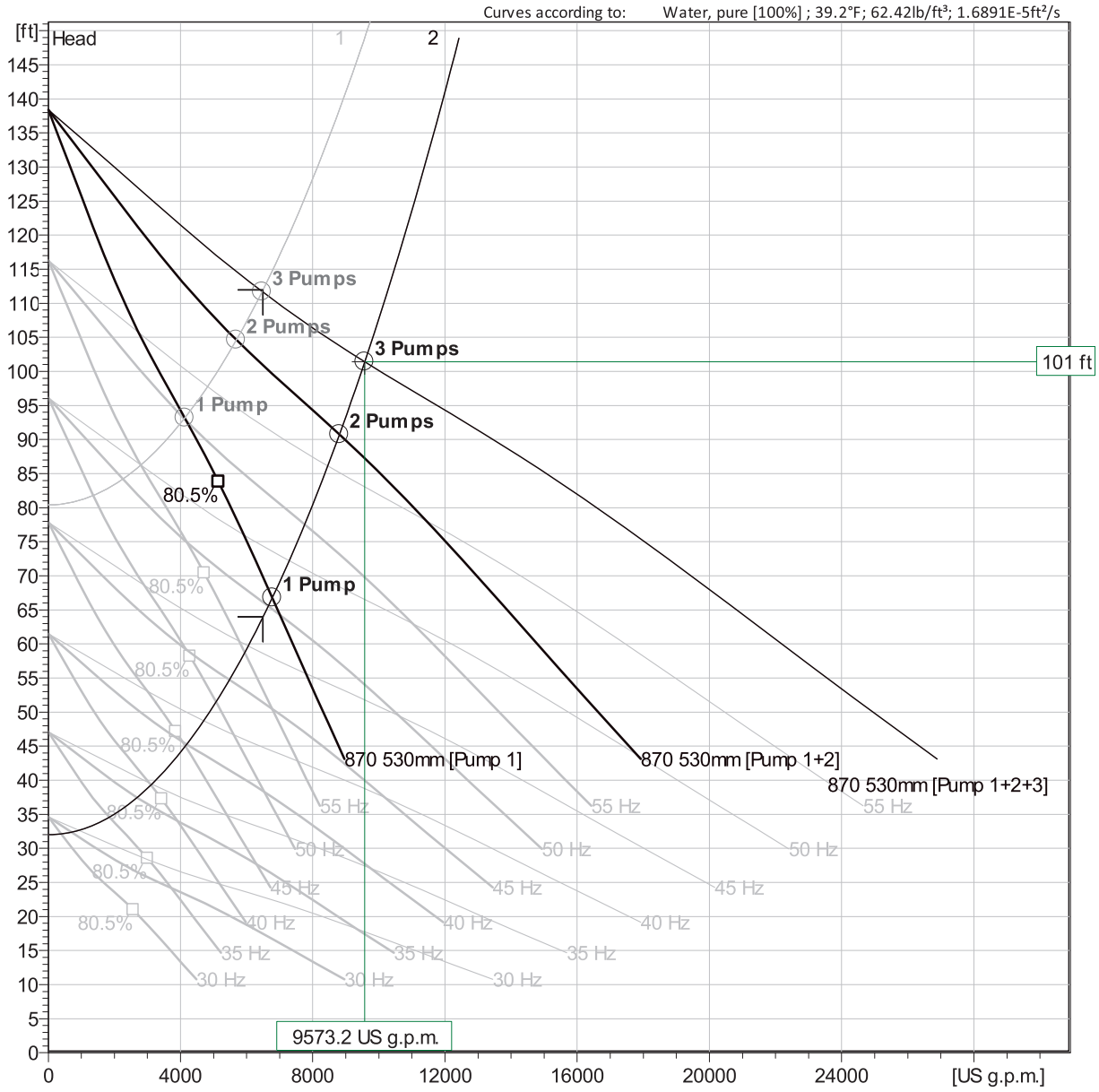


Curve: ISO 9906

Project	**Created by**	STEPHEN DENNIS	
Block	**Created on**	2/16/2022	**Last update** 2/16/2022

NP 3312/746 3~ 870

VFD Analysis



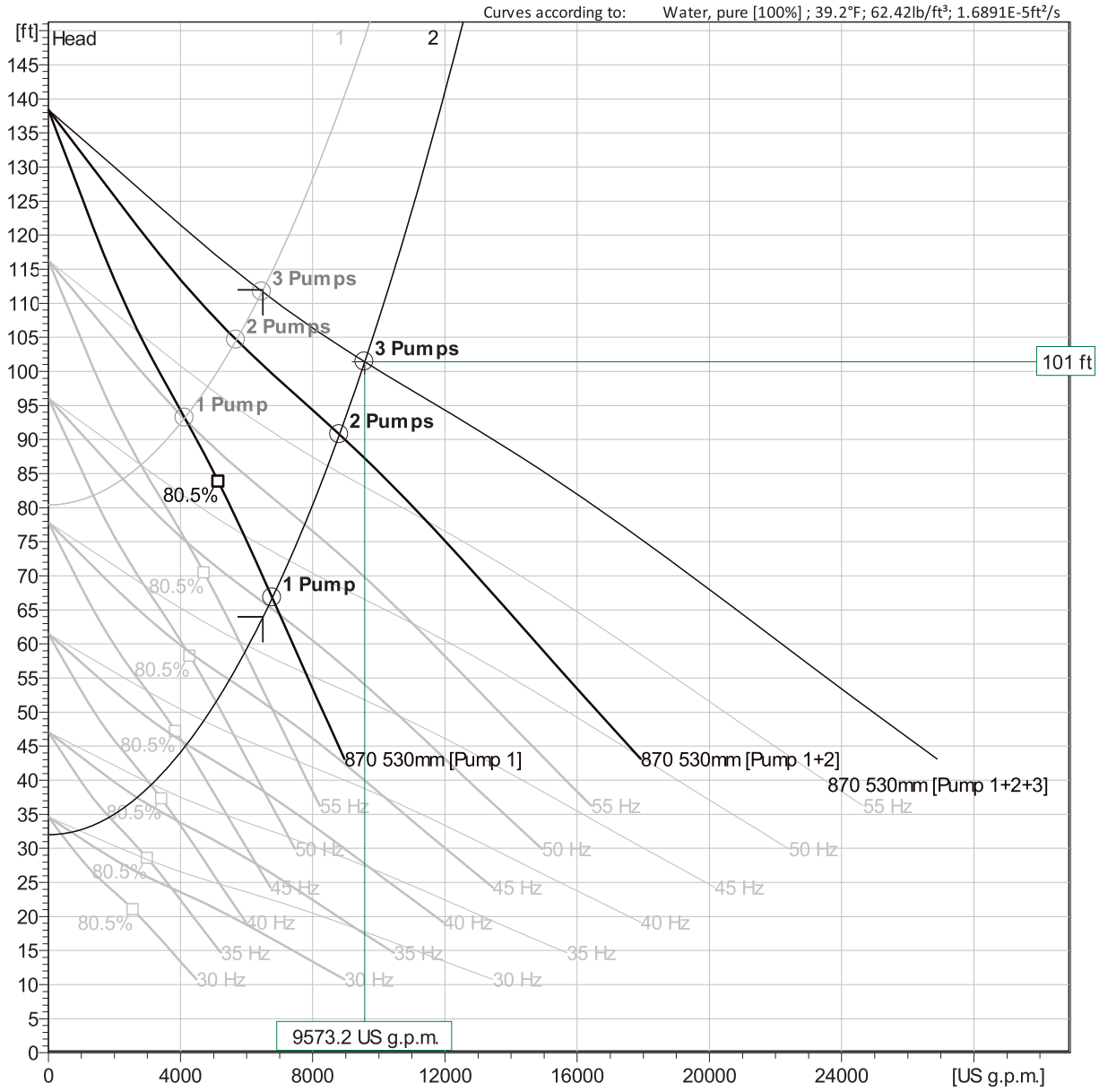
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
3 / 2	60 Hz	3190	101	113	9570	101	340	72.2 %	480	10.4
3 / 2	55 Hz	2820	86.1	86.2	8450	86.1	259	71.2 %	522	9.04
3 / 2	50 Hz	2430	72.2	63.7	7290	72.2	191	69.6 %	581	7.78
3 / 2	45 Hz	2020	59.7	45.3	6050	59.7	136	67.2 %	668	6.6

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

VFD Analysis



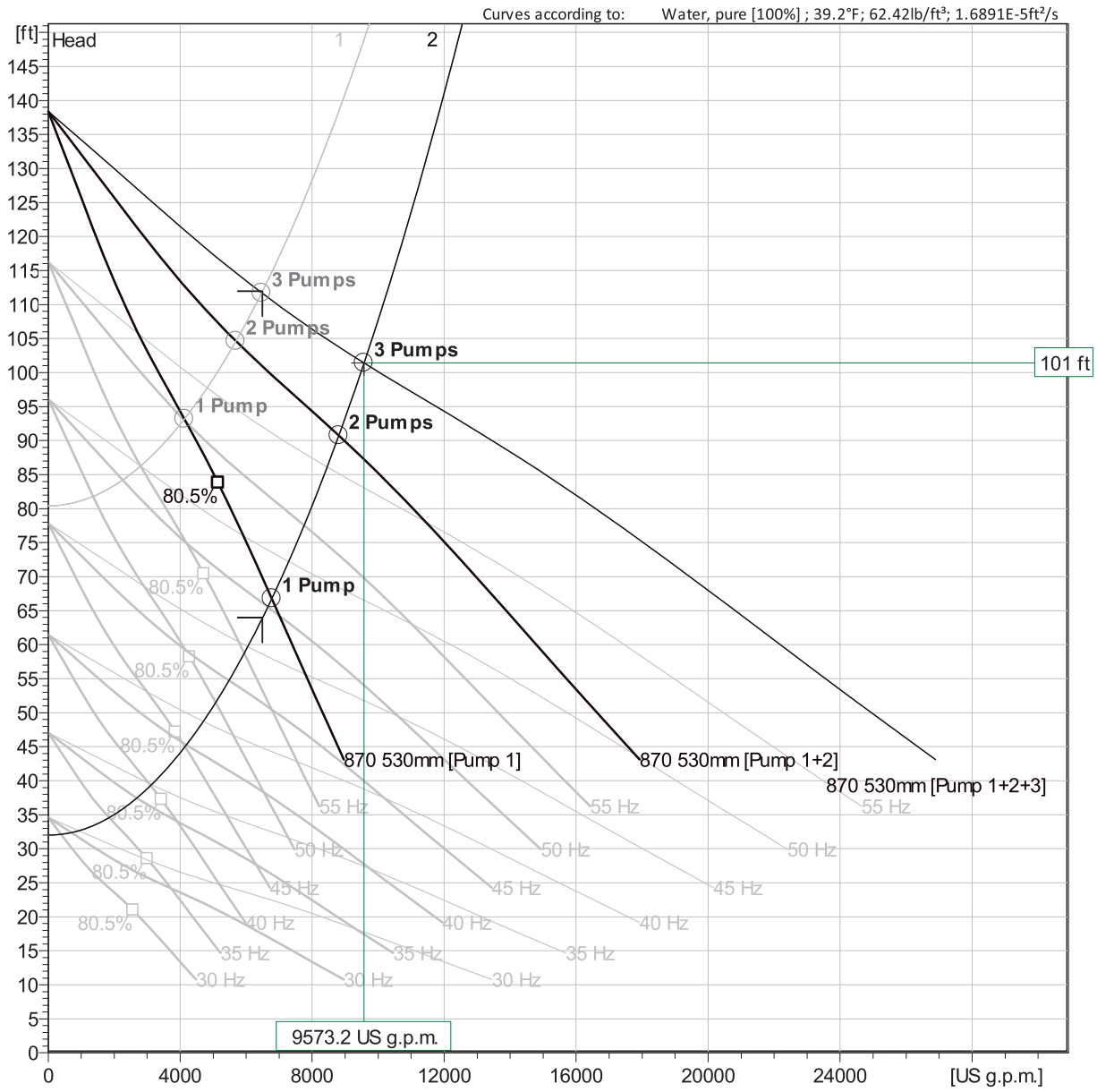
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
3 / 2	40 Hz	1570	48.7	30.6	4700	48.7	91.9	63 %	818	5.53
3 / 2	35 Hz	1040	39.4	19.3	3130	39.4	57.8	54.1 %	1160	4.65
3 / 2	30 Hz	309	32.7	10.6	927	32.7	31.8	24.1 %	3600	
2 / 2	60 Hz	4400	90.7	127	8810	90.7	255	79.3 %	390	10.8

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

VFD Analysis



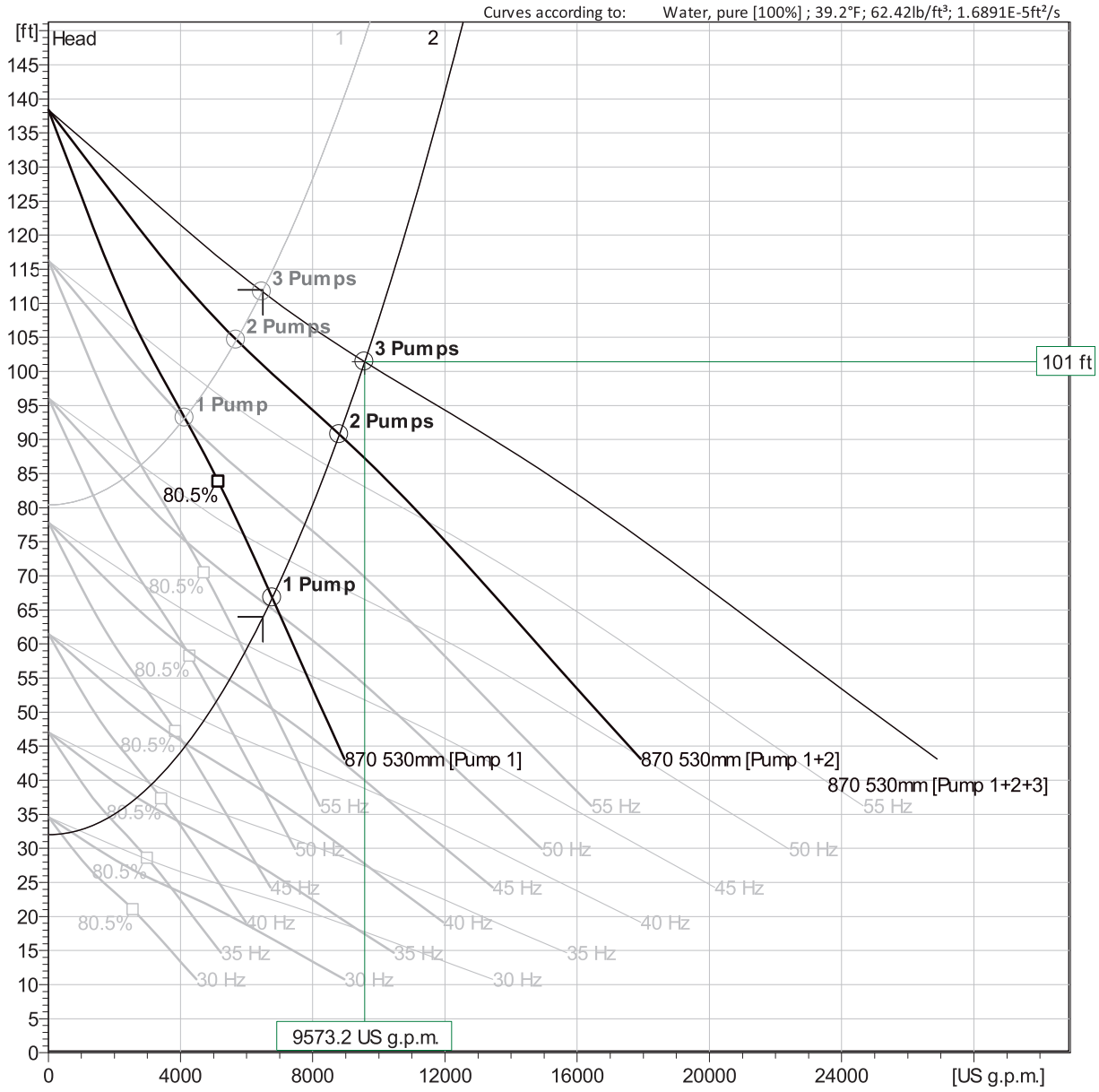
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
2 / 2	55 Hz	3880	77.6	96.6	7760	77.6	193	78.7 %	422	9.25
2 / 2	50 Hz	3330	65.5	71	6650	65.5	142	77.7 %	466	7.85
2 / 2	45 Hz	2740	54.7	50.1	5480	54.7	100	75.7 %	533	6.57
2 / 2	40 Hz	2090	45.3	33.4	4190	45.3	66.8	71.8 %	649	5.43

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

VFD Analysis



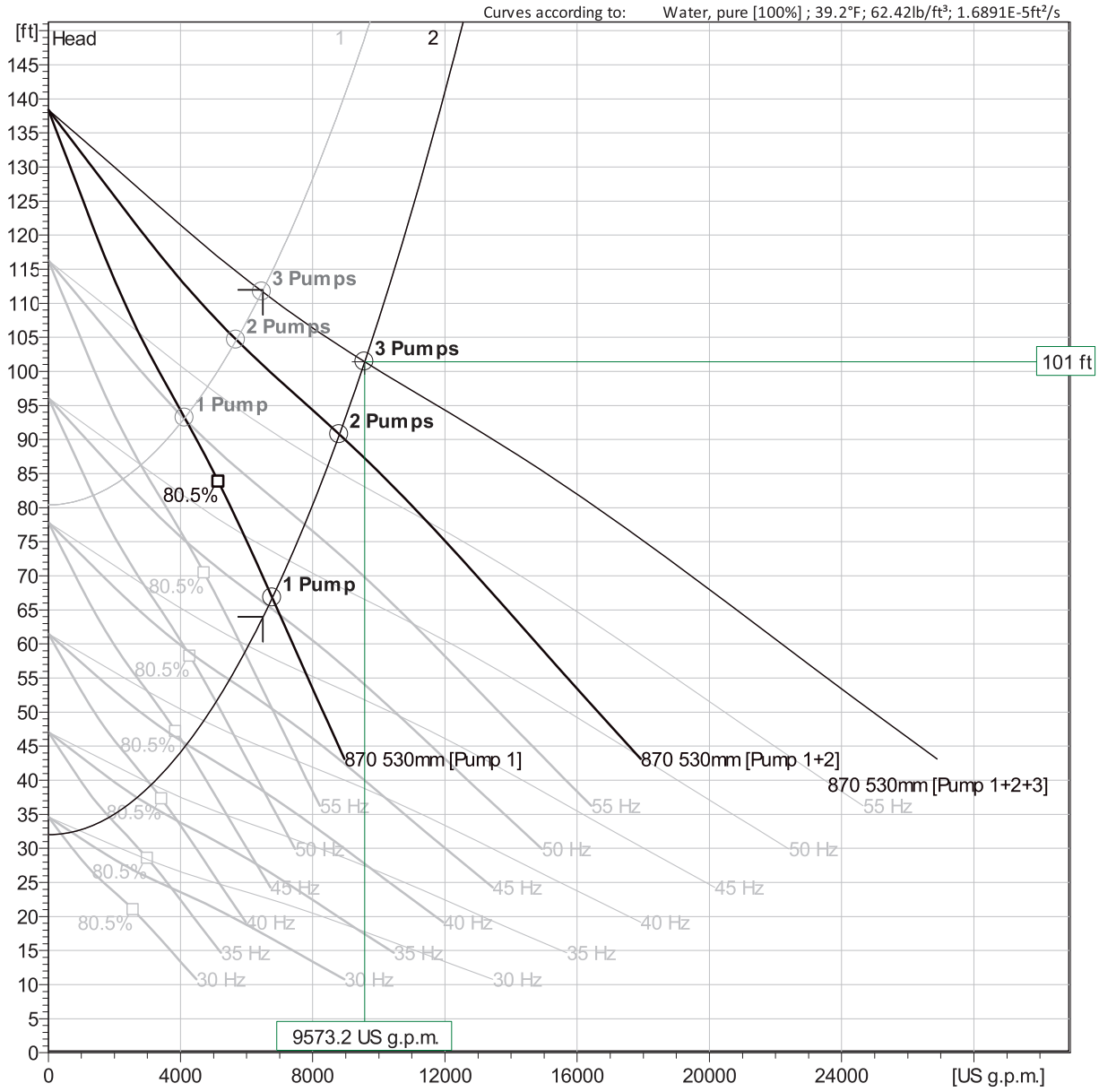
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
2 / 2	35 Hz	1340	37.5	20.4	2690	37.5	40.8	62.3 %	930	4.48
2 / 2	30 Hz	352	32.4	10.7	704	32.4	21.4	27 %	3170	4.25
1 / 2	60 Hz	6780	66.8	150	6780	66.8	150	76.2 %	299	18.9
1 / 2	55 Hz	5940	58.8	114	5940	58.8	114	77.4 %	326	15

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

VFD Analysis



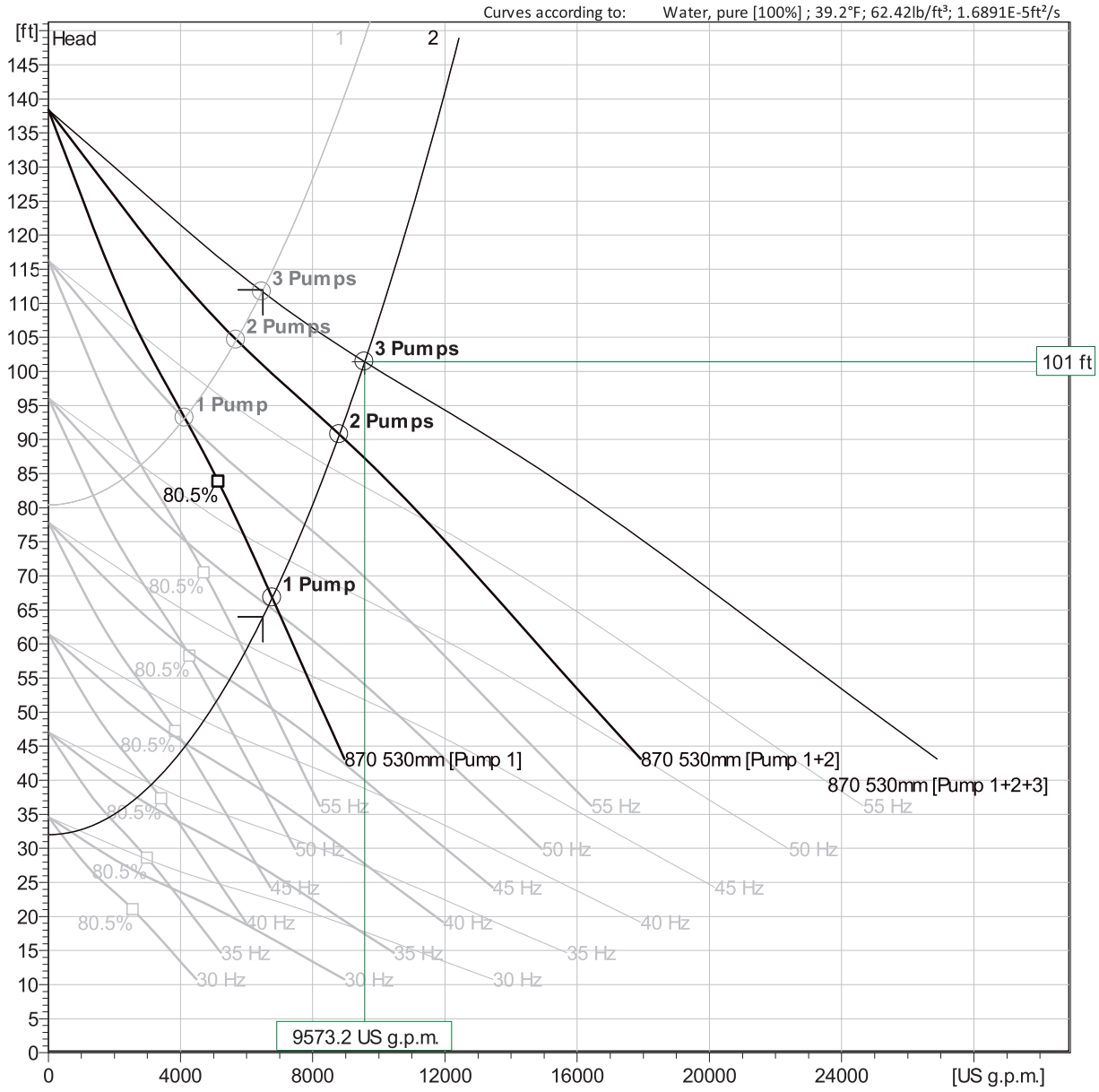
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1 / 2	50 Hz	5080	51.5	83.8	5080	51.5	83.8	78.9 %	358	11.3
1 / 2	45 Hz	4150	45	58.8	4150	45	58.8	80.2 %	405	8.18
1 / 2	40 Hz	3110	39.3	38.6	3110	39.3	38.6	80 %	488	5.78
1 / 2	35 Hz	1850	34.6	22.4	1850	34.6	22.4	72 %	716	4.38

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

VFD Analysis



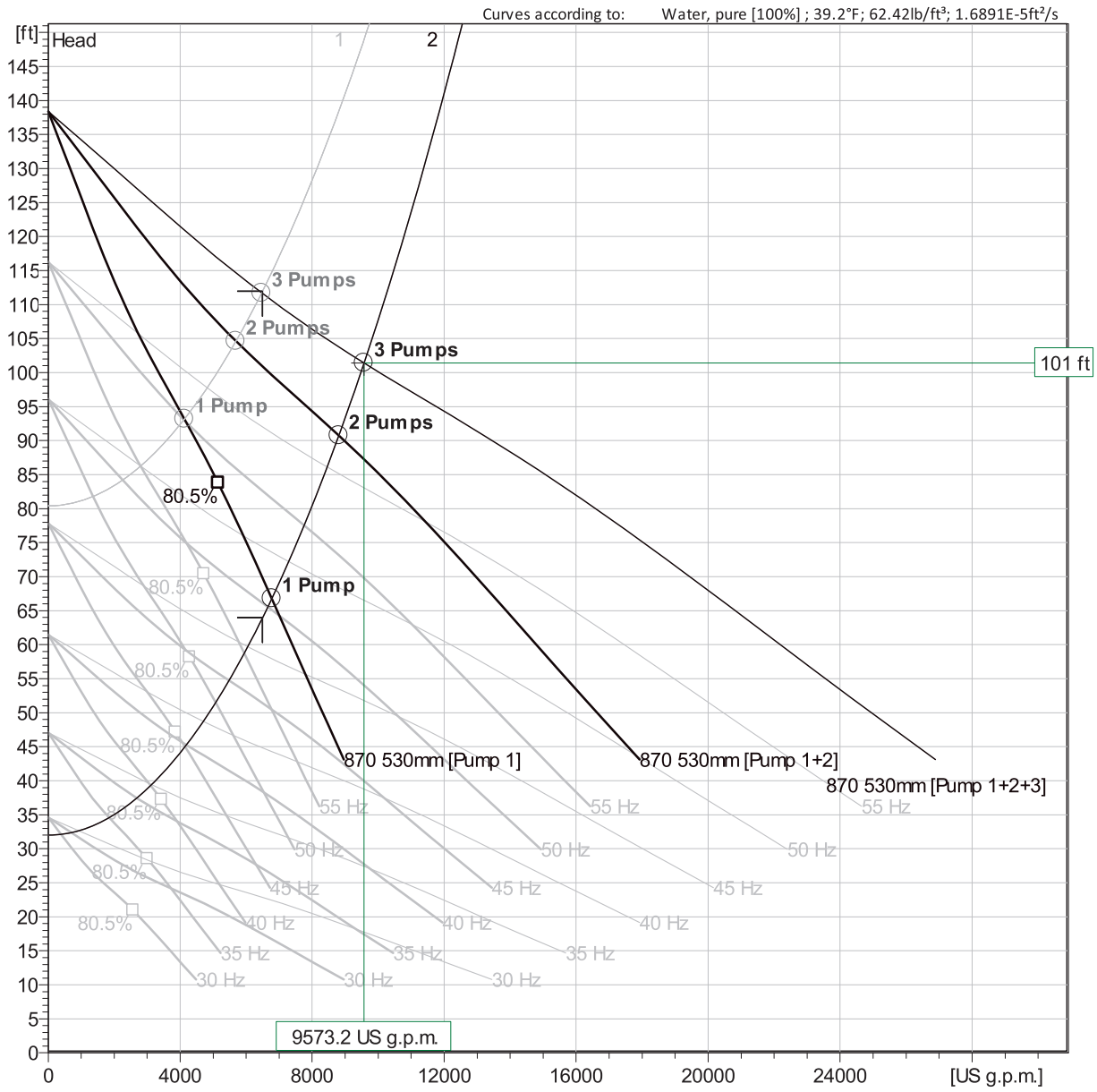
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1 / 2	30 Hz	393	32.1	10.8	393	32.1	10.8	29.6 %	2860	4.19
3 / 1	60 Hz	2160	112	101	6470	112	304	60.2 %	635	10.7
3 / 1	55 Hz	1610	97.8	74.4	4820	97.8	223	53.4 %	801	9.62
3 / 1	50 Hz	933	86.3	51.9	2800	86.3	156	39.2 %	1280	8.99

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

VFD Analysis



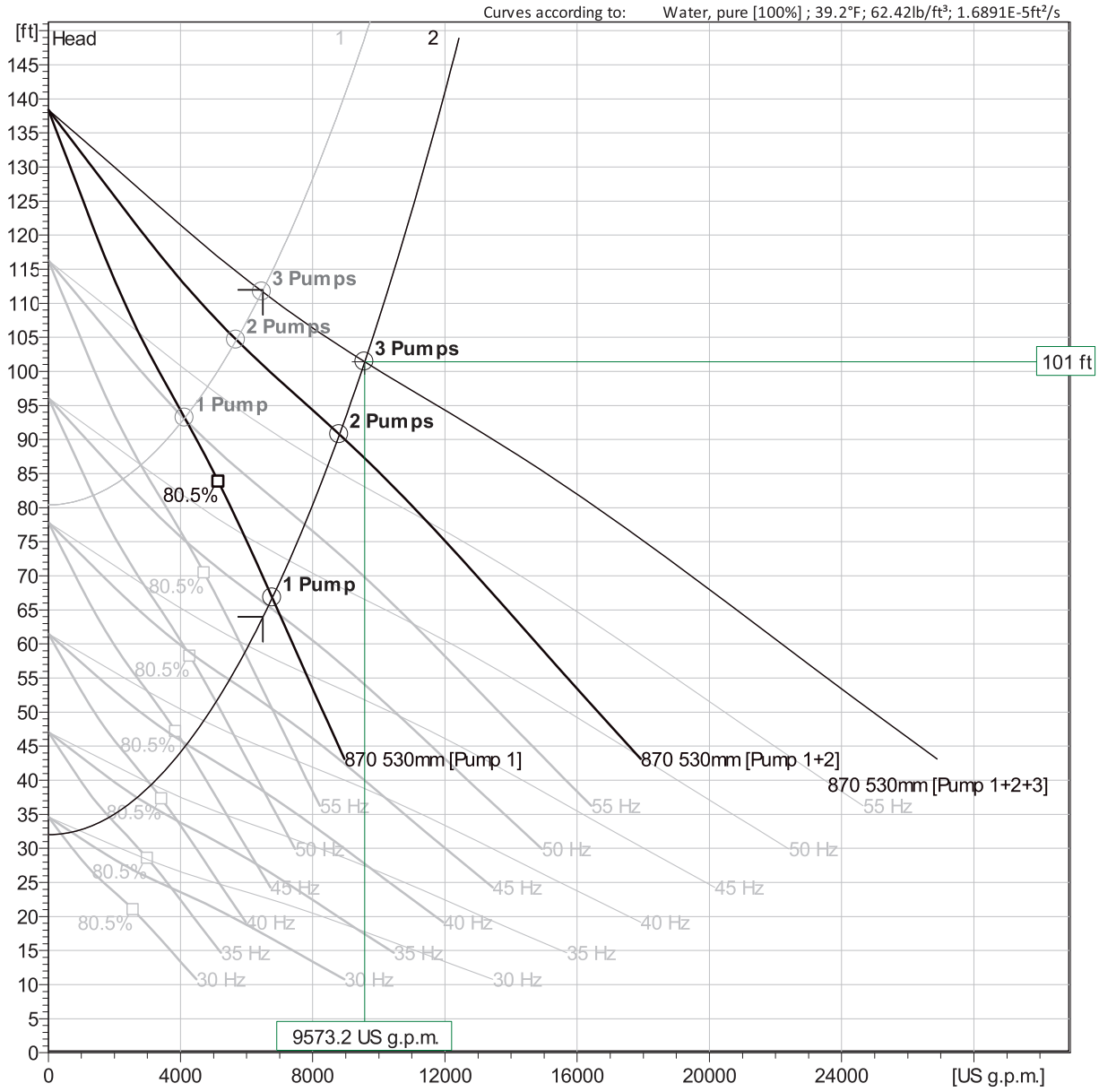
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
3 / 1	45 Hz									
3 / 1	40 Hz									
3 / 1	35 Hz									
3 / 1	30 Hz									

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

VFD Analysis



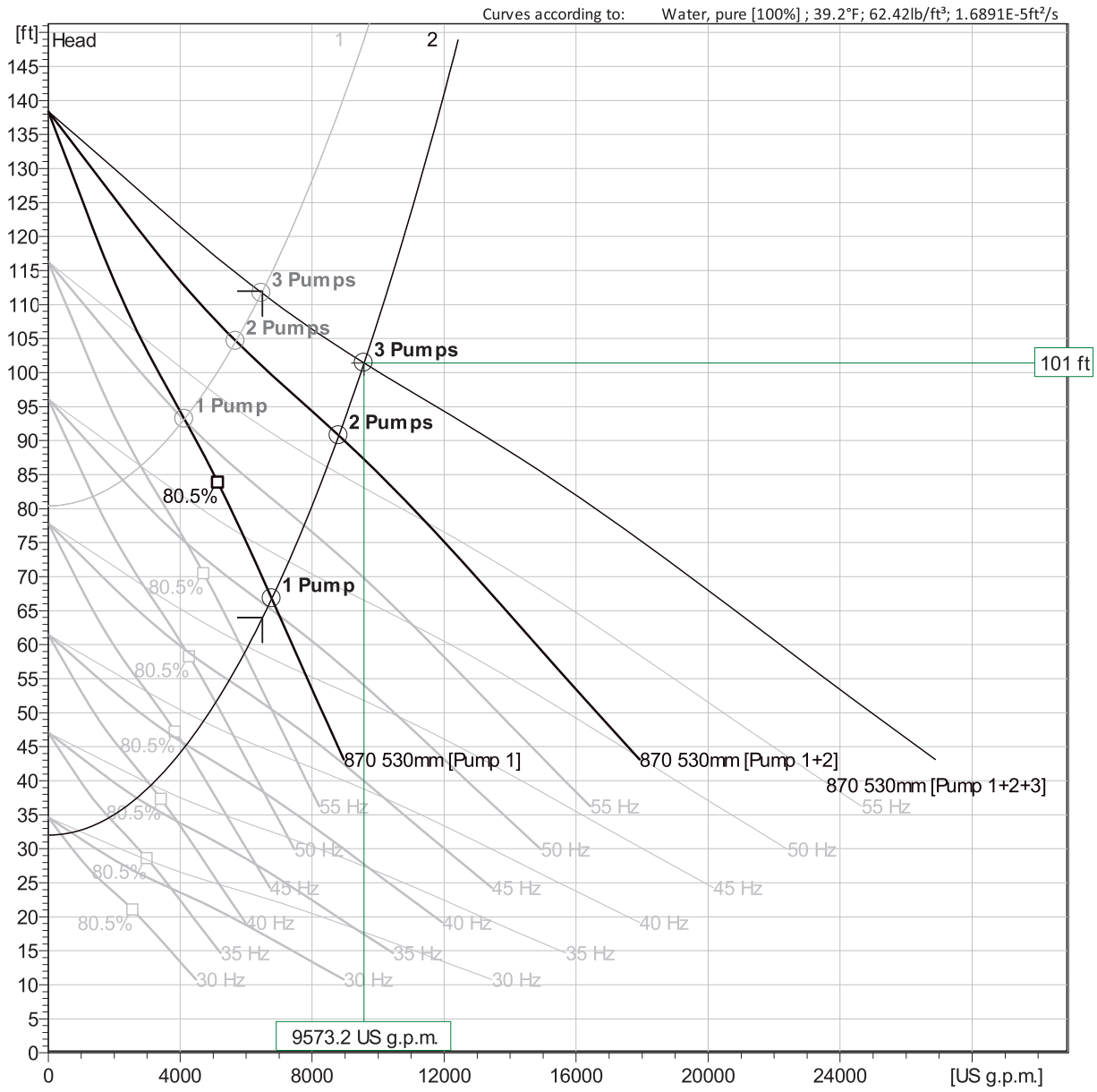
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
2 / 1	60 Hz	2850	105	109	5690	105	219	68.9 %	519	10.4
2 / 1	55 Hz	2060	93.1	78.7	4110	93.1	157	61.5 %	658	9.26
2 / 1	50 Hz	1130	84.2	53.4	2260	84.2	107	45 %	1080	8.67
2 / 1	45 Hz									

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

VFD Analysis



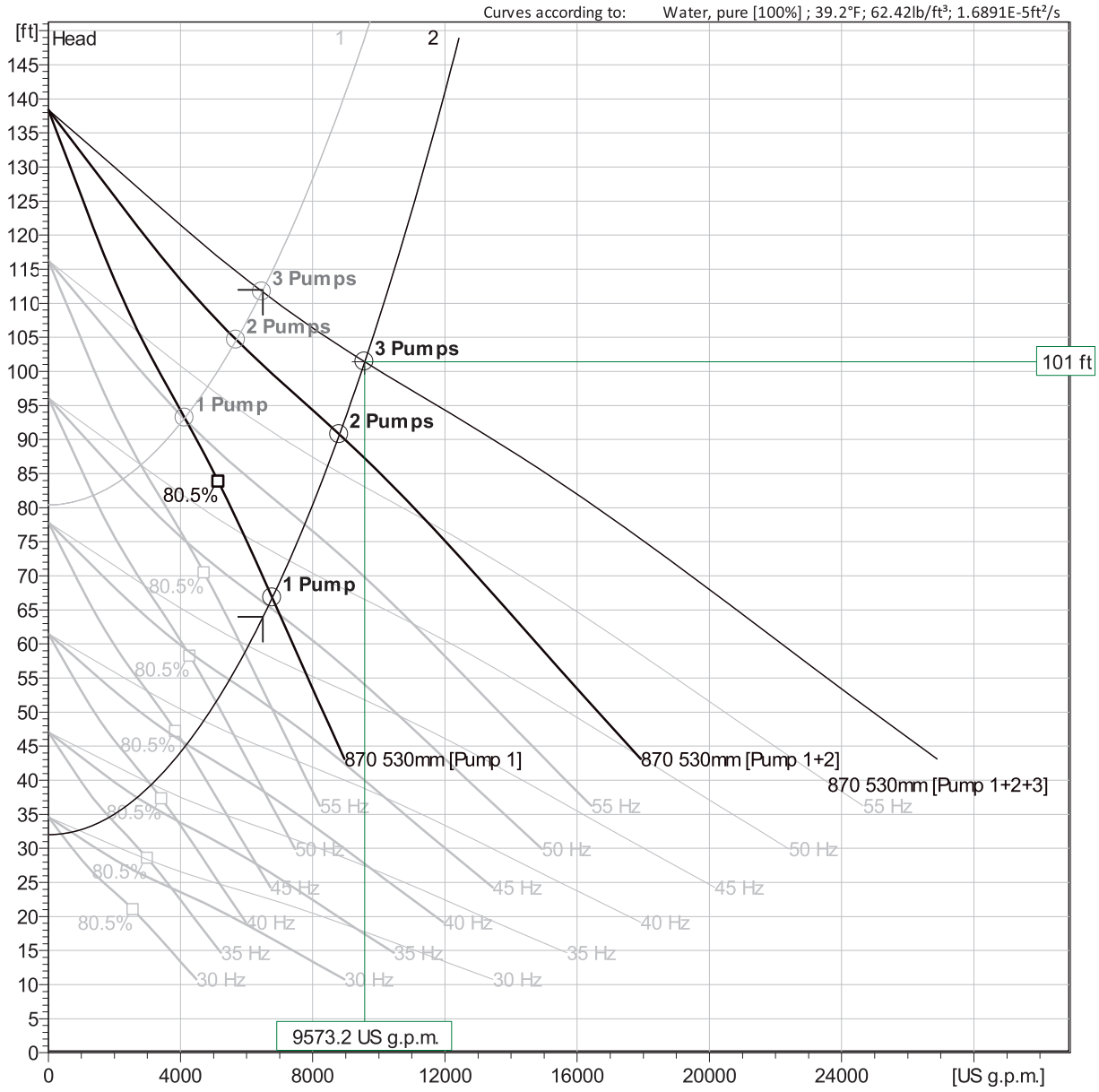
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
2 / 1	40 Hz									
2 / 1	35 Hz									
2 / 1	30 Hz									
1 / 1	60 Hz	4130	93.2	124	4130	93.2	124	78.3 %	406	10.6

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

VFD Analysis



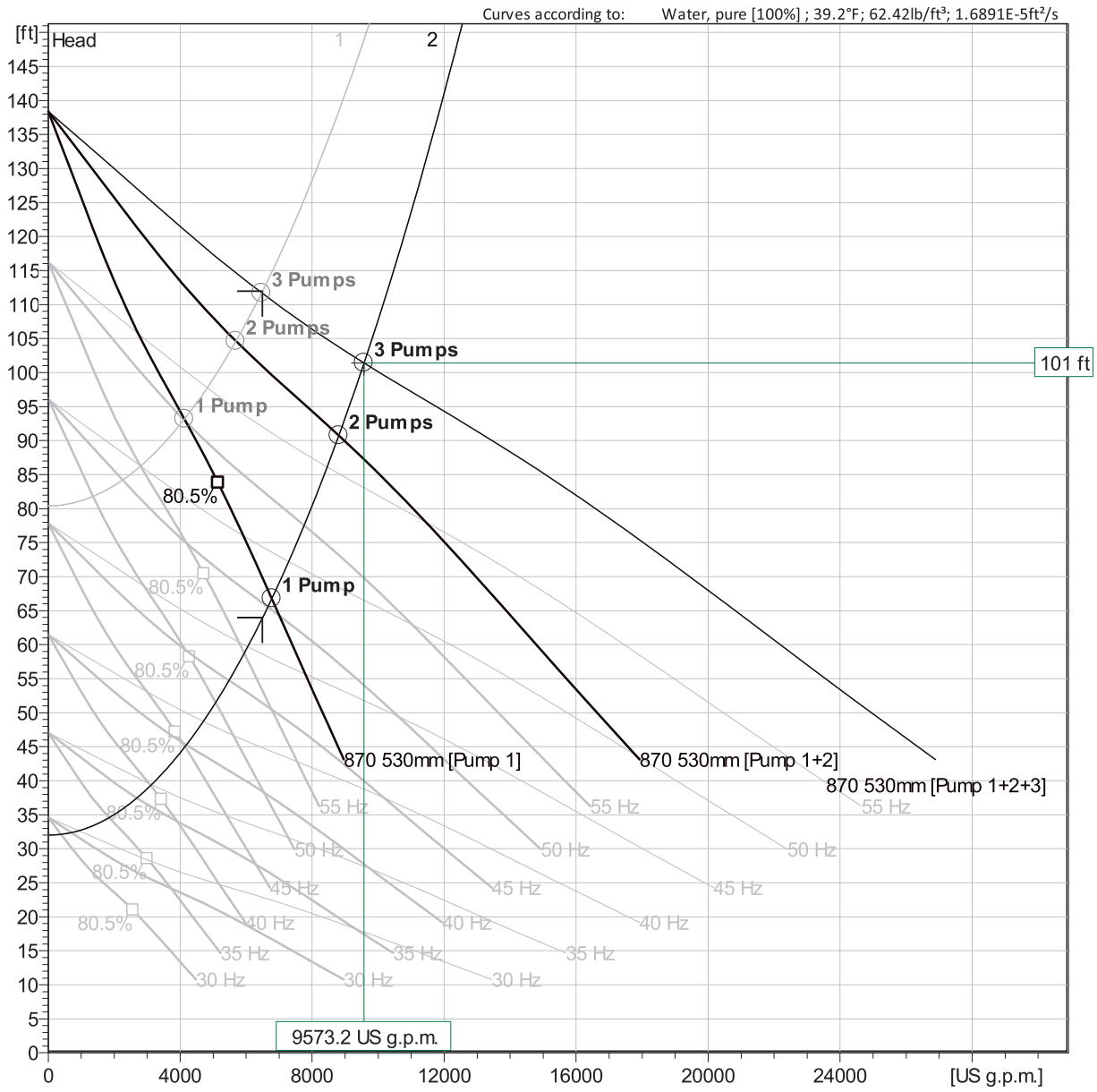
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1 / 1	55 Hz	2800	86.3	86.1	2800	86.3	86.1	71 %	525	9.04
1 / 1	50 Hz	1360	81.8	55.1	1360	81.8	55.1	51.1 %	919	8.37
1 / 1	45 Hz									
1 / 1	40 Hz									

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

VFD Analysis



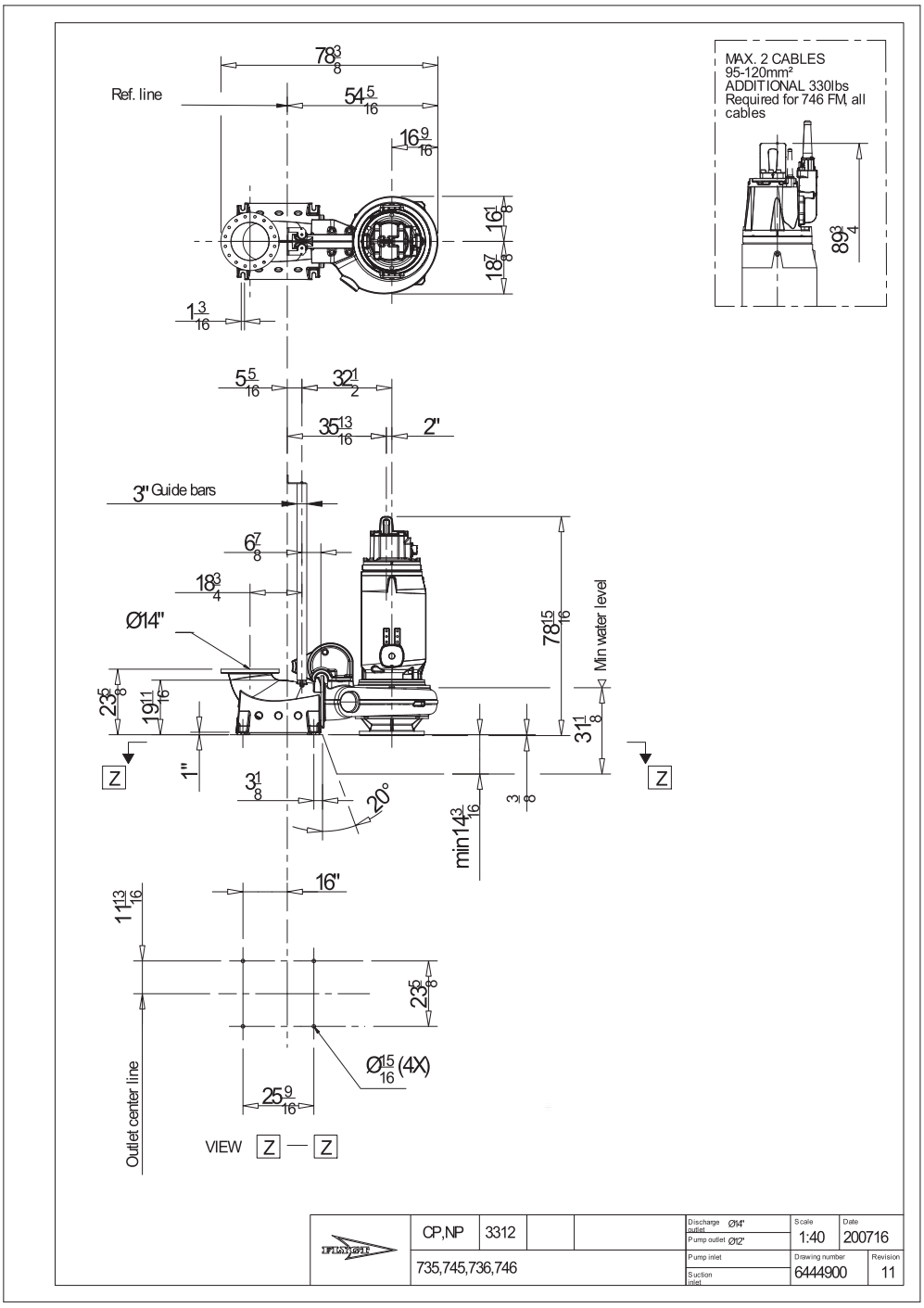
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1 / 1	35 Hz									
1 / 1	30 Hz									

Project		**Created by**	STEPHEN DENNIS		
Block		**Created on**	2/16/2022	**Last update**	2/16/2022

NP 3312/746 3~ 870

Dimensional drawing



Project		**Created by**	STEPHEN DENNIS
Block		**Created on**	2/16/2022 **Last update** 2/16/2022

PRELIMINARY DESIGN DRAWINGS

Appendix C

INSTRUMENT IDENTIFICATION LEGEND

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE,	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER FLAME		NOT USED	NOT USED	NOT USED
C	CONDUCTIVITY (ELECTRICAL)			CONTROL	CLOSED
D	DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)			
G	INTRUSION		GLASS GAGE (UNCALIBRATED)		
H	HAND (MANUALLY INITIATED)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME OR TIME SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOISTURE OR HUMIDITY				MIDDLE OR INTER-MEDIATE
N	SEQUENCE, STRATEGY		NOT USED	NOT USED	NOT USED
O	NOT USED		ORIFICE (RESTRICTION)		OPEN
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)	PULSE	
Q	QUANTITY	INTEGRATE OR TOTALIZE			
R	RADIOACTIVITY		RECORD OR PRINT		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION			VALVE, DAMPER OR LOUVER	
W	WEIGHT OR FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT STATUS	Y AXIS		RELAY OR COMPUTE	
Z	POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

BASE INSTRUMENTATION SYMBOLS

FIT #
INSTRUMENT FIELD MOUNTED
SEE THIS SHEET FOR DETAILS OF INSTRUMENT TAGGING SYSTEM.
FULL TAG NUMBER SHOULD BE INCLUDED ON INSTRUMENT INDEX. POWER SUPPLY REQUIRED LOCALLY WHERE SHOWN.

FIR #
INSTRUMENT PANEL FACE MOUNTED

FY # X Y
INSTRUMENT RELAY MOUNTED IN REAR OF PANEL (BROKEN LINE). ACTIVATES AND DEACTIVATES CONTROL AND/OR ALARM SWITCHES AT PRESET VALUE. EQUIPMENT NUMBER (Y) ONLY WHEN NECESSARY. SEE BELOW FOR FUNCTIONS (X).

- △ DIFFERENCE
- > HIGH SELECTOR
- < LOW SELECTOR
- P/I PNEUMATIC/CURRENT CONVERTER
- I/I CURRENT/CURRENT CONVERTER (REPEATER)
- Σ SUMMATION
- AV AVERAGE
- % RATIO

FR # AR # DO
FR & AR ARE TWO FUNCTIONS AS PART OF ONE UNIIT. (CIRCLES TOUCH)

SYMBOLS FOR ANALYTICAL DEVICES:
- CH_4 -METHANE
- Cl_2 -CHLORINE
- DO -DISSOLVED OXYGEN
- H_2S -HYDROGEN SULFIDE
- H_3PO_4 -PHOSPHORIC ACID
- H_2SO_4 SULFURIC ACID
- MeOH-METHANOL
- NaHOCL-SODIUM HYPOCHLORITE
- $Na_2S_2O_5$ -SODIUM METHA-BISULFITE
- O_2 -OXYGEN
- ORP -OXYDATION REDUCTION POTENTIAL
- pH -HYDROGEN ION CONCENTRATION

- △▽ DISCRETE INPUT/OUTPUT
- ▲▼ ANALOG INPUT/OUTPUT
- DIGITAL COMMUNICATION INPUT/OUTPUT-ETHERNET (E), MODBUS (M), HART (H) OR DEVICENET (D)
- IAS INSTRUMENT AIR SUPPLY
- 120V 120V AC POWER SUPPLY
- 480V 480V AC POWER SUPPLY
- 24V 24V DC POWER SUPPLY

- PROGRAMMABLE LOGIC CONTROLLER (PLC) CONTROL BLOCK
- ## ## POINT FOR SHARED VIDEO DISPLAY (FUNCTIONS IN PLC)
- ## # AS ABOVE WITH LIMITED ACCESS
- # INTERLOCK # - INTERLOCK CONTROL STRATEGY
- FIT # THERMAL MASS METER
- FE # MAGMETER
- FIT # VENTURI
- FE # ORIFICE PLATE
- FE # ROTAMETER
- FE # ANNUBAR FLOW METER
- FLUME
- LE # ULTRASONIC OR RADAR ELEMENT
- HSS # SAFETY PULL CORD
- ULTRASONIC FLOWMETER (CLAMP ON)

INSTRUMENT TAGGING SYSTEM

FIT - 0234

- INSTRUMENT IDENTIFICATION
- LOOP NUMBER

VALVE AND GATE SYMBOLS

- KNIFE GATE VALVE
- GLOBE VALVE
- PLUG VALVE
- DIAPHRAGM VALVE
- BALL VALVE
- PINCH VALVE
- NEEDLE VALVE
- CHECK VALVE
- AIR RELEASE VALVE (AR)
- RELIEF VALVE
- PRESSURE SELF REGULATING VALVE
- BACK PRESSURE SELF REGULATING VALVE
- SLUICE GATE

PIPING SYMBOLS

- Y STRAINER
- VENT
- DIAPHRAGM SEAL WITH ISOLATION VALVE
- INLINE SEAL WITH ISOLATION VALVE
- PULSATION DAMPENER
- FLEXIBLE HOSE
- QUICK-CONNECT
- CALIBRATION COLUMN
- EYE WASH/EMERGENCY SHOWER
- UNION
- BACKFLOW PREVENTOR
- SINGLE BASKET STRAINER
- SW SEAL WATER
- DRAIN
- REDUCER
- FLANGE

EQUIPMENT SYMBOLS

- CENTRIFUGAL PUMP
- METERING PUMP
- SUBMERSIBLE PUMP
- VERTICAL TURBINE PUMP
- PROGRESSIVE CAVITY PUMP
- PERISTALTIC PUMP
- POSITIVE DISPLACEMENT PUMP
- DIAPHRAGM PUMP
- GRINDER/MACERATOR
- BLOWER, CENTRIFUGAL
- BLOWER POSITIVE DISPLACEMENT
- CENTRIFUGAL FAN
- AXIAL/MIXED FLOW PUMP
- CHLORINE INJECTOR/JET PUMP
- WEIR
- M MOTOR
- GRIT SCREW
- MANUAL SCREEN
- VFD VARIABLE FREQUENCY DRIVE
- MCC MOTOR CONTROL CENTER

PANEL DEVICE SYMBOLS

HS L/O/R
HAND SWITCH (MANUAL SELECTOR)
FUNCTION SUBSCRIPT (LOCATION MAY VARY)

PB ESTOP
PUSHBUTTON
FUNCTION SUBSCRIPT (LOCATION MAY VARY)

FUNCTION SUBSCRIPTS FOR HAND SWITCH AND PUSHBUTTON CONTROLS:

ESTOP	E-STOP
F/O/R	FORWARD-OFF-REVERSE
F/O/JR	FORWARD-OFF-JOG REVERSE
H/O/A	HAND-OFF-AUTO
H/O/R	HAND-OFF-REMOTE
H/O/SBY	HAND-OFF-STANDBY
L/O/R	LOCAL-OFF-REMOTE
M/A	MANUAL-AUTO
M/O/A	MANUAL-OFF-AUTO
O/C	OPEN-CLOSE
O/O	ON-OFF
O/S/C	OPEN-STOP-CLOSE
RS	RESET
R/L	REMOTE-LOCAL
R/O	RUN-OFF
SC	SPEED CONTROL POTENTIOMETER
SCR	SILICON CRYSTAL RECTIFIER
S/S	START-STOP
S/SLO	START-STOP WITH LOCKOUT

IL G
INDICATING LIGHT UNIT
G-GREEN (OFF,STOP,CLOSED)
R-RED (RUN,START,OPEN)
W-WHITE (POWER ON)
A-AMBER (ALARM CONDITION)
F-FLASHES ON ELECTRIC OR MECHANICAL MALFUNCTION

1
INTERLOCK
1 = NOTE NUMBER

ELECTRONIC HORN

W
STROBE LIGHT
A - AMBER
W - WHITE
R - RED
B - BLUE

INTERCONNECTING LINES WITH DOT INDICATE ROUTING OF THE SAME SIGNAL.

INTERCONNECTING LINES WITHOUT DOT INDICATE ROUTING OF MORE THAN ONE SIGNAL

GENERAL NOTES

1. COORDINATE WORK WITH OTHER DRAWINGS AND DISCIPLINES.
2. THE SYMBOLS SHOWN ON THIS SHEET ARE STANDARD DESIGNATIONS. NOT ALL SYMBOLS ARE APPLICABLE TO THE INCLUDED DIAGRAMS AND INSTRUMENT TAGGING SYSTEM.
3. NOT ALL PIPING, FITTINGS, AND TANK DETAILS ARE SHOWN. REFER TO PROCESS DRAWINGS FOR ACTUAL DETAILS.
4. INSTRUMENT IDENTIFICATION AND LOOP NUMBERS APPEAR WITH INSTRUMENT SYMBOL.
5. TAG NUMBER DOES NOT CHANGE IF SIGNAL IS BROUGHT TO ANOTHER CONTRACT AREA.
6. FINAL ALPHA CHARACTER IN TAG (E.G. FI-101A) INDICATES DUPLICATE DEVICE EXISTS. FI-101B MAY BE IN A A PANEL.

LINE TYPES

- SOFTWARE LINK, SYSTEM FUNCTION CONNECTION OR COMMUNICATION LINK
- MODBUS COMMUNICATION
- ETHERNET COMMUNICATION
- DEVICENET COMMUNICATION
- MAIN PROCESS LINE
- AUXILIARY SYSTEMS
- EQUIPMENT PACKAGE LIMIT
- ELECTRIC (ELECTRONIC) SIGNAL
- PNEUMATIC SIGNAL
- CAPILLARY LINE
- HYDRAULIC SIGNAL
- SONIC SIGNAL
- HEAT TRACED AND INSULATED
- TELEPHONE LINK
- FUTURE
- EXISTING

DRAWING CONTINUATION LEGEND

PROCESS LINES (ON/OFF PAGE):
PROCESS MEDIUM
CONN | AREA OR EQUIPMENT DRAWING I-XXX

UTILITY LINES (ON/OFF PAGE):
REMARKS 1
CONN | UTILITY DRAWING NUMBER
REMARKS 2

INSTRUMENT SIGNAL LINES (ON/OFF PAGE):
SIGNAL NAME
CONN | DRAWING NUMBER

PROCESS LINE
NOT WITHIN THE BOUNDARY OF THIS SET OF DRAWINGS
PROCESS MEDIUM
PROCESS EQUIPMENT

INSTRUMENT SIGNAL LINE
NOT WITHIN THE BOUNDARY OF THIS SET OF DRAWINGS
SIGNAL NAME

CONN: CONNECTION NUMBER

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0

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A Preliminary Design | TW | | 2022/02/24

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BAYSHORE PUMP STATION
CITY OF TAMPA

PROJECT NAME
BAYSHORE PUMP STATION

City, Province/State
TAMPA, FLORIDA

Project No.: 20-C-00015
File Name: I-01

Scale: NONE

Author	Designer	Checker	YYYY.MM.DD
RS	IH	TP	2022/02/24

Title
INSTRUMENTATION SYMBOLS AND LEGEND

Revision: A

Drawing No.
I-01

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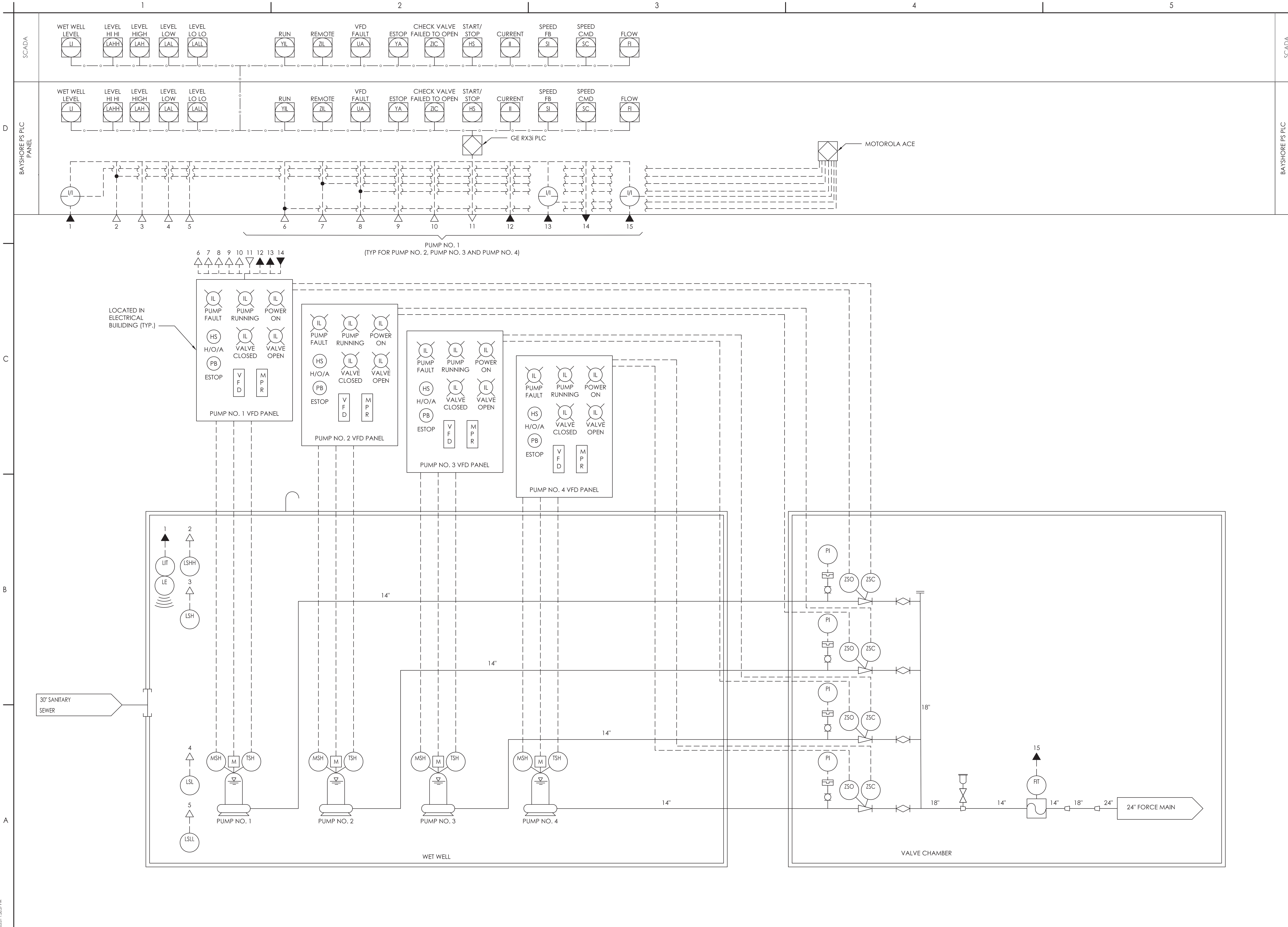

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CITY OF TAMPA

PROJECT NAME
BAYSHORE PUMP STATION

City, Province/State
TAMPA, FLORIDA

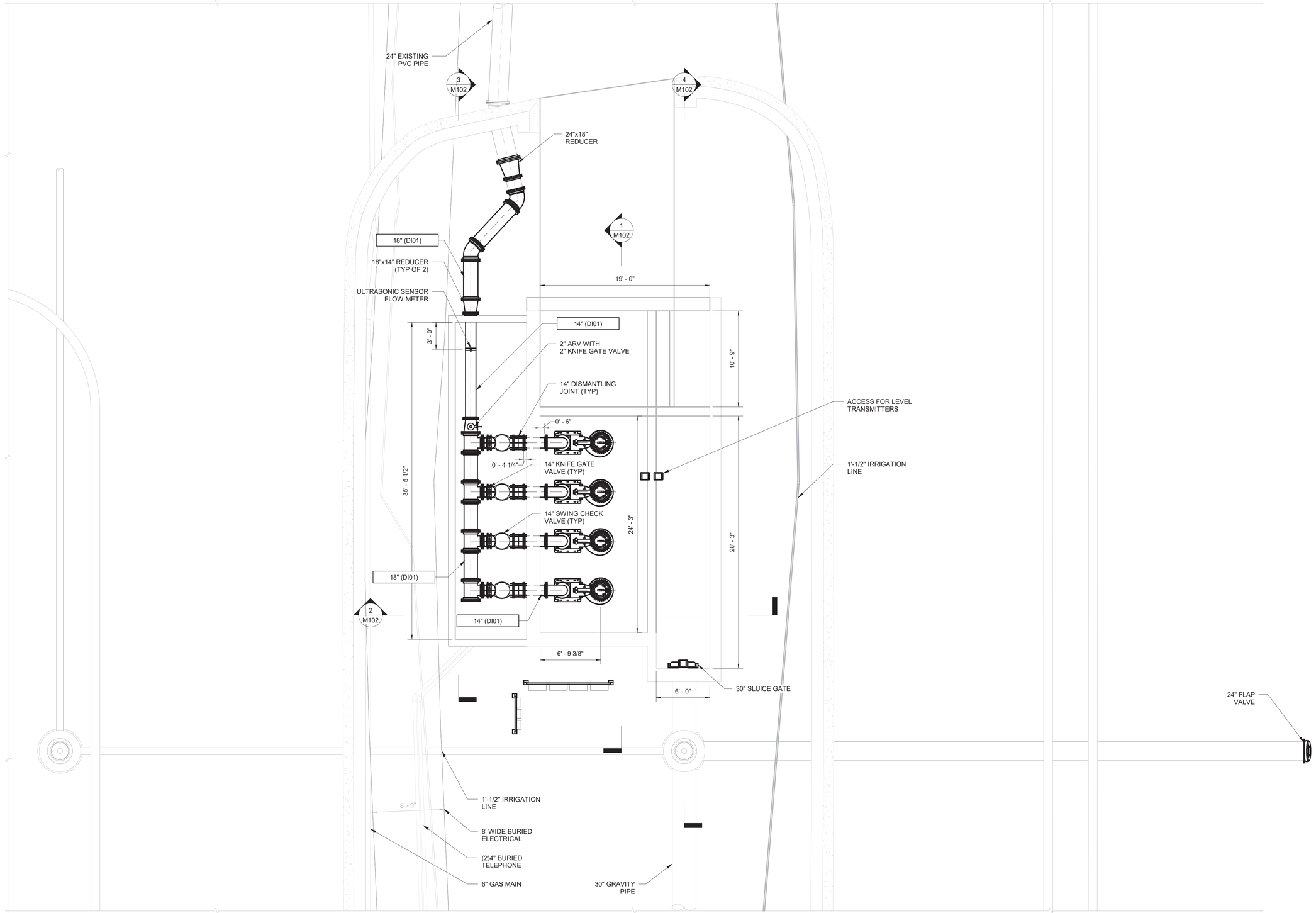
Project No.: 20-C-00015
File Name: I-02

Scale: NONE

Author	Designer	Checker	YYYY.MM.DD
RS	IH	TP	2022/02/24

Title
INSTRUMENTATION
PUMP STATION P&ID

Revision: A
Drawing No.
I-02



OVERALL PLAN @ EL 5.00

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

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Client/Project
City of Tampa

Project Name
Bayshore Pump Station

City, State/Prov
Tampa, Florida

Project No.:20-C-00015
File Name: N/A
Scale: 3/16" = 1'-0"

KSG	SER	MCL	2022.02.24
Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Title
PLAN

Revision: A Sheet: of
Drawing No.
M101

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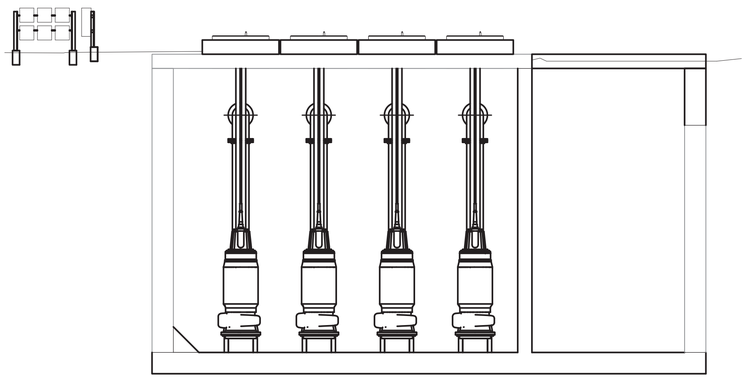

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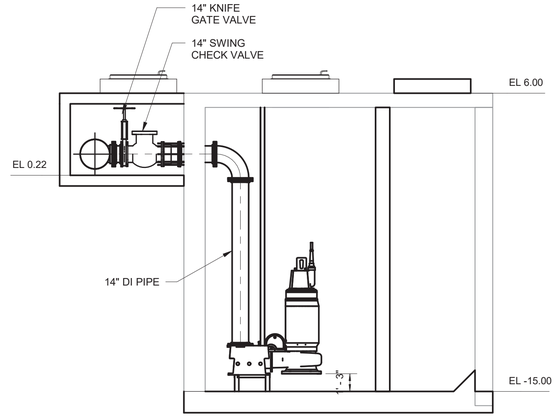

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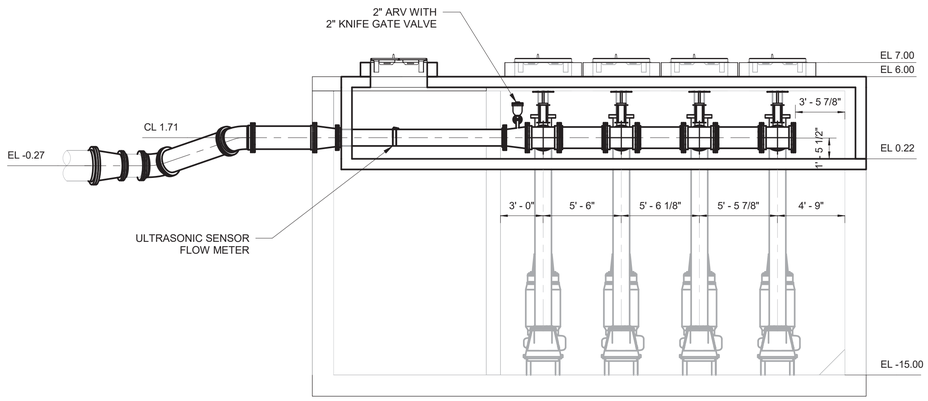

3 M101 SECTION
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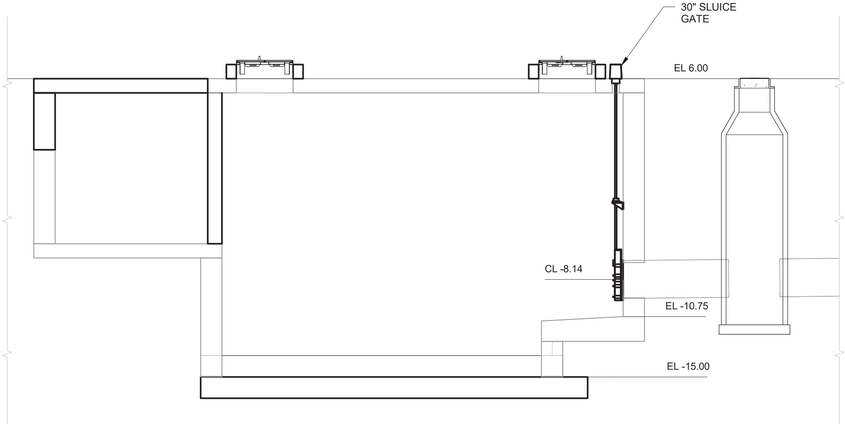

4 M101 SECTION
SCALE: 3/16" = 1'-0"

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Client/Project
City of Tampa

Project Name
Bayshore Pump Station

City, State/Prov
Tampa, Florida

Project No.:20-C-00015
File Name: N/A
Scale: 3/16" = 1'-0"

KSG	SER	MCL	2022.02.24
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Title
SECTIONS

Revision: A Sheet: of
Drawing No.
M102

2/24/2022 11:05:50 PM

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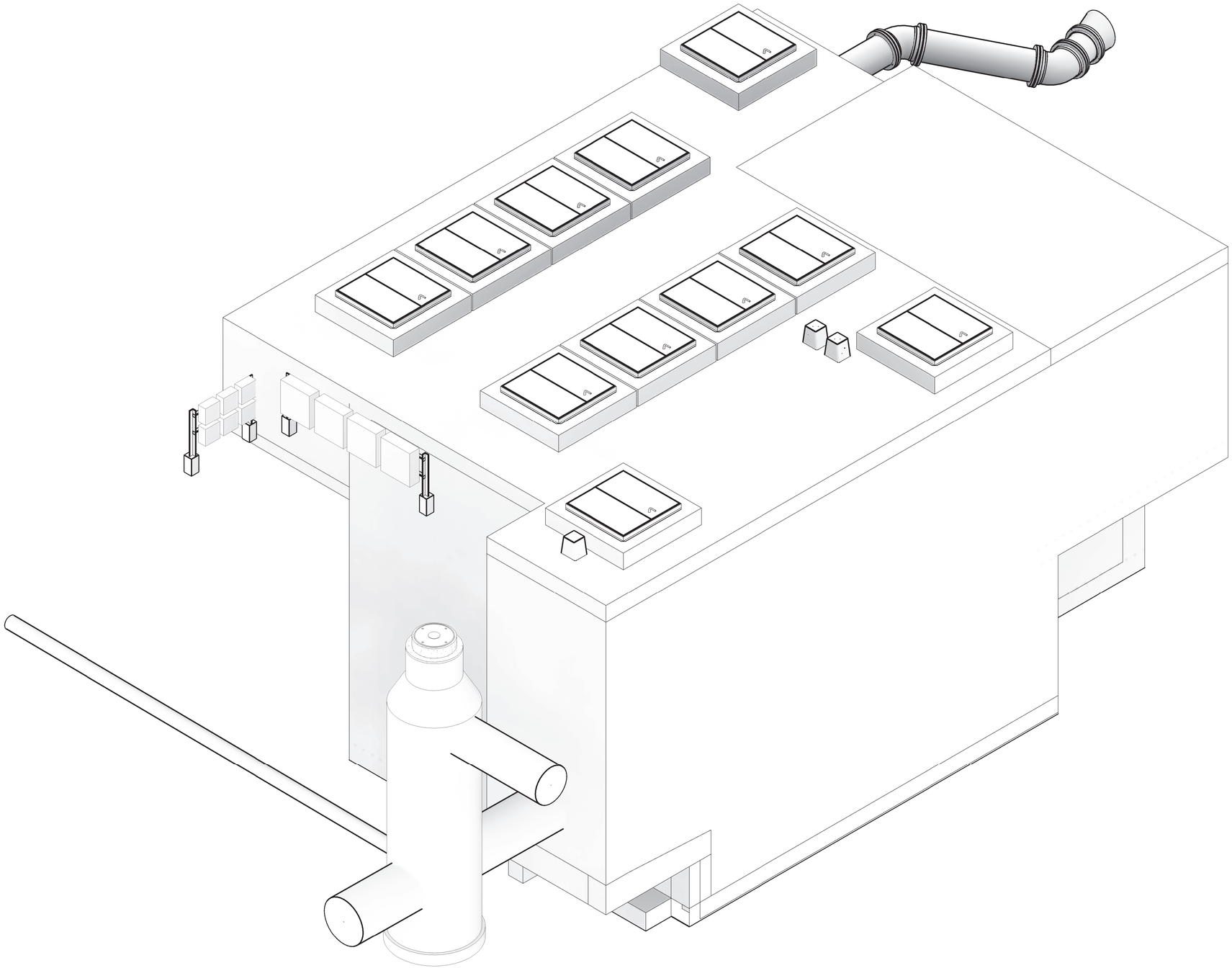

ISOMETRIC VIEW I
NO SCALE

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City of Tampa

Project Name
Bayshore Pump Station

City, State/Prov
Tampa, Florida

Project No.:20-C-00015

File Name: N/A

Scale:

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Title
ISOMETRICS

Revision: A Sheet: of

Drawing No.
M103

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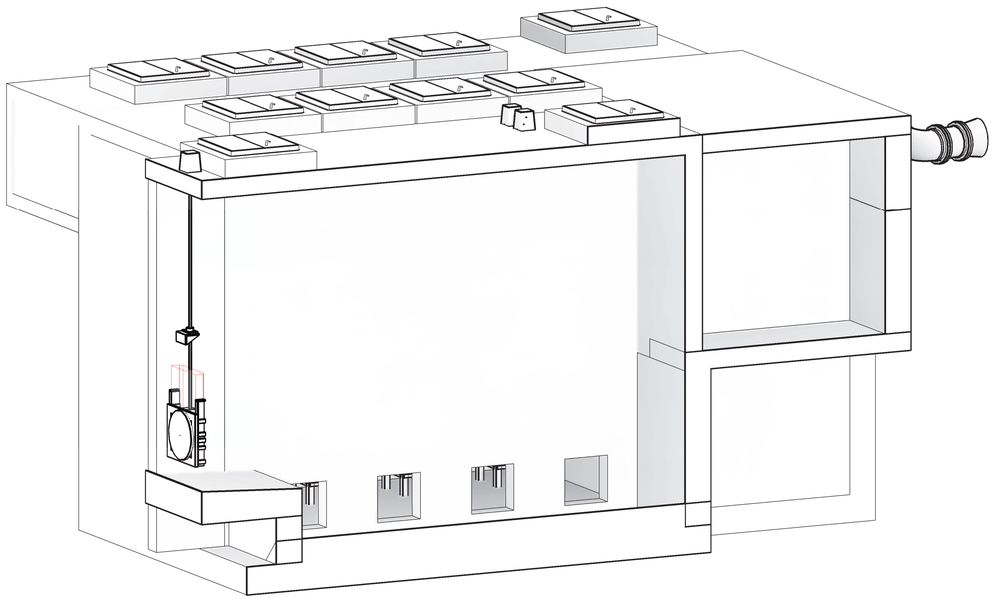
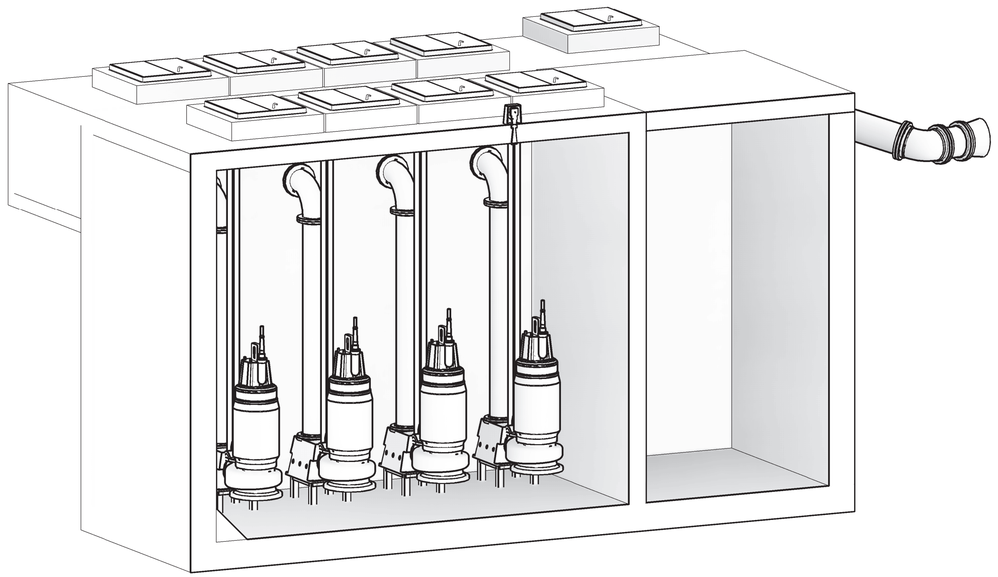


ISOMETRIC VIEW II
NO SCALE



ISOMETRIC VIEW III
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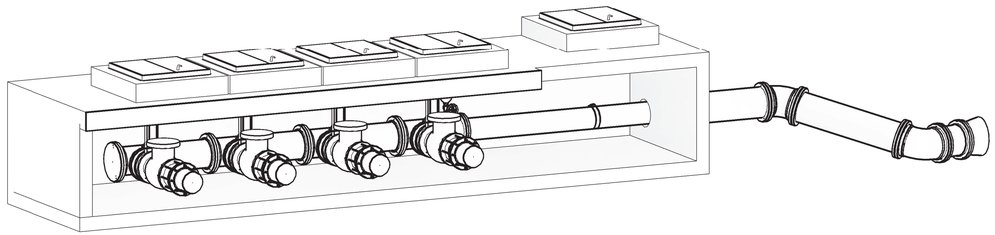

ISOMETRIC VIEW IV
NO SCALE

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Client/Project
City of Tampa

Project Name
Bayshore Pump Station

City, State/Prov
Tampa, Florida

Project No.:20-C-00015

File Name: N/A

Scale:

KSG	SER	MCL	2022.02.24
Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Title
ISOMETRICS

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Drawing No.
M104

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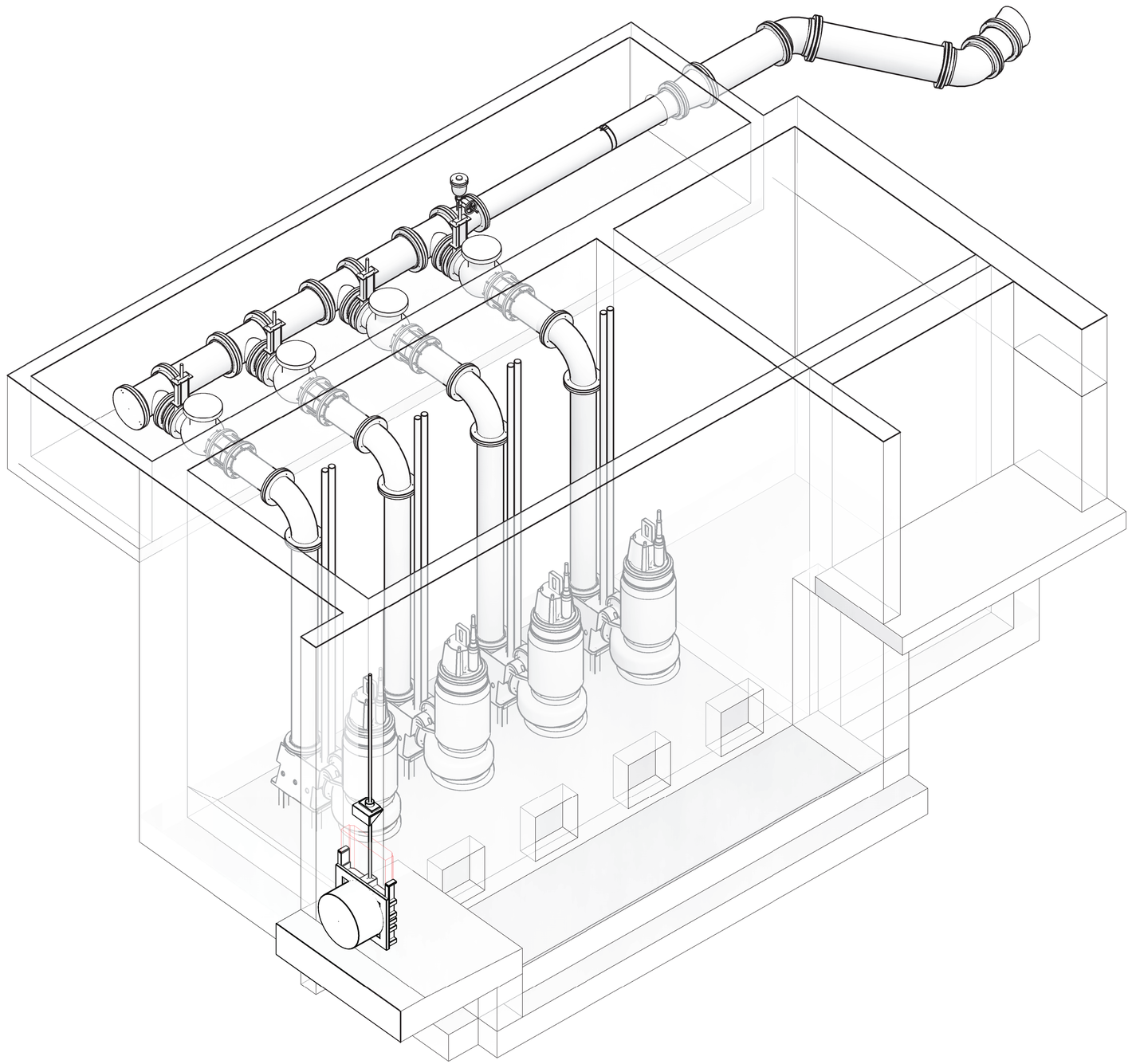

ISOMETRIC VIEW V

NO SCALE

Stantec

Stantec
7775 Harbour Island
Boulevard Suite 600. Tampa. FL
Tel: xx
www.stantec.com

Consultant

ARCADIS

LEGAL ENTITY:
ARCADIS U.S., INC.
CERTIFICATE OF AUTHORIZATION NO. 7917
4300 W CYPRESS ST. SUITE 450
TAMPA, FL 33607

Revision	By	Appd	YYYY.MM.DD
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KSG	SER	MCL	2022.02.24
Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Title
ISOMETRICS

Revision: A Sheet: of

Drawing No.
M105

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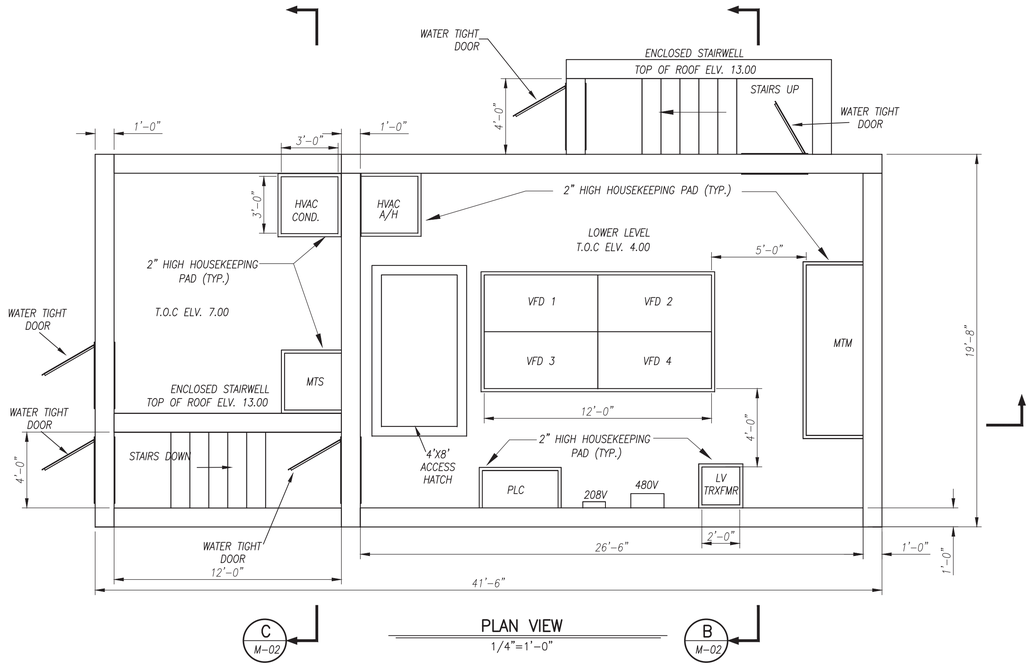

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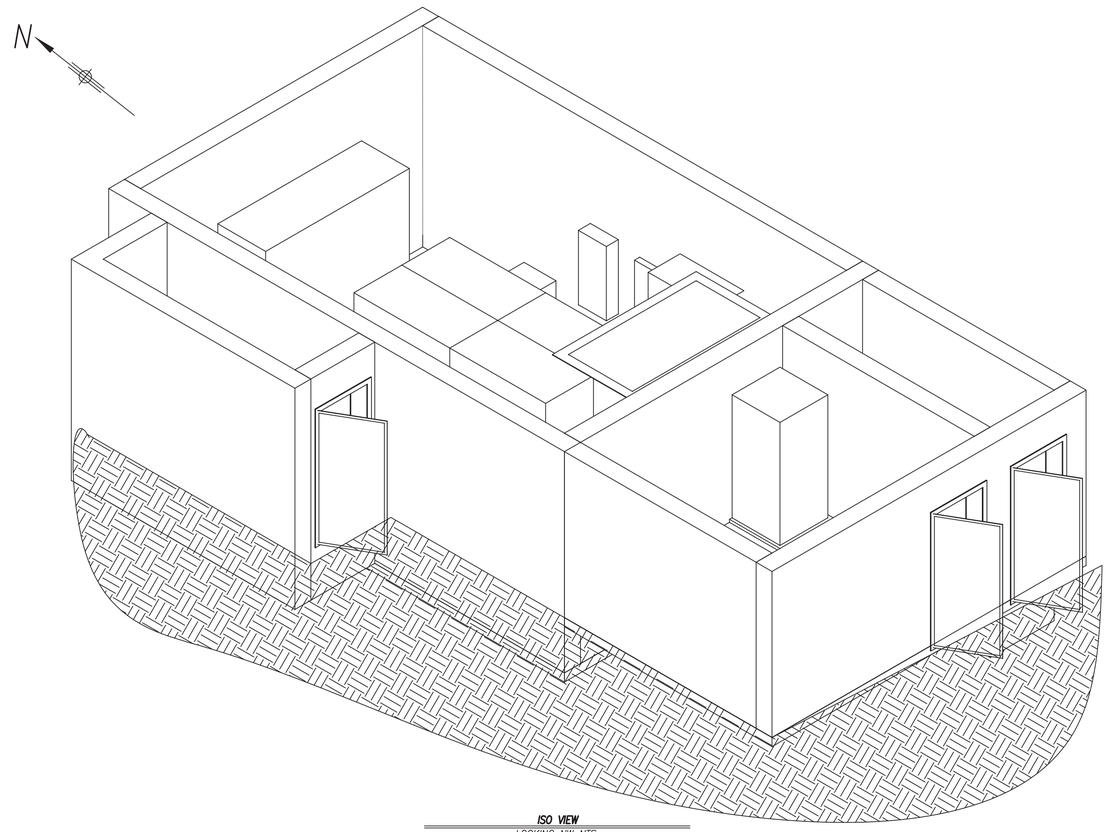

ISO VIEW
LOOKING NW NTS

REV	DATE	DESCRIPTION	REV. BY	CK. BY	APVD. BY
A	7/14/2021	FOR INFORMATION ONLY	SSC		

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Reviewed By	Date	BOM	Layout	DIMS	AB Coor	Constructability	
JONATHAN FERNALD							
ANDREW FRANOSZ							

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING

0 — 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PCL CONSTRUCTION, INC.
1711 W. Greentree Dr, Suite 201
Tempe, Arizona 85284
Phone: 480-829-6333
Fax: 480-829-8252

DESIGNED BY: SSC
DRAWN BY: SSC
CHECKED BY:
APPROVED BY: XXX
SHEET SIZE: 24x36

BAYSHORE BLVD PUMP STATION
TAMPA, FLORIDA

DRAWING TITLE: BAYSHORE PS – ELECTRICAL BLDG.

DWG NO: BAYSHORE PS – M–01

SCALE: AS NOTED
DATE: 7/14/2021
REV: A
SHEET: 1 of 1

SINGLE LINE, SCHEMATIC AND PLAN DRAWING SYMBOLS

GROUND ROD TEST WELL
GROUND ROD
GROUND ROD CABLE CONNECTION
GROUND
GROUND GRID CABLE, #4/0 BURIED MIN 2'-6" BELOW GRADE
INDICATES NEW EQUIPMENT/EXPOSED CONDUIT
CONDUIT TURNING DOWN
CONDUIT TURNING UP
CONDUIT CAPPED
INDICATES CONDUIT UNDERGROUND, CONCEALED IN WALLS OR UNDER SLAB
HOME RUN CIRCUIT TO MCC, SWITCHGEAR, PANELBOARD, ETC.
XXX = PANEL AND CIRCUIT NUMBER
J OR J — JUNCTION BOX (SIZE AS REQD BY NEC)
T OR T — TERMINAL BOX (SIZE AS REQD BY NEC)
PB OR PB — PULL BOX (SIZE AS REQD BY NEC)
XMH — MANHOLE
X = SYSTEM DESIGNATION
E = ELECTRICAL
C = COMMUNICATIONS
I = INSTRUMENTATION & CONTROL
XHH — HANDHOLE
X = SYSTEM DESIGNATION
E = ELECTRICAL
C = COMMUNICATIONS
I = INSTRUMENTATION & CONTROL
52 XXXAT YYYAF — MEDIUM VOLTAGE DRAWOUT TYPE POWER CIRCUIT BREAKER
XXX = TRIP
YYY = FRAME SIZE / RATING
SST XXXAT YYYAF (ZZZA) EO — 3-POLE, DRAWOUT TYPE CIRCUIT BREAKER WITH SOLID STATE TRIP UNIT
EO = ELECTRICALLY OPERATED
XXX = TRIP SIZE
YYY = FRAME SIZE
ZZZ = PLUG RATING
SST XXXAT YYYAF (ZZZA) EO — 3-POLE FIXED MOUNTED POWER OR MOLDED CASE CIRCUIT BREAKER WITH SOLID STATE TRIP UNIT
EO = ELECTRICALLY OPERATED
XXX = TRIP SIZE
YYY = FRAME SIZE
ZZZ = PLUG RATING
XXXAT YYYAF 2P — 3-POLE, THERMAL-MAGNETIC, MOLDED CASE CIRCUIT BREAKER
XXX = TRIP SIZE
YYY = FRAME SIZE
2P = 2-POLE
XXXA YYYA 2P — 3-POLE, FUSED DISCONNECT
XXX = DISCONNECT RATING
YYY = FUSE SIZE
2P = 2-POLE
XXXA YYY ZZZ # — COMBINATION FULL VOLTAGE STARTER AND CIRCUIT BREAKER WITH THERMAL OVERLOAD
XXX = CONTINUOUS RATING
YYY = FRAME SIZE OR MCP DESIGNATES A MOTOR CIRCUIT PROTECTOR
# = STARTER SIZE
ZZZ = STARTER TYPE
FVNR - FULL VOLTAGE NON-REVERSING
FVR = FULL VOLTAGE REVERSING
2S = TWO SPEED
2S1W = TWO SPEED ONE WINDING
SSRV = SOLID STATE REDUCED VOLTAGE
RVAT = REDUCED VOLTAGE AUTOTRANSFORMER

XXX/Y # — CURRENT TRANSFORMER
XXX/Y = RATIO
= QUANTITY
POTENTIAL TRANSFORMER
TRANSFORMER
SIZE AND CONFIGURATION AS NOTED ON THE DRAWINGS
ISOLATION OR CONTROL POWER TRANSFORMER, SIZE AND CONFIGURATION AS NOTED ON THE DRAWINGS
DELTA/WYE TRANSFORMER CONNECTION WITH GROUND
LA — LIGHTNING ARRESTOR
XXXA # CL PFD — FUSE
XXX = SIZE
# = QUANTITY
CL = CURRENT LIMITING TYPE
PFD = PULL OUT TYPE FUSED DISCONNECT
DMM — DIGITAL, MICROPROCESSOR BASED METERING DEVICE
A AS — AMMETER
AMMETER SWITCH
V VS — VOLTMETER
VOLTMETER SWITCH
VFD — VARIABLE FREQUENCY DRIVE
M OR 5 — MOTOR LOAD (NUMBER INDICATES HORSEPOWER)
5 — NON-MOTOR LOAD (NUMBER INDICATES KVA)
480V DISTRIBUTION OR PANELBOARD
120/208V OR 120/240V PANELBOARD
F XX — FUSED DISCONNECT SWITCH
XX = FUSE SIZE
CB — ENCLOSED CIRCUIT BREAKER
NON-FUSED DISCONNECT SWITCH
COMBINATION MOTOR STARTER AND FUSED DISCONNECT SWITCH
MS — 20A RATED MANUAL STARTER SWITCH
CS — CONTROL STATION
XX — RECEPTACLE WITH INTEGRAL DISCONNECT SWITCH, 600V, 3 PHASE, 4 WIRE
XX = AMP RATING
XX — RECEPTACLE, 600V, 3 PHASE, 4 WIRE
XX = AMP RATING
S^X_Y — 20A RATED, SINGLE POLE SWITCH
x = SWITCHING SCHEME DESIGNATION
Y = 3 = THREE-WAY SWITCH
Y = 4 = FOUR-WAY SWITCH
Y = D = DIMMING SWITCH
S_{2P} — 20A RATED, TWO-POLE SWITCH
MV — MOTORIZED VALVE
MV — MOTORIZED VALVE WITH INTEGRAL CONTROLLER BY VENDOR
SV — SOLENOID VALVE
SPD — SURGE PROTECTION DEVICE

x — SURFACE OR PENDANT MOUNTED LUMINAIRE, LED OR FLUORESCENT
x = SWITCHING SCHEME DESIGNATION
SURFACE OR PENDANT MOUNTED LUMINAIRE, LED OR FLUORESCENT WITH EMERGENCY BATTERY
PENDANT OR CEILING MOUNTED LUMINAIRE, LED OR FLUORESCENT
PENDANT OR CEILING MOUNTED LUMINAIRE, LED OR FLUORESCENT WITH EMERGENCY BATTERY
WALL MOUNTED LUMINAIRE
POLE OR STANCHION MOUNT LUMINAIRE
DUAL HEAD, EMERGENCY LIGHTING UNIT WITH BATTERY BACKUP
WALL MOUNTED EXIT SIGN (HATCHING DENOTES SINGLE OR DUAL FACE, ARROW INDICATES DIRECTIONAL CHEVRON REQD)
CEILING MOUNTED EXIT SIGN (HATCHING DENOTES SINGLE OR DUAL FACE, ARROW INDICATES DIRECTIONAL CHEVRON REQD)
X YY ZZZ — LUMINAIRE DESIGNATION SYMBOL
REFER TO LUMINAIRE SCHEDULE
X = DESIGNATOR
YY = LAMP TYPE AND/OR WATTAGE
ZZZ = MOUNTING HEIGHT AFF
GFI/SS/WP — DUPLEX CONVENIENCE RECEPTACLE
2-POLE, 3-WIRE, 120 VAC, 20 AMP
GFI = GROUND FAULT INTERRUPT TYPE
SS = SURGE SUPPRESSION TYPE
WP = WEATHERPROOF TYPE
SIMPLEX CONVENIENCE RECEPTACLE
2-POLE, 3-WIRE, 120 VAC, 20 AMP
POWER RECEPTACLE
2-POLE, 3-WIRE, 240 VAC, 20 AMP
QUAD CONVENIENCE RECEPTACLE
2-POLE, 3-WIRE, 120 VAC, 20 AMP
PC — PHOTOCELL
T — THERMOSTAT
XX — ANSI DEVICE, XX=DESIGNATION
27 - UNDER VOLTAGE RELAY
32 - PHASE REVERSAL
40 - LOSS OF EXCITATION
46 - NEGATIVE SEQUENCE OVERCURRENT
50 - PHASE INSTANTANEOUS OVERCURRENT
50G - GROUND INSTANTANEOUS OVERCURRENT
51 - PHASE OVERCURRENT
51G - GROUND OVERCURRENT
59 - OVER VOLTAGE
81U - UNDER FREQUENCY
81Q - OVER FREQUENCY
86 - LOCKOUT RELAY
87 - PHASE DIFFERENTIAL
YYY — INSTRUMENTATION DEVICE
xx = DEVICE FUNCTION
YYY = LOOP NUMBER

A/V 110 — AUDIO/VISUAL ALARM INDICATOR (HORN/STROBE) NUMBER INDICATES STROBE CANDELLA RATING WHEN OTHER THAN 15
H — HORN
F — MANUAL PULL STATION
B — BELL
FAA — FIRE ALARM ANNUNCIATOR
FACP — FIRE ALARM CONTROL PANEL
FS — FLOW SWITCH
TS — VALVE TAMPER SWITCH
FD — FLAME DETECTOR
SD X — SMOKE DETECTOR, MULTISENSOR
X = I = IONIZATION TYPE
X = P = PHOTOELECTRIC TYPE
X = D = DUCT DETECTOR
X = H = THERMAL DETECTOR

ABBREVIATIONS

A	AMPERES
AI	ANALOG INPUT
AO	ANALOG OUTPUT
AC	ALTERNATING CURRENT
AFC	ABOVE FINISHED CONCRETE
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AG	ABOVE GRADE
AL	ALUMINUM
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE
BKR	BREAKER
C	CONDUIT
CBV	CABLE BY VENDOR
CB	CIRCUIT BREAKER
CKT	CIRCUIT
CLG	CEILING
CONT	CONTINUED OR CONTINUATION
CTRL	CONTROL
CP	CONTROL PANEL
CPT	CONTROL POWER TRANSFORMER
CT	CURRENT TRANSFORMER
CU	COPPER
DB	DECIBEL(S)
DC	DIRECT CURRENT
DI	DISCRETE INPUT
DISC	DISCONNECT
DN	DOWN
DO	DISCRETE OUTPUT
DPDT	DOUBLE POLE DOUBLE THROW
DWG	DRAWING
EC	EMPTY CONDUIT
EL	ELEVATION
EGC	EQUIPMENT GROUNDING CONDUCTOR
EHH	ELECTRICAL HANDHOLE
EMH	ELECTRICAL MANHOLE
EMT	ELECTRICAL METALLIC TUBING
EO	ELECTRICALLY OPERATED
(E)	EXISTING
FFE	FINISHED FLOOR ELEVATION
FO	FIBER OPTIC
FUT	FUTURE
GALV	GALVANIZED
GEC	GROUNDING ELECTRODE CONDUCTOR
GFI	GROUND FAULT INTERRUPTER
G, GND	GROUND
HOA	HAND-OFF-AUTO
HTR	HEATER
HZ	HERTZ
IMT	INTERMEDIATE METALLIC TUBING
INTLK	INTERLOCK
ITB	INSTRUMENT TERMINAL BOX
KAIC	1,000 AMP INTERRUPTING CURRENT
KCMIL	THOUSAND CIRCULAR MILS
KVA	THOUSAND KILOVOLT-AMPERES
KW	KILOWATTS
KWH	KILOWATT-HOURS
LA	LIGHTNING ARRESTOR
LCP	LOCAL CONTROL PANEL
LCS	LOCAL CONTROL STATION
LTG	LIGHTING
LV	LOW VOLTAGE
MCC	MOTOR CONTROL CENTER
MFR	MANUFACTURER
MTS	MANUAL TRANSFER SWITCH
MCP	MOTOR CIRCUIT PROTECTOR
MFR	MANUFACTURER
MLO	MAIN LUG ONLY
MTG	MOUNTING
MH	MANHOLE
N/A	NON-APPLICABLE
NC	NORMALLY CLOSED
NO	NORMALLY OPENED
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OL	OVERLOAD
OS	OCCUPANCY SENSOR
PB	PUSH BUTTON
PFC	POWER FACTOR CORRECTION
PNL	PANEL
PR	PAIR
PT	POTENTIAL TRANSFORMER
PTZ	PAN-TILT-ZOOM
REC	RECEPTACLE
REQD	REQUIRED
RIO	REMOTE INPUT/OUTPUT
RGS	RIGID GALVANIZED STEEL
ROW	RIGHT OF WAY
RVSS	REDUCED VOLTAGE SOFT START
SE	SERVICE ENTRANCE
SP	SPARE
SS	STAINLESS STEEL
SPD	SURGE PROTECTION DEVICE
SPDT	SINGLE POLE DOUBLE THROW
SPST	SINGLE POLE SINGLE THROW
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
TB	TERMINAL BOX
TC	TRAY CABLE
TDR	TIME DELAY RELAY
TEW	THERMOCOUPLE EXTENSION WIRE
TOS	TOP OF STEEL
TSP	TWISTED SHIELDED PAIR
TYP	TYPICAL
UG	UNDERGROUND
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLTS
VFD	VARIABLE FREQUENCY DRIVE
W	WATTS
W/O	WITHOUT
WP	WEATHERPROOF
XFMR	TRANSFORMER
XP	EXPLOSION PROOF
1Ø, 3Ø	SINGLE PHASE, THREE PHASE
3W, 4W	THREE WIRE, FOUR WIRE

GENERAL NOTES:

1. THE SYMBOLS AND ABBREVIATIONS LIST ON THIS SHEET IS A COMPREHENSIVE STANDARD GUIDE INTENDED FOR GENERAL USE ON ALL PROJECTS. THEREFORE NOT ALL THE SYMBOLS AND ABBREVIATIONS CONTAINED IN THIS LIST ARE NECESSARILY USED ON THIS PARTICULAR PROJECT AND SHOULD BE USED FOR CLARIFICATION ONLY.
2. THE CONTRACTOR SHALL READ AND UNDERSTAND THE ENTIRE SET OF CONSTRUCTION DOCUMENTS. THIS INCLUDES BUT IS NOT LIMITED TO THE PLANS AND SPECIFICATIONS FOR ALL DISCIPLINES. THIS WILL ENSURE THAT HE UNDERSTANDS THE FULL SCOPE OF WORK AND IS ABLE TO CONVEY THE REQUIRED MATERIALS AND METHODS OF INSTALLATION TO THE HIS ESTIMATORS, SUPPLIERS AND INSTALLERS.
3. CONTRACTOR SHALL VISIT PROJECT SITE AND MAKE HIMSELF/HERSELF AWARE OF ALL EXISTING CONDITIONS PRIOR TO SUBMITTING A BID FOR THIS WORK.
4. THE TERM "PROVIDE" MEANS TO FURNISH AND INSTALL.
5. COORDINATE ANY AND ALL WORK WITH OTHER TRADES PRIOR TO INSTALLATION IN ORDER TO AVOID CONFLICTS DURING CONSTRUCTION.
6. THESE DRAWINGS ARE DIAGRAMMATIC IN NATURE. DO NOT SCALE FROM THESE DRAWINGS.
7. WHERE JOB CONDITIONS REQUIRE CHANGES FROM THE CONTRACT DOCUMENTS THAT DO NOT CHANGE THE SCOPE OF INSTALLATION OR NATURE OF THE WORK REQUIRED, THE CONTRACTOR SHALL MAKE SUCH CHANGES WITHOUT ANY ADDITIONAL COST TO THE OWNER. NO OTHER CHANGES MAY BE MADE WITHOUT WRITTEN CONSENT FROM THE ENGINEER AND OWNER.
8. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF THE ENFORCED EDITION OF THE NATIONAL ELECTRIC CODE, NATIONAL ELECTRIC SAFETY CODE, LIFE SAFETY CODE AND ALL OTHER LOCAL AND STATE CODES AND REGULATIONS. THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL PERMITS AND INSPECTIONS REQUIRED BY THE AUTHORITY HAVING JURISDICTION.
9. MOUNTING HEIGHTS INDICATED ARE TO THE CENTER OF THE DEVICE UON.
10. DETAILS SHOWN ON ANY DRAWING APPLY TO ALL EQUIPMENT AND MATERIAL ON THE PROJECT.
11. EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE. EXTEND CONDUIT & WIRE TO INSTALLED LOCATIONS AT NO ADDITIONAL COST TO THE OWNER.
12. ELECTRICAL SYSTEMS SHALL BE COMPLETE AND OPERABLE AT PROJECT COMPLETION.
13. THE DESIGNATION O.F.C.I. INDICATES EQUIPMENT FURNISHED BY THE OWNER, INSTALLED BY THE CONTRACTOR.
14. THE DESIGNATION V.F.C.I. INDICATES EQUIPMENT PROVIDED BY THE VENDOR, INSTALLED BY THE CONTRACTOR.
15. DASHED EQUIPMENT INDICATES EXISTING TO REMAIN.
16. CROSS-HATCHED EQUIPMENT INDICATES DEMOLITION.
17. AS A MINIMUM, ALL WIRING SHALL BE #12 AWG IN 3/4" CONDUIT. #10 AWG WIRE SHALL BE USED FOR RUNS EXCEEDING 50 FEET, UNLESS OTHERWISE NOTED ON DRAWINGS.

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Tampa, FL 33602-5729
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ARCADIS
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ARCADIS U.S., INC.
CERTIFICATE OF AUTHORIZATION NO. 7917
4300 W CYPRESS ST. SUITE 450
TAMPA, FL 33607

Revision: 0 — 2022/02/24 — TW — YYYY.MM.DD — By — Appd
Issued: A — Preliminary Design — By — Appd — YYYY.MM.DD

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BAYSHORE PUMP STATION
CITY OF TAMPA

PROJECT NAME
BAYSHORE PUMP STATION

City, Province/State
TAMPA, FLORIDA

Project No.: 20-C-00015
File Name: E-01
Scale: NONE

Author	Designer	Checker	YYYY.MM.DD
VN	EB	TP	2022/02/24

Title
ELECTRICAL SYMBOLS, ABBREVIATIONS & NOTES

Revision: A
Drawing No.
E-01

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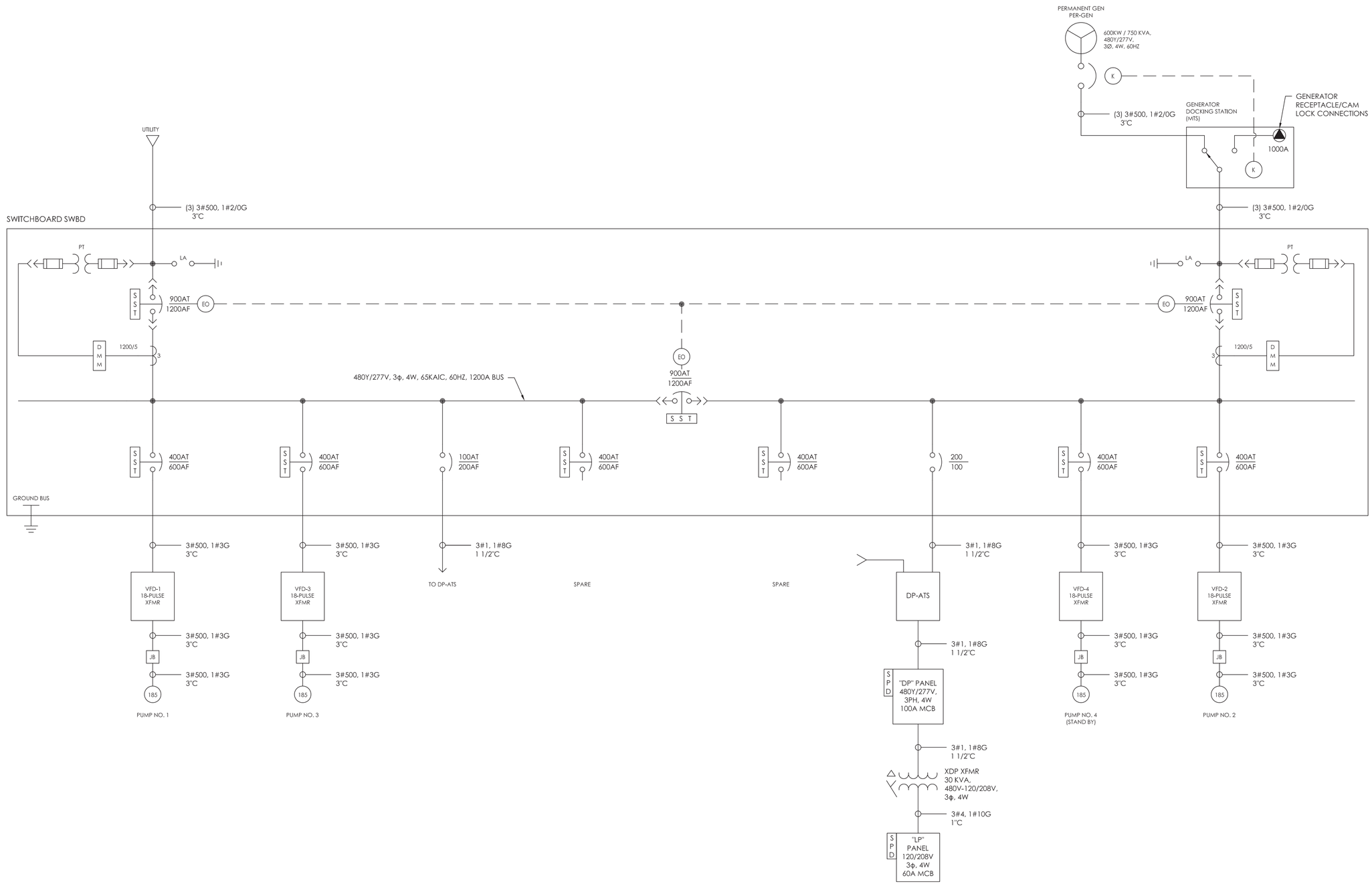

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No.	Revision	By	Appd	YYYY.MM.DD
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No.	Issued	By	By	Appd	YYYY.MM.DD
A	Preliminary Design			TW	2022/02/24

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BAYSHORE PUMP STATION
CITY OF TAMPA

PROJECT NAME
BAYSHORE PUMP STATION

City, Province/State
TAMPA, FLORIDA

Project No.: 20-C-00015

File Name: E-02

Scale: NONE

Author	Designer	Checker	YYYY.MM.DD
VN	EB	TP	2022/02/24

Title
ELECTRICAL
ONE LINE DIAGRAM

Revision: A

Drawing No.
E-02

ORIGINAL SHEET - ANSI D

GEOTECHNICAL REPORT

Appendix D

TIERRA

April 30, 2021

Attn: Mr. David Socha, P.E.
Stantec
777 Harbour Island Blvd., Suite 600
Tampa, Florida 33602-5729

RE: Geotechnical Engineering Services Report
Bayshore Boulevard Pumping Station Rehabilitation Design-Build
(COT Project 20-C-00015)
City of Tampa, Florida
Tierra Project No.: 6511-20-226

Mr. Socha:

Tierra, Inc. has completed the geotechnical engineering study for the above referenced project. The results of the study are provided herein.

Should there be any questions regarding this report, please do not hesitate to contact our office at (813) 989-1354. Tierra would be pleased to continue providing Geotechnical services throughout the implementation of the project. We look forward to working with you and your organization on this and future projects.

Respectfully Submitted,

TIERRA, INC.

Tyler R. Jean, E.I.
Geotechnical Engineer Intern

Kevin H. Scott, P.E.
Senior Geotechnical Engineer
Florida License No. 65514

7351 Temple Terrace Highway • Tampa, Florida 33637
Phone (813) 989-1354 • Fax (813) 989-1355
Florida Certificate No. 6486

TABLE OF CONTENTS

APPENDIX

PROJECT DESCRIPTION

Project Information

This project consists of improvements to the City of Tampa Bayshore Blvd. Pumping Station located in the median of Bayshore Blvd. at its intersection with Mason Street. The services have been performed to support the design build contract between the City of Tampa and PCL Construction, Inc.

Based on our understanding, this phase of the project includes modifications to the existing pump station, electrical system, and construction of a new adjacent electrical building to be located approximately 100 feet south of the existing pump station. The proposed electrical building is anticipated to be supported on shallow foundations. We understand modifications to the existing pump station will include increasing the depth of the structure footprint an additional 4 to 8 feet below the existing bottom of the structure. In addition, the project includes new force main pipeline extending north of the existing pump station within the median of Bayshore Boulevard a distance of approximately 500 feet.

This report has been developed to provide geotechnical support for the pump station, electrical building structure, and force main alignment associated with the project.

Scope of Geotechnical Services

The objective of our study was to obtain information concerning subsurface conditions at the project site in order to base engineering estimates and recommendations in each of the following areas:

1. Feasibility of utilizing shallow spread foundation system to support of the proposed electrical building structures. Suitability of a slab-on-grade.

2. Design parameters required for the proposed structure electrical building foundation system, including allowable bearing pressures, foundation levels and soil compaction recommendations.

3. General location and description of potentially deleterious materials discovered in the borings which may interfere with construction progress and structure performance, including existing fills or surficial organics.

4. Identification of groundwater levels at the boring locations.

5. Geotechnical parameters for use by the structural engineer in designing the pump station improvements.

6. General construction considerations.

In order to meet the preceding objectives, we provided the following services:

1. Reviewed published soils and topographic information. This published information was obtained from the appropriate Florida Quadrangle Map published by the USGS, and the Soil Survey of Hillsborough County, published by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS).

2. Executed a program of subsurface exploration consisting of borings, subsurface sampling and field testing.

   Pavement Area

   - Performed one (1) pavement core boring within the Bayshore/Mason intersection

   Pump Station/Electrical Building Structures

   - Performed three (3) SPT borings to depths ranging from 25 to 70 feet below grade. Developed soil strength parameters for use by the structural engineer.

   Force Main Alignment

   - Performed two (2) SPT borings to a depth of 15 feet below existing grades.

3. Measured the groundwater table depth at the boring locations.

4. Visually classified the samples in the laboratory using the Unified Soil Classification System (USCS) classification system. Identified soil conditions at each boring location.

5. Prepared an engineering report in accordance with the scope of work that summarizes the course of study pursued, the field data generated, subsurface conditions encountered and the results of our findings.

The scope of our services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic materials in the soil, geologic hazards, bedrock, groundwater, or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors, colors, unusual or suspicious items or conditions are strictly for the information of our client.

REVIEW OF PUBLISHED DATA

General Site Information

The site is located within the grassed median area of Bayshore Boulevard in Tampa, Florida.

Based on the "Tampa, Florida" United States Geological Survey (USGS) Quadrangle Map, the natural ground elevation at the project site ranges from approximately +5 to +10 feet National Geodetic Vertical Datum of 1929 (NGVD 29).

Hillsborough County Soil Survey

Soil data published by the USDA Soil Survey of Hillsborough County, Florida was reviewed as part of the subsurface investigation. This information indicates that there is one (1) primary mapping unit within the vicinity of the project site. The following paragraphs and table provides a brief description of the soil unit as presented in the Soil Survey.

Myakka - Urbanland (32)- The Myakka component makes up 50 percent of the map unit. Slopes are 0 to 2 percent. This component is on flatwoods on marine terraces on coastal plains. The parent material consists of sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during June, July, August, and September. Organic matter content in the surface horizon is about 1 percent.

The Urban Land component of these soil types consists of areas where most of the soil surface is covered with impervious materials, such as buildings and paved areas. This land type consists of areas where the original soil has been modified through cutting, grading, filling, and shaping or has been altered for urban development.

SUMMARY OF USDA SOIL SURVEY

HILLSBOROUGH COUNTY, FLORIDA

USDA Map Symbol and Soil Name	Depth (in)	Soil Classification		Permeability (in/hr)			pH	Seasonal High Water Table	
		USCS	AASHTO	Low		High		Depth (feet)	Months
(32) Myakka - Urbanland	0-5	SP, SP-SM	A-3	6.0	-	20.0	3.5-6.5	0.5-1.5	Jun-Sep
	5-20	SP, SP-SM	A-3	6.0	-	20.0	3.5-6.5		
	20-30	SM, SP-SM	A-2-4, A-3	0.6	-	6.0	3.5-6.5		
	30-80	SP, SP-SM	A-3	6.0	-	20.0	3.5-6.5		
	The USDA Soil Survey Does Not Contain Information for Urban Land Components								

It should be noted that information contained in the USDA/NRCS Soil Survey may not be reflective of current subsurface conditions, particularly if recent development in the project vicinity has modified existing soils or surface/subsurface drainage.

Review of Potentiometric Surface Information

Based on a review of the "Potentiometric Surface of the Upper Floridan Aquifer, West-Central Florida" maps published by the USGS, the potentiometric surface elevation of the upper Floridan Aquifer in the project vicinity ranges up to +10 feet, NGVD 29.

As indicated above, the natural ground elevation in the project vicinity ranges from approximately +5 to +10 feet, NGVD 29. Artesian flow conditions were not encountered at the time of our field activities; however, the contractor's tools and construction methods should address and handle a potentiometric level of up to +10 feet NGVD 29.

SUBSURFACE CONDITIONS

General

The subsurface conditions at the site were explored using five (5) SPT borings performed to depths ranging from approximately 15 to 70 feet below existing grades. Additionally, one (1) hand auger boring was completed at the location of the pavement core. The borings were located in the field by a representative of Tierra using hand-held Global Positioning System (GPS) devices. The approximate boring locations are presented in the **Appendix**. If a more accurate determination of the boring locations and elevations is required, then Tierra recommends the boring locations be survey located by the project surveyor.

The SPT borings were performed with the use of a drill rig using bentonite mud drilling procedures utilizing an automatic hammer system. The soil sampling was performed in general accordance with American Society for Testing and Materials (ASTM) Test Designation D-1586. The upper 4 to 6 feet of SPT borings were advanced manually by hand auger to verify utility clearances. SPT resistance N-values were then taken continuously to a depth of approximately 10 feet and at intervals of 5 feet to the boring termination depth.

The hand auger boring was performed by manually twisting and advancing a bucket auger into the ground, typically in 6-inch increments. The soil sampling was performed in general accordance with the American Society for Testing and Materials (ASTM) test designation D-1452.

The soil strata encountered in the borings performed at the project site are summarized in the following table:

Stratum Number	Soil Description	USCS Symbol
1	Light Gray SAND to Silty SAND with Clay Nodules and Stabilizer	SP-SM/SM
2	Light Gray to Light Brown Fine SAND to SAND with Silt	SP/SP-SM
3	Light Brown Silty SAND	SM
4	Green-Gray Clayey SAND	SC
5	Gray to Green-Gray CLAY	CL/CH
6	Calcareous Clay to Weathered Limestone	---(1)
(1) USCS does not provide nomenclature for natural limestone.		

The subsurface soil stratification is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The soil profiles included in the **Appendix** should be reviewed for specific information at individual boring locations. These profiles include soil descriptions, stratifications and penetration resistances when applicable. The stratifications shown on the boring profiles represent the conditions only at the actual boring location. Variations did occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual.

Groundwater Information

The groundwater level, at the time the SPT borings were performed, was encountered at depths ranging from 3½ to 6½ feet below grade. This groundwater table level is depicted adjacent to the corresponding borings.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences (i.e. existing swales, drainage drainages, underdrains and areas of covered soils, such as paved parking lots). It should be noted that groundwater levels tend to fluctuate during periods of prolonged drought and extended rainfall and may be affected by man-made influences. In addition, a seasonal effect will also occur in which higher groundwater levels are normally recorded in rainy seasons.

EVALUATION AND RECOMMENDATIONS

Pump Station/Wet Well

It's our understanding the existing pump is being modified as part of the improvements. Excavations for the proposed wet well/lift station structure should be carried out in accordance with OSHA requirements/guidelines. To facilitate preparation of the subgrade

soils for the construction of the proposed lift station, it may be necessary to place gravel aggregate to achieve stable/unyielding conditions.

Calcareous clay to weathered limestone (Stratum 6) was encountered in the borings performed in the vicinity of the existing pump station at depths as shallow as approximately 10 feet below existing grades. This material is rock. Excavations into or through this material will be difficult and require non-conventional construction techniques and specialized equipment. In addition, limestone is porous and will be difficult to dewater.

Based on a review of the "Potentiometric Surface of the Upper Floridan Aquifer, West-Central Florida" maps published by the USGS, the potentiometric surface elevation of the upper Floridan Aquifer in the project vicinity ranges up to +10 feet, NGVD 29. The natural ground elevation in the project vicinity ranges from approximately +5 to +10 feet, NGVD 29. Artesian flow conditions were not encountered at the time of our field activities; however, the contractor's tools and construction methods should address and handle a potentiometric level of up to +10 feet NGVD 29.

A net allowable bearing pressure of 2,000 psf and a modulus of subgrade reaction of 90 pci can be used for the design of the wet well foundation. Tierra recommends that for design purposes the water table be modelled at the ground surface.

The in-situ soils will exert lateral (horizontal) earth pressure on the walls of the wet well structure. Walls constructed below grade which have adjacent in-situ soils will be subjected to active, passive, or at-rest lateral earth pressures. Active pressures are usually employed for unrestrained retaining wall design. Walls which are restrained at the top and bottom will be subjected to at-rest soil pressures. A table of **Recommended Soil Parameters** is provided in the **Appendix**. Once pump station details are developed, Tierra can coordinate with the structural engineer to incorporate the geotechnical data, if necessary.

Pavement Core

The detailed results of the pavement coring operation are included on the **Pavement and Base Material Data Sheet** in the **Appendix**. Tierra recommends that this information and the information presented on the **Soil Profiles** sheet and the **Boring Location Plan** sheet be reviewed by the design engineer. Photographic documentation of the pavement core is also provided in the **Appendix**.

Structural Fill

If necessary, all materials to be used for structural fill or backfill should be evaluated and tested by Tierra prior to placement to determine if the materials are suitable for the intended use. Suitable fill materials should consist of fine to medium sand with less than 12% passing the No. 200 sieve, free of demolition debris, structure and pavement remnants, rubble, pavement, organics, clay, debris and other unsuitable material and evaluated against project engineering requirements.

In general, the soils of Stratum 1and 2 (SP/SP-SM) may be moved and used for grading purposes, site leveling, general engineering fill, structural fill and backfill in other areas, provided the fill is free of organic materials, clay, debris or any other material deemed unsuitable for construction and evaluated against engineering fill requirements.

Drainage and Groundwater Concerns

We recommend that the Contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on the construction procedure. Care should be given to open excavations and site grading to minimize ponding of surface water and direct surface water flow away from the excavation. Excavations

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom in accordance with OSHA 29 CFR, Part 1926, Subpart P as well as the “Trench Safety Act” in Chapter 90-96 of the Florida Statutes. The contractors “responsible persons”, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor’s safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in all local, state, and federal safety regulations.

We are providing this information solely as a service to our client. Tierra does not assume responsibility for construction site safety or the contractor’s or other party’s compliance with local, state, and federal safety or other regulations.

REPORT LIMITATIONS

The analyses, conclusions and recommendations contained in this report are opinions based on the site conditions and project layout described herein and further assume that the conditions observed in the exploratory borings are representative of the subsurface conditions throughout the site, i.e., the subsurface conditions elsewhere on the site are the same as those disclosed by the borings. If, during construction, subsurface conditions different from those encountered in the exploratory borings are observed or appear to be present beneath excavations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary.

This report was prepared for the exclusive use of our client for evaluating the design of the project as it relates to the geotechnical aspects discussed herein. It should be made available to prospective contractors for information on factual data only and not as a warranty of subsurface conditions included in this report. Unanticipated soil conditions may require that additional expense be made to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

APPENDIX

USDA and USGA Vicinity Maps

Boring Location Plan

Soil Profiles

Soil Parameter Sheet

Pavement Data Table

Representative Pavement Core Photos

USDA SOIL SURVEY MAP

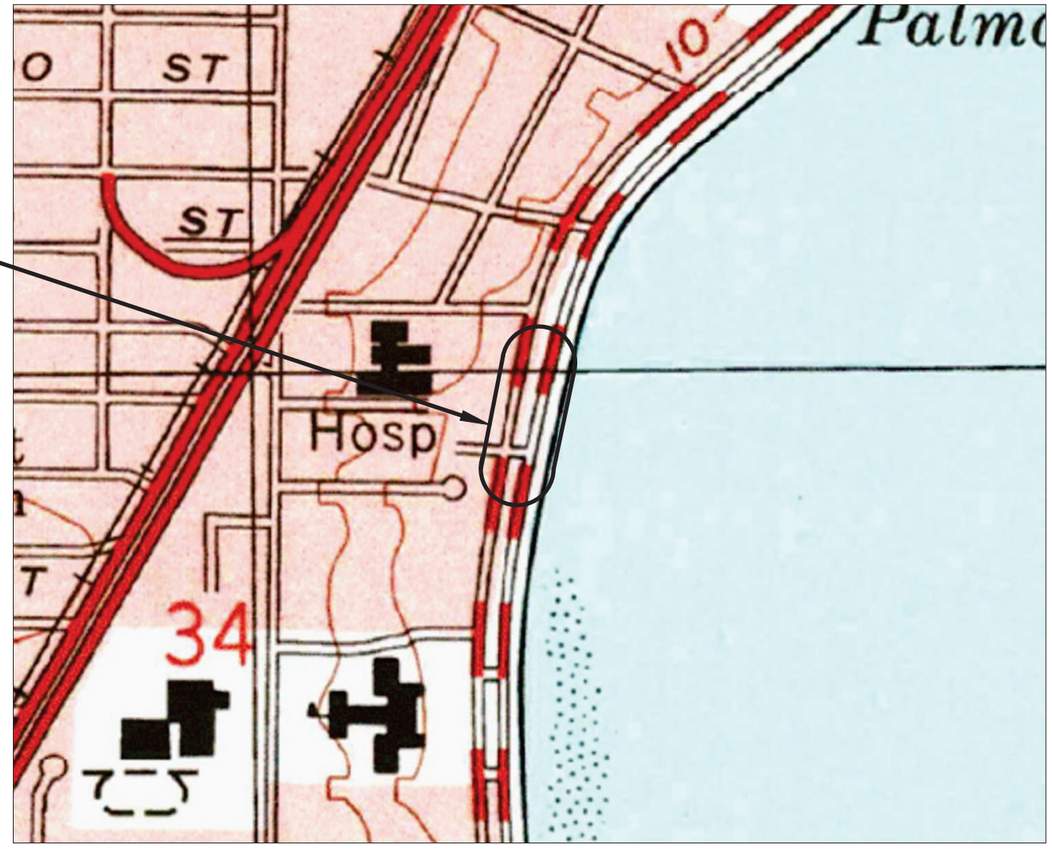
REFERENCE: USDA SOIL SURVEY OF HILLSBOROUGH COUNTY, FLORIDA

APPROXIMATE PROJECT LOCATION

0 500'

PLAN SCALE

USGS QUADRANGLE MAP



REFERENCE: "TAMPA, FLORIDA" USGS QUADRANGLE MAP

TOWNSHIP:	29 S
RANGE:	18 E
SECTION:	34

DRAWN BY: SW CHECKED BY: TJ	APPROVED BY: KHS DATE: APR 2021	ENGINEER OF RECORD: KEVIN H. SCOTT, P.E. FLORIDA LICENSE NO.: 65514	TIERRA 7351 Temple Terrace Highway Tampa, Florida 33637 Phone: 813-989-1354 Fax: 813-989-1355	SCALE: NOTED	PROJECT NUMBER: 6511-20-226	GEOTECHNICAL ENGINEERING SERVICES BAYSHORE BOULEVARD PUMP STATION HILLSBOROUGH COUNTY, FLORIDA	SHEET 1

BORING LOCATION PLAN

0 50'

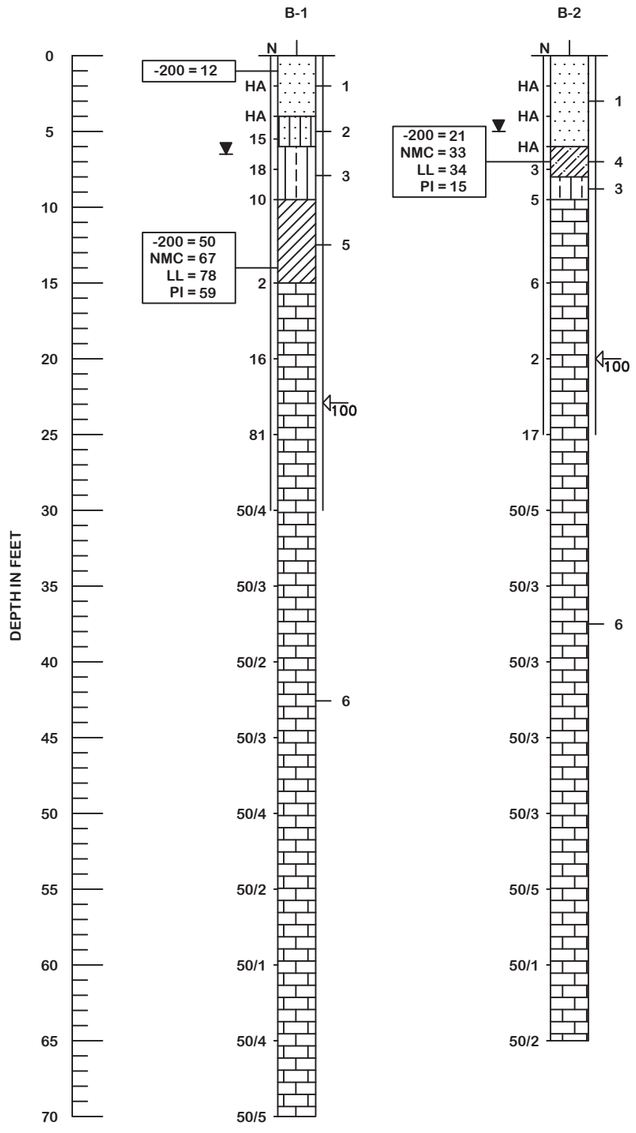
PLAN SCALE

LEGEND

- APPROXIMATE LOCATION OF SPT BORING
- APPROXIMATE LOCATION OF PAVEMENT CORE

DRAWN BY: SW CHECKED BY: TJ	APPROVED BY: KHS DATE: APR 2021	ENGINEER OF RECORD: KEVIN H. SCOTT, P.E. FLORIDA LICENSE NO.: 65514	TIERRA 7351 Temple Terrace Highway Tampa, Florida 33637 Phone: 813-989-1354 Fax: 813-989-1355	SCALE: NOTED	PROJECT NUMBER: 6511-20-226	GEOTECHNICAL ENGINEERING SERVICES BAYSHORE BOULEVARD PUMP STATION HILLSBOROUGH COUNTY, FLORIDA	SHEET 2

SOIL PROFILES



LEGEND

1 LIGHT GRAY SAND WITH SILT TO SILTY SAND WITH CLAY NODULES AND STABILIZER (SP-SM/SM)

2 LIGHT BROWN TO LIGHT GRAY FINE SAND TO SAND WITH SILT (SP/SP-SM)

3 LIGHT BROWN SILTY SAND (SM)

4 GREEN-GRAY CLAYEY SAND(SC)

5 GRAY TO GREEN-GRAY CLAY (CL/CH)

6 CALCAREOUS CLAY TO WEATHERED LIMESTONE

P PAVEMENT

▼ GROUNDWATER LEVEL ENCOUNTERED DURING INVESTIGATION

N SPT N-VALUE IN BLOWS/FOOT FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED)

SP UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2488) GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND LABORATORY TESTING ON SELECTED SAMPLES FOR CONFIRMATION OF VISUAL REVIEW

50/4 NUMBER OF BLOWS FOR 4 INCHES OF PENETRATION

HA HAND AUGERED TO VERIFY UTILITY CLEARANCES

CASING

100 LOSS OF CIRCULATION OF DRILLING FLUID (100%)

-200 PERCENT PASSING #200 SIEVE

NMC NATURAL MOISTURE CONTENT (%)

LL LIQUID LIMIT (%)

PI PLASTICITY INDEX (%)

NP NON PLASTIC

RECOMMENDED ENVIRONMENTAL CLASSIFICATION:
SUBSTRUCTURE CONCRETE: MODERATELY AGGRESSIVE
SUBSTRUCTURE STEEL: MODERATELY AGGRESSIVE

AUTOMATIC HAMMER	
GRANULAR MATERIALS-RELATIVE DENSITY	SPT (BLOWS/FT.)
VERY LOOSE	LESS THAN 3
LOOSE	3 TO 8
MEDIUM	8 TO 24
DENSE	24 TO 40
VERY DENSE	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	SPT (BLOWS/FT.)
VERY SOFT	LESS THAN 1
SOFT	1 TO 3
FIRM	3 TO 6
STIFF	6 TO 12
VERY STIFF	12 TO 24
HARD	GREATER THAN 24

DRAWN BY: SW
CHECKED BY: TJ

APPROVED BY: KHS
DATE: APR 2021

ENGINEER OF RECORD: KEVIN H. SCOTT, P.E.
FLORIDA LICENSE NO.: 65514

TIERRA
7351 Temple Terrace Highway
Tampa, Florida 33637
Phone: 813-989-1354 Fax: 813-989-1355

SCALE: NOTED

PROJECT NUMBER: 6511-20-226

GEOTECHNICAL ENGINEERING SERVICES
BAYSHORE BOULEVARD PUMP STATION
HILLSBOROUGH COUNTY, FLORIDA

SHEET 3

Recommended Soil Parameters
Bayshore Blvd and Mason St
Hillsborough County, Florida
Tierra Project No: 6511-20-226

Boring Number	Depth (ft)	N-Values	Soil Type	Total Unit Weight[1] (PCF)	Effective Unit Weight[2] (PCF)	Friction Angle φ°	Cohesion (PSF)
B-1	0 TO 4	HA	SAND	105	43	28	0
B-1	4 to 13.5	10 TO 18	SAND	112	50	30	0
B-1	13.5 TO 18.5	2	CLAY	110	44	0	250
B-1	18.5 TO 70	81 TO 100	LIMESTONE	135	73	0	15000
B-2	0 TO 6	HA	SAND	102	45	28	0
B-2	6 TO 23.5	2 TO 6	CLAY	110	48	0	250
B-2	23.5 TO 28.5	17	LIMESTONE	115	46	0	0
B-2	23.5 TO 30	100	LIMESTONE	135	44	0	15000

Notes:

(1) Assume saturated conditions, i.e. analyze with the groundwater at the surface.

(2) Effective unit weight based on saturated conditions.

PAVEMENT DATA AND CONDITION SHEET

Bayshore Blvd and Mason Street Intersection

Hillsborough County, Florida

Tierra Project No.: 6511-20-226

Core No.	Location[1]		Asphalt Layer			Base for Paved Roadway		Subgrade		Crack Depth (inches)	Pavement Condition[4]	Rut Depth (inches)	Groundwater Depth (feet)
	Easting	Northing	Thickness (inches)	Type	Total Asphalt Core Length (inches)	Type	Thickness (inches)	Type	Depth (feet)				
C-1	515062	766254	11.0	S-3[2]	11.0	Limerock	5.0	A-3	1.3 to 2.5	N/A	F	N/A	4.0

Notes:

[1] Pavement Core locations were estimated utilizing GPS coordinates referenced to the Florida State Plane East coordinate system obtained by Tierra, Inc. in the field and should be considered approximate.

[2] Pavement layer identification based on visual review using FDOT nomenclature. Pavement layer appears to be a local mix. The pavement designer should use caution when determining the structural number of the existing asphalt. Structural number values in the FDOT Flexible Pavement Manual for S-3 material may not be appropriate for the existing asphalt material. Pavement layers are classified in decending order from the top of the core sample to the bottom.

[3] Full depth cracking was observed at these core locations.

[4] Pavement condition based on visual observatoin; Good, Fair or Poor.

GNE: Groundwater Not Encountered.

N/A: Information not Available.

Pavement Core Sample Photographs

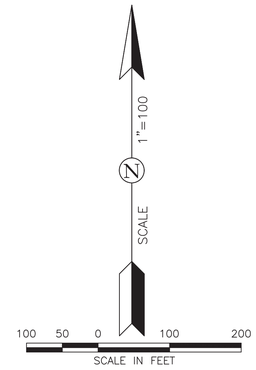
Photograph 1. Core C-1

Photograph 2. Core C-1

SURVEY

Appendix E

Section 34 - Township 29 South - Range 18 East
Hillsborough County, Florida
City of Tampa - 20-C-00015 Bayshore Pumping Station Rehabilitation Design-Build
Topographic and Subsurface Utility Survey



REVISIONS		
	DESCRIPTION	DATE
1		
2		
3		
4		
5		
6		

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THIS SURVEY AND ALL FILES HEREIN ARE A TRUE AND ACCURATE REPRESENTATION OF A FIELD SURVEY MADE UNDER MY RESPONSIBLE CHARGE, AND THAT TO THE BEST OF MY KNOWLEDGE MEETS THE STANDARDS OF PRACTICE AS SET FORTH BY THE BOARD OF PROFESSIONAL SURVEYORS AND MAPPERS IN RULE CHAPTER 5J-17 OF THE FLORIDA ADMINISTRATIVE CODE.

Digitally signed by ADAM BERRY
Date: 2021.07.02 16:30:09 -04'00'

ADAM BERRY
PROFESSIONAL SURVEYOR AND MAPPER LS 7117

UNLESS IT BEARS THE SIGNATURE AND THE ORIGINAL RAISED SEAL OF A FLORIDA LICENSED SURVEYOR AND MAPPER, THIS MAP/REPORT IS FOR INFORMATIONAL PURPOSES ONLY AND IS NOT VALID.

ECHO UES, INC.
4803 GEORGE RD, SUITE 350
TAMPA, FLORIDA 33634
TELEPHONE (888) 778-3246
CERTIFICATE OF AUTHORIZATION
NO. 8184

TOPOGRAPHIC SURVEY
SECTION 34, TOWNSHIP 29 S. RANGE 18 E.
HILLSBOROUGH COUNTY, FLORIDA
DATE OF LAST FIELD WORK: 06/17/2021
DRAWN BY: CAM
FIELD BOOK: TPA-40
DRAWING FILE: SURVRD_21-207.dwg
SHEET NO. 1 OF 7

Surveyor's Report
Topographic and Subsurface Utility Survey
City of Tampa - 20-C-00015
Bayshore Pumping Station Rehabilitation Design-Build

TYPE OF SURVEY

This is a survey of existing ground conditions including spot elevations, breaklines, drainage structures, aboveground topographic features, aboveground utility appurtenances, designating marks (paint and flags) and locating marks (iron rod and cap, nail and disk or x-cut in concrete) at the Bayshore Pumping Station in Tampa, Hillsborough County, Florida to aide in the rehabilitation design improvements.

DATUMS

Horizontal

- Florida State Plane Coordinate System, West Zone (902), North American Datum Of 1983, 2011 Adjustment (NAD 83(2011)).
- Horizontal control was established using The Florida Department of Transportation's (FDOT) Florida Permanent Reference Network (FPRN), a Real Time Kinematic (RTK) Global Positioning System (GPS).

Vertical

- Vertical control is based on the North American Vertical Datum Of 1988 (NAVD 88).
- A closed loop benchrun was completed from a Florida Department of Environmental Protection benchmark and a Hillsborough County benchmark more specifically described as:
    - V 713 - Florida Department of Environmental Protection survey disk set in top of a concrete bay along seawall, elevation 5.31'
    - FRED - Hillsborough County survey disk in concrete monument, elevation 8.08'
- All set control was elevated by completing a closed loop benchrun from the abovementioned primary vertical control points. Said benchrun closure is accurate to a standard of 0.05' times the square root of the benchrun distance in miles. See Sheet 3 for control information.

SURVEY METHODS

Conventional, terrestrial survey methods (total station and electronic data collection) were utilized to collect existing ground conditions including spot elevations, breaklines, drainage structures, aboveground topographic features, aboveground utility appurtenances and subsurface utility designating and locating marks.

Sufficient ground information was collected to create a digital terrain model (DTM) of the existing ground conditions at the time of the survey. The “surface” was created in Autodesk Civil 3D 2020.

Subsurface utilities depicted hereon are the horizontal locations of paint marks and flags placed by subsurface utility engineering field technicians. The marks were determined using surface geophysical equipment including but not limited to Ground Penetrating Radar (GPR) and/or electromagnetic locators. Utility characteristics, methods of installation, soil conditions and the surrounding environment all may adversely impact the results of any utility investigation. For these reasons the locations of the subsurface utilities should be considered approximate unless clearly exposed and visually verified at specific locations. No guarantee is made that all utilities will be found and identified.

Subsurface utilities were visually verified at specific locations using non-invasive vacuum excavation techniques. An iron rod and cap, nail and disk or x-cut in concrete were set at the ground surface above the horizontal location of the utility. Once the utility was exposed the depth from the set point at the ground surface was then surveyed to obtain an elevation. The recorded depth of the subsurface utility was subtracted from the elevation to determine the elevation of the top of the subsurface utility. Utility depth below grade measurements are certified to the last day of field effort as noted below.

All subsurface utility engineering work performed was done in accordance with the American Society of Civil Engineers' (ASCE) Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data (ASCE/CI 38-02). Quality levels shown in the survey are referenced to ASCE/CI 38-02.

GENERAL NOTES

- Any bearings shown hereon are referenced to the Florida State Plane Coordinate System, West Zone (902), North American Datum Of 1983, 2011 Adjustment (NAD83/2011).
- The last date of field effort: June 17, 2021
- The Aerial Imagery shown was obtained using The Florida Department of Transportation's Aerial Photo Look-Up system and is meant for reference purposes only. The actual ground surface may differ from what is depicted hereon.
- Additions or deletions to the survey files or reports by anyone other than the signing party or parties is prohibited without written consent of the signing party or parties.
- This report is not valid unless the digital signature/certification has been verified.
- The digital survey files and the survey report are not valid without the other.
- All .DWG files (AutoCAD file) are intended to be displayed at a scale of 1" = 10'.
- Prepared for/certified to: Arcadis

REVISIONS		
	DESCRIPTION	DATE
1		
2		
3		
4		
5		
6		

ECHO UES, INC.
4803 GEORGE RD, SUITE 350
TAMPA, FLORIDA 33634
TELEPHONE (888) 778-3246
CERTIFICATE OF AUTHORIZATION
NO. 8184

TOPOGRAPHIC SURVEY
SECTION 34, TOWNSHIP 29 S, RANGE 18 E.
HILLSBOROUGH COUNTY, FLORIDA
DATE OF LAST FIELD WORK: 06/17/2021
DRAWN BY: CAM
FIELD BOOK: TPA-40
DRAWING FILE: SURVRD_21-207.dwg
SHEET NO. 2 OF 7

Legend and Abbreviations
Topographic and Subsurface Utility Survey
City of Tampa - 20-C-00015
Bayshore Pumping Station Rehabilitation Design-Build

ABBREVIATIONS

AGV	=	Above Ground Vault
BGV	=	Below Ground Vault
BLDG	=	Building
BLVD	=	Boulevard
CIP	=	Cast Iron Pipe
CONC	=	Concrete
DIA	=	Diameter
DIR.	=	Direction
E	=	East
ELEC	=	Electric
ELEV	=	Elevation
EOI	=	End of Information
INC.	=	Incorporated
INV	=	Invert
IRC	=	Iron Rod with Cap
IRR	=	Irrigation
LP	=	Light Pole
MH	=	Manhole
N	=	North
NO.	=	Number
NW	=	Northwest
RCP	=	Reinforced Concrete Pipe
RD	=	Road
S	=	South
SAN	=	Sanitary
SERV	=	Service
ST	=	Street
TH	=	Test Hole
W	=	West
W/	=	With

LEGEND

	=	Control Point
EOI	=	End of Information
	=	Faucet
	=	Light Pole
S	=	Manhole (Sanitary)
ELEC	=	Meter (Electric)
WATER	=	Meter (Water)
	=	Post
	=	Pullbox
	=	Sign
	=	Service Box
TH	=	Test Hole
	=	Tree (Oak)
	=	Tree (Palm)
GAS	=	Valve (Gas)
SAN	=	Valve (Sanitary)
W/R	=	Valve Box (Non-Potable Water)
SAN	=	Valve Box (Sanitary)

LINE TYPE

- BE(B) — Buried Electric-Existing Type B
- BFOC(B) — Buried Fiber Optic Cable-Existing Type B
- BT(B) — Buried Telephone-Existing Type B
- G(B) — Gas-Existing Type B
- IRR(B) — Irrigation-Existing Type B
- Lane Line
- S(B) — Sanitary Sewer-Existing Type B
- UNK(B) — Unknown Utility-Existing Type B
- W(B) — Water-Existing Type B

CONTROL POINTS

NAME	NORTHING	EASTING	ELEV (NAVD88)	DESCRIPTION
B1	1,302,551.24'	497,478.47'	5.53'	SET 5/8" IRON ROD W/ CAP STAMPED "ECHO UES TP LB 8184"
B2	1,302,757.91'	497,583.42'	4.82'	SET 5/8" IRON ROD W/ CAP STAMPED "ECHO UES TP LB 8184"
B3	1,302,786.99'	497,472.35'	3.89'	SET 5/8" IRON ROD W/ CAP STAMPED "ECHO UES TP LB 8184"
B4	1,302,942.37'	497,557.97'	5.21'	SET 5/8" IRON ROD W/ CAP STAMPED "ECHO UES TP LB 8184"
B5	1,303,207.02'	497,634.60'	5.65'	SET 5/8" IRON ROD W/ CAP STAMPED "ECHO UES TP LB 8184"

TEST HOLE DATA REPORT

Date:	06/16/2021	**Test Hole Data Report**			**Crew Members:**	MG,DS
ECHO Project #:	21-207	4803 George Road, Ste. 350 Tampa, Florida 33634	ECHO UES, Inc. www.echoues.com 888.778.ECHO		**City, State:**	Tampa, FL
Financial Project #:	N/A	400 SR 434, Ste. 1016 Oviedo, Florida 32765	ECHO UTILITY ENGINEERING & SURVEY - GROW. INSPIRE. MAKE A DIFFERENCE.		**General Location:**	Bayshore Blvd.
Truck No.:	D-3/VT-2				**Coordinate Unit of Measure:**	US Survey Feet

Utility Type		Utility Material		Identified By:	Abbreviations	Offset Measured From:
BE = Buried Electrical	RCW = Reclaimed Water	AC = Transite	GALV = Galvanized Pipe	HUB = Survey Hub	N/A = Not Applicable	EP= Edge of Pavement
GM = Gas Main	RAS = Return Activated Sludge	CI= Cast Iron	HDPE = High Density Polyethylene Pipe	IRC = Iron Rod & Cap "ECHO TEST HOLE"	NAD = North American Datum	BC = Back of Curb
BT = Buried Telephone	SL = Street Light	CP = Concrete Pipe	PE = Polyethylene Pipe	NL = Nail & Disk "ECHO TEST HOLE"		BL = Baseline of Survey
FOC = Fiber Optic Cable	IRR = Irrigation Line	DBC = Direct Buried Cable	PVC = Polyvinyl Chloride	SLEEVE = Sleeve	NAVD = North American Vertical Datum	COORD = Survey Coordinates
WM = Water Main	GS = Gas Service	CMP = Corrugated Metal Pipe	STL = Steel	X = "X" in Concrete		CL = Centerline
SAN = Sanitary Sewer	WS = Water Service	CONC = Concrete	VCP = Vitrified Clay Pipe	**Surface Type**	UNK = Unknown	HUB = Survey Hub
STM = Storm Sewer	UNK = Unknown Utility	CPP = Corrugated Plastic Pipe	PCCP = Prestressed Cylinder Concrete Pipe	ASPH = Asphalt		RW = Right of Way
CATV = Cable Television	BED = Buried Electrical Duct	DCT = Duct		CONC = Concrete		ST = Swing Ties
FM = Force Main	BTD = Buried Telephone Duct	DIP = Ductile Iron Pipe	RCP = Reinforced Concrete Pipe	NG = Natural Ground		X = "X" in Concrete

Test Hole	Utility Type	Utility Material	Utility Size Outside Diameter inches	Utility Manual Depth feet	Cross Sectional View	Utility Direction	Identified By	Surface Type	Surface Thickness inches	Apparent Utility Owner	Datums: Horizontal: NAD83/2011 Vertical: NAVD88 Northing	Easting	Ground Elevation	Utility Elevation
1-1	GM	PE	6"	3.20'	○		IRC	NG	N/A	TECO	1302845.46'	497516.49'	4.29'	1.09'
1-2	BT	PVC	2-4"	2.50'	○○		IRC	NG	N/A	FRONTIER	1302771.60'	497508.47'	4.65'	2.15'
1-3	SL	GALV & PVC	2"	2.12'	◦		IRC	NG	N/A	CITY OF TAMPA	1302772.56'	497507.81'	4.60'	2.48'
1-4	SL	GALV & PVC	2"	2.20'	◦		IRC	NG	N/A	CITY OF TAMPA	1302774.01'	497508.16'	4.58'	2.38'
1-5	BE	CONC CAP	8' WIDE	2.20'	▭		IRC	NG	N/A	TECO	1302803.48'	497534.37'	6.11'	3.91'
1-6	BE	CONC CAP	8' WIDE	2.26'	▭		IRC	NG	N/A	TECO	1302801.96'	497542.47'	6.09'	3.83'
1-7	IRR	PVC	1.5"	0.94'	◦		IRC	NG	N/A	UNKNOWN	1302834.43'	497561.10'	5.72'	4.78'
1-8	FM	CI	18"	4.00'	◯		IRC	NG	N/A	CITY OF TAMPA	1302906.52'	497552.07'	5.09'	1.09'
1-9	FM	CI	18"	4.28'	◯		IRC	NG	N/A	CITY OF TAMPA	1302906.15'	497544.52'	4.81'	0.53'
1-10	BE	PVC	4"	3.14'	○	↔	IRC	NG	N/A	TECO	1302894.09'	497535.63'	5.01'	1.87'

Notes:
TH# 1-5 - PIN SET ON WEST EDGE
TH# 1-6 - PIN SET ON EAST EDGE
TH# 1-8 - UNABLE TO VISUALLY VERIFY DUE WATER AND CAVE-IN AT 3.5'
TH# 1-9 - UNABLE TO VISUALLY VERIFY DUE WATER AND CAVE-IN AT 3.5'

Prepared by: CM *Date: 06/18/2021*
Checked by: MA *Date: 06/18/2021*

REVISIONS		
	DESCRIPTION	DATE
1		
2		
3		
4		
5		
6		

ECHO UES, INC.
4803 GEORGE RD, SUITE 350
TAMPA, FLORIDA 33634
TELEPHONE (888) 778-3246
CERTIFICATE OF AUTHORIZATION
NO. 8184

TOPOGRAPHIC SURVEY
SECTION 34, TOWNSHIP 29 S, RANGE 18 E,
HILLSBOROUGH COUNTY, FLORIDA
DATE OF LAST FIELD WORK: 06/17/2021
DRAWN BY: CAM
FIELD BOOK: TPA-40
DRAWING FILE: SURVRD_21-207.dwg
SHEET NO. 3 OF 7

Section 34 - Township 29 South - Range 18 East
Hillsborough County, Florida
City of Tampa - 20-C-00015
Bayshore Pumping Station Rehabilitation Design-Build

SCALE 1"=10'

10 5 0 10 20
SCALE IN FEET

B1
ELEV=5.53'
SET $\frac{5}{8}$" IRC "ECHO UES TP LB 8184"

DIR. ONLY

SANITARY MH
RIM ELEV=6.94'
N (30" RCP) INV ELEV=0.30'
S (18" RCP) INV ELEV=1.67'

MATCH LINE
SEE SHEET 5

REVISIONS		
	DESCRIPTION	DATE
1		
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ECHO UES, INC.
4803 GEORGE RD, SUITE 350
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TOPOGRAPHIC SURVEY
SECTION 34, TOWNSHIP 29 S. RANGE 18 E.
HILLSBOROUGH COUNTY, FLORIDA
DATE OF LAST FIELD WORK: 06/17/2021
DRAWN BY: CAM
FIELD BOOK: TPA-40
DRAWING FILE: SURVRD_21-207.dwg
SHEET NO. 4 OF 7

Section 34 - Township 29 South - Range 18 East
Hillsborough County, Florida
City of Tampa - 20-C-00015
Bayshore Pumping Station Rehabilitation Design-Build

SCALE 1"=10'

10 5 0 10 20
SCALE IN FEET

SANITARY MH
RIM ELEV=5.03'
E (8" CLAY) INV ELEV=0.07'

B3
ELEV=3.89'
SET 5/8" IRC "ECHO UES TP LB 8184"

SANITARY MH
RIM ELEV=3.78'
E (8" CLAY) INV ELEV=-1.58'

4' METAL GATE
UPPER LEVEL
CONC LANDING
CONC PAD
METAL BGV
HANDRAIL
12" CIP

OLD CURB
EDGE
OF CONC

0.8' DIA IRR

EDGE OF PAVEMENT
FACE OF CURB
BACK OF CURB

0.8' DIA IRR

1-1 TH
EOI
1-3 TH 1-4
1-2
1-10 TH
EOI 1-9 TH
OLD CURB

0.8' DIA
NO ID

0.5'x0.5' CONC POST
W/ ELEC METER ON
NORTH FACE
AND 1.2'x0.4' BREAKER
BOX ON SOUTH FACE

ELEC TRANSFORMER
ON CONC PAD

DIR.
ONLY

12"
20"
15"

CONC LP, #24133

METAL BGV ELEC
1-5 TH
1-6 TH

8"

DIR.
ONLY

CONC PADS

DIRT
DIRT
CONCRETE
BLDG
#106
12" CONC WALL

1-8 TH

CONC PAD

AGV ON
CONC PAD

NO
PARKING
ON RIGHT
OF WAY

STOP BAR

STOP

LOWER LEVEL
CONC LANDING

1-7 TH

1.3'x0.9' IRR

FENCED IN GENERATOR
(NO ACCESS)

7' METAL GATE

BACK OF CURB
FACE OF CURB
FLOW LINE
EDGE OF PAVEMENT

SANITARY MH
RIM ELEV=6.26'
N (30" RCP) INV ELEV=-10.28'
S (30" RCP) INV ELEV=-10.20'
W (8" CLAY) INV ELEV=-9.40'
NW (8" CLAY) INV ELEV=-1.64'

LANDSCAPE EDGE

12" CONC WALL

SANITARY MH
RIM ELEV=7.10'
N (30" RCP) INV ELEV=-10.35'
S (30" RCP) INV ELEV=-10.30'
W (8" CLAY) INV ELEV=-2.29'

CONC
SLAB

METAL BGVS
ON CONC PAD

8" CONC WALL
FENCED IN LIFT STATION AREA
(LIMITED ACCESS)

LANDSCAPE EDGE

8" CONC WALL

METAL SERV CABINETS
W/ FANS ON 2'X'2' CONC PADS

B2
ELEV=4.82'
SET 5/8" IRC "ECHO UES TP LB 8184"

MATCH LINE
SEE SHEET 4

MATCH LINE
SEE SHEET 6

REVISIONS		
	DESCRIPTION	DATE
1		
2		
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ECHO UES, INC.
4803 GEORGE RD, SUITE 350
TAMPA, FLORIDA 33634
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TOPOGRAPHIC SURVEY
SECTION 34, TOWNSHIP 29 S. RANGE 18 E.
HILLSBOROUGH COUNTY, FLORIDA
DATE OF LAST FIELD WORK: 06/17/2021
DRAWN BY: CAM
FIELD BOOK: TPA-40
DRAWING FILE: SURVRD_21-207.dwg
SHEET NO. 5 OF 7

Section 34 - Township 29 South - Range 18 East
Hillsborough County, Florida
City of Tampa - 20-C-00015
Bayshore Pumping Station Rehabilitation Design-Build

N
SCALE
1"=10'

10 5 0 10 20
SCALE IN FEET

EDGE OF PAVEMENT
FACE OF CURB
BACK OF CURB
EOI
STOP BAR
STOP
2'x2'
2'x2'
NO PARKING ON
RIGHT OF WAY
CONC LP, #24136
B4
ELEV=5.21'
SET 5/8" IRC "ECHO UES TP LB 8184"
PAVEMENT
CROWN
MASON ST
BAYSHORE BLVD
BACK OF CURB
FACE OF CURB
FLOW LINE
EDGE OF PAVEMENT
SANITARY MH
RIM ELEV=5.65'
INV ELEV=-1.37'
BOTTOM OF STRUCTURE
FULL OF WATER
CONC PAD
0.8' DIA ELEC
CONC LP, #24140
B5
ELEV=5.65'
SET 5/8" IRC "ECHO UES TP LB 8184"

MATCH LINE
SEE SHEET 5

MATCH LINE
SEE SHEET 7

REVISIONS		
	DESCRIPTION	DATE
1		
2		
3		
4		
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ECHO UES, INC.
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TOPOGRAPHIC SURVEY
SECTION 34, TOWNSHIP 29 S. RANGE 18 E.
HILLSBOROUGH COUNTY, FLORIDA
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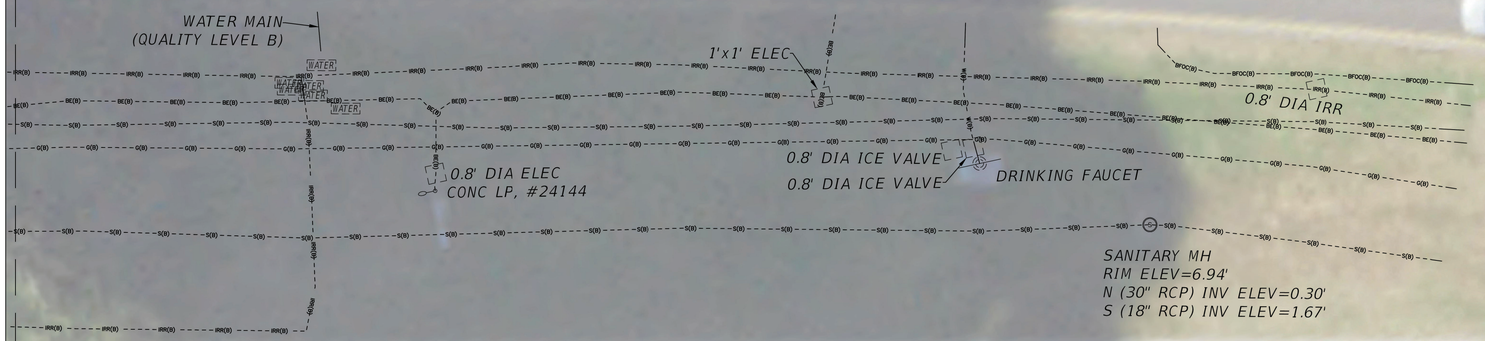
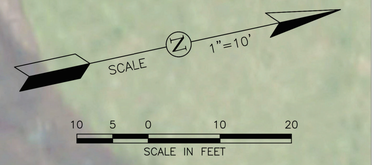
DRAWING FILE: SURVRD_21-207.dwg
SHEET NO. 6 OF 7

Section 34 - Township 29 South - Range 18 East
Hillsborough County, Florida
City of Tampa - 20-C-00015
Bayshore Pumping Station Rehabilitation Design-Build





MATCH LINE
SEE SHEET 6

REVISIONS		
	DESCRIPTION	DATE
1		
2		
3		
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6		

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4803 GEORGE RD, SUITE 350
TAMPA, FLORIDA 33634
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TOPOGRAPHIC SURVEY
SECTION 34, TOWNSHIP 29 S. RANGE 18 E.
HILLSBOROUGH COUNTY, FLORIDA
DATE OF LAST FIELD WORK: 06/17/2021
DRAWN BY: CAM
FIELD BOOK: TPA-40
DRAWING FILE: SURVRD_21-207.dwg
SHEET NO. 7 OF 7

Date:	06/16/2021	**Test Hole Data Report**	**Crew Members:** MG,DS
ECHO Project #:	21-207	4803 George Road, Ste. 350 Tampa, Florida 33634 400 SR 434, Ste. 1016 Oviedo, Florida 32765	**City, State:** Tampa, FL
Financial Project #:	N/A	ECHO UTILITY ENGINEERING & SURVEY	**General Location:** Bayshore Blvd.
Truck No.:	D-3/VT-2	**ECHO UES, Inc.** **www.echoues.com** **888.778.ECHO** - GROW, INSPIRE, MAKE A DIFFERENCE-	**Coordinate Unit of Measure:** US Survey Feet

Utility Type		Utility Material		Identified By:	Abbreviations	Offset Measured From:
BE = Buried Electrical	RCW = Reclaimed Water	AC = Transite	GALV = Galvanized Pipe	HUB = Survey Hub	N/A = Not Applicable	EP= Edge of Pavement
GM = Gas Main	RAS = Return Activated Sludge	CI= Cast Iron	HDPE = High Density Polyethylene Pipe	IRC = Iron Rod & Cap "ECHO TEST HOLE"	NAD = North American Datum	BC = Back of Curb
BT = Buried Telephone	SL = Street Light	CP = Concrete Pipe	PE = Polyethylene Pipe	NL = Nail & Disk "ECHO TEST HOLE"		BL = Baseline of Survey
FOC = Fiber Optic Cable	IRR = Irrigation Line	DBC = Direct Buried Cable	PVC = Polyvinyl Chloride	SLEEVE = Sleeve	NAVD = North American Vertical Datum	COORD = Survey Coordinates
WM = Water Main	GS = Gas Service	CMP = Corrugated Metal Pipe	STL = Steel	X = "X" in Concrete		CL = Centerline
SAN = Sanitary Sewer	WS = Water Service	CONC = Concrete	VCP = Vitrified Clay Pipe	**Surface Type**	UNK = Unknown	HUB = Survey Hub
STM = Storm Sewer	UNK = Unknown Utility	CPP = Corrugated Plastic Pipe	PCCP = Prestressed Cylinder Concrete Pipe	ASPH = Asphalt		RW = Right of Way
CATV = Cable Television	BED = Buried Electrical Duct	DCT = Duct		CONC = Concrete		ST = Swing Ties
FM = Force Main	BTD = Buried Telephone Duct	DIP = Ductile Iron Pipe	RCP = Reinforced Concrete Pipe	NG = Natural Ground		X = "X" in Concrete

Test Hole	Utility Type	Utility Material	Utility Size Outside Diameter inches	Utility Manual Depth feet	Cross Sectional View	Utility Direction (N)	Identified By	Surface Type	Surface Thickness inches	Apparent Utility Owner	Datums: Horizontal: NAD83/2011 Vertical: NAVD88 — Northing	Datums: Horizontal: NAD83/2011 Vertical: NAVD88 — Easting	Ground Elevation	Utility Elevation
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1-10	BE	PVC	4"	3.14'	○		IRC	NG	N/A	TECO	1302894.09'	497535.63'	5.01'	1.87'

Notes:

TH# 1-5 - PIN SET ON WEST EDGE

TH# 1-6 - PIN SET ON EAST EDGE

TH# 1-8 - UNABLE TO VISUALLY VERIFY DUE WATER AND CAVE-IN AT 3.5'

TH# 1-9 - UNABLE TO VISUALLY VERIFY DUE WATER AND CAVE-IN AT 3.5'

Prepared by: CM ***Date: 06/18/2021***

Checked by: MA ***Date: 06/18/2021***