APPENDIX E-3
Pump Station & Force Main Engineering Report

Prepared by Nelson + Pope- June 2024

SUFFOLK TECHNOLOGY CENTER

PUMP STATION & FORCE MAIN

ENGINEERING REPORT

TOWN OF BABYLON
SUFFOLK COUNTY, NEW YORK

PREPARED FOR:
BRISTOL SUFFOLK, LLC

NELSON+POPE NO. 21022

June 2024

NELSON+POPE
engineers • architects • surveyors

70 Maxess Road
Melville, New York 11747
631.427.5665

TABLE OF CONTENTS

	PAGE
Executive Summary	1
Section 1 – Project Familiarization	1
1.1 Introduction	1
1.2 Existing Conditions and Background Information	2
1.3 Proposed Conditions	4
1.4 Project Schedule	6
1.5 Facility Operation	6
Section 2 – System Overview	6
2.1 Wet Well Description	6
2.2 Pump Description	7
Section 3 – Pump Station Design Criteria	9
3.1 Design Flow Rate	9
3.2 Population	9
3.3 Peak Flow Rate	9
3.4 Design Flow Rate	9
3.5 Static Head	10
3.6 Friction Head	11
3.6.1 Force Main Friction Loss (New Pipe)	11
3.6.2 Force Main Friction Loss (Aged Pipe)	11
3.6.3 Force Main Fittings and Valves Losses	12
3.7 Total Dynamic Head	13
3.7.1 Total Dynamic Head (New Pipe)	13
3.7.2 Total Dynamic Head (Aged Pipe)	13
3.8 Pumps	13
3.9 Wet Wall	14
3.9.1 Wet Wall Design	14
3.9.2 Level Control Elevations	14
3.10 Pipe Line Surge Pressure	15
3.10.1 Pipe Line Surge Pressure for HDPE DR 11 Pipe	15
3.10.2 Pipe Line Surge Pressure for PVC DR 18 Pipe	16
3.11 Wet Wall Ventilation	17
Section 4 – Valve Chamber	18
Section 5 – Flow Metering Manhole	18
Section 6 – Pump Control Panel	18

Section 7 – Force Main 19
7.1 Force Main Descriptions 19
7.2 Force Main Installation Methods 23

Section 8 – Emergency Operation 25

Section 9 – Emergency Alarms 26

Section 10 – Odor Control 26

Section 11 – Cost Opinion 26

APPENDICES

A. Pump Station Site Plans
B. Force Main Routing Plan
C. Pump System Head Curves
D. Manufacturer's Specification Sheets for the Pump
E. SCSD Pipe Capacity Verification
F. Construction Cost Opinion
G. Project Schedule

FIGURES

Figure 1 – Project Site Location Map
Figure 2 – Groundwater Contours
Figure 3 – Depth to Water
Figure 4 – Proposed Force Main Routing
Figure 5 – Pump Station Layout
Figure 6 – Intersection of Little East Neck Road & Long Island Avenue
Figure 7 – Intersection of Long Island Avenue & Wellwood Avenue
Figure 8 – Intersection of Conklin Street & New Highway
Figure 9 – Existing SCSD MH-17
Figure 10 – Copy of the "as-built" Plan from previous installation

Executive Summary

Suffolk Technology Center is a proposed development to be located on a property situated on the northeast corner of Little East Neck Road and Long Island Avenue and is identified as SCTM No. 0100-38-1-1. The 111.39-acre parcel is owned by Pinelawn Cemetery and the owner intends to subdivide the parcel into two (2) lots to retain 11.38-acre of the land under their ownership. The proposed development involves construction of nine (9) buildings accommodating separate tenant spaces for Office/warehouse uses on the remaining 100.11 acres. The project sponsor made an application to The Suffolk County Sewer Agency (hereinafter referred to as "SCSA") with a proposal to connect the proposed development to the nearby Suffolk County Sewer District 3 – Bergen Point (hereinafter referred to as "SCSD # 3 – Bergen Point") and received conceptual approval.

Nelson+Pope (hereinafter referred to as "N+P") previously performed an evaluation of the project site and its surrounding areas to determine feasibility of connecting the property to the aforementioned sewer district SCSD # 3 – Bergen Point. Based upon an "as-built" plan furnished by Suffolk County Department of Public Works (SCDPW), there is an existing manhole owned by SCSD # 3 – Bergen Point (SCSD MH-17) which is located in Conklin Street, westerly of the project site and connection can be made via that manhole. The evaluation report prepared by N+P concluded that connecting the proposed project to SCSD # 3 – Bergen Point would only be feasible via a pump station and force main conveyance system to the existing manhole. N+P verified that the conveyance system downstream of the SCSD # 3 – Bergen Point manhole has available capacity to accommodate the proposed project. For this project, N+P has assumed the responsibility of providing engineering services which involve preparation of technical design documents for project construction, construction management, and preparation of closeout documents for the project finalization.

Section 1 – Project Familiarization

1.1 Introduction

The project site is currently vacant surrounded by mostly developed lands. The project proposal involves construction of nine (9) buildings providing tenant spaces for office and warehouse uses. An overall total tenant space of 1,617,849 sf. including 122, 200 sf. of office space will be provided. The total wastewater to be generated by the development is 67,157.6 gallons per day (gpd) based upon the flow rates in accordance with the Suffolk County Department of Health Services (SCDHS) commercial standards. The property will be served by Suffolk County Water Authority. A water main extension from the intersection of Little East Neck Road and Long Island Avenue will be required to serve the property.

Technical design documents describing an on-site gravity sewer collection system and an on-site pump station and force main conveyance system with necessary appurtenances are prepared. This document presents details of engineering design of the proposed on-site pump station and force main. Separate sets of design plans showing the proposed on-site collection system layout, and pump station details and the force main routing starting from the pump station to a proposed terminal manhole upstream of the

existing SCSD SM-17 in Conklin Street are included with this report under Appendices A and B respectively. Figure 1 represents the project site location.

Figure 1 – Project Site Location Map (Suffolk County GIS)

1.2 Existing Conditions and Background Information

The 111.39-acre parcel is located on the northeast corner of Little East Neck Road and Long Island Avenue in Wyandanch within the zone of 'A Residence District' in the Town of Babylon. The parcel is bordered by a park and residences to the north. The east side of the property is bordered by N 28th Street. All the parcels on the east side of N 28th Street appear to be developed with residential houses. Long Island Avenue abuts the south side of the property. The properties on the south side of Long Island Avenue also appear to have residential houses. The west property line is bordered by Little East Neck Road. The Franz Lin Grave site is located on the west side of Little East Neck Road.

The property appears to be undeveloped land with natural vegetation and wooded areas throughout the land. The land surface gradually rolls down 10-15 ft. from the property lines to almost flat land at the central area of the property. The groundwater elevation in the vicinity of the site is +/-53.8 ft. above MSL based upon USGS Groundwater Table Map as shown in Figure 2 below. The direction of groundwater flow is toward south/southeast. A Phase I Environmental Site Assessment prepared by Nelson Pope & Voorhis dated February 5, 2021, indicated that depth to groundwater ranges from 7 ft. to 27 ft. below grade throughout the property.

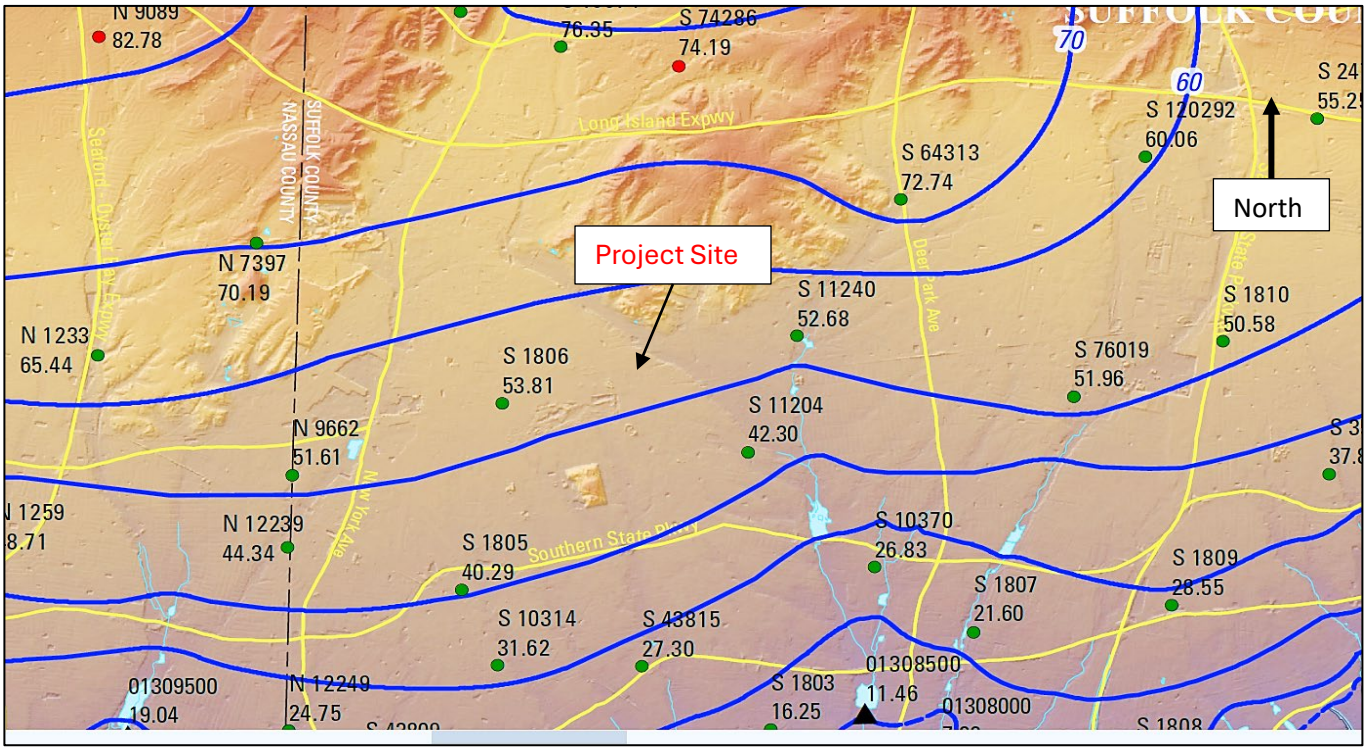


Figure 2 – Groundwater Contours (Water-table and Potentiometric-Surface Altitudes in the Upper Magothy and Lloyd Aquifers of Long Island, New York, April-May 2013)

Figures 3 below shows the depth to the groundwater table at the project site.

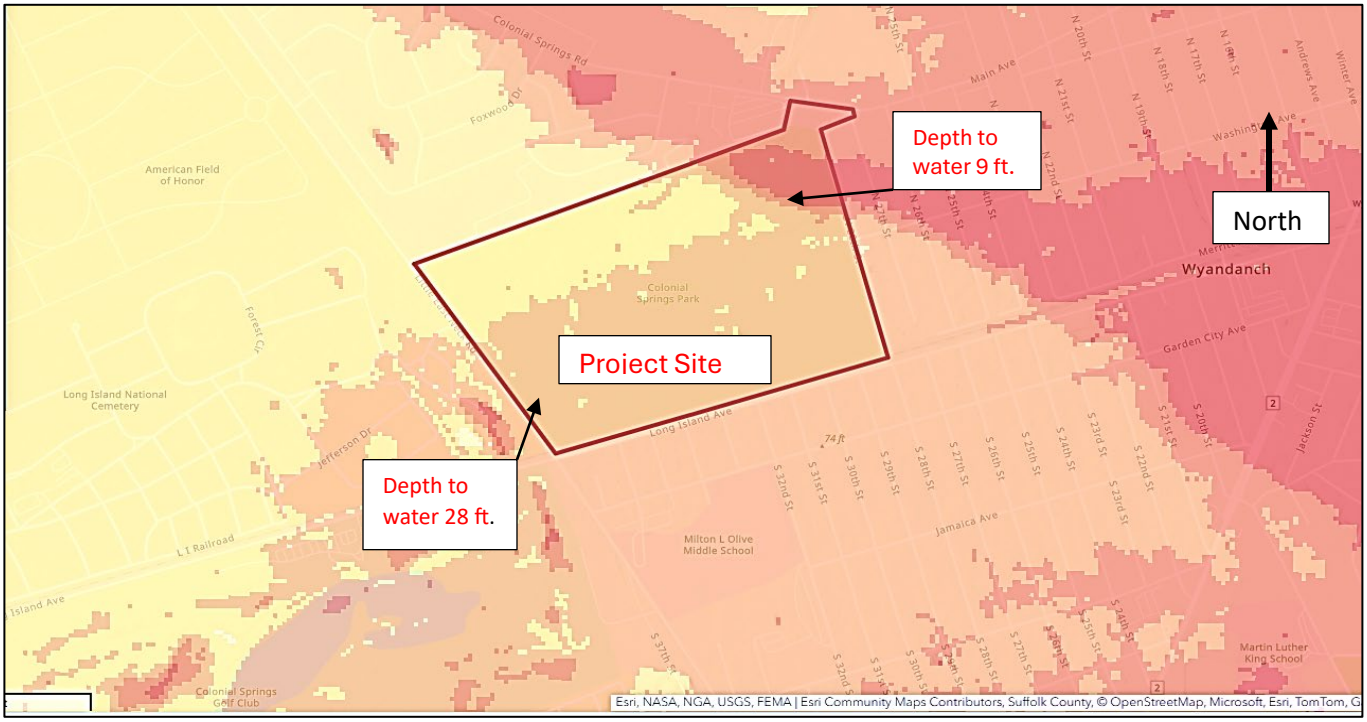


Figure 3 – Depth to Water (Long Island Depth to Water and Hydrologic Conditions Viewer, 2016)

1.3 Proposed Conditions

The project sponsor proposes to develop 100.11 acres of land which involves construction of nine (9) commercial buildings providing a total of 1,617,849 sf. tenant space for mostly warehouse use. The total tenant space also includes 122,200 sf. of space intended for office use. The current zone of 'A Residence District' in the Town of Babylon prohibits business uses and storage of commercial vehicles. The proposed uses of the project are commensurate with the uses permitted in zone 'Planned Industrial Park District-1 (PIP-1)'. Therefore, rezoning of the property to PIP-1 district by the Town will be required for allowing the proposed uses.

The property also falls within Groundwater Management Zone I of the Suffolk County Sanitary Code where development is limited by as-of-right density of a property, i.e., 600 gpd/acre. Therefore, the allowable density for the site is 65,538 gpd which is less than the proposed design flow. In accordance with the Suffolk County Sanitary Code, connection to SCSD # 3 – Bergen Point has been selected as a method of sewage disposal.

A gravity collection system consisting of ten (10) inch diameter sewer mains along with typical four (4) feet diameter pre-cast concrete manholes has been designed by Bohler Engineering for collecting sanitary wastewater to be generated by the proposed commercial buildings. The system will discharge into an on-site wet well pump station strategically located for conveniently accessing the facility from Little East Neck Road by service vehicles.

The pump station will be equipped with dual pumps – one on duty and one standby for redundancy. The pump operation will be controlled electronically via Flygt MultiSmart Pump Control System. The program logic will include a feature for pump alternation for longer useful life of the pumps. The pumps will be connected to a 6-inch diameter force main via a 3"x6" increaser fitting. The force main will be equipped with cleanouts, air relief valves and drain manholes as appropriate throughout its route to the proposed terminal manhole to be located in Conklin Street, upstream of the SCSD # 3 – Bergen Point MH-17. Typical open cut method, horizontal directional drilling method, pipe jacking method or combination of two or more such methods may be employed for installation of the proposed force main as applicable based upon the field conditions. Figure 4 shows the proposed force main route and the location of SCSD # 3 – Bergen Point MH-17.

N+P will determine the required access easements through public rights-of-way and private properties necessary to locate the force main along its entire route to the SCSD # 3 – Bergen Point MH-17 and will solicit the respective regulatory agencies and private owners for obtaining the easements as necessary. The following agencies will be contacted:

- The Town of Babylon
- Suffolk County Department of Public Works
- Suffolk County Highway Department
- Long Island Railroad

Figure 4 – Proposed Force Main Routing

The site needs to be regraded because of uneven land surface prior to constructing the proposed buildings and access roadways. The required drainage infrastructure will be designed and installed following the requirements of the regulatory agencies having jurisdictions to ensure that storm water run-off from impervious finished surfaces will remain within the property.

The pump station facility will be provided with water and other utility services for the operation and maintenance of the proposed pump station. A drive-up asphalt access way will be constructed to provide access to the facility by maintenance vehicles. A control building is designed to house the pump control units and other ancillary electrical panels. A heating and ventilation system designed considering appropriate design parameter will be provided for the control building to always maintain the room ambient temperature and humidity at a level necessary to protect the electrical equipment from dangers of static electricity and structural deterioration from corrosion.

1.4 Project Schedule

The tentative duration of the project will be governed by the following task schedule:

- Preparation of the Pump Station Engineering Report: 2 months
- Review by regulatory Agencies, revisions, and acceptance of engineering report: 1 month
- Preparation of specifications and construction documents: 4 months
- Review by regulatory Agencies, revisions, and acceptance of specifications and construction documents: 4 months
- Issuance of an approval for construction: 1 month
- Time required from regulatory approval for construction to commencement of construction of the proposed pump station and force main including project bidding and awarding a contract: 6 months
- Construction Time: 12 months
- Final Inspection and Construction Acceptance: 1 month
- Completion of Operation & Maintenance Manuals and Project Closeout: 6 months

The gravity collection system and force main will be constructed concurrently within the above scheduled timeframe. A project schedule is provided under Appendix G.

1.5 Facility Operation

The pump station will be operated and maintained by a New York State licensed operator with adequate knowledge and experience of operating a pump station. The operator will be responsible for the upkeep of the facility, pump data and maintenance chronology records.

Section 2 – System Overview

2.1 Wet Well Description

The pump station area is located approximately 770 ft. from the west property line, and 65 ft. from the north property line with 60 ft. X 35 ft. of area which will house the proposed wet well, a valve chamber, a flow meter manhole, a control building, and a generator. Figure 5 shows the layout of the pump station. The wet well, valve chamber, and the flow meter manhole will be pre-cast concrete structures. The control building will be a prefabricated precast masonry structure. The collection system main will enter the wet well through its side wall. The wet well will be equipped with a code compliant ladder, one intake fan, two pumps, a level controller and two access hatches – one for the ladder and the other one for the pumps. As indicated in the preceding sections, two pumps are provided for redundancy. The wet well will be covered with an eight (8) inch thick traffic bearing concrete slab. The intake fan, a vent pipe, and

a hoist will be installed on top of the concrete slab. A pump station site plans is provided under Appendix A.

A diesel fueled generator will be provided exclusively for the pump station for emergency power during a power outage to keep the pump station operation uninterrupted. A minimum of 3 days of fuel supply for the generator will be stored on-site. Review and approval for the storage of fuel will be required by SCDHS.

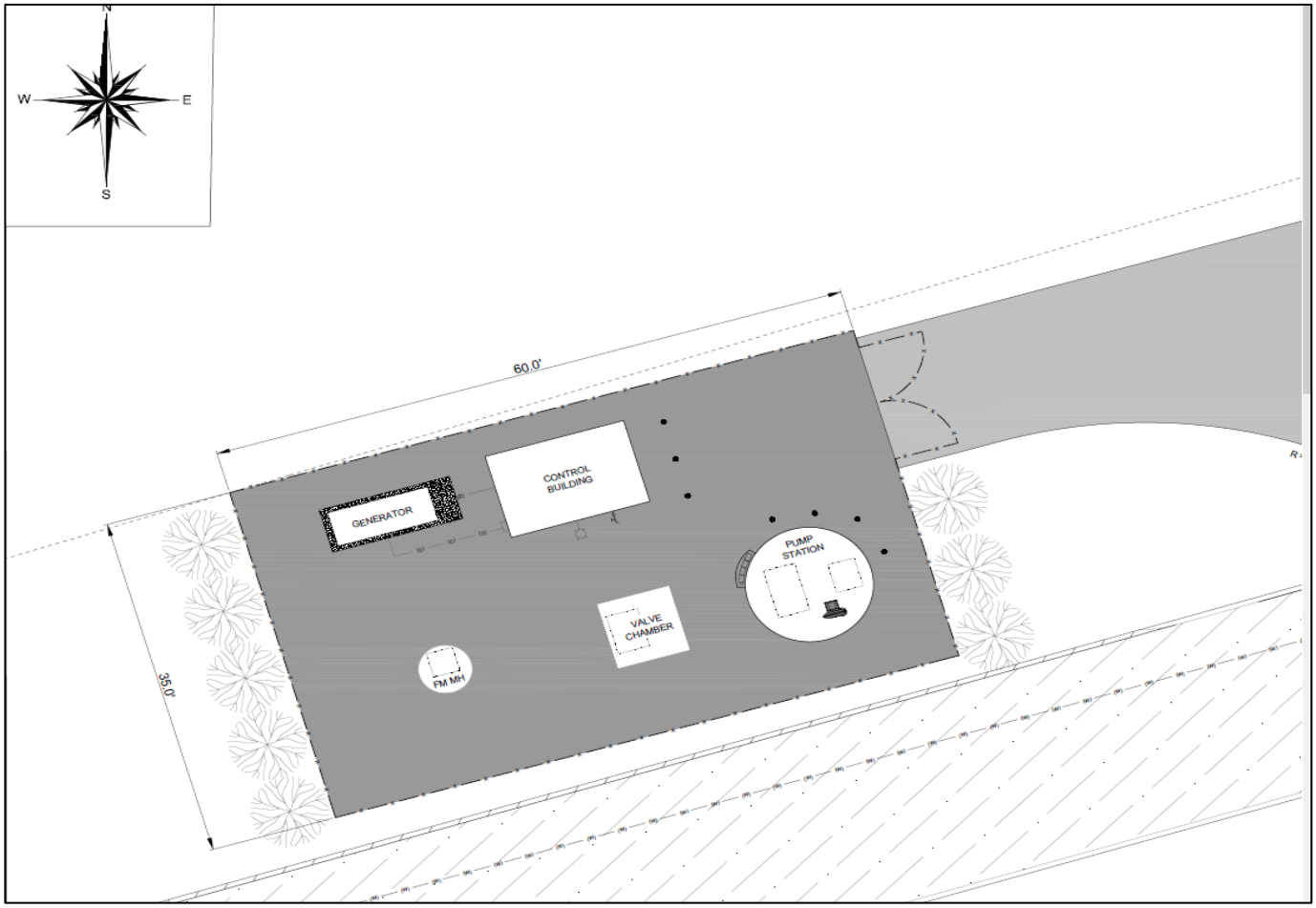


Figure 5 – Pump Station Layout

2.2 Pump Description

The pumps are designed based upon the proposed daily design flow calculated using the flow rates of the SCDHS commercial standards. The calculations are provided in the proceeding sections. Two identical submersible pumps with sewage transfer capacity in accordance with the design calculations and rated for operation in raw sewage environment are selected. The pumps will be fitted with stainless steel guide rails and break away fittings for ease of removing and reinstalling the pumps for repair and maintenance purposes from outside the wet well without the need for entering the confined space. The proposed pump's discharge port will be 3-inch NPT and the impeller diameter will be 167 mm. The 6-inch force main

will be connected to the discharge port via a 3”X6” increaser fitting. The pump will be equipped with temperature and moisture sensors for protection against overtemperature and for detection of water leakage inside the pumps. The manufacturer’s cut sheet is provided in Appendix D for more technical details.

The manufacturer’s pump performance curve and pump system curves considering ‘C’ values for ‘Old Pipe’ and ‘New Pipe’ are provided under Appendix C. On the curves, it can be seen that when the pump will operate at 55 hertz, it will transfer 222 gpm at 112 ft. total dynamic head (TDH) which will yield a velocity of 2.92 feet per second (fps) through the 6-inch HDPE 11 force main, greater than the minimum velocity of 2 fps recommended by the Ten State Standards. We evaluated a 4-inch HDPE 11 force main; however, the friction loss through the pipe would be much higher than that through the selected pipe size. Furthermore, the 6-inch pipe will have available capacity to provide sewer services to prospective future projects in the neighborhood including the 11.38-acre lot of the proposed subdivision, so construction of another new pump station and force main conveyance system and/or an upgrading of the newly installed infrastructure will not be necessary.

3.0 Pump Station Design Criterion

3.1 Design Flow Rate

The following buildings are proposed to be rented for warehouse and office uses, therefore in accordance with SCDHS commercial standards, a flow rate of 0.04 gpd/sf. is used for warehouse space and 0.06 gpd/sf. is used for the office space.

Building 1:	172,480	sf.
Building 2:	247,360	sf.
Building 3:	247,360	sf.
Building 4:	200,560	sf.
Building 5:	156,880	sf.
Building 6:	135,040	sf.
Building 7a:	166,240	sf.
Building 7b:	166,240	sf.
Building 8:	125,680	sf.
Overall GFA:	1,617,840	sf.

Total Warehouse Space:	1,495,640	sf.	Flow	=	59,826	gpd
Total Office Space:	122,200	sf.	Flow	=	7,332	gpd
			Total Flow	=	67,158	gpd
Design Sanitary Flow				=	68,000	gpd
				=	47.22	gpm
				=	0.0680	mgd

3.2 Population

68,000 gpd ÷ 75 gpd/capita	=	907	capita

3.3 Peak Flow Rate

Peak Flow Factor per SCDPW requirement	=	3.83	
3.83 x 68,000 gpd	=	260,231	gpd
	=	180.72	gpm
	=	0.26023137	mgd

3.4 Design Flow Rate

Pump Station Design Flow Rate	=	180.72	gpm

3.5 Static Head

Static Head

Proposed Discharge Elevation (HIGHEST EXPECTED ELEVATION)	=	72.00 ft.
Proposed Pump Off Elevation	=	55.00 ft.
Static Head	=	17.00 ft.

3.6 Friction Head

3.6.1 Force Main Friction Loss (New Pipe)

Roughness Coefficient "C"	=	150	
Force Main Diameter	=	6	in.
Pressure Rating of Pipe	=	HDPE DR-11	(DIPS)
Inside Diameter of Pipe	=	5.57	in.
Peak Flow Rate	=	181	gpm
Length of Force Main	=	11121.00	ft.
Head Loss in ft/100 ft (Hazen - Williams)	=	0.34	ft./ ft.
Pressure Rating of Pipe	=	PVC DR-18	
Inside Diameter of Pipe	=	6.09	in.
Peak Flow Rate	=	181	gpm
Length of Force Main	=	970.00	ft.
Head Loss in ft/100 ft (Hazen - Williams)	=	0.22	ft./ ft.
(11121 ft. x 0.34 ft. / ft.) + (970 ft. x 0.22 ft. / ft.)	=	39.95	ft.

3.6.2 Force Main Friction Loss (Aged Pipe)

Roughness Coefficient "C"	=	120	
Pipe Diameter	=	6	in.
Pressure Rating of Pipe	=	HDPE DR-11	(DIPS)
Inside Diameter of Pipe	=	5.57	in.
Peak Flow Rate	=	181	gpm
Length of Force Main	=	11,121	ft.
Head Loss in ft/100 ft (Hazen - Williams)	=	0.52	ft./ ft.
Pressure Rating of Pipe	=	PVC DR-18	
Inside Diameter of Pipe	=	6.09	in.
Peak Flow Rate	=	181	gpm
Length of Force Main	=	970	ft.
Head Loss in ft/100 ft (Hazen - Williams)	=	0.34	ft./ ft.
(11121 ft. x 0.52 ft. / ft.) + (970 ft. x 0.34 ft. / ft.)	=	61.13	ft.

3.6.3 Force Main Fittings and Valves Losses

Valves				
Description	**Quantity**	**K-Value**	**Subtotal K-Value**	**Comment**
Check Valve	1	2.50	2.50	Swing Check
Gate Valve	0	0.30	0.00	Wide open
Plug Valve	1	0.77	0.77	Wide open

Fittings				
Description	**Quantity**	**K-Value**	**Subtotal K-Value**	**Comment**
Elbows				
90 - Long Radius	3	0.23	0.69	Flanged
90 - Short Radius	3	0.30	0.90	Flanged
45 - Long Radius	6	0.20	1.20	Flanged
45 - Short Radius	4	0.45	1.80	Flanged
22.5 - Long Radius	4	0.12	0.48	Flanged
22.5 - Short Radius	0	0.15	0.00	Flanged
Entrance				
Square Edged Entry	1	0.50	0.50	
Outlet				
Into Manhole	1	1.00	1.00	
Increasers				
Standard	1	0.25	0.25	Vel. Of small end
Reducers				
Standard	0	0.25	0.00	Vel. Of small end
Tees				
Standard - Thru Side	8	1.80	14.40	AR & Drain MH
Standard - Run Thru	2	0.60	1.20	
Reducing - Thru Side	0	2.00	0.00	Vel. Of small end
Wye or Lateral				
Standard	3	1.00	3.00	Clean Out
Reducing - Thru Side	0	1.25	0.00	Vel. Of small end
Total K-Value			**28.69**	

Velocity in HDPE DR-11 Force Main	=	2.38 fps
Velocity in PVC DR-18 Force Main	=	1.99 fps
Velocity Head = $Vmax^2 / 2G$	=	0.09 ft. / ft.
Head Loss from Fittings and Valves = 0.09 ft. x 28.69	=	2.58 ft.

3.7 Total Dynamic Head

3.7.1 Total Dynamic Head (New Pipe)

Total Dynamic Head (TDH)	=	59.53 ft.
Design For	=	60.00 ft.

3.7.2 Total Dynamic Head (Aged Pipe)

Total Dynamic Head (TDH)	=	80.71 ft.
Design For	=	81.00 ft.

3.8 Pumps

The proposed pump station is a wet pit submersible station with duplicate pumping units providing 100% standby capacity. The pumps are selected to provide a velocity in the force main of a minimum of two feet per second and will be mounted on a slide rail system to facilitate removal. Pump operation will be controlled by liquid level sensors. The pump operation will be controlled by a VFD.

Design Point 181 gpm at 81 ft. TDH

Proposed Pump:

Manufacturer :	Flygt
Series :	NP 3153 SH 3 ~ 275
Impeller Size :	167 mm
RPM :	3,515
HP :	23.00
Discharge Diameter :	3 inch

A graph with the pump system curves and performance curve is provided under Appendix C

3.9 Wet Well

3.9.1 - Wet Well Design

Average Inflow	=	47	gpm
VFD Setting	=	55	Hz
Pump Discharge (from proposed pump - See System Curve)	=	222	gpm
Average Discharge = Pump Discharge - Average Inflow	=	175	gpm
Actual Velocity in DR-11 Force Main		2.92	fps*
Actual Velocity in DR-18 Force Main		2.45	fps*
Wet Well Floor Area (Diameter: 10 ft.)	=	79	ft.
Wet Well Effective Depth	=	1.50	ft.
Number of Wells	=	1.00	
Volume of liquid corresponding to the effective depth	=	118	cu. Ft.
		881	gal.
Time to Fill Wet Well	=	18.66	minutes
Time to Empty Wet Well	=	5.04	minutes
Total Cycle Time	=	23.70	minutes

For the old pipe (C=120) the operating point is 222 gpm @ 112 ft. TDH & 55 Hz.
For the new pipe (C=150) the operating point is 262 gpm @ 106 ft. TDH & 55 Hz.

3.9.2 - Level Control Elevations

LEVEL CONTROL ELEVATIONS		
CONTROL POINT	**ELEVATION**	
BACK UP HIGH WATER ALARM	58.50 ft.	
HIGH WATER ALARM	58.00 ft.	
LAG PUMP ON	57.50 ft.	
LEAD PUMP ON	56.50 ft.	
ALL PUMPS OFF	55.00 ft.	
LOW WATER ALARM	54.50 ft.	
BACK UP LOW WATER ALARM	54.25 ft.	

*Value is based on pump discharge rate.

3.10 Pipe Line Surge Pressure

3.10.1 - Pipe Line Surge Pressure For HDPE DR-11 Pipe

A water surge pressure wave is caused when the pumping equipment stops. The maximum pressure can be calculated in order to determine the need for surge control devices to protect equipment and the force main.

Velocity of Pressure Wave

a	=	Velocity of pressure wave (fps)	
g	=	32.2	Gravity acceleration (fps/s)
w	=	62.4	Weight of water (lbs/cu. ft)
d	=	5.57	Inside pipe diameter (inches)
e	=	0.627	DR-11 Thickness of pipe wall (inches)
k	=	300000	Modules of compressibility of water (psi)
E	=	110000	Modules of elasticity for PVC pipe (psi)

a = 12/sqrt((w/g)*((1/k)+(d/Ee)))
a = 939.94 fps

Maximum Surge Pressure (MSP)

V	=	2.92	Velocity of water in pipe (fps)
a	=	939.94	Velocity of pressure wave (fps)
g	=	32.2	Gravity acceleration (fps/s)

MSP = (0.433*a*V)/g
MSP = 36.91 psi

Time of pressure wave to travel the length of the force main and return:

t	=	time (seconds)	
L	=	11,121	length (feet)
a	=	939.94	velocity of wave (fps)

t = 2L/a
t = 23.66322 seconds

Total pressure on pump station piping and valves is:

Total Pressure = Pump pressure + surge pressure

Pump Pressure =	35.11	psi
Surge Pressure =	36.91	psi
Total Pressure =	72.02	psi

Pipe, fittings and valves are to be designed to withstand a total pressure of 150 psi and a controlled swing check valve shall be used to minimize pump shut down surges.

3.10.2 - Pipe Line Surge Pressure For PVC DR-18 Pipe

A water surge pressure wave is caused when the pumping equipment stops. The maximum pressure can be calculated in order to determine the need for surge control devices to protect equipment and the force main.

Velocity of Pressure Wave

a	=	Velocity of pressure wave (fps)	
g	=	32.2	Gravity acceleration (fps/s)
w	=	62.4	Weight of water (lbs/cu. ft)
d	=	6.09	Inside pipe diameter (inches)
e	=	0.383	Thickness of pipe wall (inches)
k	=	300000	Modules of compressibility of water (psi)
E	=	400000	Modules of elasticity for PVC pipe (psi)

a = 12/sqrt((w/g)*((1/k)+(d/Ee)))

a = 1313.26 fps

Maximum Surge Pressure (MSP)

V	=	2.45	Velocity of water in pipe (fps)
a	=	1313.26	Velocity of pressure wave (fps)
g	=	32.2	Gravity acceleration (fps/s)

MSP = (0.433*a*V)/g

MSP = 43.27 psi

Time of pressure wave to travel the length of the force main and return:

t	=	time (seconds)	
L	=	970	length (feet)
a	=	1,313.26	velocity of wave (fps)

t = 2L/a

t = 1.47724 seconds

Total pressure on pump station piping and valves is:

Total Pressure = Pump pressure + surge pressure

Pump Pressure =	35.11	psi
Surge Pressure =	43.27	psi
Total Pressure =	78.38	Psi

Pipe, fittings and valves are to be designed to withstand a total pressure of 150 psi and a controlled swing check valve shall be used to minimize pump shut down surges.

3.11 Wet Well Ventilation

Fresh air will be forced into the wet well to provide intermittent ventilation in accordance with Ten State Requirements. Current Ten State Standards require a minimum of 30 complete air changes per hour for spaces which are intermittently ventilated.

Diameter of Wet Well	=	10	ft.
Top Slab Elevation	=	80.25	ft.
Wet Well Ceiling Elev.	=	79.25	ft.
Low Water Elevation	=	54.50	ft.
Depth to Low Water Elev.	=	24.75	ft.
Max. Total Volume of Air	=	[PI*(Dia. of wet well)^2(Depth at LW level in wet well)]/4	
	=	[PI*(10)^2(24.75)]/4	
	=	1,943.86	cubic feet
Required capacity of fan	=	971.93	cfm

Provide one blower for each wet well capable of exhausting 972 cfm @ 1" static pressure. The blower will be an intake blower ducted to the wet well.

Section 4 – Valve Chamber

The valve chamber is a separate structure from the wet well and contains an air cushioned check valve, a plug valve, and a pressure gauge on each of the pump discharge pipes from the pump station. The valve chamber will be placed on virgin material at a sufficient distance from the wet well. Immediately outside of the valve box, the two discharge pipes will be combined into one force main with appropriate fittings. As per the Ten States Standard Section 47.2, a portable pump connection to the force main with rapid connection capabilities and appropriate valving is provided in the valve chamber.

Section 5 – Flow Metering Manhole

A flow metering manhole is installed downstream of the valve chamber to record flow volume pumped to the Ronkonkoma Hub Pump Station. The flow meter manhole is a 5-foot diameter precast concrete manhole with a rectangular access hatch. A 6" PVC flow tube with a magnetic type of flow metering sensor will be installed on the force main within the manhole which will transmit flow data to a controller unit located in the pump station control building. Coupled with the controller unit will be a recorder which will document the flow data measured by the unit.

Section 6 – Pump Control Panel

The pumps will be operated by pressure transducer or level sensor which will be connected to a Program Logic Controller (PLC). The PLC will be programed for six (6) different liquid levels inside the wet well which will be detected and transmitted to the PLC by the level sensors. The PLC will also include an alarm system and an alarm dialer for electronically transmitting messages to the operator during emergency situations such as high water or low water conditions in the wet well, equipment failure, and/or power outage at the pump station facility. The six (6) liquid levels will correspond to the following commands:

HIGH WATER LEVEL – Activates Alarm and Alarm dialer, both pumps pump simultaneously
LAG PUMP ON – Turns on the standby pump
LAG PUMP OFF – Turns off the standby pump
LEAD PUMP ON – Turns on-duty pump
LEAD PUMP OFF – Turns off the on-duty pump
LOW WATER LEVEL – Activates Alarm and Alarm dialer.

A set of two redundant float sensors as indicated below will be provided as standby pump controller.
REDUNDANT HIGH-WATER FLOAT – Operates both pumps through the throw of the floats.
REDUNDANT LOW WATER FLOAT – Activates alarms and dials out to notify the operator but does not control pump operation.

If the pressure transducer or level sensor fails to operate, they will be bypassed by the redundant pump controller which will continue to operate the pumps until the system is manually reset by the operator to revert back to the routine operation. The control panels will be located inside the pump station control building.

Section 7 – Force Main

7.1 Force Main Descriptions

The pumps will be connected to an approximately 100 ft. long 6-inch diameter ductile iron force main via a 3"x6" increaser fitting. The pipe will transition to PVC DR-18 after the ductile iron pipe is properly secured in place outside of the wet well. Inside the property and up to the property line, open cut trench method will be followed for installation of the PVC DR-18 force main. Near the property line the pipe will transition to six (6)-inch diameter HDPE DR 11 pipe rated at 200 pounds per square inch (psi) of test pressure which will continue for the rest of the proposed conveyance system. The pipe diameter will provide a minimum velocity of 2.0 feet per second (fps) at the design flow. For the actual velocity and pressure calculations, see Section 3 of this report. In general, the proposed force main will follow the contour of the existing terrain and will be installed at a minimum depth of 4.5-feet below land surface or below the frost line to prevent freezing of the wastewater during the winter months. Outside the property and in public roadways, most part of the force main will be installed following horizontal directional drilling construction method or combination of both open cut trench and directional drilling depending upon the field conditions and permission from regulatory agencies for construction in public rights-of way as well as availability of easements from private owners should the main needs to be run across any portion of one or more privately owned properties. Pipe jacking method will be followed to install the force main under the railroad tracks at the intersection of Little East Neck Road and Long Island Avenue. The force main will be fitted with cleanouts at every maximum 400 ft. and at bends equal to 45^{o} and greater, air relief valves, and drain manholes as necessary. Drain manholes will be installed at locations where low points exist and air relief manholes will be installed at locations where high points exist along the force main.

The pathways of the force main and the locales are shown in Figures 6 through 9 below.

SCDPW provided "as-built" information of the existing sewer manhole SCSD MH-17 location (See Figure 10 "as-built" drawing of the existing gravity sewer trunk in the area). The manhole is located in Conklin Street, 330 ft. west of the intersection of New Highway and Conklin Street and approximately 2.29 miles westerly of the proposed pump station on the project site. The force main will exit the project site at the westerly property line on to Little East Neck Road which is 770 ft. away from the proposed pump station and will follow the pathways described below before connecting to the proposed terminal manhole upstream of the existing SCSD MH-17 in Conklin Avenue.

- Running southerly 1,500 ft. along Little East Neck Road and crossing Long Island Railroad tracks to Long Island Avenue which is located on the south side of the railroad tracks, then
- Running westerly About 5,750 ft. along Long Island Avenue to the intersection of Long Island Avenue and Wellwood Avenue where Long Island Avenue becomes Conklin Street, then
- Running westerly along Conklin Street about 3,740 ft. to the intersection of Conklin Street and New Highway, and then
- Continuing along Conklin Street approximately 340 ft. to the proposed terminal manhole to be located upstream of the existing SCSD MH-17. From the terminal manhole wastewater will flow by gravity to the SCDPW manhole.

Figure 6 - Intersection of Little East Neck Road & Long Island Avenue

Force main plan and profiles are included with Appendix B of this report.

Figure 7 – Intersection of Long Island venue and Wellwood Avenue

Figure 8 – Intersection of Conklin Street and New Highway

Figure 9 – Existing SCSD MH-17

Figure 10 below is a photocopy of the "as-built" plan from previous installations provided by SCDPW which shows the location of the SCSD MH-17 available for connecting the proposed project. N+P evaluated the fifteen (15)-inch gravity sewer line downstream of SCSD MH-17. Manning Formula was used for determining the capacity of the pipe. The pipe is found to have a capacity of 1.9 million gallons per day at full pipe flow with a velocity of 2.49 fps. Appendix E provides the calculations.

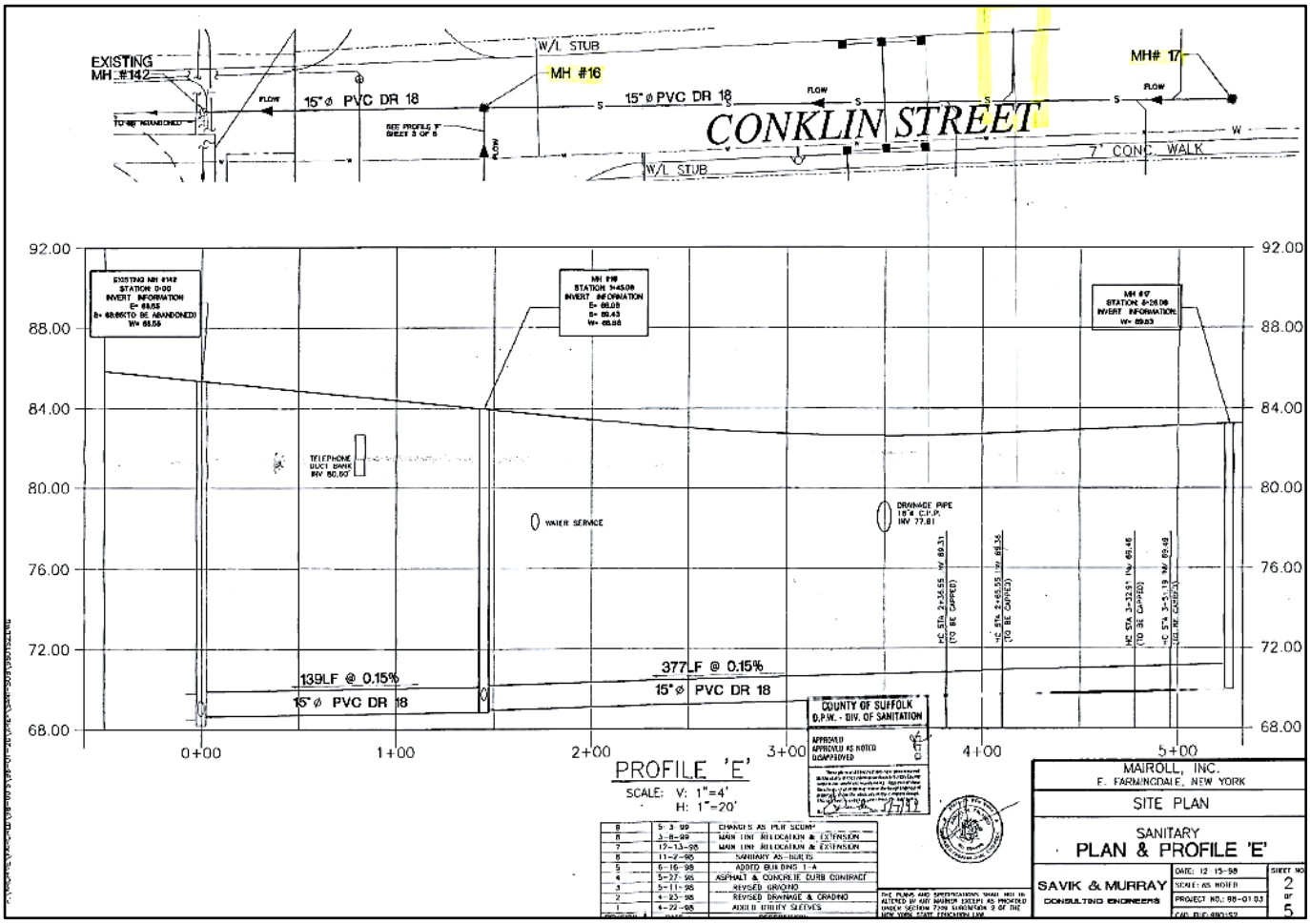


Figure 10 – Copy of the "as-built" plan from previous installation

7.2 Force Main Installation Methods

Horizontal Directional Drilling and/or Pipe Jacking techniques will be employed where Open Cut Trench method of installation is not applicable for the continuity of the force main pathway to SCSD MH-17. At least 100 ft. of the force main which will be located under LIRR tracks will be installed following Pipe Jacking technique. A brief description of each of the three installation methods is as follows:

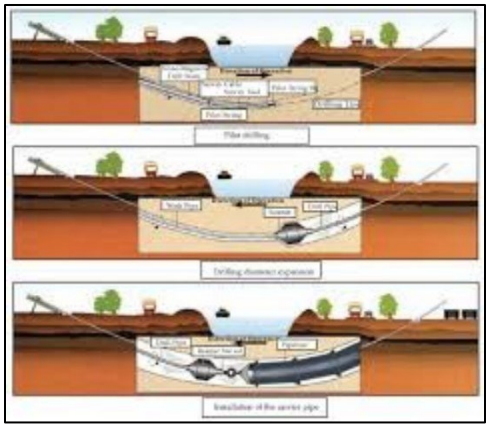
a) Open Cut Trench Method[1]

This is the most common method of installation of sewer, water, and utility pipes. It involves excavating a trench down to the depth where a proposed infrastructure is planned to be located or repair of an existing line is intended. If the location is partially or entirely under paved area, saw cutting the area sufficient for the required trench would be necessary. Upon installation, the trench area is backfilled and compacted to 95% proctor density or to a density as required by the involved regulatory agency and restored by resurfacing the area.

The installation will be less expensive than the other two methods if the installation is to be done under unpaved areas. The excavation opens up the existing conditions, presence of existing structures as well as obstructions. The disadvantages are the installation becomes expensive if groundwater is encountered in the trench and the pipe needs to be installed in groundwater in which case special permit for dewatering must be obtained from New York State Department of Environmental Protection (NYSDEC) prior to commencing the installation. Furthermore, continuous dewatering during the entire installation becomes extremely expensive. This method also requires more excavation and more area closure for public safety during installation than that of a trenchless installation; however, this method is followed for installation of gravity sewer pipes to ensure that the design pipe slopes were maintained throughout the entire length of the collection line.

Portion of the force main located inside the property of the project site will be installed following open cut trench method.

b) Horizontal Directional Drilling Method[2]



This is a trenchless method of installing underground pipes and utility cables with minimum disruption of the daily businesses and roadways. This method requires equipment set area, an entrance and a receiving pit for the operation which can be strategically located in areas avoiding traffic and activities. The drill bit enters the entering pit which contains drilling fluids to drill a pilot bore. The depth and pitch of the drill bit is tracked by the operator through a radio detection device which sends the information to a locator. The locator then interprets the

[1] *Information obtained from website of PEI Engineering and Construction*
[2] *Information obtained from website of HD Drilling Contractors*

information and gives directions to the drill bit to an experienced operator who navigates and steers the drill bit to the desired bore path. The bore path is then enlarged to one and a half size of the conduit or pipe to be installed by a reamer which is simply pulled through the bore path to create a larger hole.

The advantages of this method is that much less excavation is involved than open cut trench method which reduces expenses incurred in traffic control, roadway restoration, dewatering, etc.; however, it is a complex process which requires well trained and experienced people to correctly shape the bore hole for the installation of the pipe as planned. Furthermore, there is always a possibility of inadvertently damaging unforeseen underground structure/objects which may result in expensive repair and/or restoration; however, under certain circumstances this method of installation may be the only option to avoid installation in heavy traffic area and/or crossing railroad tracks.

c) Pipe Jacking Method [3]

Pipe jacking is a technique for installing underground pipelines, ducts, conduits, etc. The method is extensively utilized for installing sewer pipes, storm water pipes, cables and other utility lines to avoid open cut excavation if the pipeline is to be located under busy roadways, highways, railroad tracks, rivers, canals, and existing structures to minimize surface disruption. The process basically involves pushing the pipe in to the ground and simultaneously the soil within the pipe is excavated either manually or mechanically. A shield is placed in front of the pipe for safely excavating the soil. The pipe installation begins at a jacking pit equipped with a thrust block and a jacking frame to support pipe and equipment at the correct grade. The pipe is pushed behind the shield using interconnected hydraulic jacks placed in the jacking pit. A thrust ring is placed around the pipe to evenly distribute the jacking forces. After one pipe is completely jacked into the ground the entire hydraulic jacks are returned to the thrust pipe for jacking another pipe section and the process is repeated until the pipe reaches the receiving shaft. The jacking and receiving shafts are precisely located on both sides of the obstacle under which a pipeline needs to be jacked for proper placement of the pipe into the ground.

Section 8 – Emergency Operation

An emergency power system will also be designed for the facility so the pump operation during a power outage will remain uninterrupted. A standby generator powered by diesel will be installed in the vicinity of the wet well which will provide full standby power for the entire pump station, including site lighting

[3] *Information obtained from website of GeoStructures*

and other accessories. The unit will be provided with an automatic transfer switch and minimum 72-hour fuel storage tank.

Section 9 – Emergency Alarms

An emergency alarm system with audio and visual capabilities will be provided to transmit alarm signals in emergency situations such as high water and low water conditions, pumps failure and power failure. The facility will be equipped with an alarm dialer to send notifications to the pump station operator regarding emergency conditions.

Section 10 – Odor Control

A contingency design for an odor control system will be provided, if required by the County. The design plans will include a potassium permanganate chemical feed system for the purpose of odor control. The system will be housed inside of the control building with feed conduit extending to the wet well. The potassium permanganate required for the odor control system will be stored inside 55-gallon drum(s) and the amount stored on site will not exceed the storage limitation that exempts the odor control system from SCDHS Article 12 requirements for a review and approval of the system; however, a review by the SCDHS Office of Pollution Control will be required for storage of the fuel for the generator if fueled by diesel.

Section 11 – Cost Opinion

N+P prepared cost estimation for construction of the proposed pump station and conveyance system along with an estimation for annual cost of operation, maintenance, and record keeping for facility. It is to be noted that the aforementioned costs are valid for the time it is prepared and may change at the time of project implementation and construction. The estimation is included with Appendix F.

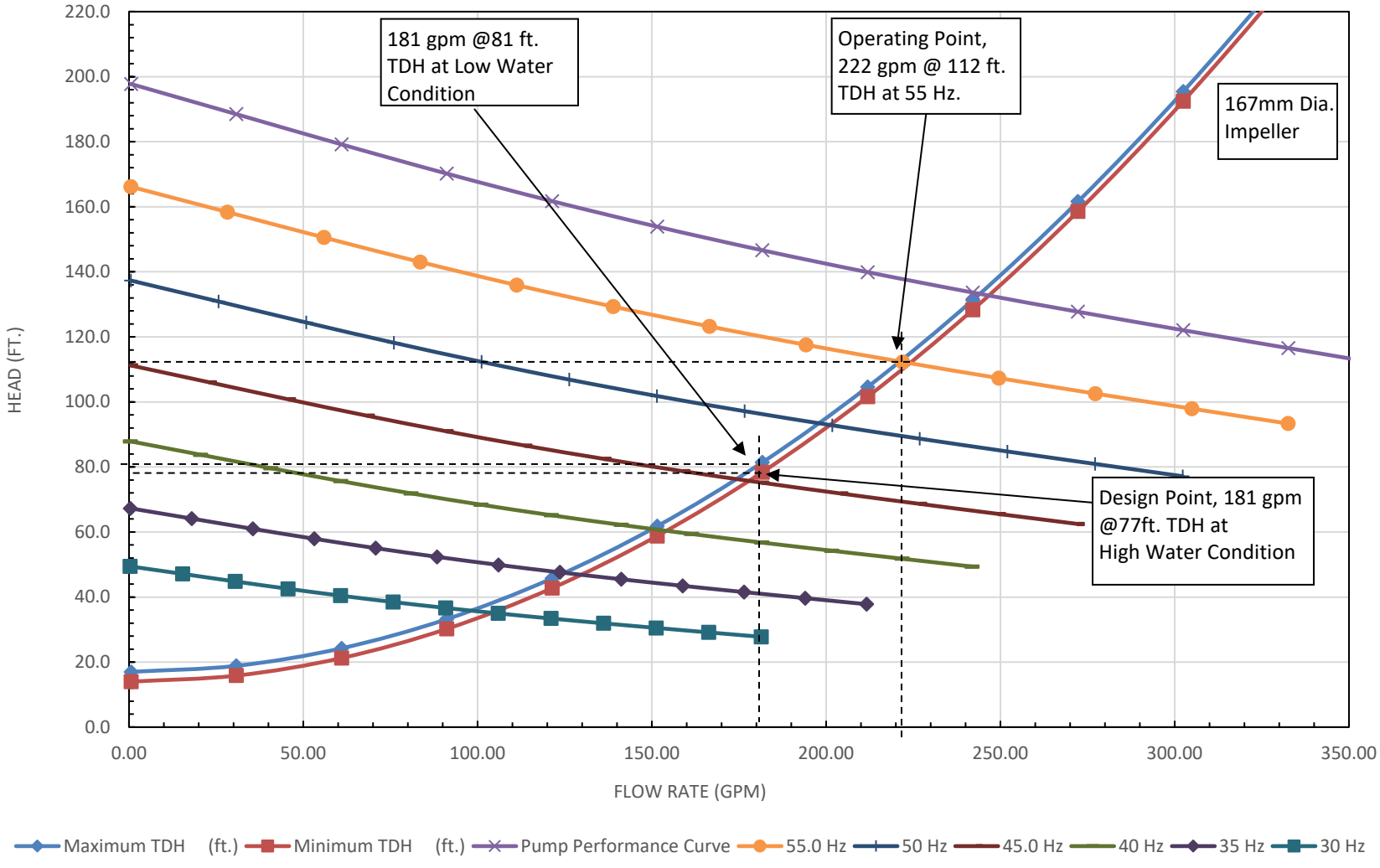
Appendix A: Pump Station Site Plans

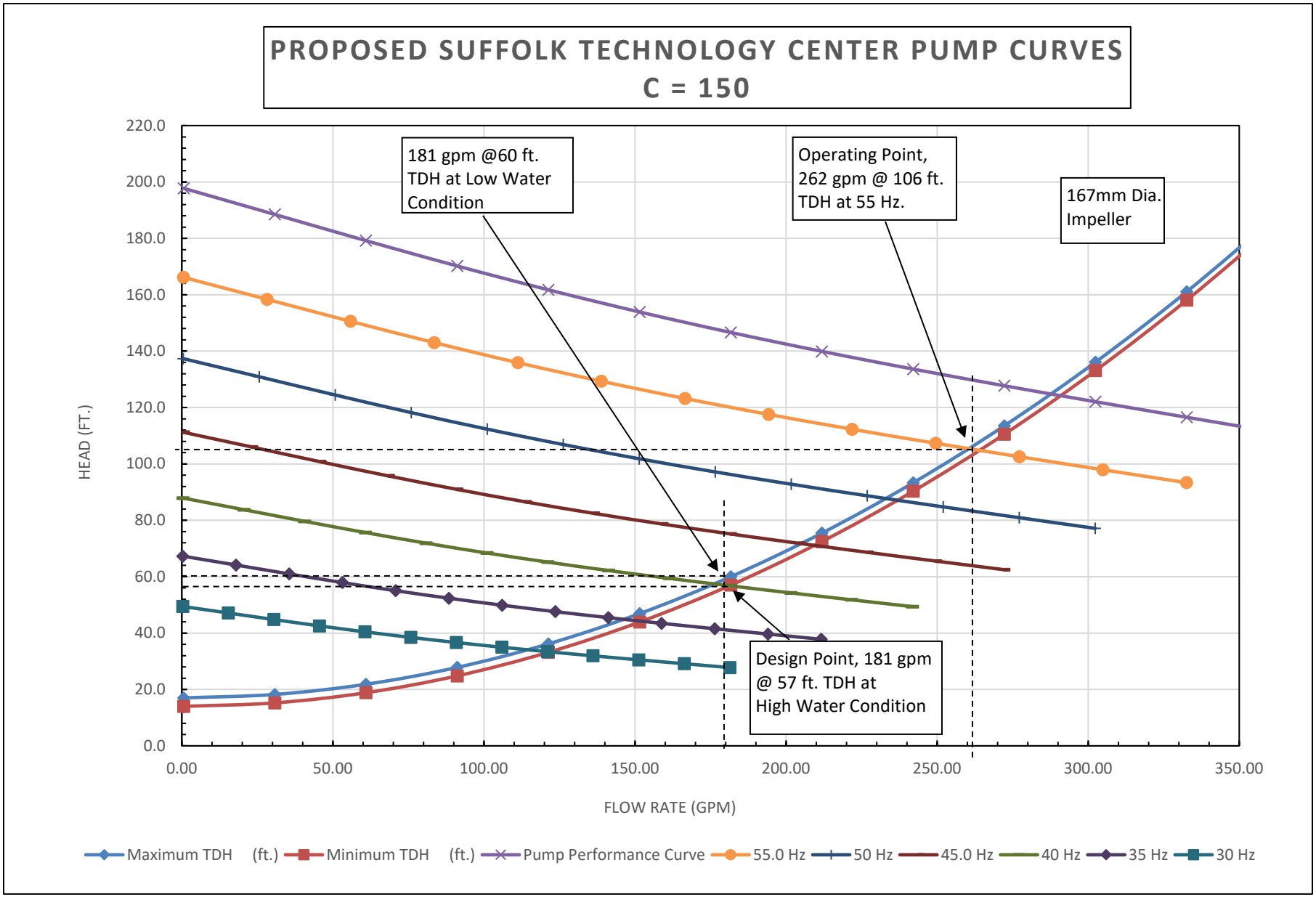
Appendix B: Force Main Routing Plan

Appendix C: Pump System Head Curves

(OLD PIPE, C = 120 & NEW PIPE, C = 150)

PROPOSED SUFFOLK TECHNOLOGY CENTER PUMP CURVES
C = 120




PROPOSED SUFFOLK TECHNOLOGY CENTER PUMP CURVES
C = 150
181 gpm @60 ft.
TDH at Low Water
Condition
Operating Point,
262 gpm @ 106 ft.
TDH at 55 Hz.
167mm Dia.
Impeller
Design Point, 181 gpm
@ 57 ft. TDH at
High Water Condition
HEAD (FT.)
FLOW RATE (GPM)
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
Maximum TDH (ft.)
Minimum TDH (ft.)
Pump Performance Curve
55.0 Hz
50 Hz
45.0 Hz
40 Hz
35 Hz
30 Hz

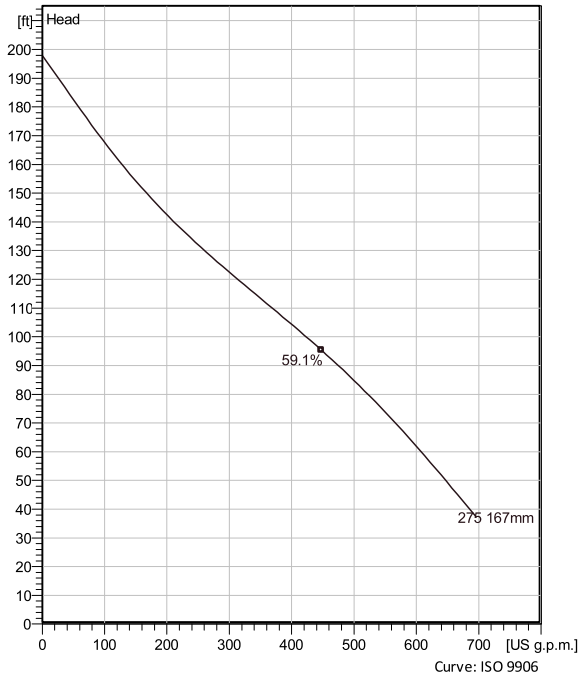
Appendix D: Manufacturer's Specification Sheet

NP 3153 SH 3~ 275

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, 1.6899E-5 ft²/s



Curve: ISO 9906

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

Configuration

Motor number
N3153.830 21-18-2IE-W IE3 23hp

Installation type
P - Semi permanent, Wet

Impeller diameter
167 mm

Discharge diameter
3 inch

Pump information

Impeller diameter
167 mm

Discharge diameter
3 inch

Inlet diameter
150 mm

Maximum operating speed
3515 rpm

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Hard-Iron ™

Project	Xylect-22266707	**Created by**	Daniel McGreevy		
Block		**Created on**	5/9/2024	**Last update**	5/9/2024

NP 3153 SH 3~ 275

Technical specification

Motor - General

Motor number N3153.830 21-18-2IE-W IE3 23hp	**Phases** 3~	**Rated speed** 3515 rpm	**Rated power** 23 hp
ATEX approved FM	**Number of poles** 2	**Rated current** 57 A	**Stator variant** 8
Frequency 60 Hz	**Rated voltage** 208 V	**Insulation class** H	**Type of Duty** S1
Version code 830			

Motor - Technical

Power factor - 1/1 Load 0.90	**Motor efficiency - 1/1 Load** 92.7 %	**Total moment of inertia** 0.729 lb ft²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.87	**Motor efficiency - 3/4 Load** 93.8 %	**Starting current, direct starting** 485 A	
Power factor - 1/2 Load 0.78	**Motor efficiency - 1/2 Load** 94.2 %	**Starting current, star-delta** 162 A	

Project	Xylect-22266707	**Created by**	Daniel McGreevy		
Block		**Created on**	5/9/2024	**Last update**	5/9/2024

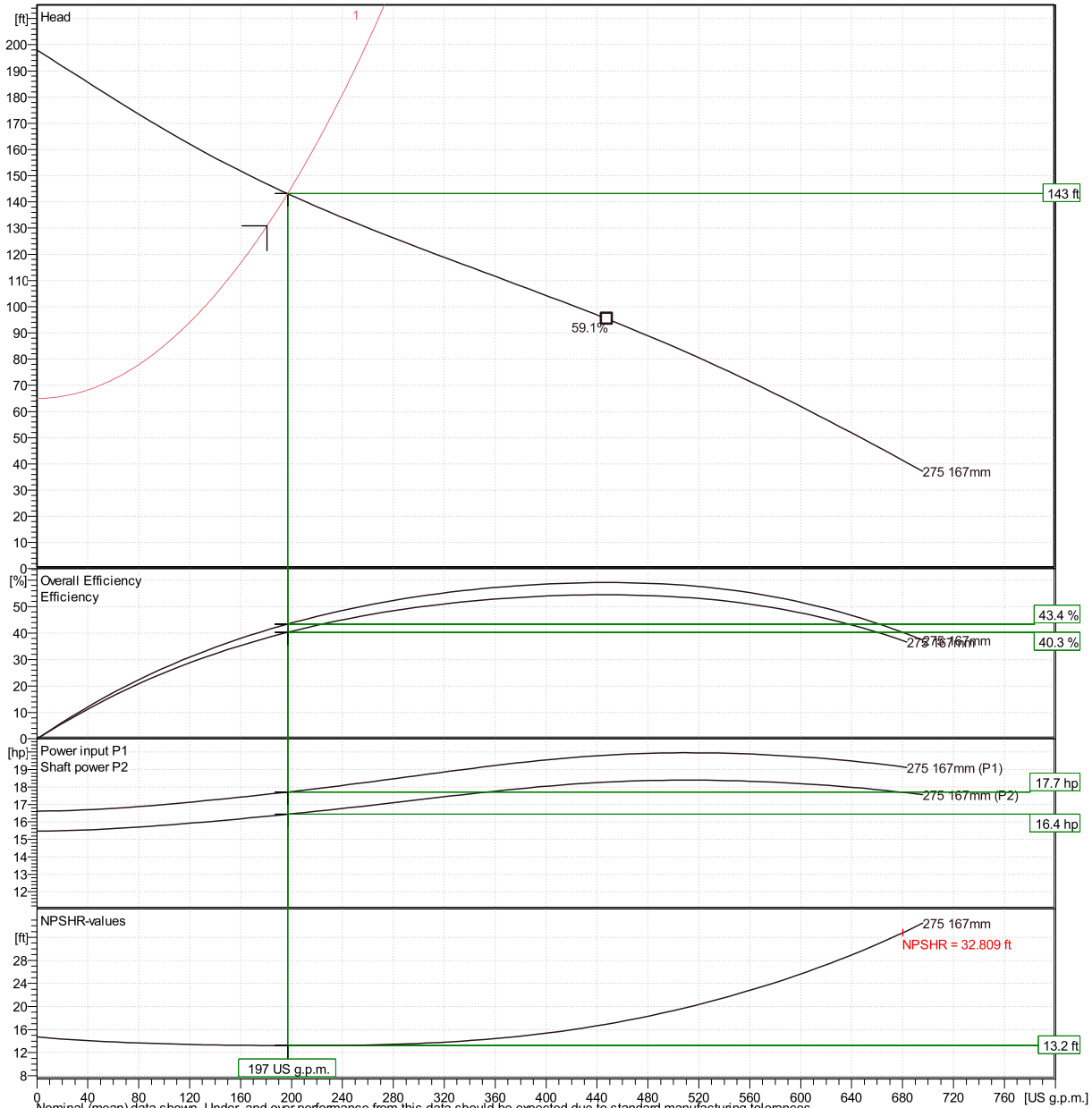
NP 3153 SH 3~ 275

Performance curve

Duty point

Flow	Head
197 US g.p.m.	143 ft

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.42 lb/ft³,1.6899E-5 ft²/s



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

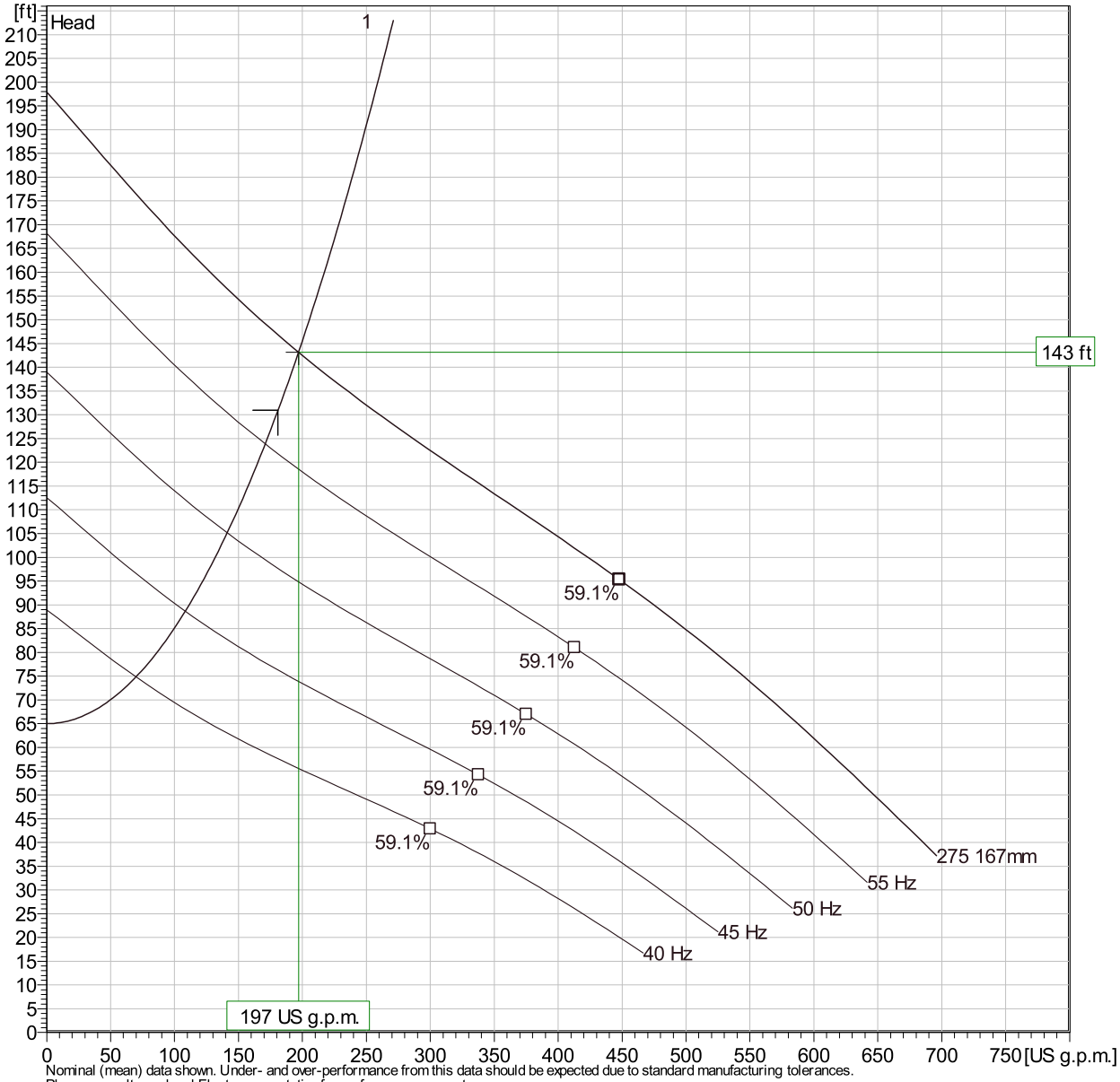
Curve: ISO 9906

Xylect-22266707	Daniel McGreevy		
Created on	5/9/2024	**Last update**	5/9/2024

NP 3153 SH 3~ 275

Duty Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.42lb/ft³; 1.69E-5ft²/s



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

Operating characteristics

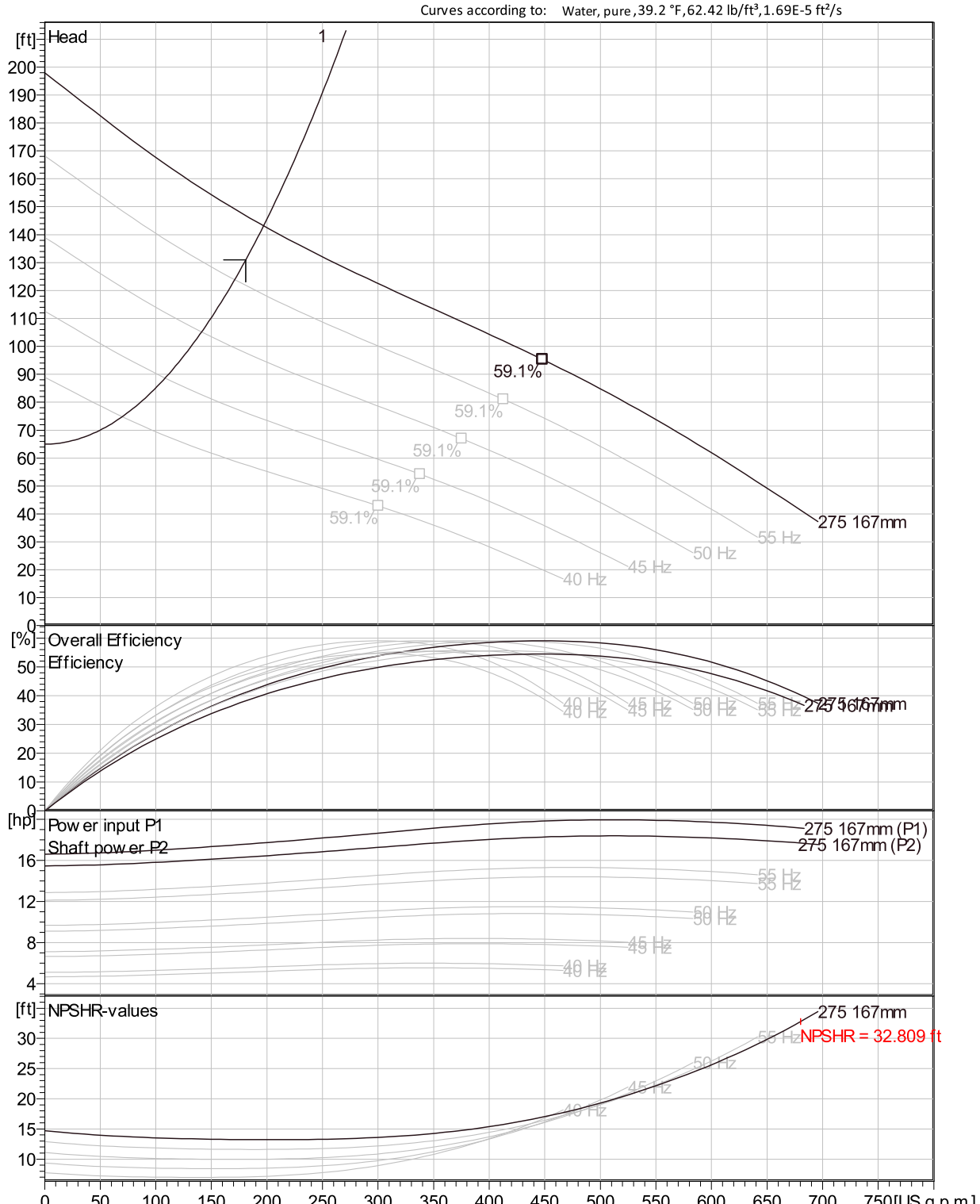
Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	197	143	16.4	197	143	16.4	43.4 %	1120	13.2

Project		**Created by**	Daniel McGreevy		
Block	Xylect-22266707	**Created on**	5/9/2024	**Last update**	5/9/2024

NP 3153 SH 3~ 275

VFD Curve

Curves according to: Water, pure ,39.2 °F,62.42 lb/ft³,1.69E-5 ft²/s



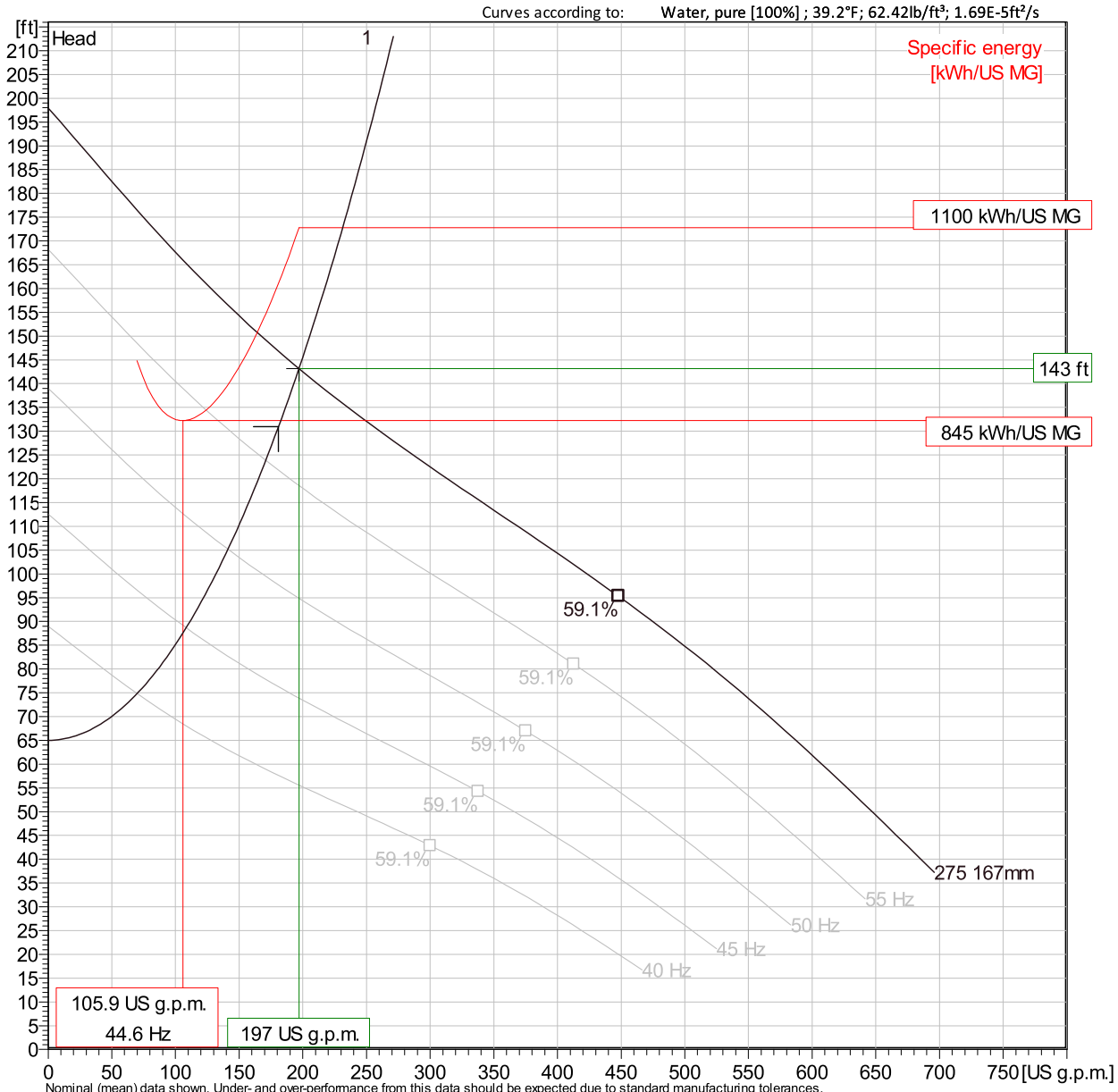
Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Curve: ISO 9906

Project	Xylect-22266707	**Created by**	Daniel McGreevy		
Block		**Created on**	5/9/2024	**Last update**	5/9/2024

NP 3153 SH 3~ 275

VFD Analysis



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

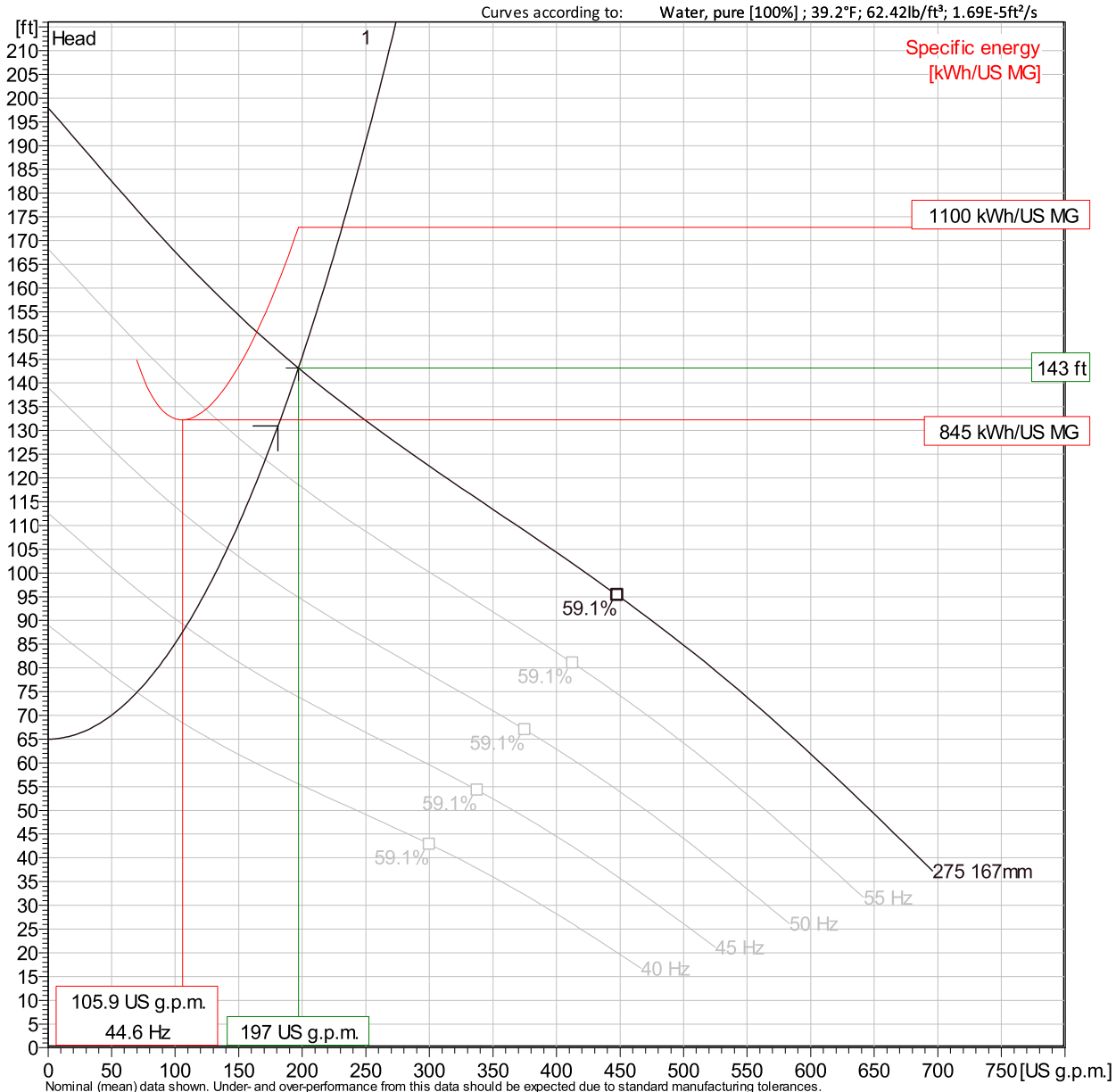
Operating Characteristics

Pumps / Systems	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	59.7 Hz	197	143	16.4	197	143	16.4	43.4 %	1120	13.2
1	55 Hz	171	124	12.8	171	124	12.8	41.8 %	989	11.6
1	50 Hz	141	105	9.56	141	105	9.56	39.3 %	893	10
1	45 Hz	108	88.7	6.9	108	88.7	6.9	35.3 %	846	8.49

Project	Xylect-22266707	**Created by**	Daniel McGreevy		
Block		**Created on**	5/9/2024	**Last update**	5/9/2024

NP 3153 SH 3~ 275

VFD Analysis



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

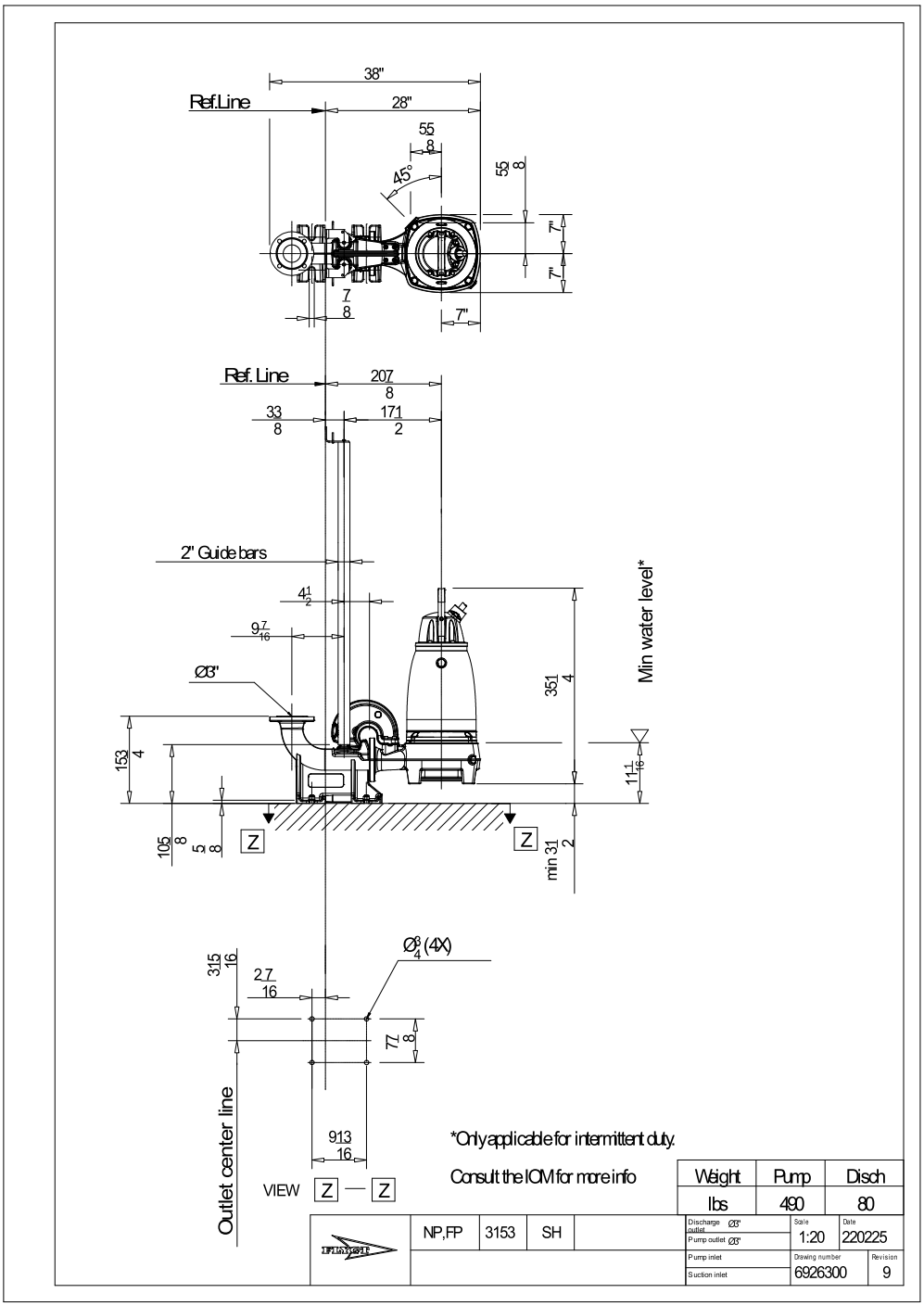
Operating Characteristics

Pumps / Systems	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	40 Hz	69.9	74.8	4.77	69.9	74.8	4.77	27.7 %	926	7.12

Project	Xylect-22266707	**Created by**	Daniel McGreevy		
Block		**Created on**	5/9/2024	**Last update**	5/9/2024

NP 3153 SH 3~ 275

Dimensional drawing



Project	Xylect-22266707	**Created by**	Daniel McGreevy
Block		**Created on**	5/9/2024 **Last update** 5/9/2024

Appendix E: SCSD Pipe Capacity Verification

Determination of Existing SCDPW Pipe Capacity

Date: June 11, 2024

Existing SCDPW Pipe Size, inch: 15 Existing Pipe Slope, S = 0.15%

For determining the capacity of the existing 15-inch SCSD 3 - Bergen Point gravity sewer trunk located downstream of the existing manhole No. 17 in Conklin Street, west of the intersection of Conklin Street and New Highway in Wyandanch, partial pipe flow with certain ratio of pipe liquid depth to pipe diameter has been considered.

Pipe Liquid Depth to Pipe Diameter Ratio (d/D): 0.6

Pipe Diameter, D = 1.25 ft. Pipe Radius, r: 0.625 ft.

Liquid Depth in Pipe, d = 0.75 ft.

Dry Area Depth in Pipe, h = 0.5 ft. Water line will be above the center of the pipe

The angle at the pipe center with respect to the liquid level, θ: 2.7388768

Area of Dry Space above water level, k: = 0.4584 ft^2

Arc Length of Dry Space, A_s: = 1.7118 ft^2

Pipe Cross-sectional Area, a = 1.2272 ft^2

Wetted Cross sectioal Area, A = 0.7688 ft^2

Wetted Perimeter, P_w = 2.2152 ft.

Hydraulic Radius, R_h = 0.347 ft.

Manning Coefficient of Roughness, n = 0.013 Aged Pipe

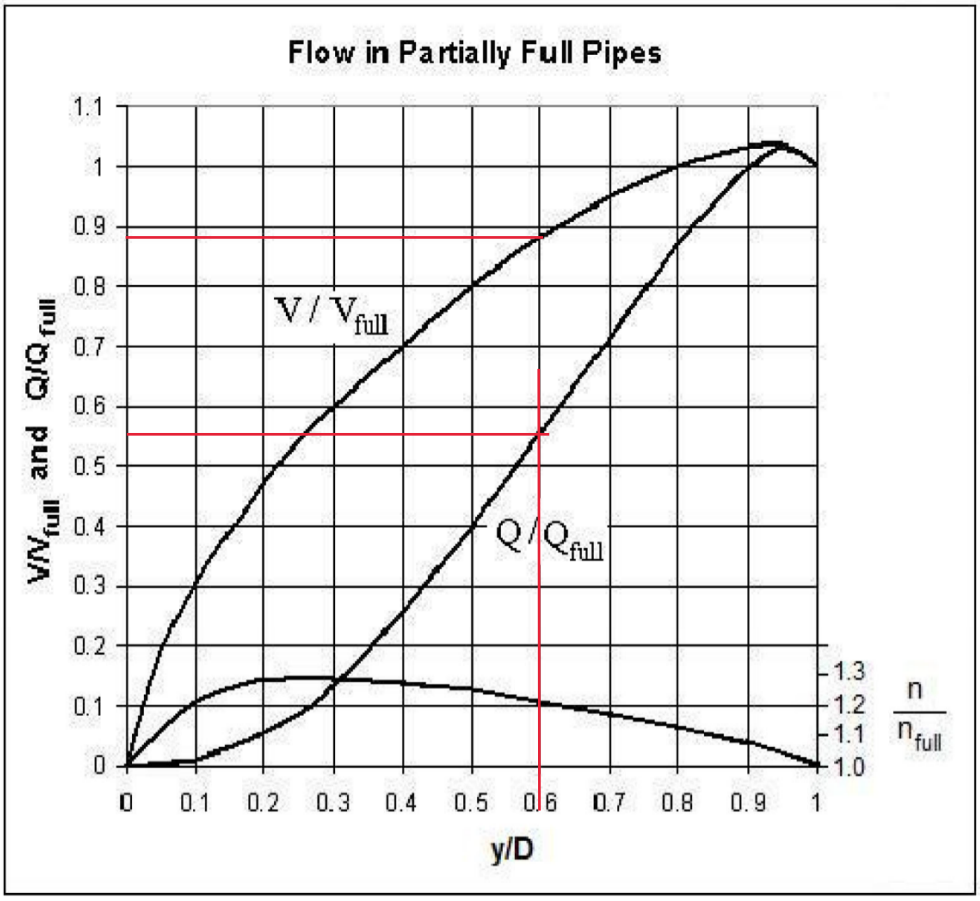
Velocity of Flow Through Pipe, $V = (1.49 * R_h^{2/3} * S^{1/2})/n$ = 2.19 ft/s

Q_{design} = A*V = 1.69 cfs = 1.09 MGD

<u>For the calculations below, data is taken from Sheet 2</u>

Q_{design}/Q_{full} = 0.56 Q_{full}, MGD = 1.95

V_{design}/V_{full} = 0.88 V_{full}, fps = 2.49


Flow in Partially Full Pipes
V/V full and Q/Q full
y/D
V / V full
Q / Q full
n / n full
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
1.3
1.2
1.1
1.0

Appendix F: Construction Cost Opinion

Construction Cost Estimate

The construction estimate represents preliminary budget pricing at the date of the report to construct the plant. These estimates may not reflect market conditions at the time of construction of the plant.

Quantity	Item	Cost
1	Influent Pumps and Controls, Wet Well, Equipment Installation	$342,500.00
1	Flow Measuring Device and Recorder	$1,500.00
1	5' Dia. Flow Metering Manhole	$6,000.00
1	Odor Control System	$15,000.00
1	Control Building	$75,000.00
1	Valve Box and Valve Installation	$10,000.00
1	Electrical Installation	$50,000.00
870	870 ft. of PVC DR-18 Pipe - Open cut trench installation	$217,500.00
100	100 ft. of PVC DR-18 Pipe - Pipe jacking under LIRR tracks	$100,000.00
11,121	11,121 ft. of HDPE 11 Pipe - Horizontal directional drilling	$2,224,200.00
1	30% Contingency	$912,510.00
	Total Cost =	**$3,954,210.00**

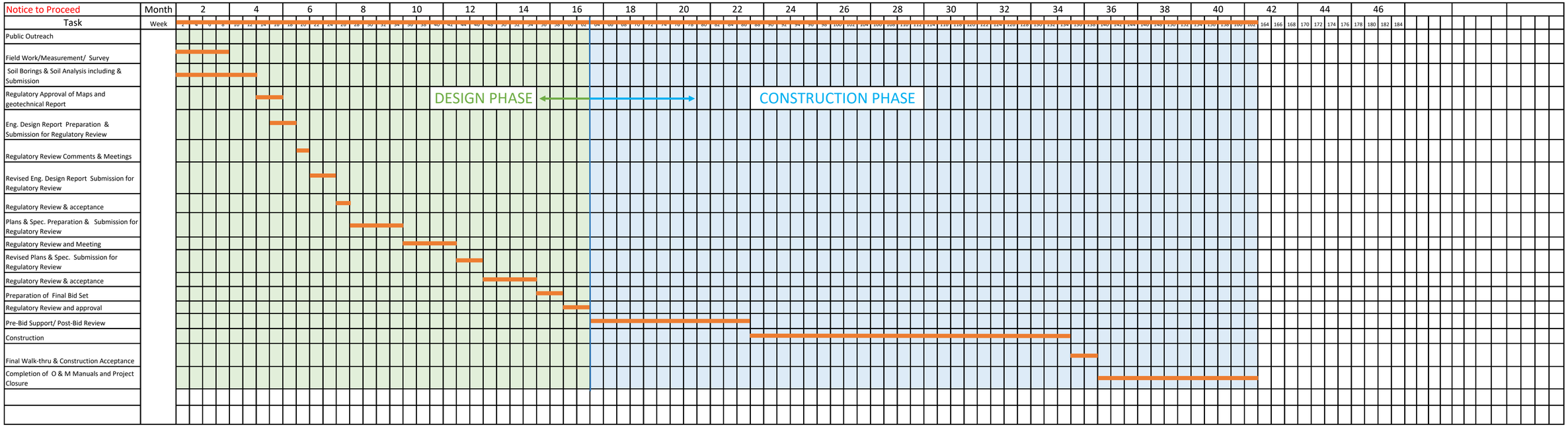
Annual Operations and Maintenance Cost Estimate

Category	Units	Quantity	Unit Cost	Total Cost
Power	KWH\day	365	$88.80	$32,411.66
Operator	-	-	$20,000.00	$20,000.00
Maintenance	Monthly	12	$500.00	$6,000.00
Miscellaneous	Monthly	12	$300.00	$3,600.00
			Total Cost =	**$62,011.66**

Appendix G: Project Schedule

Suffolk Technology Center, Wyandanch, NY

Date: April 09, 2024



Regulatory review time is estimated so overall project time may be affected.