EASTON UTILITIES

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Windmill Pump Station Relocation & Force Main Project

PROJECT PURPOSE & SUMMARY

a. **Project Description:** This project includes relocating the existing Windmill Sanitary Sewer Pump Station out of the floodway and floodplain of the Windmill Branch, located within the Lower Choptank Watershed of Easton, Talbot County, Maryland.

   The pump station will be relocated upland to property owned by the Town of Easton. The existing pump station will be demolished two (2) feet below grade, and the area filled and graded to restore the floodway of the Windmill Branch.

   Construction of the new pump station will require reconnection of the associated sanitary sewer force main into the existing force main system.

   In the attached Engineer's Report, prepared by GHD & dated 2/16/18, four design alternatives were considered to upgrade the existing pump station. After careful evaluation, Easton Utilities has determined that the 4th design alternative to relocate the Windmill Pump Station out of the floodway and floodplain is the most advantageous alternative for public health and environmental benefit.

   The project is included in the Talbot County Water and Sewer Master Plan 2019 Amendment.

   See attached site location map depicting existing and proposed pump stations and the FEMA floodway and floodplain areas.

b. **Project Purpose:** The purpose of this project is to relocate the pump station from the floodway and floodplain of the Windmill Branch, located within the Lower Choptank Watershed of Easton, Talbot County, Maryland.

   The Windmill Sanitary Sewer Pump Station is a critical facility, pumping wastewater to the Easton Wastewater Treatment Facility by way of a parallel force main system. The Windmill Pump Station is the only pump station in the Easton wastewater collection system located in a floodway.

   See attached Wastewater Collection System Map; the Windmill Pump Station collection area is shown in orange.

   Because the existing pump station is located within the FEMA floodway and floodplain of the Windmill Branch, the wet-well and open comminuter pit of the pump station are inundated by floodwater during extreme wet-weather events.

Floodwaters overwhelm the pump station, discharging untreated sewage to the stream creating risk to public health and incapacitating the sanitary sewer collection system.

To mitigate the impacts to public health and the surrounding surface waters, relocation of the pump station is required.

The comminuter pit is known to have been flooded during hurricanes Floyd (1999), Isabel (2003) and Irene (2011).

Pictured below is the Windmill Pump Station after floodwaters had subsided enough to approach the station by vehicle.

c. Preventing flood waters from overwhelming the pump station ensures the Windmill Pump Station Wastewater Collection System is adequately and safely drained and discharged to the wastewater treatment plant. Relocating the pump station out of the floodway and floodplain will mitigate the risk of flood associated sewage overflows, reducing public health risk to the entire community of Easton, Maryland.

Figure 1 Aerial photo of area surrounding Windmill Pumping Station

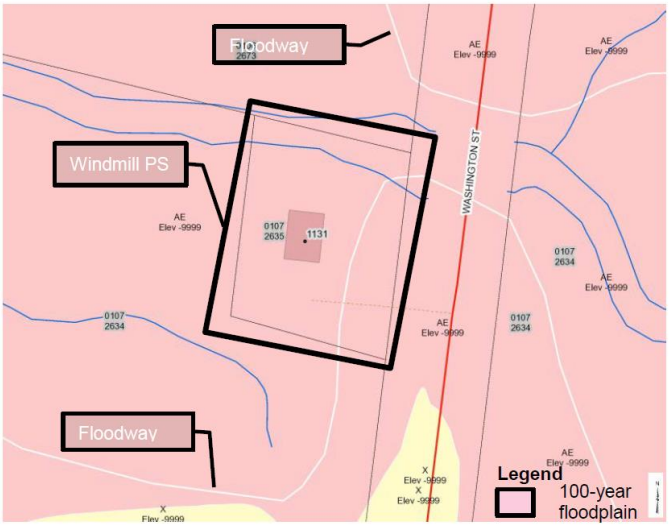


Figure 2 FEMA Floodway and Floodplain at Windmill Pumping Station

PROJECT SUPPORTING DOCUMENTS:

Maps Attached:

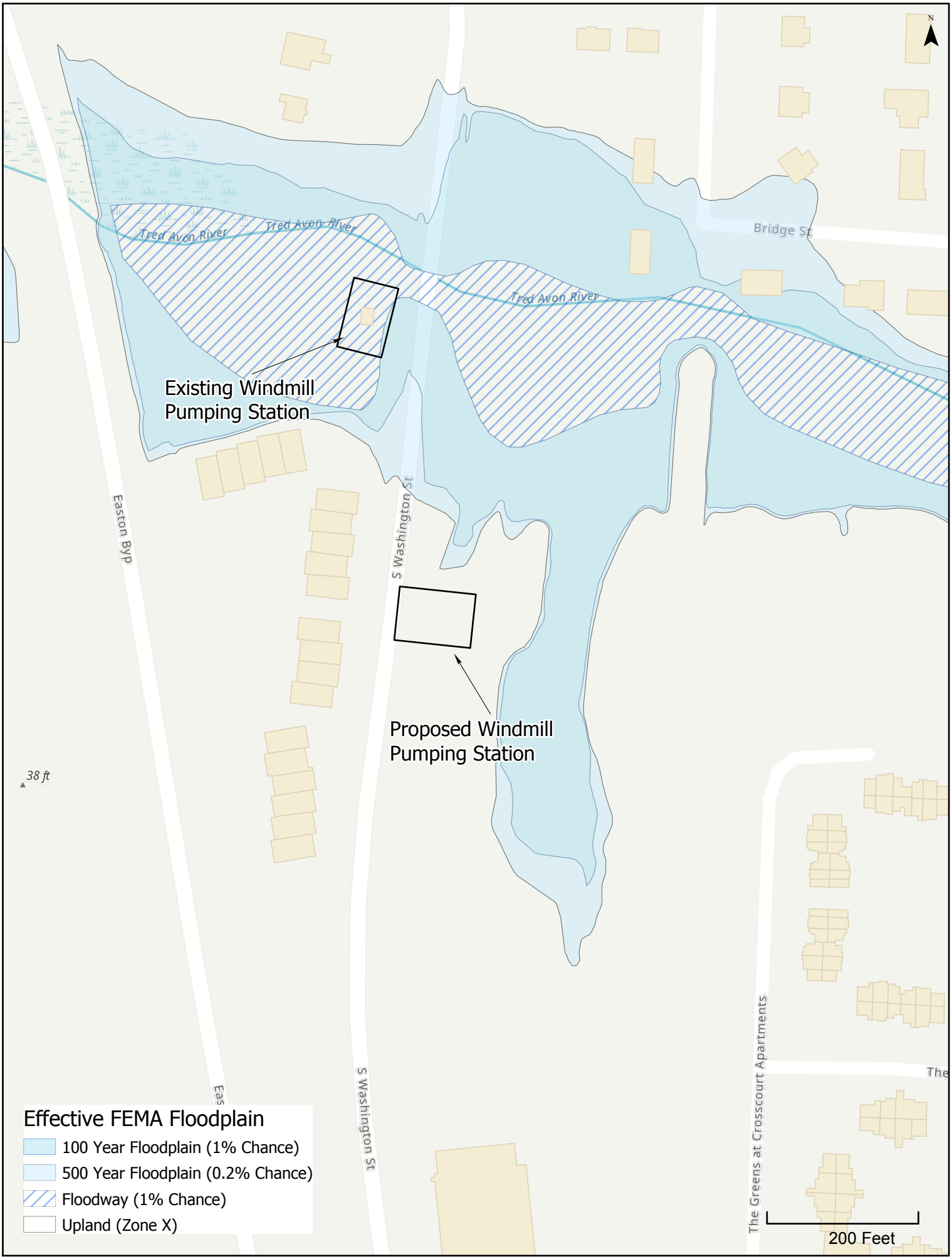
1. Site Location Map of Existing Windmill Pump Station and Proposed Pump Station showing FEMA floodway and floodplain areas.

2. Wastewater Collection System Map – Windmill Pump Station Collection Area shown in orange. Note the Lakelands Pump Station and Cookes Hope Pump Station pump to the Windmill Pump Station, which then pumps to the parallel force main pumping to the Easton Wastewater Treatment Facility.

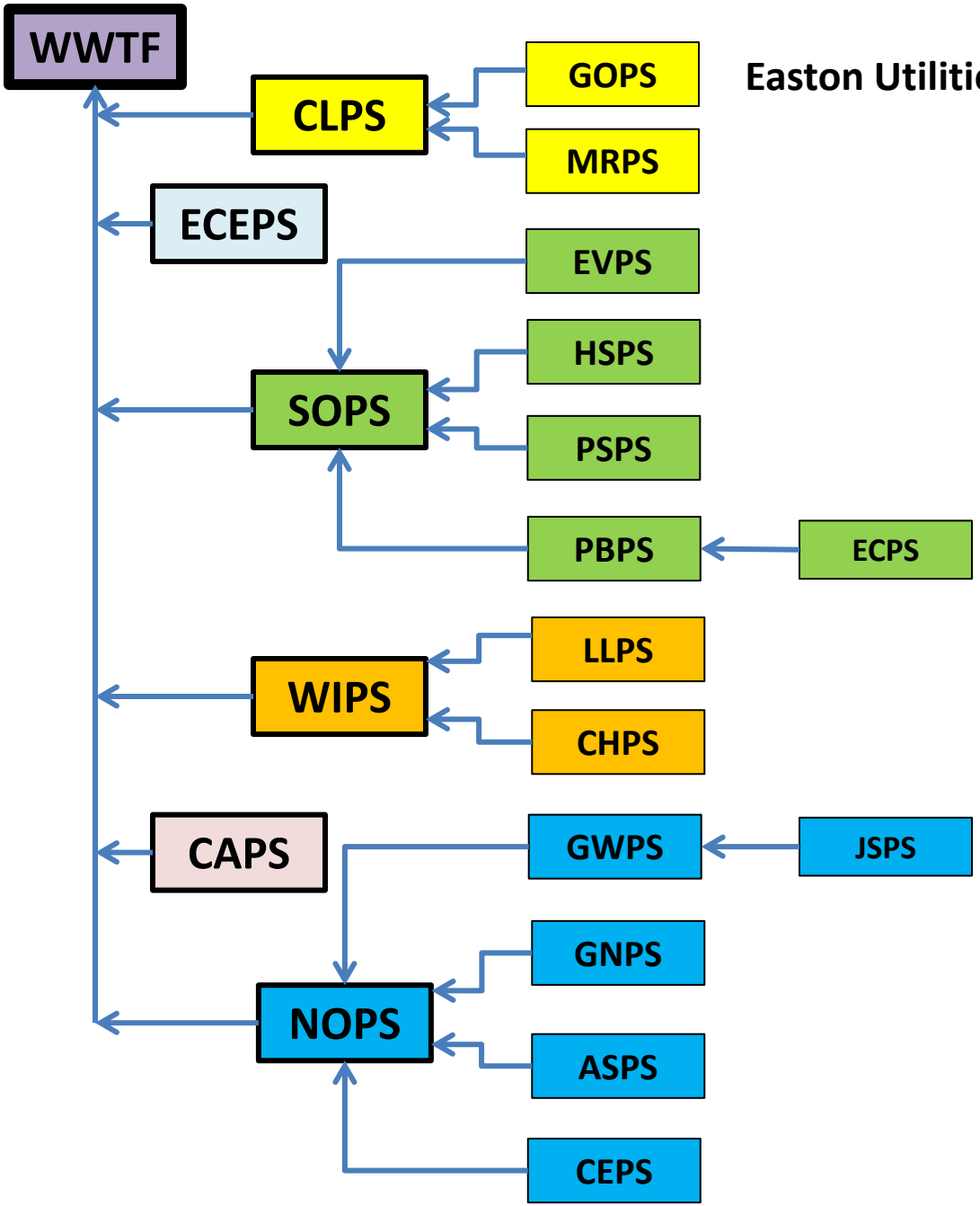
3. FIRMette created from FEMA's Map Service Center website, https://msc.fema.gov/portal/home

Reports Attached:

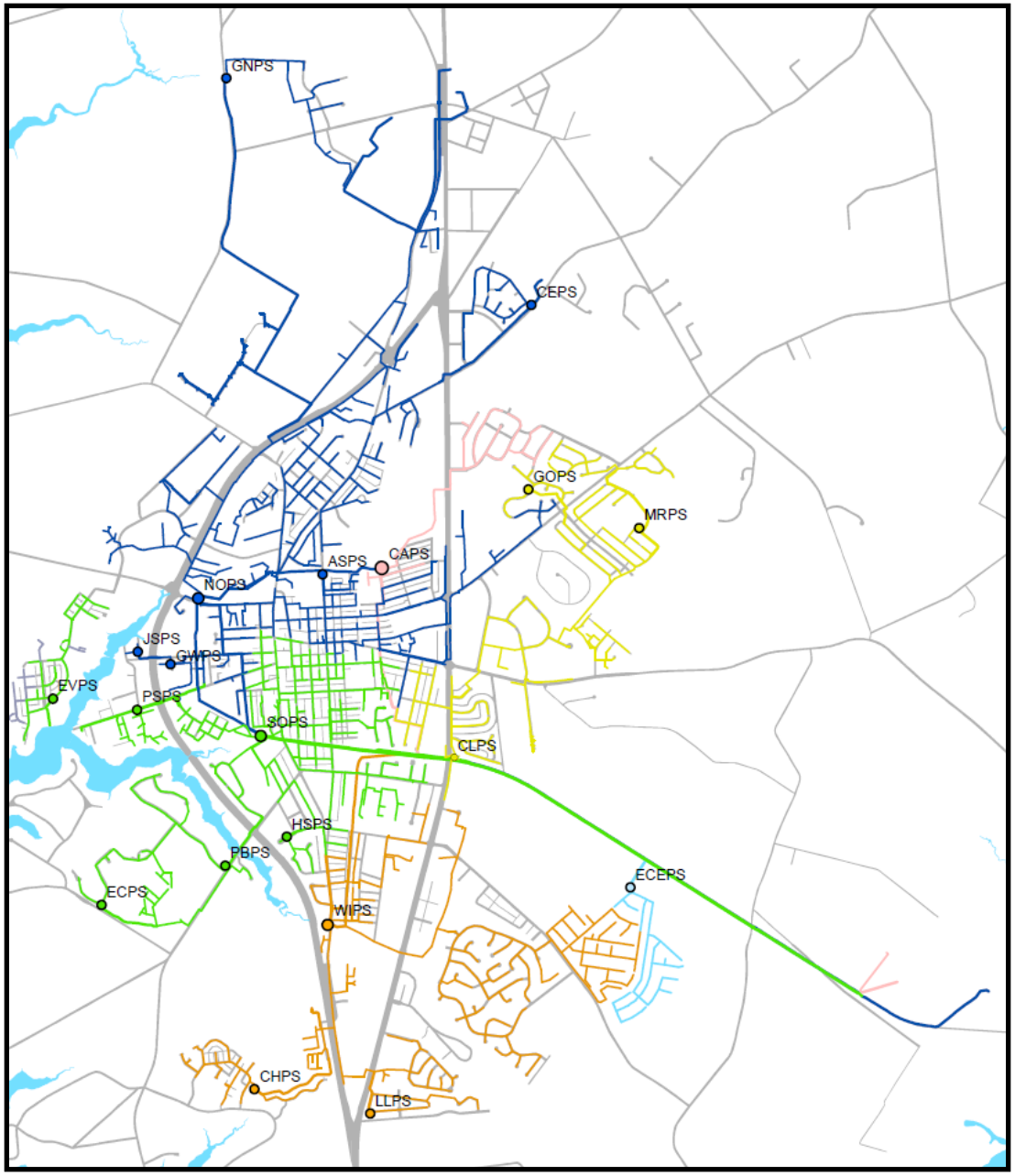
1. Windmill Pumping Station Preliminary Engineering Report, prepared by GHD, dated 2/16/18.


Tred Avon River
Tred Avon River
Tred Avon River
Bridge St
Existing Windmill
Pumping Station
Easton Byp
S Washington St
Proposed Windmill
Pumping Station
38 ft
S Washington St
The Greens at Crosscourt Apartments
The
Effective FEMA Floodplain
100 Year Floodplain (1% Chance)
500 Year Floodplain (0.2% Chance)
Floodway (1% Chance)
Upland (Zone X)
200 Feet

Easton Utilities Wastewater Pumping Stations Flow Schematic



CLIFTON PUMP STATION	**CLPS**
GOLTON	*GOPS*
MATTHEWSTOWN RUN	*MRPS*
EASTON CLUB EAST PUMP STATION	**ECEPS**
SOUTH PUMP STATION	**SOPS**
EASTON VILLAGE	*EVPS*
HUGHLETT	*HSPS*
PORT ST	*PSPS*
PEACHBLOSSOM	*PBPS*
EASTON CLUB	*ECPS*
WINDMILL PUMPSTATION	**WIPS**
LAKELANDS	*LLPS*
COOKES HOPE	*CHPS*
CALVERT PUMP STATION	**CAPS**
NORTH PUMP STATION	**NOPS**
GLENWOOD	*GWPS*
JOHNSON ST	*JSPS*
GOLDSBOROUGH NECK	*GNPS*
AURORA STREET	*ASPS*
CHAPEL EAST	*CEPS*



WW Collection System Map

CLIFTON PUMP STATION	**CLPS**
GOLTON	*GOPS*
MATTHEWSTOWN RUN	*MRPS*
EASTON CLUB EAST PUMP STATION	**ECEPS**
SOUTH PUMP STATION	**SOPS**
EASTON VILLAGE	*EVPS*
HUGHLETT	*HSPS*
PORT ST	*PSPS*
PEACHBLOSSOM	*PBPS*
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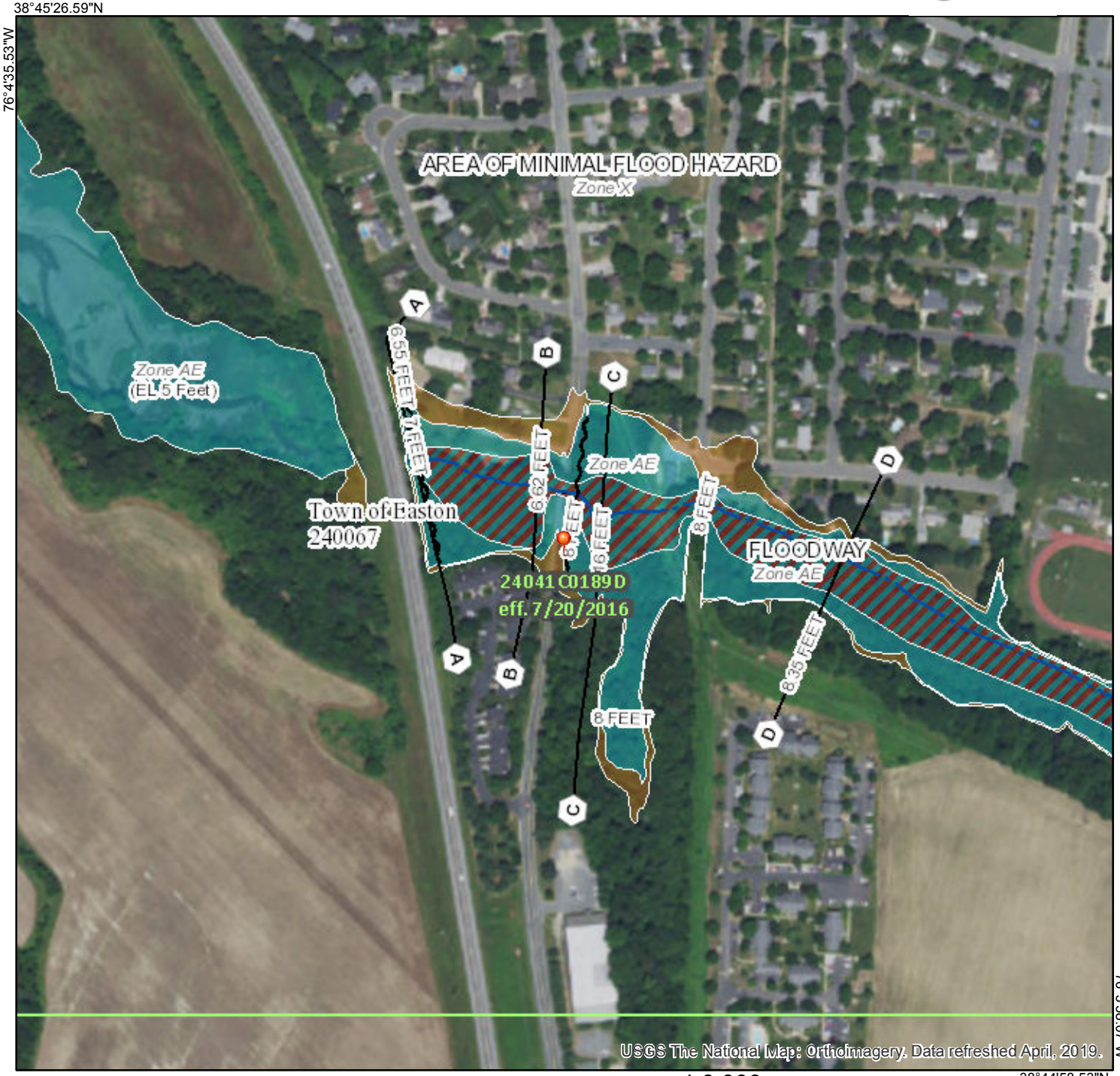
CALVERT PUMP STATION	**CAPS**
NORTH PUMP STATION	**NOPS**
GLENWOOD	*GWPS*
JOHNSON ST	*JSPS*
GOLDSBOROUGH NECK	*GNPS*
AURORA STREET	*ASPS*
CHAPEL EAST	*CEPS*

National Flood Hazard Layer FIRMette

FEMA

38°45'26.59"N

76°4'35.53"W



76°3'38.07"W

38°44'58.53"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/11/2019 at 3:53:34 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Draft for Review

This document is in draft form. A final version of this document may differ from this draft. As such, the contents of this draft document shall not be relied upon. GHD disclaims any responsibility or liability arising from decisions made based on this draft document.

Windmill Pumping Station Preliminary Engineering Report

Easton Utilities

GHD | 16701 Melford Boulevard Suite 330 Bowie MD 20715 USA

11137073 | 100 | Report No 1 | February 16, 2018

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1. Introduction

1.1 Background

The Windmill Pumping Station and associated force main was constructed in the 1950s and has a rated capacity of 1,725 gpm at 121 ft TDH. Raw wastewater flows through a comminutor channel prior to entering a below grade wet well. Two dry-pit submersible pumps are located within a dry well. The pumps discharge into an approximately 6,600 ft long, 12-inch cast iron force main, which connects to a parallel force main system consisting of a 20-inch cast iron force main and a 24-inch HDPE/20" PVC force main. Force mains from a number of other pumping stations also tie into the parallel force main system before being conveyed to the wastewater treatment plant. Electrical and SCADA components are located near grade within the same building as the pumps. There is limited room on site and the station borders Windmill Branch which has been prone to flooding.

Easton Utilities has identified a number of deficiencies at the Windmill Pumping Station, and therefore is investigating alternatives for upgrading the pumping station. The deficiencies identified include, but are not limited to, inadequate wet well storage volume, safety issues with removing pumps for maintenance and overhaul, flooding, lack of compliance with NFPA-820 and NEC, lack of backup power feed, unreliable flow measurement, and under-capacity pumping rates.

1.2 Purpose of this report

The purpose of this report is to document the economic and technical evaluation of the alternatives identified in the project scope for the upgrade of the existing Windmill Pumping Station, and determine the most effective solution to take forward to final design based on cost and non-cost considerations.

1.3 Scope

A summary of the key scope items for development of this report included the following activities:

- Analyze results of drawdown testing completed by Easton Utilities to evaluate current pump performance and force main condition.
- Develop system head curve based on record drawings and field tests.
- Calculate the required wet well volume and proposed pump operating levels.
- Develop and analyze the following four alternatives:
  - Submersible pumps with electrical equipment located in existing building.
  - Submersible pumps with electrical equipment located in new building.
  - Suction lift pumps with pumps and electrical equipment located in enlarged building.
  - Relocation of the pumping station to a new site.
- Preliminary pump selections.

- Evaluate expansion of the wet well to provide the necessary wet well volume and accommodate the proposed pumps.
- Identify necessary improvements to meet current codes, improve flood protection, and accommodate new equipment.
- Preparation of concept plan layouts.
- Preliminary Engineer's Opinion of Probable Construction Cost.
- Evaluate constructability considerations and non-cost advantages and disadvantages.
- Summary of permitting requirements.

2. Existing Conditions

2.1 Site Location

The existing pumping station is located at 1131 S Washington Street, Easton, MD, on a small parcel owned by the Town of Easton as shown in Figure 1. The site is in a residential area, however the pumping station is located over 100 ft from the nearest residence. The pumping station borders Windmill Branch, and is located within both the 100-year floodplain and floodway based on the latest FEMA map dated July 20, 2016 and as shown in Figure 2. Based on FEMA Flood Insurance Study No. 24041CV000B, the 100-year flood elevation at the site is EL 6.6, and the 500-year flood elevation at the site is approximately EL 9.5 (NAVD 88 datum). Based on survey information provided by Easton Utilities, the top of the comminutor channel and finished floor of the pumping station building are at approximately EL 8.80 (NAVD 88). Easton Utilities have reported that during recent hurricane events that the flood level has been close to the FEMA 500-year flood elevation, and has exceeded the existing finished floor elevation. Wooden boards fitted by Easton Utilities to assist with protection of the pumping station from flooding are shown in Figure 3. In addition to being within the floodplain and floodway, the site is located in close proximity to wetlands.

Figure 1 Aerial photo of area surrounding Windmill Pumping Station

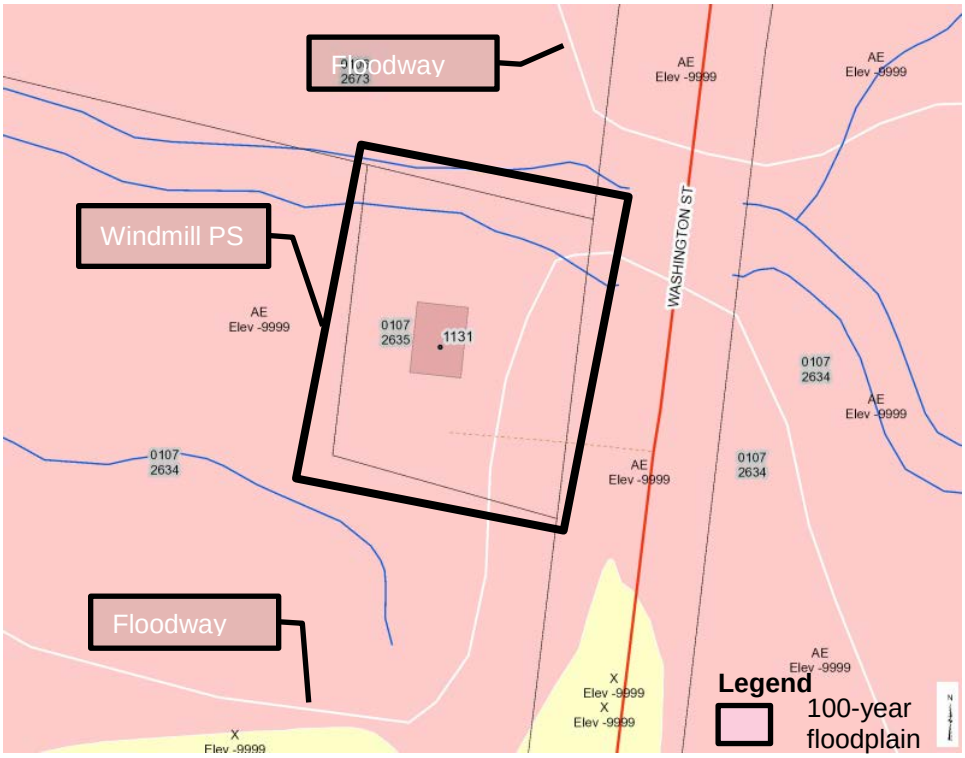


Figure 2 FEMA Floodway and Floodplain at Windmill Pumping Station

Figure 3 Exterior of Windmill Pumping Station

2.2 Pumping Station

The Windmill Pumping Station and associated force main were constructed in the 1950s and has a rated capacity of 1,725 gpm at 121 ft TDH. Raw wastewater flows through a comminutor channel prior to entering a below grade wet well. Two Yeomans 75 HP dry-pit submersible pumps are located within a dry well, and were last replaced in 1998. A photo looking into the existing pumping station dry well is shown in Figure 4. Electrical and SCADA components are located near grade within the same building as the pumps, and have minimal clearance to the opening to the dry well as shown in Figure 5.

Figure 4 Existing Pumping Station Dry Well

Figure 5 Existing MCC

2.3 Code and Regulatory Review

A review of the existing pumping station compliance relevant codes and standards was completed to assist with development of the alternatives. The versions of the referenced codes and standards that were reviewed were the latest versions as of the date of the report. A summary of the key compliance issues identified are summarized below:

1. National Electric Code (NEC)
   - Existing electrical equipment is in close proximity to the opening to the dry well, and the clearance to the guardrail does not comply with current NEC requirements. It would not be possible to install new code compliant electrical equipment without modifications to the structure.
2. National Fire Protection Association (NFPA) – NFPA 820 Standards for Fire Protection in Wastewater Treatment and Collection Facilities
   - The pumping station building and dry well are considered a Class I, Division 2 area unless ventilation and monitoring meeting NFPA 820 are provided to declassify the space. The existing ventilation system has not been evaluated, however it is likely that it does not meet the requirements of NFPA 820.
   - Compliance with NFPA 820 is not required by state or local codes, unless specifically adopted by the local jurisdiction; however, NFPA 820 is a recognized standard in the municipal wastewater industry, and the PER design alternatives incorporate its requirements.
   - It is also noted that NFPA 820 classifies the outdoor grit channel as a Class I, Division 2 area. It is unknown whether the existing grinder is rated for the condition.
3. International Building Code (IBC) and Occupational Safety and Health Administration (OHSA)
   - Access to the dry well is via ships ladder stairs that are no longer compliant with current codes for new construction. It is, however, noted that the code does not require them to be replaced if the building occupancy is not being changed.
4. Floodplain
   - It is noted that the existing finished floor elevation is approximately 2 ft above the FEMA 100-year flood elevation, and therefore compliant with minimum requirements. However, Easton Utilities have experienced higher flood elevations than would be anticipated from the FEMA 100-year flood elevation, and therefore flooding should be addressed as part of this project.
5. MDE Design Guidelines for Wastewater Facilities
   - MDE Design Guidelines for Wastewater Facilities which include the 10-State standards, along with MDE specific addenda were reviewed. As the pumping station is located within 3 miles of shellfish water, the pumping station requires a stationary auxiliary power source connected to a separate power feed substation or stationary generator. It is understood that neither of these conditions are currently met, however that Easton Utilities have plans to install a second utility feed to the pumping station. It is noted that to

meet this requirement, the two electric service utility feeds should be from two independent substations.

3. Design Criteria and Pump Selection

A summary of the key design criteria for this project, including design flow, TDH, and wet well sizing is presented in this section, along with analysis of the results of the pump testing completed by Easton Utilities.

3.1 Pump Testing

Pump testing was undertaken by Easton Utilities on March 23, 2017 to provide data to allow an analysis of current pump performance and force main condition to be completed. The testing was completed while all other major wastewater pumping stations within the system were off, therefore the results represent operating the Windmill Pumping Station with no or minimal other flow within the common force main system. The results of the pump testing including flow calculated both from wet well drawdown and as measured by the flowmeter are shown in Table 3.1. Based on discharge pressure data provided, the pump TDH was approximated. Under these conditions, the flowmeter was found to be reading within 3% of the flow calculated from the drawdown test, with the exception of one outlier.

Table 3.1 Pump Testing Results

Pump	Test No.	Flow (Drawdown) (gpm)	Flow (Flowmeter) (gpm)	TDH (feet)
1	1	1,115	1,208	103
1	2	1,210	1,183	131
1	3	1,211	1,177	133
2	1	1,163	1,162	117
2	2	1,139	1,154	121
2	3	1,160	1,165	126

The pump testing results were plotted along with the pump curve as shown in Figure 6. Other than one outlier for pump 1, the results for each pump are grouped closely together. All the results are below the pump curve, which may be due to pump and/or impeller wear, or field data accuracy.

A system curve for the existing system was also generated based on information provided by Easton Utilities. Based on the drawings, there is a high point in the parallel force main system around Dover Neck Road. Easton Utilities have advised that an air valve is not installed at the high point, therefore an air pocket is anticipated to have formed at this location, impacting force main performance. There is an elevation difference of approximately 30 feet between the high point and the discharge point at the Parshall Flume. Head loss in this section is minimal, therefore the system curve is calculated based on pumping to the high point at Dover Neck Road.

When the Windmill Pumping Station is the only station operating, nearly all of the head loss in the system is within the 12” Windmill force main, therefore enabling an estimate of the C value for the existing force main to be determined. A C value of approximately 85 for the existing 12” force main

was found to fit the results of the pump testing, as shown in Figure 6. It is not known whether the force main is lined or unlined, however based on its age, it is possible that it was constructed of unlined cast iron pipe. If the pipe is unlined cast iron, then the calculated C value is within the range that may be anticipated. If the force main is lined, the C value is lower than would be anticipated. Cleaning of the force main could be considered to improve the hydraulic performance, however it is also understood that Easton Utilities have plans to replace the force main in the future.

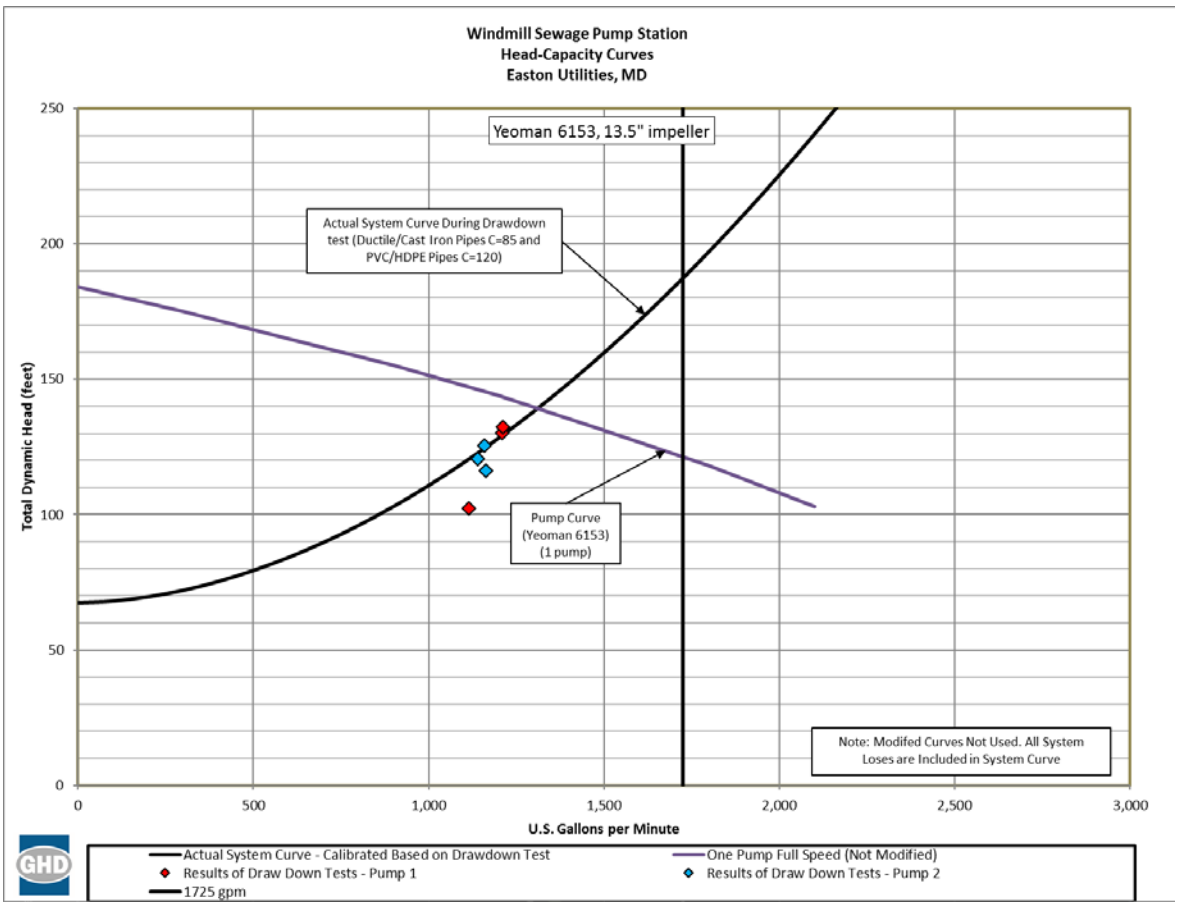


Figure 6 Pump Test Results vs Pump Curve

3.2 Wet Well Sizing

Easton Utilities have indicated that the existing wet well is undersized and additional wet well capacity is necessary. The existing wet well size and need for additional capacity was evaluated based on the existing controls.

The pumping station is fitted with variable frequency drives (VFDs), however to maintain a minimum 2 ft/s velocity in the force main, a minimum pumping rate of 705 gpm is required. If a higher flush velocity is desired, additional wet well volume may be necessary. Based on a minimum cycle time of 7.0 minutes, and maintaining the minimum submergence required by the pump manufacturer, the required operating levels for the existing wet well to accommodate new submersible Yeomans pumps were calculated as shown in Table 3.2. Based on the calculated operating levels, the high level alarm would need to be raised approximately 6-inches from the existing high level alarm,

resulting in it being around 3 inches below the influent sewer elevation. The pump shut off elevation would also need to be set very close to the minimum recommended by Yeomans, with the low level alarm set even lower, and the working volume would be reduced compared to the existing pumping station. In addition, given variations in flow in the system due to other pumping stations starting and stopping, it may be difficult to maintain a minimum flow of 705 gpm. Increasing the size of the wet well would therefore be beneficial.

The existing wet well could be expanded to the south, with the new section of wet well accommodating the new pumps. Expanding the wet well by 9 ft to the south should provide sufficient space to accommodate the new pumps, along with the additional volume necessary to address the capacity concerns relating to the existing wet well. The finished floor elevation of the new section of wet well could also be lowered slightly to improve pump submergence, and a minimum speed set on the VFD to ensure a minimum flow of 705 gpm is maintained under all conditions within the system. Setting the minimum speed to ensure a minimum flow of 705 gpm under all conditions, would result in a flow of close to 1,350 gpm on the low system curve. The proposed operating levels for the expanded wet well are included in Table 3.2.

Alternative 4 includes construction of a new pumping station on a new site, and therefore includes a new wet well, rather than expansion of the existing wet well. It is recommended that a 12 ft internal diameter circular wet well be utilized, which will be sufficient to accommodate two submersible pumps and a Channel Monster grinder installed at the end of the influent pipe. A circular wet well will provide for better removal of solids, therefore reducing the need for frequent cleaning when compared to a rectangular wet well.

Table 3.2 Wet Well Elevations

	Existing Wet Well	New/Expanded Wet Well	New Wet Well (Alternative 4)
Interior Dimensions	12 ft x 18 ft	12 ft x 27 ft	12 ft diameter
Top Slab Elevation	EL 10.00 (Raised)	EL 10.00	EL 21.50
Inlet Sewer Elevation	EL -1.34	EL -1.34	EL -3.00
High Level Alarm	EL -1.74	EL -2.20	EL -4.00
Standby Pump On	EL -2.24	EL -2.70	EL -4.50
Duty Pump On	EL -2.74	EL -3.20	EL -5.50
Pumps Shut Off	EL -3.50	EL -4.17	EL -8.50
Low Level Alarm	EL -4.00	EL -4.67	EL -9.00
Min Level Required by Pump Manufacturer (Yeomans 6153)	EL -3.54	EL -4.67	EL -9.00
Finished Floor Elevation	EL -8.00	EL -9.17	EL -13.50
Working Volume Height	0.76 ft	0.97 ft	3.0 ft
Working Volume	1,234 gallons	2,363 gallons	2,535 gallons
Minimum Cycle Time	7.0 minutes @ 705 gpm	7.0 minutes @ 1,350 gpm	7.5 minutes @ 1,350 gpm

3.1 System Hydraulics

The pumps discharge into an approximately 6,600 ft long, 12-inch cast iron force main, which connects to a parallel force main system consisting of a 20-inch cast iron force main and a 24-inch HDPE/20" PVC force main. Force mains from a number of other pumping stations also tie into the parallel force main system before being conveyed to the wastewater treatment plant. Based on a low C value of 85 for the existing Windmill force main and the existing 20" CIP and a low C value of 120 for the HDPE/PVC FM, system curves were developed for the system. The case when all the other pumps in the system were operating was also considered, with the flows provided by Easton Utilities shown in Table 3.3 used to determine the system curve under these conditions.

Table 3.3 Assumed Flow from Contributing Pumping Stations

Pumping Station	Flow (gpm)
South Pump Station	531
North Pump Station	1,923
Calvert Pump Station	2,100
Clifton Pump Station	1,039
Easton Club	660

System curves were developed to cover the range of possible operating conditions with the parameters for the minimum and maximum cases detailed in Table 3.4. The system curves are presented in Section 3.2. Note that the wet well levels are based on the existing set points, and depending on the selected alternative, the calculated TDH may change slightly, particularly if the pumping station is relocated to a new site.

Table 3.4 System Curve Parameters

	Min TDH	Max TDH	Max TDH (with replacement of 12" Windmill Force Main)
WSE at Wet Well	EL -2.50	EL -4.50	EL -4.50
WSE at System High Point	EL 64.00 (Invert)	EL 66.50 (Crown)	EL 66.50 (Crown)
Static Head	66.5 ft	71.0 ft	71.0 ft
Hazen Williams C - CIP	140	85	85
Hazen Williams C – HDPE/PVC	150	120	120
Other Pumping Stations Operating	No	Yes	Yes
TDH at 1,725 gpm	106 ft	226 ft	176 ft

In order to achieve the current rated capacity of 1,725 gpm under worst case conditions, the design pump TDH would need to increase significantly from the current design point of 121 ft TDH to 226 ft TDH. Easton Utilities have indicated that they have plans to replace the existing 12" Windmill force main, which could increase the design low C value from 85 to 120 if replaced with PVC or HDPE. Replacement of the force main would reduce the required TDH from 226 ft to 176 ft, however still

significantly higher than the existing rating point and would require the pump size to be increased to 150 HP.

Easton Utilities have evaluated historical pump run time and flow data, to determine the need for such a significant increase in the rating point, and have advised that based on their risk assessment, sizing the pumps for this condition is not necessary, and they should be sized for 1,750 gpm at 150 ft. To maintain the equivalent flow rating point as the existing, it is recommended that this be adjusted to 1,725 gpm at 152 ft. It is noted that it will be necessary to justify this rating point to MDE to obtain the MDE Construction Permit. Further evaluation of flow from the other pumping stations that could be anticipated when the Windmill Pumping Station is operating is recommended, to allow the design system curve to be better defined.

It should also be noted that data recorded by Easton Utilities when all other pumping stations are operating does not appear to match the calculated system curves for this condition. Easton Utilities have observed that the flow from the existing pumps dropped to 370 gpm with both pumps operating at a TDH of 173 ft, compared to 105 ft TDH calculated by the maximum system curve at this flow rate. It, therefore, appears that under this condition, there is significantly more head loss in the parallel force mains than anticipated. It is possible that the lack of an air valve at the system high point is contributing to this, or there may be other issues with these force mains such as a partial blockage or lower C value than anticipated. It is understood that Easton Utilities plan to install an air valve at this location. It is recommended that a combination air valve be installed. Once the high point air valve is installed, it is recommended that the pump/drawdown testing be repeated and the results re-evaluated.

3.2 Pump Selections

Two pump alternatives to meet the design point of 1,725 gpm at 152 ft TDH were considered as follows, and are detailed in this section.

- Submersible Pumps
- Suction Lift Pumps

3.2.1 Submersible Pumps

Pump selections were obtained from Easton Utilities preferred pump manufacturer, Yeomans, for submersible pumps meeting the flow and TDH requirements. A summary of the key data is included in Table 3.5, including pump speed and efficiency. The pump and system curves for this pump selection are shown in Figure 7. The manufacturer pump curves are included in Appendix A.

Table 3.5 Submersible Pump Selection

	Pump Data
Manufacturer and Model	Yeomans Model 6153
Speed	1,750 rpm
Impeller Diameter	14.5 in
Pump Efficiency	60 - 75%
Motor Size	100 HP

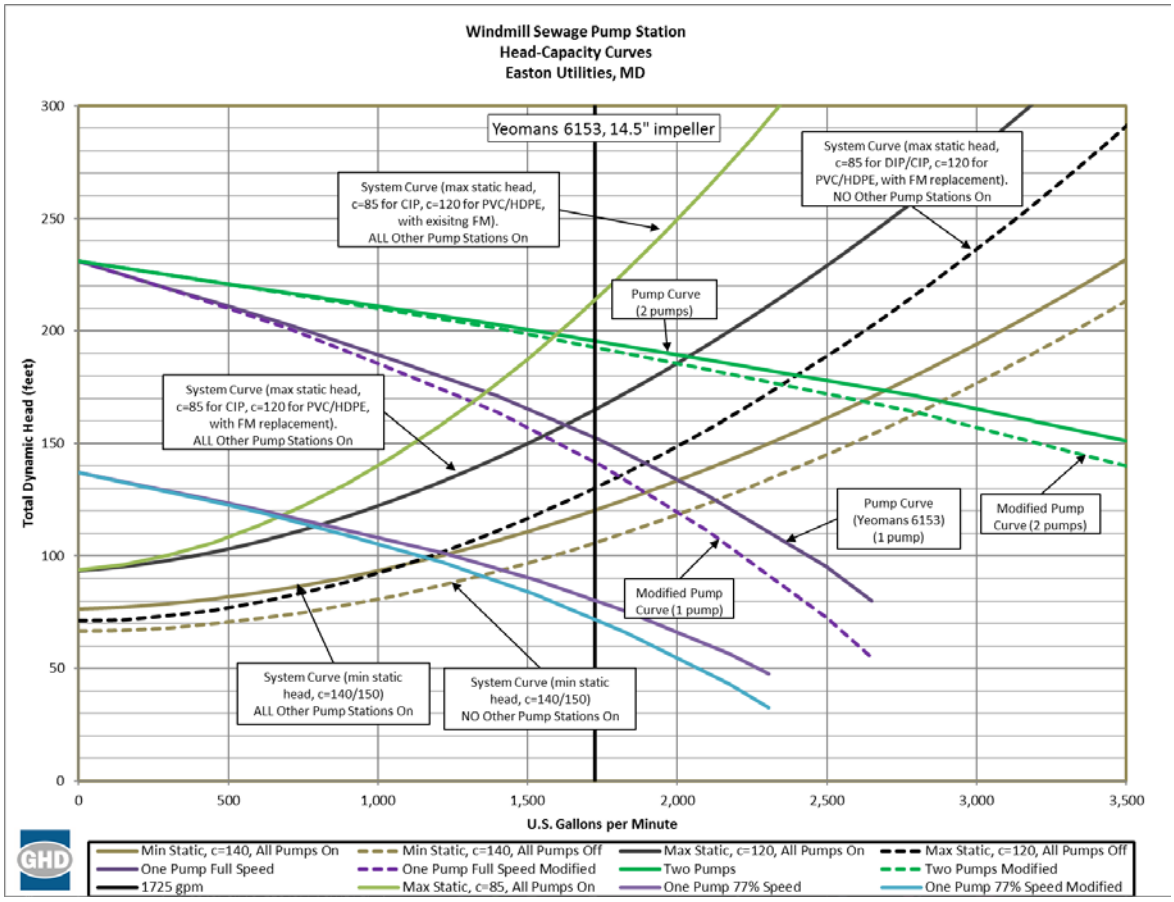


Figure 7 Head-Capacity Curves – Submersible

3.2.2 Suction Lift Pumps

Pump selections were obtained from Gorman Rupp for self-priming centrifugal pumps meeting the flow and TDH requirements. To meet the design point, it would be necessary to connect two T8A-B pumps together in series. A summary of the key data is included in Table 3.6, including pump speed and efficiency. The pump and system curves for this pump selection are shown in Figure 8. The manufacturer pump curves are included in Appendix A. The pumps would be fitted with V-belt drive systems, enabling pump speed to be set to match the flow and TDH requirements without requiring trimming the impeller. A lift of approximately 17 ft is required and is within the pump lift capability. When operating at 100% speed on the minimum system curve there is approximately 3 to 4 ft of margin between NPSH available and NPSH required.

Table 3.6 Suction Lift Pump Selection

	Pump Data
Manufacturer and Model	Gorman-Rupp T8A-B
Number of Pumps in Series	2
Drive Type	V-Belt
Speed	1,325 rpm

	Pump Data
Impeller Diameter	14.75 in
Pump Efficiency	45 - 63%
Motor Size	75 HP per pump 150 HP total per set of series pumps
NPSH required	10.2 ft @ 2,050 gpm
Reprime lift capability	23 ft

It is noted that for two Gorman Rupp T8A-B pumps in series, the total of the two motors will be 150 HP, compared to a single 100 HP motor for the submersible option, and have a pump efficiency of 45 to 63% compared to 60 to 75% for the submersible options. The increased number of motors and electrical requirements would therefore increase the cost of the electrical equipment, and may impact the size of the electrical service required at the pumping station. The corresponding additional power consumption would increase the operating cost of the suction lift alternative when compared to the submersible alternative.

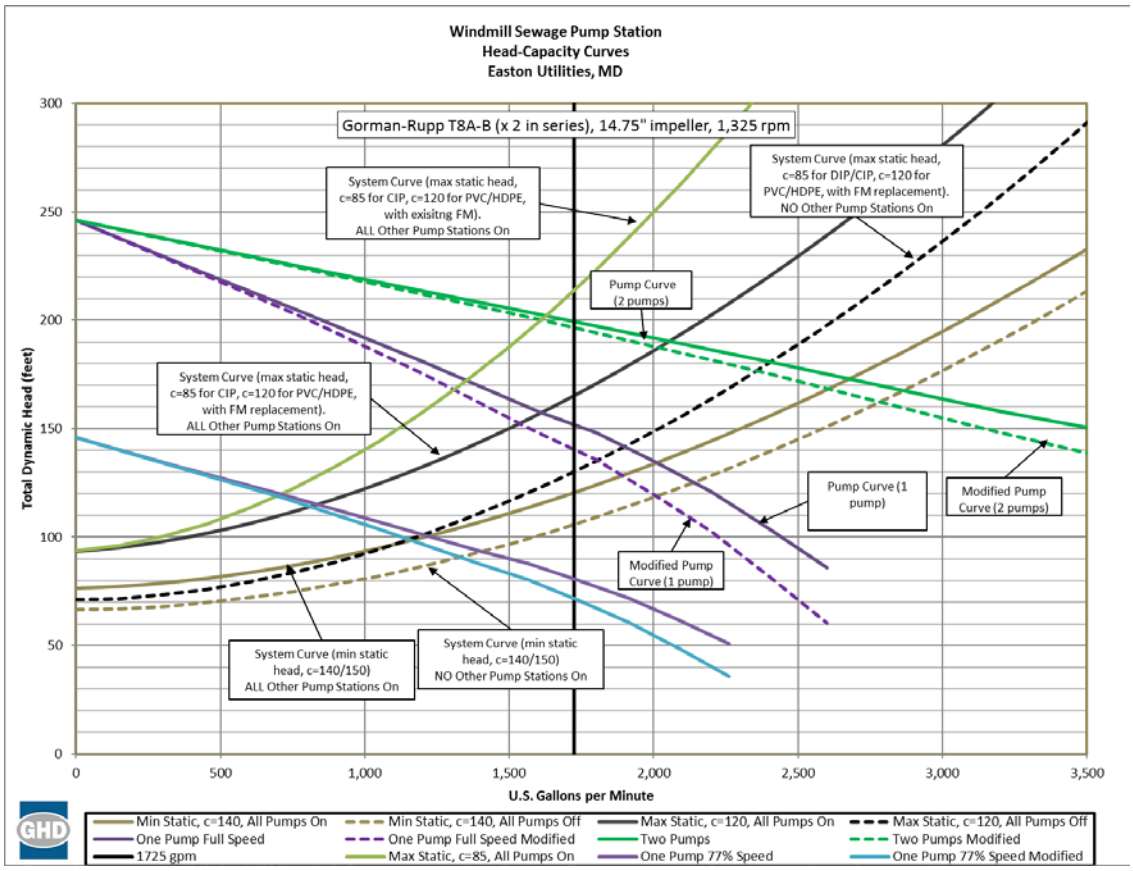


Figure 8 Head-Capacity Curves – Suction Lift

4. Pumping Station Alternatives

An evaluation of the alternatives developed for the pumping station was completed and is presented in this section. The following four alternatives were analyzed:

1. Submersible pumps with electrical equipment located within existing building footprint.
2. Submersible pumps with electrical equipment located in new building.
3. Suction lift pumps with pumps and electrical equipment located in enlarged building.
4. Relocation of the pumping station to a new site.

4.1 Alternative 1: Submersible pumps with electrical equipment located within existing building footprint

Options for flood proofing the existing building were considered to allow it to be retained as part of the pumping station upgrade. Flood door panels could be used to prevent entry of water through the doors. There is also potential for water to enter through the brick, which could be mitigated through the installation of a concrete berm. It is noted that even with the improvements to prevent entry of water into the building, it would be necessary to raise the electrical equipment above the flood elevation. The existing building height is only 8'-4", and raising the equipment would result in insufficient clearance above the equipment. Therefore, utilizing the existing building would require the roof to be raised. This would be feasible, however, given the age of the building and the other improvements required to provide flood protection, it is recommended that this alternative include demolition of the existing building and construction of a new building in its place.

Alternative 1 includes the following:

- Submersible pumps installed on guiderails in expanded wet well. The wet well will be extended to the south of the existing wet well. The top of the new section of wet well will be raised to above the flood level. Modifications to existing wet well concrete fill to accommodate wet well extension. A gooseneck vent will be provided, with portable ventilation used at any time entry into the wet well is required.
- Demolition of existing building superstructure (roof and masonry walls), and construction of a new building in its place. Existing walls will be raised and new floor slab constructed above the flood level.
- Removal of existing pumps, piping and electrical equipment, and filling existing dry well.
- Electrical and control equipment for the new pumps installed within new control building. Existing grinder controls would be moved to the new building.
- Below grade valve vault to accommodate pump discharge isolation and check valves, and below grade flowmeter vault to accommodate new magnetic flowmeter and bypass. Flood tight hatches will be installed to allow the vaults to be installed at existing grade, minimizing additional fill within the floodplain.
- Extension of existing access driveway to allow for crane truck and vactor truck access to the submersible pumps.

- Demolition of existing site fence and replacement with a new fence to provide security for all new structures.
- Relocation of existing transformer to the eastern side of the site, near S Washington Street. Addition of second electrical service for redundancy. An automatic transfer switch with two service entrance rated main circuit breakers will be required to accommodate the two utility feeds.
- Temporary pumping throughout the duration of construction.

The proposed site layout for Alternative 1 is shown in Figure 9, and also included in Appendix B.

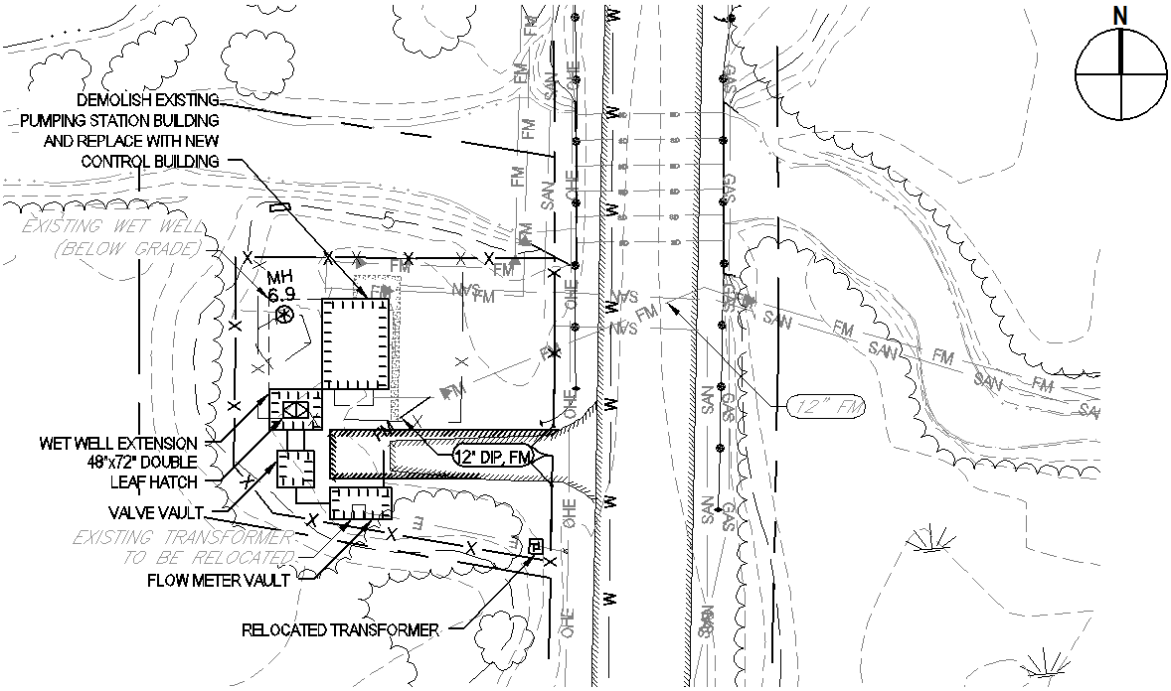


Figure 9 Alternative 1 – Site Layout

4.2 Alternative 2: Submersible pumps with electrical equipment located in new building

Alternative 2 is similar to Alternative 1, with the exception that the existing building will be retained, and a new control building will be constructed at a different location on site. This provides the benefit of allowing the majority of construction to be completed while the existing pumping station remains in service, and therefore significantly minimizing the duration of bypass pumping.

Alternative 2 includes the following:

- Submersible pumps installed on guiderails in expanded wet well. The wet well will be extended to the south of the existing wet well. The top of the new section of the wet well will be raised to above the flood level. Modifications to existing wet well concrete fill to accommodate wet well extension. A gooseneck vent will be provided, with portable ventilation used at any time entry into the wet well is required.

- Construction of a new control building, located on the south-east of the site. The control building would be constructed on an elevated slab above the flood elevation, with stairs provided for access. This would minimize the need for additional fill within the floodplain. An alternative location for the building would be to the east of the existing building, however it is understood that Easton Utilities utilize this area for setting up temporary bypass pumping when necessary.
- Electrical and control equipment for the new pumps installed within new control building. Existing grinder controls would be moved to the new building.
- Below grade valve vault to accommodate pump discharge isolation and check valves, and below grade flowmeter vault to accommodate new magnetic flowmeter and bypass. Flood tight hatches will be installed to allow the vaults to be installed at existing grade, minimizing additional fill within the floodplain.
- Extension of existing access driveway to allow for crane truck and vactor truck access to the submersible pumps.
- Demolition of existing site fence and replacement with a new fence to provide security for all new structures.
- Relocation of existing transformer to the eastern side of the site, near S Washington Street. Addition of second electrical service for redundancy. An automatic transfer switch with two service entrance rated main circuit breakers will be required to accommodate the two utility feeds.
- Temporary pumping to allow modifications to the existing wet well and wall opening to be completed.

The proposed site layout for Alternative 2 is shown in Figure 10, and also included in Appendix B.

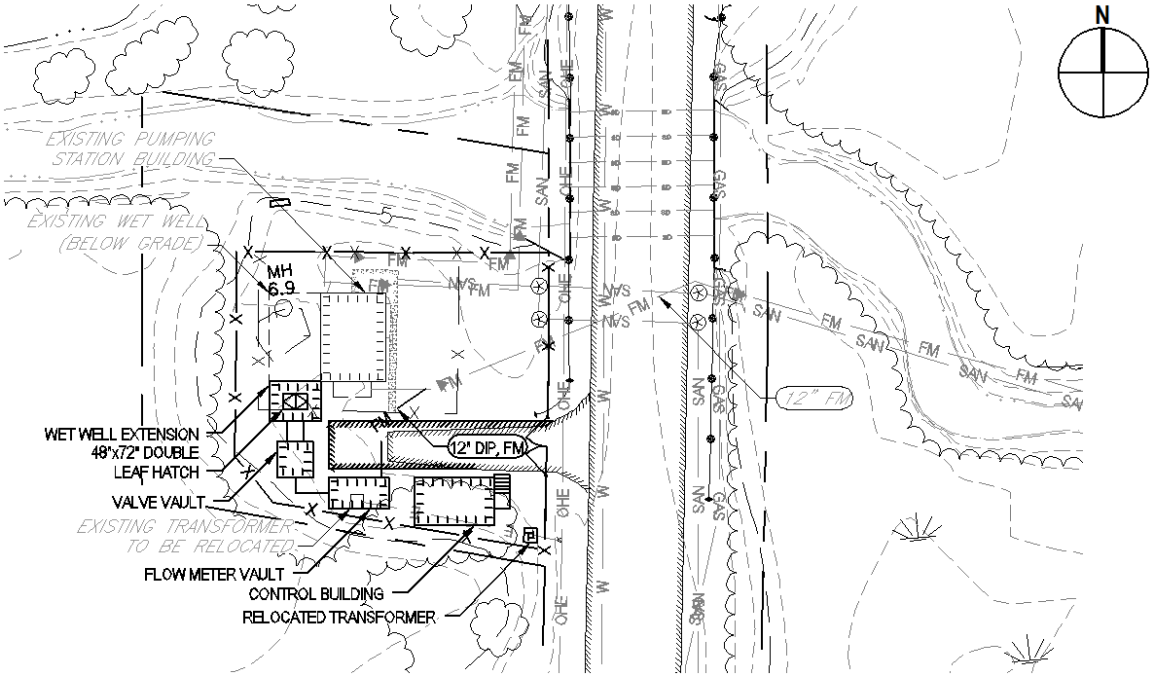


Figure 10 Alternative 2 – Site Layout

4.3 Alternative 3: Suction lift pumps with pumps and electrical equipment located in enlarged building

Alternative 3 considers the use of suction lift pumps rather than submersible pumps. The pumps would be installed within a new enlarged building slightly above grade, thereby providing good access for maintenance. Piping, valves, and flowmeter would also be installed within the building, eliminating the need for below grade vaults.

Alternative 3 includes the following:

- Suction lift pumps, two sets of two pumps in series, installed at grade within an expanded building.
- Expansion of the existing wet well to the south of the existing wet well. The top of the new section of the wet well will be raised to above the flood level. Modifications to existing wet well concrete fill to accommodate wet well extension. A gooseneck vent will be provided, with portable ventilation used at any time entry into the wet well is required.
- Demolition of existing building superstructure (roof and masonry walls), and construction of a new expanded building covering the area of the existing building and the existing wet well. Both the existing dry well and wet well walls will be raised, and new floor slab constructed above the flood level. The new building would be subdivided into two rooms, one for the electrical and control equipment and one for the pumps and piping.
- Removal of existing pumps, piping and electrical equipment, and filling existing dry well.

- Electrical and control equipment for the new pumps installed within new control building. Existing grinder controls would be moved to the new building.
- Pump discharge isolation and check valves, and new magnetic flowmeter and bypass located within new building.
- Extension of existing access driveway to allow for crane truck and vactor truck access to the pumps and wet well.
- Demolition of existing site fence and replacement with a new fence to provide security for all new structures.
- Relocation of existing transformer to the eastern side of the site, near S Washington Street, to assist with protection from flooding. Addition of second electrical service for redundancy. An automatic transfer switch with two service entrance rated main circuit breakers will be required to accommodate the two utility feeds.
- Temporary pumping throughout the duration of construction.

The proposed site layout for Alternative 3 is shown in Figure 11, and also included in Appendix B.

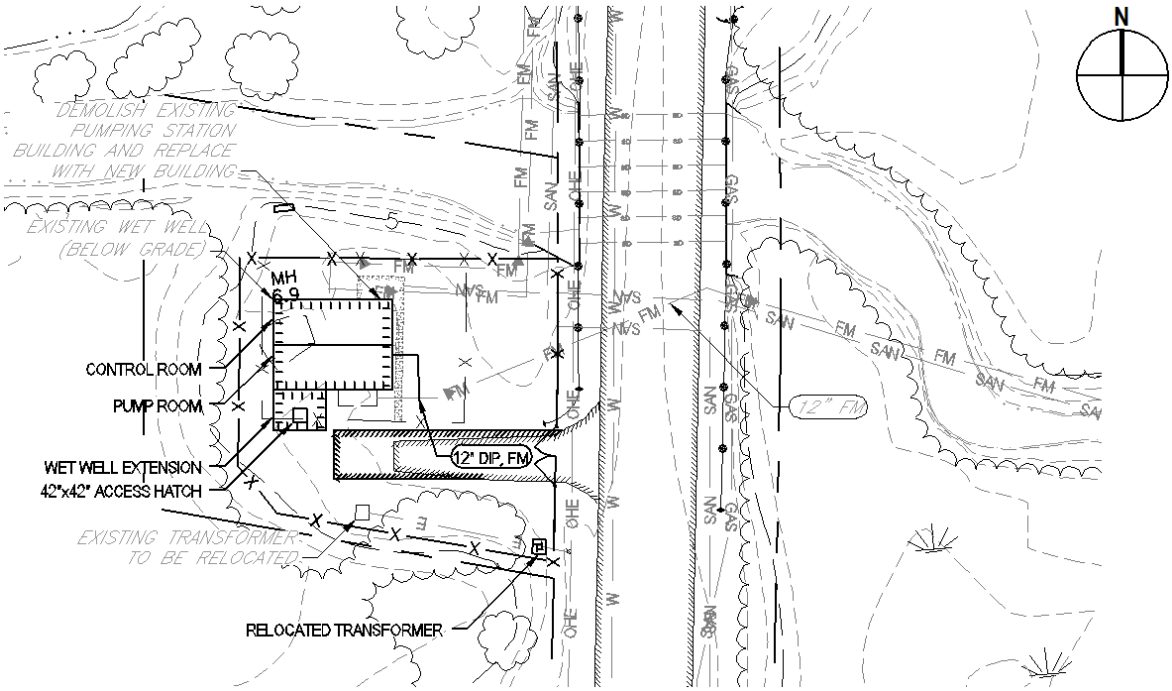


Figure 11 Alternative 3 – Site Layout

4.4 Alternative 4: Relocation of pumping station to a new site

Alternative 4 involves demolition of the existing pumping station and constructing a new pumping station at a new site located on a parcel owned by the Town of Easton. The new site is located to the south of the existing pumping station as shown in Figure 12, and also included in Appendix B. The primary advantage of relocating the pumping station to this new location is that it would allow

the pumping station to be located outside of the 100-year floodplain and the floodway, therefore improving flood protection.

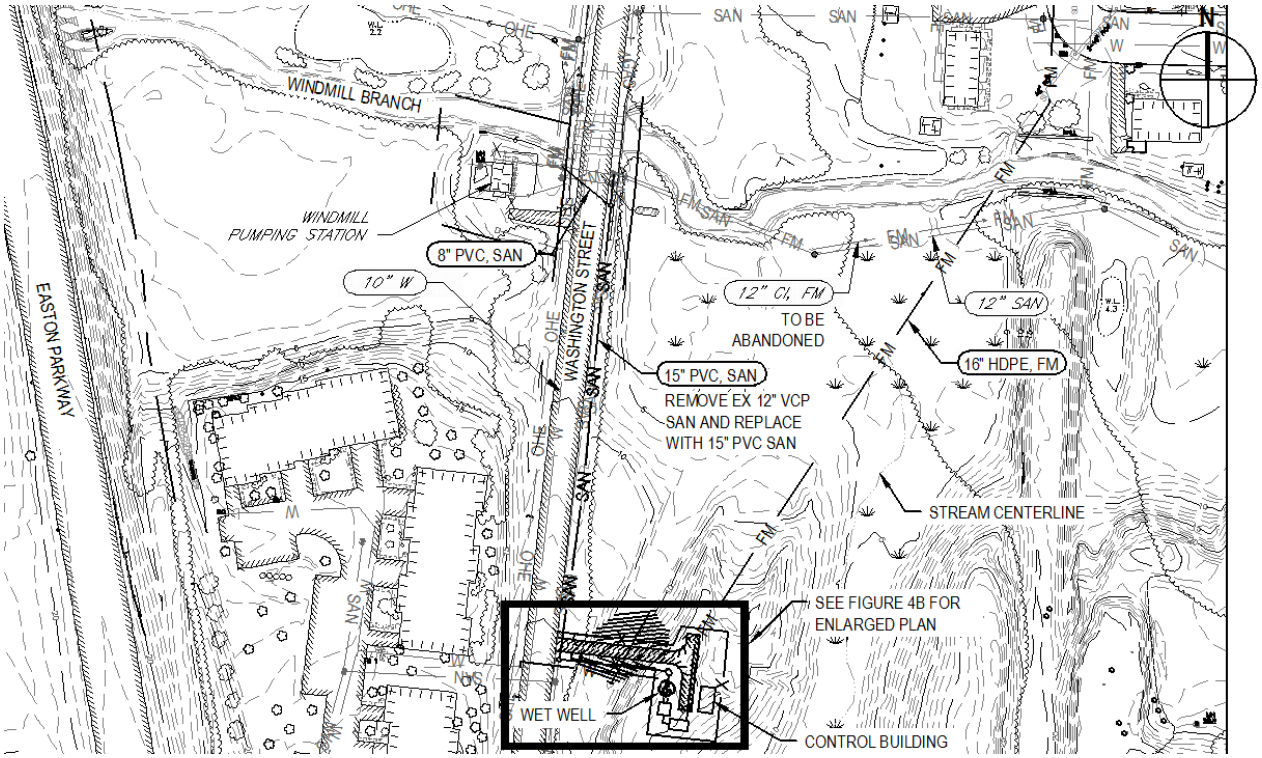


Figure 12 Alternative 4 – Site Location

The new pumping station would be a submersible style pumping station similar to Alternatives 1 and 2, and includes the following:

- Submersible pumps installed on guiderails in a new 12 ft internal diameter precast wet well. A gooseneck vent will be provided, with portable ventilation used at any time entry into the wet well is required.
- Channel Monster hydraulic grinder installed on guiderails in the new wet well. The hydraulic grinder would be powered by a Hydraulic Power Unit installed in the control building.
- Construction of a new control building to house the electrical and control equipment, and Hydraulic Power Unit.
- Electrical and control equipment for the new pumps and hydraulic grinder installed within new control building.
- Installation of a jib crane with electric hoist for pump and grinder removal.
- Installation of a new 5 ft diameter upstream manhole with rock trap in close proximity to the new wet well. The rock trap would be created by a depression in the flow channel below the pipe invert.
- Below grade valve vault to accommodate pump discharge isolation and check valves, and below grade flowmeter vault to accommodate new magnetic flowmeter and bypass.

- Construction of new access driveway to allow for crane truck and vactor truck access to the submersible pumps and hydraulic grinder. This will involve filling an existing valley and providing a storm drain to maintain drainage across the new driveway.
- Chain link fence to provide security for all new structures.
- Provision of two new electrical services. The second service will provide redundancy, thereby eliminating the need for an onsite standby generator. An automatic transfer switch with two service entrance rated main circuit breakers will be required to accommodate the two utility feeds.
- Rerouting the existing gravity sewer from the existing pumping station to the new pumping station.
- New water service to provide water for cleaning/wash-down purposes.
- New force main to replace existing, with the section from the pumping station to Bridge Street constructed by Horizontal Directional Drilling (HDD) to minimize impacts to the wetlands and streams along the proposed alignment.
- Temporary pumping to allow construction of new gravity sewer to divert flow from the existing pumping station to the new pumping station.
- Decommissioning of existing pumping station, including removal of all structures to 2 ft below grade, backfilling the structures, and removal of existing site fence and asphalt driveway.

While Alternative 4 includes construction of a new pumping station at a new location, it is a functional replacement of the existing pumping station, therefore the MDE requirement to provide a 2-hour emergency storage does not apply and has not been included.

The proposed site layout for Alternative 4 is shown in Figure 13, and also included in Appendix B.

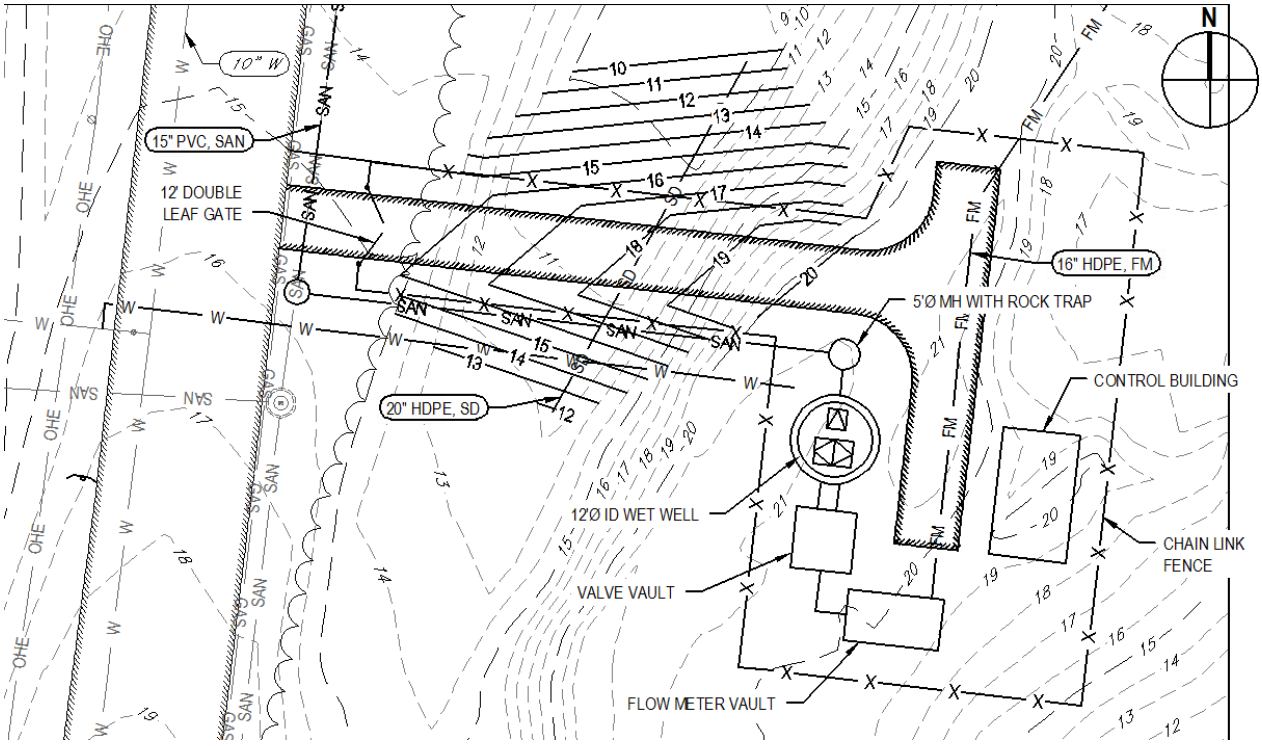


Figure 13 Alternative 4 – Site Layout

5. Permitting

A review of the anticipated permitting requirements for the project has been undertaken. A summary of the permitting requirements for this project are included in this section.

5.1 Maryland Department of the Environment (MDE)

5.1.1 Water and Sewerage Construction Permit

The Maryland Department of the Environment's (MDE) Water Management Administration regulates municipal water and sewerage systems to maintain the quality of the State's ground and surface waters. A Water and Sewerage Construction Permit is required before installing, extending, or modifying community water supply and/or sewerage systems including treatment plants, pumping stations, and major water mains and sanitary sewers. The proposed upgrade of the Windmill Pumping Station will require a Water and Sewerage Construction Permit application be submitted with proposed plans and specifications for review and approval.

5.1.2 Joint Federal/State Application for the Alteration of Any Floodplain, Waterway, Tidal or Nontidal Wetland

Waterway construction regulations assure that activities in a waterway or its floodplain do not create flooding on upstream or downstream property, maintain fish habitat and migration, and protect waterways from erosion. Authorization from the MDE is required for construction in a waterway or a

100-year floodplain. As discussed in Section 2.1, the existing site is located within both the 100-year floodplain and floodway. It will, therefore, be necessary to submit and obtain approval for a Joint Federal/State Application for the Alteration of Any Floodplain, Waterway, Tidal or Nontidal Wetland. Further review to determine whether this permit would be necessary for the demolition and utility work associated with Alternative 4 is required.

It is also noted that the site is within close proximity to wetlands. A wetland delineation should be completed during the design phase to determine whether any wetland buffers will be impacted by the project, and if necessary approval obtained within the Joint Federal/State Application for the Alteration of Any Floodplain, Waterway, Tidal or Nontidal Wetland.

5.1.3 Water Appropriation and Use Permit

Any activity that withdraws water from the State's surface and/or underground waters requires this permit, unless it qualifies under an exemption. It is anticipated that dewatering will be required to construct the new structures, particularly the expansion of the existing wet well. It is recommended that geotechnical investigations be completed during the design phase to assist with better quantifying the dewatering requirements, however based on the proximity to Windmill Branch, it is anticipated that a Water Appropriation and Use Permit will be required.

5.1.4 General Discharge Permit for Stormwater Discharges for Construction Activities

This permit, which is submitted directly to MDE, is necessary when more than one acre of site area is disturbed. The proposed site disturbance is anticipated to be less than one acre for all alternatives, excluding construction of the future force main. If the force main is constructed at the same time as the pumping station upgrade, then this permit is anticipated to be required.

5.2 Town of Easton

5.2.1 Stormwater Management

The Town of Easton has established a Stormwater Management Ordinance to establish minimum requirements and procedures that control the adverse impacts associated with increased stormwater runoff. Any developments that do not disturb over 5,000 square feet of land area are exempt from the requirements of the Ordinance. It is anticipated that the area of disturbance for Alternatives 1 to 3 can be kept below 5,000 square feet, therefore the stormwater management requirements of the Ordinance are not expected to be applicable to those alternatives. The area of disturbance will exceed 5,000 square feet for Alternative 4, therefore stormwater management will be necessary for Alternative 4.

5.2.2 Erosion and Sediment Control

The Maryland Standards and Specifications for Soil Erosion and Sediment Control sets requirements for erosion and sediment control within Maryland. Within the Town of Easton, erosion and sediment control plans are reviewed by the Talbot Soil Conservation District. If earth disturbance activity is less than 5,000 square feet and or less than 100 cubic yards, the activity is

exempt from erosion and sediment control review and approval. While it is anticipated that less than 5,000 square feet of land disturbance will be required for Alternatives 1 to 3, construction of the wet well extension and other new structures are expected to result in disturbance greater than 100 cubic yards. For Alternative 4, the area of disturbance will exceed 5,000 square feet. Therefore, erosion and sediment control plan review and approval may be necessary for all alternatives.

5.2.3 Critical Area

The pumping station is located within the Intensely Developed Area (IDA) of the Chesapeake Bay Critical Area. As the impervious surface proposed for the project will exceed 250 square feet, the requirements of the 10% rule apply. Therefore, it will be necessary for the project to implement stormwater management to reduce pollutant loadings by at least 10 percent below the level of pollution on the site prior to development or redevelopment as provided in the Critical Area 10% Rule Guidance Manual – Fall 2003.

5.2.4 Floodplain

Chapter 9A of the Town of Easton Code is the Floodplain Management Ordinance which monitors and controls development in areas prone to flooding. As discussed in Section 2.1, the existing site is located within both the 100-year floodplain and floodway. Approval of the Town of Easton Floodplain Administrator will therefore be necessary for Alternatives 1 to 3. As the proposed work for Alternatives 1 to 3 will encroach into a designated floodway, an evaluation of alternatives to such encroachment, including different uses of the site or the portion of the site within the floodway, and minimization of such encroachment will be need to be submitted. The Floodplain Management Ordinance allows for development in a designated floodway only under the following conditions:

1. The applicant has been issued a permit by MDE; and
2. The applicant has developed hydrologic and hydraulic engineering analyses and technical data prepared by a licensed professional engineer reflecting such changes, and the analyses, which shall be submitted to the Floodplain Administrator, demonstrate that the proposed activity will not result in any increase in the base flood elevation; or
3. If the analyses demonstrate that the proposed activities will result in an increase in the base flood elevation, the applicant has obtained a Conditional Letter of Map Revision or Letter of Map Revision from FEMA. Submittal requirements and fees shall be the responsibility of the applicant.

It will therefore be necessary for a flood study to be prepared to determine any impact on the base flood elevation resulting from the proposed work. Consideration of ways to mitigate any impact on the base flood elevation will be necessary. It is also recommended that the flood study be used to set the design flood elevation for the new structures, given the discrepancies with the observed flood elevation and that shown on the FEMA maps, as identified in Section 2.1.

The construction of the new pumping station for Alternative 4 will be outside of the 100-year floodplain, therefore the need for a flood study is not anticipated. However, consultation with the Floodplain Administrator would be required to determine if any approvals are necessary for the demolition and utility work.

5.2.5 Grading Permit

A grading permit is required for Alternative 4 and may be required for Alternatives 1 to 3. For projects that do not disturb over 5,000 square feet of land area, as is anticipated for Alternatives 1 to 3, the requirements for a grading permit may be waived by the Town Engineer on a case-by-case basis.

5.2.6 Building Permit

A commercial building permit application will need to be submitted to the Town of Easton Building Inspection Division, and a building permit issued to allow for construction of the proposed work. In addition, trades permits will be required to be obtained by the Contractor, including the following:

- Plumbing Permit
- Electrical Permit
- Mechanical (HVAC) Permit

6. Opinion of Probable Construction Cost

The opinion of probable construction cost (OPCC) for each alternative is summarized in Table 3.7, with a detailed breakdown included in Appendix C. Key assumptions are summarized below:

- Equipment installation cost was estimated to be 30% of the equipment cost.
- Contractor general conditions were assumed to be 12% of the total construction cost.
- General contractor overhead and profit was assumed to be 10%.
- It is assumed that temporary pumps will be required on site for approximately 5 months for Alternative 1, 1 month for Alternative 2 and 6 months for Alternative 3, and that remote monitoring of the temporary pumping system by the Contractor will be sufficient. It is assumed that 24 hour on-site monitoring is not required. Temporary pumping cost for Alternative 4 is associated with the utility relocation, and was provided by Easton Utilities.
- It is assumed that replacement of the existing grinder is not required for Alternatives 1 to 3. New Channel Monster hydraulic grinder is included for Alternative 4.
- Alternatives 1 to 3 assume that a new crane is not required, and that an Easton Utilities crane truck will be utilized for pump removal. A new jib crane with electric hoist is included for Alternative 4.
- Alternative 2 assumes no modifications will be made to the existing building.
- Cost to decommission existing pumping station assumed to be $75,000. Further research during the design phase to refine the decommissioning cost is required, including consultation with MDE.
- Mobilization was assumed to be 3% of the subtotal of all non-general costs.
- A 30% design contingency was assumed based on the current status of the design.

- Cost of new electrical service and relocating existing service is not included for Alternatives 1 to 3, including cost for providing a second utility feeder to the pumping station. Costs associated with the electrical service will be estimated by Easton Utilities. For Alternative 4, the cost of the two new electrical services, as provided by Easton Utilities, are included in the cost.
- Cost for relocation of the gravity sewer and new water service required for Alternative 4 was calculated using unit rates provided by Easton Utilities.
- The opinion of probable construction cost for the force main replacement is as provided by Easton Utilities, and is assumed to be the same for all alternatives.
- Engineering, Administration, and Inspection costs are not included.

Table 3.7 Opinion of Probable Construction Cost

	Alternative 1 (Submersible)	Alternative 2 (Submersible)	Alternative 3 (Suction Lift)	Alternative 4 (Relocation)
General	$133,000	$122,000	$160,000	$195,000
Demolition	$40,000	$26,000	$40,000	$75,000
Civil/Site	$96,000	$102,000	$72,000	$232,000
Utility Relocations (excl. Force Main)	N/A	N/A	N/A	$172,000
Temporary Pumping	$99,000	$26,000	$118,000	$33,000
Architectural	$77,000	$66,000	$154,000	$66,000
Structural	$95,000	$109,000	$59,000	$134,000
Equipment	$122,000	$122,000	$143,000	$298,000
Piping and Valves	$114,000	$114,000	$149,000	$134,000
HVAC	$10,000	$10,000	$10,000	$10,000
Electrical, Controls and Instrumentation	$246,000	$246,000	$323,000	$246,000
Subtotal	***$1,032,000***	***$943,000***	***$1,228,000***	***$1,586,000***
Contingency (30%)	$310,000	$283,000	$368,000	$476,000
Total Construction Cost excl. Force Main (Feb 2018 USD)	**$1,342,000**	**$1,226,000**	**$1,596,000**	**$2,062,000**
Force Main Replacement	$1,920,000	$1,920,000	$1,920,000	$1,920,000
Total Construction Cost incl. Force Main (Feb 2018 USD)	**$3,262,000**	**$3,146,000**	**$3,516,000**	**$3,982,000**

7. Non-Capital Cost Factors Evaluation of Alternatives

7.1 Methodology

A non-capital cost evaluation of the 4 alternatives is presented in this section to allow for a more comprehensive comparison of the options. While capital costs are important considerations, non-capital cost considerations should also be evaluated since the four alternatives have different short-term and long-term considerations that are not necessarily reflected in the capital costs. Preliminarily, 13 non-capital cost criteria are suggested for consideration in this non-capital cost evaluation, as described below. Preliminary weights for each criteria are offered in Table 7-1 by GHD along with initial scores. The scoring system is simplified as either 1, 2, or 3. A score of "1" is considered the best score whereby the alternative has the least impact to the criteria compared to the other alternatives. A score of "3" is considered the worst score whereby the alternative has the highest impact to the criteria compared to the other alternatives. A score of "2" is considered an intermediate impact. As a result, the alternative with the lowest "total score" would be considered most advantageous to Easton Utilities with respect to non-capital cost considerations.

The suggested non-capital cost criteria are briefly defined below:

- Permitting Requirements: This represents the relative quantity, complexity, and/or approval durations of permits that would apply to the noted alternative.
- Public Impacts (during construction): This represents the magnitude of impacts of the project during construction to the public and surrounding businesses.
- Public Impacts (post construction): This represents the magnitude of impacts of the project after construction of the project to the public and surrounding businesses.
- Easement/Property Acquisition: This represents the relative quantity of easement or property acquisitions needed and/or the challenges anticipated in those processes.
- Operation and Maintenance Cost: This represents the cost associated with operation and maintenance of the pumping station, including energy usage and equipment maintenance.
- Reliability: This represents how reliable the system is to Easton Utilities to perform its intended function over its lifetime.
- Accessibility: This represents the ease of safe access by Easton Utilities to the system proposed.
- Construction Risk: This represents the magnitude of risk that could be encountered during construction which could result in additional costs or delays.
- Schedule: This represents the overall anticipated project schedule from design through construction, inclusive of permits, property/easement acquisition.
- Floodplain Impacts: This represents the impact to the floodplain caused by the alternative during or after construction.

- Environmental Impacts: This represents the amount of environmental impacts caused by the alternative during or after construction.
- Ease of Expansion: This represents the relative ease of the system accommodating additional flows beyond the current design.
- Site Disturbance: This represents the relative amount of disturbance during construction for the noted alternative.

7.2 Comparison of Alternatives

Table 7-1 Non-capital cost Alternative Evaluation Matrix (Lowest % = Lowest Non-capital cost Impact)

Criteria	Weight (%)	Alternative 1 – Submersible		Alternative 2 - Submersible		Alternative 3 – Suction Lift		Alternative 4 - Relocation	
		Rating	Score	Rating	Score	Rating	Score	Rating	Score
Permitting Requirements	5	2	10	2	10	3	15	1	5
Public Impacts (during construction)	10	1	10	1	10	1	10	2	20
Public Impacts (post construction)	10	2	20	2	20	2	20	1	10
Easement/ Property Acquisition	10	1	10	1	10	1	10	1	10
Operation and Maintenance Cost	10	2	20	2	20	3	30	1	10
Reliability	10	2	20	2	20	2	20	1	10
Accessibility	10	2	20	2	20	2	20	1	10
Construction Risk	5	2	10	2	10	2	10	1	5
Schedule	5	2	10	2	10	2	10	1	5
Floodplain Impacts	10	2	20	2	20	3	30	1	10
Environmental Impacts	5	1	5	1	5	1	5	3	15
Ease of Expansion	5	2	10	2	10	2	10	1	5
Site Disturbance	5	1	5	2	10	1	5	3	15
Total	**100**	**170**		**175**		**195**		**130**	
Percentage of Max Score		**57%**		**58%**		**65%**		**43%**	

8. Summary and Recommendations

Four alternatives for the upgrade of the Windmill Pumping Station were developed as follows:

- Alternative 1 – Submersible pumps with electrical equipment within existing building footprint.
- Alternative 2 – Submersible pumps with electrical equipment located in new building.
- Alternative 3 – Suction lift pumps with pumps and electrical equipment located in enlarged building.
- Alternative 4 - Relocation of the pumping station to a new site.

All four alternatives are technically feasible and a summary of the key advantages and disadvantages of each is included in Table 8-1.

Table 8-1 Summary of Advantages and Disadvantages

Alternative	Advantages	Disadvantages
1	• Lower construction cost compared to Alternatives 3 and 4 • Reduced site footprint compared to Alternatives 2 and 4 • Higher pump efficiency compared to Alternative 3 • Reduced operating costs compared to Alternative 3	• Pump maintenance requires the pumps to be removed from the wet well • Valve and flow meter access requires confined space entry to below ground vault • Temporary pumping required throughout duration of construction. • Located within 100-year floodplain and floodway
2	• Lower construction cost compared to Alternatives 1, 3 and 4 • Higher pump efficiency compared to Alternative 3 • Reduced operating costs compared to Alternative 3 • Need for temporary pumping during construction is reduced compared to Alternatives 1 and 3	• Pump maintenance requires the pumps to be removed from the wet well • Valve and flow meter access requires confined space entry to below ground vault • Larger site footprint compared to Alternatives 1 and 3 • Located within 100-year floodplain and floodway
3	• Reduced site footprint compared to Alternatives 1 and 2 • Access for pump maintenance improved as pumps are located in above ground building • Valves, and flow meter all located inside above ground building	• Higher construction cost compared to Alternatives 1 and 2 • Highest non-capital cost impact score • Lower pump efficiency compared to Alternatives 1, 2 and 3 • Four pumps necessary, with two sets of two pumps in series • Total motor horsepower is 50% higher than Alternatives 1, 2 and 3 • Higher operating costs compared to Alternatives 1, 2 and 3 • Temporary pumping required throughout duration of construction • Located within 100-year floodplain and floodway
4	• Lowest non-capital cost impact score • Pump station located outside of 100-year floodplain and floodway, therefore flood risk reduced • All new equipment, therefore reduction in operating and maintenance requirements • Construction of pumping station can be completed while the existing pumping station remains operational	• Highest construction cost • Pump maintenance requires the pumps to be removed from the wet well • Valve and flow meter access requires confined space entry to below ground vault • Larger disturbed area compared to other alternatives • Relocation of utilities to the new pumping station is required

Alternative 3 with suction lift pumps provides a robust pumping station with the pumps, valves, and flow meter located above grade and therefore provides maintenance and operation accessibility advantages over Alternatives 1 and 2 with submersible pumps. Alternative 3 however has higher

construction costs and a higher non-capital cost impact scope when compared to Alternatives 1 and 2. Excluding the proposed force main replacement, the Opinion of Probable Construction Cost for Alternatives 1 and 2 is $1.3 million and $1.2 million respectively, compared to $1.6 million for Alternative 3.

Alternative 4 involves constructing a new pumping station at a new site that is outside of the 100-year floodplain and floodway, and therefore offers significant advantages associated with improving flood protection. Alternative 4 also has the lowest non-cost impacts score, however has the highest Opinion of Probable Construction Cost at $2.1 million excluding the proposed force main replacement. It should also be noted that the Opinion of Probable Construction Cost for Alternative 4 includes some items that were not included for Alternatives 1, 2 and 3, including a new Channel Monster hydraulic grinder and jib crane for pump and grinder removal.

Final selection of the preferred alternative will be made following consultation with Easton Utilities.

Appendices

Appendix A
Manufacturer Pump Curves

Pump Data Sheet - Yeomans Pump, Aurora, IL

Company: STH Inc
Name: Jason Poole
Date: 6/8/2017

Customer: Easton Utilities
Project: Windmill PS
Location: Easton, MD

Pump:

Model: 6153

Type: 9100
Synch speed: 1800 rpm

Speed: 1750 rpm
Dia: 14.5 in

Curve ID No.: 3603

Impeller ID No.: Y-4739

Specific Speeds:

Ns: ---
Nss: ---

Dimensions:

Suction: ---
Discharge: 6 in

Pump Limits:

Temperature: 104 °F
Pressure: 150 psi g
Sphere size: 3 in

Power: ---
Eye area: ---

Search Criteria:

Flow: 1750 US gpm

Head: 150 ft

Fluid:

Water
Density: 62.32 lb/ft³
Viscosity: 0.9946 cP

Temperature: 68 °F
Vapor pressure: 0.3391 psi a
Atm pressure: 14.7 psi a

NPSHa: ---

Motor:

Standard: YCC
Enclosure: TENV

Size: 100 hp
Speed: 1800
Frame: 360

Sizing criteria: Max Power on Design Curve

---- Data Point ----	
Flow:	1750 US gpm
Head:	151 ft
Eff:	75%
Power:	89 hp
NPSHr:	---

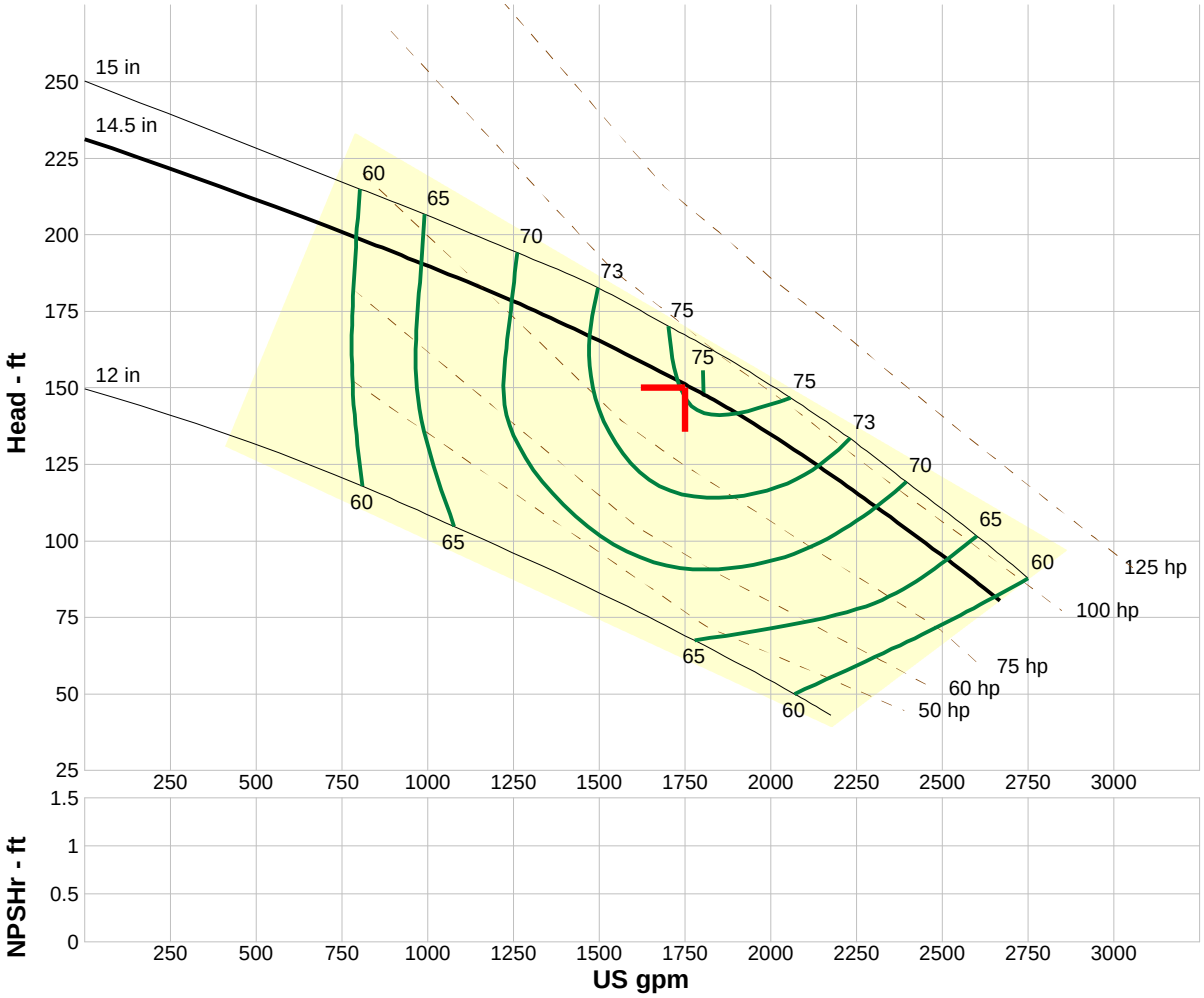
---- Design Curve ----	
Shutoff head:	231 ft
Shutoff dP:	100 psi
Min flow:	---

BEP: 75% @ 1803 US gpm

NOL power:
92.5 hp @ 2306 US gpm

-- Max Curve --

Max power:
103 hp @ 2395 US gpm



Default motor size is based upon max. power on the design curve plus a margin factor to allow for impeller trim variances that may occur to meet H.I. TDH requirements. Efficiencies and data are typical. Please contact the factory for guaranteed values. FOR TEMP. ABOVE 104 DEG. F (40 DEG C) REFER TO FACTORY FOR ASSISTANCE.

Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
2100	1750	127	73.3	91.9	---
1750	1750	151	75	89	---
1400	1750	171	72.1	83.4	---
1050	1750	187	66.3	74.6	---
700	1750	203	57.6	63.2	---

c

Self Priming Centrifugal Pump

Model T8A60S-B

Size 8” x 8”

Super T SERIES

VARIOUS PATENTS APPLY

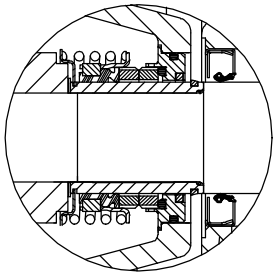
FIVE YEAR WARRANTY SUPER T SERIES

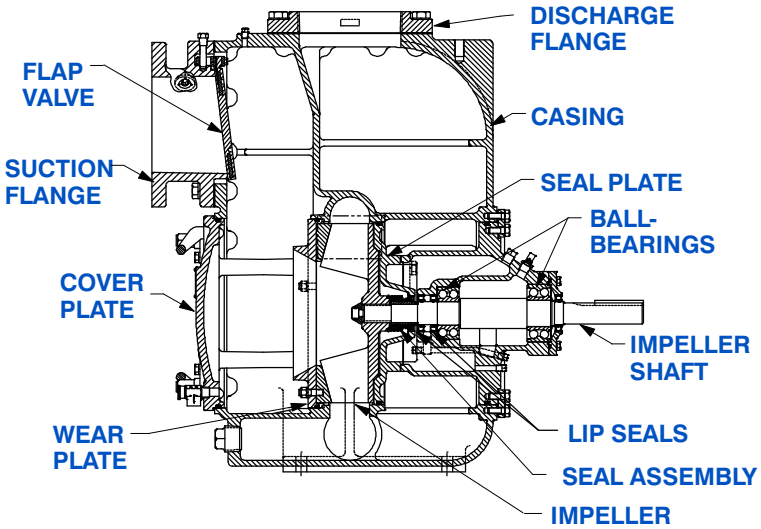
PUMP SPECIFICATIONS

Size: 8” (203 mm) ASA Flanged Suction x 8” (203 mm) NPT Female Discharge.
Casing: Gray Iron 30.
Maximum Operating Pressure 83 psi (572 kPa).*
Semi-Open Type, Two Vane Impeller: Ductile Iron 65-45-12.
Handles 3” (76,2 mm) Diameter Spherical Solids.
Impeller Shaft: Alloy Steel 4150.
Shaft Sleeve: Alloy Steel 4130.
Replaceable Wear Plate: Gray Iron 30.
Removable Adjustable Cover Plate: Gray Iron 30; 94 lbs. (43 kg).
Flap Valve: Neoprene w/Nylon and Steel Reinforcing.
Seal Plate: Gray Iron 30.
Bearing Housing: Gray Iron 30.
Radial and Thrust Bearings: Open Double Row Ball.
Bearing and Seal Cavity Lubrication: SAE 30 Non-Detergent Oil.
Flanges: Gray Iron 30.
Gaskets: Buna-N, Compressed Synthetic Fibers, PTFE, Cork, and Rubber.
O-Rings: Buna-N.
Hardware: Standard Plated Steel.
Brass Pressure Relief Valve.
Bearing and Seal Cavity Oil Level Sight Gauges.
Optional Equipment: Metal Bellows Seal. Automatic Air Release Valve. 120V/240V Casing Heater. High Pump Temperature Shutdown Kit. Self-Cleaning Wear Plate. Gray Iron 30 Spool Flanges:
8” ASA Discharge **(Specify Model T8A60S-B /F)**.
200 mm DIN 2527 (PN 16) Suction and Discharge **(Specify Model T8A60S-B /FM)**.

**Consult Factory for Applications Exceeding Maximum Pressure and/or Temperature Indicated.*

Shown with Optional Discharge Spool Flange (Available in ASA or DIN Standard Sizes).





SEAL SPECIFICATIONS

Cartridge Type, Mechanical, Oil-Lubricated, Double Floating, Self-Aligning. Silicon Carbide Rotating and Stationary Faces. Stainless Steel 316 Stationary Seat. Fluorocarbon Elastomers (DuPont Viton® or Equivalent). Stainless Steel 18-8 Cage and Spring. Maximum Temperature of Liquid Pumped, 160°F (71°C).*

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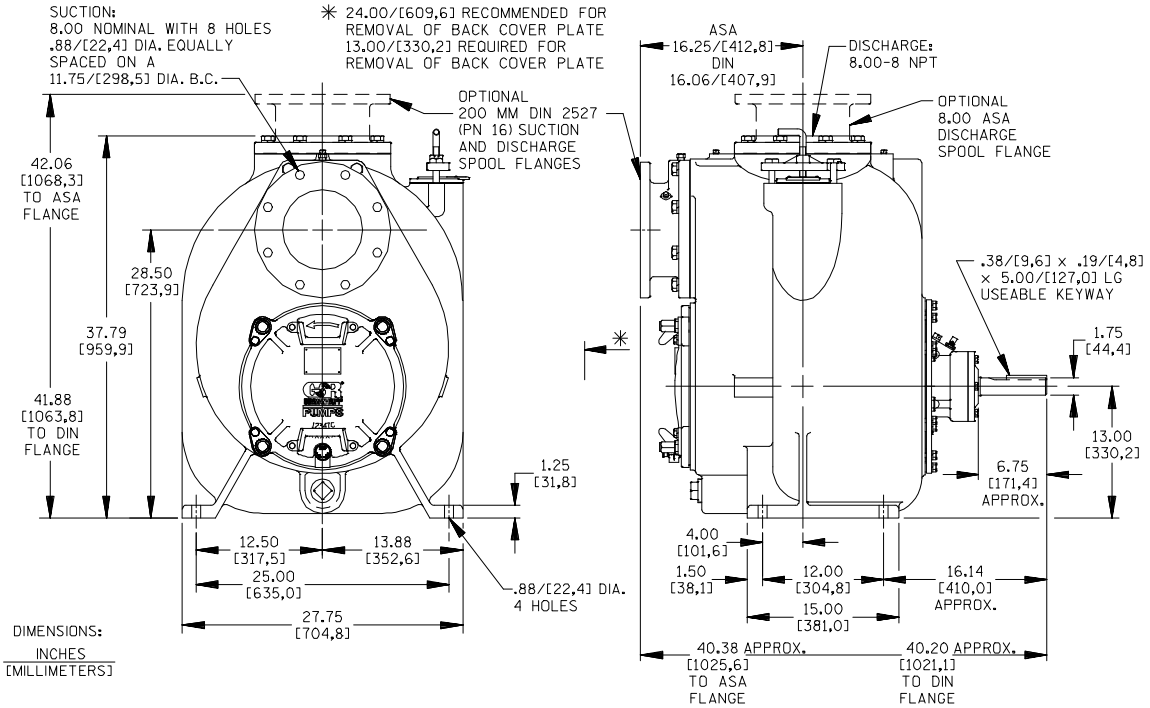
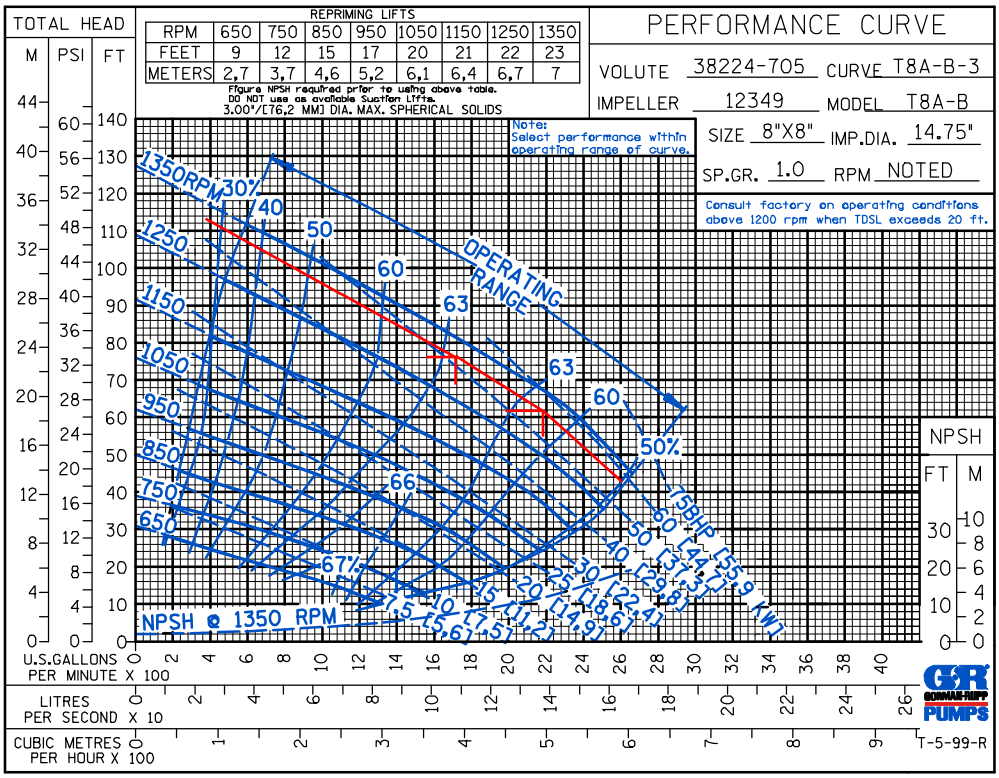
Specification Data	APPROXIMATE DIMENSIONS and WEIGHTS	NET WEIGHT: 1295 LBS. (587 KG.)*
SECTION 55, PAGE 2310		SHIPPING WEIGHT: 1399 LBS. (635 KG.)*
		EXPORT CRATE: 47.9 CU. FT. (1,36 CU. M.)
		*ADD 35 LBS. (15,9 KG.) W/EACH SPOOL FLANGE



OPTIONAL ASA OR DIN STANDARD SPOOL FLANGES AVAILABLE



THE GORMAN-RUPP COMPANY ● MANSFIELD, OHIO

GORMAN-RUPP OF CANADA LIMITED ● ST. THOMAS, ONTARIO, CANADA

Specifications Subject to Change Without Notice

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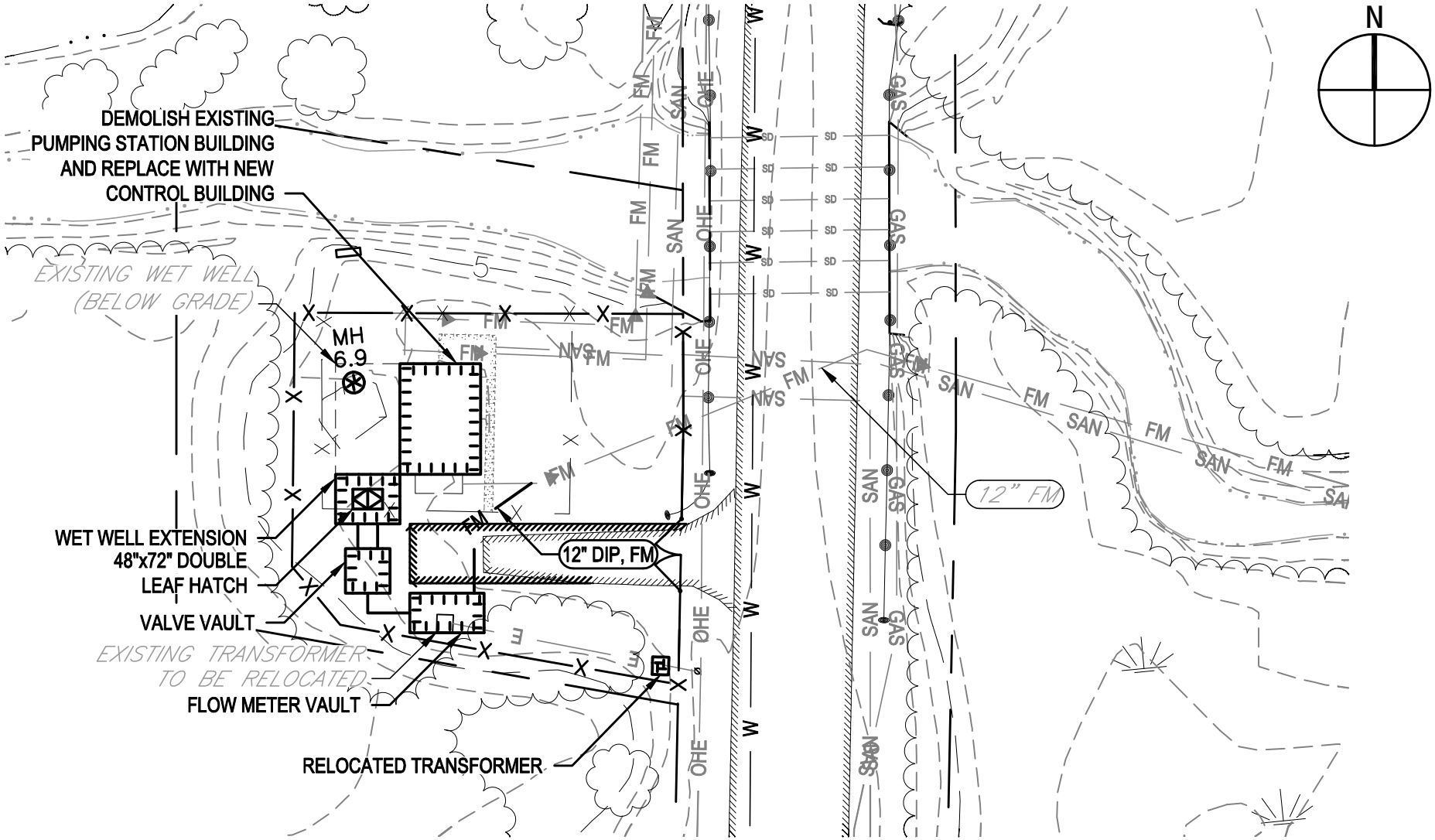
Appendix B
Figures



SITE PLAN

SCALE: 1" = 30'-0"

0 15 30 45 60'

SCALE 1"=30' AT ORIGINAL SIZE

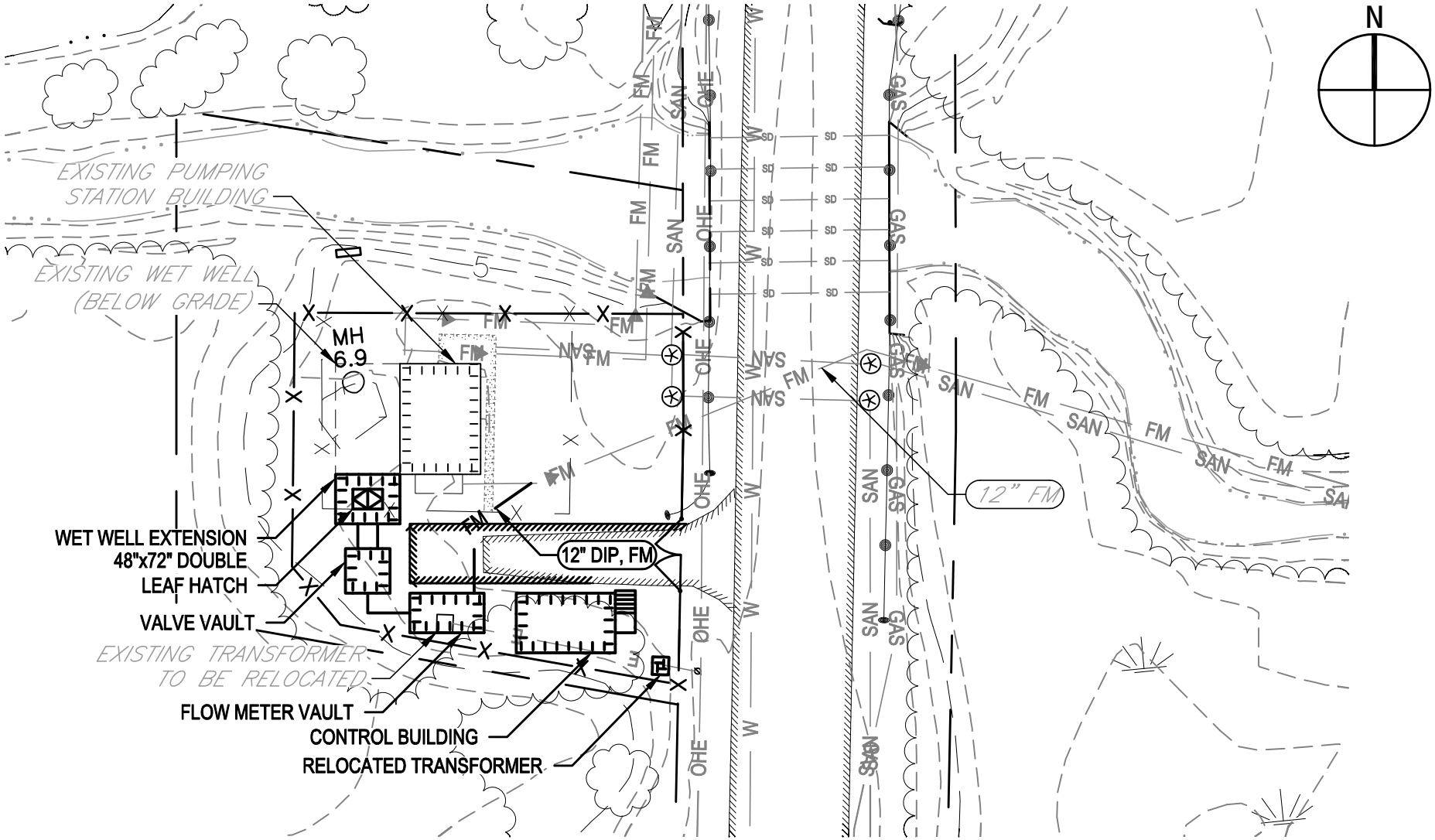
EASTON UTILITIES, MARYLAND
WINDMILL PUMPING STATION UPGRADE

ALTERNATIVE 1

Job Number	111-37073
Revision	A
Date	8/2017

Figure 01

16701 Melford Boulevard, Suite 330, Bowie MD 20715 USA T 1 301 805 5629 F 1 301 805 4665 E bowmail@ghd.com W www.ghd.com



SITE PLAN

SCALE: 1" = 30'-0"

0 15 30 45 60'

SCALE 1"=30' AT ORIGINAL SIZE

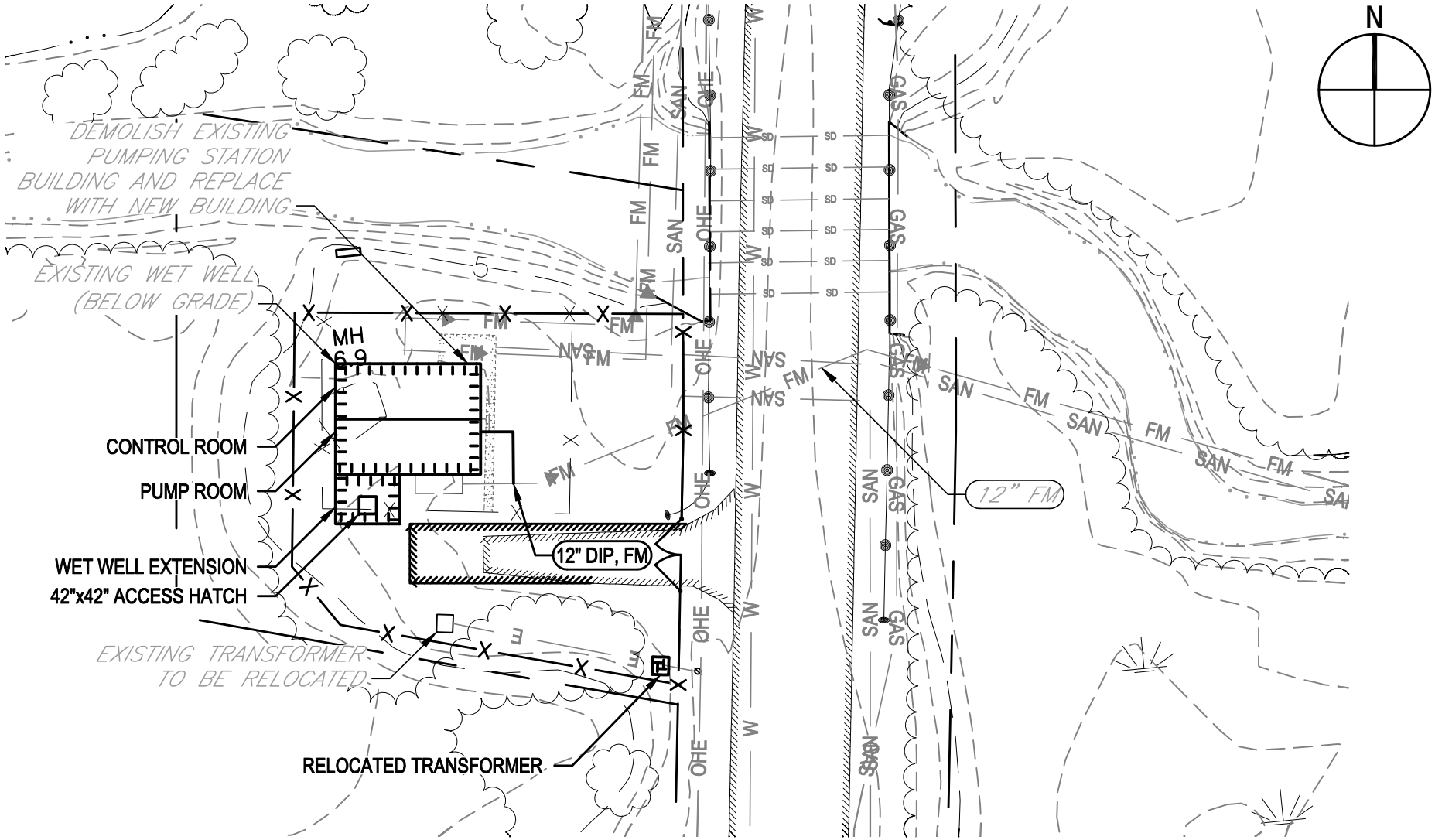
EASTON UTILITIES, MARYLAND
WINDMILL PUMPING STATION UPGRADE

ALTERNATIVE 2

Job Number	111-37073
Revision	A
Date	8/2017

Figure 02

16701 Melford Boulevard, Suite 330, Bowie MD 20715 USA T 1 301 805 5629 F 1 301 805 4665 E bowmail@ghd.com W www.ghd.com



SITE PLAN

SCALE: 1" = 30'-0"

0 15 30 45 60'

SCALE 1"=30' AT ORIGINAL SIZE

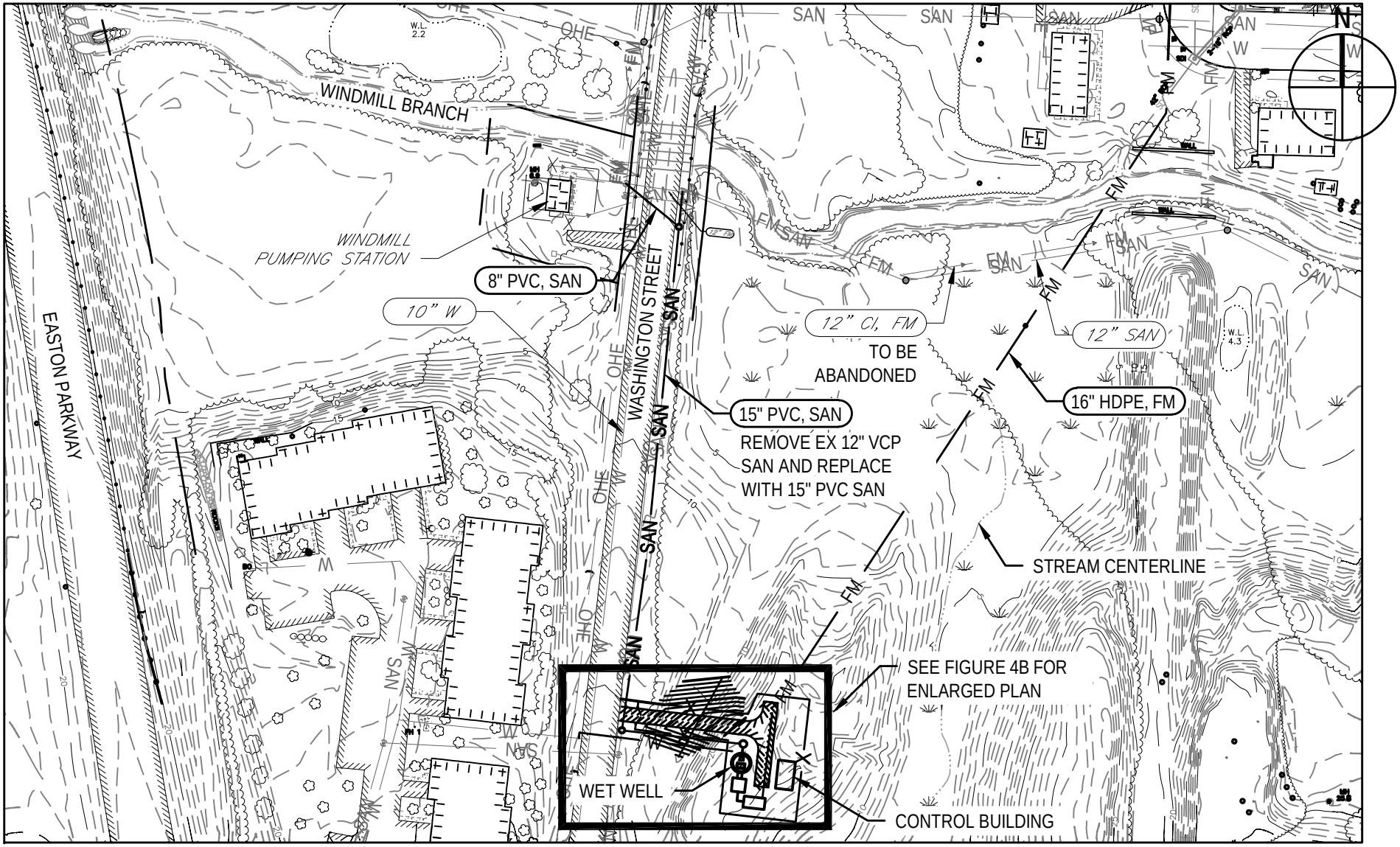
EASTON UTILITIES, MARYLAND
WINDMILL PUMPING STATION UPGRADE

ALTERNATIVE 3

Job Number	111-37073
Revision	A
Date	8/2017

Figure 03

16701 Melford Boulevard, Suite 330, Bowie MD 20715 USA T 1 301 805 5629 F 1 301 805 4665 E bowmail@ghd.com W www.ghd.com



OVERALL SITE PLAN

SCALE: 1" = 100'-0"

0 50 100 150 200'

SCALE 1"=100' AT ORIGINAL SIZE

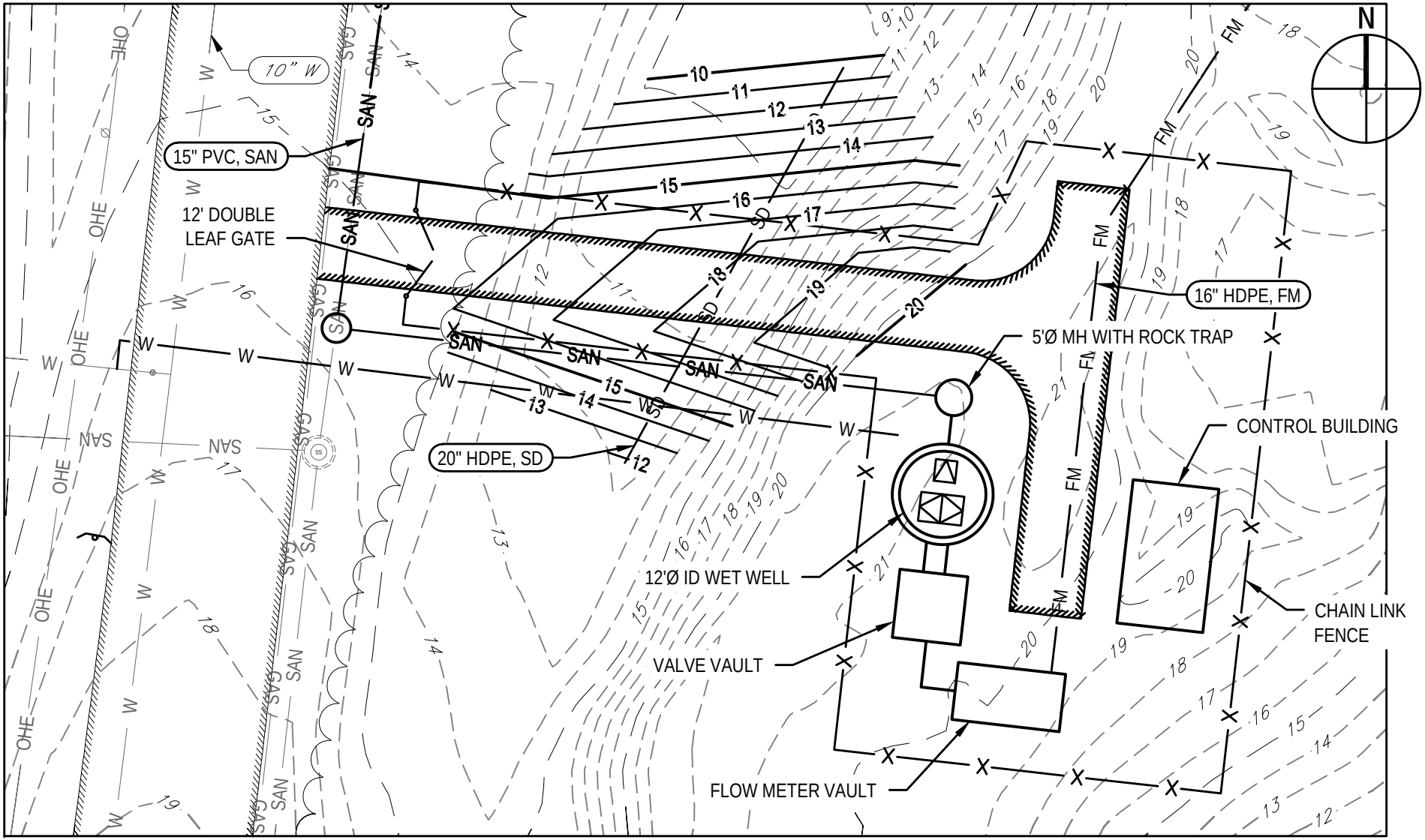
EASTON UTILITIES, MARYLAND
WINDMILL PUMPING STATION UPGRADE

ALTERNATIVE 4

Job Number	111-37073
Revision	A
Date	02/2018

Figure 4A

16701 Melford Boulevard, Suite 330, Bowie MD 20715 USA T 1 301 805 5629 F 1 301 805 4665 E bowmail@ghd.com W www.ghd.com



SITE PLAN

SCALE: 1" = 20'-0"

0 10 20 30 40'

SCALE 1"=20' AT ORIGINAL SIZE

EASTON UTILITIES, MARYLAND
WINDMILL PUMPING STATION UPGRADE

ALTERNATIVE 4

Job Number	111-37073
Revision	A
Date	02/2018

Figure 4B

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Appendix C
Opinion of Probable Construction Cost

Easton Utilities
Windmill SPS Upgrade PER
Preliminary Opinion of Probable Construction Costs
Alternative 1

Updated By: SMC
Date: 7/25/2017
Checked By: RJG
Date: 8/2/2017

Item	Qty	Unit	Unit Cost	Total Cost
General				
General Requirements	1	LS	$110,562.60	$ 110,562.60
Mobilization/Demobilization	1	LS	$22,882.40	$ 22,882.40
Demolition				
Demo Existing Building	2,992	CF	0.374	$ 1,119.01
Demo Existing Electrical Equipment	1	LS	$6,600	$ 6,600.00
Demo Pumps, Piping and Valves	1	LS	$3,960	$ 3,960.00
Demo Stairs and Guardrail	1	LS	$3,960	$ 3,960.00
Demo Existing Concrete Fill	1	LS	$3,960	$ 3,960.00
Demo Existing Fence	1	LS	$3,960	$ 3,960.00
Saw Cut Opening in Existing Wet Well	26	LF	$110	$ 2,860.00
Demo Opening in Existing Wet Well	2	CY	$110	$ 220.00
Crane Rental	5	DAY	$330	$ 1,650.00
Concrete/Masonry/Roof Disposal	1	LS	$11,000	$ 11,000.00
Paving Demolition	44	SY	$11	$ 484.00
Civil/Site				
Excavation and Backfill:				
Structure Excavation	530	CY	$ 44.00	$ 23,336.30
Trench Excavation	27	CY	$ 44.00	$ 1,173.33
Stone Bedding	43	CY	$ 33.00	$ 1,412.89
Pipe Bedding	11	CY	$ 44.00	$ 488.89
Hauling	557	CY	$ 11.00	$ 6,127.41
Backfill - Off Site Material	490	CY	$ 33.00	$ 16,178.56
Sheeting	1,431	SF	$ 22.00	$ 31,482.00
Site Fence	290	LF	$ 32.12	$ 9,314.80
16-ft double leaf swing gate	1	EA	$ 1,352.96	$ 1,352.96
Paving				
Aggregate Base Coarse - 3/4" Stone (12" Thick)	76	SY	$ 31.63	$ 2,403.97
Binder Course	76	SY	$ 24.14	$ 1,834.80
Wearing Course	76	SY	$ 11.14	$ 846.83
Bypass Pumping:				
Pump Rental	5	MONTH	$8,778	$ 43,890.00
Delivery	1	LS	$990	$ 990.00
Removal	1	LS	$990	$ 990.00
Installation	1	LS	$5,500	$ 5,500.00
Operation & Maintenance	5	MONTH	$2,633	$ 13,167.00
Diesel Fuel	150	DAY	$231	$ 34,650.00
Architectural				
Control Building	280	SF	$ 275.00	$ 77,000.00
Structural				
Concrete:				
Base Slab on Grade	11	CY	$ 440.00	$ 4,840.00
Vertical Walls	41	CY	$ 770.00	$ 31,570.00
Elevated Top Slab	5	CY	$ 990.00	$ 4,950.00
Concrete Fill	19	CY	$ 275.00	$ 5,225.00
Precast Vaults:				
Valve Vault	450	SF	$ 25.74	$ 11,583.00

Easton Utilities
Windmill SPS Upgrade PER
Preliminary Opinion of Probable Construction Costs
Alternative 1

Updated By: SMC
Date: 7/25/2017
Checked By: RJG
Date: 8/2/2017

Item	Qty	Unit	Unit Cost	Total Cost
Flowmeter Vault	608	SF	$ 25.74	$ 15,649.92
Metals:				
Access Hatches:				
38" x 30" Floodtight Hatch	1	EA	$ 3,453.45	$ 3,453.45
60" x 48" Floodtight Hatch	1	EA	$ 7,558.98	$ 7,558.98
72" x 48" Standard Hatch	1	EA	$ 4,790.50	$ 4,790.50
Aluminum Grabrail	2	EA	$ 1,650.00	$ 3,300.00
Aluminum Ladder	16	LF	$ 110.00	$ 1,760.00
Mechanical/Process				
Equipment:				
Submersible Pumps incl. guiderails	2	EA	$60,775.00	$ 121,550.00
Piping and Valves:				
6" x 8" DIP Increaser	2	EA	$688.05	$ 1,376.10
8" DIP	44	LF	$100.65	$ 4,428.60
8" DIP 90 deg bend	2	EA	$938.85	$ 1,877.70
8" Check Valve	2	EA	$2,516.80	$ 5,033.60
8" Plug Valve	3	EA	$2,988.70	$ 8,966.10
8" Dismantling Joint	2	EA	$1,457.17	$ 2,914.34
8" Wall Pipe	2	EA	$1,100.00	$ 2,200.00
8" x 12" DIP Increaser	2	EA	$1,188.00	$ 2,376.00
12" DIP 90 deg bend	4	EA	$1,800.15	$ 7,200.60
12" DIP Tee	4	EA	$3,339.60	$ 13,358.40
12" DI Pipe	35	LF	$165.00	$ 5,775.00
12" Plug Valve	3	EA	$7,025.70	$ 21,077.10
12" Dismantling Joint	1	EA	$2,551.12	$ 2,551.12
8" Quick Connect w/ Dust Cap	1	EA	$1,650.00	$ 1,650.00
Pipe Supoorts	1	LS	$8,886.31	$ 8,886.31
Link Seals	5	EA	$275.00	$ 1,375.00
12" Gooseneck Vent	1	EA	$5,500.00	$ 5,500.00
12" DI Pipe - MJ	40	LF	$110.00	$ 4,400.00
12" DI 90 deg bend - MJ	1	EA	$1,200.10	$ 1,200.10
12" DI 45 deg bend - MJ	1	EA	$1,032.90	$ 1,032.90
Connection of Existing 12" FM	1	LS	$11,000.00	$ 11,000.00
HVAC				
HVAC Allowance	1	LS	$ 10,000.00	$ 10,000.00
Electrical/Instrumentation				
Electrical, Instrumentation and Control Allowance	1	LS	$246,150.00	$ 246,150.00
			Subtotal (rounded to nearest $1,000):	$ 1,032,000.00
			30% Contingency (rounded to nearest $1,000):	$ 310,000.00
			Total (rounded to nearest $1,000):	$ 1,342,000.00

Easton Utilities
Windmill SPS Upgrade PER
Preliminary Opinion of Probable Construction Costs
Alternative 2

Updated By: SMC
Date: 7/25/2017
Checked By: RJG
Date: 8/2/2017

Item	Qty	Unit	Unit Cost	Total Cost
General				
General Requirements	1	LS	$101,036.55	$ 101,036.55
Mobilization/Demobilization	1	LS	$20,795.62	$ 20,795.62
Demolition				
Demo Existing Electrical Equipment	1	LS	$6,600	$ 6,600.00
Demo Pumps, Piping and Valves	1	LS	$3,960	$ 3,960.00
Demo Existing Concrete Fill	1	LS	$3,960	$ 3,960.00
Demo Existing Fence	1	LS	$3,960	$ 3,960.00
Saw Cut Opening in Existing Wet Well	26	LF	$110	$ 2,860.00
Demo Opening in Existing Wet Well	2	CY	$110	$ 220.00
Crane Rental	5	DAY	$330	$ 1,650.00
Concrete Disposal	1	LS	$2,750	$ 2,750.00
Paving Demolition	44	SY	$11	$ 484.00
Civil/Site				
Excavation and Backfill:				
Structure Excavation	565	CY	$ 44.00	$ 24,842.07
Trench Excavation	27	CY	$ 44.00	$ 1,173.33
Stone Bedding	54	CY	$ 33.00	$ 1,789.33
Pipe Bedding	11	CY	$ 44.00	$ 488.89
Hauling	591	CY	$ 11.00	$ 6,503.85
Backfill - Off Site Material	591	CY	$ 33.00	$ 19,511.56
Sheeting	1,431	SF	$ 22.00	$ 31,482.00
Site Fence	290	LF	$ 32.12	$ 9,314.80
16-ft double leaf swing gate	1	EA	$ 1,352.96	$ 1,352.96
Paving				
Aggregate Base Coarse - 3/4" Stone (12" Thick)	76	SY	$ 31.63	$ 2,403.97
Binder Course	76	SY	$ 24.14	$ 1,834.80
Wearing Course	76	SY	$ 11.14	$ 846.83
Bypass Pumping:				
Pump Rental	1	MONTH	$8,778	$ 8,778.00
Delivery	1	LS	$990	$ 990.00
Removal	1	LS	$990	$ 990.00
Installation	1	LS	$5,500	$ 5,500.00
Operation & Maintenance	1	MONTH	$2,633	$ 2,633.40
Diesel Fuel	30	DAY	$231	$ 6,930.00
Architectural				
Control Building	240	SF	$ 275.00	$ 66,000.00
Structural				
Concrete:				
24" Dia. Columns	120	LF	$ 55.00	$ 6,600.00
Vertical Walls	41	CY	$ 770.00	$ 31,570.00
Elevated Top Slab	14	CY	$ 990.00	$ 13,860.00
Concrete Fill	19	CY	$ 275.00	$ 5,225.00
Precast Vaults:				
Valve Vault	450	SF	$ 25.74	$ 11,583.00
Flowmeter Vault	608	SF	$ 25.74	$ 15,649.92
Metals:				

Easton Utilities
Windmill SPS Upgrade PER
Preliminary Opinion of Probable Construction Costs
Alternative 2

Updated By: SMC
Date: 7/25/2017
Checked By: RJG
Date: 8/2/2017

Item	Qty	Unit	Unit Cost	Total Cost
Access Hatches:				
38" x 30" Floodtight Hatch	1	EA	$ 3,453.45	$ 3,453.45
60" x 48" Floodtight Hatch	1	EA	$ 7,558.98	$ 7,558.98
72" x 48" Standard Hatch	1	EA	$ 4,790.50	$ 4,790.50
Aluminum Grabrail	2	EA	$ 1,650.00	$ 3,300.00
Aluminum Ladder	16	LF	$ 110.00	$ 1,760.00
Aluminum Stairs	6	EA	$ 506.00	$ 3,036.00
Stair Landing	1	EA	$ 1,100.00	$ 1,100.00
Mechanical/Process				
Equipment:				
Submersible Pumps incl. guiderails	2	EA	$60,775.00	$ 121,550.00
Piping and Valves:				
6" x 8" DIP Increaser	2	EA	$688.05	$ 1,376.10
8" DIP	44	LF	$100.65	$ 4,428.60
8" DIP 90 deg bend	2	EA	$938.85	$ 1,877.70
8" Check Valve	2	EA	$2,516.80	$ 5,033.60
8" Plug Valve	3	EA	$2,988.70	$ 8,966.10
8" Dismantling Joint	2	EA	$1,457.17	$ 2,914.34
8" Wall Pipe	2	EA	$1,100.00	$ 2,200.00
8" x 12" DIP Increaser	2	EA	$1,188.00	$ 2,376.00
12" DIP 90 deg bend	4	EA	$1,800.15	$ 7,200.60
12" DIP Tee	4	EA	$3,339.60	$ 13,358.40
12" DI Pipe	35	LF	$165.00	$ 5,775.00
12" Plug Valve	3	EA	$7,025.70	$ 21,077.10
12" Dismantling Joint	1	EA	$2,551.12	$ 2,551.12
8" Quick Connect w/ Dust Cap	1	EA	$1,650.00	$ 1,650.00
Pipe Supoorts	1	LS	$8,886.31	$ 8,886.31
Link Seals	5	EA	$275.00	$ 1,375.00
12" Gooseneck Vent	1	EA	$5,500.00	$ 5,500.00
12" DI Pipe - MJ	40	LF	$110.00	$ 4,400.00
12" DI 90 deg bend - MJ	1	EA	$1,200.10	$ 1,200.10
12" DI 45 deg bend - MJ	1	EA	$1,032.90	$ 1,032.90
Connection of Existing 12" FM	1	LS	$11,000.00	$ 11,000.00
HVAC				
HVAC Allowance	1	LS	$ 10,000.00	$ 10,000.00
Electrical/Instrumentation				
Electrical, Instrumentation and Control Allowance	1	LS	$246,150.00	$ 246,150.00
			Subtotal (rounded to nearest $1,000):	$ 943,000.00
			30% Contingency (rounded to nearest $1,000):	$ 283,000.00
			Total (rounded to nearest $1,000):	$ 1,226,000.00

Easton Utilities
Windmill SPS Upgrade PER
Preliminary Opinion of Probable Construction Costs
Alternative 3

Updated By: SMC
Date: 7/25/2017
Checked By: RJG
Date: 8/2/2017

Item	Qty	Unit	Unit Cost	Total Cost
General				
General Requirements	1	LS	$131,529.06	$ 131,529.06
Mobilization/Demobilization	1	LS	$28,658.96	$ 28,658.96
Demolition				
Demo Existing Building	2,992	CF	0.374	$ 1,119.01
Demo Existing Electrical Equipment	1	LS	$6,600	$ 6,600.00
Demo Pumps, Piping and Valves	1	LS	$3,960	$ 3,960.00
Demo Stairs and Guardrail	1	LS	$3,960	$ 3,960.00
Demo Existing Concrete Fill	1	LS	$3,960	$ 3,960.00
Demo Existing Fence	1	LS	$3,960	$ 3,960.00
Saw Cut Opening in Existing Wet Well	26	LF	$110	$ 2,860.00
Demo Opening in Existing Wet Well	2	CY	$110	$ 220.00
Crane Rental	5	DAY	$330	$ 1,650.00
Concrete/Masonry/Roof Disposal	1	LS	$11,000	$ 11,000.00
Paving Demolition	44	SY	$11	$ 484.00
Civil/Site				
Excavation and Backfill:				
Structure Excavation	230	CY	$ 44.00	$ 10,120.00
Trench Excavation	13	CY	$ 44.00	$ 586.67
Stone Bedding	13	CY	$ 33.00	$ 421.67
Pipe Bedding	6	CY	$ 44.00	$ 244.44
Hauling	243	CY	$ 11.00	$ 2,676.67
Backfill - Off Site Material	335	CY	$ 33.00	$ 11,059.89
Sheeting	1,431	SF	$ 22.00	$ 31,482.00
Site Fence	290	LF	$ 32.12	$ 9,314.80
16-ft double leaf swing gate	1	EA	$ 1,352.96	$ 1,352.96
Paving				
Aggregate Base Coarse - 3/4" Stone (12" Thick)	76	SY	$ 31.63	$ 2,403.97
Binder Course	76	SY	$ 24.14	$ 1,834.80
Wearing Course	76	SY	$ 11.14	$ 846.83
Bypass Pumping:				
Pump Rental	6	MONTH	$8,778	$ 52,668.00
Delivery	1	LS	$990	$ 990.00
Removal	1	LS	$990	$ 990.00
Installation	1	LS	$5,500	$ 5,500.00
Operation & Maintenance	6	MONTH	$2,633	$ 15,800.40
Diesel Fuel	180	DAY	$231	$ 41,580.00
Architectural				
Control Building	560	SF	$ 275.00	$ 154,000.00
Structural				
Concrete:				
Base Slab on Grade	21	CY	$ 440.00	$ 9,240.00
Vertical Walls	50	CY	$ 770.00	$ 38,500.00
Elevated Top Slab	5	CY	$ 990.00	$ 4,950.00
Concrete Fill	13	CY	$ 275.00	$ 3,575.00
Metals:				
Access Hatches:				

Easton Utilities
Windmill SPS Upgrade PER
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Alternative 3

Updated By: SMC
Date: 7/25/2017
Checked By: RJG
Date: 8/2/2017

Item	Qty	Unit	Unit Cost	Total Cost
42" x 42"" Standard Hatch	1	EA	$ 2,759.90	$ 2,759.90
Mechanical/Process				
Equipment:				
Suction Lift Pumps	4	EA	$35,750.00	$ 143,000.00
Piping and Valves:				
8" DIP	20	LF	$100.65	$ 2,013.00
8" DIP 90 deg bend	10	EA	$938.85	$ 9,388.50
8" Check Valve	2	EA	$2,516.80	$ 5,033.60
8" Plug Valve	2	EA	$2,988.70	$ 5,977.40
8" x 12" DIP Increaser	4	EA	$1,188.00	$ 4,752.00
12" Wall Pipe	5	EA	$2,200.00	$ 11,000.00
12" Bellmouth	2	EA	$3,300.00	$ 6,600.00
12" DIP 90 deg bend	10	EA	$1,800.15	$ 18,001.50
12" DIP Tee	4	EA	$3,339.60	$ 13,358.40
12" DI Pipe	100	LF	$165.00	$ 16,500.00
12" Plug Valve	3	EA	$7,025.70	$ 21,077.10
12" Dismantling Joint	1	EA	$2,551.12	$ 2,551.12
Pipe Supoorts	1	LS	$12,787.79	$ 12,787.79
Link Seals	1	EA	$275.00	$ 275.00
12" Gooseneck Vent	1	EA	$5,500.00	$ 5,500.00
12" DI Pipe - MJ	15	LF	$110.00	$ 1,650.00
12" DI 90 deg bend - MJ	1	EA	$1,200.10	$ 1,200.10
Connection of Existing 12" FM	1	LS	$11,000.00	$ 11,000.00
HVAC				
HVAC Allowance	1	LS	$ 10,000.00	$ 10,000.00
Electrical/Instrumentation				
Electrical, Instrumentation and Control Allowance	1	LS	$323,080.00	$ 323,080.00
			Subtotal (rounded to nearest $1,000):	$ 1,228,000.00
			30% Contingency (rounded to nearest $1,000):	$ 368,000.00
			Total (rounded to nearest $1,000):	$ 1,596,000.00

Easton Utilities
Windmill SPS Upgrade PER
Preliminary Opinion of Probable Construction Costs
Alternative 4

Updated By: SMC
Date: 2/13/2018
Checked By: VMM
Date: 2/16/2018

Item	Qty	Unit	Unit Cost	Total Cost
General				
General Requirements	1	LS	$169,900.19	$ 169,900.19
Mobilization/Demobilization	1	LS	$26,313.67	$ 26,313.67
Demolition				
Decommission Existing Pumping Station	1	LS	75000	$ 75,000.00
Civil/Site				
Excavation and Backfill:				
Structure Excavation	1,039	CY	$ 44.00	$ 45,715.59
Trench Excavation	71	CY	$ 44.00	$ 3,128.89
Stone Bedding	186	CY	$ 33.00	$ 6,142.58
Pipe Bedding	30	CY	$ 44.00	$ 1,303.70
Hauling	1,110	CY	$ 11.00	$ 12,211.12
Backfill - Off Site Material	708	CY	$ 33.00	$ 23,375.58
Fill for Driveway	500	CY	$ 33.00	$ 16,500.00
Sheeting	2,190	SF	$ 22.00	$ 48,180.00
Dewatering	20	DAYS	$ 275.00	$ 5,500.00
Site Grading	1	LS	$ 5,500.00	$ 5,500.00
Site Restoration	1	LS	$ 11,000.00	$ 11,000.00
Tree Clearing	0	AC	$ 19,811.00	$ 5,943.30
Site Fence	400	LF	$ 32.12	$ 12,848.00
12-ft double leaf swing gate	1	EA	$ 1,352.96	$ 1,352.96
Paving				
Aggregate Base Coarse - 3/4" Stone (12" Thick)	189	SY	$ 31.63	$ 5,978.31
Binder Course	189	SY	$ 24.14	$ 4,562.87
Wearing Course	189	SY	$ 11.14	$ 2,105.94
Storm Drain Head Walls	2	EA	$ 5,500.00	$ 11,000.00
24" Storm Drain	60	LF	$165.00	$ 9,900.00
Utilities				
Water				
1" Water Service	1	LS	$ 5,500.00	$ 5,500.00
Gravity Sewer				
15" PVC 14' deep	380	LF	$ 220.00	$ 83,600.00
12" PVC 12' deep	90	LF	$ 192.50	$ 17,325.00
10" PVC 8' deep	45	LF	$ 165.00	$ 7,425.00
5' dia m/h 12'-14'	3	EA	$ 11,000.00	$ 33,000.00
Bypass pumping	3	LS	$ 11,000.00	$ 33,000.00
Electric				
New Service	1	LS	$ 11,000.00	$ 11,000.00
Sitework for utility construction				
Clear& Grub	1	LS	$ 2,200.00	$ 2,200.00
ESC	1	LS	$ 2,200.00	$ 2,200.00
Restoration	1	LS	$ 4,400.00	$ 4,400.00
Traffic Controls	1	LS	$ 5,500.00	$ 5,500.00
Architectural				
Control Building	240	SF	$ 275.00	$ 66,000.00
Structural				
Concrete:				
Slab - On Grade	17	CY	$ 440.00	$ 7,480.00
Concrete Fill	18	CY	$ 275.00	$ 4,950.00
Precast Structures:				
Wet Well	1,892	SF	$ 25.74	$ 48,700.08

Easton Utilities
Windmill SPS Upgrade PER
Preliminary Opinion of Probable Construction Costs
Alternative 4

Updated By: SMC
Date: 2/13/2018
Checked By: VMM
Date: 2/16/2018

Item	Qty	Unit	Unit Cost	Total Cost
Manhole	1	EA	$ 18,117.40	$ 18,117.40
Valve Vault	450	SF	$ 25.74	$ 11,583.00
Flowmeter Vault	608	SF	$ 25.74	$ 15,649.92
Metals:				
Access Hatches:				
38" x 30" Hatch	1	EA	$ 2,216.50	$ 2,216.50
60" x 48" Hatch	1	EA	$ 4,218.50	$ 4,218.50
72" x 48" Hatch	1	EA	$ 4,933.50	$ 4,933.50
Aluminum Grabrail	2	EA	$ 1,650.00	$ 3,300.00
Aluminum Ladder	16	LF	$ 110.00	$ 1,760.00
Mechanical/Process				
Equipment:				
Submersible Pumps incl. guiderails	2	EA	$60,775.00	$ 121,550.00
Hydraulic Grinder w/ HPU & CP	1	EA	$92,950.00	$ 92,950.00
Jib Crane	1	EA	$83,490.00	$ 83,490.00
Piping and Valves:				
6" x 8" DIP Increaser	2	EA	$688.05	$ 1,376.10
8" DIP	52	LF	$100.65	$ 5,233.80
8" DIP 90 deg bend	2	EA	$938.85	$ 1,877.70
8" Check Valve	2	EA	$2,516.80	$ 5,033.60
8" Plug Valve	3	EA	$2,988.70	$ 8,966.10
8" Dismantling Joint	2	EA	$1,457.17	$ 2,914.34
8" Wall Pipe	2	EA	$1,100.00	$ 2,200.00
8" x 12" DIP Increaser	2	EA	$1,188.00	$ 2,376.00
12" DIP 90 deg bend	4	EA	$1,800.15	$ 7,200.60
12" DIP Tee	4	EA	$3,339.60	$ 13,358.40
12" DI Pipe	35	LF	$165.00	$ 5,775.00
12" Plug Valve	4	EA	$7,025.70	$ 28,102.80
12" Dismantling Joint	1	EA	$2,551.12	$ 2,551.12
Air Release Valve	1	EA	$9,844.38	$ 9,844.38
8" Quick Connect w/ Dust Cap	1	EA	$1,650.00	$ 1,650.00
Pipe Supoorts	1	LS	$10,830.59	$ 10,830.59
Link Seals	10	EA	$275.00	$ 2,750.00
Valve Box	1	EA	$550.00	$ 550.00
12" Gooseneck Vent	1	EA	$5,500.00	$ 5,500.00
12" DI Pipe - MJ	75	LF	$110.00	$ 8,250.00
12" DI 90 deg bend - MJ	1	EA	$1,200.10	$ 1,200.10
12" DI 45 deg bend - MJ	1	EA	$1,032.90	$ 1,032.90
Hydraulic Lines	1	LS	$5,500.00	$ 5,500.00
HVAC				
HVAC Allowance	1	LS	$ 10,000.00	$ 10,000.00
Electrical/Instrumentation				
Electrical, Instrumentation and Control Allowance	1	LS	$246,150.00	$ 246,150.00
			Subtotal (rounded to nearest $1,000):	$ 1,586,000.00
			30% Contingency (rounded to nearest $1,000):	$ 476,000.00
			Total (rounded to nearest $1,000):	$ 2,062,000.00

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