



Preliminary Design Report

Farragut Stormwater Pump Station

City of Aberdeen

Grays Harbor County, Washington
June 28, 2022

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Abbreviations

A	ampere(s)
AA	Aluminum Association
AACE	Association for the Advancement of Cost Engineering
AC	alternating current
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
AISC	American Institute of Steel Construction
AMC	City of Aberdeen Municipal Code
ANSI	American National Standards Institute
APE	area of potential effect
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing Materials
AWG	American Wire Gauge
AWWA	American Water Works Association
BSA	Berglund, Schmidt & Associates, Inc.
cfs	cubic foot/feet per second
CIP	cast-in-place
City	City of Aberdeen
CMU	concrete masonry unit
CSI	Construction Specifications Institute
DC	direct current
Ecology	Washington State Department of Ecology
EL	elevation
EOPCC	Engineer's Opinion of Probable Construction Cost
ESA	Endangered Species Act
ft	foot/feet
GFCI	ground fault circuit interrupter
GIS	geographic information system
gpm	gallon(s) per minute
HDR	HDR Engineering, Inc.
HI	Hydraulic Institute
HMI	human-machine interface
hp	horsepower
HP	H-pile
HPA	Hydraulic Project Approval
IBC	International Building Code
I&C	instrumentation and controls
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers

IESNA	Illuminating Engineering Society of North America
IFC	International Fire Code
IMC	International Mechanical Code
ISA	International Society of Automation
JARPA	Joint Aquatic Resources Permit Application
kVA	kilovolt-ampere(s)
Landau	Landau and Associates, Inc.
LED	light-emitting diode
MCB	main circuit breaker
MCC	motor control center
NA	not applicable
NAD83/91	North American Horizontal Datum of 1983/1991
NAVD88	North American Vertical Datum of 1988
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NRCS	Natural Resources Conservation Service
NWP	Nationwide Permit
OCPP	overcurrent protective device
Orange Book	<i>Criteria for Sewage Works Design</i>
OSHA	Occupational Safety and Health Administration
PLC	programmable logic controller
PVC	polyvinyl chloride
RGS	rigid galvanized steel
RMC	rigid metal conduit
rpm	revolution(s) per minute
SBUH	Santa Barbara Unit Hydrograph
SEI	Structural Engineers Institute
SEPA	State Environmental Policy Act
SPD	surge protection device
SWMMWW	<i>Stormwater Management Manual for Western Washington</i>
TCM	Total Cost Management
TDH	total dynamic head
TEFC	totally enclosed, fan-cooled
TESC	temporary erosion and sediment control
TM	technical memorandum
TSP	twisted shielded pair
UL	Underwriters Laboratories
UPC	Uniform Plumbing Code
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
V	volt(s)
VAC	volt(s) alternating current
VDC	volt(s) direct current
VFD	variable-frequency drive
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WISHA	Washington Industrial Safety and Health Act
WSDOT	Washington State Department of Transportation
WWHM	Western Washington Hydrology Model
XHHW-2	cross-linked polyethylene high heat-resistant water-resistant-2

1 Background

The City of Aberdeen (City) has selected HDR Engineering, Inc. (HDR) to provide design and permitting for the construction of a new stormwater pump station located adjacent to the existing Farragut Street booster pump station (existing Farragut pump station) in Aberdeen, Washington. Task 500 of the scope of services requires HDR to prepare a *Preliminary Design* technical memorandum (TM) to evaluate design alternatives and document the design criteria for construction of the proposed Farragut Street stormwater pump station (proposed Farragut pump station). The proposed Farragut pump station is a priority capital project that requires complete replacement of the existing pump station because of aging, structural failure, and increasing annual maintenance costs.

This preliminary design report summarizes predesign for construction of a replacement pump station. HDR will prepare conceptual site plans and preliminary plans for the building design, develop an electrical basis of design, and prepare a Class 4 Engineer's Opinion of Probable Construction Cost (EOPCC) per Association for the Advancement of Cost Engineering (AACE) Recommended Practice 18R-97 (AACE 2020a) for City staff to select a preferred alternative to move forward with for preparation of plans, specifications, and estimate for bidding in 2023.

1.1 Introduction

The existing Farragut pump station project is located in Section 15, Township 17 North, Range 9 West in the city of Aberdeen in Grays Harbor County, Washington. The existing pump station is located north of E Harriman Street and to the south of Miller Junior High School. Figure 1 and Figure 2, located in Appendix A, depict the project vicinity and site location. respectively.

Constructed in 1983, the existing Farragut pump station pumps stormwater from an unnamed ditch, located west of E Harriman Street, to an unnamed tributary to Mill Creek, reducing the potential for flooding behind the Chehalis River Levee. The existing facility is settling, causing displacement of sheet piling and the existing bar screen (trash rack), resulting in repeated clogging and required maintenance of the vertical-turbine pumps. The existing pump station lacks access to easily remove the debris from the suction end of the pump, resulting in safety concerns for City staff. The building and site are located adjacent to a junior high school and are subject to vandalism because there is no security fencing around the facility. Refer to Figure 1-1 for a photo of existing Farragut pump station.



Figure 1-1. Existing Farragut pump station

The proposed Farragut pump station project will replace the structurally failing facilities (sheet piling, bar screens) and existing building, update controls, and replace the existing aging vertical-turbine stormwater pumps and existing jockey pump. The following work will be completed separately by the City and is not considered a part of this project:

- Removal of the existing 100-horsepower (hp) pumps
- Removal of the existing facilities (inside the building)
- Demolition of the existing concrete masonry unit (CMU) building (after construction and startup of the new facility)
- Installation of a new power generator, concrete pad, and fuel tank (to be located in the footprint of the existing building structure)

1.2 Project Description

The proposed Farragut pump station project involves construction of a new pump station to collect and pump surface water from the unnamed ditch and convey it to the existing discharge outfall to the unnamed tributary to Mill Creek (Elliott Slough). The project includes construction of:

- A new CMU pump station including:
 - Two duty 100 hp vertical axial submersible pumps that collect and pump surface water from the unnamed tributary (ditch) into an existing outfall to the unnamed

tributary to Mill Creek. The combined capacity of the dual pumps is 40,000 gallons per minute (gpm).

- One duty, 15 hp vertical axial submersible pump designed at 1,500 gpm.
 - The 15 hp pump will be installed east of the existing pump station building, where the existing pump is located.
 - A wetwell (below the building floor), approximately 8 feet wide by 8 feet long, will be retrofitted to the existing 15 hp intake. Available information on the 15 hp pump and intake is insufficient and an investigation with survey will be required for design of the retrofit.
- Concrete, cast-in-place (CIP) wetwell
- Automated mechanical bar screen trash rack with fish barrier screen
- Replacement of existing sheet pile shoring with tie-backs within the unnamed ditch
- Security perimeter fence with gated access
- Pump station controls, electrical, and telemetry upgrades
- Installation of a new on-site backup generator
- Required heating, ventilation, and air conditioning (HVAC) improvements at the pump station

2 General

This section presents survey information, construction drawings, specifications, applicable design criteria and standards, and anticipated permits for the proposed Farragut pump station project.

2.1 Survey

Berglund, Schmidt & Associates, Inc. (BSA) completed a topographical survey of the property in January 2022. The survey base map (1 inch = 20 feet) of field-surveyed information uses American Public Works Association (APWA) standard layers, line types, and symbols in AutoCAD software format. The survey base map includes parcel boundaries, right-of-way, easements, utilities, roadway, sidewalk, power poles, buildings, and the existing Farragut pump station. A copy of the survey base map prepared by BSA is included as Figure 3 in Appendix A.

2.1.1 Survey Control

The North American Vertical Datum of 1988 (NAVD88) was used based upon benchmarks near the project.

2.1.2 Datum

The North American Horizontal Datum of 1983/1991 (NAD83/91), Washington State Plane Coordinates, south zone, was used.

2.2 Construction Drawings

Construction bid-ready drawings will be prepared in accordance with City codes and standards using 2020 AutoCAD software. It is estimated that up to 42 plan sheets will be needed that include the following categories:

- General and civil sheets
- Mechanical and HVAC sheets
- Structural sheets
- Electrical sheets with instrumentation and controls (I&C) details
- Architectural and roof plan sheets
- Landscape and restoration sheets

2.3 Specifications

Specifications will be prepared using:

- Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge, and Municipal Construction (M 41-10), current edition
- Project-specific Special Provisions to the WSDOT standard specifications
- Project-specific technical specifications (to supersede WSDOT standard specifications) that may be presented as either Special Provisions or in the six-digit standard Construction Specifications Institute (CSI) format.
- HDR will prepare Division 0 and Division 1 specifications similar to Fry Creek pump station

2.4 Applicable Design Criteria and Standards

Applicable standards, guidelines, and policies related to design of the proposed Farragut pump station are listed below. Electrical basis-of-design information is presented in Table 2-1.

Table 2-1. Standards, guidelines, and policies summary

Title	Origin
City of Aberdeen Adopted Codes and Standards Aberdeen Municipal Code (AMC) Title 15, Buildings and Construction. Refer to the Title 15 for a full list https://aberdeen.municipal.codes/AMC	
International Building Code (IBC) 2018 https://shop.iccsafe.org/international-codes/2018-international-building-coder.html	International Code Council
The electrical and telecommunications code in Washington Administrative Code (WAC) Chapters 296-46A, 46B, and 46C, except subsections (10), (11), (12), (13), (14), and (15) of Section 256-46B-906 and the codes and standards therein.	City of Aberdeen and Washington State Legislature
2018 Washington State Energy Code (AMC 15.04) regulates the energy-use features of new and remodeled buildings	City of Aberdeen and Washington State Legislature
The 2018 edition of the Uniform Plumbing Code (UPC) by Chapter 51 to 56 WAC, including Appendices A, B, and I, and excluding Chapters 12 and 14, which are not adopted.	International Association of Plumbing & Mechanical Officials
2018 edition of the International Fire Code (IFC), by Chapter 51-54A WAC, as amended by this chapter and including all of IFC Chapter 5, Section 503 and Appendices B, C, D, H, I, J, and K. Digital Codes (iccsafe.org)	International Code Council
2018 edition of the International Mechanical Code (IMC), by Chapter 51 WAC. https://shop.iccsafe.org/international-codes/2018-international-mechanical-coder.html	International Code Council
AMC 15.12 regulates design and installation of mechanical systems, appliances, appliance venting, duct and ventilation systems, combustion air provisions, hydronic systems, and solar systems.	City of Aberdeen
AMC Title 13: Public Services	City of Aberdeen
AMC Title 14: Environmental Regulations	City of Aberdeen
General and industry standards	
American with Disabilities Act (ADA) Standards for Accessible Design. 2010. https://www.ada.gov/regs2010/2010ADASTandards/2010ADASTandards_prt.pdf	United States Department of Justice
Occupational Safety and Health Administration (OSHA) https://www.osha.gov/laws-regs/oshact/toc	United States Department of Labor
American Society for Testing and Materials (ASTM) https://www.astm.org/products-services/standards-and-publications.html	American Society for Testing and Materials International
American Water Works Association (AWWA): Standards https://www.awwa.org/Publications/Standards/Standards-List	American Water Works Association

Title	Origin
Occupational Safety and Health Administration (OSHA) https://www.osha.gov/laws-regs/oshact/toc	United States Department of Labor
Washington Industrial Safety and Health Act (WISHA) https://app.leg.wa.gov/rcw/default.aspx?cite=49.17	State of Washington, Department of Labor & Industries
Hydraulic Institute (HI) standards (pump selection and design) http://www.pumps.org/Standards_and_Guidebooks.aspx	Hydraulic Institute
ANSI/HI Rotodynamic Pumps for Pump Intake Design https://webstore.ansi.org/Standards/HI/ansih2018-1730906	American National Standards Institute and Hydraulic Institute
Washington State Department of Ecology (Ecology) 98-37 <i>Criteria for Sewage Works Design</i> (Orange Book) https://apps.ecology.wa.gov/publications/documents/9837.pdf	Washington State Department of Ecology
Washington Department of Transportation: 2019 <i>Hydraulics Manual</i> , Publication M 23-03, Olympia, Washington. https://www.wsdot.wa.gov/publications/manuals/fulltext/M23-03/HydraulicsManual.pdf	Washington State Department of Transportation
Electrical codes and standards	
National Electrical Manufacturers Association (NEMA) https://www.nema.org/	National Electrical Manufacturers Association
Institute of Electrical and Electronic Engineers (IEEE) https://www.ieee.org/	Institute of Electrical and Electronics Engineers
International Society of Automation (ISA) https://www.isa.org/	International Society of Automation (formerly Instrument Society of America)
National Electrical Contractors Association (NECA) "Standards of Installation" www.neca-neis.org/the-standards	National Electrical Contractors Association
Insulated Cable Engineers Association (ICEA) Standards https://www.icea.net/docs	Insulated Cable Engineers Association
National Electrical Testing Association (NETA) Standards https://www.netaworld.org/standards	National Electrical Testing Association
Underwriters Laboratories (UL) Standards https://ul.org/	Underwriters Laboratories
Washington State Energy Code https://sbcc.wa.gov/state-codes-regulations-guidelines/state-building-code/energy-code	Washington State Building Code Council
National Fire Protection Association (NFPA) 70, National Electrical Code (NEC) https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70	National Fire Protection Association
IEEE C2, National Electrical Safety Code https://standards.ieee.org/ieee/C2/10814/	Institute of Electrical and Electronics Engineers

Title	Origin
Illuminating Engineering Society of North America (IESNA) <i>Lighting Handbook</i> , latest edition https://www.ies.org/product/lighting-handbook-10th-edition/	Illuminating Engineering Society of North America
NEMA-MG1, Motors and Generators https://archive.org/details/gov.law.nema.mg-1.2009/page/n0	National Electrical Manufacturers Association
Life Safety Code, NFPA-101-HB85 https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=101	National Fire Protection Association
Structural codes and standards	
American Concrete Institute (ACI) 350-06 Code Requirements for Environmental Engineering Concrete Structures and Commentary (reinforced concrete design) https://www.concrete.org/store/productdetail.aspx?ItemID=35006&Language=English	American Concrete Institute
ACI 350.4R-04 Design Considerations for Environmental Engineering Concrete Structures (buoyancy, additional design loads, stability considerations, and special design conditions) https://www.concrete.org/store/productdetail.aspx?ItemID=350404&Format=DOWNLOAD&Language=English	American Concrete Institute
ACI 350.3-06 Seismic Design of Liquid Containing Concrete Structures and Commentary (seismic design and hydrodynamic analysis) https://www.concrete.org/store/productdetail.aspx?ItemID=350306&Format=DOWNLOAD&Language=English	American Concrete Institute
American Institute of Steel Construction (AISC) <i>Seismic Design Manual</i> https://www.aisc.org/products/publication/manuals/seismic-design-manual-2nd-edition-print/#.W2SDKExFyUk	American Institute of Steel Construction
Aluminum Association (AA) <i>ADM 1 Design Manual</i> (aluminum design) http://www.aluminum.org/aluminum-design-manual-2015	Aluminum Association
ACI 318-14 Building Code Requirements for Structural Concrete (reinforced concrete design) https://www.concrete.org/store/productdetail.aspx?ItemID=31814&Language=English	American Concrete Institute
AISC <i>Steel Construction Manual</i> https://www.aisc.org/products/publication/manuals/steel-construction-manual-15th-ed-print/#.W2SB4ExFyUk	American Institute of Steel Construction
ASTM <i>Steel Standards</i> https://www.astm.org/Standards/steel-standards.html	American Society for Testing and Materials

Title	Origin
American Society of Civil Engineers (ASCE)/Structural Engineers Institute (SEI) 7-16 Minimum Design Loads for Buildings and Other Structures https://ascelibrary.org/doi/book/10.1061/9780784412916#	American Society of Civil Engineers/Structural Engineers Institute

2.5 Anticipated Permits

The proposed project will require permits and approvals from the federal government, Washington State, and the City of Aberdeen. A preliminary table of anticipated permits and approvals necessary for replacement of the existing Farragut pump station is included in Appendix B and summarized within this section.

In-water work within the ditch (to include dewatering, dredging, and installation of the new sheet pile wall and intake structure) would require a Section 404 permit from the United States Army Corps of Engineers (USACE), likely under Nationwide Permit (NWP) 7 (applicable to outfall structures and associated intake structures). This NWP requires pre-construction notification to USACE, in the form of a Joint Aquatic Resources Permit Application (JARPA). The Washington State Department of Ecology (Ecology) has certified that NWP 7 is consistent with Washington State water quality standards and thus does not require an individual Section 401 Water Quality Certification provided that the work is done in accordance with USACE's national, regional, and NWP-specific conditions and Ecology's State general conditions.

The requirement for federal approval (the NWP) leads, in turn, to the requirements for review of the project under Section 106 of the National Historic Preservation Act (NHPA) and federal Endangered Species Act (ESA) review. ESA review will require preparation of a Biological Assessment, or a No Effect Report (discussed in Section 4.3 below). ESA review is expected to take the path of informal consultation and to result in a letter of concurrence of either a No Effect or May Affect but Not Likely to Adversely Affect ESA-listed species.

In-water work will also require a Hydraulic Project Approval (HPA) from the Washington Department of Fish and Wildlife (WDFW). This approval will likely include conditions for the protection of fish habitat and marbled murrelet habitat (the latter only if suitable marbled murrelet nesting habitat is determined to be present in the vicinity of the project area). Conditions may include those related to the use of sediment and erosion control measures, daily as well as seasonal construction timing, dewatering, and monitoring.

Replacement of the existing Farragut pump station is exempt from needing a State Environmental Policy Act (SEPA) determination, per Washington Administrative Code (WAC) 197-11-800(3), which states that the repair, remodeling, and maintenance of existing public or private structures, facilities, or equipment—including utilities—is categorically exempt, except that where undertaken wholly or in part on lands covered by water (which this is), only minor repair or replacement of structures may be exempt. The only work within the water (or lands covered by water) is the replacement of the steel retaining wall and the intake, which appears to fit the description of minor repair or replacement. However, the City does require a Grading Permit because excavation will

be occurring, as well as a Building Permit for the new pump station. Critical-areas review will be integrated with review of the underlying Clear and Grade Permit, subject to Aberdeen Municipal Code (AMC) 14.100.034A, and it is likely that the project would receive a no impact waiver because the proposed activity is unlikely to degrade the function or values of the critical area. Finally, drainage review will likely be required from the City because a Grading Permit is required.

The City provides the opportunity to request a “preliminary consultation” prior to applying for development or other approvals. At this meeting, City Planning and Permitting staff would discuss the requirements of the Critical Areas Code; provide critical-areas maps, scientific information, and other source materials; outline the review process; and identify any potential concerns that might arise during the review process, in addition to discussing other permit procedures and requirements.

3 Existing Pump Station

This section describes the existing Farragut pump station, including site conditions and pump station design.

3.1 Site Conditions

The existing Farragut pump station is constructed within the Farragut Street (unimproved) right-of-way, unnamed right-of-way for the existing ditch, and on property owned by the City on the northern portion of Lots 1 and 2, Block 7 of the Union Pacific Addition Plat. The existing piping and outfall are sited on property owned by the City on Lots 18 and 19, Block 27, Broadway Addition. A copy of the City’s record drawing that depicts the property boundaries is included in Appendix G.

Access to the existing pump station is from Farragut Street (undeveloped) from the south end of the site. The north end of the site is bounded by Aberdeen School District 5, Miller Junior High School property. The northern property boundary runs from east to west along the 1/16 Section boundary line. Refer to Section 2.1 for information on the existing Farragut pump station site survey.

The east end of the property contains the unnamed ditch, where the pump and wetwell intake structures are located. The western side of the property is bounded by the unnamed tributary to Mill Creek and associated wetlands. The existing pump station discharges to the unnamed tributary to Mill Creek. The existing unnamed ditch and unnamed tributary to Mill Creek are confining features on the site and restrict both the size and location where the proposed pump station may be located.

3.2 Pump Station Design

Information on the existing Farragut pump station design and features is provided in Table 3-1.

Table 3-1. Existing Farragut pump station design summary

Item	Criterion
Building	
Construction material	CMU block walls Asphalt shingle roof
Interior dimensions	18' 0" long × 10' 6" wide
Interior height	Varies 9' 4"–10' 0"
Pump access hatches	Two 5' × 5' hatches
Finished floor elevation	15.0'
Heating and cooling	No HVAC, 40" × 48" hand-operated louver only
Concrete deck (over wetwell) elevation	14' ¾"
Structural support	Steel sheet piling with HP8×36 piling
Retaining wall system (unnamed ditch)	Sheet pile retaining wall with double-galvanized wire tie-back to concrete anchor blocks
Wetwell (100 hp pumps only)	
Construction	CIP concrete
Dimensions	18' 0" wide × 31' 1" long
Interior roof elevation	14'
Interior well bottom elevation	-3' 6"
Concrete	
Trash rack	
Construction	Welded, galvanized steel
Dimensions	13' 9" width (interior) by 6' ⅞" high 28 bars, evenly spaced
Base sill elevation	2' 0"
Top sill elevation	14' 8"
15 hp pump (duty)	
Manufacturer	Unknown
Type	Axial-flow, propeller
Motor	ABS: variable-frequency drive (VFD), 870 rpm
Design flow range	400–1,500 gpm
High total dynamic head (TDH) range	+/- 8'–12'
Discharge pipe diameter	8"
Discharge location	Connect to existing pipe (to outfall)
Two 100 hp pump control settings (peaking)	
Manufacturer	Aurora

Item	Criterion
Type	Axial-flow, propeller
Motor	ABS: VFD, US Electrical Motors
Peak flow rating (individual pump)	21,000 gpm
Design combined maximum flow	42,000 gpm
High TDH range	+/- 13'
100 hp pump discharge to outfall	
Discharge pipe diameter (per each pump)	30"
Discharge pipe elevation (centroid)	11' 9"
Discharge location	Connect to existing 30" pipes (to outfall)
Tidal flap gate	30" diameter flap gate at concrete outfall structure
Site and access	
Access and security	5' high chain-link perimeter fence with a manual locked access gate
Driveway and parking	Crushed gravel surfacing

3.2.1 Hydraulics

The existing Farragut pump station pumps are variable-frequency drives (VFDs) with settings as listed in Table 3-2 below.

Table 3-2. Existing Farragut pump station key elevations

Key elevations ^a	Water surface elevation (ft)
15 hp pump control settings (duty)^b	
15 hp pump ON	+/-3.0
15 hp pump OFF	+/- 2.5
Operational range	+/- 2.5–7.0
100 hp pump control settings (peaking)	
Pump 1 ON	4.8
Pump 2 ON	5.5
Pump 1 OFF	4.0
Pump 2 OFF	3.9
Pump well full	7.0
Operational empty	3.9

a. Based on NAVD88 datum.

b. Pump control key elevations are approximate and should be confirmed during design.

3.2.2 Electrical and Power Supply

This section describes the electrical and power supply of the existing Farragut pump station.

Utility Power

The existing pump station service is from pole-mounted transformers providing 480-volt alternating current (VAC) three-phase service. The pump station does not currently have a backup generator on site. A photo of the existing pump station service is provided in Figure 3-1.



Figure 3-1. Existing Farragut pump station power service

Electrical Service

The existing pump station has A 3-kilovolt-ampere (kVA) single-phase transformer that feeds the pump station 120/240 VAC loads. The utility service goes to a drop pole and then enters the pump station. The service then enters into an electrical enclosure that feeds:

- Two 100 hp pumps with combination starters
- One 15 hp pump (located outside the pump station building)
- A 480 VAC service with a 400-ampere (A) rated main circuit breaker (MCB).

- Main motor control cabinet

Other smaller loads are fed from a small panel that is attached to the 3 kVA transformer. The other pump station loads include the control panel housing the programmable logic controller (PLC), communications, interior and exterior lighting, power receptacle connections, located inside of the pump station.

The existing PLC has set features that are accessible from the human-machine interface (HMI) on the front of the control panel. The 100 hp motor settings are based on water depth within the wetwell. The two existing 100 hp motors have not been able to run congruently without interrupting electrical power service to the station.

All three existing station motors are controlled from the motor control cabinets. See Figure 3-2 through Figure 3-6 for tag information on the existing pump station motors.



Figure 3-2. Existing 100 hp Pump 1 tag

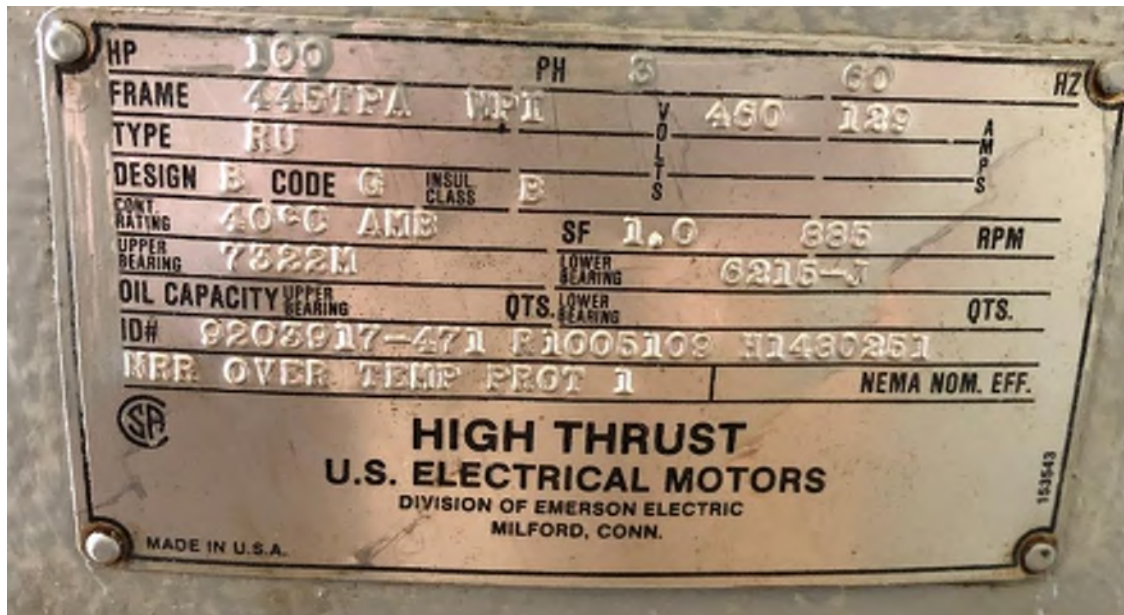


Figure 3-3. 100 hp Pump 1 motor tag



Figure 3-4. 100 hp Pump 2 tag



Figure 3-5. 100 hp Pump 2 motor tag

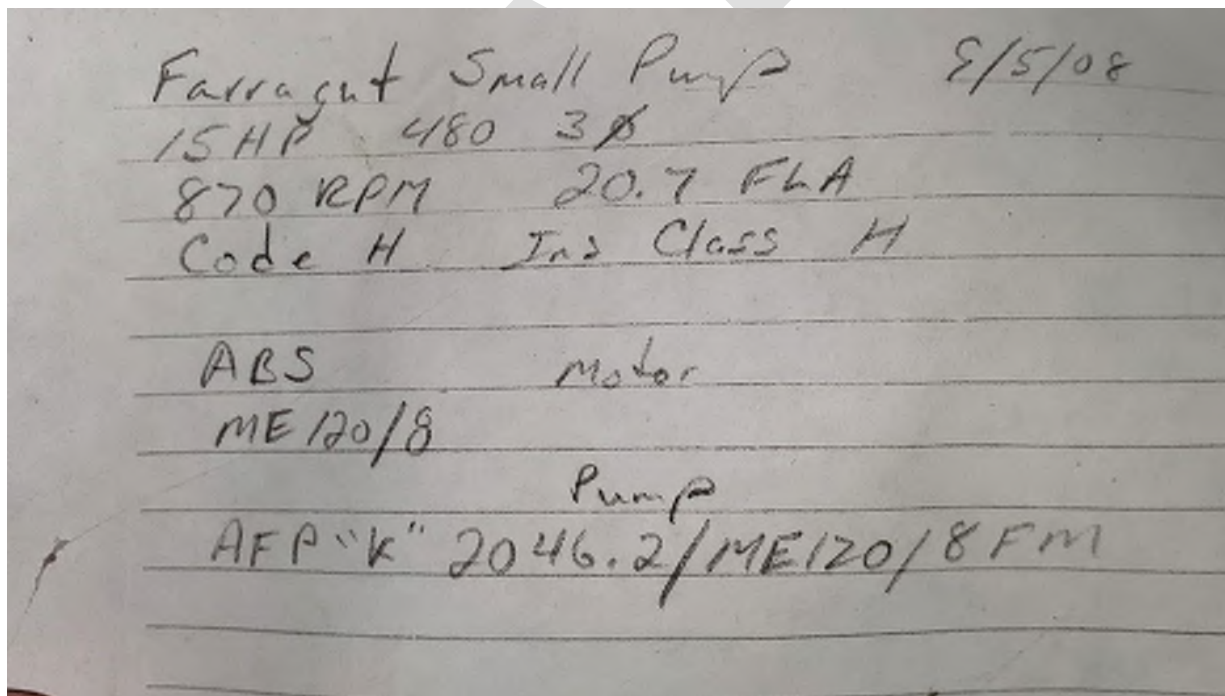


Figure 3-6. 15 hp “duty” pump information from City

Backup Power

The existing pump station does not currently have a backup power generator.

4 Proposed Pump Station Evaluation

This section describes the design criteria used for analysis of the project, including the existing system, proposed system, and design criteria.

4.1 Geotechnical Investigation

Landau and Associates, Inc. (Landau) performed subsurface explorations on January 12, 2022. Landau advanced two mud-rotary borings approximately 21.5 feet and 81.5 feet below the existing grade. Included in Appendix C is a copy of the Summary of Geotechnical Engineering Services Report (dated April 1, 2022), hereafter referred to as the Geotechnical Report, which provides recommendations to support the proposed pump station improvements.

4.1.1 Groundwater and Buoyancy

The Geotechnical Report notes the presence of shallow groundwater on site. The proposed pump station, conveyance, and related installations should be designed to account for buoyancy forces.

Per the Geotechnical Report, design of underground structures should account for potential uplift with the groundwater table assumed to be the ground surface.

4.2 Drainage and System Summary

A variety of sources were reviewed for determining the basin contributing to the proposed stormwater pump station including:

- Topography data available from the United States Geological Survey (USGS)
- Grays Harbor County geographic information system (GIS) data from the County website
- City of Aberdeen iMap
- *Stormwater Management Manual for Western Washington* (SWMMWW)

The existing delineated stormwater basin is estimated to be 321.5 acres and is zoned as low-density, single-family residential. The basin was assigned a development density of 3.0 dwelling units per acre and was assigned a 34 percent impervious area per the SWMMWW. Slopes in the basin area vary from 0 to 5 percent and the soil types are highly prone to runoff.

The Western Washington Hydrology Model (WWHM) was used to determine basin flow rates. In accordance with the 2019 SWMMWW, the Santa Barbara Unit Hydrograph (SBUH) method was used to determine runoff for the basin. Impervious areas and curve numbers were calculated using Table III-2.5: Post Development Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Areas from the 2019 SWMMWW section III-2.3: Single Event Hydrograph (SWMMWW 2019). Because most of the soil type is Class D, the soil type has been adjusted to Class "C" because Class "D" soils are not included in the WWHM. Soil group information was referenced from the Natural

Resources Conservation Service (NRCS) Web Soil Survey and is summarized in Table 4-1 below.

Table 4-1. Soil types

Soil (type)	Slopes	Percentage of basin
Calawah silt loam (B)	1%–18%	0.4%
Mopang silt loam (B)	5%–30%	10.4%
Mopang silt loam (B)	30%–65%	4.6%
Ocasta silty clay loam (D)	---	76.5%
Pits, gravel (NA)	---	0.7%
Udorthentis, level (A)	---	7.4%

The calculated flow frequency return periods for the basin are summarized in Table 4-2 and a drainage basin map is included in Appendix D

Table 4-2. Return periods

Return period	Flow (cfs)	Flow (gpm)
2-year	97	43,500
10-year	138	61,900
25-year	155	69,600
100-year	177	79,400

The WWHM model resulted in a 10-year design storm flow of 61,900 gpm, which is larger than the existing Farragut pump station capacity of approximately 42,000 gpm. The City reported that the existing pump station has been in operation since 1983 and has not experienced capacity concerns within that time frame. Per direction from the City, HDR will design the proposed pump station to match the existing station capacity.

HDR will coordinate with the City during design to validate the basin boundary assumption. One potential difference may stem from inclusion of area that drains to Alder Creek. The City plans to dredge Alder Creek to prevent flows from that area from overflowing into the drainage basin that flows to the existing Farragut pump station.

4.3 Environmental

Wetlands and streams were identified through a two-step process. HDR biologists first reviewed relevant information including online maps, delineation reports, public databases, and historical documentation. Following this review, HDR biologists completed a thorough field survey of the study area that included wetland and stream identification, delineation, and classification. The field investigation included a detailed delineation of wetlands and streams on February 22, 2022. A later site visit by an HDR fish and wildlife biologist occurred on June 28, 2022, to verify the classification of the stream/ditch system on the west side of the proposed pump station (Stream 2) and to

confirm the presence or absence of suitable marbled murrelet nesting habitat within Wetland 1 and green sturgeon critical habitat within Stream 1. This field visit was coordinated with and attended by the WDFW Area Habitat Biologist.

Off-site Wetland 1 and on-site Wetland 2 were mapped with sub-meter accuracy Trimble units and rated according to the *Washington State Wetland Rating System for Western Washington: 2014 Update*.

Wetland 1 is a Category 1 wetland that extends off site to the east and is associated with Mill Creek Slough. This riverine and depressional wetland has mature forested components and has been identified as having the potential to provide nesting habitat for marbled murrelet, a federally listed species, subject to the ESA. The proposed project will not encroach into Wetland 1 or directly impact it in any way. However, the existing pump station and the proposed pump station are within the 225-foot-wide wetland buffer and the proposed construction could adversely impact marbled murrelet should these birds be found to be nesting within this forested wetland, unless daytime work hour timing restrictions are imposed.

Wetland 2 is a Category 2 wetland associated with (along the bed and banks of) Stream 2. It is part of a wetland complex that stretches throughout this lowland area of south Aberdeen. Wetland 2 is separated from other wetlands within this wetland complex by narrow vegetated corridors along the ditch; however, the entire wetland complex provides direct or indirect habitat as well as organic input that is key to the support of downstream and interconnected aquatic habitats.

Stream 1 is the off-site tributary to Mill Creek Slough and Stream 2 is the ditch network to the west and southwest of the location of both the existing and proposed pump stations. Stream 1 drains to Mill Creek, which drains, through a mostly open tide gate (a screw gate that is normally held open, but that can be closed during high tide/flooding events), to the lower Chehalis River. Tidal and salt influence from the lower Chehalis River extends into Stream 1, to as near as 1,500 feet from the project site. Green sturgeon critical habitat is designated as extending to the high tide line within the Chehalis River and may include portions of this tributary to Mill Creek.

Stream 2 is part of a stream/ditch network that extends throughout south Aberdeen, draining the lowland area to the Chehalis River to the west.

HDR is preparing a *Wetland and Stream Delineation and Assessment* TM to fully document the wetland and stream findings; this TM will be submitted to regulatory agencies as a part of environmental permit application packages.

A Biological Assessment will be needed and will be prepared by HDR if it is determined that suitable or critical habitat is within the vicinity of the project, such that the proposed pump station could have the potential to affect ESA-listed species. If it is determined that no suitable and no critical habitat is present, a No Effect Memorandum will be prepared in place of a Biological Assessment.

4.4 Cultural

HDR will perform a desktop review of available and applicable cultural resources information identified within the area of potential effect (APE—essentially, the project's maximum disturbance area) and within a 1-mile buffer around the APE. The research will

include a review of existing cultural resource data, previously completed cultural resource surveys, assessor data, and historical maps. HDR will reach out to the Native American tribes that have interest in the APE and its vicinity, including but not limited to the Quinault Indian Nation and Confederated Tribes of the Chehalis Reservation, to ask if they have any information or concerns about the project area that they would share. This outreach does not constitute formal government-to-government consultation.

The results of the desktop review will be summarized in a Section 106 TM, which will also include a recommendation of any further cultural resources work.

4.5 Proposed Pump Station Design Criteria

The proposed Farragut pump station design criteria and recommendations are provided below.

4.5.1 Hydraulics

The existing pump station has been in operation since the 1980s using the settings controlled by the water surface elevation in the unnamed ditch that feeds the existing Farragut pump station intake. The unnamed ditch is fed primarily by stormwater tributary flows from the upstream basin (see Section 4.2). Key water surface elevations that control the existing Farragut pump station are illustrated in Table 4-3.

Table 4-3. Existing Farragut pump station key elevations

Design key elevations ^a	Water surface elevation (ft)
15 hp pump control settings (duty)	
15 hp pump ON ^b	3.0 ft
15 hp pump OFF ^b	2.5 ft
Operational range ^b	2.5–7.0 ft
100 hp pump control settings (peaking)	
Pump 1 ON	4.8 ft
Pump 2 ON	5.5 ft
Pump 1 OFF	4.0 ft
Pump 2 OFF	3.9 ft
Pump well full	7.0 ft
Operational empty	3.9 ft

a. Based on NAVD88 datum.

b. Pump key elevations are approximate and should be confirmed during design.

The most conservative water surface elevation was set at 7.0 feet. The existing Farragut pump station has performed at these settings since the station was constructed in 1983 without event. City staff have indicated that the facility has performed well with no issues. As described in Section 4.2, runoff from Alder Creek has increased the overall capacity of t

he existing pump station. The City has plans to dredge to mitigate these flows away from the existing Farragut pump station.

4.5.2 Preliminary Pump Selection

The existing Farragut pump station was sized and has a historical track record of capacity to accommodate storm events since it was commissioned in 1983. The tributary basin is developed. The original design intent was to design a pump capable of pumping the 25-year, 24-hour rainfall event.

Following discussions with the City regarding the existing pumps' historical performance, HDR moved to select pumps with the capacity to replace those at the existing pump station. For high-flow, low-head conditions, axial-flow propeller pumps are typically used. Table 4-4 presents preliminary pump selection criteria for the proposed pump station.

Table 4-4. Preliminary pump selection criteria

Design item	Criterion
General pump information	
Conditions	High flow and low head
Type	Axial-flow, propeller
Motor	VFD
15 hp pump (duty)	
Type	Axial-flow, propeller
Motor	VFD
Design flow range	400–1,500 gpm
High TDH range	+/- 8'–12'
Discharge pipe diameter	8"
Discharge location	Connect to existing 8" pipe (to outfall)
100 hp pump control settings (peaking)	
Type	Axial-flow, propeller
Motor	VFD
Design flow range (individual pump)	17,000–21,000 gpm
Design combined maximum flow	42,000 gpm
High TDH range	+/- 6'–14'
Discharge pipe diameter (per each pump)	30"
Discharge location	Connect to existing 30" pipes (to outfall)
Tidal flap gate	Retain existing gates at the outfall

The system total dynamic head (TDH) ranges from approximately 6 to 14 feet. The range is subject to design and conveyance pipe considerations and as design progresses, additional analysis will be required to establish final pump selection, design, and speeds.

Proposed Farragut pump station key water surface elevations, including intake, and discharge information is listed in Table 4-5 below.

Table 4-5. Proposed Farragut pump station intake and discharge elevations

Pump wetwell design elevations ^a	Water surface elevation (ft)
15 pump intake sill elevation ^b	EL unknown
15 hp pump nozzle intake invert elevation ^b	EL unknown
15 hp pump discharge outfall: 8" diameter pipe ^b	+/- 11'
100 hp pumps intake bar screen sill elevation	2.0'
100 hp pump nozzles intake invert elevation	-2.0'
100 hp Pump 1 discharge invert elevation: 30" diameter pipe with tidal flap gate	10.5'
100 hp Pump 2 discharge invert elevation: 30" diameter pipe with tidal flap gate	10.5'

a. Based on NAVD88 datum.

b. Elevations should be confirmed during design.

The 15 hp pump and dual 100 hp pump discharge pipes will connect to the existing discharge pipes. Because of wetland and environmental concerns, the design should avoid disturbing the existing outfalls, bank, or area adjacent to the unnamed tributary to Mill Creek, which is located downstream of the existing Farragut pump station outfall.

It should be noted that information on the existing 15 hp duty pump was limited with pump type, sizing, configuration, intake, discharge, and control elevations unavailable during predesign. It is recommended that additional survey, field measurements, and historical information be obtained as the project progresses into the design stage.

4.5.3 Preliminary Wetwell Sizing

Existing Farragut pump station 100 hp VFD pumps are housed in an open-faced wetwell intake, approximately 19 feet wide by 10 feet high. The wetwell face is covered by a bar screen trash rack and directly opens to the unnamed ditch. The opening allows storm flows to freely pass between the unnamed ditch to the wetwell. The wetwell interior is 15.0 feet wide by 21.0 feet long and +/- 7.5 feet of effective water storage depth (at the deepest point).

Historically, the combined wetwell intake and ditch storage areas have provided sufficient flows to support the existing pump station. It is recommended that the proposed wetwell be designed, at a minimum, to meet those provided by the existing pump station and that the well and intake design should be confirmed using the American National Standard for Rotodynamic Pumps for Pump Intake Design (American National Standards Institute [ANSI]/Hydraulic Institute [HI] 9.8-2012). The wetwell design should provide sufficient room for pump installation, clearances, and proper submergence per the manufacturer's recommendations. Because of the intake well size, the structure would be cast in place. The unnamed ditch conveys trash and larger debris that may potentially clog or damage the pumps and a bar screen or mechanical screen with fish barrier should be provided.

4.5.4 Electrical Design

This section presents the electrical design criteria for the proposed Farragut pump station.

Electrical System

A summary of the electrical design criteria is provided in Table 4-6 below.

Table 4-6. Electrical design summary

Design item	Criterion
Electrical system	
System capacity	Sized to accommodate the connected load of all installed equipment plus 20% spare capacity
Power systems	480-volt (V) and below power conduits and circuits
Direct current (DC) signal and PLC data highway circuits	24 V
Communications, instrumentation, and security conduits	<ul style="list-style-type: none"> Between instrumentation and telecommunication: 1" Between instrumentation and 24 volts direct current (VDC): 2" Between instrumentation and 600 V and less alternating current (AC) power or control: 6" Between instrumentation and greater than 600 VAC power: 12" Between telecommunication and 24 VDC: 2" Between telecommunication and 600 V and less AC power or control: 6" Between telecommunication and greater than 600 VAC power: 12" Between 24 VDC and 600 V and less AC power or control: 2" Between 24 VDC and greater than 600 VAC power: 2" Between 600 V and less AC and greater than 600 VAC: 2" Between process, gas, air, and water pipes: 6"
Protection	
All power circuits will be provided with overcurrent protection as follows	<ul style="list-style-type: none"> 600 V and below: circuit breakers 600 V and below motor loads: fused disconnect switches in line of sight with motor load where required by code or load equipment manufacturer Surge protection device (SPD)
Protective devices	All protective devices shall be fully rated to withstand the available short circuit current at the device, series rated devices shall not be used

Utility Power Supply

The existing pump station service is from pole-mounted transformers providing 480 VAC, three-phase service. The proposed electrical service will use the existing service and utility pole.

The proposed station will have a backup power generator, pad, and enclosure. The equipment and material will be purchased with this project. However, because of site constraints, the generator would likely be installed at the existing Farragut pump station building site following that pump station's demolition and removal. Until the new generator is installed and operational, backup power will be provided from the City's portable generator.

The proposed pump station will have a manual transfer switch located between the utility meter and MCB connection. The manual transfer switch will be 400 A, three-phase, 600 VAC rated connection with sealed cap located outside of the pump station to provide backup power from the City's portable generator when utility service is not available.

Conduits

The following list provides design criteria for raceways at the proposed pump station:

- Conduit shall not be smaller than $\frac{3}{4}$ inches.
- Conduit below grade shall be Schedule 40 polyvinyl chloride (PVC).
- Conduit above grade shall be rigid galvanized steel (RGS).
- All buried conduits shall be 36 inches minimum below grade to top of conduit. Buried conduit shall be placed in a prepared ditch with compacted sand and gravel.
- Conduit transitions from below to above grade shall be made with rigid metal conduit (RMC) extending below grade 18 inches with a steel jacket extending 6 inches above and 18 inches below.

Wire and Cable

All conductors shall be copper. All conductor insulation shall be rated for 600 V for all systems operating less than 600 V. Use the minimum conductor sizes as follows:

- No. 12 American Wire Gauge (AWG) for all power and lighting circuits
- No. 14 AWG for discrete control circuits
- No. 16 AWG for analog instrumentation circuits (twisted shielded pair [TSP])

Conductor insulation systems shall be as follows:

- 1,000 V cables: cross-linked polyethylene high heat-resistant water-resistant-2 (XHHW-2) rated for 90 degrees Celsius
- All three-phase conductors shall be color-coded, or phase taped per Table 4-7
- Wiring and conduit shall be done in an orderly and professional manner
- Grounding conductor to be #4/0 bare copper or larger
- Grounding rods shall be 3/5-inch copper-coated stainless steel
- Bus duct shall be copper and 400 A rated

Table 4-7. Three-phase conductors color coding or phase taping

Conductor	208Y/120 V	480Y/277 V
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Grey
Ground	Green	Green

Boxes, Panels, and Cabinets

The following list provides design criteria for boxes, panels, and cabinets at the proposed pump station:

- Connections to electrical enclosures shall be watertight.
- All electrical enclosures shall be Underwriters Laboratories (UL) listed.
- All panels and motor enclosures shall be National Electrical Manufacturers Association (NEMA)-1 gasketed rating minimum.
- Load panels shall be top entry.
- Load panels shall be surface-mounted flush with wall, top of panel to be mounted 5 feet from grade.
- Motor control center (MCC) shall be bottom entry.
- MCC shall be mounted on a 3-inch-thick housekeeping pad that extends a minimum of 1 inch out from the sides of the MCC.
- Dry-type step down transformers shall be UL listed in NEMA 3R enclosures. Coils shall be all aluminum with taps for adjusting to local voltage levels.
- Receptacles shall be ground fault circuit interrupter (GFCI) with local trip reset options, with outdoor-rated enclosure and cover.
- Receptacles shall be surface-mounted to the wall, no less than 18 inches from grade.

Distribution System Protection

This section presents design criteria for distribution system protection at the proposed pump station, including totally enclosed, fan-cooled (TEFC) motors, motor protection, and control.

TEFC Motors, Motor Protection, and Control

The following list provides design criteria for TEFC motors, motor protection, and control at the proposed pump station:

- All motors over 1 hp will be three-phase rated for 460 V for operation on 480 V systems.

- All motors will be high efficiency in accordance with the Washington State Energy Code and will be sized to a maximum of 95 percent of the motor rating used at 100 percent of driven load rating.
- Motors will be fed from MCCs using combination starters, unless otherwise shown in the drawings.
- All motor starters will have front-mounted controls, running and fault indicators.
- The motor will have disconnects that are no less than 3 feet from the motor.
- Disconnects to motor connection will be made with PVC-coated flexible watertight conduit to accommodate motor vibrations.
- Low-voltage overcurrent protection will be provided by magnetic only circuit breakers for breaker frame under 100 A, as applicable, and will be sized per National Electrical Code (NEC) and manufacturers' recommendations.
- Motor control circuits will be 120 VAC, derived from a control power transformer located in each low-voltage motor starter.
- Overcurrent protective devices (OCPDs) will be installed in accordance with NEC standards and guidelines.
- All OCPDs will be UL listed and sized not larger than the current carrying capacity of protected conductors.
- Existing combination starters will be replaced with VFD starters equipped with 3 percent line side reactors to reduce harmonics.
- VFD starts shall come equipped with speed controls.

Grounding

Grounding at the proposed pump station shall at a minimum comply with NEC Article 250 and shall include the requirements stated below:

- Building ground grid and duct bank ground conductors shall be minimum #4/0 bare copper. All ground rods shall be copper-clad steel, with a minimum size of 3/4 inch by 10 feet. A ground conductor shall be routed in each duct bank. All metallic parts of electrical handholes and manholes shall be grounded; a ground rod shall be installed in each handhole and manhole.
- Each conduit containing alternating current (AC) power conductors shall contain an equipment grounding conductor, sized in accordance with the NEC requirements.

Lighting

This section presents design criteria for interior and exterior lighting at the proposed pump station.

Interior Lighting

The following list provides design criteria for interior lighting at the proposed pump station:

- All spaces will be addressed on an individual basis, as to whether general room lighting is adequate. Spaces where detailed work locations are identified will be designed with additional task lighting or provisions for future or portable task lighting.
- Emergency illumination shall be provided in all appropriate spaces as required by code to provide life-safety, property, and equipment protection. Emergency illumination will consist of either battery packs or “bug-eye” type lights. The emergency lights will have battery backup capable of sustaining egress lighting for 90 minutes. Adequate lighting levels shall be provided to maintain safe building egress and critical process functions. Emergency lighting will be located near MCCs, and any equipment that requires continuous monitoring.
- Lighting fixtures will be light-emitting diode (LED).
- Lighting fixtures will be watertight and rated for outdoor use in wet locations.
- Lighting fixtures will be ceiling mounted.

Exterior Lighting

Consistent and similar lighting will be used throughout the facility. Site lighting will be kept to a minimum where practical. Building-mounted lights will be used for general lighting around the facility’s perimeter. No outdoor lighting will be provided except on the exterior of the proposed pump station. Pathway lighting is not a part of this design. Lighting will include cutoff-type optics (“dark sky”) to minimize light pollution and the source will be LED.

Backup Power Generator and Pad

Purchase and installation costs for a backup power generator and pad are included in this package. Available property to house the backup generator is limited. The backup generator and pad could be placed at the existing pump station building location following its demolition and removal. The City will complete both existing building demolition and generator and pad installation separately from this project. The proposed pump station electrical design should provide connections to accommodate the generator installation by others in the future.

4.6 Site Development

This section describes the proposed pump station building and site development, including underground utilities.

4.6.1 Proposed Pump Station Building and Site

During the developed condition, a new pump station will be constructed to the north and adjacent to the existing pump station. As described in Section 3.1, the existing unnamed ditch and unnamed tributary to Mill Creek are confining features on the site and restrict both the size and location where the proposed pump station may be sited.

Pump Station Siting

Available area is limited on the site for proposed pump station building construction, parking and access to the pump station, and for staging and material storage during construction. The proposed pump station design should address site constraints.

The existing sheet pile shoring along the unnamed ditch bank is secured using a tie-back and anchoring system. A portion of the existing sheet pile shoring system anchor and cables are located outside of City of Aberdeen right-of-way, within Aberdeen School District property.

It is anticipated that temporary construction easements will be required to provide sufficient room for the contractor's construction equipment, along with staging and material storage. Permanent easements and property acquisition may be required and should be evaluated during design.

Parking

A graveled parking area suitable for accommodating up to three vehicles should be provided. The parking area should be located adjacent to the proposed pump station building and should be sized to accommodate equipment capable of lifting the 100 hp pumps and motors.

4.6.2 Pump Station Access and Security

Building security should include:

- Entry sensor to pump station access door
- Wetwell hatch access sensor

Site access and security items include:

- A minimum 7-foot-high perimeter fence that encloses accessible areas on the site.
- Gated access to match existing width.
- A key card system with an electronic card reader at the entrance location. The reader would check the identification number coded into the access card and send a signal to unlock the door to an access control plan located in the electrical room.

4.7 Underground Utilities

A water main of unknown diameter crosses the existing Farragut pump station property running in a north-south direction beneath the access driveway. The depth of the utility is not known at this time and potholing or additional investigation will be required. The water main will need to be supported during construction and may need to be relocated, depending on the utility depth.

4.8 Force Main and Utility Trenching

In situ soils are anticipated to consist of very soft, saturated silts. Soils on site should be considered unsuitable for pipe backfill material. Quarry spalls may be installed at the bottom of the excavation to help provide a firm working surface. Vibratory compaction

should be avoided. Class A backfill meeting WSDOT specifications may be imported for use as backfill. A subgrade separation geotextile, placed beneath the quarry spalls, is recommended. Refer to the project geotechnical report for additional requirements.

5 Analysis of Alternatives

This section discusses the design alternatives considered.

5.1 Site Constraints and Considerations

The preliminary site layout considers site topography, obstacles, setbacks from various site features, and construction staging needs. Site considerations include:

- Minimize construction within the unnamed ditch, located west of E Harriman Street. The unnamed ditch is hydraulically connected to the unnamed tributary to Mill Creek.
- Avoid construction on the bank, outfall, and wetlands associated with the unnamed tributary to Mill Creek, located on the east side of the existing Farragut pump station property. This area is considered environmentally sensitive.
- Protect the existing Farragut pump station building, discharge structures, and outfalls.
- Maintain the setback from the existing Farragut pump station and wetwell and protect the existing pump station and facilities. The existing Farragut pump station will remain in service while the new pump station is constructed. The proposed wetwell excavation is proposed to be set a minimum of 10 feet from the existing pump station and wetwell, to allow room for shoring and stabilization of the existing building and wetwell structure.
- Avoid or minimize construction outside of the City-owned property and right-of-way.
- Minimize impact to the existing pump station power services.
- Allow sufficient room for drivable access to the proposed pump station building and to accommodate vehicular parking on site.

5.2 Alternatives Analysis and Recommendations

Three alternatives were considered with two pump intake configurations and three building sizes. One alternative considered housing the 15 hp pump in its current location, outside of the pump station building. Notable differences between the three alternatives are provided below.

5.2.1 Alternatives Overview and Comparison

Alternative A proposed replacing the 100 hp pumps with vertical-turbine pumps. The 15 hp pump would be replaced with a submersible pump. All of the pumps and motors would be housed within the building. Figure 4, located in Appendix A, contains a site plan overview depicting the building, pump, and piping locations. This alternative required the larg

est building footprint and would require property acquisition to accommodate the building and allow for on-site parking.

Alternative B proposed replacing the 100 hp pumps with submersible pumps. The 15 hp pump would be replaced with a submersible pump. All three pumps and motors would be housed within the building. Figure 5, located in Appendix A, contains a site plan overview depicting the building, pump, and piping locations. A smaller wetwell could be used with the submersible pumps and this reduced the building footprint from that shown in Alternative A. Property acquisition or an access easement would be required with this alternative to accommodate the building footprint.

Alternative C would replace all three pumps with submersibles. As a submersible, the 15 hp pump and motor could be located outside of the building and is shown at the same location as the existing 15 hp pump. Figure 6, located in Appendix A, depicts the conceptual site plan and building footprint. Figure 7, located in Appendix A, contains a cross section for Alternative C. In this alternative a wetwell may be required to house the 15 hp pump and motor. Additional investigation that includes survey, field measurements, and available records would be needed to determine the type and extent of facility retrofits or replacement that would be required.

Table 5-1 provides a comparison of notable differences between the three alternatives considered.

Table 5-1. Alternative design comparison summary

Item description	Alternatives analysis summary overview		
	Alternative A	Alternative B	Alternative C
Alternative description	100 hp vertical axial pumps All pumps in the building	100 hp submersible pumps All pumps in the building	100 hp submersible pumps 15 hp pump separate
Total project cost	\$10.3 M	\$9.6 M	\$9.0 M
Land purchase or permanent easement required	Yes	Yes	No
Water line and other utility relocates required	High probability	High probability	Low probability
Building			
Construction material	CMU block	CMU block	CMU block
Interior dimensions	35' 6" long × 16' 6" wide	26' 0" long × 16' 6" wide	20' 0" long × 16' 6" wide
Interior height	Varies: 9' 4"–10' 0"	Varies: 9' 4"–10' 0"	Varies: 9' 4"–10' 0"
Pump access hatches	Three: 5' × 5'	Three: 5' × 5'	Two: 5' × 5'
Pump station wetwell			
Construction	CIP concrete	CIP concrete	CIP concrete
Interior dimensions	33' long × 28' wide	24' long × 28' wide	18' long × 28' wide
Mechanical trash rack			
Rack opening dimensions	25' wide × 15' high	16' wide × 15' high	12' wide × 15' high

Item description	Alternatives analysis summary overview		
	Alternative A	Alternative B	Alternative C
15 hp pump (duty)			
Manufacturer	Vaughn	Vaughn	Vaughn
Type	Axial-flow, propeller, submersible	Axial-flow, propeller, submersible	Axial-flow, propeller, submersible
Location	In building	In building	Outside building
Two 100 hp pump control settings (peaking)			
Manufacturer	Morrison	Flygt	Flygt
Type	Vertical axial-flow, propeller	Submersible	Submersible

5.2.2 Recommended Alternative

HDR selected Alternative C as the preferred alternative for the proposed Farragut pump station. This option provides:

- Reduced building footprint
 - Requires less property for construction, access, and vehicle parking
 - Allows space for larger equipment to lift the pumps
- Lower capital cost alternative
- Reduced construction footprint and impacts to the unnamed ditch
- Reduced time of construction to help meet seasonal construction constraints for in-water work required for fish protection.

6 Preliminary Design

Preliminary design details for the recommended alternative are provided below.

6.1 Pump

The proposed pump station peak design flow rates and key water surface elevations presented in Section 4.5 were used to determine the station pump size. The preliminary 100 hp pump selection was provided from the Whitney representative for a shrouded, mixed-flow impeller submersible pump that is housed within an L-column pipe casing. The preliminary 15 hp pump selection was provided by the PumpTech, LLC representative for a submersible chopper pump that will be housed within a wetwell. Table 6-1 presents preliminary pump design criteria for the selected alternative.

Table 6-1. Selected alternative preliminary pump design criteria

Pump selection summary	Criterion
General pump information	
Conditions	High flow and low head
15 hp pump (duty)	
Brand	Vaughn
Type	Impeller submersible chopper pump
Motor	3 phase Rated 860–865 rpm 7.5–15.0 hp with a VFD
Design flow range	400–1,500 gpm
High TDH range	+/-8'–12'
Discharge pipe diameter	8"
Discharge location	Connect to existing 8" pipe (to outfall)
100 hp pump control settings (peaking)	
Brand	Flygt LL 36 2/776
Number of pumps	2
Type	Mixed-flow, impeller (stainless steel) w/bowl type diffuser pump casing
Motor	3-phase, rated 500 rpm 460 V rated voltage, VFD
Installation type	L-column pie (wet)
Pump discharge diameter	47¼"
Type	Axial-flow, propeller
Design flow range (individual pump)	17,000–21,000 gpm
Design combined maximum flow	42,000 gpm
High TDH range	±6'–14'
Discharge pipe diameter (per each pump)	30"

The 100 hp pump curve overlaid with the system curve is provided in Figure 6-1.

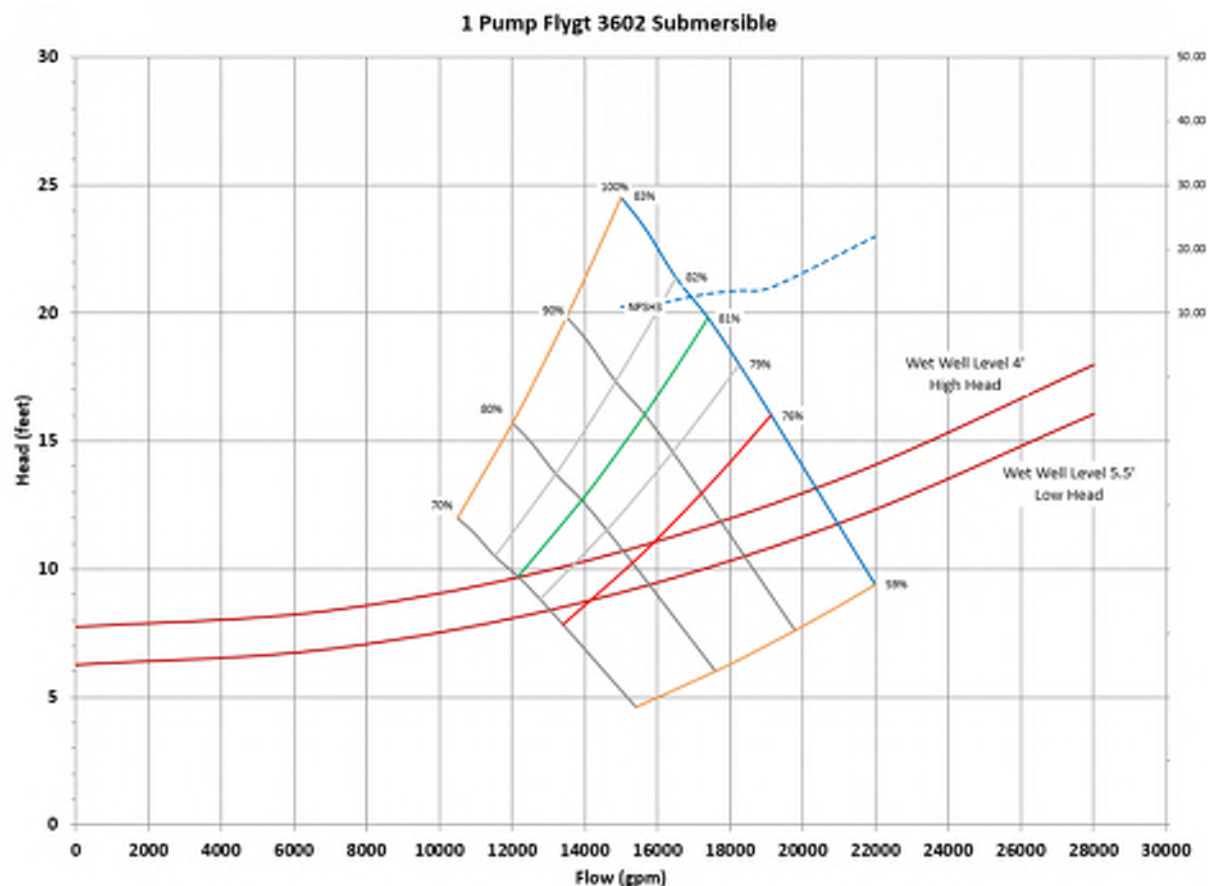


Figure 6-1. 100 hp system curve and Flygt 3602 pump curve

Information, system calculations, and pump curves for the pumps considered in the alternative analyses, including the 15 hp Vaughn pump, are provided in Appendix E.

6.2 Proposed Pump and Well Design

The wetwell for the 100 hp submersible pumps will be cast in place. Details on the preliminary wetwell sizing parameters are discussed in Section 4.5.3. The selected alternative proposes a concrete CIP wetwell with interior dimensions of 18 feet long by 28 feet wide. The 15 hp submersible pump wetwell will be housed outside of the building at the same location as that of the existing 15 hp pump. While additional information and survey are required as the project progresses into the design stage, a CIP concrete wetwell that is approximately 8 feet wide by 8 feet long was assumed for the purposes of cost estimating.

6.2.1 Wetwell

A mechanically operated trash rack with fish barrier screen will be provided to cover the 100 hp pump wetwell. The 15 hp pump is located separate from the 100 hp pump wetwell. For the 15 hp pump, it is assumed that the existing trash rack and sluice gate system may be used.

The pumps are submersibles and access will be provided for both viewing the well and for pump removals. Additional hatches or manholes will be sited over the wetwell, located on the concrete deck that is outside of the proposed pump station building.

6.2.2 Force Main Piping and Discharge

Each 100 hp pump has a separate 30 inch force main pipe that conveys flows from the pumps to the existing pump station discharge structure. The 15 hp pump will discharge flows to a new 8 inch force main pipe that connects to the existing 8 inch force main pipe outfall.

The proposed pump station force main piping will connect to the existing piping systems upstream of each pipe outfall. Existing pipe outfalls, discharge structure, slope and area adjacent to the wetland and unnamed tributary to Mill Creek undisturbed. Refer to Figure 4, Figure 5, and Figure 6 for an overview of the force main piping proposed for each alternative.

6.3 Building and Foundations

This section describes the building and foundation design.

6.3.1 Building and Materials

A CMU building with a wood-framed roof is proposed for the new building. The building would have a concrete floor slab. Because of the proximity of the existing pump station, the doorway and building access is assumed to be from the north side. While a single door is shown on the conceptual plan drawings, a double door or widened access may be considered to facilitate moving equipment and maintenance access.

6.3.2 Building Roof

The roof material may be traditional shingle or galvanized metal. The proposed roof details and materials will be coordinated with the City during design. Two hatches will be provided in the roof that will be sized to accommodate removal and replacement of the 100 hp submersible pumps and motors selected.

6.3.3 Structural Foundations

The building would have a concrete floor slab and grade beams over the top of the wetwell and would be supported by steel H-piling to prevent settlement. The steel piling is anticipated to extend 100 to 120 feet deep to reach competent bearing soils; however, additional subsurface exploration would be required to confirm the necessary pile depth.

6.4 Existing Pump Station Demolition and Staging

The existing Farragut pump station, pumps, and wetwell will remain in service during construction. Demolition of the existing pump station, along with removal and salvage of the equipment, pumps, and 100 hp motors, will be completed separately by the City. Staging will be required to allow the existing pumps and associated discharge piping to

remain operational until the new pump station and pumps are deemed operational, tested, and accepted.

Because removal of the 15 hp pump is necessary to install the replacement pump, the existing 15 hp pump removal, salvage, and delivery to the City will be included with this package. The existing 15 hp pump runs nearly continuously. The design should include considerations for phasing as needed to maintain continuous pumping while the new 15 hp pump and intake vault are installed.

6.5 Shoring and Excavation

This section provides information on shoring, excavation, and dewatering for the site. Refer to the project Geotechnical Report (Appendix C) for additional requirements.

6.5.1 Shoring

The proposed wetwell for the 100 hp pump will be constructed of braced sheet piling. This allows the shoring for the excavation work to remain in place as the permanent wetwell walls. The top of the sheet piling will be braced with steel walers as excavation progresses downward to the design elevation. A concrete floor seal will then be cast and cured in the bottom of the wetwell, and the top walers can be removed prior to constructing the building. The wetwell for the 15 hp pump will also require shored excavation work.

The existing sheet pile shoring, located along the western bank of the unnamed ditch, is showing signs of corrosion. Because of the pump station age and condition of the exposed shoring system, it is anticipated that the anchoring system condition may also be degrading, and it is recommended that they be replaced. Several existing wall anchors will be displaced to construct the new wetwell for the 100 hp pump, so temporary bracing of the affected wall segment is anticipated during excavation. Portions of the existing sheet pile shoring anchoring system are located outside of City property and within the school district property and it may be necessary to obtain construction and/or permanent easements. Figure 8, located in Appendix A, presents the structural design shoring concept.

Excavated soils will be saturated and unsuitable for use as backfill and foundation material. Available property that is owned by the City is limited. It is anticipated that a temporary construction easement may be needed to accommodate staging, stockpiling, and material storage during construction.

6.5.2 Temporary Screening and Fencing

The project is located adjacent to Miller Junior High School. Temporary fencing (minimum of 6 feet high) with screening and gated access with locks should be provided to discourage access to the site during construction. Additional measures may be identified during design to limit or restrict access to the site during construction.

6.5.3 Dewatering

Groundwater is estimated to be approximately 5 feet below the ground surface and fluctuates seasonally, with differing local subsurface conditions, the weather, or other

factors. Maximum groundwater levels are anticipated to occur during late winter and early spring. Dewatering of groundwater will be required for construction of the new pump station and wetwell. Details concerning groundwater are discussed in the Geotechnical Report prepared by Landau. A copy of this report is provided in Appendix C.

Construction is proposed within the unnamed ditch channel that is on the intake side of the existing pump station. This ditch was categorized as a wetland and as a fish-bearing stream. It is likely that fish exclusion and dewatering of the ditch section will be required prior to any work within the ditch. Timing and other work restrictions or limitations will be addressed within the HPA and NWP approval letters expected to be issued by WDFW and USACE, respectively.

The project design should address mitigation, staging, and erosion control measures and should provide for protection of the ditch and area waterways while dewatering and during construction.

6.5.4 Intake and Ditch Improvements

Construction and excavation within the unnamed ditch is anticipated to install the wetwell screens, and to grade the ditch so that flows may enter the new pump station wetwell unimpeded. Construction in the ditch and along the east ditch bank of the unnamed ditch will be necessary to remove and replace the existing shoring system and tie-backs. It is recommended that the designer coordinate with the City to determine if any construction will be required to facilitate future demolition of the existing pump station, wetwell, and intake.

Excavation may be required to install a wetwell and intake for the 15 hp pump replacement but is not anticipated at this time. Additional information, including survey, should be obtained on the existing 15 hp pump, intake, screens, piping, and discharge as the project moves into design.

6.6 Proposed Site Improvements

Above-grade site improvements outside of the proposed pump station building include installation of a generator, fuel tank, concrete pad, and enclosure; perimeter fence and access gate; and replacement of the graveled driveway and parking areas. No other above-grade structures or improvements are anticipated at this stage of design.

6.6.1 Site Security and Access

Recommended pump station access and security items are outlined in Section 4.6.2. The improvements include installation of perimeter fencing with locked gates and access system, access entry systems, and lighting at the building entrance. Other security features such as motion detector lights should be coordinated with the City during design.

6.6.2 Parking

The existing site and parking area are graveled. The graveled parking area will be located adjacent to the proposed pump station building.

7 Legal Considerations

The proposed pump station site, unnamed ditch, and building are partially located on City-owned property (parcel 029100700101) with the remaining portions and access located within the Farragut Street right-of-way, and within an unnamed right-of-way for the unnamed ditch. Access to the property is controlled by the City.

The existing Farragut pump station unnamed ditch shoring anchoring system is partially located on parcel 317091521001, addressed as 100 E Lindstrom Street. This parcel is owned by Aberdeen School District 5. It is anticipated that construction, temporary, and/or permanent easements will be required to:

- Remove the existing shoring anchoring system and install new
- Allow room for staging, storing, and stockpiling material during construction

Easements may be required to allow for maneuvering of the lifting crane or larger equipment. The maneuvering, turning movements, and parking space locations should be evaluated during design.

8 Operations and Maintenance Considerations

The project will abandon the existing pump station once the new pump station is constructed and operational. It is anticipated that routine operations tasks and frequencies, as well as preventive maintenance tasks and frequencies, are expected to be similar to those for the existing pump station.

Operations and maintenance costs are expected to be less than those for the existing pump station because of installation of new mechanical screens. No change in the required operator certification is anticipated because of this project.

9 Project Schedule

It is anticipated that there may be scheduling constraints because of weather, stormwater, or environmental considerations that affect the overall construction schedule and delivery. These should be reviewed early in the design progression.

The implementation strategy is to leave the existing pump station and two 100 hp pumps in operation while the new pump station is under construction. A portable temporary pump may be required while the existing 15 hp pump is being replaced with the new submersible pump.

Once the new pumps and wetwell are operational, the old pump station will be decommissioned. Removal of the existing pump station equipment, building, and wetwell demolition will occur separately and is not considered a part of this project.

The current timeline is for the bid documents to be completed for the proposed pump station and associated installations to be completed and advertised by November 2022.

Because of recent material procurement and supply-chain issues that are endemic within the industry, construction may commence between spring and fall 2023 (weather permitting).

The preliminary schedule is presented in Table 9-1.

Table 9-1. Preliminary project schedule

No.	Construction event and sequencing	Estimated schedule milestone event
1	Design and bid	8/2022–1/2023
2	Bid award	2/2023
3	Contractor early ordering and procurement of critical materials	3/2023–7/2023
4	Construction (presented in detail below)	5/2023–11/2023
	Contractor mobilization to the site, temporary erosion and sediment control (TESC) implementation, installation of temporary perimeter fence	
	Stabilization and/or removal of the existing shoring walls and anchoring system	
	Wetwell shoring and excavation	
	Wetwell, concrete deck, and building foundation construction	
	Grading within the unnamed ditch channel and shoring replacement	
	Pump station construction	
	Install pumps and piping	
	Install site improvements, fencing, and security	
	Startup and testing	
	Decommission existing pump station	
	Demobilization and cleanup	

10 Project Cost

This section includes details about the methodology used to develop the preliminary Class 4 cost estimates for each of the design alternatives considered. The methodology, supporting tools, and techniques used to develop the cost estimates aligned with AACE standards and Total Cost Management (TCM) practices for a Class 4 estimate (AACE 2020a).

Cost estimates for the selected alternatives were developed from calculated quantities based on a conceptual layout for each alternative. Refer to Section 5.2.1 and Table 5-1 above for a comparison and description of the three alternatives considered. The estimated quantities included materials, equipment, and labor costs and assumed that standard construction methods would be used. Direct construction costs were generated from historical allowances, referenced sources (i.e., WSDOT Unit Bid Analysis Cost Construction Tool), regional construction market pricing, and the historical databases of the estimating provider. Allowances were used where information was insufficient to develop specific design or quantity assumptions.

Indirect non-construction costs were based on AACE recommended practice for a Class 4 estimate. All costs included in the estimate reflected the best understanding of requirements and the known and defined scope as developed with limited information and limited engineering.

10.1 Accuracy of Estimate and Range

The accuracy of an estimate varies depending on the methods used, the amount of information available, and the time available to prepare the estimate. AACE classifies estimates into six classes: Unclassified/Class 10 and Classes 5, 4, 3, 2, and 1 (AACE 2020b).

The proposed Farragut pump station alternative estimates were designated and prepared as Class 4. A Class 4 estimate has an expected accuracy range of -30 percent to +50 percent. The AACE-recommended estimate allowance factors and expected accuracy range are listed in Table 10-1. Estimated costs for each alternative are presented in Table 5-1 above and the cost estimate summary sheets are provided in Appendix H.

Table 10-1. AACE estimate class allowances and expected accuracy range

AACE estimate class	Uncertainty allowance	Indeterminates allowance	Change order allowance	Project contingency	Expected accuracy range
5	5%	25%	10%	30%	-50% to +100%
4	3%	20%	10%	25%	-30% to +50%
3	2%	15%	10%	15%	-20% to +30%
2	1%	10%	10%	10%	-15% to +20%
1	0%	0%	10%	5%	-10% to +15%

Source: AACE International Recommended Practice 18R-97 (AACE 2020a).

11 References

AACE (Association for the Advancement of Cost Engineering) International

2020a AACE International Recommended Practice 18R-97. Cost Estimate Classification System. August.

2020b AACE International Recommended Practice 17R-97. Cost Estimate Classification System. August.

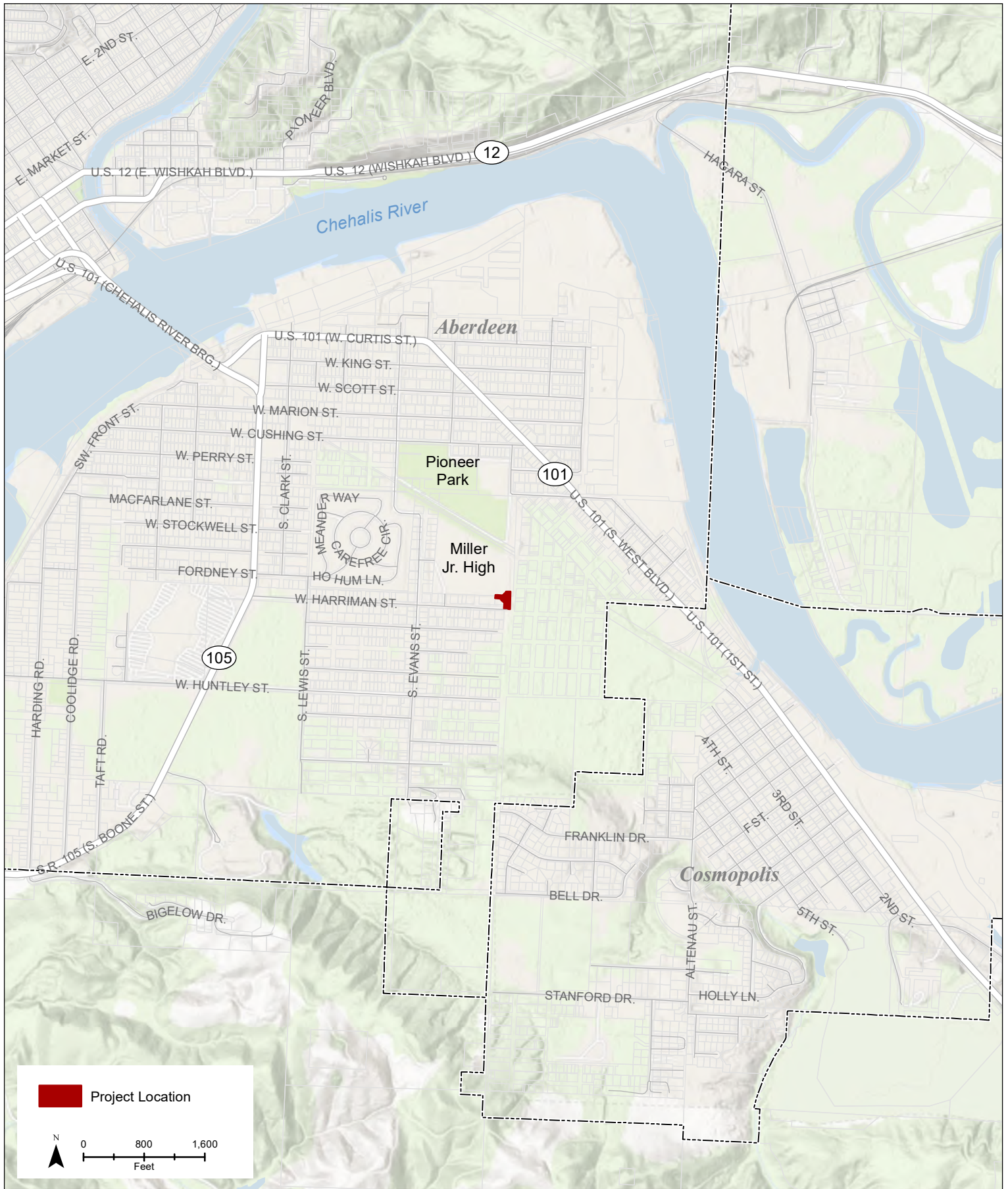
2019 State of Washington Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW). July.

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Appendix A. Figures

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**FIGURE 1
VICINITY MAP**



FARRAGUT PUMP STATION DESIGN
CITY OF ABERDEEN

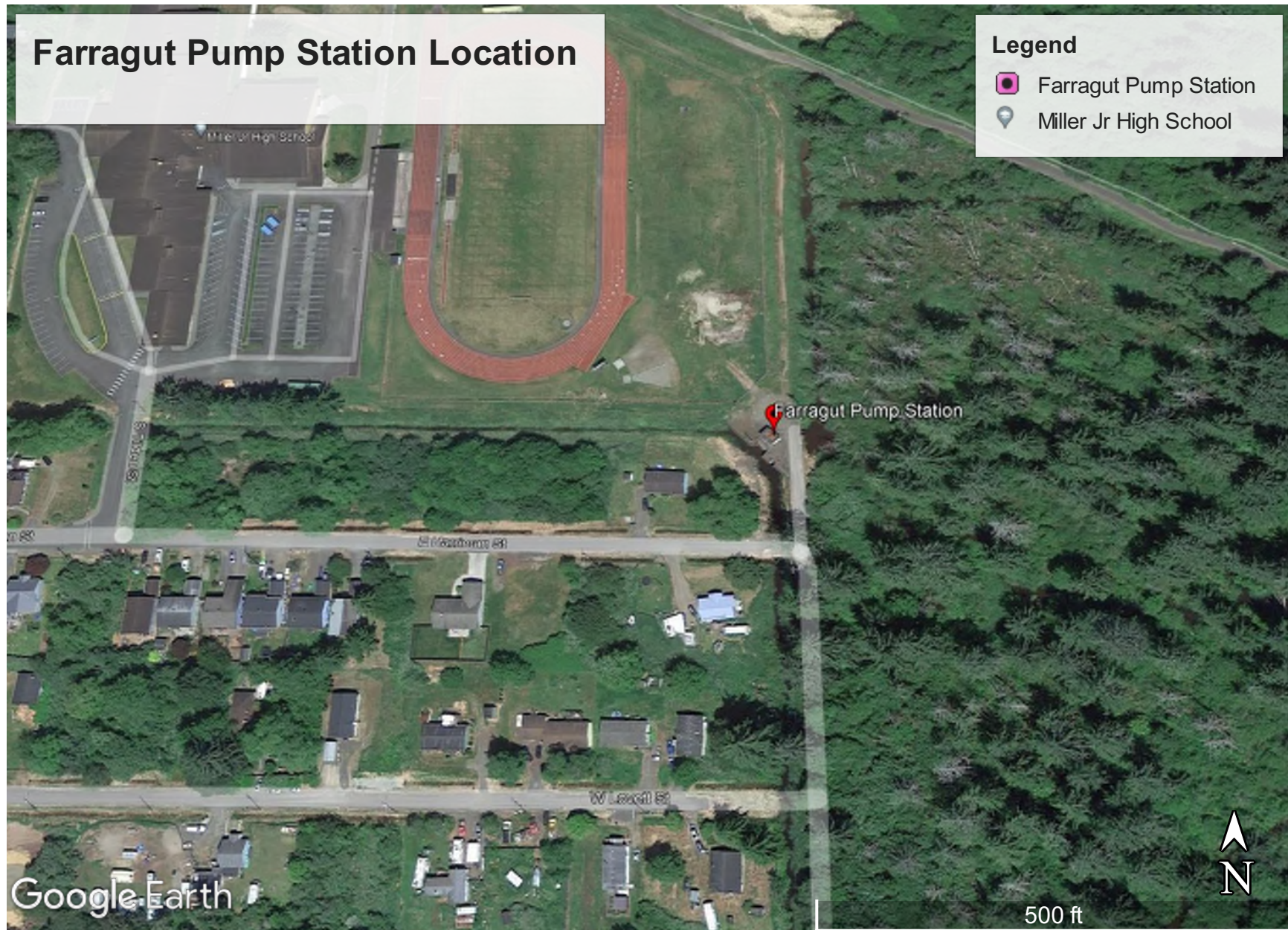


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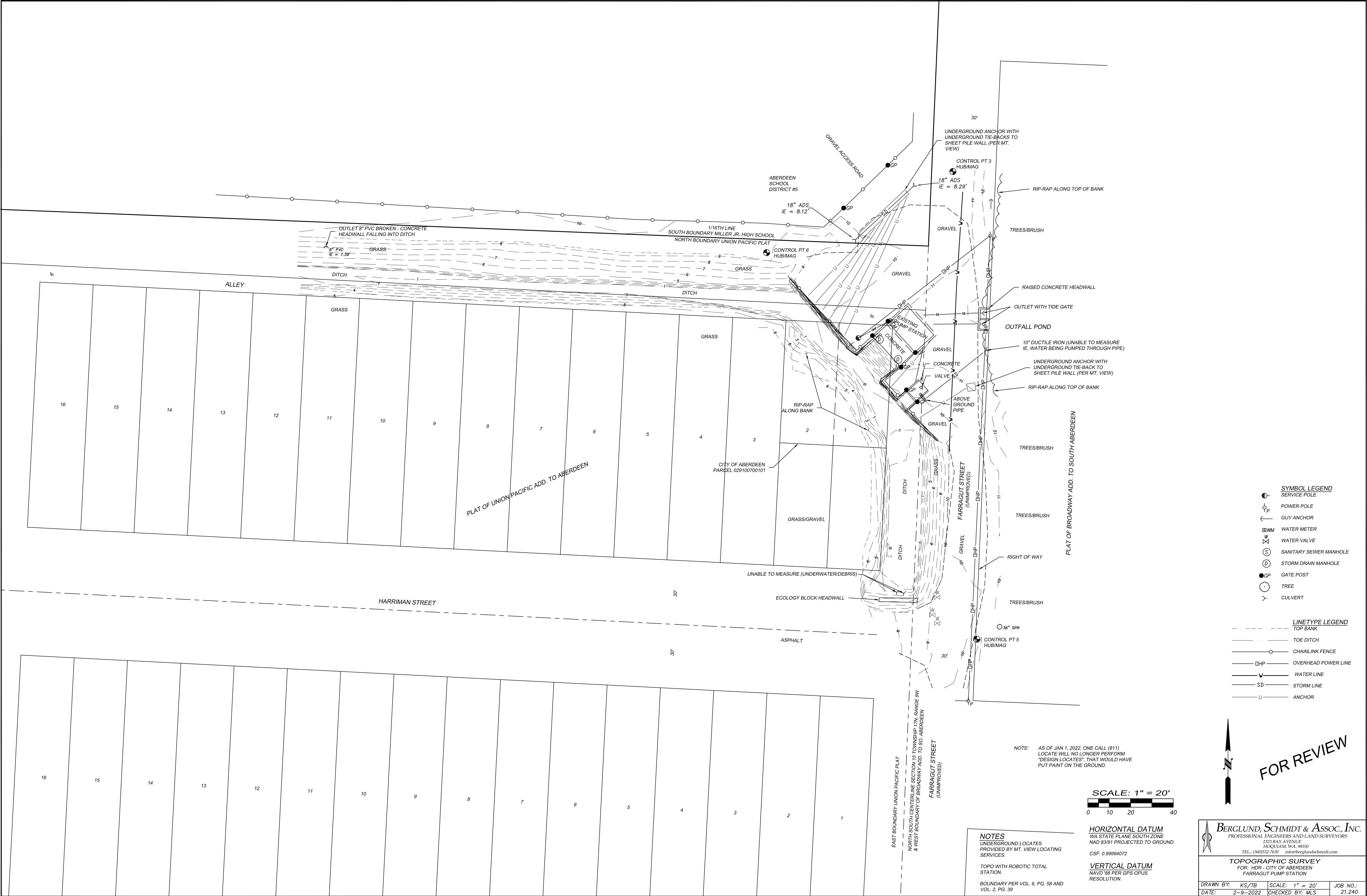
Farragut Pump Station Location

Legend

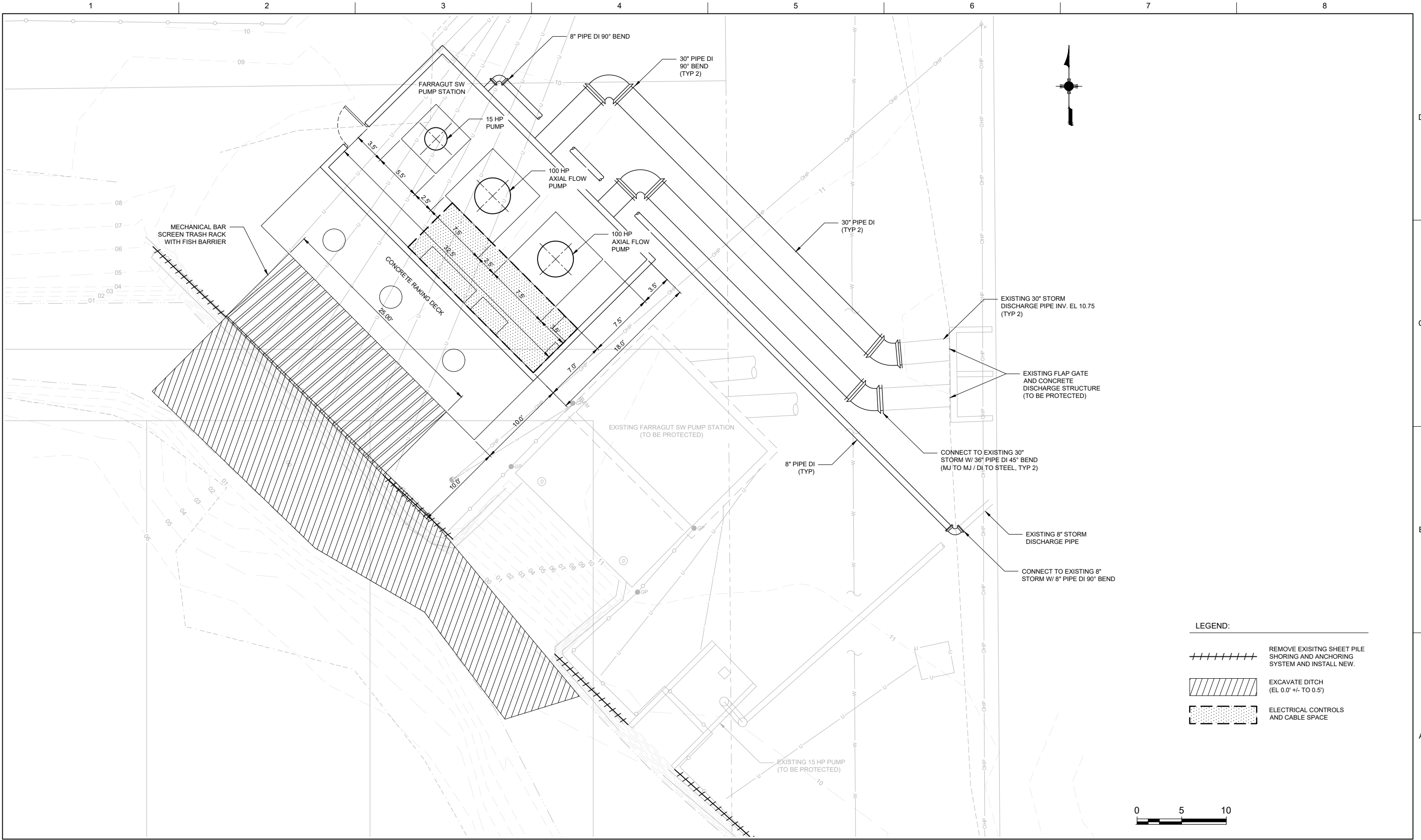
-  Farragut Pump Station
-  Miller Jr High School



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	CINDY KINZER
PROJECT NUMBER	10333386

PRELIMINARY DESIGN
(NOT FOR CONSTRUCTION)

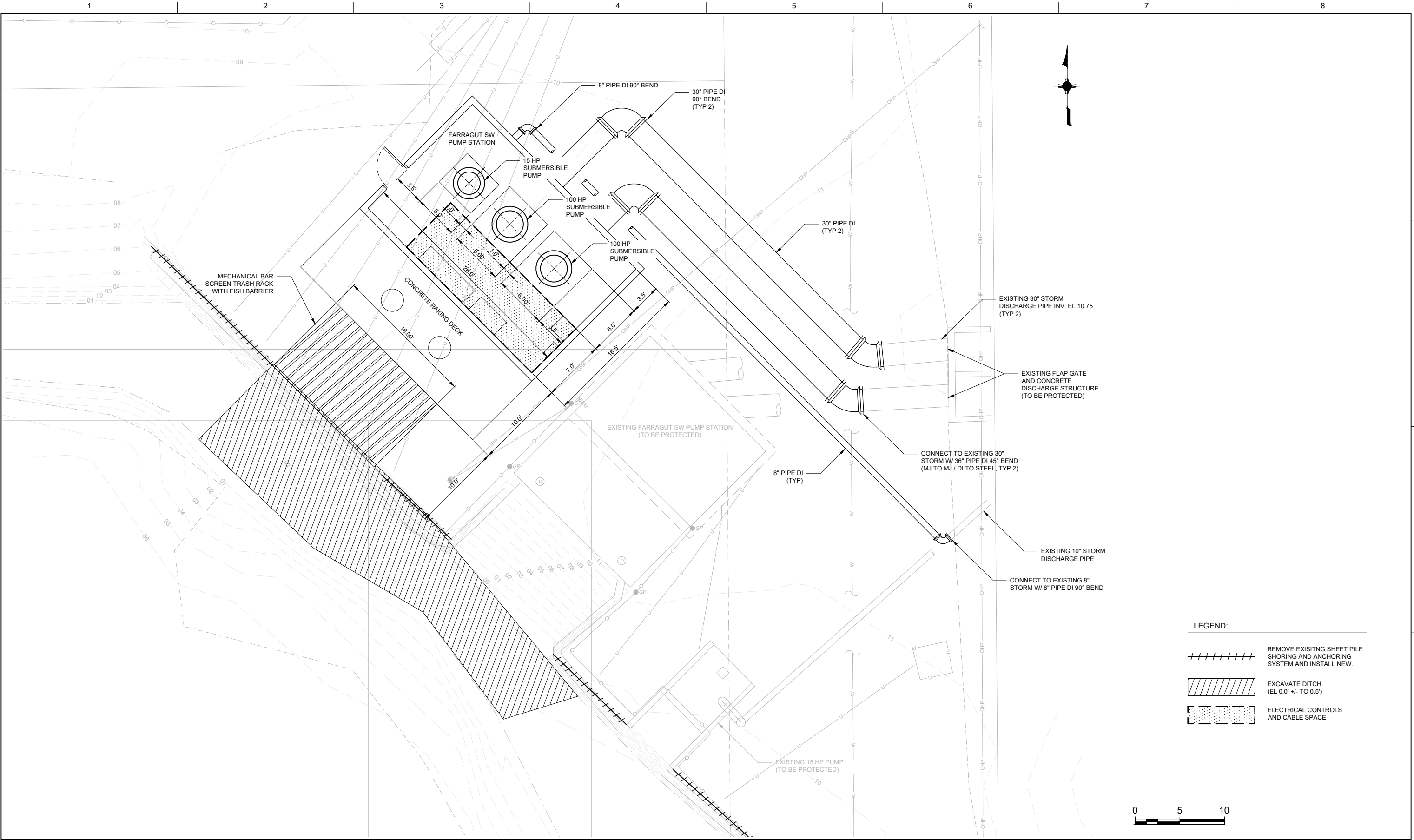


ABERDEEN FARRAGUT
STORMWATER PUMP STATION

SITE PLAN - ALTERNATIVE A
(100 HP AXIAL FLOW PUMPS)

DATE 06.17.2022

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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	CINDY KINZER
PROJECT NUMBER	10333386

PRELIMINARY DESIGN
(NOT FOR CONSTRUCTION)

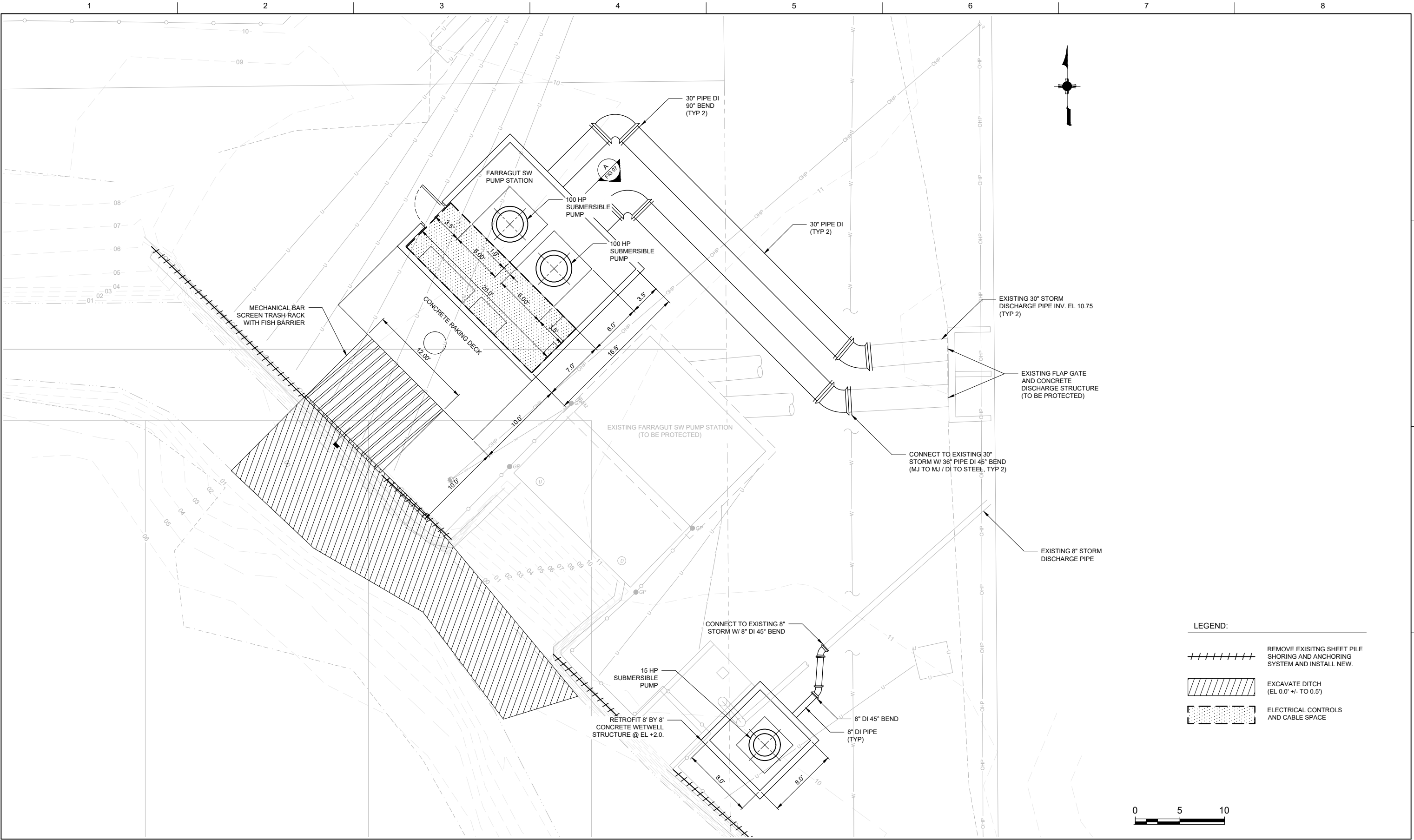


ABERDEEN FARRAGUT
STORMWATER PUMP STATION

SITE PLAN - ALTERNATIVE B
(100 HP SUBMERSIBLE PUMPS
WITH 15 HP OUTSIDE OF BUILDING)

DATE 06.17.2022

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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER		CINDY KINZER
PROJECT NUMBER		10333386

PRELIMINARY DESIGN
(NOT FOR CONSTRUCTION)

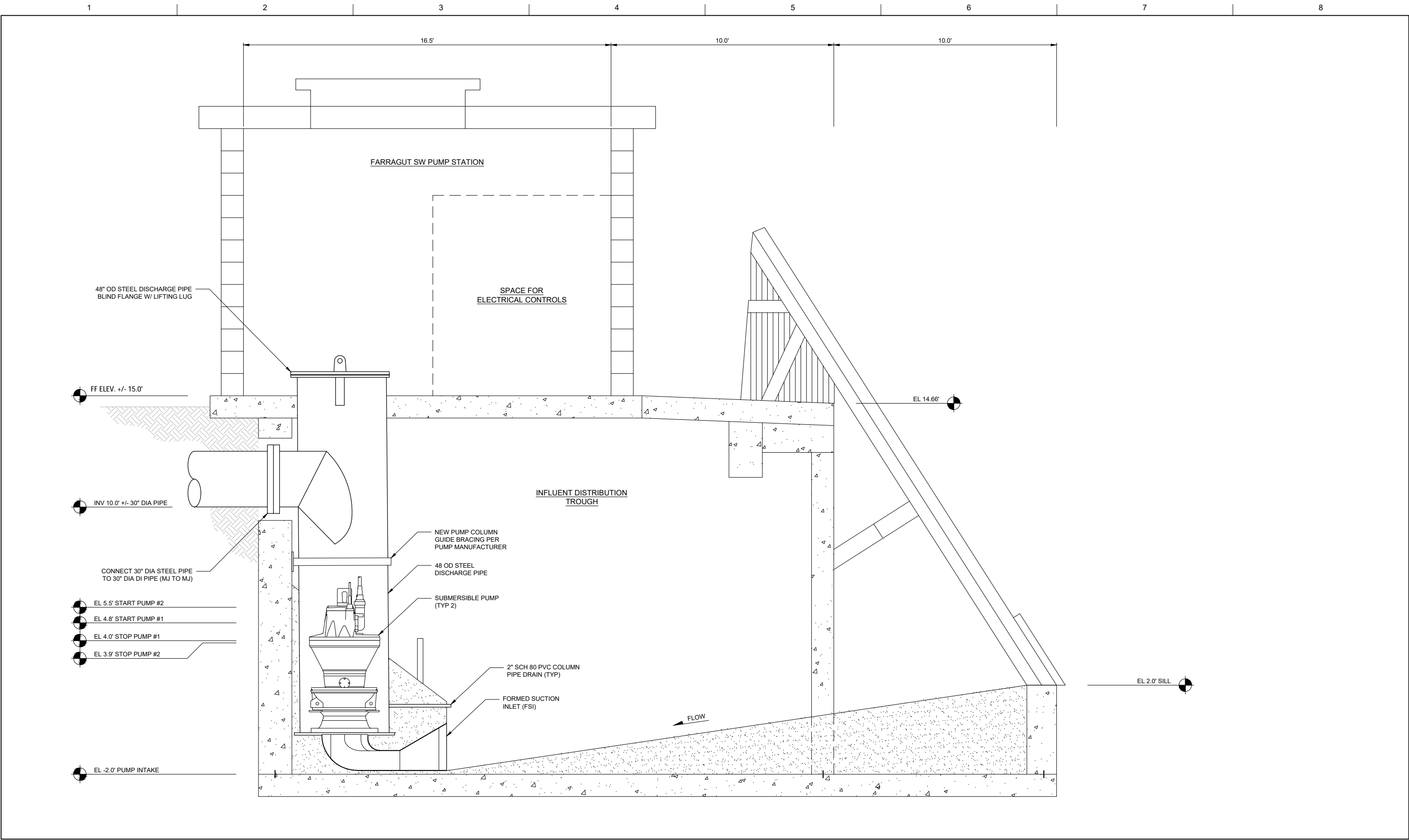


ABERDEEN FARRAGUT
STORMWATER PUMP STATION

SITE PLAN - ALTERNATIVE C
(SUBMERSIBLE PUMPS WITH
15 HP PUMP OUTSIDE THE BUILDING)

DATE 06.17.2022

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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	CINDY KINZER
PROJECT NUMBER	10333386

PRELIMINARY DESIGN
(NOT FOR CONSTRUCTION)



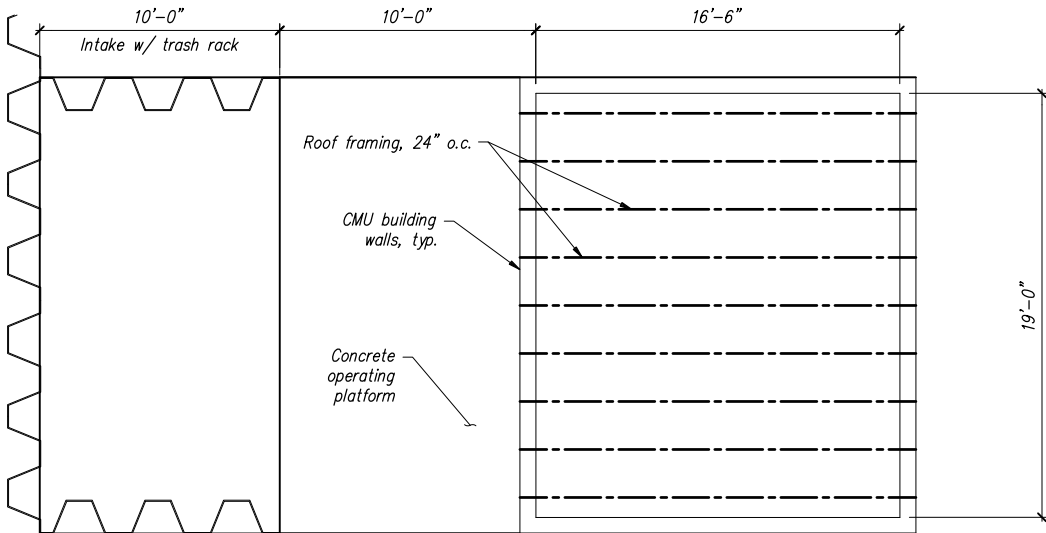
ABERDEEN FARRAGUT
STORMWATER PUMP STATION

ALTERNATIVE C
PUMP STATION SECTION A

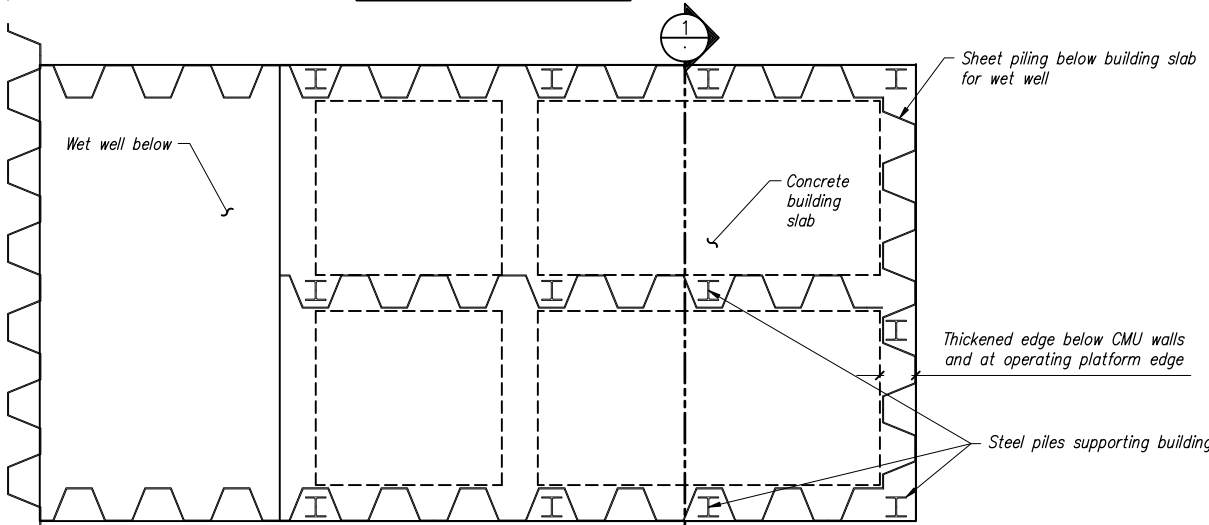
DATE 06.17.2022

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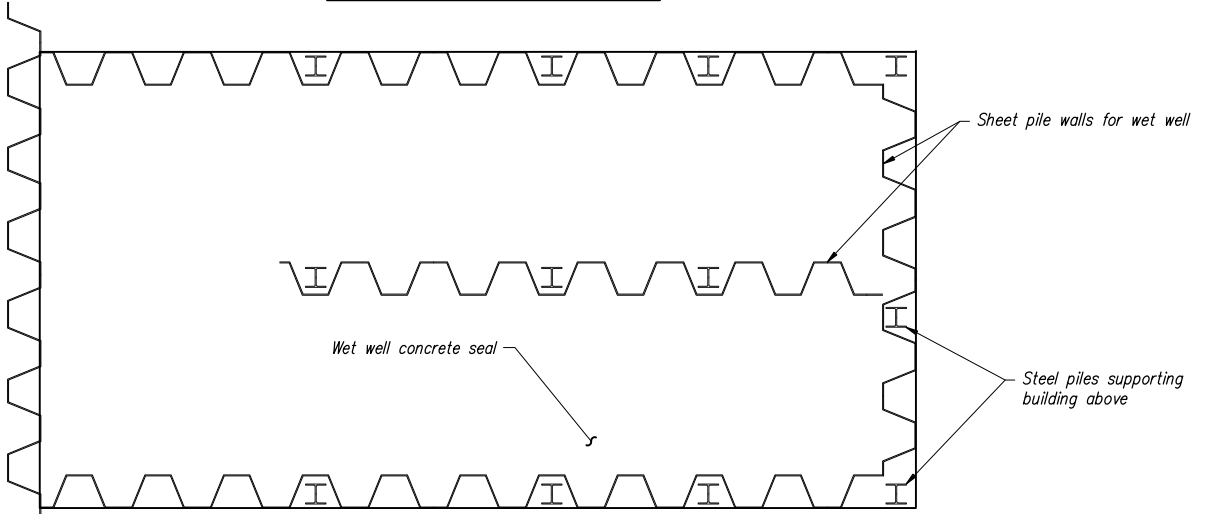
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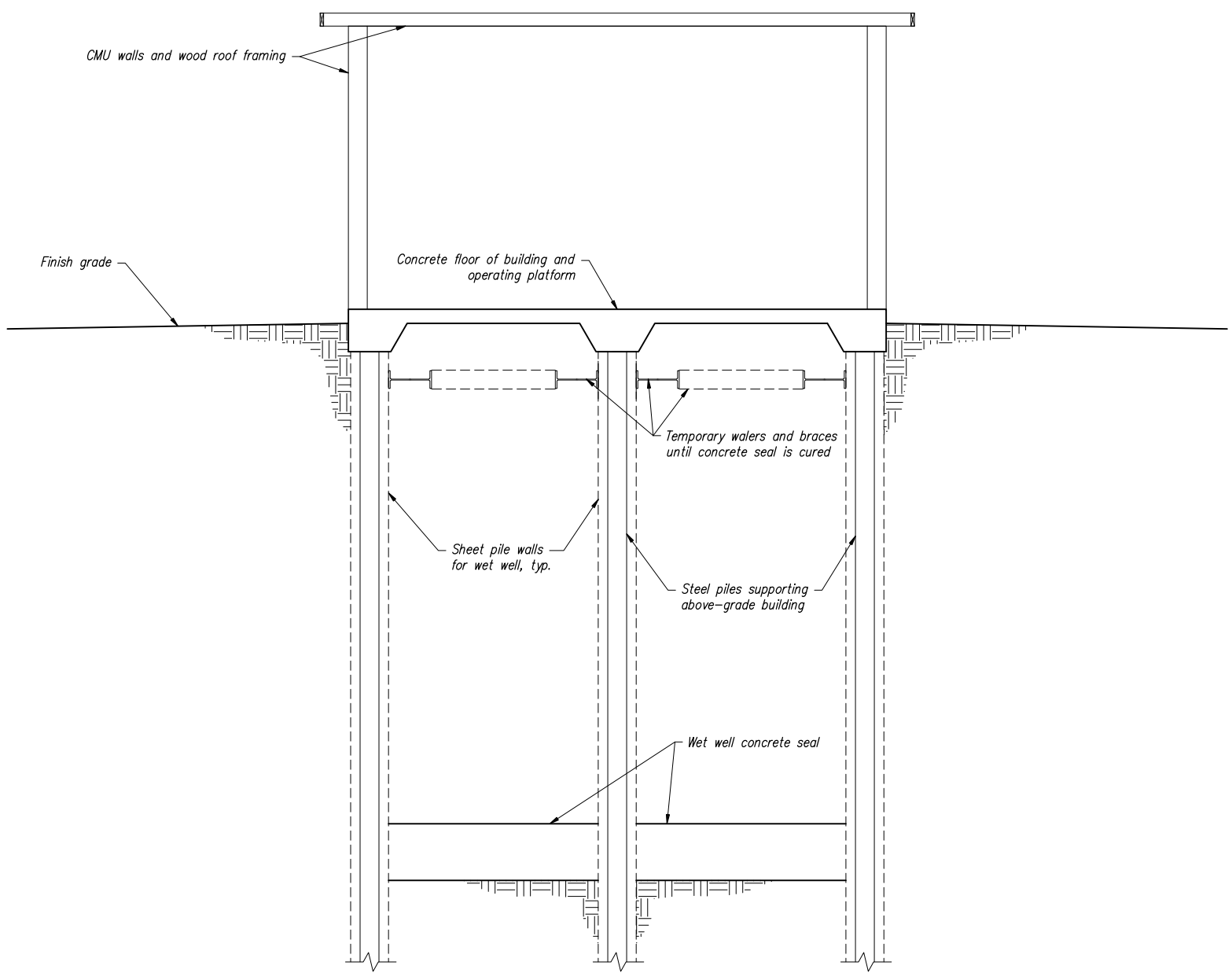
ROOF FRAMING PLAN



BUILDING FOUNDATION PLAN



WET WELL PLAN



SECTION: TYPICAL PUMP HOUSE CONSTRUCTION

1
—

PLEASE CALL 811 BEFORE YOU DIG

SARGENT
SARGENT ENGINEERS, INC.
320 Ronlee Lane NW • Olympia, WA 98502
Tel. 360 867-9284 • Fax 360 867-9318

HDR



DRAWN BY	DESIGNED BY	CHECKED BY	SCALE	DATE
RWL	RWL	JSS		
NO.	REVISION	BY	REVIEW	DATE

LINE IS 1/8" INCH
AT FULL SIZE
(IF NOT 1" = SCALE ACCORDINGLY)

CITY OF ABERDEEN
PUBLIC WORKS DEPARTMENT
FARRAGUT STORMWATER PUMP STATION
ALTERNATIVE C

SHEET NAME
**

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Appendix B. Permit Matrix

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Potential Permits	Regulated Activity	Submittal Requirements	Permit Review Timeline	Comments
Federal				
US Army Corps of Engineers (USACE) Section 404 Permit	A Section 404 Permit is required for any project that involves the excavation or discharge of dredged or fill material in waters of the United States (rivers, streams, ditches, wetlands).	<ul style="list-style-type: none"> JARPA Form Drawings to Corps standards ESA Documentation Wetland/Stream Delineation Conceptual Mitigation Plan Section 106 Documentation NEPA/SEPA Documentation 	12-18 months	Permit valid for up to 5 years from date of issuance. Typically prepared and submitted at 30% design level.
U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) Section 7 Endangered Species Act (ESA) Compliance	Before the Corps can issue the Section 10/404 Permits, they must consult with the USFWS and NMFS to ensure the project would not jeopardize the continued existence of any federally listed species or adversely modify designated critical habitat for any ESA-listed species.	<ul style="list-style-type: none"> No Effect Letter or Biological Assessment (BA) Associated maps, figures and drawings 	Concurrent to Corps permit process	This consultation must be completed before the Section 404/10 Permits can be approved by the Corps. Pre-consultation with the Services is recommended to expedite the permitting process. Typically prepared and submitted at 30% design level.
State				
Washington Dept. of Archaeology and Historic Preservation (DAHP) Section 106 Review (federal permit administered by State agency)	Projects receiving federal funding, licenses, or permits.	<ul style="list-style-type: none"> Historical/Cultural Resources Assessment Inadvertent Discovery Plan 	Concurrent to Corps permit process	The Corps will review through their permitting process. As part of this, consultation with Tribes is conducted with notices and opportunity for comment. Typically prepared and submitted at 30% design level.

Potential Permits	Regulated Activity	Submittal Requirements	Permit Review Timeline	Comments
Washington Department of Fish and Wildlife (WDFW) Hydraulic Project Approval (HPA)	Required for work below the ordinary high water mark (OHWM) of state waters and adjacent areas.	<ul style="list-style-type: none"> • HPA Application (online; uses JARPA form) • Project Plan Set, including plans and specs for work waterward of OHWM • Plans and specs for fish protection • SEPA Determination 	Most within 45 days or less of receipt of a complete application	<p>Suggest early coordination with WDFW (along with Corps/Ecology/Tribes) to keep all agencies up to date on project.</p> <p>Typically prepared and submitted around 90% design, since this is a fast turn-around permit.</p> <p>Online-only submittal.</p>
Local				
City of Aberdeen Preliminary Consultation	Project proponents can request a preliminary consultation prior to submitting an application for a development (including Grading permit).	<ul style="list-style-type: none"> • Stream/Wetland Delineation and/or Report • Letter requesting preliminary consultation, which includes questions to be asked at consultation meeting. 	Held within a few weeks of preliminary consultation request	Submit online via the City's Permitting Portal.

Potential Permits	Regulated Activity	Submittal Requirements	Permit Review Timeline	Comments
Grading Permit with Critical Areas Review or Critical Areas No Impact Waiver	<p>A Grading Permit is required for most site work including but not limited to the following:</p> <ul style="list-style-type: none"> Clearing, grading, excavation, earthwork 	<ul style="list-style-type: none"> Signed Permit Application(s) Construction Plans (Site Plans, TESC Plans, Grading/Paving Plans, Stormwater or Drainage Plan, Utilities Plan, Frontage Improvements Plan, Landscaping Plan) Reports (Drainage, Geotech, etc.) 	TBD	<p>Email submittal or drop-off.</p> <p>Typically prepared and submitted at 90% design level.</p>

Appendix C. Geotechnical Report

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Draft Technical Memorandum

TO: Ty Johnson, PE, HDR Engineering, Inc.
FROM: Calvin McCaughan, PE
DATE: April 1, 2022
RE: **Summary of Geotechnical Engineering Services
Farragut Street Pump Station
Aberdeen, Washington
Project No. 0122061.010.011**

Introduction

This memorandum summarizes the results of geotechnical engineering services provided by Landau Associates, Inc. (Landau) in support of the Farragut Street Pump Station project, located at the east end of Harriman Street in Aberdeen, Washington (site; Figure 1). Services were provided in accordance with the scope outlined in the subconsultant agreement between Landau and HDR Engineering, Inc. (HDR; project civil engineer), executed December 31, 2021.

This report has been prepared with information provided by HDR and with data collected during Landau's geotechnical field exploration and laboratory testing programs.

Project Understanding

The City of Aberdeen (City; project owner) proposes to decommission a stormwater pump station, located at the north end of Harriman Street, and replace it with a new pump station. Landau understands that ground surface settlement at the site has been severe. Project plans include replacement of a leaning bulkhead at the pump station intake. Landau understands that seismic design will not be required for the proposed improvements.

Site Conditions

The following sections describe the geologic setting of the site and surrounding area and the surface and subsurface conditions observed during the field investigation. Interpretations of site conditions are based on Landau's review of available geologic data and on the results of its site reconnaissance, subsurface exploration, and geotechnical laboratory testing.

Geologic Setting

Geologic information for the site and the surrounding area was obtained from the *Geologic Map of the Chehalis River and Westport Quadrangles, Washington* (Logan 1987). Surficial deposits in the vicinity of the site are mapped as Quaternary-age alluvium (Qa), a unit that typically consists of silt, sand, and gravel loosely deposited in streambeds and alluvial fans. Outcrops of Miocene-age tertiary marine sedimentary rock (Mm[2ms]) also are mapped in the vicinity of the site and typically consist of sandstone, claystone, shale, or mudstone.

The soils observed in Landau's exploration were consistent with the mapped geology for the site. Fill material and substantial amounts of organic soil and peat were also observed.

Surface Conditions

Site features include the pump station building, bulkhead walls, and a gravel-surfaced yard. Stormwater is conveyed to the pump station along a drainage channel, then pumped into the wetlands to the east of the site where flow continues toward the Chehalis River approximately half a mile away. Photo 1 depicts the existing pump station site; note the leaning bulkhead and settlement gap beneath the building.

Photo 1. Pump station site



At the time of our investigation, evidence of 4 inches of settlement around the building and 6 inches of settlement behind the bulkhead were observed. The site may have been re-graveled several times, and this is by no means an estimate of cumulative historic site settlement.

Portions of the bulkhead include a steel wailer affixed to steel cable. Landau believes the steel cables most likely connect to a deadman anchor system (ecology blocks or similar) buried in the gravel yard.

Subsurface Conditions

On January 12, 2021, Landau's drilling subcontractor advanced two mud-rotary borings (B-1 and B-2) approximately 81.5 feet (ft) and 21.5 ft below ground surface (bgs), respectively. The approximate location of the explorations is shown on Figure 2.

Landau personnel coordinated and monitored the field exploration, collected representative soil samples, and maintained a detailed log of the subsurface soil and groundwater conditions observed. Each representative soil type was described using the soil classification system shown on Figure 3, in general accordance with ASTM International (ASTM) standard D2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*. Summary boring logs are presented on Figures 4 and 5.

Standard penetration test (1.5-inch inside-diameter) and modified California (2.375-inch inside-diameter) split-spoon samplers were used to collect disturbed soil samples at 2.5- and 5-ft intervals. A 140-pound automatic hammer, falling approximately 30 inches, was used to drive the sampler 18 inches (or a portion thereof) into the undisturbed soil. Soil samples were transported to Landau's geotechnical laboratory for further examination and testing.

Natural moisture content tests and Atterberg limits determinations were performed on select samples to facilitate soil classification. The natural moisture content is shown as "W = xx" (i.e., percentage of dry weight) in the "Test Data" column on Figure 4. Samples selected for Atterberg limits determinations are designated with an "AL" in the "Test Data" column. The results of the Atterberg limits tests are presented on Figure 6.

Soil Conditions

The soils observed underlying existing surface conditions (i.e., asphalt pavement) were categorized into two general units:

- **Fill:** Fill was observed in both borings and extended to approximately 3 ft bgs. The fill consisted of sandy, fine to coarse gravel in a dense, moist condition.
- **Alluvium:** Alluvium was observed in boring B-1 and B-2 and extended to the maximum depths explored (81.5 and 21.5 ft bgs, respectively). The alluvium typically consisted of very soft silt or organic silt with variable wood debris, peat, and organic content.

Groundwater

Use of the mud-rotary drilling technique precluded measurement of groundwater levels. Given the distance between the site and the Hoquiam River, groundwater is anticipated to be within 5 ft of ground surface.

The groundwater conditions reported herein are for the specific location and date indicated and may not be representative of other locations and/or times. Groundwater conditions will vary depending on local subsurface conditions, weather conditions, and other factors. Groundwater levels are expected to fluctuate seasonally, with maximum groundwater levels occurring during late winter and early spring.

Conclusions and Recommendations

Site soils were found to contain an unusually high content of organics and peat relative to dozens of other projects completed by Landau in the Aberdeen/Hoquiam lowlands. Compressible organic soils are the primary culprit for the observed site settlement and wall deformation. As described in the following sections, design of replacement structures must take this into consideration.

The following key conclusions are incorporated into design recommendations in the following sections:

- **Ongoing settlement:** Site soils are undergoing long-term, secondary compression settlement estimated to be on the order of 6 inches of ground surface settlement per 10 years. This settlement will continue regardless of the proposed site improvements. Any new loads (heavy backfill soils, equipment pads, etc.) will increase the magnitude of short-and long-term settlement. Pile-supported structures will experience significantly less settlement.
- **Foundation support:** Structures should be supported by timber piles.
- **Bulkhead replacement:** A sheet pile bulkhead appears to be the most practical wall type given site soil conditions.
- **Utilities:** Lightweight backfill should be placed above settlement-sensitive utility pipelines. Flexible utility connections should be used. As a design alternative, the design team should also discuss supporting settlement-sensitive utilities on timber piles.
- **Dewatering and shoring:** Excavations for the new wet well are anticipated to extend approximately 25 ft bgs, and excavations for the new vaults and utilities approximately 15 ft bgs. The excavations will be advanced in saturated, low-permeability silt and should be shored and dewatered. Feasible shoring methods include sheet pile walls, slide rail systems, and caissons. Sumps and pumps may be more feasible than well points or deep wells for dewatering construction excavations.
- **Buoyancy:** Design of underground structures should account for potential uplift. Design should include a groundwater table at ground surface. Timber pile foundations can be used for uplift resistance if a structural foundation connection is provided.
- **Material and procedure specifications:** Geotechnical recommendations for materials and procedures are provided in Attachment 1. Recommendations comply with the Washington State Department of Transportation's (WSDOT's) *2022 Standard Specifications for Road, Bridge, and Municipal Construction (2022 WSDOT Standard Specifications)*.

Bulkhead Design

Design details of the existing wall were unavailable at the time of this writing. Given the ongoing secondary compression of site soils (roughly 6 inches per 10 years), Landau believes that some amount of wall settlement and downdrag are unavoidable for the replacement bulkhead.

A deadman anchor system is a practical way to provide lateral wall restraint, given that a drilled and grouted tieback anchor alternative would have a significant anchor length and risk of soil creep. Landau should be consulted during structural wall design to assist in establishing minimum setback distance for deadman anchors, if used.

Deadman anchors are likely to settle at a similar or slightly faster rate (depending on extents surrounding backfill) than the surrounding ground surface. The face of the wall will settle at a slightly slower to much slower rate, depending on wall embedment depth. Wall design should account for this differential settlement. It may be necessary to allow for periodic anchor adjustment at the wailer.

Landau recommends the following parameters for use in bulkhead design.

Table 1. Soil Parameters for Design Sheet Pile Bulkhead

Soil Unit	Depth Below Top of Wall (ft)	Submerged Unit Weight (pcf)	Hydrostatic Pressure (pcf)	Cohesion (psf)	Internal Angle of Friction (degrees)	Ka	Kp
Fill	0-3	63	63	0	32	0.31	3.25
Alluvium	3-80	38	63	0	22	0.45	2.20

pcf = pounds per cubic foot

psf = pounds per square foot

Ka = Active earth pressure coefficient

Kp = Passive earth pressure coefficient

Given the fine-grained site soil conditions and the difficulty of installing and maintaining a wall drain in a flood environment, Landau recommends that the wall be designed for unbalanced hydrostatic pressure. The top two feet of soil should be neglected when calculating passive earth pressure. The values in Table 1 are unfactored; to limit wall deflection, it is customary to use a safety factor of 1.5 on passive earth pressure.

Using the information in Table 1, Landau calculates a submerged, factored passive earth pressure of 92 pounds per cubic foot (equivalent fluid weight). Accordingly, significant wall embedment is anticipated.

Landau should be consulted during design to provide differential settlement estimates as wall details are developed.

Pump Station Design

Geotechnical design recommendations for the replacement pump station are provided in the following sections.

Timber Pile Foundation Support

Landau recommends that the improvements are supported on timber pile foundations. Piles should be installed to limit long-term consolidation and differential settlement, provide resistance to buoyant forces, and improve the overall performance of the proposed structures. Timber piles should meet the requirements in Section 9-10.1 of the *2022 WSDOT Standard Specifications* and should have a minimum tip diameter of 7 inches.

Downward Axial Capacity

Landau recommends an allowable downward axial capacity of 20 kips for 40-ft-long driven timber piles installed in very soft alluvium. This allowable capacity includes a factor of safety of approximately 1.8, based on the understanding that the WSDOT pile-driving formula will be used for pile-driving construction control. Provided the piles have a center-to-center spacing of at least 3D, where D is the diameter of the piles, the pile group capacity can be taken as the sum of the individual pile capacities.

Uplift Capacity

Landau recommends an allowable uplift capacity of 5 kips for 40-ft-long driven timber piles. This allowable capacity includes a factor of safety of 3.0. The weight of the pile is not included. To resist buoyant forces, a positive connection is needed between the pile and the slab or grade beam. A positive connection can be achieved by fastening a metal strap to the outside of the pile with lag bolts. Where center-to-center pile spacing is less than 3D, the geotechnical engineer should be contacted to evaluate possible capacity reductions.

Lateral Resistance

If lateral resistance is required, lateral pile capacity can be evaluated in accordance with the Naval Facilities Engineering Systems Command's *Design Manual 7.2* (1986), in which the relative stiffness factor, T (inches), is computed as: $T = [EI/f]^{1/5}$. Landau recommends using an f value of 4.0 pounds per cubic inch for static design conditions.

Lateral Earth Pressures

A groundwater elevation equal to the ground surface elevation should be used to design below-grade walls (i.e., wet well and vault structures). Wet well and vault walls should be restrained against rotation and designed for an equivalent fluid unit weight of 93 pounds per cubic foot (pcf). This

recommendation is based on the assumption that backfill is level and soil conditions are at-rest and undrained. Hydrostatic pressure is included in the equivalent fluid unit weight. Subsurface wall design should account for lateral pressures exerted by adjacent surcharge loads. A uniformly distributed lateral pressure, 0.53 times the surcharge pressure, should be added for below-grade walls.

Buoyancy and Uplift Considerations

Installing timber piles (with a structural connection) and extending the base of the wet well foundation beyond its outside perimeter can increase uplift resistance. Extended base buoyancy calculations are provided on Figure 6. Placement of backfill material will result in settlement; as such, Landau recommends installing timber piles, even if they are not used in uplift calculations.

If an extended base slab is not provided, uplift can be resisted using friction between the sides of the structure and the surrounding backfill (sidewall friction). A buoyant soil unit weight of 73 pcf, a submerged soil lateral earth pressure of 40 pcf, and a frictional resistance of 0.35 can be used to calculate the uplift resistance provided via sidewall friction.

Underground Utilities

The following sections include geotechnical design recommendations for underground utilities. Recommendations comply with the *2022 WSDOT Standard Specifications* for materials and procedures (i.e., Select Borrow, Bedding the Pipe, etc.), presented in Attachment 1.

Settlement

Post-construction settlement is expected to be negligible (relative to ongoing, site-wide secondary compression settlement) for pipes with diameters of 12 inches or more and cover of 5 ft or less, provided the pipe is underlain by firm backfill material; the ground surface over, and adjacent to, the pipe is maintained at pre-construction level; and no loads are added above the pipe. New pipes with more than 5 ft of cover will experience an increase in bearing pressure, and settlement may occur.

To limit settlement, Landau recommends using lightweight fill material that conforms to the specifications in Attachment 1. As an alternative, pile foundation support of settlement-sensitive utilities should be discussed during design. Manhole structures should be supported by Timber Piles. Flexible connections should be considered for all new pipes to limit differential settlement between structures and utilities.

Pipe Foundation Support

Very soft silt is anticipated at the proposed trench depths. Quarry Spalls may be installed at the bottom of excavations to provide a firm working surface. The Quarry Spalls should be pushed into the native subgrade with the bucket of an excavator. Vibratory compaction should be avoided. Material

placed between the Quarry Spalls and Pipe Bedding Material should meet the requirements for Class A Foundation Material. A Geotextile for Separation may be placed below the Quarry Spalls to limit quantities (i.e., the amount of Quarry Spalls pushed into/lost in the soft subgrade).

Pipe Bedding and Pipe Zone Backfill

Pipe Bedding Material should be brought up evenly around the pipe in relatively horizontal lifts, not exceeding 6 inches, and worked under the haunches of the pipe by slicing with a shovel, vibration, or other approved procedure. Pipe Bedding Material should be compacted to 90 percent of the maximum dry density. The pipe manufacturer's specifications should supersede the recommendations in this memorandum.

Trench Backfill/Lightweight Fill

Excavated material is expected to consist of fine-grained fill and alluvium removed from beneath the water table. Native site soils should not be reused as trench backfill.

To limit differential settlement between utility pipelines and structures, utility lines with more than 5 ft of cover should be partially backfilled with Lightweight Fill material, such as "hog fuel." Granular material should be placed above the hog fuel to counteract buoyant forces. If hog fuel is not readily available, cellular concrete or expanded shale aggregate are suitable sources of Lightweight Fill. Once pipe depths have been finalized, Landau will provide recommendations for layering trench backfill.

Pipes with less than 5 ft of cover should be backfilled with Select Borrow or Bank Run Gravel for Trench Backfill.

Manholes

Manholes should be supported on timber piles. Manholes should be designed to withstand a lateral pressure with an equivalent fluid unit weight of 93 pcf, based on at-rest, saturated soil conditions. (The equivalent fluid unit weight includes hydrostatic pressure.) Manholes should be backfilled with Select Borrow and designed to resist buoyant forces.

Pipe Buoyancy

Pipes will be subject to buoyant forces if the water table is located above the crown of the pipe, and the pipe is not full. Buoyant forces can be resisted by the weight of the pipe and overlying soil, W_s (pounds). If the water table rises to existing ground surface, the weight of the soil along a 1-ft length of pipe can be interpreted as:

$$W_s = 73 * H * D \text{ (McGrath 1998),}$$

where:

H = distance from the ground surface to the crown of the pipe in feet, and

D = diameter of the pipe in feet.

This equation should be modified for pipes backfilled with Lightweight Fill. It should be reevaluated after final trench depths are known.

Construction Considerations

The following key points should be reviewed when preparing project plans and specifications:

- **Subgrade preparation:** Vibratory equipment should not be used to compact soft subgrades. Quarry Spalls and Geotextile for Separation should be used locally to improve subgrades. For pile-supported structures, subgrade improvement should be sufficient to support foot traffic and allow for concrete curing. Geotextiles should not be used beneath pile-supported structures.
- **Site soils:** Site soils are not suitable for reuse as fill.
- **Pile driving:** Pile driving should be performed in accordance with Section 6-05 of the *2022 WSDOT Standard Specifications*. The pile-driving hammer should have a rated energy that meets the requirements in Section 6-05.3(9)B of the *2022 WSDOT Standard Specifications*. Driving criteria can be determined in accordance with Section 6-05.3(12) of the *2022 WSDOT Standard Specifications* (i.e., the WSDOT pile-driving formula). The criteria should be applied in end-of-driving conditions only; they are not appropriate for use after pile setup.
- **Preconstruction survey:** The effects of pile driving can be felt several hundred feet from the construction site. Landau recommends completing a preconstruction survey of all non-City-owned structures within 200 ft of the pile-driving operations. The survey should include photographs and/or videos, notes, and sketches that document existing conditions, such as cracking and other signifiers of structural settlement. The survey should be completed in the presence of the affected parties.
- **Construction dewatering:** Excavations should be dewatered to allow construction to be completed in the dry. Most site soils have a low permeability and are not expected to yield a significant quantity of groundwater. As such, pumping from open excavations and/or the use of cutoff systems is anticipated.

Significant groundwater may enter excavations that cross or tie into existing utility lines or where excavations intercept layers of wood debris. The construction dewatering plan should account for these conditions. The contractor should be responsible for the design, permitting, installation, monitoring, and maintenance of dewatering systems. In addition, the contractor should be required to manage groundwater extracted during construction.

- **Temporary excavations:** Temporary excavations should be completed in accordance with the guidelines in Section 2-09 of the *2022 WSDOT Standard Specifications*. The contractor should be responsible for actual excavation configurations and the maintenance of safe working

conditions, including temporary excavation stability. Temporary excavations in excess of 4 ft should be shored or sloped in accordance with the requirements outlined in Safety Standards for Construction Work, Part N (Washington State Department of Labor and Industries, Chapter 296-155 of the Washington Administrative Code).

The material likely to be exposed in the structural excavations should be considered Type C soil, with a maximum allowable excavation inclination of 1.5 horizontal to 1 vertical (1.5H:1V). Trench boxes should provide adequate support for shallow excavations, provided the trench is properly dewatered, and no settlement-sensitive structures or utilities are adjacent to the excavation. In instances where excavation locations are adjacent to existing structures or utilities, the contractor should perform a preconstruction survey and implement a shoring system that will protect the structures or utilities from damage.

- **Temporary shoring:** If open cuts are not feasible, engineered shoring systems may be used in deep excavations. Temporary shoring systems could also include trench boxes, slide rail systems, caissons, and soldier or sheet pile walls. Braces or anchors may be required for excavations extending more than 12 to 15 ft bgs or for excavations with large surcharge loads (e.g., backslopes or construction traffic). Use of a properly designed shoring system will help reduce settlement potential. Temporary shoring systems should be designed and constructed to support lateral loads exerted by the retained soil mass. Surcharge loads from construction equipment and materials and stockpiled soil should be included in the shoring design.

The soil parameters in Table 2 can be used to design temporary shoring systems. Hydrostatic pressure, in concert with the dewatering plan, should be included where appropriate. The shoring design should be completed by a civil or structural engineer licensed in the State of Washington and should be reviewed by the City prior to implementation.

Table 2. Soil Parameters for Design of Temporary Shoring

Soil Unit	Moist Unit Weight (pcf)	Submerged Unit Weight (pcf)	Hydrostatic Pressure (pcf)	Cohesion (psf)	Internal Angle of Friction (degrees)
Fill	125	63	63	0	32
Alluvium	110	48	63	0	28

pcf = pounds per cubic foot

psf = pounds per square foot

Final Design and Construction Support

Landau recommends that a geotechnical engineer familiar with the site review the project plans and specifications for compliance with the recommendations in this report. Landau also recommends that geotechnical monitoring, testing, and consultation be provided during construction to confirm that site subsurface conditions are consistent with those observed in the field exploration, to provide updated recommendations should conditions differ from those anticipated and to evaluate whether geotechnical construction activities comply with the project plans and specifications and with the recommendations in this report. Activities include installation of shoring and dewatering systems, pile

driving, placement and compaction of backfill material, and other earthwork construction. Landau would be pleased to provide construction support services.

Use of This Technical Memorandum

Landau Associates has prepared this technical memorandum for the exclusive use of HDR Engineering, Inc. and the City of Aberdeen for specific application to the Farragut Street Pump Station project in Aberdeen, Washington. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Reuse of the information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that, within the limitations of scope, schedule, and budget, its services have been provided in a manner consistent with that level of skill and care ordinarily exercised by members of the profession currently practicing in the same locality, under similar conditions as this project. Landau Associates makes no other warranty, either express or implied.

Closing

We trust that this memorandum provides you with sufficient information to proceed with the project. If you have questions or comments, or if we can be of further service, please contact the undersigned at 360.791.3178 or at cmccaughan@landauinc.com.

LANDAU ASSOCIATES, INC.

Calvin McCaughan, PE
Principal

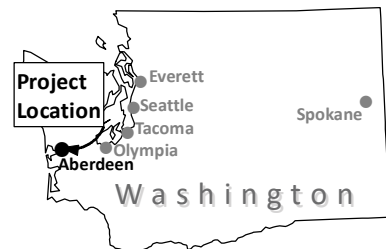
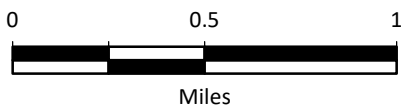
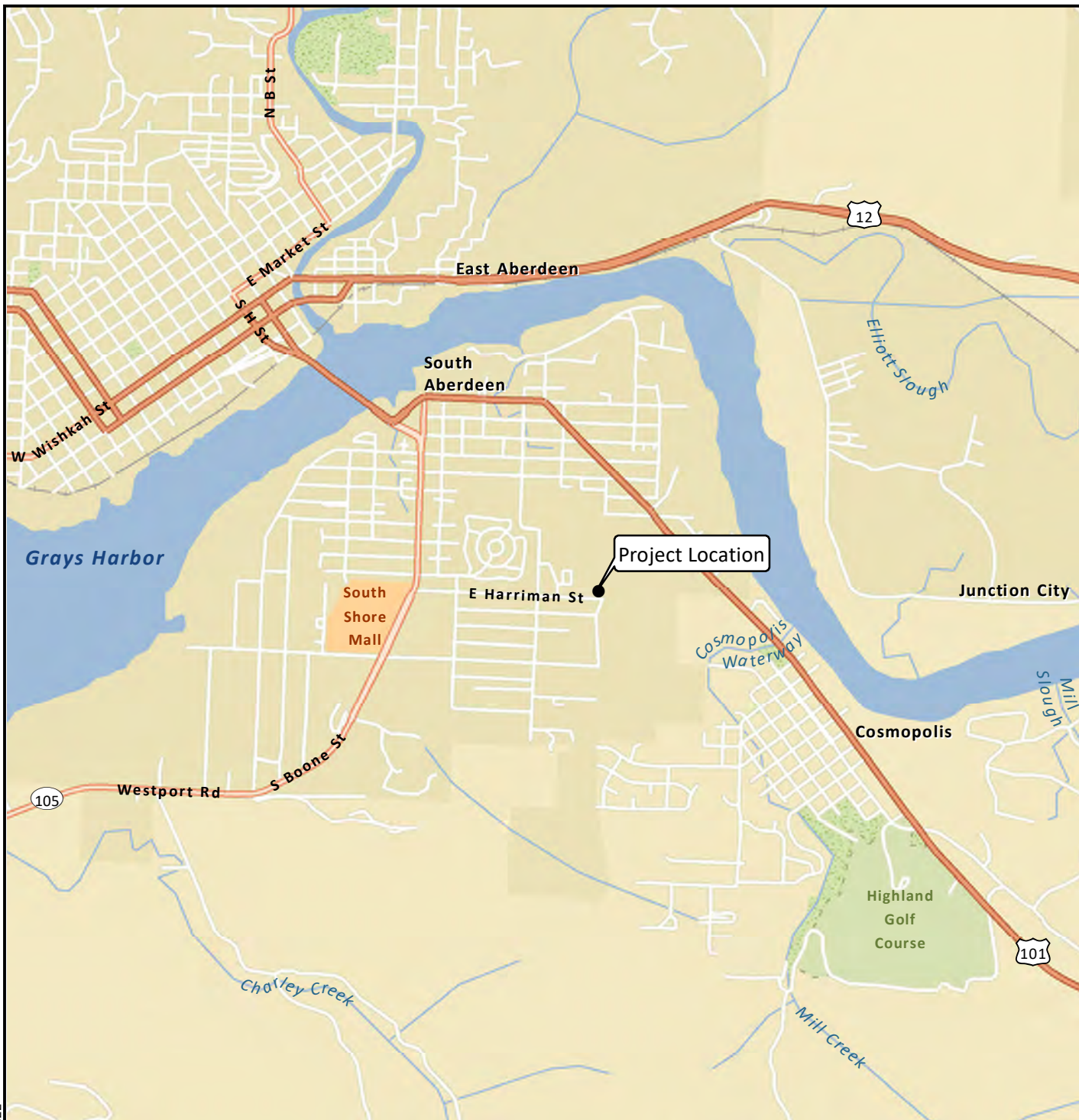
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Attachments: Figure 1. Vicinity Map
Figure 2. Site and Exploration Location Plan
Figure 3. Soil Classification System and Key
Figure 4. Log of Boring B-1
Figure 5 Log of Boring B-2
Figure 6. Plasticity Chart
Figure 7. Extended Base Buoyancy Calculation
Attachment 1. Recommended Material and Procedure Specifications

References

- ASTM. 2018. D420-D5876: Annual Book of ASTM Standards. In: *Soil and Rock(I)*. West Conshohocken, PA: ASTM International.
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- NAVFAC. 1986. Foundation and Earth Structures. In: *Design Manual 7.02*. Alexandria, VA: Naval Facilities Engineering Systems Command. September.
- WSDOT. 2021. *M 41-10: Standard Specifications for Road, Bridge, and Municipal Construction*. 2022 Edition. Washington State Department of Transportation. August 22.



G:\Projects\122\061\010\F01VicMap.mxd 1/5/2022

DRAFT

Data Source: Esri.

LANDAU
ASSOCIATES


Farragut Street
Pump Station Design
Aberdeen, Washington

Vicinity Map

Figure
1



Legend

B-1  Approximate Boring Locations and Designations

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Soil Classification System

	MAJOR DIVISIONS		USCS GRAPHIC SYMBOL	LETTER SYMBOL ⁽¹⁾	TYPICAL DESCRIPTIONS ⁽²⁾⁽³⁾
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
				GM	Silty gravel; gravel/sand/silt mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SP	Poorly graded sand; gravelly sand; little or no fines
				SM	Silty sand; sand/silt mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content

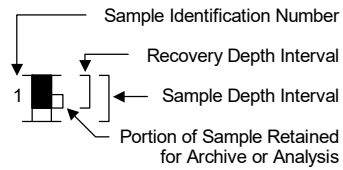
OTHER MATERIALS	USCS GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

- Notes: 1. USCS letter symbols correspond to symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM for sand or gravel) indicate soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the Standard Test Method for Classification of Soils for Engineering Purposes, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent: > 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
 Secondary Constituents: > 30% and < 50% - "very gravelly," "very sandy," "very silty," etc.
 > 15% and < 30% - "gravelly," "sandy," "silty," etc.
 Additional Constituents: > 5% and < 15% - "with gravel," "with sand," "with silt," etc.
 < 5% - "with trace gravel," "with trace sand," "with trace silt," etc., or not noted.

4. Soil density or consistency descriptions are based on judgement using a combination of sampler penetration blow counts, drilling or excavating conditions, field tests, and laboratory tests, as appropriate.

Drilling and Sampling Key			Field and Lab Test Data	
SAMPLER TYPE	SAMPLE NUMBER & INTERVAL		Code	Description
Code	Description			
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon		PP = 1.0	Pocket Penetrometer, tsf
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon		TV = 0.5	Torvane, tsf
c	Shelby Tube		PID = 100	Photoionization Detector VOC screening, ppm
d	Grab Sample		W = 10	Moisture Content, %
e	Single-Tube Core Barrel		D = 120	Dry Density, pcf
f	Double-Tube Core Barrel		-200 = 60	Material smaller than No. 200 sieve, %
g	2.50-inch O.D., 2.00-inch I.D. WSDOT		GS	Grain Size - See separate figure for data
h	3.00-inch O.D., 2.375-inch I.D. Mod. California		AL	Atterberg Limits - See separate figure for data
i	Other - See text if applicable		GT	Other Geotechnical Testing
1	300-lb Hammer, 30-inch Drop		CA	Chemical Analysis
2	140-lb Hammer, 30-inch Drop			
3	Pushed			
4	Vibrocore (Rotasonic/Geoprobe)			
5	Other - See text if applicable			



Sample Identification Number

Recovery Depth Interval

Sample Depth Interval

Portion of Sample Retained for Archive or Analysis

Groundwater	
	Approximate water level at time of drilling (ATD)
	Approximate water level at time after drilling/excavation/well

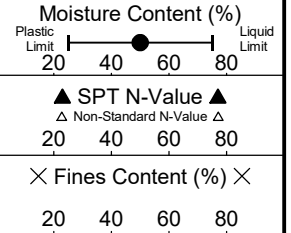
B-1

LAI Project No: 0122061.010.011

SAMPLE DATA

SOIL PROFILE

Groundwater



Depth (ft)

Elevation (ft)

Sample Number & Interval

Sampler Type

Blows/Foot

Test Data

Graphic Symbol

USCS Symbol

Drilling Method: Mud Rotary

Ground Elevation (ft): Not Measured

Drilled By: Holocene Drilling Inc.

Logged By: BP Date: 01/12/22

Groundwater Not Encountered

S-1

b2

4

W = 35

GP

Sod over gray, sandy, fine to coarse GRAVEL (dense, moist)
(FILL)

SM

Gray, silty, fine to coarse SAND (very loose, wet)
(ALLUVIUM)

S-2

b2

0

W = 191

WD

Wood (very loose, wet)

S-3

b2

2

W = 108

OH

Dark gray, organic SILT (very soft, wet)

S-4

b2

0

W = 91

AL

-Stratified peat

S-5

b2

0

W = 96

AL

-Grades to gray and with trace organics

S-6

b2

0

W = 94

AL

-Grades to tan-gray

S-7

b2

0

W = 89

OL

-Stratified peat
-Wood debris observed at 25.5 ft

S-8

b2

0

W = 89

OL

-Grades to dark gray

Tan gray, organic SILT (very soft, wet)

- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

0122061.010.011 2/10/22 Y:0122061.0101010122061.010.011.GPJ SOIL BORING LOG WITH GRAPH

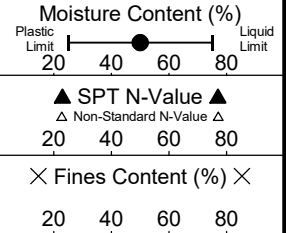
B-1

LAI Project No: 0122061.010.011

SAMPLE DATA

SOIL PROFILE

Groundwater



Depth (ft)

Elevation (ft)

Sample Number & Interval

Sampler Type

Blows/Foot

Test Data

Graphic Symbol

USCS Symbol

Drilling Method: Mud Rotary

Ground Elevation (ft): Not Measured

Drilled By: Holocene Drilling Inc.

Logged By: BP Date: 01/12/22

S-9

b2

0

W = 94
AL

OL

Tan gray, organic SILT (very soft, wet)
-Peat observed at the bottom of the sampler

S-10

b2

0

W = 95

OL

-Grades to gray
-Peat observed at the bottom of the sampler

S-11

b2

0

W = 90

OL

-Stratified peat

S-12

b2

0

W = 115

OL

115

S-13

b2

0

W = 86

OL

Gray SILT with organics (very soft, wet)

S-14

b2

0

W = 70

ML

-Grades to moist to wet

S-15

b2

0

W = 65

ML

-Grades to moist to wet

- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Groundwater Not Encountered

115

0122061.010.011 2/10/22 Y:0122061.0101010122061.010.011.GPJ SOIL BORING LOG WITH GRAPH

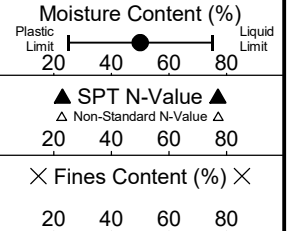
B-1

LAI Project No: 0122061.010.011

SAMPLE DATA

SOIL PROFILE

Groundwater



Depth (ft)

Elevation (ft)

Sample Number & Interval

Sampler Type

Blows/Foot

Test Data

Graphic Symbol

USCS Symbol

Drilling Method: Mud Rotary

Ground Elevation (ft): Not Measured

Drilled By: Holocene Drilling Inc.

Logged By: BP Date: 01/12/22

S-16

b2

0

W = 61

ML

OL

Gray SILT with organics (very soft, moist to wet)

Gray, organic SILT (very soft, moist to wet)

S-17

b2

0

W = 87

S-18

b2

0

W = 77

Boring Completed 01/12/22
Total Depth of Boring = 81.5 ft.

-ft - feet

Groundwater Not Encountered

- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

0122061.010.011 2/10/22 Y:\0122061\010\T0122061.010.011.GPJ SOIL BORING LOG WITH GRAPH

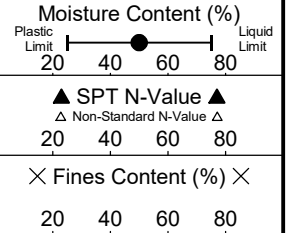
B-2

LAI Project No: 0122061.010.011

SAMPLE DATA

SOIL PROFILE

Groundwater



Depth (ft)

Elevation (ft)

Sample Number & Interval

Sampler Type

Blows/Foot

Test Data

Graphic Symbol

USCS Symbol

Drilling Method: Hollow-Stem Auger

Ground Elevation (ft): Not Measured

Drilled By: Holocene Drilling Inc.

Logged By: BP Date: 01/12/22

Groundwater Not Encountered

S-1

b2

0

GP

Sod over gray, sandy, fine to coarse GRAVEL (dense, moist)
(FILL)

S-2

b2

0

SM

Gray, silty, fine to coarse SAND (very loose, moist to wet)
(ALLUVIUM)

S-3

b2

2

OL

Gray, organic SILT (very soft, moist to wet)
-Peat observed at the bottom of the sampler

S-4

b2

5

WD

Wood (very soft, moist to wet)

S-5

b2

0

ML

Dark brown SILT with wood (medium stiff, moist to wet)

S-6

b2

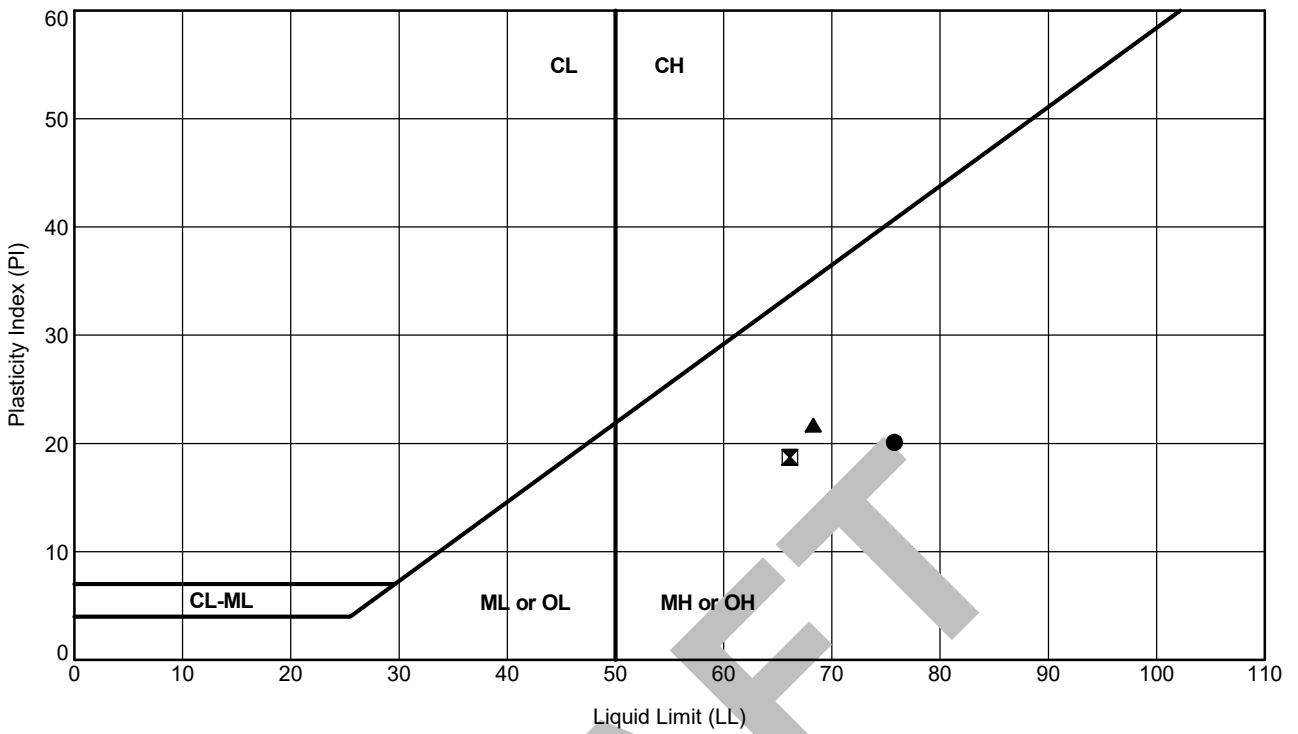
0

-Grades to with organics, gray, and very soft

Boring Completed 01/12/22
Total Depth of Boring = 21.5 ft.

-ft - feet

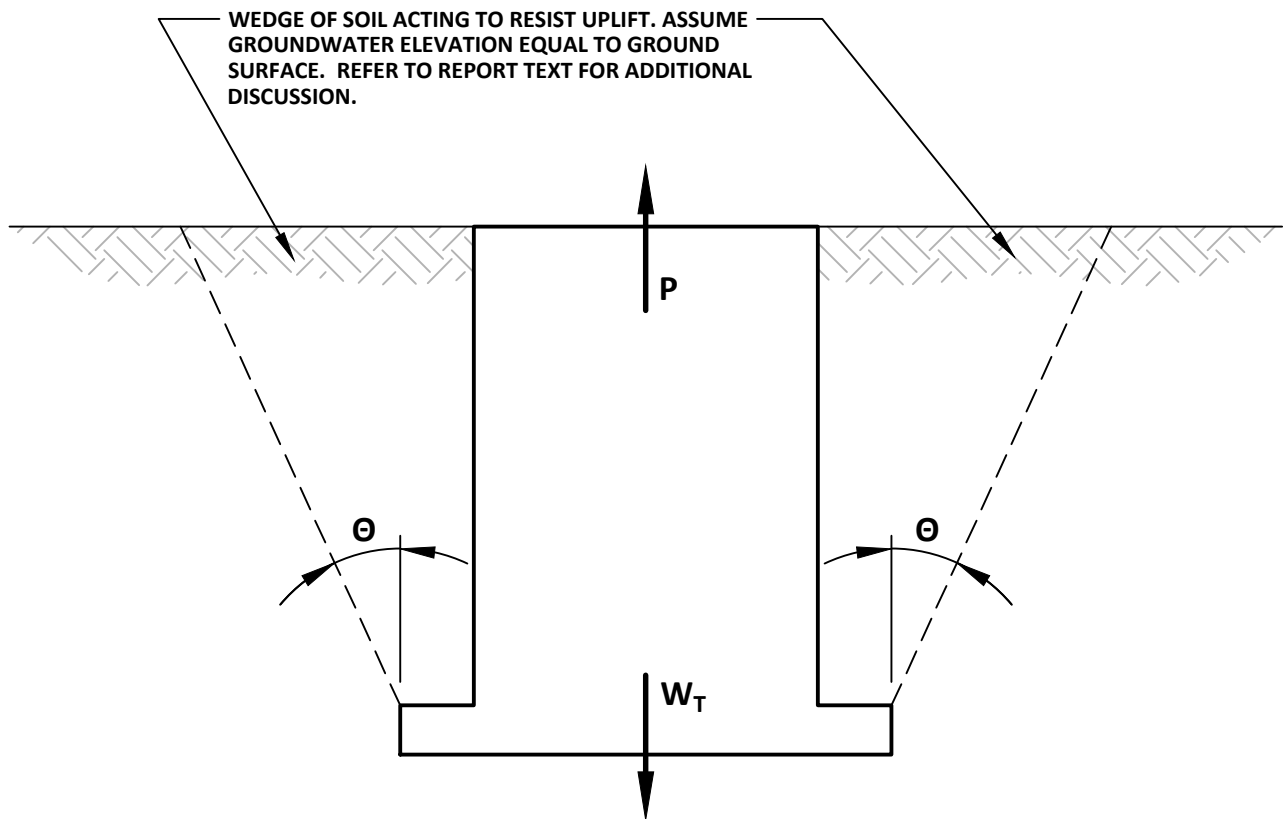
- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.



ATTERBERG LIMIT TEST RESULTS

Symbol	Exploration Number	Sample Number	Depth (ft)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Natural Moisture (%)	Soil Description	Unified Soil Classification
●	B-1	S-4	10.0	76	56	20	108	Organic SILT	OH
⊠	B-1	S-6	20.0	66	47	19	96	Organic SILT	OH
▲	B-1	S-9	35.0	68	47	21	94	Organic SILT	OH

ASTM D 4318 Test Method



Legend

W_T = Weight of structure plus weight of soil wedge. Use a buoyant soil unit weight of 73 pounds per cubic foot.

P = Buoyancy force

Factor of Safety = W_T/P

$\theta = 20^\circ$

DRAFT

Recommended Material and Procedure Specifications

Attachment 1. Recommended Material and Procedure Specifications

Material	2022 WSDOT Standard Specifications	Recommended Use
Geotextile for Separation	Section 9-33.2(1), Table 3	Subgrade improvement beneath non-pile-supported features.
Quarry Spalls	Section 9-13.1(5)	General subgrade improvement. Utility trench subgrade improvement.
Timber Piles	Section 9-10.1	Support of buried and on-grade structures.
Gravel Backfill for Foundations	Section 9-03.12(1)A	Pipe foundation material.
Gravel Backfill for Pipe Zone Bedding	Section 9-03.12(3)	Pipe bedding material.
Bank Run Gravel for Trench Backfill	Section 9-03.19	Trench backfill material.
Select Borrow	Section 9-03.14(2)	Alternate trench backfill material. Structural excavation backfill material.
Lightweight Fill	N/A. Hog Fuel or Expanded Shale Aggregate, as determined during final design.	Partial backfill of utility trenches deeper than 5 ft.

ft = feet

N/A = not applicable

WSDOT = Washington State Department of Transportation

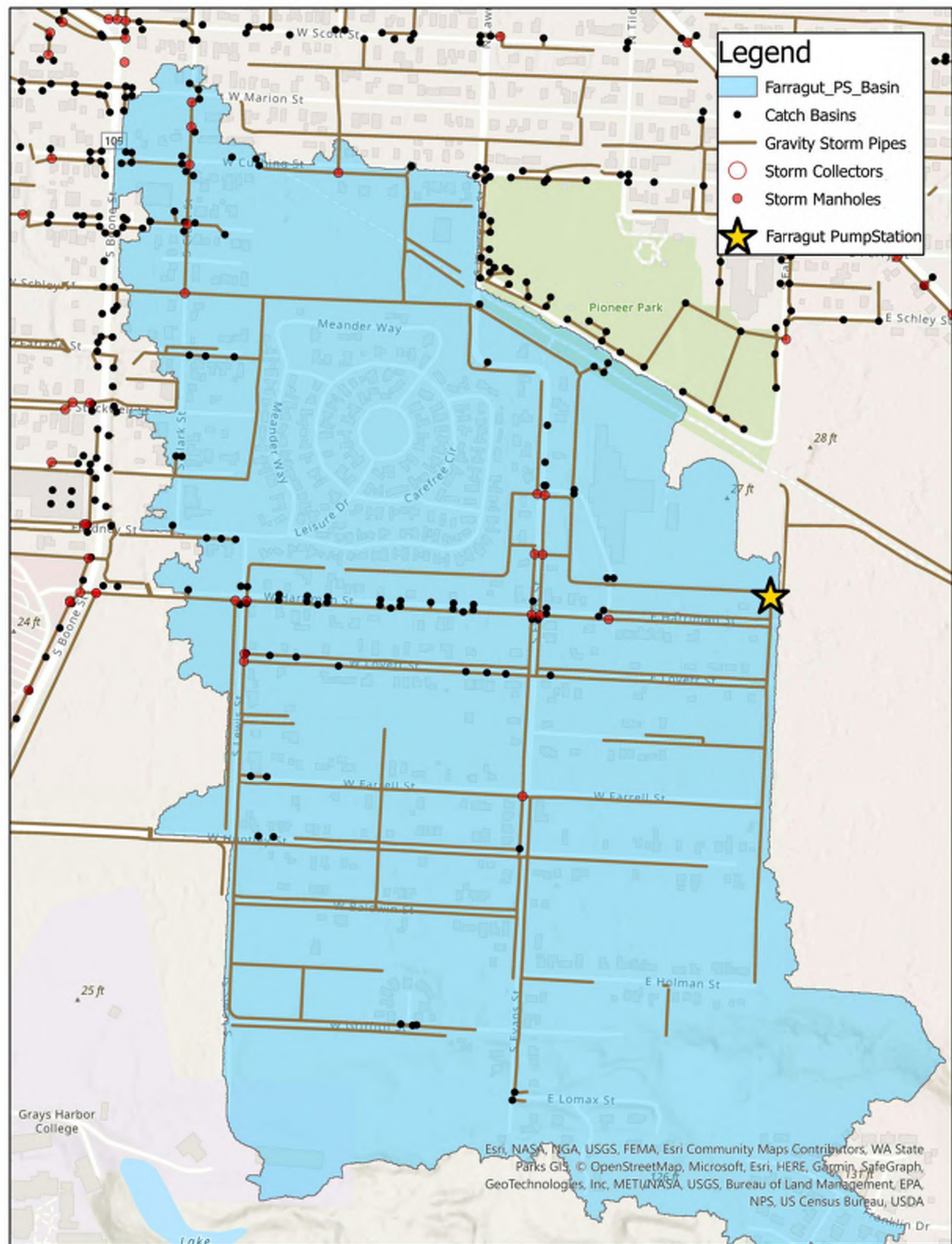
Procedure	2022 WSDOT Standard Specifications	Recommended Use
Temporary Excavations	Section 2-09	Structural and utility trench excavation procedure.
Bedding the Pipe	Section 7-08.3(1)C	Pipe bedding procedure.
Backfilling	Section 7-08.3(3)	Trench backfilling procedure.
Backfill Compaction	Section 2-03.3(14)C, Method C	Structural excavation backfill. Utility trench backfill above the pipe zone.
Compaction and Moisture Control Tests	Section 2-03.3(14)D	Fill compaction testing – sitewide.
Pile Driving	Section 6-05	Installation of Timber Piles.
Pile-driving Equipment Minimum Requirements	Section 6-05.3(9)B	Pile hammer and equipment selection.
Determination of Bearing Values	Section 6-05.3(12)	Field determination of ultimate bearing resistance during driving.

WSDOT = Washington State Department of Transportation

Appendix D. Drainage

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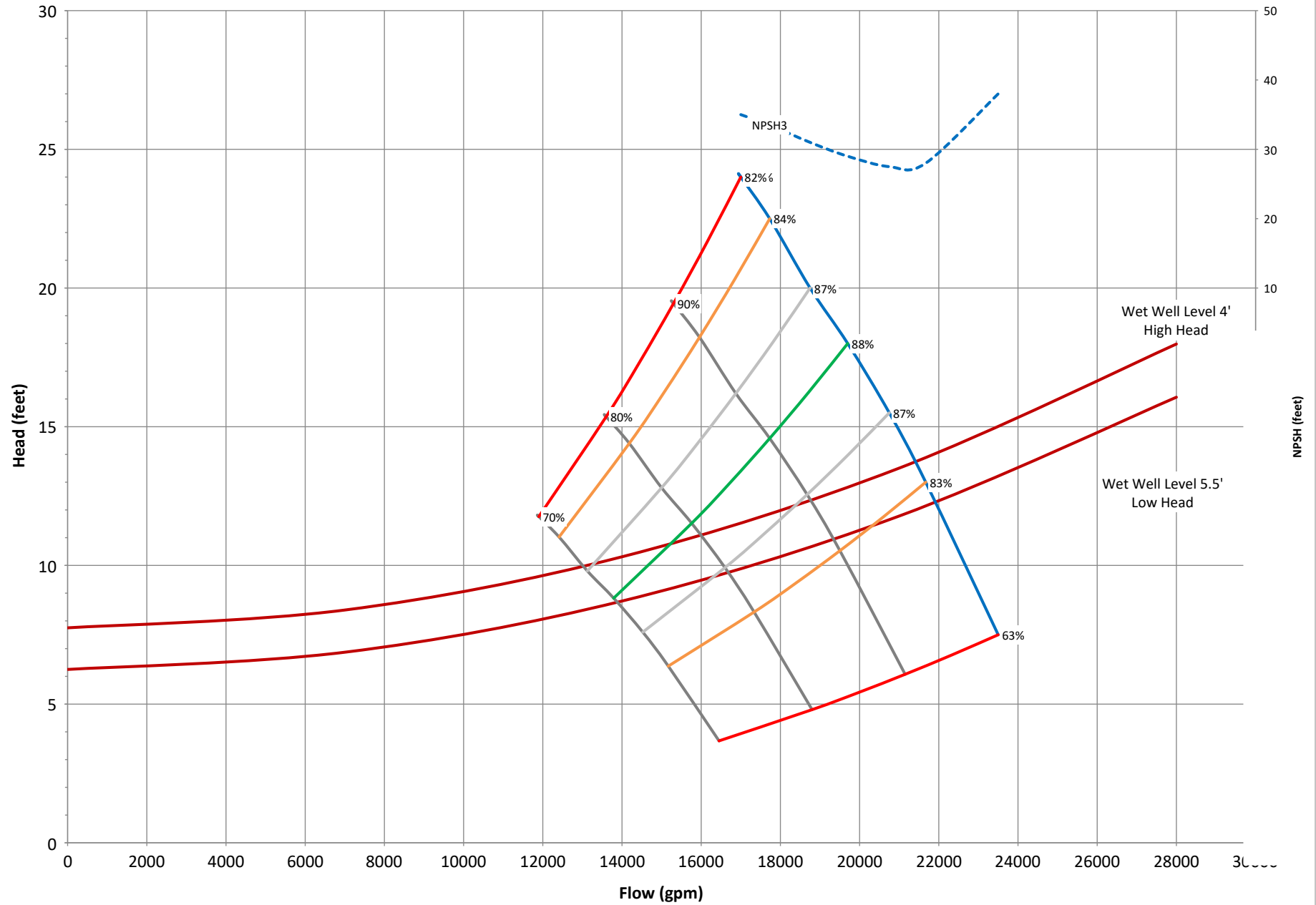
Appendix E. Pump Curves

DRAFT

PUMP AND SYSTEM CURVES

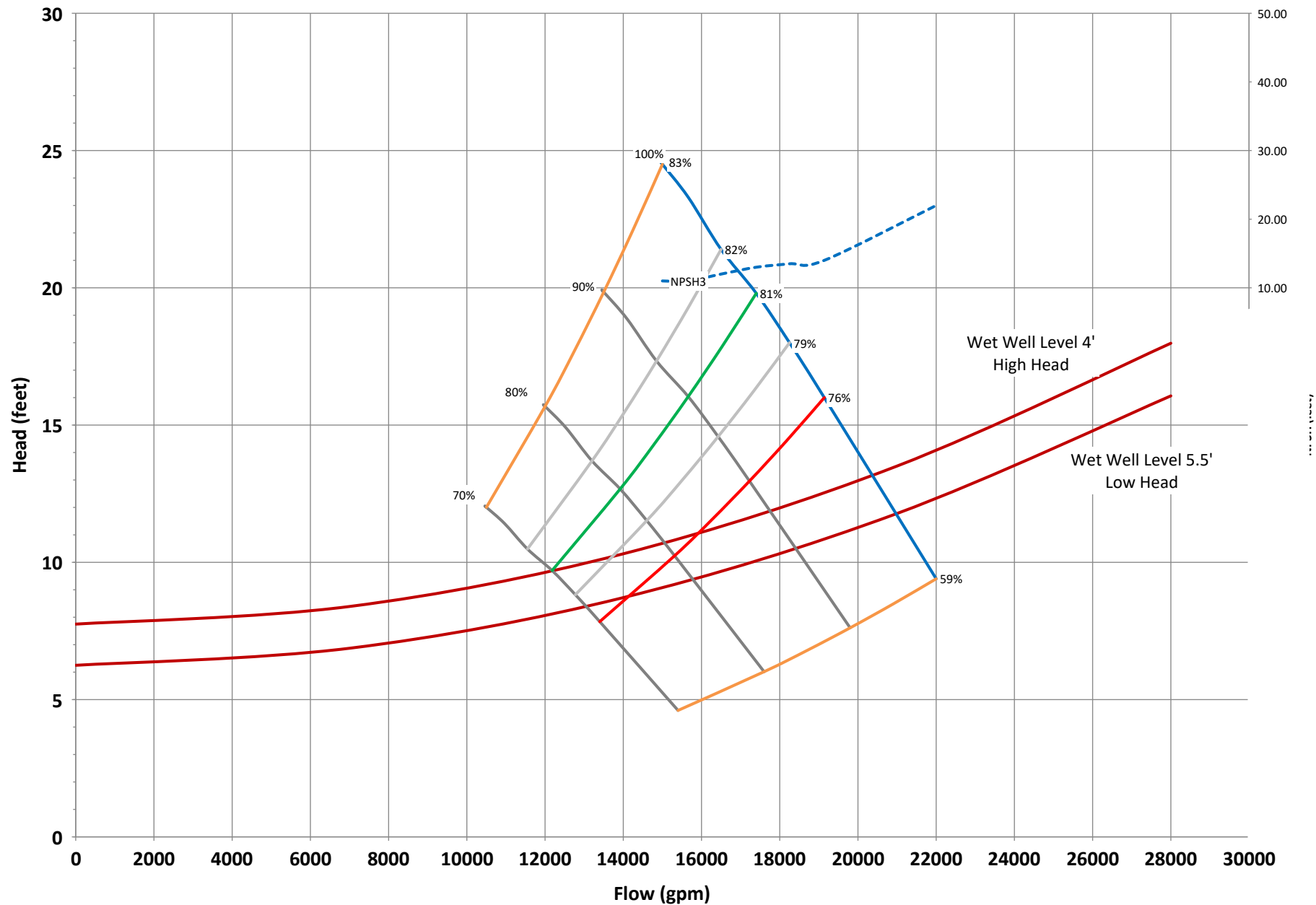
ALTERNATIVE A

1 Pump - Morrison - Axial Flow



ALTERNATIVES B & C

1 Pump Flygt 3602 Submersible



ALTERNATIVE A
100 HP MORRISON
VERTICAL AXIAL PUMP

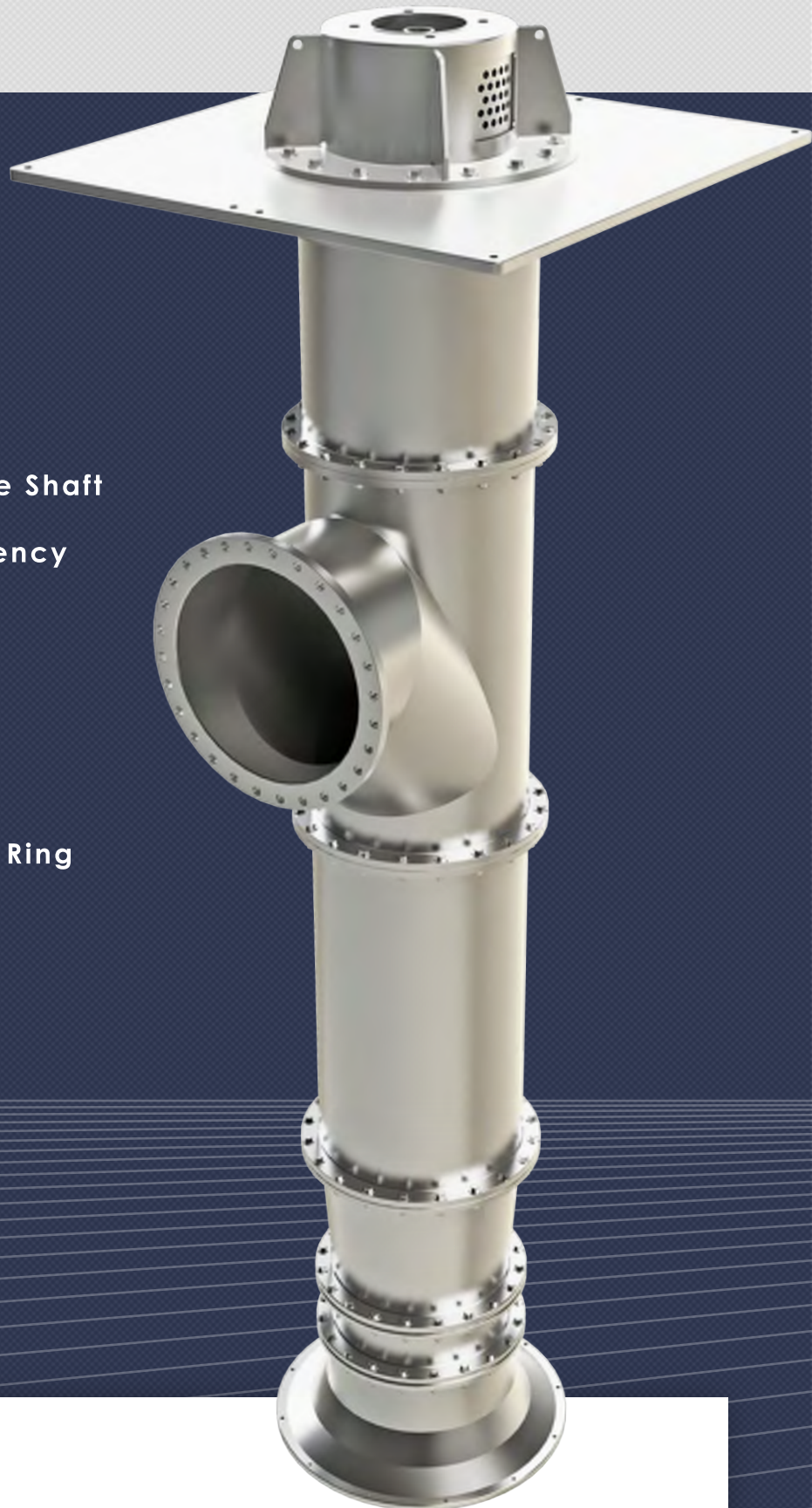
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MORRISON AXIAL FLOW PUMPS

MPC-72033-040722.pdf

PUMP FEATURES:

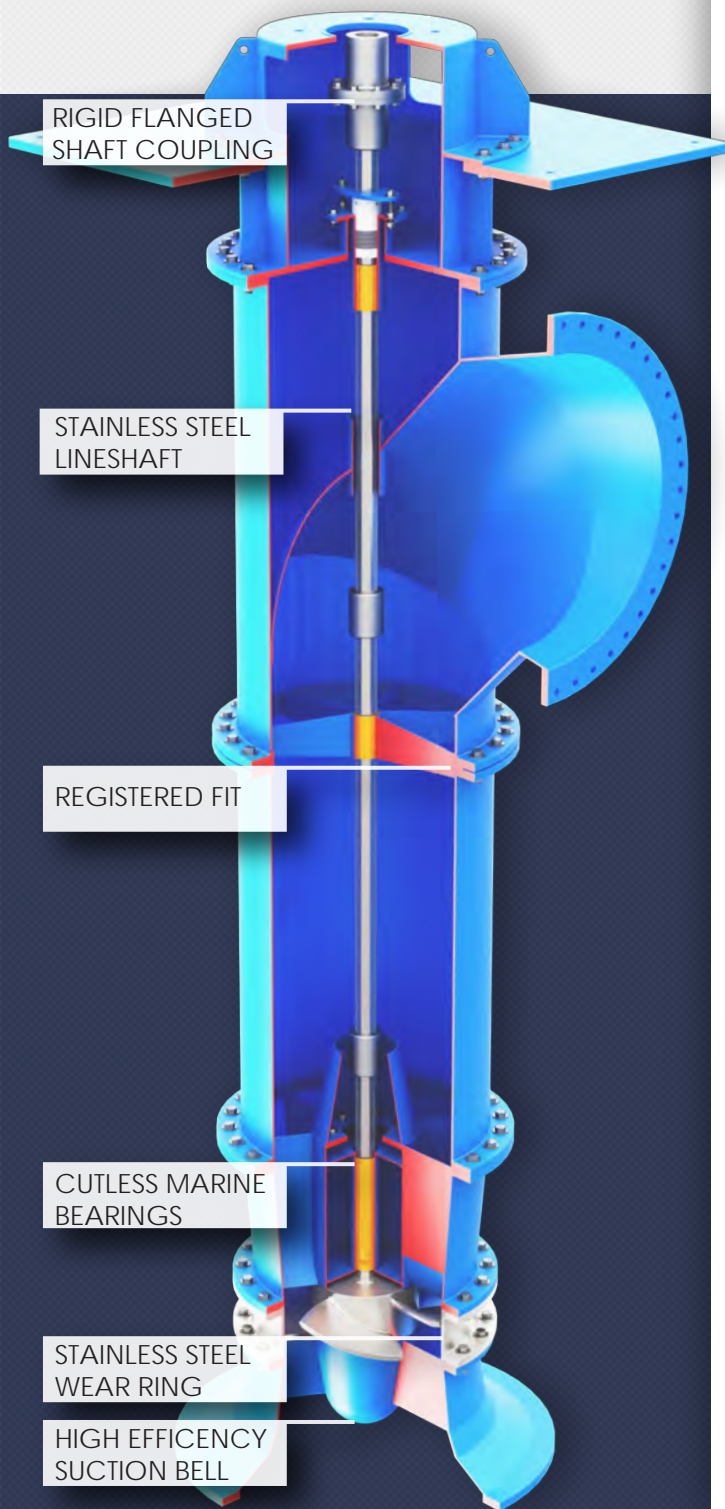
- Flanged Drive Coupling
- Removable Stuffing Box & Bearing Housing
- Duplex Stainless Steel Line Shaft
- Stainless Steel High Efficiency Forged Propeller
- Durable Nitrile Rubber Marine Bearings
- Close Tolerance Parallel Machined Flanges
- Stainless Steel Bowl Wear Ring
- Environmentally-Friendly



MORRISON
PUMP COMPANY
A BUSINESS UNIT OF PATTERSON

Tel. +1 (954) 922-5880
Fax +1 (954) 922-7729
www.morrisonpump.com

MORRISON AXIAL FLOW PUMPS

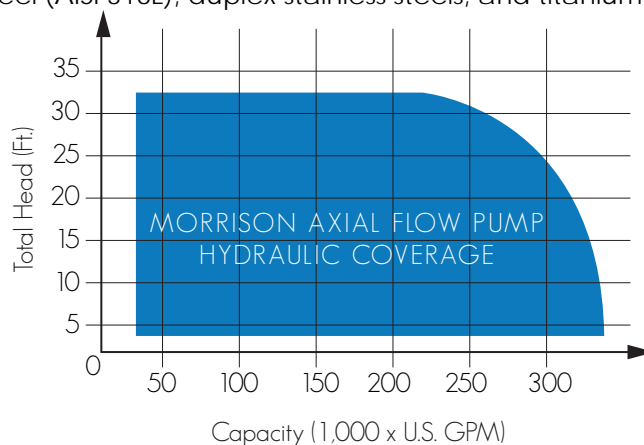


LINESHAFT PUMPS

The High Efficiency Morrison Pump Axial Lineshaft Pump Has Been Engineered And Manufactured For Severe Duty Applications And Continuous Operation.

Some Of The Standard Features That Distinguish Morrison Lineshaft Pumps include our jointed (segmented) pump construction, dynamic balancing of impellers, stainless rotating elements and wear rings, flanged drive couplings, electrical isolation of dissimilar metals, removable bearing retainers, and standard marine nitrile rubber bearings. Furthermore, all Axial Flow Pumps are provided with certified pump performance curves.

Morrison High-Efficiency Axial Flow Lineshaft Pumps can be in vertical, horizontal, or slant (angle) configurations, may be oil, water, or product lubricated (no seals, no oil). Various material options include marine steel, austenitic stainless steel (AISI 316L), duplex stainless steels, and titanium.



Please consult Morrison Pump Company for larger pump sizes. Morrison Mixed Flow also available.

Pump Part	Part Description
Pump Body	Segmented, A36 Carbon Steel
Propeller	Forged Stainless Steel 304L / 316L
Wear Ring	Flanged Isolated - Stainless Steel 304L / 316L
Lineshaft	Stainless Steel - Duplex, 304L, 316L
Bearings - Product Lube	Marine Nitrile Rubber, Synthetic Polymers
Bearings - Oil Lube	Bronze SAE 64
Bearing Retainers	Removable, A36 Carbon Steel
Support Baseplate	Split & Removable, A36 Carbon Steel
Mounting Hardware	Stainless Steel 304 / 316

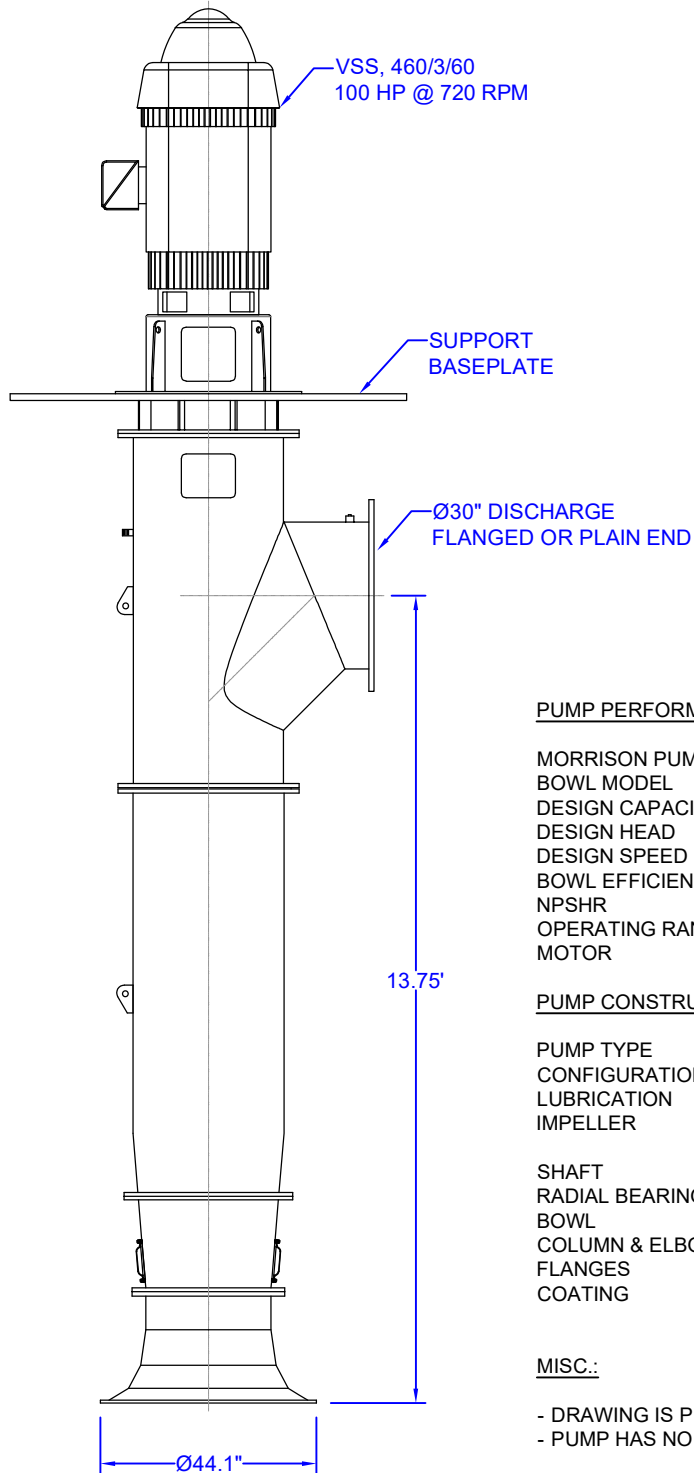



MORRISON
PUMP COMPANY
A BUSINESS UNIT OF PATTERSON

Tel. +1 (954) 922-5880
Fax +1 (954) 922-7729

www.morrisonpump.com

MORRISON MODEL VPS-30-25
GENERAL DIMENSIONS



PUMP PERFORMANCE:

MORRISON PUMP MODEL	:	VPS-30-25
BOWL MODEL	:	MP-25-03-SL (0.88)
DESIGN CAPACITY	:	21,000 GPM
DESIGN HEAD	:	14.5 FT. TDH
DESIGN SPEED	:	712 RPM
BOWL EFFICIENCY	:	86.1% AT DESIGN CONDITION
NPSHR	:	27 FT AT DESIGN CONDITION
OPERATING RANGE	:	8.0 TO 14.5 FT TDH
MOTOR	:	100 HP @ 720 RPM

PUMP CONSTRUCTION:

PUMP TYPE	:	AXIAL FLOW LINESHAFT
CONFIGURATION	:	VERTICAL BELOW GRADE DISCH.
LUBRICATION	:	PRODUCT LUBRICATION
IMPELLER	:	FORGED 316L STAINLESS STEEL, DYNAMICALLY BALANCED
SHAFT	:	DUPLEX STAINLESS STEEL, S31803
RADIAL BEARINGS	:	NITRILE RUBBER, CUTLESS
BOWL	:	316 STAINLESS STEEL & CARBON STEEL
COLUMN & ELBOW	:	A36 CARBON STEEL
FLANGES	:	MACHINED WITH REGISTERS
COATING	:	12 MILS HIGH SOLIDS 2-PART EPOXY

MISC.:

- DRAWING IS PRELIMINARY, FOR GENERAL REFERENCE.
- PUMP HAS NO OIL, NO GREASE, NO TAIL BEARING.



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DWG. TITLE:

MORRISON PUMP MODEL VPS-30-25 GENERAL DIMENSIONS

PROJECT:

MPC 72033 - HDR - FARRAGUT STORMWATER PUMP STATION

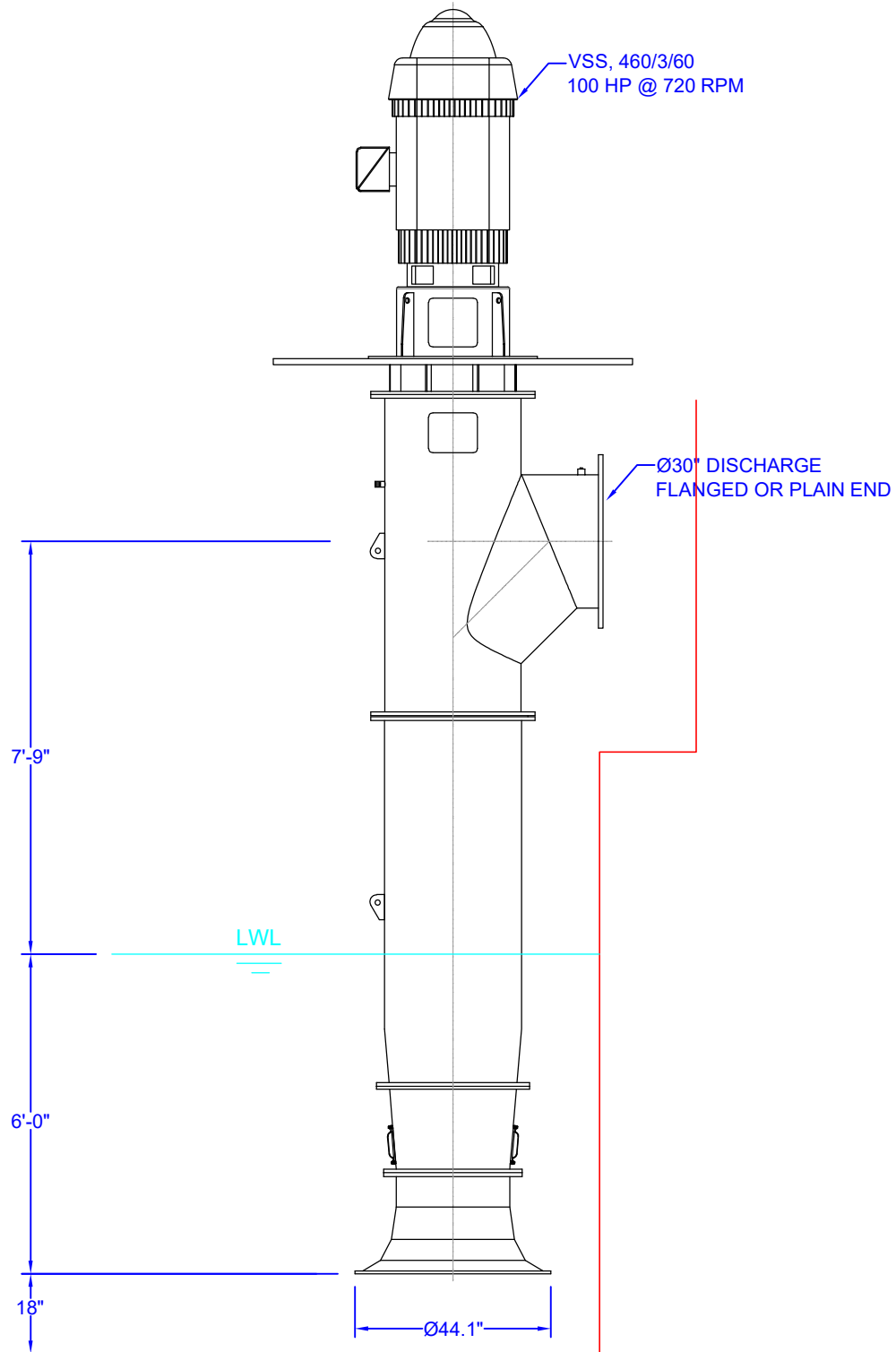
DATE:

06-APRIL-2022

FILE:

DWG-72033-001

MORRISON MODEL VPS-30-25
GENERAL LAYOUT



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DWG. TITLE:

MORRISON PUMP MODEL VPS-30-25 GENERAL LAYOUT

PROJECT:

MPC 72033 - HDR - FARRAGUT STORMWATER PUMP STATION

DATE:

06-APRIL-2022

FILE:

DWG-72033-002

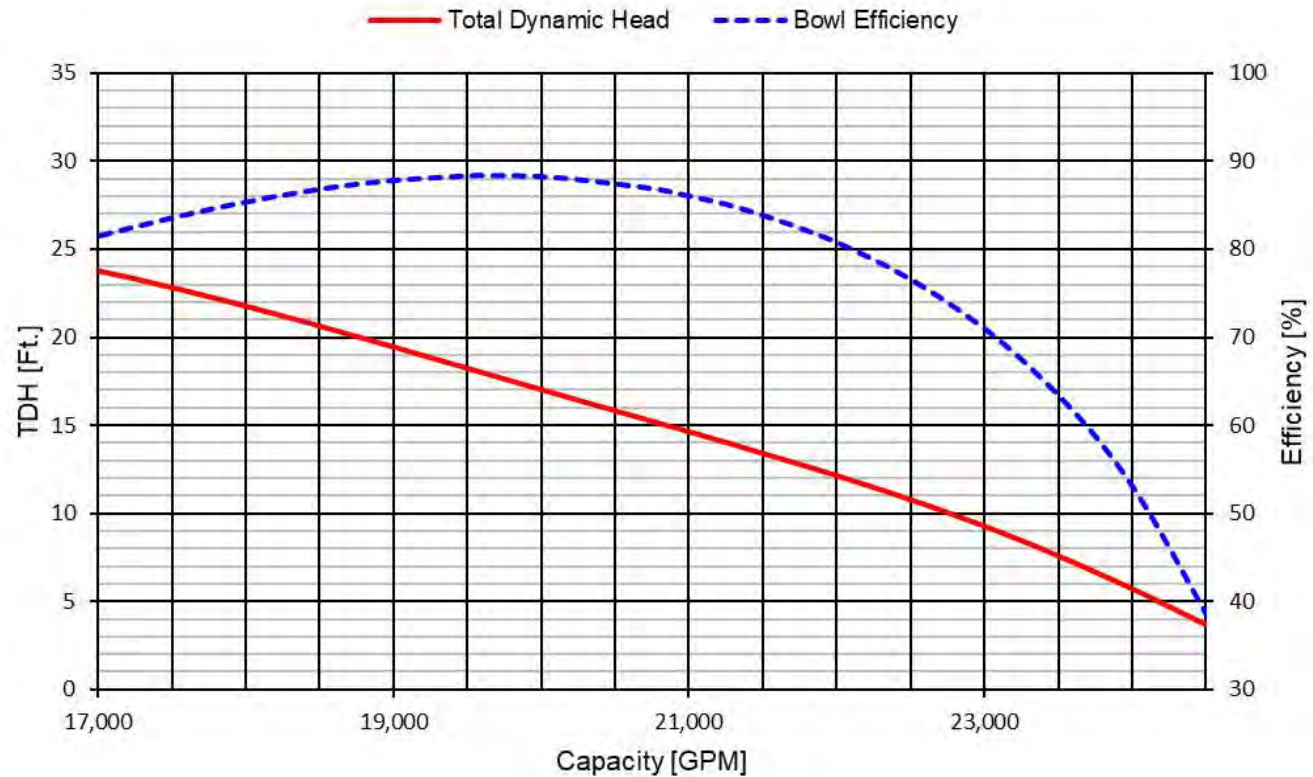
Pump Performance

Axial Flow Impeller, One-Stage, High-Efficiency

Project No: MPC 72033
Project Name: HDR - Aberdeen Farragut PS
Date: 6-Apr-2022

MORRISON PUMP MODEL VPS-30-25

Design Condition = 21,000 GPM @ 14.5 Ft. TDH



Morrison Pump Bowl No.: MP-25-03-SL (0.88)

Impeller Diameter: 24.8 inches

Shaft Speed: 712 RPM



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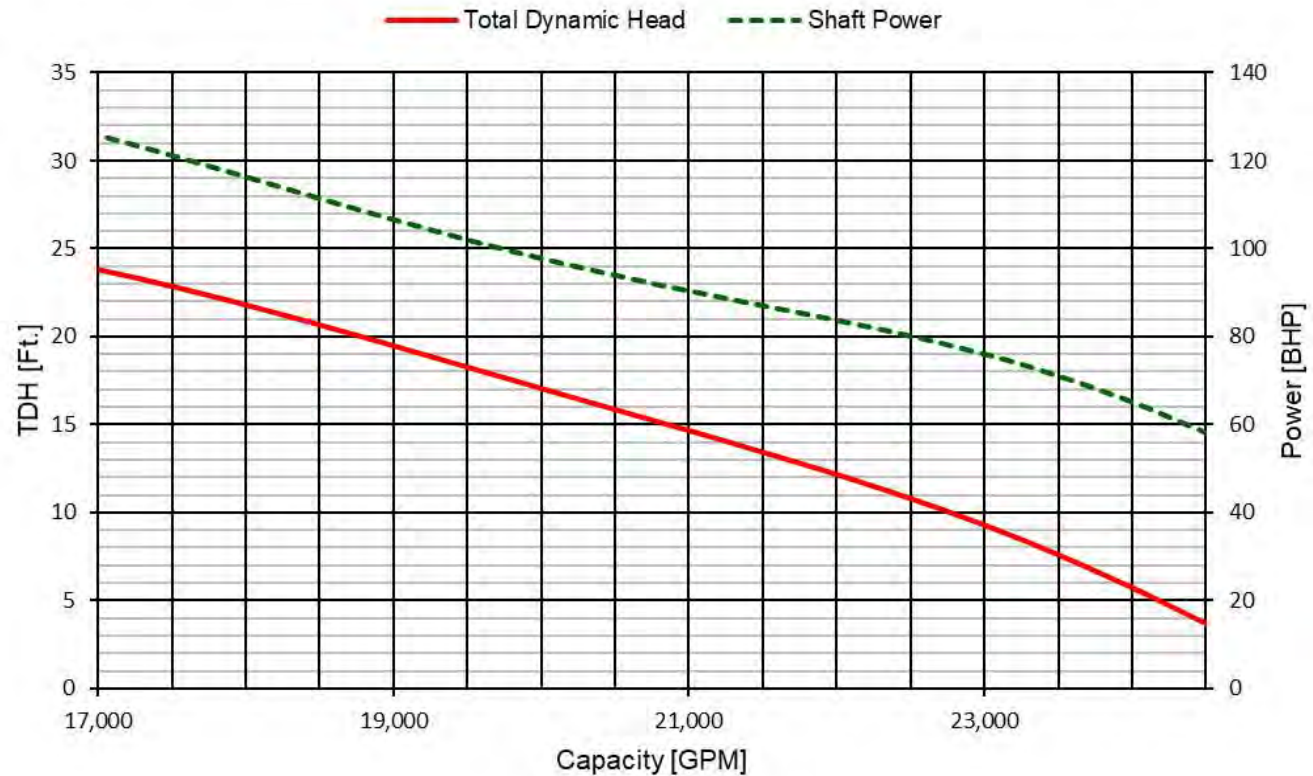
Pump Performance

Axial Flow Impeller, One-Stage, High-Efficiency

Project No: MPC 72033
Project Name: HDR - Aberdeen Farragut PS
Date: 6-Apr-2022

MORRISON PUMP MODEL VPS-30-25

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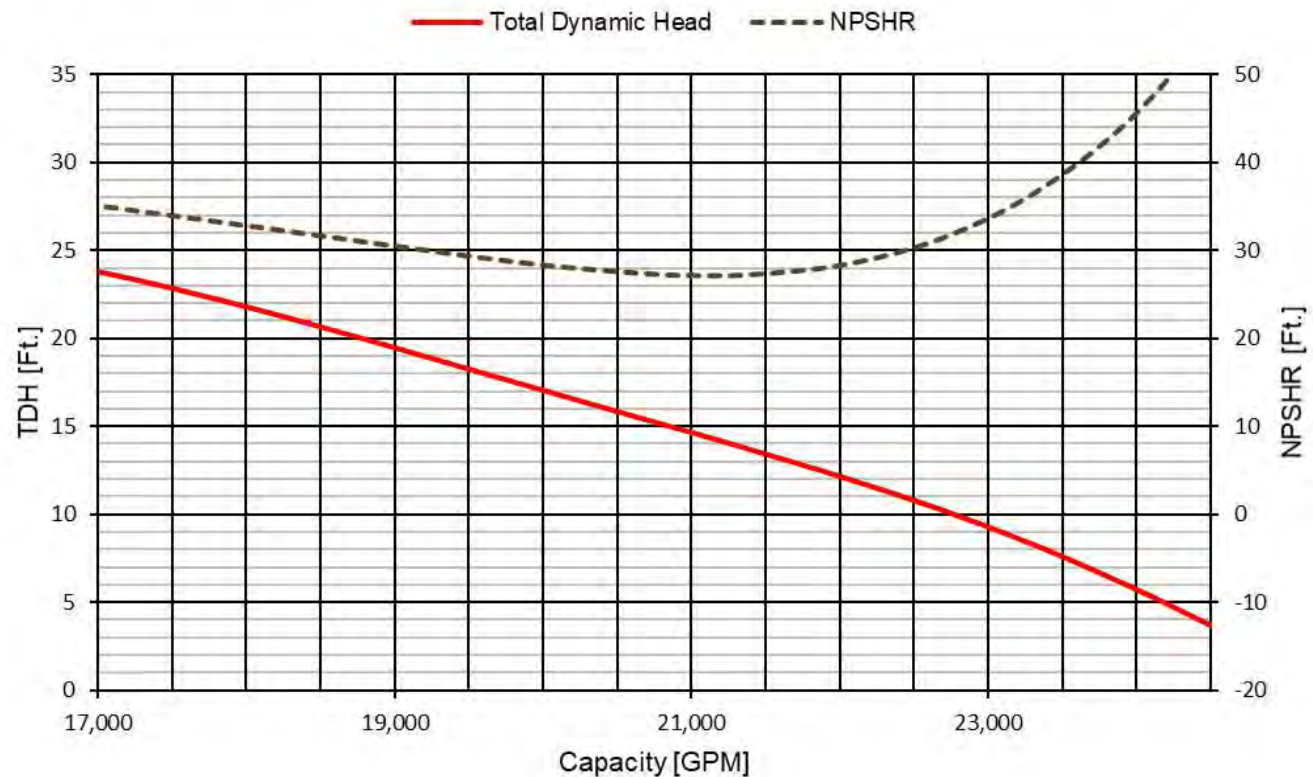
Pump Performance

Axial Flow Impeller, One-Stage, High-Efficiency

Project No: MPC 72033
Project Name: HDR - Aberdeen Farragut PS
Date: 6-Apr-2022

MORRISON PUMP MODEL VPS-30-25

Design Condition = 21,000 GPM) @ 14.5 Ft. TDH



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ALTERNATIVES B & C
100 HP FLYGT
SUBMERSIBLE PUMP

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LL 3602/776 3~ 1440

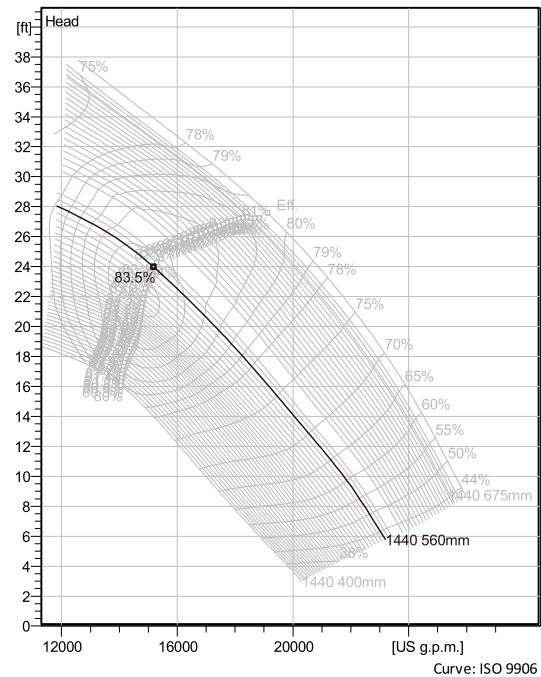
Shrouded single or multi-channel mixed flow impellers with bowl type diffuser pump casing for fibre-free liquids.



Technical specification



Curves according to: Water, pure Water, pure [100%], 39.2 °F, 62.43 lb/ft³, 1.6888E-5 ft²/s



Configuration

Motor number L0776.000 43-56-14ID-W 110hp	Installation type L - Column pipe Semi permanent, Wet
Impeller diameter 560 mm	Discharge diameter 47 1/4 inch

Pump information

Impeller diameter 560 mm
Discharge diameter 47 1/4 inch
Inlet diameter
Maximum operating speed 500 rpm
Number of blades 4
Throughlet diameter 4 15/16 inch
Max. fluid temperature 40 °C

Materials

Impeller Stainless steel

Project		Created by	Scott Vande Vusse
Block	0	Created on	4/28/2022
		Last update	4/28/2022

LL 3602/776 3~ 1440

Technical specification



Motor - General

Motor number L0776.000 43-56-14ID-W 110hp	Phases 3~	Rated speed 500 rpm	Rated power 110 hp
ATEX approved FM	Number of poles 14	Rated current 196 A	Stator variant 1
Frequency 60 Hz	Rated voltage 460 V	Insulation class H	Type of Duty
Version code 000			

Motor - Technical

Power factor - 1/1 Load 0.57	Motor efficiency - 1/1 Load 91.6 %	Total moment of inertia 317 lb ft ²	Starts per hour max. 0
Power factor - 3/4 Load 0.51	Motor efficiency - 3/4 Load 91.8 %	Starting current, direct starting 555 A	
Power factor - 1/2 Load 0.39	Motor efficiency - 1/2 Load 90.6 %	Starting current, star-delta 185 A	

Project

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Scott Vande Vusse

Created on

4/28/2022

Last update

4/28/2022

LL 3602/776 3~ 1440

Performance curve

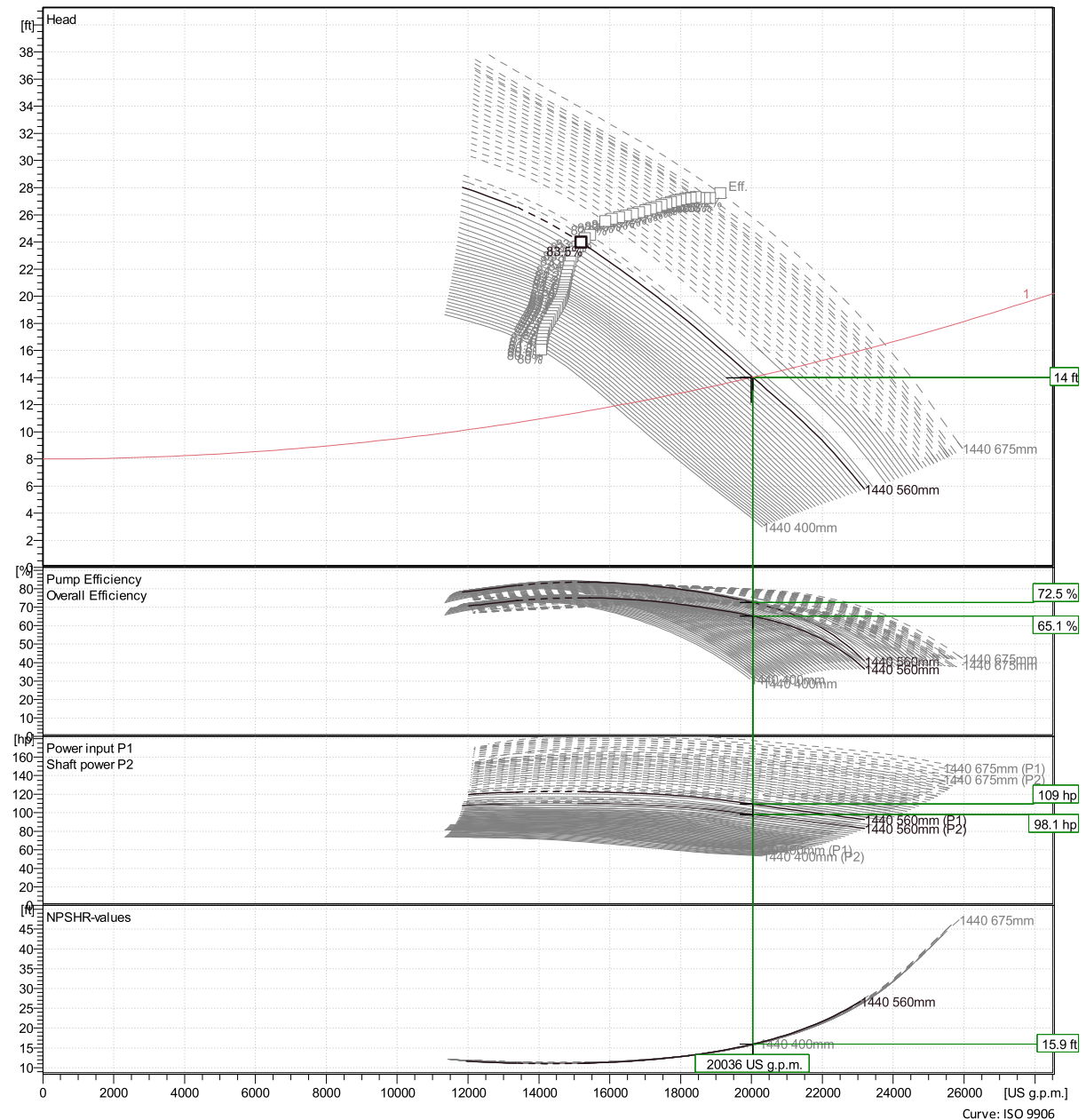


Duty point

Flow
20000 US g.p.m.

Head
14 ft

Curves according to: Water, pure Water, pure [100%], 39.2 °F, 62.43 lb/ft³, 1.6888E-5 ft²/s



Scott Vande Vusse

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Created on

4/28/2022

Last update

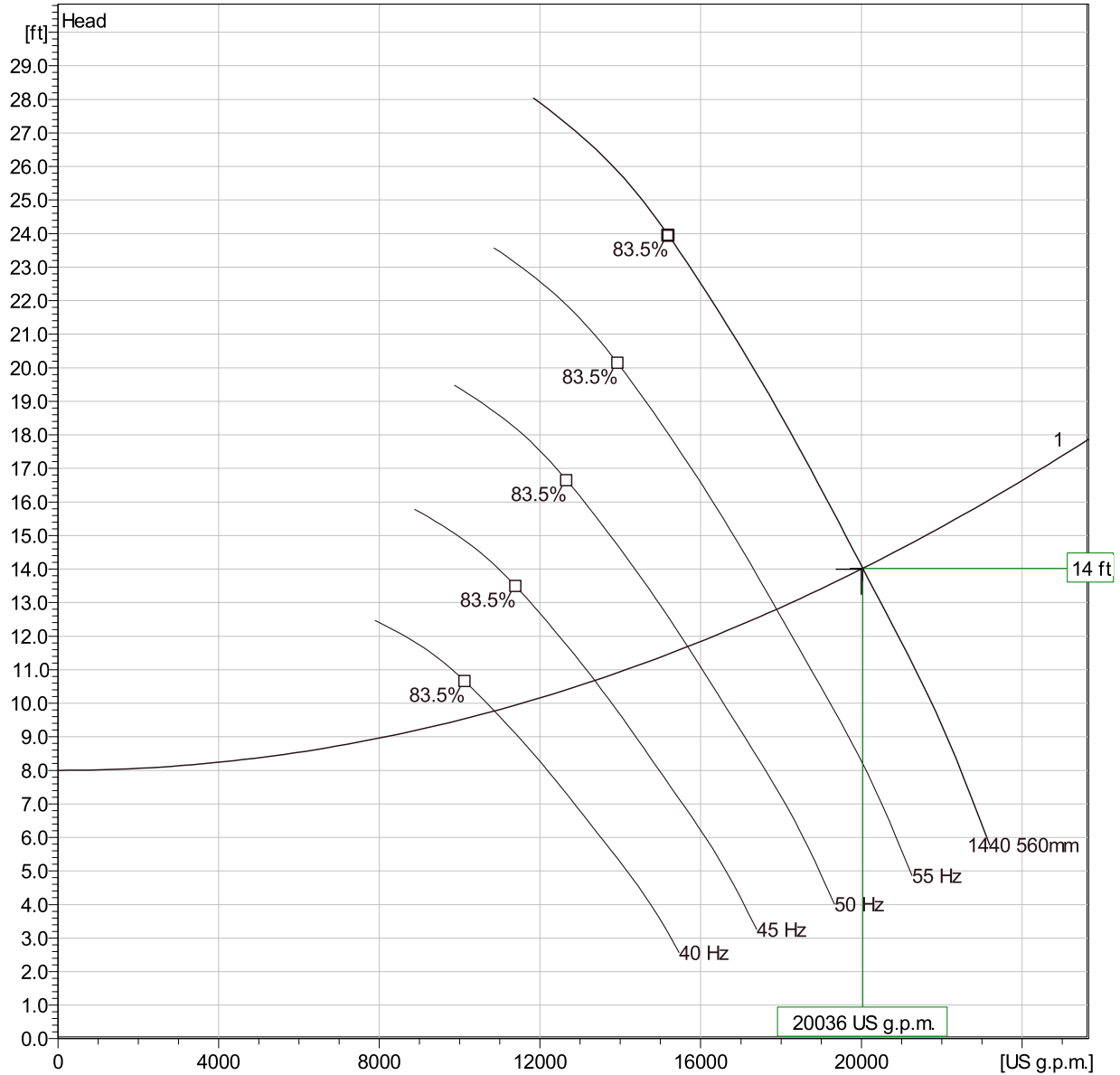
4/28/2022

LL 3602/776 3~ 1440

Duty Analysis



Curves according to: Water, pure [100%] ; 39.2°F; 62.43lb/ft³; 1.6888E-5ft²/s



Operating characteristics

Pumps / Systems	Flow US g.p.m.	Head ft	Shaft power hp	Flow US g.p.m.	Head ft	Shaft power hp	Hydr. eff.	Spec. Energy kWh/US MG	NPSHre ft
1	20000	14	98.1	20000	14	98.1	72.5 %	67.7	15.9

Project
Block

Created by Scott Vande Vusse
Created on 4/28/2022

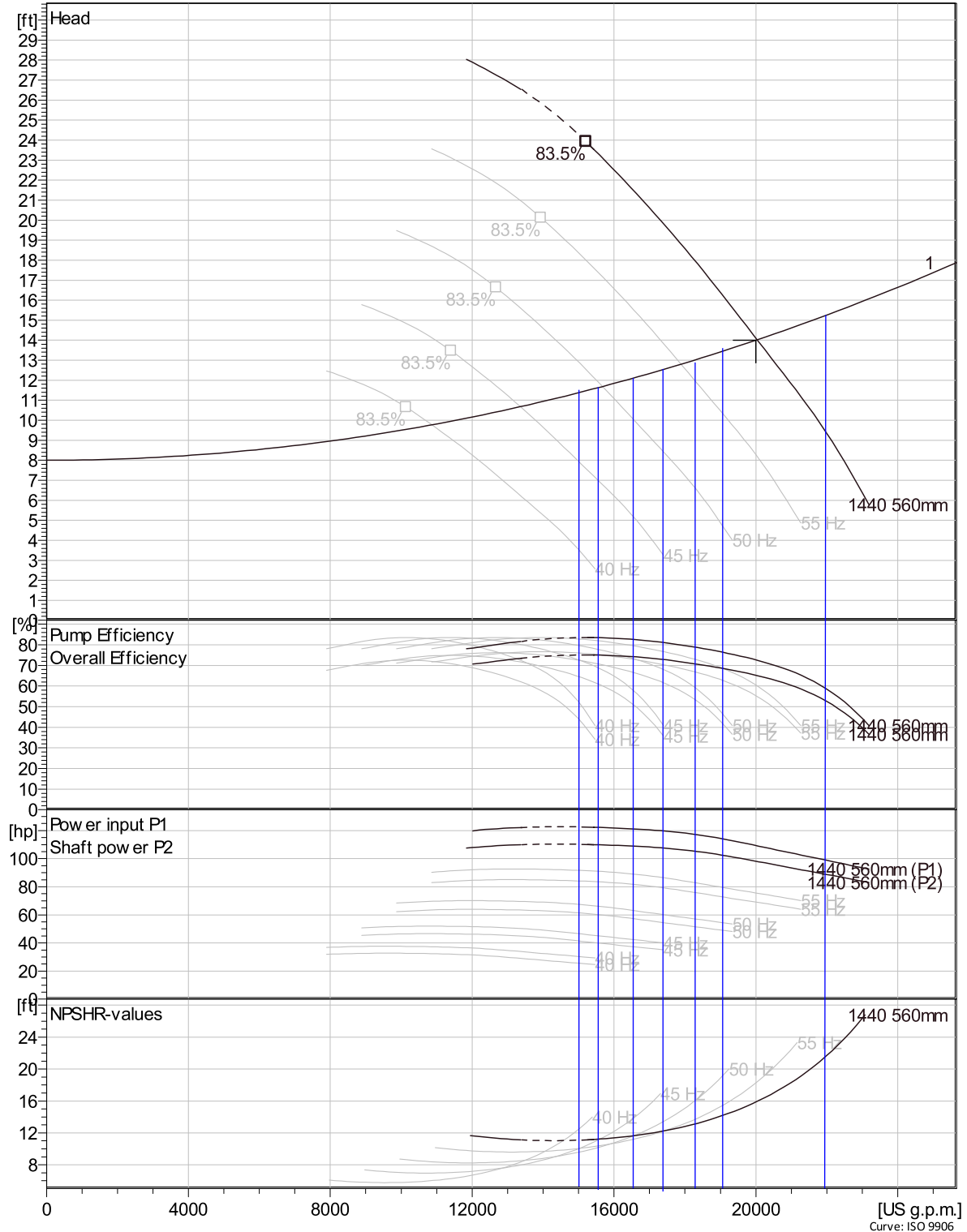
Last update 4/28/2022

LL 3602/776 3~ 1440

VFD Curve



Curves according to: Water, pure, 39.2 °F, 62.43 lb/ft³, 1.6888E-5 ft²/s



Project

Block 0

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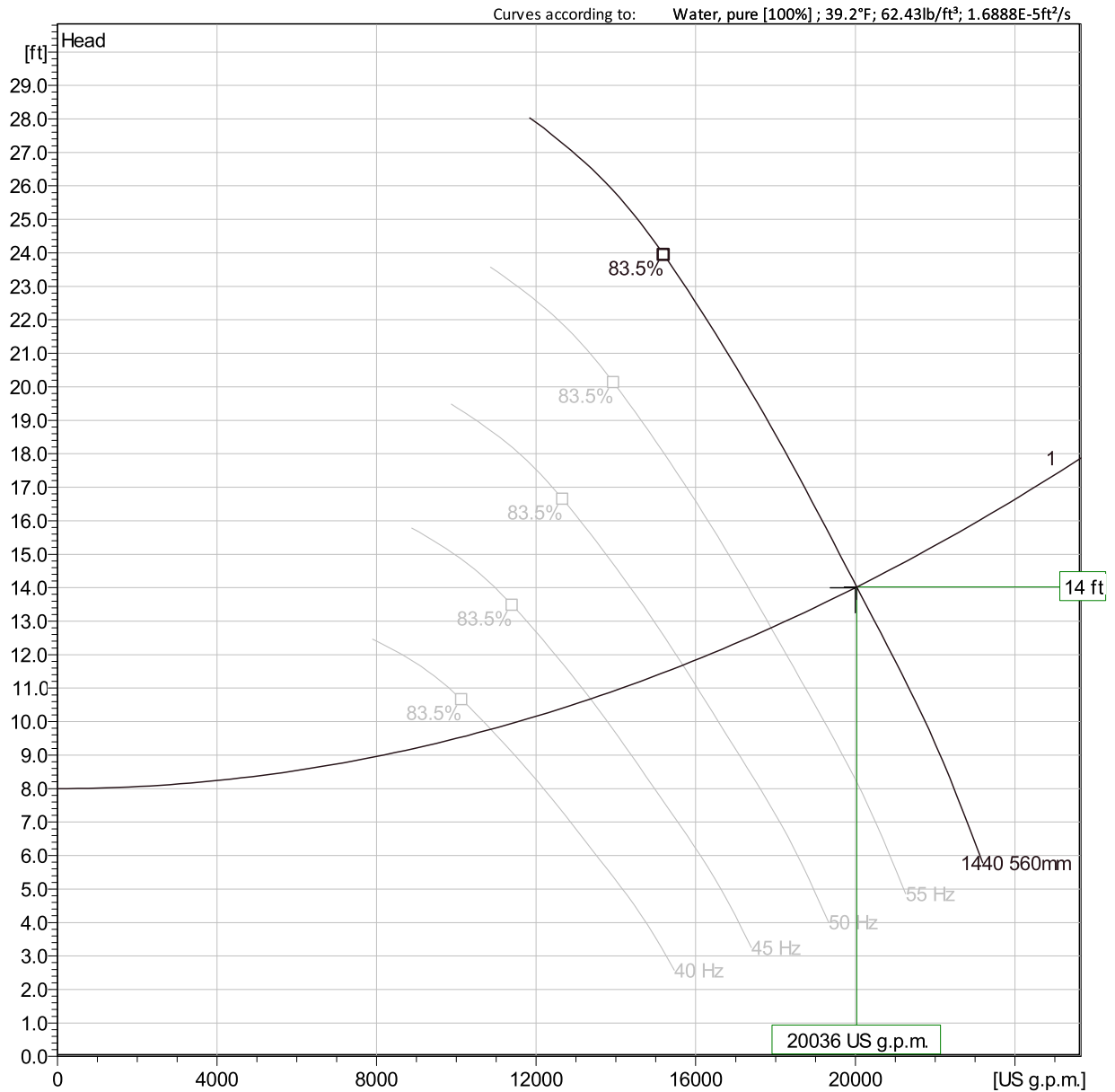
4/28/2022

Last update 4/28/2022

Curve: ISO 9906

LL 3602/776 3~ 1440

VFD Analysis



Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr. eff.	Specific energy	NPSH _{re}
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	
1	60 Hz	20000	14	98.1	20000	14	98.1	72.5 %	67.7	15.9
1	55 Hz	17900	12.8	77.5	17900	12.8	77.5	74.7 %	82.4	13
1	50 Hz	15700	11.7	59.9	15700	11.7	59.9	77.3 %	96.9	10.3
1	45 Hz	13400	10.7	45	13400	10.7	45	80.1 %	114	7.97

Project

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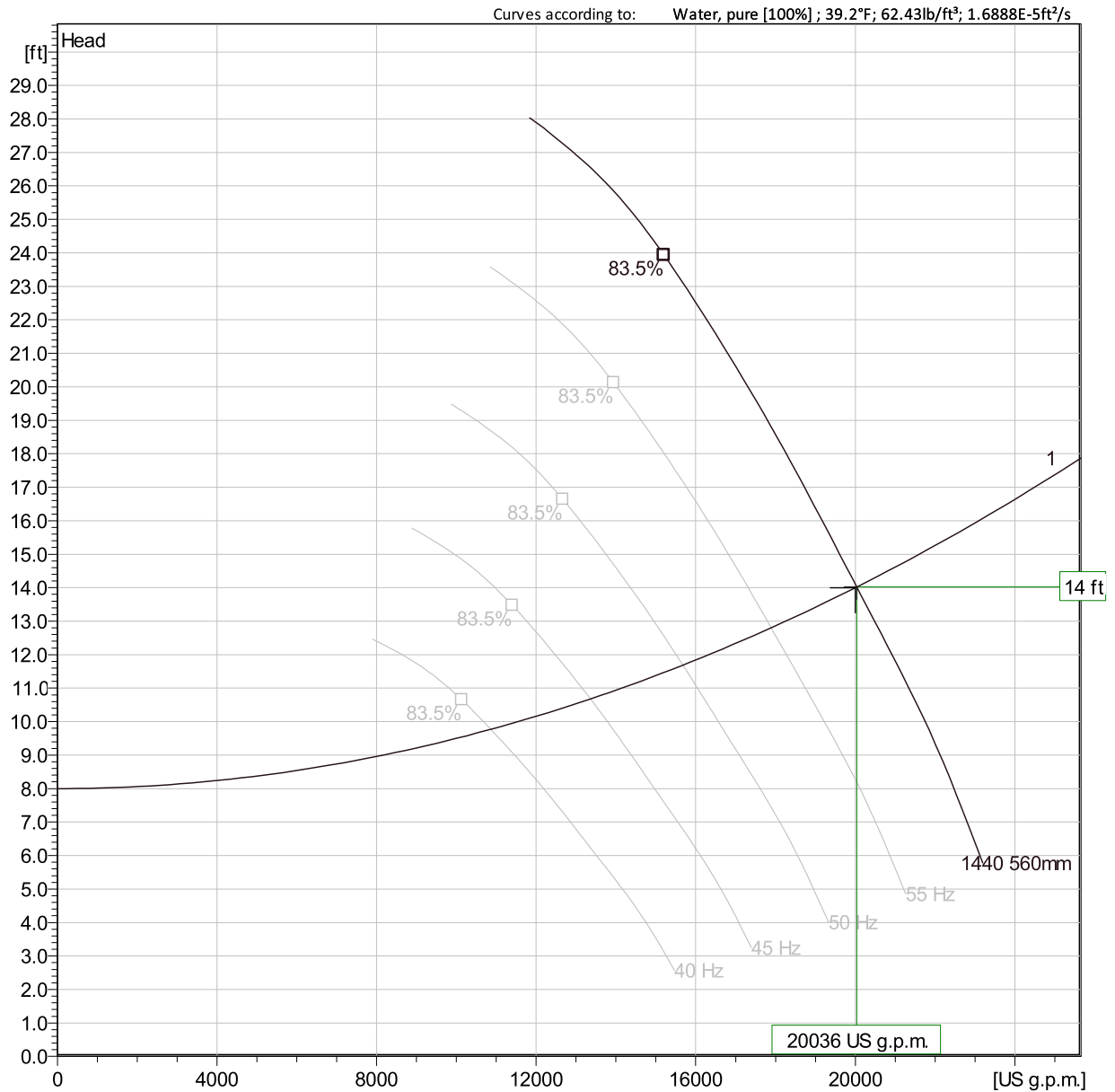
4/28/2022

Last update

4/28/2022

LL 3602/776 3~ 1440

VFD Analysis



Operating Characteristics

Pumps / Systems	Frequency	Flow US g.p.m.	Head ft	Shaft power hp	Flow US g.p.m.	Head ft	Shaft power hp	Hydr. eff.	Specific energy kWh/US MG	NPSHre ft
1	40 Hz	10900	9.77	32.4	10900	9.77	32.4	82.9 %		6.02

Project

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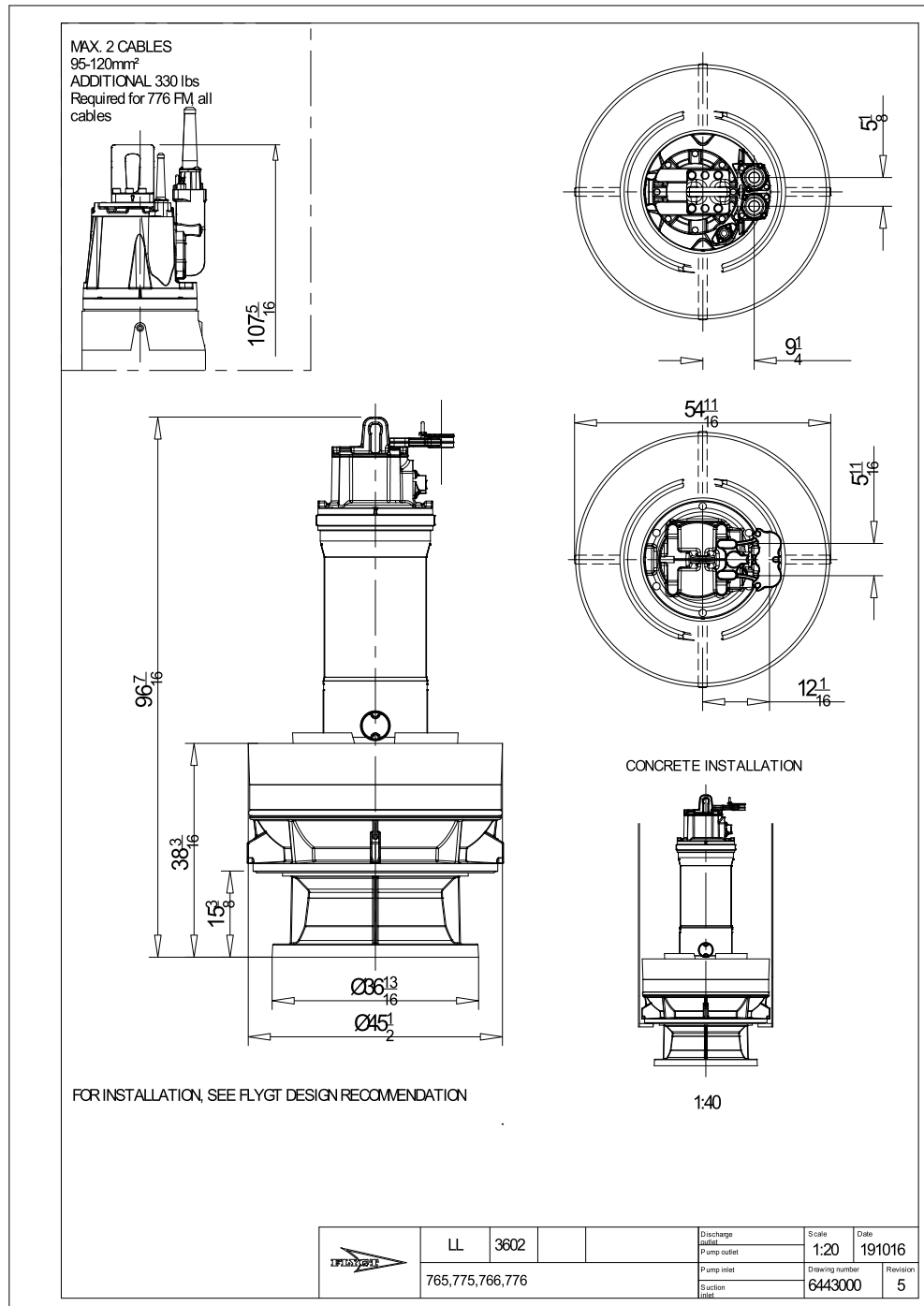
4/28/2022

Last update

4/28/2022

LL 3602/776 3~ 1440

Dimensional drawing



Project

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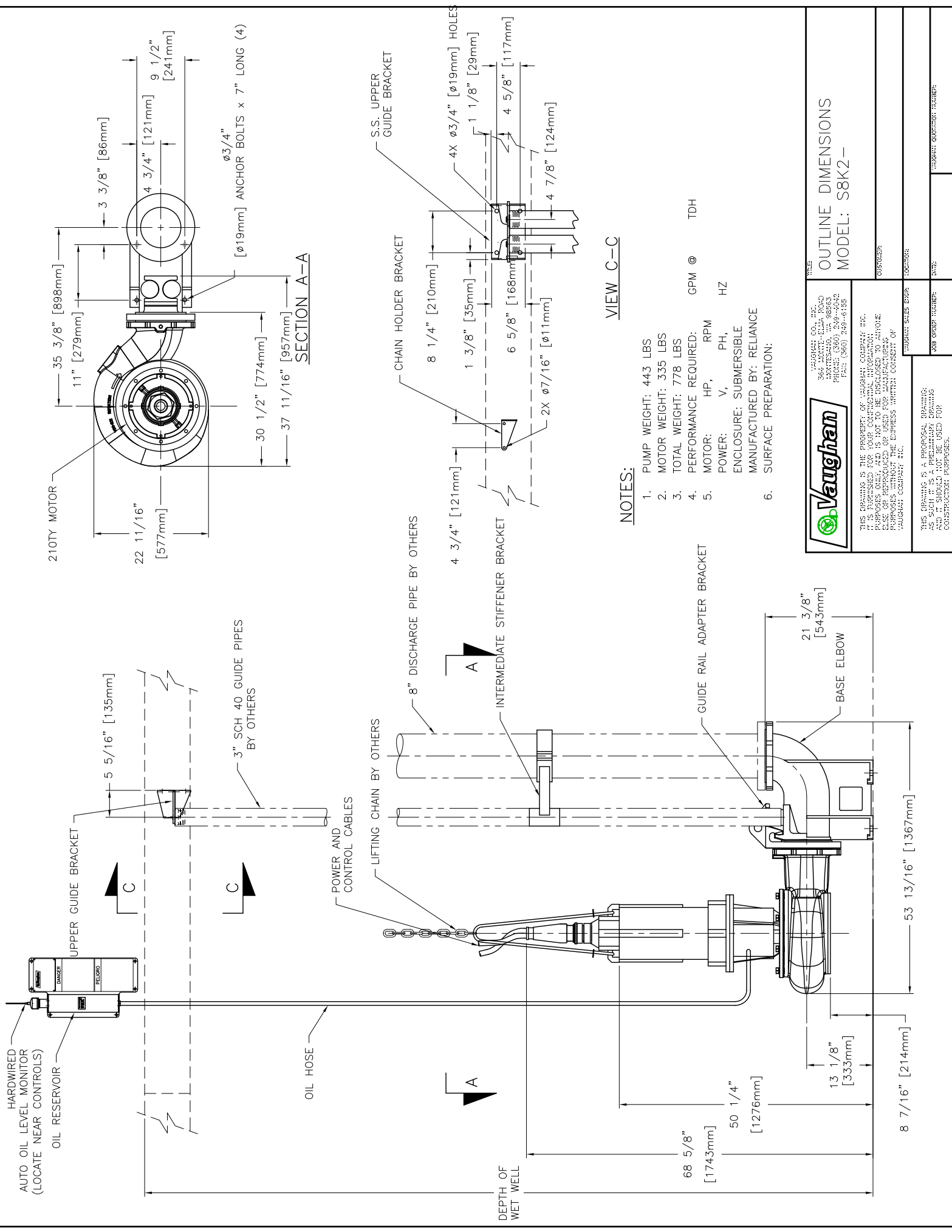
Scott Vande Vusse

Created on

4/28/2022 Last update 4/28/2022


ALTERNATIVES A, B & C
15 HP VAUGHN
CHOPPER PUMP

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NOTES:

- 1. PUMP WEIGHT: 443 LBS
- 2. MOTOR WEIGHT: 335 LBS
- 3. TOTAL WEIGHT: 778 LBS
- 4. PERFORMANCE REQUIRED: GPM @ TDH
- 5. MOTOR: HP, RPM
POWER: V, PH, HZ
- 6. SURFACE PREPARATION: ENCLOSURE: SUBMERSIBLE
MANUFACTURED BY: RELIANCE

		VAUGHAN CO., INC. 3641 MONTE-ELIA ROAD MONTESANO, VA 98953 PHONE (509) 245-4142 FAX (509) 245-4133	
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THIS DRAWING IS A PRELIMINARY DRAWING AND IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.		DATE	VAUGHAN COMPANY NUMBER
JOB ORDER NUMBER		LOCATION	



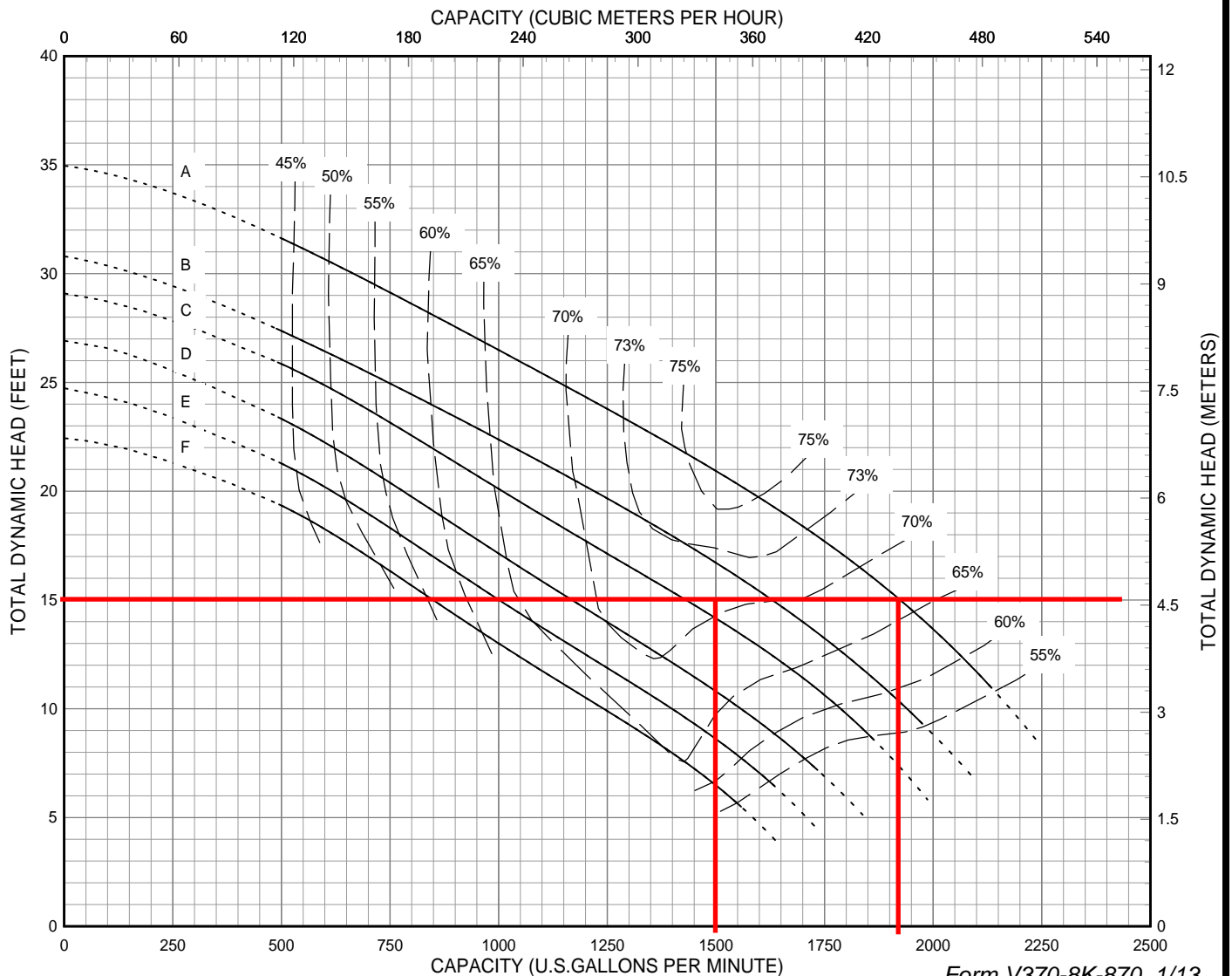
Vaughan E Series Chopper Pump PERFORMANCE CURVE

**Models:
S8K**

**Back-Pull-Out Casing
3-Blade Impeller
8" Discharge
10" Suction**

CURVE	POWER (HP/KW)	SPEED (RPM)	IMPELLER DIAMETER
A	15 / 22	860	12.00" (305 mm)
B	10 / 7.5	865	11.30" (287 mm)
C	10 / 7.5	865	11.00" (279 mm)
D	7.5 / 5.5	865	10.60" (269 mm)
E	7.5 / 5.5	865	10.30" (262 mm)
F	7.5 / 5.5	865	10.00" (254 mm)

DO NOT OPERATE PUMP IN DOTTED PORTION OF CURVES. CURVES ARE SUBJECT TO CHANGE WITHOUT NOTICE. CURVES ARE BASED ON SUBMERSIBLE SPEEDS. EFFICIENCIES SHOWN ARE NOMINAL BOWL. GUARANTEED MINIMUM EFFICIENCIES PER H.I. LEVEL B.



Appendix F. Meeting Notes

DRAFT

**Supplemental Information for the
City of Aberdeen Farragut Street Pump Station Rebuild Project**

Prepared by City Engineer Kris Koski on September 3, 2020

a. Please clarify/quantify/restate cost and benefit -- i.e., what quantitative value is protected (or impact avoided) for the cost of the project?

The pump station will protect and support \$37 million worth of improvements for a design and capital construction cost of \$2.6 million. The pump station was built in 1980 and was the first built in South Aberdeen. Today it is still the largest and most important station south of the Chehalis River in Aberdeen. The drainage basin for this pump station includes approximately 400 properties with constructed improvements totaling \$37 million in value according to 2020 County Assessor records. The pump station's tributary drainage basin is a very low, flat coastal floodplain protected from coastal flooding and riverine flooding by the Southside Levee. Without the Farragut Street Pump Station, the entire basin would be affected by local flooding by varying degrees, ranging from nuisance flooding and water over roadways to flooded buildings and property damage.

b. What is the status of the Southside Levee project (18-1543; <https://secure.rco.wa.gov/prism/search/ProjectSnapshot.aspx?ProjectNumber=18-1543>). What is the current condition of the Southside Levee? Will the proposed pump provide value under the current condition of the levee?

Apparent minor elevation deficiencies in the Southside Levee have delayed the recertification process. The final report for submitting to FEMA has been prepared by Aberdeen's consultant and Aberdeen's Engineering Division is developing the approach to address the elevation concerns. The levee structure itself is in good condition with annual inspections by the Army Corps typically generating minor maintenance corrections which are addressed each year by Public Works staff such as vegetation removal and culvert video inspections. The Farragut Street Pump Station provides flood control that is completely internal to the levee system—the station's intake and discharge are both internal to the levee. Although the Farragut Street Pump Station is an important component of the comprehensive flood protection approach in South Aberdeen which includes the Southside Levee, it is not directly related to the levee accreditation process through FEMA.

c. How does this project benefit/relate to Cosmopolis, Mill Creek, and the Mill Creek Multi Objective Implementation Plan: Channel and Culvert Improvements for Flood Reduction and Fish Passage/Habitat Restoration project?

The full design and construction of this pump station can be achieved on schedule and in full coordination and support of the Cosmopolis Mill Creek plan currently proposed. Regardless of the status or progress of the Cosmopolis plan, a downstream analysis will be required for the new Farragut Street Pump Station to ensure that discharge from the new station does not create a new downstream hydraulic problem or add to any existing downstream hydraulic problems in the lower Mill Creek basin. The downstream analysis will be completed during the design phase and will be closely coordinated with the City of Cosmopolis' master plan for the

Mill Creek system. Through the downstream analysis and coordination with Cosmopolis, there is the potential to optimize pump station discharge relative to existing conditions and improve downstream hydraulic conditions for the lower Mill Creek basin.

d. How much remaining functional life does the existing pump have? 1 year? 3 years? 5 years? Is failure imminent? What does the current pump cost to operate/maintain?

The pump station has exceeded its useful life and the pump station has emerged in recent years as a priority capital project for the City's stormwater utility. Public Works crews may continue to keep the station operational another 2-3 years through an increasing amount of manpower and resources. An estimated 800 man-hours were spent in 2019 (est. \$40,000 fully burdened labor) on regular maintenance, emergency maintenance to address clogged intakes that are chronic with the station's design, and providing a supplemental trailer-mounted pump during storms and during emergency maintenance events. Electricity costs at the pump station totaled \$22,315.83 in 2019.

e. What is the pumping volume/capacity of the existing pump, and what is the pumping volume/capacity of the proposed new pump?

correct
to
read:
40,000

The existing pump station's two 100 horsepower pumps have a total capacity of 4,000 gallons per minute (GPM). A third 15 horsepower pump runs frequently to address constant minor inflow into the station and adds an estimated 500 GPM of capacity. During intense storm events, an additional trailer-mounted pump (1,500 GPM) is brought to the site to augment the station to keep up with inflow. A professionally designed, modern pump station with variable frequency drives will likely result in significantly different pump sizing and layout compared to existing conditions. The size, capacity, and layout of the new pumps will depend on the calculated inflow to the station, the capacity of the forebay, the programming of the VFD controllers, and any flow limitations on the discharge side to avoid creating a downstream hydraulic issue in the lower Mill Creek basin. It is reasonable to expect that the capacity of the new station will match the capacity of the old station (as supplemented by trailer-mounted pump) at a minimum (approx. 6,000 GPM), and that the maximum capacity of the new station will either be 1) the design event (as described in a separate question within this supplemental information request) or 2) the identified maximum allowable discharge rate into the Mill Creek basin as calculated during the design phase of the project.

f. What flood event is the existing pump calibrated to, and what flood event will the proposed new pump calibrated to?

The existing pump station's original design calculations from 1980 are not available and the station has been field calibrated and optimized based on existing equipment and observed flows. The target design event for the new pump station will be the 25-year, 24-hour rainfall event modeled through the existing conveyance systems that collect and convey stormwater to the pump station. A 100-year, 24-hour rainfall event will also be modeled and evaluated to identify any potential for incorporating cost-effective emergency capacity or redundancy into the pump station.

g. Please describe any habitat benefits/impacts/opportunities.

The new pump station's variable frequency drives will mitigate the effects of sudden and significant changes in flow in the upstream conveyance system and in the downstream creek system associated with the on/off nature of the existing pump station. This will decrease the turbidity of water discharged into the lower Mill Creek system. The negative effects of turbidity include reduced light penetration, decreased aquatic plant growth, decrease in fish food organisms, and decrease in fish production. The new pump station will also have improved trash racks for removing trash and plastics from the flow prior to entering the pumps and being chopped into fine pieces and discharged in the downstream system.

h. Please discuss plans and budget for ensuring meaningful archaeological and cultural resource survey and documentation.

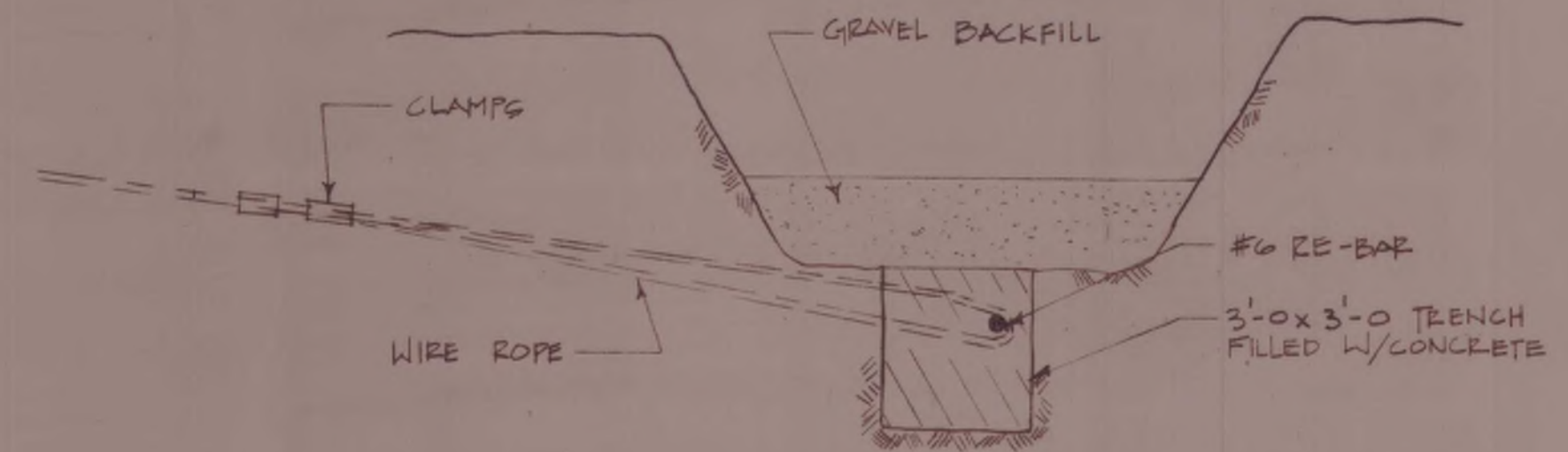
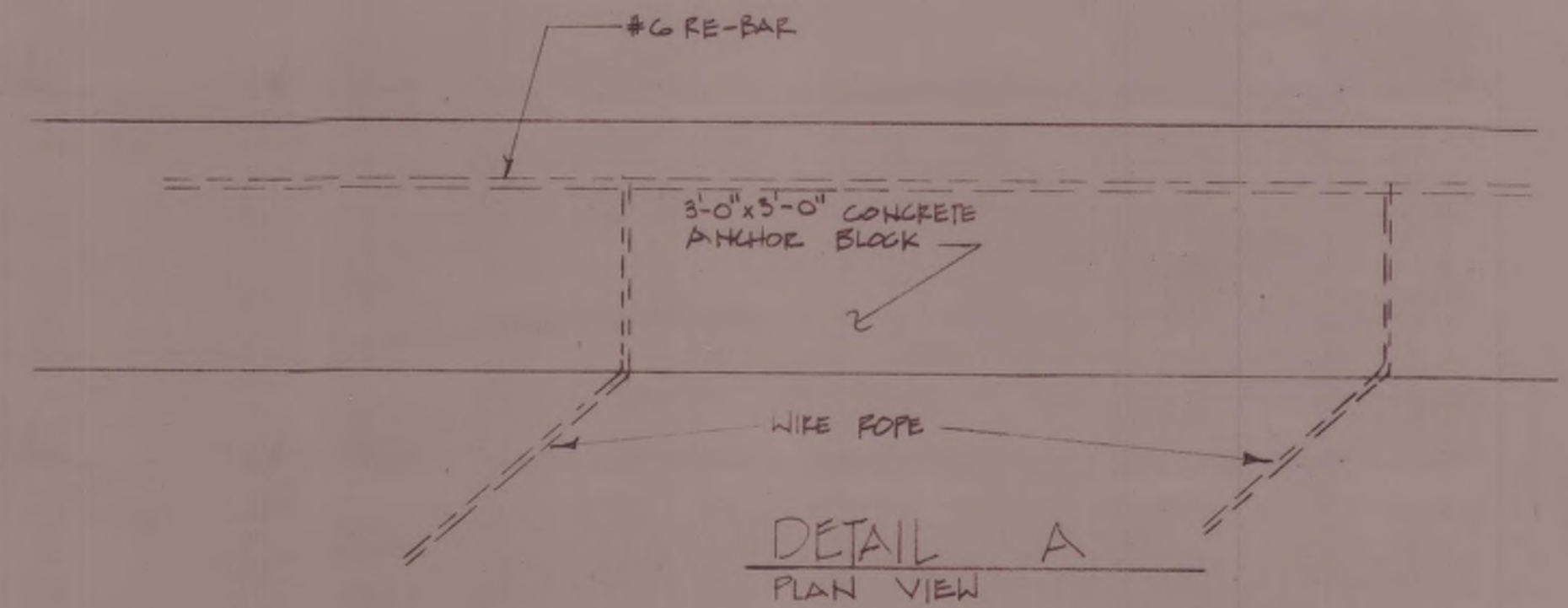
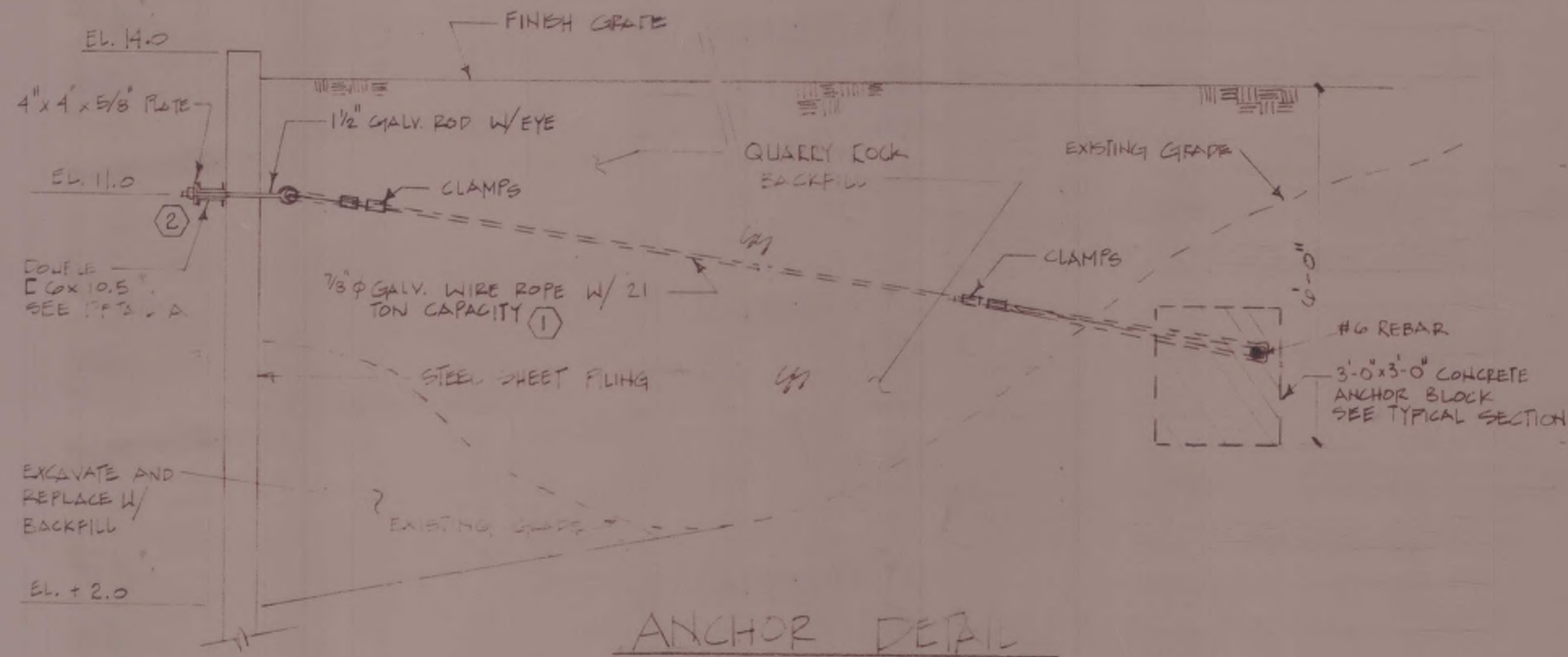
The City of Aberdeen is committed to cultural resource compliance and tribal coordination. Aberdeen's Engineering Division holds monthly meetings between the City Engineer and an appointed Cultural Resource Lead to review and maintain a database of planned projects that are anticipated to involve ground-disturbing activity. The actual archaeological review or tribal coordination for each project is either carried out by the City or by a consultant for the City depending on the size of the project and staff availability. The monthly meeting ensures that projects requiring cultural resources or tribal consultation action are identified and that no ground-disturbing activity occurs before those actions are complete. The spreadsheet is shared monthly with the Quinault Indian Nation and the Chehalis Tribe for informational purposes only. For the Farragut Street Pump Station project, we are anticipating reports required by the Department of Archaeology and Historic Preservation including background research of the WISAARD database, field investigation, and shovel test probes at the site. The project will require an inadvertent discovery plan be included in the contract documents for construction and that the plan be kept on the site during construction.

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Appendix G. Record Drawings

DRAFT

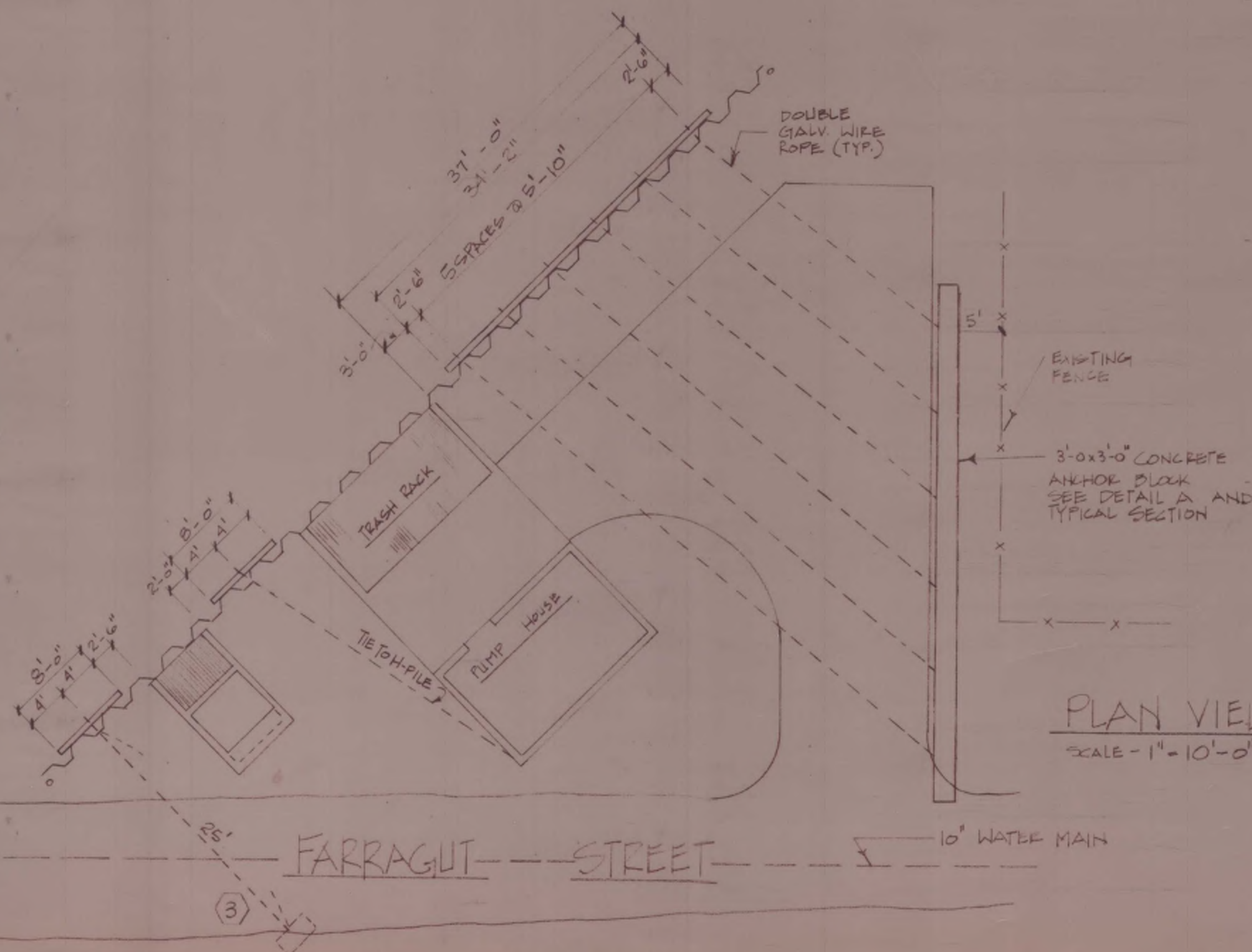
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TYPICAL SECTION
NO SCALE

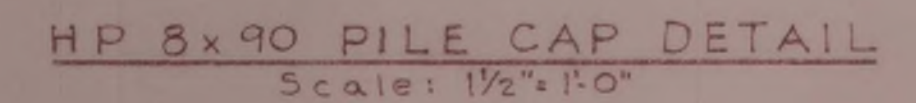
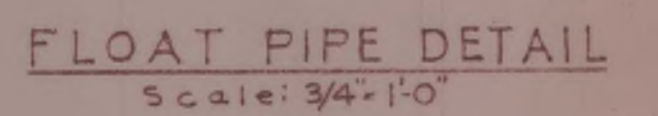
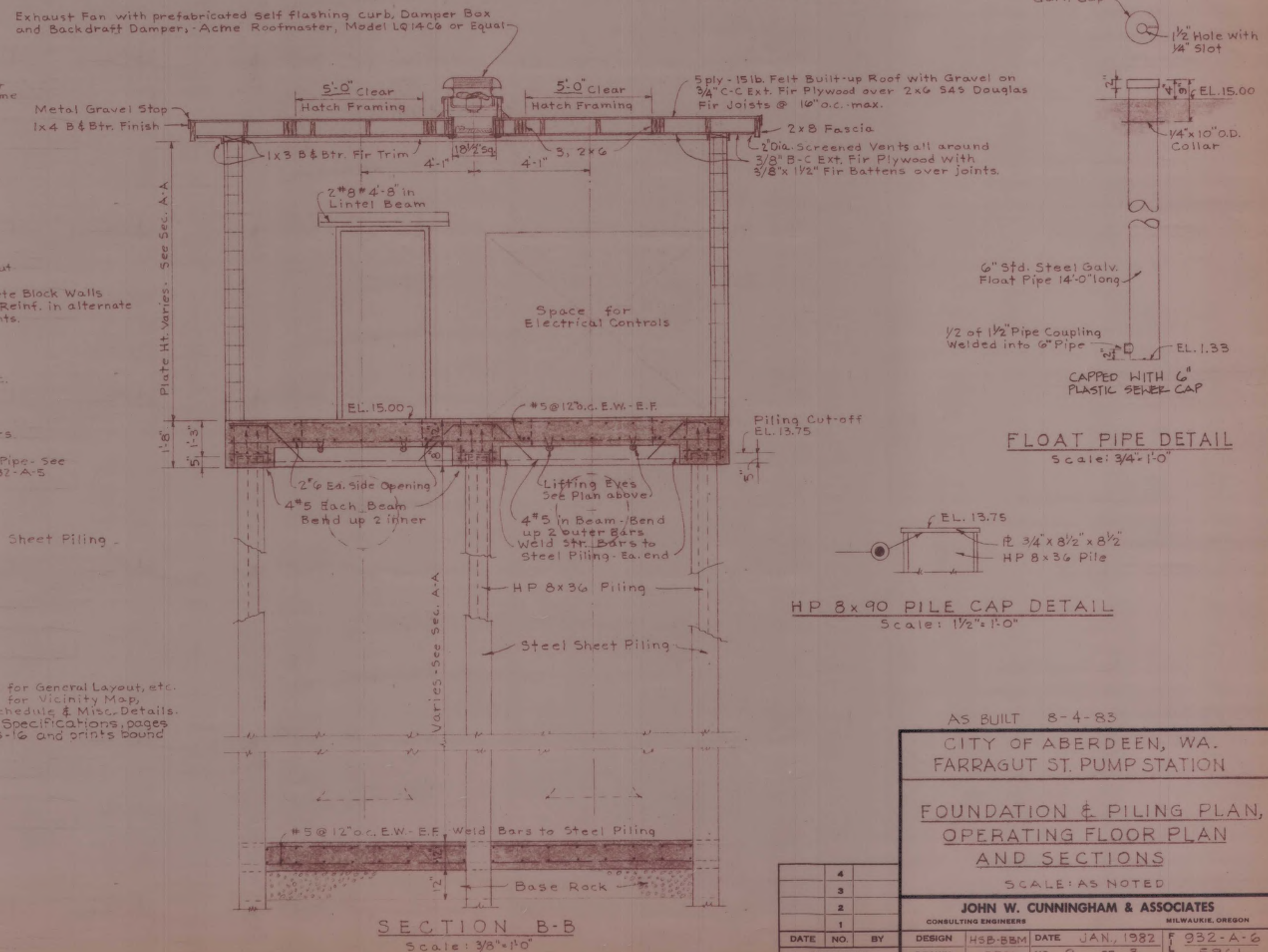
NOTES:

- ① GALV. WIRE ROPE OF 21 TON CAPACITY. ALL WIRE ROPE CONNECTIONS MUST BE APPROVED BY THE ENGINEER.
- ② ALL METAL COMPONENTS OF THE ANCHOR SYSTEM SHALL BE COATED WITH Koppers Bitu-Plastic #33 OR APPROVED EQUAL.
- ③ THE CONCRETE ANCHOR IN FARRAGUT ST. MUST BE PLACED AT AN ELEVATION TO ALLOW THE WIRE ROPE CLEARANCE UNDER 10" WATER MAIN IN FARRAGUT ST.



AS-BUILT 8-4-83
CUNNINGHAM ASSOC. INC.
FARRAGUT PUMP STATION
JOB # 782-F 11-11-82
DRAWN BY S. D. LEE

CE-S91H



AS BUILT 8-4-83

CITY OF ABERDEEN, WA.
FARRAGUT ST. PUMP STATION

FOUNDATION & PILING PLAN,
OPERATING FLOOR PLAN
AND SECTIONS

SCALE: AS NOTED

JOHN W. CUNNINGHAM & ASSOCIATES

CONSULTING ENGINEERS MILWAUKIE, OREGON

DATE	NO.	BY	DESIGN	HSB-BBM	DATE	JAN., 1982	FILE	932-A-6
REVISIONS			DRAWN	BBM	NO.	2	OF	3

Appendix H. Cost Estimates

DRAFT

ALTERNATIVE A ESTIMATE
VERTICAL AXIAL PUMPS
ALL PUMPS IN THE BUILDING

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description:	Farragut Pump Station - Alternate A Vertical Axial Pumps			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Structural, Excavation & Shoring	1	LS	\$ 1,574,000	\$ 1,574,000
2	Pump Station Facility	1	LS	\$ 941,000	\$ 941,000
3	Process Mechanical and Piping	1	LS	\$ 1,686,000	\$ 1,686,000
4	Mechanical Vertical Bar Screens (pump intake)	1	LS	\$ 752,000	\$ 752,000
5	Electrical, Lighting, and Controls	1	LS	\$ 986,000	\$ 986,000
				\$ -	\$ -
				\$ -	\$ -
Subtotal Construction Costs					\$ 5,939,000
ROW and Use Permits					\$ -
Art or Agency required Betterment Costs					\$ -
Mobilization @ 0.08					\$ 475,120
ESTIMATED PROBABLE COST OF CONSTRUCTION BID					\$ 6,414,120
SUBTOTAL ADDITIONAL CONSTRUCTION COSTS					
Allowance for Indeterminates (AFI - Design Allowance)					\$ 1,187,800
Material Pricing Uncertainty Allowance					\$ 178,170
Construction Change Order Allowance					\$ 593,900
Subtotal Primary Construction Amount					\$ 1,959,870
Retail Sales Tax					\$ 539,261
TOTAL DIRECT CONSTRUCTION COSTS					\$ 8,913,000
INDIRECT: NON-CONSTRUCTION COSTS					
Design, Admin, ROW, and Construction Management					\$ 1,191,280
Utility & Other Agency Support					\$ -
Local Agency Mitigation					\$ -
Environmental, Wetland, Permitting and Coordination					\$ 118,780
Real Estate Property and Right-of-Way Acquisition					\$ 38,280
TOTAL INDIRECT CONSTRUCTION COSTS (NOT INCLUDING CONTINGENCY)					\$ 1,348,340
Project Contingency @ 0.25					\$ 1,940,615
TOTAL PROJECT COST					\$ 10,261,000

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description	Alt A Structural, Excavation & Shoring			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Demolition and Removals			\$ -	\$ -
2	Remove and Dispose of existing Shoring and Anchoring System (Allowance)	1	LS	\$ 110,000	\$ 110,000
3	Temporary Fencing, stockpiling, and site restoration (Allowance)	1	LS	\$ 15,000	\$ 15,000
4				\$ -	\$ -
5	Below Grade Structure and Shoring			\$ -	\$ -
6	PZ40 Sheet Piling	4,741	SF	\$ 75	\$ 355,575
7	Concrete Seal	92	CY	\$ 1,500	\$ 138,000
8	Furnishing Steel Piling	1,920	LF	\$ 135	\$ 259,200
9	Driving Stee Pile	16	EA	\$ 3,250	\$ 52,000
10	Whalers and Bracing	25,493	LBS	\$ 5	\$ 127,465
11				\$ -	\$ -
12	Excavation and Backfill			\$ -	\$ -
13	Unnamed Ditch Excavation (800 sf est @ 2' ave depth) Disposal Incl. Haul	60	CY	\$ 28	\$ 1,680
14	Exc. for Pump Sta. wetwell, foundation and shoring (+/- 1400 sf est @ 18' ave. depth	940	CY	\$ 28	\$ 26,320
15	Structural Fill/Spalls	290	CY	\$ 42	\$ 12,180
16	Unnamed Ditch Excavation (800 sf est @ 2' ave depth) Disposal Incl. Haul	60	CY	\$ 28	\$ 1,680
17				\$ -	\$ -
18	Dewatering			\$ -	\$ -
19	Temporary Sheet Pile Shoring - Unnamed Ditch Bank (50 ft by 30 ft)	1,500	SF	\$ 75	\$ 112,500
20	Water Control Sediment Control and Monitoring (allowance)	1	LS	\$ 50,000	\$ 50,000
21	Super Sacks	1	LS	\$ 25,000	\$ 25,000
22	Plastic Sheeting	2,000	SF	\$ 3	\$ 5,000
23	Trash Pumps with Sump	2	EA	\$ 25,000	\$ 50,000
24				\$ -	\$ -
25	Additional Costs			\$ -	\$ -
26	TESC @ 2% of Construction Costs	2.0%	LS	\$ 1,341,600	\$ 26,832
				\$ -	\$ -
Item Subtotal Construction Costs (Year 2022)					\$ 1,368,432
DIRECT: CONSTRUCTION COST MARK-UPS					
	General Conditions	0%	1	\$	-
	Mobilization/Demobilization	0%	1	\$	-
	Overhead & Profit (OHP)	15%	1.15	\$	205,265
	Insurance	0%	1	\$	-
	Bonding	0%	1	\$	-
	Escalation Multiplier from ENR-CCI	0%	1	\$	-
Item Subtotal Construction Costs (Year 2022)					\$ 1,573,697
Direct: Subtotal Construction Costs					\$ 1,574,000

Base Year	Estimate Year
2022	2022

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description	Alt A Pump Station Facility			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
	Above Grade Building - CMU			\$ -	\$ -
	Roof Framing	710	SF	\$ 125	\$ 88,750
	CMU Walls	1080	SF	\$ 25	\$ 27,000
	Building Concrete	28	CY	\$ 2,500	\$ 70,000
	Double Door	2	LS	\$ 7,000	\$ 14,000
	Building Penetrations (HVAC)	1	LS	\$ 5,000	\$ 5,000
	Access Hatches and Ladders	3	EA	\$ 8,000	\$ 24,000
	Penetrations for pump discharge (Allowance)	1	LS	\$ 8,000	\$ 8,000
	Misc. arch items, roof finish, paint, signs, sealant, finishes	1	LS	\$ 100,000	\$ 100,000
	Allowance for Louvers	1	LS	\$ 12,000	\$ 12,000
				\$ -	\$ -
	CIP Wetwell Concrete			\$ -	\$ -
	Walls	160	CY	\$ 1,100	\$ 176,000
	Foundation	140	CY	\$ 850	\$ 119,000
	Roof Slab (includes Concrete for screening Platform)	70	CY	\$ 1,400	\$ 98,000
	Controlled Density Fill (Allowance)	50	CY	\$ 56	\$ 2,800
				\$ -	\$ -
	Site and Access				
	Chain Link Fence and Gates	230	LF	\$ 110	\$ 25,300
	Site Restoration (Allowance)	1	LS	\$ 25,000	\$ 25,000
				\$ -	\$ -
	Additional Costs			\$ -	\$ -
	Utility Relocation Allowance	1	LS	\$ -	\$ -
	TESC @ 2% of Construction Costs	2%	LS	\$ 794,850	\$ 11,923
	Traffic Control Allowance est. at 2%	2%	LS	\$ 555,000	\$ 11,100
					\$ -
Item Subtotal Construction Costs (Year 2022)				\$	817,873
DIRECT: CONSTRUCTION COST MARK-UPS					
	General Conditions	0%	1	\$	-
	Mobilization/Demobilization	0%	1	\$	-
	Overhead & Profit (OHP)	15%	1.15	\$	122,681
	Insurance	0%	1	\$	-
	Bonding	0%	1	\$	-
	Escalation Multiplier from ENR-CCI	0%	1	\$	-
Item Subtotal Construction Costs (Year 2022)				\$	940,554
Direct: Subtotal Construction Costs				\$	941,000

Base Year	Estimate Year
2022	2022

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description	Alt A Process Mechanical and Piping			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
	Discharge Piping			\$ -	\$ -
	8" DI Piping	80	LF	\$ 160	\$ 12,800
	8" DI 90 degree bend MJ	4	EA	\$ 650	\$ 2,600
	8"x6" DI Reducer, FL	2	EA	\$ 1,700	\$ 3,400
	8" Gate Valve	1	EA	\$ 6,200	\$ 6,200
	8" Check Valve	1	EA	\$ 3,500	\$ 3,500
				\$ -	\$ -
	30" DI PIPE	150	LF	\$ 460	\$ 69,000
	30" DI 90 degree bend MJ	8	EA	\$ 3,200	\$ 25,600
	42" to 30" Reducer, FL	6	EA	\$ 8,000	\$ 48,000
	30" Gate Valve	2	EA	\$ 52,000	\$ 104,000
	30" Check Valve	2	EA	\$ 95,000	\$ 190,000
	Link Seals (all station piping)	3	EA	\$ 3,200	\$ 9,600
				\$ -	\$ -
	Pumps and Process Mechanical			\$ -	\$ -
	Intake piping and casing	1	LS	\$ 320,000	\$ 320,000
	Morrison Pumps (100 HP Lineshafts)	2	EA	\$ 190,000	\$ 380,000
	Discharge Piping (Allowance)	1	LS	\$ 120,000	\$ 120,000
	Pump Accessories (Allowance)	1	LS	\$ 24,000	\$ 24,000
	Startup, Testing, and Training	1	LS	\$ 38,000	\$ 38,000
	Vaughn 15 HP Chopper Pump	1	EA	\$ 45,000	\$ 45,000
	Pump Accessories (Allowance)	1	LS	\$ 6,000	\$ 6,000
				\$ -	\$ -
	Additional Costs			\$ -	\$ -
	Adjacent Utility Support and Relocation Allowance	1	LS	\$ 30,000	\$ 30,000
	TESC @2% of Construction Costs	2%	LS	\$ 1,407,700	\$ 28,154
				\$ -	\$ -
Item Subtotal Construction Costs (Year 2022)				\$	1,465,854
DIRECT: CONSTRUCTION COST MARK-UPS					
	General Conditions	0%	1	\$	-
	Mobilization/Demobilization	0%	1	\$	-
	Overhead & Profit (OHP)	15%	1.15	\$	219,878
	Insurance	0%	1	\$	-
	Bonding	0%	1	\$	-
	Escalation Multiplier from ENR-CCI	0%	1	\$	-
Item Subtotal Construction Costs (Year 2022)				\$	1,685,732
Direct: Subtotal Construction Costs				\$	1,686,000

Base Year	Estimate Year
2022	2022

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description	Alt_A_Mechanical Vertical Bar Screens			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Screens			\$ -	\$ -
2	Mechanical Vertical Bar Screens - (2 - 12.5' Wide) includes installation	2	EA	\$ 302,000	\$ 604,000
3	Fish Screen/Barrier (Allowance)	1	LS	\$ 40,000	\$ 40,000
4				\$ -	\$ -
5	Additional Costs			\$ -	\$ -
6	TESC @ 2% of Construction Costs	2%	LS	\$ 644,000	\$ 9,660
					\$ -
Item Subtotal Construction Costs (Year 2022)					\$ 653,660
DIRECT: CONSTRUCTION COST MARK-UPS					
	General Conditions	0%	1	\$	-
	Mobilization/Demobilization	0%	1	\$	-
	Overhead & Profit (OHP)	15%	1.15	\$	98,049
	Insurance	0%	1	\$	-
	Bonding	0%	1	\$	-
	Escalation Multiplier from ENR-CCI	0%	1	\$	-
Item Subtotal Construction Costs (Year 2022)					\$ 751,709
Direct: Subtotal Construction Costs					\$ 752,000

Base Year	Estimate Year
2022	2022

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description	Alt A, Electrical, Lighting, and Controls			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Electrical and lighting			\$ -	\$ -
2	Electrical: Basic Requirements			\$ 8,000	\$ -
3	Anchors, bolts, washers, nameplates ,etc.			\$ -	\$ -
4				\$ -	\$ -
5	Wire and Conduit (allowance)	1	LS	\$ 67,500	\$ 67,500
6	MCC, Transformer, and 120/280 V Panel	1	LS	\$ 250,000	\$ 250,000
7	Instrumentation and telemetry			\$ 170,000	\$ -
8	Controls and Sensors	1	LS	\$ 46,000	\$ 46,000
9				\$ -	\$ -
10	Lighting	1	LS	\$ 3,000	\$ 3,000
11	Lighting Equipment, connections, materials, and devices			\$ 6,000	\$ -
12	Allowance - Site Security (permanent)	1	LS	\$ 28,000	\$ 28,000
13				\$ -	\$ -
14	Variable Frequency Drives - Low Voltage	1	LS	\$ 49,552	\$ 49,552
15	VFD's 460 V, 10 HP motor Size & 15 HP motor size, incl. parts, testing, and training			\$ -	\$ -
16	Engine Generator:	1	LS	\$ 250,000	\$ 250,000
17	Diesel Gen Set with Diesel			\$ -	\$ -
18	Transfer Switches, enclosed 3 pole	1	LS	\$ 40,000	\$ 40,000
19	Diesel Fuel System	1	LS	\$ 23,000	\$ 23,000
20	Pad and Enclosure (Allowance)	1	LS	\$ 25,000	\$ 25,000
21				\$ -	\$ -
22	HVAC Equipment	1	LS	\$ 75,000	\$ 75,000
				\$ -	\$ -
Item Subtotal Construction Costs (Year 2022)					\$ 857,052
DIRECT: CONSTRUCTION COST MARK-UPS					
	General Conditions	0%	1	\$	-
	Mobilization/Demobilization	0%	1	\$	-
	Overhead & Profit (OHP)	15%	1.15	\$	128,558
	Insurance	0%	1	\$	-
	Bonding	0%	1	\$	-
	Escalation Multiplier from ENR-CCI	0%	1	\$	-
Item Subtotal Construction Costs (Year 2022)					\$ 985,609
Direct: Subtotal Construction Costs					\$ 986,000

Base Year	Estimate Year
2022	2022

ESTIMATE CATEGORY INPUTS		
Alt_A Input Category	Inputs	Comments
Select AACEI Estimate Class:	Class 4	
AACE Class and Estimate Input Values		
Categories	Inputs	Comments
Subtotal Construction Costs	\$ 5,939,000	Detailed Estimate Subtotal of Construction Costs
Retail Sales Tax Rate	9.08%	Update based on State and Local Tax Requirements
Percentage of Construction Costs where sales tax applies	100%	
Allowance for Indeterminates (AFI), Dependent Upon Project Phase	20%	Based on AACE Estimate Class
Material Pricing Uncertainty Allowance	3%	Based on AACE Estimate Class
Construction Change Order Allowance	10%	Based on AACE Estimate Class
Project Contingency	25%	Based on AACE Estimate Class
Art Eligibility Costs to Be Included	0%	Add if % art eligibility is required by the Agency
Engineering Performance (Consultant, In-House, Both, N/A)	Consultant	
Design, Admin, Legal Cost	10%	
Construction Management Costs	10%	Construction support, inspections and CM
Local Agency Mitigation	0%	Coordination with local agencies
Environmental, Wetland, Floodplain, Permitting and Coordination	2%	Est at 2% - See Pre-design Report Permit List
ROW, easements, Agent and Coordination, etc.	10%	
Mobilization (% of subtotal construction costs)	8%	
ADDITIONAL PROJECT COST INPUTS		
Sales and Taxes	Inputs	Comments
Retail Sales Tax	\$ 539,261	
Allowances for Permits, Mitigation, GIS and Other Costs		
Allowance for ROW and Tree Permits (%)	\$ -	
Railroad, Utility Permit Allowance	\$ -	
Art or Agency Required Betterment Costs (%)	\$ -	
Agency and Consulting Services		
Design, Admin, Legal Cost	\$ 593,900	
Construction Management Costs	\$ 593,900	
Local Agency Mitigation	\$ -	
Environmental, Wetland, Floodplain, Permitting and Coordination	\$ 118,780	Allowance for Environmental, Wetland, Floodplain Permitting
ROW, Easements, Agent and Coordination, etc.	\$ 3,480	Est. at 10% property acquisition cost
Real Estate		
Right-of-Way Acquisition	\$ -	
Property Acquisition	\$ 34,800	Property Acquisition and Temporary Construction Easement

Farragut Pump Station
Alternate A - Vertical Axial Pumps
Property and Easement Calculations

Prices:						
Purchase					\$6	per sf
PERMANENT EASEMENT						
No Build	60%	of purchase =	\$	4	per sf	
Limited Restrictions	50%	of purchase =	\$	3	per sf	
TEMPORARY EASEMENT						
Construction ≤ 6months	30%	of purchase =	\$	2	per sf	
Construction > 6 months	40%	of purchase =	\$	2	per sf	
				Area	\$/sf	Total
Purchase for Alternative A - Parking & Building	0	ft	0	ft	2,309	\$6 \$13,852
Permanent Easement Parking and Shoring Anchoring System	0	ft	0	ft	2,178	\$4 \$8,712
Construction Easement (Includes staging & stockpiling)	0	ft	0	ft	6,098	\$2 \$12,197
						\$13,852 Purchase
						\$8,712 Permanent Easement
						\$12,197 Construction Easement
						\$34,800 Total Property and Easement

ALTERNATIVE B ESTIMATE
SUBMERSIBLE PUMPS
ALL PUMPS IN THE BUILDING

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description:	Farragut Pump Station - Alternate B Submersible Pumps All in Building			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Structural, Excavation & Shoring	1	LS	\$ 1,553,000	\$ 1,553,000
2	Pump Station Facility	1	LS	\$ 741,000	\$ 741,000
3	Process Mechanical and Piping	1	LS	\$ 1,686,000	\$ 1,686,000
4	Mechanical Vertical Bar Screens (pump intake)	1	LS	\$ 507,000	\$ 507,000
5	Electrical, Lighting, and Controls	1	LS	\$ 986,000	\$ 986,000
				\$ -	\$ -
				\$ -	\$ -
Subtotal Construction Costs					\$ 5,473,000
ROW and Use Permits					\$ -
Art or Agency required Betterment Costs					\$ -
Mobilization @ 0.08					\$ 475,120
ESTIMATED PROBABLE COST OF CONSTRUCTION BID					\$ 5,948,120
SUBTOTAL ADDITIONAL CONSTRUCTION COSTS					
Allowance for Indeterminates (AFI - Design Allowance)					\$ 1,094,600
Material Pricing Uncertainty Allowance					\$ 164,190
Construction Change Order Allowance					\$ 547,300
Subtotal Primary Construction Amount					\$ 1,806,090
Retail Sales Tax					\$ 539,261
TOTAL DIRECT CONSTRUCTION COSTS					\$ 8,293,000
INDIRECT: NON-CONSTRUCTION COSTS					
Design, Admin, ROW, and Construction Management					\$ 1,191,280
Utility & Other Agency Support					\$ -
Local Agency Mitigation					\$ -
Environmental, Wetland, Permitting and Coordination					\$ 118,780
Real Estate Property and Right-of-Way Acquisition					\$ 38,280
TOTAL INDIRECT CONSTRUCTION COSTS (NOT INCLUDING CONTINGENCY)					\$ 1,348,340
Project Contingency @ 0.25					\$ 1,824,115
TOTAL PROJECT COST					\$ 9,641,000

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description	Alternate B Structural, Excavation & Shoring			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Demolition and Removals			\$ -	\$ -
2	Remove and Dispose of existing Shoring and Anchoring System (Allowance)	1	LS	\$ 110,000	\$ 110,000
3	Temporary Fencing, stockpiling, and site restoration (Allowance)	1	LS	\$ 15,000	\$ 15,000
4				\$ -	\$ -
5	Below Grade Structure and Shoring			\$ -	\$ -
6	PZ40 Sheet Piling	4,414	SF	\$ 75	\$ 331,050
7	Concrete Seal	65	CY	\$ 1,500	\$ 97,500
8	Furnishing Steel Piling	2,400	LF	\$ 135	\$ 324,000
9	Driving Stee Pile	20	EA	\$ 3,250	\$ 65,000
10	Whalers and Bracing	22,336	LBS	\$ 5	\$ 111,680
11				\$ -	\$ -
12	Excavation and Backfill			\$ -	\$ -
13	Unnamed Ditch Excavation (800 sf est @ 2' ave depth) Disposal Incl. Haul	45	CY	\$ 28	\$ 1,260
14	Exc. for Pump Sta. wetwell, foundation and shoring +/- 900 sf est @ 18' ave. depth	600	CY	\$ 28	\$ 16,800
15	Structural Fill/Spalls	180	CY	\$ 42	\$ 7,560
16	Unnamed Ditch Excavation (800 sf est @ 2' ave depth) Disposal Incl. Haul	60	CY	\$ 28	\$ 1,680
17				\$ -	\$ -
18	Dewatering			\$ -	\$ -
19	Temporary Sheet Pile Shoring - Unnamed Ditch Bank (50 ft by 30 ft)	1,500	SF	\$ 75	\$ 112,500
20	Water Control Sediment Control and Monitoring (allowance)	1	LS	\$ 50,000	\$ 50,000
21	Super Sacks	1	LS	\$ 25,000	\$ 25,000
22	Plastic Sheeting	2,000	SF	\$ 3	\$ 5,000
23	Trash Pumps with Sump	2	EA	\$ 25,000	\$ 50,000
24				\$ -	\$ -
25	Additional Costs			\$ -	\$ -
26	TESC @ 2% of Construction Costs	2.0%	LS	\$ 1,324,030	\$ 26,481
				\$ -	\$ -
Item Subtotal Construction Costs (Year 2022)				\$	1,350,511
DIRECT: CONSTRUCTION COST MARK-UPS					
	General Conditions	0%		1	\$ -
	Mobilization/Demobilization	0%		1	\$ -
	Overhead & Profit (OHP)	15%		1.15	\$ 202,577
	Insurance	0%		1	\$ -
	Bonding	0%		1	\$ -
	Escalation Multiplier from ENR-CCI	0%		1	\$ -
Item Subtotal Construction Costs (Year 2022)				\$	1,553,087
Direct: Subtotal Construction Costs				\$	1,553,000

Base Year	Estimate Year
2022	2022

Estimate - AACE Class 4						
Project Name:	Farragut Pump Station - Predesign				Date:	6/8/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA				Estimator:	C. Kinzer
Description	Alt Pump Station Facility				Version:	2
DIRECT: SUBTOTAL CONSTRUCTION COSTS						
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost	
1	Above Grade Building - CMU			\$ -	\$ -	
2	Roof Framing	481	SF	\$ 125	\$ 60,125	
3	CMU Walls	80	SF	\$ 25	\$ 2,000	
4	Building Concrete	21	CY	\$ 2,500	\$ 52,500	
5	Double Door	2	LS	\$ 7,000	\$ 14,000	
6	Building Penetrations (HVAC)	1	LS	\$ 5,000	\$ 5,000	
7	Access Hatches and Ladders	3	EA	\$ 8,000	\$ 24,000	
8	Penetrations for pump discharge (Allowance)	1	LS	\$ 8,000	\$ 8,000	
9	Misc. arch items, roof finish, paint, signs, sealant, finishes	1	LS	\$ 90,000	\$ 90,000	
10	Allowance for Louvers	1	LS	\$ 12,000	\$ 12,000	
11				\$ -	\$ -	
12	CIP Wetwell Concrete			\$ -	\$ -	
13	Walls	124	CY	\$ 1,100	\$ 136,400	
14	Foundation	110	CY	\$ 850	\$ 93,500	
15	Roof Slab (includes Concrete for screening Platform)	60	CY	\$ 1,400	\$ 84,000	
16	Controlled Density Fill (Allowance)	50	CY	\$ 56	\$ 2,800	
17				\$ -	\$ -	
18	Site and Access					
19	Chain Link Fence and Gates	230	LF	\$ 110	\$ 25,300	
20	Site Restoration (Allowance)	1	LS	\$ 25,000	\$ 25,000	
21				\$ -	\$ -	
22	Additional Costs			\$ -	\$ -	
23	Utility Relocation Allowance	1	LS	\$ -	\$ -	
24	TESC @ 2% of Construction Costs	2%	LS	\$ 634,625	\$ 9,519	
					\$ -	
Item Subtotal Construction Costs (Year 2022)					\$	644,144
DIRECT: CONSTRUCTION COST MARK-UPS						
	General Conditions	0%	1	\$	\$ -	
	Mobilization/Demobilization	0%	1	\$	\$ -	
	Overhead & Profit (OHP)	15%	1.15	\$	\$ 96,622	
	Insurance	0%	1	\$	\$ -	
	Bonding	0%	1	\$	\$ -	
	Escalation Multiplier from ENR-CCI	0%	1	\$	\$ -	
Item Subtotal Construction Costs (Year 2022)					\$	740,766
Direct: Subtotal Construction Costs					\$	741,000

Base Year	Estimate Year
2022	2022

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description	Alt. B. Process Mechanical and Piping			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Discharge Piping			\$ -	\$ -
2	8" DI Piping	80	LF	\$ 160	\$ 12,800
3	8" DI 90 degree bend MJ	4	EA	\$ 650	\$ 2,600
4	8"x6" DI Reducer, FL	2	EA	\$ 1,700	\$ 3,400
5	8" Gate Valve	1	EA	\$ 6,200	\$ 6,200
6	8" Check Valve	1	EA	\$ 3,500	\$ 3,500
7				\$ -	\$ -
8	30" DI PIPE	150	LF	\$ 460	\$ 69,000
9	30" DI 90 degree bend MJ	8	EA	\$ 3,200	\$ 25,600
10	42" to 30" Reducer, FL	6	EA	\$ 8,000	\$ 48,000
11	30" Gate Valve	2	EA	\$ 52,000	\$ 104,000
12	30" Check Valve	2	EA	\$ 95,000	\$ 190,000
13	Link Seals (all station piping)	3	EA	\$ 3,200	\$ 9,600
14				\$ -	\$ -
15	Pumps and Process Mechanical			\$ -	\$ -
16	Intake piping and casing	1	LS	\$ 320,000	\$ 320,000
17	Flygt 3602 Pump (100 HP Submersible)	2	EA	\$ 190,000	\$ 380,000
18	Discharge Piping (Allowance)	1	LS	\$ 120,000	\$ 120,000
19	Pump Accessories (Allowance)	1	LS	\$ 24,000	\$ 24,000
20	Startup, Testing, and Training	1	LS	\$ 38,000	\$ 38,000
21	Vaughn 15 HP Chopper Pump	1	EA	\$ 45,000	\$ 45,000
22	Pump Accessories (Allowance)	1	LS	\$ 6,000	\$ 6,000
23				\$ -	\$ -
24	Additional Costs			\$ -	\$ -
25	Adjacent Utility Support and Relocation Allowance	1	LS	\$ 30,000	\$ 30,000
26	TESC @2% of Construction Costs	2%	LS	\$ 1,407,700	\$ 28,154
				\$ -	\$ -
Item Subtotal Construction Costs (Year 2022)				\$	1,465,854
DIRECT: CONSTRUCTION COST MARK-UPS					
	General Conditions	0%	1	\$	-
	Mobilization/Demobilization	0%	1	\$	-
	Overhead & Profit (OHP)	15%	1.15	\$	219,878
	Insurance	0%	1	\$	-
	Bonding	0%	1	\$	-
	Escalation Multiplier from ENR-CCI	0%	1	\$	-
Item Subtotal Construction Costs (Year 2022)				\$	1,685,732
Direct: Subtotal Construction Costs				\$	1,686,000

Base Year	Estimate Year
2022	2022

Estimate - AACE Class 4						
Project Name:	Farragut Pump Station - Predesign				Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA				Estimator:	C. Kinzer
Description	Alt. B. Mechanical Vertical Bar Screens				Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS						
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost	
1	Screens			\$ -	\$ -	
2	Mechanical Vertical Bar Screens - (2 - 8' Wide) includes installation	2	EA	\$ 202,340	\$ 404,680	
3	Fish Screen/Barrier (Allowance)	1	LS	\$ 30,000	\$ 30,000	
4				\$ -	\$ -	
5	Additional Costs			\$ -	\$ -	
6	TESC @ 2% of Construction Costs	2%	LS	\$ 434,680	\$ 6,520	
					\$ -	
Item Subtotal Construction Costs (Year 2022)					\$	441,200
DIRECT: CONSTRUCTION COST MARK-UPS						
	General Conditions	0%		1	\$	-
	Mobilization/Demobilization	0%		1	\$	-
	Overhead & Profit (OHP)	15%		1.15	\$	66,180
	Insurance	0%		1	\$	-
	Bonding	0%		1	\$	-
	Escalation Multiplier from ENR-CCI	0%		1	\$	-
Item Subtotal Construction Costs (Year 2022)					\$	507,380
Direct: Subtotal Construction Costs					\$	507,000

Base Year	Estimate Year
2022	2022

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description	Alt. B. Electrical, Lighting, and Controls			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Electrical and lighting			\$ -	\$ -
2	Electrical: Basic Requirements			\$ 8,000	\$ -
3	Anchors, bolts, washers, nameplates ,etc.			\$ -	\$ -
4				\$ -	\$ -
5	Wire and Conduit (allowance)	1	LS	\$ 67,500	\$ 67,500
6	MCC, Transformer, and 120/280 V Panel	1	LS	\$ 250,000	\$ 250,000
7	Instrumentation and telemetry			\$ 170,000	\$ -
8	Controls and Sensors	1	LS	\$ 46,000	\$ 46,000
9				\$ -	\$ -
10	Lighting	1	LS	\$ 3,000	\$ 3,000
11	Lighting Equipment, connections, materials, and devices			\$ 6,000	\$ -
12	Allowance - Site Security (permanent)	1	LS	\$ 28,000	\$ 28,000
13				\$ -	\$ -
14	Variable Frequency Drives - Low Voltage	1	LS	\$ 49,552	\$ 49,552
15	VFD's 460 V, 10 HP motor Size & 15 HP motor size, incl. parts, testing, and training			\$ -	\$ -
16	Engine Generator:	1	LS	\$ 250,000	\$ 250,000
17	Diesel Gen Set with Diesel			\$ -	\$ -
18	Transfer Switches, enclosed 3 pole	1	LS	\$ 40,000	\$ 40,000
19	Diesel Fuel System	1	LS	\$ 23,000	\$ 23,000
20	Pad and Enclosure (Allowance)	1	LS	\$ 25,000	\$ 25,000
21	HVAC Equipment	1	LS	\$ 75,000	\$ 75,000
				\$ -	\$ -
Item Subtotal Construction Costs (Year 2022)				\$	857,052
DIRECT: CONSTRUCTION COST MARK-UPS					
	General Conditions	0%	1	\$	-
	Mobilization/Demobilization	0%	1	\$	-
	Overhead & Profit (OHP)	15%	1.15	\$	128,558
	Insurance	0%	1	\$	-
	Bonding	0%	1	\$	-
	Escalation Multiplier from ENR-CCI	0%	1	\$	-
Item Subtotal Construction Costs (Year 2022)				\$	985,609
Direct: Subtotal Construction Costs				\$	986,000

Base Year	Estimate Year
2022	2022

ESTIMATE CATEGORY INPUTS		
Alternate B - Input Category	Inputs	Comments
Select AACEI Estimate Class:	Class 4	
AACE Class and Estimate Input Values		
Categories	Inputs	Comments
Subtotal Construction Costs	\$ 5,473,000	Detailed Estimate Subtotal of Construction Costs
Retail Sales Tax Rate	9.08%	Update based on State and Local Tax Requirements
Percentage of Construction Costs where sales tax applies	100%	
Allowance for Indeterminates (AFI), Dependent Upon Project Phase	20%	Based on AACE Estimate Class
Material Pricing Uncertainty Allowance	3%	Based on AACE Estimate Class
Construction Change Order Allowance	10%	Based on AACE Estimate Class
Project Contingency	25%	Based on AACE Estimate Class
Art Eligibility Costs to Be Included	0%	Add if % art eligibility is required by the Agency
Engineering Performance (Consultant, In-House, Both, N/A)	Consultant	
Design, Admin, Legal Cost	10%	
Construction Management Costs	10%	Construction support, inspections and CM
Local Agency Mitigation	0%	Coordination with local agencies
Environmental, Wetland, Floodplain, Permitting and Coordination	2%	Est at 2% - See Pre-design Report Permit List
ROW, easements, Agent and Coordination, etc.	10%	
Mobilization (% of subtotal construction costs)	8%	
ADDITIONAL PROJECT COST INPUTS		
Sales and Taxes	Inputs	Comments
Retail Sales Tax	\$ 496,948	
Allowances for Permits, Mitigation, GIS and Other Costs		
Allowance for ROW and Tree Permits (%)	\$ -	
Railroad, Utility Permit Allowance	\$ -	
Art or Agency Required Betterment Costs (%)	\$ -	
Agency and Consulting Services	\$ -	
Design, Admin, Legal Cost	\$ 547,300	
Construction Management Costs	\$ 547,300	
Local Agency Mitigation	\$ -	
Environmental, Wetland, Floodplain, Permitting and Coordination	\$ 109,460	Allowance for Environmental, Wetland, Floodplain Permitting
ROW, Easements, Agent and Coordination, etc.	\$ 2,210	Est. at 10% property acquisition cost
Real Estate	\$ -	
Right-of-Way Acquisition	\$ -	
Property Acquisition	\$ 22,100	Property Acquisition and Temporary Construction Easement

**Farragut Pump Station
Alternate B - Submersible Pumps
Property and Easement Calculations**

Prices:

Purchase	\$6 per sf
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PERMANENT EASEMENT

No Build	60% of purchase =	\$	4	per sf
Limited Restrictions	50% of purchase =	\$	3	per sf

TEMPORARY EASEMENT

Construction <u><</u> 6 months	30% of purchase =	\$	2	per sf
Construction <u>></u> 6 months	40% of purchase =	\$	2	per sf

			Area	\$/sf	Total
Purchase for Alternative B - Access and Parking	0 ft	0 ft	1,655 sf	\$6	\$9,932
Permanent Easement Parking and Shoring Anchoring System	0 ft	0 ft	0 sf	\$4	\$0
Construction Easement (Includes staging & stockpiling)	0 ft	0 ft	6,098 sf	\$2	\$12,197

\$9,932	Purchase
\$0	Permanent Easement
<u>\$12,197</u>	<u>Construction Easement</u>

\$22,100	Total Property and Easement
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ALTERNATIVE C ESTIMATE
SUBMERSIBLE PUMPS
15 HP PUMP SEPARATE

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description:	Farragut Pump Station - Alternate C Submersible Pumps with only 100 HP in Station			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Structural, Excavation & Shoring	1	LS	\$ 1,274,000	\$ 1,274,000
2	Pump Station Facility	1	LS	\$ 618,000	\$ 618,000
3	Process Mechanical and Piping	1	LS	\$ 1,720,000	\$ 1,720,000
4	Mechanical Vertical Bar Screens (pump intake)	1	LS	\$ 376,000	\$ 376,000
5	Electrical, Lighting, and Controls	1	LS	\$ 986,000	\$ 986,000
				\$ -	\$ -
Subtotal Construction Costs				\$	4,974,000
ROW and Use Permits				\$	-
Art or Agency required Betterment Costs				\$	-
Mobilization @ 0.08				\$	475,120
ESTIMATED PROBABLE COST OF CONSTRUCTION BID				\$	5,449,120
SUBTOTAL ADDITIONAL CONSTRUCTION COSTS					
Allowance for Indeterminates (AFI - Design Allowance)				\$	994,800
Material Pricing Uncertainty Allowance				\$	149,220
Construction Change Order Allowance				\$	497,400
Subtotal Primary Construction Amount				\$	1,641,420
Retail Sales Tax				\$	539,261
TOTAL DIRECT CONSTRUCTION COSTS				\$	7,630,000
INDIRECT: NON-CONSTRUCTION COSTS					
Design, Admin, ROW, and Construction Management				\$	1,191,280
Utilitiy & Other Agency Support				\$	-
Local Agency Mitigation				\$	-
Environmental, Wetland, Permitting and Coordination				\$	118,780
Real Estate Property and Right-of-Way Acquisition				\$	38,280
TOTAL INDIRECT CONSTRUCTION COSTS (NOT INCLUDING CONTINGENCY)				\$	1,348,340
Project Contingency @ 0.25				\$	1,699,365
TOTAL PROJECT COST				\$	8,978,000

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description	Alt C Structural, Exc, & Shoring			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Demolition and Removals			\$ -	\$ -
2	Remove and Dispose of existing Shoring and Anchoring System (Allowance)	1	LS	\$ 110,000	\$ 110,000
3	Temporary Fencing, stockpiling, and site restoration (Allowance)	1	LS	\$ 15,000	\$ 15,000
4				\$ -	\$ -
5	Below Grade Structure and Shoring			\$ -	\$ -
6	PZ40 Sheet Piling	3,606	SF	\$ 75	\$ 270,450
7	Concrete Seal	51	CY	\$ 1,500	\$ 76,500
8	Furnishing Steel Piling	1,800	LF	\$ 135	\$ 243,000
9	Driving Stee Pile	15	EA	\$ 3,250	\$ 48,750
10	Whalers and Bracing	17,050	LBS	\$ 5	\$ 85,250
11				\$ -	\$ -
12	Excavation and Backfill			\$ -	\$ -
13	Unnamed Ditch Excavation (500 sf est @ 2' ave depth) Disposal Incl. Haul	38	CY	\$ 28	\$ 1,064
14	Exc. for Pump Sta. wetwell, foundation and shoring (+/- 600 sf est @ 18' ave. depth	400	CY	\$ 28	\$ 11,200
15	Structural Fill/Spalls	120	CY	\$ 42	\$ 5,040
16				\$ -	\$ -
17	Dewatering			\$ -	\$ -
18	Temporary Sheet Pile Shoring - Unnamed Ditch Bank (40 ft by 30 ft)	1,200	SF	\$ 75	\$ 90,000
19	Water Control Sediment Control and Monitoring (allowance)	1	LS	\$ 50,000	\$ 50,000
20	Super Sacks	1	LS	\$ 25,000	\$ 25,000
21	Plastic Sheeting	2,000	SF	\$ 3	\$ 5,000
22	Trash Pumps with Sump	2	EA	\$ 25,000	\$ 50,000
23				\$ -	\$ -
24	Additional Costs			\$ -	\$ -
25	TESC @ 2% of Construction Costs	2%	LS	\$ 1,086,254	\$ 21,725
				\$ -	\$ -
Item Subtotal Construction Costs (Year 2022)				\$	1,107,979
DIRECT: CONSTRUCTION COST MARK-UPS					
General Conditions			0%	1	\$ -
Mobilization/Demobilization			0%	1	\$ -
Overhead & Profit (OHP)			15%	1.15	\$ 166,197
Insurance			0%	1	\$ -
Bonding			0%	1	\$ -
Escalation Multiplier from ENR-CCI			0%	1	\$ -
Item Subtotal Construction Costs (Year 2022)				\$	1,274,176
Direct: Subtotal Construction Costs				\$	1,274,000

Base Year	Estimate Year
2022	2022

Estimate - AACE Class 4						
Project Name:	Farragut Pump Station - Predesign				Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA				Estimator:	C. Kinzer
Description	Alt. C. Pump Station Facility				Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS						
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost	
1	Above Grade Building - CMU			\$ -	\$ -	
2	Roof Framing	389	SF	\$ 125	\$ 48,625	
3	CMU Walls	710	SF	\$ 25	\$ 17,750	
4	Building Concrete	15	CY	\$ 2,500	\$ 37,500	
5	Double Door	2	LS	\$ 7,000	\$ 14,000	
6	Building Penetrations (HVAC)	1	LS	\$ 5,000	\$ 5,000	
7	Access Hatches and Ladders	2	EA	\$ 8,000	\$ 16,000	
8	Penetrations for pump discharge (Allowance)	1	LS	\$ 5,000	\$ 5,000	
9	Misc. arch items, roof finish, paint, signs, sealant, finishes	1	LS	\$ 80,000	\$ 80,000	
10	Allowance for Louvers	1	LS	\$ 12,000	\$ 12,000	
11				\$ -	\$ -	
12	CIP Wetwell Concrete			\$ -	\$ -	
13	Walls	106	CY	\$ 1,100	\$ 116,600	
14	Foundation	80	CY	\$ 850	\$ 68,000	
15	Roof Slab (includes Concrete for screening Platform)	40	CY	\$ 1,400	\$ 56,000	
16	Controlled Density Fill (Allowance)	50	CY	\$ 56	\$ 2,800	
17						
18	Site and Access			\$ -	\$ -	
19	Chain Link Fence and Gates	230	LF	\$ 110	\$ 25,300	
20	Site Restoration (Allowance)	1	LS	\$ 25,000	\$ 25,000	
21				\$ -	\$ -	
22	Additional Costs			\$ -	\$ -	
23	Utility Relocation Allowance	1	LS	\$ -	\$ -	
24	TESC @ 2% of Construction Costs	2%	LS	\$ 529,575	\$ 7,944	
					\$ -	
Item Subtotal Construction Costs (Year 2022)					\$	537,519
DIRECT: CONSTRUCTION COST MARK-UPS						
	General Conditions	0%	1	\$	\$ -	
	Mobilization/Demobilization	0%	1	\$	\$ -	
	Overhead & Profit (OHP)	15%	1.15	\$	\$ 80,628	
	Insurance	0%	1	\$	\$ -	
	Bonding	0%	1	\$	\$ -	
	Escalation Multiplier from ENR-CCI	0%	1	\$	\$ -	
Item Subtotal Construction Costs (Year 2022)					\$	618,146
Direct: Subtotal Construction Costs					\$	618,000

Base Year	Estimate Year
2022	2022

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description	Alt C Process Mechanical & Piping			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Discharge Piping			\$ -	\$ -
2	8" DI Piping	80	LF	\$ 20	\$ 1,600
3	8" DI 90 degree bend MJ	4	EA	\$ 650	\$ 2,600
4	8"x6" DI Reducer, FL	2	EA	\$ 1,700	\$ 3,400
5	8" Gate Valve	1	EA	\$ 6,200	\$ 6,200
6	8" Check Valve	1	EA	\$ 3,500	\$ 3,500
7				\$ -	\$ -
8	30" DI PIPE	150	LF	\$ 460	\$ 69,000
9	30" DI 90 degree bend MJ	8	EA	\$ 3,200	\$ 25,600
10	42" to 30" Reducer, FL	6	EA	\$ 8,000	\$ 48,000
11	30" Gate Valve	2	EA	\$ 52,000	\$ 104,000
12	30" Check Valve	2	EA	\$ 95,000	\$ 190,000
13	Link Seals (all station piping)	3	EA	\$ 3,200	\$ 9,600
14				\$ -	\$ -
15	Pumps and Process Mechanical			\$ -	\$ -
16	Intake piping and casing	1	LS	\$ 320,000	\$ 320,000
17	Flygt 3602 Pump (100 HP Submersible)	2	EA	\$ 190,000	\$ 380,000
18	Discharge Piping (Allowance)	1	LS	\$ 120,000	\$ 120,000
19	Pump Accessories (Allowance)	1	LS	\$ 24,000	\$ 24,000
20	Startup, Testing, and Training	1	LS	\$ 38,000	\$ 38,000
21	Vaughn 15 HP Chopper Pump	1	EA	\$ 45,000	\$ 45,000
22	Pump Accessories (Allowance)	1	LS	\$ 6,000	\$ 6,000
23	CIP Wetwell and Retrofit (Allowance)	1	LS	\$ 40,000	\$ 40,000
24				\$ -	\$ -
25	Additional Costs			\$ -	\$ -
26	Adjacent Utility Support and Relocation Allowance	1	LS	\$ 30,000	\$ 30,000
27	TESC @2% of Construction Costs	2%	LS	\$ 1,436,500	\$ 28,730
					\$ -
Item Subtotal Construction Costs (Year 2022)					\$ 1,495,230
DIRECT: CONSTRUCTION COST MARK-UPS					
	General Conditions	0%	1	\$	-
	Mobilization/Demobilization	0%	1	\$	-
	Overhead & Profit (OHP)	15%	1.15	\$	224,285
	Insurance	0%	1	\$	-
	Bonding	0%	1	\$	-
	Escalation Multiplier from ENR-CCI	0%	1	\$	-
Item Subtotal Construction Costs (Year 2022)					\$ 1,719,515
Direct: Subtotal Construction Costs					\$ 1,720,000

Base Year	Estimate Year
2022	2022

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description	Alt_C_Mechanical Vertical Bar Screens			Version:	1/1/1900
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Screens			\$ -	\$ -
2	Mechanical Vertical Bar Screens - (1 - 12.5' Wide) includes installation	1	EA	\$ 302,000	\$ 302,000
3	Fish Screen/Barrier (Allowance)	1	LS	\$ 20,000	\$ 20,000
4				\$ -	\$ -
5	Additional Costs			\$ -	\$ -
6	TESC @ 2% of Construction Costs	2%	LS	\$ 322,000	\$ 4,830
					\$ -
					\$ -
Item Subtotal Construction Costs (Year 2022)					\$ 326,830
DIRECT: CONSTRUCTION COST MARK-UPS					
	General Conditions	0%	1	\$	-
	Mobilization/Demobilization	0%	1	\$	-
	Overhead & Profit (OHP)	15%	1.15	\$	49,025
	Insurance	0%	1	\$	-
	Bonding	0%	1	\$	-
	Escalation Multiplier from ENR-CCI	0%	1	\$	-
Item Subtotal Construction Costs (Year 2022)					\$ 375,855
Direct: Subtotal Construction Costs					\$ 376,000

Base Year	Estimate Year
2022	2022

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			Date:	6/27/2022
Location:	Market St./E. Harriman St., City of Aberdeen, WA			Estimator:	C. Kinzer
Description	Alt. C. Electrical, Lighting, and Controls			Version:	1
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
1	Electrical and lighting			\$ -	\$ -
2	Electrical: Basic Requirements			\$ 8,000	\$ -
3	Anchors, bolts, washers, nameplates ,etc.			\$ -	\$ -
4				\$ -	\$ -
5	Wire and Conduit (allowance)	1	LS	\$ 67,500	\$ 67,500
6	MCC, Transformer, and 120/280 V Panel	1	LS	\$ 250,000	\$ 250,000
7	Instrumentation and telemetry			\$ 170,000	\$ -
8	Controls and Sensors	1	LS	\$ 46,000	\$ 46,000
9				\$ -	\$ -
10	Lighting	1	LS	\$ 3,000	\$ 3,000
11	Lighting Equipment, connections, materials, and devices			\$ 6,000	\$ -
12	Allowance - Site Security (permanent)	1	LS	\$ 28,000	\$ 28,000
13				\$ -	\$ -
14	Variable Frequency Drives - Low Voltage	1	LS	\$ 49,552	\$ 49,552
15	VFD's 460 V, 10 HP motor Size & 15 HP motor size, incl. parts, testing, and training			\$ -	\$ -
16	Engine Generator:	1	LS	\$ 250,000	\$ 250,000
17	Diesel Gen Set with Diesel			\$ -	\$ -
18	Transfer Switches, enclosed 3 pole	1	LS	\$ 40,000	\$ 40,000
19	Diesel Fuel System	1	LS	\$ 23,000	\$ 23,000
20	Pad and Enclosure (Allowance)	1	LS	\$ 25,000	\$ 25,000
21	HVAC Equipment	1	LS	\$ 75,000	\$ 75,000
				\$ -	\$ -
Item Subtotal Construction Costs (Year 2022)				\$	857,052
DIRECT: CONSTRUCTION COST MARK-UPS					
	General Conditions	0%	1	\$	-
	Mobilization/Demobilization	0%	1	\$	-
	Overhead & Profit (OHP)	15%	1.15	\$	128,558
	Insurance	0%	1	\$	-
	Bonding	0%	1	\$	-
	Escalation Multiplier from ENR-CCI	0%	1	\$	-
Item Subtotal Construction Costs (Year 2022)				\$	985,609
Direct: Subtotal Construction Costs				\$	986,000

Base Year	Estimate Year
2022	2022

ESTIMATE CATEGORY INPUTS		
Alternative C - Input Category	Inputs	Comments
Select AACEI Estimate Class:	Class 4	
AACE Class and Estimate Input Values		
Categories	Inputs	Comments
Subtotal Construction Costs	\$ 4,974,000	Detailed Estimate Subtotal of Construction Costs
Retail Sales Tax Rate	9.08%	Update based on State and Local Tax Requirements
Percentage of Construction Costs where sales tax applies	100%	
Allowance for Indeterminates (AFI), Dependent Upon Project Phase	20%	Based on AACE Estimate Class
Material Pricing Uncertainty Allowance	3%	Based on AACE Estimate Class
Construction Change Order Allowance	10%	Based on AACE Estimate Class
Project Contingency	25%	Based on AACE Estimate Class
Art Eligibility Costs to Be Included	0%	Add if % art eligibility is required by the Agency
Engineering Performance (Consultant, In-House, Both, N/A)	Consultant	
Design, Admin, Legal Cost	10%	
Construction Management Costs	10%	Construction support, inspections and CM
Local Agency Mitigation	0%	Coordination with local agencies
Environmental, Wetland, Floodplain, Permitting and Coordination	2%	Est at 2% - See Pre-design Report Permit List
ROW, easements, Agent and Coordination, etc.	10%	
Mobilization (% of subtotal construction costs)	8%	
ADDITIONAL PROJECT COST INPUTS		
Sales and Taxes	Inputs	Comments
Retail Sales Tax	\$ 451,639	
Allowances for Permits, Mitigation, GIS and Other Costs		
Allowance for ROW and Tree Permits (%)	\$ -	
Railroad, Utility Permit Allowance	\$ -	
Art or Agency Required Betterment Costs (%)	\$ -	
Agency and Consulting Services	\$ -	
Design, Admin, Legal Cost	\$ 497,400	
Construction Management Costs	\$ 497,400	
Local Agency Mitigation	\$ -	
Environmental, Wetland, Floodplain, Permitting and Coordination	\$ 99,480	Allowance for Environmental, Wetland, Floodplain Permitting
ROW, Easements, Agent and Coordination, etc.	\$ 1,920	Est. at 10% property acquisition cost
Real Estate	\$ -	
Right-of-Way Acquisition	\$ -	
Property Acquisition	\$ 19,200	Property Acquisition and Temporary Construction Easement

Farragut Pump Station
Alternate C - Submersibles 100 HP in building
Property and Easement Calculations

Prices:

Purchase \$6 per sf Based on land sale value from a nearby parcel rounded up to the nearest dollar.

PERMANENT EASEMENT

No Build	60% of purchase =	\$	4	per sf
Limited Restrictions	50% of purchase =	\$	3	per sf

TEMPORARY EASEMENT

Construction < 6 months	30% of purchase =	\$	2	per sf
Construction > 6 months	40% of purchase =	\$	2	per sf

			Area	\$/sf	Total
Purchase	0 ft	0 ft	0 sf	\$6	\$0
Permanent Easement Parking and Shoring Anchoring System	0 ft	0 ft	1,742 sf	\$4	\$6,970
Construction Easement (Includes staging & stockpiling)	0 ft	0 ft	6,098 sf	\$2	\$12,197

\$0	Purchase
\$6,970	Permanent Easement
\$12,197	Construction Easement

\$19,200	Total Property and Easement
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