From: Sukola, Katrina
To: Nick Bird; Scott Boettcher
Cc: Ty"
Subject: RE: 25/27 Local Project Construction Request - Farragut Pump Station
Date: Monday, May 13, 2024 9:45:00 AM

Hi Nick. Yes, I received two submissions from you –> 1) Division Street Pump Station Construction and 2) Farragut Pump Station Construction including attachments. Looking forward to reviewing both!

Best,

Katrina

From: Nick Bird <NBird@aberdeenwa.gov>
Sent: Friday, May 10, 2024 11:27 AM
To: Sukola, Katrina <Katrina.Sukola@icf.com>; Scott Boettcher <scottb@sbgh-partners.com>
Subject: FW: 25/27 Local Project Construction Request - Farragut Pump Station

I received the out of office response to the Division Street Pump Station Request, but thought it best to double up on this one just in case. The previous email was sent with a rather large attachment (the predesign report), and I thought it wise just to make sure this small one got through.

Thanks again and have a great weekend!
Nick

From: Nick Bird
Sent: Friday, May 10, 2024 11:16 AM
To: Sukola, Katrina <Katrina.Sukola@icf.com>; Scott Boettcher <scottb@sbgh-partners.com>
Cc: Johnson, Ty <ty.johnson@hdrinc.com>
Subject: 25/27 Local Project Construction Request - Farragut Pump Station

Good Morning!
Attached you will find the construction request for Farragut Pump Station. As noted in the request, we are anticipating capping the request at $5 million and supplementing the remaining funding needs via a PWTF loan. With a good, better, best sort of mind set, any additional financial support that can be provided would beneficially reduce future debt service to our community.

Please let me know if there is any additional information that I can provide to clarify the project or our intent.

PS – since this one does include a large file, can you let me know it was received?

Thank you and have a great weekend!
Nick

NICK BIRD, PE | CITY ENGINEER
City of Aberdeen Public Works Department
200 E Market St, Aberdeen, WA 98520
O: 360.537.3218 | C: 360.472.3604 | NBird@aberdeenwa.gov

Part IB

2025-27 Local Projects Recruitment Process, Schedule

FINAL Recruitment Form for Construction, Implementation Projects

Instructions:

1. Please submit project requests (via this recruitment form) to katrina.sukola@icf.com no later than 5:00 p.m., 5/10/2024.

2. Please submit one recruitment form for each project proposed, even past projects previously or partially funded.

3. Note: Sections III and IV [marked by "(**)"] will be scored for review/evaluation. Sections I, II, and V will not be scored.

4. Note: Section V is necessary to help the Chehalis River Basin Flood Authority, Office of Chehalis Basin, and Chehalis Basin Board understand the scope and scale of future Local Projects.

5. See https://www.ezview.wa.gov/site/alias__1492/39938/2025-27_local_projects.aspx for more information.

Schedule:

April 4, 2024	Flood Authority posts/distributes FINAL 2025-27 local project recruitment request.
May 10, 2024*	Project sponsors submit proposals no later than 5:00 p.m., Friday, May 10, 2024, to Katrina Sukola, katrina.sukola@icf.com.
May 16, 2024	Flood Authority presented with local project proposals received.
June 4, 2024	Chehalis Basin Board presented with local project proposals received.
Multiple Dates	Review and ranking of proposals with Projects Committee and Review Team.
July 18, 2024	Flood Authority approves ranked, prioritized funding recommendation to Chehalis Basin Board.
August 1, 2024	Chehalis Basin Board approves ranked, prioritized funding recommendation to OCB/Ecology/Governor.

* Proposal submitters will likely be asked for additional information between May 10 through July 18.

Section I General	
1. **Date:**	May 10, 2024
2. **Project Name and Project Phase/Stage:**	Farragut Street Pump Station - Construction
3. **Project Location --** Please provide location of project and latitude, longitude coordinates (e.g., 46.712222, -122.977811).	46 58′ N 123 47 W
4. **Project Manager/Contact** -- Please identify who will be responsible for overseeing, implementing the project on a day-to-day basis (i.e., name, organization, contact information).	Nick Bird, City Engineer City of Aberdeen nbird@aberdeenwa.gov 360-472-3604
5. **Project Sponsor and Key Partners --** Please identify project sponsor and key partners who will assist in project delivery and implementation.	City of Aberdeen is the lead agency and will manage the overall construction project for Farragut Street PS. The City hired HDR Engineering to complete the design of the pump station to be bid ready by the end of 2024.

Section II Description, Timing and Cost	
6. **Project Description --** Please describe the project, what is intended to be accomplished, flood hazard reduction benefits to be accrued to whom and when. Please identify what phase/stage of the project funding is sought (e.g., construction/implementation phase/stage). Please identify any local or state funding previously secured for this project.	The City is requesting funding to construct the new Farragut Stormwater PS in Aberdeen, WA. The project will upgrade the existing failing pump station facility that consists of existing submersible stormwater pumps that are undersized and have reached the end of the equipment's useful life (not operating on the existing pump curve and failing to keep up with upstream flows during events). The project includes new stormwater pumps, new controls, backup generator port, telemetry upgrades, piling, sheet piles, site security fencing, demo, and site improvements. The building is not properly support and is failing/sinking into the subsurface.
7. **Project Timeline --** Please describe the timeline and phases/stages for completing the overall project and the timeline for completing the phase/stage to be funded by 2025-27 funding.	Construction of the Farragut Street PS is anticipated to be begin in 2025 pending funding.
8. **Project Cost and Funding --** What is the cost of the overall project (or anticipated cost)? What is	The design cost for the City to hire HDR was approx. $450K. There was an additional approx. $94K that

the cost of the phase/stage to be funded by 2025-27 funding? What are the on-going maintenance and operation requirements and costs? Who will cover on-going maintenance and operation requirements and costs?	was allocated by OCB for design in Spring 2024.The design will be completed by the end of 2024. The construction cost ranges $10 - $11 million dollars for the new facility. The cost will be refined as the design move forward to 75% mid Summer 2024. This request is for $5 million dollars and the remaining balance will be requested through the Public Works Trust Fund. As with other capital projects, the City's stormwater utility will be responsible for continued operation and maintenance of the new facility.
9. **Other Funding --** Please describe other funding sources and partners that have already contributed (or could contribute in the future) to this project and for what phase/stage.	The City of Aberdeen will cover any additional construction costs above the funding amount that is awarded to the City for construction of this project as previously noted. Any opportunity for funding above the $5 million dollar request would be welcome, as it would reduce the PWTF debt service necessary to complete the project.

Section III (**) Completion, Feasibility, Alternatives, and Impacts	
10. **Project Completion --** Does the funding requested complete, substantially complete, or continue a project already started? If so, please explain.	Funding would provide dollars required to get the project constructed beginning as early the spring of 2025 and be completed in 2026. The facility would be in service prior to the 2026 rainy weather season. If appropriate electrical parts are sourced, the facility could be on line earlier.
11. **Project Feasibility --** Can this project or the phase/stage for which funding is sought be completed by June 30, 2027? Please describe any circumstances with potential to impact the project's feasibleness or timeline (e.g., permitting or regulatory unknowns, lack of availability of other funding resources, etc.). Please describe any advance coordination or vetting with agencies, tribes, other entities, etc. and the outcomes of that effort.	The project is doable based on delivery of the bid ready set by end of 2024. Beginning construction in 2025 provides the best opportunity for the project to be complete by June 30, 2027. The biggest risk is the electrical equipment market, which is commonly impacting project schedules. Beginning construction as early as possible mitigates this risk.
12. **Project Alternatives --** Please describe alternatives to the project that were considered (including doing nothing), and the rationale for selecting the project described, proposed here.	Do Nothing – Flooding will continue to occur upstream. If the pump station fails local residents, schools, businesses will be flooded during storm events. The project is required do a failing facility both in terms of mechanical and structural. HDR prepared an preliminary design report evaluating the upstream basin, alternative layouts

	for the new facility, sizing for pumps, piping, backup onsite power while keeping the existing facility place during construction. The City selected the most cost effective alternative evaluated to move forward with PS&E development.
13. **Project Impacts Avoided, Mitigated** -- Please identify how project impacts will be avoided and mitigated, and if that mitigation will be accomplished by June 30, 2027?	At this point no mitigation is anticipated.
14. ***NEW* Investment Planning** -- Please describe the extent to which this project is derived from or connects to a local investment planning (or master planning) process.	Currently HDR (Consultant) is preparing a stormwater comprehensive plan for the City that will prioritize required pump station and conveyance improvement projects to limit flooding within stormwater basins. The construction of this facility will be one of the higher priority capital improvement projects within the City's service area.

Section IV (**) Benefits Stated and Quantified	
15. **Emergency Response Benefits** -- Please describe (and quantify) how this project enhances emergency response in a flood emergency (e.g., does it keep critical access roads and transportation facilities open/functional, does it enable easy movement of cattle, equipment and farm chemicals out of harm's way, is it part of a larger hazard mitigation plan, etc.).	This project will reduce the potential for flooding of roadways and businesses upstream of the Farragut Stormwater pump station. This will reduce traffic impacts and help emergency response teams during flood emergencies. **This project is needed now and is necessary for the protection of residential dwellings and the school. During the Jan. 2022 flood event, this basin was completed flooded.**
16. **Essential Infrastructure Protection Benefits** -- Please describe (and quantify) how this project protects essential infrastructure and the risks or consequences of not acting this funding cycle.	There are existing residences and commercial buildings within the affected drainage basin as well as Aberdeen's Junior High School. This facility will protect these facilities and the transportation infrastructure from flooding.
17. **Public Health, Safety and Welfare Benefits** -- Please describe (and quantify) how this project protects public health, safety, and welfare.	The project will prevent flooding within this stormwater Basin.
18. **Residential, Commercial and/or Agricultural Protection Benefits** -- Please describe (and quantify) how this project protects residential communities, commercial and/or agricultural interests, and benefits of acting (or consequences of not acting) this funding cycle. Consider factors like number of structures and	The city of Aberdeen experiences major flooding. Approximately 152 acres of land, primarily zoned as low density single family residential, contributes flows to this basin. This area includes approximately 400 properties with constructed improvements totaling $37 million in value according to the 2020 County Assessor records.

people at risk, historic frequency of flood damage, magnitude of benefit for the cost, etc.	Without the Farragut Street pump station, the entire basin would be affected by local flooding ranging from nuisance flooding and water over roadways to flooded buildings and property damage.
19. **Habitat Benefits –** Please describe (and quantify) how this project benefits or improves existing or future habitat conditions.	The new pump station's variable frequency drives will mitigate the effect 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. 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 facility will also have improved trash racks for removing trash and plastics from the flow prior to entering the pumps and new check valves to prevent any aquatic organisms from going upstream into the City's system.
20. **Costs, Benefits, Impacts** – Please describe (and quantify) anticipated: (a) Costs of this phase/stage of the project if funded, and if not funded? This would include any costs (beyond the direct cost of the project) that might be incurred or avoided because of the project being funded (or not funded) and when. (b) Benefits of this phase/stage of the project if funded and when those benefits would be realized? (c) Impacts of this phase/stage of the project if funded, if not funded, and when those impacts would occur.	(a) Construction cost during the final OPCC will be updated as the design progresses during PS&E development. The cost shown in the predesign report ranges from 10 to 11 million dollars. The City is seeking $5 million dollars with the intent of competing for a PWTF loan. Any increases above the $5 million dollar request would reduce the future debt service of the Aberdeen rate payers. (b) The project provides limits the opportunity for flooding in the drainage basin and provides beneficial habitat improvements previously noted. (c) If the project is not funded the facility will eventually fail, either structurally or mechanically. This will result in millions of dollars of damage to residents, businesses, and Miller Junior High. This is the only pump station in this basin.
21. **Other Project Benefits --** Please describe (and quantify) any other project benefits not already discussed. This could include how this project compliments, leverages, or implements another project or planning process already underway.	In reviewing ejscreen.epa.gov, the drainage basin is in the 95 percentile nationally for flood risk. In relations to other activities underway, this project will be identified as a priority capital project in the upcoming City Comprehensive Stormwater Plan. Initiating construction shortly after the planning document is completed will help jump start the improvements necessary to protect the residents of

	Aberdeen from flooding.
22. **Anything Else --** Please offer any additional information (e.g., links, photos, maps, video, drawings, drone, etc.) that would help to better understand the scope, timing, and benefits of this project.	The Preliminary design Report completed by HDR in March 2024 is provided for backup for this project.

Section V **Local Construction, Implementation Projects Beyond 2025-27**	
23. **Project Name and Project Phases/Stage:**	
24. **Project Location --** Please provide location of project and latitude, longitude coordinates (e.g., 46.712222, -122.977811).	
25. **Project Sponsor and Key Partners --** Please identify who would be sponsoring the project and key partners who would assist with project delivery and implementation.	
26. **Project Description --** Please describe the project, what is intended to be accomplished, the flood hazard reduction benefits to be accrued and to who and when. Please identify what phase/stage of the project funding would be sought (e.g., construction/implementation phase/stage).	
27. **Costs --** Please describe (quantify) anticipated project costs.	
28. **Benefits –** Please describe (quantify) anticipated project benefits.	
29. **Impacts --** Please describe (quantify) anticipated project impacts.	

Preliminary Design Report

Farragut Stormwater Pump Station

City of Aberdeen

Grays Harbor County, Washington

March 31, 2024

Certificate of the Engineer

The technical material and data contained in this report was prepared under the supervision and direction of the undersigned.

Cindy Kinzer, PE (WA)
Stormwater Business Class Lead
HDR Engineering, Inc.

Contents

Tables

Figures

Appendices

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
OCPD	overcurrent protective device
Orange Book	*Criteria for Sewage Works Design*
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	*Stormwater Management Manual for Western Washington*
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:

- One (new) duty, 15 hp vertical axial submersible pump that will pump base flow from the unnamed ditch and discharge to the existing discharge outfall to the unnamed tributary to Mill Creek. The 15 hp pump has a design capacity of 1,500 gallons per minute (gpm).

  - The 15 hp pump will be installed east of the existing pump station building, where the existing pump is located.
  - Concrete, cast-in-place wetwell, assumed to be 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 to determine the exact wetwell sizing, design, or placement and an investigation with survey will be required to further the design.
- 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 gpm.
  - Concrete, cast-in-place (CIP) wetwell with access hatches.
  - Bar screen trash rack with fish barrier screen.
  - Stop logs to block flow into the wetwell for O&M activities.
- Replacement of existing sheet pile shoring with tie-backs within the unnamed ditch.
- A minimum 6-foot high 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:

- Construction Specification Institute (CSI) six digit specifications using HDR's master specification templates.
- The City of Aberdeen front end specifications (contract documents).

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
Occupational Safety and Health Administration (OSHA) https://www.osha.gov/laws-regs/oshact/toc	United States Department of Labor

Title	Origin
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/ansihi2018-1730906	American National Standards Institute and Hydraulic Institute
Washington State Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW) current adopted version. Stormwater manuals - Washington State Department of Ecology	Washington State Department of Ecology
Washington State Department of Ecology (Ecology) 98-37 *Criteria for Sewage Works Design* (Orange Book) https://apps.ecology.wa.gov/publications/documents/9837.pdf	Washington State Department of Ecology
Washington Department of Transportation: 2019 *Hydraulics Manual,* 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
Illuminating Engineering Society of North America (IESNA) *Lighting Handbook,* latest edition https://www.ies.org/product/lighting-handbook-10th-edition/	Illuminating Engineering Society of North America

Title	Origin
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) *Seismic Design Manual* https://www.aisc.org/products/publication/manuals/seismic-design-manual-2nd-edition-print/#.W2SDKExFyUk	American Institute of Steel Construction
Aluminum Association (AA) *ADM 1 Design Manual* (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 *Steel Construction Manual* https://www.aisc.org/products/publication/manuals/steel-construction-manual-15th-ed-print/#.W2SB4ExFyUk	American Institute of Steel Construction
ASTM *Steel Standards* https://www.astm.org/Standards/steel-standards.html	American Society for Testing and Materials
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 anticipated permits and approvals

necessary for replacement of the existing Farragut pump station are 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 the federal Endangered Species Act (ESA). 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 B.

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, and Miller Jr High School property line 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 inside the building
Finished floor elevation	15.0'

Item	Criterion
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
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"

Item	Criterion
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.

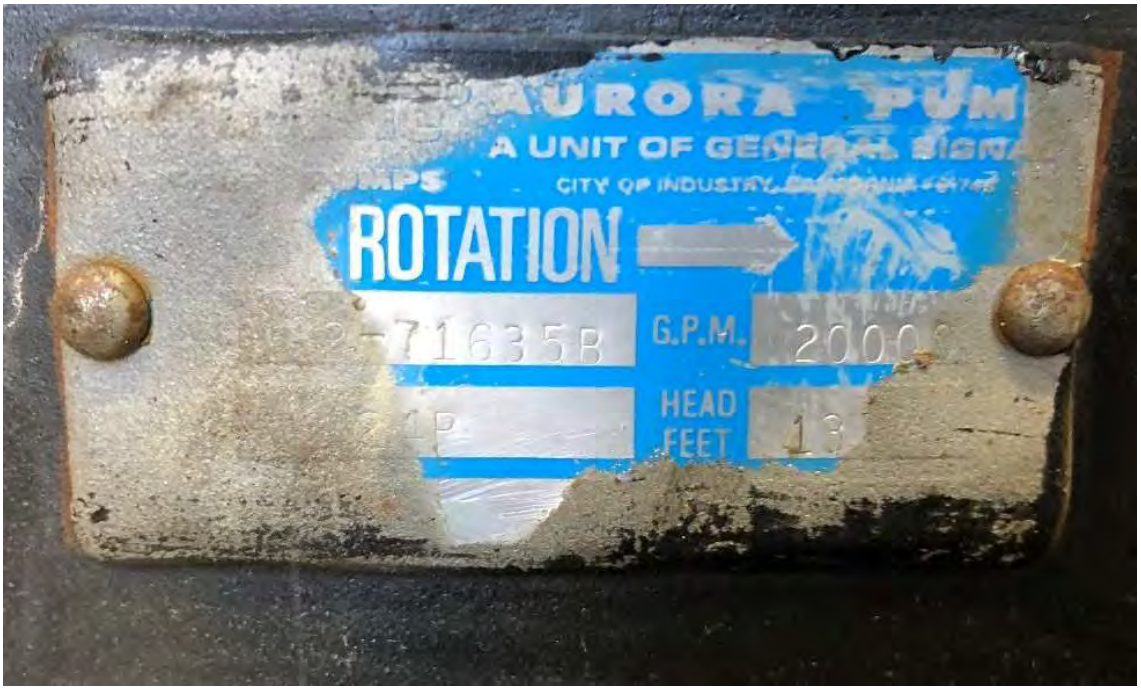


Figure 3-2. Existing 100 hp Pump 1 tag

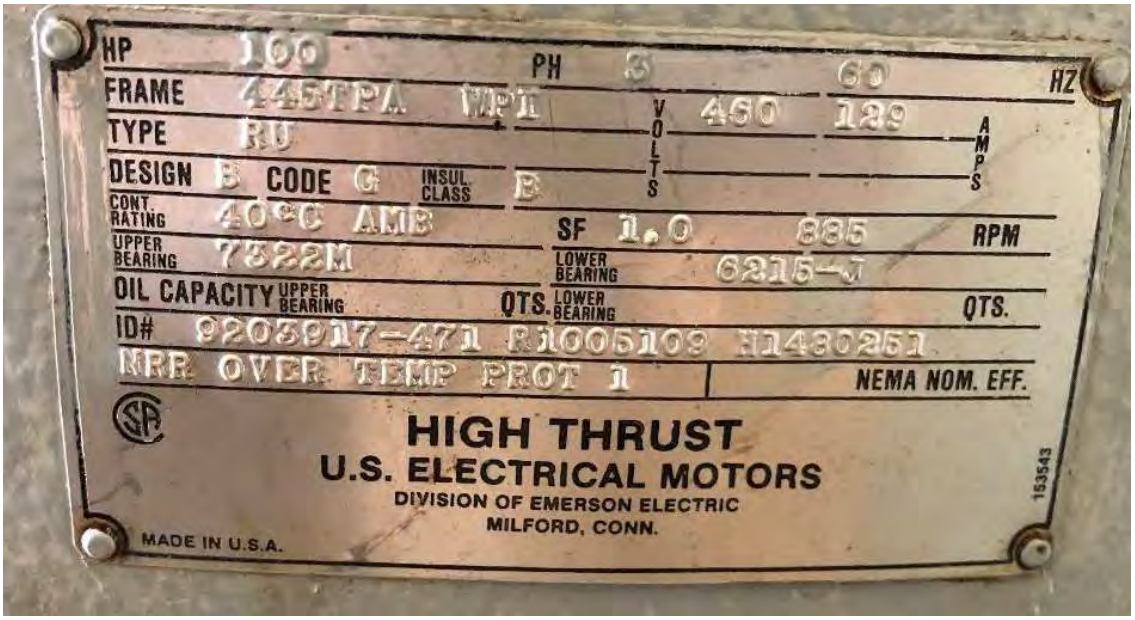


Figure 3-3. 100 hp Pump 1 motor tag

Figure 3-4. 100 hp Pump 2 tag

Figure 3-5. 100 hp Pump 2 motor tag

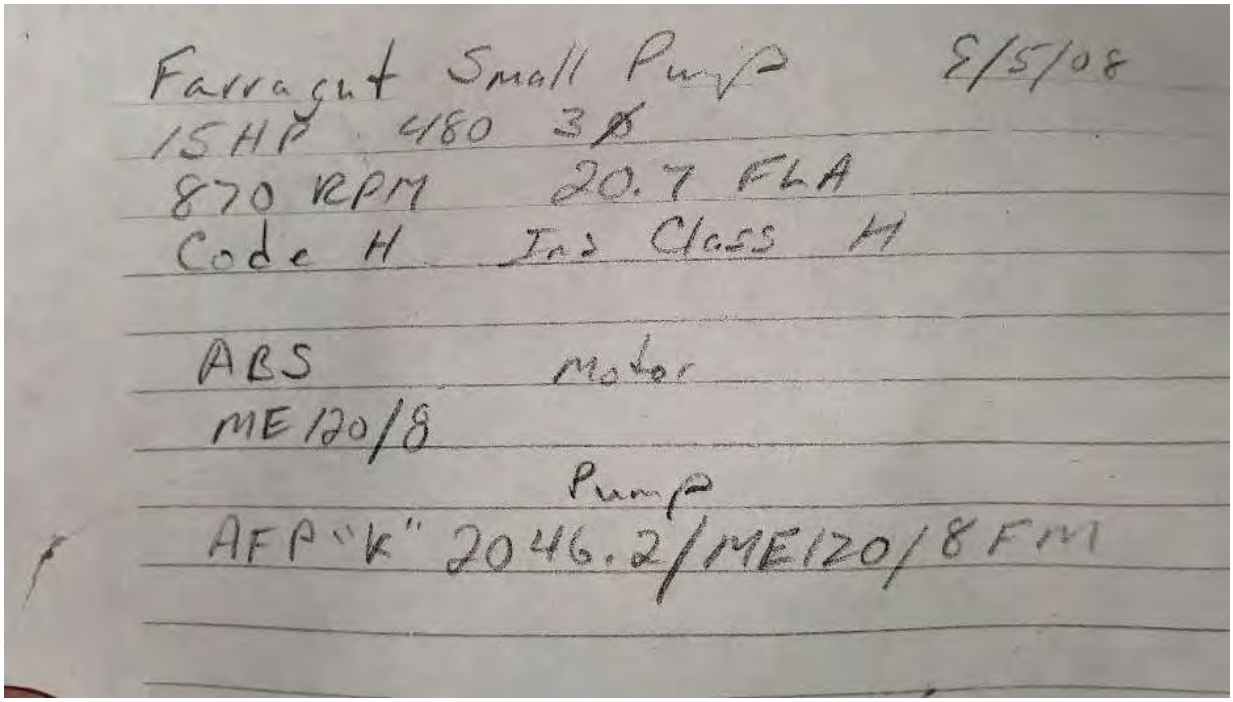


Figure 3-6. 15 hp "duty" pump information from City

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 Site Soils

Site soils were found to contain a high content of organics and peat. The Geotechnical Report noted that site soils are undergoing long-term, secondary settlement. Any new loading will increase the magnitude of short and long-term settlement. Pile supported structures were recommended.

It should be noted that this site is defined as Class D and the City of Aberdeen building department recommends that a seismic design be completed. This requirement will be coordinated with the Geotechnical Engineer during project design.

4.1.2 Groundwater and Buoyancy

The Geotechnical Report states that given the site proximity to the Chehalis River that groundwater is anticipated to be within 5 feet of the ground surface. Groundwater levels are expected to fluctuate seasonally. 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 Western Washington Hydrology Model (WWHM) continuous simulation hydrologic model was used to determine basin flow rates at Farragut Pump Station. Project WWHM modeling assumptions include:

- Stormwater tributary basin area 152.67 acres.
- The basin soil types are listed below. A large portion of the basin was comprised of Ocasta silty clay loam, and is designated as Hydrological Soil Group (HSG) Class D. Because Class D soils are not included in the WWHM model, the soil type was adjusted to Class “C”. Soil group information was referenced from the Natural Resources Conservation Service (NRCS) Web Soil Survey and is summarized in Table 4-1 below.
- Slopes in the basin typically vary from 0 to 5 percent.

Table 4-1. Soil types

Soil (type)	Slopes	Percentage of basin
Mopang silt loam (B)	5%–30%	17.8%
Mopang silt loam (B)	30%–65%	4.7%
Ocasta silty clay loam (D)	---	76.8%
Pits, gravel (NA)	---	0.7%

The basin is primarily zoned as low-density, single-family residential with areas zoned as Civic (school), and Open Space (forested). Developmental density was assigned as follows:

  - Existing condition development density was assigned 3.0 dwelling units per gross acre (DU/GA) with 34-percent impervious area per the SWMMWW.
  - Future condition was assigned a development density of 4.0 DU/GA with 42-percent impervious area based.

- 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).

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. Existing Condition Flow Summary

Return period	Flow (cfs)	Flow (gpm)
2-year	68	30,500
10-year	97	43,500
25-year	109	48,900
100-year	124	55,700

The existing condition WWHM model reported a 10-year design storm flow of 43,500 gpm. The existing Farragut Pump Station was rated at 43,500 gpm (42,000 gpm using both 100 hp pumps plus 1,500 gpm using the 15 hp pump). The City reported that the existing pump station has been in operation since 1983 and has not experienced capacity concerns within that time frame.

Table 4-3. Future Condition Flow Summary

Return period	Flow (cfs)	Flow (gpm)
2-year	71	30,900
10-year	99	44,400
25-year	111	49,800
100-year	126	56,600

The Future condition WWHM model reported a 10-year design storm flow of 44,400 gpm. Per direction from the City, the pumps were designed to match existing station capacity. It is recommended that the next stage of design include a cost-benefit-risk expansion for designing the pump station to allow for expanded pumping capacity should development progress within the Farragut PS tributary basin.

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. Daytime work hour restrictions may be necessary to avoid potential adverse impacts.

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 by 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. T

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 4-4. 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

Design key elevations[a]	Water surface elevation (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 flows to the existing pump station. The City needs to work with WDFW to correct inadvertent discharge into the Farragut basin.

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 proposed design will match existing capacity and is capable of pumping the 10-year, 24-hour rainfall event. 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 4-5. 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

Design item	Criterion
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 4-6. 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 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 4-7. 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	• 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	• 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 manual transfer switch and an external attachment for a trailer mounted generator. 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. A space will be provided for a future automatic transfer switch (ATS).

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 ¾ 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 4-8. 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 ¾ 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. A manual transfer switch will be provided as part of this project with external attachment for a trailer mounted generator. The proposed pump station electrical design will provide connections to accommodate an ATS 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 and school district property to the north 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 and Services

A 10-inch ductile iron water main 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.

Water service to the pump station will be provided by connecting to the existing 10-inch main. The exact water service location will be coordinated as design progresses.

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. 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 largest 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 axial pumps All pumps in the building	100 hp submersible axial pumps 15 hp pump separate
Total project cost	$11.0 M	$10.5 M	$9.8 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' inside bldg.. Three: 5'x5' on the concrete deck	Three: 5' × 5' inside bldg.. Three: 5'x5' on the concrete deck	Two: 5' × 5' Inside bldg.. Two: 5'x5' on the concrete deck
Pump station wetwell			
Construction	CIP concrete	CIP concrete	CIP concrete
Interior dimensions	33' long × 28' wide	24' long × 28' wide	18' long × 28' wide

Item description	Alternatives analysis summary overview		
	Alternative A	Alternative B	Alternative C
Trash rack			
Rack opening dimensions	25' wide × 15' high	16' wide × 15' high	12' wide × 15' high
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.

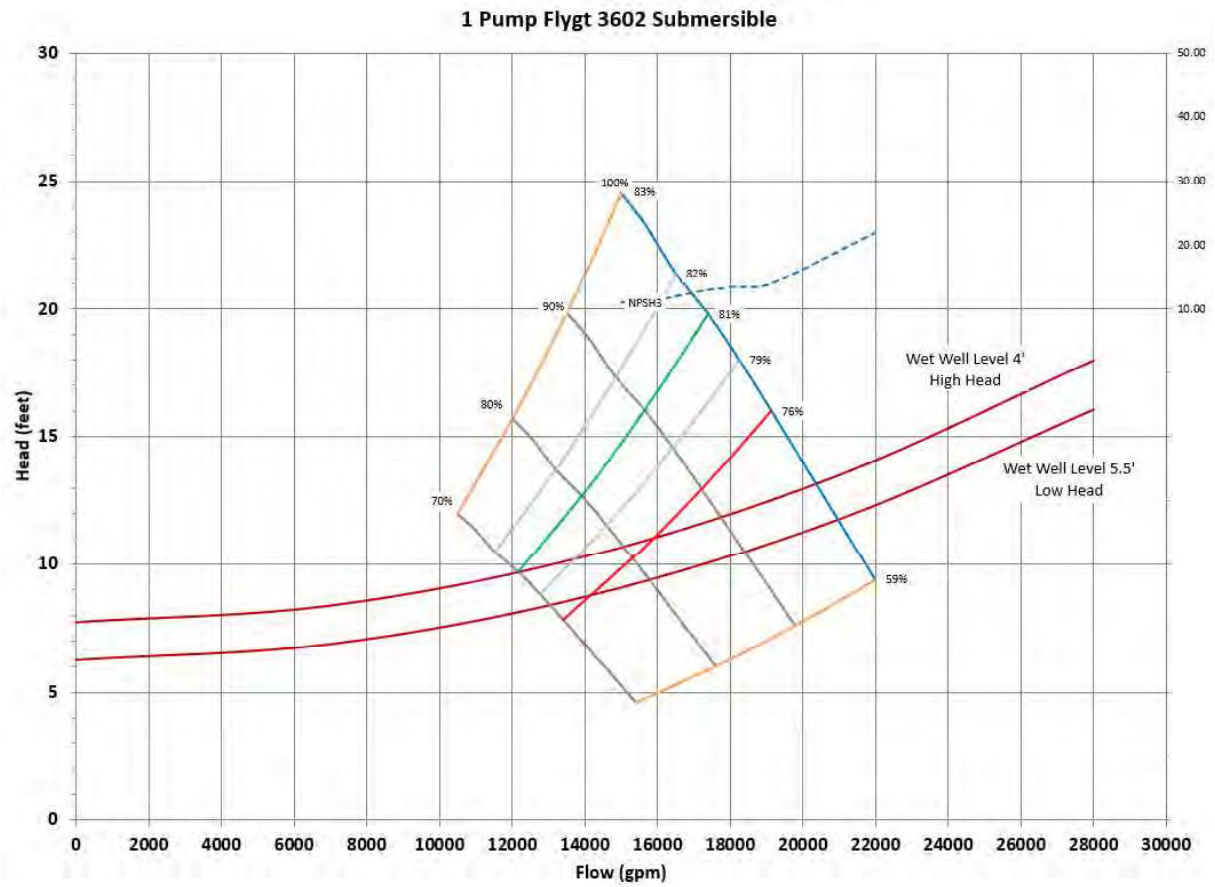


Figure 6-1. 100 hp system curve and Flygt 3602 pump curve

Information 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 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, keyed lock, 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 similar to the existing pump station and 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 2026 (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	4/2024–3/2025
2	Bid award	4/2025
3	Contractor early ordering and procurement of critical materials	5/2025–5/2026
4	Construction (presented in detail below)	5/2026–11/2027
	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 G.

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.

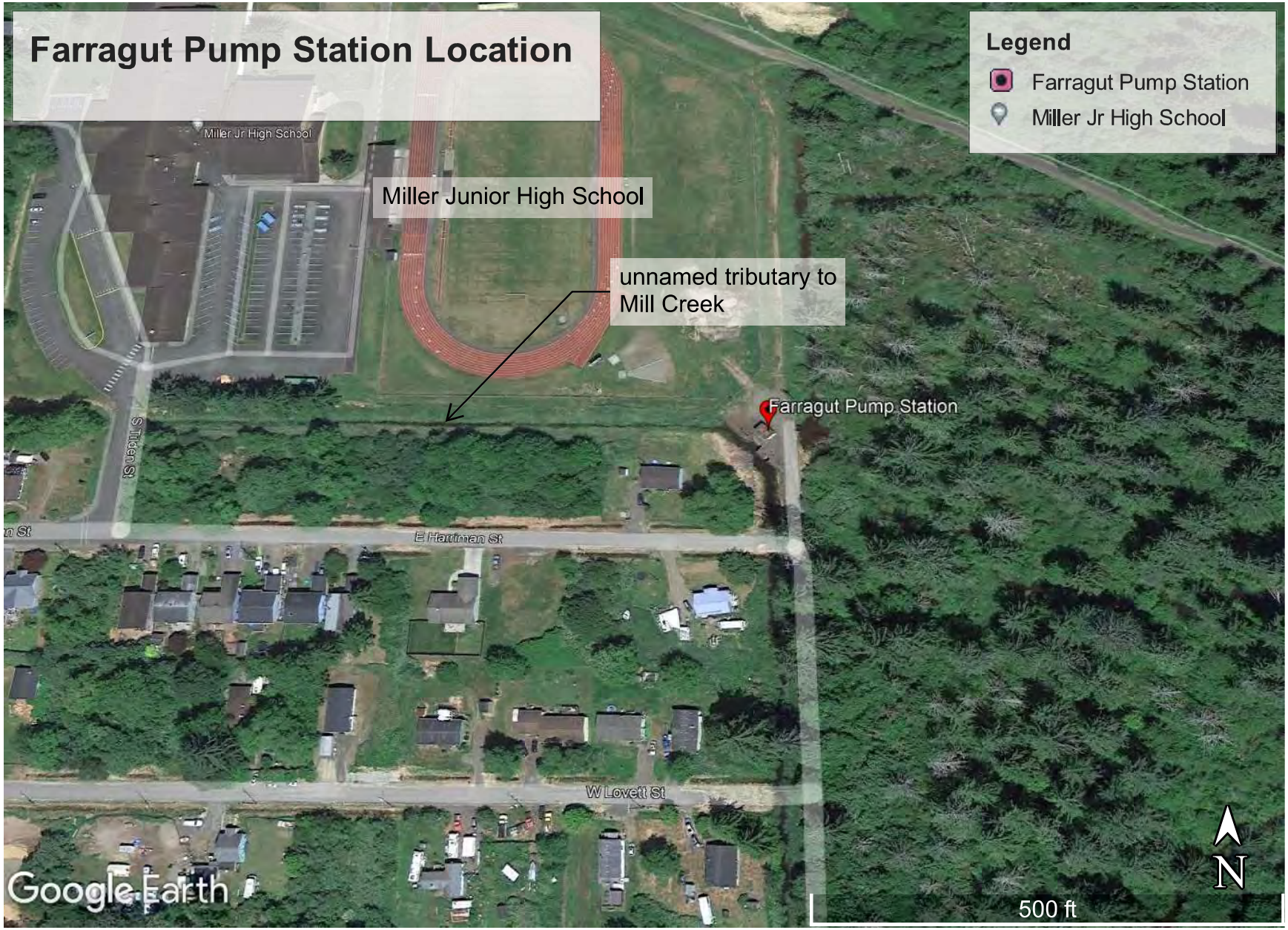
2019 State of Washington Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW). July.

Appendix A. Figures

Page intentionally left blank

FIGURE 1
VICINITY MAP

FARRAGUT PUMP STATION DESIGN
CITY OF ABERDEEN


Farragut Pump Station Location
Legend
Farragut Pump Station
Miller Jr High School
Miller Junior High School
unnamed tributary to Mill Creek
Farragut Pump Station
Miller Jr High School
S Tipton St
E Hartman St
W Lovell St
Google Earth
N
500 ft

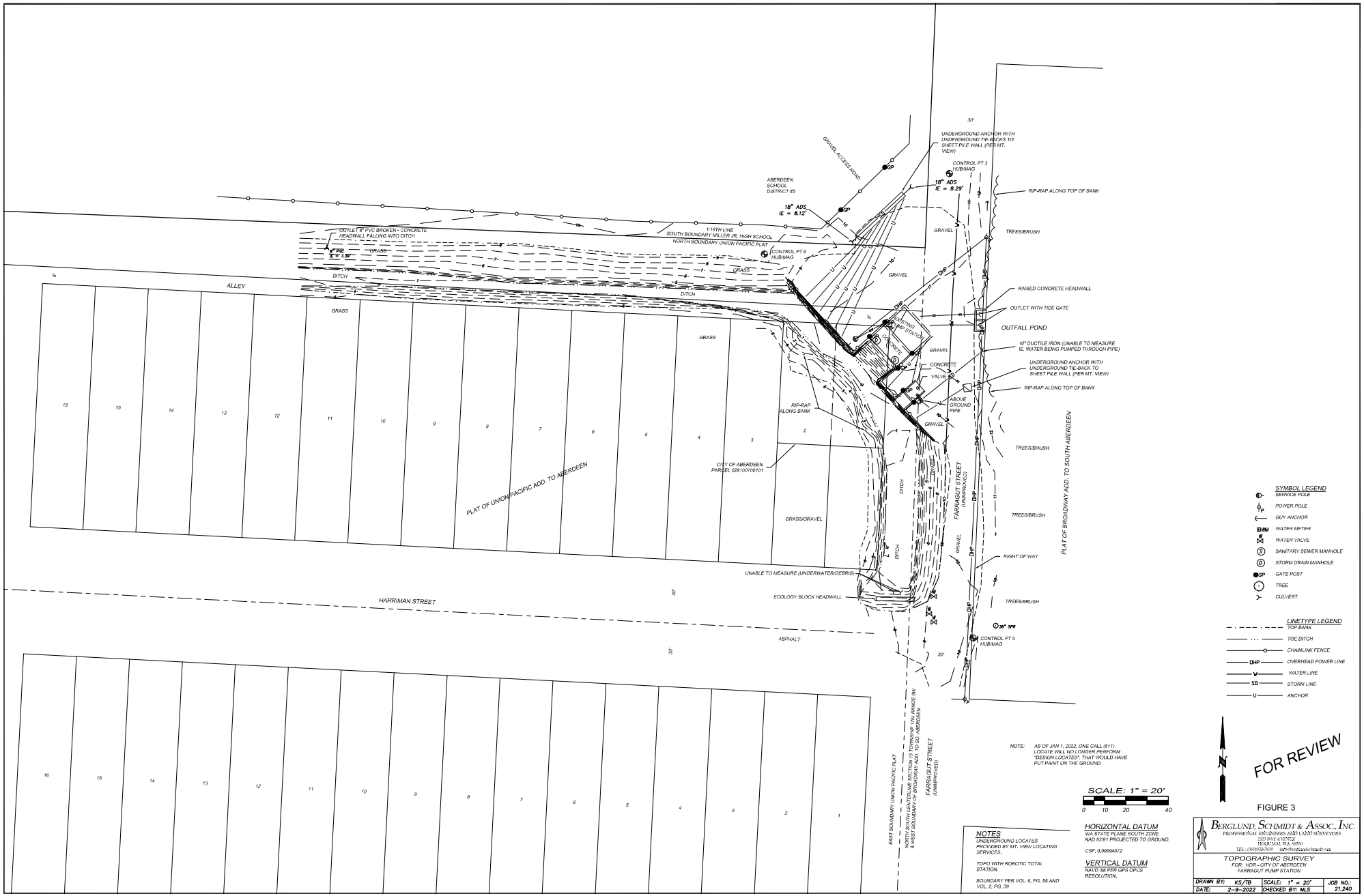
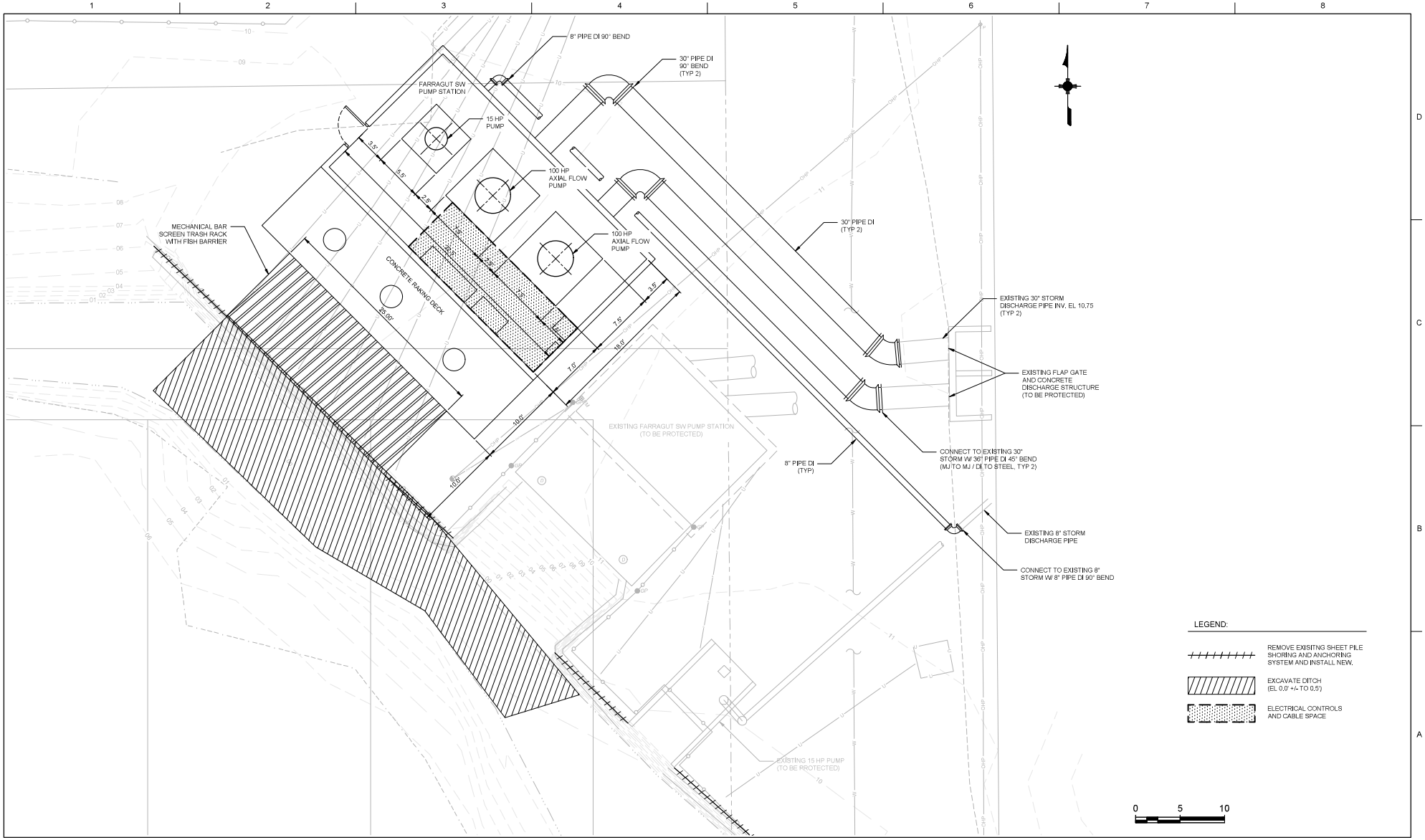


FIGURE 3

BERGLUND, SCHMIDT & ASSOC., INC.
PROFESSIONAL ENGINEERS AND LAND SURVEYORS
2323 BAY AVENUE
HOQUIAM, WA. 98550
TEL.: (360)532-7630 info@berglundschmidt.com

TOPOGRAPHIC SURVEY
FOR: HOR - CITY OF ABERDEEN
FARRAGUT PUMP STATION

DRAWN BY:	KS/TB	SCALE:	1" = 20'	JOB NO.:
DATE:	2-9-2022	CHECKED BY:	MLS	21.240



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER CINDY KINZER

PROJECT NUMBER 10333386

PRELIMINARY DESIGN
(NOT FOR CONSTRUCTION)

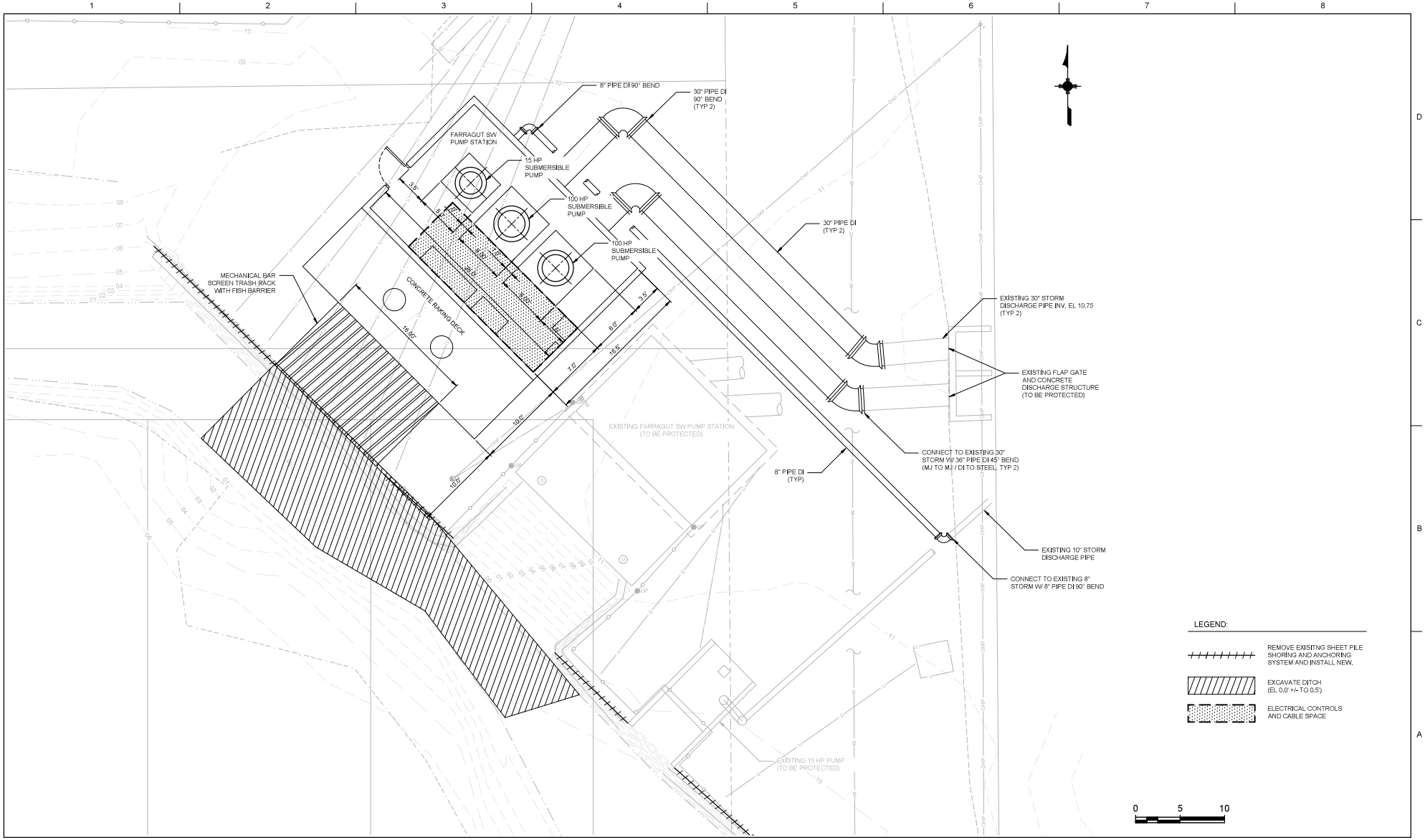
CITY OF ABERDEEN

ABERDEEN FARRAGUT STORMWATER PUMP STATION

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

DATE 06.17.2022

FIGURE 04



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER CINDY KINZER

PROJECT NUMBER 10333386

PRELIMINARY DESIGN
(NOT FOR CONSTRUCTION)

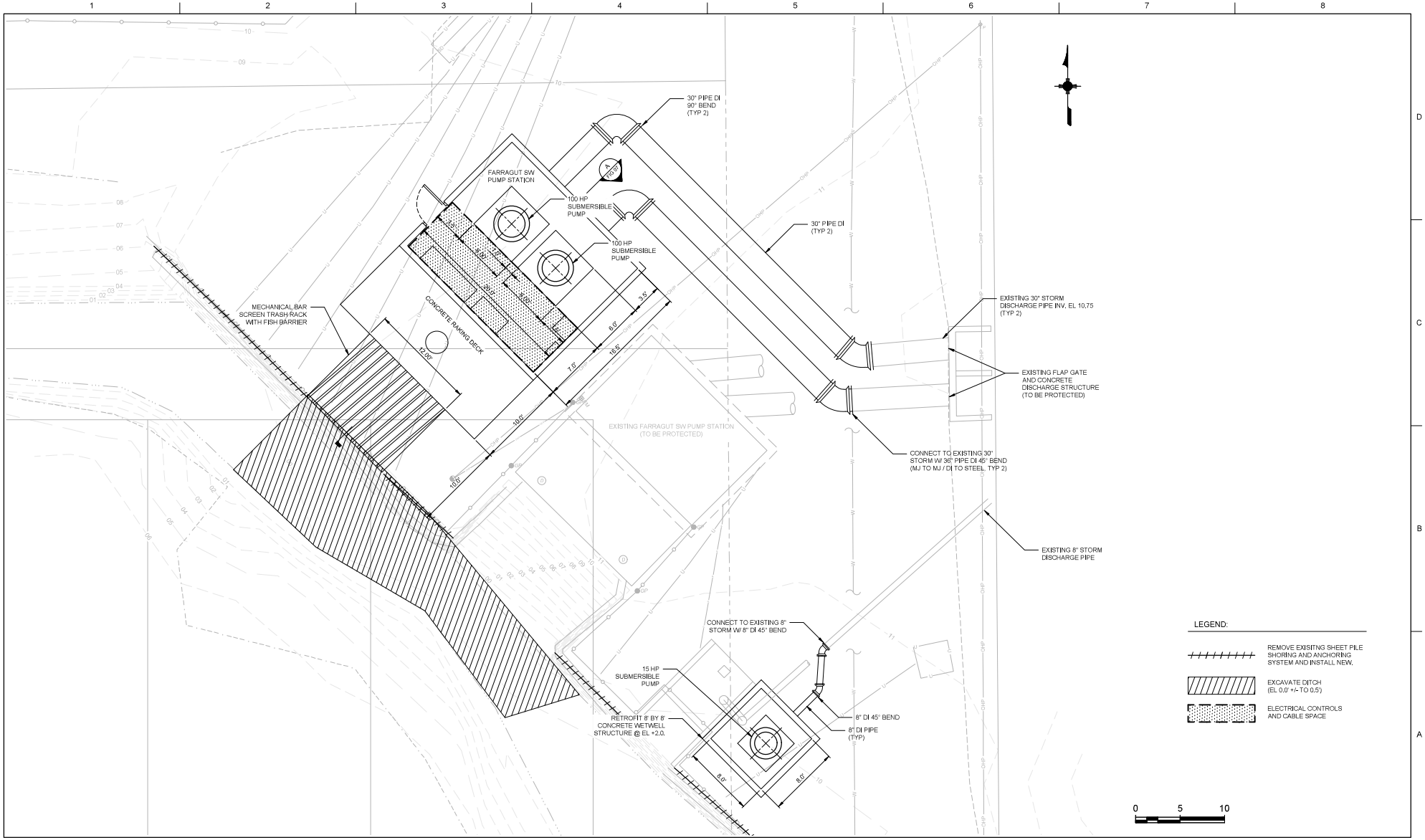
CITY OF ABERDEEN

ABERDEEN FARRAGUT STORMWATER PUMP STATION

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

DATE 06.17.2022

FIGURE 05



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	CINDY KINZER
PROJECT NUMBER	10333386

PRELIMINARY DESIGN
(NOT FOR CONSTRUCTION)

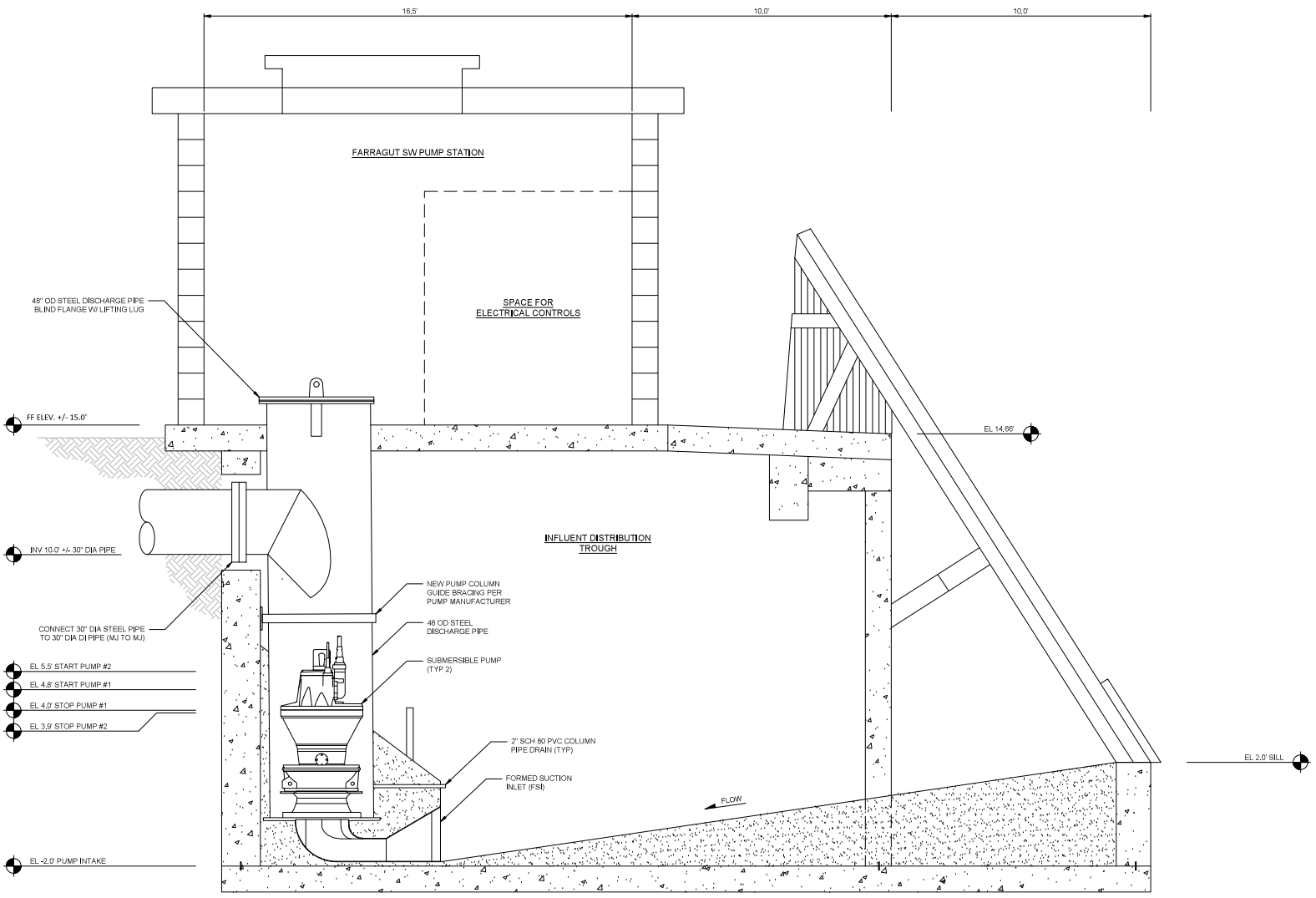
CITY OF ABERDEEN

ABERDEEN FARRAGUT STORMWATER PUMP STATION

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

DATE 06.17.2022

FIGURE 06



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER CINDY KINZER

PROJECT NUMBER 10333386

PRELIMINARY DESIGN
(NOT FOR CONSTRUCTION)

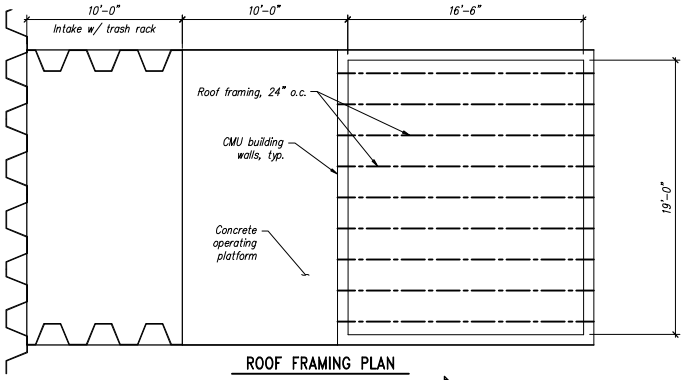
CITY OF ABERDEEN

ABERDEEN FARRAGUT
STORMWATER PUMP STATION

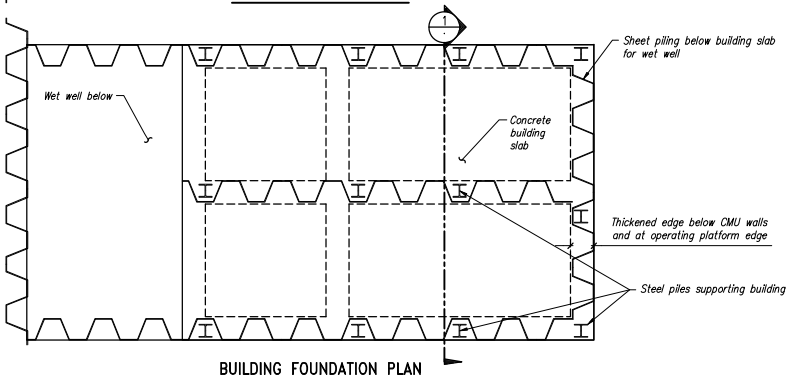
ALTERNATIVE C
PUMP STATION SECTION A

DATE 06.17.2022

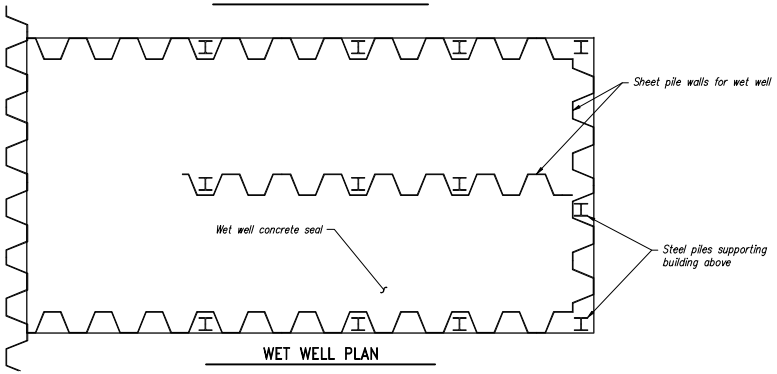
FIGURE
07



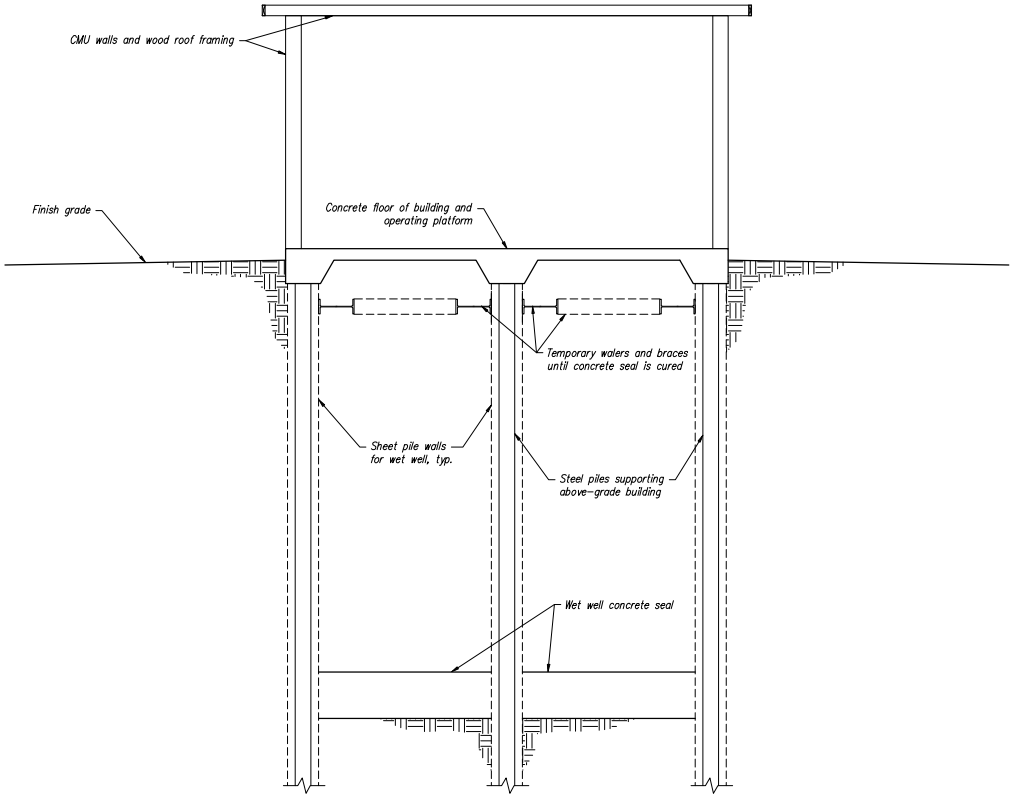
ROOF FRAMING PLAN



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

PRELIMINARY
JESSICA S SOMA
STATE OF WASHINGTON
25272
REGISTERED PROFESSIONAL ENGINEER

DRAWN BY	DESIGNED BY	CHECKED BY	SCALE	DATE
RWL	RWL	JSS		

NO.	REVISION	BY	REVIEW	DATE

LINE IS 1 INCH
AT FULL SIZE
(IF NOT 1" - SCALE ACCORDINGLY)

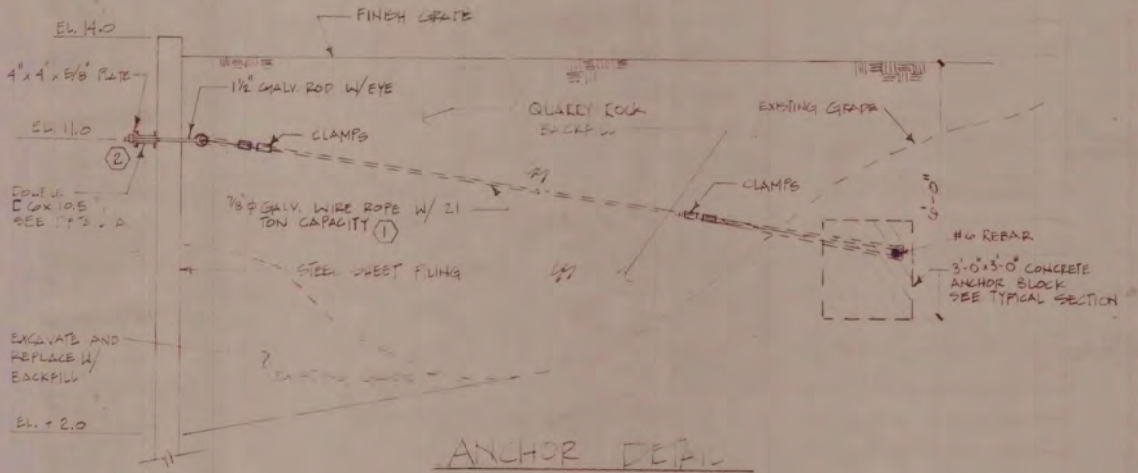
CITY OF ABERDEEN
PUBLIC WORKS DEPARTMENT

FARRAGUT STORMWATER PUMP STATION
ALTERNATIVE C

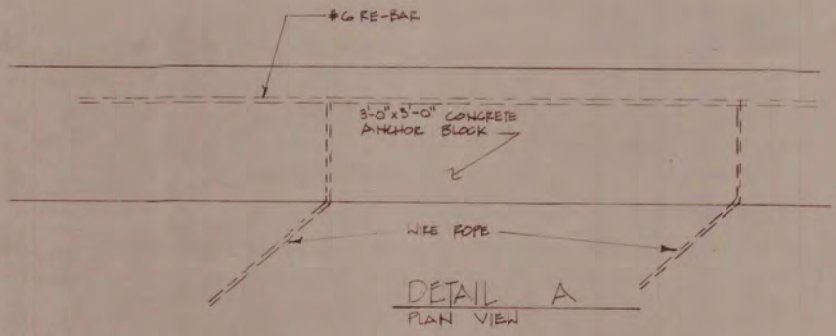
SHEET NAME
FIGURE 8
**

Appendix B. Record Drawings

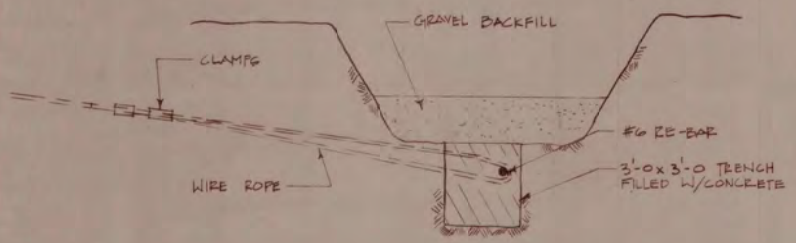
Page intentionally left blank



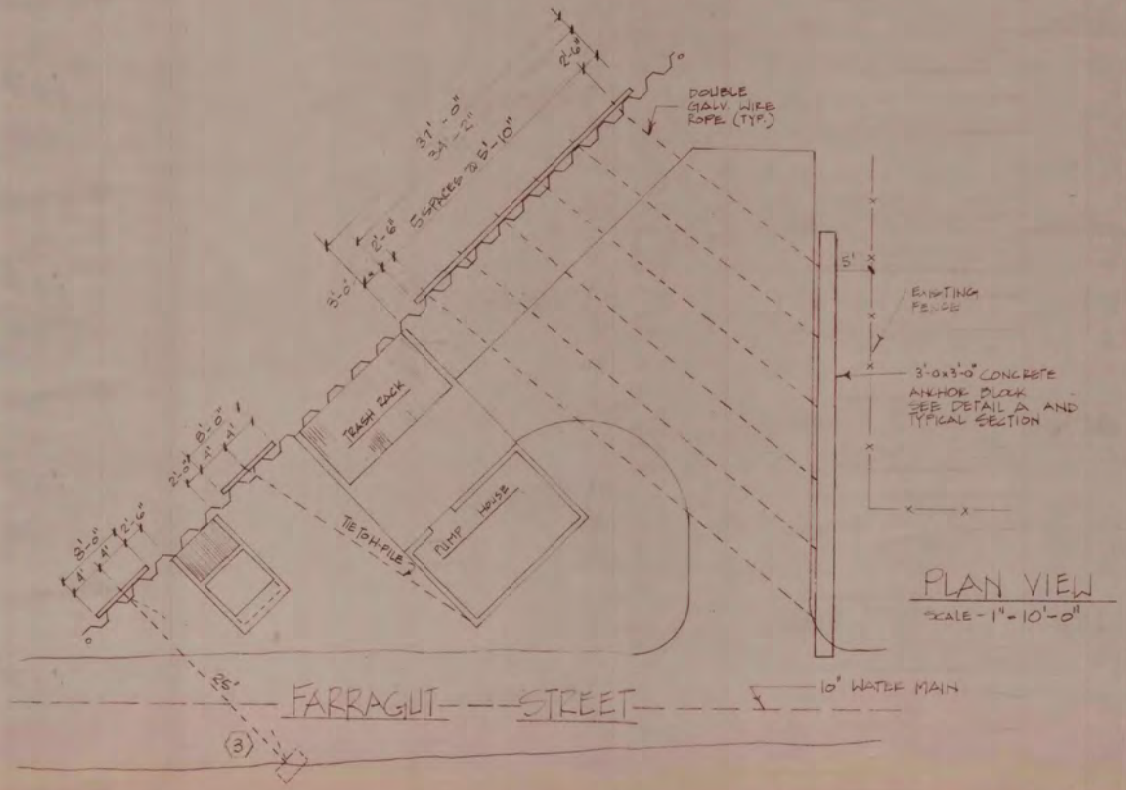
ANCHOR DETAIL



DETAIL A
PLAN VIEW



TYPICAL SECTION
NO SCALE



PLAN VIEW
SCALE - 1" = 10'-0"

NOTES:

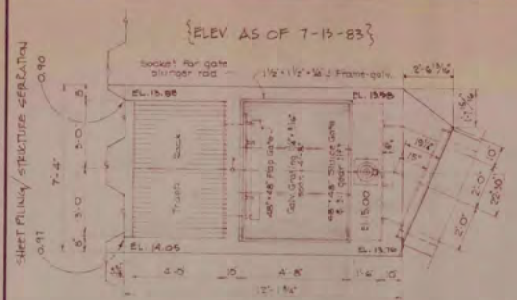
(1) GALV. WIRE ROPE OF 21 TON CAPACITY. ALL WIRE ROPE CONNECTIONS MUST BE APPROVED BY THE ENGINEER.

(2) ALL METAL COMPONENTS OF THE ANCHOR SYSTEM SHALL BE COATED WITH KOPPERS BITUPLASTIC #33 OR APPROVED EQUAL.

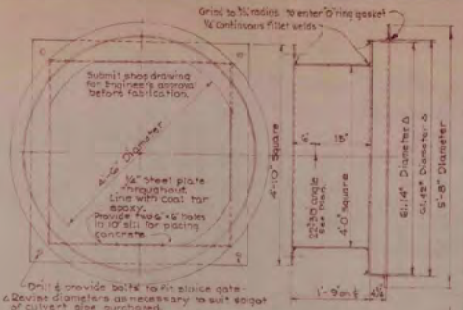
(3) THE CONCRETE ANCHOR IN FARRAGUT ST. MUST BE PLACED AT AN ELEVATION TO ALLOW THE WIRE ROPE CLEARANCE UNDER 10" WATER MAIN IN FARRAGUT ST.

AS-BUILT 8-4-83
CUNNINGHAM ASSOC. INC.
FARRAGUT PUMP STATION
[illegible] 11-11-82

CE-891H

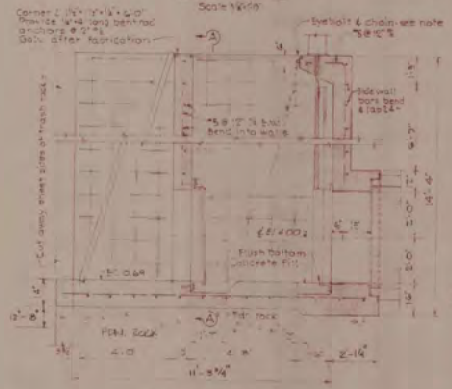


DECK PLAN
Scale 1/4"=1'-0"

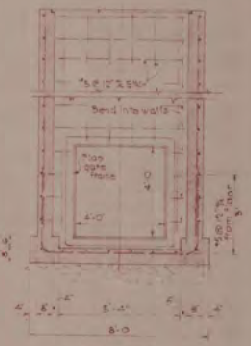


Drill & provide bolts to fit sluice gate - Revise diameters as necessary to suit edge of culvert pipe purchased.

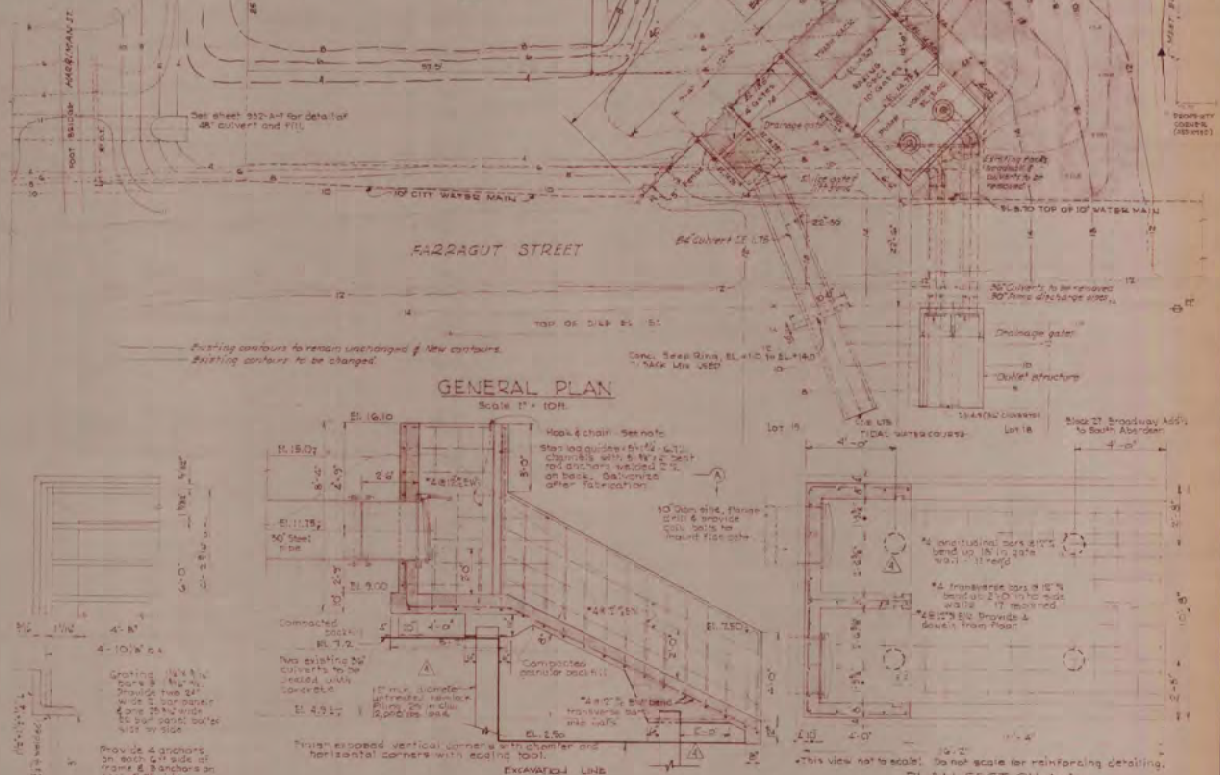
ADAPTER 48"x48" GATE TO 54" DIAM. CULVERT
Scale: 3/4" = 1'-0"



SECTION ON ℄
Scale 3/4"=1'-0"



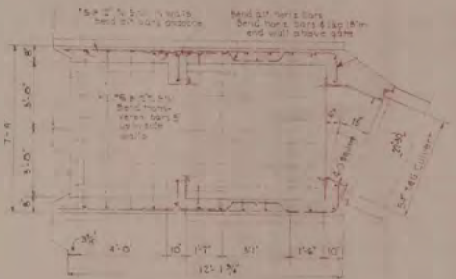
SECTION A-A
Scale 3/4"=1'-0"



GENERAL PLAN
Scale 1" = 10ft.

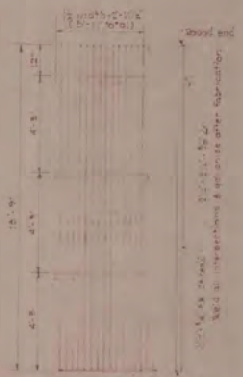
PUMP DISCHARGE OUTLET STRUCTURE
Scale 3/4"=1'-0"

PLAN-SECTION A-A
AS-BUILT 8-4-85



FLOOR PLAN-SECTION AT EL. 4.0
Scale 3/4"=1'-0"

RACK SEAT
Half Size



TRASH RACK
Scale 1/4"=1'-0"

DETAIL FOR FLOOR GRATING & FRAME
Half Size

DETAILS FOR CULVERT INLET BOX

NOTE:
For each flap gate, provide galvanized chain attached to eye on gate leaf and secured to eyebolt set in concrete at top of structure. Purpose is to raise & hold leaf open when removing obstructions.

All flap gates shall have synthetic rubber seats. Flap gates on zinc discharges shall be provided with stirling bumpers.

DATE	NO.	BY
2/6/85	4	DJS
9/26/84	3	DJS
6/4/84	2	DJS
5/24/84	1	DJS
REVISIONS		

CITY OF ABERDEEN
FARRAGUT ST. PUMP STATION

GENERAL PLAN
54" CULVERT INLET AND PUMP DISCHARGE STRUCTURES

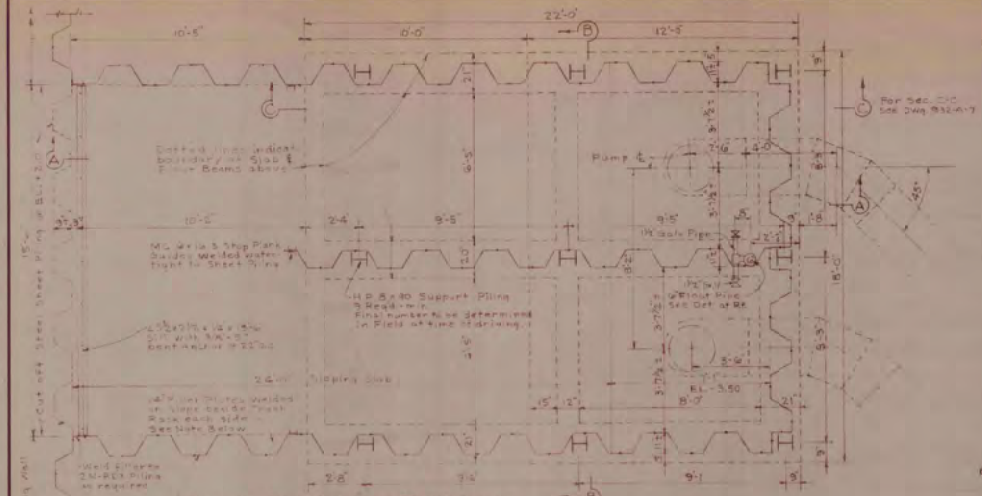
SCALES AS NOTED

JOHN W. CUNNINGHAM & ASSOCIATES
CONSULTING ENGINEERS
MILWAUKIE, OREGON

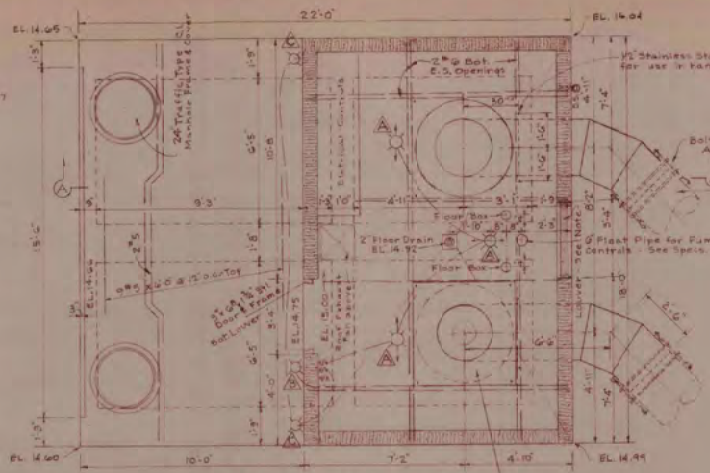
DESIGN	H.S.B.	DATE	DEC. 1983
DRAWN	H.S.B.	NO. 1	OF 3

E 350-A-5
E 355-A

CE-S92H

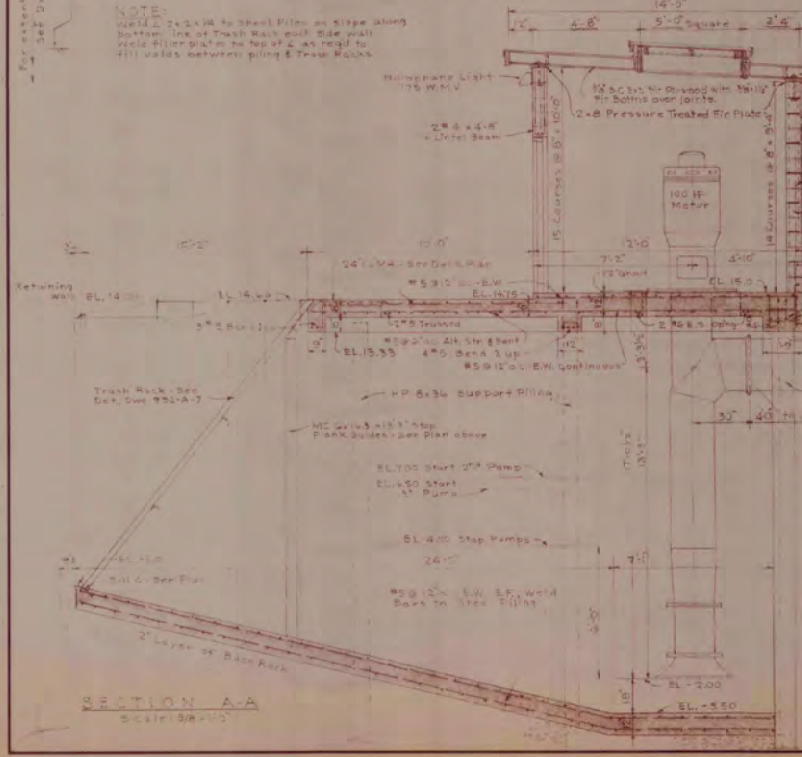


FOUNDATION SLAB & STEEL PILING PLAN
Scale: 3/8"=1'0"

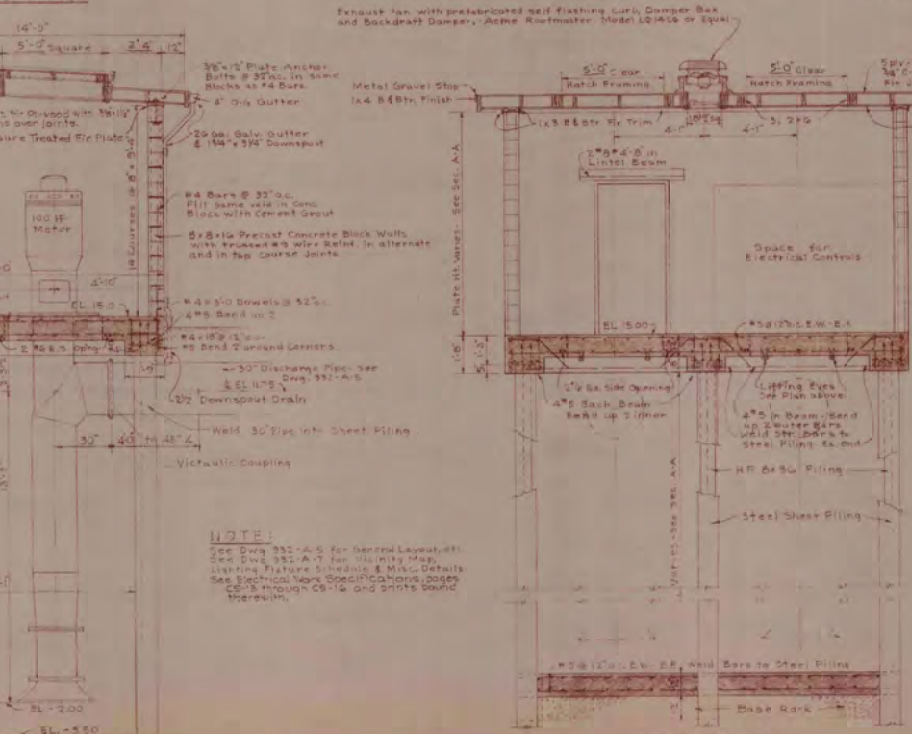


OPERATING FLOOR PLAN
Scale: 3/8"=1'0"

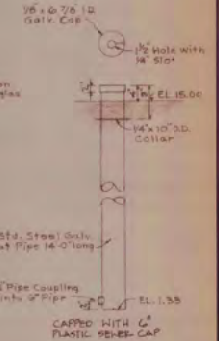
NOTE:
Louver shall be 40"x48", 16 Ga. Galv. Steel Hand operated, with insect Screen. Bot. EL. 14.95± Louver shall be AIROLITE Type 648-A or equal



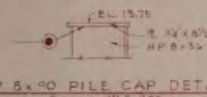
SECTION A-A
Scale: 3/8"=1'0"



SECTION B-B
Scale: 3/4"=1'0"



FLOAT PIPE DETAIL
Scale: 3/4"=1'0"



HP 8x 90 PILE CAP DETAIL
Scale: 1½"=1'0"

AS BUILT 8-4-83

CITY OF ABERDEEN, WA.
FARRAGUT ST. PUMP STATION

FOUNDATION & PILING PLAN, OPERATING FLOOR PLAN AND SECTIONS

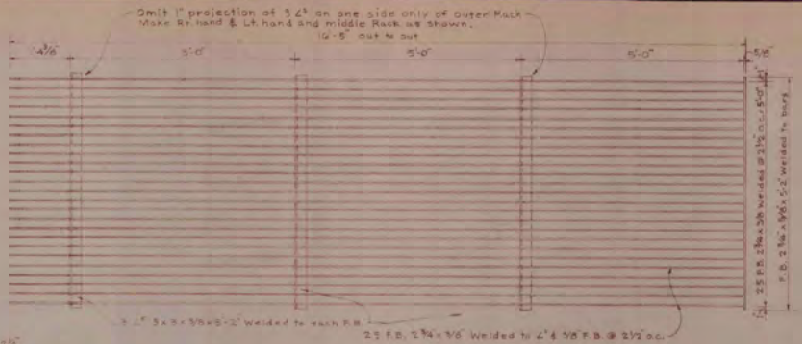
SCALE: AS NOTED

JOHN W. CUNNINGHAM & ASSOCIATES
CONSULTING ENGINEERS — MILWAUKIE, OREGON

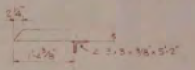
DATE	NO.	BY	REVISIONS
	4		
	3		
	2		
	1		

DESIGN WSB&BSH DATE JAN. 1982 | 352-A-6
DRAWN BSH NO. 2 OF 5 | 5861

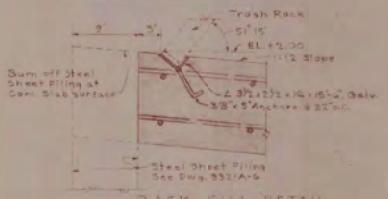
CE-593H



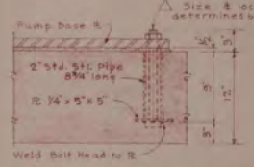
TRASH RACK DETAIL
Scale: ¾"=1'-0"
3 REQUIRED AS NOTED SALV.



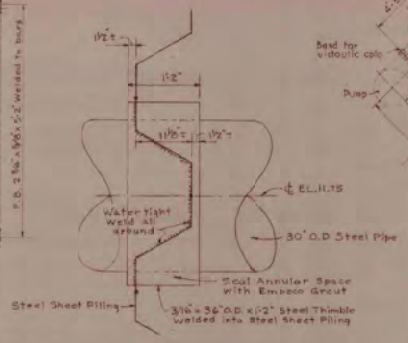
TOP BEVEL DETAIL



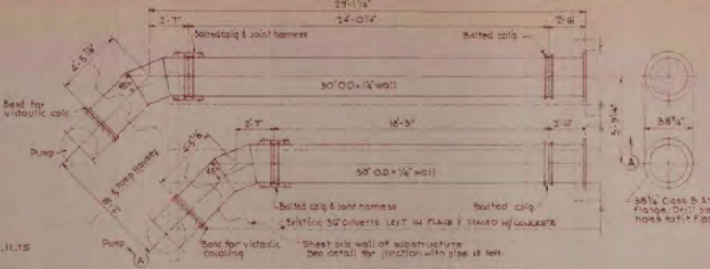
RACK SILL DETAIL
Scale: 1½"=1'-0"



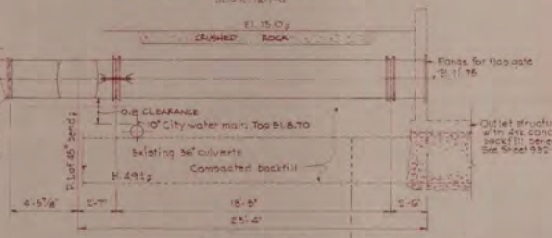
PUMP ANCHOR BOLT DETAIL
Scale: 1½"=1'-0"



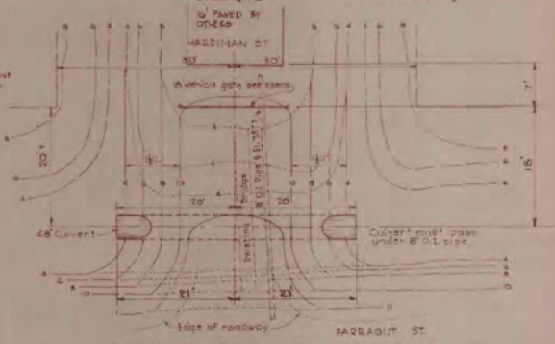
DETAIL OF WALL THIMBLE FOR DISCHARGE PIPES
Scale: 1"=1'-0"
TWO REQ'D



PLAN OF DISCHARGE PIPES
Scale: ¼"=1'-0"

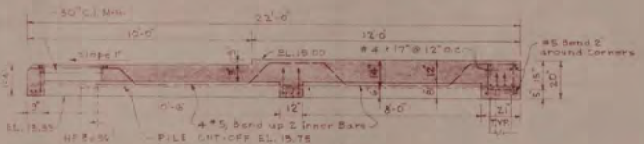


SECTION A-A
Scale: ¼"=1'-0"

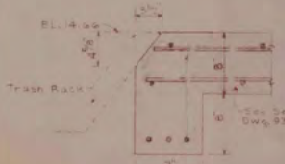


PLAN OF FILL & CULVERT at HARRIMAN ST.
Scale: 1"=10'-0"

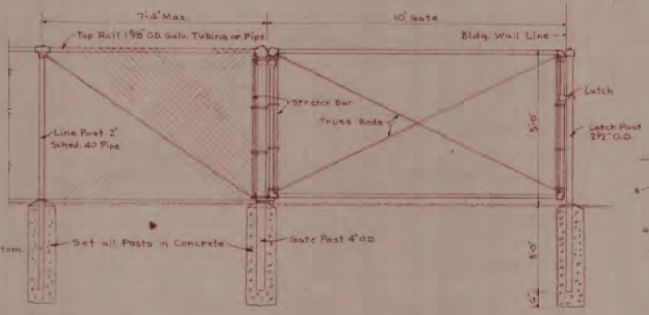
SECTION ON CULVERT ℄
Scale: 1"=10'-0"



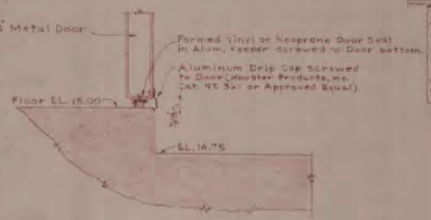
SECTION C-C
Scale: 3/8"=1'-0"
TYPICAL FOR 8 CHANNEL WALLS
(Slab Steel not Shown)



DETAIL OF TRASH RACK SEAT, ETC.
Scale: 1"=1'-0"



TYPICAL FENCE & 10' GATE DETAIL
Scale: ½"=1'-0"
See Specifications for List of Materials, etc.
NOTE: ROLL-FORMED SECTIONS MAY BE SUBSTITUTED FOR PIPE



DOOR SILL DETAIL
Scale: 3"=1'-0"

LIGHTING FIXTURE SCHEDULE				
LOC	MANUFACTURER	CATALOG NO	QUAN.	WATTAGE
A	LITHONIA	DLP 260 2R-GW	3	2T-40
B	APPLETON	V51, V1050G-A	1	100
C	HOLOPHANE	4R1	2	175 M.V.
See Specifications pages CS-3 through CS-16 & Detail sketch.				

AS-BUILT 5-4-83

CITY OF ABERDEEN, WA.
FARRAGUT ST. PUMP STATION

MISCELLANEOUS DETAILS

SCALE: AS NOTED

DATE	NO.	BY
	4	
	3	
4/26/82	2	J.C.B.
6/4/82	1	J.C.B.
REVISIONS		

JOHN W. CUNNINGHAM & ASSOCIATES
CONSULTING ENGINEERS — MILWAUKIE, OREGON

DESIGN	J.C.B.	DATE	JAN. 1982
DRAWN	J.B.M.	NO. 3 OF 3	J. 932-A-7
			E. 5862

CE-594H

Appendix C. Geotechnical Report

Page intentionally left blank

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 (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

AOF/CAM/tac
[O:\0122\061.010\R\REPORT FILES\FARRAGUT STREET DRAFT TECHNICAL MEMORANDUM.DOCX]

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.

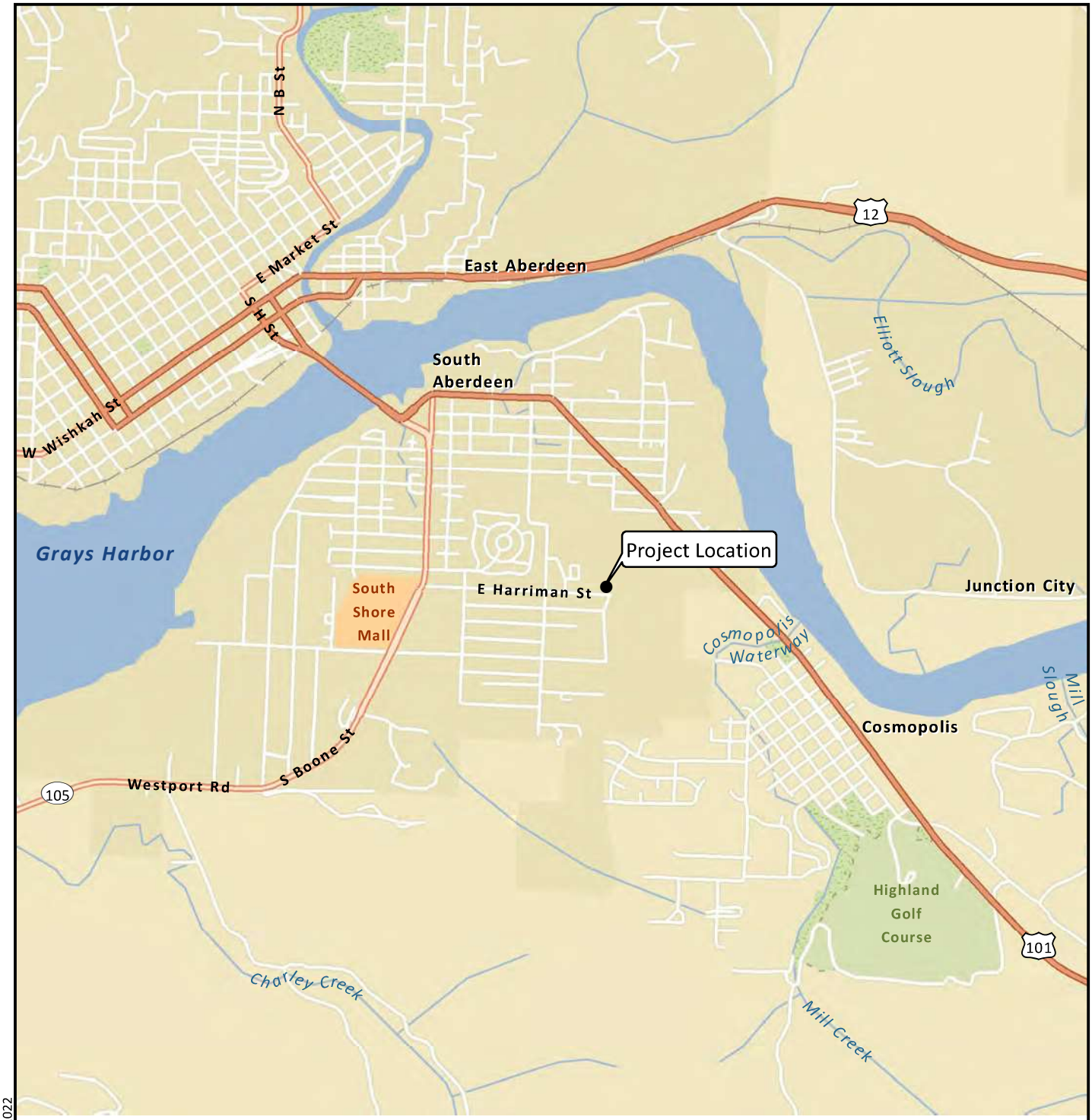
LNI. 2020. Construction Work. Chapter 296-155 WAC; Part N. Excavation, Trenching, and Shoring. Washington State Department of Labor and Industries. Effective October.

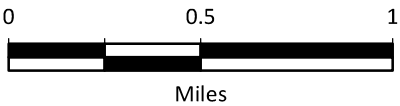
Logan, R.L. 1987. *Geologic Map of the Chehalis River and Westport Quadrangles, Washington.* Open File Report 87-8. Washington State Department of Natural Resources.

McGrath, T.J. 1998. "Calculating Loads on Buried Culverts Based on Pipe Hoop Stiffness." Presented at the 1999 TRB Annual Meeting in Washington, D.C.

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

0 40 80

Scale in Feet

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.

Source: Google Imagery 2021

DRAFT

LANDAU ASSOCIATES

Farragut Street Pump Station Design Aberdeen, Washington	**Site and Exploration Location Plan**	Figure 2

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS 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
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay 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
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay 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	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.

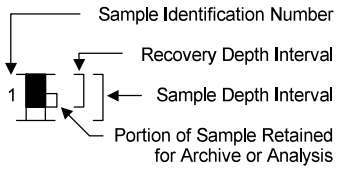
4. Soil density or consistency descriptions are based on judgement using a combination of sampler penetration blow counts, drilling or excavating conditions, field tests, and laboratory tests, as appropriate.

Drilling and Sampling Key

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Single-Tube Core Barrel
f	Double-Tube Core Barrel
g	2.50-inch O.D., 2.00-inch I.D. WSDOT
h	3.00-inch O.D., 2.375-inch I.D. Mod. California
i	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Vibrocore (Rotosonic/Geoprobe)
5	Other - See text if applicable

SAMPLE NUMBER & INTERVAL



Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

Groundwater

▽ Approximate water level at time of drilling (ATD)

▼ Approximate water level at time after drilling/excavation/well

DRAFT

LANDAU ASSOCIATES

Farragut Street
Pump Station Design
Aberdeen, Washington

Soil Classification System and Key

Figure 3

B-1

LAI Project No: 0122061.010.011

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
0							GP	Sod over gray, sandy, fine to coarse GRAVEL (dense, moist) **(FILL)**	Groundwater Not Encountered
		S-1	b2	4	W = 35		SM	Gray, silty, fine to coarse SAND (very loose, wet) **(ALLUVIUM)**	
5		S-2	b2	0					
							WD	Wood (very loose, wet)	
		S-3	b2	2	W = 191		OH	Dark gray, organic SILT (very soft, wet)	
10		S-4	b2	0	W = 108 AL			-Stratified peat	
15		S-5	b2	0	W = 91			-Grades to gray and with trace organics	
20		S-6	b2	0	W = 96 AL			-Grades to tan-gray	
25		S-7	b2	0	W = 94			-Stratified peat -Wood debris observed at 25.5 ft	
30		S-8	b2	0	W = 89			-Grades to dark gray	
35							OL	Tan gray, organic SILT (very soft, wet)	

Drilling Method: Mud Rotary
Ground Elevation (ft): Not Measured
Drilled By: Holocene Drilling Inc.
Logged By: BP Date: 01/12/22

Moisture Content (%) — Plastic Limit — Liquid Limit
20 40 60 80

▲ SPT N-Value ▲
△ Non-Standard N-Value △
20 40 60 80

× Fines Content (%) ×
20 40 60 80

191

108

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\T\0122061.010.011.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Farragut Street
Pump Station Design
Aberdeen, Washington

Log of Boring B-1

Figure
4
(1 of 3)

B-1

LAI Project No: 0122061.010.011

SAMPLE DATA | **SOIL PROFILE**

Drilling Method: Mud Rotary
Ground Elevation (ft): Not Measured
Drilled By: Holocene Drilling Inc.
Logged By: BP Date: 01/12/22

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Description
35		S-9	b2	0	W = 94 AL		OL	Tan gray, organic SILT (very soft, wet) -Peat observed at the bottom of the sampler
40		S-10	b2	0	W = 95			-Grades to gray -Peat observed at the bottom of the sampler
45		S-11	b2	0	W = 90			-Stratified peat
50		S-12	b2	0	W = 115			
55		S-13	b2	0	W = 86		ML	Gray SILT with organics (very soft, wet)
60		S-14	b2	0	W = 70			
65		S-15	b2	0	W = 65			-Grades to moist to wet
70								

Groundwater Not Encountered

Moisture Content (%)
Plastic Limit — Liquid Limit
20 40 60 80

▲ SPT N-Value ▲
△ Non-Standard N-Value △
20 40 60 80

× Fines Content (%) ×
20 40 60 80

115

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\T\0122061.010.011.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Farragut Street
Pump Station Design
Aberdeen, Washington

Log of Boring B-1

Figure 4 (2 of 3)

B-1

LAI Project No: 0122061.010.011

SAMPLE DATA | **SOIL PROFILE**

Drilling Method: Mud Rotary
Ground Elevation (ft): Not Measured
Drilled By: Holocene Drilling Inc.
Logged By: BP Date: 01/12/22

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile
70		S-16	b2	0	W = 61		ML	Gray SILT with organics (very soft, moist to wet)
							OL	Gray, organic SILT (very soft, moist to wet)
75		S-17	b2	0	W = 87			
80		S-18	b2	0	W = 77			
85								
90								
95								
100								
105								

Groundwater: Groundwater Not Encountered

Moisture Content (%) — Plastic Limit — Liquid Limit — 20 40 60 80

▲ SPT N-Value ▲ △ Non-Standard N-Value △ — 20 40 60 80

× Fines Content (%) × — 20 40 60 80

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

0122061.010.011 2/10/22 Y:\0122061.010\T\0122061.010.011.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Farragut Street
Pump Station Design
Aberdeen, Washington

Log of Boring B-1

Figure 4 (3 of 3)

B-2

LAI Project No: 0122061.010.011

SAMPLE DATA | **SOIL PROFILE**

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): Not Measured
Drilled By: Holocene Drilling Inc.
Logged By: BP Date: 01/12/22

Moisture Content (%) — Plastic Limit — Liquid Limit — 20 40 60 80
▲ SPT N-Value ▲ △ Non-Standard N-Value △ — 20 40 60 80
× Fines Content (%) × — 20 40 60 80

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Description	Groundwater
0							GP	Sod over gray, sandy, fine to coarse GRAVEL (dense, moist) **(FILL)**	Groundwater Not Encountered
		S-1	b2	0			SM	Gray, silty, fine to coarse SAND (very loose, moist to wet) **(ALLUVIUM)**	
5		S-2	b2	0			OL	Gray, organic SILT (very soft, moist to wet) -Peat observed at the bottom of the sampler	
		S-3	b2	2			WD	Wood (very soft, moist to wet)	
10		S-4	b2	5			ML	Dark brown SILT with wood (medium stiff, moist to wet)	
15		S-5	b2	0				-Grades to with organics, gray, and very soft	
20		S-6	b2	0					
25									

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.

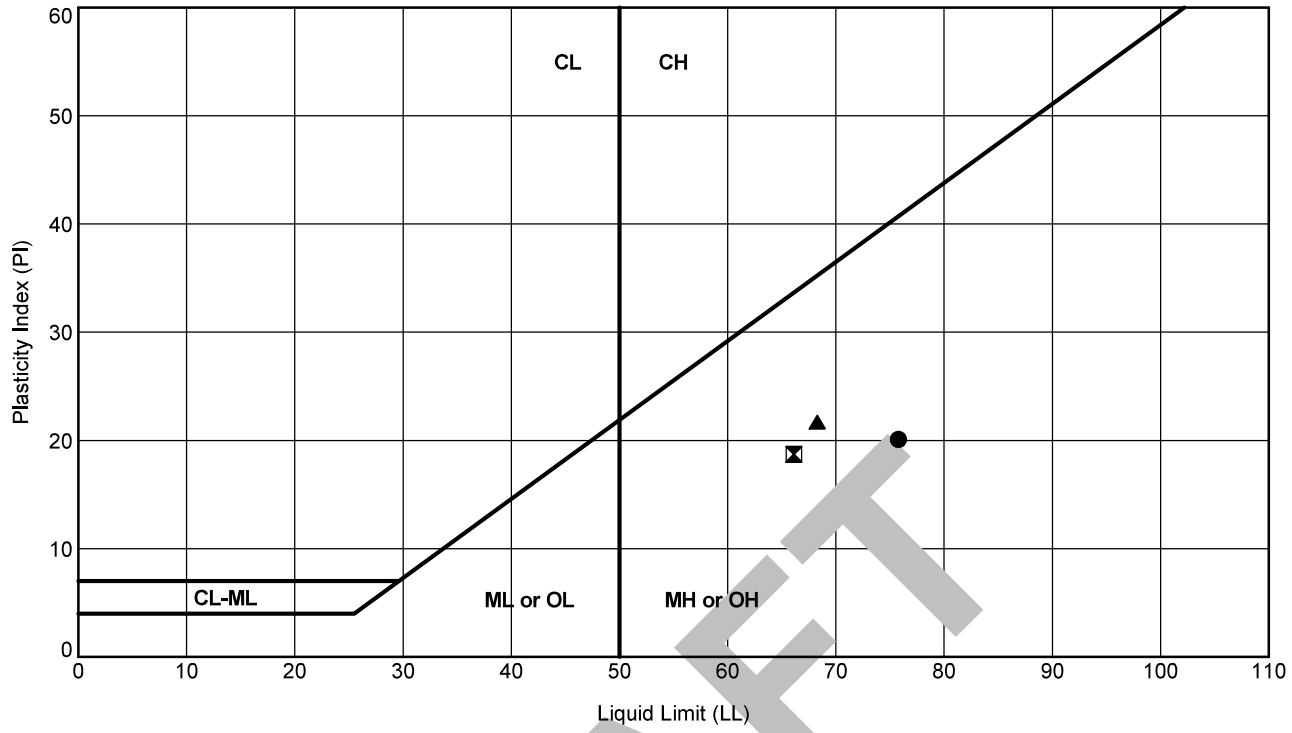
0122061.010.011 2/10/22 Y:\0122061.010\T\0122061.010.011.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Farragut Street
Pump Station Design
Aberdeen, Washington

Log of Boring B-2

Figure 5



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

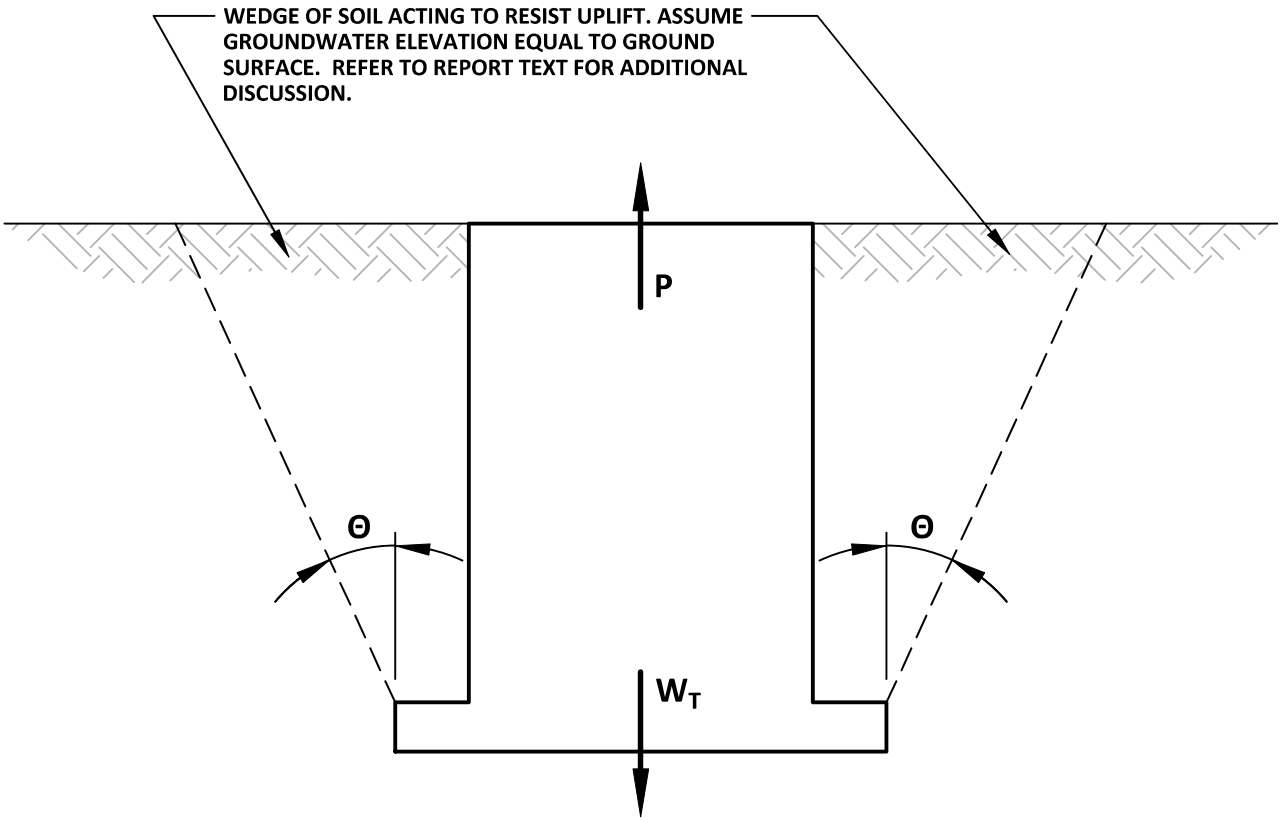
ASTM D 4318 Test Method

LANDAU ASSOCIATES

Farragut Street
Pump Station Design
Aberdeen, Washington

Plasticity Chart

Figure 6



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

Θ= 20°

Source: Naval Facilities Engineering Command Design Manual 7.2 1986

DRAFT

LANDAU ASSOCIATES

Farragut Street Pump Station Design Aberdeen, Washington	**Extended Base Buoyancy Calculation**	Figure 7

ATTACHMENT 1

Recommended Material and Procedure Specifications

DRAFT

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

Page intentionally left blank

Appendix D. Drainage

Page intentionally left blank

Aberdeen Farragut Pump Station Drainage Basin

N

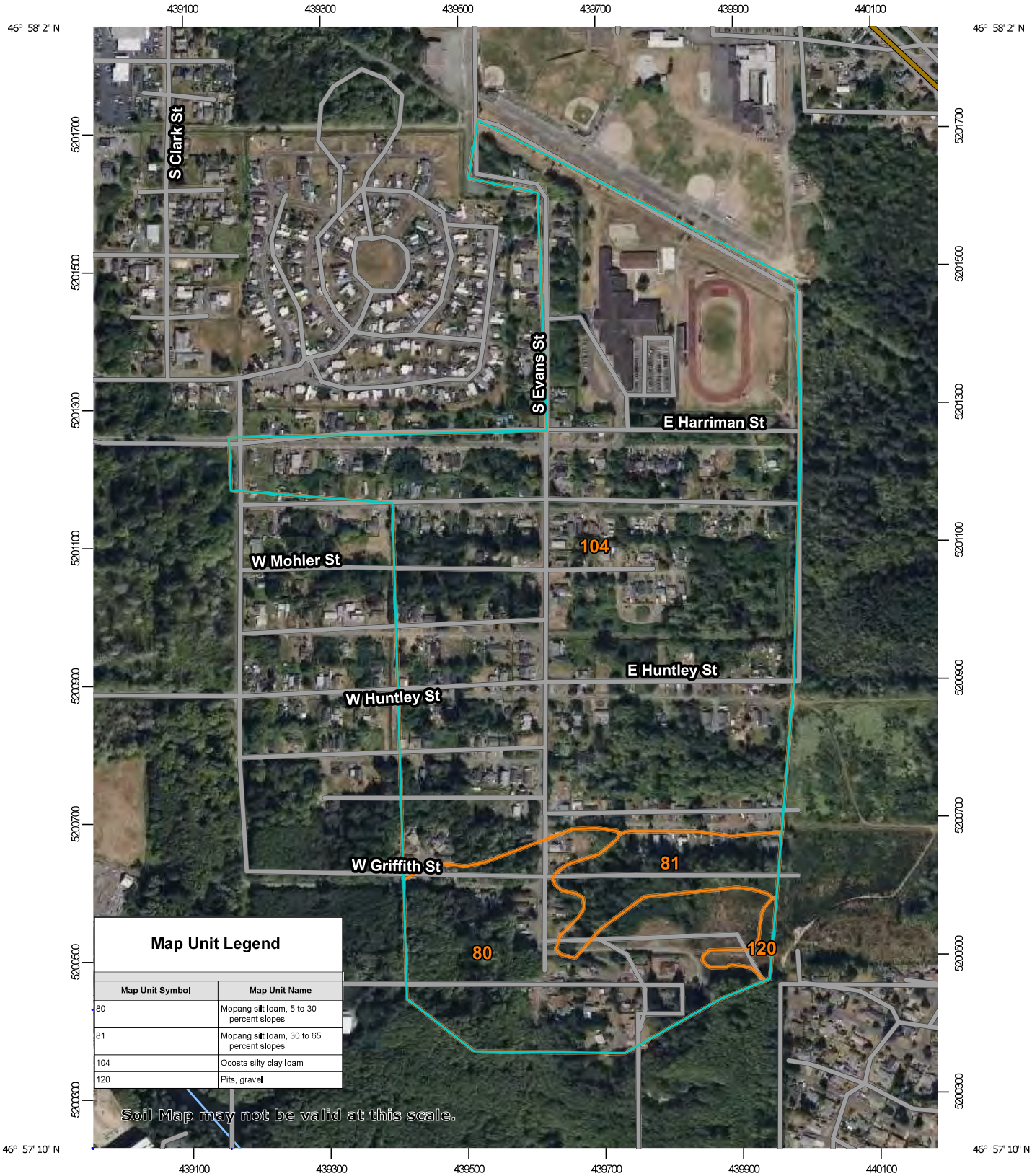
0 250 500 750 Feet

Legend

- Farragut PumpStation
- Stormdrain Manholes
- Catch Basins
- Links
- Stormwater Dikes
- Gravity Mains
- Forest
- Lawn
- Farragut_PS_Basin

Page intentionally left blank

Soil Map—Grays Harbor County Area, Pacific and Wahkiakum Counties, Washington
(Farragut PS Basin)



Map Unit Legend

Map Unit Symbol	Map Unit Name
80	Mopang silt loam, 5 to 30 percent slopes
81	Mopang silt loam, 30 to 65 percent slopes
104	Ocosta silty clay loam
120	Pits, gravel

Map Scale: 1:7,920 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Grays Harbor County Area, Pacific and Wahkiakum Counties, Washington
Survey Area Data: Version 22, Aug 29, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 8, 2022—Sep 25, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: Farragut WWHM Model

Site Name:	Farragut Pump Station
Site Address:	
City:	Aberdeen
Report Date:	3/4/2024
Gage:	Montesano
Data Start:	1955/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.100
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Farragut PS Basin
Existing Condition

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Forest, Flat	10.7
A B, Lawn, Flat	14.33
C, Forest, Flat	14.15
C, Lawn, Flat	65.24
Pervious Total	104.42

Impervious Land Use	acre
ROADS FLAT	7.48
ROOF TOPS FLAT	40.77
Impervious Total	48.25
Basin Total	152.67

Mitigated Land Use

Farragut PS Basin
Future (Build Out)
Condition

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Forest, Flat	14.15
C, Lawn, Flat	57.37
A B, Forest, Flat	10.7
A B, Lawn, Flat	14.33
Pervious Total	96.55

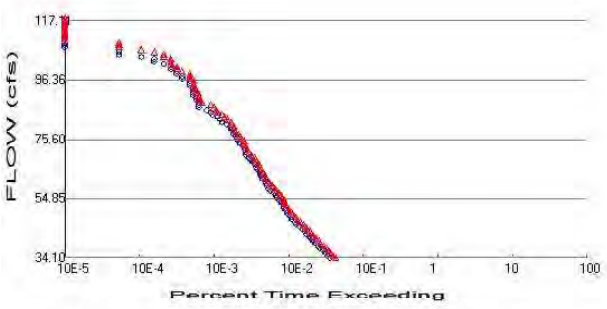
Impervious Land Use	acre
ROADS FLAT	7.48
ROOF TOPS FLAT	48.64
Impervious Total	56.12
Basin Total	152.67

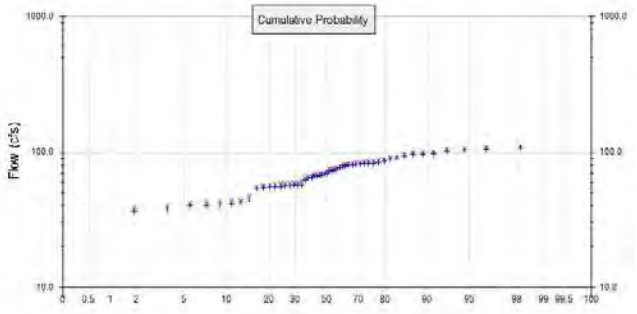
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 104.42
Total Impervious Area: 48.25

Mitigated Landuse Totals for POC #1
Total Pervious Area: 96.55
Total Impervious Area: 56.12

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	68.197558
5 year	86.808322
10 year	97.39479
25 year	109.223495
50 year	117.110965
100 year	124.338797

Farragut PS Basin Existing Condition

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	70.664149
5 year	89.063062
10 year	99.454446
25 year	111.010667
50 year	118.687606
100 year	125.703886

Farragut PS Basin Future (Build Out) Condition

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1956	82.949	84.561
1957	93.773	96.789
1958	63.605	66.634
1959	74.617	76.430
1960	80.385	82.031
1961	55.011	56.355
1962	107.761	109.838
1963	96.932	99.130
1964	72.701	75.572
1965	81.678	83.941

1966	81.735	83.504
1967	42.320	44.421
1968	77.137	79.240
1969	77.645	79.235
1970	55.846	59.043
1971	105.133	107.521
1972	98.388	100.037
1973	78.688	81.485
1974	82.927	84.635
1975	66.885	69.034
1976	86.162	88.452
1977	56.296	58.567
1978	102.403	105.911
1979	68.113	70.093
1980	56.830	58.682
1981	73.993	76.881
1982	83.810	87.067
1983	68.573	71.082
1984	64.948	66.881
1985	37.067	39.751
1986	79.960	82.364
1987	53.916	55.806
1988	82.086	84.526
1989	67.068	69.575
1990	96.798	98.962
1991	56.786	58.695
1992	40.300	41.886
1993	40.286	43.156
1994	62.502	64.827
1995	44.446	47.539
1996	56.073	60.939
1997	69.386	72.367
1998	40.482	42.839
1999	57.404	59.537
2000	55.298	57.387
2001	41.316	44.379
2002	55.826	57.983
2003	104.366	106.333
2004	90.672	92.983
2005	67.714	69.935
2006	73.199	75.337
2007	89.132	91.216
2008	36.221	38.505
2009	32.886	35.245

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	107.7610	109.8380
2	105.1330	107.5210
3	104.3660	106.3330
4	102.4030	105.9110
5	98.3884	100.0370
6	96.9321	99.1299
7	96.7979	98.9624
8	93.7732	96.7889
9	90.6720	92.9832
10	89.1318	91.2157

11	86.1624	88.4519
12	83.8097	87.0674
13	82.9488	84.6354
14	82.9265	84.5607
15	82.0859	84.5258
16	81.7349	83.9407
17	81.6781	83.5037
18	80.3854	82.3639
19	79.9600	82.0314
20	78.6878	81.4851
21	77.6448	79.2395
22	77.1374	79.2354
23	74.6171	76.8805
24	73.9925	76.4304
25	73.1993	75.5720
26	72.7006	75.3369
27	69.3857	72.3666
28	68.5727	71.0823
29	68.1127	70.0932
30	67.7141	69.9352
31	67.0675	69.5751
32	66.8852	69.0341
33	64.9482	66.8805
34	63.6049	66.6343
35	62.5018	64.8273
36	57.4039	60.9387
37	56.8302	59.5367
38	56.7858	59.0428
39	56.2956	58.6947
40	56.0726	58.6821
41	55.8464	58.5667
42	55.8261	57.9826
43	55.2983	57.3865
44	55.0113	56.3545
45	53.9160	55.8057
46	44.4460	47.5391
47	42.3204	44.4208
48	41.3164	44.3790
49	40.4816	43.1559
50	40.2998	42.8390
51	40.2856	41.8862
52	37.0673	39.7505
53	36.2212	38.5054
54	32.8861	35.2449

Duration Flows

The Duration Matching Failed

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
34.0988	675	806	119	Fail
34.9373	633	747	118	Fail
35.7758	587	688	117	Fail
36.6143	543	648	119	Fail
37.4528	500	599	119	Fail
38.2913	470	555	118	Fail
39.1298	435	510	117	Fail
39.9683	406	482	118	Fail
40.8068	374	445	118	Fail
41.6453	356	409	114	Fail
42.4838	328	383	116	Fail
43.3224	310	366	118	Fail
44.1609	289	336	116	Fail
44.9994	266	316	118	Fail
45.8379	240	297	123	Fail
46.6764	230	270	117	Fail
47.5149	211	248	117	Fail
48.3534	202	231	114	Fail
49.1919	189	216	114	Fail
50.0304	178	206	115	Fail
50.8689	169	190	112	Fail
51.7074	164	181	110	Fail
52.5459	162	174	107	Fail
53.3844	151	166	109	Fail
54.2229	143	164	114	Fail
55.0615	131	157	119	Fail
55.9000	126	149	118	Fail
56.7385	119	138	115	Fail
57.5770	108	129	119	Fail
58.4155	100	122	122	Fail
59.2540	96	115	119	Fail
60.0925	94	105	111	Fail
60.9310	91	99	108	Fail
61.7695	84	96	114	Fail
62.6080	82	92	112	Fail
63.4465	80	88	110	Fail
64.2850	78	83	106	Fail
65.1235	72	81	112	Fail
65.9620	69	78	113	Fail
66.8005	67	76	113	Fail
67.6391	62	70	112	Fail
68.4776	58	68	117	Fail
69.3161	55	66	120	Fail
70.1546	51	60	117	Fail
70.9931	50	56	112	Fail
71.8316	49	53	108	Pass
72.6701	48	50	104	Pass
73.5086	46	49	106	Pass
74.3471	42	48	114	Fail
75.1856	39	48	123	Fail
76.0241	38	44	115	Fail
76.8626	37	42	113	Fail
77.7011	35	40	114	Fail
78.5396	35	37	105	Pass

79.3782	32	35	109	Pass
80.2167	31	35	112	Fail
81.0552	28	33	117	Fail
81.8937	24	32	133	Fail
82.7322	23	29	126	Fail
83.5707	21	26	123	Fail
84.4092	18	24	133	Fail
85.2477	17	21	123	Fail
86.0862	15	20	133	Fail
86.9247	12	19	158	Fail
87.7632	12	17	141	Fail
88.6017	12	13	108	Pass
89.4402	11	12	109	Pass
90.2787	11	12	109	Pass
91.1173	10	12	120	Fail
91.9558	10	11	110	Pass
92.7943	10	11	110	Pass
93.6328	10	10	100	Pass
94.4713	9	10	111	Fail
95.3098	9	10	111	Fail
96.1483	9	10	111	Fail
96.9868	7	9	128	Fail
97.8253	7	9	128	Fail
98.6638	6	9	150	Fail
99.5023	6	7	116	Fail
100.3408	5	6	120	Fail
101.1793	5	6	120	Fail
102.0178	4	5	125	Fail
102.8563	3	5	166	Fail
103.6949	3	5	166	Fail
104.5334	2	4	200	Fail
105.3719	1	4	400	Fail
106.2104	1	3	300	Fail
107.0489	1	2	200	Fail
107.8874	0	1	n/a	Fail
108.7259	0	1	n/a	Fail
109.5644	0	1	n/a	Fail
110.4029	0	0	n/a	Pass
111.2414	0	0	0	Pass
112.0799	0	0	0	Pass
112.9184	0	0	0	Pass
113.7569	0	0	0	Pass
114.5954	0	0	0	Pass
115.4340	0	0	0	Pass
116.2725	0	0	0	Pass
117.1110	0	0	0	Pass

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

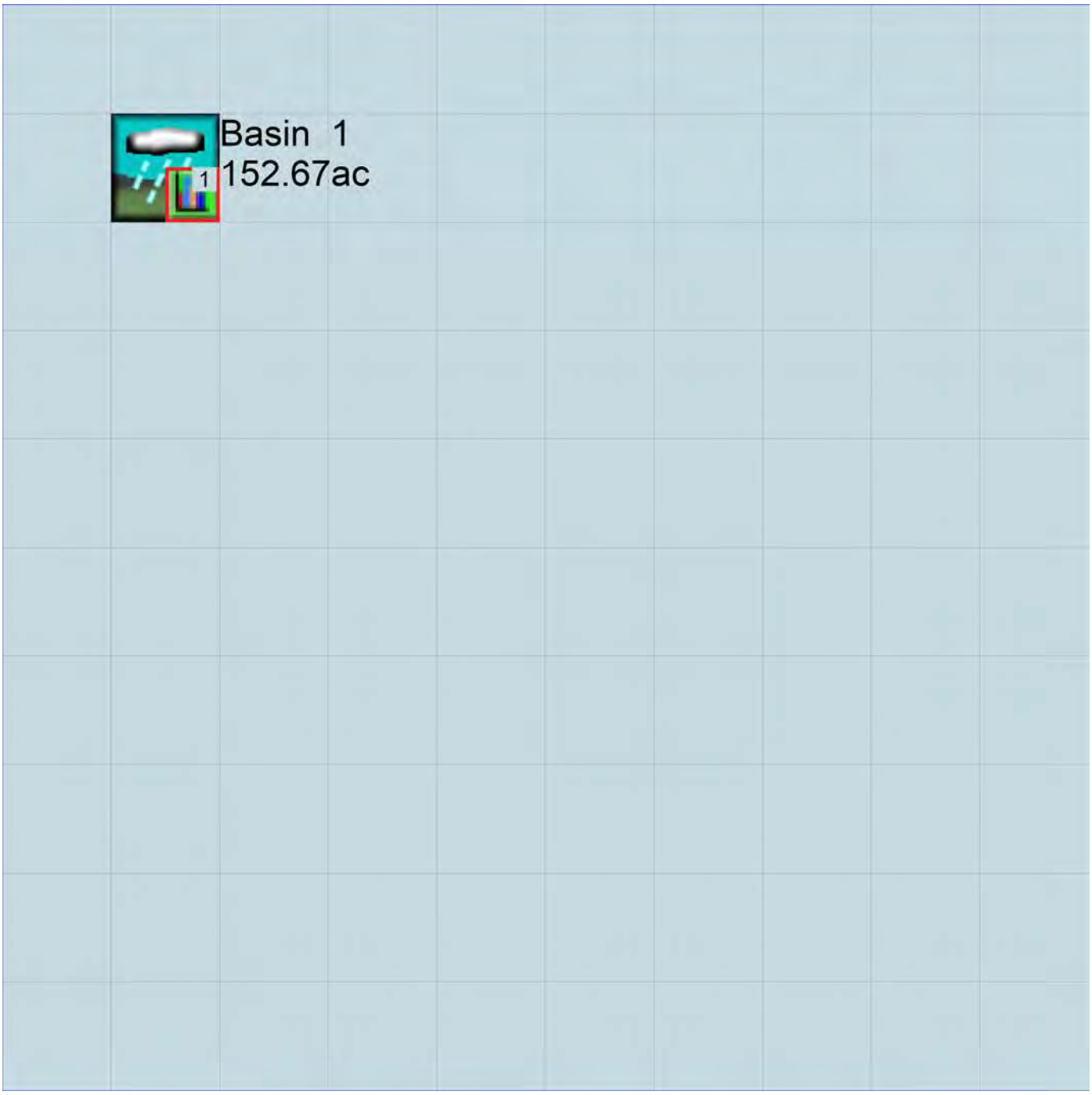
PERLND Changes

No PERLND changes have been made.

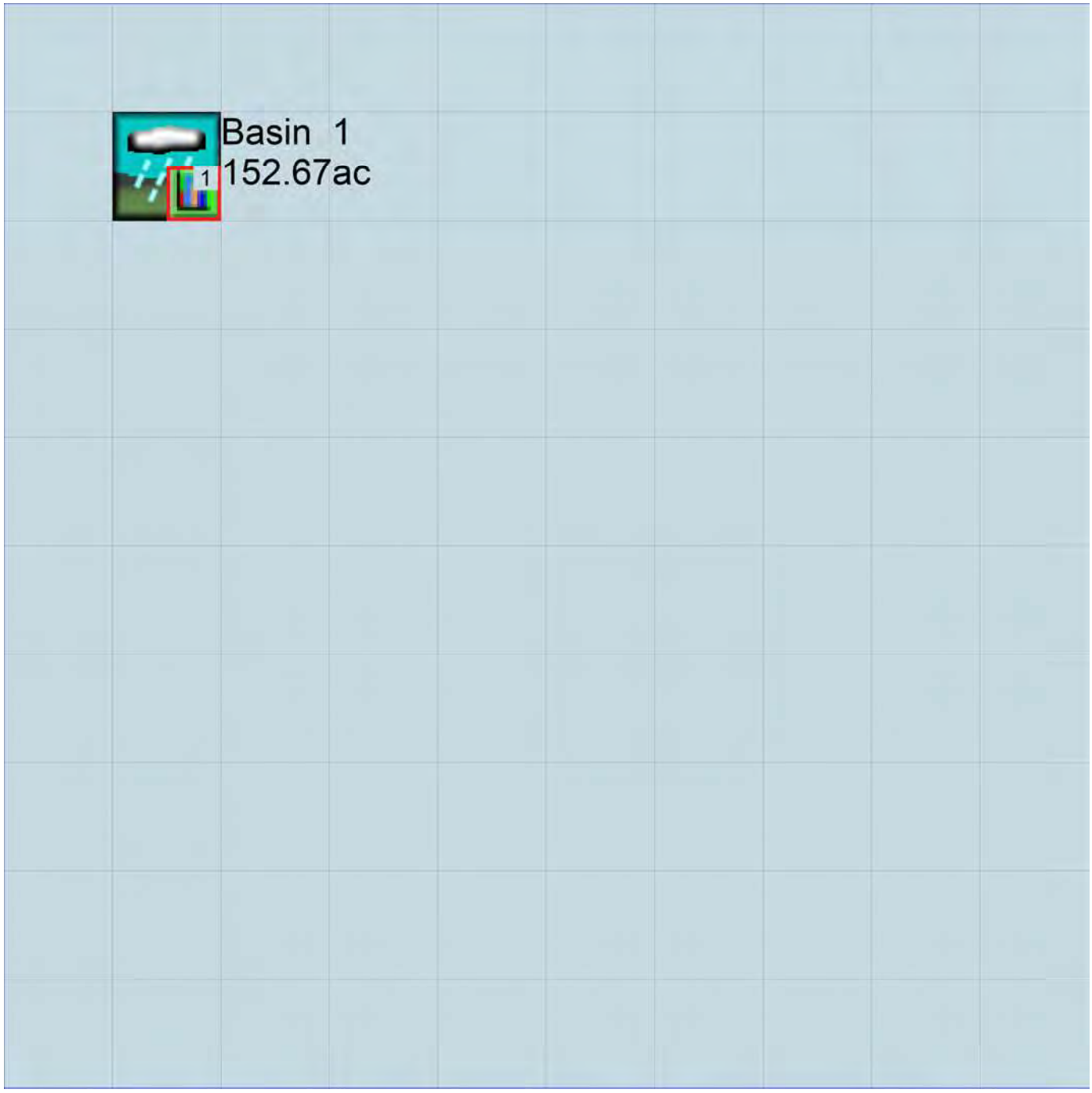
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01         END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   Farragut WWHM Model.wdm
MESSU       25   PreFarragut WWHM Model.MES
            27   PreFarragut WWHM Model.L61
            28   PreFarragut WWHM Model.L62
            30   POCFarragut WWHM Model1.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND        1
      PERLND        7
      PERLND       10
      PERLND       16
      IMPLND        1
      IMPLND        4
      COPY        501
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -   #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1         Basin  1                    MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -   #  NPT  NMN ***
    1          1    1
  501          1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #          K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -   #                          User  t-series Engl Metr ***
                                            in  out           ***
    1     A/B, Forest, Flat       1    1    1    1   27    0
    7     A/B, Lawn, Flat         1    1    1    1   27    0
   10     C, Forest, Flat         1    1    1    1   27    0
   16     C, Lawn, Flat           1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -   # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1          0    0    1    0    0    0    0    0    0    0    0    0
```

```
    7          0    0    1    0    0    0    0    0    0    0    0    0
   10          0    0    1    0    0    0    0    0    0    0    0    0
   16          0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    1          0    0    4    0    0    0    0    0    0    0    0    0    1    9
    7          0    0    4    0    0    0    0    0    0    0    0    0    1    9
   10          0    0    4    0    0    0    0    0    0    0    0    0    1    9
   16          0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    1          0    0    0    0    0    0    0    0    0    0    0
    7          0    0    0    0    0    0    0    0    0    0    0
   10          0    0    0    0    0    0    0    0    0    0    0
   16          0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2          ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR      KVARY      AGWRC
    1              0         5         2       400      0.05        0.3      0.996
    7              0         5       0.8       400      0.05        0.3      0.996
   10              0       4.5      0.08       400      0.05        0.5      0.996
   16              0       4.5      0.03       400      0.05        0.5      0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    1              0         0         2         2         0         0         0
    7              0         0         2         2         0         0         0
   10              0         0         2         2         0         0         0
   16              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    1          0.2       0.5      0.35         0       0.7       0.7
    7          0.1       0.5      0.25         0       0.7      0.25
   10          0.2       0.5      0.35         6       0.5       0.7
   16          0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    1              0         0         0         0         3         1         0
    7              0         0         0         0         3         1         0
   10              0         0         0         0       2.5         1         0
   16              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***
```

```
  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    4    1    9
    4         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    4         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >       IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    4              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    4              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   1                       10.7     COPY   501     12
PERLND   1                       10.7     COPY   501     13
PERLND   7                      14.33     COPY   501     12
PERLND   7                      14.33     COPY   501     13
PERLND  10                      14.15     COPY   501     12
PERLND  10                      14.15     COPY   501     13
PERLND  16                      65.24     COPY   501     12
PERLND  16                      65.24     COPY   501     13
IMPLND   1                       7.48     COPY   501     15
IMPLND   4                      40.77     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1
```

```
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                       in  out                               ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                   ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                      ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.1            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.1            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
```

```
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01         END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   Farragut WWHM Model.wdm
MESSU       25   MitFarragut WWHM Model.MES
            27   MitFarragut WWHM Model.L61
            28   MitFarragut WWHM Model.L62
            30   POCFarragut WWHM Model1.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      10
      PERLND      16
      PERLND       1
      PERLND       7
      IMPLND       1
      IMPLND       4
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   10     C, Forest, Flat         1    1    1    1   27    0
   16     C, Lawn, Flat           1    1    1    1   27    0
    1     A/B, Forest, Flat       1    1    1    1   27    0
    7     A/B, Lawn, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   10         0    0    1    0    0    0    0    0    0    0    0    0
```

```
   16         0    0    1    0    0    0    0    0    0    0    0    0
    1         0    0    1    0    0    0    0    0    0    0    0    0
    7         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   10         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   16         0    0    4    0    0    0    0    0    0    0    0    0    1    9
    1         0    0    4    0    0    0    0    0    0    0    0    0    1    9
    7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   10         0    0    0    0    0    0    0    0    0    0    0
   16         0    0    0    0    0    0    0    0    0    0    0
    1         0    0    0    0    0    0    0    0    0    0    0
    7         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   10              0       4.5      0.08       400      0.05       0.5     0.996
   16              0       4.5      0.03       400      0.05       0.5     0.996
    1              0         5         2       400      0.05       0.3     0.996
    7              0         5       0.8       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   10              0         0         2         2         0         0         0
   16              0         0         2         2         0         0         0
    1              0         0         2         2         0         0         0
    7              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   10          0.2       0.5      0.35         6       0.5       0.7
   16          0.1      0.25      0.25         6       0.5      0.25
    1          0.2       0.5      0.35         0       0.7       0.7
    7          0.1       0.5      0.25         0       0.7      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS       AGWS      GWVS
   10              0         0         0         0       2.5          1         0
   16              0         0         0         0       2.5          1         0
    1              0         0         0         0         3          1         0
    7              0         0         0         0         3          1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***
```

```
  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    4    1    9
    4         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    4         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    4              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    4              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  10                      14.15     COPY   501     12
PERLND  10                      14.15     COPY   501     13
PERLND  16                      57.37     COPY   501     12
PERLND  16                      57.37     COPY   501     13
PERLND   1                       10.7     COPY   501     12
PERLND   1                       10.7     COPY   501     13
PERLND   7                      14.33     COPY   501     12
PERLND   7                      14.33     COPY   501     13
IMPLND   1                       7.48     COPY   501     15
IMPLND   4                      48.64     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1
```

```
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                       in  out                               ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                   ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                      ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.1            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.1            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12
```

```
  MASS-LINK        13
PERLND     PWATER IFWO        0.083333      COPY           INPUT  MEAN
  END MASS-LINK    13

  MASS-LINK        15
IMPLND     IWATER SURO        0.083333      COPY           INPUT  MEAN
  END MASS-LINK    15


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

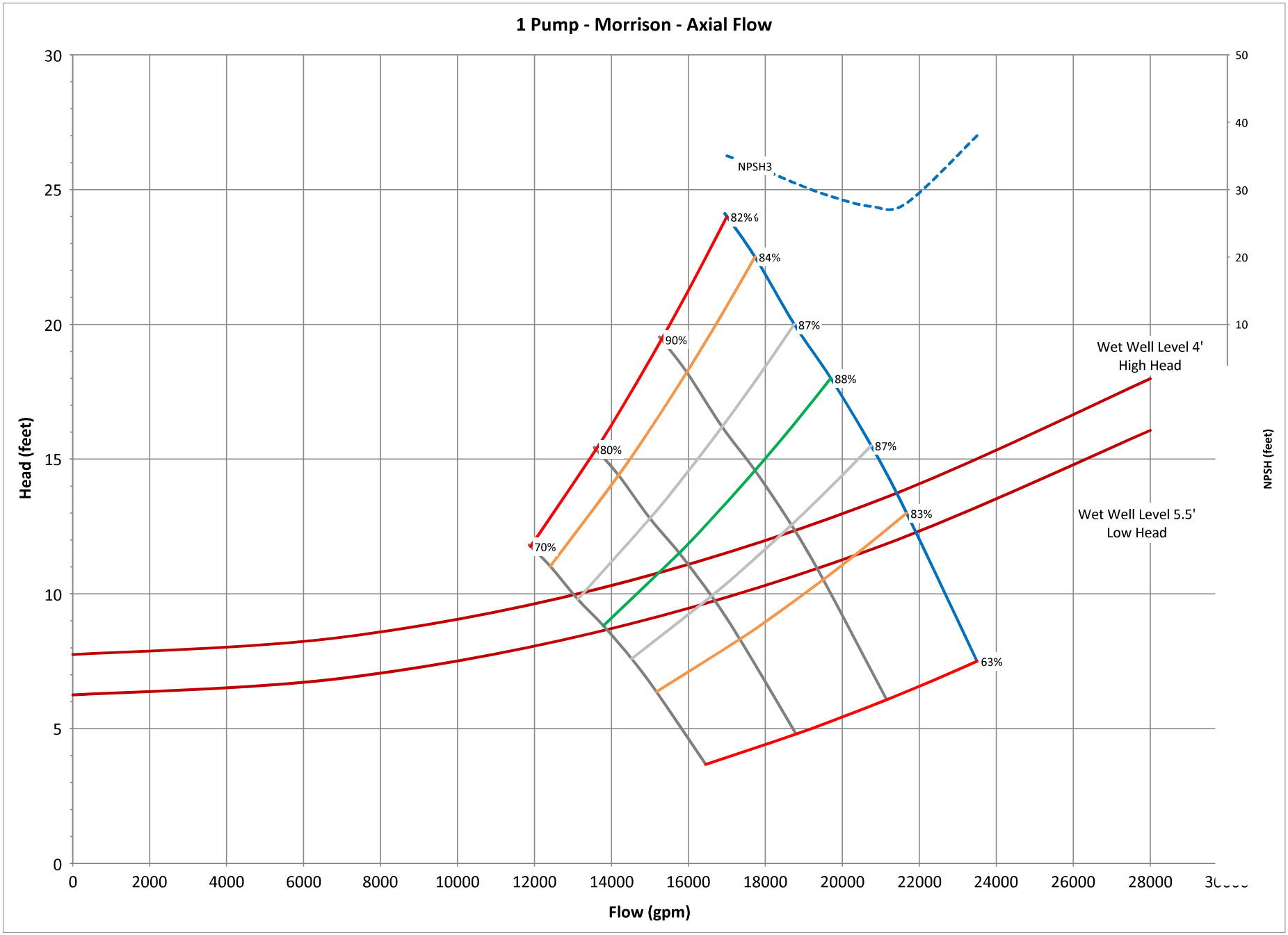
Page intentionally left blank

Appendix E. Pump Curves

Page intentionally left blank

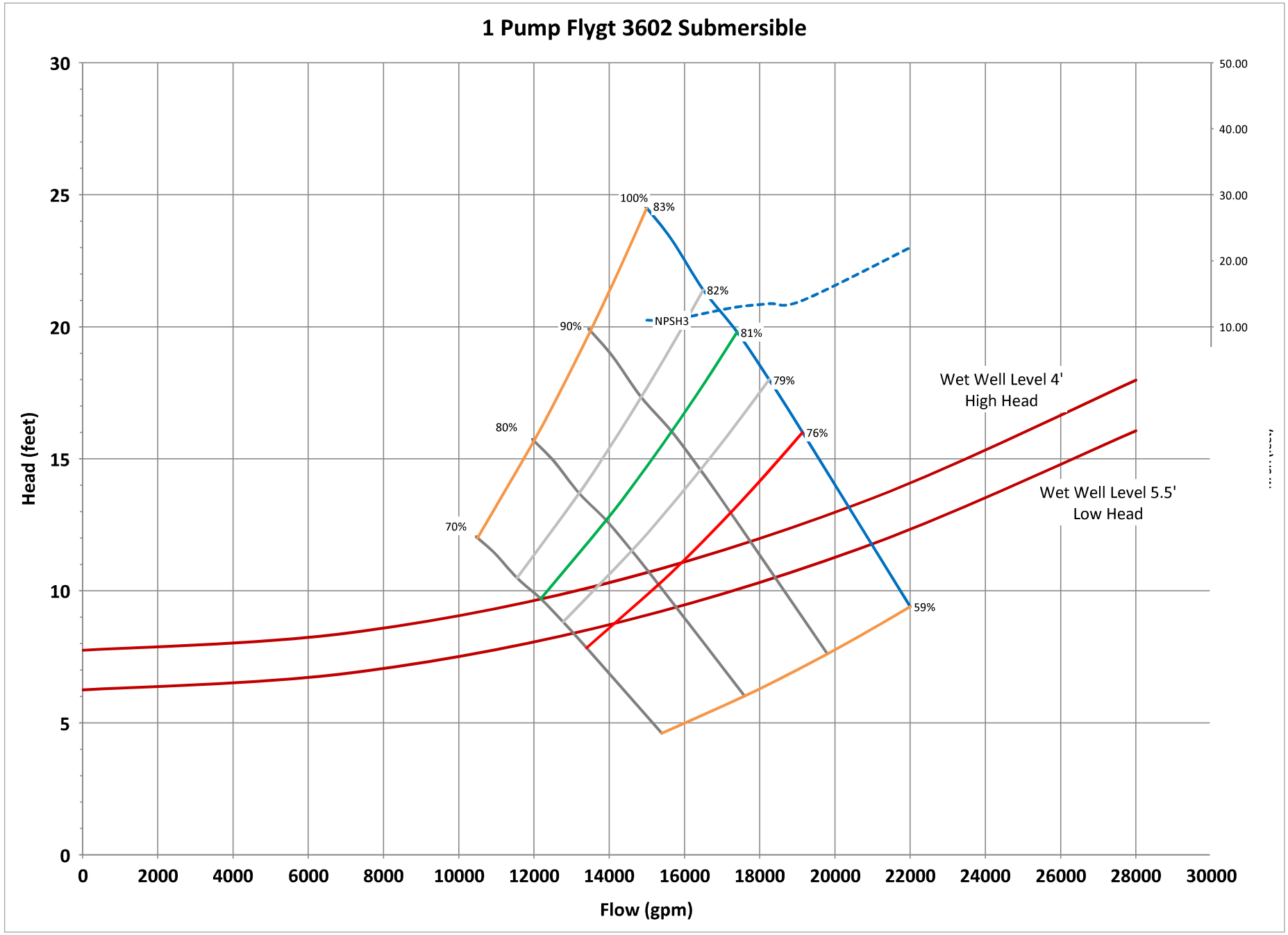
PUMP AND SYSTEM CURVES

ALTERNATIVE A



1 Pump Morrison

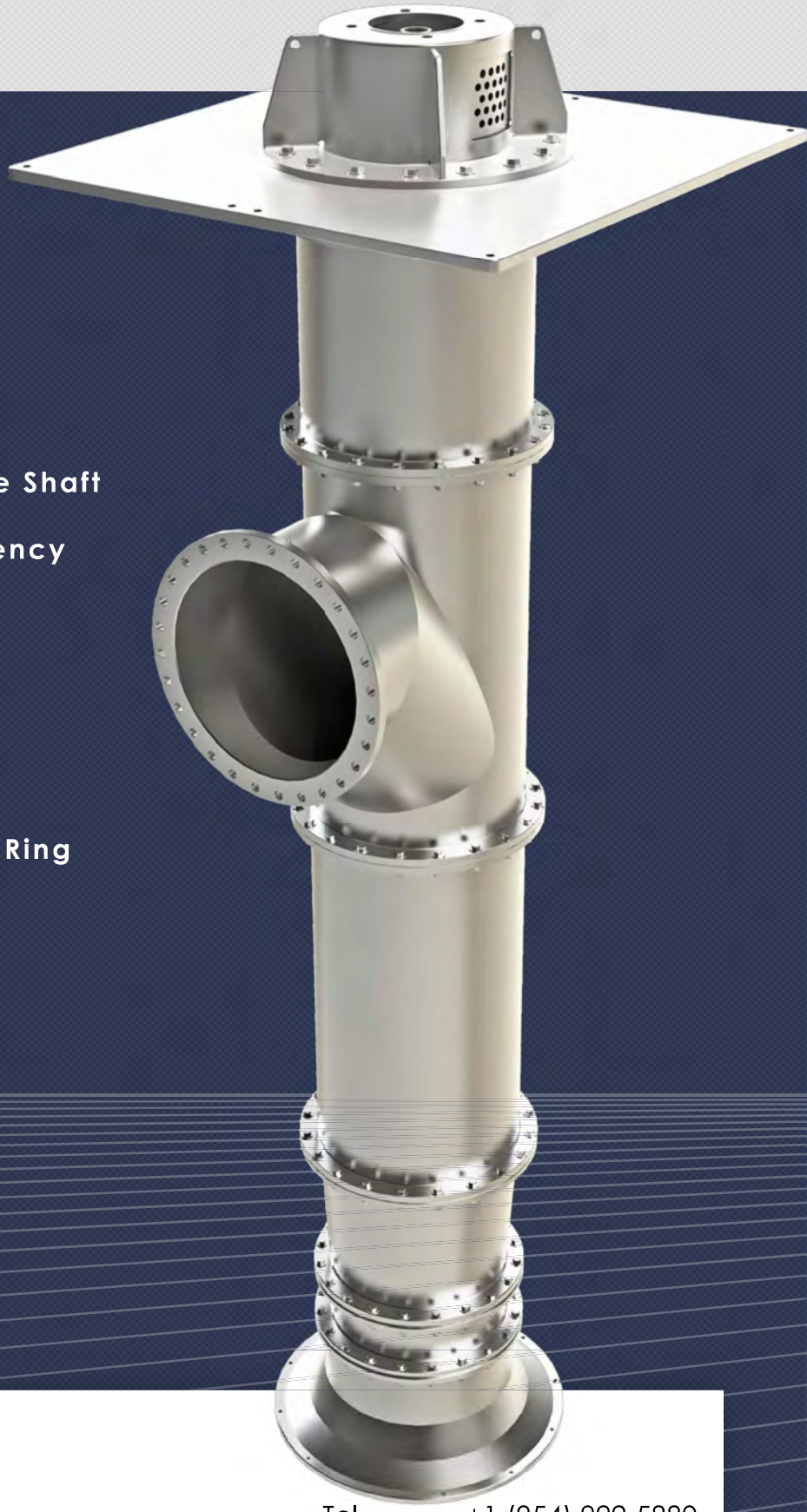
ALTERNATIVES B & C



ALTERNATIVE A
100 HP MORRISON
VERTICAL AXIAL PUMP

MORRISON **AXIAL** FLOW PUMPS

MPC-72033-040722.pdf



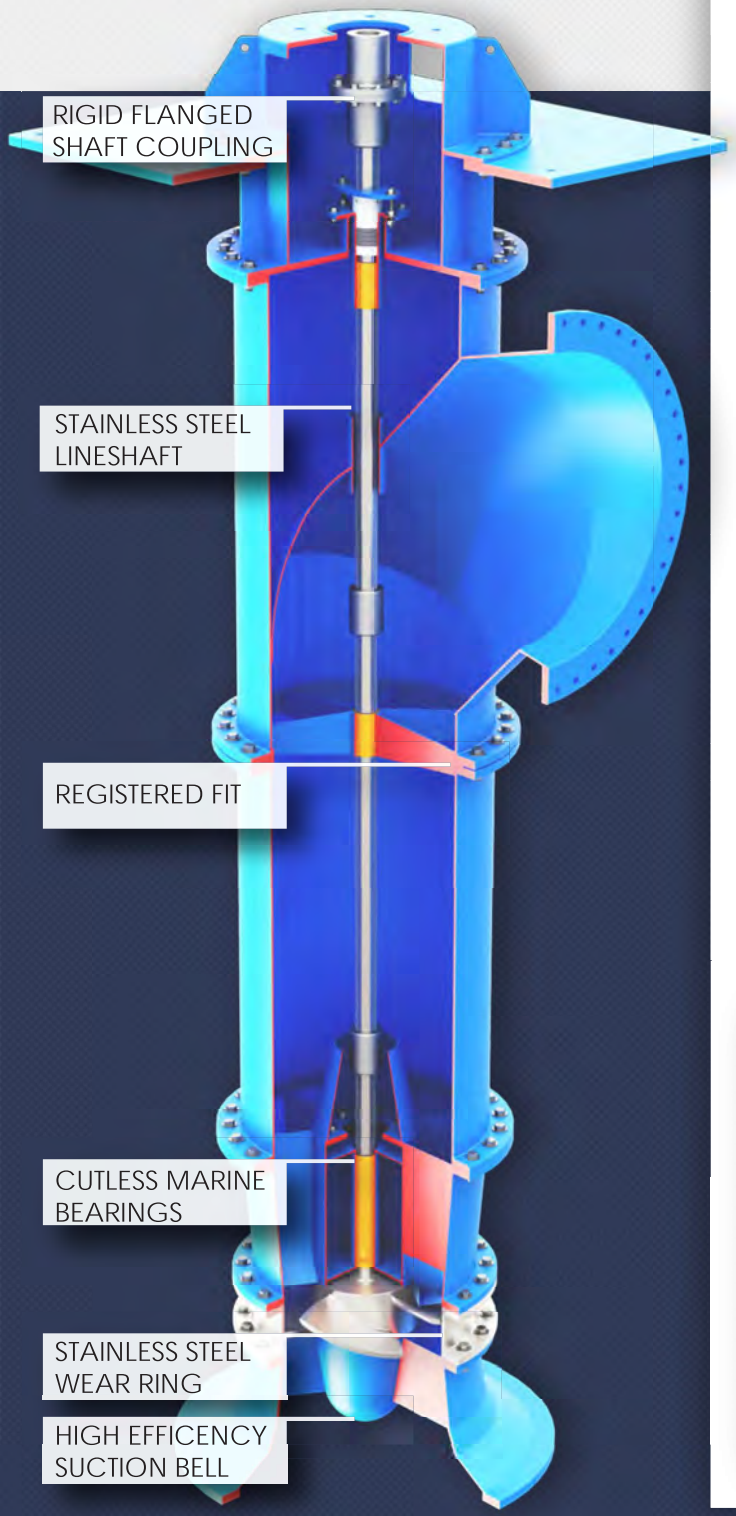
PUMP FEATURES:

- 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

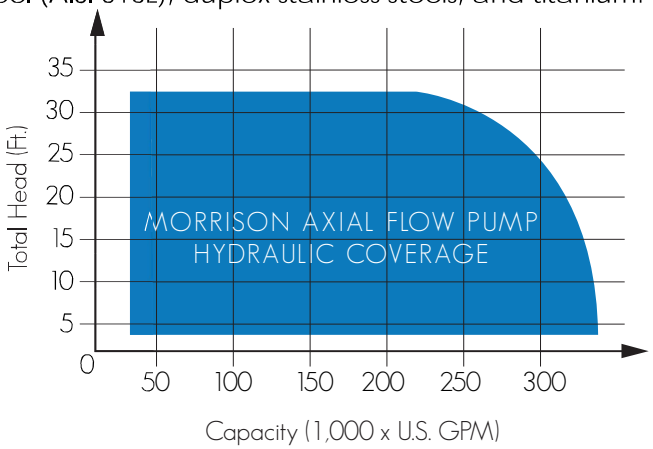


LINESHAFT PUMPS

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.



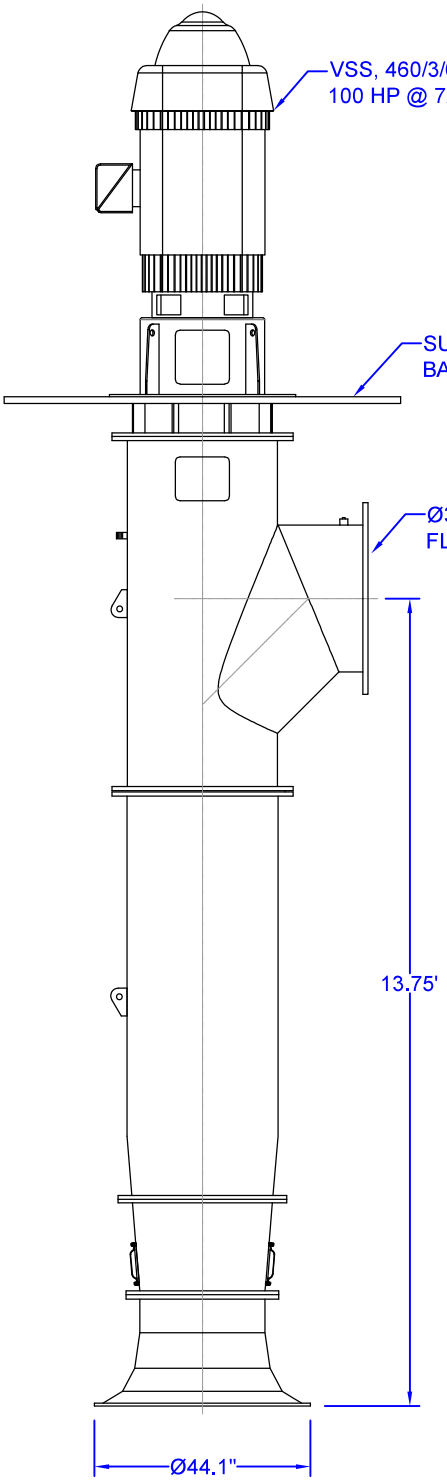
Please consult Morrison Pump Company for larger pump sizes. Morrison Mixed Flow also available.

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.

MORRISON PUMP COMPANY
A BUSINESS UNIT OF PATTERSON

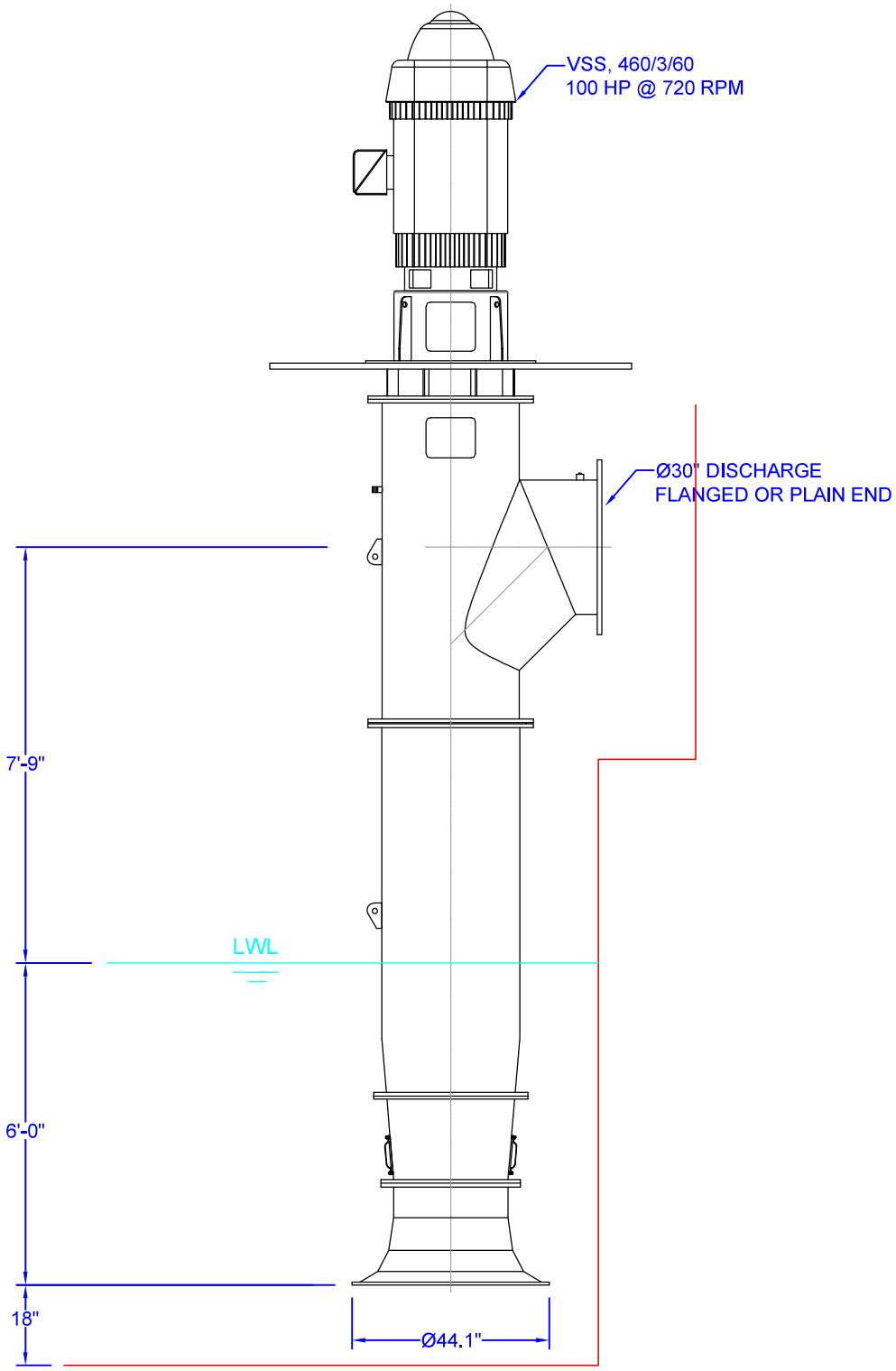
DWG. TITLE: MORRISON PUMP MODEL VPS-30-25 GENERAL DIMENSIONS

PROJECT: MPC 72033 - HDR - FARRAGUT STORMWATER PUMP STATION

DATE: 06-APRIL-2022

FILE: DWG-72033-001

MORRISON MODEL VPS-30-25
GENERAL LAYOUT



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

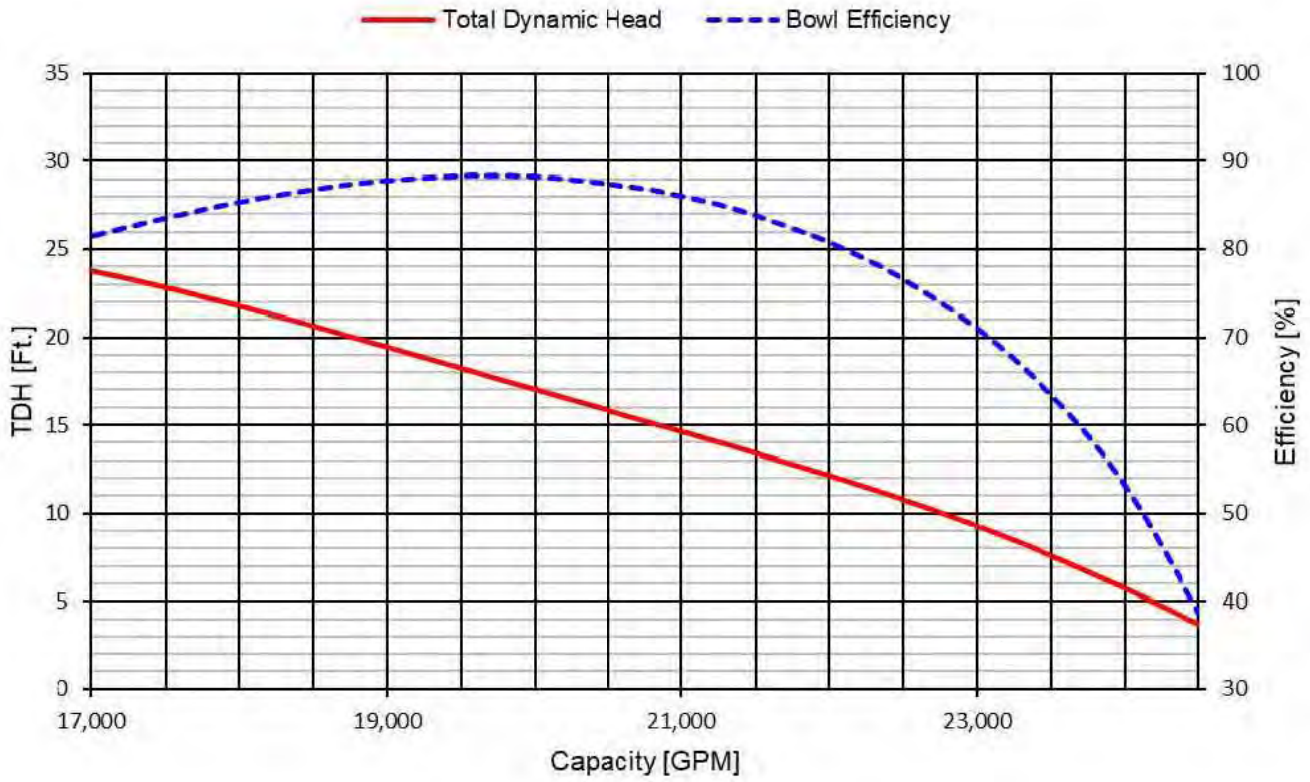
Pump Performance

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

MORRISON PUMP COMPANY
A BUSINESS UNIT OF PATTERSON

 Pump performance is based on open sump testing on clean water with a specific gravity 1.00 at 76°F.

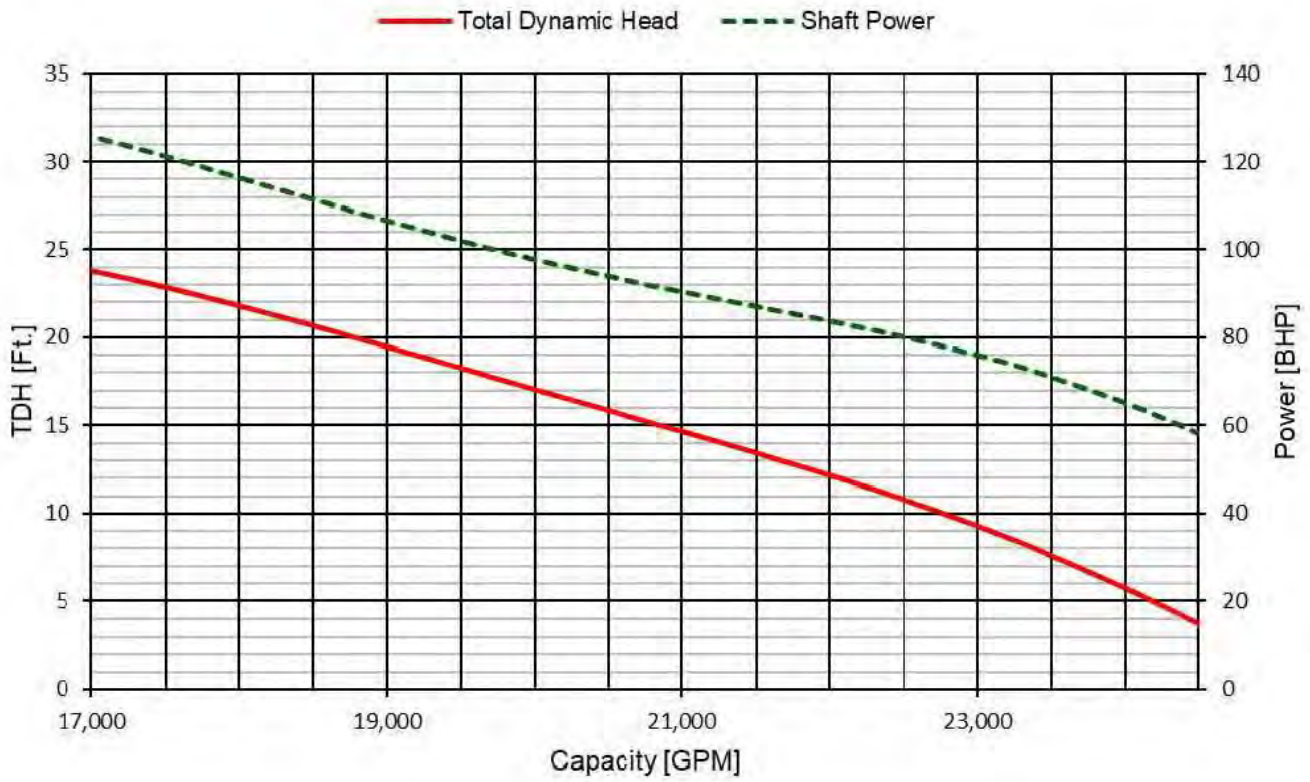
Pump Performance

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

MORRISON PUMP COMPANY
A BUSINESS UNIT OF PATTERSON

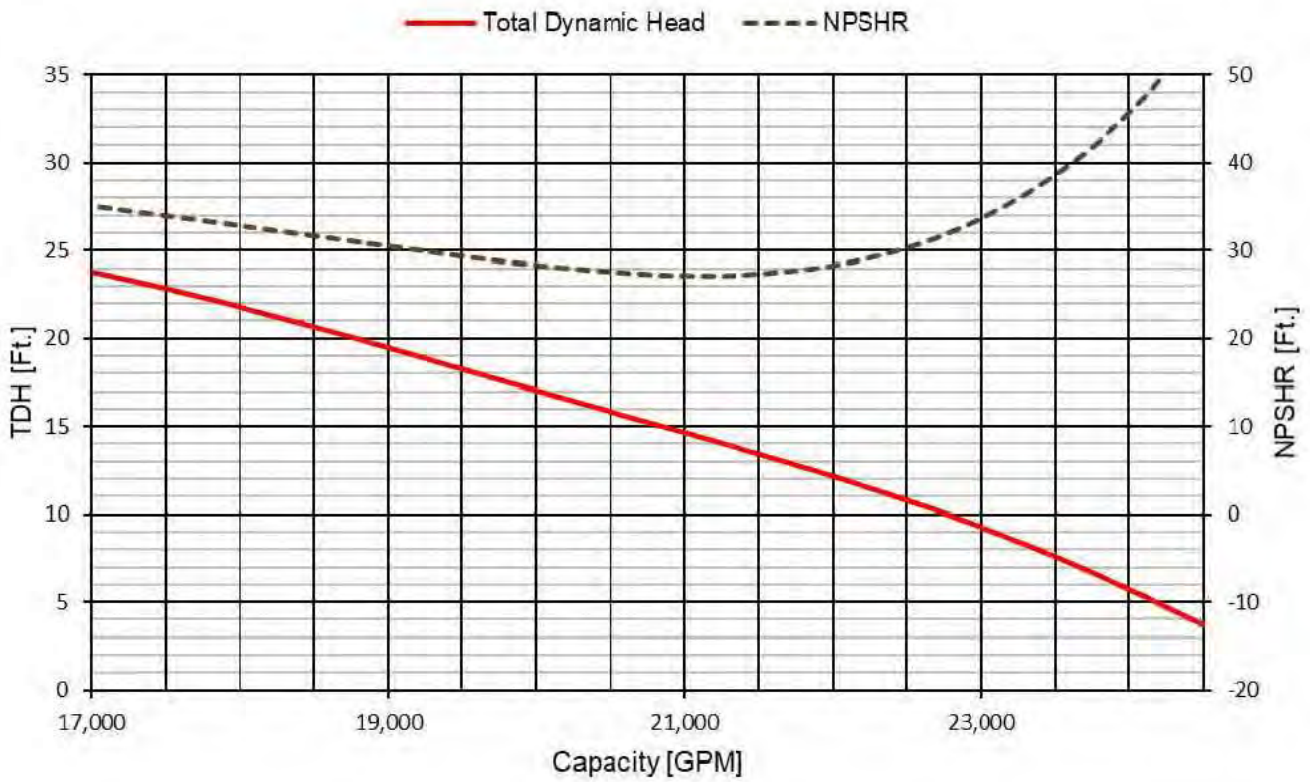
Pump Performance

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

MORRISON PUMP COMPANY
A BUSINESS UNIT OF PATTERSON

 Pump performance is based on open sump testing on clean water with a specific gravity 1.00 at 76°F.

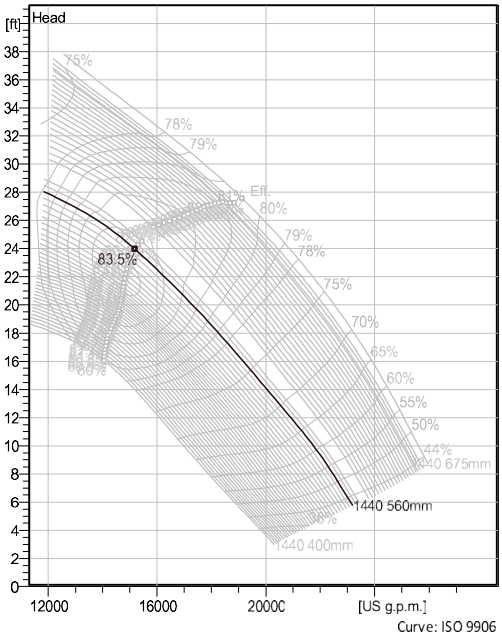
ALTERNATIVES B & C
100 HP FLYGT
SUBMERSIBLE PUMP

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



Curve: ISO 9906

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 ft²	**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		**Created by**	Scott Vande Vusse		
Block	0	**Created on**	4/28/2022	**Last update**	4/28/2022

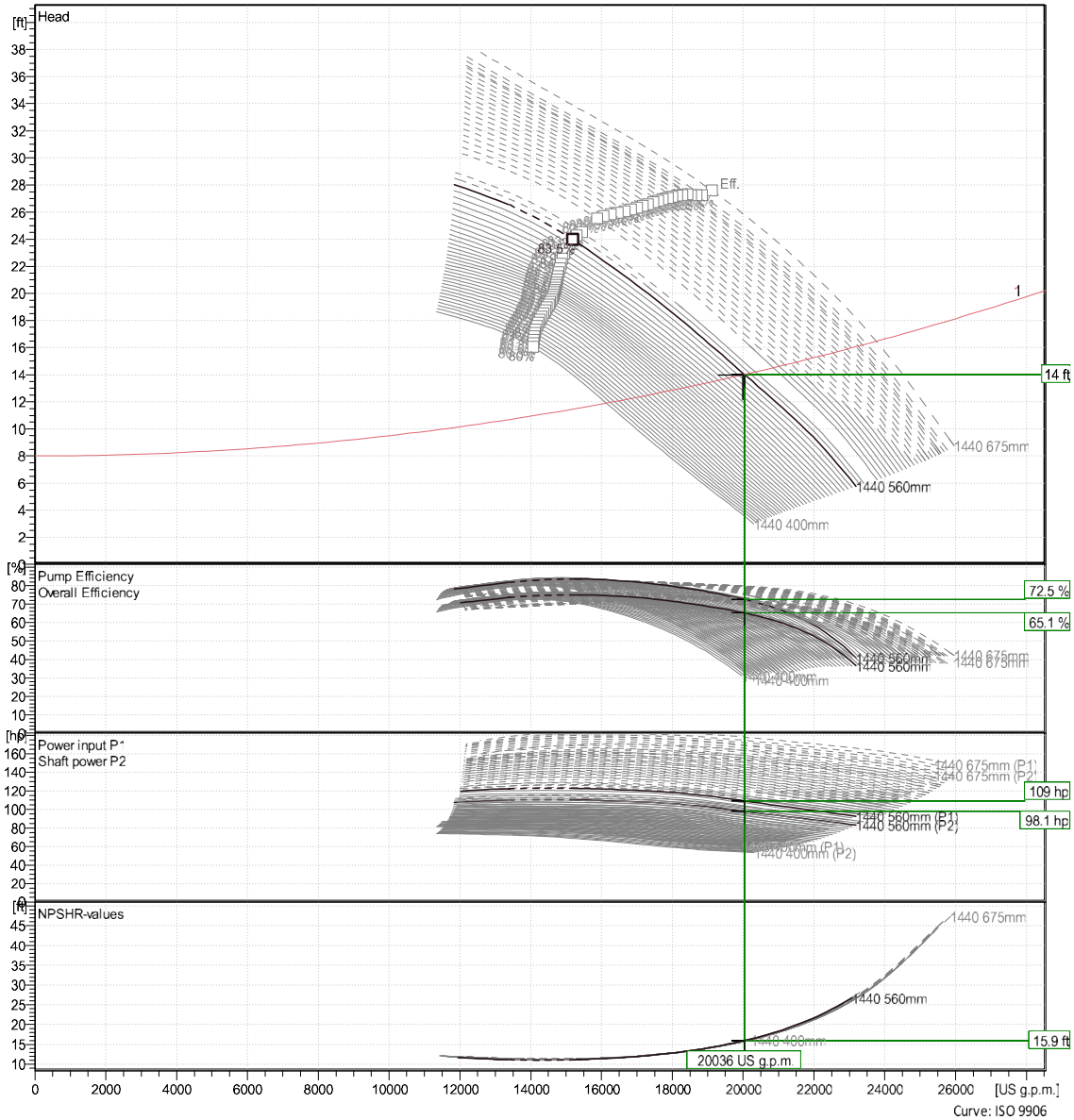
LL 3602/776 3~ 1440

Performance curve

Duty point

Flow	Head
20000 US g.p.m.	14 ft

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



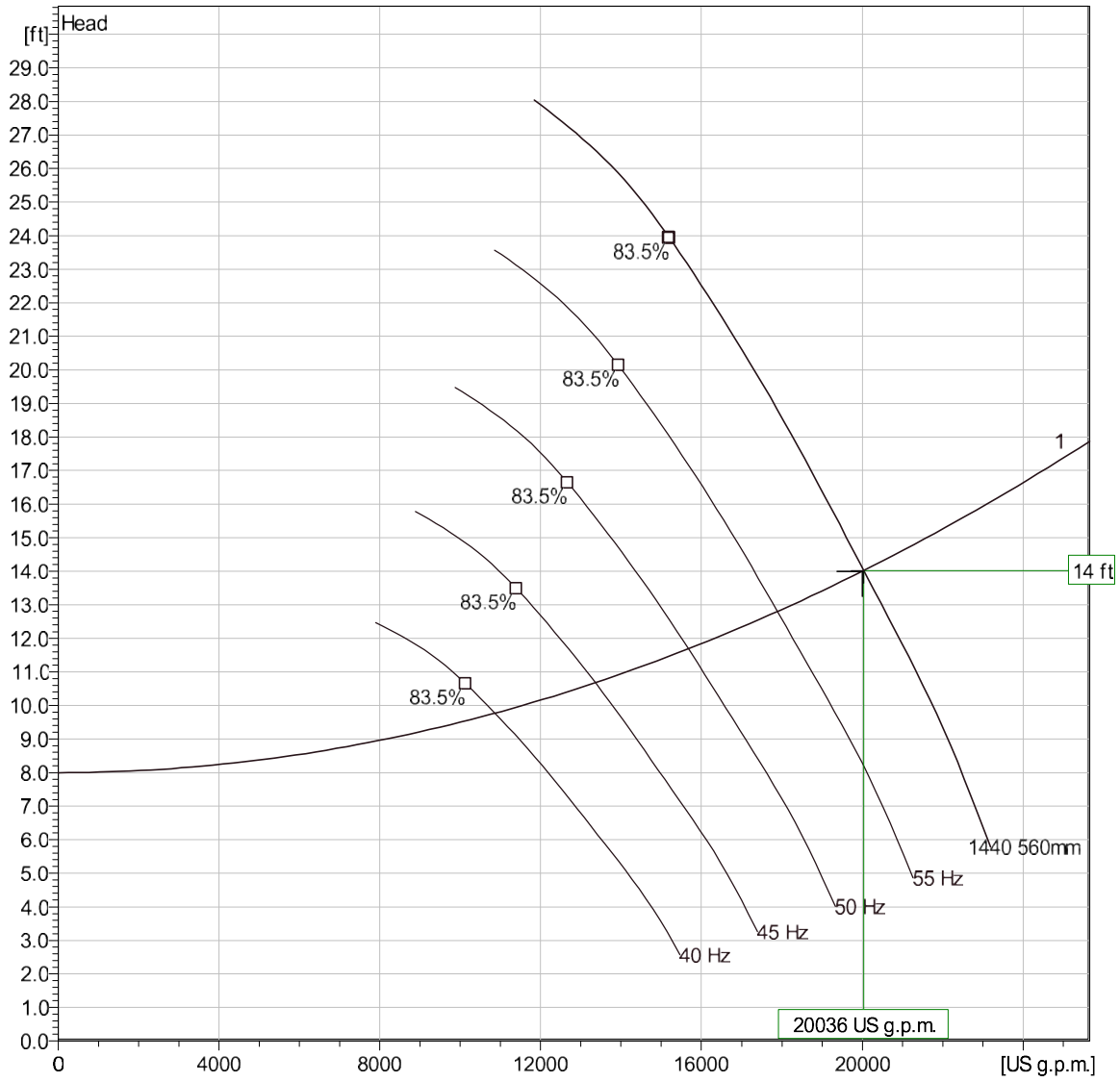
Curve: ISO 9906

			Scott Vande Vusse		
0		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



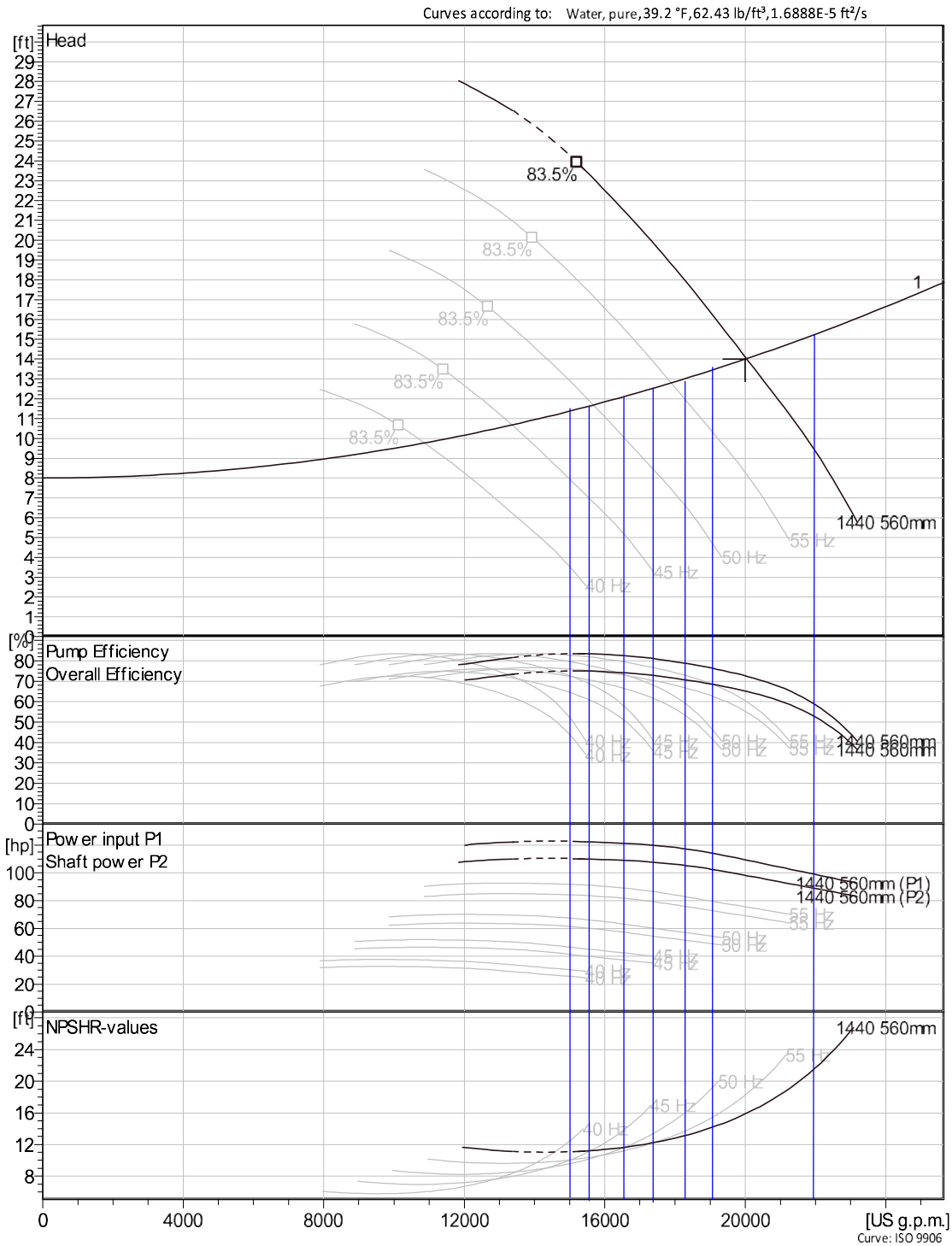
Operating characteristics

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

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

LL 3602/776 3~ 1440

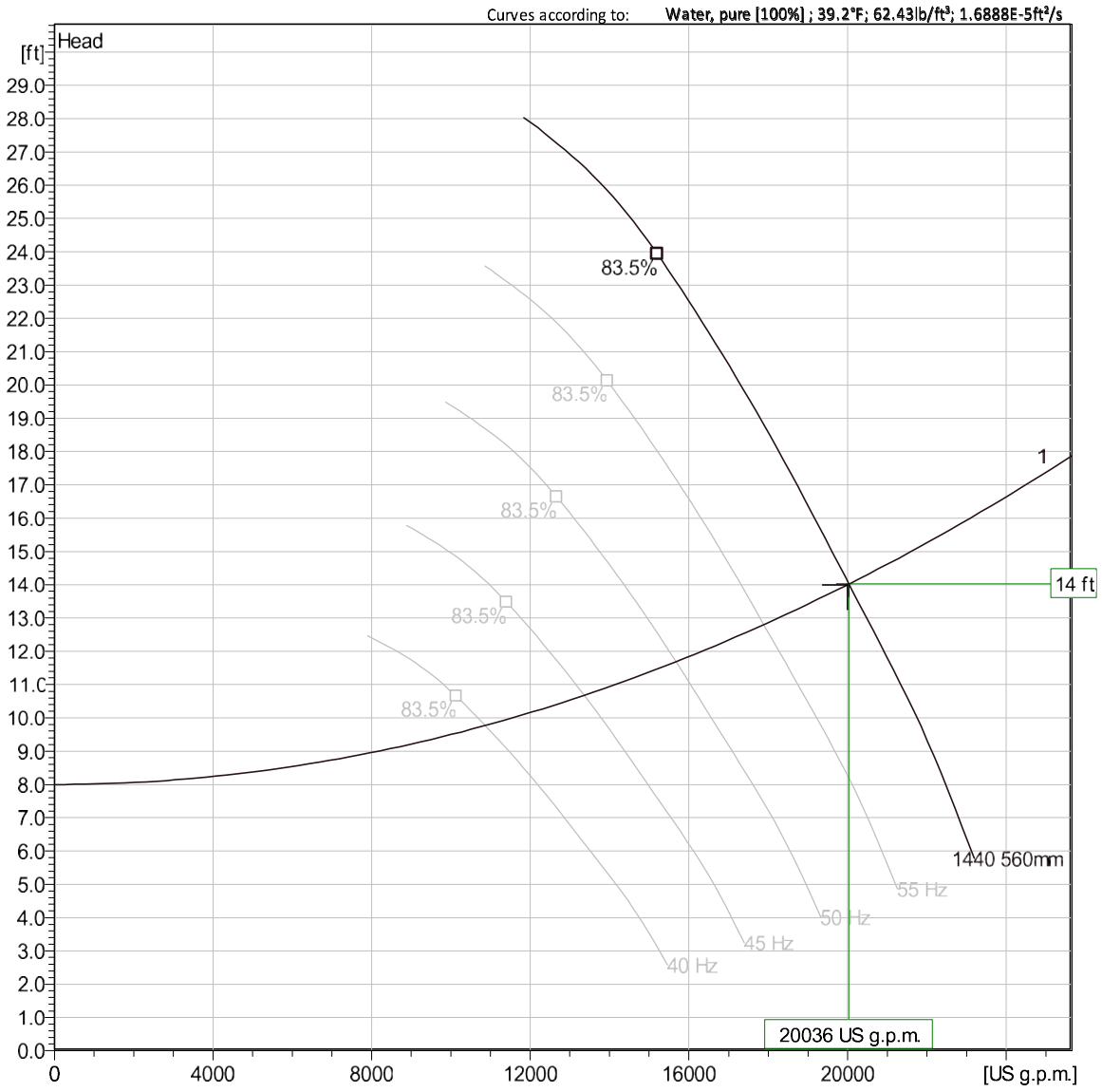
VFD Curve



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

LL 3602/776 3~ 1440

VFD Analysis



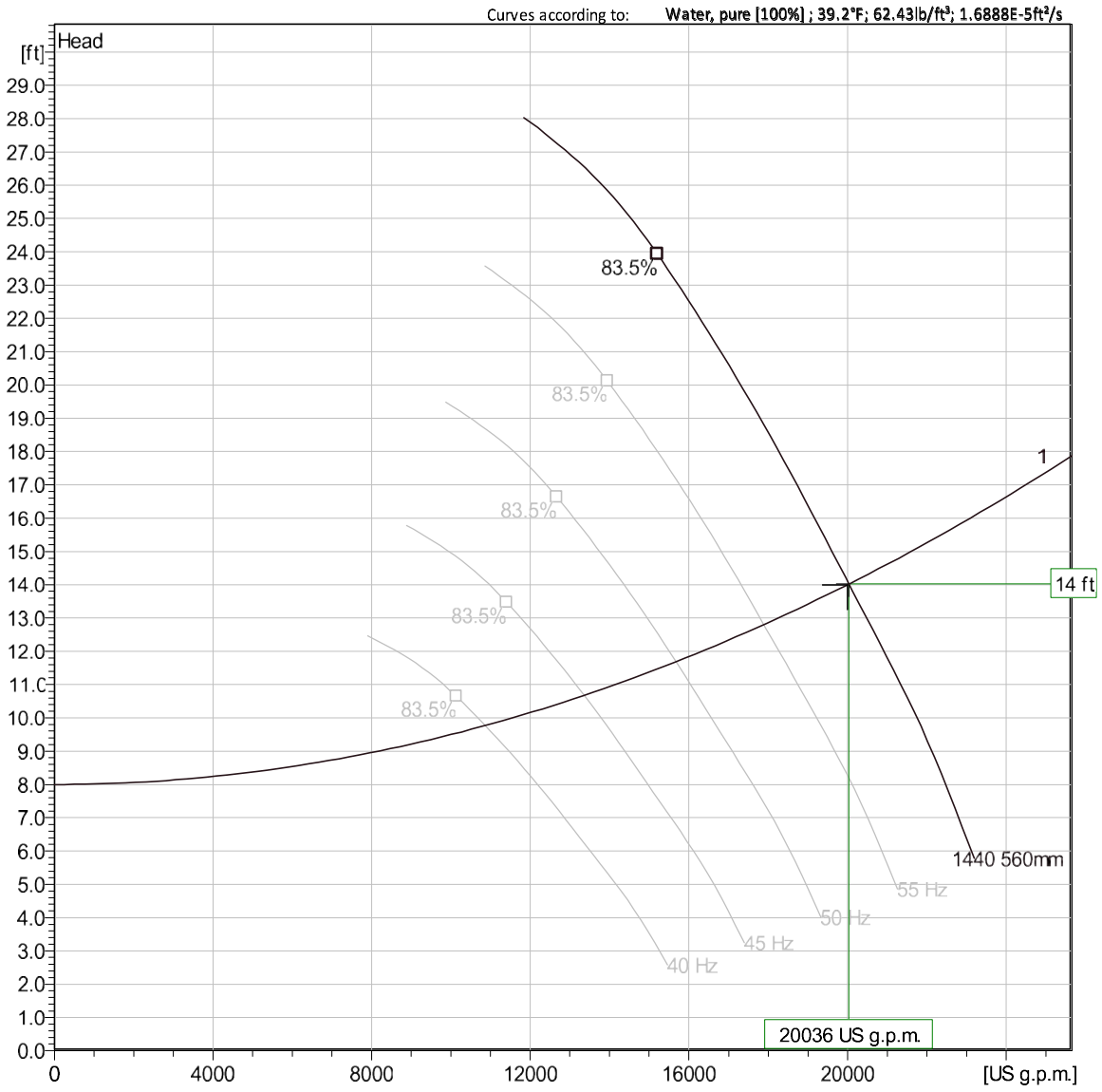
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	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		**Created by**	Scott Vande Vusse		
Block	0	**Created on**	4/28/2022	**Last update**	4/28/2022

LL 3602/776 3~ 1440

VFD Analysis



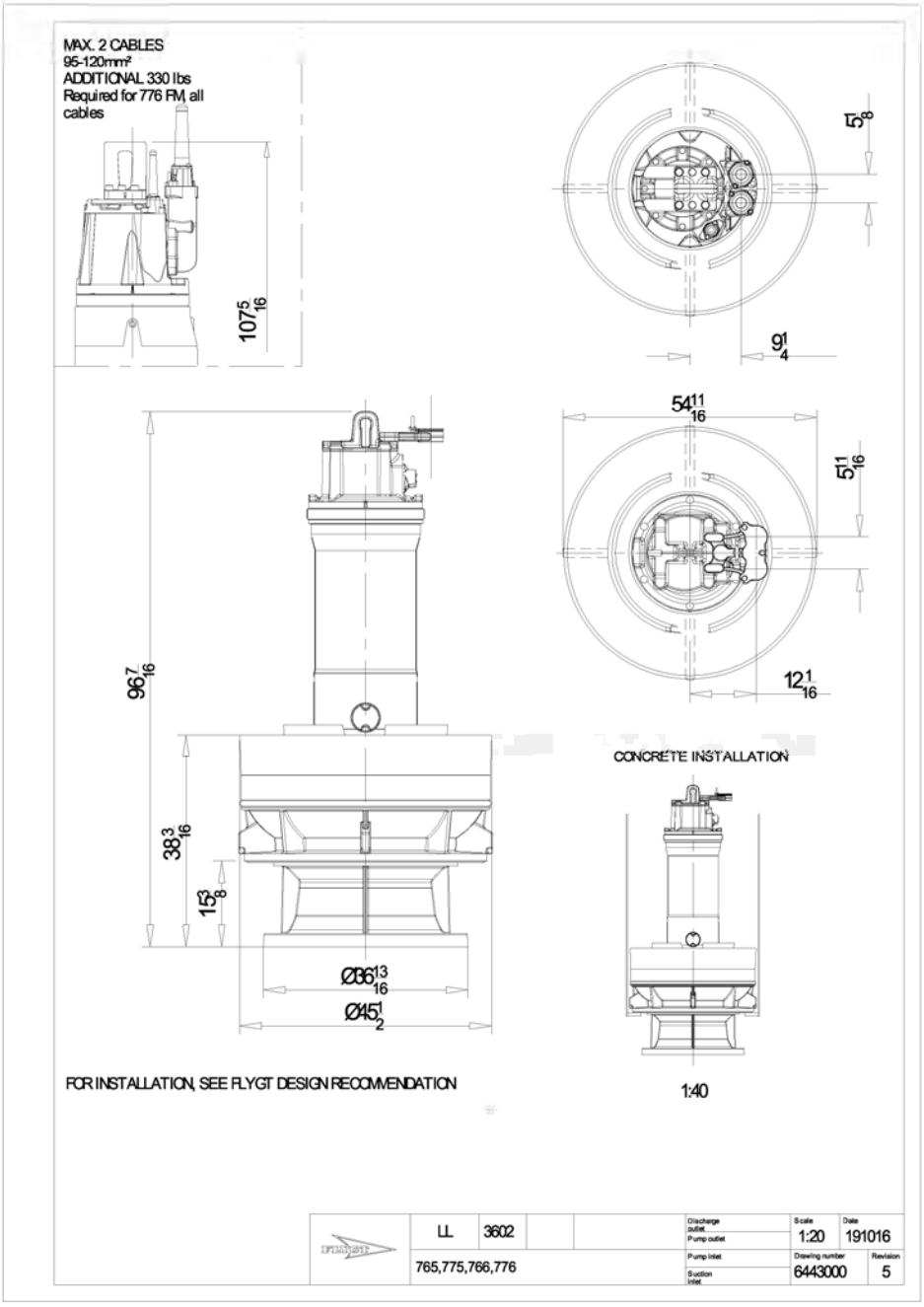
Operating Characteristics

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

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

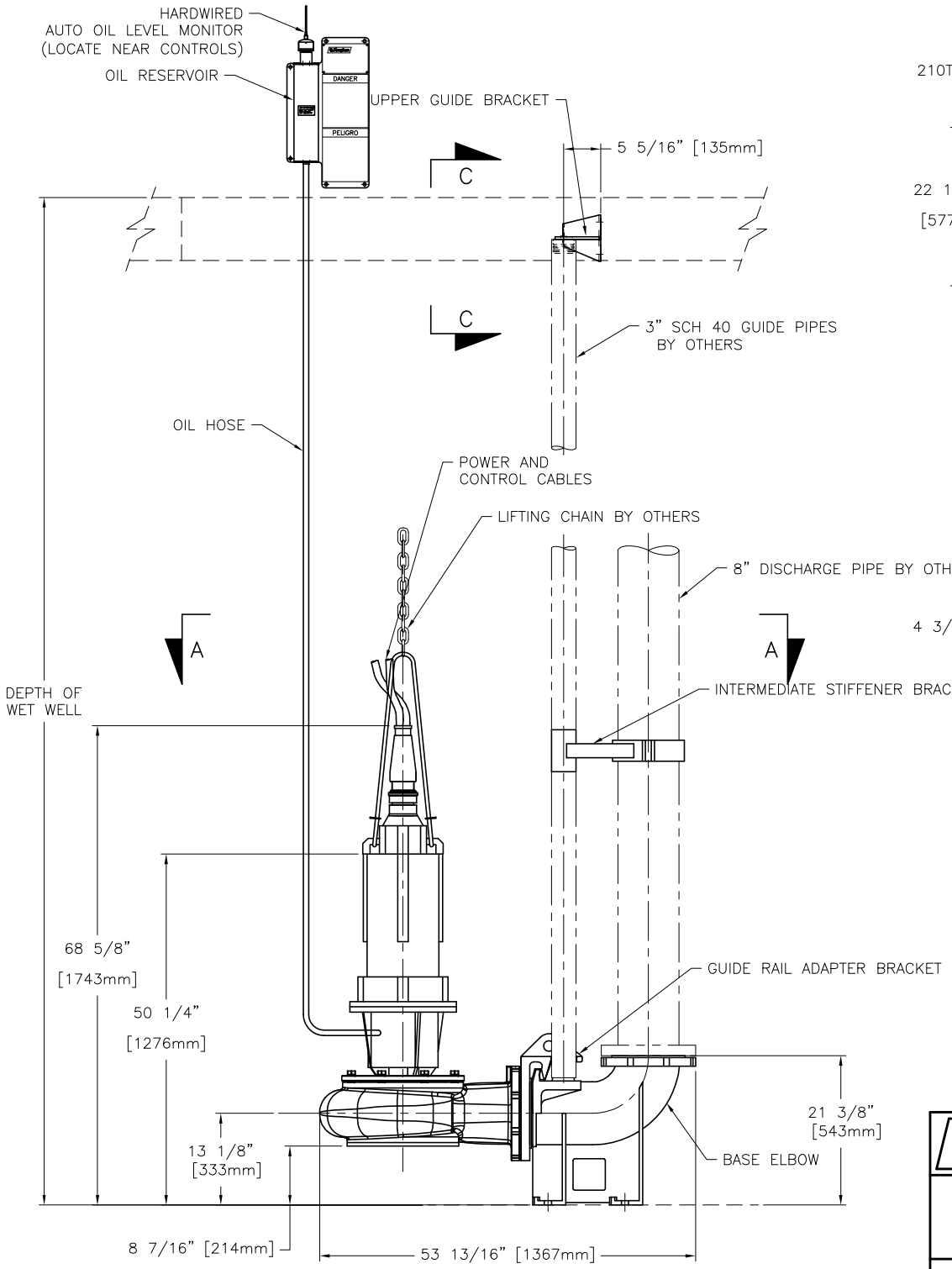
LL 3602/776 3~ 1440

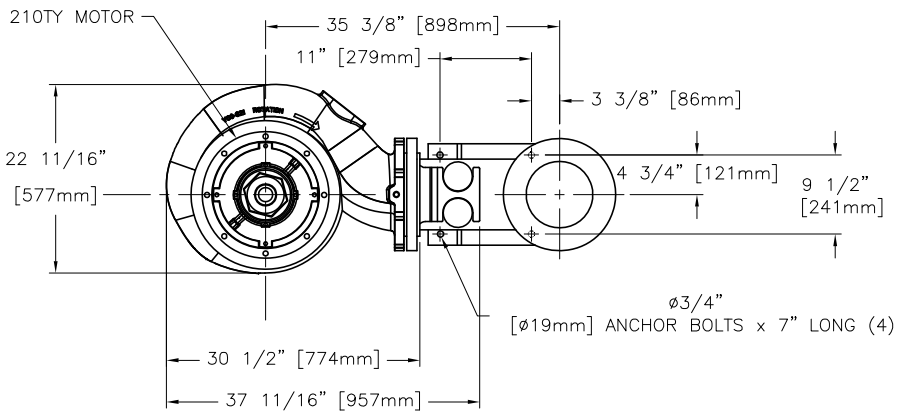
Dimensional drawing



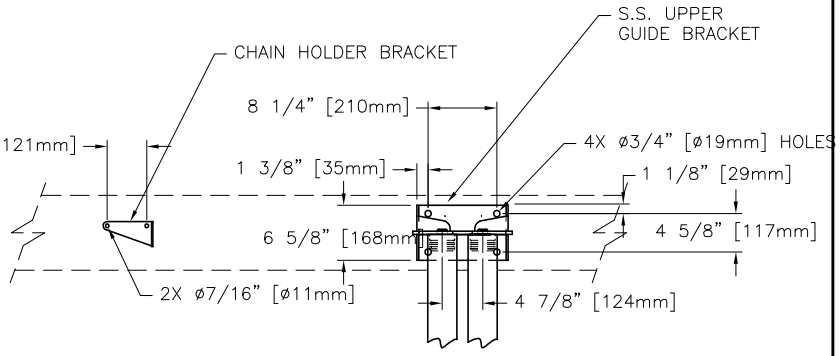
Project		**Created by**	Scott Vande Vusse
Block	0	**Created on**	4/28/2022 **Last update** 4/28/2022

ALTERNATIVES A, B & C
15 HP VAUGN
CHOPPER PUMP





SECTION A–A



VIEW C–C

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
   ENCLOSURE: SUBMERSIBLE
   MANUFACTURED BY: RELIANCE
6. SURFACE PREPARATION:

Vaughan

VAUGHAN CO., INC.
364 MONTE-ELMA ROAD
MONTESANO, WA 98563
PHONE: (360) 249-4042
FAX: (360) 249-6155

TITLE:
OUTLINE DIMENSIONS
MODEL: S8K2–

CUSTOMER:

VAUGHAN SALES ENGR: LOCATION:

JOB ORDER NUMBER: DATE: VAUGHAN QUOTATION NUMBER:

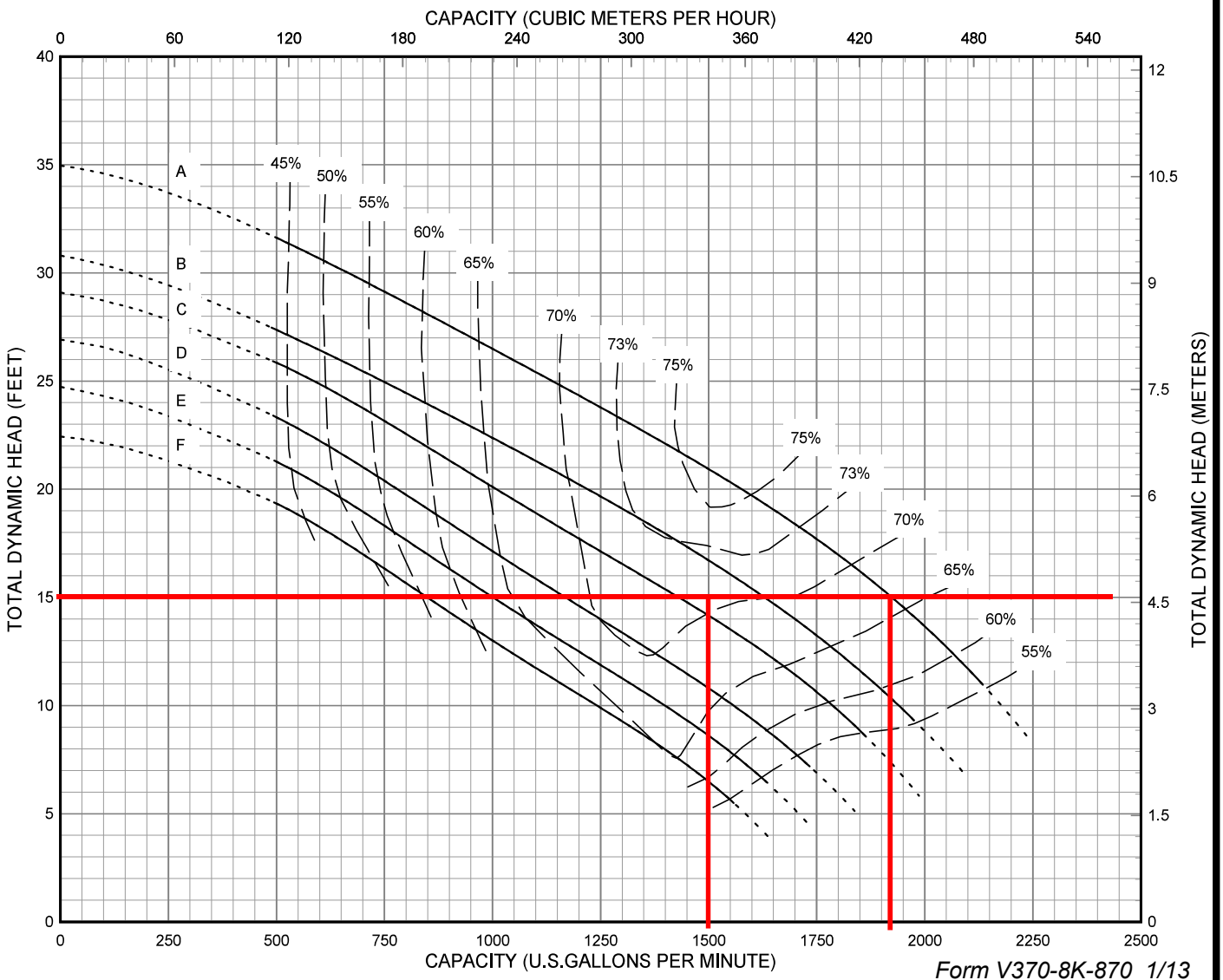
Vaughan E Series Chopper Pump PERFORMANCE CURVE

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.



Page intentionally left blank

Appendix F. Meeting Notes

Page intentionally left blank

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.

Page intentionally left blank

Appendix G. Cost Estimates

Page intentionally left blank

CALCULATION COVER SHEET

HDR "Non-Standard Spreadsheet"

Spreadsheet Last Accessed: 3/3/2024

Client: City of Aberdeen

Project: Farragut Stormwater Pump Station - Predesign Report

Project Number: 10333386

Calculation No: 1 Rev.

Title: Pre-Design Report Cl. 4 Estimate Page of

Purpose:
Spreadsheet calculates the engineer's estimate of construction cost based on the conceptual Preliminary Designs for Alternatve A, Alternative B, & Alternative C. Refer to Figures 4, 5, & 6 in Appendix A of the Pre-design Report.

Originator: Cindy Kinzer Date: 6/26/2022

Checked By: Date:

QC Review By: Jason Hill Date: 6/27/2022

Approved By: Date:

Estimate Update 1: 3/3/2024 - Escalated to 2024

Superseded by Calculation No.:

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			**Date:**	3/3/2024
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	$ 1,656,000	$ 1,656,000
2	Pump Station Facility	1	LS	$ 1,067,000	$ 1,067,000
3	Process Mechanical and Piping	1	LS	$ 1,774,000	$ 1,774,000
4	Vertical Bar Screens (pump intake)	1	LS	$ 282,000	$ 282,000
5	Electrical, Lighting, and Controls	1	LS	$ 1,037,000	$ 1,037,000
				$ -	$ -
					$ -
				Subtotal Construction Costs	***$ 5,816,000***
				ROW and Use Permits	$ -
				Art or Agency required Betterment Costs	$ 174,480
				Mobilization @ 0.1	$ 581,600
				ESTIMATED PROBABLE COST OF CONSTRUCTION BID	***$ 6,397,600***
SUBTOTAL ADDITIONAL CONSTRUCTION COSTS					
				Allowance for Indeterminates (AFI - Design Allowance)	$ 1,163,200
				Material Pricing Uncertainty Allowance	$ 581,600
				Construction Change Order Allowance	$ 581,600
				Subtotal Primary Construction Amount	***$ 2,326,400***
				Retail Sales Tax	$ 528,093
				TOTAL DIRECT CONSTRUCTION COSTS	***$ 9,252,000***
INDIRECT: NON-CONSTRUCTION COSTS					
				Design, Admin, ROW, and Construction Management	$ 1,454,000
				Utilitiy & Other Agency Support	$ 174,480
				Local Agency Mitigation	$ -
				Environmental, Wetland, Permitting and Coordination	$ 116,320
				Real Estate Propery and Right-of-Way Acquisition	$ 40,810
				TOTAL INDIRECT CONSTRUCTION COSTS (NOT INCLUDING CONTINGENCY)	***$ 1,785,610***
				Project Contingency @ 0.25	$ 2,045,803
				TOTAL PROJECT COST	***$ 11,038,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4			
Project Name:	Farragut Pump Station - Predesign	**Date:**	3/3/2024
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	6%	1.06	$	82,106
Item Subtotal Construction Costs (Year 2024)			$	1,655,803
Direct: Subtotal Construction Costs			***$***	***1,656,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4			
Project Name:	Farragut Pump Station - Predesign	**Date:**	3/3/2024
Location:	Market St./E. Harriman St., City of Aberdeen, WA	**Estimator:**	C. Kinzer
Description	Alt_A_Pump Station Facility	**Version:**	1

Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
	DIRECT: SUBTOTAL CONSTRUCTION COSTS				
1	**Above Grade Building - CMU**			$ -	$ -
2	Roof Framing	710	SF	$ 125	$ 88,750
3	CMU Walls	1080	SF	$ 25	$ 27,000
4	Building Concrete	28	CY	$ 2,500	$ 70,000
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	$ 100,000	$ 100,000
10	Allowance for Louvers	1	LS	$ 12,000	$ 12,000
11				$ -	$ -
12	**CIP Wetwell Concrete**			$ -	$ -
13	Walls	160	CY	$ 1,100	$ 176,000
14	Foundation	140	CY	$ 850	$ 119,000
15	Roof Slab (includes Concrete for screening Platform)	70	CY	$ 1,400	$ 98,000
16	Controlled Density Fill (Allowance)	50	CY	$ 56	$ 2,800
17	Access Hatches and Ladders	3	EA	$ 8,000	$ 24,000
18	Stop Logs	1	LS	$ 38,700	$ 38,700
19				$ -	$ -
20	**Site and Access**				
21	Chain Link Fence and Gates	230	LF	$ 110	$ 25,300
22	Site Restoration (Allowance)	1	LS	$ 25,000	$ 25,000
23				$ -	$ -
24	**Additional Costs**			$ -	$ -
25	Utility Relocation Allowance	1	LS	$ -	$ -
26	TESC @ 2% of Construction Costs	2%	LS	$ 857,550	$ 12,863
27	Traffic Control Allowance est. at 2%	2%	LS	$ 555,000	$ 11,100
					$ -
	Item Subtotal Construction Costs (Year 2022)				***$ 881,513***
	DIRECT: CONSTRUCTION COST MARK-UPS				
	General Conditions		0%	1	$ -
	Mobilization/Demobilization		0%	1	$ -
	Overhead & Profit (OHP)		15%	1.15	$ 132,227
	Insurance		0%	1	$ -
	Bonding		0%	1	$ -
	Escalation Multiplier from ENR-CCI		6%	1	$ 53,557
	Item Subtotal Construction Costs (Year 2024)				$ 1,067,297
	Direct: Subtotal Construction Costs				***$ 1,067,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4			
Project Name:	Farragut Pump Station - Predesign	**Date:**	3/3/2024
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
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	Morrison Pumps (100 HP Lineshafts)	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	6%	1	$ 87,951
Item Subtotal Construction Costs (Year 2024)			$ 1,773,683
Direct: Subtotal Construction Costs			***$ 1,774,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			**Date:**	3/3/2024
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	**Vertical Bar Screens - (2 - 12.5' Wide) includes installation**	2	EA	$ 95,000	$ 190,000
3	Fish Screen/Barrier (Allowance)	1	LS	$ 40,000	$ 40,000
4				$ -	$ -
5	**Additional Costs**			$ -	$ -
6	TESC @ 2% of Construction Costs	2%	LS	$ 230,000	$ 3,450
					$ -
				Item Subtotal Construction Costs (Year 2022)	***$ 233,450***
DIRECT: CONSTRUCTION COST MARK-UPS					
	General Conditions		0%	1	$ -
	Mobilization/Demobilization		0%	1	$ -
	Overhead & Profit (OHP)		15%	1.15	$ 35,018
	Insurance		0%	1	$ -
	Bonding		0%	1	$ -
	Escalation Multiplier from ENR-CCI		6%	1	$ 14,007
				Item Subtotal Construction Costs (Year 2024)	$ 282,475
				Direct: Subtotal Construction Costs	***$ 282,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4			
Project Name:	Farragut Pump Station - Predesign	**Date:**	3/3/2024
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	6%	1	$ 51,423
Item Subtotal Construction Costs (Year 2024)			$ 1,037,033
Direct: Subtotal Construction Costs			***$ 1,037,000***

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	$ 5,816,000	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), Dependenent Upon Project Phase	20%	Based on AACE Estimate Class
Material Pricing Uncertainty Allowance	10%	Based on AACE Estimate Class
Construction Change Order Allowance	10%	Based on AACE Estimate Class
Project Contingency	25%	Based on AACE Estimate Class
Art Eligability Costs to Be included	0%	Add if % art eligability is required by the Agency
Engineering Performance (Consultant, In-House, Both, N/A)	Consultant	
Design, Admin, Legal Cost	15%	
Construction Management Costs	10%	Construction support, inspections and CM
Utility and Other Agency Support	3%	Coordination for services and agencies
Environmental, Wetland, Floodplain, Permitting and Coordinatior	2%	Est at 2% - See Pre-design Report Permit List
ROW, easements, Agent and Coordination, etc.	10%	
Mobilization (% of subtotal construction costs)	10%	

ADDITIONAL PROJECT COST INPUTS		
Sales and Taxes	**Inputs**	**Comments**
Retail Sales Tax	$ 528,093	
Allowances for Permits, Mitgation, GIS and Other Costs		
Allowance for ROW and Tree Permits (%)	$ -	
Utility and Other Agency Support	$ 174,480	
Art or Agency Required Betterment Costs (%)	$ -	
Agency and Consulting Services	$ -	
Design, Admin, Legal Cost	$ 872,400	
Construction Management Costs	$ 581,600	
Local Agency Mitigation	$ -	
Environmental, Wetland, Floodplain, Permitting and Coordinatior	$ 116,320	Allowance for Environmental, Wetland, Floodplain Permitting
ROW, Easements, Agent and Coordination, etc.	$ 3,710	Est. at 10% property acquisition cost
Real Estate	$ -	
Right-of-Way Acquistion	$ -	
Property Acquisition	$ 37,100	Property Acquisition and Temporary Construction Easement

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

Prices:

Purchase		$7	per sf	
PERMANENT EASEMENT				
No Build	60% of purchase =	$ 4	per sf	
Limited Restrictions	50% of purchase =	$ 4	per sf	
TEMPORARY EASEMENT				
Construction ≤ 6months	30% of purchase =	$ 2	per sf	
Construction > 6 months	40% of purchase =	$ 3	per sf	

			Area	$/sf	Total	
Purchase for Alternative A - Parking & Building	0 ft	0 ft	2,309 sf	$7	$16,161	
Permanent Easement Parking and Shoring Anchoring System	0 ft	0 ft	2,178 sf	$4	$8,712	
Construction Easement (Includes staging & stockpiling)	0 ft	0 ft	6,098 sf	$2	$12,197	
					$16,161	Purchase
					$8,712	Permanent Easement
					$12,197	Construction Easement
					$37,100	**Total Property and Easement**

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			**Date:**	3/3/2024
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	$ 1,634,000	$ 1,634,000
2	Pump Station Facility	1	LS	$ 848,000	$ 848,000
3	Process Mechanical and Piping	1	LS	$ 1,774,000	$ 1,774,000
4	Vertical Bar Screens (pump intake)	1	LS	$ 224,000	$ 224,000
5	Electrical, Lighting, and Controls	1	LS	$ 1,037,000	$ 1,037,000
				$ -	$ -
					$ -
				Subtotal Construction Costs	***$ 5,517,000***
				ROW and Use Permits	$ -
				Art or Agency required Betterment Costs	$ 165,510
				Mobilization @ 0.1	$ 581,600
				ESTIMATED PROBABLE COST OF CONSTRUCTION BID	***$ 6,098,600***
SUBTOTAL ADDITIONAL CONSTRUCTION COSTS					
				Allowance for Indeterminates (AFI - Design Allowance)	$ 1,103,400
				Material Pricing Uncertainty Allowance	$ 551,700
				Construction Change Order Allowance	$ 551,700
				Subtotal Primary Construction Amount	***$ 2,206,800***
				Retail Sales Tax	$ 557,217
				TOTAL DIRECT CONSTRUCTION COSTS	***$ 8,863,000***
INDIRECT: NON-CONSTRUCTION COSTS					
				Design, Admin, ROW, and Construction Management	$ 1,379,250
				Utilitiy & Other Agency Support	$ 165,510
				Local Agency Mitigation	$ -
				Environmental, Wetland, Permitting and Coordination	$ 110,340
				Real Estate Propery and Right-of-Way Acquisition	$ 26,180
				TOTAL INDIRECT CONSTRUCTION COSTS (NOT INCLUDING CONTINGENCY)	***$ 1,681,280***
				Project Contingency @ 0.25	$ 1,944,970
				TOTAL PROJECT COST	***$ 10,544,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4			
Project Name:	Farragut Pump Station - Predesign	**Date:**	3/3/2024
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	6%	1	$ 81,031
Item Subtotal Construction Costs (Year 2024)			$ 1,634,118
Direct: Subtotal Construction Costs			***$ 1,634,000***

8

Base Year	Estimate Year
2022	2024

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	Access Hatches and Ladders	3	EA	$ 8,000	$ 24,000
18	Stop Logs	1	LS	$ 32,250	$ 32,250
19				$ -	$ -
20	**Site and Access**				
21	Chain Link Fence and Gates	230	LF	$ 110	$ 25,300
22	Site Restoration (Allowance)	1	LS	$ 25,000	$ 25,000
23				$ -	$ -
24	**Additional Costs**			$ -	$ -
25	Utility Relocation Allowance	1	LS	$ -	$ -
26	TESC @ 2% of Construction Costs	2%	LS	$ 690,875	$ 10,363
					$ -
	Item Subtotal Construction Costs (Year 2022)				***$ 701,238***

DIRECT: CONSTRUCTION COST MARK-UPS				
General Conditions	0%	1	$	-
Mobilization/Demobilization	0%	1	$	-
Overhead & Profit (OHP)	15%	1.15	$	105,186
Insurance	0%	1	$	-
Bonding	0%	1	$	-
Escalation Multiplier from ENR-CCI	6%	1	$	42,074
Item Subtotal Construction Costs (Year 2024)			$	848,498
Direct: Subtotal Construction Costs			***$***	***848,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4			
Project Name:	Farragut Pump Station - Predesign	**Date:**	3/3/2024
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	6%	1	$ 87,951
Item Subtotal Construction Costs (Year 2024)			$ 1,773,683
Direct: Subtotal Construction Costs			***$ 1,774,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4			
Project Name:	Farragut Pump Station - Predesign	**Date:**	3/3/2024
Location:	Market St./E. Harriman St., City of Aberdeen, WA	**Estimator:**	C. Kinzer
Description	Alt_B_Vertical Bar Screens	**Version:**	1

DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	**Item Description**	**Quantity**	**Units**	**Unit Cost**	**Item Cost**
1	**Screens**			$ -	$ -
2	**Vertical Bar Screens - (2 - 8' Wide) includes installation**	2	EA	$ 76,000	$ 152,000
3	Fish Screen/Barrier (Allowance)	1	LS	$ 30,000	$ 30,000
4				$ -	$ -
5	**Additional Costs**			$ -	$ -
6	TESC @ 2% of Construction Costs	2%	LS	$ 182,000	$ 2,730
					$ -
				Item Subtotal Construction Costs (Year 2022)	***$ 184,730***

DIRECT: CONSTRUCTION COST MARK-UPS			
General Conditions	0%	1	$ -
Mobilization/Demobilization	0%	1	$ -
Overhead & Profit (OHP)	15%	1.15	$ 27,710
Insurance	0%	1	$ -
Bonding	0%	1	$ -
Escalation Multiplier from ENR-CCI	6%	1	$ 11,084
Item Subtotal Construction Costs (Year 2024)			$ 223,523
Direct: Subtotal Construction Costs			***$ 224,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4			
Project Name:	Farragut Pump Station - Predesign	**Date:**	3/3/2024
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	6%	1	$ 51,423
Item Subtotal Construction Costs (Year 2024)			$ 1,037,033
Direct: Subtotal Construction Costs			***$ 1,037,000***

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	$ 5,517,000	Detailed Estimate Subtotal of Construction Costs
Retail Sales Tax Rate	10.10%	Update based on State and Local Tax Requirements
Percentage of Construction Costs where sales tax applies	100%	
Allowance for Indeterminates (AFI), Dependenent Upon Project Phase	20%	Based on AACE Estimate Class
Material Pricing Uncertainty Allowance	10%	Based on AACE Estimate Class
Construction Change Order Allowance	10%	Based on AACE Estimate Class
Project Contingency	25%	Based on AACE Estimate Class
Art Eligability Costs to Be included	0%	Add if % art eligability is required by the Agency
Engineering Performance (Consultant, In-House, Both, N/A)	Consultant	
Design, Admin, Legal Cost	15%	
Construction Management Costs	10%	Construction support, inspections and CM
Utility and Other Agency Support	3%	Coordination for services and agencies
Environmental, Wetland, Floodplain, Permitting and Coordinatior	2%	Est at 2% - See Pre-design Report Permit List
ROW, easements, Agent and Coordination, etc.	10%	
Mobilization (% of subtotal construction costs)	10%	

ADDITIONAL PROJECT COST INPUTS		
Sales and Taxes	**Inputs**	**Comments**
Retail Sales Tax	$ 557,217	
Allowances for Permits, Mitgation, GIS and Other Costs		
Allowance for ROW and Tree Permits (%)	$ -	
Utility and Other Agency Support	$ 165,510	
Art or Agency Required Betterment Costs (%)	$ -	
Agency and Consulting Services	$ -	
Design, Admin, Legal Cost	$ 827,550	
Construction Management Costs	$ 551,700	
Local Agency Mitigation	$ -	
Environmental, Wetland, Floodplain, Permitting and Coordinatior	$ 110,340	Allowance for Environmental, Wetland, Floodplain Permitting
ROW, Easements, Agent and Coordination, etc.	$ 2,380	Est. at 10% property acquisition cost
Real Estate	$ -	
Right-of-Way Acquistion	$ -	
Property Acquisition	$ 23,800	Property Acquisition and Temporary Construction Easement

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

Prices:

Purchase		$7	per sf	
PERMANENT EASEMENT				
No Build	60% of purchase =	$ 4	per sf	
Limited Restrictions	50% of purchase =	$ 4	per sf	
TEMPORARY EASEMENT				
Construction ≤ 6months	30% of purchase =	$ 2	per sf	
Construction > 6 months	40% of purchase =	$ 3	per sf	

			Area	$/sf	Total
Purchase for Alternative B - Access and Parking	0 ft	0 ft	1,655 sf	$7	$11,587
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

$11,587	Purchase
$0	Permanent Easement
$12,197	Construction Easement
$23,800	**Total Property and Easement**

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			**Date:**	3/3/2024
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	$ 1,341,000	$ 1,341,000
2	Pump Station Facility	1	LS	$ 727,000	$ 727,000
3	Process Mechanical and Piping	1	LS	$ 1,809,000	$ 1,809,000
4	Vertical Bar Screens (pump intake)	1	LS	$ 141,000	$ 141,000
5	Electrical, Lighting, and Controls	1	LS	$ 1,037,000	$ 1,037,000
				$ -	$ -
				Subtotal Construction Costs	***$ 5,055,000***
				ROW and Use Permits	$ -
				Art or Agency required Betterment Costs	$ 151,650
				Mobilization @ 0.1	$ 505,500
				ESTIMATED PROBABLE COST OF CONSTRUCTION BID	***$ 5,712,150***
SUBTOTAL ADDITIONAL CONSTRUCTION COSTS					
				Allowance for Indeterminates (AFI - Design Allowance)	$ 1,011,000
				Material Pricing Uncertainty Allowance	$ 505,500
				Construction Change Order Allowance	$ 505,500
				Subtotal Primary Construction Amount	***$ 2,022,000***
				Retail Sales Tax	$ 510,555
				TOTAL DIRECT CONSTRUCTION COSTS	***$ 8,245,000***
INDIRECT: NON-CONSTRUCTION COSTS					
				Design, Admin, and Construction Management	$ 1,263,750
				Utilitiy & Other Agency Support	$ 151,650
				Local Agency Mitigation	$ -
				Environmental, Wetland, Permitting and Coordination	$ 101,100
				Real Estate Propery and Right-of-Way Acquisition	$ 21,120
				TOTAL INDIRECT CONSTRUCTION COSTS (NOT INCLUDING CONTINGENCY)	***$ 1,537,620***
				Project Contingency @ 0.25	$ 1,812,443
				TOTAL PROJECT COST	***$ 9,783,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4			
Project Name:	Farragut Pump Station - Predesign	**Date:**	3/3/2024
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. Hau	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	6%	1	$	66,479
Item Subtotal Construction Costs (Year 2024)			$	1,340,655
Direct: Subtotal Construction Costs			***$***	***1,341,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4			
Project Name:	Farragut Pump Station - Predesign	**Date:**	3/3/2024
Location:	Market St./E. Harriman St., City of Aberdeen, WA	**Estimator:**	C. Kinzer
Description	Alt_C_Pump Station Facility	**Version:**	1

Item No.	Item Description	Quantity	Units	Unit Cost	Item Cost
	DIRECT: SUBTOTAL CONSTRUCTION COSTS				
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	Access Hatches and Ladders	3	EA	$ 8,000	$ 24,000
18	Stop Logs	1	LS	$ 38,700	$ 38,700
19					$ -
20	**Site and Access**			$ -	$ -
21	Chain Link Fence and Gates	230	LF	$ 110	$ 25,300
22	Site Restoration (Allowance)	1	LS	$ 25,000	$ 25,000
23				$ -	$ -
24	**Additional Costs**			$ -	$ -
25	Utility Relocation Allowance	1	LS	$ -	$ -
26	TESC @ 2% of Construction Costs	2%	LS	$ 592,275	$ 8,884
					$ -
	Item Subtotal Construction Costs (Year 2022)				***$ 601,159***
	DIRECT: CONSTRUCTION COST MARK-UPS				
	General Conditions		0%	1	$ -
	Mobilization/Demobilization		0%	1	$ -
	Overhead & Profit (OHP)		15%	1.15	$ 90,174
	Insurance		0%	1	$ -
	Bonding		0%	1	$ -
	Escalation Multiplier from ENR-CCI		6%	1	$ 36,070
	Item Subtotal Construction Costs (Year 2024)				$ 727,403
	Direct: Subtotal Construction Costs				***$ 727,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4			
Project Name:	Farragut Pump Station - Predesign	**Date:**	3/3/2024
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	6%	1	$	89,714
Item Subtotal Construction Costs (Year 2024)			$	1,809,228
Direct: Subtotal Construction Costs			***$***	***1,809,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4					
Project Name:	Farragut Pump Station - Predesign			**Date:**	3/3/2024
Location:	Market St./E. Harriman St., City of Aberdeen, WA			**Estimator:**	C. Kinzer
Description	Alt_C_Vertical Bar Screens			**Version:**	1/1/1900
DIRECT: SUBTOTAL CONSTRUCTION COSTS					
Item No.	**Item Description**	**Quantity**	**Units**	**Unit Cost**	**Item Cost**
1	**Screens**			$ -	$ -
2	**Vertical Bar Screens - (1 - 12.5' Wide) includes installation**	1	EA	$ 95,000	$ 95,000
3	Fish Screen/Barrier (Allowance)	1	LS	$ 20,000	$ 20,000
4				$ -	$ -
5	**Additional Costs**			$ -	$ -
6	TESC @ 2% of Construction Costs	2%	LS	$ 115,000	$ 1,725
					$ -
					$ -
				Item Subtotal Construction Costs (Year 2022)	***$ 116,725***
DIRECT: CONSTRUCTION COST MARK-UPS					
			General Conditions	0% 1	$ -
			Mobilization/Demobilization	0% 1	$ -
			Overhead & Profit (OHP)	15% 1.15	$ 17,509
			Insurance	0% 1	$ -
			Bonding	0% 1	$ -
			Escalation Multiplier from ENR-CCI	6% 1	$ 7,004
				Item Subtotal Construction Costs (Year 2024)	$ 141,237
				Direct: Subtotal Construction Costs	***$ 141,000***

Base Year	Estimate Year
2022	2024

Estimate - AACE Class 4			
Project Name:	Farragut Pump Station - Predesign	**Date:**	3/3/2024
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		6%	1	$ 51,423
	Item Subtotal Construction Costs (Year 2024)				$ 1,037,033
	Direct: Subtotal Construction Costs				***$ 1,037,000***

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	$ 5,055,000	Detailed Estimate Subtotal of Construction Costs
Retail Sales Tax Rate	10.10%	Update based on State and Local Tax Requirements
Percentage of Construction Costs where sales tax applies	100%	
Allowance for Indeterminates (AFI), Dependenent Upon Project Phase	20%	Based on AACE Estimate Class
Material Pricing Uncertainty Allowance	10%	Material price uncertainty set based on electrical/Mechanical/controls cost fluctuations
Construction Change Order Allowance	10%	Based on AACE Estimate Class
Project Contingency	25%	Based on AACE Estimate Class
Art Eligability Costs to Be included	0%	Add if % art eligability is required by the Agency
Engineering Performance (Consultant, In-House, Both, N/A)	Consultant	
Design, Admin, Legal Cost	15%	
Construction Management Costs	10%	Construction support, inspections and CM
Utility and Other Agency Support	3%	Coordination for services and agencies
Environmental, Wetland, Floodplain, Permitting and Coordinatior	2%	Est at 2% - See Pre-design Report Permit List
ROW, easements, Agent and Coordination, etc.	10%	
Mobilization (% of subtotal construction costs)	10%	

ADDITIONAL PROJECT COST INPUTS		
Sales and Taxes	**Inputs**	**Comments**
Retail Sales Tax	$ 510,555	
Allowances for Permits, Mitgation, GIS and Other Costs		
Allowance for ROW and Tree Permits (%)	$ -	
Utility and Other Agency Support	$ 151,650	
Art or Agency Required Betterment Costs (%)	$ -	
Agency and Consulting Services	$ -	
Design, Admin, Legal Cost	$ 758,250	
Construction Management Costs	$ 505,500	
Local Agency Mitigation	$ -	
Environmental, Wetland, Floodplain, Permitting and Coordinatior	$ 101,100	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 Acquistion	$ -	
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	$7 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 =	$ 4 per sf		
TEMPORARY EASEMENT				
Construction < 6months	30% of purchase =	$ 2 per sf		
Construction > 6 months	40% of purchase =	$ 3 per sf		

			Area	$/sf	Total
Purchase	0 ft	0 ft	0 sf	$7	$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**

Page intentionally left blank