Engineering Report

Port Washington WTP Improvements Project

Port Washington, WI

PORWA 153082   June 29, 2022

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June 29, 2022

RE: Port Washington WTP Improvements Project
Engineering Report
Port Washington, WI
SEH No. PORWA 153082 4.00

Wisconsin Department of Natural Resources
101 S Webster Street
Madison, WI 53703

To Whom it May Concern:

Please find enclosed an engineering report for the design of the City of Port Washington's Water Treatment Improvements Project.

The proposed project aims to address deficiencies noted in the WDNR's 2018 Sanitary Survey and end of life needs noted in the 2021 Needs Assessment completed by SEH. This project generally consists of the following improvements, which will be described in greater depth in this report:

- Replacement of the Plant 1 & 2 rapid mixers and flocculators
- Reconstruction of the Plant 2 gravity filters
- New low lift pumps
- New backwash pumps
- New sludge & clarifier drain down pumps
- New intermediate pumps and piping
- Improvements to the chemical feed systems
- New UV treatment system
- New clearwell and equalization tank
- Construct new high service pumping facilities
- Construct new generator room
- Electrical improvements
- Architectural Improvements

This report is also intended to satisfy the preliminary engineering report requirements for the Wisconsin Department of Natural Resources and Safe Drinking Water Loan Program.

Please contact me with any comments or questions regarding this submittal. You may reach me at 507.440.7485 or via email, bweiss@sehinc.com.

Sincerely,

Brad J. Weiss

Bradley J. Weiss, PE
Project Engineer

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Short Elliott Hendrickson Inc., 10 North Bridge Street, Chippewa Falls, WI 54729-2550
SEH is 100% employee-owned | **sehinc.com** | 715.720.6200 | 800.472.5881 | 888.908.8166 fax

Engineering Report

Engineering Report
Port Washington, WI

Prepared for:
City of Port Washington, Wisconsin

Prepared by:
Short Elliott Hendrickson Inc.
3535 Vadnais Center Drive
St. Paul, MN 55110
651.490.2000

I, Bradley J. Weiss, PE, hereby certify that I am a registered Professional Engineer in the State of Wisconsin in accordance with ch. A-E 4, Wis. Adm. Code and that this report has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code.

	48442-6	6/29/2022
Bradley J. Weiss, PE, Project Engineer	PE Number	Date

Distribution

No. of Copies	Sent to
3	Wisconsin Department of Natural Resources 101 S Webster Street Madison, WI 53703
3	Mr. Rob Vanden Noven City of Port Washington 100 W. Grand Avenue P.O. Box 307 Port Washington, WI 53074

Executive Summary

General

The City of Port Washington plans to improve their existing water treatment plant. The improvements are intended to address WDNR noted deficiencies and end of life equipment replacements.

The City of Port Washington water system consists of two (2) intakes in Lake Michigan, the WTP, and the distribution system. The quality of raw water varies depending on water quality in Lake Michigan. The WTP treats an average of 1.18 MGD and has a rated capacity of 4 MGD. The WTP is comprised of two (2) 2.0 MGD treatment plants built, each with their own dedicated treatment processes, i.e., coagulation, flocculation, sedimentation, filtration, storage, and pumping. Chemical feeds and residuals processing components are shared between the two plants.

Need for Project

In 2018 the Wisconsin Department of Natural Resources completed a sanitary survey or the WTP. The 2018 Sanitary Survey Report identified deficiencies within the drinking water system that that have the potential to cause serious health risks or represent long-term health risks to consumers. Deficiencies indicate noncompliance with one or more Wisconsin Administrative Codes. Throughout their survey, the WDNR identified one (1) significant deficiency and five (5) deficiencies. The Sanitary Survey Report also included the discovery of non-conforming features with regards to meeting the code requirements at the time of the public water system's construction, but would not be allowed under the current code. It is not a requirement to correct these non-conforming features at this time, however they are recommended to be corrected when any major work is done in the future.

A Need Assessment report was completed in 2021, assessing the overall condition of the WTP and the various treatment components. Overall, the WTP is in good condition and has been well maintained over the years. However, much of the plant process equipment has reached the end of its useful life and needs replacement to ensure reliable operation for the next 20 years.

Findings of the 2021 Needs Assessment determined that improvements to the WTP can be classified into two categories:

1) End of useful life replacements
2) WDNR requirements

To address the end of life needs and the WDNR requirements, a WTP improvements project is proposed.

Proposed Project

The proposed improvements project addresses needs identified in the 2018 Sanitary Survey 2021 Needs Assessment report and generally consists of:

- Improvements to the pretreatment process to include:
  - Replacement of the Plant 1 & 2 rapid mixers
  - Replacement of the Plant 1 & 2 flocculators
- Improvements to the filtration process include:
  - Reconstruction of the Plant 2 gravity filters including:
    - New underdrains
    - New media
    - New airwash system
    - New media retaining backwash troughs

- Improvements to the pumping facilities include:
  - New low lift pumps
  - New backwash pumps
  - New sludge pump & clarifier drain down pump
  - New intermediate pumps and piping
- Improvements to the chemical feed processes:
- Construct new UV treatment system
- Construct new clearwell and equalization tank
- Construct new high service pumping facilities
- Construct new generator room and install new generator
- Electrical improvements
- Architectural Improvements
- Mechanical/HVAC Improvements

Alternatives analyses for these improvements is provided in this report.

Construction Sequencing

The existing WTP will need to be in operation while the proposed improvements are being constructed. This will require operating one complete treatment train, clearwell, pumping facility, and chemical feed system while the rest of the WTP is under construction. As new components are brought online, existing components can be removed from service.

Construction Timeline

In general, project design and bidding efforts are anticipated to occur in 2022 and construction efforts are anticipated to occur in 2023 and 2024.

Opinion of Probable Cost

An opinion of probable cost is shown below.

Item		Estimated Cost
Construction Subtotal		$14,165,300
Construction Contingency (25%)		$2,124,800.00
Total Probable Construction cost		$16,290,100.00
Legal/Admin/Miscellaneous	1.5%	$244,400.00
Engineering – Design		$914,000.00
Engineering - Construction	5.5%	$896,000.00
Total Estimate Project Cost		**$18,345,000.00**

Contents

Contents (continued)

List of Tables

List of Figures

List of Appendices

Engineering Report

Prepared for the City of Port Washington

1. Introduction and Background

The City of Port Washington plans to improve their existing water treatment plant. The improvements are intended to address WDNR noted deficiencies and end of life equipment replacements.

1.1 General Overview

The City of Port Washington water system consists of two (2) intakes in Lake Michigan, the WTP, and the distribution system. The quality of raw water varies depending on water quality in Lake Michigan. The WTP treats an average of 1.18 MGD and has a rated capacity of 4 MGD. The WTP is comprised of two (2) 2.0 MGD treatment plants built, each with their own dedicated treatment processes, i.e., coagulation, flocculation, sedimentation, filtration, storage, and pumping. Chemical feeds and residuals processing components are shared between the two plants.

1.2 Need for Project

Overall, the WTP is in good condition and has been well maintained over the years. However, much of the plant process equipment has reached the end of its useful life and needs replacement to ensure reliable operation for the next 20 years. In general, process and equipment in need of replacement include:

- Plant 1 & Plant 2 rapid mix/flocculation mixers
- Plant 2 filters
- Plant 1 & Plant 2 filter function valves
- Plant 1 & Plant 2 low lift, high service, and backwash pumping
- Residuals processing
- Chemical feeds
- Architectural components
- Electrical systems
- Mechanical components.

Findings of the 2021 Needs Assessment determined that improvements to the WTP can be classified into two categories:

3) End of useful life replacements
4) WDNR requirements

To address the end of life needs and the WDNR requirements, a WTP improvements project is proposed.

2. Description of Project

NR 811.09(4)(a)

The proposed improvements project addresses needs identified in the 2018 Sanitary Survey 2021 Needs Assessment report and generally consists of:

- Improvements to the pretreatment process to include:
    - Replacement of the Plant 1 & 2 rapid mixers
    - Replacement of the Plant 1 & 2 flocculators
- Improvements to the filtration process include:
    - Reconstruction of the Plant 2 gravity filters including:
        - New underdrains
        - New media
        - New airwash system
        - New media retaining backwash troughs
- Improvements to the pumping facilities include:
    - New low lift pumps
    - New backwash pumps
    - New sludge pump & clarifier drain down pump
    - New intermediate pumps and piping
- Improvements to the chemical feed processes:
- Construct new UV treatment system
- Construct new clearwell and equalization tank
- Construct new high service pumping facilities
- Construct new generator room and install new generator
- Electrical improvements
- Architectural Improvements

The WDNR's 2018 Sanitary Survey can be found in Appendix A. The 2021 Needs Assessment Report can be found in Appendix B. Preliminary layouts of the proposed building expansion and proposed improvements are shown in Appendix C.

3. Location

NR 811.09(4)(b)

The City of Port Washington is located in eastern Wisconsin in Ozaukee County. The City serves a population of approximately 12,307 as of 2021 and spans an area of 5.865 square miles.

The Location of the proposed project is the Water Treatment Plant (WTP) at 408 North Lake Street, north of the Port Washington Marina and west of Lake Michigan. The site layout and surrounding area can be seen in Figure 1**Error! Reference source not found.**. The legal description of the WTP site is as follows:

104/145 & 254 92/470 83/519 82/539
N 10 FT LOT 36 BLK 7 LOTS 37 THRU 52 LOTS 1 THRU 49 BLK 8 BLK 9 /LOWER LAKE PARK/ BLK 10 BLK 11
NORTHEAST ADDITION

4. Population and Demand

NR 811.09(4)(d) and (e)

4.1 Population

The City's annual projected population growth is 1%. Projected populations in 5 year increments are presented in **Error! Reference source not found.**.

Table 1: City of Port Washington Population Projections

Year	**2021**	**2025**	**2030**	**2035**	**2040**	**2042**
Population	12,307	12,809	13,465	14,154	14,878	15,178

4.2 Demand

The WTP has a rated capacity of 4 million gallons (MGD); on average the plant treats approximately between 1.1 MGD and 1.2 MGD. Historical average and maximum day demands are shown in **Error! Reference source not found.**, below.

Table 2: Average and maximum day demands between 2011 and 2020 and projected demands through 2042

Year	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Peaking Factor	Yearly Production (MG)
2011	1.15	1.73	1.50	418.77
2012	1.18	1.98	1.68	430.81
2013	1.25	1.86	1.49	455.28
2014	1.18	1.82	1.54	431.83
2015	1.15	1.86	1.62	418.1
2016	1.17	1.82	1.56	427.03
2017	1.14	1.53	1.34	417.66
2018	1.2	1.76	1.47	439.69
2019	1.24	1.79	1.44	452.72
2020	1.16	1.7	1.47	422.57
2025	1.21	1.83	1.51	441.65
2030	1.27	1.92	1.51	463.55
2035	1.33	2.01	1.51	485.45
2040	1.39	2.10	1.51	507.35
2042	1.41	2.13	1.51	514.65
Notes: Projected water demands are highlighted				

The linear trend of yearly water production from 2011 to 2020 is a 0.9% increase. While there are years where the yearly production is higher this linear trend, the max day demands have not approached the rated capacity of the WTP. Considering the currently projected increase in population and water demand, it is not anticipated that the water demand will see significant increases during the design period. However, the City is friendly to wet industry and the development of a new industries or businesses in Port Washington could cause an increase in water demands. As such it is recommended to construct improvements such that they can be easily expanded to account for sudden demand increases.

5. Design Period

NR811.09(4)(e)

The design period used for sizing major system components is 20 years.

6. Investigations

NR811.09(4)(f)

6.1 Sanitary Survey

The most recent Sanitary Survey Report completed by the Wisconsin Department of Natural Resources was completed in 2018. During these assessments the WDNR identified deficiencies within the drinking water system that have the potential to cause serious health risks or represent long-term health risks to consumers. Deficiencies may indicate noncompliance with one or more Wisconsin Administrative Codes. Throughout their survey, the WDNR identified one (1) significant deficiency and five (5) deficiencies, described in Table 3. Significant deficiencies indicated noncompliance with one or more Wisconsin Administrative Codes and/or represent an immediate health risk to consumers. A deficiency is a problem in the drinking water system that has the potential to cause serious health risks or represent long-term health risks to consumers.

Table 3: Noted Deficiencies from the 2018 WDNR Sanitary Survey

Deficiencies	**Code Citation**	**Category**
1. The clearwell overflow is not downward-facing at 90-degrees and the overflow pipe outlet is not covered by a 24-mesh screen.	811.64	Significant Deficiency
2. No updated distribution map since 2014	810.26(2)	Deficiency
3. The air relief valve discharge piping at Plants 1 and 2 does not terminate 24 inches above the finished floor.	911.72(2)(a)	Deficiency
4. The chemical feeder pump does not have required appurtenances.	811.39(2)	Deficiency
5. Auxiliary Power does not currently meet the standard.	811.27	Deficiency
6. The floor of the clearwell is not at least two feet above the water table.	8.63(4)	Deficiency

The Sanitary Survey Report also included the discovery of non-conforming features with regards to meeting the code requirements at the time of the public water system's construction, but would not be allowed under the current code. It is not a requirement to correct these non-conforming features at this time, however they are recommended to be corrected when any major work is done in the future.

Table 4: Noted Non-Conforming Deficiencies from the 2018 WDNR Sanitary Survey

Non-conforming Deficiencies
1. Clearwell hatches at Plant 1 are not 24 inches above grade.
2. There is no overflow at Plant 1 clearwell.
3. The clearwell high lift pumps and motors are not above grade.
4. The low lift pumps and motors, discharge piping, pump facilities and/or controls are below grade.
5. Chemical feed line injectors at Plants 1 and 2 are not installed in the vertical pipe or bottom half of the horizontal pipe.

6.2 Conditions Assessment Report

In 2021, City staff and SEH completed a condition assessment of the equipment, processes and systems at the WTP. The assessments included an operational review of the facility's entire process train. Informal interviews and facility tours were conducted with WTP operations staff to capture their perspective on operations related to such elements as the WTP operation, flow rate, filter run durations, and backwash frequencies of the filtration process, as well as the interrelations between process elements such as, raw water inflow and quality to filter backwash events.

Over the course of the on-site evaluations, Port Washington WTP staff were encouraged to share their experience and knowledge of each process. The onsite observations and staff experience were essential in evaluating complete system operations related to individual system component flow rates, production and start/stop procedures as well as the effects caused by seasonal changes. The on-site observations also allowed for the building facilities and equipment assets to be inventoried as they related to physical condition, age, observed performance and possible deficiencies.

6.3 Risk and Resiliency Assessment

America's Water Infrastructure Act (AWIA) was signed into loan on October 23, 2018, replacing the Bioterrorism Act of 2022. Section 2013 of the law requires community water systems serving more than 3,300 people to develop or update a risk and resilience assessment (RRA), to assess the risks to, and the resilience of, their drinking water system. The results of the RRA identified that 10 of the top 12 risks were the reliability of plant pumping equipment due to the age and location of the pumps and motors.

7. Natural Features

7.1 Topography

NR 811.09(4)(c)

The elevation at the WTP site is approximately 591 feet MSL. General topography slopes east towards Lake Michigan.

7.2 Regional Flood Elevation

NR 811.09(4)(g)

The WTP is not located within a regulatory floodway or a flood hazard zone. The nearest floodway and regulatory elevation is identified on Wisconsin Department of Natural Resources Surface Water Data Viewer, https://dnr.wi.gov/topic/surfacewater/swdv/,and is located just north of the WTP and buried clearwell on the north side of the WTP. Figure 2 shows the floodway boundaries for the site.

7.3 Wetlands

NR 811.09(4)(h)

No wetland impacts are anticipated from construction of the proposed improvements. There are no wetlands identified on the WTP site as shown in Figure 2

8. Proposed Project

NR811.09(4)(i)

This section presents alternatives considered and addresses specific information required for WDNR review of water treatment, including a summary of establishing the adequacy of the proposed processes for the treatment of the specific water under consideration, reporting data from testing, and addressing the method of waste disposal from the treatment process including any environmental effects.

8.1 Proposed Improvements

The improvements described below are listed in order of plant treatment processes. A description of need, an alternatives analysis, and the proposed improvement are provided.

8.1.1 Low Lift Pumping

8.1.1.1 Description of Need

Current low lift pumping capacity for each plant is presented in Table 5. The Plant 1 low lift pumping firm capacity is 1,400 gpm. The Plant 2 low lift pumping firm capacity is 1,580 gpm.

Table 5: Plant 1 & 2 Low Lift Pump Capacities

Pump Name	Pump Capacity (gpm)
Plant 1 Low Lift 1	1,400

Plant 1 Low Lift 2	1,800
Plant 2 Low Lift 1	740
Plant 2 Low Lift 2	840
Plant 2 Low Lift 3	1,130

The existing low lift pump have reached the end of their useful life, require frequent maintenance, and their ability to operate reliably is a concern. Additionally, the WDNR noted that the low lift motors and the associated controls are below grade and could be damaged if the plant were to flood.

8.1.1.2 Alternatives Analysis & Proposed Improvements

Three (3) alternatives were considered for the low lift pumping facilities.

Alternative 1. Do nothing.

Alternative 2. In-kind pump replacements with raised motors installed in the same locations as existing. Install new pumps with VFDs.

Alternative 3. Develop low lift pump room in WTP 1 to pump to Plant 1 & 2. Install three (3) pump cans with 2.0 MGD vertical turbine pumps to raise the motors above grade. Install new pumps with VFDs. Size new pumps to meet plant demands.

Alternative 4. Develop low lift pump room in WTP 1 to pump to Plant 1 & 2. Install three (3) 2.0 MGD split case centrifugal pumps with the motors raised above grade. Install new pumps with VFDs. Size new pumps to meet plant demands.

Pros and cons and an opinion of probable cost for each alternate is presented in Table 6. The selected proposed alternate is highlighted.

Table 6: Low Lift Pumping Improvements Alternatives Analysis

Alternate	Pros	Cons	Probable Cost*
Alternate 1	• None	• Doesn't address end of life concerns • Doesn't address WDNR concerns	$0
Alternate 2	• Most cost effective. • Addresses end of life concerns	• Doesn't facilitate intermediate pumping facilities, described later, as low lift pumps installed in Plant 2 take pump slots necessary for intermediate pumping redundancy	$500,000

Alternate 3	• Addresses end of life concerns • Address WDNR concerns • Creates low lift pump facility which simplifies plant operations by locating all low lift pumps in same room.	• Requires more piping modifications to install vertical turbine pumps.	$475,000
Alternate 4	• Addresses end of life concerns • Address WDNR concerns • Creates low lift pump facility which simplifies plant operations by locating all low lift pumps in same room.		$425,000
* 2023 dollars not including contingencies			

Based on current and projected demands it is proposed to install three (3) 2.0 MGD horizontal centrifugal low lift pumps in the existing Plant 1 pump room. All pumps are proposed to be installed with VFDs. The proposed pumps will be piped to serve both Plant 1 and Plant 2. Direction of flow will be controlled by automated valve actuators connected to the WTP SCADA system. Operators will be able to select which plant to send raw water flow to from the WTP's operator work stations.

8.1.2 Filtration

8.1.2.1 Description of Need

Plant 1 has four (4) filter cells which were reconstructed in 1996. They are 12' x 15' concrete cells providing a filter area of 180SF per filter. Operating at 2.0MGD the calculated filter flux is 1.9 gpm/SF. A concrete walkway around the top perimeter. Two concrete wash troughs are installed in each filter and drain to the waste gullet on the west side of the filters. In 1996 the filters were rebuilt and the original Wheeler underdrain was removed and a concrete false bottom type underdrain with media retaining nozzles was intstalled. An airwash system was added during this reconstruction for an air followed by water backwash sequence. The Plant 1 filters have 7" of anthracite and 30" of silica sand installed which is original to the 1996 reconstruction. The media has been sampled for testing to determine if it still meets the design specifications. No process improvements are recommended for the Plant 1 filters. Backwash water supply is provided by the backwash pump located in the Plant 1 pump room. The pump is original to the facility and is nearing the end of its useful life. This pump will be discussed later in this report.

Plant 2 has four (4) filter cells. According to asbuilt drawings they are 13' x 14'-3" providing a filter area of 185.25SF per filter. Operating at 2.0MGD the calculated filter flux is 1.9 gpm/SF. According to asbuilt drawings, these filters contain dual media of 30 inches of silica sand and 6 inches of anthracite coal, with support gravel, clay block underdrains, and rotary surface wash systems. The filters in Plant 2 are backwashed with the older "water-only" and surface wash technologies. These surface wash systems, do not provide as thorough of a backwash as modern air wash system. These filters are original to the Plant 2 construction in 1969 and have reached the end of their useful life. It is recommended that these filters be reconstructed to include air wash technology, which provides a more explosive backwash, allowing trapped particles to be more easily wash out of the filter and results in water savings.

Backwash water supply to the Plant 1 filters is provided by the backwash pump located in the Plant 1 pump room. The pump is original to the facility and is nearing the end of its useful life. Backwash water supply to the Plant 2 filters is provided by the backwash pump located in the Plant 2 pump room. The pump is original to the facility and is nearing the end of its useful life. It is recommended that both backwash supply pumps be replaced. It is recommended that the new pumps be installed in the Plant 2 pump room to access the Plant 1 and Plant 2 clearwells.

The filter function valves are approaching 25 years old and are nearing the end of their useful life. It is recommended that filter function valves in Plant 1 & 2 be replaced as part of this project.

8.1.2.2 Alternatives Analysis & Proposed Improvements

Three (3) alternatives were considered for the Plant 2 filters.

Alternative 1.	Do nothing.
Alternative 2.	Replace the filter media only and maintain existing surface wash system.
Alternative 3.	Reconstruct filters and install airwash system.

Pros and cons and an opinion of probable cost for each alternate is presented in Table 7. The selected proposed alternate is highlighted.

Table 7: Plant 2 Filter Improvements Alternatives Analysis

Alternate	**Pros**	**Cons**	**Probable Cost***
Alternate 1	• None	• Doesn't address end of life concerns	$0
Alternate 2	• Most cost effective improvement. • Addresses end of life concerns.	• Doesn't update outdated technology.	$850,000
Alternate 3	• Addresses end of life concerns. • Improves backwash process. • Simplifies plant process by making the Plant 1 & Plant 2 backwash processes the same.	• Most costly option.	$1,625,000
* 2023 dollars not including contingencies			

8.1.3 Plant 1 & 2 Clearwells

8.1.3.1 Description of Need

The WTP has two (2) clearwells that provide storage and chlorine contact time. The Plant 1 clearwell has a volume of 175,000 gallons and the Plant 2 clearwell has a volume of 500,000 gallons. Both clearwells are located directly below their respective filters. The Plant 1 clearwell serves the Plant 1 high service and backwash pump. The Plant 2 clearwell serves the Plant 2 high service pumps, backwash pump, and the Thomas Port Pump Station. There is a 12-inch interconnect pipe between the Plant 1 clearwell and the Plant 2 clearwell. Flow between the two clearwells is controlled using a butterfly valve. The WDNR's 2018 sanitary survey noted that the floor of the existing clearwells are below the lake high water level of 582.3 feet and that the Plant 1 overflow is does not terminate with a downward-facing 90 bend covered with a mesh screen. The Utility is addressing the overflow deficiency as a separate project.

As-built drawings of each clearwell show that the bottom floor elevations for Clearwell 1 and Clearwell 2 are 579.85 feet and 578.14 feet, respectively. The floor level of Clearwell 1 and Clearwell 2 is approximately 2.5 feet and 4 feet, respectively, below the high water level in Lake Michigan.

It is recommended that the Utility pursue a project to either:

1. raise the floor of the existing clearwells to be a minimum of two feet above the high water level of Lake Michigan or
2. construct a new clearwell with the new floor a minimum of two feet above the high water level of Lake Michigan.

8.1.3.2 Alternatives Analysis

Four (4) alternatives were considered for the WTP clearwell improvements.

Alternative 1.	Do nothing.
Alternative 2.	Fill in the existing clearwells to raise the floor to be a minimum of two feet above the high water level of Lake Michigan
Alternative 3.	Leave existing clearwells in operation and abandon treatment credits, install intermediate pumping facilities, UV treatment facilities, and build new clearwell & equalization basin, and new high service pumping facilities. The UV treatment, clearwell & equalization basin, and high service pumping facilities are proposed to be constructed immediately south of the WTP.
Alternative 4.	Fill in existing clearwells to raise the floor to a minimum of two feed above the high water level of Lake Michigan, install intermediate pumping facilities, UV treatment facilities and build a new clearwell & equalization basin, and new high service pumping facilities. The UV treatment, clearwell & equalization basin, and high service pumping facilities are proposed to be constructed immediately south of the WTP.

Pros and cons and an opinion of probable cost for each alternate is presented in Table 8. The selected proposed alternate is highlighted.

Table 8: Clearwell Improvements Alternatives Analysis

Alternate	**Pros**	**Cons**	**Probable Cost***
Alternate 1	• None	• Doesn't address WDNR concerns	$0
Alternate 2	• Addresses WDNR concerns	• Requires extremely high free chlorine concentration to achieve chlorine contact time. Free chlorine residual would approach concentrations greater than 3mg/L.	$950,000
Alternate 3	• Addresses WDNR concerns • Maintains existing clearwells as flow through basins providing storage for backwash supply. • Storage in clearwells also provides a buffer for treatment operations, i.e., the plant could shutdown for periods of time and run using water stored in existing clearwells, new clearwell, and equalization basin.	• Abandons disinfection credits achieved from tradition treatment and requires additional UV treatment and clearwell for disinfection credits • Requires new high service pumping facilities for main zone and Thomas Port Zone.	$4,950,000
Alternate 4	• Addresses WDNR concerns	• Filling in existing clearwells and leak testing is a difficult and costly construction process due to the confined space area • Requires UV treatment similar to Alternate No. 3. • Requires new high service pumping facilities for main zone and Thomas Port Zone.	$5,480,000
* 2023 dollars not including contingencies			

8.1.3.3 Discussion of Chosen Alternative

Alternate 3 constructs a new UV disinfection facility, clearwell & EQ basin, and high service pumping facility immediately south of Plant 1. The UV disinfection facility and high service pumping facility will be part of an occupiable building expansion that will also include a generator room. The preliminary layout of the proposed addition is shown in Appendix A.

8.1.4 Intermediate Pumping

An intermediate pumping station is proposed to be developed. This pump station is proposed to be located in the Plant 2 pump room. The Plant 2 pump room is located between the Plant 1 and Plant 2 clearwells and locating the intermediate pump here allows the intermediate pump to access water in both clearwells.

Three (3) 1.5 MGD pumps are proposed for the intermediate pumping to provide 3.0 MGD firm capacity for the intermediate pumping facilities. It is recommended that these pumps be installed with VFDs. Similar to the low lift pumps, it is recommended to install split case centrifugal pumps with the motors raise grade. A spare pump base pump slot is proposed to be installed to facilitate the installation of a fourth pump in the event that an increase in demands requires additional intermediate pumping capacity.

8.1.5 UV Disinfection

Alternate 3 does nothing to existing clearwells and, in discussions with WDNR, the existing clearwells will be considered non-compliant, therefore all the inactivation credit for crypto, giardia and viruses must be obtained after the non-compliant clearwells. UV treatment will obtain some of the inactivation credit and help reduce the overall size of the new clearwell. Preliminary design from manufacturers indicates that a 12” UV system with a dose of 40mJ/cm^2 can achieve 4 log giardia and 3.5 log cryptosporidium removal at a 2.5 MGD flow rate. The remaining disinfection credits will be achieved in the clearwell located immediately downstream of the UV treatment system.

Two (2) UV system are proposed, with one system online and one as a redundant system. A third UV bay is proposed to facilitate the installation of a third UV system in the event that an increase in demands requires additional UV treatment capacity. The UV disinfection system will be designed to direct off spec water, including off spec water while the lamps are heating up, away from the clearwells. Off spec water is proposed to be sent to the existing clearwells or to the shorewells, both of which are upstream of the proposed UV treatment.

8.1.6 Clearwell & EQ Basin

The new clearwell & EQ structure is proposed to comprise two independent clearwells for disinfection credits and two independent equalizations basins that will provide water for pumping. The clearwells will receive water from the UV treatment system.

Geotechnical exploration and borings performed in the proposed footprint of the clearwell & EQ basin found ground water to be at elevation 582.9’ The floor of the new clearwell and EQ basin is anticipated to be set at an approximate elevation of 585’.

Two independent clearwells are proposed. An internal baffle wall will be constructed in each clearwell to reduce short-circuiting through the clearwell. Through internal valving, the clearwells will be able to be operated in parallel mode or in series. The clearwells are sized to achieve the required CT. The clearwell effluent will flow by gravity to the EQ basins using rectangular weirs in the upper portion of the end wall. The clearwells will designed such that the WTP can remove a clearwell from service during low flow periods for maintenance and inspection and still meet disinfection requirements in the second clearwell. The EQ basins will designed such that the WTP can remove an EQ basin from service during low flow periods for maintenance and inspection.

Preliminary sizing indicates that the clearwells and EQ basins will be sized as shown in the table below:

Table 9: Proposed clearwell & EQ basin dimensions and capacities

Structure	Length, ft.	Width, ft.	High Water Level, ft.	Usable Volume, gal.
Clearwell 1	86.25	23.125	12.75	190,231
Clearwell 2	86.25	23.125	12.75	190,231
EQ Basin 1	26.25	23.125	12.75	57,896
EQ Basin 2	26.25	23.125	12.75	57,896

The EQ basin effluent pipe will serve as the high service pump suction pipe. It is anticipated that plant operations will “bounce” the water level in the EQ basin and that, at times, the EQ basin effluent piping may not have a positive pressure head higher than the elevation of the ground surface. It is proposed that the pipes be encased in concrete to meet NR811 regulations. The clearwells and EQ basins are proposed to be accessed by roof hatches.

The Utility is considering a green roof for aesthetic purposes. In discussion with WDNR, it is understood that a green roof over the clearwell and EQ basins could be permitted if the system were designed to the same standards as a buried clearwell.

8.1.7 High Lift Pumping

The new high service pumping facility to pump from the new equalization basin into the distribution system. The new high service pump station will have pumps to service the main distribution zone and the Thomas Port Zone. The existing high service pumps are as follows:

- One (1) 1.5 MGD and two (2) 1.0 MGD pumps in the Plant 1 pump room.
- One (1) 1.3 MGD and one (1) 1.7 MGD pump in the Plant 2 pump room.
- Two (2) 0.5 MGD pumps in the Thomas Port Pump Station.

It is recommended that the high service pumps be sized as follows:

- Three (3) 1.5 MGD pumps service the main zone. It is proposed that these pumps be installed with VFDs.
- Two (2) 0.5 MGD pumps service the Thomas Port zone. It is proposed that these pumps be installed with VFDs.

As the plant operators are familiar with and have a long history with split case centrifugal pumps they are proposed for the high service pumps. Multistage vertical centrifugal pumps will also be evaluated during design. Based ground water elevation, the floor of the high service pump room will be approximately 4-feet above the floor of the clearwell. Selection of the pumps will consider suction lift capabilities and design duty points for each application.

8.1.8 Chemical Addition

8.1.8.1 Description of Need

Five chemicals are fed into the treatment train at various points in the water treatment process.

8.1.8.1.1 Polyaluminum Chloride

Polyaluminum Chloride (PACL) is fed as a coagulant prior to the rapid mix basins. A bulk tank and transfer pump is stored in the garage. Operators transfer PACL to the day tanks as needed. The existing transfer pump is reaching the end of its useful life and should be replaced. The day tanks and metering pumps for the PACL feed system are installed in the common chemical feed room. PACL is fed from two, 25 gallon day tanks. Each day tank has a dedicated metering pump which are manually controlled by operators. The day do not have secondary containment. The day tanks are installed on top of scales to monitor chemical use.

It is recommended to:

- Install secondary containment for the PACL day tanks
- Connect the metering pumps to SCADA and to be flow paced based on raw water flow
- Replace the existing PACL transfer pump

8.1.8.1.2 Powdered Activated Carbon

Powdered activated carbon (PAC) is fed seasonally at the rapid mix tanks for taste and odor control. The PAC feed system is housed in a dedicated PAC feed room. The feed system includes a bag hopper, 150 gallon polyethylene slurry tank, impeller mixer and a metering pump. A dust collection system is installed and is used when PAC is being loaded into the bag hoppers. Dosages are manually controlled by plant operators.

It is recommended to:

- Connect the metering pumps to SCADA and to be flow paced based on raw water flow

8.1.8.1.3 Fluorosilicic Acid

Fluorosilicic acid is added to the filter effluent line via two metering pumps. The feeders are flow paced and operate through the SCADA system. Signals from the low lift pump motor starters provide secondary control. Each feeder has a 5 function anti siphon valve. Fluoride is fed directly from drums located on scales. Two drums are in service at one time. The fluoride feed system is located in its own room. Extra drums of fluoride are stored outside of the fluoride feed room in the common chemical feed room. Operators manually receive drums of fluoride and use the WTP’s freight elevator to bring the drums to the common chemical feed room. There is no secondary containment for the fluoride storage or the fluoride feed system. Operators have reported that it is difficult for them to dispose of spent drums and have a large stockpile of empty drums onsite. The architectural, mechanical, and electrical components of the room have reached the end of their useful life and are showing significant signs of wear after prolonged exposure to chemical fumes.

It is recommended to:

- Install a bulk tank and transfer system be installed to allow operators to receive bulk deliveries of fluoride in lieu of drums. This will eliminate the need for operators to receive and transport drums creating a safer work environment.
- Install secondary containment for the day tanks
- Replace the architectural, mechanical, and electrical components of the fluoride feed room

8.1.8.1.4 Phosphate

Blended phosphates are fed at the end of the process for corrosion control. It is injected after the finished water turbidity and chlorine meter. The feed system is installed in the common chemical feed room. Phosphate is fed directly from drums located on scales. Two drums are in service at one time. Extra drums of phosphate are stored in the common chemical feed room. Operators manually receive drums of phosphate and use the WTP's freight elevator to bring the drums to the common chemical feed room. Each drum has a dedicated metering pump that is manually controlled by operators. There is no secondary containment around the phosphate feed system or the storage area. The process of receiving and delivering drums to the chemical feed room is a labor intensive process. Additionally, operators have reported that it is difficult for them to dispose of spent drums and have a large stockpile of empty drums onsite.

It is recommended to:

- Install a bulk tank and transfer system be installed to allow operators to receive bulk deliveries of phosphate in lieu of drums. This will eliminate the need for operators to receive and transport drums creating a safer work environment.
- Install secondary containment for the day tanks.

8.1.8.1.5 Chlorine

Chlorine is fed in multiple locations. Each intake pipe receives a chlorine dose for zebra mussel control. The raw water line also receives a chlorine dose on an as needed basis before entering the rapid mix basins. The third injection point is after the filtration just prior to the phosphate injection. Chlorine cylinders are located in the Chlorine Storage Room adjacent to the garage. One (1) 1-ton cylinders is in use at a time with one (1) 1-ton cylinder in storage. An overhead coiling door and a bridge crane allows for delivery and placement of chlorine cylinders. Operators noted that the bridge crane does not allow for proper delivery of the cylinders and operators are required to manually roll cylinders into and out of the room which is a safety concern. The man door to the chlorine room opens into the garage, which is not allowed by modern code. The chlorine feeders are installed in a separate room on the filter operating floor. Chlorine booster pumps are installed generally near the flocculators in Plant 1. The WTP is located in downtown Port Washington and is bordered by residential buildings on two sides and a park on one side. Today, many utilities with WTPs located near residential or public facilities are switching from chlorine to sodium hypochlorite due to safety concerns with the storage and operation of a chlorine feed system.

It is recommended to:

- Convert to the WTP from chlorine feed to a sodium hypochlorite (NaOCl) feed to improve the safety for operators and the public.
    - Remove existing chlorine feed system.
    - Install new bulk NaOCl tank, transfer pump, day tank, and metering pumps connected to SCADA.

8.1.8.1.6 Dechlorination

The WTP did not meet the total chlorine residual discharge limit for 2020 for the backwash water clarifier effluent. In 2021 a sodium thiosulfate feed system was installed to dechlorinate the backwash waste waters. Operators manually add sodium thiosulfate to reduce the total chlorine residual to concentrations below 38 ug/l. A single metering pump doses sodium thiosulfate into the clarifier.

It is recommended to:

- Connect the metering pump to SCADA and to be flow paced based on backwash waste flow

8.1.8.2 Alternatives Analysis & Proposed Improvements

Several alternatives were considered for the chemical feed improvements.

8.1.8.2.1 Polyaluminum Chloride

Alternative 1.	Do nothing.
Alternative 2.	Connect the metering pumps to SCADA and to be flow paced based on raw water flow.

8.1.8.2.2 Powdered Activated Carbon

Alternative 1.	Do nothing.
Alternative 2.	Connect the metering pumps to SCADA and to be flow paced based on raw water flow.

8.1.8.2.3 Fluorosilicic Acid

Alternative 1.	Do nothing.
Alternative 2.	Install a bulk tank and transfer system be installed to allow operators to receive bulk deliveries of fluoride in lieu of drums. Based on the 2021 peak month use of 987 pounds, a 150 gallon double walled bulk tank and 50 gallon day tank in a secondary containment tote would be recommended. Replace the architectural, mechanical, and electrical components of the fluoride feed room.

Alternative 3. Install secondary containment for the drums and chemical storage area. Replace the architectural, mechanical, and electrical components of the fluoride feed room.

8.1.8.2.4 Phosphate

Alternative 1. Do nothing.

Alternative 2. Install a bulk tank and transfer system be installed to allow operators to receive bulk deliveries of phosphate in lieu of drums. Based on the 2021 peak month use of 1447.8 pounds, a 200 gallon double walled bulk tank and 75 gallon day tank in a secondary containment tote would be recommended. This will eliminate the need for operators to receive and transport drums creating a safer work environment.

Alternative 3. Install secondary containment for the drums and chemical storage area.

8.1.8.2.5 Chlorine

Alternative 1. Do nothing.

Alternative 2. Reconfigure the chlorine room man door to exit to the exterior of the building rather than the interior of the building. Upgrade the chlorine room safety equipment, i.e., leak detection, automatic shutoffs, etc. Upgrade the bridge crane so that operators do not need to manually roll cylinders to the floor trundles.

Alternative 3. Convert the WTP to a NaOCl feed. Install a bulk tank and transfer system be installed to allow operators to receive bulk deliveries of phosphate in lieu of drums. Based on the 2021 peak month use of 814 pounds, a 1000 gallon double walled bulk tank and 200 gallon day tank either double walled or in a secondary containment tote would be recommended.

8.1.8.2.6 Dechlorination

Alternative 1. Do nothing.

Alternative 2. Connect the metering pump to SCADA and to be flow paced based on backwash waste flow

Pros and cons and an opinion of probable cost for each alternate is presented in Table 10. The selected proposed alternate is highlighted.

Table 10: Chemical Feed Improvements Alternatives Analysis

Alternate		**Pros**	**Cons**	**Probable Cost***
PACL	Alternate 1	• None	• Relies on operators to manually change chemical feed pumps.	$0
	Alternate 2	• Provides plant automation and	• Most costly option.	$15,000

		accurate chemical doses with changing plant flows		
Powdered Activated Carbon	Alternate 1	• None	• Relies on operators to manually change chemical feed pumps.	$0
	Alternate 2	• Provides plant automation and accurate chemical doses with changing plant flows	• Most costly option.	$15,000
Fluorosilicic Acid	Alternate 1	• None	• Doesn’t address secondary containment concerns. • Doesn’t address architectural concerns. • Requires operators to continue to manually transport chemicals to the second floor chemical feed room.	$0
	Alternate 2	• Addresses secondary containment concerns. • Addresses architectural concerns. • Bulk storage and transfer system eliminates operator need to handle chemicals.	• Most costly option.	$40,000
	Alternate 3	• Addresses secondary containment concerns. • Addresses architectural concerns.	• Requires operators to continue to manually transport chemicals to the second floor chemical feed room.	$25,000

Phosphate	Alternate 1	None	Doesn't address secondary containment concerns. Requires operators to continue to manually transport chemicals to the second floor chemical feed room.	$0
	Alternate 2	Addresses secondary containment concerns. Bulk storage and transfer system eliminates operator need to handle chemicals.	Most costly option.	$40,000
	Alternate 3	Addresses secondary containment concerns.	Requires operators to continue to manually transport chemicals to the second floor chemical feed room.	$25,000
Chlorine	Alternate 1	None	Doesn't address safety concerns.	$0
	Alternate 2	Addresses safety concerns. Eliminates the need for operators to manually transfer chlorine cylinders around the room.	Most costly option.	$75,000
	Alternate 3	Addresses safety concerns	Introduces new chemical into WTP that operators haven't historically used Addition of a transfer pump from bulk storage to day tank introduces additional maintainable equipment	$65,000

Decolorination System	Alternate 1	• None	• Relies on operators to manually change chemical feed pumps.	$0
	Alternate 2	• Provides plant automation and accurate chemical doses with changing plant flows.	• Most costly option.	$15,000

* 2023 dollars not including contingencies

8.1.9 Treatment Residuals

8.1.9.1 Description of Need

The WTP has clarifier to that receives backwash waste and settles solids prior to discharging the supernatant. The clarifier has a chain and flight system installed to collect sludge on one end of the clarifier where it is then pumped to the nearby wastewater treatment plant. There are two pumps associated with the treatment residuals process, the sludge pump, which pumps settled solids to the wastewater plant and the drain down pump which is used to drain the sedimentation basins to the clarifier once they are no longer able to drain by gravity. These pumps are original to the Plant 2 construction and have reached the end of their useful life. Operators noted that they require frequent maintenance to ensure they operate when they are needed. Operators also noted that the chain and flight system is generally in good condition, but several of the flights are broken and need replacement.

8.1.9.2 Alternatives Analysis

Two (2) alternatives were considered for the treatment residuals improvements.

Alternative 1. Do nothing.

Alternative 2. Replace the aged pumps and the broken flights.

Pros and cons and an opinion of probable cost for each alternate is presented in Table 11. The selected proposed alternate is highlighted.

Table 11: Treatment Residuals Improvements Alternatives Analysis

Alternate		**Pros**	**Cons**	**Probable Cost***
PACL	Alternate 1	• None	• Residuals processing continues to rely on equipment that has reached the end of its useful life	$0
	Alternate 2	• Replaces equipment that has	• Most costly option.	$101,200.00

		reached the end of its useful life.		

8.1.10 Architectural Improvements

Many of the WTP's architectural components are reaching the end of their useful life and are recommended to be replaced as part of this proposed project. The exterior of the WTP was refurbished in 1985 with the application of an EFIS (exterior insulation and finish system), new roofing, and new windows. The facility's occupiable spaces and building egress are consistent with the requirements that were in place at the time of original construction. Building accessibility is not fully in accordance with current ADA code. Some portions of the facility are in accordance with ADA accessibility requirements. The WTP maintains a freight elevator that is primarily used for chemical deliveries to the second floor. The elevator is not used as a passenger elevator.

The interior and exterior doors, windows, and roofing system are now over 30 years old and are reaching the end of their useful life. The coatings systems on the walls, floors, ceilings, and piping have been recoated several times throughout the years, but are now showing signs of wear, particularly in high traffic areas. The laboratory is in need of an updated exhaust hood and an overall updated to replaced aging components. Operators have noted that there are operational issues with existing exhaust hood. The WTP's two (2) restrooms now over 30 years old and are reaching the end of their useful life.

SEH has coordinated with Wisconsin Department of Safety and Professional Services (DSPS) to discuss the requirements for upgrading occupiable spaces as part of the improvements project. Preliminary layouts of the building expansion and the anticipated building improvements were presented to DSPS. The following code related items were discussed, responses from DSPS are shown in *italics*:

1. Can the UV & generator rooms proposed to be constructed on the south side of the existing Plant 1 be used as an egress path? *Yes, these rooms can be used as an egress path provided the rooms are classified as F1 occupancy and meet the required exit distances for a non-sprinkled building.*

2. Does the second floor toilet room need to be ADA compliant? *If the bathroom is upgraded it needs to be brought into compliance.*

3. Does the exiting freight elevator need to be upgraded to be a passenger elevator? *No, the existing freight elevator does not need to be upgraded to be a passenger elevator.*

4. Do the new lab countertops need to be ADA compliant? *Yes, if the lab countertops are upgraded they need to be ADA compliant.*

5. Does the existing chlorine room need to be sprinkled? *The existing chlorine room does not need to be sprinkled provided the amount of stored chlorine does not increase.*

The following replacements are recommended:

- Doors
- Windows
- Coatings

- Laboratory counters/cabinets and fume hood
- Restrooms

8.1.10.1 Alternatives Analysis & Proposed Improvements

Two (2) alternatives were considered for the WTP architectural improvements.

Alternative 1. Do nothing.

Alternative 2. Replace the existing door & windows. Recoat the walls, floors, ceilings, and piping. Demo and install new lab counter/cabinets, and fume hood meeting ADA requirements. Demo and reconstruct the two (2) restrooms to meet ADA requirements.

Pros and cons and an opinion of probable cost for each alternate is presented in Table 12Table 14Table 13. The selected proposed alternate is highlighted.

Table 12: WTP Architectural Improvements Alternatives Analysis

Alternate	**Pros**	**Cons**	**Probable Cost**
Alternate 1	• None	• Doesn't address end of life concerns	$0
Alternate 2	• Addresses end of life concerns of architectural components • Updated lab hood improves operator safety	• Most costly option.	$640,000

8.1.11 Electrical

8.1.11.1 Description of Need

The WTP's power distribution system consists of a mixture of ages. The newest distribution equipment was installed in 1997. Older equipment have installation dates of 1987 back to the 1970's and earlier.

In general the distribution system consists of three WE Energies outdoor pad-mounted transformers that provide power to various parts of the plant. The power systems in Plant 1 & 2 has reached the end of their useful lives and should be replaced. The Plant 1 distribution equipment is a mixture of 1950 equipment, 1987 equipment, and 1998 equipment. The 1950's equipment is all of the panelboards, the 1987 equipment is the main switchboard and various feeder breakers, the 1998 equipment is the MCC-1 and panelboard MDP-2. The original Plant 2 was constructed in 1969. Most electrical distribution equipment in Plant 2 is original and is beyond 50-years of age. In addition to their age, the MCCs in both plants are located in the pump rooms and was noted by the WDNR to be at risk of flooding.

Due to the three service entrances, the WDNR has allowed the WTP to operate without emergency backup power until this was noted as a deficiency on the 2018 Sanitary Survey.

The existing light fixtures are of mixed type and installation ages. It is recommended to replace the existing fixtures with modern LED fixtures.

The existing security system consists of the following:

- cameras throughout the facility
- door contacts on all exterior doors
- key code access on several exterior doors

The system is aged and operators noted that the cameras are low quality and experience frequent problems. It is recommended to modernize this security system as part of the work. As part of this modernization, new security cameras are recommended as well as key fobs for exterior doors that match the City's existing system.

8.1.11.2 Alternatives Analysis & Proposed Improvements

Two (2) alternatives were considered for the WTP electrical improvements.

Alternative 1.	Do nothing.
Alternative 2.	Replace the aging electrical systems and install an emergency backup power generator and transfer switch. The new Install the new MCCs above grade of the pump rooms.

Pros and cons and an opinion of probable cost for each alternate is presented in Table 13. The selected proposed alternate is highlighted.

Table 13: WTP Electrical Improvements Alternatives Analysis

Alternate	**Pros**	**Cons**	**Probable Cost**
Alternate 1	• None	• Doesn't address end of life concerns • Doesn't address WDNR noted concerns	$0
Alternate 2	• New generator provides emergency backup power	• Most costly option.	$1,410,000

The new generator is proposed to be housed in a generator room connected to the UV and high service pumping room. This generator room is located between the Plant 1 pump room and the clearwell. Both diesel and natural gas generators are being considered. The location of the generator, which is closer to than 50 feet from the proposed clearwell, has been discussed with WDNR. If a diesel powered generator is selected it is understood that the WDNR will approve of the system and location provided it has a double walled fuel tank with leak detection.

8.1.12 Mechanical/HVAC

8.1.12.1 Description of Need

Dehumidification throughout the plants is provided by portable dehumidifiers. These portable dehumidifiers are not sufficient and the plant experiences challenges with condensation, particularly in the filter pipe galleries during the summer. It is recommended to install dehumidification in both plants. Rooftop mounted dehumidifiers ducted throughout the WTP provide a more efficient form of dehumidification in the WTP compared to the existing portable dehumidifiers. Two units are recommended, one to generally serve Plant 1 and one to generally serve Plant 2.

The only space in the plant that is cooled is the control room. It is recommended to condition other plant spaces that are frequently occupied, in this case, the office, lab, and operators meeting room.

Plant 1 heat is provided by a boiler system and steam loop. Radiators and steam heaters provide heat to the various areas of Plant 1. These radiators and heaters are older and nearing the end of their service life. Plant 2 heat is provided by gas fired unit heaters. These gas fired unit heaters are of multiple vintages, some are original to the plant and other have been replaced. All of the gas fired unit heaters are aging and nearing the end of their service life. It is recommended that the heaters in both plants be replaced. The new addition on the south side of the plant is recommended to be heated by gas unit heaters.

8.1.12.2 Alternatives Analysis & Proposed Improvements

Plant wide dehumidification and conditioning of the occupiable spaces is proposed.

Four (4) alternatives were considered for the WTP heating improvements.

Alternative 1. Do nothing.

Alternative 2. In-kind replacement of the aging heaters in Plants 1 & 2

Alternative 3. In-kind replacement of the heaters in Plant 1. Install steam loop in Plant 2 and replace gas fired unit heaters with steam heaters.

Alternative 4. Install gas loop in Plant 1 and replace steam unit heaters with gas fired unit heaters. In-kind replacement of heaters in Plant 2

Pros and cons and an opinion of probable cost for each alternate is presented in Table 14Table 13. The selected proposed alternate is highlighted.

Table 14: WTP Heating Improvements Alternatives Analysis

Alternate	Pros	Cons	Probable Cost
Alternate 1	• None	• Doesn't address end of life concerns	$0
Alternate 2	• Addresses end of useful life concerns. • Most cost efficient alternate.	• More costly than the "Do Nothing" approach.	$85,000

Alternate 3	• Addresses end of useful life concerns.	• Costly to install steam loop in Plant 2. • May require increasing boiler size.	$200,000 assuming no change to boiler.
Alternate 4	• Addresses end of useful life concerns.	• Costly to install gas loop in Plant 1.	$200,000

8.2 Construction Considerations

8.2.1 Geotechnical Investigation

A geotechnical report was prepared based on geotechnical exploration and soil borings focused on the south side of the WTP. A draft of this geotechnical report can be found in Appendix E.

Soils vary throughout the site due to the presence of fill soils. The uniformity and stability of the fill soils at the proposed foundation elevations are variable. Based on the boring logs, the fill soils encountered do not appear to have been placed with the intent to support structural building loads. It is proposed to remove the fill and replace with an engineered fill below the proposed construction area.

In general, excavated soils without debris, organic material, silt (defined as soils containing 80% or more silt-sized particles), or marl, may be reused as backfill outside structural foundation footprints extending downward and outward at a 1:1 slope from the foundation edge. Replacement soils beneath the proposed structures, and within this extended zone, are recommended to meet Type B Structural Backfill per WisDOT 210. All structural fill placed beneath the proposed structure are recommended to be placed in 8-inch loose lifts and compacted to 100 percent of its standard Proctor.

Water levels recorded during the drilling and design phase from the piezometers indicate that the structural foundations may be near the maximum recorded groundwater during the brief observation period (approximate elevation 583 ft). In areas where the water level is near or above the elevation of the proposed foundation, it is proposed to prepare the bottom of the structural excavations with a minimum of 12 inches of 100 percent crushed ¾-inch rock wrapped in a Type SAS geotextile meeting requirement of WisDOT 645.

All foundations are proposed to be prepared in dry conditions. Based on recorded water levels, it is expect that dewatering will be required. It is anticipate that the dewatering will include either a series of wet wells or deep well placed at set intervals around the perimeter of the excavation zone. In addition, the use of sumps may be needed at the bottom of the excavation in the proposed rock pad during construction

8.3 Waste Handling and Environmental Impacts

It is not anticipated that there will be an increase in waste handling as a result of this proposed project.

8.4 Construction Considerations

8.4.1 Construction Sequencing

The existing WTP will need to be in operation while the proposed improvements are being constructed. This will require operating one complete treatment train, clearwell, pumping facility, and chemical feed system while the rest of the WTP is under construction. As new components are brought online, existing components can be removed from service.

8.4.2 Construction Timeline

The anticipated construction schedule can be seen in Figure 3. In general, project design and bidding efforts are anticipated to occur in quarter 1 of 2023 and construction efforts are anticipated to occur between quarter 2 of 2023 to quarter 2 of 2025.

8.4.3 Opinion of Probable Cost

An opinion of probable cost is shown below.

Item		Estimated Cost
Construction Subtotal		$14,165,300
Construction Contingency (25%)		$2,124,800.00
Total Probable Construction cost		$16,290,100.00
Legal/Admin/Miscellaneous	1.5%	$244,400.00
Engineering – Design		$914,000.00
Engineering - Construction	5.5%	$896,000.00
Total Estimate Project Cost		**$18,345,000.00**

9. Conclusion

The proposed Port Washington WTP Improvements Project will replace treatment components that have reached the end of useful life and will address deficiencies identified in the WDNR's 2018 Sanitary Survey and the 2021 Needs Assessment. The proposed project is both feasible and necessary for the WTP to continue operation and to provide safe, high quality, water to its customers.

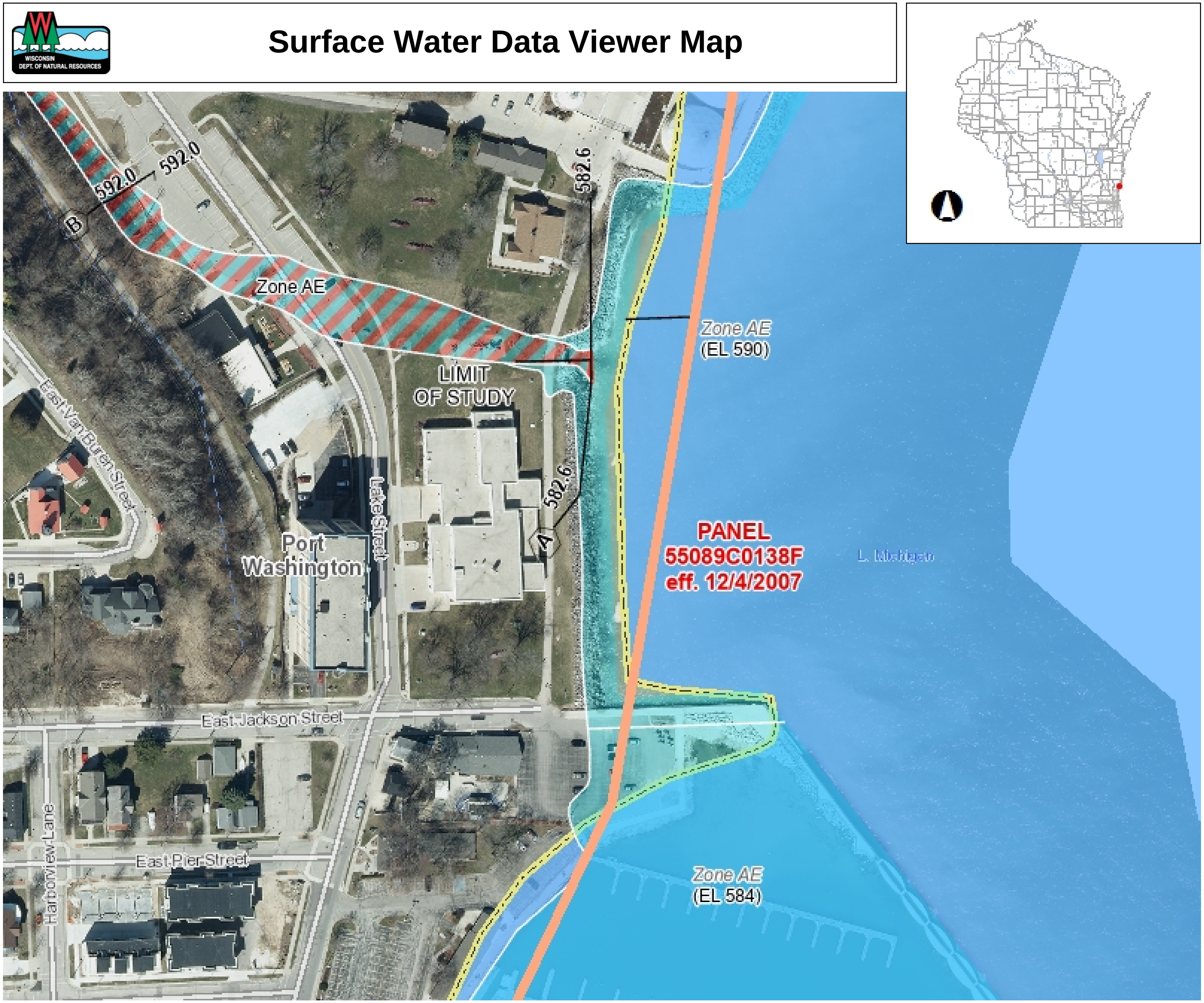
Figures

Figure 1 – Port Washington WTP Vicinity


PORT
WASHINGTON WTP

Figure 2 – Wetland and Floodplain Map

Surface Water Data Viewer Map



Legend

- ▨ Wetland Indicators
- 2D Water Surface Elevation Grid
  - 🟦 High : 937.446
  - 🟦
  - 🟦 Low : 855.125
- Dams
  - ☒ Dams with FERC License
  - 🟥 Dams
- ● Record Flood Levels
- Analysis Lines
  - — Other
  - — Flood Insurance Study
  - — Letter of Map Revision
  - — Case By Case Analysis
  - — Bridge
- Analysis Points
  - ● Other
  - ● Flood Insurance Study
  - ● Letter of Map Revision
  - ● Case By Case Analysis
  - ● Bridge
- ☐ Analysis Catchments
- ☒ Floodplain Storage
- — Cross Sections
- Floodplains
  - ▨ Flood Fringe
  - ▨ Floodway
- ▨ FERC Project Area Boundaries
- ● DOT Bridges
- ☐ FIRM Panels
- — Cross-Sections
- Flood Hazard Boundaries
  - — Limit Lines

Notes

0.1 0 0.03 0.1 Miles

NAD_1983_HARN_Wisconsin_TM

1: 1,980

Figure 3 – Anticipated Project Schedule

Port Washington Water Treatment Plant Upgrades - Preliminary Schedule

Item	2021												2022												2023												2024											
	Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4		
Plant Improvement Project																																																
Funding Approval							▨	▨	▨	▨	▨																																					
Design Proposal						▨	▨																																									
Preliminary Engineering Report								▨	▨	▨	▨	▨	▨	▨																																		
Final Design													▨	▨	▨	▨	▨	▨	▨	▨																												
Regulatroy Approval														PSC					DNR																													
Bidding & Award																						▨	▨	▨	▨	▨	▨																					
Construction																												▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨				
Start-up and training																																													▨	▨	
Contract Close out																																																▨

REMOVED FROM REPORT AND PROVIDED AS ATTACHMENT 4 IN CA APPLICATION

Appendix A

2018 Sanitary Survey

REMOVED FROM REPORT AND PROVIDED AS ATTACHMENT 5 IN CA APPLICATION

Appendix B

2021 Needs Assessment

REMOVED FROM REPORT AND
PROVIDED AS SEPERATE
ATTACHMENT IN CA APPLICATION

Appendix C

Preliminary Layout and Proposed Improvement Drawings

Appendix D

Detailed Preliminary Opinion of Probably Cost

Port Washington WTP Improvements Project
Preliminary Opinion of Probable Cost
Port Washington WTP
24-Jun-22

Item	Qty	UNIT	2023 UNIT COST	2023 TOTAL COST	GEN. DESCRIPTION - 2023
DIVISION 1 - GENERAL CONDITIONS	1	LS	$1,847,646.49	$1,847,646.49	
Total Division 1					$1,847,646.49
DIVISION 2 - EXISTING CONDITIONS					
Miscellaneous Facility Demo	1	LS	$65,000.00	$71,500.00	
Abandon Thomas Port Booster Station	1	LS	$4,500.00	$4,950.00	
High Lift Pump and Piping Demo	1	LS	$7,500.00	$8,250.00	
Misc WTP Demo for Clearwell 1 Work	1	LS	$50,000.00	$55,000.00	
Total Division 2					$139,700.00
DIVISION 3 - CONCRETE					
CIP Concrete - Above ground CW and EQ	1710	CY	$1,250.00	$2,351,250.00	
Concrete Stoops	2	EA	$7,500.00	$16,500.00	
Insulated Precast Wall Panels (Architectural Finish) - HSP & UV	2000	SF	$45.00	$99,000.00	
Precast Roof Plank	2800	SF	$25.00	$77,000.00	
Total Division 3					$2,543,750.00
DIVISION 4 - MASONRY					
Concrete Unit Masonry - Interior Walls	350	SF	$15.00	$5,775.00	
Total Division 4					$5,775.00
DIVISION 5 - METALS					
Aluminum Guardrail Assembly	32	LF	$89.11	$3,136.67	
Aluminum Platforms & Supports	1	LS	$2,000.00	$2,200.00	
Aluminum Grating	1	LS	$40,000.00	$5,500.00	
Total Division 5					$10,836.67
DIVISION 6 - WOOD, PLASTICS AND COMPOSITES					
FRP Ladders	4	EA	$2,250.00	$9,900.00	
Total Division 7					$9,900.00
DIVISION 7 - THERMAL AND MOISTURE PROTECTION					
EPDM Roofing - WTP 1 & 2	2800	SF	$20.00	$61,600.00	
Total Division 7					$61,600.00
DIVISION 8 - Openings					
Hollow Metal Doors & Frames - Single Leaf	8	EA	$3,500.00	$30,800.00	
Hollow Metal Doors & Frames - Double Leaf	8	EA	$5,500.00	$48,400.00	
FRP Doors & Frames - Single Leaf	2	EA	$3,000.00	$6,600.00	
Roof Hatches	5	EA	$7,500.00	$41,250.00	
Aluminum Storefront Windows	53	EA	$2,500.00	$145,750.00	
Total Division 8					$272,800.00
DIVISION 9 - FINISHES					
Metal Stud/Gyp. Bd. Walls	100	SF	$20.00	$2,200.00	
Ceramic Tiling	600	SF	$25.00	$16,500.00	
Carpet Tile	100	SF	$15.00	$1,650.00	
Acoustical Ceiling Tile	1000	SF	$10.00	$11,000.00	
Misc Coatings (Pipe, Fittings, etc.)	1	LS	$40,000.00	$44,000.00	
EFIS system for new clearwell, pumping, and generator facilities	1	LS	$70,000.00	$77,000.00	
Room and Floor Painting	1	LS	$40,000.00	$44,000.00	
Total Division 9					$196,350.00
DIVISION 10 - Specialties					
Signage	1	LS	$8,000.00	$8,800.00	
Toilet Accessories	1	LS	$12,000.00	$13,200.00	
Safety Specialties	1	LS	$3,500.00	$3,850.00	
Total Division 12					$25,850.00
DIVISION 12 - Furnishings					
Window Blinds	1	LS	$50,000.00	$55,000.00	
Manufacturered Casework - Lab	1	LS	$50,000.00	$55,000.00	
Lab Hood	1	LS	$15,000.00	$16,500.00	
Total Division 12					$126,500.00
DIVISION 22 - PLUMBING					
Lab & Restroom Plumbing Updates	1	LS	$100,000.00	$110,000.00	
Total Division 22					$110,000.00
DIVISION 23 - HVAC					
HVAC	1	LS	$350,000.00	$385,000.00	
Total Division 23					$385,000.00
DIVISION 26 - ELECTRICAL					
WTP Power	1	LS	$400,000.00	$440,000.00	
WTP Controls	1	LS	$400,000.00	$440,000.00	
HSP & UV - Power	1	LS	$150,000.00	$165,000.00	
HSP & UV - Control	1	LS	$150,000.00	$165,000.00	
Generator, Transfer Switch, and Wiring Modifications	1	LS	$525,000.00	$577,500.00	

Total Division 26					$1,787,500.00
DIVISION 31 - EARTHWORK					
Site Grading	1	LS	$5,000.00	$5,500.00	
Site Restoration	1	LS	$7,500.00	$8,250.00	
Structural Excavation	8718	CY	$11.00	$105,487.80	
Structural Backfill	6164	CY	$32.00	$216,972.80	
Dewatering	1	LS	$250,000.00	$275,000.00	
Total Division 31					$611,210.60
DIVISION 33 - UTILITIES					
8" PVC Watermain Pipe and Fittings	183	LF	$70.00	$14,091.00	
12" PVC Watermain Pipe and Fittings	200	LF	$110.00	$24,200.00	
16" PVC Watermain Pipe and Fitting	125	LF	$160.00	$22,000.00	
8" Gate Valve	1	EA	$3,600.00	$3,960.00	
12" Gate Valve	3	EA	$6,900.00	$22,770.00	
16" Gate Valve	3	EA	$22,500.00	$74,250.00	
Misc. Utility Relocation	1	LS	$30,000.00	$33,000.00	
Total Division 33					$194,271.00
DIVISION 40 - PROCESS INTEGRATION					
WTP Piping Modifications	1	LS	$225,000.00	$247,500.00	
WTP No. 2 Airwash Valves and Piping	1	LS	$275,000.00	$302,500.00	
Replace WTP No. 1 & 2 Filter Function Valves & Actuators	1	LS	$1,500,000.00	$1,650,000.00	
UV Disinfection Valves & Piping	1	LS	$165,000.00	$181,500.00	
Total Division 40					$2,381,500.00
DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT					
Low Lift Pumps	3	EA	$99,800.00	$329,340.00	
Intermediate Lift Pumps	3	EA	$36,000.00	$118,800.00	
BW Pumps	2	EA	$86,800.00	$190,960.00	
High Service Pumps	3	EA	$68,600.00	$226,380.00	
Thomas Port High Service Pumps	2	EA	$68,600.00	$150,920.00	
Sludge Pump	1	EA	$36,000.00	$39,600.00	
Sed Basin Drain Pump	1	EA	$36,000.00	$39,600.00	
Rebuild Clarifier Sludge Collector - Two new flygts	1	EA	$20,000.00	$22,000.00	
Total Division 43					$1,117,600.00
DIVISION 44 - PROCESS EQUIPMENT					
Rebuild WTP No. 2 Filters and Add Airwash System	1	LS	$1,350,000.00	$1,485,000.00	
Rapid Mixers and Flocculators	10	EA	$35,000.00	$385,000.00	
Chem Feed Improvements - Containment, Dechlorination System, Etc.	1	LS	$150,000.00	$165,000.00	
UV Disinfection System	1	LS	$275,000.00	$302,500.00	
Total Division 44					$2,337,500.00
Construction Subtotal					$14,165,300.00
Contingency (Construction)					$2,124,800.00
Total Probable Construction Cost					$16,290,100.00
Legal/Admin/Miscellaneous					$244,400.00
Engineering - Design					$914,000.00
Engineering - Construction					$896,000.00
Total Probable Project Cost					**$18,345,000.00**

Appendix E

Draft Geotechnical Report

Geotechnical Evaluation

Water Treatment Plant Improvements

PORWA 161592

Port Washington, Wisconsin | February 3, 2022

SEH

Building a Better World
for All of Us®

Engineers | Architects | Planners | Scientists

Contents

Contents (continued)

List of Tables

List of Appendices

Geotechnical Evaluation

Water Treatment Plant Improvements

Prepared for Port Washington, WI

1 Introduction

This report presents the results of the geotechnical investigation for the proposed water treatment plant (WTP) improvements located at 408 North Lake Street in Port Washington, Wisconsin. Improvements will include an addition to the south end of the existing plant, repurposing of tanks, pumps, basins, other plant updates on the east side of the plant, and associated piping on the east and west sides of the building.

2 Scope of Work

The scope of services for the geotechnical investigation originally included eight (8) standard penetration test (SPT) soil borings to depths ranging from 14 ½ to 35 feet. Two piezometers were installed to monitor water tables at locations selected by SEH (Borings B-02 and B-05). Results of the subsurface investigation, analyses, evaluation, and geotechnical recommendations for the proposed improvements are included as part of the project deliverables.

Observations and recommendations are included for:

- Soil types likely to be encountered during construction,
- Groundwater conditions observed during drilling, as well as from the installed piezometer readings,
- Parameters for foundation designs including allowable bearing capacity, and equivalent fluid density for determining lateral earth pressure against structures.

3 Project Information

3.1 General

The proposed project will consist of the following improvements:

1. Low lift, intermediate pumps and backwash pumps
2. Internal WTP tank and building improvements
3. New clearwell and equalization basins
4. High lift pumps
5. Generator and electrical room spaces
6. UV disinfection facilities
7. Site and underground utilities

The 8,500 square foot addition on the south side of the WTP will be a slab-on-grade, single story reinforced concrete structure that will house a clearwell, equalization basin, generator, pump room and UV room. We assume the finished floor elevation will match that of the existing floor at approximately elevation 590 feet. Structural loads for the addition have not been provided, but we estimate that they would be less than 4 kips per lineal foot along the bearing walls. We do not anticipate any columns. Improvements to the east side of the WTP are proposed to be repurposed existing structures. A site layout is provided as part of Appendix A for further reference.

3.2 Subsurface Exploration and Laboratory Testing

SEH geotechnical staff developed the subsurface investigation scope. As described above, eight (8) soil borings were proposed. However, due to potential utility conflicts and adjacent project working area restraints, three of the borings (B-04, B-07, and B-08) were not able to be completed. Boring B-04 was originally staked in the southwest corner of the proposed equalization basin. However, at the time of drilling, an adjacent project had fenced off that location preventing access to the staked location. In addition, surrounding utilities made it impractical to relocate the boring in the vicinity of the original staked location. Borings B-07 and B-08 were staked in areas of proposed new piping on the east and west sides of the plant. However, Plant staff informed us there were potential subsurface utilities that had not been clearly identified or located in those areas. Therefore, we were directed to refrain from performing B-07 and B-08 to eliminate potential existing utility damage during the field work.

Intertek Professional Service Industries, Inc. (PSI) from Waukesha, Wisconsin, performed the field and laboratory work. PSI reviewed the soil samples and prepared draft logs, which were reviewed by SEH geotechnical staff, who assigned laboratory testing. Testing included the following:

- Sieve Analyses
- Moisture Content tests
- Atterberg Limit tests

Further information regarding the final soil boring logs and testing results are provided in the Geotechnical Data Report (GDR) in Appendix B.

4 Site Conditions

4.1 Site Soils and Groundwater Conditions

4.1.1 General Site and Soil Conditions

The WTP is located on flat terrain with Lake Michigan to the east. The south end of the site contains manicured grass and mature trees with a paved pedestrian/bike running north-south along the east side of the plant. General surface elevation at the plant is approximately elevation 590 feet.

As described in above sections, five (5) SPT borings were performed within the proposed footprint and near the proposed corners of the structure. Soils encountered in the borings consisted of sandy fill soils to depths ranging from 10 to 13 feet below the surface. Some samples retrieved from the fill encountered wood chips. Underlying soils generally consisted of stiff to hard lean clay with some exceptions. These exceptions include samples from Borings B-

01, B-05 and B-06. The following table summarizes the soils encountered in the borings and their corresponding depths. Underlying soils at these locations transition to stiff to hard clay beneath the soil referenced in the following table.

Table 1 – Summary of Soils

Soil Borings	Depth (ft)	Approximate Bottom Elev. (ft)	N value(s)	Soil Description
All Borings	0 to 13	577	varies	Fill: Moist to wet sand, gravel, some debris (wood chips)
B-05	10 1/2 to 13	580 1/2 to 578	4	Soft Organic Silt (OL)
B-01 and B-06	11 to 12 1/2	579 1/2 to 577	7 to 8	Medium Lean Clay (CL)
All Borings	13 to 33	577 to 553	15 to 50/5"	Stiff to Hard Lean Clay (CL)
B-02	33 to 35	555 1/2 to 553 1/2	50/3"	Dense Silt/Silty Sand (SM)

Groundwater was recorded during drilling and encountered in every soil boring. In order to allow groundwater levels to stabilize, temporary water level indicators (piezometers) were installed adjacent to Borings B-02 and B-05. PSI recorded water level readings 5 times following piezometer installation. The following table summarizes the results of the water levels readings.

Table 2 – Groundwater and Piezometer Readings

Soil Boring	Surface Elev. (ft)	Depth to Recorded Water (ft)	Recorded Water at time of Drilling Elev. (ft)	Maximum Elev. From Piezometer (ft)
B-01	590.7	8	582.7	na
B-02	588.4	5.5	582.9	582.4
B-03	588.0	6	582.0	na
B-05	591.1	9	582.1	583
B-06	589.8	7	582.8	na
*Piezometer only installed at B-02 and B-05 locations.				

Groundwater measurements were attempted in each borehole only during and shortly after drilling operations. Groundwater measurements in sandy soils may be indicative of the water table. In silty, clayey, or organic soils, longer duration observations within the borehole are typically necessary to obtain a more accurate measurement of the water table. Groundwater levels should be expected to fluctuate based on a variety of reasons, including season, runoff, temperature, and other factors. It is our opinion that water levels at this site will fluctuate in unison with Lake Michigan. During the time of the borings (late-October 2021) the lake elevation near Milwaukee was about 580 feet, according to NOAA data. A water level of about 582 ½ was recorded in June of 2020, which was the highest recorded level in the past 40 years.

We anticipate groundwater to be encountered during excavation for the proposed improvements.

5 Geotechnical Considerations

5.1 General

Soils vary throughout the site due to the presence of fill soils. The uniformity and stability of the fill soils at the proposed foundation elevations are variable. Based on the boring logs, the fill soils encountered do not appear to have been placed with the intent to support structural building loads. We recommend the removal of the fill and replacement with an engineered fill below the proposed construction area.

In general, excavated soils without debris, organic material, silt (defined as soils containing 80% or more silt-sized particles), or marl, may be reused as backfill outside structural foundation footprints extending downward and outward at a 1:1 slope from the foundation edge. Replacement soils beneath the proposed structures, and within this extended zone, are recommended to meet Type B Structural Backfill per WisDOT 210. All structural fill placed beneath the proposed structure are recommended to be placed in 8-inch loose lifts and compacted to 100 percent of its standard Proctor.

Based on site plans and discussions with the WTP staff, we understand existing utilities are present within the proposed area of construction. We recommend relocating all utilities outside of the structural footprint during construction.

Water levels recorded during the drilling and design phase from the piezometers indicate that the structural foundations may be near the maximum recorded groundwater during the brief observation period (approximate elevation 583 ft). In areas where the water level is near or above the elevation of the proposed foundation, we recommend preparing the bottom of the structural excavations with a minimum of 12 inches of 100 percent crushed ¾-inch rock wrapped in a Type SAS geotextile meeting requirement of WisDOT 645.

5.2 Dewatering

All foundations are recommended to be prepared in dry conditions. Based on recorded water levels, we expect dewatering will be required. We anticipate the dewatering to include either a series of wet wells or deep well placed at set intervals around the perimeter of the excavation zone. In addition, the use of sumps may be needed at the bottom of the excavation in the proposed rock pad during construction.

6 Site Preparation and Excavation

The topsoil on the site should be salvaged and reused for restoration.

Prior to the construction of new structural foundations on the south end of the building, we recommend a soil correction consisting of excavating to approximately elevation 577 to remove all fill soils and soft soils encountered in soil borings B-01, B-05 and B-06.

Excavated material is recommended to be replaced with structural backfill in maximum loose lifts of 8 inches for clayey soils and up to 12-inch lifts for sandy soil, depending on the conditions at the time of construction and compaction equipment used. Under the proposed compact soils to 100 percent of standard Proctor within the 1:1 zone extending downward of proposed foundations. We recommend maintaining a 3-foot buffer zone from the existing foundation of the south side of the building extending down and out at a 1:1 to the bottom of the proposed excavation.

Based on the information provided by the structural design team, the proposed elevation for the bottom of the structures to the south of the existing building is around 585 feet or shallower. The surface elevation is approximately elevation 590 feet. The proposed new structures include the clearwell and equalization basins, a pump room, UV room and a generator. The clearwell and equalization basin are anticipated to be constructed of concrete tanks which will hold fluctuating levels of fluids. The pump room, UV room, and generator are anticipated to be founded on strip footings and concrete pads at elevations shallower than the two proposed tanks.

After the recommended soil corrections are completed, the following parameters may be used for foundation design:

- Net allowable bearing capacity with soil correction: 3,000 pounds per square foot (psf)*
- Angle of Internal Friction (Matrix Soils): 28 degrees
- At Rest Earth Pressure Coefficient (Matrix Soils): 0.53
- Moist Unit Weight (Matrix Soils): 115 pounds per cubic foot (pcf)
- Equivalent Fluid Density Above Water Table: 61 pcf
- Equivalent Fluid Density Below Water Table: 90 pcf

* Factor of safety against shear or bearing capacity failure is 3 or greater.

Excavation depths up to 13 feet are expected to be required for foundation construction and process pipe installation. The soils are expected to be a mix of clayey, silty, and sandy soils. Based on OSHA guidelines excavation in the sandy fill soils may be individually classified as Type C soil. Slopes in Type C soil may be excavated no steeper than 1.5H:1V in accordance with OSHA guidelines.

All excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P “Excavations and Trenches”. This requires that the excavation safety is solely the responsibility of the contractor. The contractor should confirm the soil type being excavated and provide backslopes, shoring and excavation support as necessary.

7 Backfill for Structures

In general, excavated material that is considered suitable meeting USCS Classification SM, SP, SC, and CL, and does not contain debris or contaminated material may be used for backfill in areas outside the footprint of structures. In these areas, backfill can be placed in maximum 12-inch loose lifts and compacted to 95 percent of standard proctor. All backfill where soils within the footprint of a new structure to be built extending down at a 1:1 to the bottom of the excavation are recommended to be compacted at 100 percent of standard Proctor.

Place backfill evenly on all sides of structures.

7.1 Exterior Slabs and Utility Pads

Surficial soils vary greatly in material type. We recommend stripping topsoil and scarifying the upper 12 inches beneath the proposed base material and compacting to 100 percent of standard

Proctor. We recommend placing a 6-inch layer of ¾ inch dense graded aggregate base meeting WisDOT 301 and 305 and compacting to 100 percent of standard Proctor prior to placing slabs and pads.

7.2 Sidewalks

We recommend sidewalks to be placed on a minimum of 6 inches of ¾ inch dense graded aggregate base meeting WisDOT 301 and 305. The aggregate base should be compacted to 100 percent of standard proctor. Surficial soils vary greatly in material type. We recommend stripping topsoil and scarifying the upper 12 inches beneath the proposed base material and compacting to 100 percent of standard Proctor.

7.3 Entrance Stoops

It is recommended that entrance stoops be founded on shallow strip footings at a depth of 5 feet below finished grade on either the native site soils or on clean fill. Compact the fill and foundation soil to 100 percent of standard Proctor maximum dry unit weight in maximum 12-inch loose lifts.

8 Piping and Utilities

8.1 Trench Bedding

Sandy and clayey material will be encountered during trenching for piping and utilities. Conform to WisDOT 608 for trench excavation and backfilling. Generally, non-organic, debris-free, onsite material can be used for trench backfill. Silt is not acceptable to reuse for backfill.

Bed piping on minimum six inches of pipe bedding conforming to WisDOT 520.

Dewatering will be required if water is encountered. If soils remain saturated, bed pipe on a minimum of 12 inches of 100 percent ¾ inch clear crushed rock wrapped in geotextile.

8.2 Beneath Structures

Once bedding has been placed and compacted to the top of the utility pipe, it is recommended that utility trenches be backfilled with granular backfill meeting WisDOT 209 and compacted in 8-inch loose lifts, or less, to 100 percent of standard Proctor effort maximum dry unit weight.

8.3 Beneath Paved Areas

Backfill trenches with native site soils beneath driveways, parking lots, sidewalks, and other paved areas. Compact the soil in 8-inch loose lifts, or less, to at least 95 percent of standard Proctor effort maximum dry unit weight to within 3 feet of the subgrade. Within 3 feet of subgrade, compact trench backfill to at least 100 percent of standard Proctor maximum density.

8.4 All Other Areas

Backfill with native site soils to at least 90 percent of standard Proctor effort maximum dry unit weight. Compact the soils in 12-inch loose lifts, or less. In areas where turf is to be re-established maintain the upper 12 inches in a relatively loose condition, approximately compacted to 85 percent of standard Proctor effort maximum dry unit weight.

9 Pavement Subgrade Recommendations

The subgrade shall be constructed in general accordance with WisDOT 211. The subgrade soils for pavements may consist of variable material including clay, clayey sand, silty sand, and sand with silt.

After excavating to top of subgrade, we recommend scarifying, blending, and recompacting the upper 12 inches of the exposed subgrade material. Compact subgrade soils to 100 percent of standard Proctor.

10 Construction Considerations

10.1 Winter Construction

The following recommendations are provided if construction occurs during winter. Do not place concrete on frozen ground. All ice and snow should be removed from areas to receive fill. No fill should be placed on frozen ground or ground that contains snow or ice. Only unfrozen backfill should be used. No frozen materials or materials containing snow or ice should be used as fill. Utilization of material which requires on-site moisture modification(s) will be impractical and difficult to control compaction levels.

If foundation soils freeze after testing and prior to concrete placement, we recommend the soils be retested and meet project specifications prior to further construction or placing concrete.

11 Construction Safety

Construction safety is the sole responsibility of the Contractor. All excavations must comply with OSHA 29 CFR, Part 1926, Subpart P, “Excavations and Trenches”.

12 Field Observation and Testing

A geotechnical engineer or technician should observe the excavation to evaluate if the subgrade soils are consistent with the results of the soil borings. These observations should be conducted prior to placement of backfill in the excavation.

It is recommended that dry unit weight testing of the native soils and imported granular borrow be conducted prior to placement of backfill. It will be necessary to sample the material and perform a standard Proctor dry unit weight test (ASTM D 698). A minimum of three days should be allocated for sampling and testing. A minimum of three dry unit weight and moisture tests (ASTM D 2922 and D 3017) should be taken at the base of the excavation to confirm that the upper foot has been compacted to 100 percent of standard Proctor effort maximum dry unit weight.

Dry unit weight and moisture content testing of the backfill beneath the structure foundations should take place at a rate of 3 tests (or greater) per lift. Backfill around walls should be tested for dry unit weight and moisture content at a rate of one test per 500 cubic yards (compacted volume), or a minimum of three test, per material type, per structure. Test compaction of backfill utility trenches at a rate of 1 test per 300 cubic yards.

13 Basis of Recommendation

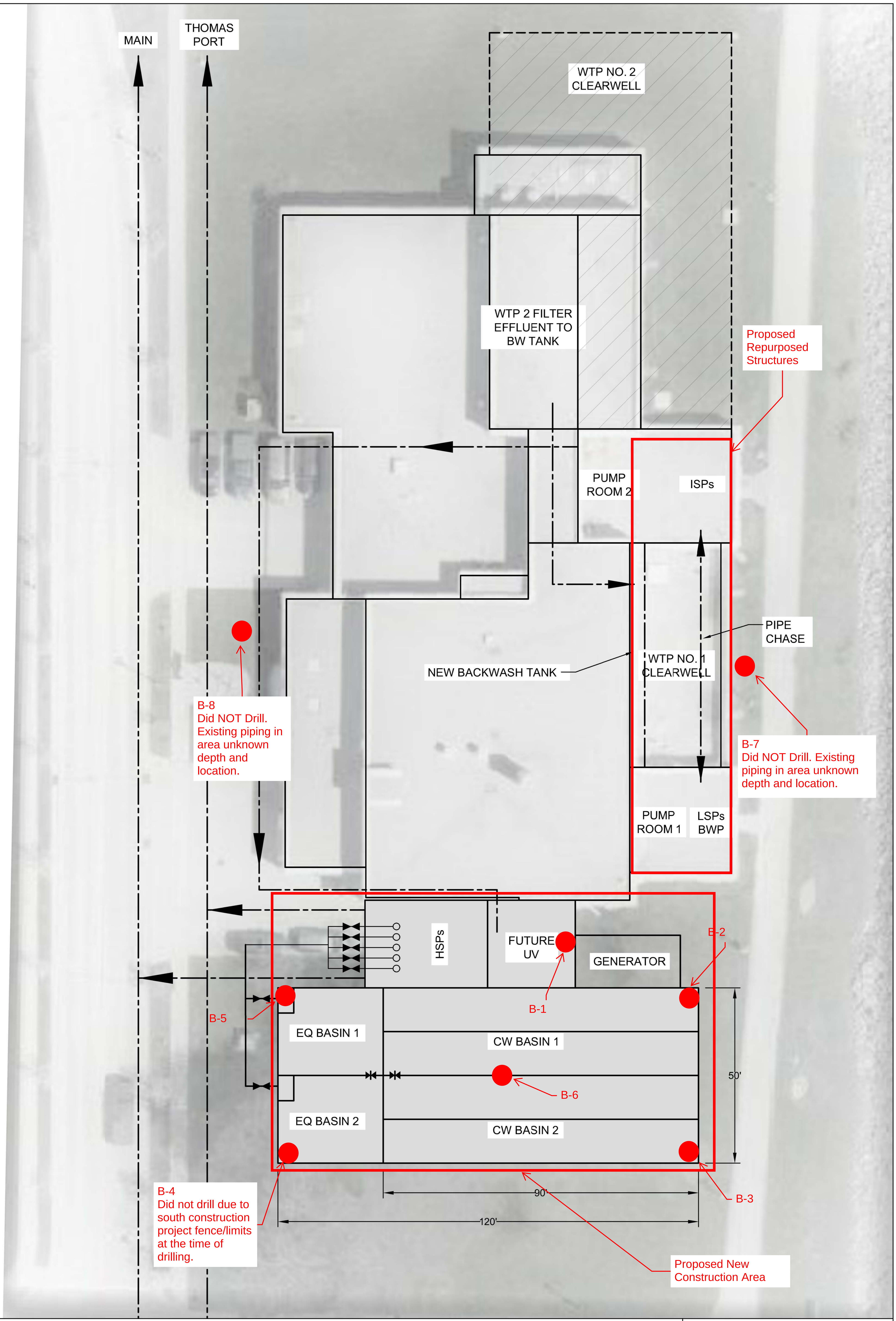
The analysis, conclusion and recommendations contained in this report are based on the data obtained from the soil borings, the locations of which are indicated in this report, and our interpretation of that data with respect to the proposed structures.

Groundwater conditions are extremely susceptible to fluctuation. The period of observation in any one borehole was relatively short and changes can be expected to occur during flooding, due to rainfall or irrigation, spring thaw, drainage and other seasonal and periodic cycles not evident when the observations were made. Designs and related construction dewatering planning should recognize the potential for groundwater level changes before, during and after construction.

This report is intended for use in preparing the plans and specifications of the WTP at the location indicated in this report. Use for any other structure or purpose is not recommended without review by a competent professional familiar with the soils at the site and implication regarding the proposed facilities.

Appendix A

Soil Boring Layout



Proposed Repurposed Structures

B-8
Did NOT Drill.
Existing piping in area unknown depth and location.

B-7
Did NOT Drill. Existing piping in area unknown depth and location.

B-4
Did not drill due to south construction project fence/limits at the time of drilling.

Proposed New Construction Area

OPTION 1
Port Washington, WI

Appendix B

Geotechnical Data Report – PSI

Professional Service Industries, Inc.
821 Corporate Court
Waukesha, WI 53189
Phone: (262) 521-2125
Fax: (262) 521-2471

December 12, 2021

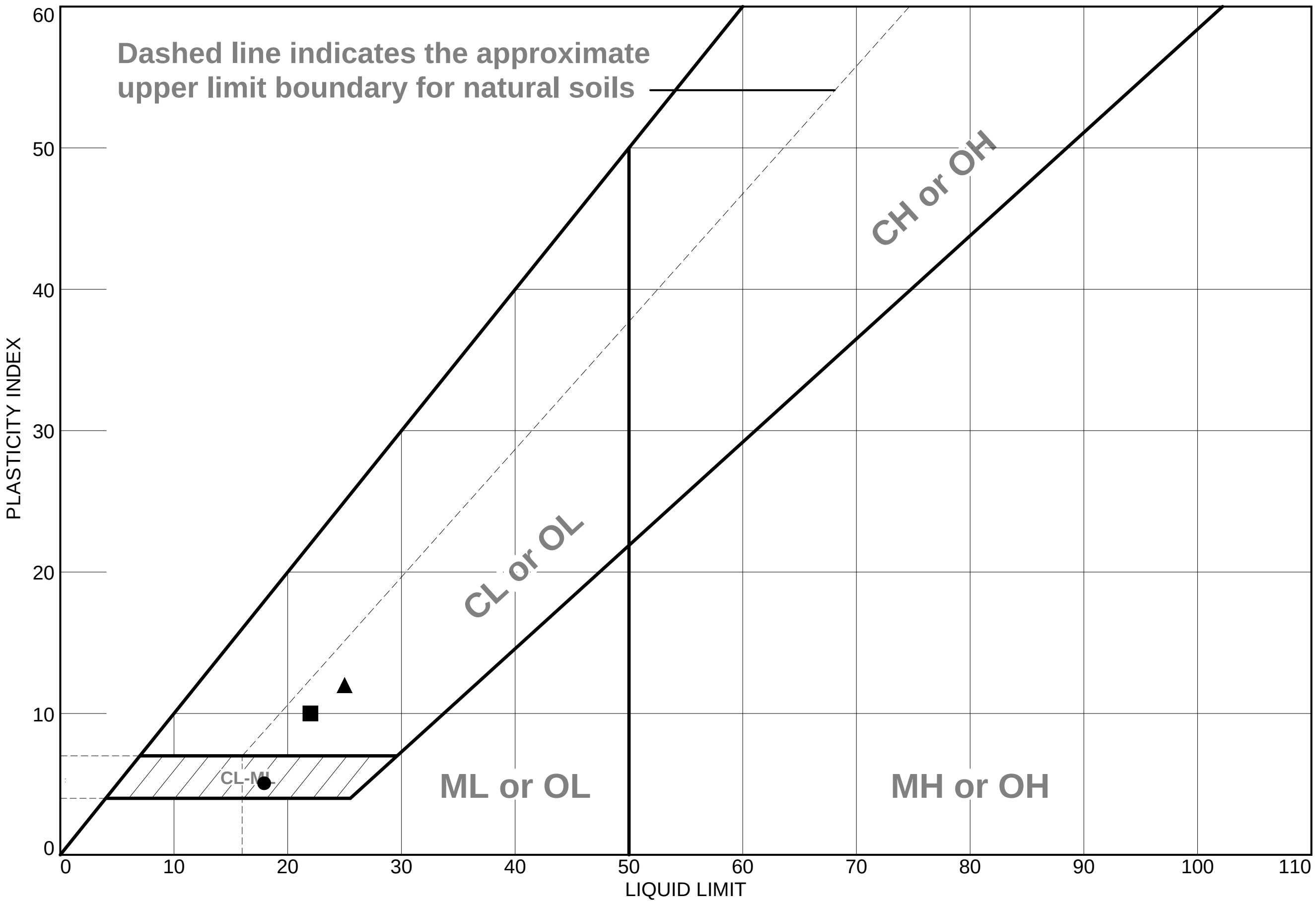
Short Elliot Hendrickson Inc.
3535 Vadnais Center Drive
Minneapolis, MN 55405

Attn: Mr. Luke Thompson, P.E.
Project Manager

Re: Geotechnical Exploration and Laboratory Services
Port Washington WTP Improvements
450 N. Lake Street
Port Washington, WI
PSI Project No.00522858

As requested, PSI’s project scope of services included drilling and sampling the subsurface materials and observing current groundwater levels within the borings, installing two piezometers to a depth 20 feet with weekly water level readings for four weeks; and laboratory testing of the subsurface materials. B-1 was drilled to a depth of 14.5 feet, and B-2, B-3, B-5, and B-6 were drilled to a depth of 35 feet. The client eliminated B-7 and B-8 due to potential utility conflict. Due to an easement issue, B-4 was also eliminated by the client. Attached are the lab test results that were assigned and a draft copy of the logs.

LIQUID AND PLASTIC LIMITS TEST REPORT



Dashed line indicates the approximate upper limit boundary for natural soils

	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Lean Clay	18	13	5			
■	Brown to Gray Lean clay, trace sand and gravel	22	12	10			
▲	Brown Lean Clay	25	13	12			

Project No. **Client:**

Project:

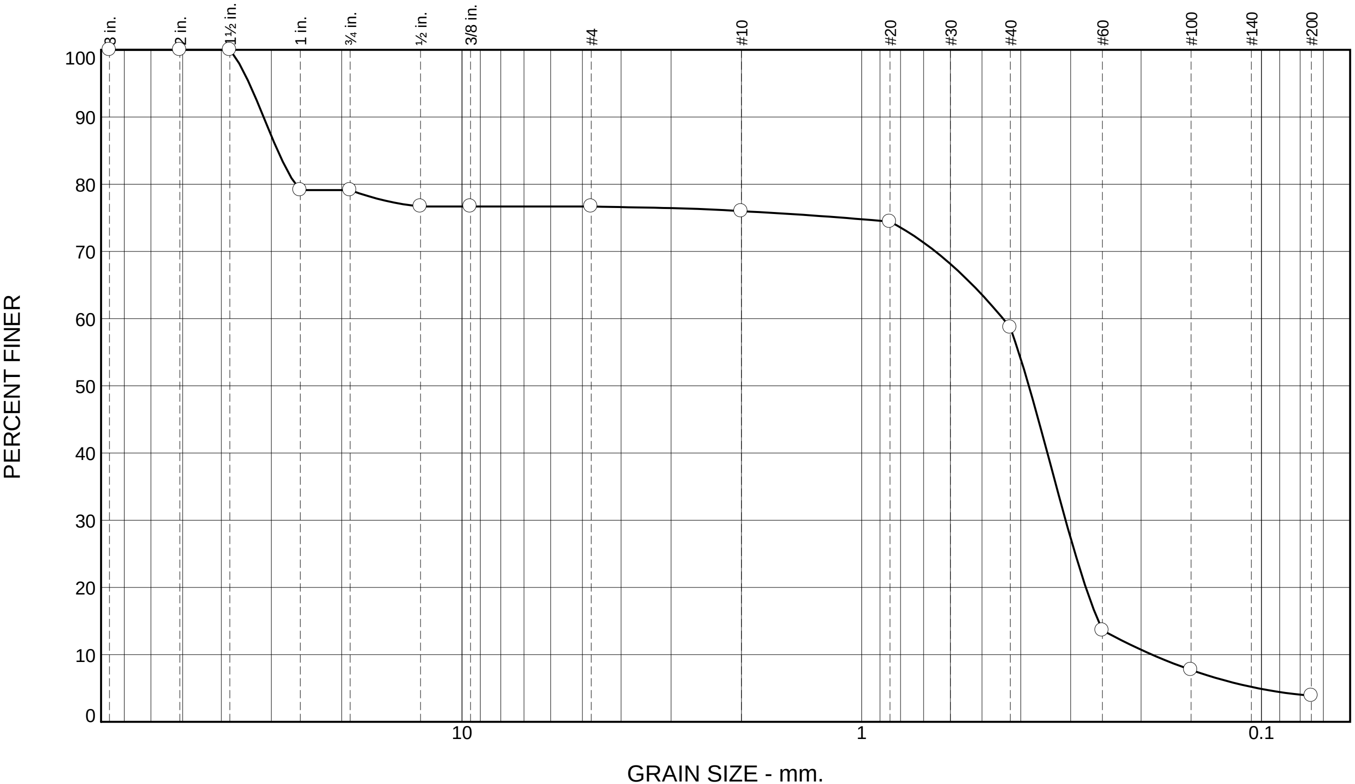
●**Location:** B-2 **Depth:** 18.5-20' **Sample Number:** 7
■**Location:** B-6 **Depth:** 11-12.5 **Sample Number:** 5
▲**Location:** B-2 **Depth:** 11.12.5 **Sample Number:** 5

Remarks:

Figure

Tested By: James King

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
0.0	20.9	2.4	0.7	17.3	54.8	3.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	79.1		
.75	79.1		
.50	76.7		
.375	76.7		
#4	76.7		
#10	76.0		
#20	74.4		
#40	58.7		
#60	13.6		
#100	7.7		
#200	3.9		

* (no specification provided)

Soil Description

Possible Fill, Brown Fine Sand, Trace Gravel, Wet

Atterberg Limits

PL= LL= NP PI= NP

Coefficients

D_{90}= 31.3655	D_{85}= 28.9210	D_{60}= 0.4432
D_{50}= 0.3819	D_{30}= 0.3090	D_{15}= 0.2560
D_{10}= 0.1879	C_u= 2.36	C_c= 1.15

Classification

USCS= SP AASHTO=

Remarks

Location: B-1
Sample Number: 4 **Depth:** 8.5'-10' **Date:**

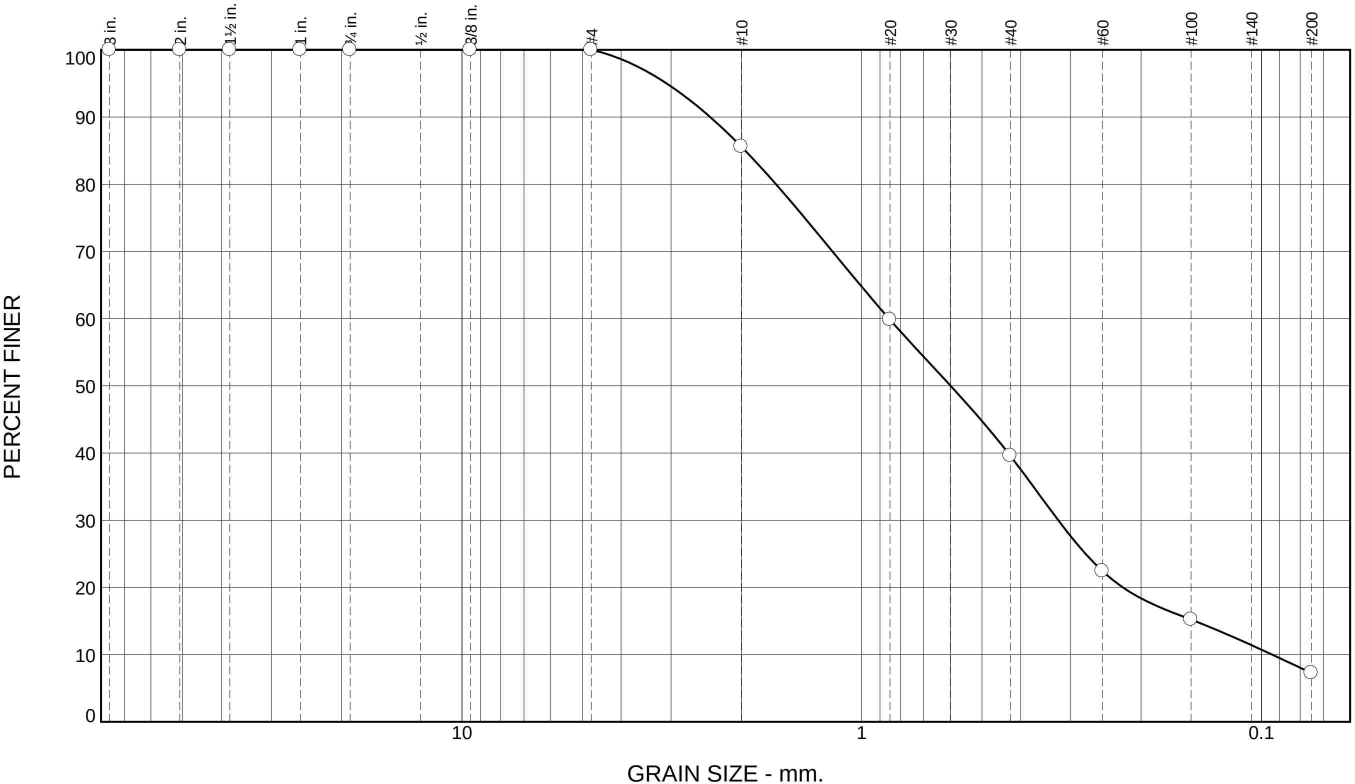
intertek psi

Client: Short Elliot Hendrickson
Project: Port Washington WTP Improvements

Project No: 00522853 **Figure**

Tested By: James King

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	14.4	46.0	32.3	7.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	85.6		
#20	59.8		
#40	39.6		
#60	22.4		
#100	15.2		
#200	7.3		

* (no specification provided)

Soil Description

Possible Fill, Brown Fine Sand and Gravel, Moist to Wet

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 2.3951 D_{85}= 1.9572 D_{60}= 0.8546
D_{50}= 0.5994 D_{30}= 0.3223 D_{15}= 0.1468
D_{10}= 0.0940 C_u= 9.09 C_c= 1.29

Classification

USCS= SW-SM AASHTO= A-1-b

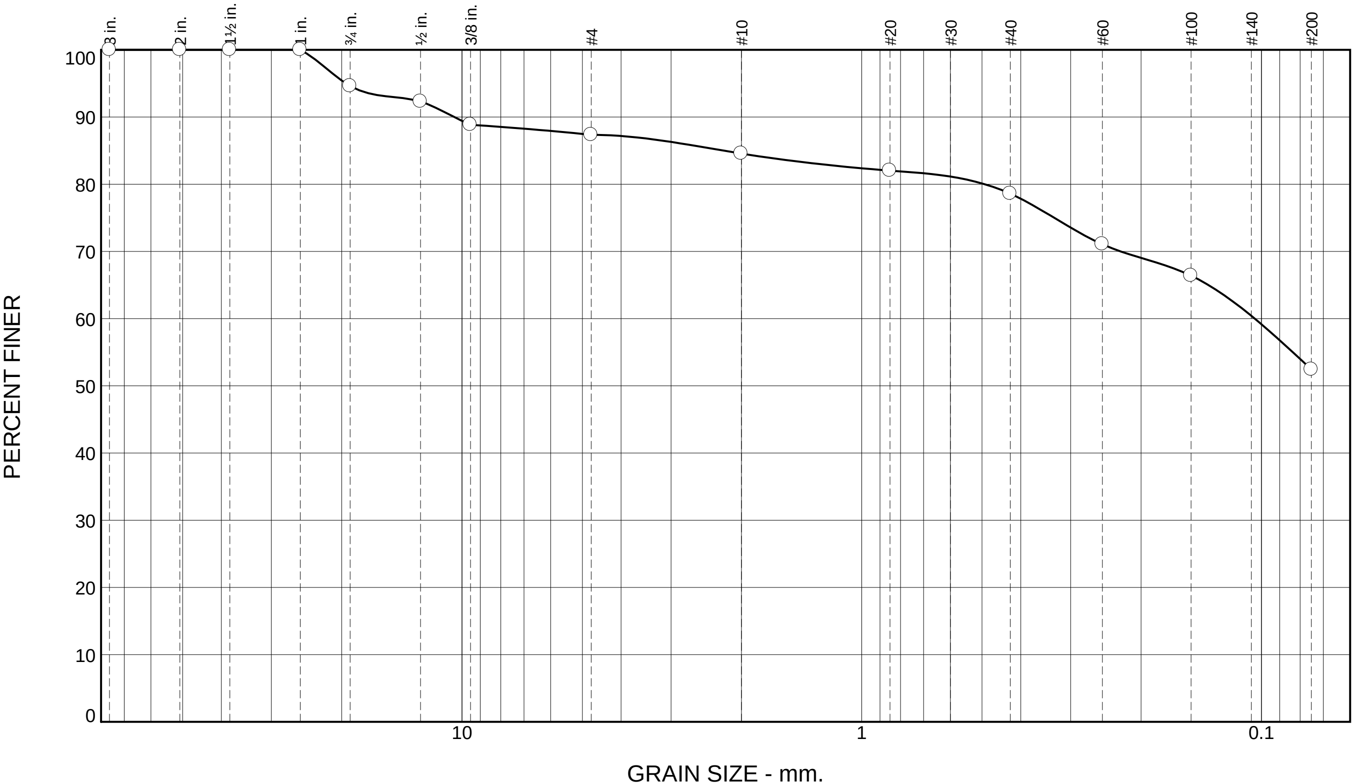
Remarks

Location: B-2
Sample Number: 2 **Depth:** 3.5'-5' **Date:** 11/25

Client: Short Elliot Hendrickson
Project: Port Washington WTP Improvements
Project No: 00522853 **Figure**

Tested By: James King

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
0.0	5.4	7.3	2.7	6.0	26.2	52.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	94.6		
1/2"	92.3		
.375	88.8		
#4	87.3		
#10	84.6		
#20	82.0		
#40	78.6		
#60	71.1		
#100	66.4		
#200	52.4		

* (no specification provided)

Soil Description

Fill, Brown Lean Clay, Trace Sand and Gravel, Moist

Atterberg Limits

PL= NV LL= NV PI= NV

Coefficients

D_{90}= 10.4642 D_{85}= 2.2192 D_{60}= 0.1040
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

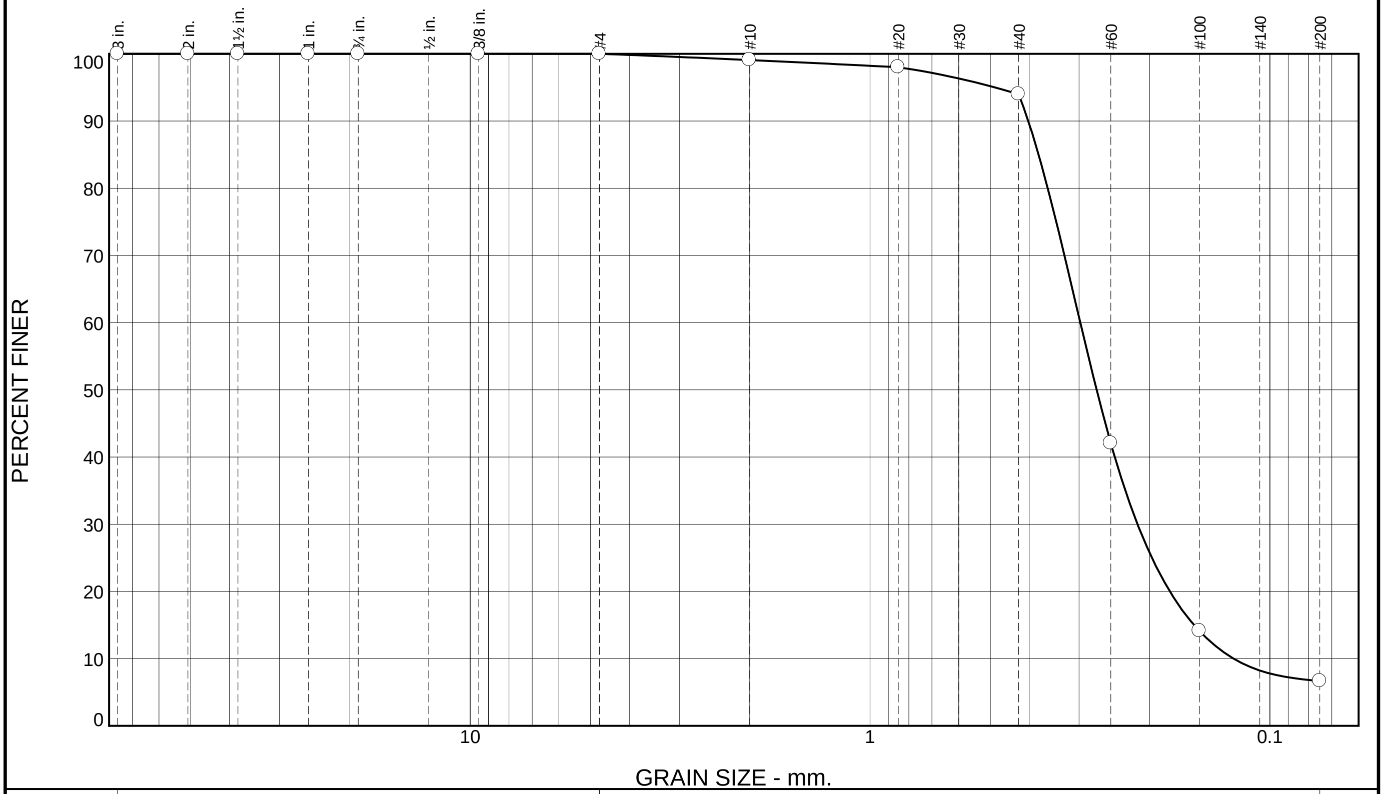
NV=No value. Attereberg testing was not done on sample

Location: B-3
Sample Number: 1 **Depth:** 1'-2.5 **Date:** 11/25/2021

Client: Short Elliot Hendrickson
Project: Port Washington WTP Improvements
Project No: 00522853 **Figure** 1

Tested By: James King

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	0.9	5.1	87.3	6.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.1		
#20	98.0		
#40	94.0		
#60	42.0		
#100	14.1		
#200	6.7		

* (no specification provided)

Soil Description

Possible Fill, Brown Sand and Gravel, Wet

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.4019 D_{85}= 0.3789 D_{60}= 0.2979
D_{50}= 0.2712 D_{30}= 0.2143 D_{15}= 0.1548
D_{10}= 0.1232 C_u= 2.42 C_c= 1.25

Classification

USCS= SP-SM AASHTO= A-3

Remarks

Location: B-3
Sample Number: 3 **Depth:** 6'-7.5' **Date:** 11/25

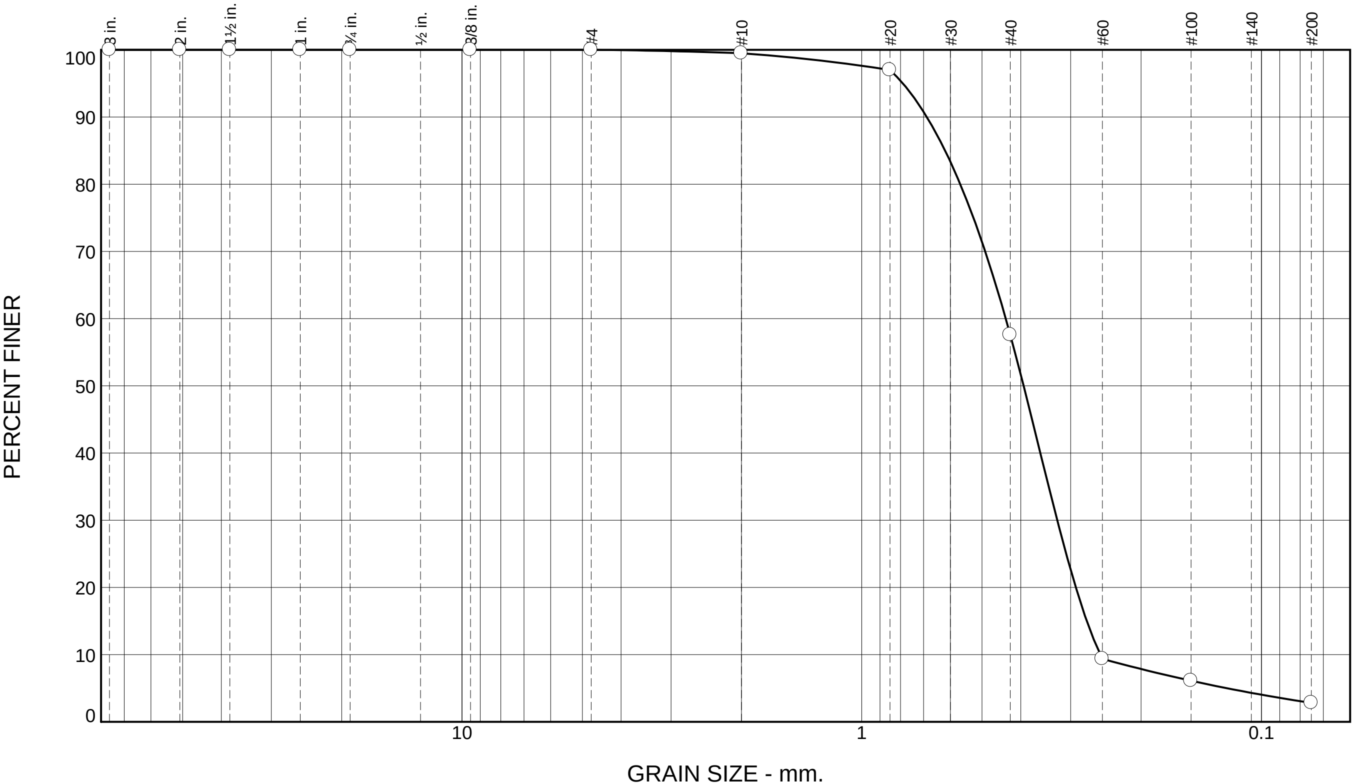
intertek psi

Client: Short Elliot Hendrickson
Project: Port Washington WTP Improvements

Project No: 00522853 **Figure**

Tested By: James King

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	0.5	41.9	54.8	2.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	99.5		
#20	97.0		
#40	57.6		
#60	9.4		
#100	6.1		
#200	2.8		

* (no specification provided)

Soil Description

Possible Fill, Brown to Dark Brown Fine Sand, Wet

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.6873 D_{85}= 0.6187 D_{60}= 0.4362
D_{50}= 0.3936 D_{30}= 0.3242 D_{15}= 0.2736
D_{10}= 0.2531 C_u= 1.72 C_c= 0.95

Classification

USCS= SP AASHTO= A-3

Remarks

Location: B-6
Sample Number: 3 **Depth:** 6-7.5 **Date:** 11/25

intertek psi

Client: Short Elliot Hendrickson
Project: Port Washington WTP Improvements

Project No: 00522853 **Figure**

Tested By: James King

BORING B-01

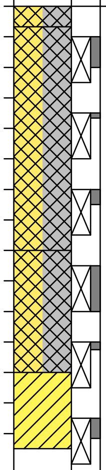
DATE STARTED: 10/21/21
DATE COMPLETED: 10/21/21
COMPLETION DEPTH 14.5 ft
BENCHMARK: N/A
ELEVATION: 590.74 ft
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS:

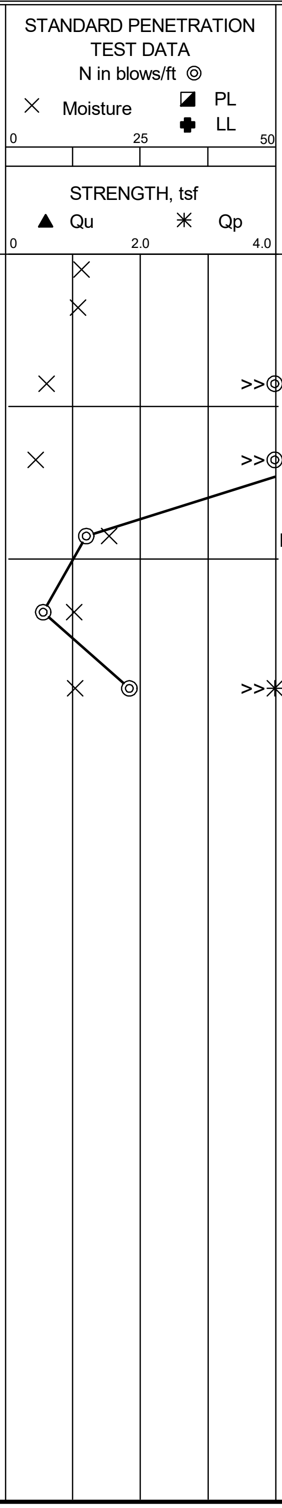
DRILL COMPANY: PSI, Inc.
DRILLER: TE **LOGGED BY:** AW
DRILL RIG: Diedrich HD D-50 ATV - Rig #419
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY:

Water		
▽	While Drilling	10 feet
▼	Upon Completion	8 feet
⊻	Delay	N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA	Additional Remarks
590	0					Topsoil Fill, Silty Clay With Sand and Gravel, Moist (8"± Thick)	FILL		14		
				1	12	Fill, Brown to Light Gray Sand and Gravel, With Wood Chips, Moist		6-6-50/4"	13		
	5			2	2		FILL	50/2"	8	>>	
585				3	6			50/6"	6	>>	
	10			4	18	Possible Fill, Brown Fine Sand, Trace Gravel, Wet	P FILL	13-9-6 N=15	19		P_{200} = 3.9%
580				5	3	Brown Lean Clay, Trace Sand, Moist	CL	3-3-4 N=7	13		
				6	8			7-8-15 N=23	13	>>	
						End of Boring at 14.5' Cave-In at 10'					





Professional Service Industries, Inc.
821 Corporate Court, Suite 100
Waukesha, WI 53189
Telephone: (262) 521-2125

PROJECT NO.: 00522858
PROJECT: Port Washington WTP Improvements
LOCATION: 450 N Lake St
Port Washington, WI

The stratification lines represent approximate boundaries. The transition may be gradual.

DATE STARTED: 10/20/21
DATE COMPLETED: 10/20/21
COMPLETION DEPTH 35.0 ft
BENCHMARK: N/A
ELEVATION: 588.42 ft
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS:

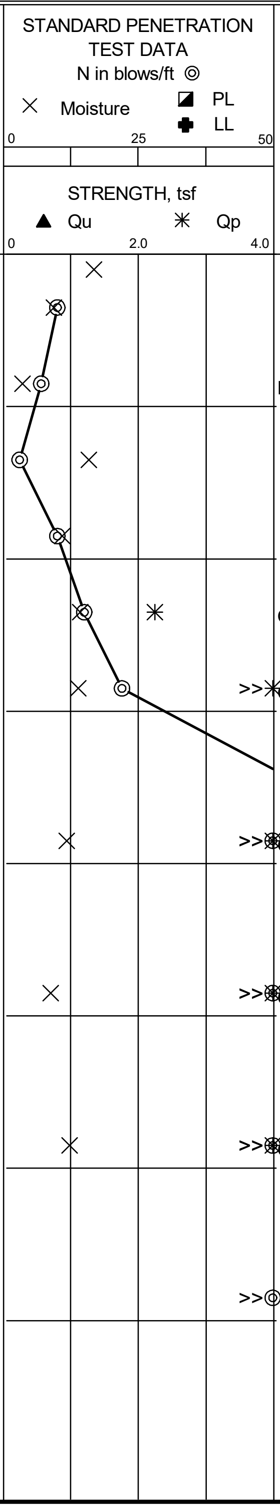
DRILL COMPANY: PSI, Inc.
DRILLER: DT **LOGGED BY:** AW
DRILL RIG: ASV D-50 ATV - Rig #420
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY:

BORING B-02

Water		
▽	While Drilling	5.5 feet
▼	Upon Completion	6 feet
▽	Delay	N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					Topsoil, Brown Silty Clay With Sand, and Fine Roots, Moist (6"± Thick)	FILL		17	
				1	12	Fill, Brown to Black Sand and Gravel, With Glass Pieces, Moist	FILL	6-6-4 N=10	9	
585	5			2	15	Possible Fill, Brown Fine Sand and Gravel, Moist to Wet		3-4-3 N=7	4	P_{200} = 7.3%
				3	7		P FILL	4-2-1 N=3	16	
580	10			4	12			3-5-5 N=10	11	
				5	12	Brown Lean Clay, Moist		5-7-8 N=15	14	Q_r = 1.5 tsf
575	15			6	17			10-11-11 N=22	14	Q_r = 4.5 tsf
570	20			7	18			22-29-46 N=75	12	Q_r = 5.6 tsf
							CL			
565	25			8	18			18-35-41 N=76	9	Q_r = 4.3 tsf
560	30			9	4			50/6"	12	Q_r = 2.7 tsf
555				10	2	Gray Silt, Very Moist	SM	50/3"		
	35					End of Boring at 35' Cave-In at 14'				



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PROJECT NO.: 00522858
PROJECT: Port Washington WTP Improvements
LOCATION: 450 N Lake St
Port Washington, WI

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-03

DATE STARTED: 10/20/21
DATE COMPLETED: 10/20/21
COMPLETION DEPTH 35.0 ft
BENCHMARK: N/A
ELEVATION: 588.01 ft
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS:

DRILL COMPANY: PSI, Inc.
DRILLER: DT **LOGGED BY:** AW
DRILL RIG: ASV D-50 ATV - Rig #420
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY: N/A
REVIEWED BY:

Water		
▽	While Drilling	6 feet
▼	Upon Completion	6 feet
▽	Delay	N/A

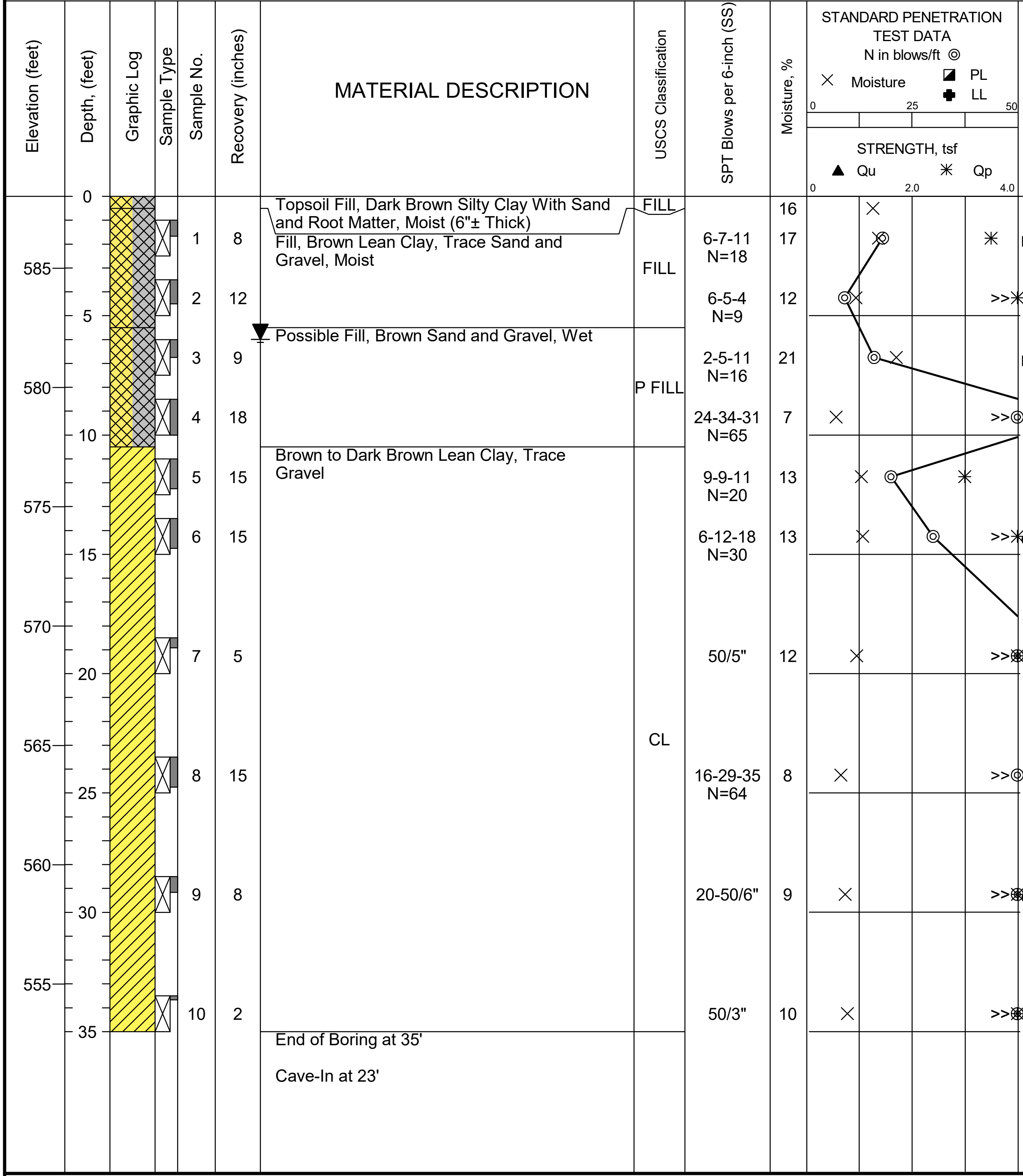
BORING LOCATION:

MATERIAL DESCRIPTION	USCS Classification
Topsoil Fill, Dark Brown Silty Clay With Sand and Root Matter, Moist (6"± Thick)	FILL
Fill, Brown Lean Clay, Trace Sand and Gravel, Moist	FILL
Possible Fill, Brown Sand and Gravel, Wet	P FILL
Brown to Dark Brown Lean Clay, Trace Gravel	CL

End of Boring at 35'

Cave-In at 23'

Sample No.	Recovery (inches)	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
			16	
1	8	6-7-11 N=18	17	P_{200} = 52.4%
2	12	6-5-4 N=9	12	
3	9	2-5-11 N=16	21	P_{200} = 6.7%
4	18	24-34-31 N=65	7	
5	15	9-9-11 N=20	13	
6	15	6-12-18 N=30	13	Q_r = 5.2 tsf
7	5	50/5"	12	
8	15	16-29-35 N=64	8	
9	8	20-50/6"	9	Q_r = 6.2 tsf
10	2	50/3"	10	



The stratification lines represent approximate boundaries. The transition may be gradual.

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PROJECT NO.: 00522858
PROJECT: Port Washington WTP Improvements
LOCATION: 450 N Lake St
Port Washington, WI

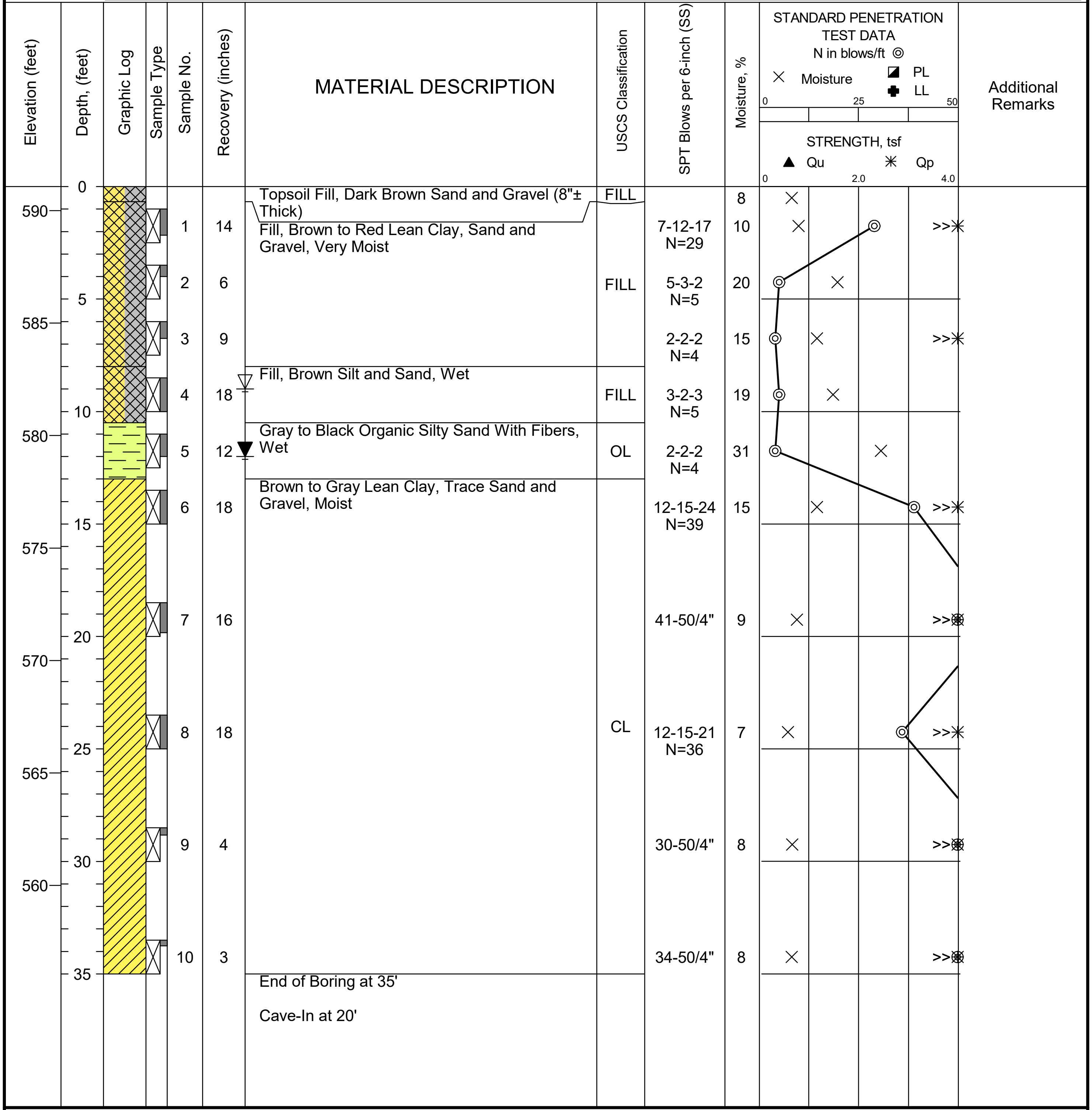
BORING B-05

DATE STARTED: 10/21/21
DATE COMPLETED: 10/21/21
COMPLETION DEPTH 35.0 ft
BENCHMARK: N/A
ELEVATION: 591.07 ft
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS:

DRILL COMPANY: PSI, Inc.
DRILLER: TE **LOGGED BY:** AW
DRILL RIG: Diedrich HD D-50 ATV - Rig #419
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY:

Water		
▽	While Drilling	9 feet
▼	Upon Completion	12 feet
▽	Delay	N/A

BORING LOCATION:



Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %
		Topsoil Fill, Dark Brown Sand and Gravel (8"± Thick)	FILL		8
1	14	Fill, Brown to Red Lean Clay, Sand and Gravel, Very Moist		7-12-17 N=29	10
2	6		FILL	5-3-2 N=5	20
3	9			2-2-2 N=4	15
4	18	Fill, Brown Silt and Sand, Wet	FILL	3-2-3 N=5	19
5	12	Gray to Black Organic Silty Sand With Fibers, Wet	OL	2-2-2 N=4	31
6	18	Brown to Gray Lean Clay, Trace Sand and Gravel, Moist		12-15-24 N=39	15
7	16			41-50/4"	9
8	18		CL	12-15-21 N=36	7
9	4			30-50/4"	8
10	3			34-50/4"	8

End of Boring at 35'

Cave-In at 20'

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821 Corporate Court, Suite 100
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PROJECT NO.: 00522858
PROJECT: Port Washington WTP Improvements
LOCATION: 450 N Lake St
Port Washington, WI

The stratification lines represent approximate boundaries. The transition may be gradual.

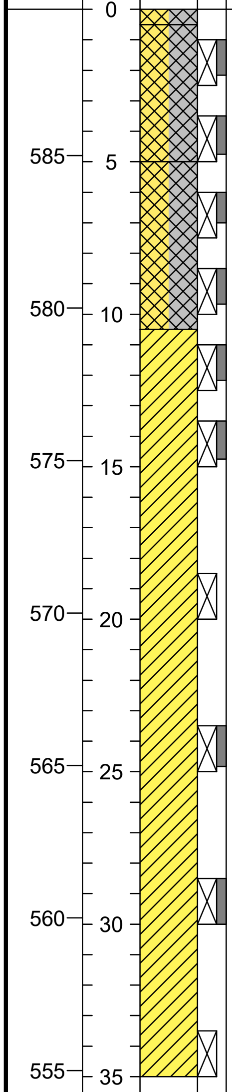
DATE STARTED: 10/21/21
DATE COMPLETED: 10/21/21
COMPLETION DEPTH 35.0 ft
BENCHMARK: N/A
ELEVATION: 589.80 ft
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS:

DRILL COMPANY: PSI, Inc.
DRILLER: TE **LOGGED BY:** AW
DRILL RIG: Diedrich HD D-50 ATV - Rig #419
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY: N/A
REVIEWED BY:

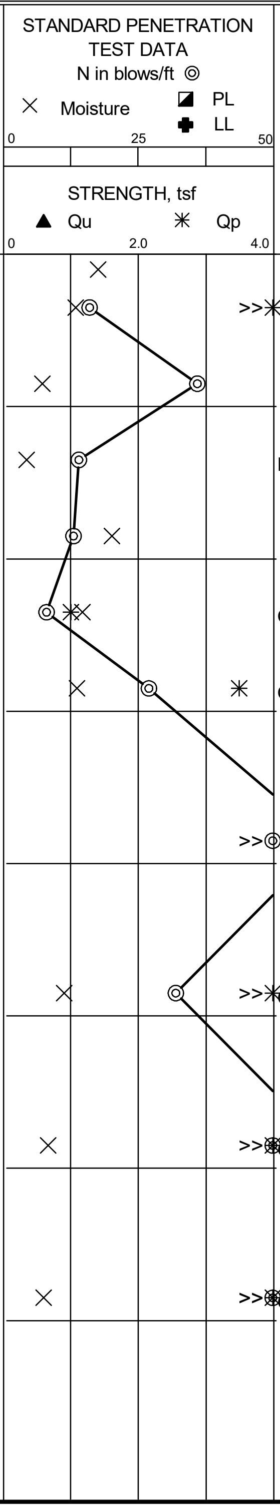
BORING B-06

Water		
▽	While Drilling	7 feet
▼	Upon Completion	Not Obsvd
▽	Delay	N/A

BORING LOCATION:



Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
		Topsoil Fill, Dark Brown Silty Sand With Fine Roots, Moist (6"± Thick)	FILL		18	
1	14	Fill, Brown to Light Gray Sand and Gravel, Wood Chips, Moist	FILL	8-8-8 N=16	13	
2	15			23-18-18 N=36	7	
3	12 ▽	Possible Fill, Brown to Dark Brown Fine Sand, Wet	P FILL	8-7-7 N=14	4	P_{200} = 2.8%
4	14			3-3-10 N=13	20	
5	14	Brown to Gray Lean Clay, Trace Sand and Gravel, Moist	CL	6-3-5 N=8	15	Q_r = 1.8 tsf
6	15			6-9-18 N=27	14	Q_r = 3.9 tsf
7						
8	16			7-15-17 N=32	11	Q_r = 5.0 tsf
9	18			32-50/5"	8	Q_r = 3.3 tsf
10				32-50/6"	7	Q_r = 9.7 tsf
		End of Boring at 35' Cave-In at 5'				



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PROJECT NO.: 00522858
PROJECT: Port Washington WTP Improvements
LOCATION: 450 N Lake St
Port Washington, WI

The stratification lines represent approximate boundaries. The transition may be gradual.

Project: Port Washington WTP Improvements

Project No: 00522858

Well	Well Depth	Water level on 10/28/2021	Water level on 11/4/2021	Water level on 11/11/2021	Water level on 11/18/2021	Water level on 11/29/2021
SB-2	13.4’	6.2’	6.6’	6.0’	7.9’	7.1’
SB-5	15.3’	8.7’	8.1’	9.2’	9.6’	9.9’

- Depths are estimated to be accurate to within about one tenth.

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Sustainable buildings, sound infrastructure, safe transportation systems, clean water, renewable energy and a balanced environment. Building a Better World for All of Us communicates a companywide commitment to act in the best interests of our clients and the world around us.

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