2018 Ports Assessment: Port of Coeymans

Pre-front End Engineering Design Report

Final Report | NYSERDA Report Number 19-04 | February 2019

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2018 Ports Assessment:
Port of Coeymans

Pre-front End Engineering Design Report

Final Report

Prepared for:

New York State Energy Research and Development Authority

Albany, NY

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Acronyms and Abbreviations

BFE	Base Flood Elevation
CM	Cubic meter
CY	Cubic Yard
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water
MSL	Mean Sea Level
MT	Metric Ton
NOAA	National Oceanic and Atmospheric Administration
OPC	Opinion of Probable Cost
OSW	Offshore Wind
Pre-FEED	Pre-front End Engineering Design
PSF	Pounds per Square Foot
RSLR	Relative Sea Level Rise
SY	Square Yard
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WEA	Wind Energy Area

Executive Summary

The Port of Coeymans Pre-front End Engineering Design (Pre-FEED) is one of a series of targeted sites for Pre-FEED prepared on behalf of New York State as a part of the 2018 Ports Study. The 2018 Ports Study builds on the Assessment of Ports and Infrastructure [1] completed in support of the New York State Offshore Wind Master Plan [2]. The objective of the 2018 study is to identify facilities with greatest feasibility for offshore wind use and develop concept designs of those facilities in order to illustrate their potential, while also developing a deeper understanding of activities, schedule, and costs required to develop each facility. The Port of Coeymans is one of the facilities selected by NYSERDA, inclusive of significant stakeholder input, for Pre-FEED.

The Port of Coeymans Pre-FEED is based on a combination of site characterization information provided by the terminal operator, publicly available information, and an exploratory geotechnical investigation program completed for NYSERDA. It should be noted that there may be some scope of offshore wind operations that would require less infrastructure development than what is outlined in this Pre-FEED.

The Port of Coeymans site is located along the west bank of the Hudson River in Coeymans, NY, north of the Mid-Hudson Bridge. The Port of Coeymans, which is a privately owned and operated marine terminal, is a subsidiary of Carver Companies. The Port of Coeymans recently supported construction of the New NY Bridge (Tappan Zee Bridge) Project and the PSEG Sewaren Heat Recovery Steam Generator (HRSG) unit.

A significant portion of the Port of Coeymans is developed; it consists of multiple laydown areas, a berth capable of accommodating vessels up to 228.5 m (750 ft.) in length, and a barge slip. The northern portion of the site varies significantly in elevation; and the northwestern corner is currently used for storage and scrap material (on level land). The northeastern corner (waterfront area) is largely undeveloped due to the existing topography of the land.

The Port of Coeymans is located adjacent to the Coeymans Industrial Park (CIP), also owned by Carver Companies. CIP provides space for various businesses and includes areas for warehousing, office spaces, and outdoor storage yards. The Port of Coeymans is optimistic for offshore wind projects in North America and currently seeking business opportunities for long- and short-term uses of the facility.

Carver Companies expressed interest in potentially devoting a significant portion of the Port of Coeymans for offshore wind use. The Port of Coeymans proposed three distinct offshore (OSW) zones:

- OSW Zone 1, which is investigated by this Pre-FEED, is to be located at elevation +4.0 m (13.13 ft.) NAVD88 in order to match existing elevation at the waterfront, is approximately 8.2 hectares (20 acres), encompassing waterfront area within the northern portion of the site.
- OSW Zone 1a is an existing area currently located at +3.5 m (11.48 ft.) to +6 m (19.68 ft.) NAVD88 and may be available intermittently; it is approximately 1.7 hectares (4 acres), encompassing waterfront area at the south end of the site (south of barge slip).

- OSW Zone 2, which is an existing area further investigated by this Pre-FEED, is to be located at elevation +40 m (131.23 ft.) NAVD88 to match existing elevation, is approximately 5 hectares (12 acres), encompassing upland area within the northern portion of the site.

The other areas at the Port of Coeymans are intended to continue to service existing clients and may be available intermittently to support offshore wind.

The site may potentially support manufacturing and fabrication activities; for example, this may include manufacturing of nacelles, towers, or blades, foundation fabrication, or substation fabrication activities. The Port of Coeymans is an active marine terminal. However, infrastructure improvement and/or rehabilitation may be required in order to support certain scopes of offshore wind operations. The Port of Coeymans Pre-FEED is based on general preparation activities intended to facilitate a range of staging and installation, foundation fabrication, and substation fabrication activities. Additional offshore wind related uses beyond those identified are possible at the Port of Coeymans, but the Pre-FEED is focused on those uses most commonly identified by supply chain and stakeholder input. The scope and associated cost and schedule are subject to refinement depending upon the ultimate use of the facility, as well as future stages of design. The Pre-FEEDs are intended to be conservative, yet realistic to address the needs of the supply chain. Potential port developers should use the information and estimates in this report as it is relevant to their specific infrastructure needs. The following site development activities were identified, quantified, and incorporated into the Opinion of Probable Cost (OPC):

- Clearing and grubbing the unmaintained areas within OSW Zone 1 (0.9 hectares or 2.3 acres).
- Constructing a heavy load wharf with 30 MT/m² (6,000 PSF) of live load capacity. The wharf is pile-supported and 200 m (660 ft.) length and 35 m (115 ft.) width.
- Excavating and grading (including hauling and placing material) the site to the design level surface elevations. This activity is applicable to the portion of OSW Zone 1 that is not already developed, OSW Zone 2, and the area in between these two zones. Grading these areas results in a gross cut volume is approximately 423,970 m³ (554,538 CY) and a gross fill volume of approximately 124,850 m³ (163,300 CY).
- Constructing a 500 m (1,640 ft.) long retaining wall at the westerly and northerly extents of OSW Zone 1 that will tie into the site's existing slopes.
- Procuring and installing 40,870 m³ (53,460 CY) of crushed stone to cover 4.4 hectares (11 acres) of surface of OSW Zone 1.
- Dredging 185,400 m³ (242,490 CY) of sediment from the berth area.

The OPC to develop the Port of Coeymans site yields a total projected construction cost of $149 million (2018-dollar value). The OPC includes both a $115 million estimate of primary activities, and a 30% design and construction contingency of $34 million due to the Pre-FEED level of the design.

The Port of Coeymans is air draft restricted by the Mid-Hudson Bridge, having a clearance of 40.8 m (134 ft.) MHHW and water depth restricted by the authorized depth of the Hudson River Federal Channel at -9.8 m (-32 ft.) MLLW. The air and water drafts may potentially affect the vessels calling at

the facility and the ability to transport some components in a vertical mode. Some components may need to be transported horizontally due to the air draft restriction.

The offshore wind industry in New York is poised for rapid expansion. In his 2019 State of the State Address, Governor Andrew M. Cuomo announced an expansion of the State's Clean Energy Standard from 50% to 70% renewable electricity by 2030. As part of that announcement, New York also increased its commitment to offshore wind from 2,400 MW by 2030 to 9,000 MW by 2035. Achieving this goal will require thoughtful planning, design, and construction of highly capable, modern, and dedicated port facilities. The Port of Coeymans site presents an opportunity to develop such an offshore wind port facility. Developing the Port of Coeymans would provide an enormous benefit to the offshore wind industry by delivering a dedicated port facility, which will be critical for the supply chain while creating new and local jobs in Upstate New York.

1 Introduction

The Port of Coeymans Pre-front End Engineering Design (Pre-FEED) is one of a collection of targeted sites taken from the 2018 Ports Study specifically selected for Pre-FEED prepared on behalf of New York State. The 2018 Ports Study builds upon the Assessment of Ports and Infrastructure [1] completed in support of the New York State Offshore Wind Master Plan [2].

The objective of the 2018 study is to identify the facilities with the greatest feasibility for offshore wind use and develop Pre-FEED designs of those facilities to illustrate their potential, while also developing a further understanding of the activities, schedules, and costs necessary to develop each facility. The Port of Coeymans is one of the facilities selected by NYSERDA, inclusive of significant stakeholder input, for Pre-FEED.

The offshore wind industry in New York is poised for rapid expansion. In his 2019 State of the State Address, Governor Andrew M. Cuomo announced an expansion of the State's Clean Energy Standard from 50% to 70% renewable electricity by 2030. As part of that announcement, New York also increased its commitment to offshore wind from 2,400 MW by 2030 to 9,000 MW by 2035. Achieving this goal will require thoughtful planning, design, and construction of highly capable, modern, and dedicated port facilities. The Port of Coeymans site presents an opportunity to develop such an offshore wind port facility. Developing the Port of Coeymans would provide an enormous benefit to the offshore wind industry by delivering a dedicated port facility, which will be critical for the supply chain while creating new and local jobs in Upstate New York.

1.1 Site Description

The Port of Coeymans is a waterfront facility located along the west bank of the Hudson River in Coeymans, NY, north of the Mid-Hudson Bridge. Carver Companies owns and operates several facilities, including the Port of Coeymans, as well as Coeymans Industrial Park (CIP), an adjacent property to the west of Port of Coeymans comprised of multiple warehouses, office spaces, outdoor storage yards, and ancillary support businesses. Carver Companies stated intentions to acquire an additional approximately 162 hectares (400 acres) of land north of CIP. A vicinity map and facility map are shown in Figure 1 and Figure 2.

Figure 1. Port of Coeymans Vicinity Map

Source: satellite imagery by Google. County boundaries by New York State.

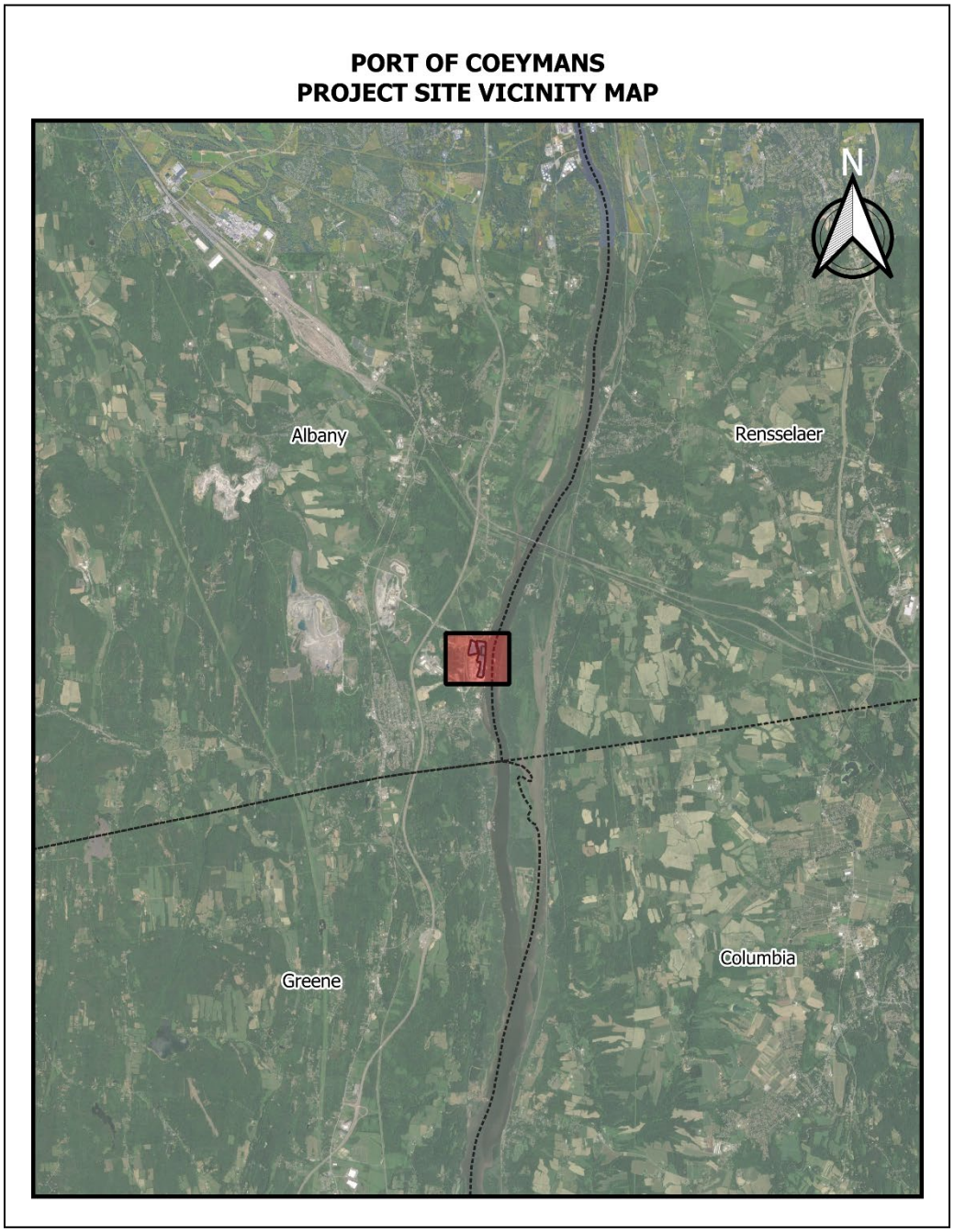
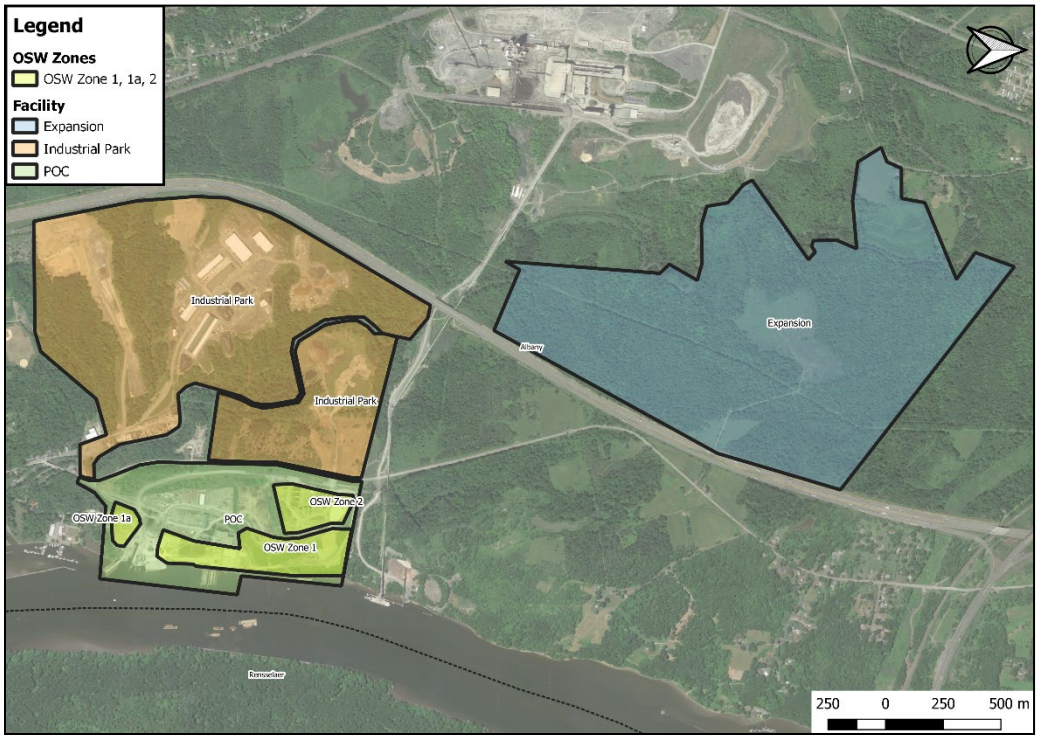


Figure 2. Port of Coeymans Facility Map

Source: satellite imagery by Google. County boundaries by New York State.



A significant portion of the Port of Coeymans site is developed, with the southern half of the waterfront area ready for heavy construction in its existing form; this area consists of a relatively level, heavy load rating laydown area, a berth capable of accommodating vessels up to 228.5 m (750 ft.) in length, and a barge slip. This area is used by ongoing operations and is not included in the area under investigation for offshore wind use. The northern portion of the site varies significantly in elevation, with level land at high elevations currently being used for storage and scrap material. Waterfront area within the northern half of the site is underutilized due to lack of level land. The site is intended to continue several existing operations within the southern half of the site, while dedicating specific portions, or zones, to offshore wind operations on a full-time or part time basis.

The Port of Coeymans proposes to have three offshore wind (OSW) zones: OSW Zone 1 encompassing waterfront area within the northern portion of the site; OSW Zone 1a encompassing waterfront area at the south end of the site (heavy load rating area south of barge slip); and OSW Zone 2 encompassing upland area within the northern portion of the site (see Figure 3). It should be noted that OSW Zones 1 and 2 were the primary areas investigated for the Pre-FEED. Both Zone 1A and the southern portion of Zone 1 are already developed. OSW Zone 1A is expected to be available for offshore wind use intermittently when not in use for other activities. The total platform area expected to be potentially available for offshore wind (OSW Zones 1 and 2) is approximately 13.2 hectares (33 acres).

Figure 3. OSW Zone Map

Source: USGS

1.2 Potential Use

Offshore wind requires the support of several different types of port facilities, ranging from fabrication to transport to operations and maintenance facilities. The Port of Coeymans is potentially capable of serving multiple purposes over the lifetime of one or multiple offshore wind farms. The NYSERDA 2018 Pre-FEED concept for Port of Coeymans is based upon general preparation activities, with the intention of being able to facilitate multiple potential uses. Accordingly, some aspects of the Pre-FEED may be overdesigned for some uses, while other aspects may be under designed, depending on the ultimate functionality and use of the facility. In general, the Pre-FEED is intended to facilitate a broad range of component manufacturing, foundation fabrication and substation fabrication activities. Within these scenarios, activities at the terminal may include the following:

- Receive sub-components (e.g., Steel sections, electrical modules, fabricated subcomponents) and raw materials (aggregate, cement), etc.
- Fabricate concrete and/or steel foundations
- Fabricate offshore electrical substations
- Provide laydown area and ancillary support to a manufacturing or fabrication contractor to handle subcomponents
- Apply protective coating and paints to fabricated components
- Prepare and load out components for transportation either to a secondary staging and installation site or directly to the offshore site

The activities identified here are an example of potential uses of the Port of Coeymans. Additional offshore wind related uses beyond those identified are certainly possible at the Port of Coeymans, but the Pre-FEED focus was on most appropriate uses while taking into consideration supply chain and stakeholder input and ideas.

The Port of Coeymans is air draft restricted by the Mid-Hudson Bridge, having a clearance of 40.8 m (134 ft.) MHW. This restriction can be addressed with accommodating vessels and is not anticipated to significantly impact the potential use of the Port of Coeymans.

1.3 Operational Characteristics

General facility characteristics were observed and published in the 2017 Ports Assessment. Leveraging that previous work, NYSERDA solicited feedback from industry seeking to confirm or update general characteristics for the facilities that will be used to support New York's offshore wind goals. Based on consolidated industry responses, the Pre-FEED seeks to provide the following:

- One berth area with a length of 200 m (660 ft.), dedicated to load in and load out. It should be noted that the site has an operational heavy load wharf along the southern portion of the site (north of the barge slip) that may also be used for offshore wind operations when not in use for other activities.
- Live load capacity of 30 MT/m² (6,000 PSF) of uniform distributed live load at the wharf and a staging area behind the wharf. The load rating is intended to allow for unrestricted movement of large crawler cranes and self-propelled modular trailers, as well as staging of components.
- Live load capacity of 15 MT/m² (3,000 PSF) of uniform distributed live load within the staging areas of the site. The load rating is intended to allow for movement of self-propelled modular trailers and component manufacturing or fabrication.
- A maximized area available for component laydown.

It should be noted that stakeholder input and responses varied widely depending on the particular stakeholder's role or interest. Some stakeholders had more comprehensive requirements while other stakeholder requirements were less significant. The Pre-FEED design is intended to cover conservative, yet realistic needs of the industry, through New York's 2030 timeframe and beyond. Potential port developers should use the information and estimates in this report as it is relevant to their specific infrastructure needs.

1.4 Site Characteristics

Table 1. Port of Coeymans Site Characteristics

Location	Address: 2170 River Rd, Coeymans, NY 12045 Latitude:42°28'53" N Longitude: 73°47'18" W
Owner	Carver Companies, Port of Coeymans: (518) 756-2164 http://portofcoeymans.com/about-us/
Significant Tenants	Same as the Owner
Distance to Wind Energy Areas (WEAs), approximate water route lengths calculated using the GRS 1980 ellipsoid	Hudson North Area: 349.2 km (217 mi) Hudson South Area: 342.8 km (213 mi) Fairways North Area: 405.6 km (252 mi) Fairways South Area: 360.5 km (224 mi) Deepwater Wind South Fork Windfarm: 490.8 km (305 mi) Equinor Empire Wind Offshore Wind Farm: 297.7 km (185 mi)
Area	Facility Total (Port of Coeymans and CIP): 161.9 hectares (400 acres) Upland Area (above MHHW) included in Pre-FEED (OSW Zones 1 and 2): 9.4 hectares (23 acres) Area below MHHW included in Pre-FEED: 2.4 hectares (6 acres)
Water Frontage	Along OSW Zone 1: 770 m (2,520 ft.)
Primary Wharf Length(s)	1 x 200 m (660 ft.) @ 30 MT/m² (6,000 PSF), along north shoreline of site
Wharf & Storage Area Live Load Capacity	30 MT/m² (6,000 PSF) in staging/pre-assembly areas 15 MT/m² (3,000 PSF) in storage areas
Navigable Depth	9.8 m (32 ft.) MLLW federally authorized for Hudson River Channel
Limiting Air Draft Restrictions (from facility to unrestricted offshore area)	Mid-Hudson Bridge: 40.8 m or 134 ft.
Intermodal Connections	Adjacent to Interstate I-87 1.0 km (0.6 miles) to railway connection
Surrounding Land Use	Undeveloped

2 Design Basis

The Pre-FEED Design Basis for Port of Coeymans is found in Appendix A of this Design Report.

3 Pre-front End Engineering Design

The Port of Coeymans Pre-FEED is an indicative design, with facility characteristics compiled and consolidated from industry input and tailored to best suit the site. The Pre-FEED is intended to provide a uniform and level use area with appropriate capacity live load rating, as well as a heavy load wharf to support offshore wind components. The slope under the wharf will be supported and protected from wave action and scour by a bulkhead-revetment system.

Due to the variation in elevation and lack of waterfront infrastructure within the zones envisioned for offshore wind, the Port of Coeymans expressed interest in infrastructure improvements at the facility. Key site improvement and major infrastructure items investigated for the Pre-FEED include the following:

- Clear and grub unmaintained areas within OSW Zone 1.
- Install one 30 MT/m² (6,000 PSF) heavy load quay 200 m (660 ft.) long and 20 m (65 ft.) in width along the northeastern shoreline.
- Grade existing site's waterfront area (OSW Zone 1) and upland area (OSW Zone 2), as well as the portion of land in between these zones.
- Install a retaining wall between at the westerly and northerly extents of OSW Zone 1 that will tie into the site's existing slopes to remain.
- Improve the ground-bearing capacity across the waterfront portion of the site by placing crushed rock above existing grade with a thickness of 1.0 m (3.3 ft.) in the 15 MT/m² (3,000 PSF) areas, and 1.2 m (4 ft.) in the 30 MT/m² areas. The crushed rock also provides the working surface treatment, so no additional surface treatment is required. Since OSW Zone 2 is currently being used for heavy construction activities, it is assumed that bearing capacity improvements in this area are unnecessary.
- Dredged berth area to allow safe vessel access to the site.

These items are described in further detail and incorporated into the OPC in Section 5.

3.1 Clearing and Grubbing

Demolition is not anticipated at the site, the Pre-FEED avoids use of areas containing existing infrastructure (buildings, etc.). Portions of OSW Zone 1 currently consists of some vegetation, including trees and bushes ranging in size. Clearing and grubbing of this area (approximately 0.9 hectares or 2.3 acres) is anticipated for the Pre-FEED.

3.2 Marine Structures

A heavy load wharf for loading and unloading OSW components from vessels is the key marine structure included in the Port of Coeymans Pre-FEED. Additional structures are necessary to support and protect

the wharf, as detailed in the following sections. A plan view identifying the location and extent of marine structures is seen in Pre-FEED Drawing S-01.

30 MT/m² Wharf

One continuous heavy load wharf, with a 200 m (660 ft.) length to accommodate one design vessel, is included in the Port of Coeymans Pre-FEED. The wharf was designed to support 30 MT/m² (~6,000 PSF) live load. A steel sheet pile bulkhead, in conjunction with the wharf, is included in the design to function as a cut-off wall.

The wharf platform consists of a heavily reinforced concrete slab supported by steel pipe piles. Piles are spaced every 3.2 m (10.5 ft.) on center longitudinally and every 3.65 m (12 ft.) on center laterally. A rock anchor at the end of each pile is proposed as foundation underpinning due to the anticipated existence of shallow bed-rock at the wharf. Batter piles are included to ensure lateral stability. A cutoff wall is provided approximately 20 m (65 ft.) landward from the offshore face of the wharf. The cutoff wall effectively decreases the necessary width of pile-supported wharf and will extend beyond the wharf by approximately 43 m (141 ft.) to the north and 60 m (197 ft.) to the south in order to stabilize the shoreline in parallel with the extents of dredging. A cross-section of the heavy load wharf that identifies its extents, as well as its components' (piles, concrete deck, etc.) sizing, elevations, and location can be seen in Pre-FEED Drawing S-02.

Mooring hardware and fendering systems were not designed within the Pre-FEED; however, for the purposes of the indicative Opinion of Cost, 100-ton mooring bollards and a continuous fender system with a rubber cell and steel panel are included along the face of the heavy load wharf. Both systems are assumed to be installed every 20 m (65 ft.) on center.

A stone revetment beneath the wharf (200 m or 660 ft.) is included in the Pre-FEED. The revetment will stabilize the slope under the wharf and protect from scour. The revetment consists of two layers of primary stone on top of an underlayer; at the base of the revetment, an embedded toe design was incorporated to prevent scour. Revetment elevations, stone sizing, layer thickness, and toe design can be seen in Pre-FEED Drawing S-02.

Rip rap stone along the shoreline north and south of the wharf (for shoreline in which rip rap does not already exist) is also included in the Pre-FEED to protect the natural shoreline from scour. This rip rap slope will start at the platform elevation (+4.0 m or 13.1 ft. NAVD88) and extend until it reaches the existing shoreline slope. For details, see Pre-FEED Drawing S-03.

As mentioned previously, the site has an operational heavy load wharf along the southern portion of the site (north of the barge slip) that may be used intermittently for offshore wind operations when not in use for other activities.

3.3 Upland Structures

Retaining Wall

A retaining wall is proposed between the northern portion of OSW Zone 1 and OSW Zone 2. The Pre-FEED retaining wall design is a soldier pile wall, with W-section soldier piles, three levels of tension anchors, and reinforced composite lumber lagging. Soldier piles are driven to refusal. The anchors are installed at 45 degrees and anchor the outside face of the wall to the bedrock. Lagging and anchors are installed progressively, as excavation proceeds from the outside of the wall. A plan and cross-section of the retaining wall that identifies its extents, as well as its components' (piles, anchors, etc.) sizing, elevations, and location can be seen in Pre-FEED Drawing S-03.

3.4 Earthwork and Ground Improvement

Design Platform Elevation

As discussed in the Design Basis (Appendix A), Port of Coeymans has two design deck elevations. The design deck elevation for OSW Zone 1 matches the existing elevation of the portion of the site that is developed (and in-use currently), at approximately 4.00 m (13.12 ft.) NAVD88. The design deck elevation for OSW Zone 2 was chosen to match the approximate existing average elevation in this area, 40.00 m (131.23 ft.) NAVD88, in order to reduce cut/fill operations.

Grading

Grading the site is necessary to meet the site's design elevations. The southern portion of OSW Zone 1 is developed and currently being used for heavy construction in its existing condition; therefore, this area is not considered within this Pre-FEED. The northern portion of OSW Zone 1 varies significantly in elevation and requires excavation and grading to provide greater laydown area and a level surface adjacent to the heavy load wharf. Although OSW Zone 2 is also already developed and used for heavy construction, elevations in this area vary, requiring grading. The land in between OSW Zones 1 and 2 currently consists of a roadway and average slopes ranging between approximately 1V:3H and 1V:4H. Grading of this area is also included in the Pre-FEED to ensure a mild slope (1V:4H) in this area. By creating this slope, a less robust retaining wall design is required, resulting in cost savings.

A layer of crushed stone, which functions as both bearing capacity improvement and surface treatment, is placed on top of the graded site and is discussed further in the report.

Earthwork volumes were calculated using publicly availably topographic data (discussed in Appendix A). Since the Port of Coeymans site is an operational marine terminal, it has stockpiles of material throughout the site that vary temporally in location and size. To discount the volume associated with stockpiles captured at the time the topographic data was recorded, in an attempt to capture a more realistic cut volume for OSW Zones 1 and 2, the existing topographic surface was manipulated to omit elevations above specific thresholds. For OSW Zone 1, the threshold was 15.2 m (50.0 ft.) NAVD88, as

this is the contour that the proposed retaining wall approximately follows and is the high end of the observed ground elevation range for OSW Zone 1. For OSW Zone 2, the threshold was 42 m (137.8 ft.) NAVD88 as this is the high end of the observed ground elevation range for OSW Zone 2.

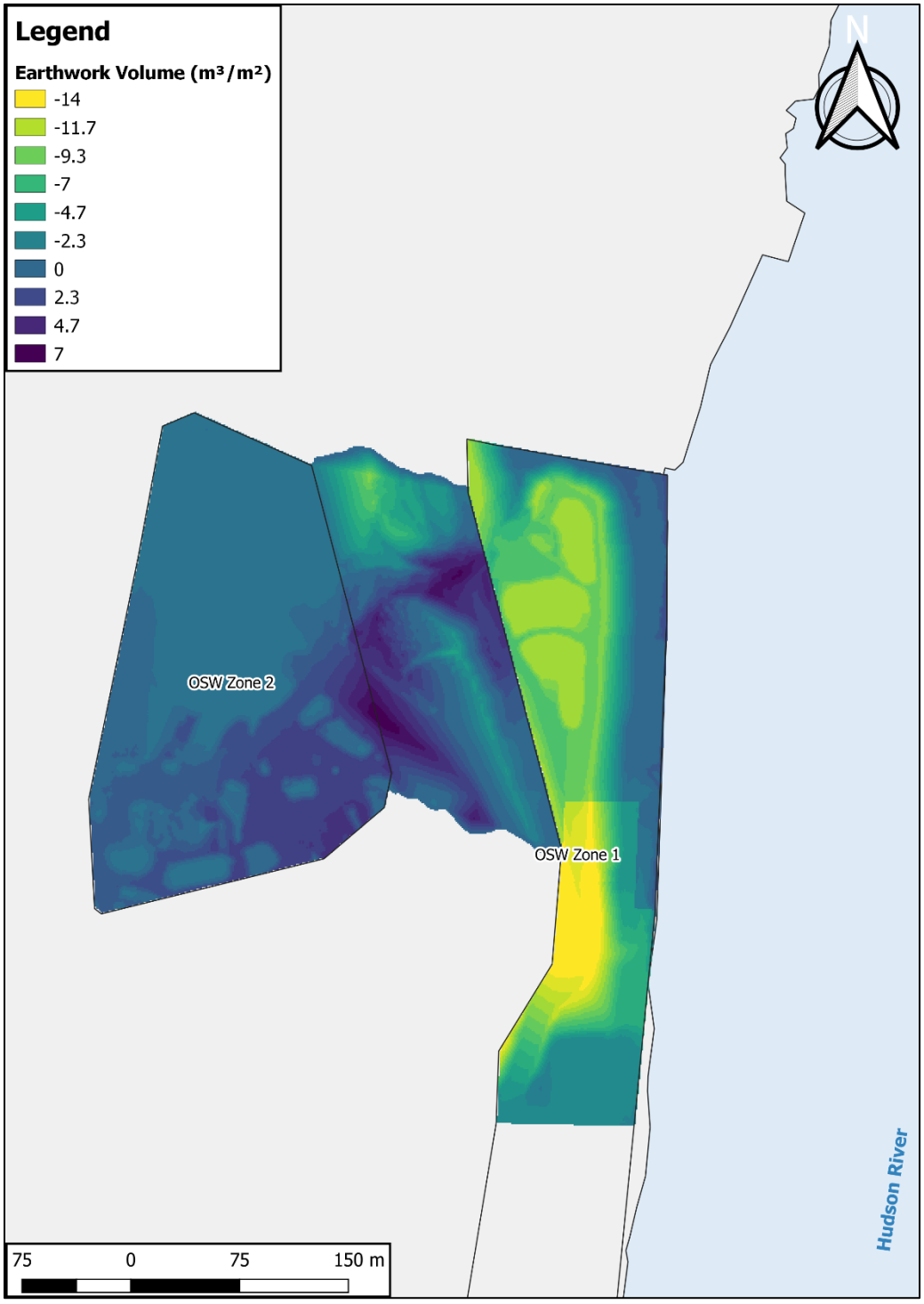
For OSW Zone 1, grading the site to the design level surface elevation results in a net cut volume of approximately 326,240 m^3 (426,700 CY). The net volume is derived from an anticipated gross cut volume of approximately 328,020 m^3 (429,030 CY) and a gross fill volume of approximately 1,780 m^3 (2,330 CY).

For OSW Zone 2, grading the site to the design level surface elevation results in a net cut volume of approximately 12,610 m^3 (16,500 CY). The net volume is derived from an anticipated gross cut volume of approximately 51,290 m^3 (67,090 CY) and a gross fill volume of approximately 38,680 m^3 (50,590 CY).

For the area in between OSW Zones 1 and 2, grading the site to the design slope (1V:4H) results in a net cut volume of approximately 8,080 m^3 (10,560 CY). The net volume is derived from an anticipated gross cut volume of approximately 44,660 m^3 (58,410 CY) and a gross fill volume of approximately 36,580 m^3 (47,850 CY).

This design assumes that granular fill is obtained from the materials excavated from the hill at the northern end of Zone 1. Additional excavated materials are assumed to be hauled to the adjacent Coeymans Industrial Park and stored for beneficial reuse; the method and cost (or revenue) associated reuse is not considered in this Pre-FEED. The areas designated for cut and fill for OSW Zones 1 and 2, as well as the area in between these zones, is shown in Figure 4.

Figure 4. Earthwork Volume for OSW Zones 1 and 2 and Slope In Between



Ground Improvement

Ground Improvement design is evaluated for the 4.6 hectares (11 acres) portion of OSW Zone 1 which is subject to infrastructure improvements. Based upon the location of soil borings within OSW Zone 1, approximately 40% of the area is assumed to be improved according to the characteristics observed in boring PTCY-2 (northern portion of OSW Zone 1) and 60% of the area is assumed to be improved according to the characteristics observed in PTCY-3 (central portion of OSW Zone 1). The southern portion of OSW Zone 1 is already in-use by Port of Coeymans and is not evaluated for ground improvement design.

Zone 1, Northern Area

Ground improvement is not recommended for this area. The 15 MT/m² (3,000 PSF) portion of this area can be excavated/graded down to elevation +3.00 m (9.84 ft.) NAVD88 and then topped with a 1 m (3.3 ft.) thick surface layer of crushed stone. The 30 MT/m² (6,000 PSF) portion of this area can be excavated/graded down to elevation +2.80 m (9.18 ft.) NAVD88 and then topped with a 1.2 m (4 ft.) thick surface layer of crushed stone.

Zone 1, Southern Area:

A 5.7 m (18 ft.) thick layer of sandy silt, is located from approximately 9.5 m below the top of the boring. It is recommended that this layer is partially excavated down to elevation +0.00 m (+0.00 ft.) NAVD88. The 15 MT/m² (3,000 PSF) portion of this area can then be backfilled with granular fill to an elevation of +3.00 m (9.84 ft.) NAVD88, and then topped with a 1 m (3.3 ft.) thick surface layer of crushed stone. The 30 MT/m² (6,000 PSF) portion of this area can then be backfilled with granular fill to an elevation of +2.80 m (9.18 ft.) NAVD88, and then topped with a 1.2 m (4 ft.) thick surface layer of crushed stone. It is assumed the granular fill will be obtained from excavations at other areas of Zone 1.

It should be noted that there are two (2) 'no load' areas along the shoreline that are adjacent, northerly and southerly, to the 30 MT/m² (6,000 PSF) area behind the wharf. These no-load areas extend approximately 40 m (131 ft.) along the shoreline and 20 m (66 ft.) landward and are due to the increased slope of the shoreline associated with dredging the berth. The no-load areas may potentially be reduced or eliminated with additional infrastructure improvement to stabilize the shoreline (e.g., shoreline piles, bulkhead wall, etc.); however, the cost for additional improvements is not considered in this Pre-FEED.

OSW Zone 2 is used for heavy construction in its existing form and is not anticipated to require ground improvements.

3.5 Surface Treatment

Crushed stone is used for providing a surface treatment for operations in both the 15 MT/m² (3,000 PSF) and 30 MT/m² (6,000 PSF) areas of the site within OSW Zone 1. For the 15 MT/m² (3,000 PSF) areas, a 1 m (3.3 ft.) thick layer of crushed stone is placed on top the site's design grade elevation to raise the sites graded elevation to final platform elevation of +4.00 m (13.12 ft.) NAVD88. Similarly, for the 30 MT/m²

(3,000 PSF) areas, a 1.2 m (4 ft.) thick layer of crushed stone is placed on top of the site's design grade elevation. This is sufficient to distribute loads to the granular soils. Some settling of the stone is expected over the life of the facility, especially early into the operational phase. The crushed stone surface is readily repairable by minor grading or fill with new stone.

OSW Zone 2 is used for heavy construction in its existing form and is therefore not anticipated to require surface treatment.

The above thickness of crushed stone was applied over the total platform area (dependent upon proposed capacity/area) of OSW Zone 1 to determine the quantity of stone required.

Compacted bank run gravel, similar to what is used in roadway applications, was assumed to serve this purpose. Due to the quantities required, the surface treatment material is anticipated to be delivered to the site by barge.

3.6 Dredging

Berth Dredging

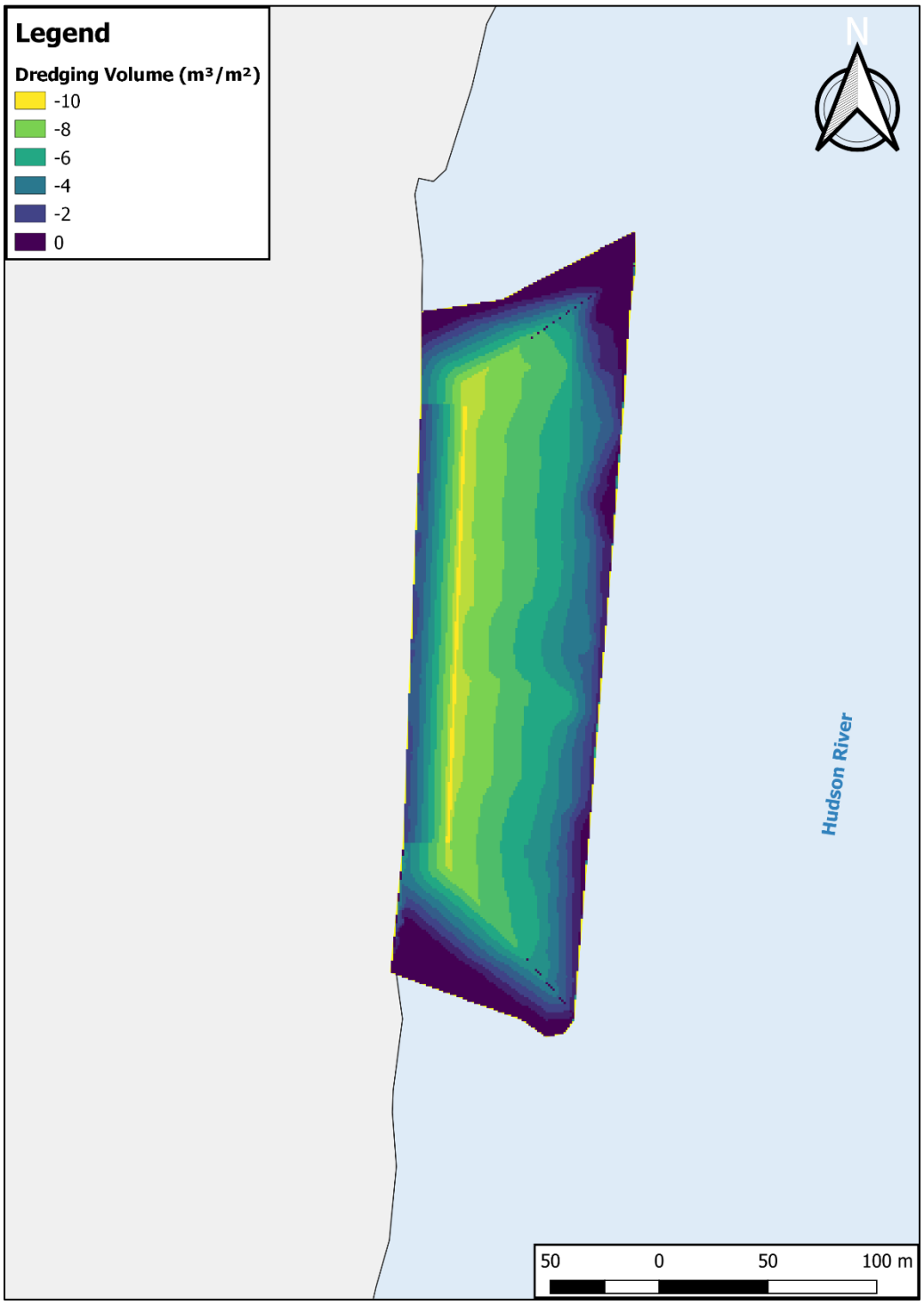
Vessels are anticipated to berth at the location of the heavy load wharf along the north shoreline of the site in parallel to the Hudson River Federal Navigation Channel. The berthing area, as well as the slope under the wharf to accommodate the revetment to be installed, will be dredged.

From west to east, the dredge footprint at the site extends from the face of the berth to the Hudson River channel. From north to south, the dredge footprint extends 220 m (720 ft.), spanning the length of the wharf with the inclusion of buffers at the north and south wharf extents. The dredge footprint also includes 45-degree angle flares extending from its landward extent to the offshore extents of the footprint to accommodate approaching vessels. The design dredge elevation matches the authorized depth of the Hudson River at -10.3 m (–33.8 ft.) NAVD88. See Pre-FEED Drawings S-01 and S-02 for information on anticipated dredging conditions.

Dredge volumes were calculated using the design dredge extents and difference in elevation between the planned dredge elevation and the site's existing bathymetry. The resulting berth dredge volume was found to be 185,400 m^3 (242,490 CY). Dredging volume per area is shown in Figure 5.

Dredging is anticipated to be completed by mechanical means (crane with clamshell bucket, excavator, etc.) with upland disposal. If future site characterization activities determine the material to be of acceptable quality, it may be used for site grading and filling operations, potentially resulting in a significant cost savings to both dredging and grading costs.

Figure 5. Wharf Dredging Volume



Channel Dredging

The authorized depth of the Hudson River Federal Channel (-10.3 m or –33.8 ft. NAVD88) is the responsibility of the U.S. Army Corps of Engineers (USACE). Therefore, existing depths in the project site vicinity were considered to be sufficient for design vessel operations without the need for channel dredging. It will be important to coordinate closely with USACE to understand the frequency or likelihood of channel maintenance dredging.

4 Site Analysis, Benefits and Challenges

4.1 Navigation Considerations

To access the site from offshore, a vessel must navigate through New York Harbor and up the Hudson River. This navigation route includes travel beneath several bridges, including the Castleton, Alfred H. Smith Memorial, Rip Van Winkle, Kingston-Rhinecliff, Poughkeepsie, Mid-Hudson, Newburgh-Beacon, Bear Mountain, Tappan Zee, George Washington, and Verrazano-Narrows bridges. The controlling air draft restriction posed on the Port of Coeymans site is due to the Mid-Hudson Bridge, having a clearance of 40.8 m (134 ft.) MHW. Water depths are limited by the Hudson River authorized dredging depth of -9.8 m (-32 ft.) MLLW.

4.2 Environmental Permitting

Port facilities will likely require either upland or shoreline improvements or both, in order to support offshore wind development. As such, the port developer or the port facility owner will be required to obtain all necessary federal, state and local permits to undertake the required improvements. Further, in accordance with New York State environmental regulations, the site improvements will be subject to an environmental review (State Environmental Quality Review). The environmental review and permitting process typically involves a public participation component and developers must be prepared to address public concerns.

Port developers need to account for both the time and the cost for completing the environmental review and permitting processes. In addition, port developers may need to account for additional costs associated with the review process, such as providing compensatory mitigation for project impacts.

Preapplication meetings with all involved federal, State, and local permitting agencies are always recommended to ensure port developers have a full understanding of all potential environmental issues related to the development of the port facility. For State-level permitting, the New York State Department of Environmental Conservation (DEC) is an excellent initial point of contact regarding the environmental review and permit processes. The DEC can facilitate preapplication meetings and will often include the other State and federal agencies in initial meetings to provide port developers with a comprehensive picture of the environmental review and permitting processes.

The federal and State agencies likely to have jurisdiction or an interest in the port development, though some may be added or subtracted as plans develop, are as follows:

Federal

U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
NOAA/NMFS

State

NYS Department of Environmental Conservation
NYS Office of Parks, Recreation, and Historic Preservation
NYS Office of General Service
NYS Department of State

Figure 6. Environmental Permitting Considerations

Source: New York State DEC

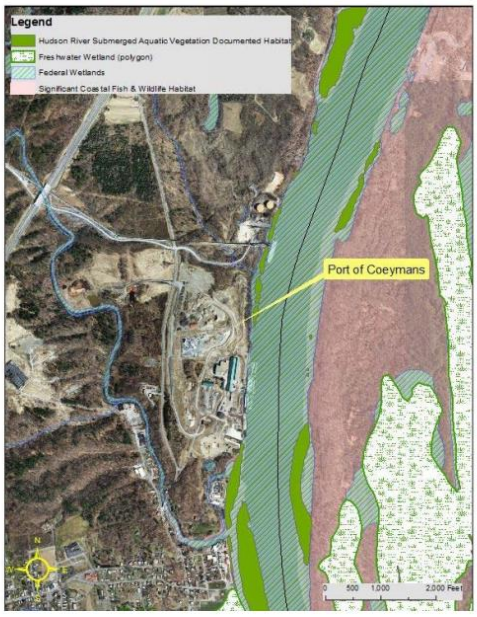
Port of Coeymans OSW Area

Permitting Considerations:

- Federally Regulated Wetlands and Other Waters of the U.S.
- Submerged Aquatic Vegetation (SAV)
- Significant Coastal Fish & Wildlife Habitat (Schodack and Houghtaling Islands)
- Threatened and Endangered Species (Shortnose Sturgeon, Bald Eagle)
- Shoreline improvements will require appropriate mitigation to compensate for habitat loss

Other Considerations:

- Potentially contaminated sediments in Hudson River
- The existing Port of Coeymans facility has undergone rapid expansion in the past few years and has many different activities ongoing at one time including manufacturing, recycling, processing and fabrication of various materials and products. Therefore, site development needs to consider local impacts on community character, archeological and historical resources, traffic and noise.
- The proposed "expansion area" north of Lehigh Cement is the site of the former proposed City of Albany C-2 landfill.



4.3 Benefits

- Heavy load capacity available at southern portion of site
- Operator is familiar with large infrastructure projects and may assist in manufacturing/fabricating activities
- Operator is capable of being involved in redevelopment efforts
- Owner operates aggregate company
- Significant quantity of land available adjacent to port
- Good transportation (railroad, road, water) access

4.4 Challenges

- Distance to existing/potential offshore WEAs is greater relative to other sites
- Northern portion of site will require significant modification to excavate existing slope in order to increase laydown area
- One berth must remain operational for continuation of existing operations
- The length of the access road from the waterfront to the upland area will likely reduce the operational efficiency when transporting components between OSW Zones 1 and 2
- Low-limiting air draft of 40.8 m (134 ft.) of the Mid-Hudson Bridge may limit operations at the site by restricting maximum OSW component height or requiring vessels to transport the components horizontally

4.5 Optimizations

For a detailed design of the port site, the following may provide room for optimization of the key site improvement and infrastructure items:

- The Pre-FEED design has been performed based on an exploratory geotechnical investigation consisting of three soil borings and associated laboratory testing program. Additional geophysical and geotechnical investigation in precise structure locations will increase certainty of design parameters and reduce conservatism, potentially allowing for a more optimized design. Additional geophysical and geotechnical investigation should target the stratigraphy and soil parameters near the retaining wall. Further, the investigation should target an accurate prediction of the top level of bedrock in the wharf area.
- The data sets used to approximate the dredging volume consist of the Coastal New York LiDAR Hydro Flattened Raster DEM dataset and the USACE Hudson River Condition Survey dates: February 6, 2017 to February 22, 2017. There is a gap in the data sets between the horizontal extent of the federal navigation channel and the shoreline; therefore, existing surface data is interpolated between the data sets. A site-specific hydrographic survey should be conducted in the vicinity of the proposed new wharf and dredging areas.

5 Opinion of Probable Cost

An OPC was prepared for the key infrastructure improvements identified in Section 3. As noted in Section 1.2, the Pre-FEED is intended to facilitate multiple potential offshore wind related uses. Therefore, depending on the ultimate use of the facility, some infrastructure improvement activities included within the Pre-FEED may be overdesigned, while other aspects may be under designed. Accordingly, the ultimate cost to complete offshore wind related infrastructure improvements may vary significantly, based upon the ultimate use of the facility and the improvements needed to facilitate that use.

The OPC for the Port of Coeymans Pre-FEED was developed using similar methods as marine contractors. COWI develops OPCs using the same methodology that contractors do. Most of the work items were estimated by preparing a detailed estimate of the materials, labor, and equipment anticipated to be used in execution of the work, with the exception of a few work items in which unit pricing was used. Direct wage rates and fringe benefit rates for all labor are consistent with current Prevailing Wage rates for Albany County as published by the New York State Department of Labor. COWI leveraged unit costs professional experience with waterfront construction in and around New York State as well as published cost data resources.

The OPC was prepared in accordance with AACE International 18R-97 guidelines for a Class 3 Estimate. Class 3 estimates are used for budget authorization, where the current project definition is between 10% and 40% of full project definition with actual costs typically falling within 30% above to as little as 20% below the estimate.

The OPC Summary is found in Table 1. The unit cost data presented in the summary are developed based upon a detailed breakdown on construction activities, which can be found in Appendix C.

Published bare unit cost data (materials, labor and equipment) were obtained in 2018-dollar values from published cost data references, marked up for general conditions (8%), overhead (10%), and profit (10%). Unit costs based on observed cost data of waterfront construction projects in the Northeast U.S. within the past 10 years were escalated to 2018 dollars; general conditions, overhead and profit are included within observed costs and no additional markups were applied. A uniform contingency is applied to the project subtotal.

The authors of this report have no control over the cost of labor, materials, equipment, or services furnished by others, or over competitive bidding or market conditions. The OPC provided herein are made on the basis of best judgment as experienced and qualified professional engineers, familiar with the construction industry; the authors cannot and do not guarantee that actual project or construction costs will not vary from this OPC.

Table 2. OPC Summary Table

WORK ITEM DESCRIPTION		QUANTITY	UNITS	UNIT PRICE	TOTAL
Mobilization and De-mobilization					
	Mobilization And Demobilization	1	Lump Sum	$1,444,000.00	$1,444,000.00
Demolition, Clearing, and Grubbing					
	Clearing And Grubbing	9,470	Square Meter	$1.90	$18,000.00
Marine Structures					
	30 mt/M² Pile Supported Wharf	6,960	Square Meter	$8,204.74	$57,105,000.00
Upland Structures					
	Retaining Wall	500	Linear Meter	$48,282.00	$24,141,000.00
Earthwork and Ground Improvement					
	Upland Excavation Above Mhw	423,970	Cubic Meter	$11.50	$4,874,000.00
	Upland Fill Above Mhw	124,850	Cubic Meter	$5.39	$673,000.00
Surface Treatment					
	Gravel 30 mt/M² Staging Area	13,030	Square Meter	$158.79	$2,069,000.00
	Gravel 15 mt/M² Staging Area	27,840	Square Meter	$132.29	$3,683,000.00
Dredging					

	Berth Dredging	185,400	Cubic Meter	$111.19	$20,614,000.00
Subtotal					$114,621,000.00
			Design and Construction Contingency:	30%	$34,386,000.00
Total					$149,007,000.00

5.1 Exclusions

The following line items are excluded from the design and OPC:

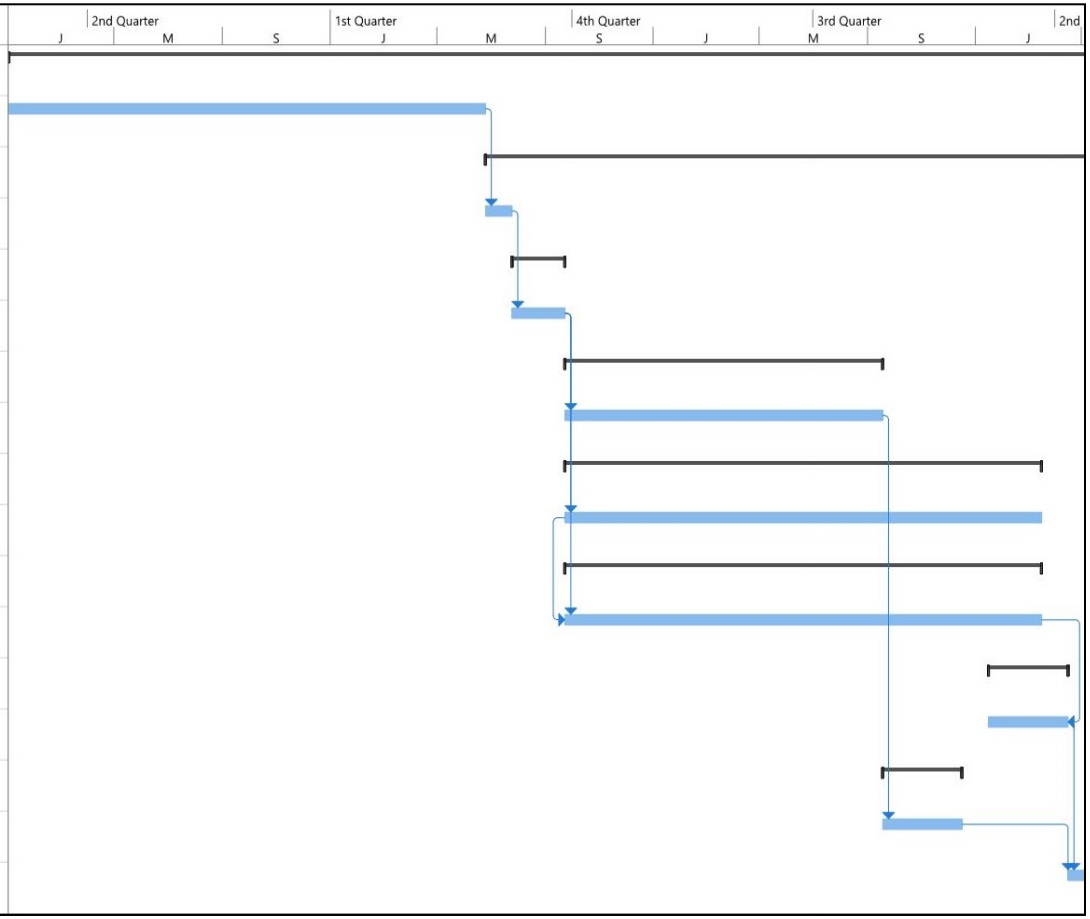
- Utilities
- Public access
- Operating infrastructure and equipment
- Site acquisition costs
- Permits and permit acquisition fees
- Professional services (design, regulatory, legal, etc.)
- Construction management (cm) fees
- Environmental mitigation/remediation
- Excavated soils are assumed to be clean—no disposal costs were accounted for

6 Schedule

An estimate schedule was prepared for the key improvements developed for the Pre-FEED. As noted in Sections 1.2, the Pre-FEED is intended to facilitate multiple potential offshore wind related uses. Accordingly, the schedule to complete offshore wind related infrastructure improvements may vary significantly, based on the ultimate use of the facility and the improvements needed to facilitate that use. The schedule presented in Figure 7 assumes a traditional design-bid-build project delivery. Alternative delivery methods, (e.g., design-build) may reduce the time required to develop the site.

Figure 7. Project Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
1	**PROJECT TOTAL**	**41 mons**	**Wed 1/2/19**	**Mon 5/16/22**	
2	**Planning, Engineering and Permittin**	18 mons	Wed 1/2/19	Thu 6/25/20	
3	**Construction Phase**	**23 mons**	**Thu 6/25/20**	**Mon 5/16/22**	
4	**Mobilization**	1 mon	Thu 6/25/20	Sat 7/25/20	2
5	**Demolition, Clearing**	**2 mons**	**Sat 7/25/20**	**Wed 9/23/20**	
6	Clearing and Grubbing	2 mons	Sat 7/25/20	Wed 9/23/20	4
7	**Marine Structures**	**12 mons**	**Wed 9/23/20**	**Sat 9/18/21**	
8	30 MT/SM Wharf	12 mons	Wed 9/23/20	Sat 9/18/21	6
9	**Upland Structures**	**18 mons**	**Wed 9/23/20**	**Thu 3/17/22**	
10	Retaining Wall	18 mons	Wed 9/23/20	Thu 3/17/22	6
11	**Earthwork & Ground Improveme**	**18 mons**	**Wed 9/23/20**	**Thu 3/17/22**	
12	Grading	18 mons	Wed 9/23/20	Thu 3/17/22	6,10SS
13	**Surface Treatment**	**3 mons**	**Sun 1/16/22**	**Sat 4/16/22**	
14	Crushed Stone	3 mons	Sun 1/16/22	Sat 4/16/22	12FF+1 mon
15	**Dredging**	**3 mons**	**Sat 9/18/21**	**Fri 12/17/21**	
16	Berth Dredging	3 mons	Sat 9/18/21	Fri 12/17/21	8
17	Demobilization	1 mon	Sat 4/16/22	Mon 5/16/22	16,14



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Appendix A: Pre-FEED Design Basis

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1 Project Description

1.1 Key Infrastructure Improvements

As stated previously, only OSW Zones 1 and 2 are under investigation for improvements, as OSW Zone 1a is already developed and ready for use and only available when not in use for other activities.

In order prepare the site for use as a manufacturing or fabrication facility, the following key infrastructure improvements are proposed within the Pre-FEED:

- Clear and grub 0.9 hectares (2.3 acres) of the site in unmaintained and vegetated areas around the shoreline and northern property extents currently consisting of trees and bushes in order to increase the laydown area available in OSW Zone 1. Clearing and grubbing will provide access for site grading and ground improvement activities.
- Install marine structures along the waterfront edge of the site, in order to provide one heavy load wharf for load/unload components. The top elevation of marine structures will match the design platform elevation (Section 4.10). The bottom elevation of structures will be based upon the design dredge elevation in berthing areas and the existing elevation in non-berthing areas. At Port of Coeymans, proposed marine structures include the following:
    - Construct pile-supported wharf along the shoreline of the site, at the location shown in Figure 2. The wharf will provide a heavy load capacity (see Figure 2) berthing area for vessels.
- Install a retaining wall between the northern portion of OSW Zone 1 and OSW Zone 2. The type of retaining wall will be determined during the Pre-FEED. The primary purpose of the retaining wall is to increase the amount of available laydown area at the northern end of Zone 1.
- Improve the ground-bearing capacity and grade areas within the site (4.6 hectares or 11 acres). Ground-bearing capacity improvements provide a compact base for the proposed surface treatment to meet the required load capacities associated with different areas on site (see Section 2.4). Grading provides a level working surface to then install the surface treatment across the site. The northern portion of OSW Zone 1 will be expanded in order to provide greater waterfront access, resulting in a significant excavation effort due to the hill on site in this area. The method to complete site grading and ground improvements will be determined during the Pre-FEED.
- Stabilize the shoreline, if necessary, in order to allow live loads to be applied closer to the crest of the existing shoreline slopes.
- Install surface treatment within laydown areas of the site. Crushed stone will be used as surface treatment to accommodate the weight and durability of components, and to reduce maintenance costs. Surface treatment design may vary depending on the live load requirement.

- Dredge the berthing area to provide sufficient depth for design vessels to safely access the site. Under wharf slope will also be dredged to accommodate the revetment to be installed. Vessels are anticipated to berth at the location of the heavy load wharf along the north shoreline of the site. The design depth for dredging is discussed in Section 4.12. The limits of dredging extend from the face of the berth to the Hudson River Federal Navigation Channel. The location of the Hudson River extents is shown in Figure 1.

The authorized depth of the Hudson River Federal Channel (-10.3 m or –33.8 ft. NAVD88) is the responsibility of the U.S. Army Corps of Engineers (USACE) and is not considered by this Pre-FEED.

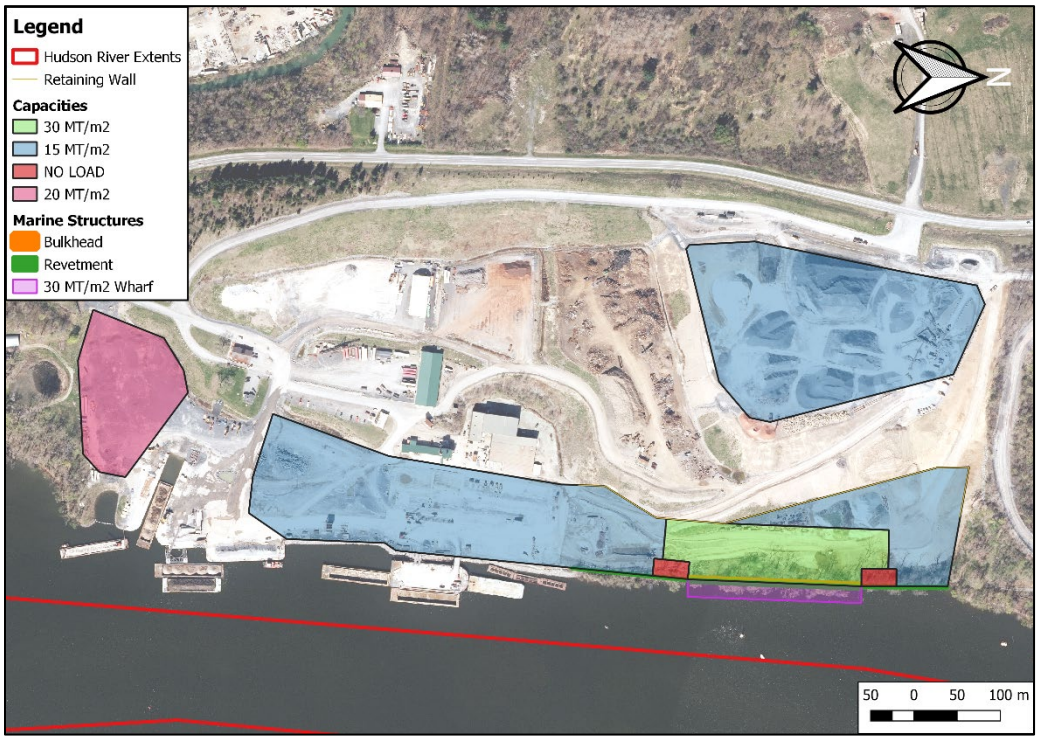
1.2 Definition of Load

The heavy load wharf area will be along the northeastern portion of the site and will have 30 MT/m² (6,000 PSF) capacity to support the on-loading/offloading and pre-assembly of components as well as the required equipment. The rest of the site will have a 15 MT/m² (3,000 PSF) capacity to support manufacturing or fabrication activities and required equipment. Figure 1 provides the proposed load areas.

Figure 1. Proposed Structures and Load Areas

Source: USGS

OSW Zone 1A capacity as reported by facility. Note that the proposed revetment that will run beneath the proposed wharf is not included here for image clarity.



2 Project Definition

2.1 Service Life

The design service life of facilities proposed in this project is 50 years, starting in 2020 and ending 2070.

2.2 Codes and Design Guidelines

The following codes and guidelines were used for the design of the proposed key improvements at the site:

- Dredging
  - United States Army Corps of Engineers Engineering Manual 1110-2-1611, "Layout and Design of Shallow-Draft Waterways," dated December 31, 1980
  - United States Army Corps of Engineers Engineering Manual 1110-2-1613, "Hydraulic Design of Deep Draft Navigation Projects," dated May 31, 2006
- Marine Structures
  - Unified Facilities Criteria (UFC), "Geotechnical Engineering," UFC 3-220-01, dated November 1, 2012
  - Unified Facilities Criteria (UFC), "Design: Piers and Wharves," UFC 4-152-01, dated January 24, 2017
  - American Society of Civil Engineers, "Minimum Design Loads and Associated Criteria for Buildings and Other Structures," ASCE/SEI 7-16
  - Specifications for Structural Steel Buildings, ANSI/AISC 360-16
  - American Concrete Institute, "Building Code Requirements for Structural Concrete," ACI 318-14
  - American Society of Civil Engineers, "Seismic Design of Piers and Wharves," ASCE/COPRI 61-14
  - United States Army Corps of Engineers Engineering Manual 1110-2-2504, "Design of Sheet Pile Walls," dated March 31, 1994
  - United States Army Corps of Engineers Engineering Manual 1110-2-2503, "Design of Sheet Pile Cellular Structures, Cofferdams, and Retaining Structures," dated September 29, 1989
- Coastal Revetments
  - United States Army Corps of Engineers Coastal Engineering Manual 1110-2-1100, dates vary
  - The Rock Manual, "The use of rock in hydraulic engineering (2nd edition)," dated to 2007

2.3 Horizontal and Vertical Control

The horizontal datum for this project will be the North American Datum of 1983 (NAD83). The coordinate reference system for this project will be the projected coordinate system NAD83/UTM Zone 18N, EPSG 26918, with horizontal units being meters.

The vertical reference datum for this project will be the North American Vertical Datum of 1988 (NAVD88). See Table 1 for conversions between NAVD88 and local tidal datums.

2.4 Units

Designs for this project will be completed using SI units, unless otherwise specified. Conversions to U.S. customary units will be provided where appropriate.

3 Site Characterization

3.1 Topographic and Hydrographic Data

Topographic and hydrographic data obtained via publicly-available resources will be used to establish existing site elevations, to prepare infrastructure design, and to estimate dredging and earthwork quantities for the purpose of material and cost estimation. The Coastal New York LiDAR Hydro Flattened Raster DEM dataset [2] will be used to for topography (above elevation 0.9 m or 3 ft. NAVD88) of the topo-bathymetric model. The Hudson River Condition Survey 4531, survey dates February 6, 2017 to February 22, 2017 by the USACE [3] will be used to develop the bathymetry (within the vicinity of the channel's extents) of the site topobathymetric model.

It should be noted there is a gap between the LiDAR and Condition Survey datasets; publicly available data that captured the gap between these datasets was not found. Therefore, the elevations of this area will be estimated through interpolation between the extents of the available datasets.

3.2 Tidal Datums

Tidal Datums for the Port of Coeymans are based upon USGS Station 01359139 Hudson River at Albany NY [4], located approximately 19 km (12 mi) north of the project site. This gauge was chosen because it is the closest gauge in proximity to the site with published tidal data. These tidal datums will be used in defining the design platform elevation as well as the design dredge elevation.

Table 1. Tidal Datums

Tidal Datum	NAVD 88	MLLW
Mean Higher High Water (MHHW)	1.15 m (3.78 ft.)	1.70 m (5.58 ft.)
NAVD '88	0.00 m (0.00 ft.)	0.55 m (1.80 ft.)
Mean Lower Low Water (MLLW)	-0.55 m (-1.80 ft.)	0.00 m (0.00 ft.)

3.3 Relative Sea-level Rise

Relative sea-level rise (RSLR) was calculated for each site, as part of the design berth elevation analysis. RSLR calculations used NOAA data to account for RSLR from 1992–2002 and Climate Change in New York State by NYSERDA (ClimAID) [5] data for Region 5 (Troy Dam) to account for RSLR from 2002–2070. Year 1992 is the baseline for the RSLR calculation because it is the middle of the current tidal epoch (1983–2001). The total design RSLR value was obtained as a sum of 1992–2002 SLR (NOAA) and 2002–2070 SLR (ClimAID). Low (10th percentile), middle (75th percentile), and high (90th percentile)

estimates were considered within the design berth elevation analysis (see Table 2). The RSLR value chosen for this project is the ClaimAID high estimate.

Table 2. Relative Sea-level Rise

RSLR	1992–2002[a]	2002–2070[b]	1992–2070
Low Estimate	0.03 m (0.09 ft.)	0.22 m (0.72 ft.)	0.25 m (0.82 ft.)
Middle Estimate		0.77 m (2.52 ft.)	0.80 m (2.62 ft.)
High Estimate		1.14 m (3.73 ft.)	1.17 m (3.83 ft.)

Note(s):
[a] As per mean RSLR trend provided by NOAA for Station 8518750, The Battery, NY; 2.93 mm/yr [6].
[b] As per ClimAID RSLR estimates for Region 5 (Troy Dam) [5].

3.4 Waves

Waves will feed the design platform elevation as well as the revetment design. Due to the site's location up the Hudson River, wake waves will likely be controlling. Wake wave data, based on typical vessels, was obtained from the Engineering Manual 1110-2-1100 [7]. Using this guidance, the maximum vessel generated wave height at a distance of 30 m (98 ft.) is 0.9 m (3 ft.) was chosen for conservatism.

3.5 Current

Currents do not typically control the design of marine structures included in this Pre-FEED. Revetment design uses significant wave height as the controlling parameter.

The nearest current prediction station is the Castleton-on-Hudson Bridge NOAA prediction station HUR0617 [8], which is located approximately 2.6 km (1.6 mi) North of the project site. Average currents at a depth of 9.8 m (32 ft.), based on one year of data (2018), can be used as a point of reference for typical conditions:

- ebb: -0.76 knots
- flood: 0.87 knots

3.6 Wind

The location and elevation of the structures is such that the wind load on the structures will have no significant impact on the structures' capacities; therefore, wind load on structures will not be considered in this analysis.

The Applied Technology Council (ATC) [9] provides an online resource that can be used to identify wind speeds for design. As a point of reference, the 100-year mean recurrence interval (MRI) wind speed (3-second gust, at 10 m or 33 ft. above ground) at Port of Coeymans is 41.6 m/s (93 mph).

3.7 Snow and Ice

Vertical loads due to snow and ice loads are less than the design live loading and should not occur simultaneously. Therefore, snow and ice loads do not control the design of marine structures in this Pre-FEED.

The Applied Technology Council (ATC) [9] provides an online resource that can be used to identify ground snow loads for design. As a point of reference, a ground snow load at Port of Coeymans is 0.2 MT/m² (40 psf).

3.8 Seismic activity

Seismic design is not considered in this Pre-FEED. The seismic performance of structures will be confirmed in later phases of design.

The ATC [9] provides an online resource that can be used to identify basic seismic parameters and can be used as a point of reference if sought out in later phases.

3.9 River Ice

River ice does not affect the pre-FEED design of infrastructure improvements at the site, though may affect day-to-day operations depending on the ultimate end use.

The National Oceanic and Atmospheric Administration (NOAA) provides air freezing index (AFI) values that can be used to predict ice loads. As a point of reference, the 100-year AFI for Port of Coeymans is 1,451-degree F-Days [10].

3.10 Design Platform Elevation

As mentioned previously, the site is envisioned to have two areas fully dedicated to offshore wind use (OSW Zones 1 and 2), with Zone 1 within the waterfront area onsite and OSW Zone 2 within the upland area on site. Therefore, Port of Coeymans has two design deck elevations. Since the OSW Zone 1 encompasses the waterfront area, several alternative methods of determining the design platform elevation have been reviewed, including estimates of existing platform/terrain elevation [2], FEMA base flood elevation (BFE) [11], and the United Facilities Criteria (UFC) formula [12]. These values were used to inform the final decision for OSW Zone 1 when selecting an optimal platform elevation for the site and are summarized in Table 3.

Table 3. Design Platform Elevation Alternatives—OSW Zone 1

Method	Elevation (NAVD88)
Existing Land Elevation, Average	4.00 m (13.1 ft.)
UFC Guidance	3.13 m (10.27 ft.)
Base Flood Elevation	4.88 m (16.00 ft.)

The design deck elevation for OSW Zone 1 was determined to match the existing elevation of the portion of the site developed (and in-use currently), at approximately 4.00 m (13.1 ft.) NAVD88, which exceeds the UFC criteria and is 0.9 m (3 ft.) below FEMA BFE. This elevation was chosen to keep the site consistent throughout for ease of ongoing and future operations. Additionally, matching the existing elevation allows for easier facilitation of potential future expansion southward of OSW Zone 1, if sought out in later phases. Since OSW Zone 2 is in the upland region of the site where UFC guidance and the FEMA BFE are not applicable, the design deck elevation was chosen to match the approximate existing average elevation in this area, 40.00 m (131.23 ft.) NAVD88, in order to reduce cut/fill operations.

3.11 Design Vessel

The design depth is based the design vessel for the site, which is dependent on its intended use, as well as under keel clearance (0.6 m or 2 ft.) and allowable overdepth for dredging (0.6 m or 2 ft.).

As a manufacturing or fabrication facility, Port of Coeymans may have several types of vessels berthing at the site. Table 4 provides the list of potential vessels their associated characteristics.

Table 4. Design Vessel Characteristics

	Heavy Lift Cargo Vessel[a]	Transport Barge[b]	Inshore Feeder Barge[c]
LOA	152.6 m (501 ft.)	91.4 m (300 ft.)	122 m (400 ft.)
Beam	27.4 m (90 ft.)	17.1 m (56 ft.)	36.6 m (120 ft.)
Operational Draft	8.1 m (27 ft.)	3.7 m (12 ft.)	8 m (27 ft.)

Note(s):
[a] Based on the JUMBO heavy lift cargo vessel HLV Fairmaster, K3000 Class.
[b] Based on typical intracoastal barges used for inshore waterways in the U.S.
[c] Based on the inshore feeder barge provided in the "Inshore Feeder Barge Conceptual Feasibility Study" completed by COWI in 2018.

3.12 Design Depth

Based on this information, the design depth, including under keel clearance and allowable over depth allowance for dredging, would be 9.4 m (31 ft.); however, due to the site's location, a design depth of 10.3 m (33.8 ft.) NAVD88 will be used to match the Hudson River.

3.13 Geotechnical Conditions

A geotechnical site investigation has been performed by TRC Engineers, cf. [13], and consists of the following:

- Three boreholes to 171 ft. (52.1 m), 92 ft. (28.0 m) and 106.5 ft. (32.5 m) depth below ground level for boreholes PTCY-1, PTCY-2 and PTCY-3, respectively.
- For all boreholes Standard Penetration Tests are performed per approximately every 5 ft. (1.5 m) interval.
- Laboratory testing consisting of the following:
  - 6 Atterberg limit tests
  - 2 Unconsolidated undrained triaxial tests
  - 2 Unit weight of Soil
  - 27 Sieve tests
  - 28 Moisture content tests
  - 6 Hydrometer tests
  - 4 Unconfined compressive strength tests of rock

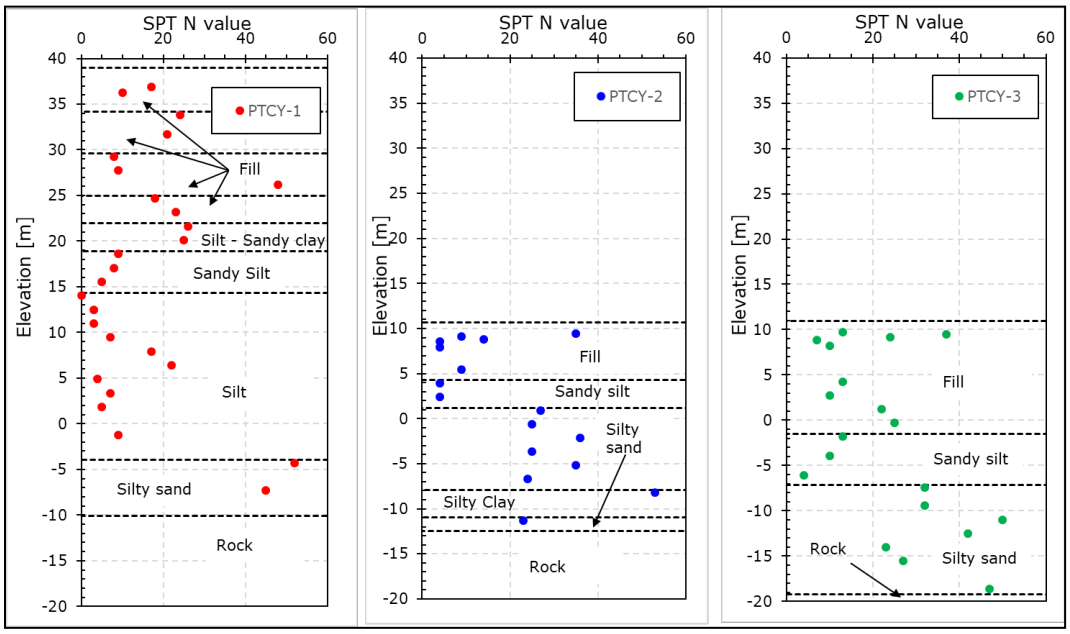
The location of the boreholes is shown in Figure 2.

Figure 2. Overview of Approximate Borehole Locations

Source: Google Earth

The stratigraphy encountered at the three available boreholes and the measured SPT-N values are shown in Figure 3.

Figure 3. SPT-N Measurements and Interpreted Stratigraphy from the Three Boreholes



The soil conditions consist of various fill material, sandy silt, silt, silty sand, silty clay and rock:

- The fill materials have a varying thickness across the site. Towards the river they appear to
- have a thickness increasing as we move towards the South of the site from 6.5 to 9.5 m (21 ft. to 31 ft.) approximately. In the upland borehole PTCY-1 indicates that there is a more substantial zone of fill material of approximately 17 m (56 ft.). The fill material is very variable in nature and it is described locally as clay, silt, sand, gravel with generally increased amount of debris and brick and traces of organic material locally.
- At the upland area (PTCY-1) only, below the very variable fill material, an approximately 3 m (10 ft.) thick layer of more fine-grained material (sandy clay and silt) is found.
- Immediately below the fill deposits a layer of sandy silt is encountered in all three boreholes (in the upland area the sand appears as lenses within the silt). The layer thickness varies between approximately 3 m (10 ft.) to 6 m (20 ft.).
- Below the layer of sandy silt, a layer of silt is encountered for borehole PTCY-1 (located upland). This layer has a thickness of approximately 18 m (59 ft.) and the layer appears to have strength properties somewhat similar to the properties of the above layer of sandy silt. This silt layer has not been encountered for the boreholes nearshore (PTCY-2 and PTCY-3).
- Below the layers of sandy silt and silt, a layer of silty sand is encountered. SPT-N values in this layer indicate that the layer is competent and deposited in a dense to very dense state. In position PTCY-2 the silty sand is interrupted towards its bottom by a silty clay layer (3 m or 10 ft.), which also appears to be very competent.

- At the bottom of the boreholes, bedrock has been encountered. Bedrock consist of weathered dolomite and is reported to be more broken towards the top. It should be noted that the three boreholes have ended at a maximum depth of around 6.4 m (21 ft.) below the top of the weathered rock.

Soil parameters to be applied for design purposes have been predicted based on the available laboratory test data and recommendations of Kulhawy and Mayne, cf. [14], for the soils (based primarily on SPT-measurements) and based on unconfined compressive strength tests for dolomite. In general, the sieve tests confirmed to quite a large extend the SI borehole descriptions. The more fine-grained soil is generally low plasticity, irrespective of the depth of the specimen tested. The water contents of the fine-grained specimens tested result in a large variation of liquidity index but they in general imply materials with strength properties in line with the SPT measurements in the respective depths.

Soil parameters adopted for design purposes are presented in Table 5, Table 6, and Table 7. It should be noted that for the interpretation of fill soil parameters an additional level of conservatism was inherently adopted since some of the high N-SPT values may represent the presence of brick or other debris material.

As far as the rock is concerned, the borehole logs indicate a dolostone. The tests in the rock samples result in unconfined compressive strengths in the order of 40 MPa where good quality samples are recovered. However, the RQD values in PTCY-1 and PTCY-3 clearly indicate the presence of a weathered zone at the top of the intact rock. The depth of the weathered zone does not seem to extend to large depths and both PTCY-1 and PTCY-2 boreholes end within competent rock.

Water level reading in the near shore position PTCY-2 indicates a water table at an elevation of approximately +5.5 m. The water level in the near shore position is believed to be in a general equilibrium with the water level in the river and it will fluctuate due to seasonal and tidal variations. The Pre-FEED design can conservatively be conducted with above-mentioned consideration as seen in the borehole. Water level in the upland area as indicated in position PTCY-1 indicates a high-water table at around 25 m elevation. It is believed this is due to the fact that this was the first reading after drilling and might be affected from the water used for the drilling. It can be expected that the water table upland could be higher than the near shore since sue to the presence of the thick silt layer. It could be realistic at this stage to assume that the water table is located at the top of this layer, i.e., +14.6 m (48 ft.).

Table 5. Representative Soil Profile for the Upland Area

With Characteristic Soil Parameters based on soil profile PTCY-1

Depth below ground, top of layer	**Depth below ground, bottom of layer**	**Layer description**	**SPT-N, representative value**	**Bulk/ effective unit weight, γ/γ'**	**Undrained shear strength, s_u**	**Peak internal angle of friction, φ'**	**Effective cohesion, c'**	**Unconfined compressive strength, q_u**
m (ft.)	m (ft.)		-	kN/m³ (pcf)	kPa (psf)	°	kPa (psf)	MPa (tsf)
39 (127.9)	34 (111.5)	Fill (sandy)	14	17/7 (109.2/45)	-	35	0 (0)	
34.1 (111.5)	29.6 (97.1)	Fill (clayey)	23	17/7 (109.2/45)	135 (2820)	-	-	
29.6 (97.1)	25 (82)	Fill (silt with organic traces)	9	15/5 (96.3/32.1)	50 (1045)	-	-	
25 (82)	21.9 (71.8)	Fill (gravelly)	21	19/9 (122/57.8)	-	35	0 (0)	
21.9 (71.8)	18.9 (62)	Sandy clay and silt	26	17/7 (109.2/45)	150 (3130)	-	-	
18.9 (62)	14.3 (46.9)	Sandy silt	7	17/7 (109.2/45)	50 (1045)	29	0 (0)	
14.3 (46.9)	-4 (-13.1)	Silt	8	17/7 (109.2/45)	50 (1045)	-	-	
-4 (-13.1)	-10.1 (-33.1)	Silty sand	36	18/8 (115.6/51.4)		39	-	
-10.1 (-33.1)	Non proven	Dolostone (bedrock)	n/a					40 (415)

Table 6. Representative Soil Profile for the Northern End of the Near Shore Area

With Characteristic Soil Parameters based on soil profile PTCY-2

Depth below ground, top of layer	**Depth below ground, bottom of layer**	**Layer description**	**SPT-N, representative value**	**Bulk/ effective unit weight, γ/γ'**	**Undrained shear strength, s_u**	**Peak internal angle of friction, φ'**	**Effective cohesion, c'**	**Unconfined compressive strength, q_u**
m (ft.)	m (ft.)		-	kN/m³ (pcf)	kPa (psf)	°	kPa (psf)	MPa (tsf)
10.7 (35.1)	4.3 (14.1)	Fill (sandy)	8	17/7 (109.2/45)	-	34	0 (0)	
4.3 (14.1)	1.2 (3.9)	Sandy silt	7	17/7 (109.2/45)	50 (1045)	29	0 (0)	
1.2 (3.9)	-7.9 (-25.9)	Silty sand	36	18/8 (115.6/51.4)		39	-	
-7.9 (-25.9)	-11 (-36.1)	Silty Clay	58	17/7 (109.2/45)	>200 (>4180)	-	-	
-11 (-36.1)	-12.5 (-41)	Silty sand	36	18/8 (115.6/51.4)		39	-	
-12.5 (-41)	Non proven	Dolostone (bedrock)	n/a					40 (415)

Table 7. Representative Soil Profile for the Northern End of the Near Shore Area

With Characteristic Soil Parameters based on soil profile PTCY-3

Depth below ground, top of layer	**Depth below ground, bottom of layer**	**Layer description**	**SPT-N, representative value**	**Bulk/ effective unit weight, γ/γ'**	**Undrained shear strength, s_u**	**Peak internal angle of friction, φ'**	**Effective cohesion, c'**	**Unconfined compressive strength, q_u**
m (ft.)	m (ft.)		-	kN/m³ (pcf)	kPa (psf)	°	kPa (psf)	MPa (tsf)
11 (36.1)	-1.5 (-4.9)	Fill (sandy)	14	17/7 (109.2/45)	-	34	0 (0)	
-1.5 (-4.9)	-7.2 (-23.6)	Sandy silt	7	17/7 (109.2/45)	50 (1045)	29	0 (0)	
-7.2(-23.6)	-19.2 (-63)	Silty sand	36	18/8 (115.6/51.4)		39	-	
-10.1 (-33.1)	Non proven	Dolostone (bedrock)	n/a					40 (415)

4 Loads

Based on participation from industry, responses from stakeholders (manufacturers, developers, government agencies, etc.) were aggregated. Based on this feedback, the design loads were determined to be 30 MT/m² (6,000 PSF) for onloading and offloading areas, and 15 MT/m² (3,000 PSF) for storage and handling areas.

The higher live load areas at the dock are intended to handle the loads associated with crawler cranes. The lesser live loads are intended to handle the loads associated with Self Propelled Modular Transporters (SPMTs) and other equipment.

5 Materials

5.1 Concrete

All new structural concrete will conform to the following:

- Concrete will be normal weight with a minimum compressive strength of 5,000 psi at 28 days
- Concrete reinforcement will conform to ASTM A 615, Grade 60 and will be epoxy coated in accordance with ASTM A 775
- Concrete cover will be 3 in. minimum
- Maximum water to cementitious materials (w/cm) ratio allowed will be 0.4

5.2 Steel

All new structural steel work will conform to the following:

- Steel pipe pile material will be fabricated in accordance with API 5L with material either API5LX52, ASTM A572 Grade 50 or approved alternative with a minimum yield strength of 50 ksi or greater
- Structural pipe will conform to ASTM A500 Grade B
- All welding will conform to the Structural Welding Code for Steel as adopted by the American Welding Society

5.3 Stone

Acceptable rock material will be any of the following: granite, quartzite, basalt, diabase, gabbro, dolomite, or rhyolite. Stone will weigh more than 165 pounds per cubic foot, have a specific gravity, saturated surface dry (SSD), greater than 2.60.

5.4 Fill

Where possible, fill material will be reused cut material on site and/or dredge material.

5.5 Corrosion Protection

Corrosion protection will be considered in the design of waterfront facilities. Corrosion protection will involve a combination of protective coating and sacrificial steel.

6 Exclusions

The following items are not included in the Pre-FEED:

- Design of mooring/berthing structures (e.g., fender system, bollards, etc.)—representative cost of these items will be included in the OPC
- Utilities
- Ancillary structures (e.g., office buildings, etc.)
- Operational infrastructure and equipment
- Intermodal connections
- Property ownership
- Professional services
- Permitting

7 References

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Attachment A

Geotechnical Data Report

TRC Engineers, Inc. "NYSERDA Port Study Investigation, Port of Coeymans, Coeymans, New York," December 21, 2018.

GEOTECHNICAL DATA REPORT

NYSERDA Port Study Investigation
Port of Coeymans
Coyemans, New York

Prepared by

TRC Engineers, Inc.
16000 Commerce Parkway
Suite B
Mount Laurel, New Jersey 08054

December 21, 2018
TRC Project No. 317660

Submitted to

BTMI Engineering, P.C./COWI, Inc.
276 Fifth Avenue, Suite 1006
New York, NY 10001

Contents

Appendices

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December 21, 2018

Mr. Brent D. Cooper, PE
Project Manager
BTMI Engineering, P.C./COWI
276 Fifth Avenue, Suite 1006
New York, New York 10001

Re: Geotechnical Services
NYSERDA Port Study Investigation
Port of Coeymans
Coeymans, New York
TRC Project No. 317660

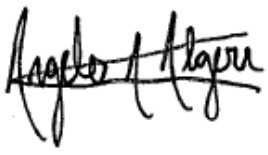
Dear Mr. Cooper,

TRC Engineers (TRC) is pleased to present our geotechnical data report for this project. This report contains a summary of the results of our field investigation, and our subsequent analysis.

We trust that this report contains the information required and we thank you for the opportunity to assist you on this project. If you have any questions regarding the contents of this report, please call our office.

Sincerely,

TRC Engineers, Inc.



Angelo A. Algieri
Geotechnical Engineer

Petro W. Kazaniwsky, PE
Chief Geotechnical Engineer

cc: J. Benjamin, TRC

1.0 PROPOSED WORK AND OBJECTIVES

The project site is located at the Port of Coeymans Marine Terminal located in Coeymans, New York. The New York State Energy Research and Development Authority (NYSERDA) proposes improvement of waterfront facilities to support the development of offshore wind facilities. The proposed site was identified by BTMI/COWI (COWI) and will require infrastructure upgrades to be determined related to the offshore wind activities.

The objectives of TRC's work were to provide information relative to the subsurface conditions based on field testing at locations specified by the design engineer.

2.0 FIELD AND LABORATORY TESTING

2.1 Test Borings

The field investigation for this project included advancing three (3) test borings (PTCY-1 to PTCY-3) to rock, with rock coring performed in each boring ranging from approximately 7.5 to 16 ft. Test Borings PTCY-2 and PTCY-3 were drilled near the waterfront area of the site, while PTCY-1 was drilled at an upslope location approximately 700 west of the river's edge. Prior to drilling, the test borings were marked in the field by TRC using a hand-held GPS at the locations selected in the field by TRC based on requested locations by COWI. The as-drilled boring locations based on GPS coordinates are identified on the boring logs.

Test borings were completed by TRC's in-house drilling division during the period from November 5 to 11, 2018. Test Borings were advanced using an Acker track mounted drill rig with an automatic hammer. Drilling and sampling were performed in general accordance with ASTM D 1586, D 1587, and D 2213. Continuous split spoon sampling was performed in the upper 10 ft and at 5 ft intervals thereafter. Three (3) thin walled, Shelby tube samples were attempted to obtain undisturbed samples. Rock coring was performed in general accordance with ASTM D 2113. Test borings were logged in the field by one of our geotechnical engineers.

Copies of the Test Boring Layout sketch and test boring logs are attached for your reference.

2.2 Laboratory Testing

Upon completion of the field investigation, soil and rock samples were delivered to our ASTM/AASHTO certified soil mechanics laboratory. Laboratory testing was performed on soil and rock samples selected by COWI. The following table outlines the laboratory testing performed.

Table 1. Laboratory Testing Performed

Laboratory Test	***Reference Standard***	***Quantity of Tests Performed***
Moisture Content	ASTM D 2216	28
Atterberg Limits	ASTM D 4318	6
Grain Size Analysis (Sieve)	STM D 422	27
Grain Size Analysis (Hydrometer)	ASTM D 422	6
Unit Weight of Soil	ASTM D 7263	2
UU Triaxial Testing	ASTM D 2850	2
Unconfined Compression of Rock	ASTM D 7012	4

Laboratory test results are summarized in Section 3.0 below, and are also attached for your reference.

3.0 SITE CONDITIONS

3.1 Location and Features

The site is located along the western coastline of the Hudson River, approximately 10 miles south of Albany, NY. Test boring locations were conducted in an area just north of the developed area of the marine terminal. The three test borings had a relative elevation change of on the order of approximately 80 feet moving approximately 600 feet westward across the site from the waterfront to the upslope area.

3.2 Site Geology

Published geologic data indicates the project site is underlain by the Austin Glen Formation. This geologic formation primarily consists of interbedded greywackes and shales.

Surficial geologic mapping indicates the project site is underlain by Lacustrine silt and clay as well as recently deposited soils. Lacustrine silt and clay are generally laminated and calcareous silts and clays deposited by proglacial lakes, yielding variable thickness and potential land instability.

3.3 Subsurface Conditions

The subsoils encountered have been grouped into distinct strata based on their physical and engineering properties as observed in the test borings and laboratory test data. The general strata encountered at the project site in the test borings are described below. Please refer to the individual test boring logs for more detailed soil descriptions.

3.3.1 Upslope Boring

One boring (PTCY-1) was advanced inland near the highest elevation of the site. The subsoils encountered in this boring are described below:

FILL – Fill material generally composed of sand, silt, clay, and gravel mixtures with varying percentages of organics and brick debris. This stratum was encountered and extended to depths ranging from 0 ft to 56 ft below ground surface (bgs). This layer was found to be underlying the surface. SPT N-values indicate this layer ranges from "loose" to "dense" in relative density.

CLAY & SILT – This stratum was encountered underlying FILL at the test location to depths extending to 141 ft bgs. This stratum generally consists of low plasticity clays with varying percentages of sand and silt. SPT N-values indicate this layer as "medium" in consistency. Results of laboratory testing on select samples indicate a USCS classification of CL, a plastic limit of 21%, a liquid limit of 36% and a plasticity index of 15%. Laboratory determined moisture contents ranged from approximately 18% to 38%.

SILT & SAND – This stratum was encountered underlying the CLAY & SILT at this test boring location an approximate depth of 161 ft bgs. This stratum generally consists of silty sands and sandy non-plastic silts. SPT N-values indicate this layer ranges from "dense" to "very dense" in relative density. Results of laboratory testing on a select representative sample indicates a laboratory determined moisture content of approximately 20%.

DECOMPOSED ROCK – This stratum was encountered underlying the SILT & SAND layer in this boring extending to the auger refusal depths of 163 ft bgs. Decomposed rock is formed from the in-place weathering of the underlying parent bedrock and retains the same relic structure. It is typically identified by refusal to penetration by the split spoon sampler and therefore, no sample were obtained within this stratum.

WEATHERED ROCK – This stratum was encountered underlying the DECOMPOSED ROCK in this boring extending to the boring termination depths of 171 ft bgs. The rock samples obtained from the core runs in this layer consist of broken, gravel-sized fragments of greywacke and gray, slightly weathered, hard dolostone. Core recoveries ranged from 26% to 43%. RQD values ranged from 0% to 16%. Results of unconfined compressive testing on a representative sample of the dolostone indicates a compressive strength of approximately 563 tsf, and a unit weight of 167.2 pcf.

Groundwater was encountered during drilling at a depth of approximately 47 ft bgs. The table below contains recommended soil parameters at this boring location. These parameters are based on the results of the subsurface investigation, laboratory testing of representative samples and TRC's experience with similar subsurface conditions.

RECOMMENDED SOIL PARAMETERS: Boring PTCY-1				
Parameter	**Loose to Dense FILL** (0-56 ft)	**Soft to Stiff CLAY & SILT** (56-141 ft)	**Dense SILT & SAND** (141-161 ft)	**Decomposed Rock** (161-163 ft)
γ (pcf)[1]	115	115	125	130
ϕ	28°	0	36°	42°
c (psf)	0	500	0	0
c_a (psf)	0	500	0	0
δ (concrete)	17°	0	24°	31°
δ (steel)	11°	0	17°	22°

1. Unit weight indicates total unit weight of the subsurface soils at in-situ moisture contents.

3.3.2 Waterfront Borings

Two borings (PTCY-2 and PTCY-3) were advanced near the waterfront on the landside of the terminal. The subsoils encountered in these borings are described below:

FILL – Fill material generally composed of sand, silt, clay, and gravel mixtures with varying percentages of organics and brick debris, similar to the upslope boring PTCY-1. This stratum was encountered at both waterfront borings from the existing ground surface extending to depths ranging from 21 ft to 41 ft bgs at borings PTCY-2 and PTCY-3, respectively. SPT N-values indicate this layer ranges from "very loose" to "very dense" in relative density. However, the higher range of SPT N-values is likely the result of oversized gravel or debris particles.

Silty/Gravelly SAND – This stratum was encountered underlying the FILL at each test boring location to depths ranging from 76 ft to 99 ft bgs at borings PTCY-2 and PTCY-3, respectively. This layer consists of sand with varying percentages of gravel and silt. SPT N-values indicate this layer ranges from "medium dense" to "dense" in relative density. Laboratory determined moisture contents ranged from approximately 9% to 25%.

SILT AND CLAY – This stratum was encountered underlying the FILL at boring PTCY-3 to a depth of 59.5 ft bgs. This stratum generally consists of low to non-plastic silts, and low plasticity clays. SPT N-values indicate this layer ranges from "medium stiff" to "stiff" in consistency. Results of laboratory testing on select samples indicate a USCS classification of ML, CL, or CL-ML. Results of Atterberg limits testing on two samples revealed plastic limits of 16% to 24%, liquid limits of 21% to 23% and plasticity indices of 1 to 8. Two Unconsolidated Undrained Triaxial (UU) tests were performed on select undisturbed samples from this layer. Results of this testing indicate total cohesion of the samples ranged from 13.2 psi to 20.4 psi. Laboratory determined moisture contents ranged from approximately 18% to 37% and dry unit weights ranged from approximately 85 to 102 pounds per cubic foot (pcf).

Gravelly CLAY – This stratum was encountered underlying the SAND at test boring location PTCY-2 at a depth ranging from approximately 61 ft to 71 ft bgs. This stratums generally consists of low clay with traces percentages of sand and silt. SPT N-values indicate this layer is typically "hard" in consistency. Results of laboratory testing on select samples indicate a USCS classification of CL, a plastic limit of 22%, a liquid limit of 38% and a plasticity index of 16%.

DECOMPOSED ROCK – This stratum was encountered underlying the SAND in boring PTCY-3 extending to the boring termination depths of 106.5 ft bgs and required coring to advance the boring. The samples obtained from the core runs in this layer consisted of gray, coarse grained sand and rock fragments. There was no intact rock recovery while coring.

DOLOSTONE – This stratum was encountered underlying the SAND in boring PTCY-2 extending to the boring termination depths of 92 ft bgs. The rock samples obtained from the core runs in this layer consist of gray, slightly to very slightly weathered dolostone. Core recoveries ranged from 90% to 100%. RQD values ranged from 56% to 74%. Results of unconfined compressive testing indicate a compressive strength ranging from 364 tsf to 458 tsf, and unit weights ranging from approximately 166 pcf to 172 pcf.

Stabilized groundwater measurements were taken 24 hours after completion at a depth of approximately 17 ft bgs in test boring PTCY-2. The tables below contain recommended soil parameters at each boring location. These parameters are based on the results of the subsurface investigation, laboratory testing of representative samples and TRC's experience with similar subsurface conditions.

RECOMMENDED SOIL PARAMETERS: Boring PTCY-2			
Parameter	**Very Loose to Dense FILL** (0-21 ft)	**Medium Dense Silty/Gravelly SAND** (21-61 ft & 71-76 ft)	**Hard Gravelly CLAY** (61-71 ft)
γ (pcf)[1]	115	125	130
ϕ	26°	34	26°*
c (psf)	0	0	0
c_a (psf)	0	0	0
δ (concrete)	17°	24°	24°
δ (steel)	11°	17°	14°

1. Unit weight indicates total unit weight of the subsurface soils at in-situ moisture contents.
2. * Indicates effective friction angle.

RECOMMENDED SOIL PARAMETERS: Boring PTCY-3				
Parameter	**Loose to Very Dense FILL** (0-41 ft)	**Medium Stiff to Stiff SILT & CLAY** (41-59.5 ft)	**Dense Silty/Gravelly SAND** (59.5-99 ft)	**Decomposed Rock** (99-106.5 ft)
γ (pcf)[1]	115	115	125	130
ϕ	28°	0	34	42°
c (psf)	0	1500	0	0
c_a (psf)	0	750	0	0
δ (concrete)	17°	0	24°	31°
δ (steel)	11°	0	17°	22°

1. Unit weight indicates total unit weight of the subsurface soils at in-situ moisture contents.

4.0 LIMITATIONS

This report has been prepared for the exclusive use of COWI and their agents for specific application to the above referenced project. The work has been performed in general accordance with our authorized scope of work and in accordance with generally accepted practice in the field of geotechnical engineering. This warranty is in lieu of all other warranties either expressed or implied. The discussions as presented in this report are based on the data revealed by this investigation based on specific borings as selected by COWI. We are not responsible for any conclusions or opinions drawn from the data included herein, other than those specifically stated. An attempt has been made to provide for normal contingencies but the possibility remains that unexpected conditions may be encountered during future investigations or construction. If this should occur, or if additional or contradictory data are revealed in the future, we should be notified so that modifications to this report can be made, if necessary.

APPENDIX A
FIELD DATA

TEST BORING LOG

BORING	**PTCY-1**
G.S. ELEV.	
FILE	317660
SHEET	1 OF 5

PROJECT: NYSERDA - PORT OF COEYMANS

LOCATION: COEYMANS, NY

GROUNDWATER DATA			
FIRST ENCOUNTERED 47.2 '			
DEPTH	HOUR	DATE	ELAPSED TIME

METHOD OF ADVANCING BOREHOLE				
d	FROM	0.0 '	TO	163.0 '
c_2	FROM	163.0 '	TO	171.0 '

DRILLER	S. WARD
HELPER	A. FISHER
INSPECTOR	NA
DATE STARTED	11/10/2018
DATE COMPLETED	11/11/2018

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
5				***UNSAMPLED FILL***		
				6.0		
	S-1	6 7 10 6				
10	S-2	5 5 5 8		***BROWN F/M SAND, TR TO SM GRAVEL, TR TO SM SILT, TR DEBRIS (FILL)***		
15				16.0		
	S-3	10 12 12 14				
20						
	U-1			***BROWN SILT, TR SAND, TR GRAVEL (FILL)***		U-1: NDISTURBED SAMPLE ATTEMPTED FROM 21-23 FT; NO RECOVERY
25	S-4	10 10 11 11				
30				31.0		
	S-5	4 4 4 4		***BLACK SILT, SM BRICK DEBRIS, SM SAND, TR ORGANICS (FILL)***		
35						

N: 42.4871458; E: -73.7899654

DRN.	AAA
CKD.	JPB

TEST BORING LOG

BORING	**PTCY-1**
G.S. ELEV.	
FILE	317660
SHEET	2 OF 5

PROJECT: NYSERDA - PORT OF COEYMANS
LOCATION: COEYMANS, NY

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-6	5 5 4 6				
40				***BLACK SILT, SM BRICK DEBRIS, SM SAND, TR ORGANICS (FILL)***		
	S-7	5 16 32 8				
45				46.0		
▽	S-8	7 10 8 8				
50				***BROWN SILTY GRAVEL, SM SAND, TR BRICK DEBRIS (FILL)***		
	S-9	15 12 11 10				
55				56.0		
	S-10	8 12 14 12		***GRAY SANDY CLAY, SM SILT***		
60				61.0		
	S-11	10 10 15 12		***GRAY SILT, SM F/M SAND, TR TO SM GRAVEL***		
65				66.0		
	S-12	3 4 5 6				
70				***GRAY AND BROWN SILT, TR CLAY, TR F/M SAND (AS LENSES)***		
	S-13	5 5 3 3				
75						

TEST BORING LOG

PROJECT: NYSERDA - PORT OF COEYMANS
LOCATION: COEYMANS, NY

BORING **PTCY-1**
G.S. ELEV.
FILE 317660
SHEET 3 OF 5

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-14	2 2 3 4		***GRAY AND BROWN SILT, TR CLAY, TR F/M SAND (AS LENSES)***		
80				81.0		
	S-15	WH/1.5' 5				
85						
	S-16	1 1 2 1				
90				***GRAY CLAY, TR SILT***		
	S-17	WH/1.0' 3 3				
95						
	S-18	WH 1 6 6				
100				101.0		
	S-19	7 7 10 11				
105						
	S-20	9 10 12 13				
110				***GRAY SILT, TR CLAY***		
	S-21	WH/1.0' 4 6				
115						
	S-22	2 2 5 8				

TEST BORING LOG

BORING	**PTCY-1**
G.S. ELEV.	
FILE	317660
SHEET	4 OF 5

PROJECT: NYSERDA - PORT OF COEYMANS
LOCATION: COEYMANS, NY

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
120						
	S-23	2 2 3 5				
125						
130				***GRAY SILT, TR CLAY***		
	S-24	3 4 5 4				
135						
140						
				141.0		
	S-25	23 23 29 33				
145						
150				***GRAY F/ SANDY SILT TO SILTY F/ SAND***		
	S-26	20 20 25 23				
155						

TEST BORING LOG

PROJECT: NYSERDA - PORT OF COEYMANS
LOCATION: COEYMANS, NY

BORING **PTCY-1**
G.S. ELEV.
FILE 317660
SHEET 5 OF 5

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
				161.0 ***GRAY F/ SANDY SILT TO SILTY F/ SAND***		S-27: 50/0 AT 161 FT
				DECOMPOSED ROCK 163.0		TOP OF ROCK AT 163 FT
165	R-1	REC =43% RQD =0%		***GRAY, GRAVEL-SIZED ROCK FRAGEMENTS (BROKEN ROCK)***		
170	R-2	REC =26% RQD =16%		169.7 ***GRAY SLIGHTLY WEATHERED, HARD DOLOSTONE, CLOSE, LOW ANGLE JOINTS*** 171.0		
				END OF BORING AT 171'		
175						
180						
185						
190						
195						
200						

NEW PROJECTS TEST BORING LOG 317660 NYSERDS -COEYMANS AND IVORY POINTS.GPJ SITE BLAUVELT.GDT 12/20/18

TEST BORING LOG

PROJECT: NYSERDA - PORT OF COEYMANS
LOCATION: COEYMANS, NY

BORING **PTCY-2**
G.S. ELEV.
FILE 317660
SHEET 1 OF 3

GROUNDWATER DATA			
FIRST ENCOUNTERED NR			
DEPTH	HOUR	DATE	ELAPSED TIME
16.8'	0800	11/6	24 HRS

METHOD OF ADVANCING BOREHOLE				
a	FROM	0.0 '	TO	10.0 '
d	FROM	10.0 '	TO	76.0 '
c_2	FROM	76.0 '	TO	92.0 '

DRILLER S. WARD
HELPER A. FISHER
INSPECTOR A. ALGERI
DATE STARTED 11/05/2018
DATE COMPLETED 11/06/2018

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-1	9 20 15 5		***GRAY SILT AND BRICK DEBRIS, SM ORGANICS (FILL)***		
				2.0		
	S-2	4 5 9 15		***GRAY SILTY SAND, TR GRAVEL (FILL)***		
				4.0		
5	S-3	9 5 4 9				
	S-4	2 1 3 2				
10	S-5	5 2 2 3		***BRICK DEBRIS (FILL)***		
				16.0		
15 ▼	S-6	4 2 7 11		***GRAY SILTY GRAVEL, TR SAND, TR BRICK DEBRIS (FILL)***		
20				21.0		
	S-7	1 2 2 2				
25	S-8	WH/1.0' 4 6		***GRAY F/ SANDY SILT TO SILTY F/M SAND***		
30	U-1			31.0		
	S-9	8 13 14 15		***GRAY GRAVELLY F/M/C SAND, TR TO SM SILT***		
35						

N: 42.4868; E: -73.7880

DRN. AAA
CKD. JPB

NEW PROJECTS TEST BORING LOG 317660 NYSERDS -COEYMANS AND IVORY POINTS.GPJ SITE BLAUVELT.GDT 12/20/18

TEST BORING LOG

PROJECT: NYSERDA - PORT OF COEYMANS
LOCATION: COEYMANS, NY

BORING **PTCY-2**
G.S. ELEV.
FILE 317660
SHEET 2 OF 3

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-10	7 8 17 25				
40				***GRAY GRAVELLY F/M/C SAND, TR TO SM SILT***		
	S-11	6 13 23 14				
45				46.0		
	S-12	9 9 14 19		***GRAY SILTY F/M/C SAND***		
50				51.0		
	S-13	12 16 19 19				
55				***DARK GRAY SILTY ROCK FRAGMENTS, SM F/M/C SAND***		
	S-14	12 9 15 31				
60				61.0		
	S-15	41 27 26 26				
65				***GRAY GRAVELLY CLAY, TR SILT, TR SAND***		
	S-16	11 20 42 37				
70				71.0		
	S-17	12 12 11 14				
75				***GRAY M/F/C SAND, TR SILT***		
		REC =90%		76.0		TOP OF ROCK AT 76

NEW PROJECTS TEST BORING LOG 317660 NYSERDS -COEYMANS AND IVORY POINTS.GPJ SITE BLAUVELT.GDT 12/20/18

TEST BORING LOG

BORING	**PTCY-2**
G.S. ELEV.	
FILE	317660
SHEET	3 OF 3

PROJECT: NYSERDA - PORT OF COEYMANS
LOCATION: COEYMANS, NY

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	R-1	RQD =70%				FT BROKEN ROCK FROM 77 TO 77.5 FT
80	R-2	REC =96% RQD =56%		***GRAY SLIGHTLY TO VERY SLIGHTLY WEATHERED, HARD DOLOSTONE, VERY CLOSE TO MODERATELY CLOSE, 30 TO 60 DEGREE FRACTURES***		
85	R-3	REC =100% RQD =62%				
90	R-4	REC =100% RQD =74%		92.0 ***END OF BORING AT 92'***		
95						
100						
105						
110						
115						

NEW PROJECTS TEST BORING LOG 317660 NYSERDS -COEYMANS AND IVORY POINTS.GPJ SITE BLAUVELT.GDT 12/20/18

TEST BORING LOG

BORING	**PTCY-3**
G.S. ELEV.	
FILE	317660
SHEET	1 OF 3

PROJECT: NYSERDA - PORT OF COEYMANS

LOCATION: COEYMANS, NY

GROUNDWATER DATA			
FIRST ENCOUNTERED NR			
DEPTH	HOUR	DATE	ELAPSED TIME

METHOD OF ADVANCING BOREHOLE				
a	FROM	0.0 '	TO	10.0 '
d	FROM	10.0 '	TO	99.0 '
c_3	FROM	99.0 '	TO	107.0 '

DRILLER	S. WARD
HELPER	A. FISHER
INSPECTOR	A. ALGERI
DATE STARTED	11/07/2018
DATE COMPLETED	11/09/2018

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-1	1 6 7 5		***BROWN F/M SANDY SILT, TR BRICK DEBRIS (FILL)*** 2.0		
	S-2	11 11 13 14		***BROWN GRAVELLY F/M/C SAND, TR SILT (FILL)***		
5	S-3	24 23 14 9		6.0		
	S-4	5 4 3 3				
	S-5	8 6 4 3		***BROWN SILTY F/M/C SAND -SILT CONTENT DECREASES WITH DEPTH (FILL)***		
10				14.0		
15	S-6	30 50				
20	S-7	10 8 5 5		***GRAY-BROWN GRAVELLY F/M/C SAND, TR SILT, TR BRICK DEBRIS (FILL)***		
25	S-8	9 5 5 5				
30	S-9	12 9 13 12				
35						

N: 42.488222; E: -73.788374

DRN.	AAA
CKD.	JPB

NEW PROJECTS TEST BORING LOG 317660 NYSERDS -COEYMANS AND IVORY POINTS.GPJ SITE BLAUVELT.GDT 12/20/18

TEST BORING LOG

BORING	**PTCY-3**
G.S. ELEV.	
FILE	317660
SHEET	2 OF 3

PROJECT: NYSERDA - PORT OF COEYMANS
LOCATION: COEYMANS, NY

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-10	10 8 17 10		***GRAY-BROWN GRAVELLY F/M/C SAND, TR SILT, TR BRICK DEBRIS (FILL)***		
40				41.0		
	S-11	5 6 7 12		***GRAY AND LIGHT BROWN SILTY CLAY, SM F/M/C SAND***		
45				46.0		
	U-1					S-12: PP=1.75 TSF
50	S-12	1 4 6 6		***DARK GRAY SILT, TR CLAY, TR SAND***		
55	S-13	1 2 2 3				S-13: PP=0.5 TSF
	U-2					
60	S-14	7 13 19 23		59.5 ***LIGHT BROWN SILTY F/ SAND***		
65				66.0		
	S-15	13 14 18 18		***LIGHT BROWN F/ SANDY SILT***		
70				71.0		
	S-16	13 27 23 23		***GRAY GRAVELLY F/M/C SAND, TR SILT***		
75						

NEW PROJECTS TEST BORING LOG 317660 NYSERDS -COEYMANS AND IVORY POINTS.GPJ SITE BLAUVELT.GDT 12/20/18

TEST BORING LOG

PROJECT: NYSERDA - PORT OF COEYMANS
LOCATION: COEYMANS, NY

BORING **PTCY-3**
G.S. ELEV.
FILE 317660
SHEET 3 OF 3

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-17	17 21 21 20				
80				***GRAY GRAVELLY F/M/C SAND, TR SILT***		
	S-18	10 11 12 15				
85				86.0		
	S-19	12 13 14 16				
90						SILT CONTENT DECREASES WITH DEPTH
	S-20	31 30 33 36		***GRAY SILTY F/M/C SAND, SM GRAVEL***		
95						
	S-21	22 23 24 25		99.0		
100	R-1	REC =0% RQD =0%		***GRAY COARSE SAND AND GRAVEL-SIZED ROCK FRAGMENTS (DECOMPOSED ROCK)***		TOP OF ROCK AT 99 FT
105	R-2	REC =0% RQD =0%		106.5		
				END OF BORING AT 106.5'		
110						
115						

KEY TO SYMBOLS

Symbol Description

Strata symbols


Clay with Low Plasticity


Silty Clay


USCS Low Plasticity Sandy Clay


Highly Weathered or Decomposed Rock


Dolomite


Fill (made ground)


Silty Gravel


Graywacke


Silt with Low Plasticity


USCS Sandy Silt


Silty Sand


Poorly graded silty fine sand


USCS Poorly-graded Gravelly Sand


Poorly-graded Sand with Silt

Symbol Description

Misc. Symbols


Water table first encountered


Water table first reading after drilling


Water table second reading after drilling


Water table third reading after drilling

NR Not Recorded

MH Moh's Hardness

Sample Type


Rock Core


Split Barrel


Undisturbed Sample

Lab Symbols

FINES = Fines %

LL = Liquid Limit %

PI = Plasticity Index %

U_c = Unconfined Compressive Strength

W/V = Unit Weight

Notes:

COLUMN A) Soil sample number.

COLUMN B) FOR SOIL SAMPLE (ASTM D 1586): indicates number of blows obtained for each 6 ins. penetration of the standard split-barrel sampler. FOR ROCK CORING (ASTM D2113): indicates percent recovery (REC) per run and rock quality designation (RQD). RQD is the % of rock pieces that are 4 ins. or greater in length in a core run.

COLUMN C) Strata symbol as assigned by the geotechnical engineer.

DESCRIPTION) Description including color, texture and classification of subsurface material as applicable (see Descriptive Terms). Estimated depths to bottom of strata as interpolated from the borings are also shown.

DESCRIPTIVE TERMS: F = fine M = medium C = coarse

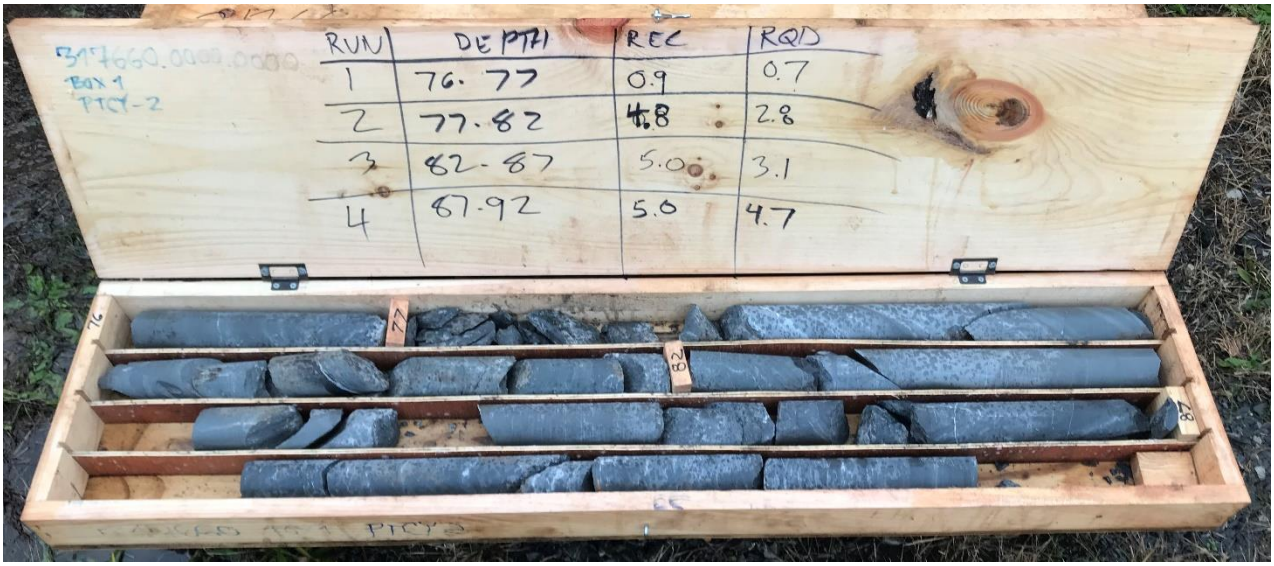
RELATIVE PROPORTIONS:

-Descriptive Term-	-Symbol-	-Est. Percentages-
Trace	TR	1-10
Trace to Some	TR to SM	10-15
Some	SM	15-30
Silty, Sandy, Clayey, Gravelly	-	30-40
And	and	40-50

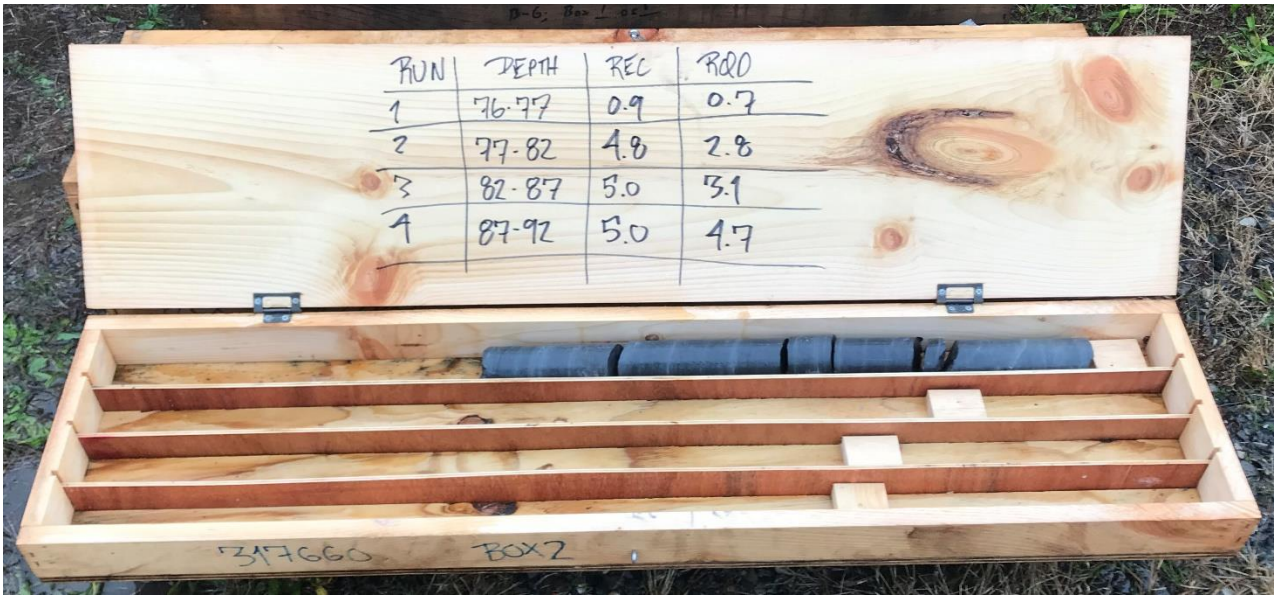
REMARKS) Special conditions or test data as noted during investigation. Note that W.O.P. indicates water observation pipes.

* Free water level as noted may not be indicative of daily, seasonal, tidal, flood, and/or long term fluctuations.

Boring PTCY-1, Box 1 of 1



Boring PTCY-2, Box 1 of 2



Boring PTCY-2, Box 2 of 2

APPENDIX B
LABORATORY DATA

SUMMARY OF LABORATORY TEST DATA

Project Name: NYSERDA Port Study Investigation
Client Name: COWI North America, Inc.
TRC Project #: 317660

SAMPLE IDENTIFICATION			SOIL GROUP (USCS)	MOISTURE CONTENT (%)	GRAIN SIZE DISTRIBUTION				PLASTICITY				Unit Weight (PCF)	Unconfined Compressive Strength (TSF)
Boring #	Sample #	Depth (ft)			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)		
PTCY-1	S-3	16.0-18.0	ML	27.5	4.4	5.2	90.4		-	-	-	-	-	-
PTCY-1	S-4	23.0-25.0	ML	32.7	1.4	2.2	96.4		-	-	-	-	-	-
PTCY-1	S-5	31.0-33.0	ML	37.9	11.0	38.7	50.3		42	34	8	0.5	-	-
PTCY-1	S-6	36.0-38.0	SC-SM	20.3	29.9	36.7	33.4		26	20	6	0.1	-	-
PTCY-1	S-10	56.0-58.0	ML	19.4	2.7	38.1	33.9	25.3	-	-	-	-	-	-
PTCY-1	S-11	61.0-63.0	SM	18.5	12.8	38.4	48.8		-	-	-	-	-	-
PTCY-1	S-15	81.0-83.0	CL	38.0	0.0	0.2	14.6	85.2	36	21	15	1.1	-	-
PTCY-1	S-19	101.0-103.0	ML	31.6	0.0	0.1	99.9		-	-	-	-	-	-
PTCY-1	S-23	121.0-123.0	ML	27.4	0.0	0.1	99.9		-	-	-	-	-	-
PTCY-1	S-25	141.0-143.0	ML	20.2	0.0	19.3	80.7		-	-	-	-	-	-
PTCY-1	R-2	166.0-171.0	-	-	-	-	-		-	-	-	-	167.2	563
PTCY-2	S-5	8.0-10.0	-	19.3	-	-	-		-	-	-	-	-	-
PTCY-2	U-1	29.0-31.0	ML	24.8	0.1	26.8	73.1		-	-	-	-	101.7	-
PTCY-2	S-9	31.0-33.0	SM	9.4	20.0	57.8	22.2		-	-	-	-	-	-
PTCY-2	S-10	36.0-38.0	SM	10.0	37.3	45.8	16.9		-	-	-	-	-	-
PTCY-2	S-12	46.0-48.0	SM	15.6	8.1	71.4	20.5		-	-	-	-	-	-
PTCY-2	S-14	56.0-58.0	GM	15.3	33.5	24.3	42.2		-	-	-	-	-	-
PTCY-2	S-15	61.0-63.0	CL	19.4	41.9	6.6	7.5	44.0	38	22	16	-0.2	-	-
PTCY-2	S-17	71.0-73.0	SP-SM	18.1	0.4	89.5	10.1		-	-	-	-	-	-

DRAWN BY: TBT 12/10/18

CHECKED BY: JPB 12/10/18

SUMMARY OF LABORATORY TEST DATA

Project Name: NYSERDA Port Study Investigation
Client Name: COWI North America, Inc.
TRC Project #: 317660

SAMPLE IDENTIFICATION			SOIL GROUP (USCS)	MOISTURE CONTENT (%)	GRAIN SIZE DISTRIBUTION				PLASTICITY				Unit Weight (PCF)	Unconfined Compressive Strength (TSF)
Boring #	Sample #	Depth (ft)			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)		
PTCY-2	R-2	78.0-78.5	-	-	-	-	-		-	-	-	-	171.9	458
PTCY-2	R-3	84.6-85.0	-	-	-	-	-		-	-	-	-	172.1	387
PTCY-2	R-4	89.5-90.0	-	-	-	-	-		-	-	-	-	166.4	364
PTCY-3	S-5	8.0-10.0	SM	17.2	35.9	51.1	13.0		-	-	-	-	-	-
PTCY-3	S-7	21.0-23.0	GP-GM	13.1	64.2	30.5	5.3		-	-	-	-	-	-
PTCY-3	S-9	31.0-33.0	SP-SM	14.7	37.4	56.1	6.5		-	-	-	-	-	-
PTCY-3	S-11	41.0-43.0	CL-ML	18.3	1.3	22.1	37.7	38.9	23	16	7	0.3	-	-
PTCY-3	U-1	46.0-48.0	ML	36.6	0.0	6.3	72.7	21.0	-	-	-	-	85.2	-
PTCY-3	U-2	57.0-59.0	ML	24.3	0.0	0.7	84.2	15.1	21	20	1	4.3	-	-
PTCY-3	S-14	59.0-61.0	ML	24.4	0.7	6.1	93.2		-	-	-	-	-	-
PTCY-3	S-15	66.0-68.0	ML	26.1	0.0	26.7	73.3		-	-	-	-	-	-
PTCY-3	S-17	76.0-78.0	SW-SM	8.7	39.6	51.9	8.5		-	-	-	-	-	-
PTCY-3	S-20	91.0-93.0	SM	12.9	20.7	63.9	15.4		-	-	-	-	-	-

DRAWN BY: TBT 12/10/18

CHECKED BY: JPB 12/10/18

SUMMARY OF LABORATORY TEST DATA

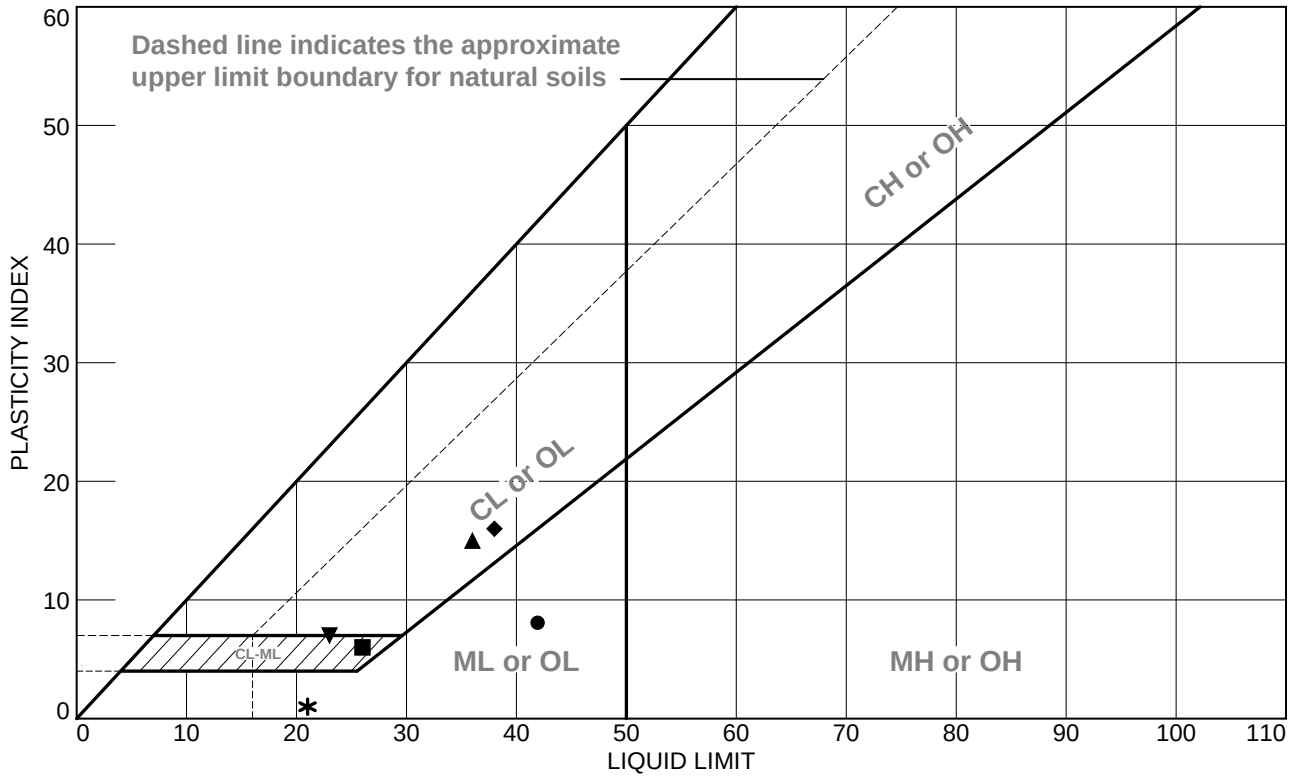
Project Name: NYSERDA Port Study Investigation
Client Name: COWI North America, Inc.
TRC Project #: 317660

SAMPLE IDENTIFICATION			ASSUMED SPECIFIC GRAVITY	INITIAL MOISTURE CONTENT (%)	AT TEST MOISTURE CONTENT (%)	VOLUMETRIC PROPERTIES			SHEAR STRENGTH PROPERTIES		
Boring #	Sample #	Depth (ft)				Dry Unit, PCF	Void Ratio	Degree of Saturation (%)	Type of Test	Normal Stress (PSI)	Strain (%)
PTCY-2	U-1	29.0-31.0	2.75	24.8	24.4	101.7	0.69	99.2	UU	13.2	16.0
PTCY-3	U-1	46.0-48.0	2.75	36.7	36.6	85.2	1.02	99.2	UU	20.3	8.9

DRAWN BY: TBT 12/10/18

CHECKED BY: JPB 12/10/18

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

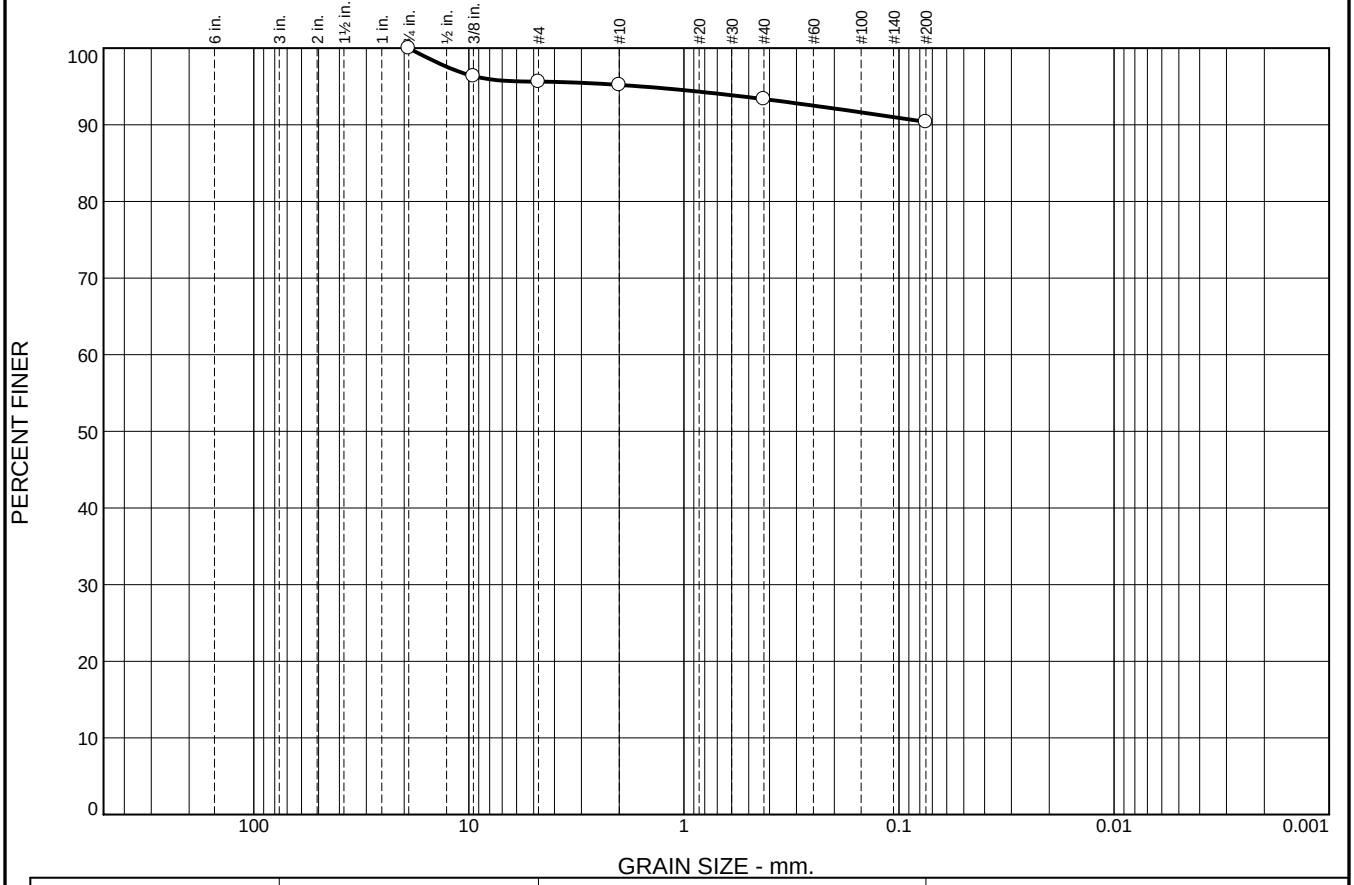
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	PTCY-1	S-5	31.0-33.0 FT	37.9	34	42	8	0.5	ML
■	PTCY-1	S-6	36.0-38.0 FT	20.3	20	26	6	0.1	SC-SM
▲	PTCY-1	S-15	81.0-83.0 FT	38.0	21	36	15	1.1	CL
◆	PTCY-2	S-15	61.0-63.0 FT	19.4	22	38	16	-0.2	CL
▼	PTCY-3	S-11	41.0-43.0 FT	18.3	16	23	7	0.3	CL-ML
✱	PTCY-3	U-2	57.0-59.0 FT	24.3	20	21	1	4.3	ML

TRC Engineers, Inc. Mt. Laurel, NJ

Client: COWI NORTH AMERICA, INC.
Project: NYSERDA PORT STUDY INVESTIGATION

Project No.: 317660 **Figure** 1

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	4.4	0.4	1.8	3.0	90.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SILT	11/26/18	ML	27.5

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-1 **Depth:** 16.0-18.0 FT **Sample Number:** S-3

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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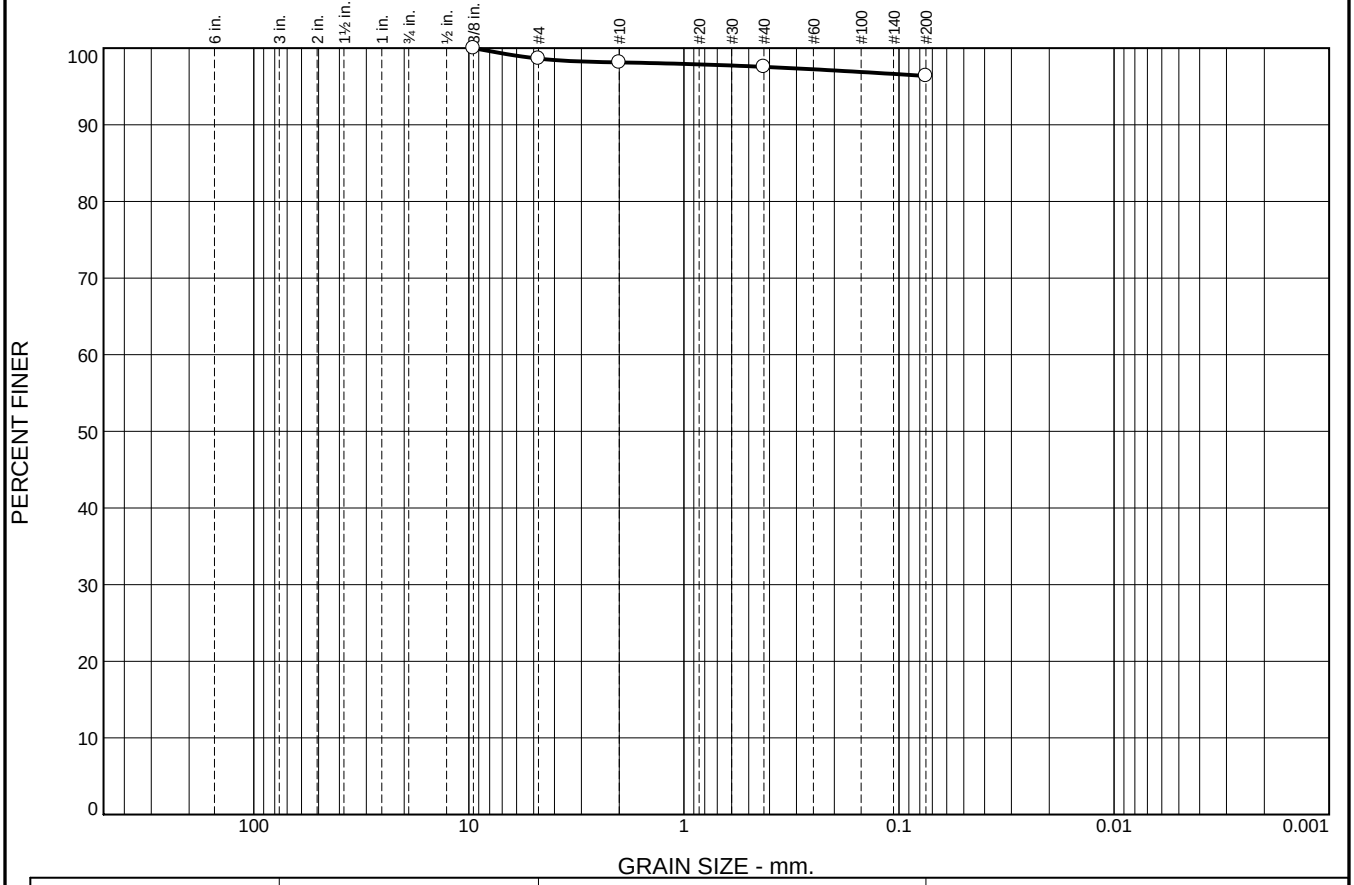
Figure 2

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.4	0.5	0.5	1.2	96.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SILT	11/26/18	ML	32.7

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-1 **Depth:** 23.0-25.0 FT **Sample Number:** S-4

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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Figure 3

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	11.0	6.9	15.9	15.9	50.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	42	34	3.1005	0.2285						

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ DARK BROWN SANDY SILT	11/28/18	ML	37.9

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-1 **Depth:** 31.0-33.0 FT **Sample Number:** S-5

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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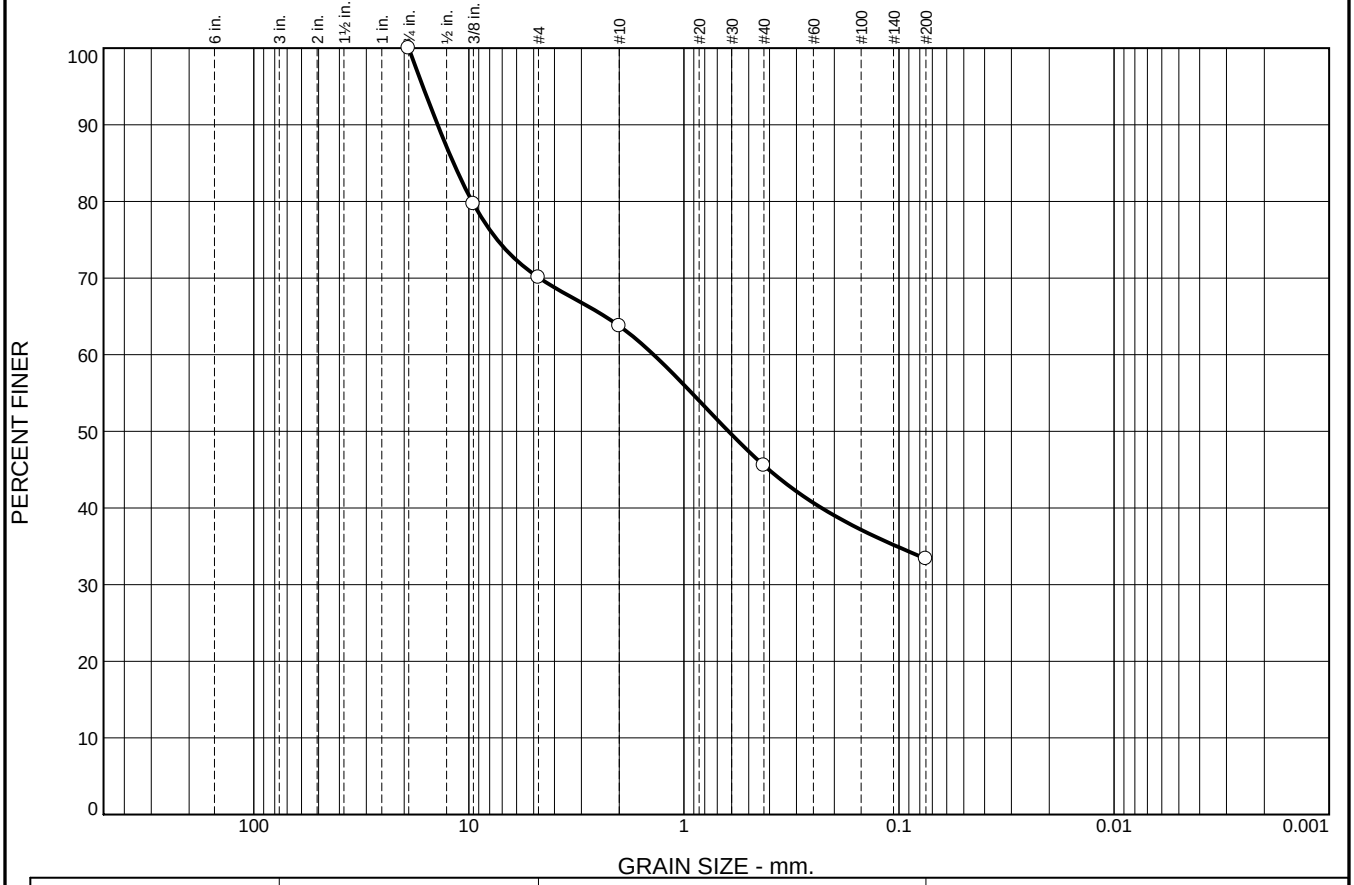
Figure 4

Tested By: CWZ 11/28/18 **Checked By:** JPB 12/03/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	29.9	6.3	18.2	12.2	33.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	26	20	11.7805	1.3834	0.6205					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SILTY, CLAYEY SAND WITH GRAVEL	11/28/18	SC-SM	20.3

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-1 **Depth:** 36.0-38.0 FT **Sample Number:** S-6

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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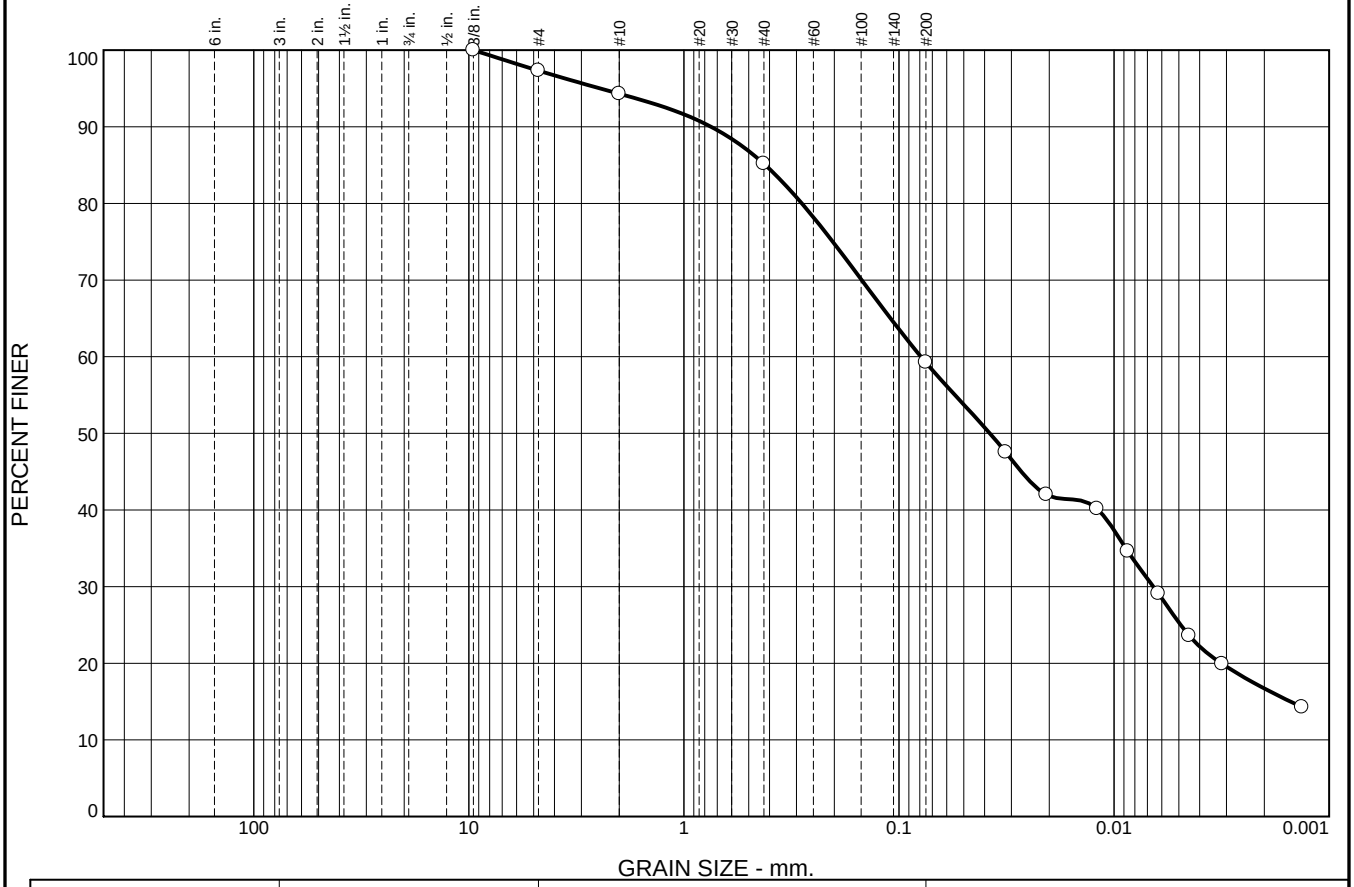
Figure 5

Tested By: CWZ 11/28/18 **Checked By:** JPB 12/03/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.7	3.0	9.1	26.0	33.9	25.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.4182	0.0790	0.0378	0.0066	0.0015			

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SANDY SILT	11/27/18	ML	19.4

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-1 **Depth:** 56.0-58.0 FT **Sample Number:** S-10

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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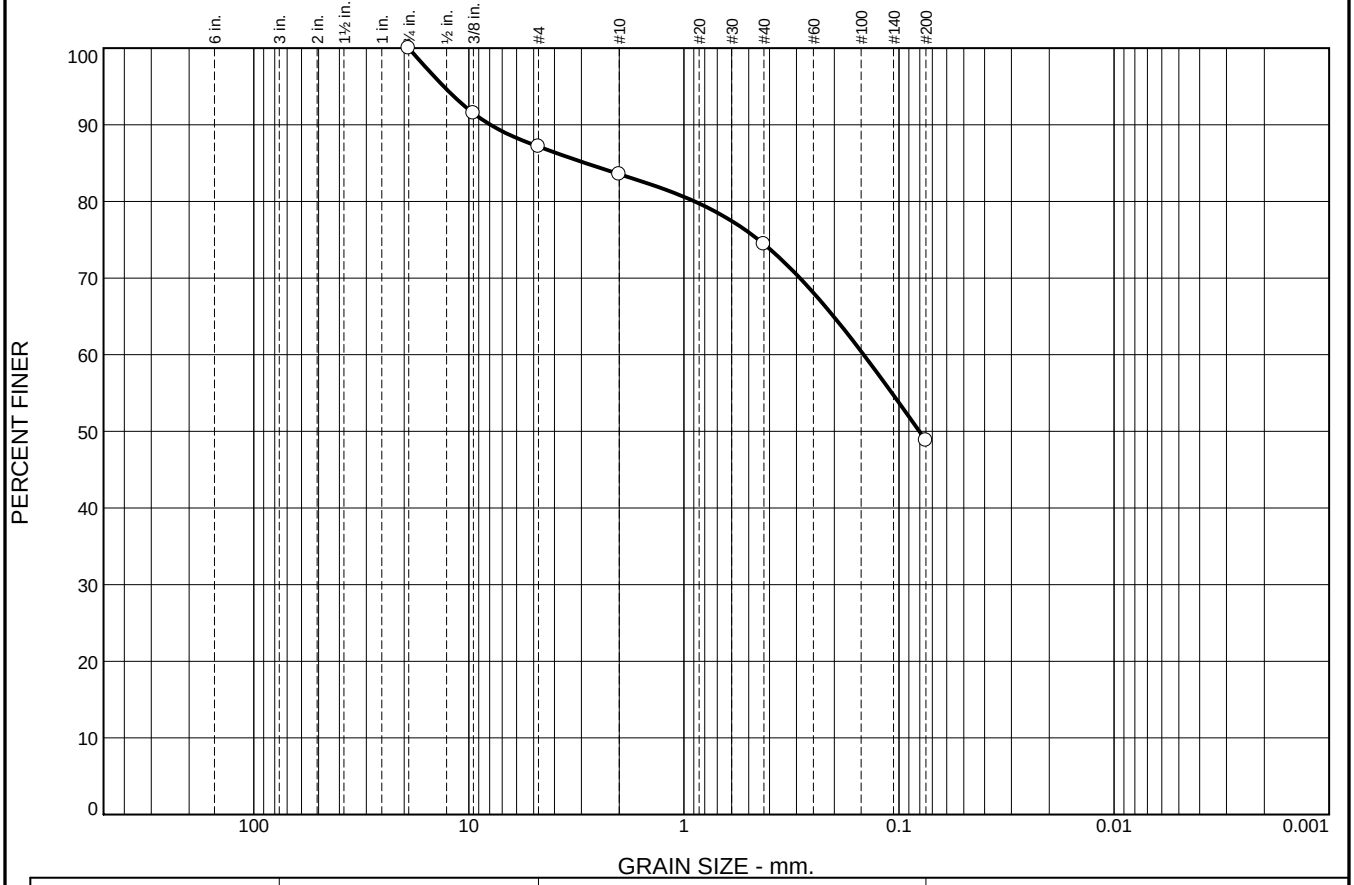
Figure 6

Tested By: CWZ 11/27/18 **Checked By:** JPB 12/03/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	12.8	3.6	9.2	25.6	48.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			2.8670	0.1460	0.0804					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SILTY SAND	11/26/18	SM	18.5

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-1 **Depth:** 61.0-63.0 FT **Sample Number:** S-11

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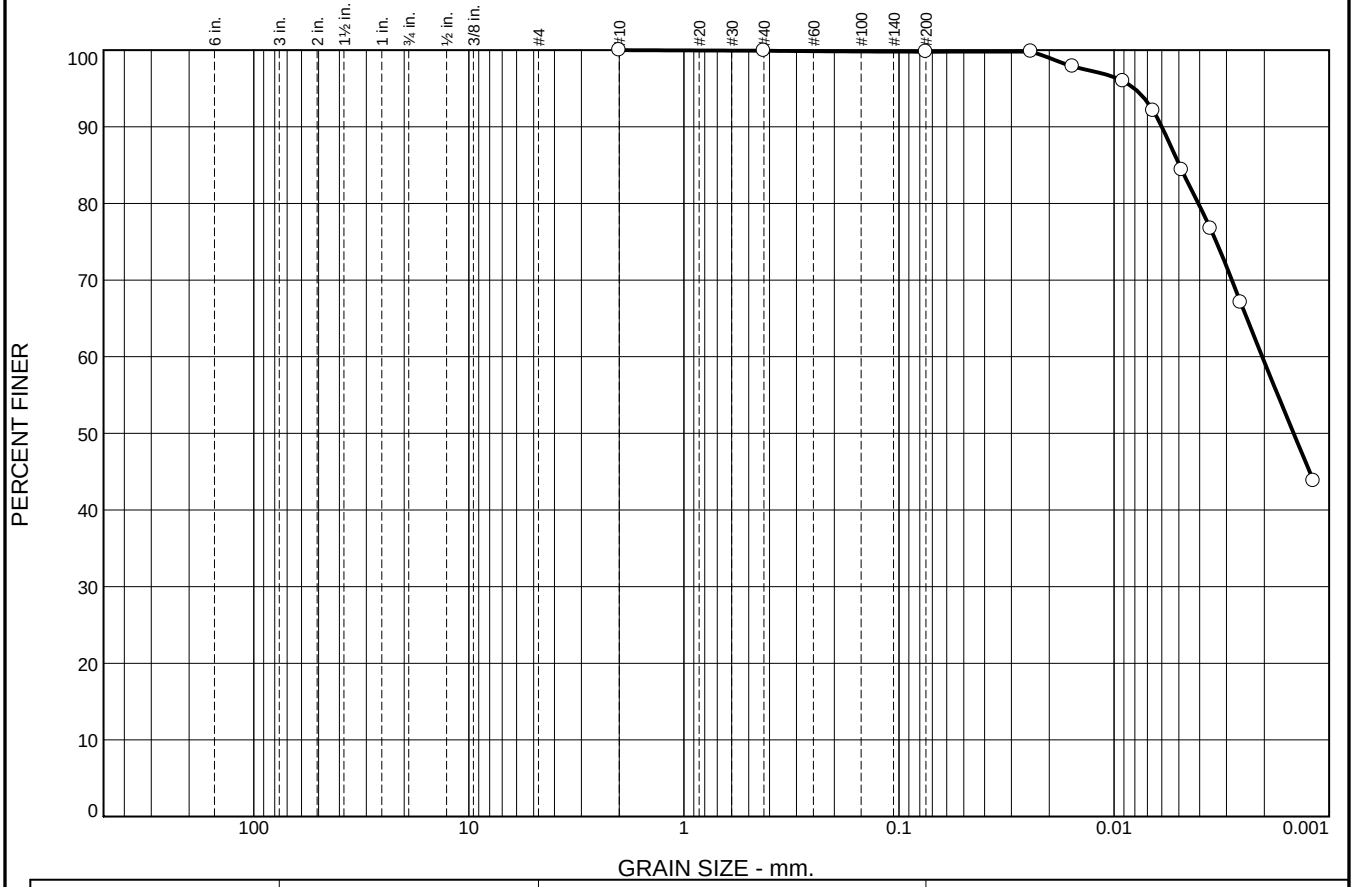
Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

Figure 7

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	0.1	14.6	85.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	36	21	0.0050	0.0020	0.0015					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY CLAY	11/27/18	CL	38.0

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-1 **Depth:** 81.0-83.0 FT **Sample Number:** S-15

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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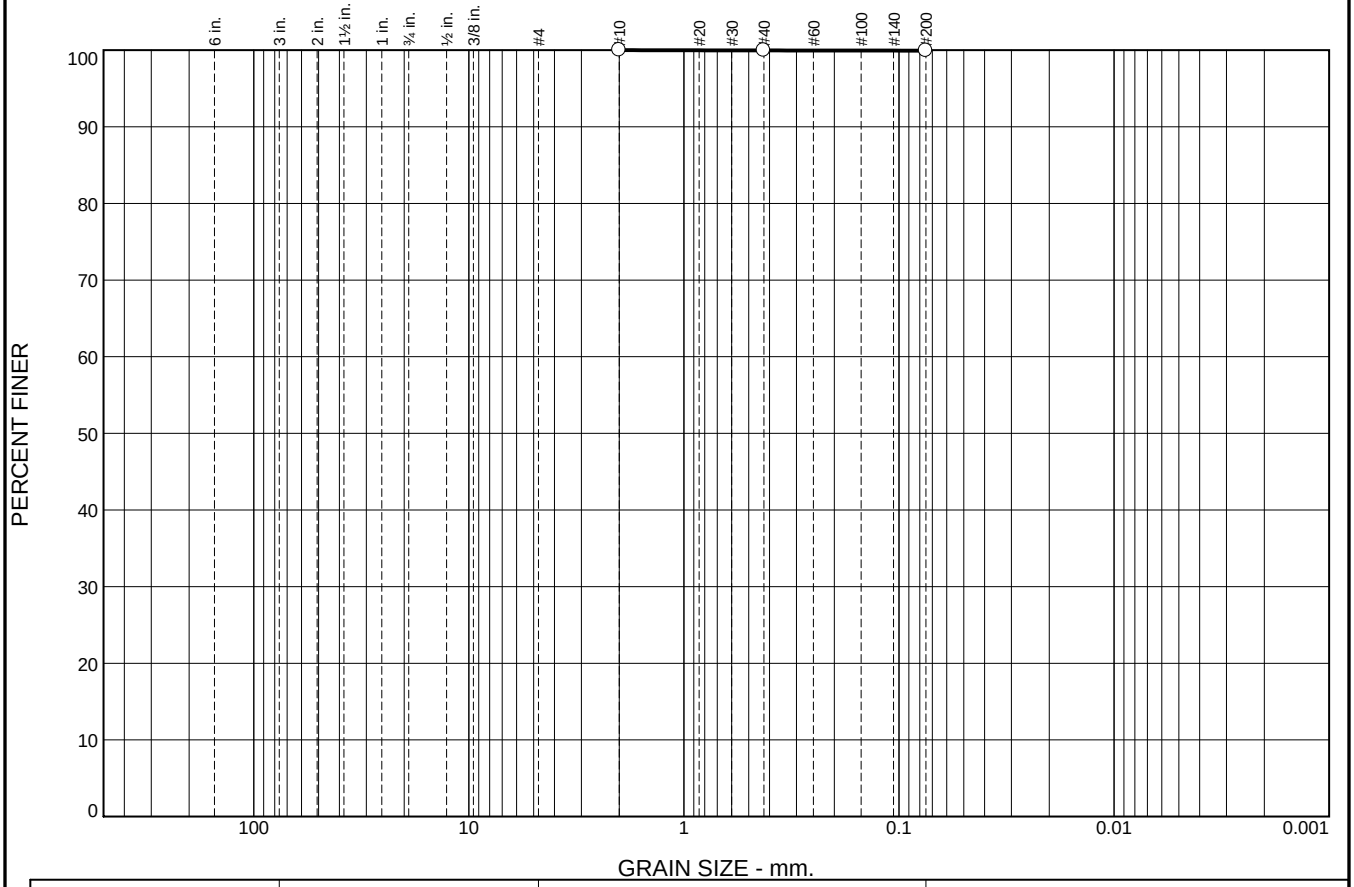
Figure 8

Tested By: CWZ 11/27/18 **Checked By:** JPB 12/03/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.1	99.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SILT	11/26/18	ML	31.6

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-1 **Depth:** 101.0-103.0 FT **Sample Number:** S-19

Remarks:
○SAMPLE DESCRIPTION
BASED ON USCS

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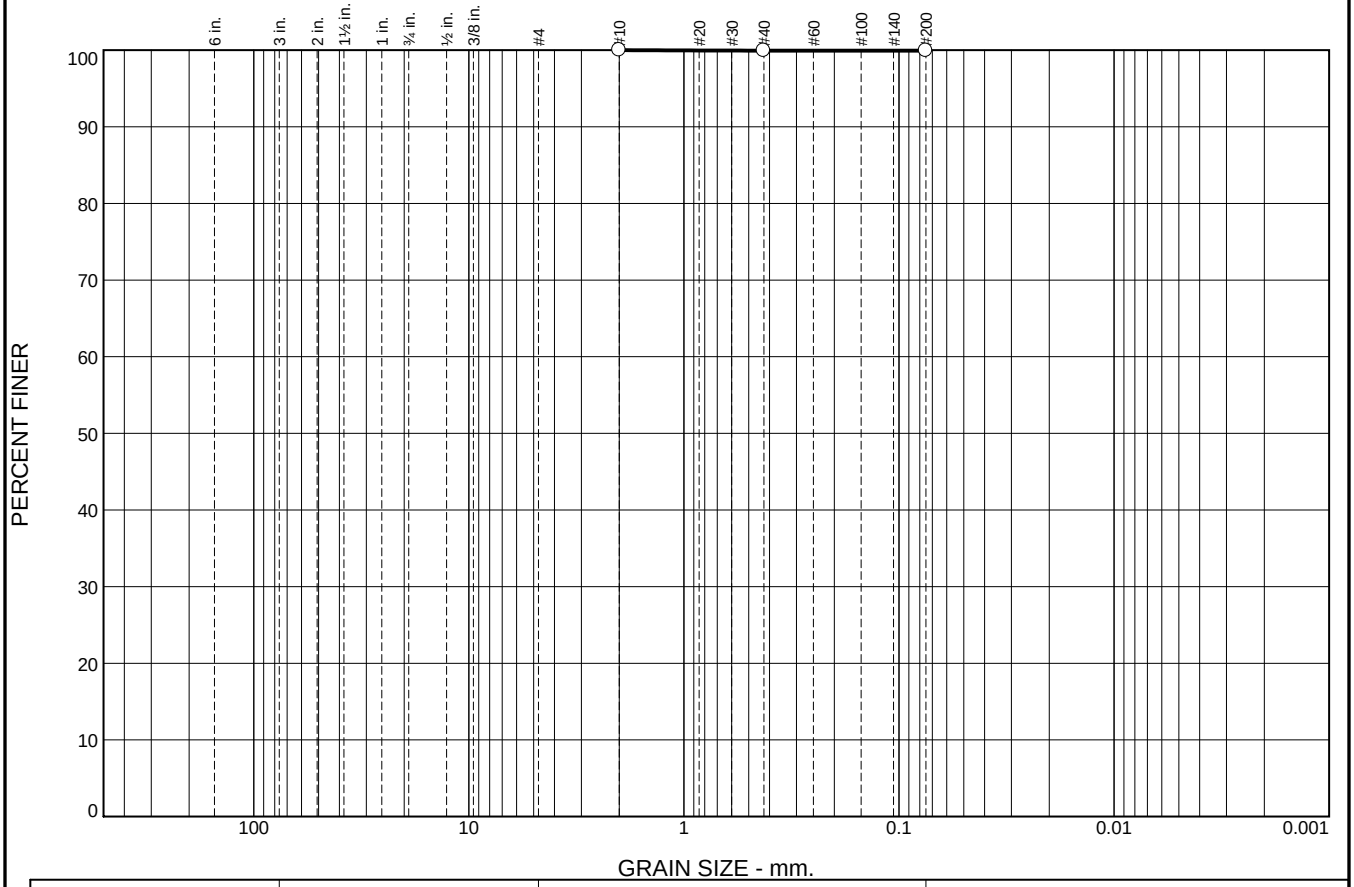
Figure 9

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	0.0	99.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SILT	11/26/18	ML	27.4

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-1 **Depth:** 121.0-123.0 FT **Sample Number:** S-23

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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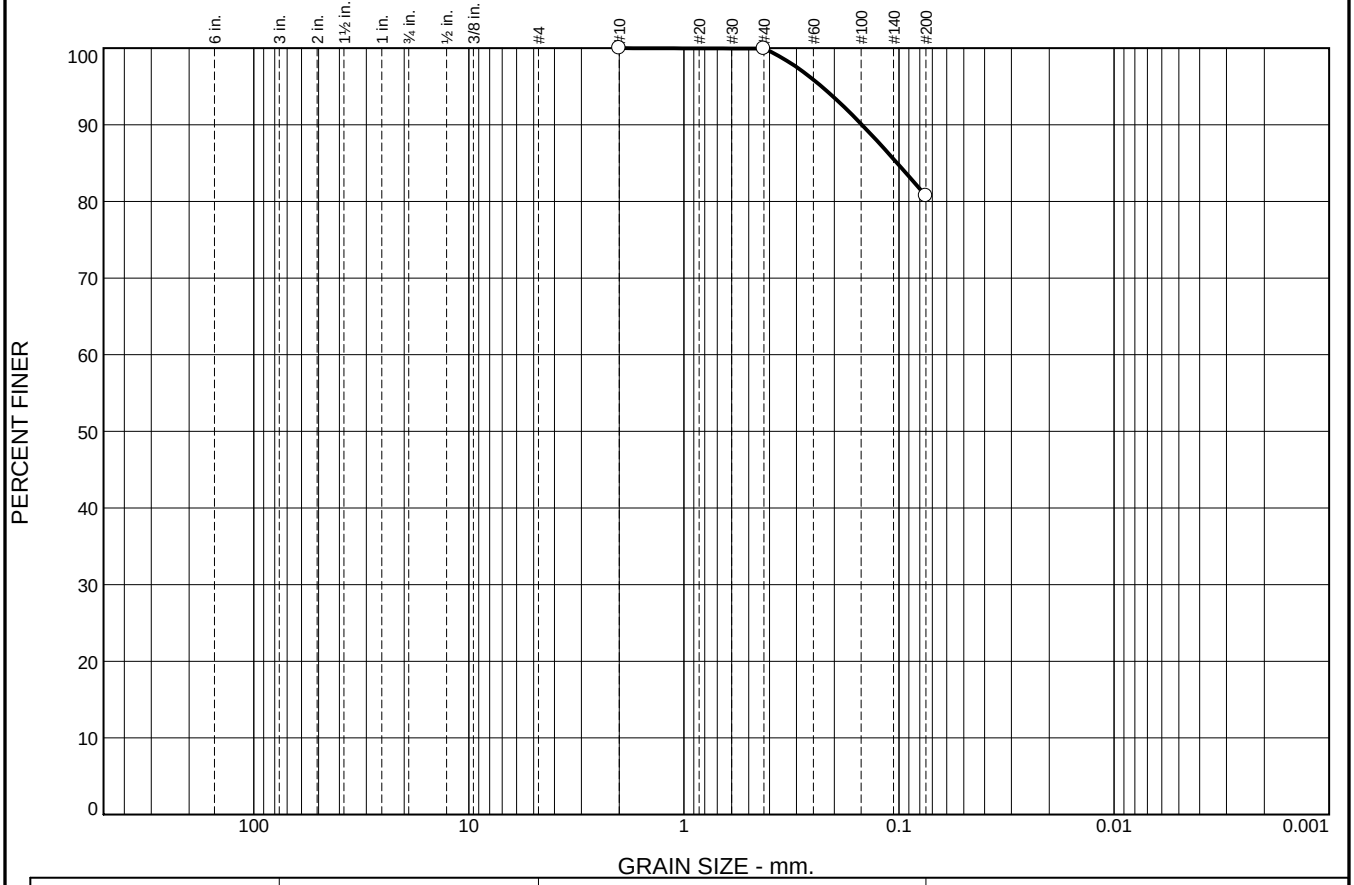
Figure 10

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	19.2	80.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1019							

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SILT WITH SAND	11/26/18	ML	20.2

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-1 **Depth:** 141.0-143.0 FT **Sample Number:** S-25

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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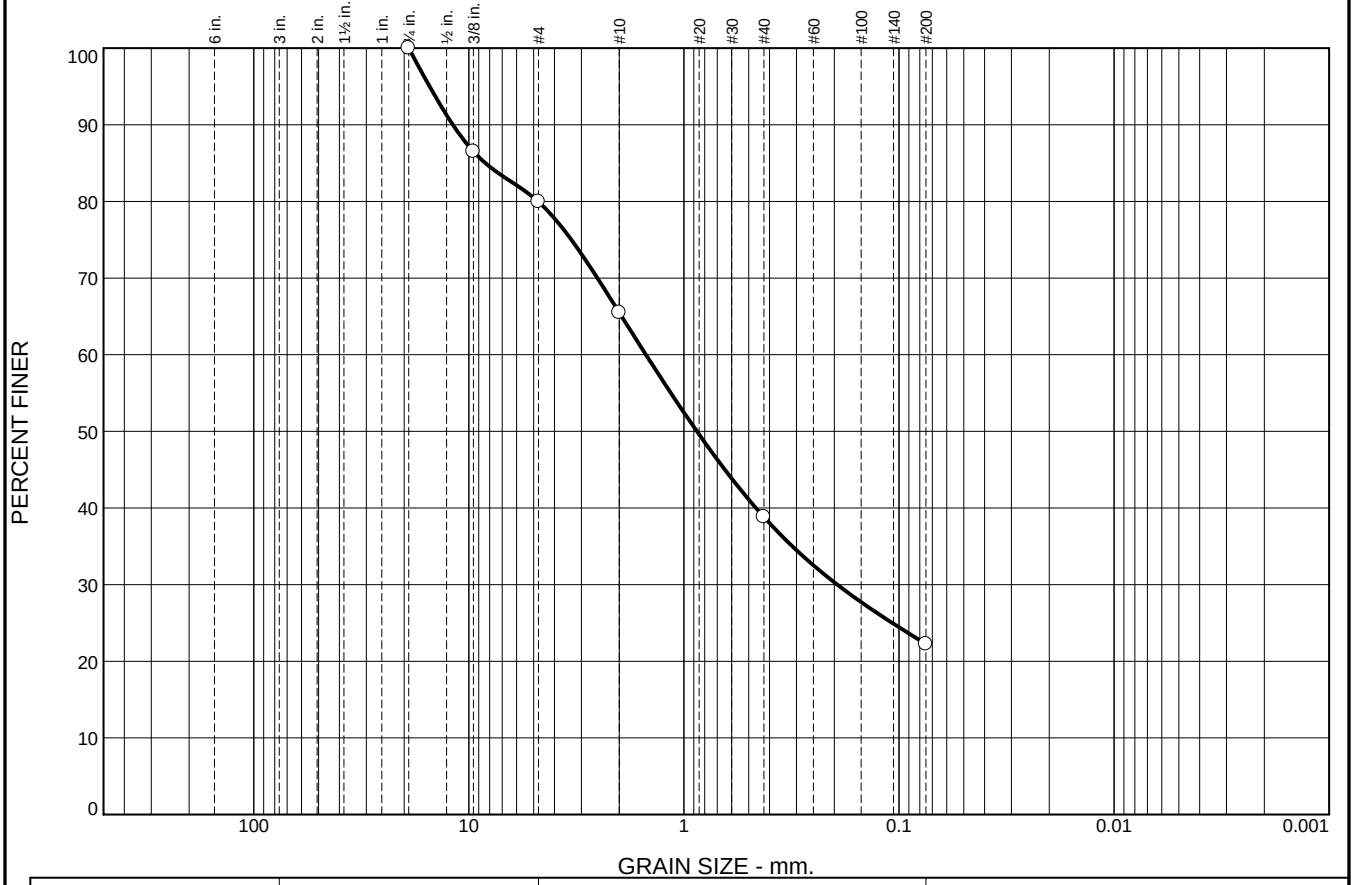
Figure 11

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	20.0	14.5	26.7	16.6	22.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			8.3909	1.5027	0.8700	0.1937				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SILTY SAND WITH GRAVEL	11/26/18	SM	9.4

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-2 **Depth:** 31.0-33.0 FT **Sample Number:** S-9

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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Figure 12

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	14.5	22.8	16.0	16.5	13.3	16.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			18.2756	4.1557	2.4475	0.4167				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SILTY SAND WITH GRAVEL	11/26/18	SM	10.0

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-2 **Depth:** 36.0-38.0 FT **Sample Number:** S-10

Remarks:

○SAMPLE DESCRIPTION BASED ON USCS

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Figure 13

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	8.1	7.5	11.9	52.0	20.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			2.1606	0.2437	0.1742	0.0973				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SILTY SAND	11/26/18	SM	15.6

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-2 **Depth:** 46.0-48.0 FT **Sample Number:** S-12

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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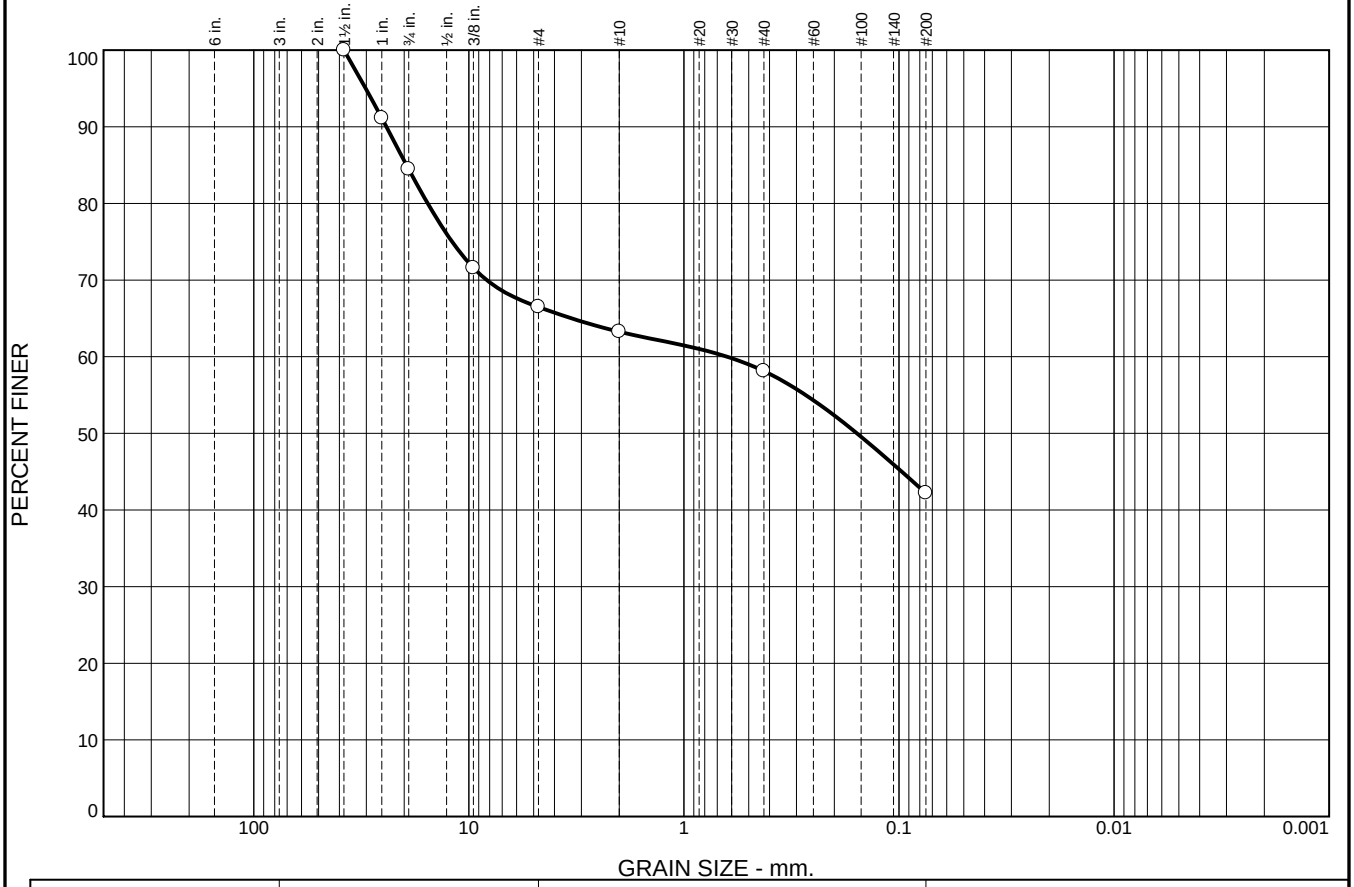
Mt. Laurel, NJ

Figure 14

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	15.5	18.0	3.2	5.2	15.9	42.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			19.4973	0.6300	0.1568					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SILTY GRAVEL WITH SAND	11/26/18	GM	15.3

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-2 **Depth:** 56.0-58.0 FT **Sample Number:** S-14

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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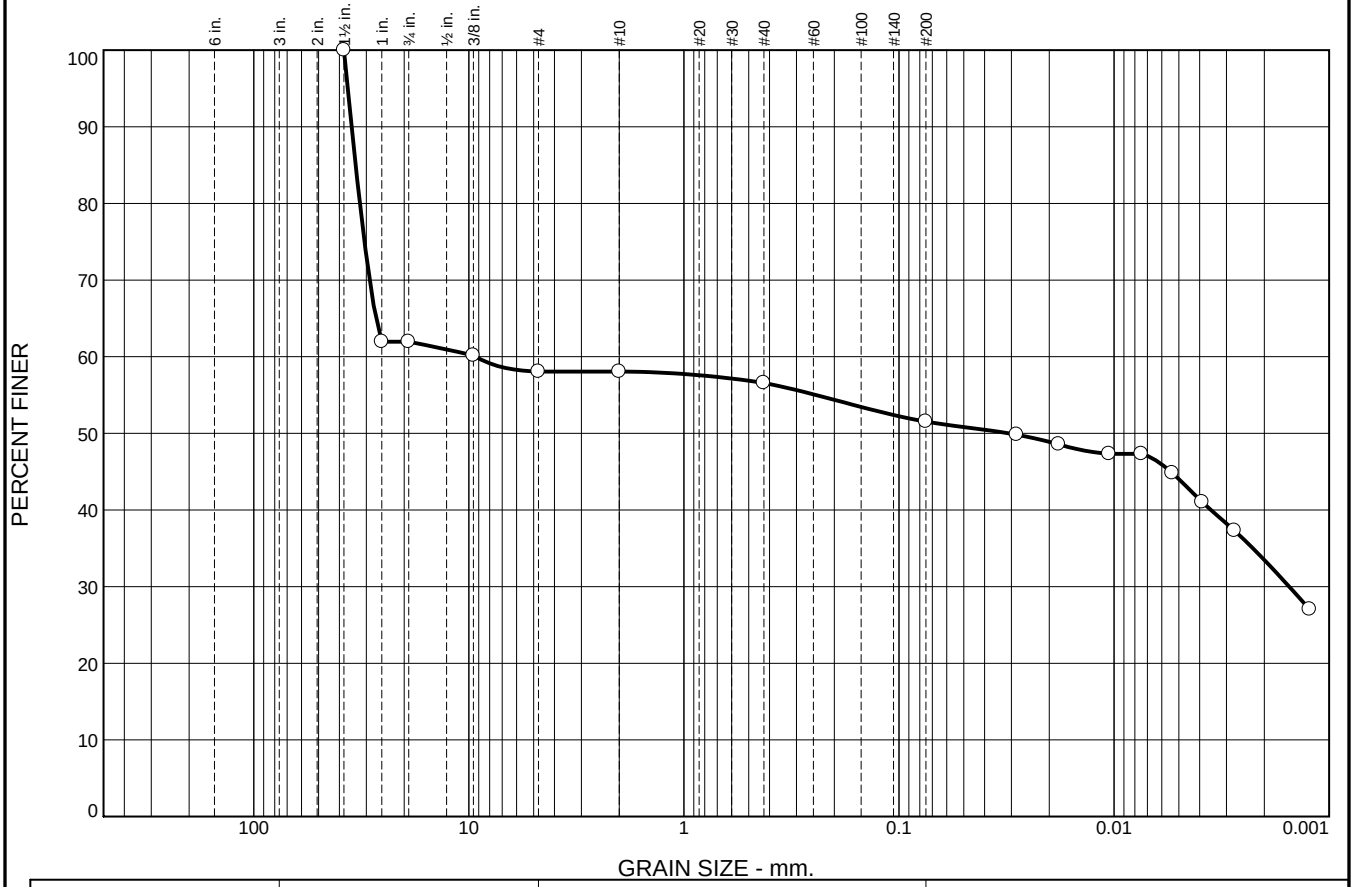
Mt. Laurel, NJ

Figure 15

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	38.0	3.9	0.0	1.5	5.1	7.5	44.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	38	22	33.6095	9.3112	0.0308	0.0015				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY GRAVELLY CLAY	11/28/18	CL	19.4

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-2 **Depth:** 61.0-63.0 FT **Sample Number:** S-15

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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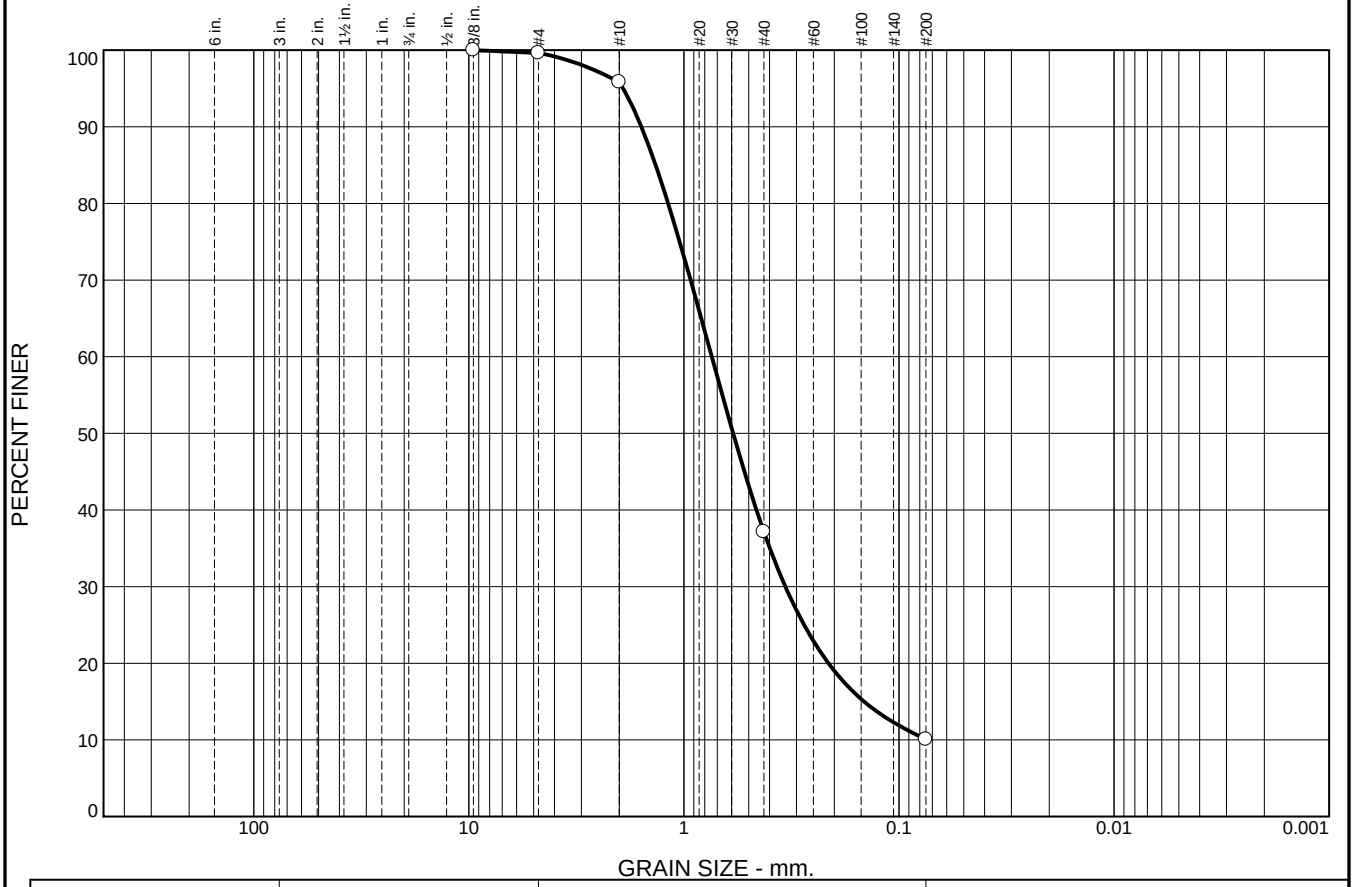
Mt. Laurel, NJ

Figure 16

Tested By: CWZ 11/28/18 **Checked By:** JPB 12/03/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.4	3.8	58.7	27.0	10.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.3541	0.7422	0.5904	0.3376	0.1453			

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SAND WITH SILT	11/26/18	SP-SM	18.1

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-2 **Depth:** 71.0-73.0 FT **Sample Number:** S-17

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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Mt. Laurel, NJ

Figure 17

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.1	0.3	2.1	24.4	73.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1507							

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN-GRAY SILT WITH SAND	11/27/18	ML	24.8

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-2 **Depth:** 29.0-31.0 FT **Sample Number:** U-1

Remarks:

○SAMPLE DESCRIPTION BASED ON USCS

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Figure 18

Tested By: CWZ 11/27/18 **Checked By:** JPB 12/03/18

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	3.6	32.3	10.2	22.3	18.6	13.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			13.1748	3.2002	1.5223	0.3752	0.0924			

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SILTY SAND WITH GRAVEL	11/26/18	SM	17.2

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-3 **Depth:** 8.0-10.0 FT **Sample Number:** S-5

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

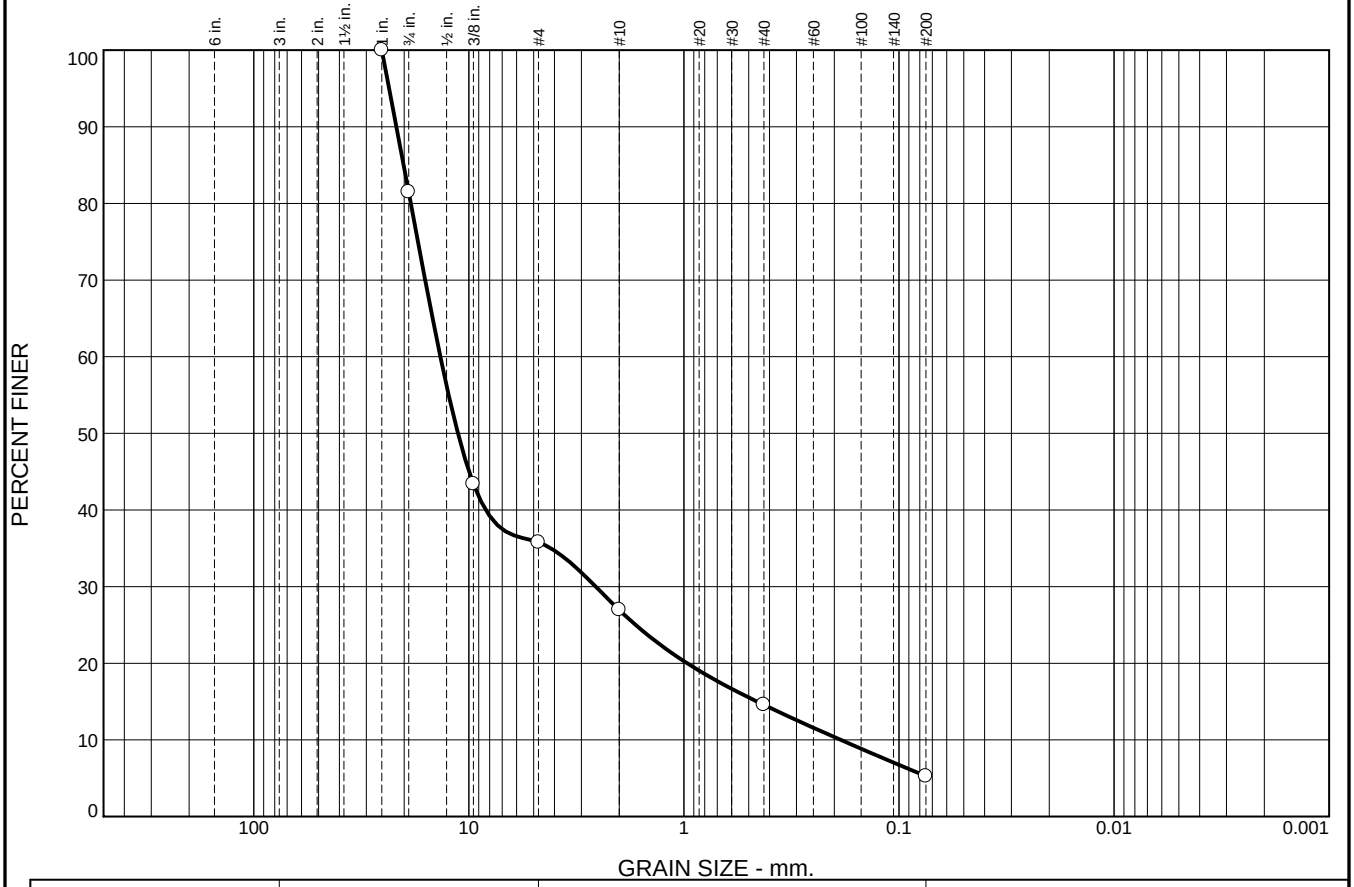
TRC Engineers, Inc.

Mt. Laurel, NJ

Figure 19

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	18.5	45.7	8.8	12.4	9.3	5.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			20.1085	13.5666	11.2411	2.5711	0.4565	0.1864	2.61	72.78

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN GRAVEL WITH SILT AND SAND	11/26/18	GP-GM	13.1

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-3 **Depth:** 21.0-23.0 FT **Sample Number:** S-7

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

TRC Engineers, Inc.

Mt. Laurel, NJ

Figure 20

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	37.4	14.6	23.2	18.3	6.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			12.7312	4.0549	2.2523	0.6297	0.1798	0.1086	0.90	37.34

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SAND WITH SILT AND GRAVEL	11/29/18	SP-SM	14.7

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-3 **Depth:** 31.0-33.0 FT **Sample Number:** S-9

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

TRC Engineers, Inc.

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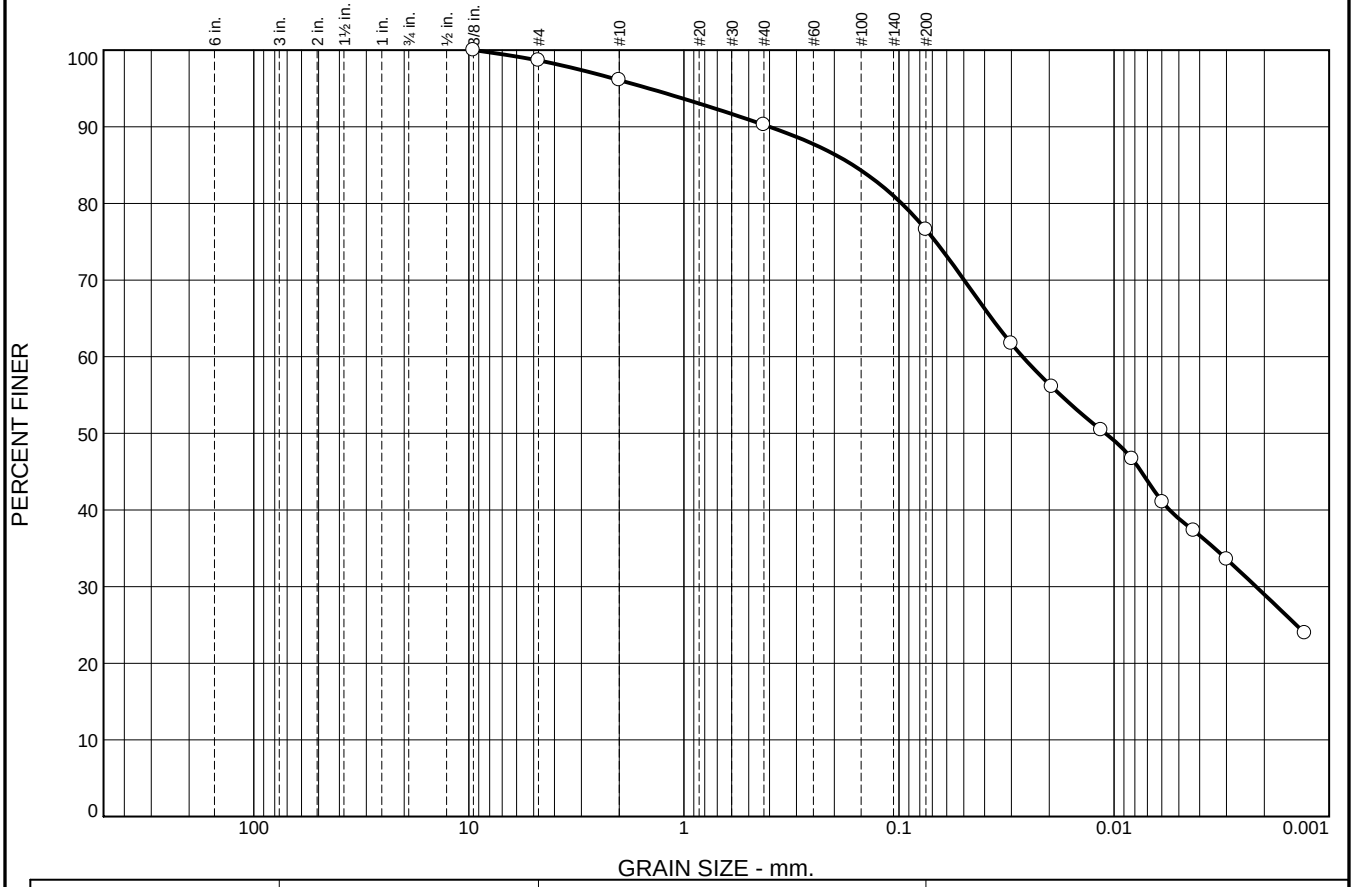
Figure 21

Tested By: CWZ 11/29/18 **Checked By:** JPB 12/03/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.3	2.6	5.8	13.7	37.7	38.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	23	16	0.1636	0.0266	0.0110	0.0022				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN-GRAY SILTY CLAY WITH SAND	11/27/18	CL-ML	18.3

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-3 **Depth:** 41.0-43.0 FT **Sample Number:** S-11

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

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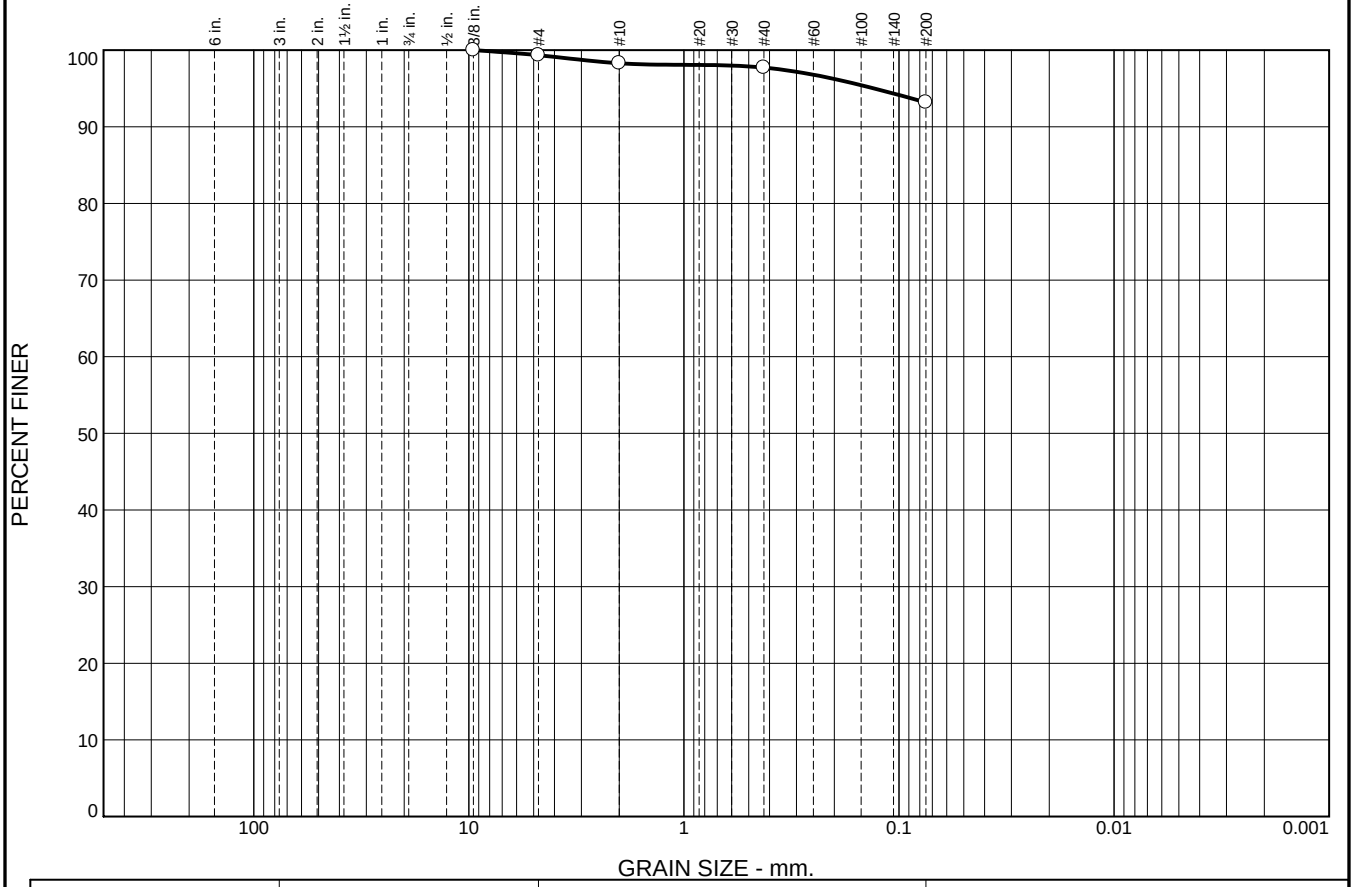
Mt. Laurel, NJ

Figure 22

Tested By: CWZ 11/27/18 **Checked By:** JPB 12/03/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.7	1.0	0.6	4.5	93.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SILT	11/26/18	ML	24.4

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-3 **Depth:** 59.0-61.0 FT **Sample Number:** S-14

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

TRC Engineers, Inc.

Mt. Laurel, NJ

Figure 23

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.4	26.2	73.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1399							

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SANDY SILT	11/26/18	ML	26.1

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-3 **Depth:** 66.0-68.0 FT **Sample Number:** S-15

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

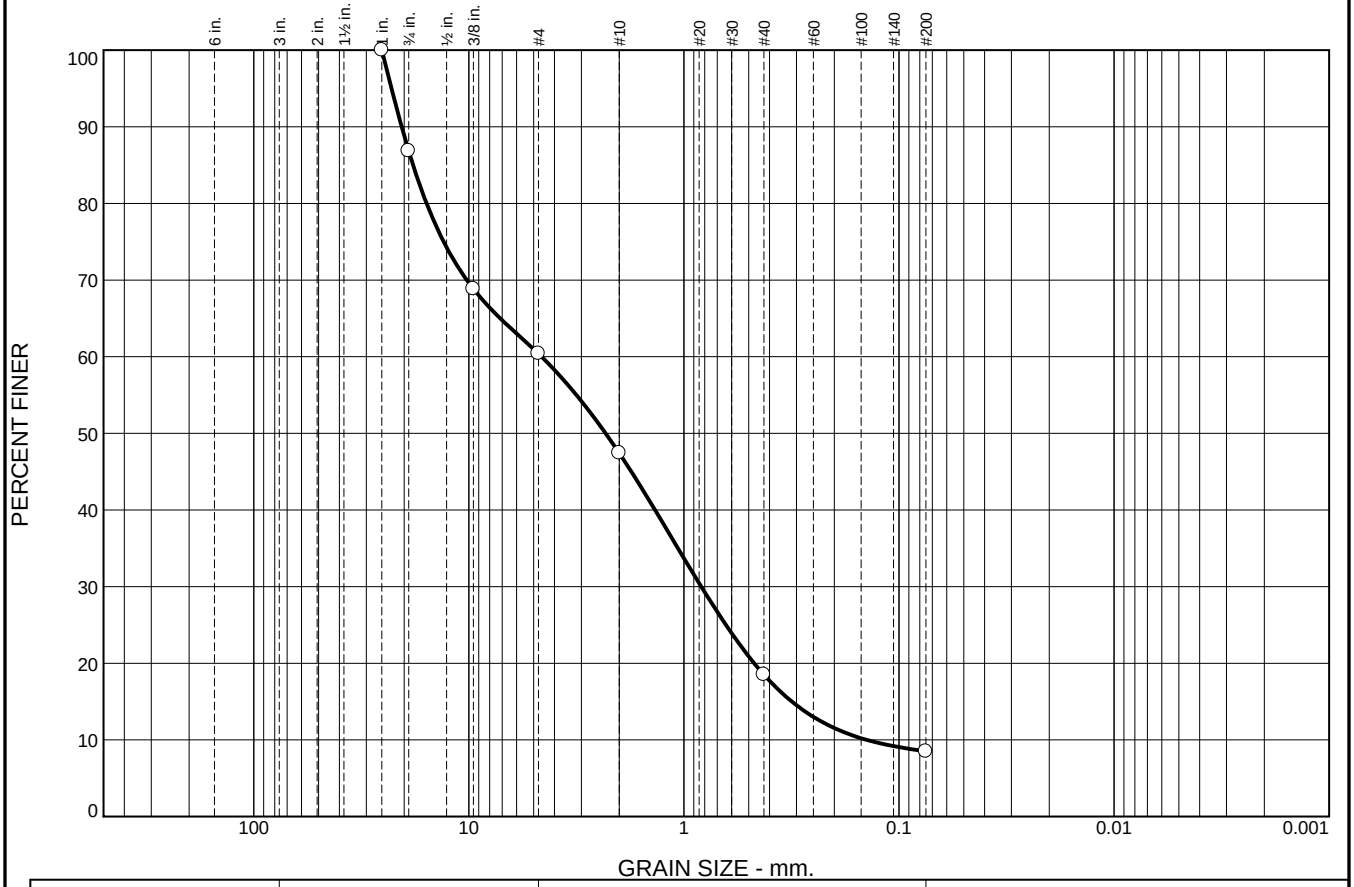
TRC Engineers, Inc.

Mt. Laurel, NJ

Figure 24

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	13.2	26.4	13.0	28.9	10.0	8.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			18.1812	4.5919	2.3129	0.8307	0.3148	0.1413	1.06	32.50

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SAND WITH SILT AND GRAVEL	11/26/18	SW-SM	8.7

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-3 **Depth:** 76.0-78.0 FT **Sample Number:** S-17

TRC Engineers, Inc.

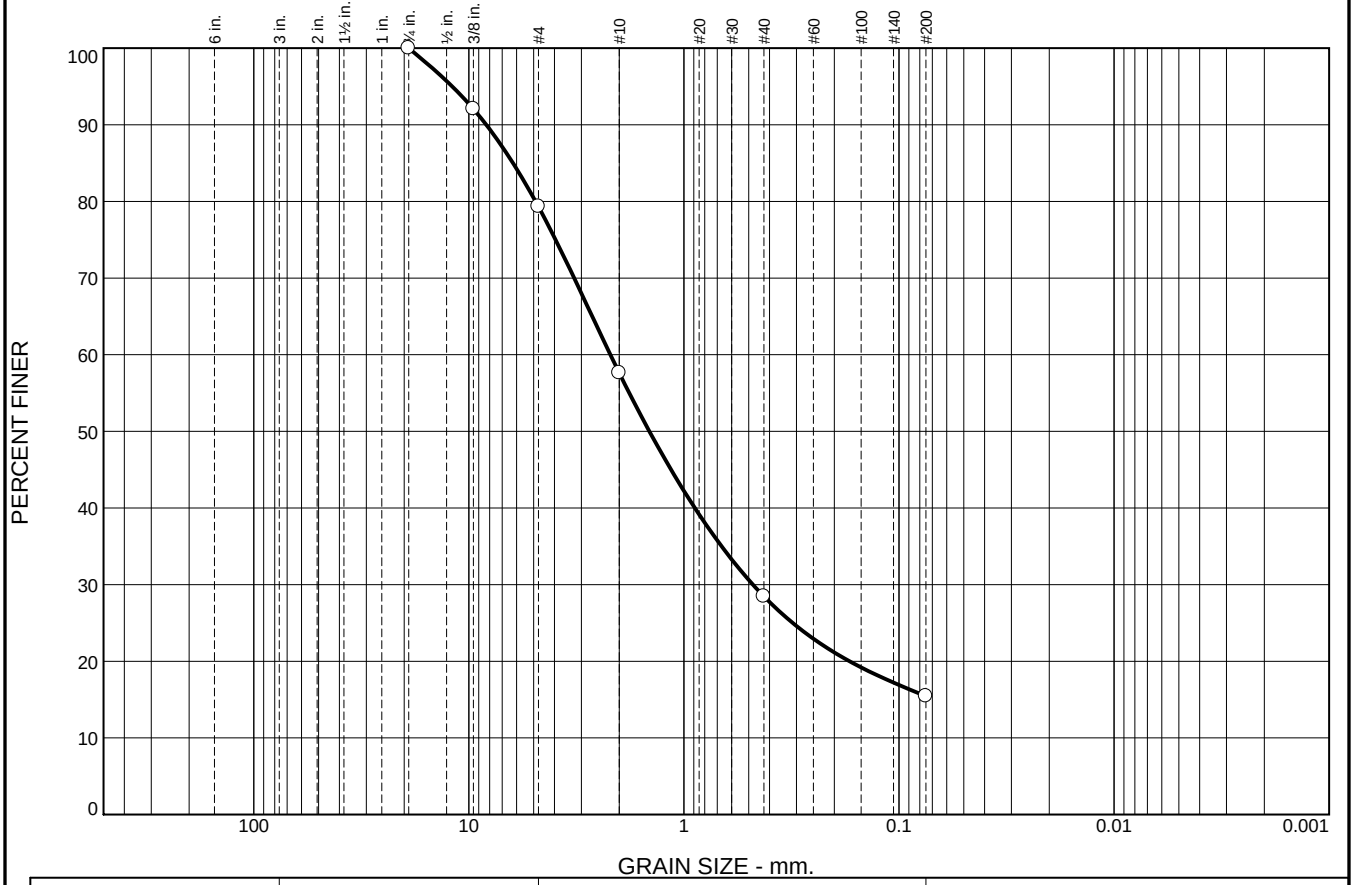
Mt. Laurel, NJ

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

Figure 25

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	20.7	21.7	29.1	13.1	15.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			6.2343	2.1981	1.4477	0.4779				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SILTY SAND WITH GRAVEL	11/26/18	SM	12.9

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-3 **Depth:** 91.0-93.0 FT **Sample Number:** S-20

Remarks:

○SAMPLE DESCRIPTION BASED ON USCS

TRC Engineers, Inc.

Mt. Laurel, NJ

Figure 26

Tested By: CWZ 11/26/18 **Checked By:** JPB 11/30/18

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.1	6.1	72.7	21.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0498	0.0206	0.0139	0.0078	0.0036	0.0025	1.20	8.28

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN-GRAY SILT	11/30/18	ML	36.6

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-3 **Depth:** 46.0-48.0 FT **Sample Number:** U-1

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

TRC Engineers, Inc.

Mt. Laurel, NJ

Figure 27

Tested By: CWZ 11/30/18 **Checked By:** JPB 12/03/18

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	0.6	84.2	15.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	21	20	0.0364	0.0187	0.0140	0.0088	0.0050	0.0037	1.12	4.99

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ GRAY SILT	12/05/18	ML	24.3

Project No. 317660 **Client:** COWI NORTH AMERICA, INC.

Project: NYSERDA PORT STUDY INVESTIGATION

○ **Source of Sample:** PTCY-3 **Depth:** 57.0-59.0 FT **Sample Number:** U-2

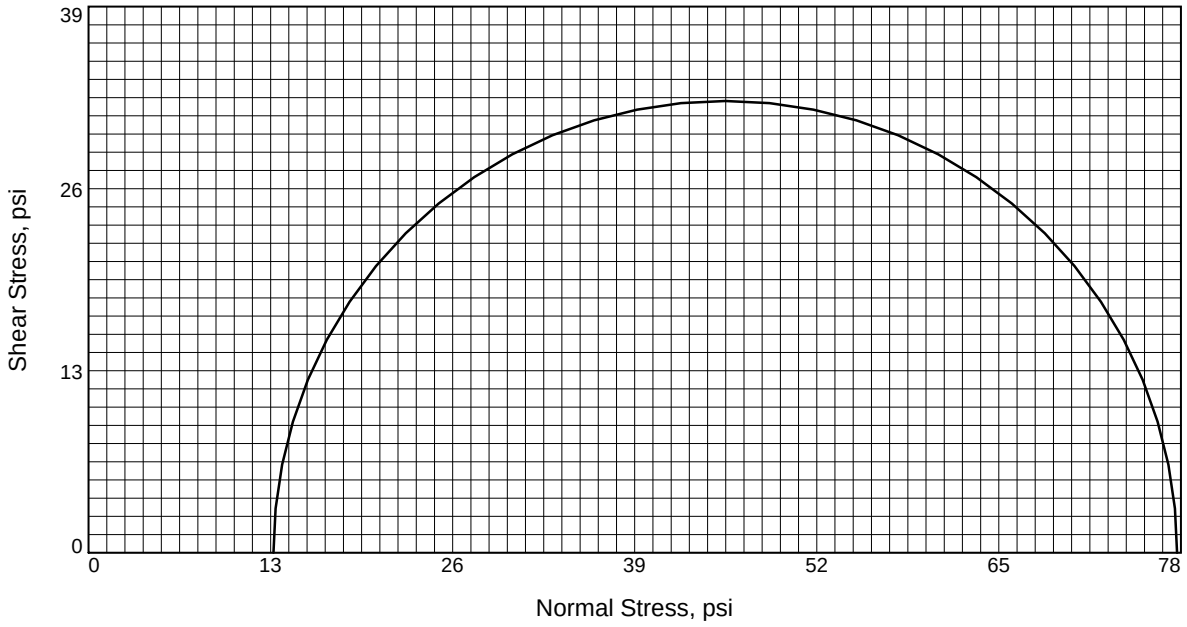
Remarks:
○SAMPLE DESCRIPTION BASED ON USCS

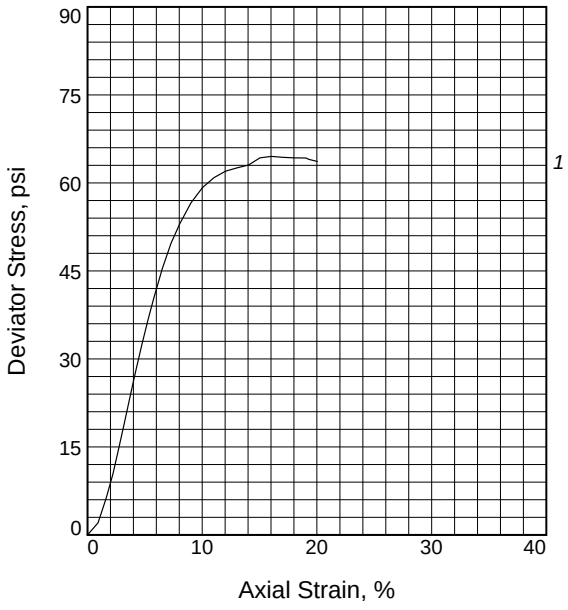
TRC Engineers, Inc.

Mt. Laurel, NJ

Figure 28

Tested By: CWZ 12/05/18 **Checked By:** JPB 12/06/18





Sample No.		1
Initial	Water Content, %	24.8
	Dry Density, pcf	101.7
	Saturation, %	99.2
	Void Ratio	0.6886
	Diameter, in.	2.844
	Height, in.	5.537
At Test	Water Content, %	24.4
	Dry Density, pcf	101.7
	Saturation, %	97.5
	Void Ratio	0.6886
	Diameter, in.	2.844
	Height, in.	5.537
Strain rate, in./min.		0.300
Back Pressure, psi		0.0
Cell Pressure, psi		13.2
Fail. Stress, psi		64.5
Strain, %		16.0
Ult. Stress, psi		
Strain, %		
σ_1 Failure, psi		77.7
σ_3 Failure, psi		13.2

Type of Test:
Unconsolidated Undrained
Sample Type: SHELBY TUBE
Description: BROWN-GRAY SILT WITH SAND

Assumed Specific Gravity= 2.75
Remarks: SAMPLE DESCRIPTION BASED ON USCS

Figure 29

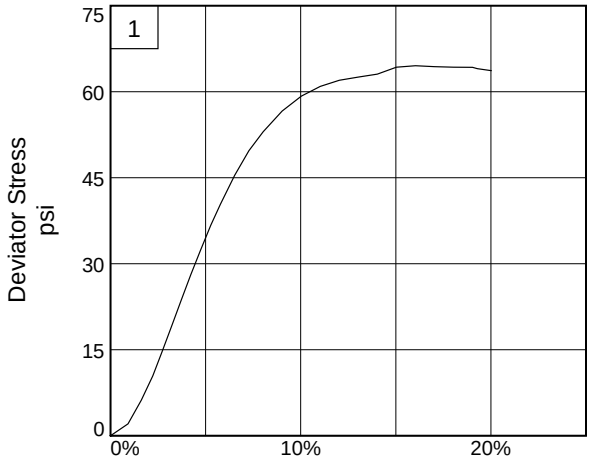
Client: COWI NORTH AMERICA, INC.

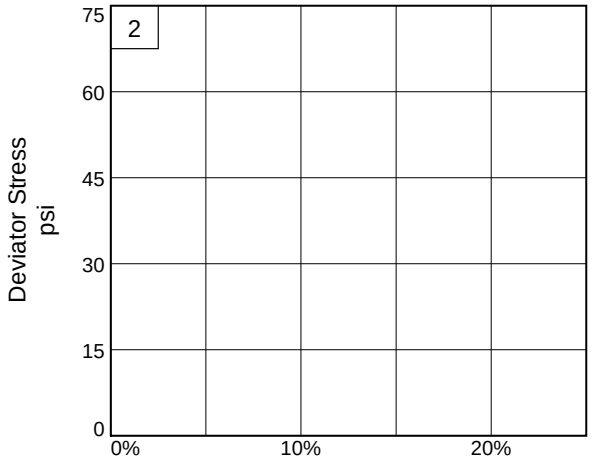
Project: NYSERDA PORT STUDY INVESTIGATION

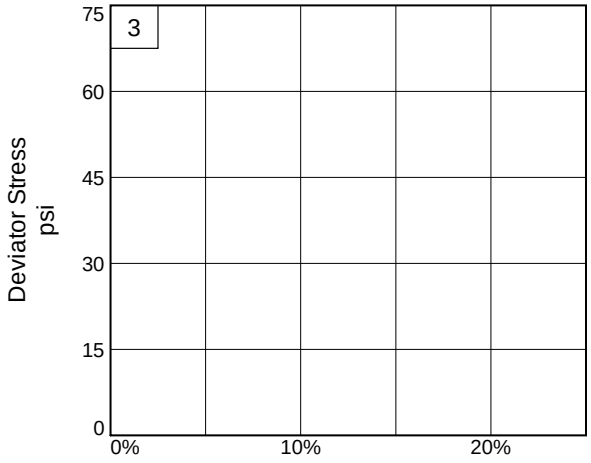
Source of Sample: PTCY-2 **Depth:** 29.0-31.0 FT
Sample Number: U-1
Proj. No.: 317660 **Date Sampled:**

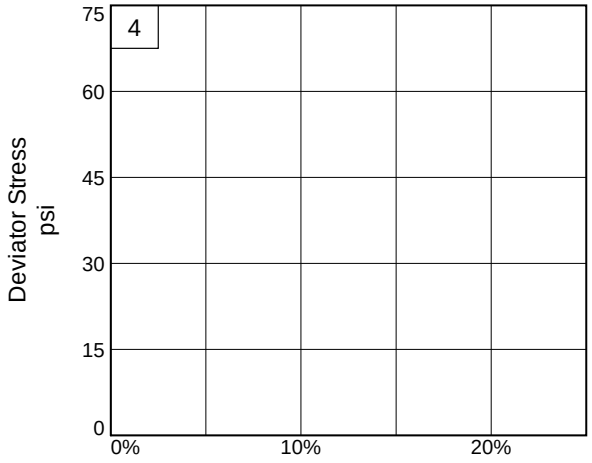
TRIAXIAL SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

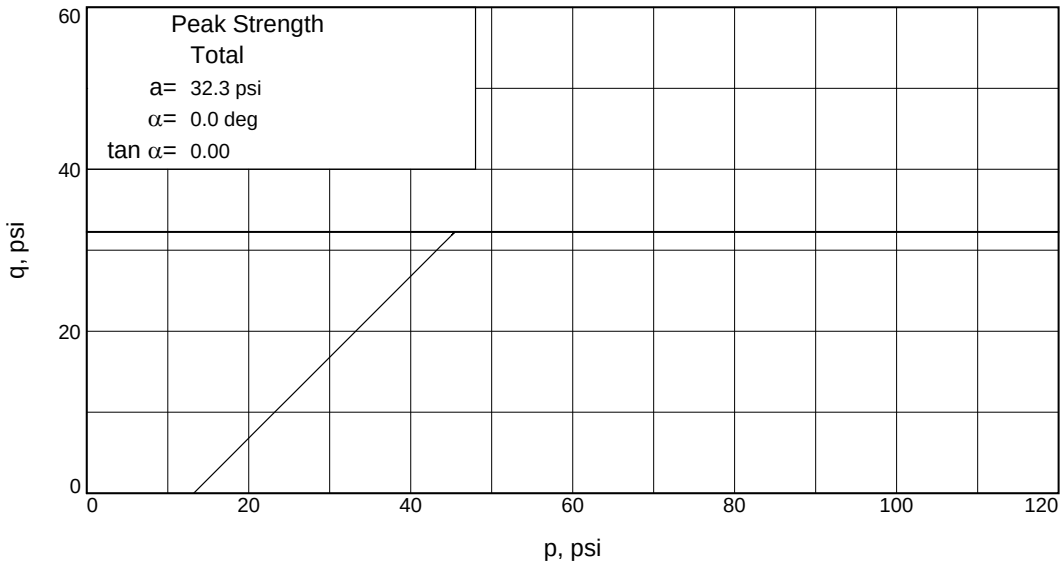
Tested By: TBT 11/27/18 **Checked By:** JPB 12/03/18







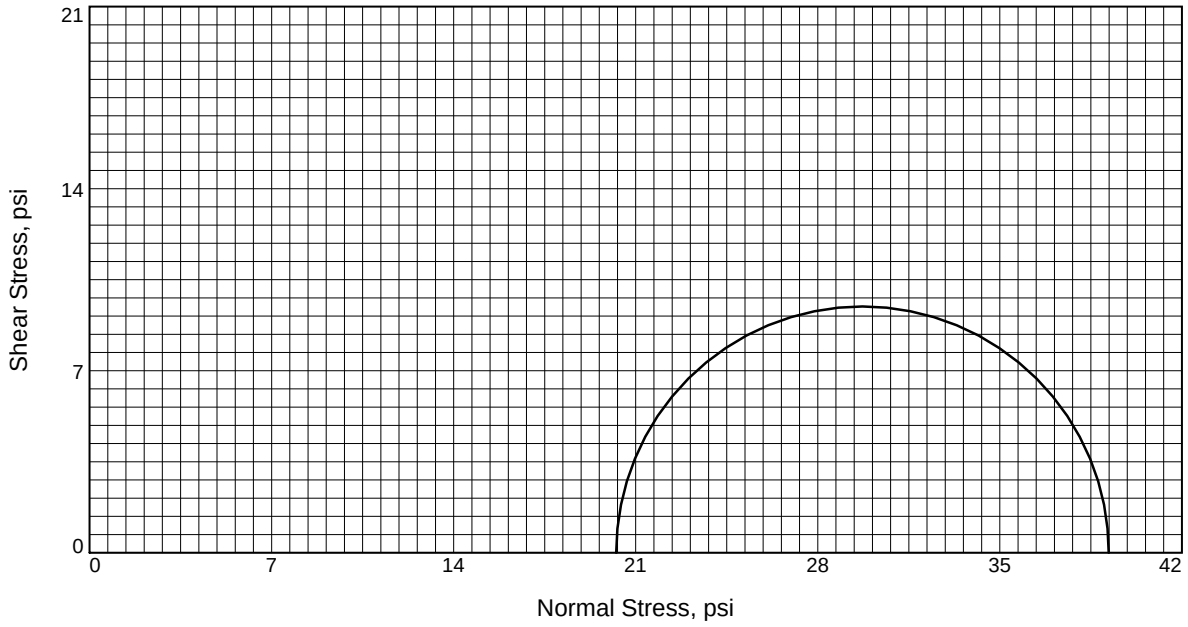


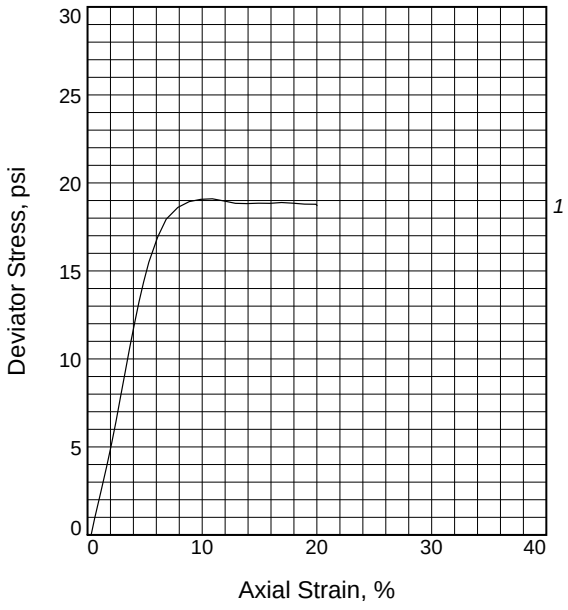


Client: COWI NORTH AMERICA, INC.
Project: NYSERDA PORT STUDY INVESTIGATION
Source of Sample: PTCY-2 **Depth:** 29.0-31.0 FT **Sample Number:** U-1
Project No.: 317660 **Figure** _____

TRC Engineers, Inc.

Tested By: TBT 11/27/18 **Checked By:** JPB 12/03/18





Sample No.		1
Initial	Water Content, %	36.7
	Dry Density, pcf	85.2
	Saturation, %	99.2
	Void Ratio	1.0159
	Diameter, in.	2.838
	Height, in.	5.568
At Test	Water Content, %	36.6
	Dry Density, pcf	85.2
	Saturation, %	99.0
	Void Ratio	1.0159
	Diameter, in.	2.838
	Height, in.	5.568
Strain rate, in./min.		1.000
Back Pressure, psi		0.0
Cell Pressure, psi		20.3
Fail. Stress, psi		18.9
Strain, %		8.9
Ult. Stress, psi		
Strain, %		
σ_1 Failure, psi		39.2
σ_3 Failure, psi		20.3

Type of Test:
Unconsolidated Undrained
Sample Type: SHELBY TUBE
Description: BROWN-GRAY SILT

Assumed Specific Gravity= 2.75
Remarks: SAMPLE DESCRIPTION BASED ON USCS

Figure 30

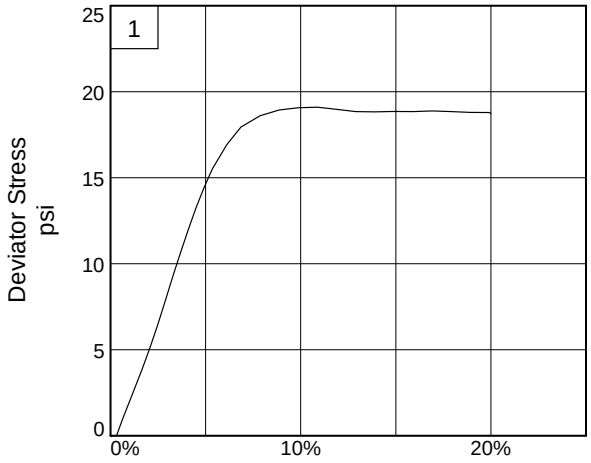
Client: COWI NORTH AMERICA, INC.

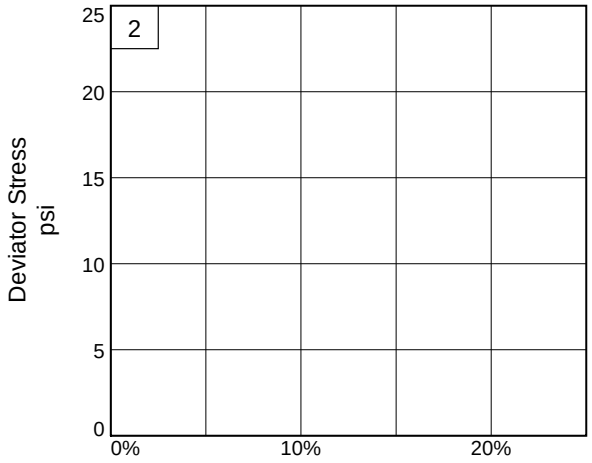
Project: NYSERDA PORT STUDY INVESTIGATION

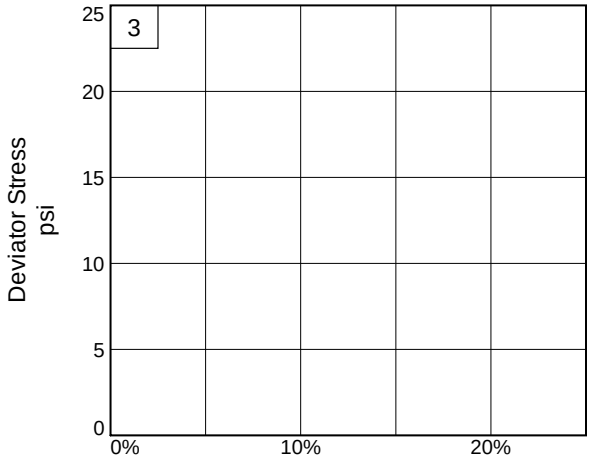
Source of Sample: PTCY-3 **Depth:** 46.0-48.0 FT
Sample Number: U-1
Proj. No.: 317660 **Date Sampled:**

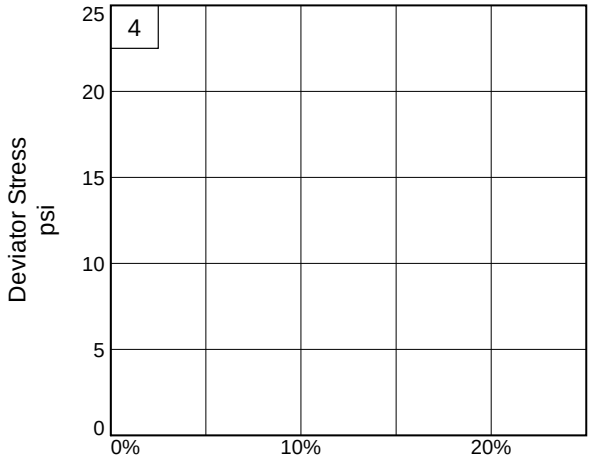
TRIAXIAL SHEAR TEST REPORT
TRC Engineers, Inc.
Mt. Laurel, NJ

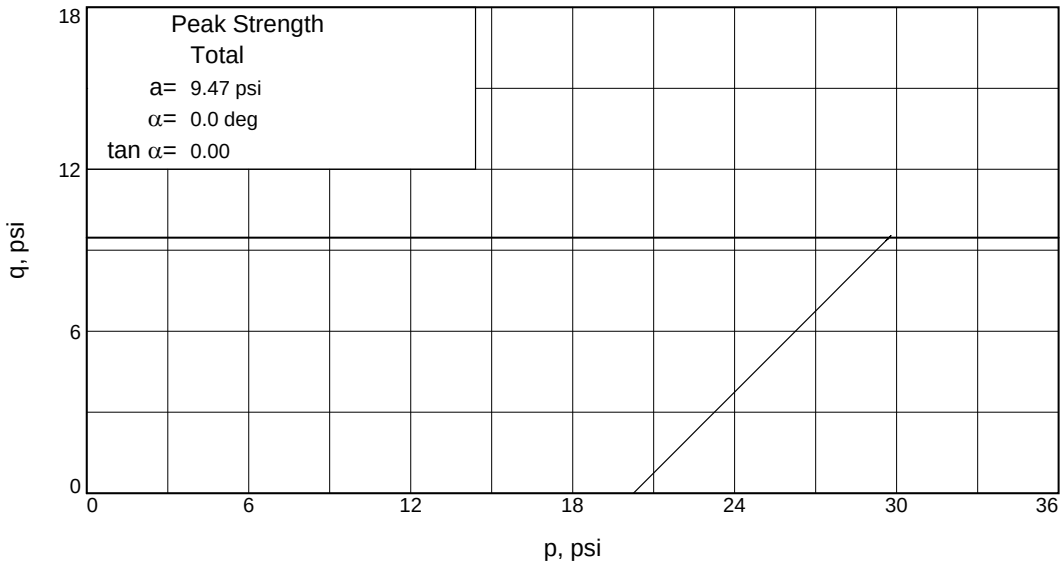
Tested By: TBT 11/27/18 **Checked By:** JPB 12/03/18











Client: COWI NORTH AMERICA, INC.
Project: NYSERDA PORT STUDY INVESTIGATION
Source of Sample: PTCY-3 **Depth:** 46.0-48.0 FT **Sample Number:** U-1
Project No.: 317660 **Figure** _____

TRC Engineers, Inc.

Tested By: TBT 11/27/18 **Checked By:** JPB 12/03/18

TRC Engineers, Inc.
Soil Mechanics Laboratory

Unconfined Compression Strength Test of Rock Core

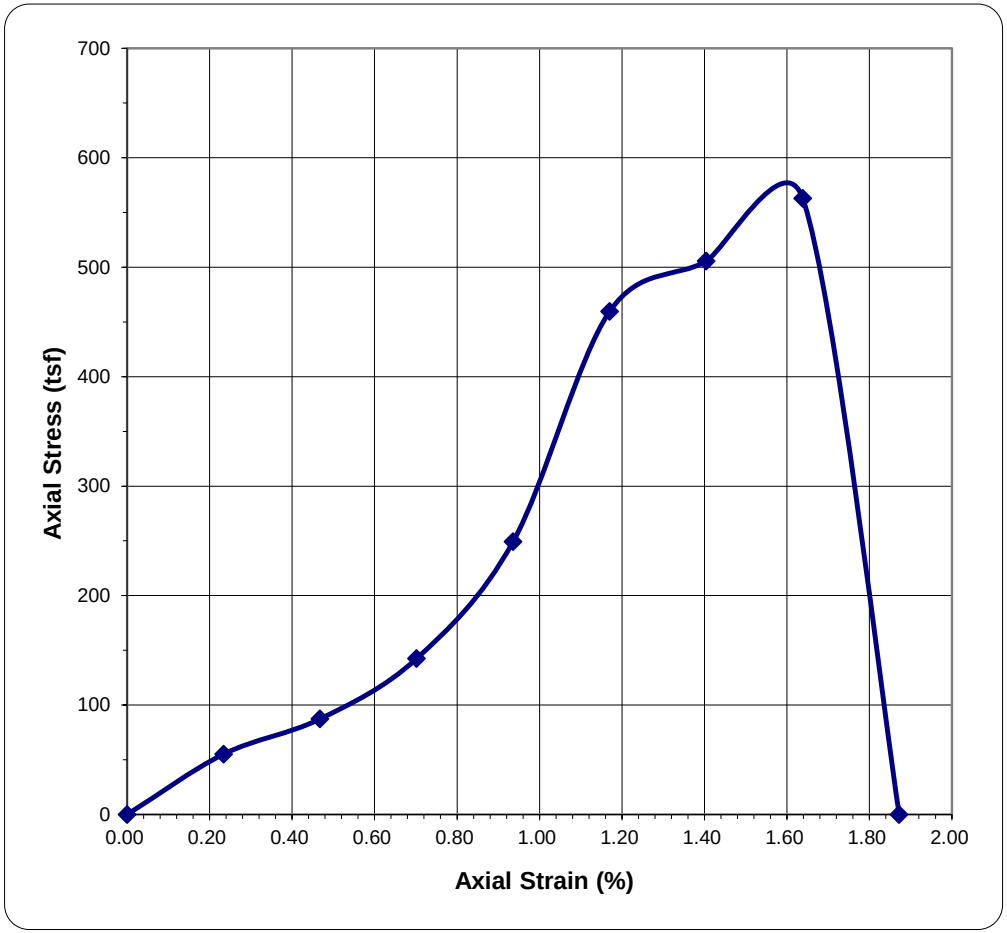
Project Name: NYSERDA PORT STUDY INVESTIGATION
Project No.: 317660.0000
Boring No.: PTCY-1
Sample No: R-2
Depth (ft): 166.0-171.0

Average Sample Diameter (in.):	1.997
Cross Sectional Area (sq. in.)	3.133
Average Sample Height (in.):	4.273
Sample Mass (g):	587.62
Unit Weight (PCF)	167.2

Sample Description:
GRAY
DOLOMITE

Test Data

Strain Dial (in.)	Load (lb)	Strain (%)	Stress (tsf)
0.000	0	0.00	0
0.010	2400	0.23	55
0.020	3800	0.47	87
0.030	6200	0.70	142
0.040	10850	0.94	249
0.050	20000	1.17	460
0.060	22000	1.40	506
0.070	24500	1.64	563
0.080	0	1.87	0



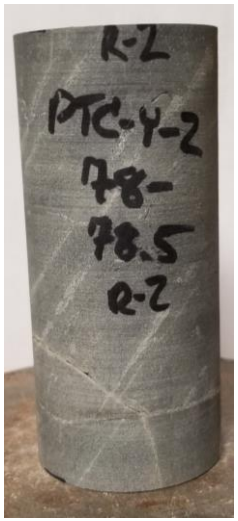
TRC Engineers, Inc.
Soil Mechanics Laboratory

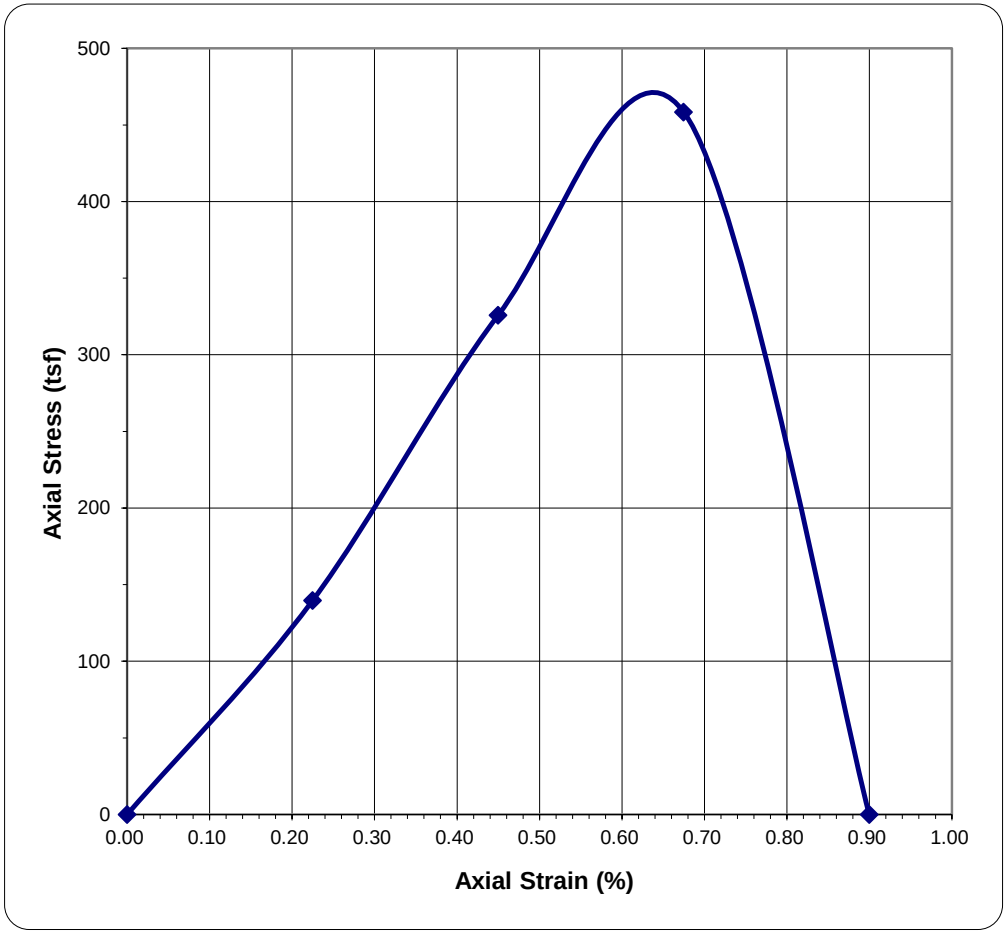
Unconfined Compression Strength Test of Rock Core

Project Name:	NYSERDA PORT STUDY INVESTIGATION				
Project No.:	317660.0000	**Average Sample Diameter (in.):**	1.985	**Sample Description:**	
Boring No.:	PTCY-2	**Cross Sectional Area (sq. in.)**	3.094	GRAY	
Sample No:	R-2	**Average Sample Height (in.):**	4.446	*DOLOMITE*	
Depth (ft):	78.0-78.5	**Sample Mass (g):**	620.76		
		Unit Weight (PCF)	171.9		

Test Data

Strain Dial (in.)	Load (lb)	Strain (%)	Stress (tsf)
0.000	0	0.00	0
0.010	6000	0.22	140
0.020	14000	0.45	326
0.030	19700	0.67	458
0.040	0	0.90	0





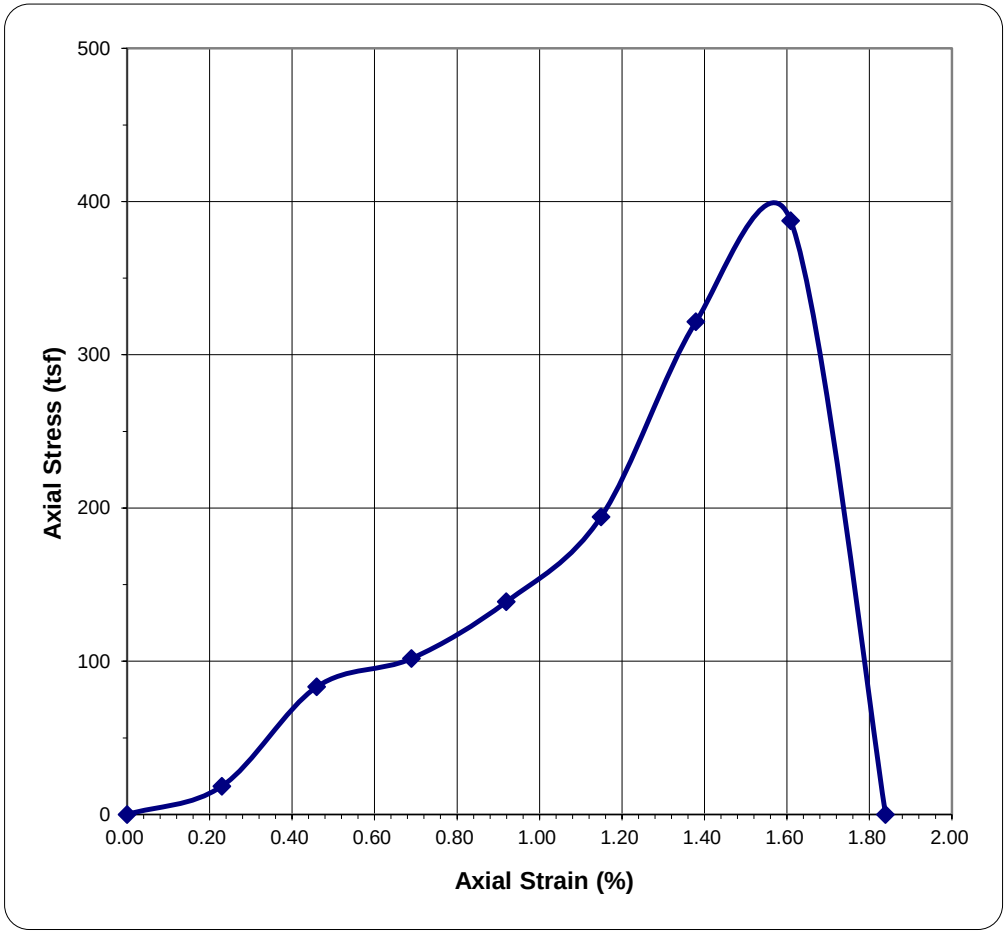
TRC Engineers, Inc.
Soil Mechanics Laboratory

Unconfined Compression Strength Test of Rock Core

Project Name:	NYSERDA PORT STUDY INVESTIGATION				
Project No.:	317660.0000	**Average Sample Diameter (in.):**	1.991	**Sample Description:**	
Boring No.:	PTCY-2	**Cross Sectional Area (sq. in.)**	3.113	GRAY	
Sample No:	R-3	**Average Sample Height (in.):**	4.350	*DOLOMITE*	
Depth (ft):	84.6-85.0	**Sample Mass (g):**	611.43		
		Unit Weight (PCF)	172.1		

Test Data

Strain Dial (in.)	Load (lb)	Strain (%)	Stress (tsf)
0.000	0	0.00	0
0.010	800	0.23	19
0.020	3600	0.46	83
0.030	4400	0.69	102
0.040	6000	0.92	139
0.050	8400	1.15	194
0.060	13900	1.38	322
0.070	16750	1.61	387
0.080	0	1.84	0



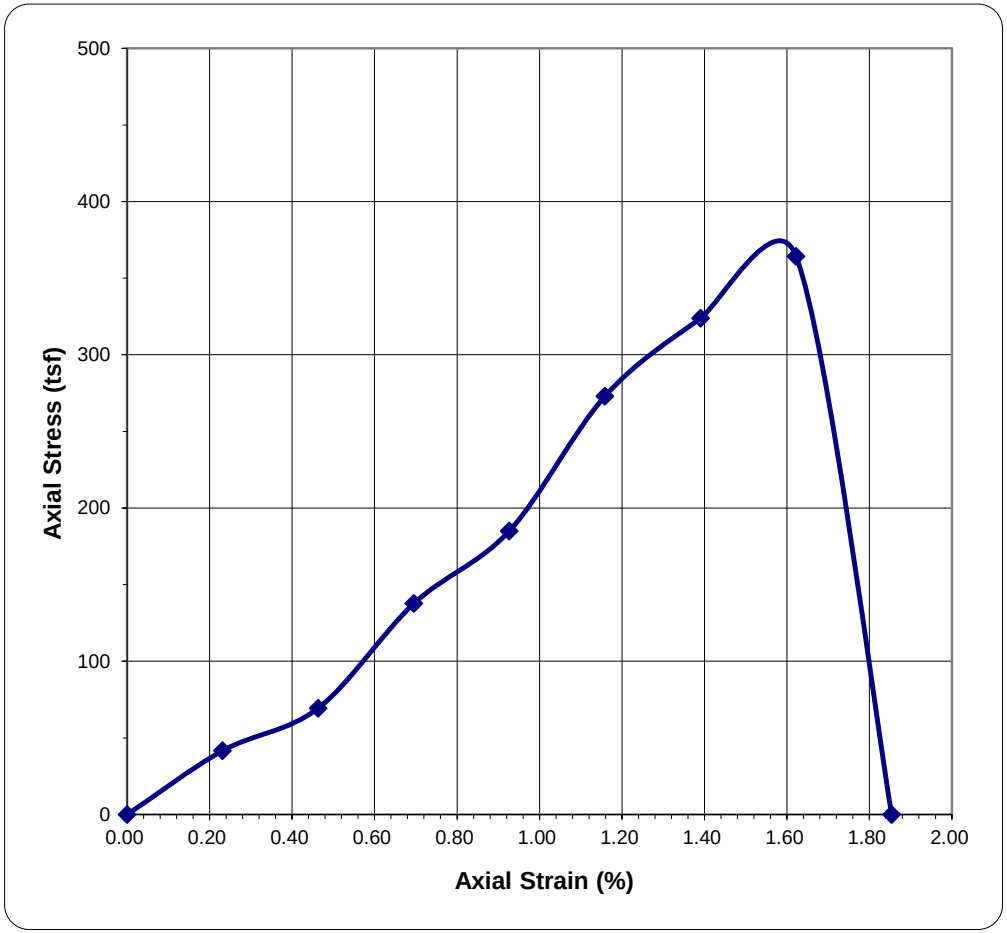
TRC Engineers, Inc.
Soil Mechanics Laboratory

Unconfined Compression Strength Test of Rock Core

Project Name:	NYSERDA PORT STUDY INVESTIGATION				
Project No.:	317660.0000	**Average Sample Diameter (in.):**	1.991	**Sample Description:**	
Boring No.:	PTCY-2	**Cross Sectional Area (sq. in.)**	3.113	GRAY	
Sample No:	R-4	**Average Sample Height (in.):**	4.316	*DOLOMITE*	
Depth (ft):	89.5-90.0	**Sample Mass (g):**	586.77		
		Unit Weight (PCF)	166.4		

Test Data

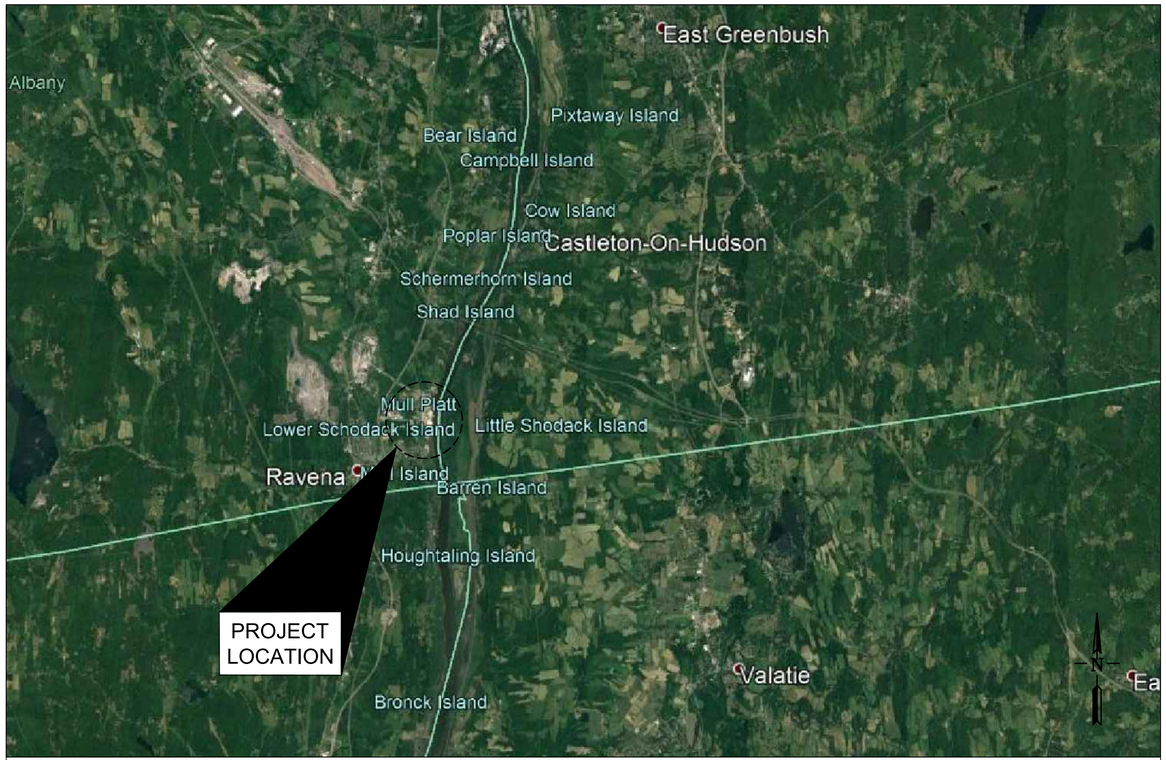
Strain Dial (in.)	Load (lb)	Strain (%)	Stress (tsf)
0.000	0	0.00	0
0.010	1800	0.23	42
0.020	3000	0.46	69
0.030	5950	0.70	138
0.040	8000	0.93	185
0.050	11800	1.16	273
0.060	14000	1.39	324
0.070	15750	1.62	364
0.080	0	1.85	0



Appendix B: Pre-FEED Drawings

NYSERDA 2018 PORTS ASSESSMENT

PORT OF COEYMANS PRE-FRONT END ENGINEERING DESIGN



LOCATION PLAN SCALE: N.T.S.

DRAWING INDEX

DWG NO.	DRAWING TITLE	REV.
A093893-G-01	COVER SHEET AND DRAWING INDEX	B
A093893-G-02	EXISTING SITE PLAN	B
A093893-S-01	PROPOSED SITE PLAN	B
A093893-S-02	EXISTING SLOPE AND PROPOSED WHARF AND DREDGE SECTIONS	B
A093893-S-03	EXISTING UPLAND AND PROPOSED RETAINING WALL SECTIONS	B

REV	DATE	DESCRIPTION	BY	CHK
B	01-23-2019	PORT OF COEYMANS PRE-FEED - FINAL DRAWING SET	PNCN	NLKP
A	12-28-2018	PORT OF COEYMANS PRE-FEED - PROGRESS DRAWING SET	PNCN	NLKP

OWNER

CLIENT

NEW YORK STATE OF OPPORTUNITY. | NYSERDA

CONSULTANT

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Tel.: 646.545.2125 Fax: 646.553.1620
Website: www.cowi-na.com

PROJECT TITLE
NYSERDA 2018 PORTS ASSESSMENT

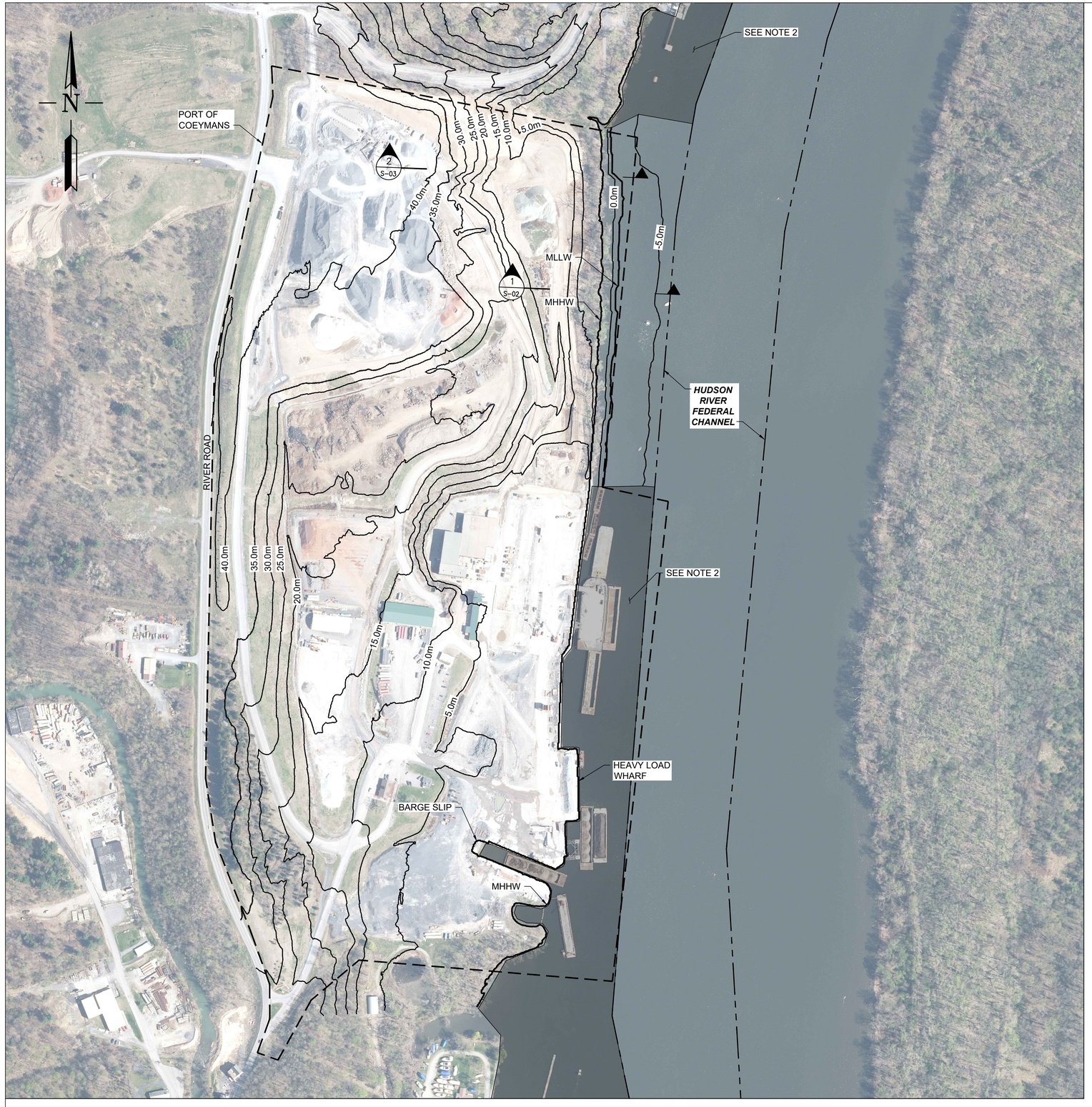
POC PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE
COVER SHEET AND DRAWING INDEX

ENGINEER'S STAMP

FOR PLANNING PURPOSES ONLY

SCALE	DESIGNED	APPROVED
N/A	NLKP	BRCO
DRAWN	CHECKED	DATE
PNCN	NLKP	01-23-2019
JOB NO.	DRAWING NO.	REV.
A093893	G-01	B



EXISTING SITE PLAN

1:2500

LEGEND:

- MHHW OR MLLW
- MAJOR CONTOUR LINES
- PORT OF COEYMANS FACILITY
- HIDDEN BATHYMETRY (SEE NOTE 2)

GENERAL NOTES:

1. ELEVATION DATA IS BASED ON A COMBINATION OF THE FOLLOWING DATA SOURCES: COASTAL NEW YORK LIDAR HYDRO FLATTENED RASTER DEM DATASET AND HUDSON RIVER CONDITION SURVEY 4531. HORIZONTAL DATUM IS UTM 18N COORDINATE SYSTEM NAD 83; THE PROJECT VERTICAL DATUM IS THE NORTH AMERICAN DATUM 1988 (NAVD 88).
2. DATA IN THIS AREA UNKNOWN DUE TO LACK OF ACCURATE PUBLICLY AVAILABLE DATA. SITE SURVEY RECOMMENDED.

TIDAL DATUM	NAVD 88
MEAN HIGHER HIGH WATER (MHHW)	1.15 m (3.78 FT.)
NAVD '88	0.00m (0.00 FT.)
MEAN LOWER LOW WATER (MLLW)	-0.55 m (-1.80 FT.)

GRAPHIC SCALES

CHECK GRAPHIC SCALES BEFORE USING

0 1:2500 100

REV	DATE	DESCRIPTION	BY	CHK
B	01-23-2019	PORT OF COEYMANS PRE-FEED - FINAL DRAWING SET	PNCN	NKLP
A	12-28-2018	PORT OF COEYMANS PRE-FEED - PROGRESS DRAWING SET	PNCN	NKLP

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PROJECT TITLE

NYSERDA 2018 PORTS ASSESSMENT

POC PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE

EXISTING SITE PLAN

ENGINEER'S STAMP

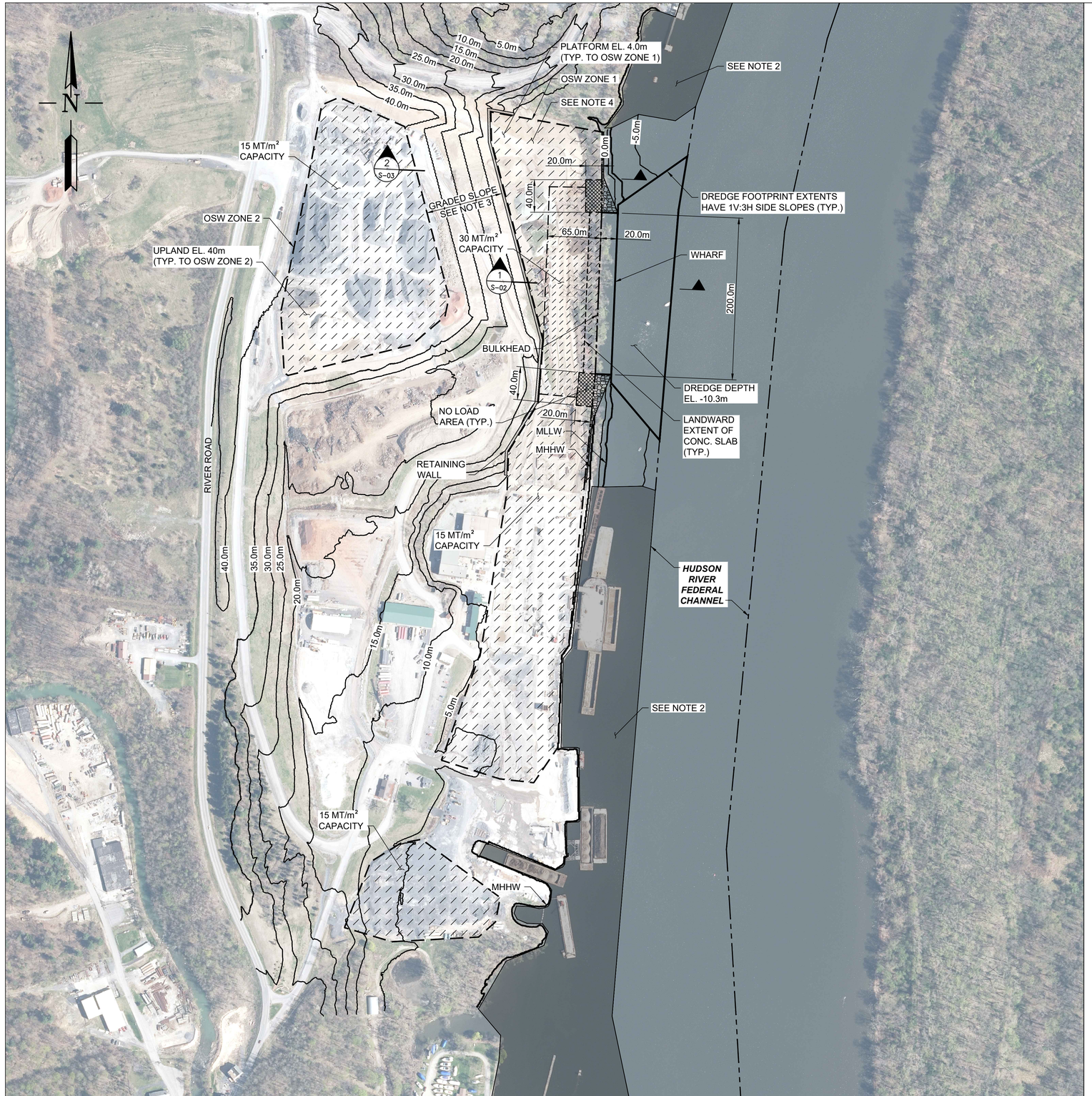
FOR PLANNING PURPOSES ONLY

SCALE	DESIGNED	APPROVED
1:2500	NLKP	BRCO
DRAWN	CHECKED	DATE
PNCN	NLKP	01-23-2019

JOB NO.	DRAWING NO.	REV.
A093893	G-02	B

PLOTTED BY: PENNY CONRAD PLOT DATE: 1/24/2019 9:18:09 AM

FILE LOCATION: O:\A060000\A093893\CAD\PORT OF COEYMANS\A093893-POC-G02.DWG



PROPOSED SITE PLAN

1:2500

LEGEND:

- MHHW OR MLLW
- MAJOR CONTOUR LINES
- PORT OF COEYMANS FACILITY
- EXTENT OF BULKHEAD
- RETAINING WALL
- HIDDEN BATHYMETRY (SEE NOTE 2)
- 15 MT/m² CAPACITY
- 30 MT/m² CAPACITY
- NO LOAD AREA
- REVETMENT

GENERAL NOTES:

1. ELEVATION DATA IS BASED ON A COMBINATION OF THE FOLLOWING DATA SOURCES: COASTAL NEW YORK LIDAR HYDRO FLATTENED RASTER DEM DATASET AND HUDSON RIVER CONDITION SURVEY 4531. HORIZONTAL DATUM IS UTM ZONE 18N COORDINATE SYSTEM NAD 83; THE PROJECT VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).
2. DATA IN THIS AREA UNKNOWN DUE TO LACK OF ACCURATE PUBLICLY AVAILABLE DATA. SITE SURVEY RECOMMENDED.
3. SLOPE BETWEEN OSW ZONES 1 AND 2 SHALL BE REGRADED SUCH THAT THE INCLINATION IS NOT STEEPER THAN 1V:4H.
4. PROPOSED SURFACE TREATMENT FOR NORTHERN PORTION OF OSW ZONE 1 (AREA INCLUDED IN PRE-FEED) OUTSIDE OF CONCRETE SLAB IS CRUSHED STONE. SEE DRAWINGS S-02 AND S-03 FOR DETAILS.

GRAPHIC SCALES

CHECK GRAPHIC SCALES BEFORE USING

0 1:2500 100

REV	DATE	DESCRIPTION	BY	CHK
B	01-23-2019	PORT OF COEYMANS PRE-FEED - FINAL DRAWING SET	PNCN	NLKP
A	12-28-2018	PORT OF COEYMANS PRE-FEED - PROGRESS DRAWING SET	PNCN	NLKP

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PROJECT TITLE

NYSERDA 2018 PORTS ASSESSMENT

POC PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE

PROPOSED SITE PLAN

ENGINEER'S STAMP

FOR PLANNING PURPOSES ONLY

SCALE	DESIGNED	APPROVED
1:2500	NLKP	BRCO
DRAWN	CHECKED	DATE
PNCN	NLKP	01-23-2019
JOB NO.	DRAWING NO.	REV.
A093893	S-01	B

PLOTTED BY: PENNY CONRAD PLOT DATE: 1/24/2019 9:23:20 AM
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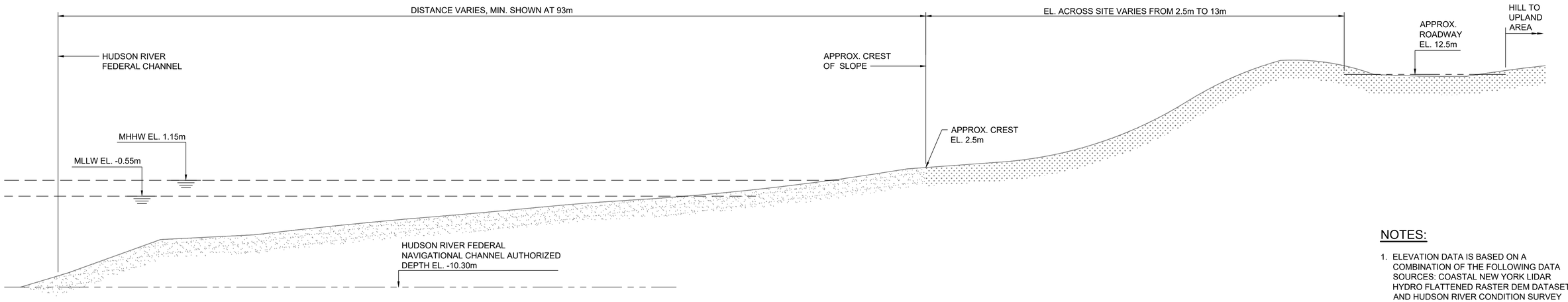
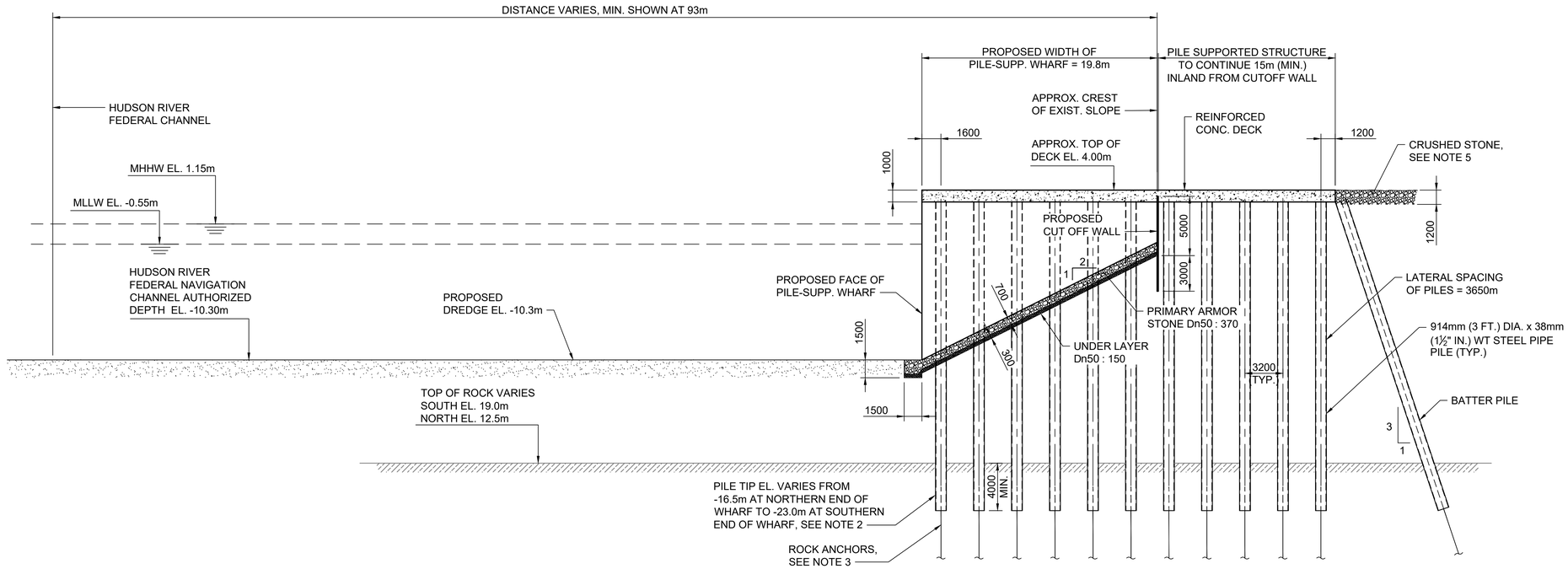


TYPICAL EXISTING CONDITIONS – AT PROPOSED WHARF

SECTION 1 / G–02

1:200



TYPICAL PROPOSED WHARF

SECTION 1 / S–01

1:200

NOTES:

1. ELEVATION DATA IS BASED ON A COMBINATION OF THE FOLLOWING DATA SOURCES: COASTAL NEW YORK LIDAR HYDRO FLATTENED RASTER DEM DATASET AND HUDSON RIVER CONDITION SURVEY 4531. ALL ELEVATIONS REFERENCE NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).
2. ALL PILES TO BE DRIVEN A MINIMUM OF 4m INTO ROCK UNLESS REFUSAL OCCURS EARLIER.
3. ROCK ANCHORS APPROXIMATED FOR PRE-FEED, ASSUMED TO BE APPROXIMATELY 6m (20 FT.) OF BONDED LENGTH INTO ROCK.
4. MATERIAL FOR STEEL PIPE PILES AND CUT OFF WALL SHALL BE ASTM A572 GR 50; STEEL SHEET PILES OR COMBINED WALLS WITH LARGER MOMENT OF INERTIA THAN THE SPECIFIED MAY BE ADOPTED.
5. SURFACE TREATMENT IN OSW ZONE 1 PRE-FEED AREA IS 1.2m (4 FT.) OF CRUSHED STONE IN 30 MT/m² AREAS, AND 1m (3 FT.) OF CRUSHED STONE IN 15 MT/m² AREAS.

GRAPHIC SCALES

CHECK GRAPHIC SCALES BEFORE USING

0 1:200 10

REV	DATE	DESCRIPTION	BY	CHK
B	01-23-2019	PORT OF COEYMANS PRE-FEED - FINAL DRAWING SET	PNCN	NLKP
A	12-28-2018	PORT OF COEYMANS PRE-FEED - PROGRESS DRAWING SET	PNCN	NLKP

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PROJECT TITLE

NYSERDA 2018 PORTS ASSESSMENT

POC PRE-FRONT END ENGINEERING DESIGN

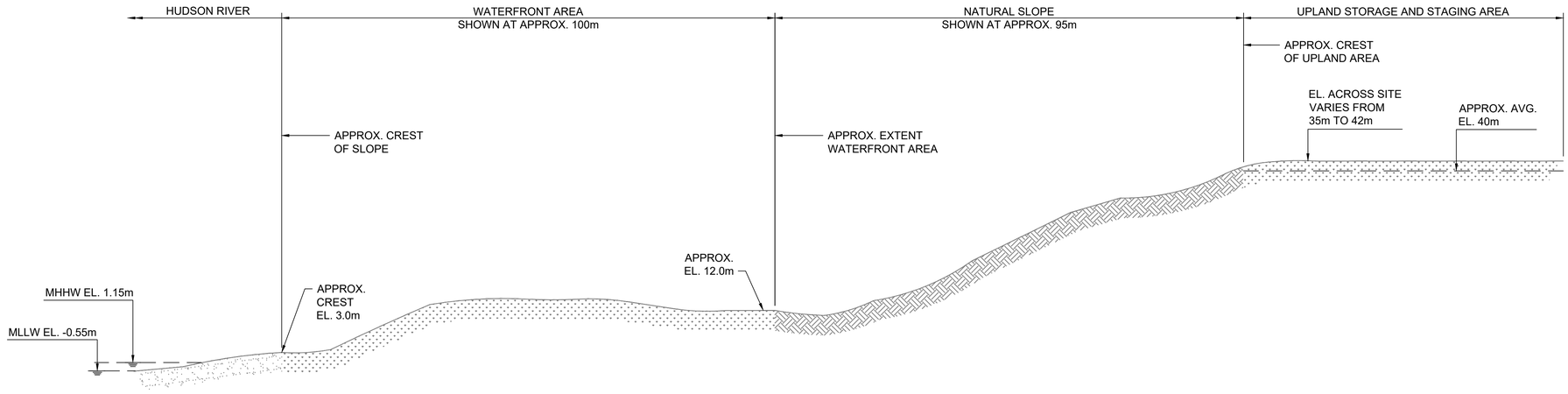
DRAWING TITLE

EXISTING SLOPE AND PROPOSED WHARF AND DREDGE SECTIONS

SCALE	DESIGNED	APPROVED
1:200	NLKP	BRCO
DRAWN	CHECKED	DATE
PNCN	NLKP	01-23-2019
JOB NO.	DRAWING NO.	REV.
A093893	S-02	B

ENGINEER'S STAMP

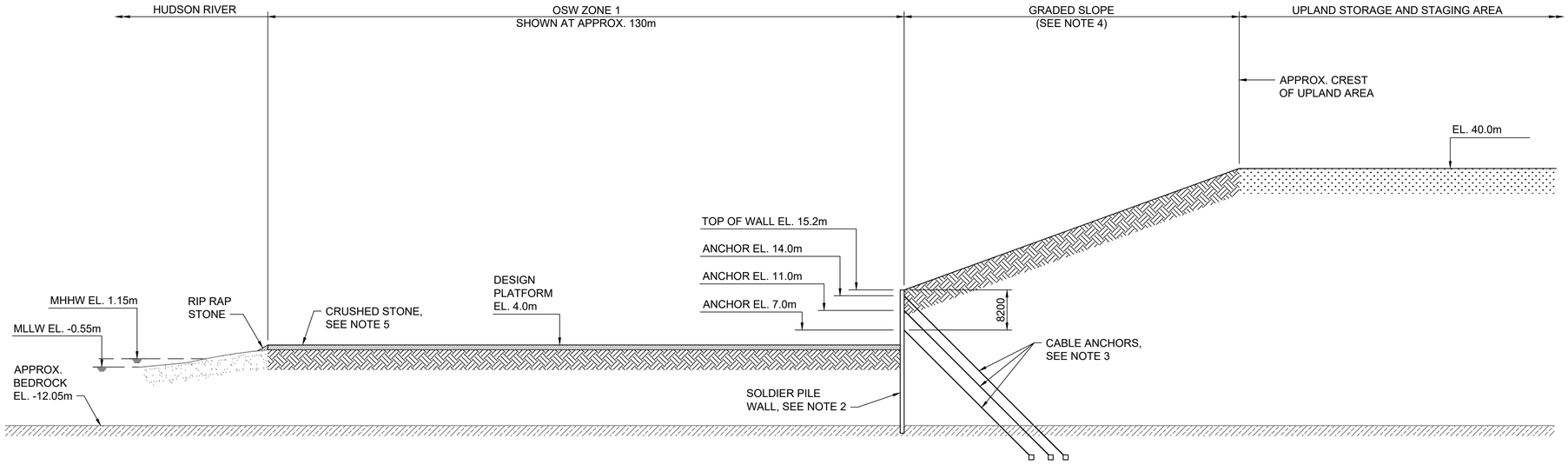
FOR PLANNING PURPOSES ONLY



TYPICAL EXISTING CONDITIONS UPLAND – NORTH END OF SITE

SECTION 2 / G–02

1:500



PROPOSED WATERFRONT AND UPLAND SECTION – NORTH END OF SITE

SECTION 2 / S–01

1:500

NOTES:

1. ELEVATION DATA IS BASED ON A COMBINATION OF THE FOLLOWING DATA SOURCES: COASTAL NEW YORK LIDAR HYDRO FLATTENED RASTER DEM DATASET AND HUDSON RIVER CONDITION SURVEY 4531. ALL ELEVATIONS REFERENCE NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).
2. SOLDIER PILE WALL SHALL CONSIST OF W40x211 SECTIONS SPACED AT 1.2m (4 FT.) ON CENTER. MATERIAL FOR STEEL PIPE PILES SHALL BE ASTM A572 GR 50. PILES SHALL BE DRIVEN INTO ROCK UNTIL REFUSAL. PILES LENGTH IS APPROXIMATELY 28m (92 FT.).
3. ROCK ANCHORS SHALL BE GROUTED TO BEDROCK, BELOW. MATERIAL FOR ANCHOR CABLES SHALL BE ASTM A572 GR 50 CABLES. ANCHOR CABLES TO BE SPACED AT 1.2m (4 FT.) ON CENTER.
   - TOP ANCHOR SHALL BE 45m (148 FT.) IN LENGTH AND CONSIST OF A 40mm (1.6 IN.) CABLE.
   - MIDDLE ANCHOR SHALL BE 40m (131 FT.) IN LENGTH AND CONSIST OF (4) 40mm (1.6 IN.) CABLES.
   - BOTTOM ANCHOR SHALL BE 35m (115 FT.) IN LENGTH AND CONSIST OF (5) 40mm (1.6 IN.)
4. SLOPE SHALL BE REGRADED SUCH THAT THE INCLINATION IS NOT STEEPER THAN 1V:4H.
5. SURFACE TREATMENT IN OSW ZONE 1 PRE-FEED AREA IS 1.2m (4 FT.) OF CRUSHED STONE IN 30 MT/m² AREAS, AND 1m (3 FT.) OF CRUSHED STONE IN 15 MT/m² AREAS.

GRAPHIC SCALES
CHECK GRAPHIC SCALES BEFORE USING
0 1:500 25

REV	DATE	DESCRIPTION	BY	CHK
B	01-23-2019	PORT OF COEYMANS PRE-FEED - FINAL DRAWING SET	PNCN	NLKP
A	12-28-2018	PORT OF COEYMANS PRE-FEED - PROGRESS DRAWING SET	PNCN	NLKP

OWNER

CLIENT
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PROJECT TITLE
NYSERDA 2018 PORTS ASSESSMENT

POC PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE
EXISTING UPLAND AND PROPOSED RETAINING WALL SECTIONS

ENGINEER'S STAMP

FOR PLANNING PURPOSES ONLY

SCALE	DESIGNED	APPROVED
1:500	NLKP	BRCO
DRAWN	CHECKED	DATE
PNCN	NLKP	01-23-2019
JOB NO.	DRAWING NO.	REV.
A093893	S-03	B

PLOTTED BY: PENNY CONRAD PLOT DATE: 1/24/2019 10:24:45 AM

FILE LOCATION: O:\A090000\A093893\CAD\PORT OF COEYMANS\A093893-POC-S03.DWG

Appendix C: Opinion of Probable Cost Backup

NYSERDA 2018 PORTS STUDY					
PRE-FRONT END ENGINEERING DESIGN REPORT					
PORT OF COEYMANS (POC)					
OPINION OF PROBABLE COSTS					
PROJECT NO:	A093893.2				
PROJECT NAME:	NYSERDA 2018 PORTS STUDY				
CLIENT:	NYSERDA				
SITE LOCATION:	COEYMANS, NY, HUDSON RIVER				
PREPARED BY:	NLKP				
DATE:	24-Jan-2019				
CHECKED BY:	BRCO				

WORK ITEM DESCRIPTION		QUANTITY	UNITS	UNIT PRICE	TOTAL
MOBILIZATION AND DE-MOBILIZATION					
_	Mobilization and Demobilization	1	Lump Sum	$1,444,000.00	$1,444,000.00
_					
DEMOLITION, CLEARING AND GRUBBING					
_	Clearing and Grubbing	9470	Square Meter	$1.90	$18,000.00
MARINE STRUCTURES					
_	30T/m² Pile Supported Wharf	6960	Square Meter	$8,204.74	$57,105,000.00
_					
UPLAND STRUCTURES					
_	Retaining Wall	500	Linear Meter	$48,282.00	$24,141,000.00
_					
EARTHWORK & GROUND IMPROVEMENT					
_	Upland Excavation above MHW	423970	Cubic Meter	$11.50	$4,874,000.00
_	Upland Fill above MHW	124850	Cubic Meter	$5.39	$673,000.00
_					
SURFACE TREATMENT					
_	Gravel 30T/m² Staging Area	13030	Square Meter	$158.79	$2,069,000.00
_	Gravel 15T/m² Storage Area	27840	Square Meter	$132.29	$3,683,000.00
_					

DREDGING					
-	Berth Dredging	185400	Cubic Meter	$111.19	$20,614,000.00
SUBTOTAL					**$114,621,000.00**
			CONTINGENCY:	30%	$34,386,300.00
				TOTAL	**$149,008,000.00**
NOTE: COWI HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, EQUIPMENT, OR SERVICES FURNISHED BY OTHERS, OR OVER THE CONTRACTOR'S METHODS OF DETERMINING PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. COWI'S OPINIONS OF PROBABLE PROJECT COST AND CONSTRUCTION COST PROVIDED FOR HEREIN, ARE MADE ON THE BASIS OF COWI'S BEST JUDGEMENT AS EXPERIENCED AND QUALIFIED PROFESSIONAL ENGINEERS, FAMILIAR WITH THE CONSTRUCTION INDUSTRY; BUT COWI CANNOT AND DOES NOT GUARANTEE THAT PROPOSALS, BIDS OR ACTUAL PROJECT OR CONSTRUCTION COSTS WILL NOT VARY FROM OPINIONS OF PROBABLE COST PREPARED BY COWI.					

PROJECT NO.:		A093893.2				
DATE:		24-Jan-2019				
REFERENCES:						
THIS OPINION OF PROBABLE COST IS BASED UPON THE FOLLOWING DRAWINGS						
	PREPARED BY	**DRAWING NAME**	**DRAWING NO.**	**REV.**	**DATE**	**COPY ATTACHED?**
	COWI	COVER SHEET AND DRAWING INDEX	G-01	B	01/24/2019	YES
	COWI	EXISTING SITE PLAN	G-02	B	01/24/2019	YES
	COWI	PROPOSED SITE PLAN	S-01	B	01/24/2019	YES
	COWI	EXISTING SLOPE AND PROPOSED WHARF AND DREDGE SECTIONS	S-02	B	01/24/2019	YES
	COWI	EXISTING UPLAND AND PROPOSED RETAINING WALL SECTIONS	S-03	B	01/24/2019	YES

PROJECT NO.:			A093893.2						
DATE:			24-Jan-2019						
ASSUMPTIONS:									

1	CURRENCY IN U.S. DOLLARS	
2	COSTS ARE BASED ON FY 2018$	
3	OPC IS BASED ON MATERIAL PRICING AND AVAILABILITY AS OF THE DATE OF THE OPC. MATERIAL PRICING AND AVAILABILITY AT TIME OF CONSTRUCTION MAY VARY.	
4	RESOURCES USED FOR PRICING:	
	a	PREVAILING WAGE RATES FOR ALBANY COUNTY, NY
	b	R.S. MEANS HEAVY CONSTRUCTION COST DATA
5	EXCLUDED ITEMS:	
	a	SALES AND USE TAXES
	b	UTILITIES
	c	CONTAMINATED MATERIALS HANDLING AND DISPOSAL
	d	ELECTRICAL WORK
	e	MECHANICAL WORK
	f	ITEMS NOT SPECIFICALLY LISTED IN "REFERENCES" SECTION OF THIS OPC.

	g	ENGINEERING AND CONSTRUCTION OVERSIGHT				
	h	CONSTRUCTION MANAGEMENT FEES				
	i	PERMIT ACQUISITION AND PERMIT FEES				
	j	ARCHITECTURAL FINISHES				
	k	FENDERING AND MOORING APPURTENANCES				
6	ACCESS FOR WORK IS FROM WATERBORNE AND UPLAND-BASED EQUIPMENT WITH UPLAND STAGING ON SITE OR ADJACENT TO THE WORK AREA.					
7	IT IS ASSUMED THAT THERE WILL BE UNRESTRICTED ACCESS FOR THE WORK WITH NO DISRUPTIONS.					

PROJECT NO.:	A093893.2					
DATE:	24-Jan-2019					
MOBILIZATION AND DE-MOBILIZATION						
Mobilization and Demobilization						
Quantity:	1	Lump Sum				
OPINION OF PROBABLE COSTS						
MATERIALS	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL MATERIALS					0.00	
LABOR & EQUIPMENT	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
COORDINATION	120.0	MH	100.00	12000.00		PROJECT MANAGER
PREP OFF SITE	10.0	SHIFT	13170.72	131707.18		
MOBILIZATION	10.0	SHIFT	13170.72	131707.18		

SET-UP ON SITE	5.0	SHIFT	13170.72	65853.59		
BREAK-DOWN ON SITE	10.00	SHIFT	13170.72	131707.18		
DEMOBILIZATION	10.00	SHIFT	13170.72	131707.18		
TOTAL LABOR & EQUIPMENT					604682.30	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
MARINE TOWING	1	LS	500000.00	500000.00		
TOTAL SUBCONTRACTORS					500000.00	
SUBTOTAL PROJECT					1104682.30	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		88374.58	
OVERHEAD		10%	PERCENT		119305.69	
PROFIT		10%	PERCENT		131236.26	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$1,443,598.83**	
PROJECT NO.:	A093893.2					

DATE:	24-Jan-2019					
DEMOLITION, CLEARING AND GRUBBING						
Clearing and Grubbing						
Quantity:	9470	Square Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL MATERIALS					0.00	
LABOR & EQUIPMENT	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL LABOR & EQUIPMENT					0.00	

SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
CLEARING AND GRUBBING	0.9	HECTARE	14639.45	13175.51		RS MEANS BARE TOTAL, LINE NO. 311110100200, MEDIUM TREES TO 300 mm, CUT AND CHIP.
TOTAL SUBCONTRACTORS					13175.51	
SUBTOTAL PROJECT					13175.51	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		1054.04	
OVERHEAD		10%	PERCENT		1422.95	
PROFIT		10%	PERCENT		1565.25	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$17,217.75**	

PROJECT NO.:	A093893.2					
DATE:	24-Jan-2019					
MARINE STRUCTURES						
30T/m² Pile Supported Wharf						
Quantity:	6960	Square Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
STEEL PIPE PILES	8649392.5	KG	2.20	19068623.80		914 DIA. X 25 mm WT
PIPE PILE COATING	12084.5	SM	43.06	520303.62		EXPOSED PILE LENGTH + 3.00m
CONCRETE SLAB	6960.0	CM	196.19	1365499.80		1.0 m THICK
CONCRETE SLAB REINFORCEMENT	825839.7	KG	2.20	1820662.75		118 KG/CM ASSUMED
CONCRETE FORMWORK	7429.6	SMCA	53.82	399857.36		
STEEL SHEET PILES	519252.6	KG	2.20	1144754.58		AZ44-700N ASSUMED
BULKHEAD COATING	3563.28	SM	43.06	153419.16		OUTER FACE, COMPLETE HEIGHT

REVETMENT ARMOR STONE	12739.8	MT	110.23	1404320.15		DUMPED, 25% VOIDS ASSUMED, D50=370 mm TOP LAYER, D50=150 mm UNDERLAYER; INCLUDES RIP RAP STONE N & S OF WHARF
MARINE FENDER UNITS	5.0	EA	25000.00	125000.00		
MOORING BOLLARDS	5.0	EA	2500.00	12500.00		
TOTAL MATERIALS					26014941.21	
LABOR & EQUIPMENT	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
SET AND DRIVE PIPE PILES	103.5	SHIFT	10450.72	1081649.29		ASSUME 3.25 PER SHIFT
SET AND DRIVE PIPE PILES	112.0	SHIFT	13170.72	1475120.39		ASSUME 3 PER SHIFT
PLACE REBAR	70.0	SHIFT	10109.06	707634.47		ASSUME 100 SM PER SHIFT
FORM AND POUR CONCRETE	140.0	SHIFT	10109.06	1415268.95		ASSUME 50 CM PER SHIFT
SET & DRIVE SSP BULKHEAD	31.0	SHIFT	10450.72	323972.25		ASSUME 10 LM PER SHIFT
PLACE REVETMENT ARMOR STONE	27.0	SHIFT	11970.72	323209.38		ASSUME 7.5 LM PER SHIFT
ERECT FENDER UNITS	2.0	SHIFT	11970.72	23941.44		
ERECT BOLLARDS	1.0	SHIFT	11970.72	11970.72		

TOTAL LABOR & EQUIPMENT					5362766.88	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
INSTALL ROCK ANCHORS	616.00	EA	20000.00	12320000.00		
TOTAL SUBCONTRACTORS					12320000.00	
SUBTOTAL PROJECT					43697708.09	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		3495816.65	
OVERHEAD		10%	PERCENT		4719352.47	
PROFIT		10%	PERCENT		5191287.72	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$57,104,164.93**	

PROJECT NO.:	A093893.2					
DATE:	24-Jan-2019					
EARTHWORK & GROUND IMPROVEMENT						
Upland Excavation above MHW						
Gross Quantity:	423970	Cubic Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL MATERIALS					0.00	
LABOR & EQUIPMENT	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**

SOIL EXCAVATION	423970.0	BCM	1.56	661393.20		RS MEANS BARE TOTAL, LINE NO. 312316435720, EXCAVATOR, 4.59 CM BUCKET, 80% FILL FACTOR, WITH TRUCK LOADING
HAULING	508764.0	LCM	6.03	3067846.92		RS MEANSE BARE TOTAL, LINE NO. 312323206510, 26 CM TRUCK, 20 MIN WAIT, 32KM/H FOR CYCLE OF 6.4 KM
TOTAL LABOR & EQUIPMENT					3729240.12	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL SUBCONTRACTORS					0.00	
SUBTOTAL PROJECT					3729240.12	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		298339.21	
OVERHEAD		10%	PERCENT		402757.93	
PROFIT		10%	PERCENT		443033.73	

SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$4,873,370.99**	

PROJECT NO.:	A093893.2					
DATE:	24-Jan-2019					
EARTHWORK & GROUND IMPROVEMENT						
Upland Fill above MHW						
Quantity:	124850	Cubic Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL MATERIALS					0.00	
LABOR & EQUIPMENT	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
BACKFILL SOILS	124850.0	LCM	4.12	514382.00		RS MEANS BARE TOTAL, LINE NO. 312323142400, DOZER, 90 m HAUL, ASSUME ALL CUT IS USED AS BACKFILL

TOTAL LABOR & EQUIPMENT					514382.00	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL SUBCONTRACTORS					0.00	
SUBTOTAL PROJECT					514382.00	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		41150.56	
OVERHEAD		10%	PERCENT		55553.26	
PROFIT		10%	PERCENT		61108.58	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$672,194.40**	

PROJECT NO.:	A093893.2					
DATE:	24-Jan-2019					
UPLAND STRUCTURES						
Retaining Wall						
Quantity:	**500**	Linear Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
SOLDIER PILES	3573420.72	KG	1.5435	5515574.881		ASSUME W40X211 (314.8 KG/M)
SOLDIER PILE COATING	18130.2	SM	43.056	780613.89		ASSUME TOP 13.2m OF EACH PILE @ 3.35 SM/LM
SOLDIER PILE REINFORCEMENT	147875	KG	6.615	978193.13		ASSUME 125 KG PER ROCK ANCHOR
LAGGING	5347.76	LM	213.265	1140490.04		ASSUME FIBERGLASS REINFORCED COMPOSITE TIMBERS, 30cm HIGH, AVERAGE OF 23cm THICK
				0.00		
				0.00		

TOTAL MATERIALS					8414871.93	
LABOR & EQUIPMENT	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
INSTALL SOLDIER PILES	103	SHIFT	10450.72	1076423.93		
ERECT REINFORCEMENT OF SOLDIER PILES	35	SHIFT	10109.06	353817.24		
ERECT LAGGING	66	SHIFT	5251.281	346584.55		
				0.00		
TOTAL LABOR & EQUIPMENT					1776825.72	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
FURNISH & INSTALL ROCK ANCHORS	1183	EA	7000	8281000.00		
TOTAL SUBCONTRACTORS					8281000.00	
SUBTOTAL PROJECT					18472697.65	
ESCALATION		0.0	PERCENT		0.00	
GENERAL CONDITIONS		0.1	PERCENT		1,477,815.81	
OVERHEAD		0.1	PERCENT		1,995,051.35	

PROFIT		0.1	PERCENT		2,194,556.48	
SALES TAX		0.0	PERCENT		0.00	
TOTAL OPC					**24,140,121.29**	

PROJECT NO.:	A093893.2					
DATE:	24-Jan-2019					
SURFACE TREATMENT						
Gravel 30T/m² Staging Area						
Quantity:	13030	Square Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
GRAVEL FOR SURFACE TREATMENT	30050.0	MT	49.60	1490598.70		1922 KG/CM ASSUMED
TOTAL MATERIALS					1490598.70	

LABOR & EQUIPMENT	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
PLACE GRAVEL FILL (LOOSE)	18754.2	LCM	2.76	51761.59		RS MEANS BARE TOTAL, LINE NO. 312323142200. ASSUME LOOSE VOLUME IS 20% GREATER THAN IN-PLACE VOLUME.
COMPACT GRAVEL FILL	15628.5	ECM	2.60	40634.10		RS MEANS BARE TOTAL, LINE NO. 312323237640, 300 mm LIFTS, 4 PASSES, VIBRATING ROLLER
TOTAL LABOR & EQUIPMENT					92395.69	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL SUBCONTRACTORS					0.00	
SUBTOTAL PROJECT					1582994.39	

ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		126639.55	
OVERHEAD		10%	PERCENT		170963.39	
PROFIT		10%	PERCENT		188059.73	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$2,068,657.07**	

PROJECT NO.:	A093893.2					
DATE:	24-Jan-2019					
SURFACE TREATMENT						
Gravel 15T/m² Storage Area						
Quantity:	27840	Square Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
GRAVEL FOR SURFACE TREATMENT	53500.0	MT	49.60	2653600.00		1922 KG/CM ASSUMED
TOTAL MATERIALS					2653600.00	
LABOR & EQUIPMENT	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**

PLACE GRAVEL FILL (LOOSE)	33397.9	LCM	2.76	92178.29		RS MEANS BARE TOTAL, LINE NO. 312323142200. ASSUME LOOSE VOLUME IS 20% GREATER THAN IN-PLACE VOLUME.
COMPACT GRAVEL FILL	27831.6	ECM	2.60	72362.19		RS MEANS BARE TOTAL, LINE NO. 312323237640, 300 mm LIFTS, 4 PASSES, VIBRATING ROLLER
TOTAL LABOR & EQUIPMENT					164540.48	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL SUBCONTRACTORS					0.00	
SUBTOTAL PROJECT					2818140.48	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		225451.24	
OVERHEAD		10%	PERCENT		304359.17	
PROFIT		10%	PERCENT		334795.09	

SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$3,682,745.98**	

PROJECT NO.:	A093893.2					
DATE:	24-Jan-2019					
DREDGING						
Berth Dredging						
Quantity:	185400	Cubic Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL MATERIALS					0.00	
LABOR & EQUIPMENT	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
				0.00		
				0.00		

TOTAL LABOR & EQUIPMENT					0.00	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
BERTH DREDGING	185400.0	BCM	85.08	15774230.15		INCLUDES UPLAND DISPOSAL. BASED ON $111.18/CM ESTIMATE. THIS UNIT COST HAS BEEN REDUCED TO $85.08/CM IN ORDER TO REMOVE GENERAL CONDITIONS, OVERHEAD, AND PROFIT THAT WAS INCLUDED IN ESTIMATE. THIS WAS ORIGINALLY ESTIMATED TO BE $65-$162 / CM IN PHASE 1.
TOTAL SUBCONTRACTORS					15774230.15	
SUBTOTAL PROJECT					15774230.15	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		1261938.41	
OVERHEAD		10%	PERCENT		1703616.86	
PROFIT		10%	PERCENT		1873978.54	
SALES TAX		0%	PERCENT		0.00	

TOTAL OPC					**$20,613,763.96**	

PROJECT NO.:	A093893.2							
DATE:	24-Jan-2019							
LABOR AND EQUIPMENT RATE BREAKDOWN								
<u>CREW 1 - MARINE CONSTRUCTION WITH PILE DRIVING - UPLAND ACCESS</u>								
				FULL COST	A	B	A+B	
				W / BURDEN	DIRECT WAGES*	FRINGES		
	LABOR							
		DOCKBUILDER FOREMAN		91.91	37.78	21.35	59.13	
		DOCKBUILDER		80.15	31.48	21.35	52.83	
		DOCKBUILDER		80.15	31.48	21.35	52.83	
		DOCKBUILDER		80.15	31.48	21.35	52.83	
		DOCKBUILDER		80.15	31.48	21.35	52.83	
		DOCKBUILDER		80.15	31.48	21.35	52.83	
		OILER		100.79	39.99	26.10	66.09	
		OPERATOR - CRANE		112.90	46.47	26.10	72.57	
	EQUIPMENT							
		COMPRESSOR		50.00				

		CRANE		300.00				
		UTILITY TRUCK		50.00				
		PILE DRIVING HAMMER		150.00				
		MISC		50.00				
	TOTAL HOURLY RATE			1306.34				
	TOTAL SHIFT RATE			10450.72	BASED ON EIGHT (8) HOUR SHIFT			

PROJECT NO.:	A093893.2						
DATE:	24-Jan-2019						
LABOR AND EQUIPMENT RATE BREAKDOWN							
CREW 2 - MARINE CONSTRUCTION - UPLAND ACCESS							
				FULL COST	A	B	A+B
				W / BURDEN	DIRECT WAGES*	FRINGES	
	LABOR						
		DOCKBUILDER FOREMAN		91.91	37.78	21.35	59.13
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		OPERATOR - EXCAVATOR		107.29	43.47	26.10	69.57
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		OILER		100.79	39.99	26.10	66.09
		OPERATOR - CRANE		112.90	46.47	26.10	72.57

	EQUIPMENT						
		COMPRESSOR		50.00			
		CRANE		300.00			
		UTILITY TRUCK		50.00			
		MISC		50.00			
	TOTAL HOURLY RATE			1263.63			
	TOTAL SHIFT RATE			10109.06	BASED ON EIGHT (8) HOUR SHIFT		

PROJECT NO.:	A093893.2						
DATE:	24-Jan-2019						
LABOR AND EQUIPMENT RATE BREAKDOWN							
CREW 3 - SITE WORK - UPLAND							
				FULL COST	A	B	A+B
				W / BURDEN	DIRECT WAGES*	FRINGES	
	LABOR						
		LABORER FOREMAN		92.20	37.13	22.85	59.98
		LABORER		80.64	30.94	22.85	53.79
		LABORER		80.64	30.94	22.85	53.79
		LABORER		80.64	30.94	22.85	53.79
		OPERATOR - EXCAVATOR		107.29	43.47	26.10	69.57
	EQUIPMENT						
		EXCAVATOR		120.00			
		COMPACTOR		20.00			
		UTILITY TRUCK		25.00			

		MISC		50.00			
	TOTAL HOURLY RATE			656.41			
	TOTAL SHIFT RATE			5251.28	BASED ON EIGHT (8) HOUR SHIFT		

PROJECT NO.:	A093893.2						
DATE:	24-Jan-2019						
LABOR AND EQUIPMENT RATE BREAKDOWN							
<u>CREW 4 - MARINE CONSTRUCTION - WATERBORNE PILE DRIVING</u>							
				FULL COST	A	B	A+B
				W / BURDEN	DIRECT WAGES*	FRINGES	
	LABOR						
		DOCKBUILDER FOREMAN		91.91	37.78	21.35	59.13
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83

		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		OILER		100.79	39.99	26.10	66.09
		OPERATOR - CRANE		112.90	46.47	26.10	72.57
	EQUIPMENT						
		BARGE - MATERIAL		75.00			
		COMPRESSOR		50.00			
		CRANE - BARGE MOUNTED		300.00			
		FLOAT STAGE (4)		40.00			
		TUG BOAT		200.00			
		PILE DRIVING HAMMER		150.00			
		UTILITY TRUCK		75.00			
		MISC		50.00			
	TOTAL HOURLY RATE			1646.34			
	TOTAL SHIFT RATE			13170.72	BASED ON EIGHT (8) HOUR SHIFT		

PROJECT NO.:	A093893.2						
DATE:	24-Jan-2019						
LABOR AND EQUIPMENT RATE BREAKDOWN							
CREW 5 - MARINE CONSTRUCTION - WATERBORNE							
				FULL COST	A	B	A+B
				W / BURDEN	DIRECT WAGES*	FRINGES	
	LABOR						
		DOCKBUILDER FOREMAN		91.91	37.78	21.35	59.13
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		OILER		100.79	39.99	26.10	66.09
		OPERATOR - CRANE		112.90	46.47	26.10	72.57
	EQUIPMENT						

		BARGE - MATERIAL		75.00			
		COMPRESSOR		50.00			
		CRANE - BARGE MOUNTED		300.00			
		FLOAT STAGE (4)		40.00			
		TUG BOAT		200.00			
		UTILITY TRUCK		75.00			
		MISC		50.00			
	TOTAL HOURLY RATE			1496.34			
	TOTAL SHIFT RATE			11970.72	BASED ON EIGHT HOUR SHIFT		

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