BRIERLEY ASSOCIATES
Creating Space Underground

July 26, 2023
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Kiewit Engineering (NY) Corporation
470 Chestnut Ridge Rd, 2nd Floor
Woodcliff Lake, NJ 07677

Attention: Monir Sarker, PE - Design Engineering Manager

Subject: HDD Design Summary Report
Crossings HDD 134 and HDD 135
Champlain Hudson Power Express – Package 8
Randall's Island, New York

Dear Mr. Sarker:

Brierley Associates Underground Engineers, PLLC (Brierley) is pleased to provide this HDD Design Summary Report for Package 8 of the Champlain Hudson Power Express Project. This work was conducted in general accordance with our contract with Kiewit Engineering (NY) Corporation (Kiewit).

We thank you for this opportunity to be of service to you and your team on this project. Should you have any questions or require additional information, please do not hesitate to contact the undersigned at your convenience.

Sincerely,

Brierley Associates Underground Engineers, PLLC

Nick Strater, PG
HDD Design Manager

Brian C. Dorwart, PG, PE
Sr. Consultant

6323 Fly Road Ste. 4, East Syracuse, NY 13057
www.BrierleyAssociates.com

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1.0 Introduction

The Champlain Hudson Power Express (CHPE) project will install a pair of HVDC electrical transmission cables with an associated telecommunications line from Canada to New York City, NY. The portion of the work addressed herein is located in the upland portion of the route from the south end of Lake Champlain to New York City along the uplands of the Hudson River Valley. This work includes approximately 126 crossings under roads, railroads, wetlands water bodies, and obstructions to be installed using horizontal directional drilling (HDD) methods to minimize interference with use or impacts to the surface environment. This Design Summary Report addresses the design for the HDD crossings in Package 8 which extends from Harlem River Yard to Astoria. These crossings are designated HDD #134 and HDD #135.

The Design Summary Report objectives are to provide the following:

- Summarized review of the existing geological and geotechnical conditions for HDD #134 and HDD #135 for a total of two (2) crossings in Package 8.
- Provide a descriptive narrative of the HDD Crossings in support of the design drawings and technical specifications.
- Pipe stress, assumed annular pressure, and formation drill fluid confinement capacity analyses for the proposed design paths.
- Provide constructability assessment with risks and risk mitigation recommendations.

2.0 Project Description

The proposed CHPE route follows the Hudson River Valley of New York. The new transmission line will be approximately 146 miles in length, extending from the south end of Lake Champlain to Astoria, NY. Package 8 is approximately 2 miles in length and represents the southern limit of the CHPE route.

A Project Locus Map and a plan showing the locations of the HDD#134 and HDD#135 crossings are presented in Figure 1. Elevations in this report reference NAVD 88 and locations reference the project stationing.

The HDD crossings addressed in this report are located as shown in Table 1 below:

Table 1: HDD Locations, Lengths, and Description

HDD #	Start Station*	End Station*	HDD Length, ft	Obstruction Crossed
134	80011+25	80032+04	2,039	Bronx Kill Channel, Parks Dept. Ball Fields
135	80048+30	80100+62	5,232	Parks Dept. Ball Fields, East River

*Project stationing shown. Each HDD has its own independent stationing.

Figure 1 – Site Locus. Photo from www.googleearth.com. Not to scale. Site Features Approximate.

3.0 Background

The underground construction of two HVDC electrical transmission cables is proposed to be housed in individual 10-inch-diameter plastic conduit with spacing dictated by thermal requirements. A third, minimum 2-inch-diameter plastic conduit will be bundled with one of the 10-inch diameter conduits for a telecommunications line. A discussion of cable duct materials for the two HDD sections is included in Section 7.3.

Project design criteria include installation of the cable duct at least 25 feet below congested areas, roads, railroads, under/around other obstructions, 15 to 25 feet below wetlands, and 35 to 45 feet below open bodies of water using horizontal directional drilling (HDD) methods.

HDD is a widely used trenchless construction method to install pipe and conduits with limited disturbance to the ground around the bore alignment. The purpose for using HDD methods is to install the conduits while controlling and minimizing the amount of social, surface and traffic impact in congested areas, while avoiding existing underground obstructions, and to reduce impacts to adjacent wetlands to the extent possible.

4.0 Surface Conditions

HDD #134

HDD #134 is approximately 2,039-ft long (plan length) and crosses the Bronx Kill Channel and active recreational ballfields operated by the New York City Department of Parks and Recreation (Parks Dept, Figure 1). The HDD entry is located to the northwest, immediately adjacent to and southwest of an active CSX railroad. The HDD exit is located to the southeast, within Bronx Shore Road.

Surface grades in the crossing vicinity are relatively flat and range from about El. 8 to El. 10. Bronx Kill Channel is approximately 200 feet wide, 2 to 4-ft deep (below Mean Low Water, MLW) and tidally influenced. The water depths at the Bronx Kill Channel were investigated by marine geophysical (bathymetric) survey, which is summarized in an appendix to a report entitled "Geotechnical Data Report, Champlain Hudson Power Express – Package 8, Randall's Island, New York", dated August 2022 (Brierley Randall's Island GDR). The banks of the Bronx Kill Channel are covered by stone rip rap.

HDD #135

HDD #135 is approximately 5,230-ft long (plan length) and extends from the northeastern edge of Randall's Island, below the East River, to the northwest corner of Astoria (Figure 1). The anticipated HDD entry is located at the northwest end of the alignment (Randall's Island) within and adjacent to Wetland A and ballfields operated by the Parks Dept. Surface grades in this area slope downward gently toward the river, from about El. 10 to El. 0. The anticipated HDD exit is located at the southeast end of the alignment at Astoria, within an existing industrial facility operated by NY ConEdison. Surface grades in this area are relatively flat and range from about El. 4 to El. 6.

The East River is approximately 1,500 to 4,000 feet wide at the crossing vicinity, flows to the south and is tidally influenced. The center of the river is used as a shipping channel, and commercial, industrial and recreational boat traffic are common. The water depths within the crossing vicinity were investigated by bathymetric survey, which is contained in an appendix to the Brierley Randall's Island GDR. Within the shipping channel, water depths range from about 60 to 90 feet below MLW. On the northwest and southeast ends of the alignment water depths range from about 10 to 25 feet below MLW. In general, the banks of the East River are covered by stone rip rap.

5.0 Below-grade Structures

5.1 Land-based Utilities

The location of existing known below-grade utilities are shown on the design drawings. Additional soft dig information will be evaluated prior to IFC. Minimum offsets between the existing utilities and the HDD bore paths will be included on the IFC profiles.

5.2 Marine Utilities

According to available NOAA bathymetric plans, marine cables may be present within and under the East River and may cross the HDD #135 alignment. The marine geophysical survey contained in the Brierley Randall's Island GDR was not able to locate these utilities. The location and depth of these cables will need to be verified prior to construction.

5.3 Astoria Gas Tunnel

The Astoria Gas Tunnel passes below the East River, and crosses the HDD#135 alignment. The approximate location of the tunnel alignment is shown on Figure 1. According to Davies (1915) the tunnel was constructed in bedrock with a length of 4,662-ft, a horizontal width of 19-ft and a height of 18-ft. Davis notes:

> *"For the first 1,200 ft from Astoria the tunnel was driven through a hard, compact, and tough granite gneiss, requiring heavy drilling and large consumption of powder. For the next 2,336 ft the tunnel passed through the dolomite and the passage through the easterly contact between the gneiss and dolomite was made without any apparent disturbance or shear of the geologic structure, a condition quite different from the contact encountered by the Bronx heading, where the geological change was featured by violent shear, accompanied by innumerable water fissures and excessive disintegration. At a point 3536 ft from the Astoria Shaft, this heading met the first indications of the water bearing disintegration of the westerly contact between the gneiss and dolomite".*

For discussion purposes, this zone is considered to be a fault or shear zone. Copies of a plan and profile for the Astoria Gas Tunnel from Davies (1915) are included for reference in Appendix A.

Based on the plan and profile included in Appendix A, the Astoria Gas Tunnel is believed to be approximately 130 feet below the river bottom, and approximately 100 feet below the proposed HDD bore paths.

6.0 Subsurface Conditions

The subsurface conditions in the vicinity of the HDD #134 through #135 crossings were investigated by subsurface investigations and laboratory testing. Details of the investigative methods and the data collected are contained in the following project documents:

- Report entitled "Geotechnical Data Report, Champlain Hudson Power Express – Package 8, Randall's Island, New York", dated August 2022, prepared by Brierley Associates (Brierley Randall's Island GDR).
- Report entitled "Geotechnical Data Report, Downstate Segment: Randall's Island, Bronx and Queens Counties, NY, Champlain Hudson Power Express", dated July 2022, prepared by AECOM.
- Letter entitled "Laboratory Test Results for 602.21.1013 – CHPE – Randall's Island/Astoria-Rainey Borings", dated May 2022, prepared by TerraSense.

Copies of these documents are included in Appendix B.

HDD#134

Soil conditions in the vicinity of HDD#134 include a layer of surficial fill placed during previous site development. Highly variable in gradation, the fill includes Sand (SP, SW), silty Sand (SM), clayey Silt

(ML) and silty Clay (CL). Although not encountered by the test borings, the fill is expected to contain cobbles and boulders, debris and possibly abandoned utilities. The thickness of the fill in this area is expected to range from about 15 to 25 feet.

Bedrock on the northwest and southeast end of the alignment is relative shallow, ranging in depth from about 15 to 27 feet below grade. Bedrock was not encountered in the central portion of the alignment. In this vicinity test boring BR-2 encountered a thick deposit of Glacial Till below the fill, consisting of silty Sand (SM) and sandy Silt (ML) with cobbles and boulders. Bedrock was not encountered by BR-2 which extended to a depth of 52 ft below ground surface.

Bedrock material in the vicinity of HDD#134 is expected to consist of gneiss and schist of the Fordham Gneiss, with lesser marble of the Inwood Marble/ Dolomite. This is based on the results of the test borings, and the mapping completed during excavation of the Astoria Gas Tunnel.

The annular pressure and formation pressure capacity analysis for HDD#134 based on the available data is included in Appendix C. Analyses considers four (4) general geologic layers: Mixed Fill, Sandy Fill, Glacial Till and Bedrock.

HDD#135

On the banks of the East River, at both ends of HDD#135, the test borings encountered approximately 35 feet of fill consisting of Sand (SP, SW), silty Sand (SM), sandy Silt (ML) and silty Gravel (SM) which overlies native organic soil and silty Clay (Estuarine/Marsh Deposits). Bedrock is expected at depths of about 40 to 50 feet on both ends of the HDD#135 alignment.

Within the East River, the subsurface conditions are expected to consist of 5 to 25 feet of granular glacial soils (possible Glacial Till) overlying bedrock. The approximate bedrock surface below the river is shown in the marine geophysical survey included in the Brierley Randall's Island GDR. Bedrock in the vicinity of HDD#135 is expected to consist of gneiss and schist of the Fordham Gneiss, with lesser marble of the Inwood Marble/Dolomite. Note that test borings were not completed within the deepest portions (shipping channel) of the East River due to strong currents and barge access limitations. Observations made during mining of the Astoria Gas Tunnel suggest that poor quality highly weathered bedrock may be present in this area, possibly associated with a fault or shear zone.

The annular pressure analysis for HDD#135 included in Appendix C considers four general geologic layers: Fill, Estuarine Deposits, Glacial Till and Bedrock.

7.0 HDD Process

HDD involves drilling a small diameter (6 to 9-in) "pilot hole" along a pre-established, design alignment from and entry pit to an exit pit. The pilot is then enlarged as necessary by a series of reaming passes, and the product pipe or duct bundle is pulled into place. HDD generally does not require pits (or shafts), or dewatering. The depth and trajectory of the HDD needs to be carefully designed to account for subsurface conditions and the bending tolerances of the drill rods, steering limits of the drill tools, anticipated reaction of the subsurface conditions, and bending tolerances and the product pipe/conduit. All stages of the HDD process involve pumping a bentonite-based, environmentally safe, NSF 61 certified, drilling fluid into the borehole through the drill rods. The drilling fluid maintains borehole stability, removes cuttings, and cools the drilling tools. A common risk associated with HDD is release of drilling fluid to the ground surface, which is referred to as an inadvertent return (IR) or "frac-out". Inadvertent returns may occur when the downhole drill fluid pressure exceeds the confining capability of the surrounding soil, or if zones of weakness or previous disturbance are present (e.g., existing utilities, utility poles, deep foundations, open joints and water bearing zones in bedrock). Drilling fluid and drilling fluid additives are chemically inert, NSF certified, biodegradable, and non-toxic. However, the occurrence of a frac-out typically requires cleanup, may result in surface heave or settlement, and may result in borehole instability (e.g., collapse, squeezing). Three mechanisms lead to inadvertent returns: Leakage, Hydraulic Jacking, and Hydraulic fracturing. Analyses provided with this design addresses Hydraulic Jacking and Hydraulic Fracturing. No calculations are available to address Leakage.

8.0 Design Components

8.1 HDD Geometry

The design alignments for HDD#134 and HDD#135 have been developed in general accordance with the Project Design Criteria Manual (document entitled "Project Design Criteria", Champlain Hudson Power Express, 400kV HVDC Underground Transmission Line, KIEWIT PROJECT NO. 104809, Dated June 2022, herein referred to as the "Design Manual").

The proposed bore path alignments, entry and exit locations, entry angle, exit angle, and a vertical and horizontal design radii of curvature for each HDD crossing in this segment are shown in the design drawings. The HDD technical specifications are found in Section 330507.13 of the Technical

Specifications. Inadvertent release prevention and mitigation plans for each HDD crossing are provided as separate documents.

8.2 Inadvertent Return Analysis

Drill fluid loss from the borehole typically occurs when the annular hydraulic pressure exceeds either the confining pressure of the formation, the pressure necessary to hydraulically jack open a plane of weakness, or the pressure necessary to exceed the resisting pressure along a leakage path.

- Hydraulic Jacking: Hydraulic jacking occurs when there are existing cracks in the formation such as fractures within bedrock or stiff cohesive soils, or relatively high permeability zones contained within a relatively low permeability materials (e.g. a sand lense in clay). When the drill fluid pressure exceeds the weight or force restraining the materials on the sides of the fracture or higher permeability zone, the confining material will be hydraulically jacked open resulting in an enlarged opening with more fluid volume capacity and eventually, the possibility of a new flow path for the fluid. The Total Stress calculations provides a conservative method for assessment of this type of drill fluid loss.

- Hydraulic Fracturing. Hydraulic fracturing occurs when the drill fluid pressure exceeds the static stress state in the formation *plus* the strength of the formation material. The result is a fracturing of the formation providing access for the drill fluid to a path that will continue to grow until the drill fluid pressure is reduced or the formation strength increases. The stress plus strength and the Kirsch methods may be used to assess this type of drill fluid loss in rock. In soil formations the Delft may be used to model for drill fluid loss when hydraulic fracturing occurs.

- Leakage: Flow of the drill fluid into existing open space, such as open bedrock fractures and soil porosity, and along manmade weak zones such as along pile shafts or other manmade construction planes of weakness.

It's common to lose upwards of 30% (or more) of the drill fluid to the adjacent formation (soil and bedrock) during HDD construction. If the drill fluid reaches to ground surface or water (river) mudline, it's referred to as a "fracout" or inadvertent drill fluid return ("IR"). This may require conditioning of the borehole to stop the drill fluid loss, and cleanup of the drill fluid, if accessible. This event occurs at some time interval after the initiation of drill fluid loss. Therefore, there is typically a time lag or interval between the initiation of drill fluid loss and release to the ground or mudline surface. Immediate loss of drill fluid volume results in an rapid reduction of the annular pressure followed by a reduction of return drill fluid to the surface pit(s). Hydraulic Jacking causes formation pressure buildup that may result in by excessive drill fluid backwash emitting from the downhole drill rods during rod changes. Obstruction of the bore by inadequate cutting removal or swelling ground will cause a slow buildup of annular pressure prior to release to the ground by hydraulic fracturing. Early detection indicators may provide both time to stop drilling advance and time to remediate the identified issue prior to release at the ground surface. Techniques to detect fluid loss include annular pressure monitoring by an experienced field engineer, observation of the relative volume of fluid returns at the drill pit, and observation of the time drill fluid 'blows' out of the downhole drill rods during drill rod changes. Timely recognition and mitigation can significantly reduce the risk of an inadvertent return.

Mitigation may require conditioning of the borehole to remove cuttings, reduction of drill fluid density to reduce static fluid pressure, reduction in the pumping rate to reduce dynamic annular pressure, or change in the drill advance rate to reduce the time that maximum drill fluid pressure is applied to any specific hole location. An additional mitigation measure may include injection of a 'pill' consisting of material that seals the borehole at the point of fluid loss. Once drilling fluid release to the ground surface occurs, mitigation is based on containment and control at the release location such as confinement with barriers and pumping the discharge back to the entry or exit pits. This would be followed by cleanup of excess fluids after completion of the bore. Practical cleanup methods vary depending on surface access and surface conditions.

A preliminary annular pressure analysis was completed for the pilot hole for each of the currently proposed HDD bore path geometries, based on the available geotechnical data. This process compares the anticipated range of downhole annular drill fluid pressures required to complete the pilot bore to the estimated confining capabilities of the surrounding geologic materials. This exercise can be useful in the evaluation of risk of inadvertent returns (IR's, or "fracout") during drilling. This prediction is only valid for the assumed drill fluid pumping rate and density. This exercise can be useful in the evaluation of risk of inadvertent returns (IR's, or "fracout") during drilling as both the drill fluid pumping pressure and density may be quickly determined in the field. These rates, pressures, and densities should be monitored frequently as part of a concerted proactive mitigation program to prevent drill fluid loss from reaching the ground surface or mudline.

The potential for an IR may be considered greatest at locations where the anticipated range of downhole drill fluid pressures are close to or exceed the estimated confining capabilities of the surrounding materials such as at either end of a bore path. Note that the pilot hole (vs the reamed hole) is generally the most constrained, and presents the greatest risk of IR during the HDD construction process.

The following should be noted:

- HDD requires drill fluid pressures sufficient to stabilize the borehole and remove cuttings. In general, it may be possible to reduce the risk of drill fluid loss through careful drilling and drill fluid management, but IR risk cannot be completely eliminated.
- The annular pressure analysis is considered to be a tool to identify areas of potential risk. *It is not considered an exact predictor of the location or degree of an IR.*
- The annular pressure analysis does not account for existing pathways or zones of weakness in the subsurface, which may be related to existing utilities, foundations, utility poles and below-grade space. Where present, these features will *increase* the risk of drill fluid loss.
- The annular pressure analysis is not an accurate predictor of borehole leakage, where drill fluid leaks to the adjacent materials through existing porosity or fractures.
- Drill fluid loss from the borehole may not migrate to the surface. In some cases, the drill fluid may escape to the surrounding formation.

The anticipated range of downhole drill fluid pressures (combined static and dynamic) for HDD#134 and HDD#135 are shown in Appendix C, along with a generalized subsurface profile for each bore. The static drill fluid pressure is a function of the density of the drill fluid at a specific location and depth below the drill entry elevation. The dynamic pressure is the pressure required to move the drill fluid (and cuttings) up the borehole annulus, and is a function of pump rates, hole geometry, fluid density, fluid velocity, and fluid rheology. The estimated annular pressures included in Appendix C are based on the API-13D method to assess the dynamic pressure of a visco-plastic fluid based on a modified Hershel-Buckley fluid model.

Geotechnical parameters used in the analysis were derived through evaluation of laboratory testing and engineering judgement based on the subsurface and laboratory data. The confining capability of the native materials was approximated using a variety of methods, which include the following:

- **Total Stress Model**: The Total Stress Model is based on the dead weight of the formation material above the drill path and excludes the potential strength of the formation. This method is considered *conservative* but is considered a reasonable approximation for the formation pressure capacity of bedrock and very dense soil to resist Hydraulic Jacking.

- **Cavity Expansion Model (Delft Equation)**: This method considers the strength of the formation to resist a cylindrical cavity expansion caused by annular pressure and is based on Ko = 1 conditions. The initial equation was derived from the Mohr-Coulomb failure model adjusted by Delft University for low angle cylindrical cavity expansion in a host material when subjected to internal pressure. This method has been found more realistic in fine grained materials such as fine sand, silt, and stiffer cohesive formations than the Total Stress Model. However the method require assumptions of a horizontal surface with homogeneous isotropic soil properties. Additionally, the equations require significant property assumptions such as the Shear Modulus, G, and an assumption of whether or not the drill is being advanced under drained or undrained conditions. *This model is not generally appropriate for most bedrock, particularly hard sedimentary bedrock, and metamorphic and igneous lithologies.*

- **Minor Stress plus Strength Model**: This method was initially implemented by the US Corps of Engineers to assess the damage potential to levees from the HDD fluids during drilling. This model is based on the minimum principal effective stress defined as Ko*σ'v and adds the strength of the formation material at the location at the drill face. The basis of the model, like the cavity expansion model is the Mohr-Coulomb failure approach. This model is generally appropriate for any soil and may apply to some bedrock situations.

- **Kirsch Model**: This method was developed by the Shell Oil Company for oil field drilling and is based in rock mechanics and Hooks Law for elastic material properties. This method is generally considered appropriate for bedrock, including fractured bedrock and is similar to the Total Stress approach.

Additional input assumptions included:

- A mud motor will be used to complete the pilot hole for each bore;
- A drill fluid pump rate of 400 gpm necessary to drive the mud motor;
- An average return drill fluid assumed density of 74 pcf, and maximum drill fluid density of 89 pcf.
- For HDD #134, an assumed drill bit diameter of 6.5 inches and a drill rod diameter of 3.5 inches.
- For HDD #135, an assumed drill bit diameter of 9-7/8 inches and a drill rod diameter of 5 inches.

The results of the annular pressure analyses included in Appendix C suggest the following:

- For both HDD #134 and HDD#135, there is an apparent risk of IR is near the HDD entry and exit. This is common, and related to limited confining capabilities of the surround geologic formations due to limited depth of cover. At these locations it may be prudent to control the drill fluid through use of temporary steel conductor casings or if the work area is available, maintaining the bore path down to a soil depth of 20 feet inside the confined and contained work boundaries.
- An apparent risk of IR is present for HDD#135 within the deepest parts of the East River (shipping channel). It should be noted that poor quality bedrock may be present in this vicinity due to a possible fault zone, consistent with the observations made during mining of the Astoria Gas Tunnel (See Appendix A). *Note that the depth of HDD#135 may be increased to reduce the risk of IR during final design, and will be related to conduit and casing material selection.*

The HDD contractor(s) should be prepared to monitor the downhole drill fluid pressures in each bore, and respond to elevated pressures and drill fluid loss. The Inadvertent Return Contingency Plan details additional methods for mitigating inadvertent returns.

8.3 Conduit Material Selection

The conduit installed by HDD for the CHPE project must be non-conductive such as plastic to satisfy cable ampacity requirements. The conduit must also be designed with sufficient strength to withstand the short-term installation (pullback) loads, and the long-term external loads that may cause confined or unconfined buckling or deformation from different vertical and horizontal loads applied to the installed ducts.

It should be noted that plastic duct (HDPE and FPVC) are assembled through butt-fusion, which creates an internal “bead”. This bead must be removed following fusion (“debeading”) to reduce risk of cable damage during cable pulling. In cases where the duct is installed without a casing, it must be fully assembled and debeaded prior to pullback.

HDD #134 conduit is DR9 High Density Polyethylene (HDPE), which is consistent with the requirements of the Design Manual. Note that we have assumed and recommend using a larger than Design Manual assumption for the telecommunication conduit of DR93-in diameter (versus 2-in) to improve pullback survivability and to provide sufficient inside diameter to install the cable.

For HDD#135. we have considered DR14 fusible polyvinyl chloride (fPVC) as a potential alternative to HDPE, as the fPVC has greater pull strength. We have also considered a 4-in fPVC conduit for the telecommunications cable, as a 3-in FPVC conduit is not readily available. Note that while fPVC has sufficient material strength to accommodate pullback, it's also more susceptible to brittle damage from point loading than HDPE during handling and installation. During installation, external point loads may occur during pullback from cobbles and boulders, bedrock fragments or "dog legs" in the reamed borehole geometry. As noted, a zone of poor quality rock appears to be present below the East River, as encountered by the Astoria Gas Tunnel, which could increase the risk for short and long-term pipe stress and point loading leading to a high risk of duct failure during or after installation.

Due to the potential for long-term pipe loading associated with the bedrock conditions present, we recommend sleeving the HDD#135 borehole with a steel casing prior to duct installation. The casing could be installed in sections (e.g. thirds), reducing the need for laydown space, followed by the duct. This will also avoid the need to fully assemble and debead the HD#135 duct prior to pullback, as the beads will damage the cable . However, steel casing will impact cable ampacity and should be evaluated for ampacity impact prior to use. At this time, it should be expected that the steel casing cannot be removed from the bore once installed. We have assumed a 20-in diameter steel casing having a wall thickness of 0.375-in.

Preliminary pullback calculations for HDD#134 (assuming HDPE) and HDD#135 (assuming steel casing) are included in Appendix D. These will be updated prior to IFC final design.

These calculations have been developed in general accordance with ASCE Manual of Practice 108 (MOP 108) and modified ASTMF-1962 to assess pull force based on hole geometry, independent vertical curves, and fluid drag. The safe pull stress are in accordance with recommendations of the Plastic Pipe Institute for HDPE and the manufacturer for fPVC. Both water ballasted and unballasted conduit have been considered. Water ballasting is recommended to reduce the pull force in each case.

It should be noted that HDPE and fPVC are assembled through butt-fusion, which creates an internal "bead" which must be removed during fusion ("debeading") to reduce risk of cable damage during cable pulling. In cases where the duct is installed without a casing, it must be fully assembled and debeaded prior to pullback, no intermediate welds will be allowed as they cannot be debeaded.

9.0 Construction Considerations

The following construction considerations are presented regarding potential risks. It is the sole responsibility of the HDD Contractor to develop appropriate construction means and methods. However, the Contractor's means and methods must be capable of addressing the risks defined in this report within reasonable industry practice. are presented for discussion purposes.

9.1 Subsurface Conditions

The subsurface conditions present along the HDD#134 and HDD#135 include Glacial Till and bedrock, which we have assumed will require a mud motor during pilot hole advance, and rock reaming tools for hole enlargement. Pump rates required to operate the mud motor will likely be 400 gallons per minute (possibly greater). Temporary steel conductor casings may be required at the HDD entry and exit for both HDD#134 and HDD#135 to control and contain drill fluid during the transition from soil to bedrock..

Glacial Till is expected to contain cobbles and boulders which could become obstructions and adversely impact HDD steering and conductor casing installation. Pre-excavation in the vicinity of the HDD entry and exit may be prudent to remove these materials prior to drilling where they may be encountered at shallow depths.

The bedrock encountered by the test borings completed in the vicinity of HDD#134 and HDD#135 is hard and abrasive. The abrasive potential (primary, secondary and tertiary potential) is expected to be high, and excessive tool and pump wear should be expected. In addition, the gneissic bedrock in the site vicinity demonstrates a pervasive foliation, which could impact HDD steering during pit hole advance.

9.1 Steering Tool Selection and Steering Tolerance

A downhole steering tool will be required for both HDD#134 and HDD#135. Walkover steering tools are not considered appropriate due to depth and subsurface conditions, combined with the desired accuracy of the installations. While a magnetic steering system (utilizing a surface tracking coil) may be appropriate for HDD#134, we envision that the water depths associated with HDD#135 dictate that a gyro based guidance system will be required. In addition, it is unlikely that tracking cables will be allowed to be lain on the bottom of the channel.

A magnetic survey was completed as part of the marine geophysical survey contained in the Brierley Randall's Island GDR. The driller's steering consultant should review this survey during selection of the steering tools.

The steering tool selection is the responsibility of the drilling contractor. Reasonable tolerance is typically plus/minus 5 feet vertical and horizontal of the design path, possibly greater.

9.1 Drill Fluid Pressure Monitoring

The HDD contractor should employ a downhole pressure tool during pilot hole drilling to monitor the annular drill fluid pressures. This will help maintain pressure levels below an established threshold, reduce risk of IR's, and may provide details on locations where drilling fluid is lost. The HDD contractor should employ a certified drill fluid engineer to develop a drill fluid program and manage drill fluid during the bore construction.

9.1 Conduit Laydown and Pullback

As-noted, butt-fused plastic conduit (HDPE and FPVC) used for cable raceway must be completely assembled and debeaded prior to pullback. This will require significant work and storage space for both HDD#134 and HDD#135 prior to pull back. The conduit is typically assembled during drilling, and will need to be protected prior to installation.

In each case, pullback of the conduit should be completed without interruption to reduce the risk of the conduit becoming stuck and damaged. We recommend that the conduit be fully water-ballasted to reduce the pullback forces.

Note that use of a steel casing for HDD #135 will allow the duct to be assembled and debeaded during installation (into the casing) which will reduce the need for duct laydown.

10.0 References

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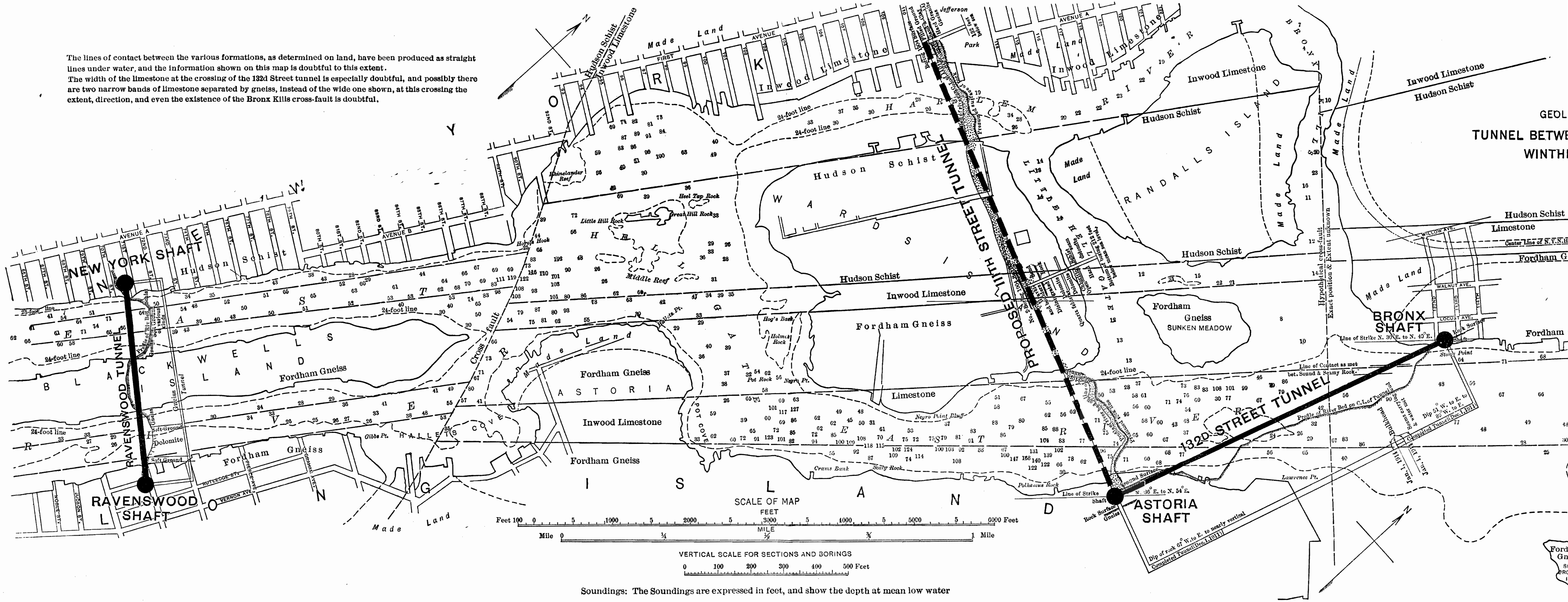
Directional Drilling,

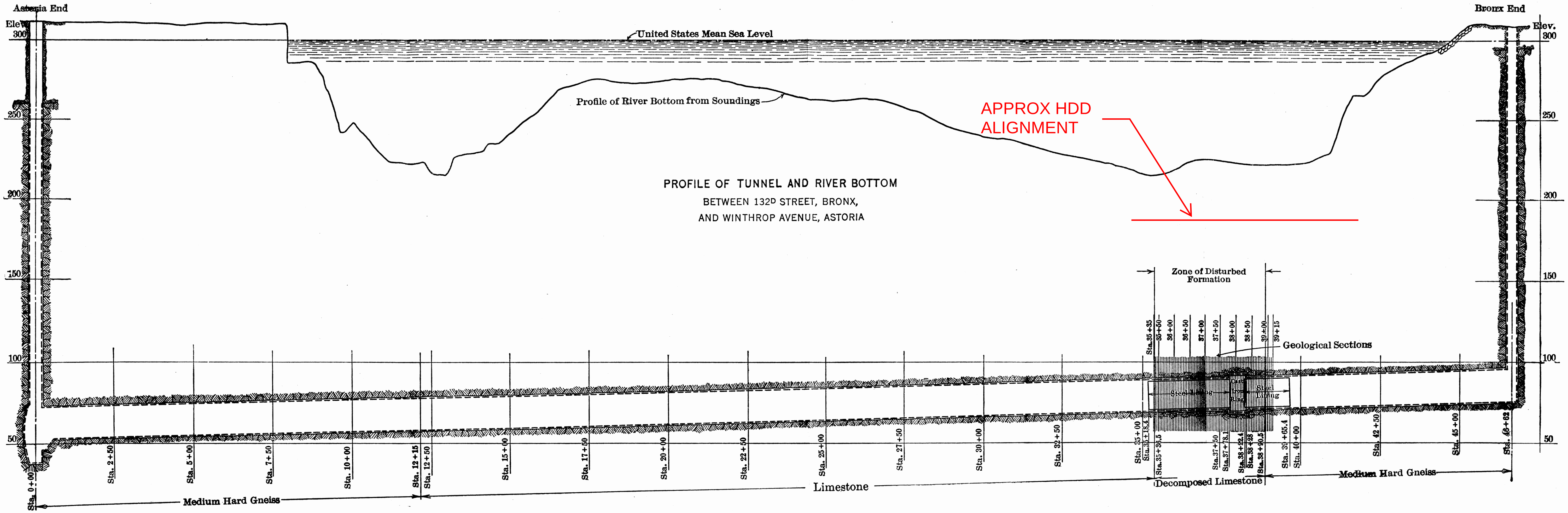
APPENDIX A

ASTORIA GAS TUNNEL PLAN AND PROFILE FROM DAVIES, 1915



The lines of contact between the various formations, as determined on land, have been produced as straight lines under water, and the information shown on this map is doubtful to this extent.
The width of the limestone at the crossing of the 132d Street tunnel is especially doubtful, and possibly there are two narrow bands of limestone separated by gneiss, instead of the wide one shown, at this crossing the extent, direction, and even the existence of the Bronx Kills cross-fault is doubtful.
GEOL
TUNNEL BETWE
WINTH
NEW YORK SHAFT
RAVENSWOOD TUNNEL
RAVENSWOOD SHAFT
PROPOSED 111TH STREET TUNNEL
132D STREET TUNNEL
ASTORIA SHAFT
BRONX SHAFT
BLACKWELLS ISLAND
WARDS ISLAND
RANDALLS ISLAND
ASTORIA
HALLETS COVE
POT COVE
HELL GATE
LITTLE HELL GATE
HARLEM RIVER
BRONX KILLS
EAST RIVER
NEW YORK
LONG ISLAND
Hudson Schist
Inwood Limestone
Fordham Gneiss
Limestone
Dolomite
Soft Ground
Made Land
Cross fault
Hypothetical cross-fault
Exact position & Extent unknown
SUNKEN MEADOW
24-foot line
Hallets Pt.
Gibbs Pt.
Negro Point Bluff
Lawrence Pt.
Stony Point
Polhemus Rock
Crams Bank
Scaly Rock
Pot Rock
Hog's Back
Holmes Rock
Heel Tap Rock
Great Hill Rock
Little Hill Rock
Middle Reef
Rhinelander Reef
Horn's Hook
Jefferson Park
Line of Strike N. 36° E. to N. 54° E.
Line of Strike N. 30° E. to N. 40° E.
Line of Contact as met bet. Sound & Seamy Rock
Profile of River Bed on C. L. of Tunnel
Dip 51° W. to E. to 89° W. to E.
Dip of rock 67° W. to E. to nearly vertical
Completed Tunnel (Dec. 1, 1911)
SCALE OF MAP
FEET
Feet 100 0 5 1000 5 2000 5 3000 5 4000 5 5000 5 6000 Feet
MILE
Mile 0 ¼ ½ ¾ 1 Mile
VERTICAL SCALE FOR SECTIONS AND BORINGS
0 100 200 300 400 500 Feet
Soundings: The Soundings are expressed in feet, and show the depth at mean low water

PLATE XXV.
TRANS. AM. SOC. CIV. ENGRS.
VOL. LXXX, No. 1359.
DAVIES ON
THE ASTORIA TUNNEL.



PROFILE OF TUNNEL AND RIVER BOTTOM
BETWEEN 132D STREET, BRONX,
AND WINTHROP AVENUE, ASTORIA

APPENDIX B
GEOTECHNICAL DATA

GEOTECHNICAL DATA REPORT
CHAMPLAIN HUDSON POWER EXPRESS – SEGMENT 8
RANDALL'S ISLAND, NEW YORK

Report to:
KIEWIT ENGINEERING (NY) CORPORATION
LONG TREE, CO

Submitted by:
BRIERLEY ASSOCIATES UNDERGROUND ENGINEERS, PLLC
EAST SYRACUSE, NY

August 2022

August 12, 2022
File No. 322004-000

Kiewit Engineering (NY) Corporation
1005 Trainstation Circle
Lone Tree, CO 80124

Attention: Mr. Jaren Knighton, PE

Subject: Geotechnical Data Report
Champlain Hudson Power Express – Segment 8
Randall's Island, New York

Dear Mr. Knighton:

Brierley Associates Underground Engineers, PLLC (Brierley) is pleased to provide this Geotechnical Data Report (GDR) summarizing the results of our field exploration and laboratory testing performed for the Champlain Hudson Power Express Project, Segment 8. This work was conducted in general accordance with our contract with Kiewit Engineering (NY) Corporation (Kiewit). This GDR is a compilation of the field and geotechnical information obtained for this project, including borehole logs, geophysical survey, and laboratory test results.

We thank you for this opportunity to be of service to you and your team on this project. Should you have any questions or require additional information, please do not hesitate to contact the undersigned at your convenience.

Sincerely,

Brierley Associates Underground Engineers, PLLC

Kurt Breitenbucher, PE
Geotechnical Engineer

Dave Sackett, PG
Senior Consultant - Geologist

Nick Strater, PG
Principal

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1.0 INTRODUCTION

Brierley Associates has completed a supplemental geotechnical investigation program for Kiewit for Segment 8 of the Champlain Hudson Power Express (CHPE) upland cable route. The vicinity of the work completed is shown in Figure 1, below. The Champlain Hudson Power Express (CHPE) is a renewable power transmission project intended to bring clean power to the State of New York. The project will play a key role in the state's energy transformation, lowering greenhouse gas emissions and delivering 1,250 Megawatts of low-cost renewable energy to New York state.

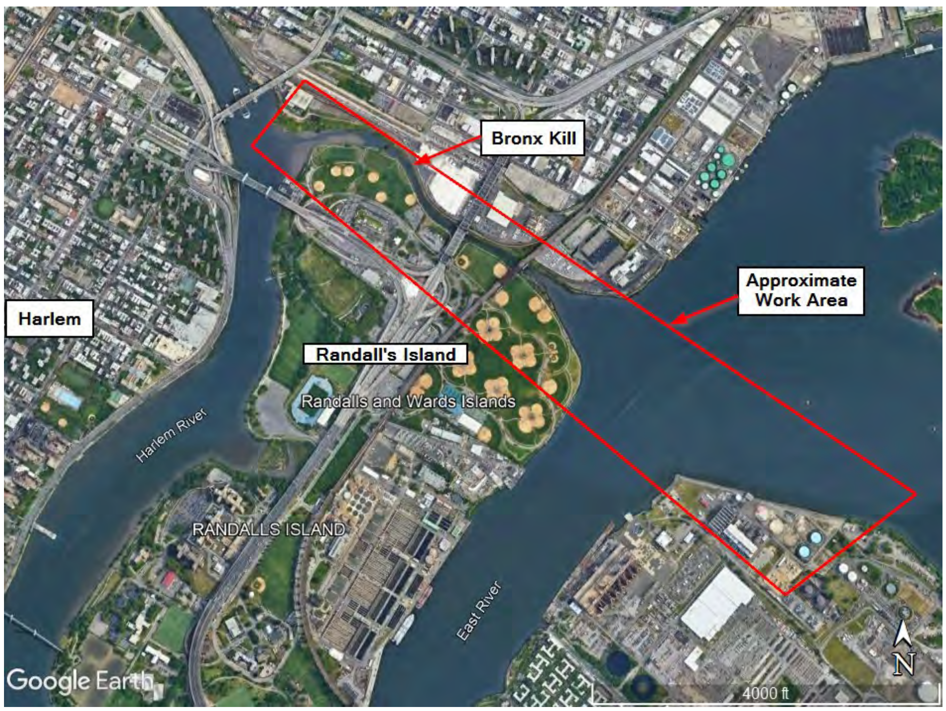

Figure 1: General Project Location. Scale Approximate. Photograph from www.googleearth.com.

Kiewit retained Brierley to perform geotechnical field exploration and laboratory testing. Our scope included performing several onshore and offshore explorations. Brierley retained the services of Warren George, Inc. (WGI) to perform the borings under direction of Brierley's field personnel. WGI conducted three (3) land-based borings on Randall's Island (Figure 2) and three (3) marine borings (Figure 3) along the project alignment.

In addition, Brierley subcontracted with representatives of Ocean Surveys, Inc. (OSI) to complete a marine geophysical survey along the project alignment within the Bronx Kill and East Rivers.

2.0 DATA PURPOSE

The purpose of this GDR is to present the methods and results of the field and laboratory testing programs conducted for this study.

The geotechnical field and laboratory investigations were performed to obtain samples of soil and bedrock for characterization of subsurface conditions and development of geotechnical parameters for project design. The site investigation program was performed in May and June of 2022, and laboratory testing of recovered samples was performed in June and July of 2022. The marine geophysical survey was completed during May 2022.

The locations and specifications for exploratory borings were selected to provide characterization of geologic stratigraphy and geotechnical properties of conditions along the proposed alignment. Detailed descriptions of the soils and bedrock encountered in the borings are presented on the boring logs in Appendix A. Appendix B includes photographs of recovered rock cores. The results of the geotechnical laboratory testing are presented in Appendix C. Thermal resistivity testing results are included in Appendix D. The results of the marine geophysical survey completed by OSI is included in Appendix E.

3.0 SURVEY DATUM

Land based borehole locations and elevations were surveyed by a subcontractor of Kiewit and provided to Brierley. Marine borings were surveyed by WGI using their onboard navigation equipment and a Global Positioning sensor placed just adjacent to the drill casing. All boring coordinates were converted to NY State Plane coordinates (State Plane Zone 3104), in US standard survey feet. Boring elevations are based on NAVD88.

4.0 TEST BORING PROGRAM

Three (3) land-based test borings, designated as BA-103, BA-104 & BA-105, were drilled and sampled onsite on Randall's Island to depths of 40 to 65 feet below grade, at the locations shown in Figure 2. The land-based test borings were conducted between May 23 and May 27, 2022. Note that these borings were originally designated K-103 through K-105, but were later changed at the request of Kiewit. However, the core photographs (Appendix B) and laboratory test results (Appendices C and D) show the original K- prefix for these boreholes.

Figure 2: Land-based Boring Location Plan. Scale Approximate. Photograph from www.googleearth.com.

Three (3) marine borings were completed in the East River between June 1, 2022, to June 16, 2022. Designated as BA-101, BA-102 & BA-106, these borings were drilled and sampled to depths of 108 to 125 feet below the river mudline. The locations of the marine test borings are shown on Figure 3.

Figure 3: Marine Boring Location Plan. Scale Approximate. Photograph from www.googleearth.com.

Test boring logs presenting descriptions of the materials encountered are included in Appendix A, along with a soil and bedrock classification key. The as-drilled coordinates and elevations of each borehole are presented in Table 1.

Table 1: Borehole Coordinates and Elevations

Boring ID	Easting	Northing	Elevation
BA-101	1009905	227831	-18
BA-102	1010122	227509	-12
BA-103 (K-103)	1006168	230281	10.4
BA-104 (K-104)	1005980	230572	9.5
BA-105 (K-105)	1007420	229752	10.3
BA-106	1008320	229287	-22
State Plane Zone 3104, US Survey Feet, NAVD88			

The onshore and offshore test borings were supervised by a Brierley field engineer, who directed drilling activities, logged the samples, photographed the rock cores, and prepared the field logs. Field sampling, laboratory testing, soil classifications and strata descriptions are in general accordance with methods, procedures, and practices set forth by 1) the Unified Soil

Classification System (USCS), and 2) the American Society for Testing and Materials, as noted herein.

The land-based borings were drilled and sampled using a truck mounted Acker Soil Max drilling rig provided by WGI. Hollow stem augers were used to advance the borehole through the soil overburden. The first 18-in of borings BA-103 and BA-105 was completed by hand digging due to the potential for shallow utilities. Where relatively unweathered bedrock was encountered a double barrel coring system was used to continuously core the bedrock to the completion depth.

The marine borings were also drilled and sampled by a drilling crew provided by WGI, using a skid mounted Acker Soil Max drill rig from a moonpool near the center of a twin-spud 30-foot by 90-foot barge. At each marine location, WGI initially advanced 6-in diameter thick wall steel casing to the river bottom ("mudline"), and then placed a 4-in diameter casing within the 6-in casing to maintain drill string verticality due to the strong currents within the East River. Drilling was conducted by standard mud-rotary methods from the surface through the mudline to the top of rock, inside the 4-inch casing. The barge was moved between locations using the Annie G II, a small tugboat owned by WGI. Crews mobilized daily aboard the tug from the World's Fair Marina in the East River, Flushing Bay area of Flushing, NY. Tidal corrections were made based on North Brother Island Station and the bathymetric survey performed by Ocean Surveys, Inc. (OSI) of Old Saybrook, CT.

Following termination, each test boring was backfilled with cementitious grout from the bottom of the hole upward.

4.1 Soil Sampling

Soil sampling was performed at 2-ft to 5-ft depth increments using a standard split-spoon barrel (1 $^3/_8$-inch inside diameter, 2-inch outside diameter) using equipment and methods described in ASTM D1586. A 140-lb donut hammer and rotating cathead was used to perform the SPT tests. The split tube sampler was typically driven 24 inches in soil with blows recorded for each six-inch interval of penetration. The number of blows required to drive the sampler for the second and third six-inch intervals were recorded on the logs as the N-blow count value. In very dense soils, the SPT sampler refusal criteria was typically to drive a maximum of 50 blows and record the actual penetration, (e.g., 50 blows/3 inches). The blow counts indicated on the test boring logs are the actual number of blows; no attempt was made to standardize or convert the blow counts for hammer efficiency.

The split tube sampler was opened at the drill site and the recovered materials were visually described and classified by the Brierley field representative in general accordance to ASTM D2488. Portions of each sample were placed in glass jars, labeled, and stored in a cardboard box. The soil description on the boring logs in Attachment A are based on the field descriptions recorded by the Brierley field representative and confirmed according to ASTM D2487 where lab test results were available.

4.2 Rock Coring

Where the test boring was advanced to the top of relatively unweathered bedrock, the down hole tools were switched to a rock core barrel system using coring equipment and methods described in ASTM D2113. Rock coring was conducted using a 5-ft length, NV/NWL conventional core barrel and a 3-inch-OD drill string. Rock cores were generally cored and recovered in 60-inch core runs. Once the core run was complete, the core barrel was retrieved to the surface, and the recovered core was placed in wooden core boxes.

Brierley's field engineer logged each recovered rock core run. Rock core properties that were recorded on the field logs include total recovery (total inches of core recovered / interval cored expressed as a percentage), Rock Quality Designation or RQD (total inches of intact core at least 4 inches in length / interval cored expressed as a percentage), total time to core the interval, rock type, estimated field strength, color, texture, foliation frequency and angle, and presence of discontinuities such as fractures. Discontinuities were described with respect to dip angle, frequency, type, weathering, aperture, healing, infilling, and degree of unevenness.

As each core run was retrieved to the surface, Brierley's field engineer placed the core into wooden core boxes and labelled each core box with information including job number, core run number, depth interval, box number, and RQD/recovery for each core run. Core boxes were either photographed in the field or later within a well-lit area where the cores were stored onsite. Core photographs can be found in Appendix B.

Once the field program had been completed, Brierley's onsite representative selected representative samples for laboratory testing. Soil samples were maintained in the glass jars where they were originally placed in the field. Rock core samples were selected in lengths generally between 6 and 10 inches, wrapped in saran wrapped, placed in a plastic Ziploc bag, and then bubble wrapped. Samples were labelled with the borehole number, sample depth (bgs), and the top of the sample noted. Samples were then hand carried by the Brierley representative to a nearby UPS store, carefully packaged and forwarded to the laboratories for testing.

4.3 Groundwater Measurements

Groundwater was measured based on visual means in land borings BA-103, BA-104, and BA-105. In boring BA-103 the groundwater level was observed to be 8.5-feet below ground surface (bgs), in BA-104, the soil varied in visible moisture too much to determine the water level, and in BA-105, the water was observed at 8-feet bgs. These depths are estimated and are expected to vary depending on season and weather. The groundwater table in these areas may also be tidally influenced.

5.0 LABORATORY TESTING PROGRAM

Lab assignments were made by Brierley personnel. The following laboratory testing was performed on recovered soil and rock samples from the 6 test borings:

- One (1) Moisture Content Test (Soil, ASTM D2216),
- One (1) Standard Grain Size Test (Soil, ASTM D6931),
- One (1) Atterberg Limits Test (Soil, ASTM D4318),
- Twelve (12) Unconfined Compressive Strength tests (Bedrock, ASTM D2166),
- Twelve (12) Cerchar Abrasivity Index tests (Bedrock, ASTM D7625), and
- Six (6) Thermal Resistivity tests (Soil and bedrock, IEEE 442-2017).

Geotechnical laboratory testing of recovered soil and rock samples was performed by GeoTesting Express in their Acton, Massachusetts laboratory during June 2022. A complete summary of the results of the geotechnical laboratory testing program are presented in Appendix C.

Thermal resistivity testing of recovered soil and rock samples was performed by GeothermUSA in their Cypress, Texas laboratory during July 2022. Four rock core samples were tested "as is". The soil samples were recompacted at the "as received" moisture content and at 95% of the single point standard Proctor density as directed by Brierley. A complete summary of the results of the thermal resistivity laboratory testing program are presented in Appendix D.

5.1 Soil Geotechnical Test Results

Geotechnical laboratory testing was performed on select samples from Borings BA-103 and BA-105. The summaries are listed below. The grain size test was performed on a composite sample from boring BA-105. An Atterberg Limits test was performed on a potentially clayey sample from Boring BA-103, but the sample was described by the lab to be non-plastic.

Table 2: Moisture Content Results

Moisture Content		
Boring ID	Depth (Ft BGS)	Value (%)
BA-103 (K-103)	8.0-10.0	13.1

Table 3: Grain Size Distribution Results

Grain Size				
Boring ID	Depth (Ft BGS)	Value (% GRAVEL)	Value (%, SAND)	Value (%, Fines)
BA-105 (K-105)	Mix of Sample 6 and Sample 9	64.6	30.6	4.8

Table 4: Atterberg Limits Results

Atterberg Limits		
Boring ID	Depth Ft BGS)	Value (#, NP)
BA-103 (K-103)	8.0-10.0	Non-Plastic

5.2 Rock Geotechnical Laboratory Test Results

Unconfined Compressive Strength (UCS) testing (ASTM D7012) was performed on twelve (12) recovered rock core samples from Borings BA-101, BA-102, BA-103, BA-104, and BA-106. Table 5 presents a summary of the sample depths, bulk density, and strength test values.

Table 5: Unconfined Compressive Strength Results

Unconfined Compressive Strength (UCS) and Bulk Density			
Boring ID	Depth (ft BGS)	Bulk Density Value (pcf)	UCS Value (psi)
BA-101	41-41.39	170	7,594
BA-101	80.26-80.63	165	12,471
BA-101	111.51-111.87	173	6,025
BA-102	78.59-78.97	178	12,363
BA-102	91.37-91.75	170	16,387
BA-102	100.56-100.89	162	19,499
BA-102	101.65-102.03	174	15,501
BA-103 (K-103)	52.78-53.15	161	8,114
BA-104 (K-104)	55.39-55.77	169	2,814
BA-106	40.04-40.37	169	17,245
BA-106	87.26-87.64	166	16,264
BA-106	104.51-104.88	163	14,240

Cerchar abrasivity index (CAI) tests were performed in accordance with ASTM D7625 on twelve (12) rock core samples. Table 6 presents the range of CAI Index Values as assigned by ASTM D7625. The CAI test results are summarized in Table 7. D7625.

Table 6: Cerchar Abrasivity Index Value Ranges per ASTM D7625

Cerchar Values Based on ASTM D7625 (2010)	
Very low abrasiveness	0.30-0.50
Low abrasiveness	0.50-1.00
Medium abrasiveness	1.00-2.00
High abrasiveness	2.00-4.00
Extremely abrasiveness	4.00-6.00
Quarzitic	6.00-7.00

Table 7: Cerchar Abrasivity Index Results

Cerchar Abrasivity Index (CAI)			
Boring ID	Depth (Ft BGS)	CAI Value (#)	ASTM D7625 Classification
BA-101	41.0-41.5	5.24	Extreme Abrasiveness
BA-101	80.6-80.7	4.04	Extreme Abrasiveness
BA-101	111.9-111.9	3.28	High Abrasiveness
BA-102	78.9-79.1	4.00	Extreme Abrasiveness
BA-102	91.8-91.9	4.07	Extreme Abrasiveness
BA-102	100.5-100.6	3.37	High Abrasiveness
BA-102	102.0-102.1	4.96	Extreme Abrasiveness
BA-103(K-103)	51.8-51.9	4.12	Extreme Abrasiveness
BA-104(K-104)	46.1-46.2	3.11	High Abrasiveness
BA-106	40.9-40.9	4.58	Extreme Abrasiveness
BA-106	87.7-87.7	3.80	High Abrasiveness
BA-106	104.9-104.9	4.06	Extreme Abrasiveness

BGS = Below ground surface

5.3 Thermal Resistivity Test Results

Thermal resistivity testing was completed by GeothermUSA in their Cypress Texas laboratory. Six (6) samples (two performed on recovered soil and four in recovered rock samples) had both dry and wet resistivity performed, moisture content was tested in the lab. Proctor compaction recommendations were provided by Brierley for the soil samples tested. The report issued by GeothermUSA for the thermal resistivity testing is presented in Appendix D. The test results are summarized in Table 8.

Table 8: Thermal Resistivity Testing Results

Sample ID	Depth (ft)	Description (Brierley Associates)	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft^3)
			Wet	Dry		
K-103	0 - 17	Fine to coarse sand, trace silt, little mica, little gravel	57	154	12	114
	45.5 - 45.9	Rock	44	57	1	168
	54 - 54.8	Rock	42	52	1	170
K-104	35.1 - 36.4	Rock	45	59	1	165
	41.11 - 42.6	Rock	43	58	1	167
K-105	0 - 26	Fine to coarse sand, trace silt, little mica, little gravel	45	163	17	117

6.0 MARINE GEOPHYSICAL PROGRAM

Brierley subcontracted with Ocean Surveys, Inc. (OSI) to complete a marine geophysical survey within an approximate 200-ft wide corridor in the vicinity of the proposed cable alignment crossing of the East River and Bronx Kill. In each case the survey included the following components:

a. Hydrographic,
b. Subbottom profiling,
c. Magnetometer, and
d. Side scan sonar imagery.

The location, methods and results of the marine geophysical survey is included in Appendix E.

7.0 LIMITATIONS

The strata boundaries designating the interface between soil types and rock types presented on the test boring reports are approximate. The transition between materials may be gradual. The test boring reports and related information depict subsurface conditions only at the specific locations and at the time designated on the reports. Subsurface conditions at other locations may differ from conditions occurring at these boring locations. Also, the passage of time may result in a change in the subsurface conditions at these boring locations. The nature and extent of variations between explorations may not become evident until construction.

This report has been prepared for Kiewit for specific application to the Champlain Hudson Power Express project as understood at this time, in accordance with generally-accepted geotechnical engineering practices common to the local area. No other warranty, express or implied, is made.

Nothing contained in this report shall be construed to create, impose, or give rise to any duty owed by Brierley to any individual or entity other than Kiewit. This report is for the sole use and benefit of Kiewit and may not be used or relied upon by any other individual or entity without the express written approval of Brierley.

The scope of Brierley's services does not include a full environmental assessment and does not provide an analysis for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report or on the test boring reports regarding odors of soil or other unusual conditions observed are strictly for the information of our client. Unless complete environmental information regarding the site is already available, an environmental assessment is recommended prior to construction.

8.0 REFERENCES

ASTM D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

ASTM D2166 - Standard Test Method for Unconfined Compressive Strength of Cohesive Soil.

ASTM D7625 - Standard Test Method for Laboratory Determination of Abrasiveness of Rock Using the CERCHAR Method.

ASTM D 2487 – 06 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

ASTM D1586 - Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.

ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedures).

IEEE 442-2017 - IEEE Guide for Thermal Resistivity Measurements of Soils and Backfill Materials.

APPENDIX A
BORING LOGS

BORING NUMBER BA-101

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp.
PROJECT NAME Champlain Hudson Power Express
PROJECT NUMBER 322004.001
PROJECT LOCATION Randall's Island, NY
DATE STARTED 6/7/22 **COMPLETED** 6/10/22
GROUND ELEVATION -18 ft NAVD88 **NORTHING** 227831.382
DRILLING CONTRACTOR Warren George, Inc.
GROUND WATER LEVELS: **EASTING** 1009904.618
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING ---
DRILL RIG Acker Soil Max **DRILLER** Greg Williams
AT END OF DRILLING ---
LOGGED BY Kurt Breitenbucher **CHECKED BY** Dave Sackett, P.G.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
0		Medium to coarse SAND, medium dense, black to gray, wet, with organics and shells, organic odor	SPT 1	25	13-14-5 (19)				
5		-5' - 7' coarse sand with fine gravel below 5' -5.9' clay seam	SPT 2	46	50-28-50 (78)				
10		-28.0 SCHIST, micaceous, medium strong to strong, light gray, highly weathered -11' - 12' very weak, intensely fractured, fractures dip to 20 degrees -fresh below 12'	RC 1	88 (53)					
15		-15' - 20' intensely fractured, fracture dips range from 20 degrees to 60 degrees	RC 2	100 (60)					
20		-20' - 45' slightly to moderately fractured, light gray with black foliation, slightly to moderately weathered along foliation planes and quartzite veins, foliation dip 0 to 20 degrees	RC 3	100 (95)					
25		-25' - 29' light gray with black foliation, foliation horizontal -29' - 30' moderately to intensely fractured, fractures dip 0 to 10 degrees	RC 4	100 (87)					
30			RC 5	100 (77)					
35									

(Continued Next Page)

BORING NUMBER BA-101

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp.
PROJECT NAME Champlain Hudson Power Express
PROJECT NUMBER 322004.001
PROJECT LOCATION Randall's Island, NY

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
35		SCHIST, micaceous, medium strong to strong, light gray, fresh -35' - 40' slightly to moderately fractured, light gray with black foliation, foliation dip 0 to 20 degrees	RC 6	100 (77)					
40		-39' - 39.4' quartzite vein -40' - 45' slightly to moderately fractured, light gray with black foliation, foliation dip 0 to 20 degrees -40.1' quartzite veins, horizontal dip	RC 7	98 (90)		7594	5.24	170	
45		-46' - 47' intensely fractured, with quartzite	RC 8	80 (57)					
50		-50' - 55' foliation dip 20 degrees -52' - 52.3' quartzite seam -59' - 59.3' quartzite seam	RC 9	91 (83)					
55			RC 10	87 (87)					
60		-60' - 70' slightly to moderately fractured, light gray with black foliation, foliation dip 0 to 20 degrees -63' - 64' quartzite, porphyritic texture	RC 11	100 (85)					
65			RC 12	100 (93)					
70		-70' - 73' quartzite banding, moderately fractured, light gray with black and white banding	RC 13	100 (90)					
75									

(Continued Next Page)

BORING NUMBER BA-101

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp. **PROJECT NAME** Champlain Hudson Power Express

PROJECT NUMBER 322004.001 **PROJECT LOCATION** Randall's Island, NY

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
75		SCHIST, micaceous, medium strong to strong, light gray, fresh 75' - 80' thinly foliated, horizontal foliation, quartzite veins	RC 14	100 (83)					
80		-80' - 85' thinly foliated, light gray with black foliation, foliation dip horizontal -81' - 81.3' quartzite veins -82' - 83' intensely fractured, dip 0 to 10 degrees	RC 15	93 (82)		12471	4.04	165	
85		-85' - 90' strong, moderately fractured, wavy foliation, with quartzite veins	RC 16	100 (96)					
90		-90' - 95' slightly fractured, light gray with black foliation, wet -92.5' - 92.8' quartzite seam	RC 17	98 (91)					
95		-95' - 100' moderately fractured, wet, horizontal foliation	RC 18	100 (96)					
100		-100' - 101' intensely fractured, light gray with black foliation -101'- 103' quartzite, porphyritic texture, rose to tan coloration with black foliation	RC 19	100 (83)					
105		-105' - 110' slightly fractured, light gray with black foliation, foliation dip 20 degrees -109' - 1/2" quartzite seam, black and white, porphyritic texture	RC 20	100 (96)					
110		-128.0 GNEISS, medium strong to strong, black and white, crudely foliated	RC 21	100 (88)		6025	3.28	173	
115									

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BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp. **PROJECT NAME** Champlain Hudson Power Express
PROJECT NUMBER 322004.001 **PROJECT LOCATION** Randall's Island, NY

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE)	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
115		GNEISS, medium strong to strong, black and white, crudely foliated -115' - 120' rose/tan into black and white coloration	RC 22	97 (94)					
120		-wavy foliation below 120'	RC 23	90 (81)					
125									

Bottom of borehole at 125.0 feet.

-Marine Boring

-Boring coordinates are in State Plane System:
State Plane Zone 3104
US Survey Feet

BORING NUMBER BA-102

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp.
PROJECT NAME Champlain Hudson Power Express
PROJECT NUMBER 322004.001
PROJECT LOCATION Randall's Island, NY
DATE STARTED 6/1/22 **COMPLETED** 6/3/22
GROUND ELEVATION -12 ft NAVD88 **NORTHING** 227509.784
DRILLING CONTRACTOR Warren George, Inc.
GROUND WATER LEVELS: **EASTING** 1010121.865
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING ---
DRILL RIG Acker Soil Max **DRILLER** Cesar Moreira
AT END OF DRILLING ---
LOGGED BY Dave Sackett, P.G. **CHECKED BY** Dave Sackett, P.G.
AFTER DRILLING ---

DEPTH (ft)	MATERIAL DESCRIPTION	Elev.	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE)	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
0	Medium to coarse SAND, medium dense, black, with rounded gravel, wet, with gravel to 1", with organics		SPT 1	29	7-7-3 (10)				
5	-5' very loose, brown, sub-rounded to rounded gravel to 1/2"		SPT 2	25	3-0-0 (0)				
10	-10' - 12' no recovery		SPT 3	0	35-15-8 (23)				
15	-silty sand layer below 15'	-27.5							
	Fine to medium SAND, medium dense, brown, with few coarse sub-rounded to rounded gravel to 1", micaceous		SPT 4	50	16-14-14 (28)				
20	-20' - 20.5' dense, showing some layering -20.5' becoming rock like, weathered black rock fragments		SPT 5	54	11-17-19 (36)				
25		-37.0							
	Gravelly medium to coarse SAND, dense, brown with black cemented rock fragments, with sub-rounded gravel to 1"		SPT 6	46	14-11-20 (31)				
30		-42.0							
	SCHIST, micaceous, strong to very strong, black with light gray banding, moderately weathered		SPT 7	100	50/4"				
	-extremely weak to weak, extremely weathered, to 30.5'		RC 1	90 (75)					
35									

(Continued Next Page)

BORING NUMBER BA-102

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp. **PROJECT NAME** Champlain Hudson Power Express

PROJECT NUMBER 322004.001 **PROJECT LOCATION** Randall's Island, NY

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE)	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
35		SCHIST, micaceous, strong to very strong, black with light gray banding, moderately weathered -34' - 34.2' quartzite veins, dip 10 degrees -slighty weathered 34.2' to 39.5'	RC 2	100 (93)					
40		-fresh below 41' - 40.5' - 42.4' black and white banding, dip 10 to 20 degrees, with many quartzite veins -42.4' - 42.8' quartzite veins	RC 3	100 (100)					
45		-45.5' - 50.5' wavy foliation dip 20 to 30 degrees	RC 4	100 (100)					
50		-50.5' - 55.5' wavy foliation dip 30 to 40 degrees -53.8' - 53.9' quartzite seam	RC 5	100 (100)					
55		-pyrite crystals on foliation planes along breaks, below 50' -59.9 - 60.1 quartzite vein	RC 6	95 (95)					
60		-62.9' - 63.2' pitted within quartzite rich vein -60.5' - 63.2' foliation dip 30 to 45 degrees -64.5' - 65.2' chlorite minerals along fractures on foliation planes	RC 7	97 (85)					
65		-68.3' - 68.5' quartzite vein -69.1' - 69.3' discolored fractures, dip 10 degrees	RC 8	100 (97)					
70		-70.5' - 75.5' wavy foliation dip 10 to 20 degrees	RC 9	100 (100)					
75									

(Continued Next Page)

BORING NUMBER BA-102

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp. **PROJECT NAME** Champlain Hudson Power Express

PROJECT NUMBER 322004.001 **PROJECT LOCATION** Randall's Island, NY

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE)	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
75		SCHIST, micaceous, strong to very strong, black with light gray banding, moderately weathered -76.3' - 76.6' darker mineralization, moderately weak	RC 10	100 (90)		12363	4.00	178	
80		-80.5' - 85.5' foliation dip 20 to 40 degrees -80.5' - 80.8' fracture zone, intensely fractured, slightly slickensided	RC 11	100 (82)					
85		-85.5' - 88' aphanitic texture -87.2' - 87.4' fracture dip 45 degrees -87.5' - 88.1' twin fractures dip 70 degrees -88.5' - 90.5 chlorite and pyrite crystals visible on core exterior	RC 12	90 (87)					
90		-90.5' - 95.5' foliation dip 45 to 60 degrees	RC 13	100 (100)		16387	4.07	170	
95		-95.5 - 100.5' large quartzite veins/inclusions -96.8' - 97.1' intensely fractured	RC 14	92 (85)		19499	3.37	162	
100		-100' - 101.2' quartzite layer (porphyritic) -101.8' - 104' wavy foliation dip 45 to 60 degrees -103.8' - 104.2' quartzite veins	RC 15	97 (92)		15501	4.96	174	
105		-undulating foliation dip up to 75 degrees below 105.5	RC 16	97 (80)					

Bottom of borehole at 108.0 feet.

-Driller reports lost circulation at 108', pulled up coring barrel and bit was completely melted due to heat. Boring terminated at 108'.

-Marine Boring

-Boring coordinates are in State Plane System:
State Plane Zone 3104
US Survey Feet

BORING NUMBER BA-103 (K-103)

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp.
PROJECT NAME Champlain Hudson Power Express
PROJECT NUMBER 322004.001
PROJECT LOCATION Randall's Island, NY
DATE STARTED 5/26/22 **COMPLETED** 5/26/22
GROUND ELEVATION 10.36 ft NAVD88 **NORTHING** 230281
DRILLING CONTRACTOR Warren George, Inc.
GROUND WATER LEVELS: **EASTING** 1006168.1
DRILLING METHOD Mud Rotary
∇ **AT TIME OF DRILLING** 8.50 ft / Elev 1.86 ft
DRILL RIG Acker Soil Max **DRILLER** Greg Williams
AT END OF DRILLING ---
LOGGED BY Colby Jesset, P.E. **CHECKED BY** Dave Sackett, P.G.
AFTER DRILLING ---

DEPTH (ft)	MATERIAL DESCRIPTION	Elev.	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
0	Silty fine-medium SAND, dense, gray, moist, few coarse sand, trace fine gravels	8.4	SPT S-1	42	14-22-27 (49)				
	Sandy SILT, very dense, blackish gray, moist, few medium to coarse gravels, rounded to sub-rounded	6.4	SPT S-2	50	25-34-38 (72)				
5	- 4.0' - 4.5' silty layer, red, with little coarse sand -4.5' to 6', Silty fine to coarse SAND, gray		SPT S-3	58	35-46-44 (90)				
	Fine SAND with Silt, very dense, black to brown gray, trace fine gravel, rounded	2.4	SPT S-4	38	76-8-4 (12)				
10	∇ Clayey SILT, firm, gray, wet, few fine to coarse sand, trace fine gravel, angular	0.4	SPT S-5	50	2-4-4 (8)				
	Silty fine SAND, very dense, gray, wet	-4.6	SPT S-6	4	100				
15	Silty Clayey PEAT, very soft, dark gray, wet, strong odor, partially decomposed organic material	-5.6	SPT S-7A	83	0-0-0/0"				
	SCHIST, very weak, grey white black, highly weathered		SPT S-7B	83	76-66 (142)				
			NR S-8	0	100				
20	20.0' - 30.0' medium strong, lightly fractured, redish brown staining on joints		RC R-1	90 (87)					
25	-29.4' - 30' highly weathered, moderately fractured		RC R-2	100 (78)					
30	-30' - 35' slightly fractured -fresh below 31.0'		RC R-3	95 (95)					
35									

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BORING NUMBER BA-103 (K-103)

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp. **PROJECT NAME** Champlain Hudson Power Express

PROJECT NUMBER 322004.001 **PROJECT LOCATION** Randall's Island, NY

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE)	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
35		SCHIST, strong, gray white, fresh, redish brown staining on joints - 35' to 40' moderately fractured, slight weathering of joints	RC R-4	98 (87)					
40		-40' - 45' moderately fractured - highly weathered from 44.2' to 44.7'	RC R-5	100 (92)					
45		-45' - 50' slightly fractured	RC R-6	100 (92)					
50		-50' - 55' moderately fractured - 50.4' to 53.6' feldspar in pegmatite intrusions, pink	RC R-7	100 (100)		8114	4.12	161	
55		-55' - 60' moderately fractured - 56.6' to 56.8' feldspar in pegmatite intrusions, pink	RC R-8	97 (92)					
60		-60' - 65' slightly fractured	RC R-9	100 (97)					
65									

Bottom of borehole at 65.0 feet.

-Boring coordinates are in State Plane System:
State Plane Zone 3104
US Survey Feet

BORING NUMBER BA-104 (K-104)

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp.
PROJECT NAME Champlain Hudson Power Express
PROJECT NUMBER 322004.001
PROJECT LOCATION Randall's Island, NY
DATE STARTED 5/23/22 **COMPLETED** 5/25/22
GROUND ELEVATION 9.46 ft NAVD88 **NORTHING** 230572.9
DRILLING CONTRACTOR Warren George, Inc.
GROUND WATER LEVELS: **EASTING** 1005979.5
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING ---
DRILL RIG Acker Soil Max **DRILLER** Greg Williams
AT END OF DRILLING ---
LOGGED BY Colby Jesset, P.E. **CHECKED BY** Dave Sackett, P.G.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	Elev.	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE)	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
0		Silty fine to coarse SAND, brown, moist -sampler pushed in with WOR and TDS	7.5	SPT S-1	13					
		Silty SAND, medium dense, brown, moist, little fine to coarse gravel, sub-rounded, trace organic material, possible cobble or boulder, refusal at 3.5'		SPT S-2	50	3-12-50 (62)				
5		-possible cobble or boulder -refusal at 4.5' -5'- 6' lots of rig chatter while drilling	3.5	NR S-3	0	6-50				
		Fine to coarse SAND, dense, grey, some fine gravel, angular, trace coarse gravel -possible cobble or boulder fragments at tip of SS -8'-10' rig chatter while drilling, possible gravel layer		SPT S-4	21	6-8-30 (38)				
10			-0.5							
		Silty fine to coarse SAND, loose, grey/black, moist, some fine to coarse gravel, sub-angular, mps 1.5" -possible cobble fragment		SPT S-5	25	6-4-4 (8)				
15			-5.5							
		Silty CLAY, stiff, gray, wet, few shell fragments, trace coarse gravel, sub-rounded, mps 1.5"		SPT S-6	42	6-6-12 (18)				
20			-10.5							
		Silty fine to coarse SAND, medium dense, reddish brown to brown, moist, fine to coarse gravel, sub-rounded		SPT S-7	42	6-11-10 (21)				
25			-15.5							
		Silty fine to coarse SAND, very dense, brown to light brown, moist, some fine to coarse gravel, sub-angular to angular -chatter 25' to 27.5', possible gravel layer	-17.5	SPT S-8	38	59-38-30 (68)				
		SCHIST, extremely weak to very weak, black white gray, highly weathered, moist								
30		- weak below 32'		SPT S-9	50	41-17-73 (90)				
35			-25.5							

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BRIERLEY ASSOCIATES *Creating Space Underground*

CLIENT Kiewit Engineering (NY) Corp. **PROJECT NAME** Champlain Hudson Power Express

PROJECT NUMBER 322004.001 **PROJECT LOCATION** Randall's Island, NY

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE)	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
35		SCHIST, weak, reddish brown to gray-white, weathered joints with oxidation staining in most fractures	SPT S-10	8	100				
		-35' - 40' intensely fractured	RC R-1	85 (45)					
		-35.2 'SCHIST, reddish grayish brown, highly decomposed residual soil, moist							
40		-slightly fractured below 35'	RC R-2	98 (72)					
45			RC R-3	100 (83)			3.11		
50			RC R-4	95 (85)					
55			RC R-5	85 (52)		2814		169	
		- 58' quartzite seam 1.5" thick							
60			RC R-6	92 (53)					
65									

Bottom of borehole at 65.0 feet.

-Boring coordinates are in State Plane System:
State Plane Zone 3104
US Survey Feet

BORING NUMBER BA-105 (K-105)

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT	Kiewit Engineering (NY) Corp.	**PROJECT NAME**	Champlain Hudson Power Express
PROJECT NUMBER	322004.001	**PROJECT LOCATION**	Randall's Island, NY
DATE STARTED	5/27/22	**COMPLETED**	5/27/22
GROUND ELEVATION	10.3 ft NAVD88	**NORTHING**	229752.4
DRILLING CONTRACTOR	Warren George, Inc.	**EASTING**	1007419.7
DRILLING METHOD	Mud Rotary	**GROUND WATER LEVELS:**	
DRILL RIG	Acker Soil Max	**DRILLER**	Greg Williams
LOGGED BY	Colby Jesset, P.E.	**CHECKED BY**	Dave Sackett, P.G.

GROUND WATER LEVELS:
- ∇ **AT TIME OF DRILLING** 8.00 ft / Elev 2.30 ft
- **AT END OF DRILLING** ---
- **AFTER DRILLING** ---

DEPTH (ft)	MATERIAL DESCRIPTION	ELEV.	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE)	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
0	Top Soil	9.8							
	Fine SAND, brown, moist	8.3	SPT S-1	17					
	Silty fine to medium SAND, dense to very dense, gray/brown, moist, trace fine to coarse gravel		SPT S-2	67	21-20-9 (29)				
5			SPT S-3		8-8-14 (22)				
	-Possible cobble/boulder, split spoon bouncing ∇	2.3	NR S-4	0	100				
	Sandy SILT, medium dense, brown, wet, little red gravel	0.3	SPT S-5	17	6-13-6 (19)				
10	Silty fine to coarse GRAVEL, medium dense, red black white, wet, some silty brown fine sand		SPT S-6	29	10-13-14 (27)				
15		-4.7							
	Silty fine to medium SAND with gravel, dense, trace fine to coarse gravel		SPT S-7	88	19-21-50 (71)				
	-16.5' cobble fragment of highly weathered schist								
20	-20.0 driller switched to rock coring -20.0' - 20.5' - cobble fragment of weathered schist		RC R-1	56 (40)					
25		-15.1							
	Silty fine to coarse GRAVEL, dense, black, wet,sub-rounded to sub-angular, little fine to medium sand		SPT S-8	50	19-30				
30		-19.7							
	Silty fine to medium SAND, medium dense, black, wet, little coarse sand, some fine to coarse gravel - 31' to 32' light chatter while drilling, possible gravel		SPT S-9	42	14-7-15 (22)				
	- 33' top of possible cobble/boulder								
35		-24.7							

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BORING NUMBER BA-105 (K-105)

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp. **PROJECT NAME** Champlain Hudson Power Express

PROJECT NUMBER 322004.001 **PROJECT LOCATION** Randall's Island, NY

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE)	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
35		PEAT, black, wet, odorous 35.0' driller switched to rock coring 35.0' to 35.8' small cobble of weathered schist		RC R-2	12 (10)					
40			-29.7							

Bottom of borehole at 40.0 feet.

-Boring coordinates are in State Plane System:
State Plane Zone 3104
US Survey Feet

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp.
PROJECT NAME Champlain Hudson Power Express
PROJECT NUMBER 322004.001
PROJECT LOCATION Randall's Island, NY
DATE STARTED 6/13/22 **COMPLETED** 6/16/22
GROUND ELEVATION -22 ft NAVD88 **NORTHING** 229287.097
DRILLING CONTRACTOR Warren George, Inc.
GROUND WATER LEVELS: **EASTING** 1008320.238
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING ---
DRILL RIG Acker Soil Max **DRILLER** Greg Williams
AT END OF DRILLING ---
LOGGED BY Kurt Breitenbucher **CHECKED BY** Dave Sackett, P.G.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	Elev.	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
0		Clayey SAND, very loose, black, wet, oderous, trace organics, shells		SPT 1	83	0-0-0 (0)				
5		CLAY, very soft, black to gray, wet, medium sand from 5' to 5.1'	-27.0	SPT 2	75	0-0-0 (0)				
10		-2" of fine gravel, angular		SPT 3	75	0-0-0 (0)				
15		SCHIST, micaceous, strong to very strong, slightly weathered, gray with black banding, thinly foliated, foliation dip 70 degrees to 90 degrees -15.2' to 15.5' quartzite vein -19' - 20' vertical foliation -15' - 20' pyrite along fractures/mechanical breaks	-37.0	RC 1	95 (95)					
20		-fresh below 20' -20' - 25' slightly fractured, pyrite along fractures/mechanical breaks -23' - 25' nearly vertical foliation dip becoming 70 degrees		RC 2	96 (91)					
25		-25' - 30' slightly fractured, wavy foliation dip 70 degrees to vertical, quartzite veins along foliation planes		RC 3	100 (90)					
30		-30' - 35' slightly fractured, porphyritic texture, foliated to intensely foliated, dip vertical to 70 degrees		RC 4	100 (96)					
35										

(Continued Next Page)

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp. **PROJECT NAME** Champlain Hudson Power Express
PROJECT NUMBER 322004.001 **PROJECT LOCATION** Randall's Island, NY

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE)	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
35		SCHIST, micaceous, strong to very strong, fresh, gray with black banding, wet, intensely foliated to thinly foliated -35' - 40' slightly fractured, foliated dip 65 to 70 degrees. -35' - 36' quartzite/schist, porphyritic texture	RC 5	100 (94)					
40		-40' - 70' slightly fractured, thinly foliated dip to 70 degrees	RC 6	100 (93)		17245	4.58	169	
45		-49' - 50' possible fracture zone, horizontal dip	RC 7	100 (83)					
50		-50' - 55' intensely foliated, 65 to 70 degrees.	RC 8	83 (79)					
55		-55' - 57' thinly foliated 57' - 60' porphyritic texture, quartzite seams	RC 9	91 (86)					
60		-61.5' - 65' slightly fractured, aphanitic texture, quartzite veins	RC 10	70 (63)					
65		-66' - 70' foliated dip 65 to 70 degrees, quartz veins throughout on foliation planes	RC 11	89 (88)					
70		-70' - 73' slightly to moderately fractured, thinly foliated to intensely foliated dip 60 degrees -70' - 75' pyrite crystals along fractures and mechanical breaks	RC 12	100 (88)					
75									

(Continued Next Page)

BORING NUMBER BA-106

BRIERLEY ASSOCIATES
Creating Space Underground

CLIENT Kiewit Engineering (NY) Corp. **PROJECT NAME** Champlain Hudson Power Express

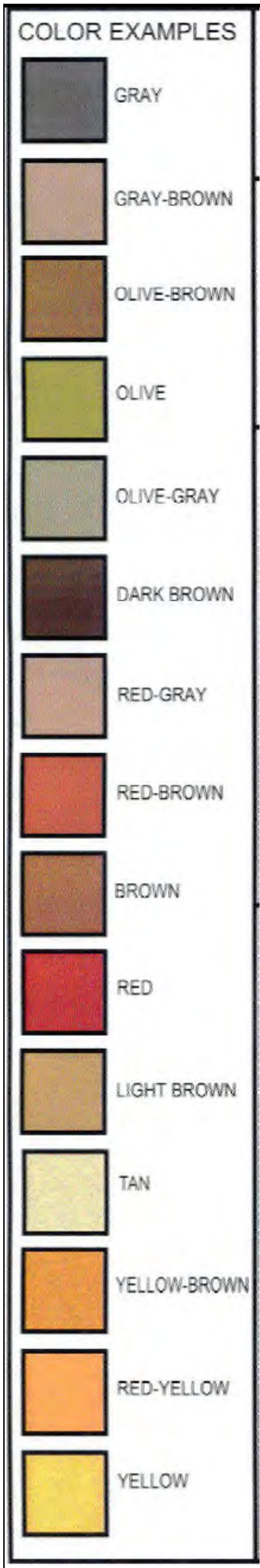
PROJECT NUMBER 322004.001 **PROJECT LOCATION** Randall's Island, NY

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	N VALUE)	UCS (psi)	CERCHAR	BULK DENSITY (pcf)	FINES (%)
75		SCHIST, micaceous, strong to very strong, fresh, gray with black banding, wet, intensely foliated to thinly foliated -75' - 80' moderately fractured, foliated to intensely foliated dip 60 degree -77' -78.5' quartzite vein, white with black foliation	RC 13	99 (90)					
80		-80' - 85' porphyritic texture, foliated dip 60 degree	RC 14	96 (96)					
85		-85' - 95' foliated to intensely foliated, nearly vertical foliation	RC 15	100 (95)		16264	3.8	166	
90		-90- 92' quartzite, black and white	RC 16	99 (99)					
95		-95' - 100' vertical foliation becoming wavy dip to 50 degrees -97' -97.7' darker coloration, black porphyritic material	RC 17	100 (100)					
100		-moderately fractured, thinly foliated to intensely foliated dip 60 degrees below 100' -103.5 - 105' darker coloration, possible fracture zone, dip 10 degrees	RC 18	100 (92)		14240	4.06	163	
105									

Bottom of borehole at 105.0 feet.

-Marine Boring

-Boring coordinates are in State Plane System:
State Plane Zone 3104
US Survey Feet



GRAIN SIZE

Clear Square Sieve Openings — U.S. Standard Series Sieve

Sieve: 12” | 3” | ¾” | 4 | 10 | 40 | 200

	Boulders	Cobbles	Gravel		Sand			Silts and Clays
SOILS			Coarse	Fine	Coarse	Medium	Fine	
FILLS	Blocks	Pieces	Fragments		Particles			Specks

300mm | 75mm | 19mm | 4.75mm | 2.0mm | 0.042mm | 0.75mm

APPARENT/RELATIVE DENSITY - NON-COHESIVE SOIL

APPARENT DENSITY	SPT (# blows/ft)	MODIFIED CA, SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very loose	0 - 4	0 - 4	0 - 5	0 - 15
Loose	5 - 10	5 - 12	6 - 15	15 - 35
Medium dense	11 - 30	13 - 35	16 - 40	35 - 65
Dense	31 - 50	36 - 60	41 - 70	65 - 85
Very dense	> 50	> 60	> 70	85 - 100

CONSISTENCY - COHESIVE SOIL

		TORVANE	POCKET PENETROMETER
CONSISTENCY	SPT (# blows/ft)	UNDRAINED SHEAR STRENGTH (tsf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)
Very soft	0 - 2	< 0.13	< 0.25
Soft	3 - 4	0.13 - 0.25	0.25 - 0.5
Medium stiff	5 - 8	0.25 - 0.5	0.5 - 1.0
Stiff	9 - 15	0.5 - 1.0	1.0 - 2.0
Very stiff	16 - 30	1.0 - 2.0	2.0 - 4.0
Hard	> 30	> 2.0	> 4.0

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

SOIL IDENTIFICATION SHOULD INCLUDE:

1. Percent of gravel, sand & fines
2. Dilatancy, toughness, plasticity, dry strength
3. Density/consistency
4. Color
5. Group name/group symbol
6. Percent oversized
7. Maximum particle size
8. Structure
9. Odor
10. Moisture
11. Optional descriptions
12. Geologic interpretation

Criteria for Describing Soil Structure

Description	Criteria
Bed	A sedimentary layer bounded by depositional surfaces
Blocky	A characteristic in which cohesive soil can be broken down into small angular lumps which resist further breakdown
Bonded	Attached or adhering
Fissured	Broken along definite planes of fracture
Foliated	Planar arrangement of textural or structural features
Frequent	More than one per foot of thickness
Homogeneous	Same color and appearance throughout
Interbedded	Alternating soil layers of different composition
Laminae	A very thin cohesive layer
Layer	A general term for material lying essentially parallel to the surfaces againt which it was formed
Lens	A lenticular deposit, larger than a pocket
Occasional	One or less per foot of thickness
Parting	A very thin granular layer
Pocket	Small erractic deposits less than 12-inches in thickness
Seam	A thin layer separating two distinctive layers of different composition or greater magnitude
Stratified	Alternating layers of varying material or color
Stratum	A stratigraphic unit
Varve	A cyclic sedimentary couplet consisting of a coarser and a finer layer representing the variation in depositional energy resulting from the annual freeze-thaw cycle typically found in glaciolacustrine environments.

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Criteria for Describing Dilatancy

Description	Criteria
None	No visible change in the specimen
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing

---

Criteria for Describing Toughness

Description	Criteria
Low	Only slight pressure is required to roll a 1/8-inch (3mm) thread near the platic limit. The thread and the lump are weak and soft
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

Criteria for Describing Plasticity

Description	Criteria
Non-plastic	1/8-inch (3mm) thread cannot be rolled at any water content
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

---

Criteria for Describing Dry Strength

Description	Criteria
None	The dry specimen crumbles into powder with mere pressure of handling
Low	The dry specimen crumbles into powder with some finger pressure
Medium	The dry specimen breaks into pieces or crumbles with considerable finger pressure
High	The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface
Very High	The dry specimen cannot be broken between the thumb and a hard surface

SUMMARY OF TEST RESULTS				
	Dilatancy	**Toughness**	**Plasticity**	**Dry Strength**
ML	slow – rapid	low	none – low	none – low
MH	none – slow	low – medium	low – medium	low – medium
CL	none – slow	medium	medium	medium – high
CH	none	high	high	high – very high

Rock descriptions noted on logs of subsurface explorations are based on visual-manual examination of exposed rock and core samples, and should be presented in the following order: **Field Hardness, Weathering, Color, Texture, Lithology, Discontinuity Spacing and Discontinuity Type** as shown in the following example:

Hard, slightly to moderately weathered, gray and pink, medium-grained GNEISS with closely spaced foliation – IDAHO SPRINGS FORMATION

Rock discontinuities will be described in further detail under "Description of Rock Discontinuities."

COLOR

- Moderate Red
- Moderate Red/Orange
- Grayish Red
- Light Brown
- Moderate Brown
- Pale Olive
- Light Olive Gray
- Light Gray
- Medium Gray
- Medium Bluish/Gray

FIELD HARDNESS

A measure of resistance to scratching or abrasion:

Term	Description
Very Hard	Cannot be scratched with a knife or sharp pick.
Hard	Can be scratched with knife or pick only with difficulty.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point.
Soft	Can be gouged or grooved readily with knife or pick point.
Very Soft	Can be carved with knife. Can be scratched readily by fingernail.

WEATHERING

The degree of rock alteration produced by chemical and/or mechanical processes:

Term	Description
Fresh	No visible sign of rock material weathering: perhaps slight discoloration on major discontinuity surfaces.
Slightly Weathered	Discoloration of rock material on discontinuity surfaces.
Moderately Weathered	Less than half of the rock material is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly Weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.

TEXTURE

The general physical appearance or character of a rock including the geometric aspects and the relations between the component particles or crystals. The following grain size ranges are used in describing rock:

Term	Description
Very fine-grained	Grains not individually visible to the unaided eye
Fine-grained	Grains barely visible to the unaided eye, up to 1/16 inch diameter
Medium-grained	Grains between 1/16 and 3/16 inch in diameter
Coarse-grained	Grains between 3/16 and 1/4 inch in diameter
Very coarse-grained	Grains larger than 1/4 inch in diameter

LITHOLOGY

Identify the geologic name and, if possible, the formation name. The principal constituent is written in capital letters. Examples are: biotite GNEISS, quartz mica SCHIST, dolomitic LIMESTONE.

DISCONTINUITY SPACING

The perpendicular distance between discontinuities normal to the plane of the fractures of a single system

Term	Spacing (in.)
Extremely Close	<3/4
Very Close	<3/4 to 2-1/2
Close Moderate	>2-1/2 to 8
Moderate	>8 to 24
Wide	> 24 to 80
Very Wide	>80

DISCONTINUITY TYPE

Term	Description
Joint	Break of geologic origin in the continuity of a body of rock along which there has been no visible displacement. A group of parallel joints is called a set and joint sets intersect to form a joint system. Joints frequently form parallel to bedding planes, foliations, and cleavages and may be termed bedding plane joints, foliation joints, or cleavage joints accordingly
Shear	A discontinuity along which differential movement has taken place parallel to the discontinuity surface, sufficient to produce slickensides, (i.e. striations and polishing). Shear discontinuities may be accompanied by a zone of fractured rock up to a few inches wide
Foliation	A general term used for a planar arrangement of textural or structural features, most commonly applied to metamorphic rock such as cleavage in slate or schistocity in other rocks. The attitude (strike and dip), spacing between beds, and persistence (continuity) of beds are described where possible. Terminology used in foliation description is the same as given for discontinuities.
Bedding	Bedding is the arrangement of a sedimentary rock in beds or layers. The bedding surface represents and original surface of deposition. The following terminology is used to describe the thickness of bedding as measured between bedding surfaces.

Term	Thickness (in.)
Extremely Thin	<3/4
Very Thin	>3/4 to 2-1/2
Thin	>2-1/2 to 8
Medium	>8 to 24
Thick	>24

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Flow Chart for Identifying Fine-Grained Soils (50% or more fines)

Group Symbol				Group Name
CL (LEAN CLAY)	<30% plus No. 200	<15% plus No. 200		LEAN CLAY
		15-29% plus No. 200	% sand ≥% gravel	LEAN CLAY with sand
			% sand <% gravel	LEAN CLAY with gravel
	≥30% plus No. 200	% sand ≥% gravel	<15% gravel	sandy LEAN CLAY
			≥15% gravel	sandy LEAN CLAY with gravel
		% sand <% gravel	<15% sand	gravelly LEAN CLAY
			≥15% sand	gravelly LEAN CLAY with sand
CL-ML (SILTY CLAY)	<30% plus No. 200	<15% plus No. 200		SILTY CLAY
		15-29% plus No. 200	% sand ≥% gravel	SILTY CLAY with sand
			% sand <% gravel	SILTY CLAY with gravel
	≥30% plus No. 200	% sand ≥% gravel	<15% gravel	sandy SILTY CLAY
			≥15% gravel	sandy SILTY CLAY with gravel
		% sand <% gravel	<15% sand	gravelly SILTY CLAY
			≥15% sand	gravelly SILTY CLAY with sand
ML (SILT)	<30% plus No. 200	<15% plus No. 200		SILT
		15-29% plus No. 200	% sand ≥% gravel	SILT with sand
			% sand <% gravel	SILT with gravel
	≥30% plus No. 200	% sand ≥% gravel	<15% gravel	sandy SILT
			≥15% gravel	sandy SILT with gravel
		% sand <% gravel	<15% sand	gravelly SILT
			≥15% sand	gravelly SILT with sand
OL/OH (ORGANIC SOILS)	<30% plus No. 200	<15% plus No. 200		ORGANIC SOIL
		15-25% plus No. 200	% sand ≥% gravel	ORGANIC SOIL with sand
			% sand <% gravel	ORGANIC SOIL with gravel
	≥30% plus No. 200	% sand ≥% gravel	<15% gravel	sandy ORGANIC SOIL
			≥15% gravel	sandy ORGANIC SOIL with gravel
		% sand <% gravel	<15% sand	gravelly ORGANIC SOIL
			≥15% sand	gravelly ORGANIC SOIL with sand
CH (FAT CLAY)	<30% plus No. 200	<15% plus No. 200		FAT CLAY
		15-29% plus No. 200	% sand ≥% gravel	FAT CLAY with sand
			% sand <% gravel	FAT CLAY with gravel
	≥30% plus No. 200	% sand ≥% gravel	<15% gravel	sandy FAT CLAY
			≥15% gravel	sandy FAT CLAY with gravel
		% sand <% gravel	<15% sand	gravelly FAT CLAY
			≥15% sand	gravelly FAT CLAY with sand
MH (ELASTIC SILT)	<30% plus No. 200	<15% plus No. 200		ELASTIC SILT
		15-29% plus No. 200	% sand ≥% gravel	ELASTIC SILT with sand
			% sand <% gravel	ELASTIC SILT with gravel
	≥30% plus No. 200	% sand ≥% gravel	<15% gravel	sandy ELASTIC SILT
			≥15% gravel	sandy ELASTIC SILT with gravel
		% sand <% gravel	<15% sand	gravelly ELASTIC SILT
			≥15% sand	gravelly ELASTIC SILT with sand

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Flow Chart for Identifying Fine-Grained Soils (50% or more fines)

Group Symbol						Group Name
GRAVEL % gravel >% sand	<5% fines	Well-graded		**GW**	<15% sand	well-graded GRAVEL
					≥15% sand	well-graded GRAVEL with sand
		Poorly-graded		**GP**	<15% sand	poorly-graded GRAVEL
					≥15% sand	poorly-graded GRAVEL with sand
	5-12% fines	Well-graded	fines = ML or MH	**GW-GM**	<15% sand	well-graded GRAVEL with silt
					≥15% sand	well-graded GRAVEL with silt and sand
			fines = CL, CH, (or CL-ML)	**GW-GC**	<15% sand	well-graded GRAVEL with clay (or silty clay)
					≥15% sand	well-graded GRAVEL with clay and sand (or silty clay and sand)
		Poorly-graded	fines=ML or MH	**GP-GM**	<15% sand	poorly-graded GRAVEL with silt
					≥15% sand	poorly-graded GRAVEL with silt and sand
			fines = CL, CH, (or CL-ML)	**GP-GC**	<15% sand	poorly-graded GRAVEL with clay (or silty clay)
					≥15% sand	poorly-graded GRAVEL with clay and sand (or silty clay and sand)
	>12% fines		fines = ML or MH	**GM**	<15% sand	silty GRAVEL
					≥15% sand	silty GRAVEL with sand
			fines = CL or CH	**GC**	<15% sand	clayey GRAVEL
					≥15% sand	clayey GRAVEL with sand
			fines = CL-ML	**GC-GM**	<15% sand	silty, clayey GRAVEL
					≥15% sand	silty, clayey GRAVEL with sand
SAND % sand ≥ % gravel	<5% fines	Well-graded		**SW**	<15% gravel	well-graded SAND
					≥15% gravel	well-graded SAND with gravel
		Poorly-graded		**SP**	<15% gravel	poorly-graded SAND
					≥15% gravel	poorly-graded SAND with gravel
	5-12% fines	Well-graded	fines = ML or MH	**SW-SM**	<15% gravel	well-graded SAND with silt
					≥15% gravel	well-graded SAND with silt and gravel
			fines = CL, CH, (or CL-ML)	**SW-SC**	<15% gravel	well-graded SAND with clay (or silty clay)
					≥15% gravel	well-graded SAND with clay and gravel (or silty clay and gravel)
		Poorly-graded	fines = ML or MH	**SP-SM**	<15% gravel	poorly-graded SAND with silt
					≥15% gravel	poorly-graded SAND with silt and gravel
			fines = CL, CH (or CL-ML)	**SP-SC**	<15% gravel	poorly-graded SAND with clay (or silty clay)
					≥15% gravel	poorly-graded SAND with clay and gravel (or silty clay and gravel)
	>12% fines		fines = ML or MH	**SM**	<15% gravel	silty SAND
					≥15% gravel	silty SAND with gravel
			fines = CL or CH	**SC**	<15% gravel	clayey SAND
					≥15% gravel	clayey SAND with gravel
			fines = CL-ML	**SC-SM**	<15% gravel	silty, clayey SAND
					≥15% gravel	silty, clayey SAND with gravel

APPENDIX B
CORE PHOTOGRAPHS

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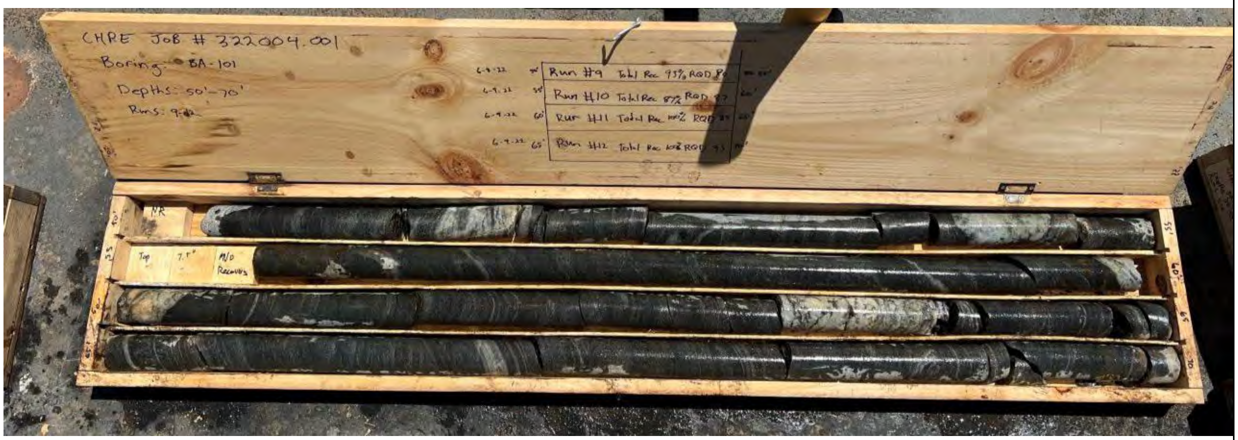
CORE PHOTOGRAPHS

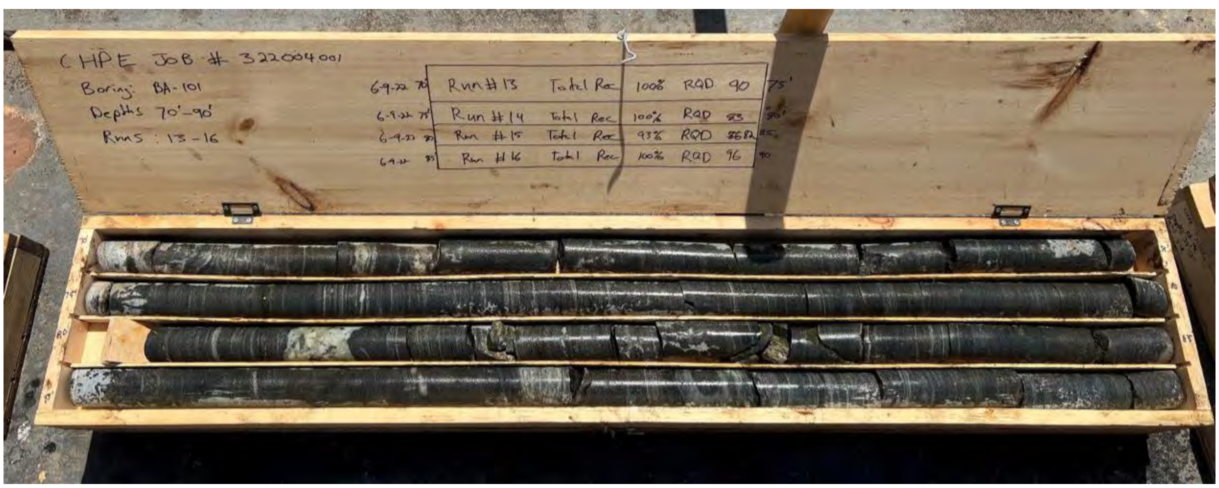
BA-101 (R-1-4)

BA-101 (R-5-8)

CORE PHOTOGRAPHS

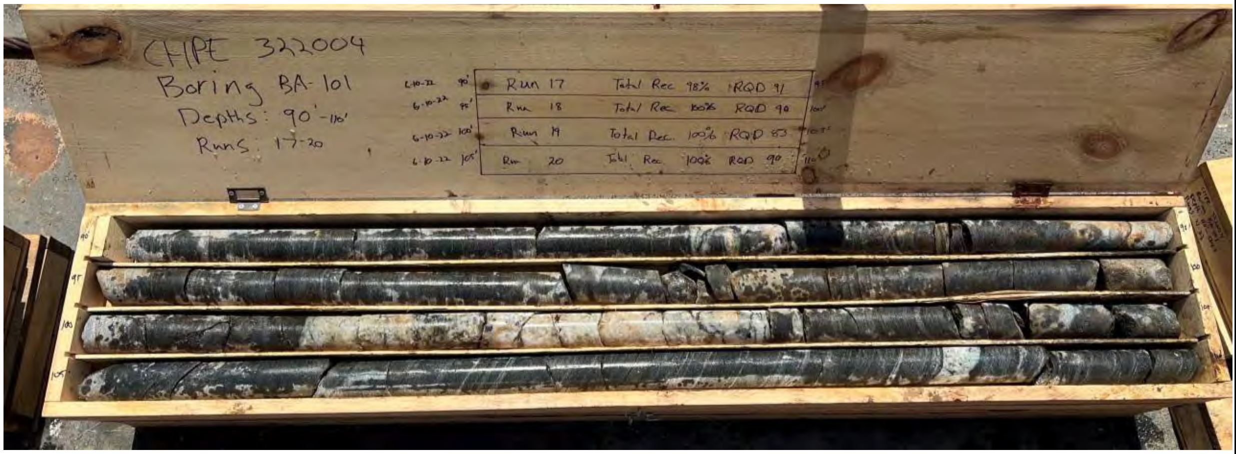


BA-101 (R-9-12)

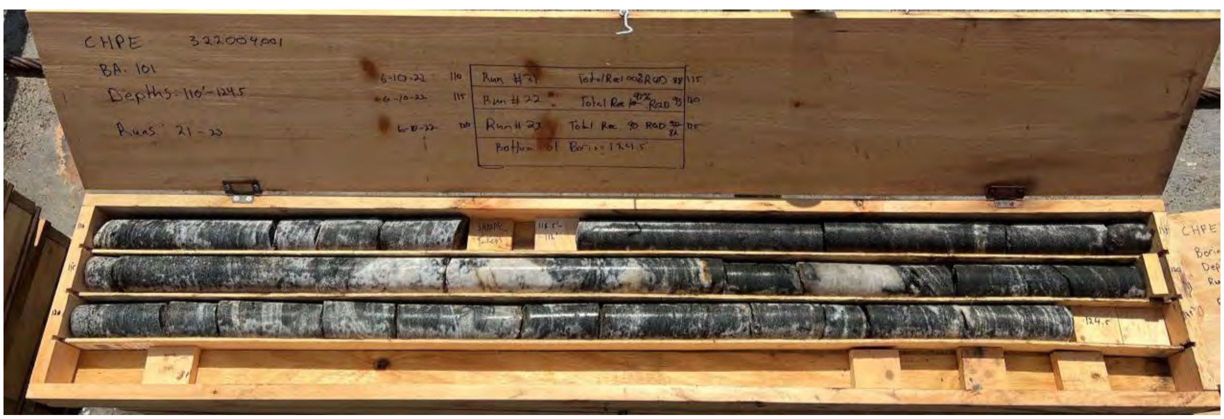


BA-101 (R-13-16)

CORE PHOTOGRAPHS



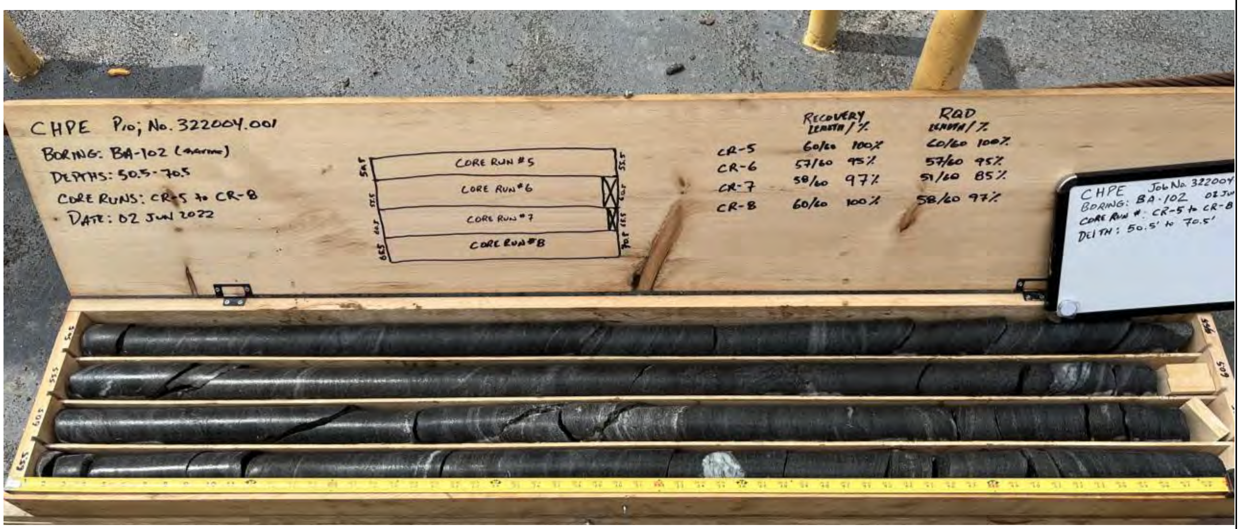
BA-101 (R-17-20)



BA-101 (R-21-23)

CORE PHOTOGRAPHS

BA-102 (R-1-4)



BA-102 (R-5-8)

CORE PHOTOGRAPHS

BA-102 (R-9-12)

BA-102 (R-13-16)

CORE PHOTOGRAPHS

Dry:

Wet:

BA-103 (K-103) (R-1, R-2) – lower two rows of core box only

CORE PHOTOGRAPHS

Dry:

Wet:

BA-103 (K-103) (R-3, R-4, R-5, R-6)

CORE PHOTOGRAPHS

Dry (does not include K-105):

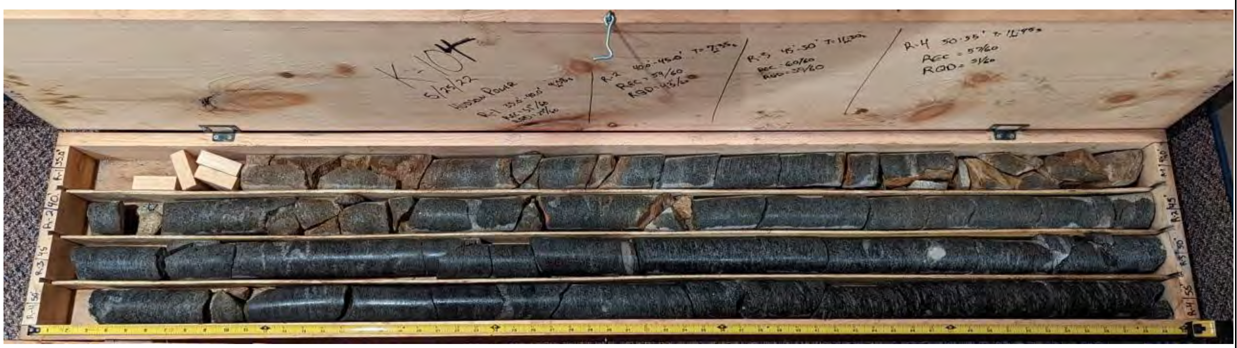
Wet:

BA-103 (K-103) (R-7, R-8, R-9), first three rows of core box only

CORE PHOTOGRAPHS

Dry:

Wet:



BA-104 (K-104) (R-1, R-2, R-3, R-4)

CORE PHOTOGRAPHS

Dry:

Wet:

BA-104 (K-104) (R-5, R-6), upper two rows of core box only

CORE PHOTOGRAPHS

BA-105 (K-105) (R-1)

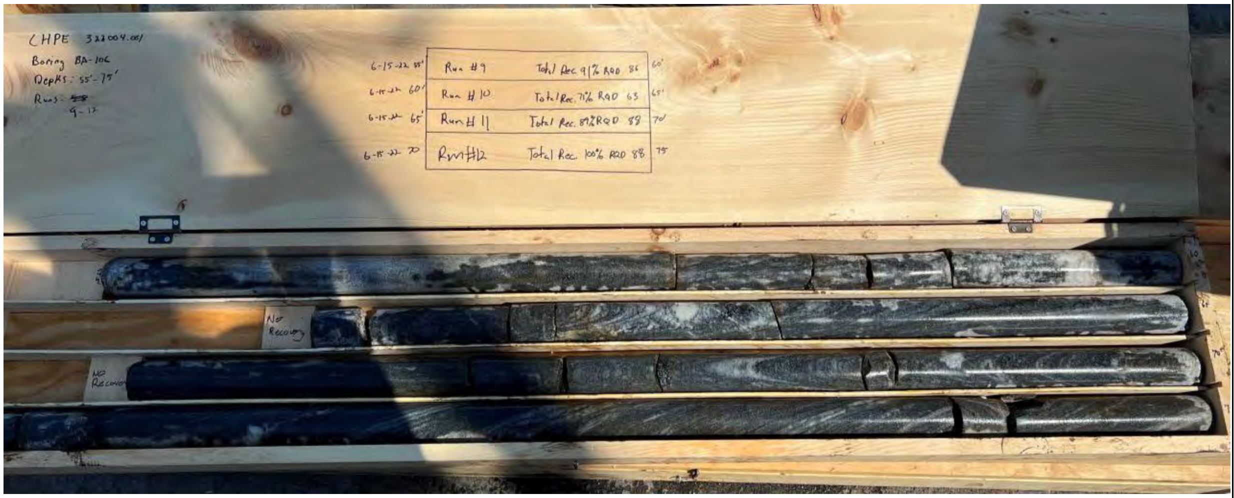
BA-105 (K-105) (R-2)

CORE PHOTOGRAPHS

BA-106 (R-1-4)

BA-106 (R-5-8)

CORE PHOTOGRAPHS



BA-106 (R-9-12)

BA-106 (R-13-16)

CORE PHOTOGRAPHS

BA-106 (R-17-18)

APPENDIX C
GEOTECHNICAL LABORATORY TEST RESULTS

SOIL TESTING DATA:
MOISTURE CONTENT
GRAIN SIZE CURVES
ATTERBERG LIMITS

Client:	Brierley Associates, LLC				
Project:	Champlain-Hudson Power Express				
Location:	Randall's Island, NYC			Project No:	GTX-315596
Boring ID:	K-103	Sample Type:	bag	Tested By:	ckg
Sample ID:	S5	Test Date:	06/27/22	Checked By:	ank
Depth :	8-10	Test Id:	674475		

Test Comment: ---
Visual Description: Moist, gray sand with silt
Sample Comment: ---

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
K-103	S5	8-10	Moist, gray sand with silt	13.1

Notes: Temperature of Drying : 110° Celsius

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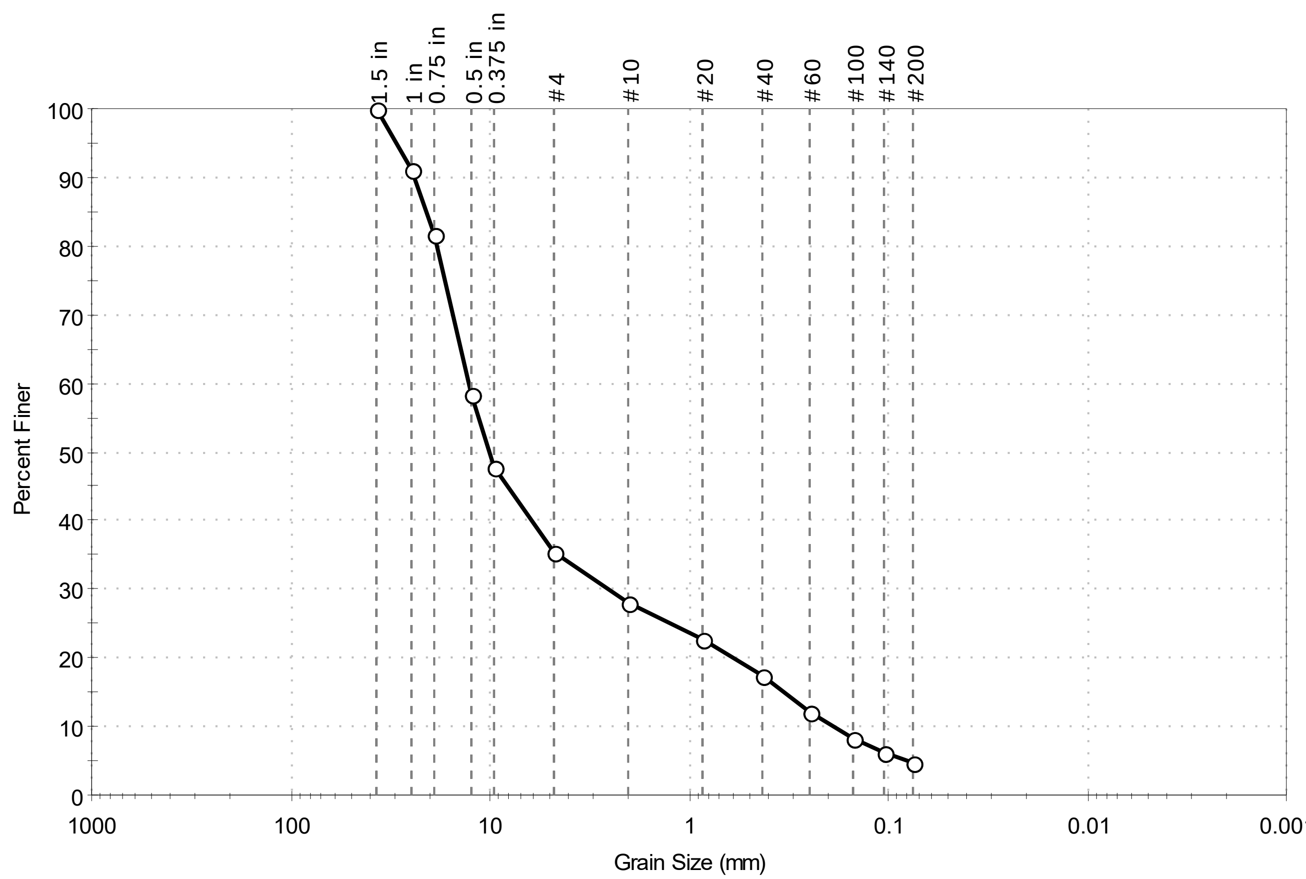
Client:	Brierley Associates, LLC
Project:	Champlain-Hudson Power Express
Location:	Randall's Island, NYC
Project No:	GTX-315596
Boring ID:	K-105
Sample Type:	bag
Tested By:	ckg
Sample ID:	S6, S9
Test Date:	06/27/22
Checked By:	ank
Depth :	---
Test Id:	674495
Test Comment:	---
Visual Description:	Moist, brown gravel with sand
Sample Comment:	---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	64.6	30.6	4.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	91		
0.75 in	19.00	82		
0.5 in	12.50	58		
0.375 in	9.50	48		
#4	4.75	35		
#10	2.00	28		
#20	0.85	23		
#40	0.42	17		
#60	0.25	12		
#100	0.15	8		
#140	0.11	6		
#200	0.075	4.8		

Coefficients

D_{85} = 20.8697 mm
D_{30} = 2.5381 mm
D_{60} = 12.8754 mm
D_{15} = 0.3347 mm
D_{50} = 10.0747 mm
D_{10} = 0.1897 mm
C_u = 67.872
C_c = 2.637

Classification

ASTM Well-graded GRAVEL with Sand (GW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (1))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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GeoTesting EXPRESS

Client:	Brierley Associates, LLC				
Project:	Champlain-Hudson Power Express				
Location:	Randall's Island, NYC			Project No:	GTX-315596
Boring ID:	K-103	Sample Type:	bag	Tested By:	cam
Sample ID:	S5	Test Date:	06/29/22	Checked By:	bfs
Depth :	8-10	Test Id:	674472		

Test Comment: ---
Visual Description: Moist, gray sand with silt
Sample Comment: ---

Atterberg Limits - ASTM D4318

Sample Determined to be non-plastic

Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S5	K-103	8-10	13	n/a	n/a	n/a	n/a	

Dry Strength: LOW
Dilatancy: RAPID
Toughness: n/a
The sample was determined to be Non-Plastic

ROCK TESTING DATA:
UNCONFINED COMPRESSIVE STRENGTH

Client:	Brierley Associates, LLC				
Project:	Champlain-Hudson Power Express				
Location:	Randall's Island, NYC			Project No:	GTX-315596
Boring ID:	---	Sample Type:	---	Tested By:	tlm
Sample ID:	---	Test Date:	07/07/22	Checked By:	smd
Depth :	---	Test Id:	674352		

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C

Boring ID	Sample Number	Depth	Bulk Density, pcf	Compressive strength, psi	Failure Type	Meets ASTM D4543	Note(s)
BA-101	Run 7	41.01-41.39 ft	170	7594	1	Yes	---
BA-101	Run 15	80.26-80.63 ft	165	12471	1	Yes	---
BA-101	Run 21	111.51 - 111.87 ft	173	6025	1	Yes	---

Notes: Density determined on core samples by measuring dimensions and weight and then calculating.

All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure
(See attached photographs)

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Client:	Brierley Associates, LLC				
Project:	Champlain-Hudson Power Express				
Location:	Bedford, NH			Project No:	GTX-315596
Boring ID:	---	Sample Type:	---	Tested By:	tlm
Sample ID:	---	Test Date:	06/22/22	Checked By:	smd
Depth :	---	Test Id:	671874		

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C

Boring ID	Sample Number	Depth	Bulk Density, pcf	Compressive strength, psi	Failure Type	Meets ASTM D4543	Note(s)
BA-102	---	78.59-78.97 ft	178	12363	1	Yes	---
BA-102	---	91.37-91.75 ft	170	16387	1	No	2,*
BA-102	---	100.56-100.89 ft	162	19499	1	Yes	---
BA-102	---	101.65-102.03 ft	174	15501	2	Yes	---

Notes: Density determined on core samples by measuring dimensions and weight and then calculating.

All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

1: Best effort end preparation. See Tolerance report for details.
2: The as-received core did not meet the ASTM side straightness tolerance due to irregularities in the sample as cored.
3: Specimen L/D < 2.
4: The as-received core did not meet the ASTM minimum diameter tolerance of 1.875 inches.
5: Specimen diameter is less than 10 times maximum particle size.
6: Specimen diameter is less than 6 times maximum particle size.

*Because the indicated tested specimens did not meet the ASTM D4543 standard tolerances, the results reported here may differ from those for a test specimen within tolerances.

Client:	Brierley Associates, LLC		
Project:	Champlain-Hudson Power Express		
Location:	Randall's Island, NYC	Project No:	GTX-315596
Boring ID: ---	Sample Type: ---	Tested By:	tlm
Sample ID: ---	Test Date: 07/07/22	Checked By:	smd
Depth : ---	Test Id: 674436		

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C

Boring ID	Sample Number	Depth	Bulk Density, pcf	Compressive strength, psi	Failure Type	Meets ASTM D4543	Note(s)
K-103	---	52.78-53.15 ft	161	8114	3	Yes	---
K-104	---	55.39-55.77 ft	169	2814	2	Yes	---

Notes: Density determined on core samples by measuring dimensions and weight and then calculating.

All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure
(See attached photographs)

Client:	Brierley Associates, LLC				
Project:	Champlain-Hudson Power Express				
Location:	Randall's Island, NYC			Project No:	GTX-315596
Boring ID:	---	Sample Type:	---	Tested By:	tlm
Sample ID:	---	Test Date:	07/07/22	Checked By:	smd
Depth :	---	Test Id:	674352		

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C

Boring ID	Sample Number	Depth	Bulk Density, pcf	Compressive strength, psi	Failure Type	Meets ASTM D4543	Note(s)
BA-106	Run 7	40.04-40.37 ft	169	17245	1	Yes	---
BA-106	Run 15	87.26-87.64 ft	166	16264	1	Yes	---
BA-106	Run 18	104.51 - 104.88 ft	163	14240	1	Yes	---

Notes: Density determined on core samples by measuring dimensions and weight and then calculating.

All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

Client:	Brierley Associates, LLC	Test Date:	7/6/2022
Project Name:	Champlain-Hudson Power Express	Tested By:	kdp
Project Location:	Randall's Island, NYC	Checked By:	smd
GTX #:	315596		
Boring ID:	BA-101		
Sample ID:	Run 7		
Depth:	41.01-41.39 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.31	4.31	4.31		
Specimen Diameter, in:	1.98	1.98	1.98		
Specimen Mass, g:	593.08				
Bulk Density, lb/ft^3	170	**Minimum Diameter Tolerence Met?**		YES	
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**		YES	

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00020	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010	0.00010	0.00020
Diameter 2, in (rotated 90^o)	0.00020	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020

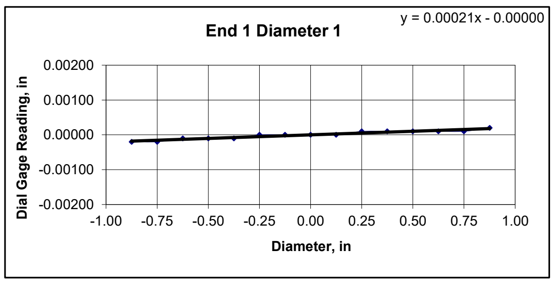
Difference between max and min readings, in:
0° = 0.00040 90° = 0.00040

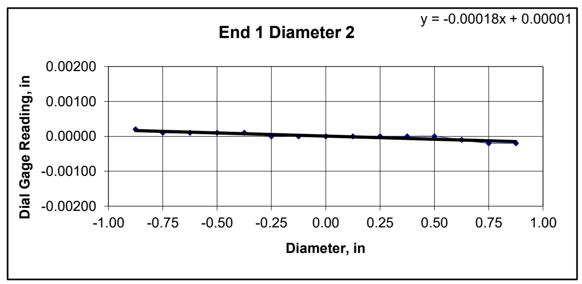
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00030	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010	0.00020
Diameter 2, in (rotated 90^o)	-0.00020	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010

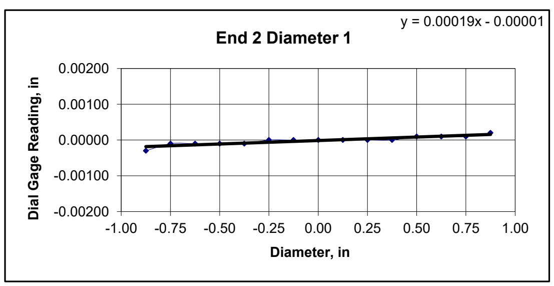
Difference between max and min readings, in:
0° = 0.0005 90° = 0.0003

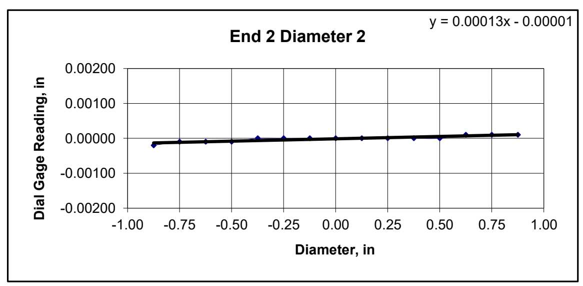
Maximum difference must be < 0.0020 in. Difference = ± 0.00025

Flatness Tolerance Met? YES









DIAMETER 1

End 1:	
Slope of Best Fit Line	0.00021
Angle of Best Fit Line:	0.01179
End 2:	
Slope of Best Fit Line	0.00019
Angle of Best Fit Line:	0.01113
Maximum Angular Difference:	0.00065

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:	
Slope of Best Fit Line	0.00018
Angle of Best Fit Line:	0.01031
End 2:	
Slope of Best Fit Line	0.00013
Angle of Best Fit Line:	0.00769
Maximum Angular Difference:	0.00262

Parallelism Tolerance Met? YES
Spherically Seated

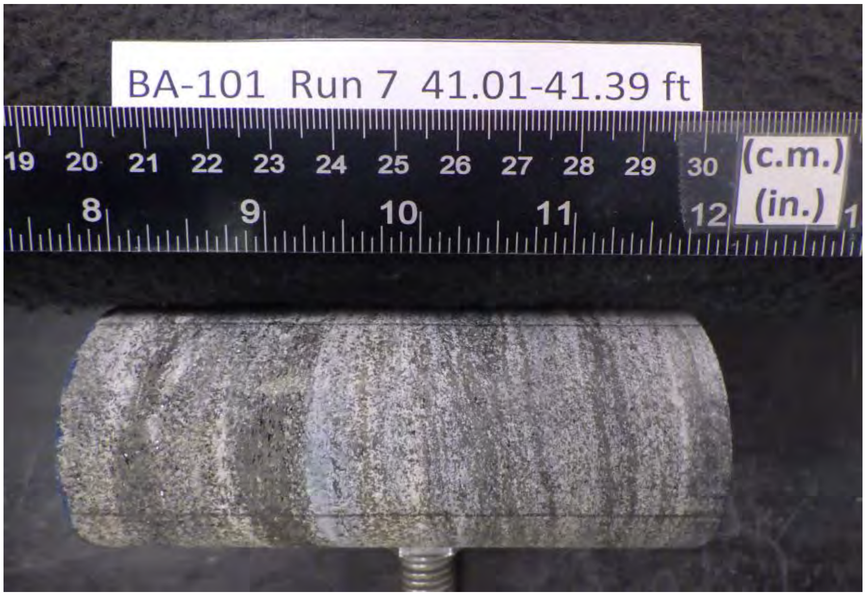
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00040	1.980	0.00020	0.012	YES
Diameter 2, in (rotated 90^o)	0.00040	1.980	0.00020	0.012	YES
END 2					
Diameter 1, in	0.00050	1.980	0.00025	0.014	YES
Diameter 2, in (rotated 90^o)	0.00030	1.980	0.00015	0.009	YES

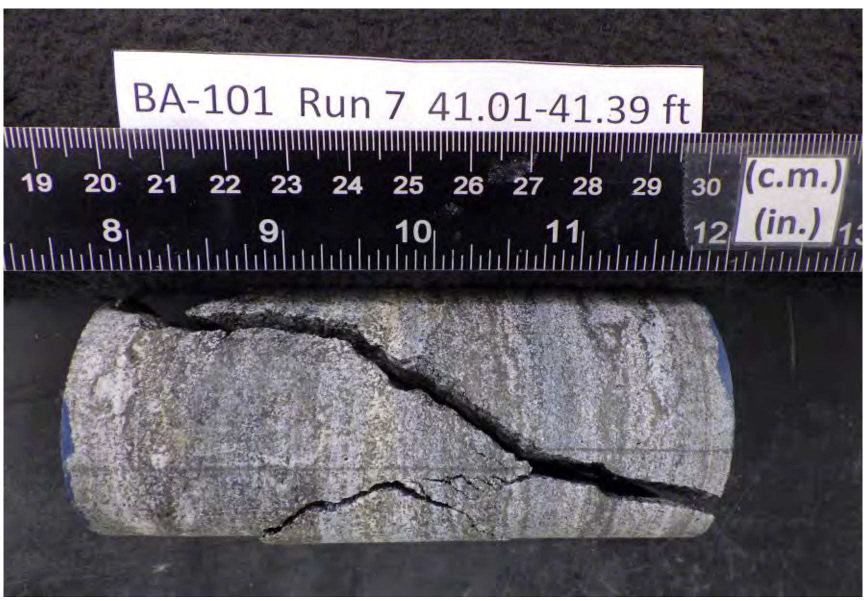
Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Brierley Associates, LLC
Project Name:	Champlain-Hudson Power Express
Project Location:	Randall's Island, NYC
GTX #:	315596
Test Date:	7/7/2022
Tested By:	bp
Checked By:	smd
Boring ID:	BA-101
Sample ID:	Run 7
Depth, ft:	41.01-41.39



After cutting and grinding



After break

GeoTesting EXPRESS	Client:	Brierley Associates, LLC	Test Date:	7/6/2022
	Project Name:	Champlain-Hudson Power Express	Tested By:	kdp
	Project Location:	Randall's Island, NYC	Checked By:	smd
	GTX #:	315596		
	Boring ID:	BA-101		
	Sample ID:	Run 15		
	Depth:	80.26-80.63 ft		
	Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.32	4.32	4.32		
Specimen Diameter, in:	1.99	1.99	1.99		
Specimen Mass, g:	582.59				
Bulk Density, lb/ft^3	165			**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2			**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

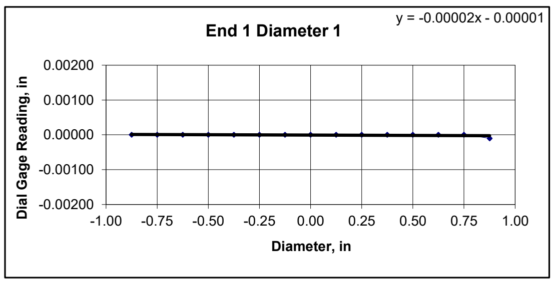
Difference between max and min readings, in:
0° = 0.00010 90° = 0.00000

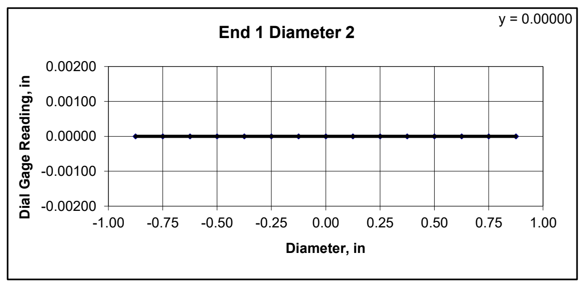
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

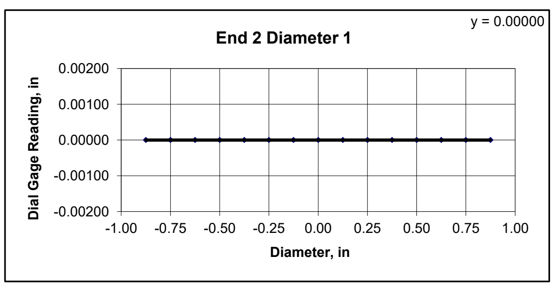
Difference between max and min readings, in:
0° = 0 90° = 0

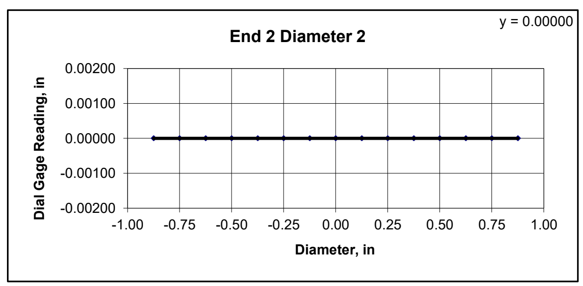
Maximum difference must be < 0.0020 in. Difference = ± 0.00005

Flatness Tolerance Met? YES









DIAMETER 1

End 1:	
Slope of Best Fit Line	0.00002
Angle of Best Fit Line:	0.00115
End 2:	
Slope of Best Fit Line	0.00000
Angle of Best Fit Line:	0.00000
Maximum Angular Difference:	0.00115

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:	
Slope of Best Fit Line	0.00000
Angle of Best Fit Line:	0.00000
End 2:	
Slope of Best Fit Line	0.00000
Angle of Best Fit Line:	0.00000
Maximum Angular Difference:	0.00000

Parallelism Tolerance Met? YES
Spherically Seated

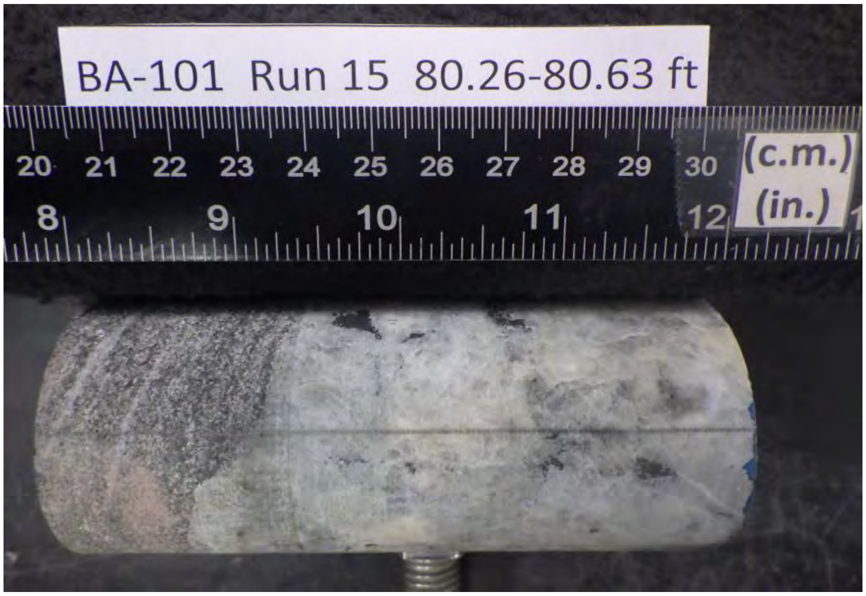
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00010	1.990	0.00005	0.003	YES
Diameter 2, in (rotated 90°)	0.00000	1.990	0.00000	0.000	YES
END 2					
Diameter 1, in	0.00000	1.990	0.00000	0.000	YES
Diameter 2, in (rotated 90°)	0.00000	1.990	0.00000	0.000	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Brierley Associates, LLC
Project Name:	Champlain-Hudson Power Express
Project Location:	Randall's Island, NYC
GTX #:	315596
Test Date:	7/7/2022
Tested By:	bp
Checked By:	smd
Boring ID:	BA-101
Sample ID:	Run 15
Depth, ft:	80.26-80.63



After cutting and grinding

After break

GeoTesting EXPRESS

Client:	Brierley Associates, LLC	Test Date:	7/6/2022
Project Name:	Champlain-Hudson Power Express	Tested By:	kdp
Project Location:	Randall's Island, NYC	Checked By:	smd
GTX #:	315596		
Boring ID:	BA-101		
Sample ID:	Run 21		
Depth:	111.51-111.87 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.32	4.32	4.32		
Specimen Diameter, in:	1.98	1.98	1.98		
Specimen Mass, g:	604.58				
Bulk Density, lb/ft^3	173			**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2			**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap $\leq$ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010
Diameter 2, in (rotated 90°)	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00030

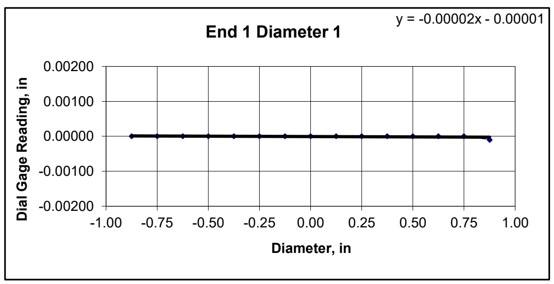
Difference between max and min readings, in:
0° = 0.00010 90° = 0.00040

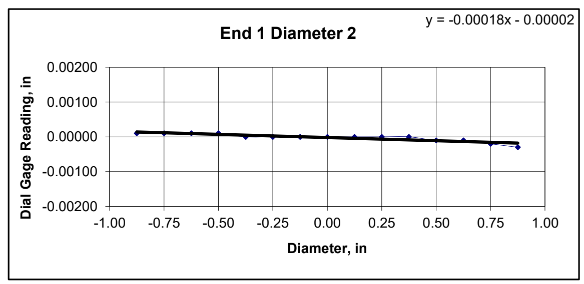
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010
Diameter 2, in (rotated 90°)	-0.00030	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010

Difference between max and min readings, in:
0° = 0.0001 90° = 0.0004

Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00020

Flatness Tolerance Met? YES





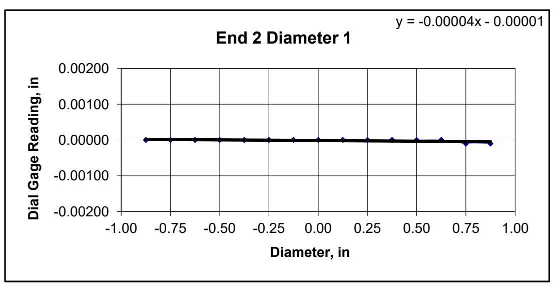
DIAMETER 1

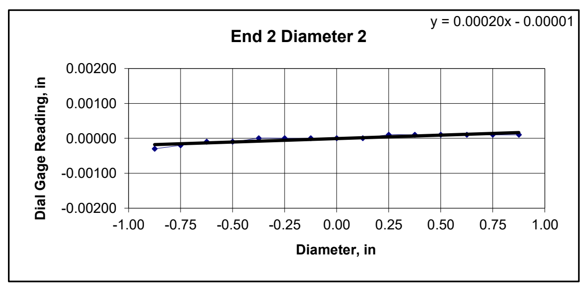
End 1:
Slope of Best Fit Line 0.00002
Angle of Best Fit Line: 0.00115

End 2:
Slope of Best Fit Line 0.00004
Angle of Best Fit Line: 0.00213

Maximum Angular Difference: 0.00098

Parallelism Tolerance Met? YES
Spherically Seated





DIAMETER 2

End 1:
Slope of Best Fit Line 0.00018
Angle of Best Fit Line: 0.01048

End 2:
Slope of Best Fit Line 0.00020
Angle of Best Fit Line: 0.01130

Maximum Angular Difference: 0.00082

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

Maximum angle of departure must be $\leq$ 0.25°

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00010	1.980	0.00005	0.003	YES
Diameter 2, in (rotated 90°)	0.00040	1.980	0.00020	0.012	YES
END 2					
Diameter 1, in	0.00010	1.980	0.00005	0.003	YES
Diameter 2, in (rotated 90°)	0.00040	1.980	0.00020	0.012	YES

Perpendicularity Tolerance Met? YES

Client:	Brierley Associates, LLC
Project Name:	Champlain-Hudson Power Express
Project Location:	Randall's Island, NYC
GTX #:	315596
Test Date:	7/7/2022
Tested By:	bp
Checked By:	smd
Boring ID:	BA-101
Sample ID:	Run 21
Depth, ft:	444.51-111.87

After cutting and grinding

After break

Client:	Brierley Associates, LLC.	Test Date:	6/20/2022
Project Name:	Champlain-Hudson Power Express	Tested By:	bp
Project Location:	Bedford, NH	Checked By:	smd
GTX #:	315596		
Boring ID:	BA-102		
Sample ID:	---		
Depth:	78.59-78.97 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.32	4.33	4.33
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	629.26		
Bulk Density, lb/ft^3	178		
Length to Diameter Ratio:	2.2		

Minimum Diameter Tolerence Met? YES

Length to Diameter Ratio Tolerance Met? YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90^o)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00020

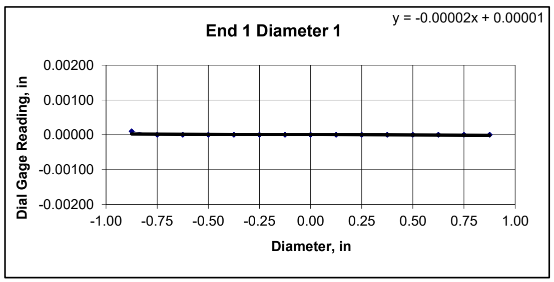
Difference between max and min readings, in:
0° = 0.00010 90° = 0.00020

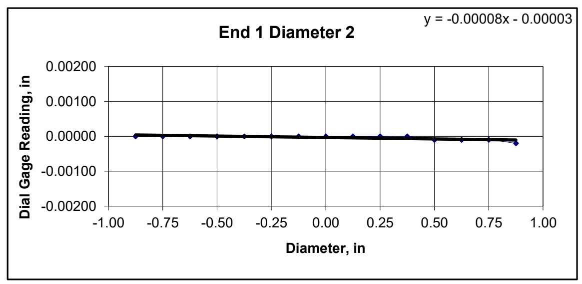
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010
Diameter 2, in (rotated 90^o)	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010

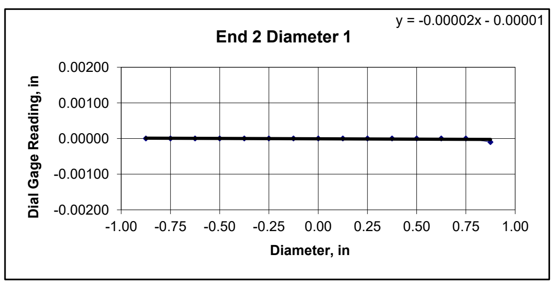
Difference between max and min readings, in:
0° = 0.0001 90° = 0.0003

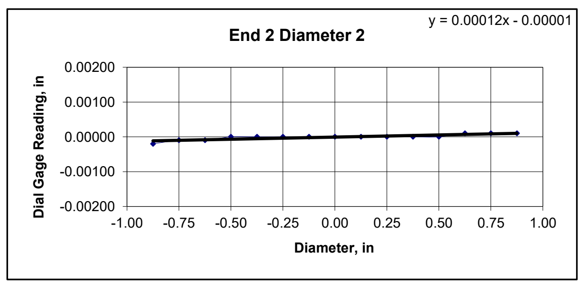
Maximum difference must be < 0.0020 in. Difference = ± 0.00015

Flatness Tolerance Met? YES









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00002
Angle of Best Fit Line: 0.00115

End 2:
Slope of Best Fit Line 0.00002
Angle of Best Fit Line: 0.00115

Maximum Angular Difference: 0.00000

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00008
Angle of Best Fit Line: 0.00475

End 2:
Slope of Best Fit Line 0.00012
Angle of Best Fit Line: 0.00704

Maximum Angular Difference: 0.00229

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

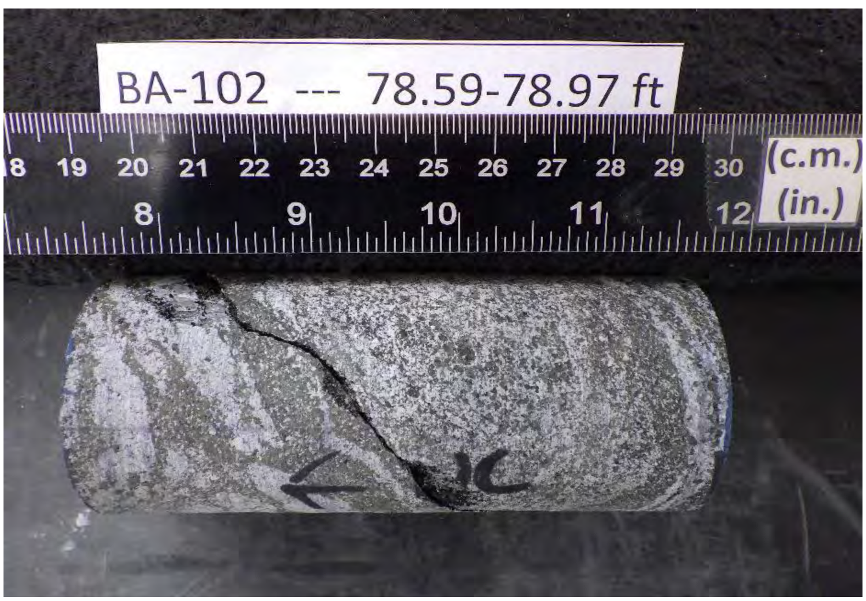
END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00010	1.990	0.00005	0.003	YES
Diameter 2, in (rotated 90^o)	0.00020	1.990	0.00010	0.006	YES
END 2					
Diameter 1, in	0.00010	1.990	0.00005	0.003	YES
Diameter 2, in (rotated 90^o)	0.00030	1.990	0.00015	0.009	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Brierley Associates, LLC.
Project Name:	Champlain-Hudson Power Express
Project Location:	Bedford, NH
GTX #:	315596
Test Date:	6/22/2022
Tested By:	bp
Checked By:	smd
Boring ID:	BA-102
Sample ID:	---
Depth, ft:	78.59-78.97

After cutting and grinding



After break

GeoTesting EXPRESS

Client:	Brierley Associates, LLC.		Test Date:	6/20/2022
Project Name:	Champlain-Hudson Power Express		Tested By:	bp
Project Location:	Bedford, NH		Checked By:	smd
GTX #:	315596			
Boring ID:	BA-102			
Sample ID:	---			
Depth:	91.37-91.75 ft			
Visual Description:	See photographs			

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.20	4.19	4.20		
Specimen Diameter, in:	2.00	2.01	2.01		
Specimen Mass, g:	593.68				
Bulk Density, lb/ft^3	170			**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.1			**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap $\leq$ 0.02 in.? NO

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? NO

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00020	0.00030
Diameter 2, in (rotated 90°)	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010

Difference between max and min readings, in:

0° = 0.00070 90° = 0.00020

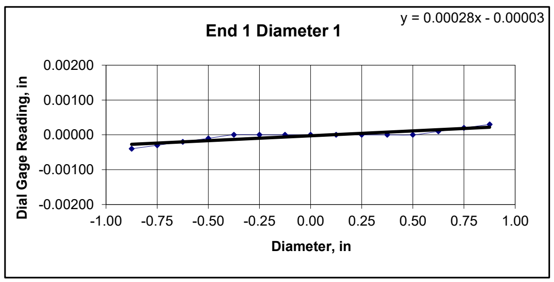
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00040	-0.00030	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00020	0.00030
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

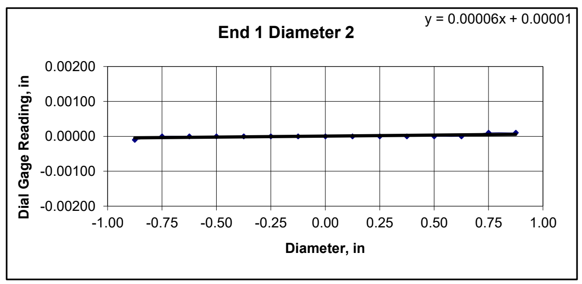
Difference between max and min readings, in:

0° = 0.0007 90° = 0

Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00035

Flatness Tolerance Met? YES





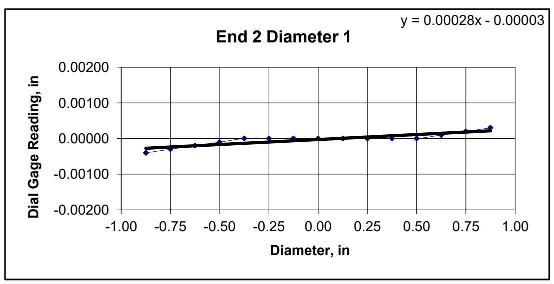
DIAMETER 1

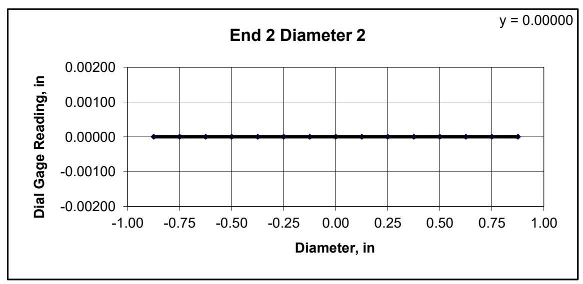
End 1:
Slope of Best Fit Line 0.00028
Angle of Best Fit Line: 0.01604

End 2:
Slope of Best Fit Line 0.00028
Angle of Best Fit Line: 0.01604

Maximum Angular Difference: 0.00000

Parallelism Tolerance Met? YES
Spherically Seated





DIAMETER 2

End 1:
Slope of Best Fit Line 0.00006
Angle of Best Fit Line: 0.00327

End 2:
Slope of Best Fit Line 0.00000
Angle of Best Fit Line: 0.00000

Maximum Angular Difference: 0.00327

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

Maximum angle of departure must be $\leq$ 0.25°

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00070	2.005	0.00035	0.020	YES
Diameter 2, in (rotated 90°)	0.00020	2.005	0.00010	0.006	YES
END 2					
Diameter 1, in	0.00070	2.005	0.00035	0.020	YES
Diameter 2, in (rotated 90°)	0.00000	2.005	0.00000	0.000	YES

Perpendicularity Tolerance Met? YES

Client:	Brierley Associates, LLC.
Project Name:	Champlain-Hudson Power Express
Project Location:	Bedford, NH
GTX #:	315596
Test Date:	6/22/2022
Tested By:	bp
Checked By:	smd
Boring ID:	BA-102
Sample ID:	---
Depth, ft:	91.37-91.75

After cutting and grinding

After break

Client:	Brierley Associates, LLC.	Test Date:	6/20/2022
Project Name:	Champlain-Hudson Power Express	Tested By:	bp
Project Location:	Bedford, NH	Checked By:	smd
GTX #:	315596		
Boring ID:	BA-102		
Sample ID:	---		
Depth:	100.56-100.89 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.10	4.10	4.10		
Specimen Diameter, in:	2.00	2.00	2.00		
Specimen Mass, g:	549.72				
Bulk Density, lb/ft^3	162			**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.1			**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010
Diameter 2, in (rotated 90^o)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Difference between max and min readings, in:

0° = 0.00020 90° = 0.00000

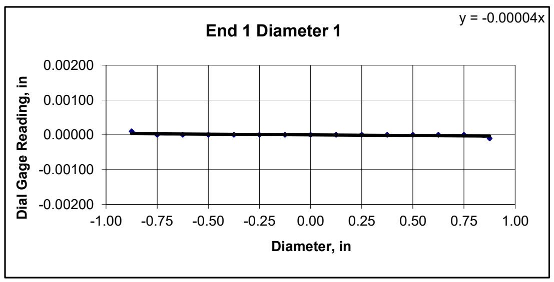
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010
Diameter 2, in (rotated 90^o)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

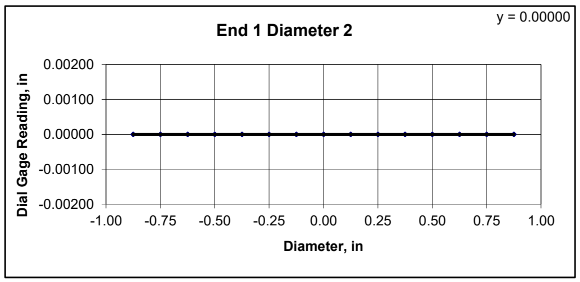
Difference between max and min readings, in:

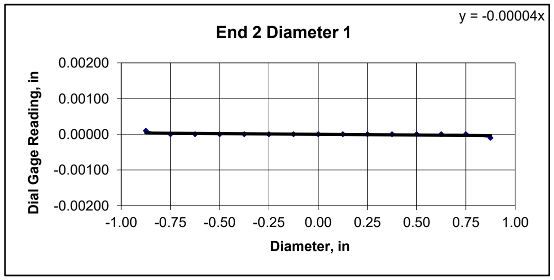
0° = 0.0002 90° = 0

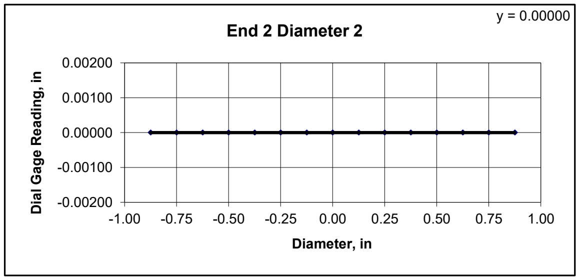
Maximum difference must be < 0.0020 in. Difference = ± 0.00010

Flatness Tolerance Met? YES









DIAMETER 1

End 1:		
	Slope of Best Fit Line	0.00004
	Angle of Best Fit Line:	0.00229
End 2:		
	Slope of Best Fit Line	0.00004
	Angle of Best Fit Line:	0.00229
Maximum Angular Difference:		0.00000

Parallelism Tolerance Met? YES

Spherically Seated

DIAMETER 2

End 1:		
	Slope of Best Fit Line	0.00000
	Angle of Best Fit Line:	0.00000
End 2:		
	Slope of Best Fit Line	0.00000
	Angle of Best Fit Line:	0.00000
Maximum Angular Difference:		0.00000

Parallelism Tolerance Met? YES

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00020	2.000	0.00010	0.006	YES
Diameter 2, in (rotated 90^o)	0.00000	2.000	0.00000	0.000	YES
END 2					
Diameter 1, in	0.00020	2.000	0.00010	0.006	YES
Diameter 2, in (rotated 90^o)	0.00000	2.000	0.00000	0.000	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Brierley Associates, LLC.
Project Name:	Champlain-Hudson Power Express
Project Location:	Bedford, NH
GTX #:	315596
Test Date:	6/22/2022
Tested By:	bp
Checked By:	smd
Boring ID:	BA-102
Sample ID:	---
Depth, ft:	100.56-100.89

After cutting and grinding

After break

GeoTesting EXPRESS

Client:	Brierley Associates, LLC.	Test Date:	6/20/2022
Project Name:	Champlain-Hudson Power Express	Tested By:	bp
Project Location:	Bedford, NH	Checked By:	smd
GTX #:	315596		
Boring ID:	BA-102		
Sample ID:	---		
Depth:	101.65-102.03 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.22	4.22	4.22		
Specimen Diameter, in:	1.99	1.99	1.99		
Specimen Mass, g:	600.59				
Bulk Density, lb/ft³	174			**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.1			**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00020	0.00020
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

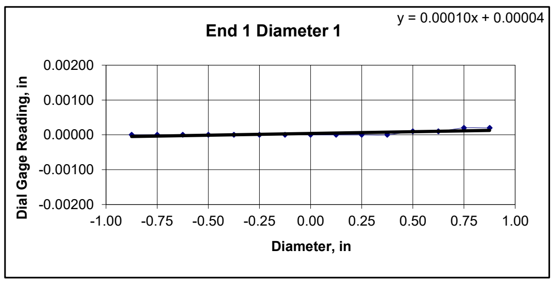
Difference between max and min readings, in:
0° = 0.00020 90° = 0.00000

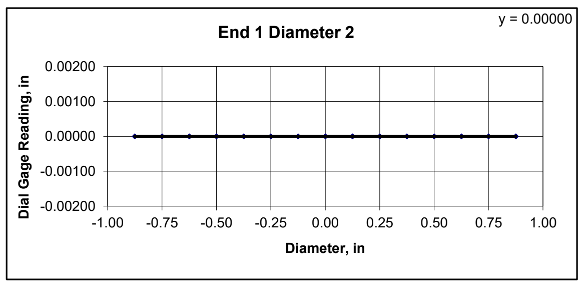
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00020
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Difference between max and min readings, in:
0° = 0.0003 90° = 0

Maximum difference must be < 0.0020 in. Difference = ± 0.00015

Flatness Tolerance Met? YES





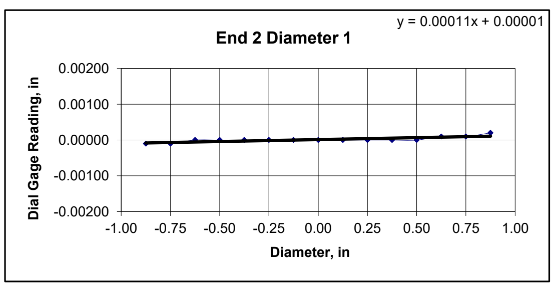
DIAMETER 1

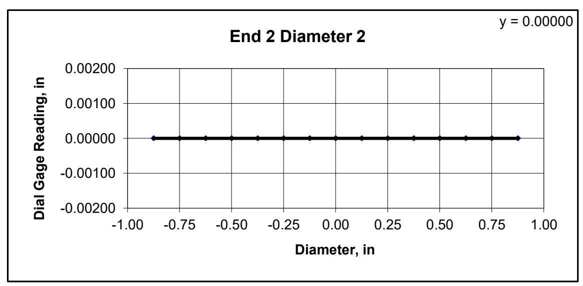
End 1:
Slope of Best Fit Line 0.00010
Angle of Best Fit Line: 0.00573

End 2:
Slope of Best Fit Line 0.00011
Angle of Best Fit Line: 0.00622

Maximum Angular Difference: 0.00049

Parallelism Tolerance Met? YES
Spherically Seated





DIAMETER 2

End 1:
Slope of Best Fit Line 0.00000
Angle of Best Fit Line: 0.00000

End 2:
Slope of Best Fit Line 0.00000
Angle of Best Fit Line: 0.00000

Maximum Angular Difference: 0.00000

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00020	1.990	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00000	1.990	0.00000	0.000	YES
END 2					
Diameter 1, in	0.00030	1.990	0.00015	0.009	YES
Diameter 2, in (rotated 90°)	0.00000	1.990	0.00000	0.000	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Brierley Associates, LLC.
Project Name:	Champlain-Hudson Power Express
Project Location:	Bedford, NH
GTX #:	315596
Test Date:	6/22/2022
Tested By:	bp
Checked By:	smd
Boring ID:	BA-102
Sample ID:	---
Depth, ft:	101.65-102.03

After cutting and grinding

After break

Client:	Brierley Associates, LLC	Test Date:	7/6/2022
Project Name:	Champlain-Hudson Power Express	Tested By:	kdp
Project Location:	Randall's Island, NYC	Checked By:	smd
GTX #:	315596		
Boring ID:	K-103		
Sample ID:	---		
Depth:	52.78-53.15 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.30	4.30	4.30		
Specimen Diameter, in:	1.99	1.99	1.99		
Specimen Mass, g:	566.83				
Bulk Density, lb/ft^3	161			**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2			**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

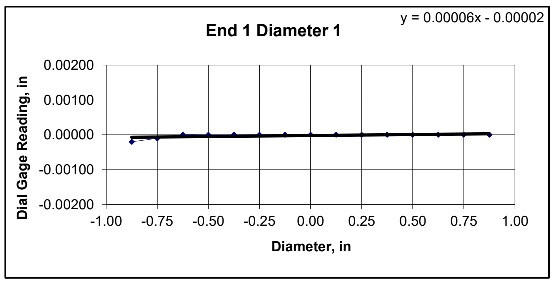
Difference between max and min readings, in:
0° = 0.00020 90° = 0.00000

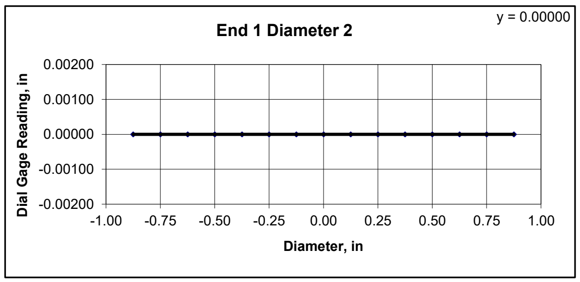
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

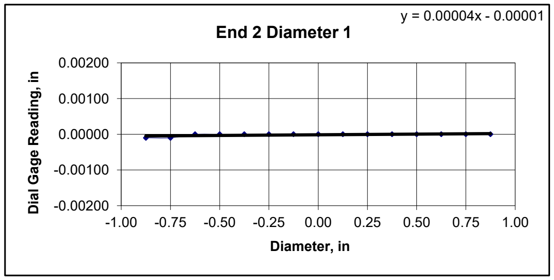
Difference between max and min readings, in:
0° = 0.0001 90° = 0.0001

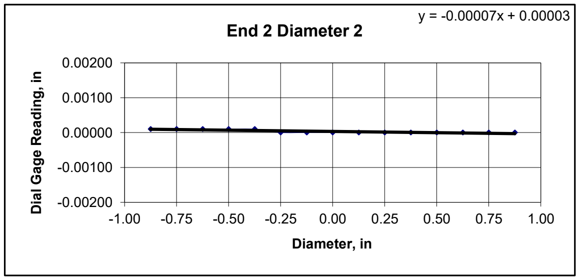
Maximum difference must be < 0.0020 in. Difference = ± 0.00010

Flatness Tolerance Met? YES









DIAMETER 1

End 1:	Slope of Best Fit Line	0.00006
	Angle of Best Fit Line:	0.00327
End 2:	Slope of Best Fit Line	0.00004
	Angle of Best Fit Line:	0.00213
Maximum Angular Difference:		0.00115

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:	Slope of Best Fit Line	0.00000
	Angle of Best Fit Line:	0.00000
End 2:	Slope of Best Fit Line	0.00007
	Angle of Best Fit Line:	0.00409
Maximum Angular Difference:		0.00409

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00020	1.990	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00000	1.990	0.00000	0.000	YES
END 2					
Diameter 1, in	0.00010	1.990	0.00005	0.003	YES
Diameter 2, in (rotated 90°)	0.00010	1.990	0.00005	0.003	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Brierley Associates, LLC
Project Name:	Champlain-Hudson Power Express
Project Location:	Randall's Island, NYC
GTX #:	315596
Test Date:	7/7/2022
Tested By:	bp
Checked By:	smd
Boring ID:	K-103
Sample ID:	---
Depth, ft:	52.78-53.15

After cutting and grinding

After break

GeoTesting EXPRESS

Client:	Brierley Associates, LLC	Test Date:	7/6/2022
Project Name:	Champlain-Hudson Power Express	Tested By:	kdp
Project Location:	Randall's Island, NYC	Checked By:	smd
GTX #:	315596		
Boring ID:	K-104		
Sample ID:	---		
Depth:	55.39-55.77 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.37	4.37	4.37		
Specimen Diameter, in:	1.98	1.98	1.98		
Specimen Mass, g:	599.37				
Bulk Density, lb/ft^3	169			**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2			**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap $\leq$ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00050	0.00040	0.00030	0.00020	0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00020	-0.00030	-0.00040	-0.00050
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00020

Difference between max and min readings, in:

0° = 0.00100 90° = 0.00020

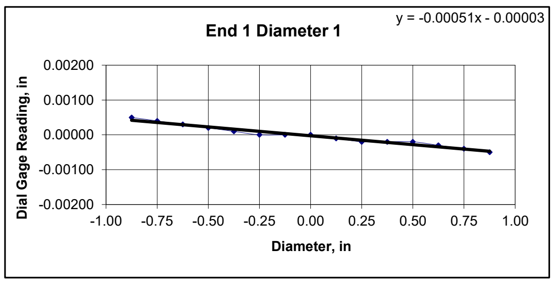
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00050	0.00040	0.00030	0.00020	0.00020	0.00010	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00030	-0.00040	-0.00050	-0.00060
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

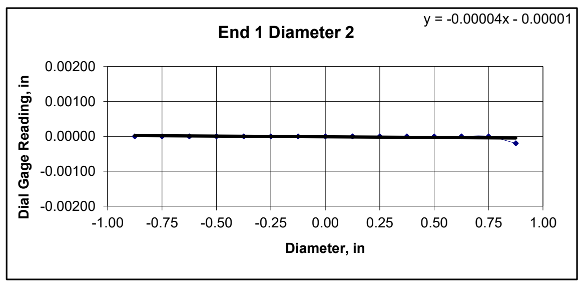
Difference between max and min readings, in:

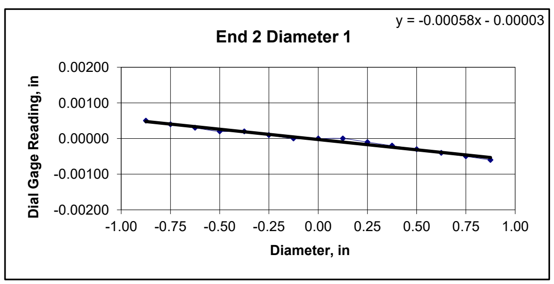
0° = 0.0011 90° = 0

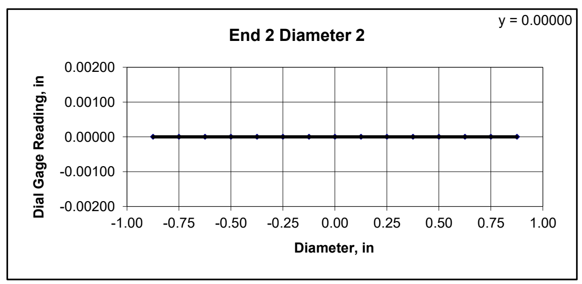
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00055

Flatness Tolerance Met? YES









DIAMETER 1

End 1:		
	Slope of Best Fit Line	0.00051
	Angle of Best Fit Line:	0.02914
End 2:		
	Slope of Best Fit Line	0.00058
	Angle of Best Fit Line:	0.03307
Maximum Angular Difference:		0.00393

Parallelism Tolerance Met? YES

Spherically Seated

DIAMETER 2

End 1:		
	Slope of Best Fit Line	0.00004
	Angle of Best Fit Line:	0.00229
End 2:		
	Slope of Best Fit Line	0.00000
	Angle of Best Fit Line:	0.00000
Maximum Angular Difference:		0.00229

Parallelism Tolerance Met? YES

Spherically Seated

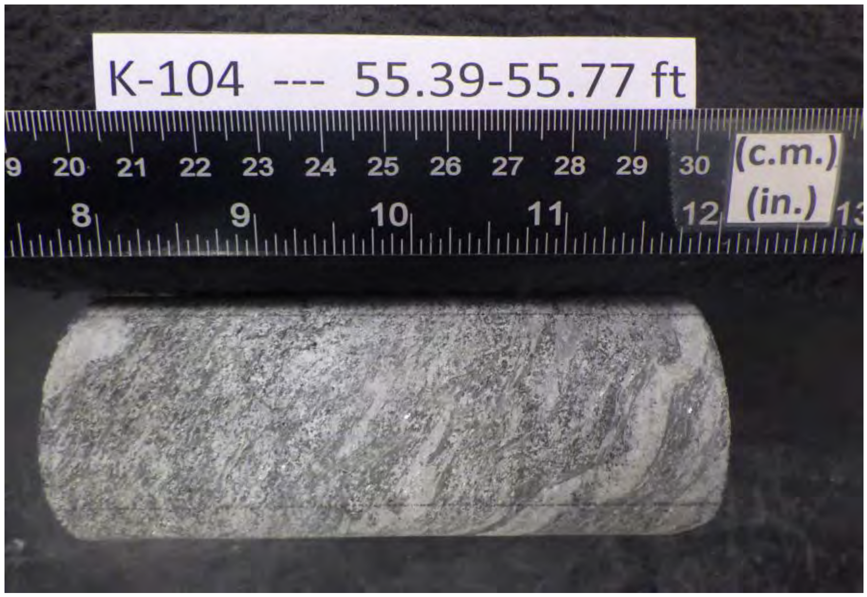
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00100	1.980	0.00051	0.029	YES
Diameter 2, in (rotated 90°)	0.00020	1.980	0.00010	0.006	YES
END 2					
Diameter 1, in	0.00110	1.980	0.00056	0.032	YES
Diameter 2, in (rotated 90°)	0.00000	1.980	0.00000	0.000	YES

Maximum angle of departure must be $\leq$ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Brierley Associates, LLC
Project Name:	Champlain-Hudson Power Express
Project Location:	Randall's Island, NYC
GTX #:	315596
Test Date:	7/7/2022
Tested By:	bp
Checked By:	smd
Boring ID:	K-104
Sample ID:	---
Depth, ft:	55.39-55.77



After cutting and grinding

After break

Client:	Brierley Associates, LLC	Test Date:	7/6/2022
Project Name:	Champlain-Hudson Power Express	Tested By:	kdp
Project Location:	Randall's Island, NYC	Checked By:	smd
GTX #:	315596		
Boring ID:	BA-106		
Sample ID:	Run 7		
Depth:	40.01-40.37 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.34	4.34	4.34		
Specimen Diameter, in:	1.96	1.96	1.96		
Specimen Mass, g:	581.08				
Bulk Density, lb/ft^3	169			**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2			**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90^o)	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

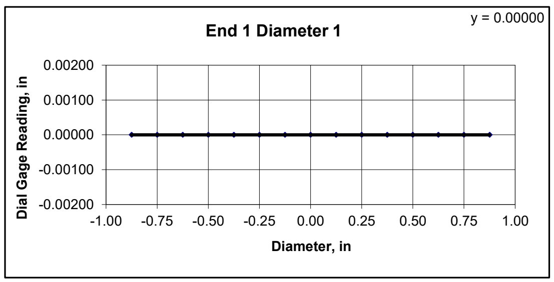
Difference between max and min readings, in:
0° = 0.00000 90° = 0.00010

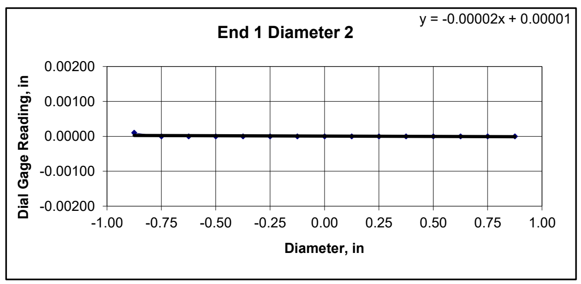
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90^o)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010

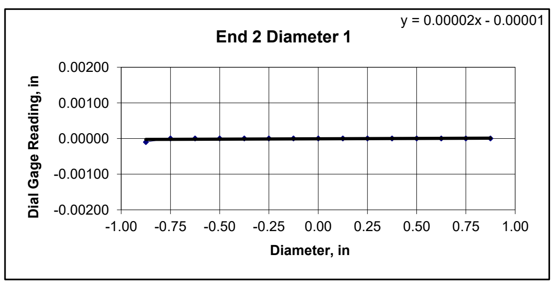
Difference between max and min readings, in:
0° = 0.0001 90° = 0.0001

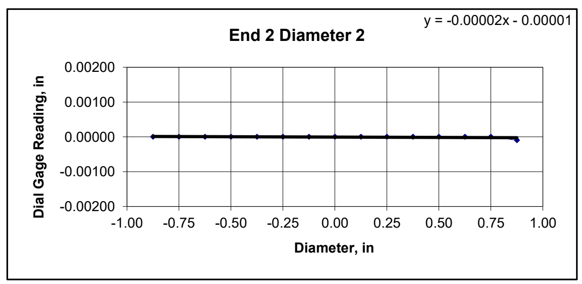
Maximum difference must be < 0.0020 in. Difference = ± 0.00005

Flatness Tolerance Met? YES









DIAMETER 1

End 1:		
	Slope of Best Fit Line	0.00000
	Angle of Best Fit Line:	0.00000
End 2:		
	Slope of Best Fit Line	0.00002
	Angle of Best Fit Line:	0.00115
Maximum Angular Difference:		0.00115

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:		
	Slope of Best Fit Line	0.00002
	Angle of Best Fit Line:	0.00115
End 2:		
	Slope of Best Fit Line	0.00002
	Angle of Best Fit Line:	0.00115
Maximum Angular Difference:		0.00000

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00000	1.960	0.00000	0.000	YES
Diameter 2, in (rotated 90^o)	0.00010	1.960	0.00005	0.003	YES
END 2					
Diameter 1, in	0.00010	1.960	0.00005	0.003	YES
Diameter 2, in (rotated 90^o)	0.00010	1.960	0.00005	0.003	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Brierley Associates, LLC.
Project Name:	Champlain-Hudson Power Express
Project Location:	Randall's Island, NYC
GTX #:	315596
Test Date:	7/7/2022
Tested By:	bp
Checked By:	smd
Boring ID:	BA-106
Sample ID:	Run 7
Depth, ft:	40.01-40.37

No photo available

After cutting and grinding

After break

GeoTesting EXPRESS

Client:	Brierley Associates, LLC	Test Date:	7/6/2022
Project Name:	Champlain-Hudson Power Express	Tested By:	kdp
Project Location:	Randall's Island, NYC	Checked By:	smd
GTX #:	315596		
Boring ID:	BA-106		
Sample ID:	Run 15		
Depth:	87.26-87.64 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.23	4.23	4.23		
Specimen Diameter, in:	1.97	1.97	1.97		
Specimen Mass, g:	564				
Bulk Density, lb/ft^3	166	**Minimum Diameter Tolerence Met?**		YES	
Length to Diameter Ratio:	2.1	**Length to Diameter Ratio Tolerance Met?**		YES	

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap $\leq$ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00020	-0.00020	-0.00030
Diameter 2, in (rotated 90^o)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

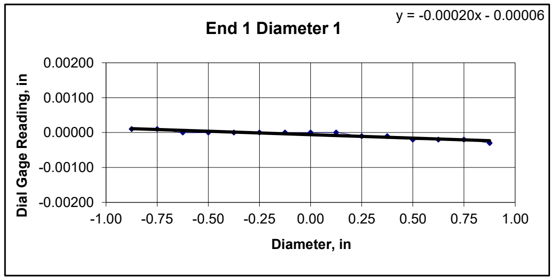
Difference between max and min readings, in:
0° = 0.00040 90° = 0.00000

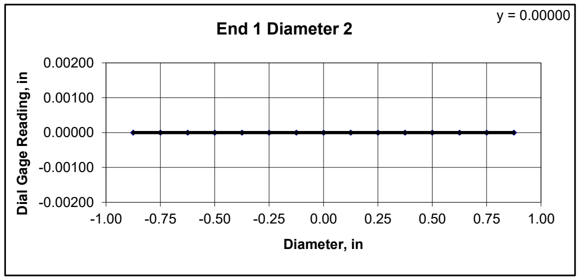
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00020	0.00010	0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010
Diameter 2, in (rotated 90^o)	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010

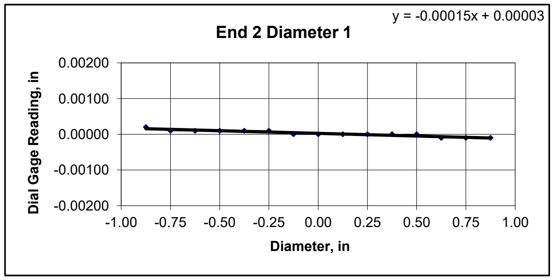
Difference between max and min readings, in:
0° = 0.0003 90° = 0.0002

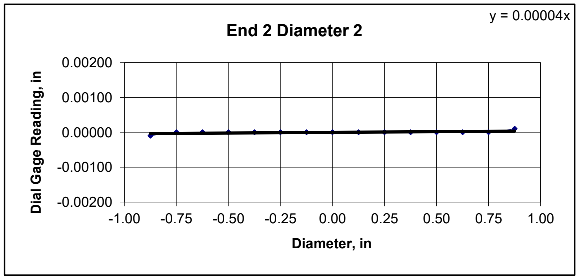
Maximum difference must be < 0.0020 in. Difference = $\pm$ 0.00020

Flatness Tolerance Met? YES









DIAMETER 1

End 1:	
Slope of Best Fit Line	0.00020
Angle of Best Fit Line:	0.01130
End 2:	
Slope of Best Fit Line	0.00015
Angle of Best Fit Line:	0.00851
Maximum Angular Difference:	0.00278

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:	
Slope of Best Fit Line	0.00000
Angle of Best Fit Line:	0.00000
End 2:	
Slope of Best Fit Line	0.00004
Angle of Best Fit Line:	0.00229
Maximum Angular Difference:	0.00229

Parallelism Tolerance Met? YES
Spherically Seated

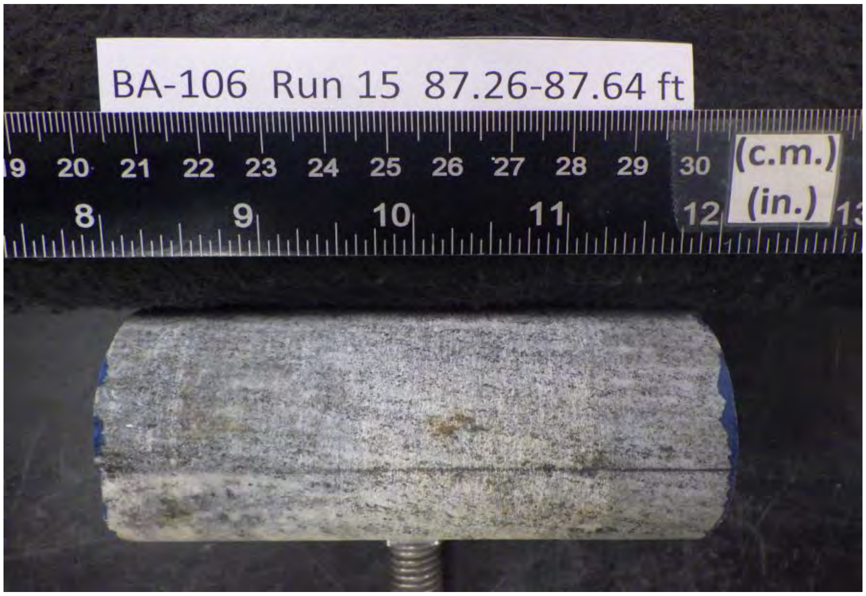
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00040	1.970	0.00020	0.012	YES
Diameter 2, in (rotated 90^o)	0.00000	1.970	0.00000	0.000	YES
END 2					
Diameter 1, in	0.00030	1.970	0.00015	0.009	YES
Diameter 2, in (rotated 90^o)	0.00020	1.970	0.00010	0.006	YES

Maximum angle of departure must be $\leq$ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Brierley Associates, LLC
Project Name:	Champlain-Hudson Power Express
Project Location:	Randall's Island, NYC
GTX #:	315596
Test Date:	7/7/2022
Tested By:	bp
Checked By:	smd
Boring ID:	BA-106
Sample ID:	Run 15
Depth, ft:	87.26-87.64



After cutting and grinding

After break

GeoTesting EXPRESS

Client:	Brierley Associates, LLC	Test Date:	7/6/2022
Project Name:	Champlain-Hudson Power Express	Tested By:	kdp
Project Location:	Randall's Island, NYC	Checked By:	smd
GTX #:	315596		
Boring ID:	BA-106		
Sample ID:	Run 18		
Depth:	104.51-104.88 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average		
Specimen Length, in:	4.34	4.34	4.34		
Specimen Diameter, in:	1.98	1.98	1.98		
Specimen Mass, g:	571.68				
Bulk Density, lb/ft^3	163			**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2			**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Difference between max and min readings, in:

0° = 0.00020 90° = 0.00000

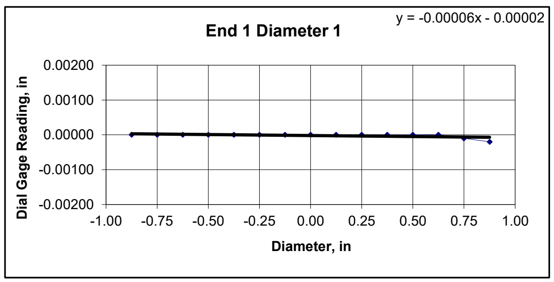
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010

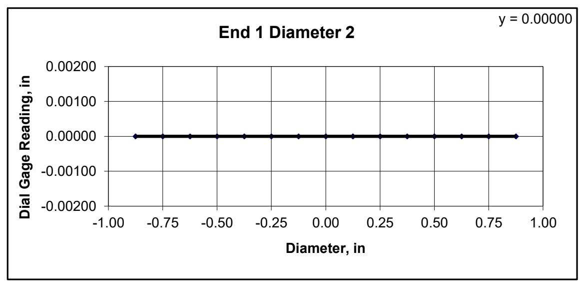
Difference between max and min readings, in:

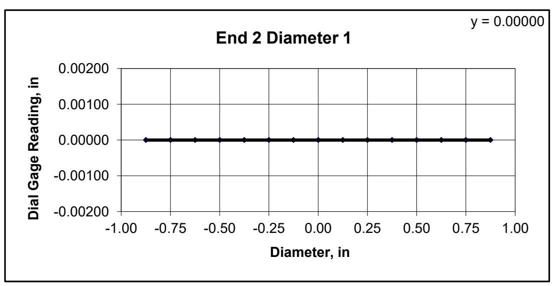
0° = 0 90° = 0.0001

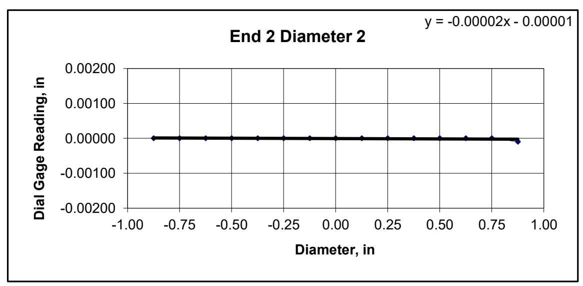
Maximum difference must be < 0.0020 in. Difference = ± 0.00010

Flatness Tolerance Met? YES









DIAMETER 1

End 1:	
Slope of Best Fit Line	0.00006
Angle of Best Fit Line:	0.00327
End 2:	
Slope of Best Fit Line	0.00000
Angle of Best Fit Line:	0.00000
Maximum Angular Difference:	0.00327

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:	
Slope of Best Fit Line	0.00000
Angle of Best Fit Line:	0.00000
End 2:	
Slope of Best Fit Line	0.00002
Angle of Best Fit Line:	0.00115
Maximum Angular Difference:	0.00115

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00020	1.980	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00000	1.980	0.00000	0.000	YES
END 2					
Diameter 1, in	0.00000	1.980	0.00000	0.000	YES
Diameter 2, in (rotated 90°)	0.00010	1.980	0.00005	0.003	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Brierley Associates, LLC
Project Name:	Champlain-Hudson Power Express
Project Location:	Randall's Island, NYC
GTX #:	315596
Test Date:	7/7/2022
Tested By:	bp
Checked By:	smd
Boring ID:	BA-106
Sample ID:	Run 18
Depth, ft:	104.51-104.88

After cutting and grinding

After break

ROCK TESTING DATA:
CERCHAR ABRASIVITY INDEX

Client:	Brierley Associates, LLC		
Project:	Champlain-Hudson Power Express		
Location:	Randall's Island, NYC	Project No:	GTX-315596

Boring ID:	BA-101	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	Run 7	Test Date:	07/07/22	Checked By:	smd
Depth :	41-41.5 ft	Test Id:	674353		

Test Comment: ---
Visual Description: ---
Sample Comment: ---

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
BA-101	Run 7	41.40-41.49 ft	1	6.1	4.4	5.25	
			2	4.8	3.7	4.25	
			3	4.4	4.5	4.45	
			4	5.6	5.0	5.30	
			5	4.9	4.7	4.80	
			Average CAIs			4.81	
			Average CAI *			5.24	
			CERCHAR Abrasiveness Index Classification			**Extreme abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

Client:	Brierley Associates, LLC		
Project:	Champlain-Hudson Power Express		
Location:	Randall's Island, NYC	Project No:	GTX-315596
Boring ID: BA-101	Sample Type: cylinder	Tested By: tlm	
Sample ID: Run 15	Test Date: 07/07/22	Checked By: smd	
Depth : 80.25-80.75 ft	Test Id: 674354		
Test Comment: ---			
Visual Description: ---			
Sample Comment: ---			

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
BA-101	Run 15	80.64-80.73 ft	1	3.3	3.5	3.40	
			2	3.4	4.6	4.00	
			3	2.7	3.0	2.85	
			4	3.6	3.4	3.50	
			5	4.3	4.2	4.25	
			Average CAIs			3.6	
			Average CAI *			4.04	
			CERCHAR Abrasiveness Index Classification			**Extreme abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

GeoTesting EXPRESS

Client: Brierley Associates, LLC			
Project: Champlain-Hudson Power Express			
Location: Randall's Island, NYC		Project No:	GTX-315596
Boring ID: BA-101	Sample Type: cylinder	Tested By:	tlm
Sample ID: Run 21	Test Date: 07/07/22	Checked By:	smd
Depth : 111.5-112 ft	Test Id: 674355		
Test Comment: ---			
Visual Description: ---			
Sample Comment: ---			

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
BA-101	Run 21	111.88-111.98 ft	1	1.5	1.6	1.55	
			2	1.4	2.0	1.70	
			3	3.7	4.8	4.25	
			4	3.6	1.9	2.75	
			5	4.3	3.5	3.90	
			Average CAIs			2.83	
			Average CAI *			3.28	
			CERCHAR Abrasiveness Index Classification			High abrasiveness	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

GeoTesting EXPRESS

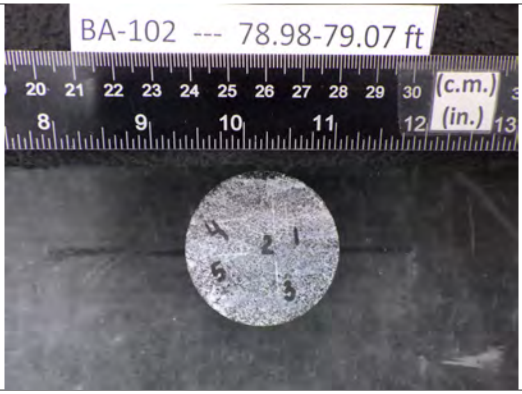
Client:	Brierley Associates, LLC		
Project:	Champlain-Hudson Power Express		
Location:	Bedford, NH	Project No:	GTX-315596
Boring ID: BA-102	Sample Type: cylinder	Tested By:	tlm
Sample ID: ---	Test Date: 06/21/22	Checked By:	smd
Depth : 78.5-79.3 ft	Test Id: 671867		
Test Comment: ---			
Visual Description: ---			
Sample Comment: ---			

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
BA-102	---	78.98-79.07 ft	1	3.8	2.6	3.20	
			2	3.3	2.2	2.75	
			3	4.8	3.7	4.25	
			4	2.9	3.8	3.35	
			5	4.5	4.0	4.25	
			Average CAIs			3.56	
			Average CAI *			4.00	
			CERCHAR Abrasiveness Index Classification			**Extreme abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:



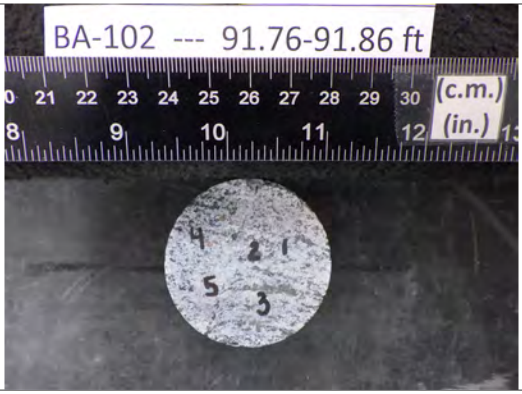
Client:	Brierley Associates, LLC		
Project:	Champlain-Hudson Power Express		
Location:	Bedford, NH	Project No:	GTX-315596
Boring ID:	BA-102	Sample Type:	cylinder
Sample ID:	---	Test Date:	06/21/22
Depth :	91.3-92.0 ft	Test Id:	671868
Tested By:	tlm	Checked By:	smd
Test Comment:	---		
Visual Description:	---		
Sample Comment:	---		

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
BA-102	---	91.76-91.86 ft	1	3.3	3.2	3.25	
			2	4.0	4.2	4.10	
			3	3.2	3.6	3.40	
			4	3.5	4.3	3.90	
			5	3.2	3.8	3.50	
			Average CAIs			3.63	
			Average CAI *			4.07	
			CERCHAR Abrasiveness Index Classification			Extreme abrasiveness	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:



Client:	Brierley Associates, LLC
Project:	Champlain-Hudson Power Express
Location:	Bedford, NH
Project No:	GTX-315596
Boring ID:	BA-102
Sample ID:	---
Depth :	100.5-100.9 ft
Sample Type:	cylinder
Test Date:	06/21/22
Test Id:	671869
Tested By:	tlm
Checked By:	smd
Test Comment:	---
Visual Description:	---
Sample Comment:	---

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
BA-102	---	100.50-100.55 ft	1	3.1	2.3	2.70	
			2	3.2	2.0	2.60	
			3	3.0	2.5	2.75	
			4	3.3	2.0	2.65	
			5	3.0	4.8	3.90	
			Average CAIs			2.92	
			Average CAI *			3.37	
			CERCHAR Abrasiveness Index Classification			**High abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

Client:	Brierley Associates, LLC		
Project:	Champlain-Hudson Power Express		
Location:	Bedford, NH	Project No:	GTX-315596

Boring ID:	BA-102	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	---	Test Date:	06/21/22	Checked By:	smd
Depth :	101.6-102.3 ft	Test Id:	671870		

Test Comment: ---
Visual Description: ---
Sample Comment: ---

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
BA-102	---	102.04-102.14 ft	1	4.3	5.1	4.70	
			2	3.8	4.4	4.10	
			3	4.4	5.7	5.05	
			4	5.5	5.0	5.25	
			5	3.2	3.9	3.55	
			Average CAIs			4.53	
			Average CAI *			4.96	
			CERCHAR Abrasiveness Index Classification			**Extreme abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

Client:	Brierley Associates, LLC
Project:	Champlain-Hudson Power Express
Location:	Randall's Island, NYC
Project No:	GTX-315596
Boring ID:	K-103
Sample ID:	---
Depth :	51'9"-52'5"
Sample Type:	cylinder
Test Date:	07/07/22
Test Id:	674433
Tested By:	tlm
Checked By:	smd
Test Comment:	---
Visual Description:	---
Sample Comment:	---

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
K-103	---	51.82-51.92 ft	1	4.7	4.1	4.40	
			2	4.6	4.5	4.55	
			3	3.2	3.9	3.55	
			4	4.0	2.8	3.40	
			5	2.6	2.4	2.50	
			Average CAIs			3.68	
			Average CAI *			4.12	
			CERCHAR Abrasiveness Index Classification			**Extreme abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

GeoTesting EXPRESS

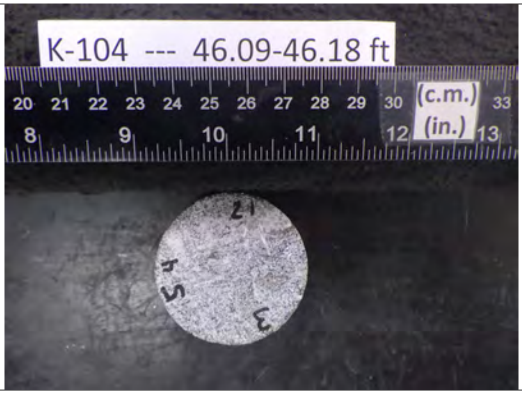
Client:	Brierley Associates, LLC
Project:	Champlain-Hudson Power Express
Location:	Randall's Island, NYC
Project No:	GTX-315596
Boring ID:	K-104
Sample ID:	---
Depth :	46'0"-46'7"
Sample Type:	cylinder
Test Date:	07/07/22
Test Id:	674434
Tested By:	tlm
Checked By:	smd
Test Comment:	---
Visual Description:	---
Sample Comment:	---

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
K-104	---	46.09-46.18 ft	1	2.4	2.9	2.65	
			2	3.5	2.5	3.00	
			3	1.9	2.3	2.10	
			4	2.5	3.3	2.90	
			5	3.2	2.1	2.65	
			Average CAIs			2.66	
			Average CAI *			3.11	
			CERCHAR Abrasiveness Index Classification			**High abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:



Client:	Brierley Associates, LLC
Project:	Champlain-Hudson Power Express
Location:	Randall's Island, NYC
Project No:	GTX-315596
Boring ID:	BA-106
Sample ID:	Run 7
Depth :	40-40.5 ft
Sample Type:	cylinder
Test Date:	07/07/22
Test Id:	674356
Tested By:	tlm
Checked By:	smd
Test Comment:	---
Visual Description:	---
Sample Comment:	---

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
BA-106	Run 7	40.88-40.97 ft	1	5.2	4.6	4.90	
			2	5.0	4.0	4.50	
			3	3.7	3.4	3.55	
			4	4.4	4.8	4.60	
			5	2.7	3.6	3.15	
			Average CAIs			4.14	
			Average CAI *			4.58	
			CERCHAR Abrasiveness Index Classification			Extreme abrasiveness	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:

GeoTesting EXPRESS

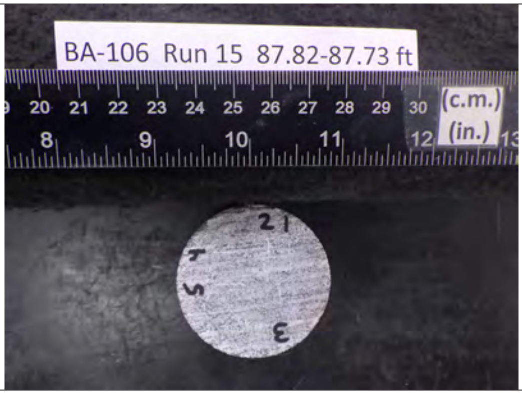
Client:	Brierley Associates, LLC		
Project:	Champlain-Hudson Power Express		
Location:	Randall's Island, NYC	Project No:	GTX-315596
Boring ID: BA-106	Sample Type: cylinder	Tested By:	tlm
Sample ID: Run 15	Test Date: 07/07/22	Checked By:	smd
Depth : 87.25-87.75 ft	Test Id: 674357		
Test Comment:	---		
Visual Description:	---		
Sample Comment:	---		

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
BA-106	Run 15	87.65-87.73 ft	1	3.1	2.8	2.95	
			2	3.1	4.6	3.85	
			3	3.4	3.3	3.35	
			4	2.3	3.5	2.90	
			5	4.0	3.4	3.70	
			Average CAIs			3.35	
			Average CAI *			3.80	
			CERCHAR Abrasiveness Index Classification			**High abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:



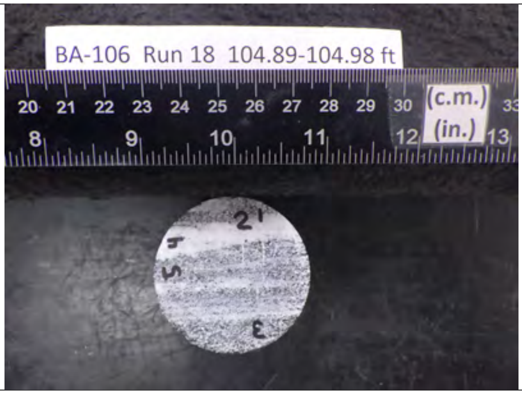
Client:	Brierley Associates, LLC				
Project:	Champlain-Hudson Power Express				
Location:	Randall's Island, NYC			Project No:	GTX-315596
Boring ID:	BA-106	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	Run 18	Test Date:	07/07/22	Checked By:	smd
Depth :	104.5-105 ft	Test Id:	674358		
Test Comment:	---				
Visual Description:	---				
Sample Comment:	---				

Abrasiveness of Rock Using the Cerchar Method by ASTM D7625

Boring ID	Sample ID	Depth	Stylus No	Reading 1	Reading 2	Average	Comments
BA-106	Run 18	104.89-104.98 ft	1	3.0	3.4	3.20	
			2	3.6	3.5	3.55	
			3	4.6	3.9	4.25	
			4	3.2	4.4	3.80	
			5	3.5	3.1	3.30	
			Average CAIs			3.62	
			Average CAI *			4.06	
			CERCHAR Abrasiveness Index Classification			Extreme abrasiveness	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 54/56 HRC
Stylus Displacement Relative to Rock Fabric:
Styli 1-3: Normal; Styli 4-5: Parallel
* CAI = (0.99 * CAIs) + 0.48
CAIs = CERCHAR index for smooth (saw cut) surface
CAI = CERCHAR index for natural surface
Comments:



APPENDIX D
THERMAL RESISTIVITY LABORATORY TEST RESULTS

21239 FM529 Rd., Bldg. F
Cypress, TX 77433
Tel: 281-985-9344
Fax: 832-427-1752
info@geothermusa.com
http://www.geothermusa.com

July 18, 2022

Kiewit Engineering Group Inc.
8880 Penrose Ln.
Lenexa, KS 66219
Attn: Jaren Knighton, P.E.

Re: Thermal Analysis of Native Soil & Rock Core Samples (Project No. TO_02)
Champlain to Hudson Power Express Randall's Island, NY

The following is the report of thermal dryout characterization tests conducted on two (2) bulk samples of native soils and four (4) rock core samples from the referenced project sent to our laboratory.

Thermal Resistivity Tests: The rock core samples were tested 'as is.' The bulk samples were recompacted at the 'as received' moisture content and at 95% of the **'single point' standard Proctor** density as received from Brierley Associates Corporation. The tests were conducted in accordance with the IEEE standard 442-2017. The results are tabulated below and the thermal dryout curves are presented in **Figures 1 to 3.**

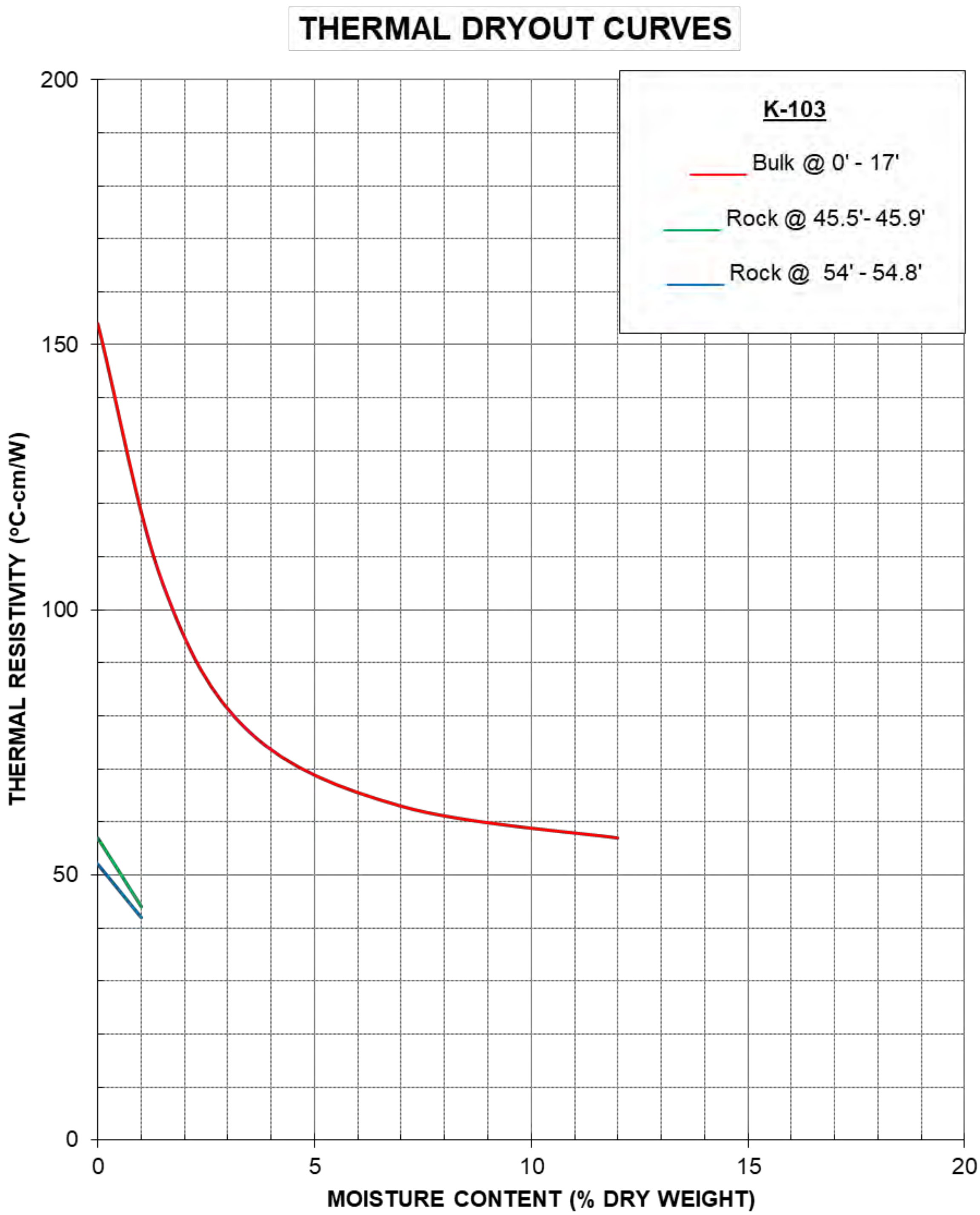
Sample ID, Description, Thermal Resistivity, Moisture Content and Density

Sample ID	Depth (ft)	Description (Brierley Associates)	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft^3)
			Wet	Dry		
K-103	0 - 17	Fine to coarse sand, trace silt, little mica, little gravel	57	154	12	114
	45.5 - 45.9	Rock	44	57	1	168
	54 - 54.8	Rock	42	52	1	170
K-104	35.1 - 36.4	Rock	45	59	1	165
	41.11 - 42.6	Rock	43	58	1	167
K-105	0 - 26	Fine to coarse sand, trace silt, little mica, little gravel	45	163	17	117

Please contact us if you have any questions or if we can be of further assistance.

Geotherm USA

Nimesh Patel



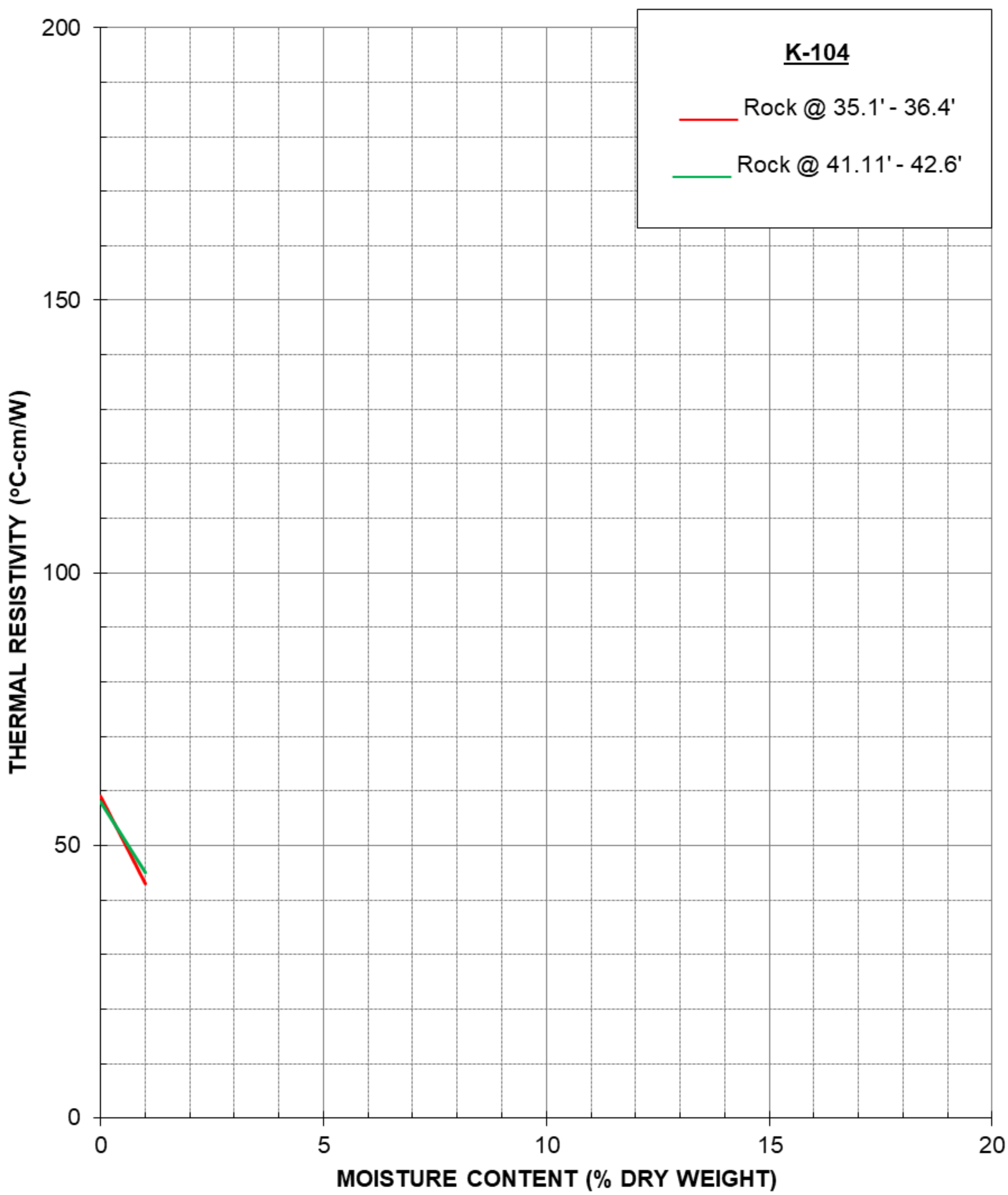
Kiewit Engineering Group (Project No. TO_02)

Champlain Hudson Power Express (CHPE)– Randall's Island, NY

Thermal Analysis of Native Soil Samples

July 2022 **Figure 1**

THERMAL DRYOUT CURVES

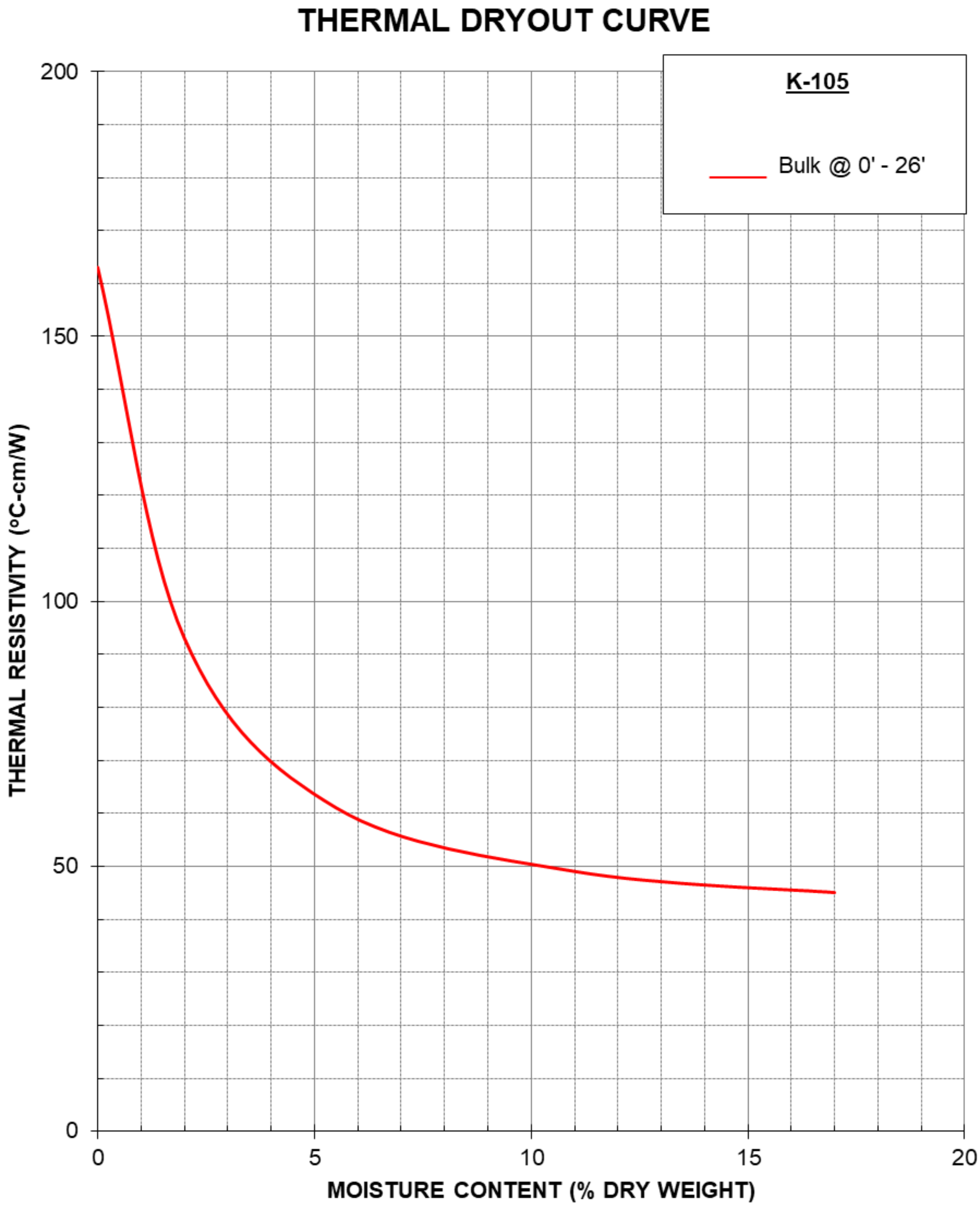


Kiewit Engineering Group (Project No. TO_02)

Champlain Hudson Power Express (CHPE)– Randall's Island, NY

Thermal Analysis of Native Soil Samples

July 2022 **Figure 2**



Kiewit Engineering Group (Project No. TO_02)

Champlain Hudson Power Express (CHPE)– Randall's Island, NY

Thermal Analysis of Native Soil Samples

July 2022 **Figure 3**

APPENDIX E
MARINE GEOPHYSICAL SURVEY REPORT
(OCEAN SURVEYS, INC.)

OCEAN SURVEYS, INC.

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OSI

NATIONWIDE * WORLDWIDE

SURVEY REPORT

MARINE GEOPHYSICAL SURVEY
PROPOSED HDD CROSSINGS
EAST RIVER AND BRONX KILL
NEW YORK

OSI REPORT NO. 22ES017

Prepared For: Brierley Associates, LLC
167 S. River Rd., Unit 8
Bedford, NH 03110

Prepared By: Ocean Surveys, Inc.
129 Mill Rock Road East
Old Saybrook, CT 06475

23 June 2022

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- 2.1 Summary of Field Investigation and Equipment.....2
- 2.2 Horizontal and Vertical Control.....6
- 2.3 Chronology of Field Operations and Acquisition Summary.....6

3.0 DATA PROCESSING AND PRODUCTS.....7

4.0 DATA ANALYSIS AND DISCUSSION.....8
- 4.1 East River Survey.....9
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5.0 SUMMARY AND RECOMENDATIONS.....15

APPENDICES

1 Summary Table of Magnetic Anomalies

2 Summary Table of Side Scan Sonar Targets & Side Scan Sonar Target Reports

3 Project Drawing

Digital Appendix – Final Report and digital drawing files (AutoCAD and PDF formats), ASCII files containing processed soundings for both sites and field photographs of the shorefalls at each crossing.

John D. Sullivan, P.G.
Manager Geophysical Surveys
OCEAN SURVEYS, INC.

Justin A. Kuntz
Geophysical Project Manager
OCEAN SURVEYS, INC.

SURVEY REPORT
MARINE GEOPHYSICAL SURVEY
PROPOSED HDD CROSSINGS
EAST RIVER AND BRONX KILL
NEW YORK

1.0 INTRODUCTION

During the period 16 - 19 May 2022, Ocean Surveys, Inc. (OSI) performed a multi-sensor marine geophysical survey in the East River between Randalls Island and Queens, NY, and within a small study area across the Bronx Kill between Randalls Island and Bronx, NY to support two proposed horizontal directional drill (HDD) route crossings (Figure 1). The objectives of these investigations were to document riverbed and subsurface conditions within two corridors where the proposed HDD alignments are currently being considered.

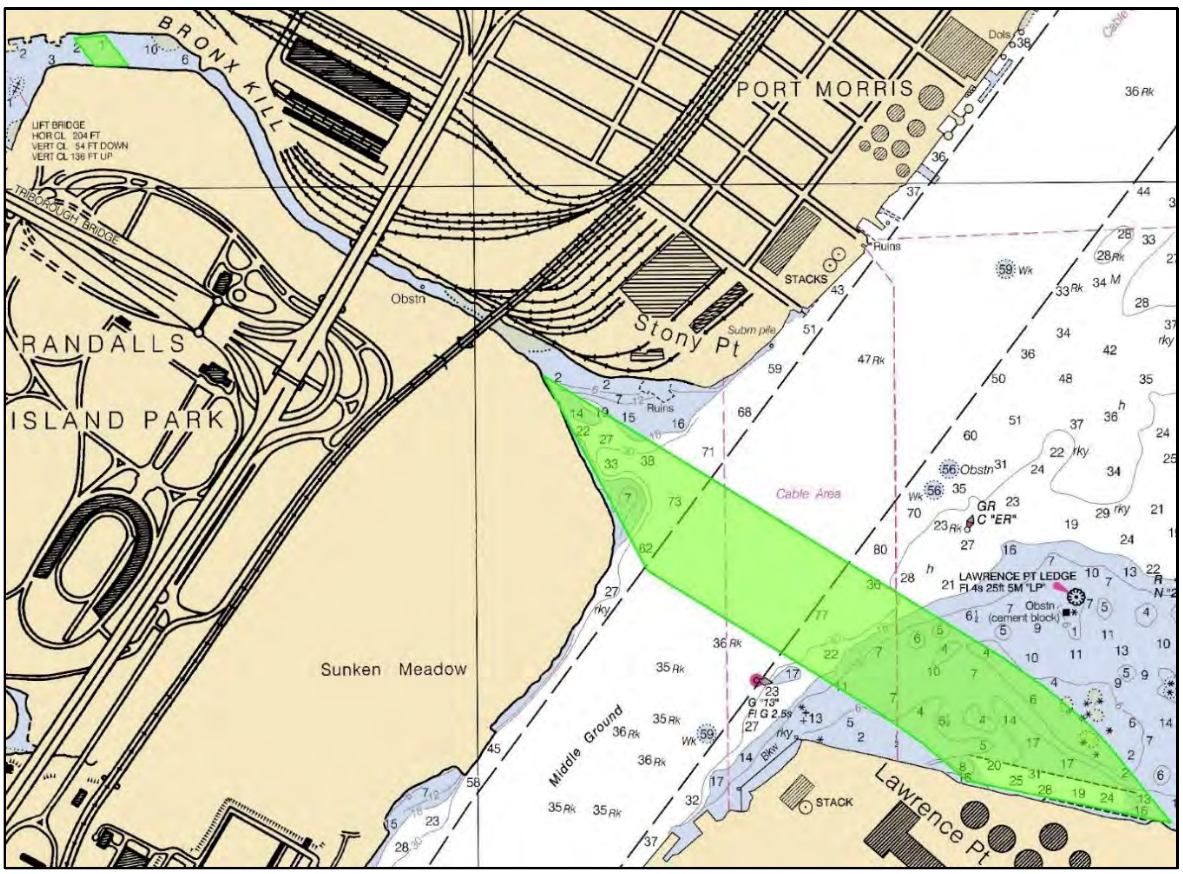


Figure 1. Site location map illustrating route corridors where the proposed HDD crossings are currently being considered. Survey areas investigated are shaded green (background image based on NOAA Raster Chart No. 12339, Tallman Island to Queensboro Bridge).

2.0 SUMMARY OF INVESTIGATION

2.1 Summary of Field Investigation and Equipment

Survey investigations were performed across the East River, east of Randalls Island, and a small section of the Bronx Kill on the north side of Randalls Island where the HDD crossings are currently being considered. The East River Survey incorporates three potential HDD alignment "Paths" (Path 1, Path 2, and Path 3) whereas the Bronx Kill Survey includes only one. Prior to the field investigation, Brierley worked with OSI on the survey line design for the crossings. The survey line plan was generated by OSI and approved by Brierley prior to the start of the field investigation (sent via email 5/14/2022 in an ACAD drawing and Google Earth kmz file entitled, "OSI_ProposedSurveyLinePlan_EastRiver&BronxKill(5-14-22)").

Within the survey corridors single beam depth soundings, side scan sonar imagery, marine magnetometer and subbottom profiling data were acquired along a series of primary survey tracklines, oriented parallel to the proposed HDD alignments (generally spaced 100 feet apart in the East River and 80 feet apart in the Bronx Kill corridor). In the East River, proposed Paths 1 and 2 were covered by the base line design however an additional survey line was run along Path 3 to complete the data set. As a means of providing quality control and confirmation of the data acquired along the primary tracklines, additional data were acquired along a series of "tie" lines oriented perpendicular to the primary lines and generally spaced approximately 100 feet apart in the deeper reaches of the East River, 500 feet apart in the shallows of the East River corridor, and 50 feet apart in the Bronx Kill. Figure 2 provides an overview of both sites, the pre-survey line layout within the sites (white/blue lines) and the HDD alignment options (green lines) currently being considered in the proposed East River survey site (outlined in red).

OSI utilized both a high-resolution Chirp and a lower frequency Boomer type profiler to acquire subbottom data during the investigations. The intent of deploying both subbottom profilers was that the two instruments would provide a broad range of energy and frequency to investigate the expected variable sequence of sediments expected in the rivers. Since site conditions (specifically the nearsurface sediments) control the success of the subbottom penetration and data developed, employing both systems maximized the probability of acquiring the most informative data for the Project.

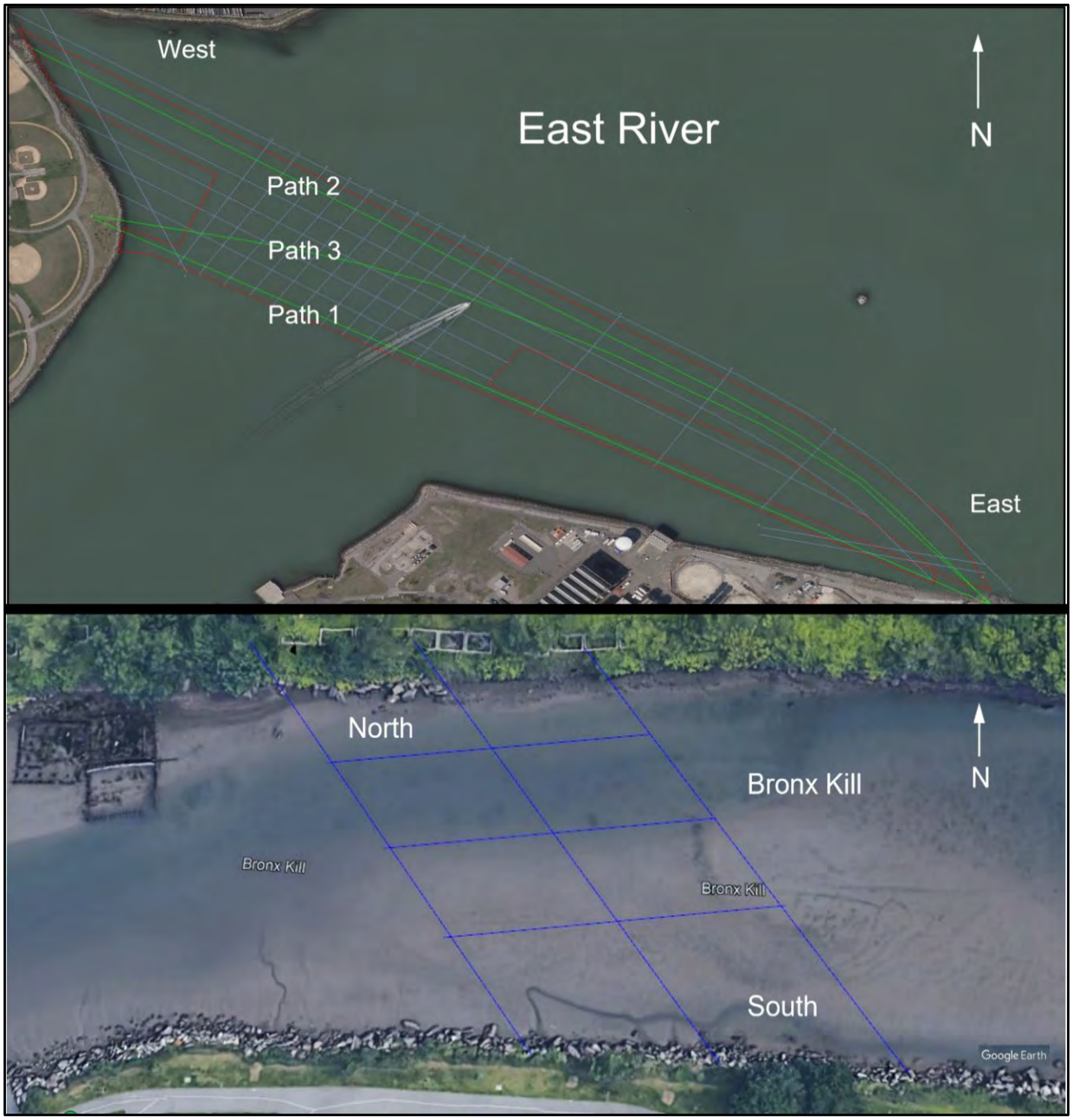


Figure 2. East River (upper) and Bronx Kill (lower) survey corridors, with survey line layout (white/blue lines). Images are portrayed at different scales. Survey area extents (red polygon) and proposed HDD route paths (green) shown in East River image whereas Bronx Kill image only showing survey line plan. Google Earth imagery shown in background.

Survey operations were performed by an OSI field crew including a geologist/geophysical survey specialist, hydrographer, and a vessel operator onboard the OSI survey vessel *R/V North Cove*. *R/V North Cove* is a 34-foot aluminum survey vessel equipped with a fully enclosed cabin, dual-outboard motors, swing arm davits, winches, and all USCG safety equipment required to safely complete the survey. The survey was supervised by a Professional Geologist and an ACSM/NSPS Certified Hydrographer.

The primary equipment that was employed to complete the investigation included:

- *Trimble Global Navigation Satellite System (GNSS) SPS 461 heading and position sensor operating in Network Real Time Kinematic (NRTK) mode employing correctors from* from NYSNet
- *HYPACK* Navigation *and Data Logging Computer System*
- *Odom Echotrac E20 Digital Dual-Frequency Depth Sounder (200kHz frequency employed)*
- *Klein 3000 100/500 kHz Dual-Frequency Digital Side Scan Sonar System*
- *Geometrics G882 Cesium Marine Magnetometer* equipped with bottom tracking altimeter and pressure sensor
- *EdgeTech 3200-XS Chirp Subbottom Profiling System equipped with a SB216 Tow Vehicle (2-16 kHz)*
- *Applied Acoustics 200J 0.5-8 kHz high-resolution "Boomer" Subbottom Profiling System interfaced with a CODA Octopus DA4G data logger – operated @ 100J*

*Specification sheets for equipment used during the survey are available upon request.

Survey equipment was configured to optimize data quality, reduce ambient noise and cross talk, and maximize survey efficiency. The single beam depth sounder was fixed mounted starboard side midship and the Chirp subbottom profiler was towed from a davit on the port side of the vessel. The side scan sonar towfish was towed from the stern with the magnetometer sensor in tandem behind. In shallow water settings, the side scan sonar and the magnetometer were towed near the water's surface, in tandem from the port side stern cleat. Towfish layback (side scan sonar and magnetometer) was determined by means of a digital cable counter or a general offset. The side scan sonar system was operated employing a 164-foot (50-meter) sweep range. The Boomer subbottom profiling system (hydrophone array and sound source) was towed from a spreader bar fixed to the stern and laid back 20 feet. Figure 3 (upper) provides a photo of the vessel and (lower) illustrates the general equipment configuration used onboard during "deep tow" investigations. In the Bronx Kill Survey area, survey instruments were deployed and run separately in order to operate safely and effectively in the narrow and shallow water site. Survey direction and vessel speed were recorded in a detailed field line log. In addition to the geophysical survey work, the OSI crew photographed the shorefalls at each proposed crossing to document pertinent site-specific features such as docks, obstructions, and informational signage.

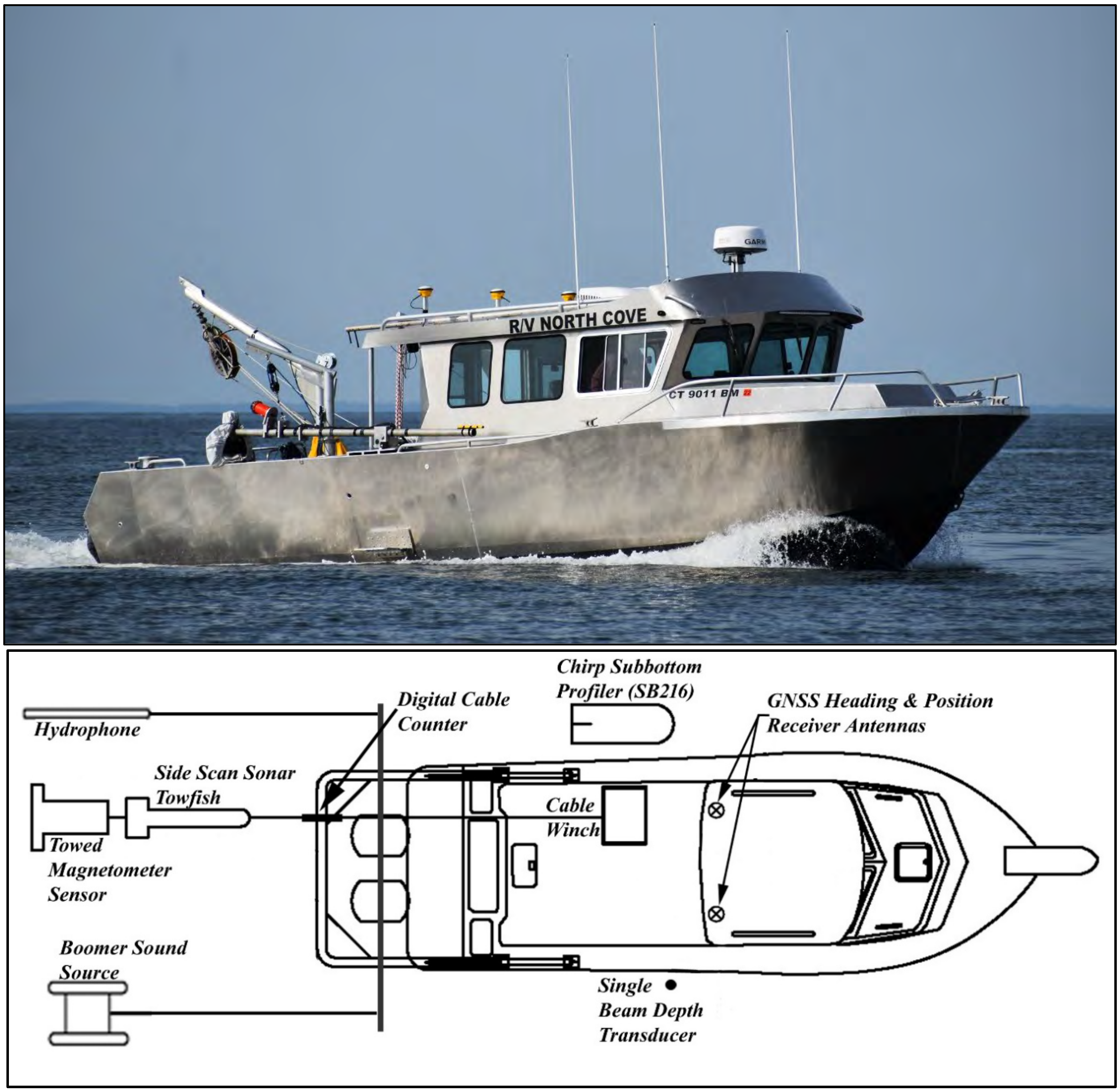


Figure 3. Survey vessel *R/V North Cove* (upper) and overview of equipment layout and general sensor configuration maintained onboard the vessel during deep water operations (lower). Note vessel sketch not to scale.

2.2 Horizontal and Vertical Control

Project horizontal reference is the New York State Plane Coordinate System, East Zone (3101), NAD83, US Survey Feet. Project vertical reference is the North American Vertical Datum of 1988 (NAVD88), feet. During acquisition, three-dimensional (3-D) positioning of the survey vessel was accomplished utilizing a Trimble SPS-461 interfaced with a computer running HYPACK, a PC-based navigation and data logging software package. NYSNet correctors were employed resulting in full time NRTK quality 3-D positioning throughout the survey. Water depths were corrected for tidal variations and reduced to project vertical datum based on a blended solution of local NOAA tide gauge data and the NRTK vertical component.

The OSI crew established a temporary, dockside control point at the Project marina utilizing a Trimble R10 GNSS receiver and NGS's Online Positioning Users Service (OPUS). Navigation checks were performed routinely to ensure the positioning system onboard the vessel was functioning properly and delivering the horizontal and vertical accuracy required for the project.

2.3 Chronology of Field Operations and Acquisition Summary

Field operations were conducted during daylight hours from 16 to 19 May 2022. In total, approximately 18 statute miles (16.7 in the East River and 1.3 in Bronx Kill) of multi-sensor tracklines were investigated during the course of the investigation (including reruns, overruns beyond the end of the planned lines, and additional/supplemental survey work for discrete area investigations). Table 1 provides a general chronology of the fieldwork including vessel on-site mobilization and demobilization.

Table 1 - Chronology of Field Investigation

May 2022 Dates	Task Description
16	OSI crew and survey vessel arrive at Mamaroneck Harbor Island Park boat ramp, launch vessel and travel to World's Fair Marina. Conduct safety meeting, complete vessel on-site mobilization, establish XYZ checkpoint at World's Fair Marina and perform testing/calibration of equipment.

May 2022 Dates	Task Description
17	Begin survey work at East River Survey area. Wind picked up early afternoon and adversely affected data quality. Survey operations concluded transit to Bronx Kills survey area to evaluate survey location and formulate survey strategy for the challenging restricted access site.
18	Continue survey work in East River Survey area. Start and complete Bronx Kill Survey at high tide. Transit back to East River Survey area for additional data coverage.
19	Conclude survey work in the East River. Crew pulls survey vessel and prepares for overland travel back to OSI home office.

3.0 DATA PROCESSING AND PRODUCTS

During the course of the investigation, the field crew reviewed data onsite to ensure quality and survey coverage. At the end of each day, data were transmitted back to the OSI home office for preliminary processing and QA/QC. Following completion of the field investigation, the acquired data sets were more fully processed and interpreted. Table 2 provides a summary of the software packages used to process each data set. Appendices 1 and 2 provide summary tables of magnetic anomalies side and scan sonar targets, respectively. Appendix 2 includes thumbnail images for each side scan sonar target.

Table 2 – Data Processing Software

Data Set	Processing Software
Navigation & Hydrographic Data	HYPACK single beam editor software (tracklines and depth soundings). QuickSurf digital terrain modeling and Blue Marble's Geographics Global Mapper software packages were used to generate the hydrographic contours and the colorized sounding surface.
Magnetometer Data	HYPACK magnetometer editor software.
Side Scan Sonar Imagery	Chesapeake Technologies, Inc. SonarWiz side scan sonar processing software.
Chirp & Boomer Subbottom Profile Data	Chesapeake Technologies, Inc. SonarWiz subbottom processing software.

To illustrate the results of the investigation and data analysis, one Project drawing consisting of two sheets was constructed on ARCH D size drawing sheets (24 by 36 inches). Project Drawing, Sheet 1 is a three-panel drawing, constructed at a horizontal scale of 1 inch = 200 feet, which presents data acquired at both the East River and Bronx Kill crossings. The Bronx Kill is included as an inset in each drawing panel. On Project Drawing Sheet 1 the uppermost panel presents survey tracklines overlain on an aerial imagery of the area, the middle panel presents elevation (depth) contours (1-foot contour interval) underlain by a colorized image created from the sounding data, the lower panel presents a sonar mosaic on which sonar targets (green squares) and magnetic anomalies (triangles) are overlain (targets and anomalies are keyed to summary tables presented). To aid in review magnetic anomalies were grouped into Classes based on amplitude (Class 1: ≤25 gammas; Class 2: 25-100 gammas, Class 3: > 100 gammas). Project Drawing Sheet 2 presents profiles constructed along the proposed HDD route alignments underlain by boomer subbottom profile data, in which prominent subsurface reflectors have been traced. This drawing was constructed at a horizontal scale of 1 inch = 200 feet and a vertical scale of 1 inch = 20 feet.

All drawings are presented in full size in Appendix 3. Digital drawing files (AutoCAD and PDF formats), ASCII files containing processed soundings for both sites and field photographs of the shoreline at each crossing are provided in the report’s digital appendix. All raw digital data files acquired during the survey (HYPACK, side scan sonar, and subbottom profiles) will be archived in-house.

4.0 DATA ANALYSIS AND DISCUSSION

Multi-sensor geophysical data documented current riverbed and subsurface conditions within the two survey sites where proposed HDD crossings are being considered across the East River and Bronx Kill, NY. Geophysical data sets were reviewed individually and analyzed in conjunction with each other to develop an understanding of surface and subsurface conditions at each crossing.

The East River crossing traverses through a charted cable area, which extends between Lawrence Point (Queens) and Stony Point (Bronx), and an ACOE maintained navigation channel with a project depth of 35 feet. The Bronx Kill crossing passes through a narrow shallow strait, between the Bronx and Randalls Island, not maintained by the ACOE and is located approximately 500 feet east of a charted cable and pipeline area at the confluence of the Harlem River. The shorelines of both the East River and Bronx Kill crossings are primarily comprised of rip-rap.

Magnetometer data acquired in the East River and Bronx Kill showed high variability making the interpretation of this data set very difficult. This variability is related to the overwhelming background magnetic influence of New York City and infrastructure along the shorelines (including a power generating station on the East River and a train depot on the Bronx Kill). When considering the following analysis, it is important to note that only the larger anomalies could be differentiated from the background magnetic field and that smaller amplitude anomalies may be masked in their surroundings and not identified. Similarly, although every effort has been made to document detected target dimensions accurately, it should be noted that side scan sonar only detects objects lying on the bottom and cannot detect buried objects. It is possible that some of the sonar targets identified that exhibited low relief may represent objects that are partially buried, so their full dimensions may not be resolved.

The following presents a brief synopsis of conditions documented within the proposed HDD crossings. All depths are reported in feet and are referenced to NAVD88. Stationing along each crossing is separate, oriented West to East, and is in feet. Seasonal variations, storm events, and/or man's influence since the time of the survey may have altered conditions reported herein.

4.1 East River Survey

Overall, the East River crossing is characterized by deep water located in and around the East River navigation channel. Maximum depth recorded within the survey corridor was approximately 109 feet on the western side of the river. The channel, in this section of the river (commonly referred to as "Middle Ground"), is not flat lying and is separated by a plateau centrally located in the middle of the river with two deep trenches on its flanks. Two relatively shallow water regions are located on either side of the river channel. The plateau in the center of the channel shoals from north to south from approximately 74 feet to 42 feet. East of the navigation channel, water depths shallow gradually to 15 to 20 feet before reaching what appears to be a dredge cut along eastern shoreline, where depths of 25-35 feet were recorded. West of the navigation channel depths shoal steeply to the western shoreline.

Side scan sonar imagery show slight variations in bottom reflectivity (observed as light to dark reflections in the sonar mosaic) throughout the survey corridor documenting changes in what has been interpreted as concentrations of cobble size rocks and unconsolidated surficial sediment types. Finer sediments occur in larger concentrations in shallower water depths outside of the channel on either side of the river as well as in the deep trenches on the edges of the channel.

Chirp and boomer subbottom profile records were reviewed together to gain an understanding of subsurface conditions within the corridor. While both subbottom profilers achieved varying depths of penetration, the Boomer subbottom profiler consistently achieved deeper penetration than the Chirp profiling system and was used as the primary basis for subsurface mapping and has been projected onto the profiles presented on Drawing Sheet 2.

Within the East River corridor, the boomer subbottom profiler intermittently resolved a shallow traceable subbottom reflector, referred herein as the acoustic basement (AB). The AB is defined as the deepest continuous subsurface reflector resolved by the profiling system and is generally interpreted as the upper surface of glacial till and/or bedrock as the boomer subbottom profiling system does not have the energy needed to penetrate rock or an appreciable thickness of glacial till. The sequence of sediments overlying the AB reflector are generally interpreted as unconsolidated. Throughout the survey corridor, the boomer subbottom profiler was able to resolve the AB reflector at the surface (outcropping on the riverbed) down to approximately 25 feet below the riverbed. Figure 4 provides a representative section of Chirp (upper) and Boomer (lower) subbottom profile data acquired along the Path 2 HDD alignment. These profiles provide good illustration of the subbottom data attained by each profiling system. Note the deeper subbottom penetration achieved by the Boomer subbottom profiler on the right side of figure, which allowed for tracing the AB reflector at depth (highlighted red), whereas the Chirp subbottom profiler only achieved limited penetration but was of higher resolution and resolved a shallow subsurface reflector (most likely associated with a coarse sediment horizon above the AB). Areas interpreted as unconsolidated sediment infill have been highlighted in green in the figure.

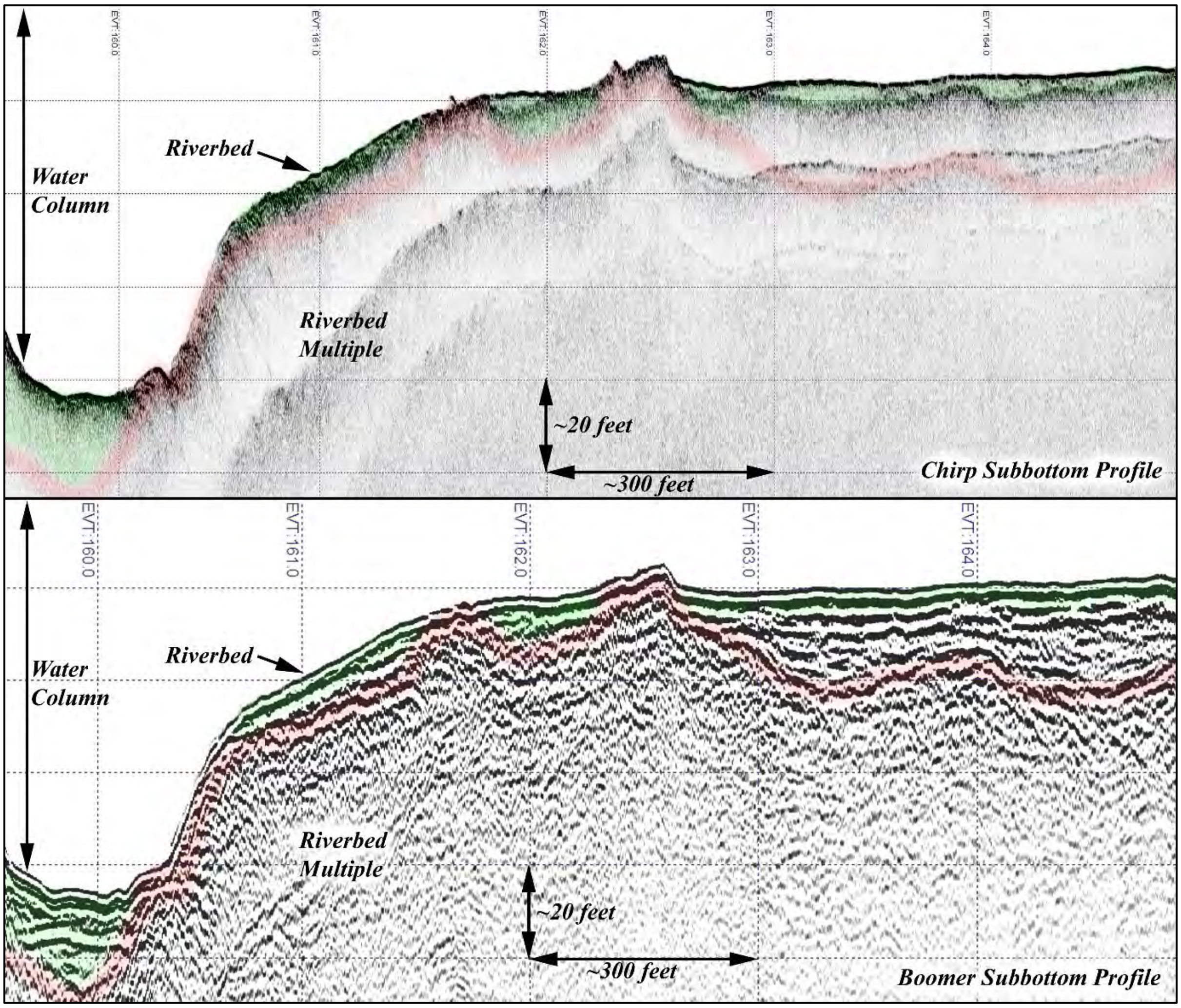


Figure 4. Representative sections of Chirp (upper) and Boomer (lower) profile data acquired in the East River along “Path 2”. AB reflector shaded red in Boomer profile and projected onto Chirp profile. Note the deeper subbottom penetration achieved by the Boomer subbottom profiler on the right side of figure, which allowed for tracing the AB reflector at depth, whereas the Chirp subbottom profiler only achieved limited penetration but was of higher resolution to resolve a shallower subsurface reflector, likely associated with a coarse sediment horizon, above the AB. Green highlighted areas indicate areas of interpreted sediment infill.

Side scan sonar imagery and magnetometer data were reviewed to identify isolated features on or just below the riverbed within the East River corridor. A total of fifty-nine (59) sonar targets were identified at the East River crossing. None of the targets identified appear as recognizable manmade features. Most targets are described as either oblong or linear shaped and none had a clear magnetic anomaly association. Many of the targets identified are associated with the abundance of rocks and/or groups of rocks observed on the riverbed within the corridor. Given the sheer abundance of these features only those that were unique in their surroundings, or representative of typical individual targets in areas with high concentrations, have been targeted.

Linear features were reviewed for their association with existing utilities within the charted cable area. Based on this review three sonar targets stood out S30, S31 and S32. S31 and S32 were identified in the middle of the river (and charted cable area) on the north side of the corridor and appear to pass over Path 2 in the vicinity of STA 16+10. Both of these linear features (each >140 feet long) appear to branch out into multiple linear features that extend north outside of the corridor. One of the features associated with S32 appears to extend south and may be associated with linear target, S30. S30, was identified in the middle of the corridor and appears to pass over Path 3 in the vicinity of STA 11+00. Unfortunately, the presence of abundant rocks in this area of the river often masked these linear features (in the sonar imagery) and none could be confidently traced across the corridor [magnetically] as they produced no clear magnetic response. Additional research, beyond the scope of work presented herein, will have to be conducted to determine if these features are utilities and to better understand what utilities should be expected within the charted corridor.

A total of fifty (50) magnetic anomalies were detected within the survey area, most of which appear isolated and scattered with no discernable alignments. As previously mentioned, the background magnetic field influence was significant in the area which generally masked the detection of smaller amplitude anomalies (only 3 of the anomalies detected were Class 1 (≤ 25 gammas)). The majority of anomalies detected were either Class 2 (46%) or Class 3 (48%). Several anomalies were identified along all three HDD path options, primarily along Paths 1 and 2, and largely in the shallower waters east of the channel.

The largest amplitude anomaly detected within the East River corridor is M56, a 678-gamma positive monopole, located on the eastside of the river, approximately 100 feet north of Path 1 near STA STA 15+14. The anomaly was detected in an area of what has been interpreted as rocks but had no clear sonar target association although M31 (291-gamma positive monopole) was detected approximately 35 feet northeast of the anomaly and may be associated. M53, the second largest anomaly detected within the East River corridor was identified just north of sonar targets S31 and S32 at STA 16+10, however given the anomaly’s distance from the sonar targets (approximately 70 feet) it seems unlikely that the anomaly is related to the targets. Within the shallows on the east side of the river, several anomaly clusters were identified on Path 1 (M12 – M18) and Path 2 (M26 - M29, & M50). None of these anomalies had a sonar target association suggesting whatever is being detected is buried or masked in its surroundings.

4.2 Bronx Kill Survey

The Bronx Kill Survey area is shallow (less than 5 feet deep) with deeper water along the north shoreline and shallower water approaching the southern shoreline. Shallow site conditions allowed for the groundtruthing technique of manual push probing. Push probes were performed by the OSI crew while the vessel was surveying on-line and consisted of pushing a 1-inch diameter, thick-walled aluminum pipe into the bottom and interpreting the “feel” of the sediments through the probe. The relatively simple task of push probing while surveying provided immediate information to the field team and allowed for a basic understanding/ground truthing of surficial sediment types within the route corridors (as will be described herein).

Side scan sonar imagery was reviewed along with results of push probes to gain a basic understanding of surficial sediment types within the corridor. Side scan sonar imagery shows the survey area to be generally featureless with no large scale bedforms present. Overall sonar imagery documents primarily lighter reflections with slight variations in bottom reflectivity throughout the crossing. Based on the reflectivity of the imagery and push probes performed by the field crew, the surficial sediments within the Bronx Kill corridor are interpreted to be aqueous silts and clay.

Chirp and boomer subbottom profilers were restricted in attaining penetration below the riverbed within the Bronx River corridor by what has been interpreted as nearsurface organic rich sediments in the shallow subsurface. Organic-rich sediments often contain high concentrations of gas generated as a by-product of the decomposition of organic matter (remnant of a paleo-estuarine environments). The gases trapped in the sediment attenuate the acoustic signal generated by the subbottom profiler(s) and reduce the ability of their acoustic waves to penetrate the bottom and resolve deeper subsurface stratigraphy.

Side scan sonar imagery and magnetometer data were reviewed to identify isolated features on or just below the bottom within the Bronx Kill Survey area. A total of four (4) sonar targets were identified at this crossing (S60, S61, S62 & S63). All of the targets are described as oblong and exhibit minimal relief (generally less than 1 foot), and all, except S60 are less than 5 feet in overall length. S60, located immediately adjacent to the northern shoreline, measuring 30 by 25 feet in size, may be related to a pile of rocks sloughing into the water from the rip-rap shoreline.

Magnetic data acquired at the Bronx Kill crossing was strongly influenced by the overwhelming background field in the area associated with the city and specifically the train depot along the northern shoreline, which contains a significant ferrous mass (Figure 5). Six (6) magnetic anomalies were able to be resolved within Bronx Kill corridor. All anomalies are Class 3 anomalies (>100 gammas) and appear isolated with no discernable alignments. No sonar targets were associated with any of the anomalies suggesting the detected features are either buried or masked in their surroundings.

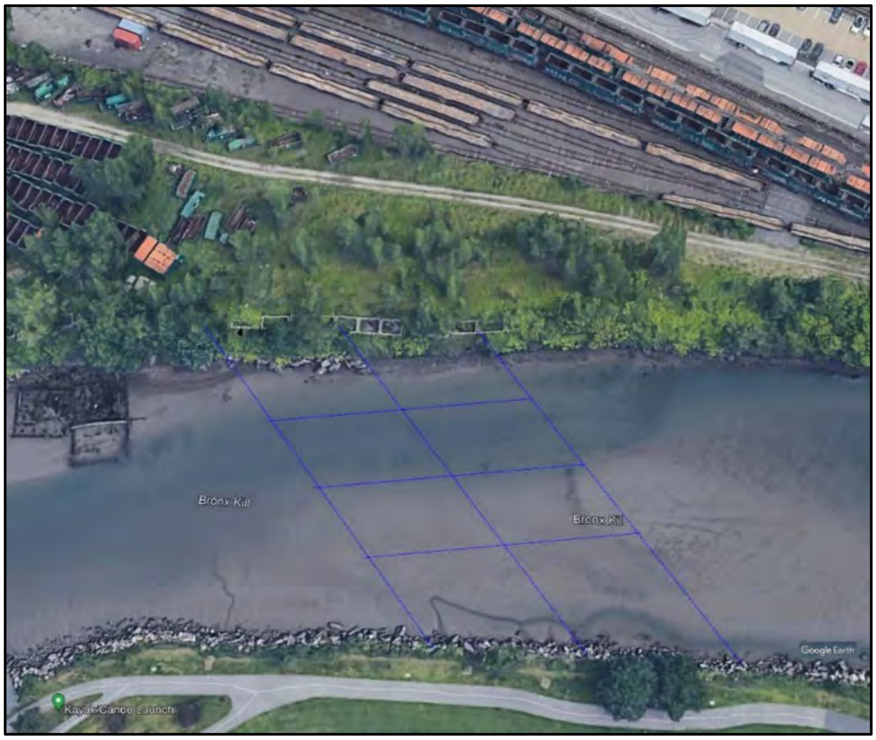


Figure 5. Google Earth imagery showing a train depot adjacent to the northern shore of the proposed Bronx Kill HDD crossing.

5.0 SUMMARY AND RECOMMENDATIONS

A multi-sensor geophysical survey was performed in the East River between Randalls Island and Queens and across the Bronx Kill between Randalls Island and Bronx, NY to support two proposed HDD crossings. Three HDD route options ("Paths") were investigated in the East River, and one in the Bronx Kill. The objective of these investigations was to document riverbed and subsurface conditions within the corridors where the proposed HDD alignments are currently being considered.

The East River crossing traverses through a charted cable area and an ACOE maintained navigation channel, while the Bronx Kill crossing passes through a narrow shallow strait outside of any charted utility crossing areas and is not maintained by the ACOE. Measured water depths within the East River survey corridor, range from approximately 6 to over 109 feet, while the Bronx Kill survey corridor is very shallow and less than 5 feet. Side scan sonar imagery document variable reflectivity within the East River corridor consistent with changes in concentrations of cobble size rocks and unconsolidated surficial sediment types on the riverbed. At the Bronx Kill crossing sonar imagery revealed only slight variations in bottom reflectivity consistent with fine grain aqueous sediment.

Subbottom profiling data suggest the East River corridor is underlain by a variable thickness of unconsolidated sediments (less than 25 feet thick). A semi-continuous subbottom reflector, herein referred to as the acoustic basement (AB), was resolved throughout much of the corridor either cropping out on the riverbed or overlain by +/- 25 of unconsolidated sediments. The AB reflector most likely represents the upper surface of glacial till or bedrock. Unfortunately, subbottom penetration was not achieved at the Bronx Kill crossing (due to what has been interpreted as organic gaseous in sediments) and no interpretable subbottom data could be attained regarding the subsurface stratigraphy at this crossing

A combined sixty-three (63) individual sonar targets and fifty-six (56) magnetic anomalies were identified within the two survey corridors. Most of the sonar targets are small, described as oblong or linearly shaped, and exhibit only minimal relief (<1 foot). Many of the targets identified in the East River corridor are related to the abundance of rocks and/or groups of rocks present on the riverbed. Magnetometer data acquired within both corridors showed high variability in the background magnetic field due to the influence of New York City and infrastructure along the shorelines. Side scan sonar imagery and magnetic data were reviewed with the specific intent to identify features or alignments suggestive of utility crossings, especially within the East River corridor where the Project passes through a NOAA charted cable area. Three suspect linear features were identified within the charted cable area in the East River corridor, and none were observed in the Bronx Kill. The suspect alignments (linear features) identified via side scan sonar imagery within the East River corridor had no corelative magnetic anomaly associations (which may be a result of the variability in the background magnetic field) and it remains unclear if these linear features are utilities. Further research may provide additional insight into the nature and location of any utilities within the charted cable area to determine if their presence will affect or be affected by the current proposed HDD crossing. It should be noted that the magnetometer can only detect objects with ferrous mass within a reasonable distance from the sensor and the side scan sonar is only a surface mapping tool. If utilities have little or no ferrous content (i.e., fiber optic cables) or were installed deep below the riverbed by HDD methods (outside the field of detection of the instruments) they would not have been detected during this investigation.

To better understand subsurface conditions in both corridors and ground-truth the geophysical interpretation presented herein, it is highly recommended that the nature of the charted utilities is investigated followed up by a geotechnical boring program performed along the preferred HDD alignments to support the Project. Once the geotechnical investigation and analysis are completed, the subbottom data acquired during this investigation should be re-evaluated (with respect to geotechnical findings) to better plan the HDD utility installation. When planning any supplemental work in support of the HDD crossings it is recommended that the results of this investigation be considered, and that individual targets and anomalies be avoided or further investigated to determine their potential impact.

APPENDIX 1

SUMMARY TABLE OF MAGNETIC ANOMALIES

Summary Table of Magnetic Anomalies

Magnetic Anomaly	Easting[1]	Northing[1]	Latitude[1]	Longitude[1]	Type[2]	Amplitude[3]	Duration[4]	Sensor Altitude[4]	Event	Class[5]	Site
M1	655058	714305	40.792927	73.911515	M-	36	28	13	7.9	2	East River
M2	655116	714363	40.793085	73.911304	CD	192	64	17	8.4	3	East River
M3	655158	714413	40.793221	73.911151	M+	20	30	20	8.5	1	East River
M4	655218	714507	40.793478	73.910932	M+	54	37	26	8.8	2	East River
M5	655312	714662	40.793902	73.910589	M+	68	45	32	9.5	2	East River
M6	655376	714743	40.794123	73.910356	Di	43	44	32	9.8	2	East River
M7	655481	714896	40.794541	73.909973	M-	21	29	31	10.8	1	East River
M8	654852	714376	40.793125	73.912257	M+	41	25	17	18.8	2	East River
M9	655154	714804	40.794295	73.911156	Di	323	76	18	20.6	3	East River
M10	654509	714660	40.793911	73.913489	M-	71	39	30	58.8	2	East River
M11	655837	713917	40.791847	73.908711	M-	43	29	16	63.9	2	East River
M12	656282	713714	40.791282	73.907109	M+	63	32	9	65.6	2	East River
M13	656394	713665	40.791145	73.906706	Di	86	40	11	66	2	East River
M14	656456	713636	40.791064	73.906482	Di	123	52	11	66.3	3	East River
M15	656565	713597	40.790955	73.90609	Di	36	31	8	76.7	2	East River
M16	656455	713639	40.791073	73.906486	Di	264	65	7	77.2	3	East River
M17	656394	713673	40.791167	73.906705	Di	130	53	8	77.5	3	East River
M18	656299	713735	40.791339	73.907047	M-	93	26	8	77.7	2	East River
M19	655975	713922	40.791858	73.908213	M+	246	69	12	78.9	3	East River
M20	654695	715292	40.795642	73.912802	M+	135	45	25	94.6	3	East River
M21	657130	713712	40.791261	73.904046	M+	373	7	2	104.4	3	East River
M22	657168	713677	40.791164	73.90391	CD	204	16	2	104.5	3	East River
M23	657183	713666	40.791133	73.903856	M-	174	14	3	104.6	3	East River
M24	657240	713627	40.791025	73.903651	Di	109	18	5	104.7	3	East River
M25	657253	713609	40.790976	73.903605	M+	306	8	3	104.8	3	East River
M26	657245	713491	40.790652	73.903636	M-	237	38	5	111.5	3	East River
M27	656576	714046	40.792188	73.906039	M-	85	32	9	114.5	2	East River
M28	656148	714297	40.792885	73.907579	M-	53	19	27	116.1	2	East River
M29	657235	713485	40.790636	73.903673	Di	278	67	9	141.5	3	East River

Magnetic Anomaly	Easting[1]	Northing[1]	Latitude[1]	Longitude[1]	Type[2]	Amplitude[3]	Duration[4]	Sensor Altitude[4]	Event	Class[5]	Site
M30	654541	714929	40.794649	73.913367	M-	274	78	20	182	3	East River
M31	655840	714125	40.792418	73.908695	M+	291	103	28	187.3	3	East River
M32	657101	713464	40.79058	73.904157	Di	74	69	16	232.9	2	East River
M33	656830	713644	40.791079	73.905132	M+	31	29	19	234.1	2	East River
M34	654661	714995	40.794828	73.912932	M-	282	73	33	242.6	3	East River
M35	655284	714973	40.794756	73.910683	M+	22	17	22	273.5	1	East River
M36	655166	714802	40.794289	73.911113	Di	84	46	24	274	2	East River
M37	654981	714546	40.79359	73.911787	Di	50	37	21	275	2	East River
M38	655261	714759	40.794169	73.910771	M+	99	58	25	279.6	2	East River
M39	654764	714431	40.793278	73.912574	Di	85	44	18	287.8	2	East River
M40	654994	714714	40.79405	73.911736	M-	78	42	22	289.1	2	East River
M41	651548	717650	40.802172	73.924113	M-	102	18	4	372.3	3	Bronx Kill
M42	651331	717655	40.80219	73.924896	M+	303	19	5	373.5	3	Bronx Kill
M43	651419	717749	40.802446	73.924576	M+	1547	27	6	378.7	3	Bronx Kill
M44	651331	717651	40.802179	73.924896	M+	517	25	5	382.3	3	Bronx Kill
M45	651521	717732	40.802398	73.924208	M+	186	11	6	384.4	3	Bronx Kill
M46	651414	717723	40.802375	73.924595	M+	584	16	7	384.8	3	Bronx Kill
M47	655724	714736	40.794097	73.909099	Di	26	25	36	395.1	2	East River
M48	655609	714581	40.793674	73.909518	M-	278	57	24	395.7	3	East River
M49	655430	714352	40.793049	73.91017	M+	261	62	14	396.7	3	East River
M50	657234	713489	40.790646	73.903676	Di	387	41	6	416.8	3	East River
M51	657301	713341	40.790239	73.903438	M+	37	73	11	422.4	2	East River
M52	657094	713452	40.790548	73.904183	Di	103	65	12	423.1	3	East River
M53	655604	714758	40.79416	73.909532	Di	508	119	26	432.4	3	East River
M54	655401	714468	40.793368	73.910272	Di	61	49	14	433.5	2	East River
M55	655105	714715	40.794051	73.911335	M+	224	54	19	438.3	3	East River
M56	655818	714095	40.792336	73.908775	M+	678	118	16	502.5	3	East River

[1]Coordinates are in feet in the New York State Plane Coordinate System, East Zone (3101), NAD83. Geographic coordinates are WGS84.
[2] M+ positive monopole, M- negative monopole, Di dipole, CD complex dipole.
[3]Amplitude is measured in Gammas (note: 1Gamma (γ) = 1 Nanotesla (nT))
[4]Duration and Sensor Altitude are measured in feet.
[5]Class 1: ≤ 25 gammas, Class 2: >25 -100 gammas, Class 3: >100 gammas.

APPENDIX 2

SUMMARY TABLE OF SIDE SCAN SONAR TARGETS & SIDE SCAN SONAR TARGET REPORTS

Summary Table of Side Scan Sonar Targets

Sonar Target	Easting[1]	Northing[1]	Latitude (WGS84)	Longitude (WGS84)	Length[2]	Width[2]	Height[2]	Description	Site
S1	657620	713185	40.789804	-73.902291	22.9	13.6	3.0	Oblong target	East River
S2	657579	713152	40.789715	-73.902440	7.0	4.2	3.3	Oblong target	East River
S3	657599	713274	40.790049	-73.902365	9.7	5.4	3.2	Oblong target	East River
S4	657421	713261	40.790019	-73.903007	34.8	1.2	0.5	Linear target	East River
S5	657326	713233	40.789942	-73.903352	11.7	5.4	5.3	Oblong target	East River
S6	657300	713287	40.790089	-73.903441	9.2	6.8	1.7	Oblong target	East River
S7	657213	713187	40.789819	-73.903759	13.1	7.1	3.2	Oblong target	East River
S8	657229	713277	40.790064	-73.903701	65.2	10.4	5.5	Oblong targets, possible group of rocks	East River
S9	657207	713359	40.790289	-73.903776	118.0	11.5	2.6	Oblong targets, possible group of rocks	East River
S10	657151	713265	40.790032	-73.903980	10.7	8.3	4.4	Oblong target	East River
S11	657066	713329	40.790209	-73.904289	30.8	17.6	4.6	Oblong target, possible outcrop	East River
S12	657033	713252	40.790001	-73.904407	7.2	5.3	1.0	Oblong target	East River
S13	657064	713431	40.790490	-73.904290	71.7	19.1	2.0	Oblong targets, possible group of rocks	East River
S14	657011	713315	40.790172	-73.904485	6.4	4.2	3.8	Oblong targets, multiple large rocks	East River
S15	656990	713433	40.790499	-73.904559	7.1	5.6	3.5	Oblong target	East River
S16	656995	713843	40.791622	-73.904530	9.1	6.1	1.9	Oblong target	East River
S17	656681	713424	40.790479	-73.905673	8.3	5.3	0.9	Oblong target	East River
S18	656675	713696	40.791225	-73.905689	22.2	1.2	0.4	Linear target	East River
S19	656561	713498	40.790684	-73.906105	14.1	10.8	2.5	Oblong target	East River

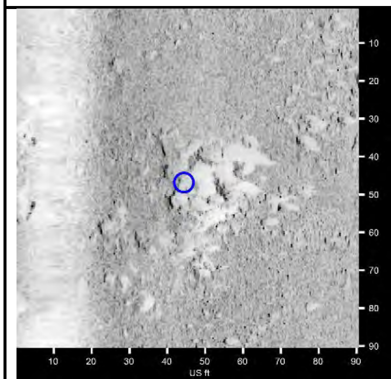
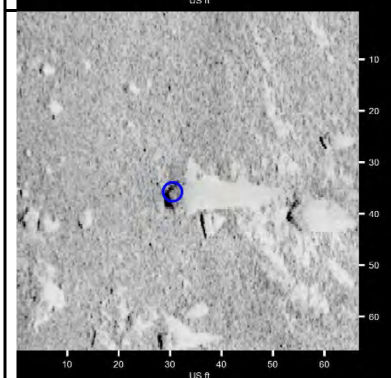
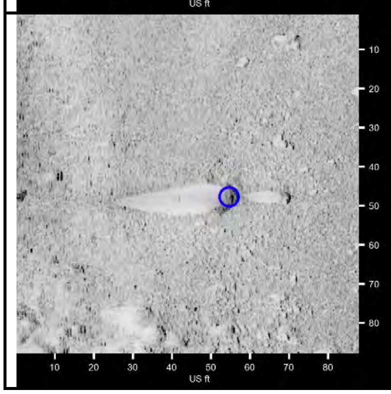
Sonar Target	Easting[1]	Northing[1]	Latitude (WGS84)	Longitude (WGS84)	Length[2]	Width[2]	Height[2]	Description	Site
S20	656526	714232	40.792699	-73.906213	43.1	1.3	1.2	Linear targets	East River
S21	656452	714225	40.792681	-73.906481	3.4	1.8	1.5	Oblong target	East River
S22	656171	714109	40.792369	-73.907502	12.0	7.3	5.6	Oblong target	East River
S23	656202	714283	40.792844	-73.907382	6.9	4.4	2.5	Oblong targets, one large feature among smaller features	East River
S24	655930	713902	40.791804	-73.908377	14.7	5.2	4.3	Oblong target	East River
S25	655939	713962	40.791969	-73.908343	7.2	4.9	1.4	Oblong target	East River
S26	655886	714009	40.792098	-73.908533	13.1	4.1	1.0	Oblong target	East River
S27	655975	714311	40.792926	-73.908204	25.0	4.2	2.7	Linear target	East River
S28	655976	714391	40.793146	-73.908199	9.6	5.3	7.3	Oblong target	East River
S29	655518	714444	40.793300	-73.909849	6.8	3.6	8.6	Oblong target	East River
S30	655485	714462	40.793349	-73.909970	149.9	1.9	1.3	Linear target	East River
S31	655600	714699	40.793997	-73.909546	139.3	2.3	1.1	Multiple linear targets	East River
S32	655567	714696	40.793990	-73.909668	152.6	1.7	1.0	Multiple linear targets	East River
S33	655417	714572	40.793653	-73.910212	13.3	5.2	1.9	Oblong target	East River
S34	655323	714530	40.793539	-73.910552	10.7	4.6	4.5	Oblong target	East River
S35	655415	714689	40.793973	-73.910216	16.5	6.9	8.0	Oblong target	East River
S36	655511	714853	40.794424	-73.909867	9.6	6.6	7.3	Oblong targets, possibly multiple rocks	East River
S37	655425	714891	40.794529	-73.910174	22.5	6.1	2.7	Oblong target, possible rock outcrop	East River
S38	655098	714472	40.793384	-73.911367	9.4	5.0	3.5	Oblong targets, possibly multiple rocks	East River
S39	655065	714633	40.793828	-73.911482	6.4	4.7	1.6	Oblong target	East River

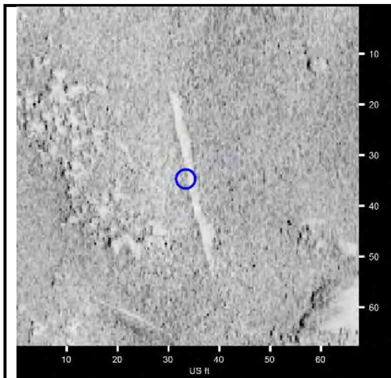
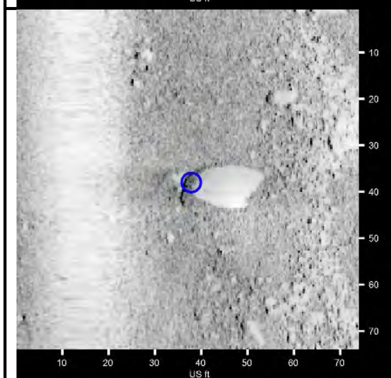
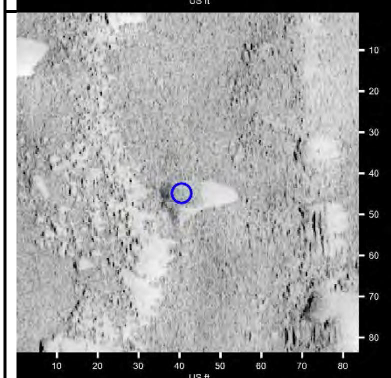
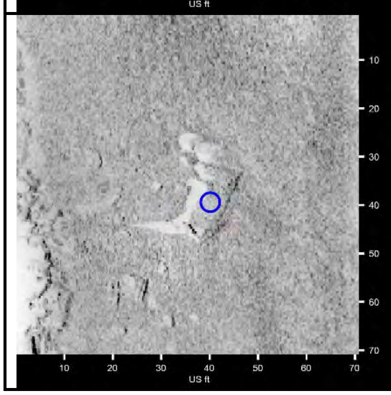
Sonar Target	Easting[1]	Northing[1]	Latitude (WGS84)	Longitude (WGS84)	Length[2]	Width[2]	Height[2]	Description	Site
S40	655196	714909	40.794582	-73.911001	35.3	14.8	5.7	Oblong target, possible rock outcrop	East River
S41	654864	714487	40.793431	-73.912211	18.4	6.1	7.2	Oblong target	East River
S42	655158	715022	40.794894	-73.911136	14.5	10.5	4.7	Oblong target, possible rock outcrop	East River
S43	655020	714854	40.794435	-73.911641	46.8	6.0	3.0	Oblong target, possible rock outcrop	East River
S44	654676	714930	40.794649	-73.912881	7.3	4.1	4.2	Oblong target	East River
S45	654536	714718	40.794070	-73.913392	22.3	8.6	4.9	Oblong target	East River
S46	654640	714922	40.794627	-73.913011	9.1	4.3	4.8	Oblong target	East River
S47	654544	714752	40.794162	-73.913361	8.8	3.6	5.7	Oblong target	East River
S48	654866	715266	40.795567	-73.912184	10.2	5.1	11.1	Oblong target	East River
S49	654586	714913	40.794605	-73.913204	23.5	7.7	2.7	Oblong target	East River
S50	654801	715304	40.795674	-73.912418	4.3	3.4	3.4	Oblong targets possibly multiple rocks	East River
S51	654585	715043	40.794962	-73.913207	7.9	5.7	4.1	Oblong targets possiblbly group of rocks	East River
S52	654612	715111	40.795146	-73.913106	42.4	38.0	9.9	Oblong target, possible rock outcrop	East River
S53	654758	715341	40.795776	-73.912575	10.7	4.1	4.1	Oblong target	East River
S54	654519	715116	40.795162	-73.913441	9.3	7.3	7.9	Oblong target	East River
S55	654454	715069	40.795036	-73.913680	5.3	3.1	1.9	Oblong target	East River

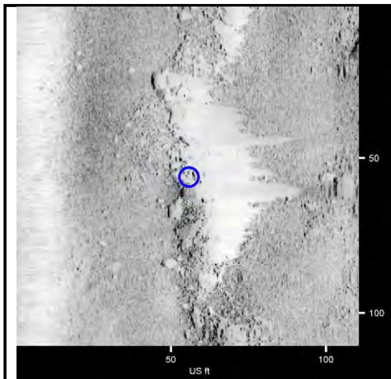
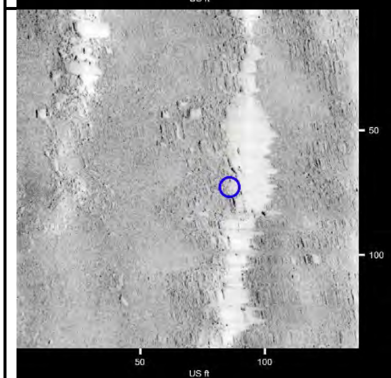
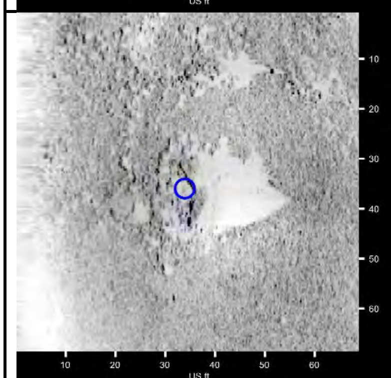
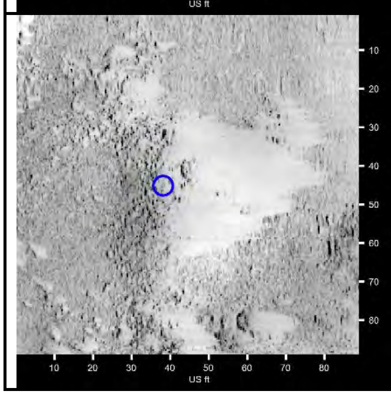
Sonar Target	Easting[1]	Northing[1]	Latitude (WGS84)	Longitude (WGS84)	Length[2]	Width[2]	Height[2]	Description	Site
S56	654659	715386	40.795901	-73.912930	4.9	3.1	1.7	Oblong targets, possible group of rocks	East River
S57	654483	715159	40.795282	-73.913570	18.2	6.8	9.2	Oblong target	East River
S58	654524	715441	40.796053	-73.913417	7.7	4.5	1.4	Oblong target	East River
S59	654366	715231	40.795481	-73.913993	4.9	3.6	1.2	Oblong target	East River
S60	651550	717747	40.802437	-73.924104	29.2	24.5	0.2	Oblong target may appear to be pile of rocks	Bronx Kill
S61	651310	717735	40.802411	-73.924971	4.2	2.2	0.8	Oblong target	Bronx Kill
S62	651303	717727	40.802387	-73.924997	3.4	2.3	0.5	Oblong target	Bronx Kill
S63	651266	717746	40.802440	-73.925128	5.2	3.3	0.2	Oblong target	Bronx Kill

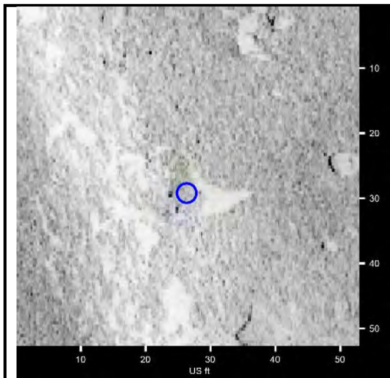
[1]Coordinates are in feet in the New York State Plane Coordinate System, East Zone (3101), NAD83. Geographic coordinates are WGS84.
[2]All measurements are in feet.

Side Scan Target Reports

Target Image	Target Info	User Entered Info
	**S0001** • Click Position 40.7898037588 -73.9022913709 (WGS84) (X) 657619.54 (Y) 713184.60 (Projected Coordinates) • Line Name: SSS_2205191356	**Dimensions and attributes** • Target Length: 22.9 US ft • Target Width: 13.6 US ft • Target Height: 3.0 US ft • Description: Oblong target
	**S0002** • Click Position 40.7897154734 -73.9024400664 (WGS84) (X) 657578.59 (Y) 713152.16 (Projected Coordinates) • Line Name: SSS_2205191400	**Dimensions and attributes** • Target Length: 7.0 US ft • Target Width: 4.2 US ft • Target Height: 3.3 US ft • Description: Oblong target
	**S0003** • Click Position 40.7900485739 -73.9023645496 (WGS84) (X) 657598.67 (Y) 713273.65 (Projected Coordinates) • Line Name: SSS_2205191400	**Dimensions and attributes** • Target Length: 9.7 US ft • Target Width: 5.4 US ft • Target Height: 3.2 US ft • Description: Oblong target

	**S0004** • Click Position 40.7900185481 -73.9030067749 (WGS84) (X) 657420.93 (Y) 713261.50 (Projected Coordinates) • Line Name: SSS_2205191356	**Dimensions and attributes** • Target Length: 34.8 US ft • Target Width: 1.2 US ft • Target Height: 0.5 US ft • Description: Linear target
	**S0005** • Click Position 40.7899418014 -73.9033520884 (WGS84) (X) 657325.50 (Y) 713232.89 (Projected Coordinates) • Line Name: SSS_2205191356	**Dimensions and attributes** • Target Length: 11.7 US ft • Target Width: 5.4 US ft • Target Height: 5.3 US ft • Description: Oblong target
	**S0006** • Click Position 40.7900894584 -73.9034413863 (WGS84) (X) 657300.41 (Y) 713286.51 (Projected Coordinates) • Line Name: SSS_2205191356	**Dimensions and attributes** • Target Length: 9.2 US ft • Target Width: 6.8 US ft • Target Height: 1.7 US ft • Description: Oblong target
	**S0007** • Click Position 40.7898185902 -73.9037592482 (WGS84) (X) 657213.07 (Y) 713187.24 (Projected Coordinates) • Line Name: SSS_2205191356	**Dimensions and attributes** • Target Length: 13.1 US ft • Target Width: 7.1 US ft • Target Height: 3.2 US ft • Description: Oblong target

	**S0008** • Click Position 40.7900640243 -73.9037006490 (WGS84) (X) 657228.69 (Y) 713276.76 (Projected Coordinates) • Line Name: SSS_2205191356	**Dimensions and attributes** • Target Length: 65.2 US ft • Target Width: 10.4 US ft • Target Height: 5.5 US ft • Description: Oblong targets, possible group of rocks
	**S0009** • Click Position 40.7902891614 -73.9037756798 (WGS84) (X) 657207.36 (Y) 713358.64 (Projected Coordinates) • Line Name: SSS_2205171515	**Dimensions and attributes** • Target Length: 118.0 US ft • Target Width: 11.5 US ft • Target Height: 2.6 US ft • Description: Oblong targets, possible group of rocks
	**S0010** • Click Position 40.7900322717 -73.9039801579 (WGS84) (X) 657151.38 (Y) 713264.67 (Projected Coordinates) • Line Name: SSS_2205191400	**Dimensions and attributes** • Target Length: 10.7 US ft • Target Width: 8.3 US ft • Target Height: 4.4 US ft • Description: Oblong target
	**S0011** • Click Position 40.7902094146 -73.9042885266 (WGS84) (X) 657065.56 (Y) 713328.62 (Projected Coordinates) • Line Name: SSS_2205191356	**Dimensions and attributes** • Target Length: 30.8 US ft • Target Width: 17.6 US ft • Target Height: 4.6 US ft • Description: Oblong target, possible outcrop

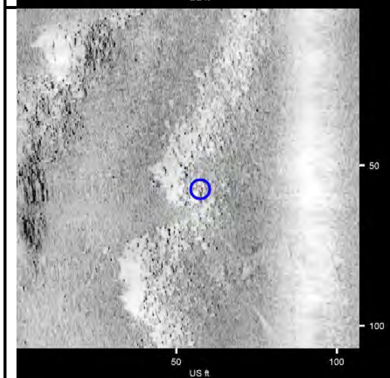


S0012

- Click Position
  40.7900009219 -73.9044066446 (WGS84)
  (X) 657033.37 (Y) 713252.44 (Projected Coordinates)
- Line Name: SSS_2205191400

Dimensions and attributes

- Target Length: 7.2 US ft
- Target Width: 5.3 US ft
- Target Height: 1.0 US ft
- Description: Oblong target

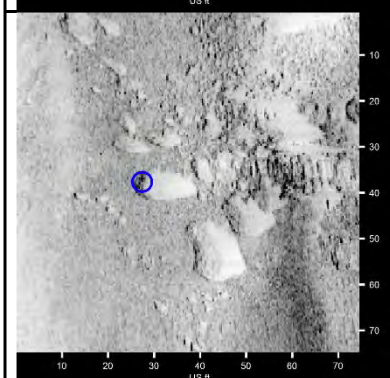


S0013

- Click Position
  40.7904901134 -73.9042899307 (WGS84)
  (X) 657064.48 (Y) 713430.88 (Projected Coordinates)
- Line Name: SSS_2205181828

Dimensions and attributes

- Target Length: 71.7 US ft
- Target Width: 19.1 US ft
- Target Height: 2.0 US ft
- Description: Oblong targets, possible group of rocks

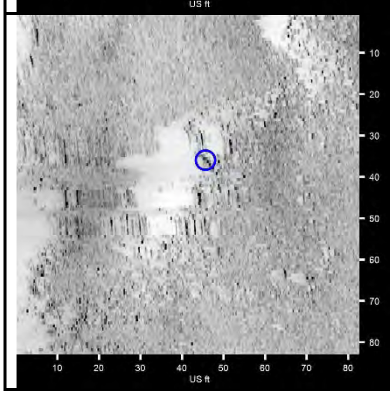


S0014

- Click Position
  40.7901720644 -73.9044848878 (WGS84)
  (X) 657011.28 (Y) 713314.64 (Projected Coordinates)
- Line Name: SSS_2205191356

Dimensions and attributes

- Target Length: 6.4 US ft
- Target Width: 4.2 US ft
- Target Height: 3.8 US ft
- Description: Oblong targets, multiple large rocks

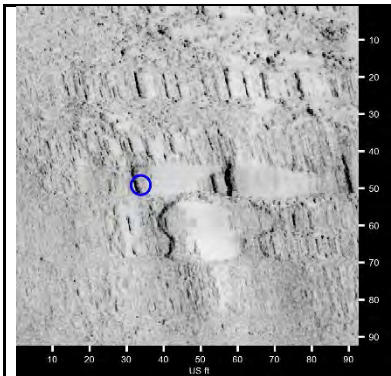
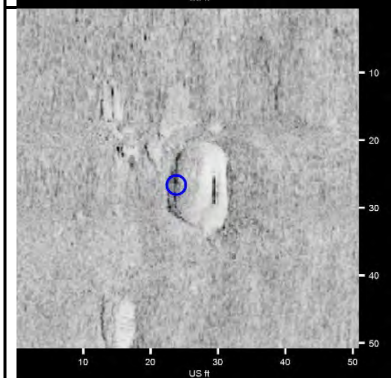
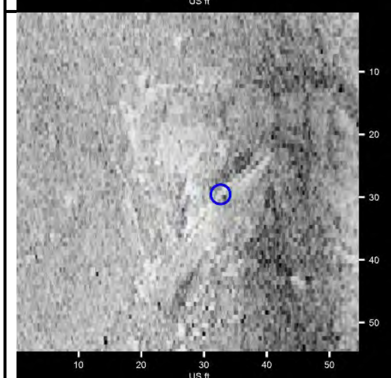
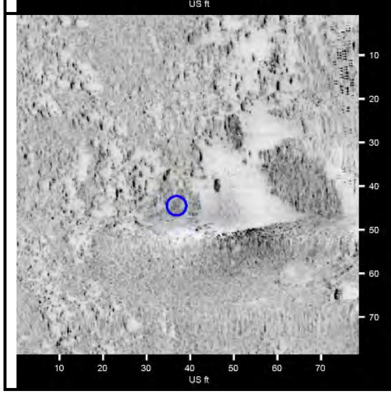


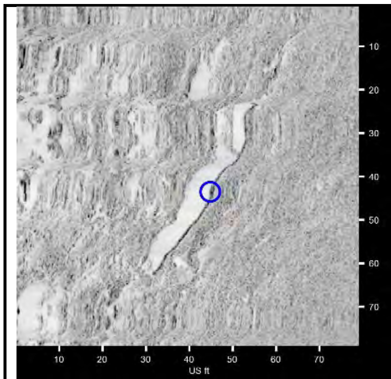
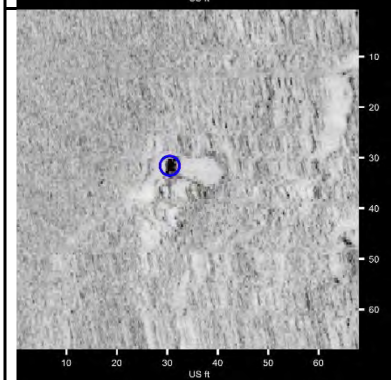
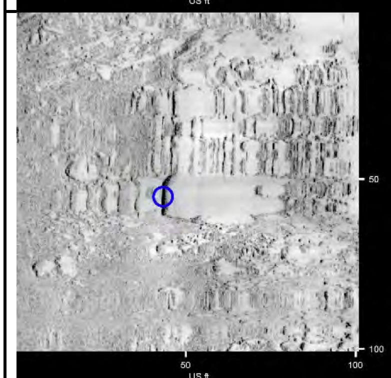
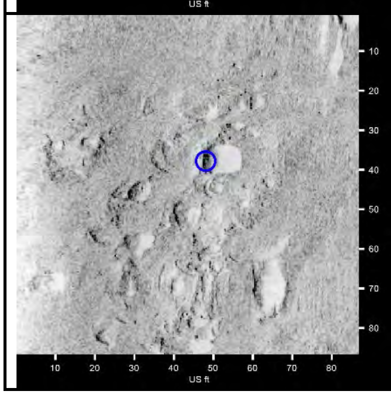
S0015

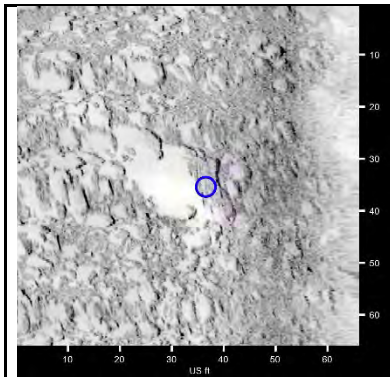
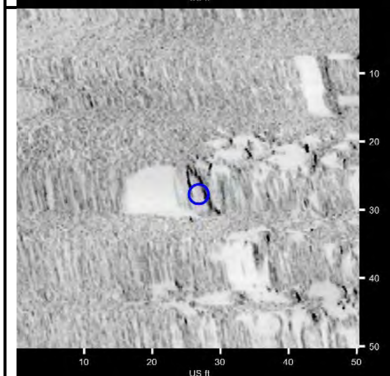
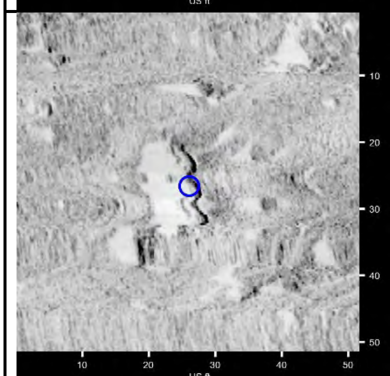
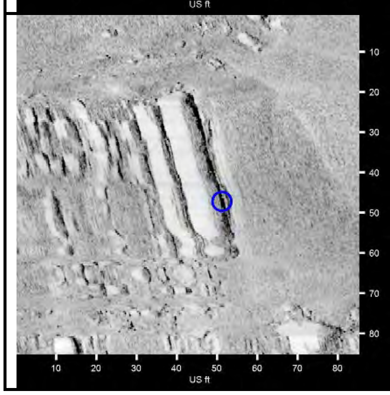
- Click Position
  40.7904985275 -73.9045590924 (WGS84)
  (X) 656989.93 (Y) 713433.43 (Projected Coordinates)
- Line Name: SSS_2205181828

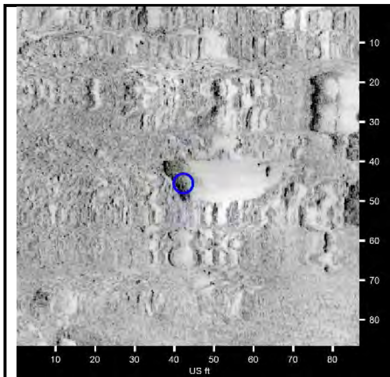
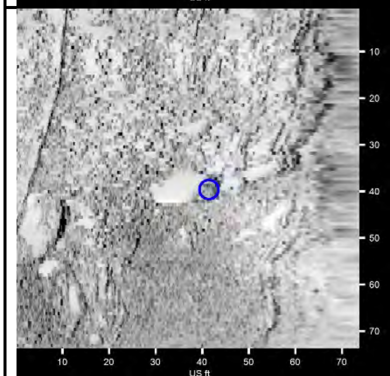
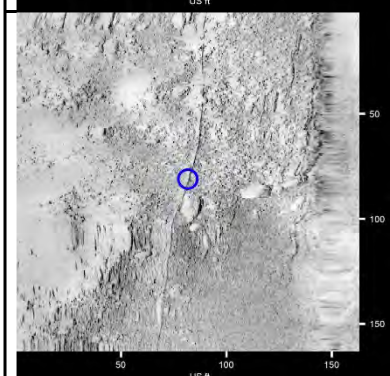
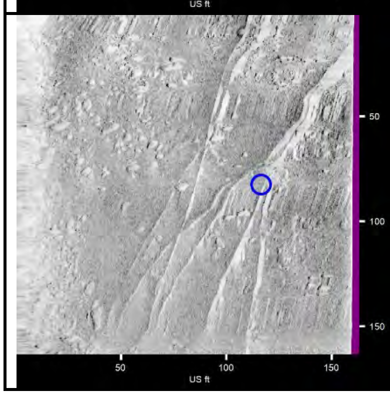
Dimensions and attributes

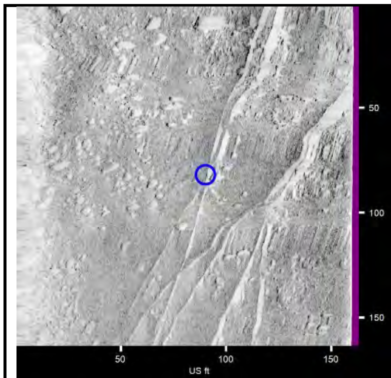
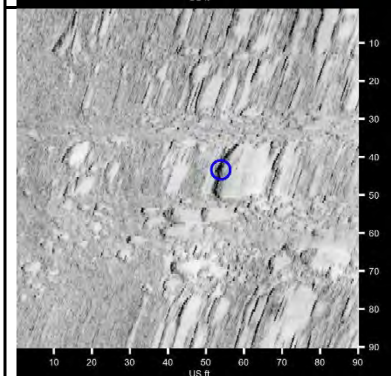
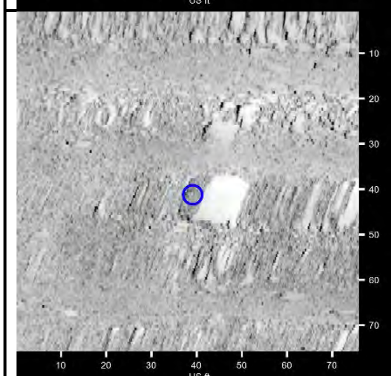
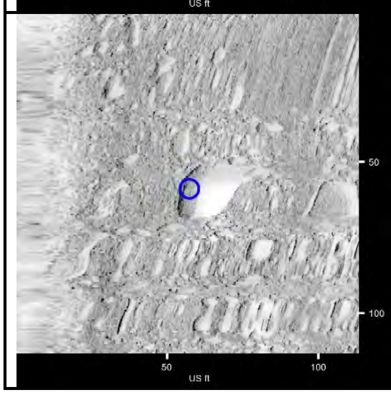
- Target Length: 7.1 US ft
- Target Width: 5.6 US ft
- Target Height: 3.5 US ft
- Description: Oblong target

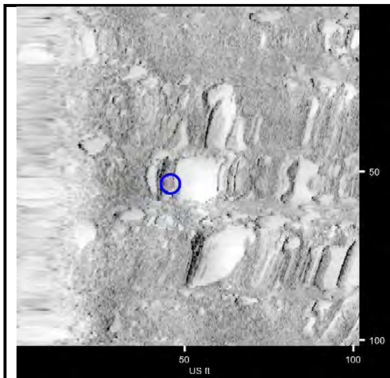
	**S0016** • Click Position 40.7916215065 -73.9045301456 (WGS84) (X) 656995.17 (Y) 713842.59 (Projected Coordinates) • Line Name: SSS_2205171627	**Dimensions and attributes** • Target Length: 9.1 US ft • Target Width: 6.1 US ft • Target Height: 1.9 US ft • Description: Oblong target
	**S0017** • Click Position 40.7904790612 -73.9056733188 (WGS84) (X) 656681.47 (Y) 713424.25 (Projected Coordinates) • Line Name: SSS_2205171456	**Dimensions and attributes** • Target Length: 8.3 US ft • Target Width: 5.3 US ft • Target Height: 0.9 US ft • Description: Oblong target
	**S0018** • Click Position 40.7912252839 -73.9056894776 (WGS84) (X) 656675.15 (Y) 713696.07 (Projected Coordinates) • Line Name: SSS_2205181828	**Dimensions and attributes** • Target Length: 22.2 US ft • Target Width: 1.2 US ft • Target Height: 0.4 US ft • Description: Linear target
	**S0019** • Click Position 40.7906839750 -73.9061048948 (WGS84) (X) 656561.47 (Y) 713498.09 (Projected Coordinates) • Line Name: SSS_2205171456	**Dimensions and attributes** • Target Length: 14.1 US ft • Target Width: 10.8 US ft • Target Height: 2.5 US ft • Description: Oblong target

	**S0020** • Click Position 40.7926986424 -73.9062134840 (WGS84) (X) 656526.43 (Y) 714231.84 (Projected Coordinates) • Line Name: SSS_2205171536	**Dimensions and attributes** • Target Length: 43.1 US ft • Target Width: 1.3 US ft • Target Height: 1.2 US ft • Description: Linear targets
	**S0021** • Click Position 40.7926805043 -73.9064812696 (WGS84) (X) 656452.34 (Y) 714224.73 (Projected Coordinates) • Line Name: SSS_2205171627	**Dimensions and attributes** • Target Length: 3.4 US ft • Target Width: 1.8 US ft • Target Height: 1.5 US ft • Description: Oblong target
	**S0022** • Click Position 40.7923693521 -73.9075018611 (WGS84) (X) 656170.53 (Y) 714109.46 (Projected Coordinates) • Line Name: SSS_2205171614	**Dimensions and attributes** • Target Length: 12.0 US ft • Target Width: 7.3 US ft • Target Height: 5.6 US ft • Description: Oblong target
	**S0023** • Click Position 40.7928443570 -73.9073823891 (WGS84) (X) 656202.44 (Y) 714282.73 (Projected Coordinates) • Line Name: SSS_2205171536	**Dimensions and attributes** • Target Length: 6.9 US ft • Target Width: 4.4 US ft • Target Height: 2.5 US ft • Description: Oblong targets, one large feature among smaller features

	**S0024** • Click Position 40.7918042923 -73.9083767240 (WGS84) (X) 655929.69 (Y) 713901.97 (Projected Coordinates) • Line Name: SSS_2205171456	**Dimensions and attributes** • Target Length: 14.7 US ft • Target Width: 5.2 US ft • Target Height: 4.3 US ft • Description: Oblong target
	**S0025** • Click Position 40.7919685991 -73.9083431790 (WGS84) (X) 655938.58 (Y) 713961.89 (Projected Coordinates) • Line Name: SSS_2205171456	**Dimensions and attributes** • Target Length: 7.2 US ft • Target Width: 4.9 US ft • Target Height: 1.4 US ft • Description: Oblong target
	**S0026** • Click Position 40.7920983009 -73.9085331769 (WGS84) (X) 655885.65 (Y) 714008.79 (Projected Coordinates) • Line Name: SSS_2205171456	**Dimensions and attributes** • Target Length: 13.1 US ft • Target Width: 4.1 US ft • Target Height: 1.0 US ft • Description: Oblong target
	**S0027** • Click Position 40.7929261347 -73.9082035406 (WGS84) (X) 655974.89 (Y) 714310.99 (Projected Coordinates) • Line Name: SSS_2205171627	**Dimensions and attributes** • Target Length: 25.0 US ft • Target Width: 4.2 US ft • Target Height: 2.7 US ft • Description: Linear target Feature possibly stretched due to towfish attitude

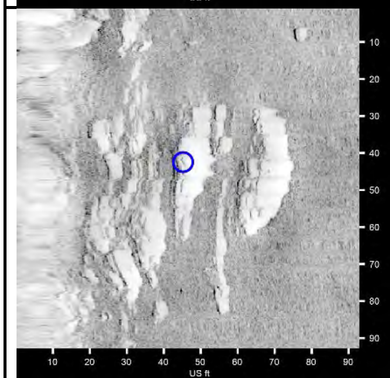
	**S0028** • Click Position 40.7931455155 -73.9081987338 (WGS84) (X) 655975.68 (Y) 714390.92 (Projected Coordinates) • Line Name: SSS_2205171536	**Dimensions and attributes** • Target Length: 9.6 US ft • Target Width: 5.3 US ft • Target Height: 7.3 US ft • Description: Oblong target
	**S0029** • Click Position 40.7933003623 -73.9098490859 (WGS84) (X) 655518.37 (Y) 714444.25 (Projected Coordinates) • Line Name: SSS_2205181333	**Dimensions and attributes** • Target Length: 6.8 US ft • Target Width: 3.6 US ft • Target Height: 8.6 US ft • Description: Oblong target
	**S0030** • Click Position 40.7933488372 -73.9099695580 (WGS84) (X) 655484.89 (Y) 714461.68 (Projected Coordinates) • Line Name: SSS_2205181333	**Dimensions and attributes** • Target Length: 149.9 US ft • Target Width: 1.9 US ft • Target Height: 1.3 US ft • Description: Linear target
	**S0031** • Click Position 40.7939967441 -73.9095464157 (WGS84) (X) 655600.46 (Y) 714698.51 (Projected Coordinates) • Line Name: SSS_2205181214	**Dimensions and attributes** • Target Length: 139.3 US ft • Target Width: 2.3 US ft • Target Height: 1.1 US ft • Description: Multiple linear targets

	**S0032** • Click Position 40.7939897157 -73.9096683543 (WGS84) (X) 655566.71 (Y) 714695.72 (Projected Coordinates) • Line Name: SSS_2205181214	**Dimensions and attributes** • Target Length: 152.6 US ft • Target Width: 1.7 US ft • Target Height: 1.0 US ft • Description: Multiple linear targets
	**S0033** • Click Position 40.7936530016 -73.9102122219 (WGS84) (X) 655416.96 (Y) 714572.04 (Projected Coordinates) • Line Name: SSS_2205171302	**Dimensions and attributes** • Target Length: 13.3 US ft • Target Width: 5.2 US ft • Target Height: 1.9 US ft • Description: Oblong target
	**S0034** • Click Position 40.7935386081 -73.9105523260 (WGS84) (X) 655323.08 (Y) 714529.73 (Projected Coordinates) • Line Name: SSS_2205171302	**Dimensions and attributes** • Target Length: 10.7 US ft • Target Width: 4.6 US ft • Target Height: 4.5 US ft • Description: Oblong target
	**S0035** • Click Position 40.7939727134 -73.9102158252 (WGS84) (X) 655415.18 (Y) 714688.51 (Projected Coordinates) • Line Name: SSS_2205171302	**Dimensions and attributes** • Target Length: 16.5 US ft • Target Width: 6.9 US ft • Target Height: 8.0 US ft • Description: Oblong target



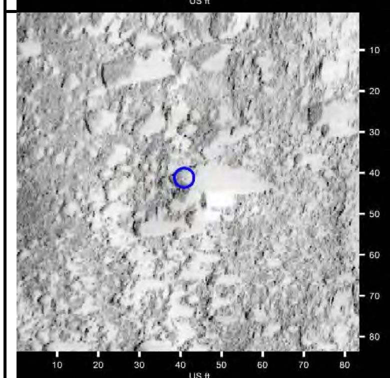
S0036
- Click Position
  40.7944236435 -73.9098666067 (WGS84)
  (X) 655510.76 (Y) 714853.43 (Projected Coordinates)
- Line Name: SSS_2205171302

Dimensions and attributes
- Target Length: 9.6 US ft
- Target Width: 6.6 US ft
- Target Height: 7.3 US ft
- Description: Oblong targets, possibly multiple rocks



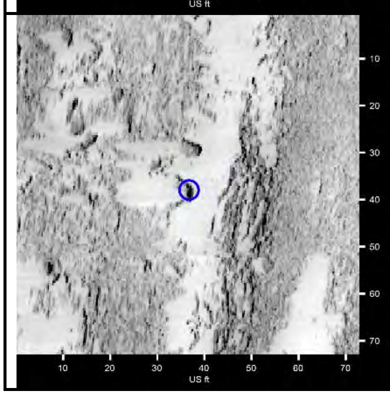
S0037
- Click Position
  40.7945292261 -73.9101744963 (WGS84)
  (X) 655425.26 (Y) 714891.32 (Projected Coordinates)
- Line Name: SSS_2205181201

Dimensions and attributes
- Target Length: 22.5 US ft
- Target Width: 6.1 US ft
- Target Height: 2.7 US ft
- Description: Oblong target, possible rock outcrop



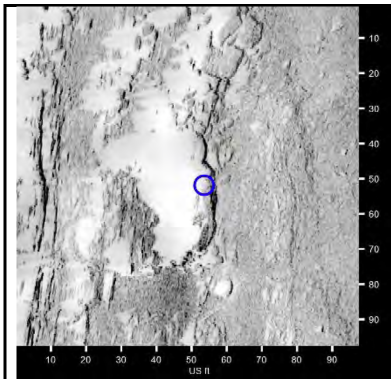
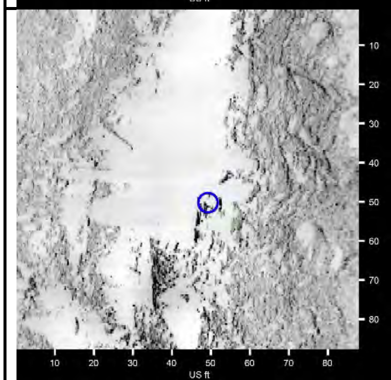
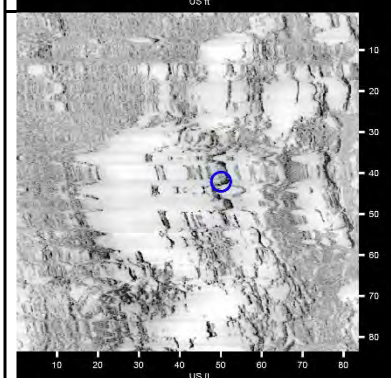
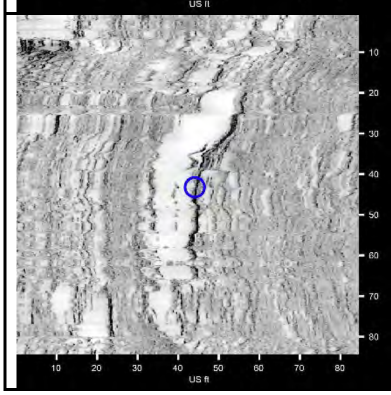
S0038
- Click Position
  40.7933840045 -73.9113672690 (WGS84)
  (X) 655097.82 (Y) 714471.90 (Projected Coordinates)
- Line Name: SSS_2205181743

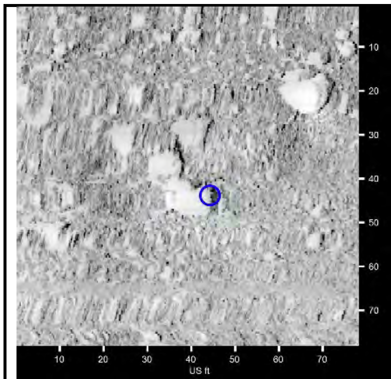
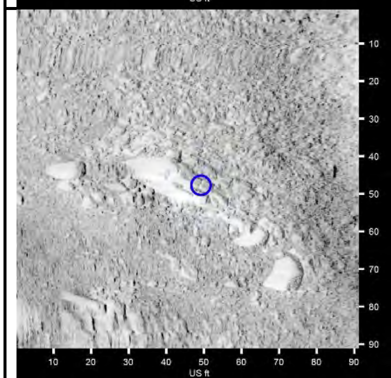
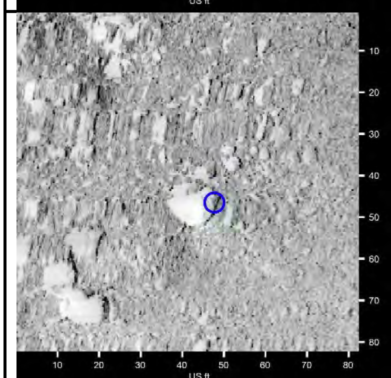
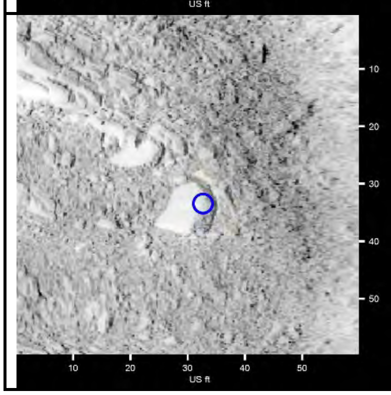
Dimensions and attributes
- Target Length: 9.4 US ft
- Target Width: 5.0 US ft
- Target Height: 3.5 US ft
- Description: Oblong targets, possibly multiple rocks

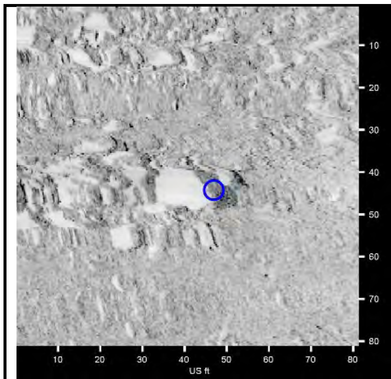
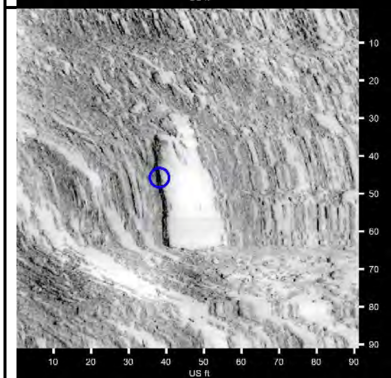
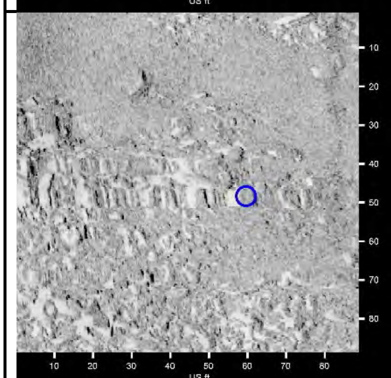
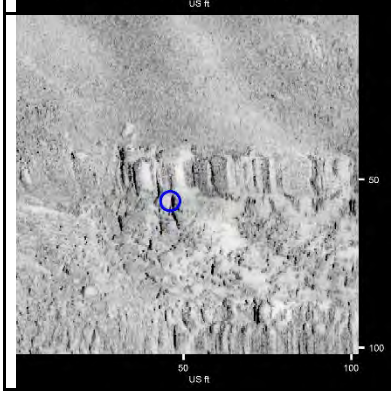


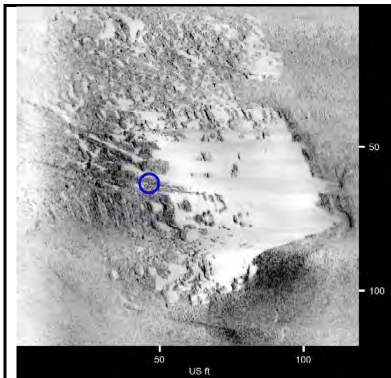
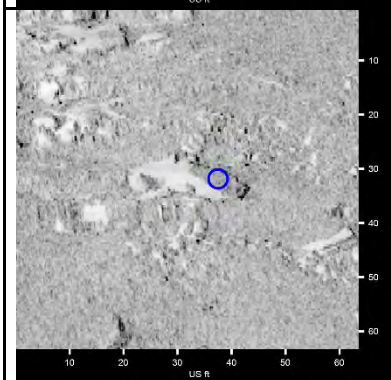
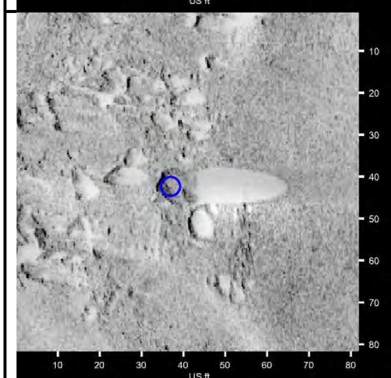
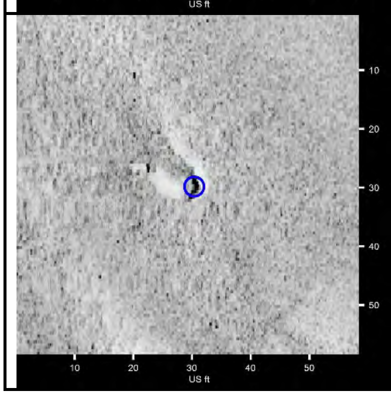
S0039
- Click Position
  40.7938276553 -73.9114821257 (WGS84)
  (X) 655064.94 (Y) 714633.31 (Projected Coordinates)
- Line Name: SSS_2205181808

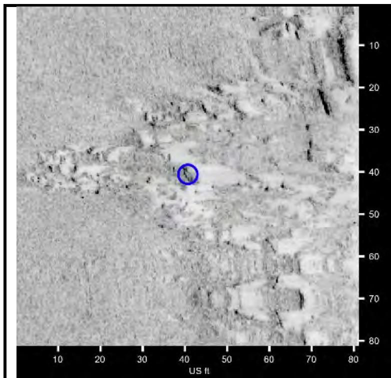
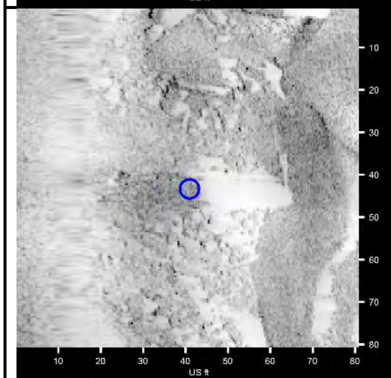
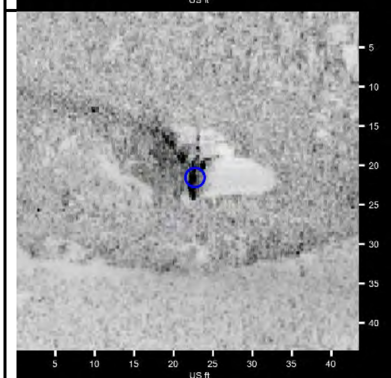
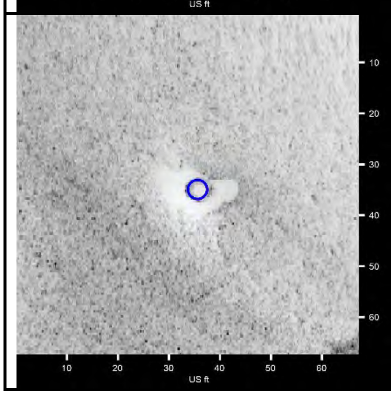
Dimensions and attributes
- Target Length: 6.4 US ft
- Target Width: 4.7 US ft
- Target Height: 1.6 US ft
- Description: Oblong target

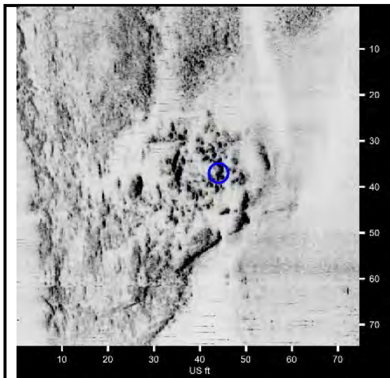
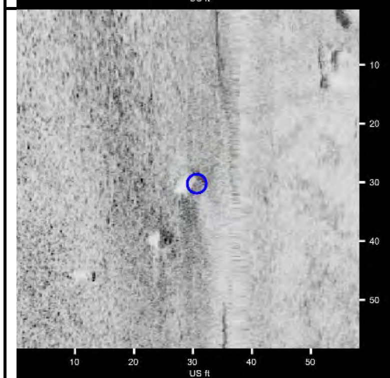
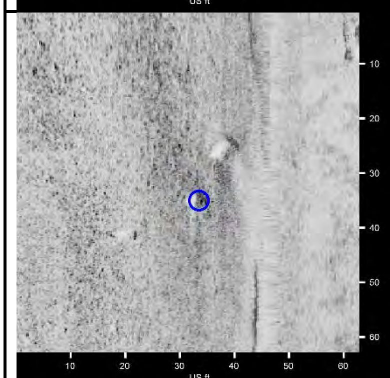
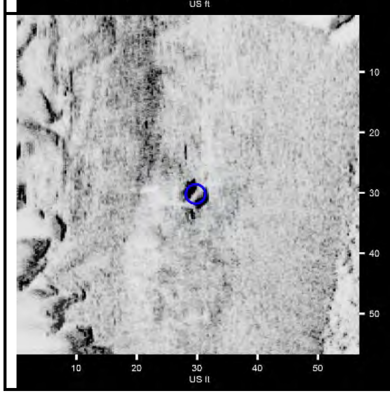
	**S0040** • Click Position 40.7945815193 -73.9110008961 (WGS84) (X) 655196.33 (Y) 714908.83 (Projected Coordinates) • Line Name: SSS_2205181808	**Dimensions and attributes** • Target Length: 35.3 US ft • Target Width: 14.8 US ft • Target Height: 5.7 US ft • Description: Oblong target, possible rock outcrop
	**S0041** • Click Position 40.7934310584 -73.9122105472 (WGS84) (X) 654864.23 (Y) 714487.47 (Projected Coordinates) • Line Name: SSS_2205181808	**Dimensions and attributes** • Target Length: 18.4 US ft • Target Width: 6.1 US ft • Target Height: 7.2 US ft • Description: Oblong target
	**S0042** • Click Position 40.7948938910 -73.9111364384 (WGS84) (X) 655158.04 (Y) 715022.38 (Projected Coordinates) • Line Name: SSS_2205181258	**Dimensions and attributes** • Target Length: 14.5 US ft • Target Width: 10.5 US ft • Target Height: 4.7 US ft • Description: Oblong target, possible rock outcrop
	**S0043** • Click Position 40.7944346587 -73.9116405166 (WGS84) (X) 655019.60 (Y) 714854.14 (Projected Coordinates) • Line Name: SSS_2205181258	**Dimensions and attributes** • Target Length: 46.8 US ft • Target Width: 6.0 US ft • Target Height: 3.0 US ft • Description: Oblong target, possible rock outcrop

	**S0044** • Click Position 40.7946488689 -73.9128810463 (WGS84) (X) 654675.62 (Y) 714929.88 (Projected Coordinates) • Line Name: SSS_2205171718	**Dimensions and attributes** • Target Length: 7.3 US ft • Target Width: 4.1 US ft • Target Height: 4.2 US ft • Description: Oblong target
	**S0045** • Click Position 40.7940703255 -73.9133921685 (WGS84) (X) 654535.52 (Y) 714718.17 (Projected Coordinates) • Line Name: SSS_2205171530	**Dimensions and attributes** • Target Length: 22.3 US ft • Target Width: 8.6 US ft • Target Height: 4.9 US ft • Description: Oblong target
	**S0046** • Click Position 40.7946273857 -73.9130107811 (WGS84) (X) 654639.76 (Y) 714921.81 (Projected Coordinates) • Line Name: SSS_2205171718	**Dimensions and attributes** • Target Length: 9.1 US ft • Target Width: 4.3 US ft • Target Height: 4.8 US ft • Description: Oblong target
	**S0047** • Click Position 40.7941622559 -73.9133606060 (WGS84) (X) 654544.04 (Y) 714751.72 (Projected Coordinates) • Line Name: SSS_2205171530	**Dimensions and attributes** • Target Length: 8.8 US ft • Target Width: 3.6 US ft • Target Height: 5.7 US ft • Description: Oblong target

	**S0048** • Click Position 40.7955668459 -73.9121838420 (WGS84) (X) 654866.41 (Y) 715265.59 (Projected Coordinates) • Line Name: SSS_2205171536	**Dimensions and attributes** • Target Length: 10.2 US ft • Target Width: 5.1 US ft • Target Height: 11.1 US ft • Description: Oblong target
	**S0049** • Click Position 40.7946045745 -73.9132043102 (WGS84) (X) 654586.23 (Y) 714913.14 (Projected Coordinates) • Line Name: SSS_2205171710	**Dimensions and attributes** • Target Length: 23.5 US ft • Target Width: 7.7 US ft • Target Height: 2.7 US ft • Description: Oblong target Feature stretched due to towfish attitude
	**S0050** • Click Position 40.7956739842 -73.9124177502 (WGS84) (X) 654801.39 (Y) 715304.19 (Projected Coordinates) • Line Name: SSS_2205171536	**Dimensions and attributes** • Target Length: 4.3 US ft • Target Width: 3.4 US ft • Target Height: 3.4 US ft • Description: Oblong targets possibly multiple rocks
	**S0051** • Click Position 40.7949622449 -73.9132070215 (WGS84) (X) 654584.61 (Y) 715043.44 (Projected Coordinates) • Line Name: SSS_2205171733	**Dimensions and attributes** • Target Length: 7.9 US ft • Target Width: 5.7 US ft • Target Height: 4.1 US ft • Description: Oblong targets possiblbly group of rocks

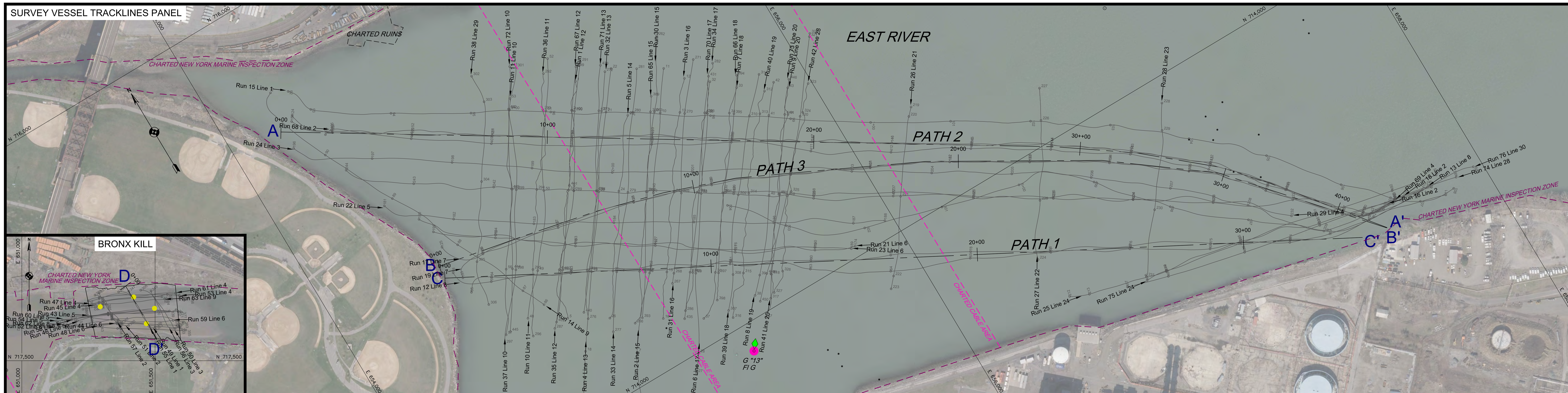
	**S0052** • Click Position 40.7951464802 -73.9131062562 (WGS84) (X) 654612.06 (Y) 715110.74 (Projected Coordinates) • Line Name: SSS_2205171821	**Dimensions and attributes** • Target Length: 42.4 US ft • Target Width: 38.0 US ft • Target Height: 9.9 US ft • Description: Oblong target, possible rock outcrop
	**S0053** • Click Position 40.7957764684 -73.9125747947 (WGS84) (X) 654757.66 (Y) 715341.24 (Projected Coordinates) • Line Name: SSS_2205171536	**Dimensions and attributes** • Target Length: 10.7 US ft • Target Width: 4.1 US ft • Target Height: 4.1 US ft • Description: Oblong target
	**S0054** • Click Position 40.7951619185 -73.9134413024 (WGS84) (X) 654519.26 (Y) 715115.75 (Projected Coordinates) • Line Name: SSS_2205171733	**Dimensions and attributes** • Target Length: 9.3 US ft • Target Width: 7.3 US ft • Target Height: 7.9 US ft • Description: Oblong target
	**S0055** • Click Position 40.7950357246 -73.9136797742 (WGS84) (X) 654453.54 (Y) 715069.33 (Projected Coordinates) • Line Name: SSS_2205171821	**Dimensions and attributes** • Target Length: 5.3 US ft • Target Width: 3.1 US ft • Target Height: 1.9 US ft • Description: Oblong target

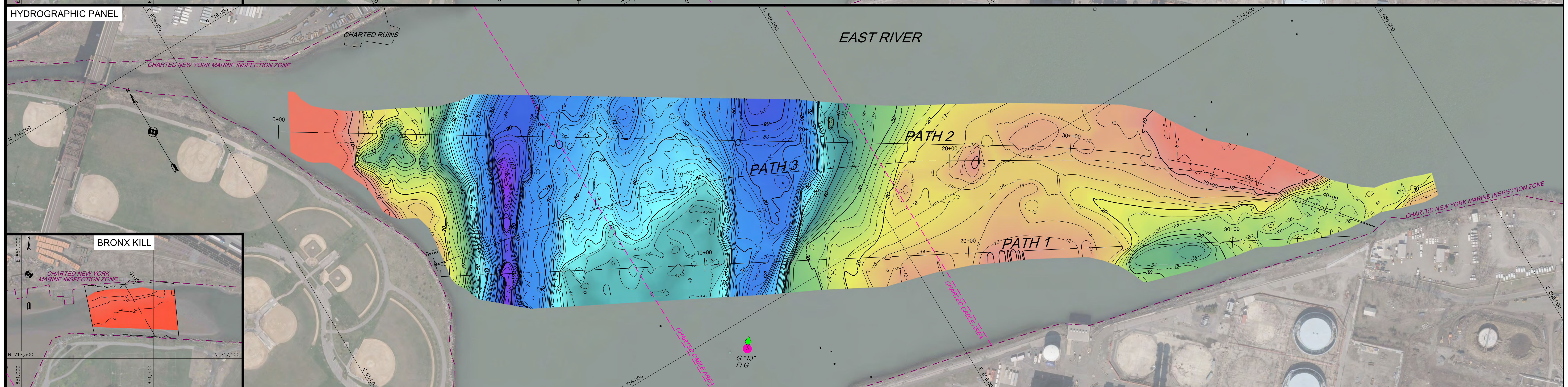
	**S0056** • Click Position 40.7959007762 -73.9129299798 (WGS84) (X) 654659.02 (Y) 715385.86 (Projected Coordinates) • Line Name: SSS_2205171627	**Dimensions and attributes** • Target Length: 4.9 US ft • Target Width: 3.1 US ft • Target Height: 1.7 US ft • Description: Oblong targets, possible group of rocks
	**S0057** • Click Position 40.7952815257 -73.9135696445 (WGS84) (X) 654483.43 (Y) 715159.08 (Projected Coordinates) • Line Name: SSS_2205171821	**Dimensions and attributes** • Target Length: 18.2 US ft • Target Width: 6.8 US ft • Target Height: 9.2 US ft • Description: Oblong target
	**S0058** • Click Position 40.7960534372 -73.9134174886 (WGS84) (X) 654523.68 (Y) 715440.57 (Projected Coordinates) • Line Name: SSS_2205171627	**Dimensions and attributes** • Target Length: 7.7 US ft • Target Width: 4.5 US ft • Target Height: 1.4 US ft • Description: Oblong target
	**S0059** • Click Position 40.7954810974 -73.9139929400 (WGS84) (X) 654365.75 (Y) 715231.00 (Projected Coordinates) • Line Name: SSS_2205171733	**Dimensions and attributes** • Target Length: 4.9 US ft • Target Width: 3.6 US ft • Target Height: 1.2 US ft • Description: Oblong target

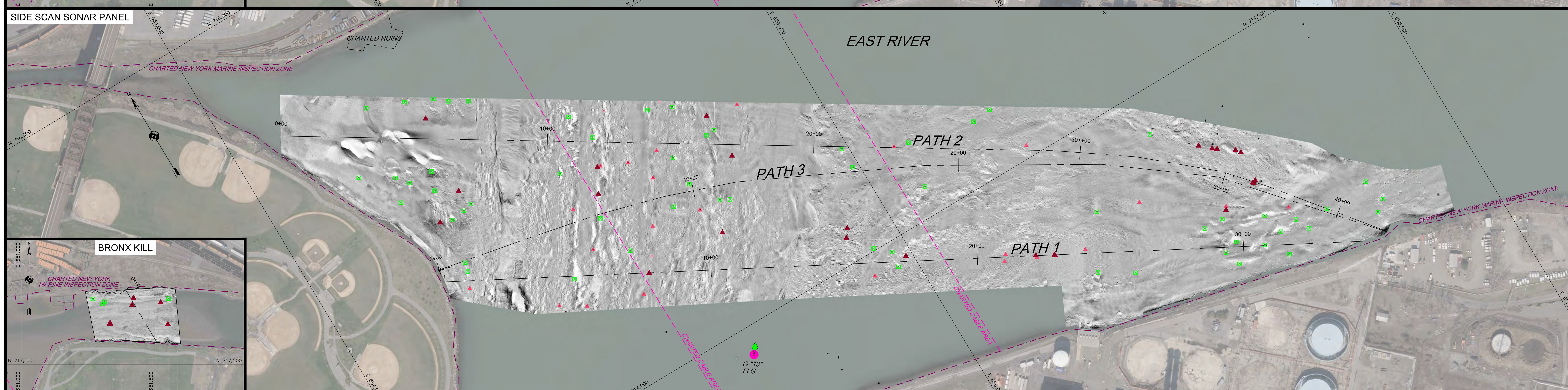
	**S0060** • Click Position 40.8024374181 -73.9241036790 (WGS84) (X) 651549.86 (Y) 717746.67 (Projected Coordinates) • Line Name: SSS_2205181654	**Dimensions and attributes** • Target Length: 29.2 US ft • Target Width: 24.5 US ft • Target Height: 0.2 US ft • Description: Oblong target may appear to be pile of rocks
	**S0061** • Click Position 40.8024106076 -73.9249705935 (WGS84) (X) 651309.93 (Y) 717735.32 (Projected Coordinates) • Line Name: SSS_2205181657	**Dimensions and attributes** • Target Length: 4.2 US ft • Target Width: 2.2 US ft • Target Height: 0.8 US ft • Description: Oblong target
	**S0062** • Click Position 40.8023874066 -73.9249969206 (WGS84) (X) 651302.70 (Y) 717726.82 (Projected Coordinates) • Line Name: SSS_2205181657	**Dimensions and attributes** • Target Length: 3.4 US ft • Target Width: 2.3 US ft • Target Height: 0.5 US ft • Description: Oblong target
	**S0063** • Click Position 40.8024398806 -73.9251277468 (WGS84) (X) 651266.36 (Y) 717745.70 (Projected Coordinates) • Line Name: SSS_2205181654	**Dimensions and attributes** • Target Length: 5.2 US ft • Target Width: 3.3 US ft • Target Height: 0.2 US ft • Description: Oblong target

APPENDIX 3

PROJECT DRAWING







LOCATION MAP

LEGEND

GENERAL:

10+00 — CENTERLINE STATIONING IN FEET

SURVEY VESSEL TRACKLINES PANEL:

SURVEY VESSEL TRACKLINE WITH EVENT NUMBERS

A—A' REPRESENTATIVE SUBBOTTOM PROFILE LOCATION

PUSH PROBE LOCATION

HYDROGRAPHIC PANEL:

—10— MAJOR HYDROGRAPHIC CONTOUR

—7— MINOR HYDROGRAPHIC CONTOUR

ELEVATION (NAVD 88, FEET)

−25 −50 −75 −100

SIDE SCAN SONAR PANEL:

SIDE SCAN SONAR TARGET

MAGNETIC ANOMALY CLASSIFICATION:

CLASS 1: ≤ 25 GAMMAS

CLASS 2: 25–100 GAMMAS

CLASS 3: > 100 GAMMAS

PROFILE PANEL:

AB REFLECTOR

NOTES

1. GRID SYSTEM IS THE NEW YORK STATE PLANE COORDINATE SYSTEM, EAST ZONE, NAD 83, U.S SURVEY FEET.
2. ELEVATIONS ARE IN FEET AND ARE REFERENCED TO NAVD 88 BASED ON NYNET RTK GNSS CORRECTORS.
3. CONTOURS ARE IN FEET AND WERE GENERATED USING QUICKSURF OPERATING WITHIN AUTODESK AUTOCAD.
4. BOTTOM FEATURES AND GEOLOGICAL INTERPRETATIONS ARE BASED ON THE ANALYSIS OF SIDE SCAN SONAR, SUBBOTTOM PROFILER, AND MAGNETOMETER DATA. DEPTHS BELOW THE BOTTOM TO ACOUSTICAL REFLECTORS HAVE BEEN DETERMINED USING AN ACOUSTIC VELOCITY OF 5,000 FEET/SEC. ADDITIONAL INFORMATION REGARDING THE INTERPRETATION PRESENTED CAN BE FOUND IN OSI REPORT NO. 22ES017.
5. CHARTED FEATURES ARE APPROXIMATE AND WERE PLOTTED FROM NOAA ENC CHART NO. US5NYCFH AND US5NY1DE (DATED 14 APRIL 2022).
6. SHORELINE AND ONSHORE FEATURES ARE APPROXIMATE AND WERE TAKEN FROM DIGITAL ORTHOPHOTO QUADRANGLES FLOWN IN 2020 AND OBTAINED FROM THE NYS GIS CLEARINGHOUSE.
7. THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 16–19 MAY 2022 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

SURVEY VESSEL: R/V NORTH COVE	ECHOSOUNDER: ODOM ECHOTRAC E20
NAVIGATION SYSTEM: TRIMBLE SPS-461 IN REAL TIME KINEMATIC MODE	
SURVEY ACQUISITION SOFTWARE: HYPACK, SONARPRO	SIDE SCAN SONAR: KLEIN 3000
MAGNETOMETER: GEOMETRICS 882	SUBBOTTOM PROFILER: APPLIED ACOUSTICS 200J 0.5–8 kHz BOOMER
SURVEY PROCESSING SOFTWARE: HYPACK, CHESAPEAKE SONARWIZ	

SCALE: 1"=200'

200 0 200 400 600

CHECK GRAPHIC SCALE BEFORE USING

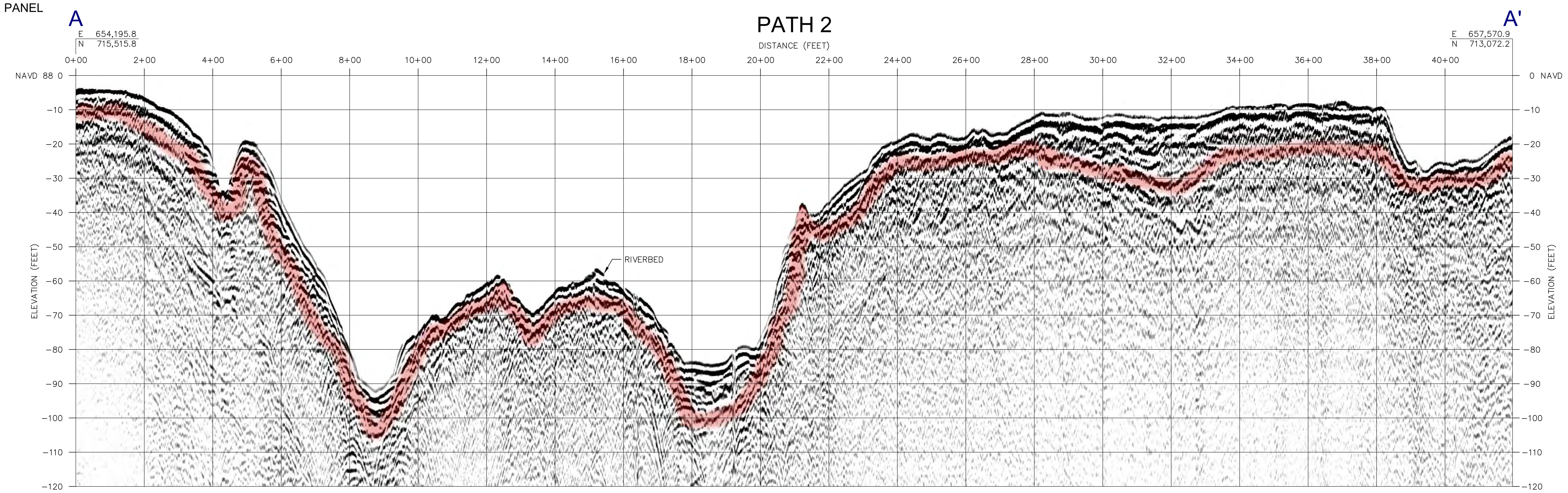
OCEAN SURVEYS, INC.
OLD SAYBROOK, CONNECTICUT
(860) 388-4631
www.oceansurveys.com

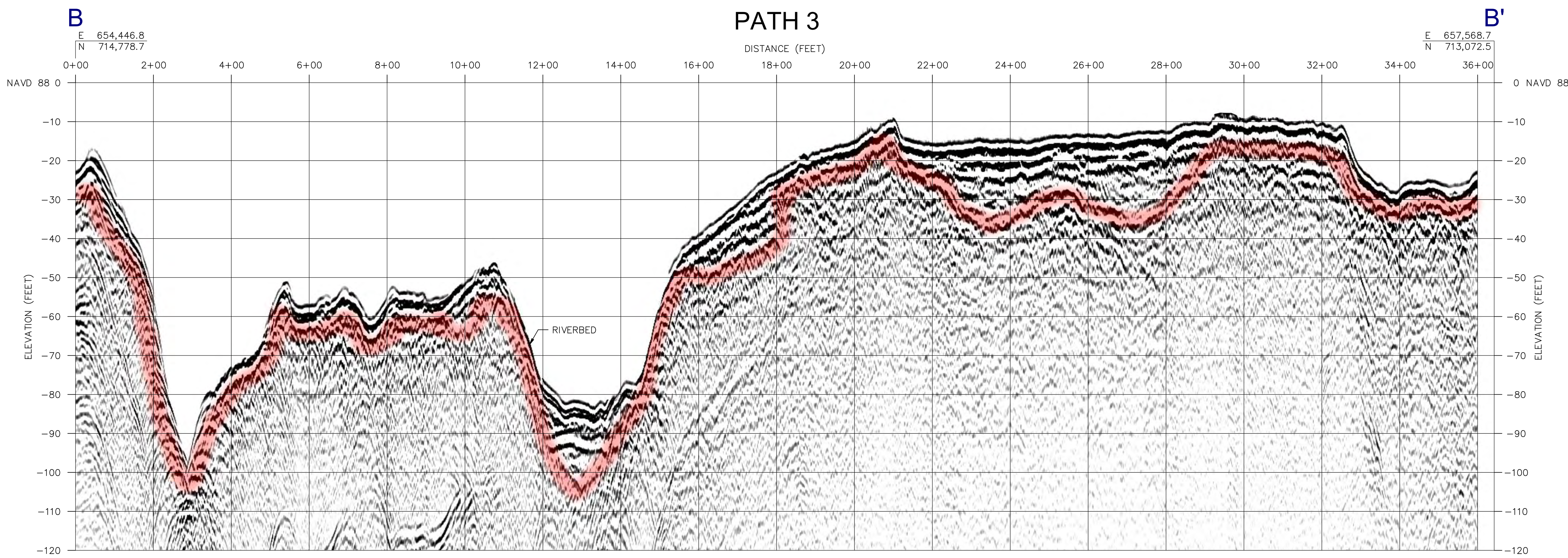
PREPARED FOR: BRIERLEY ASSOCIATES, LLC

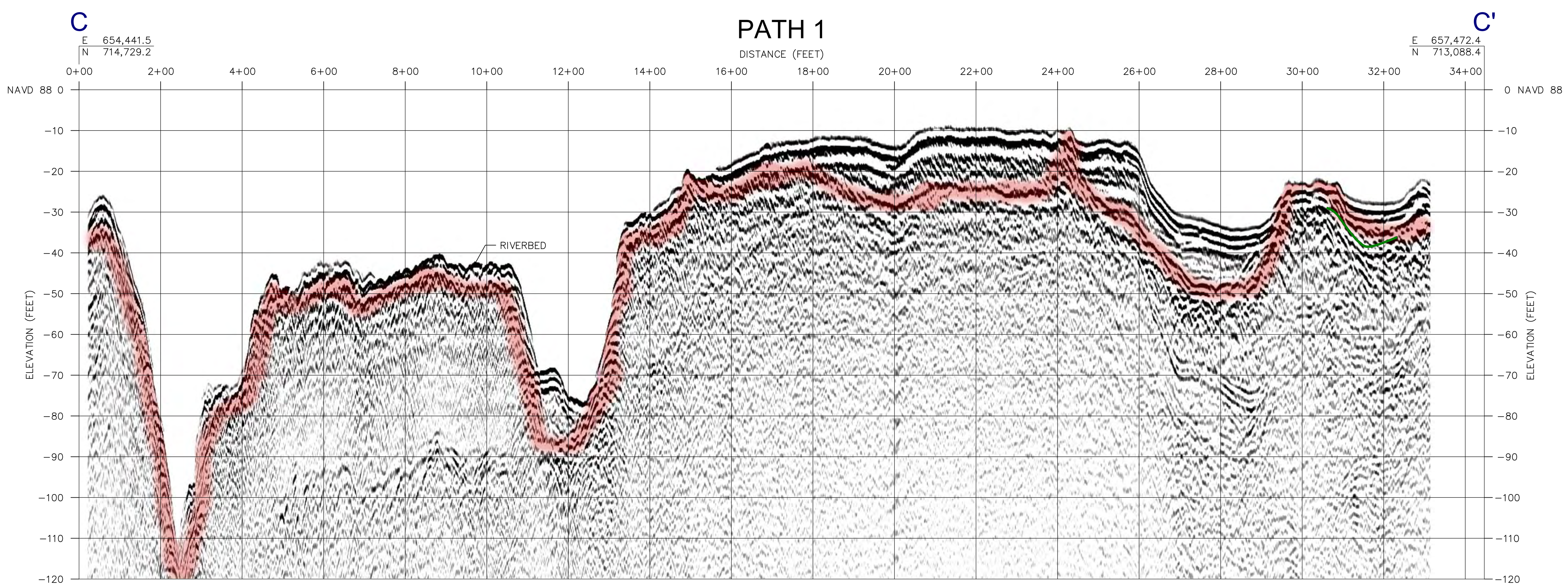
MARINE GEOPHYSICAL RESULTS
PROPOSED HDD CROSSINGS
EAST RIVER & BRONX KILL
NEW YORK, NEW YORK

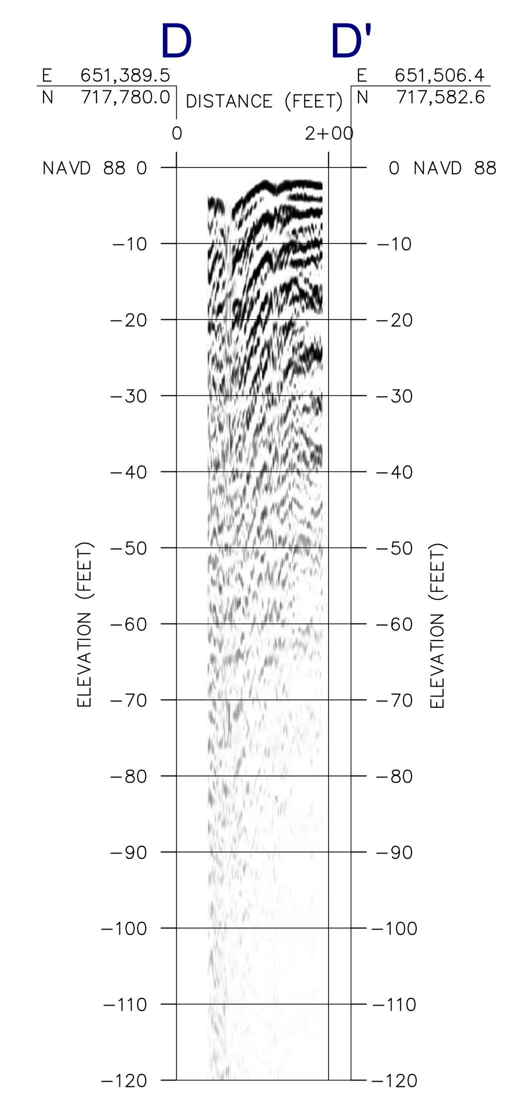
PROJECT MANAGER: J. SULLIVAN	SURVEY DATE: 16–19 MAY 2022	PROJECT NUMBER: 22ES017	
DRAFTED BY: A. RIZZO	DATE: 20 JUNE 2022	DRAWING: 1	SHEET: 1 OF 2

PROFILE PANEL









LOCATION MAP

LEGEND

GENERAL:

10+00 — CENTERLINE STATIONING IN FEET

SURVEY VESSEL TRACKLINES PANEL:

SURVEY VESSEL TRACKLINE WITH EVENT NUMBERS

A—A' REPRESENTATIVE SUBBOTTOM PROFILE LOCATION

PUSH PROBE LOCATION

HYDROGRAPHIC PANEL:

—10— MAJOR HYDROGRAPHIC CONTOUR

—7— MINOR HYDROGRAPHIC CONTOUR

ELEVATION (NAVD 88, FEET)

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AB REFLECTOR

NOTES

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2. ELEVATIONS ARE IN FEET AND ARE REFERENCED TO NAVD 88 BASED ON FPRN RTK GNSS CORRECTORS. PROJECT CONTROL BENCHMARK WAS "872 2125 E" (PID DM4024) WHICH HAS AN ELEVATION OF 3.96 FEET NAVD 88 PER AN OPUS SHARED SOLUTION FROM 2017–01–24.
3. CONTOURS ARE IN FEET AND WERE GENERATED USING QUICKSURF OPERATING WITHIN AUTODESK AUTOCAD.
4. BOTTOM FEATURES AND GEOLOGICAL INTERPRETATIONS ARE BASED ON THE ANALYSIS OF SIDE SCAN SONAR, SUBBOTTOM PROFILER, AND MAGNETOMETER DATA. DEPTHS BELOW THE BOTTOM TO ACOUSTICAL REFLECTORS HAVE BEEN DETERMINED USING AN ACOUSTIC VELOCITY OF 5,000 FEET/SEC. ADDITIONAL INFORMATION REGARDING THE INTERPRETATION PRESENTED CAN BE FOUND IN OSI REPORT NO. 22ES017.
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Geotechnical Data Report (Rev. 1)
Downstate Segment: Randall's Island, Bronx and Queens Counties, NY
Champlain Hudson Power Express

Submission Date: June 02, 2022 (Revised July 22, 2022)

Prepared by:
AECOM
40 British American Blvd.
Latham, New York 12110

On behalf of:
Transmission Developers, Inc.
1301 Avenue of the Americas
New York, NY 10019-6022

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Michael A. Izdebski
____
Lead Field Geologist: Michael Izdebski

____
Prepared By: Carsten H. Floess, P.E.

____
Reviewed By: Walter O. Howard, P.G. (NY)

____
Approved By: Peter Montalvo, PMP

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Appendix C Rock Core Photographic Logs
Appendix D Thermal Resistivity Laboratory Test Data Reports
Appendix E Geotechnical Laboratory Test Data Reports
Appendix F Investigation Derived Waste Transport and Disposal Documentation

1.0 Introduction

AECOM USA, Inc. (AECOM), under contract with Transmission Developers, Inc. (TDI), conducted a geotechnical boring investigation along the Randall's Island segment of the Champlain Hudson Power Express (CHPE) upland cable route. This segment extends approximately 2.3 miles between the Bronx and Queens Counties, New York.

The investigation includes 8 borings drilled along the cable route, with 2 borings on Waste Management (WM) property within the Harlem River Yard (HRY) Intermodal Facility in the Bronx (BR-1 & BR-4), 3 borings within Randall's Island Park (BR-2, BR-3, & RA-1), and 3 borings at the Con Edison (Con Ed) Astoria Generating Complex (AGC) in Astoria, Queens (RA-2, RA-3, & RA-4). The three borings made within Randall's Island Park in June 2021 (BR-2, BR-3, & RA-1) were previously summarized in AECOM's February 2, 2022, *Geotechnical Data Report* for this segment. This revised report (Rev. 1) incorporates the results of the 2 borings drilled on WM property in February 2022 and the 3 borings drilled at the Con Ed Astoria Generating Complex in March 2022.

1.1 Report Organization

This report provides a general overview of the boring investigation and associated geotechnical and thermal resistivity (TR) laboratory testing (Section 2). This is followed by a summary of findings for the Randall's Island upland segment (Section 3).

1.2 Project Team

Test borings were made by Aquifer Drilling & Testing, Inc. (ADT), a Cascade Company, of Mineola, NY, under subcontract to TDI. Geotechnical laboratory testing was performed by TerraSense, LLC (TerraSense), of Totowa, NJ, under subcontract to ADT.

Thermal resistivity (TR) testing was performed by GeothermUSA, LLC (GeothermUSA), of Cypress, TX, under subcontract to TDI.

1.3 Randall's Island Segment Overview

The submarine cable segment in the Harlem River transitions to the Randall's Island upland segment within the HRY Intermodal Facility in the Bronx. The proposed cable route then crosses under the Bronx Kill to Randall's Island. After traversing Randall's Island Park, the cable crosses under the East River to the Con Ed Astoria Generating Complex in Astoria, Queens, where it terminates at the proposed CHPE Converter Station.

Horizontal directional drilling (HDD) will be used to install twin cables at the two river crossings in this segment. The remainder of the cable route will be constructed using cut & cover construction. It is understood that, in the cut & cover sections, the cable will typically be buried at depths of about 5 to 13 feet.

1.4 HDD Overview

Horizontal directional drilling (HDD) will be used to install twin cables at the two river crossings in this segment:

1. Under the Bronx Kill between the Bronx and Randall's Island. It is understood that this HDD will extend about 30 feet below the river mudline and continue to approximately the midpoint of Randall's Island. The cables will be "stacked" with (plan view) lengths on the order of 1,900 feet for the upper cable and 2,100 feet for the lower cable.

2. Under the East River between Randall's Island and Astoria, Queens. It is understood that this HDD will extend about 40 feet below the river mudline. The cables will be "side-by-side" and have (plan view) length on the order of 3,700 feet.

It is also understood that HDD may be used where the subaqueous cable enters the Harlem River Yard. Details of this HDD, if needed, are still under development at this time.

1.5 General Geologic Setting

The Astoria-Rainey cable segment is located at the southern end of the Manhattan Prong physiographic province of New England (Figure 2). It abuts the boundary with the Atlantic Coastal Plain province to the east. Bedrock in the region generally comprises extensively metamorphosed rock of late Precambrian age, mainly gneisses and schists. Geologic references indicate the bedrock surface in the vicinity of the cable route ranges between approximately 0 and 50 feet below mean sea level.

Unconsolidated sediments overlying bedrock in the region consist of sand, gravel, some cobbles and boulders, and silt and clay deposits of glacial and post-glacial origin.

1.6 Previous Investigations

No previous subsurface investigations were made for the CHPE project along the Randall's Island segment.

1.7 Investigation Objectives

Primary objectives include:

- Evaluate subsurface conditions along the upland route to allow the upland contractor to optimize means and methods of construction.
- Collect deep subsurface data for use in HDD design and construction.
- Perform laboratory TR testing of representative soil and rock samples to establish TR values for heat dissipation purposes in cable system design.
- Perform geotechnical laboratory testing to characterize representative soil samples.
- Perform geotechnical laboratory testing to estimate the hardness and strength of representative rock core samples.

2.0 Field Investigation Overview

A total of 8 test borings were drilled along this 2.3-mile upland cable segment:

- BR-1 and BR-4 on WM property in the Bronx (February 2022);
- BR-2, BR-3, and RA-1 on Randall's Island (June 2021); and
- RA-2, RA-3, and RA-4 on Con Ed property in Astoria (March 2022).

In total, this results in nominal boring spacing on the order of a half mile or less.

ADT was selected to drill borings for the upland cable route based on competitive bids and best value. All field work was observed by an AECOM engineer or geologist, who logged the borings and collected soil and rock samples for laboratory testing.

This section provides an overview of the field program and associated laboratory testing.

2.1 Permitting and Con Ed Work Requirements

<u>Randall's Island Borings (BR-2, BR-3 & RA-1):</u> ADT, in conjunction with AECOM and TDI, procured a Construction Permit from the City of New York Department of Parks & Recreation for the three borings located within Randall's Island Park.

<u>Waste Management Borings (BR-1 & BR-4):</u> TDI, in conjunction with AECOM and ADT, coordinated with Waste Management (WM) to drill two borings within WM property in the HRY Intermodal Facility.

<u>Con Ed Borings RA-2, RA-3, & RA-4):</u> Prior to field work, TDI, in conjunction with AECOM and ADT, coordinated with Con Ed for a License Agreement to drill borings on Con Ed property. As part of that agreement, AECOM provided submittals for Con Ed approval under Con Ed's "Construction Requirements for Advancing Soil Borings", which included procedures to clear drilling locations of underground utilities and to containerize and manage investigation derived waste (IDW). As part of these Requirements, during intrusive drilling activities, AECOM also implemented full-time work-zone perimeter air-monitoring for volatile organic compounds and particulates in accordance with the New York State Department of Health Generic Community Air Monitoring Plan (CAMP).

Although this was not an environmental investigation, under Con Ed's requirements, AECOM monitored subsurface materials encountered in the test borings for evidence of potential petroleum and/or manufactured gas plant (MGP) impacts. AECOM provided Con Ed's Construction EHS staff daily updates and weekly status reports of environmental observations from the borings, CAMP monitoring results, and IDW management and waste characterization testing activities.

As indicated on the logs for Boring RA-2, RA-3, and RA-4 made on Con Ed property, a faint "burnt" odor was noted at depths of 3 to 7 feet in Boring RA-3. Otherwise, no evidence of petroleum and/or manufactured gas plant (MGP) impacts was observed. In addition, none of the CAMP results warranted action.

2.2 Utility Clearance

Randall's Island Borings (BR-2, BR-3 & RA-1): Prior to mobilization, ADT used AECOM's proposed boring plan drawings and coordinates to field-stake the borings. At that time, ADT also used its own ground penetrating radar (GPR) equipment to scan the planned boring locations for potential subsurface utilities, debris, or obstructions. ADT also called in underground utility markout requests to DigSafelyNY for the borings.

Waste Management Borings (BR-1 & BR-4): Prior to mobilization, ADT used AECOM's proposed boring plan drawings and coordinates to field-stake the borings. At that time, ADT also used its own ground penetrating radar (GPR) equipment to scan the planned boring locations for potential subsurface utilities, debris, or obstructions. ADT also called in underground utility markout requests to DigSafelyNY for the borings.

Con Ed Borings (RA-2, RA-3, & RA-4): ADT coordinated with Con Ed to clear utilities and other interferences at the proposed boring locations. As required by Con Ed, a formal site walk was held prior to mobilization to review the boring locations, attended by ADT, AECOM, and Con Ed. At that time, ADT also used its own ground penetrating radar (GPR) equipment to scan the planned boring location for potential subsurface utilities, debris, or obstructions. Under NYS Code Rule 753, ADT also called in underground utility markout requests to DigSafelyNY for the borings.

During the drilling program, ADT used soft dig techniques (exclusively hand auger) to advance each boring to a minimum of 5 feet below the ground surface to verify that no shallow underground utilities were present at the boring locations.

2.3 Subsurface Investigation

A total of 8 geotechnical borings were drilled along this upland cable alignment by ADT. The work was completed in three phases:

- June 2021 (Randall's Island);
- February 2022 (Waste Management property); and
- March 2022 (Con Ed property)

Truck-mounted CME-LC-55 and CME 85 drill rigs were used. Boring locations are shown on plans attached as Appendix A and are summarized below:

Boring No.	Location	Cable Installation	Boring Depth (feet)
BR-4	HRY, Bronx	Entry from Harlem River to HRY (Possible HDD)	82
BR-1	HRY, Bronx	HDD under Bronx Kill	70
BR-2	Randall's Island	HDD under Bronx Kill	52

BR-3	Randall's Island	Continuation of Bronx Kill HDD into Randall's Island	40
RA-1	Randall's Island	HDD under East River	80
RA-2	Con Ed Astoria Generating Complex, Queens	HDD under East River	78.5
RA-3	Con Ed Astoria Generating Complex, Queens	Cut & Cover (possible HDD)	39
RA-4	Con Ed Astoria Generating Complex, Queens	Cut & Cover (possible HDD)	47

Borings were drilled using casing to stabilize the borehole with wash water to clear drill cuttings.

At each boring location, continuous split spoon samples with Standard Penetration Tests (SPTs) were obtained to a depth of about 16 feet, followed by standard 5-foot sampling intervals to boring termination. Where encountered, bedrock was cored using NQ-sized core barrels.

Boring information is summarized in Table 1. The intent is to provide a convenient overview of available subsurface data along the length of this upland route. Refer to the boring logs for more detailed information.

AECOM boring logs are presented in Appendix B.

2.3.1 Soil Sampling

Soil samples were obtained in all borings using a stainless steel, thick-wall, ring-lined drive sampler (modified California sampler), in accordance with ASTM-D3550. The dimensions of the sampler were 3.0-inch outside diameter (O.D.), by 2.5-inch inside diameter (I.D.), by 24.0-inch length. The interior wall of the sampler was lined with three removable 6.0-inch long sleeve rings, with 2.5-inch O.D. and 2.4-inch I.D., and a non-lined 6.0-inch long section. The modified California sampler was driven with a 140-lb automatic hammer free-falling 30 inches.

Note that the blow counts per 6-inch interval indicated on the boring logs represent raw field data. The SPT N-values indicated on the logs, however, have been corrected (correction factor provided on boring logs) for the non-standard size of the California sampler, in accordance with ASTM-D1586. Therefore, the indicated N-values shown on the boring logs can be used directly to assess soil compactness/consistency; no further correction is needed.

2.3.2 Rock Coring

Rock coring was performed in general accordance with ASTM D2113. An NQ-size core barrel (2.97-inch O.D., 1.88-inch I.D., 1.875-inch core diameter) was used to core bedrock. Rock Quality Designation (RQD) was calculated in accordance with ASTM D6032. Measured RQD values are discussed in later report sections. Rock Quality, as used herein, is based on the following correlation to RQD values:

RQD, %	Rock Quality
90-100	Excellent
75-90	Good
50-75	Fair
25-50	Poor
0-25	Very Poor

A rock core photographic log is presented as Appendix C.

2.3.3 Groundwater Measurements

No groundwater observation wells were installed for this investigation.

Because casing drive-and-wash methods were used to advance the borings, reliable groundwater measurements could not be obtained during drilling operations. In addition, borings were generally backfilled immediately after completion, allowing insufficient time for water levels to stabilize in the borehole, particularly where low permeability clay soils were encountered.

Because of these limitations, groundwater levels recorded on the boring logs were sometimes inferred from observations of the moisture conditions of the soil samples (e.g., a sample visually judged to be “saturated” infers that it is likely below groundwater). In some borings, it was not possible to estimate groundwater levels. Water levels in such borings are indicated on the logs as “not encountered” or “not observed.” Note that this does not necessarily suggest that groundwater is deeper than the boring, but only that it could not be measured in the borehole.

Groundwater data based on these observation techniques are summarized in Table 1. Note that actual groundwater levels may differ from those recorded because water levels were not provided sufficient time to stabilize in boreholes and because of variations due to seasonal and weather conditions.

It is important to note that groundwater levels in close proximity to the Harlem River, Bronx Kill, and East River are likely controlled by the adjacent river level and may be tidally influenced.

2.4 Boring Location Survey and Datum

As-drilled boring coordinates and elevations were surveyed by ADT using a Trimble R8 GNSS mapping grade GPS receiver and TSC3 controller.

In this report, the vertical elevations provided by ADT are referenced to the North American Vertical Datum of 1988 (NAVD88). The measured elevations are accurate to at least ±0.1 feet, according to ADT. Lateral geometric locations from ADT are based upon the New York State Plane Coordinate System and North American Datum of 1983 (NAD83).

2.5 Thermal Resistivity Testing

Laboratory Thermal Resistivity (TR) testing was performed by GeothermUSA on representative soil and rock samples selected by AECOM. Because field TR testing was not performed, GeothermUSA developed a modified field sampling and laboratory testing protocol, which was reviewed and approved by NKT (cable supplier). This protocol is summarized below:

1. Soil samples were obtained using a modified California sampler with stainless-steel sampler rings (described previously). Samples selected for laboratory TR testing were sealed directly in their sampling ring, providing a “relatively undisturbed” sample. The intent was to collect samples that preserved, to the extent practicable, the in-situ soil density and moisture content.
2. When it was not feasible to obtain such “undisturbed” samples (e.g., within the soft dig zone), bulk samples were obtained. GeothermUSA performed 1-point modified Proctor density tests on the bulk samples to provide a reference density, compacting laboratory samples to 95% of the modified Proctor maximum dry density. This conforms to a “dense” state. Although this procedure does not necessarily produce laboratory samples that match field densities, GeothermUSA believes it will provide reasonable results.
3. Because field TR testing was not performed, no information is available regarding the ambient temperature in the ground at sample locations. Nevertheless, GeothermUSA indicated that the TR values obtained from the modified field sampling and laboratory TR testing program would provide reasonable and useful results, suitable for determining suggested TR design values for use by NKT to evaluate heat dissipation in cable system design.

GeothermUSA performed TR testing on a total of 45 samples collected by AECOM during the investigation. These are summarized by the general soil/rock sample type, as follows:

Summary of Laboratory Thermal Resistivity Sample Testing Randall's Island Segment					
SOIL SAMPLE TESTS					ROCK SAMPLE TESTS
SAND	GRAVELLY SAND/ SANDY GRAVEL	SILTY CLAY, CLAYEY SILT	SILTY CLAYEY SAND with or without Organics	SAND/SILT & CLAY/ GRAVEL MIXTURE (TILL)	GNEISS or SCHIST
9	10	4	2	4	16

GeothermUSA's laboratory test reports are attached as Appendix D. GeothermUSA's reports also include suggested TR values corresponding to the estimated cable depth at each boring location. Cable depths at boring locations were estimated by AECOM. For convenience, the suggested TR values at each boring location are summarized in Table 2.

Note that GeothermUSA's laboratory test reports in Appendix D also include data for the Astoria-Rainey segment of the CHPE project. These data points are not applicable to the Randall's Island segment and should be ignored.

Note that GeothermUSA's suggested TR values strictly apply to the estimated cable depth at the boring location, as estimated by AECOM. For any locations where the cable depth is changed during final design development, GeothermUSA should be consulted to determine if suggested TR values need to be modified.

2.6 Geotechnical Laboratory Testing

Geotechnical laboratory testing was performed by TerraSense. This included index testing to characterize soil, and strength and hardness tests to characterize rock. Testing was performed on representative soil and rock samples selected by AECOM. A total of 38 samples were tested, including 26 soil samples and 12 rock core samples. Testing is summarized as follows:

Summary of Laboratory Geotechnical Testing									
Segment	SOIL SAMPLE TESTS					ROCK SAMPLE TESTS			
	Visual Classification	Water Content	Sieve and Hydrometer	Liquid & Plastic Limits	Organic Content	Water Content	Unit Weight	Mohs Hardness	Unconfined Strength
	D2488	D2216	D6913 & D792	D4318	D2974				D7012
Randall's Island	26	26	26	6	3	12	12	12	12

Laboratory test data for soil samples are summarized in Table 3. Laboratory test data for rock core samples are summarized in Table 4. Note that Table 4 also includes a summary of measured RQD values. Detailed laboratory test reports are attached as Appendix E.

Note that the TerraSense laboratory test reports also include data for the Astoria-Rainey segment of the CHPE project. These Astoria-Rainey test reports are not applicable to the Randall's Island segment and should be ignored.

3.0 Summary of Findings: Randall's Island

This overland segment extends approximately 2.3 miles from the HRY Intermodal Facility in the Bronx, crossing under the Bronx Kill to Randall's Island, and then crossing under the East River from Randall's Island to the Con Ed Astoria Generating Complex in Astoria, Queens.

3.1 Subsurface Investigation

Eight test borings have been completed by AECOM for this segment (BR-1 and BR-4 located on WM property in the Bronx; BR-2, BR-3, and RA-1, all located on Randall's Island; and RA-2, RA-3, and RA-4 located on Con Ed property in Queens).

Borings are designated by the prefixes "BR" (Bronx-Randall's Island) and "RA" (Randall's Island-Astoria). Boring locations are shown on plans attached as Appendix A. AECOM boring logs are attached as Appendix B.

Based on Con Ed requirements, all IDW (drilling spoils) generated from the borings made on Con Ed property was drummed for subsequent offsite disposal. A total of 3 drums of IDW was generated from borings RA-2, RA-3 and RA-4 and staged in Con Ed's drum storage area until the waste could be profiled and shipped to the disposal facility. Drummed waste was sampled for waste characterization analyses by Innovative Recycling Technologies, Inc. (IRT), an ADT subcontractor, in accordance with Con Ed and the selected disposal facility requirements. With Con Ed and TDI approval, IRT transported the IDW to the Republic Environmental Systems (PA) Clean Earth facility in Hatfield, PA, for treatment/disposal. IDW transport and disposal documentation is provided in Appendix F.

Borings are summarized in Table 1.

3.2 Geologic Conditions

3.2.1 Surficial Geology Mapping

Surficial geology mapping and as-drilled boring locations are shown in Figure 3.

Mapping indicates glacial till soils in the Bronx and Astoria portions of this cable segment, with artificial fill in Randall's Island.

3.2.2 Bedrock Geology Mapping

Bedrock geology mapping and as-drilled boring locations are presented in Figure 4.

Bedrock mapping indicates several rock types along the cable route. From (cable) north to south, these include:

- Fordham Gneiss
- Inwood Marble
- Manhattan Formation
- Inwood Marble

- Fordham Gneiss
- Harrison Gneiss

3.3 Soil Investigation Results

Principal soil strata found along this cable alignment are summarized in the following sections. Note that some variation and layering may occur within these principal strata; for detailed information, refer to the boring logs.

The cable route in this segment is typically located near the shore of the Harlem River, Bronx Kill, and the East River. It also crosses Randall's Island, which was artificially filled. Therefore, significant urban fill deposits should be anticipated along this segment route. The thickness and characteristics of fill can be highly variable, although the borings indicate that it is generally granular material.

3.3.1 Fill

Sand and gravel fill with bricks and asphalt was encountered in the borings, extending to depths of about 8 to 27 feet. These soils are typically brown sand and gravel with trace to little silt, and trace organics. The fill contained ash, cinders, rock, brick, asphalt, and other building debris.

Based on SPT blow counts, the sand and gravel fill soils are typically loose to medium dense. Occasional split spoon refusal is interpreted to reflect the presence of cobbles, boulders, or large-sized debris.

Although this was not an environmental investigation, it is noted that a faint odor (burnt smell) was observed in shallow soils in Boring RA-3 on Con Ed property. Evidence of contamination, based on visual, olfactory, and photoionization detector screening of soil samples, was not observed in Borings RA-2 and RA-4, also made on Con Ed property. Refer to the appended boring logs for details.

3.3.2 Silty Clay

Silt and clay soil was encountered underlying the fill in some of the borings, notably at the Astoria Generating Complex. This soil is interpreted to be buried river and swamp deposits. Typically, these soils are gray silt and clay, with trace organics, and minor percentages of sand and gravel. The silty clay layers encountered in the borings had thickness ranging from about 5 to 10 feet.

Based on SPT blow counts, these silt and clay soils are generally soft.

3.3.3 Sand and Gravel

Sand and gravel soils were encountered underlying the fill and extending to top of glacial till or to bedrock. These soils are typically brown sand and gravel with trace of organics, and they include layers of clayey silt with little to trace organics.

Based on SPT blow counts, the sand and gravel soils are typically loose to medium dense. The intermittent clayey silt layers are typically medium stiff to stiff.

3.3.4 Glacial Till

Glacial till soils were encountered in Boring BR-2 beginning at a depth of about 24.5 feet, where drilling refusal occurred, and extending to bedrock. The upper part of this stratum, to a depth of about 44.5 feet, was sampled with a core barrel. Although core recovery was poor, making interpretation difficult, this upper zone is inferred to be cobbles and boulders. Below about 44.5 feet, the glacial till soil is brown silt with little to trace sand and gravel. Based on SPT blow count, this till soil is generally very dense, typically with split spoon sampler refusal (defined as > 50 blows per 6" penetration).

Glacial till soils were also encountered in Boring BR-4 at a depth of about 73 feet and in Boring RA-3 at a depth of about 26 feet.

3.4 Bedrock Investigation Results

Bedrock was encountered in the following borings:

Boring No.	Depth to Rock, feet	Remarks
BR-1	19	
BR-3	22	
RA-1	30	
RA-2	50	Decomposed rock at 42'
RA-3	30	

Bedrock encountered in this segment is schist and gneiss.

3.4.1 Schist

Schist bedrock (Manhattan Formation) was encountered in Boring BR-3. The schist is generally grey and grey-white, hard, moderately fractured, and moderately weathered with oxidation staining. Measured RQD values range from 7 to 82 percent, averaging approximately 49 percent. On average, this corresponds to "poor" to "fair" rock quality.

Laboratory unconfined compressive strengths of representative core samples ranged from 8,000 to 12,000 psi, averaging approximately 10,000 psi. Mohs hardness values ranged from 8 to 9.

3.4.2 Gneiss

Gneiss bedrock (Fordham Gneiss) was encountered in Borings BR-1, RA-1, RA-2, and RA-3. The gneiss is generally black, hard, very slightly fractured, with occasional vertical fractures. Measured RQD values range from 38 to 100 percent; however, they average 84 percent, corresponding to "good" rock quality.

Laboratory unconfined compressive strengths of representative core samples ranged from 9,000 to 31,000 psi, averaging approximately 19,000 psi. Mohs hardness values ranged from 5 to 9.

3.5 Thermal Resistivity Values

TR testing conducted during the investigation is described in Section 2.5. GeothermUSA performed laboratory TR testing on a total of 45 samples collected by AECOM from the Randall's Island segment. Suggested TR Values included in GeothermUSA's report (Appendix D) are summarized as follows:

Suggested Thermal Resistivity Values: Randall's Island Segment			
Boring No.	Milepost	Estimated Cable Depth (ft)	Suggested TR Value* (˚C-cm/W)
BR-1	0.46	5'-10"	100
BR-2	0.60	46'-6""	75
BR-3	0.84	10'-5"	120
BR-4	0.20	6'-3"	80
		14'-3"	110
		26'-3"	95
		31'-3"	85
		76'-3"	80
RA-1	1.41	38'-8"	70
RA-2	2.11	5'-10"	80
RA-3	2.21	5' to 10'	90
RA-4	2.30	5' to 10'	90

* - Suggested TR values from GeothermUSA (reports dated July 30, 2021 & April 25, 2022), correspond to the estimated cable depths provided by AECOM at each boring location. GeothermUSA should be consulted for modifications in suggested TR values wherever cable depths are changed.

3.6 Generalized Subsurface Conditions

Based on the three borings made for this segment and available mapping, it is anticipated that soils along the cable route will generally include urban fill at the surface, underlain by soft silt and clay soils, and then followed by sand, silt, and gravel deposits and dense glacial till.

Mapping indicates that bedrock is variable, including the Fordham and Harrison Gneiss, Inwood Marble, and the Manhattan Formation.

Because borings are widely spaced, and geologic mapping is not precise, variation from these generalized (or anticipated) conditions should be expected.

3.6.1 Bedrock Conditions at HDDs

Bedrock conditions at HDDs are summarized below.

	Bedrock Conditions at HDD Locations						
HDD	Approximate HDD MP		Approximate Length (feet)	Boring No.	Boring Depth (feet)	Depth to Bedrock (feet)	Type of Rock
	Start MP	End MP					
Entry From Harlem River (if needed)	TBD	TBD	TBD	BR-4	82	>82	-
Bronx Kill Crossing	0.46	0.85	1,900 (Upper HDD) 2,100 (Lower HDD)	BR-1	70	20	GNEISS
				BR-2	52	>52	-
				BR-3	40	22	SCHIST
East River Crossing	1.4	2.11	3,700	RA-1	80	30	GNEISS
				RA-2	78.5	50	GNEISS

4.0 Limitations

4.1 General

This report has been prepared solely for the Randall's Island Upland Segment of the Champlain Hudson Power Express project.

4.2 Subsurface Information

The following limitations should be considered when using the boring data in this report:

- Soil and rock conditions, by their nature, can be highly variable. The widely spaced borings are intended to only provide a general indication of subsurface conditions along the upland cable route. Variation from conditions found at boring locations should be expected.
- The placement of fill and prior construction activities contribute to subsurface variability, especially at the shallow depths where cut and cover construction is planned.
- The stratification lines shown on the individual boring logs represent approximate boundaries between soil types; the transition may be gradual.
- Suggested TR values from GeothermUSA (reports dated July 30, 2021 & April 25, 2022), correspond to the estimated cable depths provided by AECOM at each boring location. GeothermUSA should be consulted for modifications in suggested TR values wherever cable depths are changed.
- Being outside the scope of work, this report offers no facts related to potential contaminants along the upland route other than what is stated or noted on the boring logs.

5.0 References

Geologic Map of New York, Lower Hudson Sheet, Fisher, D.W., Isachsen, Y.W., and Rickard, L.V., The University of the State of New York, The State Education Department, 1970, Reprinted 1995.

Surficial Geologic Map of New York, Lower Hudson Sheet, Cadwell, D.H., The University of the State of New York, The State Education Department, 1989.

Bedrock and Engineering Geologic Maps of Bronx County and Parts of New York and Queens County, New York, Miscellaneous Investigation Series, Map I-2003 (Sheet 1 of 2), Bedrock Sheet, Baskerville, C.A., U.S. Department of the Interior, U.S. Geological Survey, 1992.

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Subsurface Geology and Paleogeography of Queens County, Long Island, New York, Soren, J., U.S. Geological Survey, Water Resources Investigations 77-34, Open File Report, 1978.

Tables

Table 1: Summary of Test Borings Bronx, Randall's Island to AGC Receiving Pit Segment										
Boring No.	Approx. Mile Post	Total Depth of Boring (ft.)	Generalized Soil Conditions	Depth to Top of Bedrock (ft)	Type of Rock	Remarks	Depth to Water (ft.)	Northing (2)	Easting (2)	Top of Boring Elevation (1)
BR-1	0.46	70	Sand, Gravel	19	GNEISS	-	~10	231769.52	1004985.70	9.571
BR-2	0.59	52	Sand and Gravel/Till	-	-	-	~10	231170.86	1005447.71	9.2
BR-3	0.86	40	Sand & Gravel	22	SCHIST		~10	230106.95	1006207.64	10.4
BR-4	0.19	82	Sand, Gravel, Decomposed Rock (Fill)	-	-	-	~10	232421.11	1003933.71	10.5
RA-1	139	80	Fill (sand & gravel w/brick)/Sand & Gravel	30	GNEISS	-	~10	228681.71	1007966.69	12.0
RA-2	2.11	78.5	Sand, Gravel (Fill)	50	GNEISS	-	~10+ (tidal)	226849.03	1011267.97	12.2
RA-3	2.21	39	Sand, Gravel (Fill) over Silty Clay	30	GNEISS	-	not observed	226450.19	1011554.93	8.0
RA-4	2.3	47	Sand, Gravel	-	-	-	~11.7	226260.88	1011955.67	13.4

Notes:
(1) Elevations refer to NAVD88
(2) Northing and Easting in NYS Plane East (ft.)
N/A- Surveyor unable to record elevation.

Table 2: Suggested Thermal Resistivity Values Bronx, Randall's Island to AGC Converter Station			
Boring No.	**Milepost**	**Estimated Cable Depth (ft)**	**Suggested TR Value [1] (˚C-cm/W)**
BR-1	0.46	5' 10''	100
BR-2	0.59	46' 6''	75
BR-3	0.86	10' 5''	120
BR-4	0.19	6'-3"	80
		14'-3"	110
		26'-3"	95
		31'-3"	85
		76'-3"	80
RA-1	139	38' 8''	70
RA-2	2.11	5' 10"	80
RA-3	2.21	5' to 10'	90
RA-4	2.3	5' to 10'	90

[1] - Suggested TR value from GeothermUSA (reports dated July 30, 2021 and April 25, 2022), corresponds to the estimated cable depth provided by AECOM at each boring location. GeothermUSA should be consulted for modifications in suggested TR values wherever cable depths are changed.

Table 3: Summary of Geotechnical Laboratory Test Results: Soil Samples
Bronx, Randall's Island to AGC Receiving Pit Segment

Boring ID	Sample ID	Depth (ft)	USCS Symbol	% Gravel	% Sand	% Silt	% Clay	LL [1] (%)	PL [2] (%)	PI [3] (%)	Water Content (%)	Org. Content (%)
BR-1	S-3	7-9	SW-SM	16	76	5	3	-	-	-	16.6	
	-	15-17	SM	0	86.8	10.2	3	-	-	-	21.7	
BR-2	S-5	20-22	SW-SM	36	52	9	3	-	-	-	10.7	-
	S-7	44.5-46.5	SC	17	59	17	7	26	15	11	8.9	-
BR-3	S-4	10-12	SW	38	61	1	0	-	-	-	22.8	-
	S-5	12-14	OH	2	4	61	33	99	35	64	73.1	4.2
	S-7	20-22	SP-SM	38	55	6	1	-	-	-	8.4	-
BR-4	S-6	20-22	GP	79	19	1	1	-	-	-	7.2	-
	S-7	25-27	CH	0.1	5.3	94.6	-	77	30	47	56.1	-
	S-8	30-32	SP-SM	0.8	87.7	8.5	3	-	-	-	26.3	-
	S-10	40-42	SP-SM	4	94	1	1	-	-	-	19.4	-
	S-15	60-61.5	ML	0	32.1	67.9	-	-	-	-	26.5	-
	S-16	61.5-62	CL	0	4.5	95.5	-	36	18	18	32.6	-
RA-1	No lab testing conducted on soil from this boring due to insufficient sample recovery											
RA-2	S-1	5-7	SC	18	60	19	3	-	-	-	28.2	-
	S-7	20-22	GP	95	4	1	0	-	-	-	9.4	-
	S-11A	40-41.5	CH	6	34	39	21	70	32	38	71.0	3.2
	S-12	45-47	SM	40	45	12	3	-	-	-	14.0	-
RA-3	S-2	5-7	GP-GM	63	31	5	1	-	-	-	11.9	-
	S-3	7-9	GW	85	13	2	0	-	-	-	4.9	-
	S-6	13-15	CL	7	25	58	10	38	22	16	35.3	2.6
	S-9	26-26.5	GP-GM	61	33	5	1	-	-	-	6.6	-
RA-4	S-4	9-11	SM	21	65	11	3	-	-	-	16.6	-
	S-6	15-17	GP	79	19	2	0	-	-	-	4.2	-
	S-9	30-32	SW-SM	7	87	5	1	-	-	-	15.1	-
	S-11	36-37	SP-SM	0	89.5	8.5	2	-	-	-	25.8	-
	S-12	45-46	SP	0.9	94.9	3.2	1	-	-	-	24.5	-

Notes:
(1) LL = Liquid Limit
(2) PL = Plastic Limit
(3) PI = Plasticity Index
(4) SG = Specific Gravity

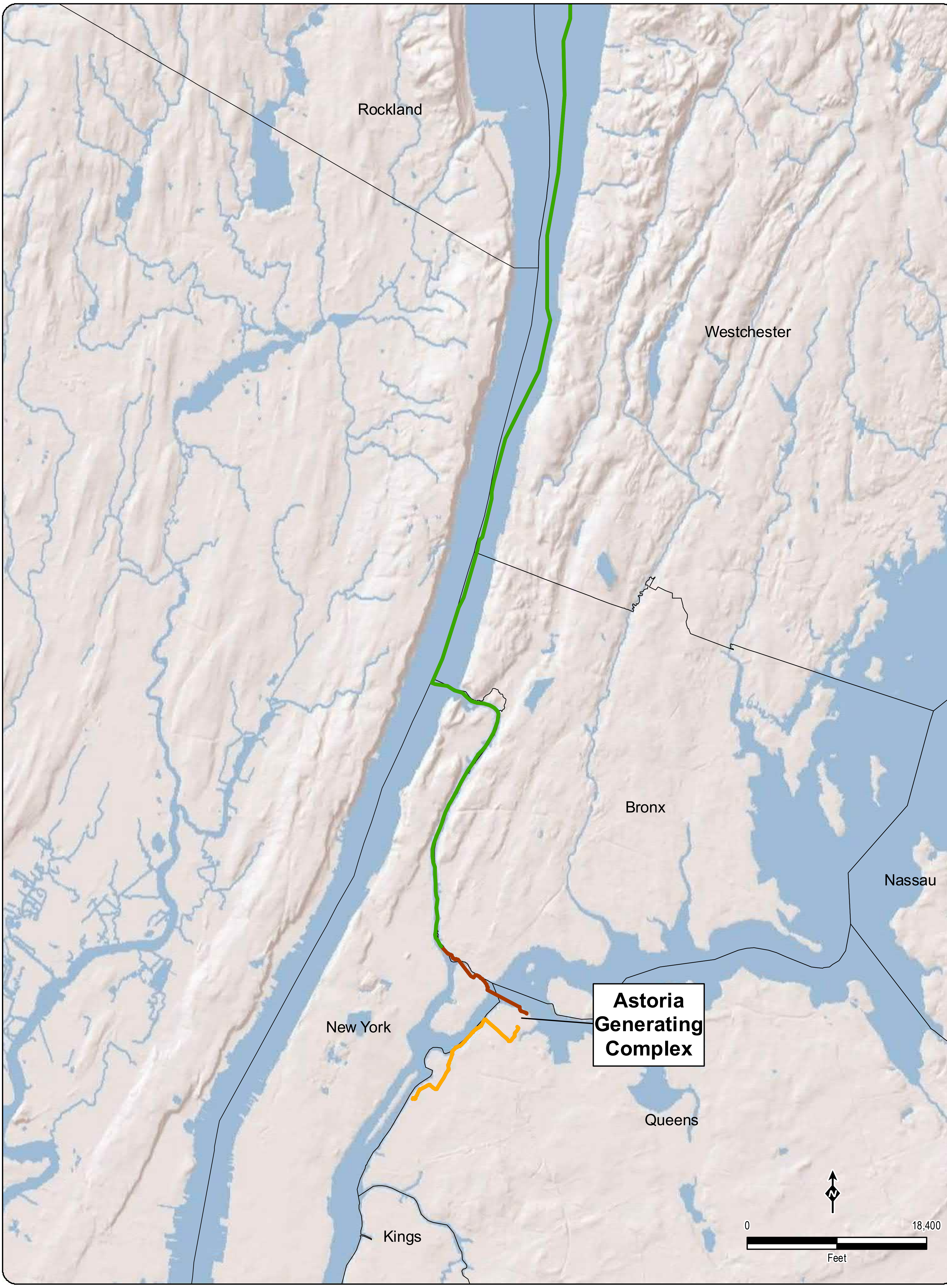
Table 4: Summary of Geotechnical Laboratory Test Results: Rock Samples
Bronx, Randall's Island to AGC Receiving Pit Segment

Boring ID	Core Run	Depth (ft)	Rock Type	RQD %	Water Content %	Dry Unit Weight (pcf)	Mohs Hardness	Unconfined Compressive Strength Test			Point Load Test		
								Compressive Strength (psi)	Axial Strain (%)	Estimated Elastic Modulus (psi)	Sample Orientation	Strength Index (Is50) (psi)	Estimated Compressive Strength (psi)
BR-1	R-1	20-25	Gneiss	47	-	-	-	-	-	-	-	-	-
	R-2	25-30		79	0.1	166	5	27930	0.32	9.00E+06	-	-	-
	R-3	30-33		100	-	-	-	-	-	-	-	-	-
	R-4	33-35		65	-	-	-	-	-	-	-	-	-
	R-5	35-40		91	-	-	-	-	-	-	-	-	-
	R-6	40-45		78	-	-	-	-	-	-	-	-	-
	R-7	45-50		100	0.2	164	6	30720	0.39	8.00E+06	-	-	-
	R-8	50-55		92	-	-	-	-	-	-	-	-	-
	R-9	55-60		79	-	-	-	-	-	-	-	-	-
	R-10	60-65		93	-	-	-	-	-	-	-	-	-
	R-11	65-70		98	0.2	162	5	31050	0.35	9.00E+06	-	-	-
BR-3	R-1	25-30	Schist	56.7	0.3	164	9	8040	0.26	4.00E+06	-	-	-
	R-2	30-35		7	-	-	-	-	-	-	-	-	-
	R-3	35-40		82	0.2	167	8	12030	0.21	7.00E+06	-	-	-
RA-1	R-1	32-35	Gneiss	93	0.2	177	8	20100	0.24	9.00E+06	-	-	-
	R-2	35-40		96	-	-	-	-	-	-	-	-	-
	R-3	40-45		98	0.2	178	9	17510	0.21	9.00E+06	-	-	-
	R-4	45-40		64	-	-	-	-	-	-	-	-	-
	R-5	50-55		90	0.1	186	8	21120	0.2	1.00E+07	-	-	-
	R-6	55-60		95	-	-	-	-	-	-	-	-	-
	R-7	60-65		100	-	-	-	-	-	-	-	-	-
	R-8	65-70		92	0.1	177	9	14130	0.21	8.00E+06	-	-	-
	R-9	70-75		94	-	-	-	-	-	-	-	-	-
	R-10	75-80		90	-	-	-	-	-	-	-	-	-
RA-2	R-1	55-60	Gneiss	38	-	-	-	-	-	-	-	-	-
	R-2	55-60		81	0.2	173	8	8990	0.25	4.00E+06	-	-	-
	R-3	70-75		83	-	-	-	-	-	-	-	-	-
	R-4	70-75		90	-	-	-	-	-	-	-	-	-
	R-5	70-75		100	0.2	168	9	8880	0.22	5.00E+06	-	-	-
	R-6	70-75		100	-	-	-	-	-	-	-	-	-
RA-3	R-1	31.8-34.0	Gneiss	53	-	-	-	-	-	-	-	-	-
	R-2	34-39		40	0.1	172	7-8	10280	0.18	6.00E+06	-	-	-

Table 5: Bedrock Conditions at HDD Locations						
Bronx, Randall's Island to AGC Receiving Pit Segment						
Approximate HDD MP		**Approximate Length (feet)**	**Boring No.**	**Boring Depth (feet)**	**Depth to Bedrock (feet)**	**Type of Rock**
Start MP	**End MP**					
* TBD	* TBD	* TBD	BR-4	82	>82	-
0.46	0.85	1,900 (Upper HDD) 2,100 (Lower HDD)	BR-1	70	**20**	**GNEISS**
			BR-2	52	>52	-
			BR-3	40	**22**	**SCHIST**
1.4	2.11	3,700	RA-1	80	**30**	**GNEISS**
			RA-2	78.5	**50**	**GNEISS**

* Entry from Harlem River, if needed.

Figures



LEGEND

Certified Route

- Terrestrial Route HVDC (Randall's Island Segment)
- Terrestrial Route HVAC (Astoria-Rainey Segment)
- Submarine Route HVDC
- County

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

Project Location Overview
Figure 1

Prepared by: AECOM 5/31/2022

DATA SOURCES: ESRI, NETWORK MAPPING 2010, NYSDOT, OPRHP, TDI, TRC

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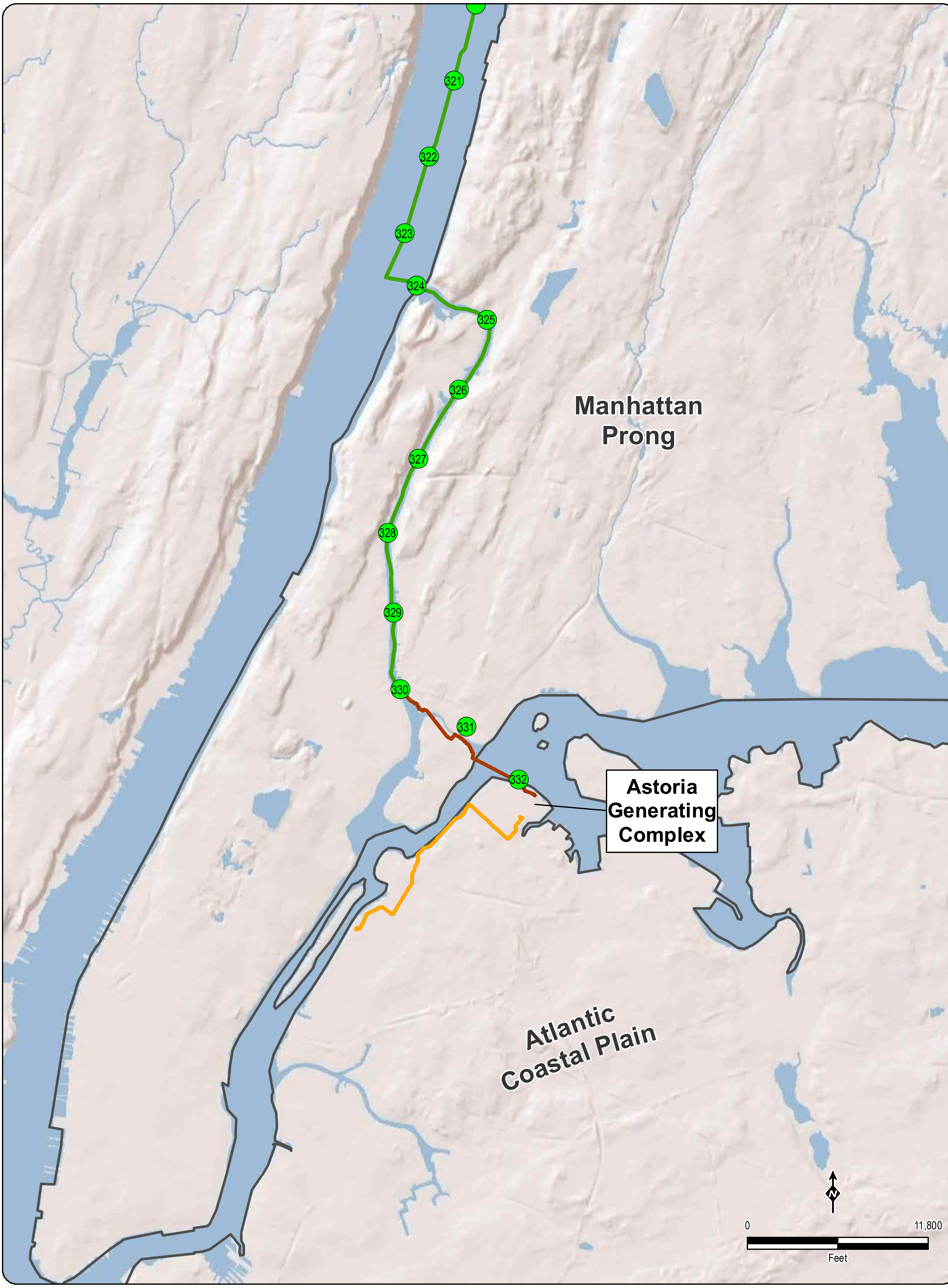

LEGEND

Certified Milepost

Certified Route

- Terrestrial Route HVDC (Randall's Island Segment)
- Terrestrial Route HVAC (Astoria-Rainey Segment)
- Submarine Route HVDC
- Physiographic Provinces

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

Physiographic Overview
Figure 2

Prepared by: AECOM 5/31/2022

DATA SOURCES: ESRI, NETWORK MAPPING 2010, NYSDOT, OPRHP, TDI, TRC

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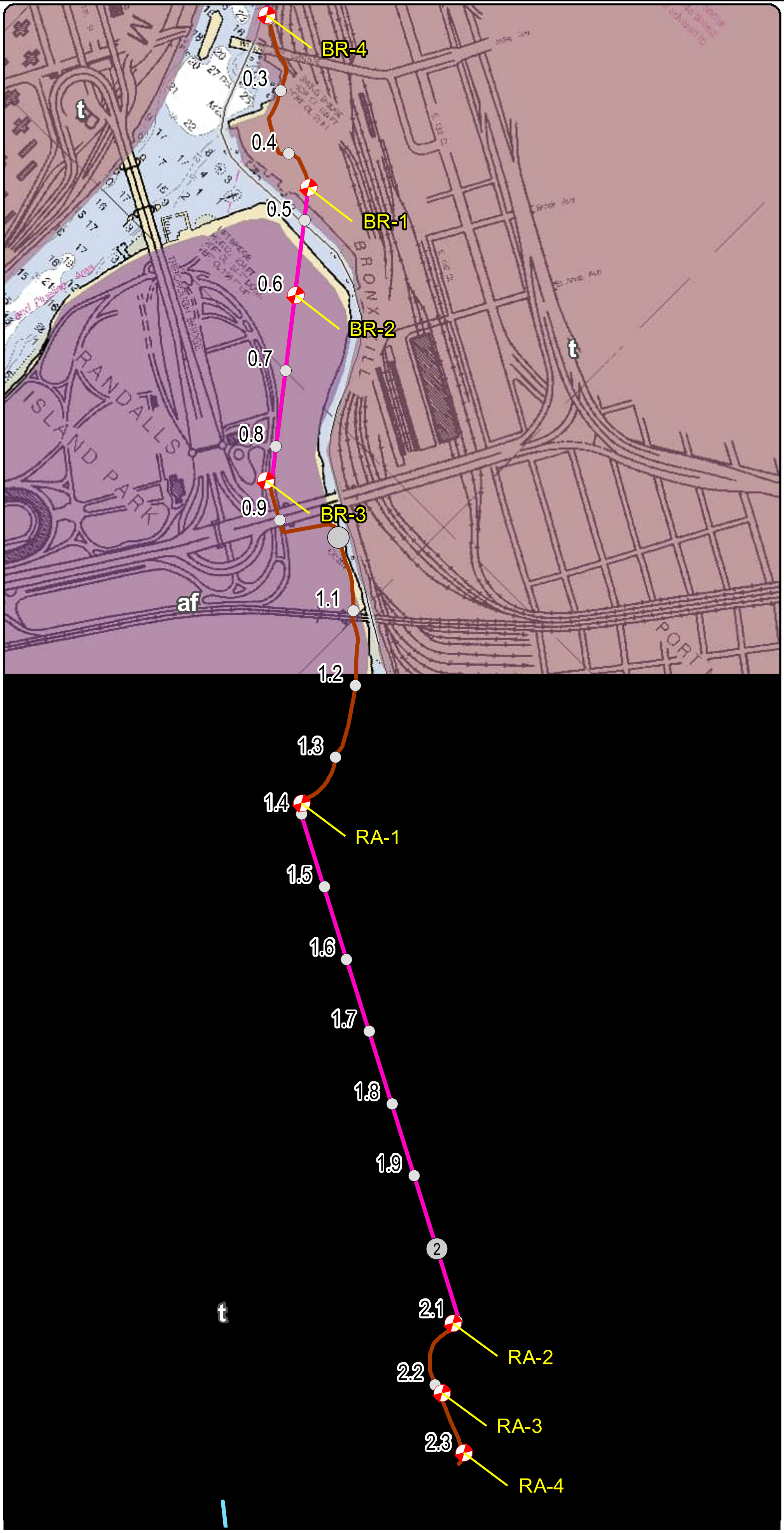

LEGEND

- Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

Surficial Geology

- af - Artificial fill
- t - Till

N

0.1 0.05 0 0.1 Miles

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

Surficial Geology and Geotechnical Borings Randall's Island Figure 3

Prepared on 5/23/2022

by: AECOM

DATA SOURCES: ESRI, NYSDOT, NOAA, USACE, NYDOS, TDI, TRC

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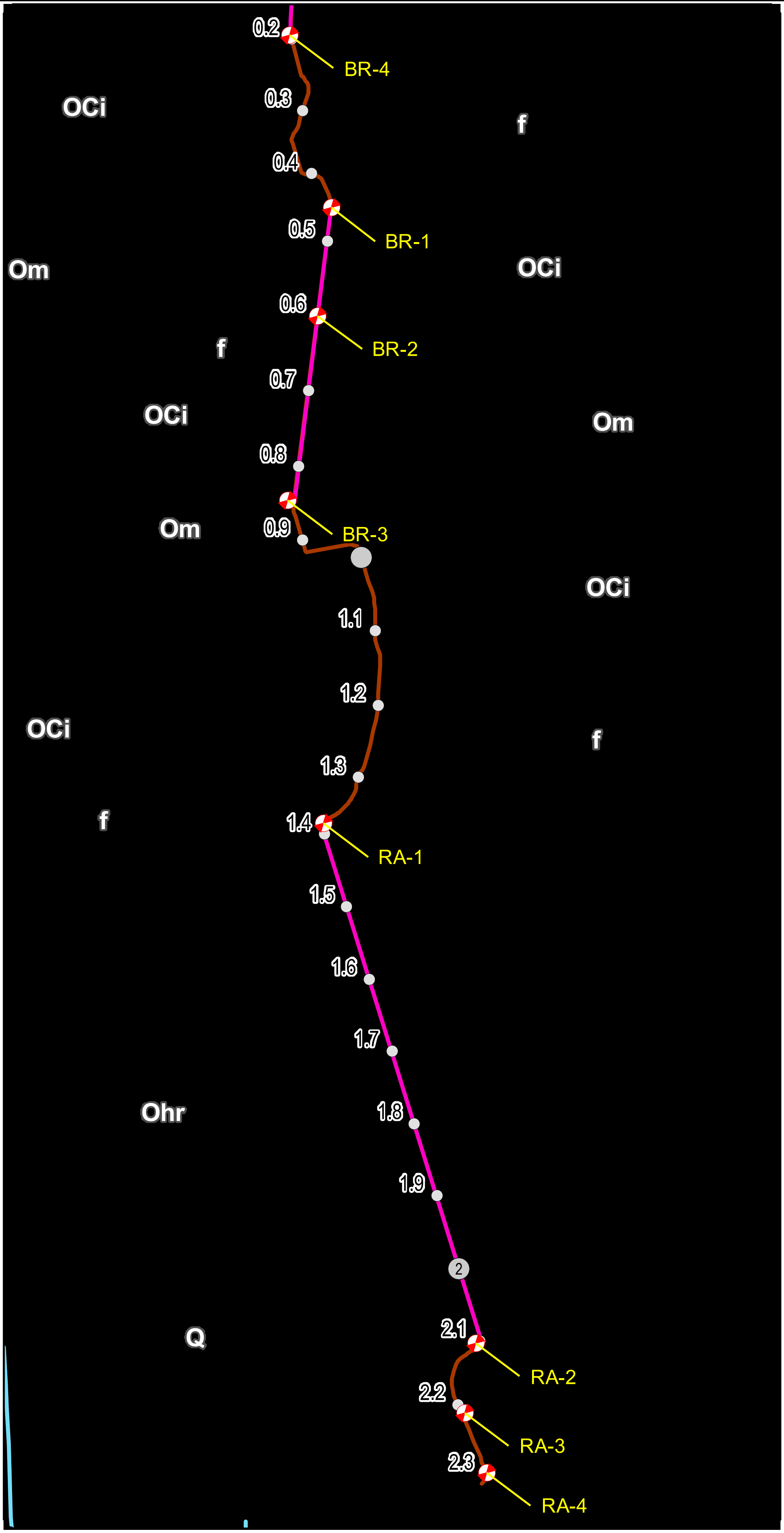

LEGEND

- Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

Bedrock Geology

- OCi - Inwood Marble
- Ohr - Harrison Gneiss
- Om - Manhattan Formation
- Q - Glacial and Alluvial Deposits
- f - Fordham Gneiss

N

0.1 0.05 0 0.1 Miles

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

Bedrock Geology and Geotechnical Borings Randall's Island Figure 4

Prepared on 5/23/2022

by: AECOM

DATA SOURCES: ESRI, NYSDOT, NOAA, USACE, NYDOS, TDI, TRC

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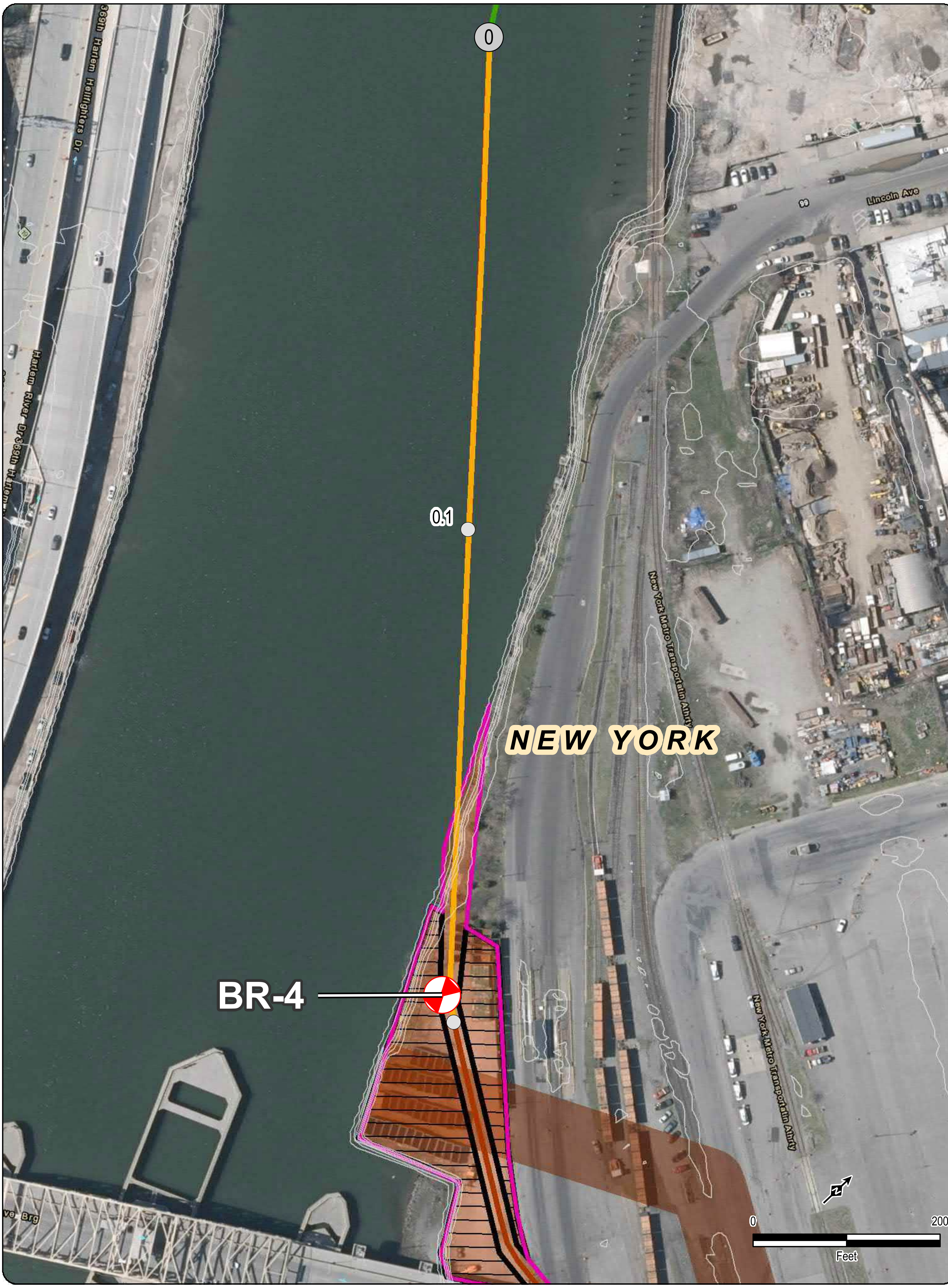
Appendices

Appendix A – Boring Location Plans



LEGEND

- Preferred Alternative Milepost - Tenths
- Preferred Alternative Milepost
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Contour-2'
- Perennial Streams
- Parcel
- 2022 Boring Location
- Previous (2013) Boring Location
- Railroad ROW
- Road ROW
- Deviation Zone
- Preferred Alternative Deviation Zone
- Preferred Alternative Deviation Zone Outside ROW
- Town Boundary
- Village Boundary
- State Park (OPRHP)
- Road Name
- TOWN NAME
- Village Name

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Randalls Island Preferred Alternative

Sheet 1 of 9

Prepared by: AECOM 6/1/2022

DATA SOURCES: ESRI, NETWORK MAPPING 2010, NYSDOT, OPRHP, TDI, TRC

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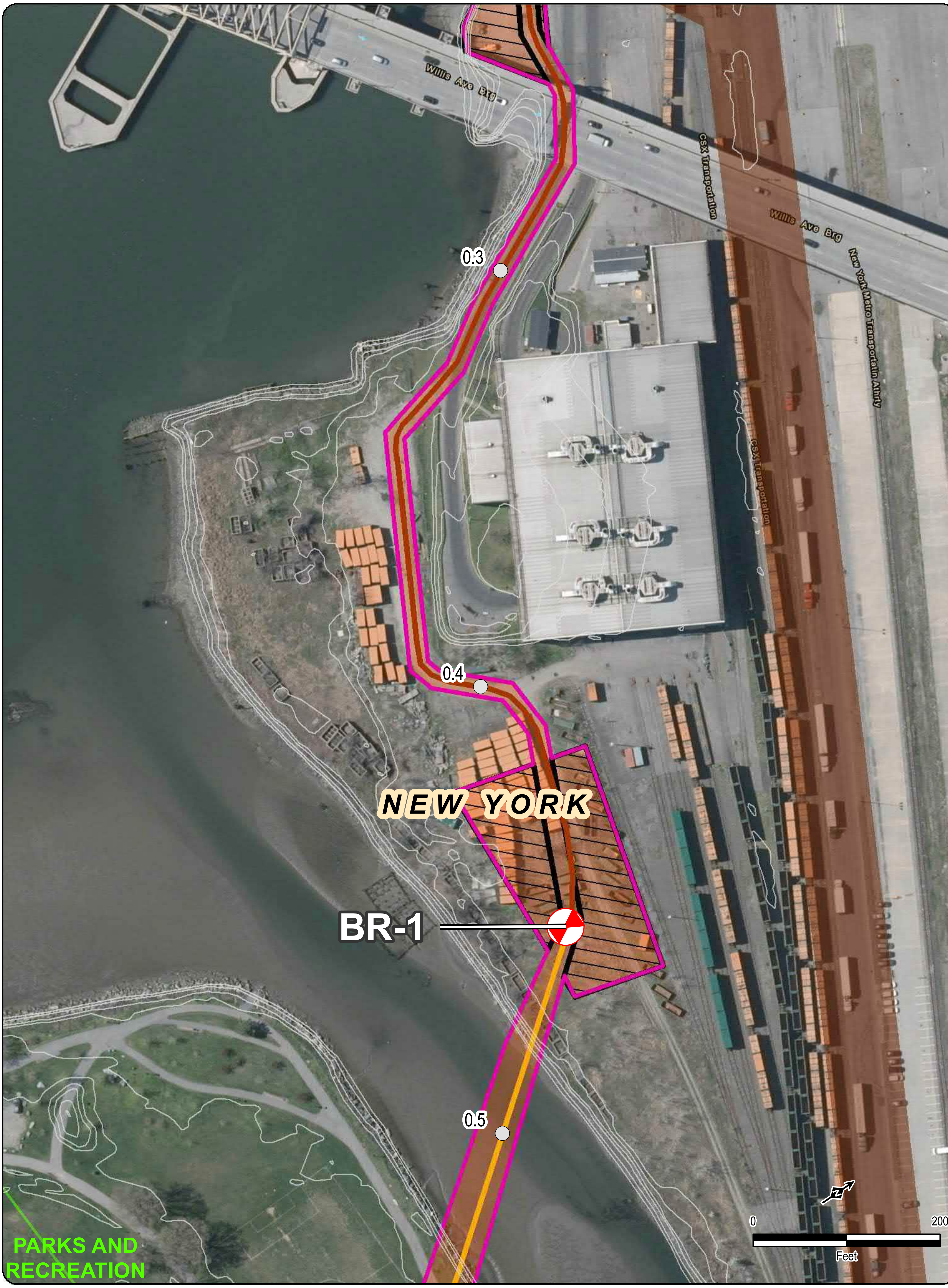

LEGEND

- 111.8 Preferred Alternative Milepost - Tenths
- 135 Preferred Alternative Milepost
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Contour-2'
- Perennial Streams
- Parcel
- 2022 Boring Location
- Previous (2013) Boring Location
- Railroad ROW
- Road ROW
- Deviation Zone
- Preferred Alternative Deviation Zone
- Preferred Alternative Deviation Zone Outside ROW
- Town Boundary
- Village Boundary
- State Park (OPRHP)

Road Name
TOWN NAME
Village Name

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Randalls Island Preferred Alternative

Sheet 2 of 9

Prepared by: AECOM 6/1/2022

DATA SOURCES: ESRI, NETWORK MAPPING 2010, NYSDOT, OPRHP, TDI, TRC

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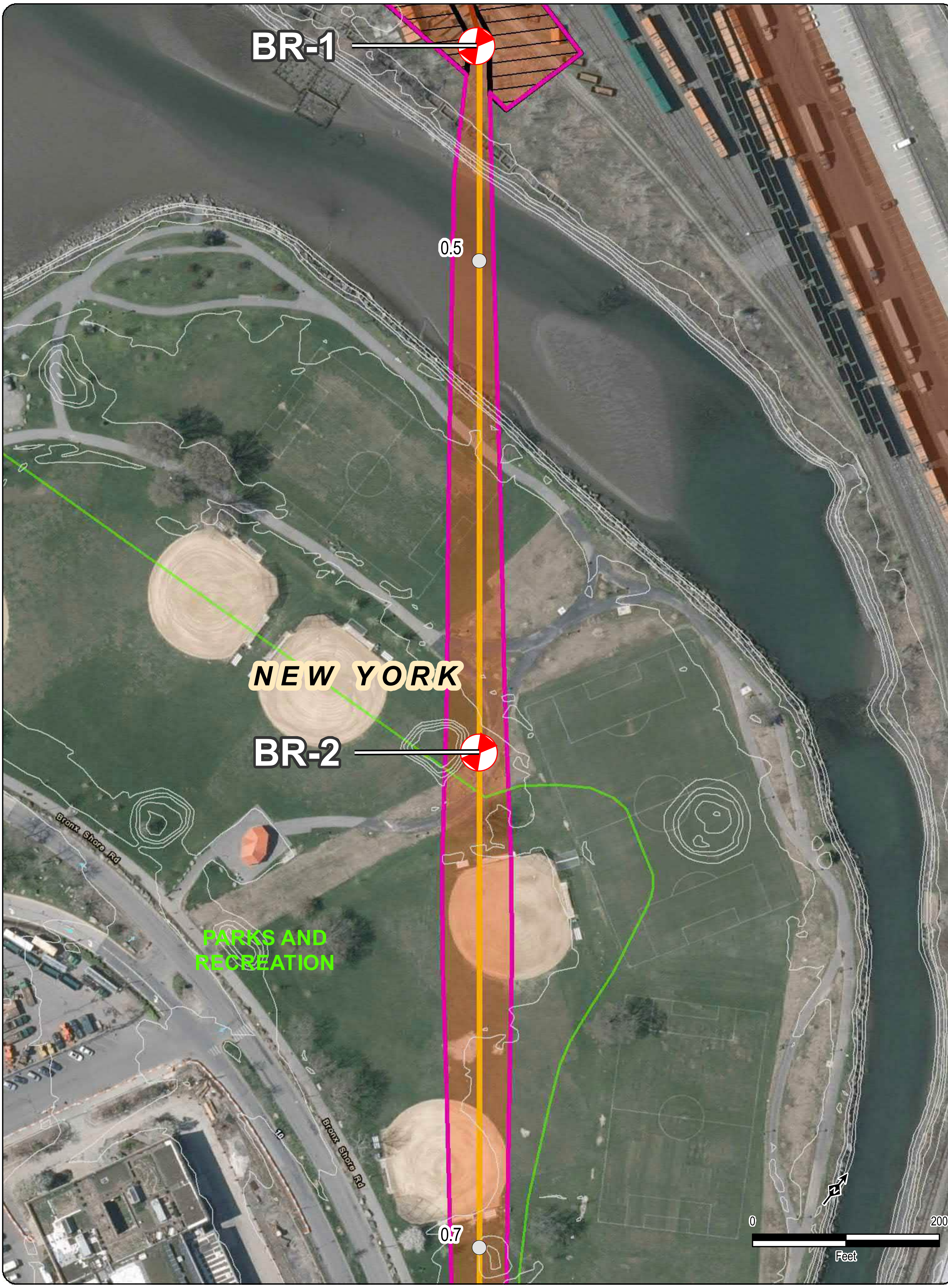

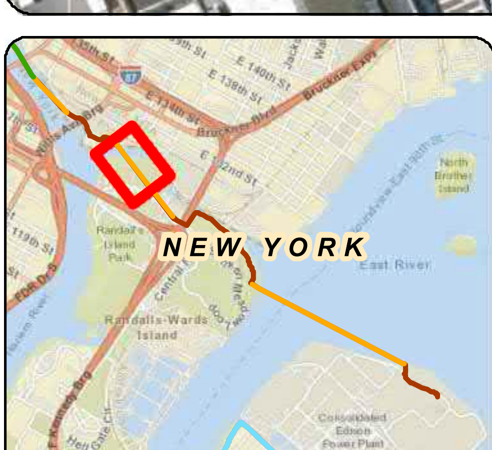

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Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Randalls Island Preferred Alternative

Sheet 3 of 9

Prepared by: AECOM 6/1/2022

DATA SOURCES: ESRI, NETWORK MAPPING 2010, NYSDOT, OPRHP, TDI, TRC

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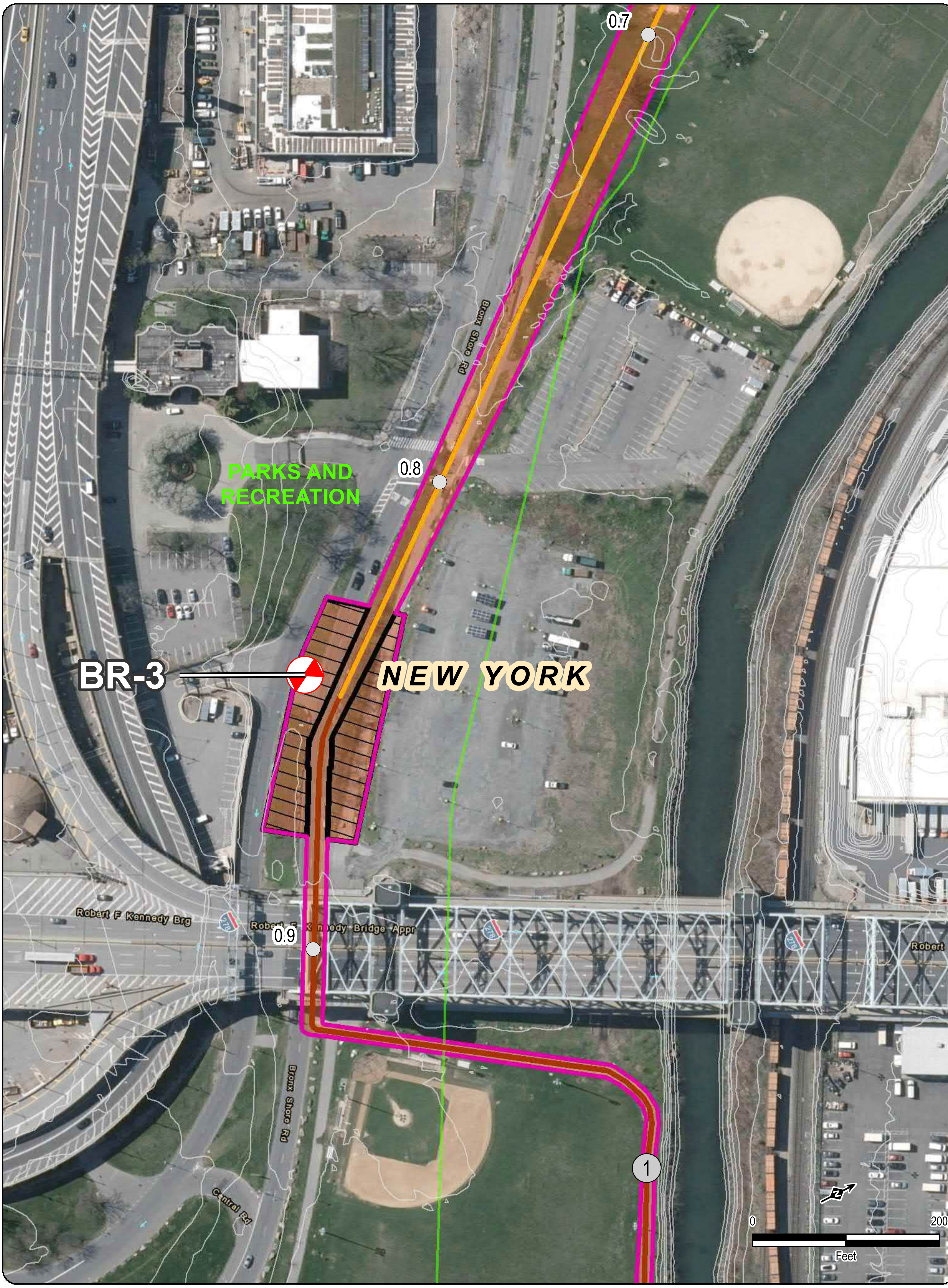

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Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Randalls Island Preferred Alternative

Sheet 4 of 9

Prepared by: AECOM 6/1/2022

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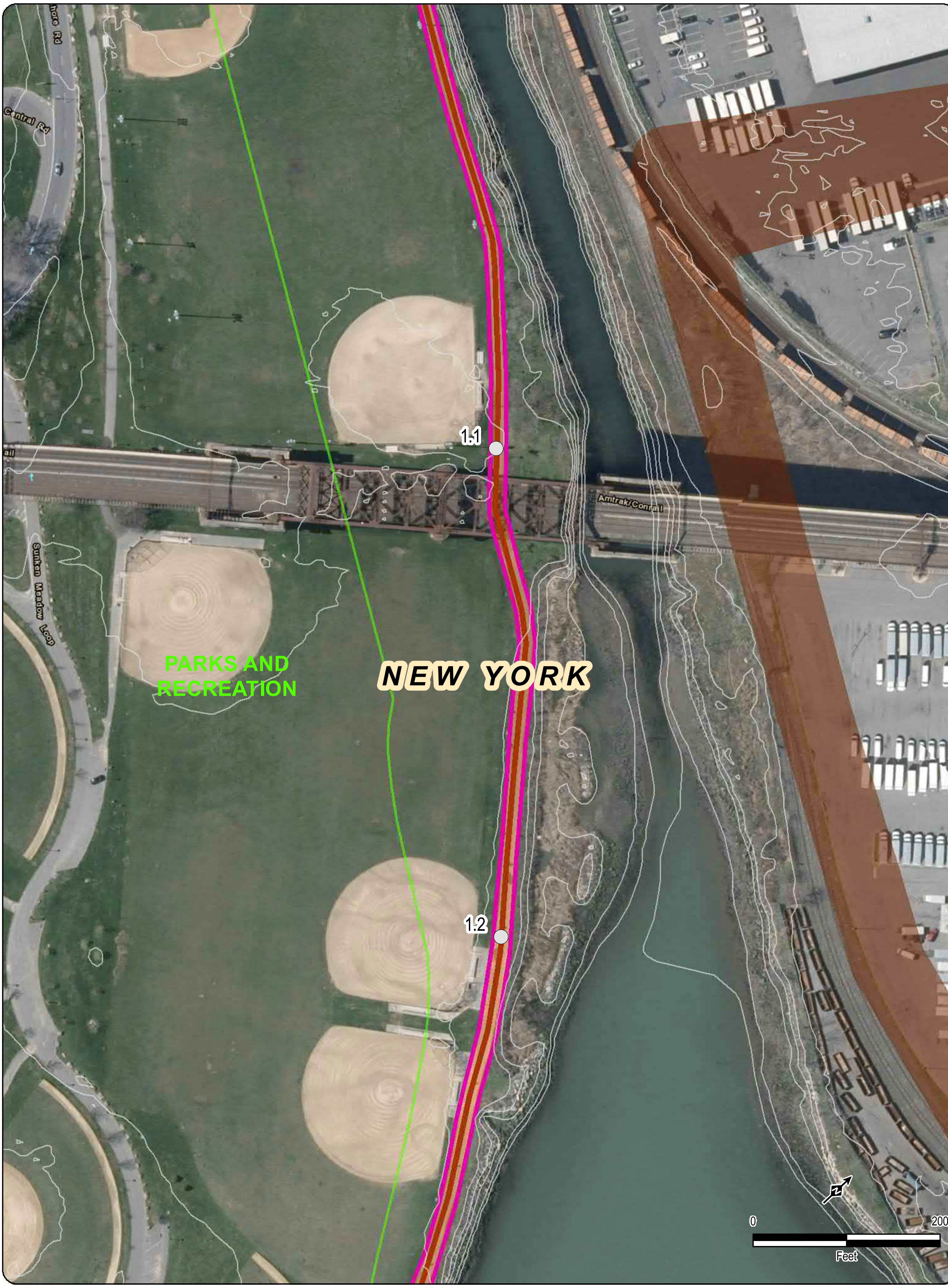

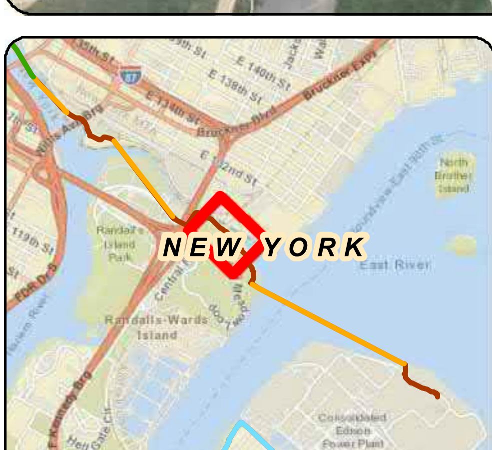

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Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Randalls Island Preferred Alternative

Sheet 5 of 9

Prepared by: AECOM 6/1/2022

DATA SOURCES: ESRI, NETWORK MAPPING 2010, NYSDOT, OPRHP, TDI, TRC

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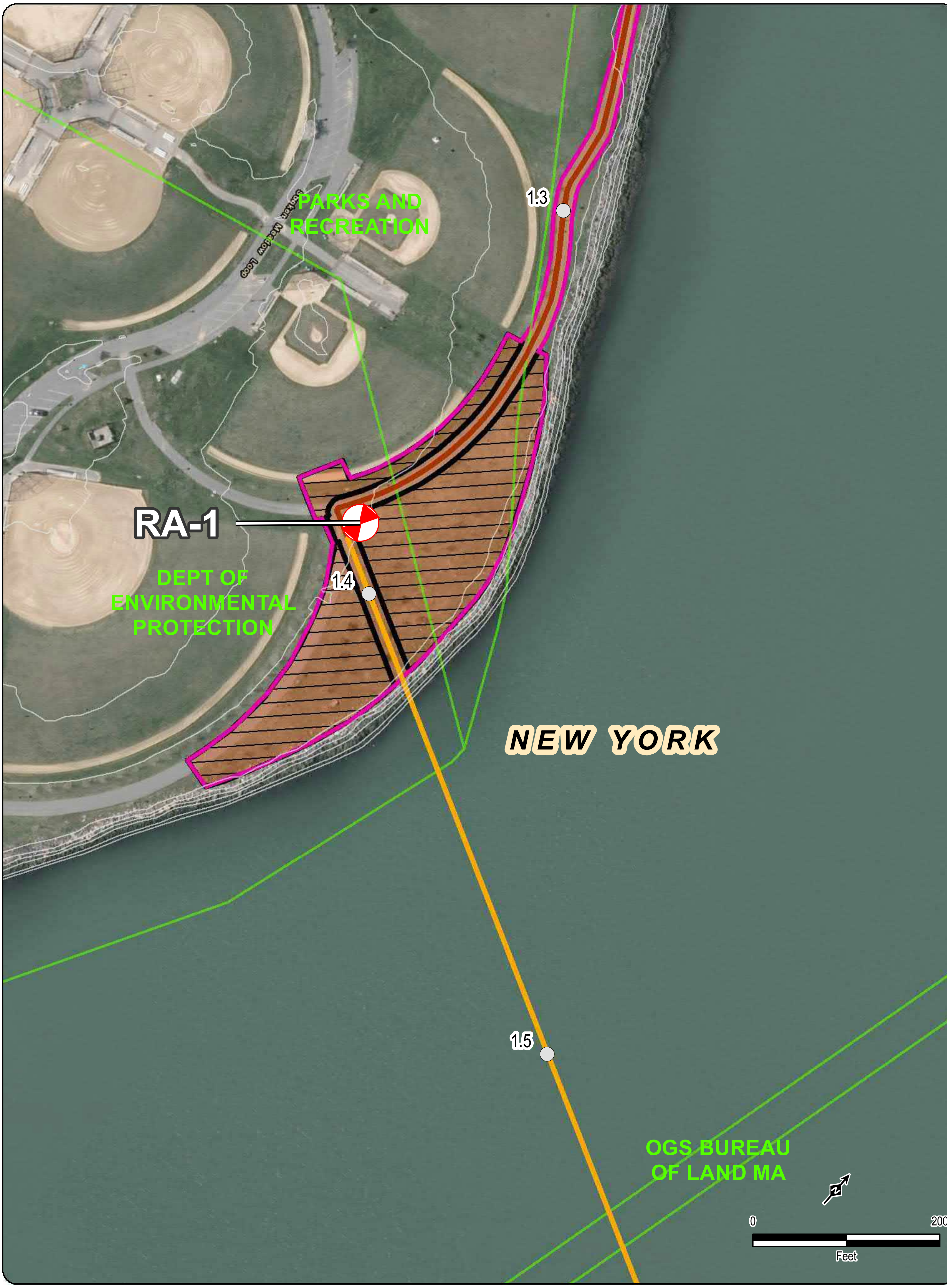

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Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Randalls Island Preferred Alternative

Sheet 6 of 9

Prepared by: AECOM 6/1/2022

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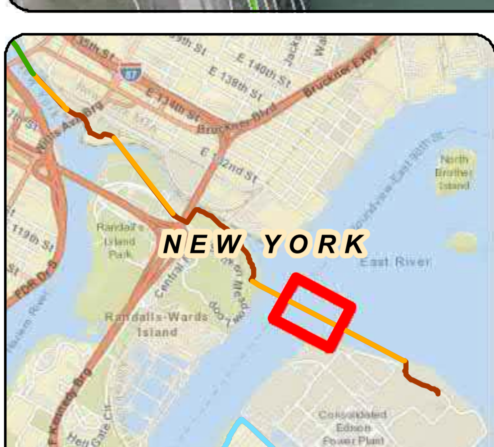

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Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Randalls Island Preferred Alternative

Sheet 7 of 9

Prepared by: AECOM 6/1/2022

DATA SOURCES: ESRI, NETWORK MAPPING 2010, NYSDOT, OPRHP, TDI, TRC

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Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Randalls Island Preferred Alternative

Sheet 8 of 9

Prepared by: AECOM 6/1/2022

DATA SOURCES: ESRI, NETWORK MAPPING 2010, NYSDOT, OPRHP, TDI, TRC

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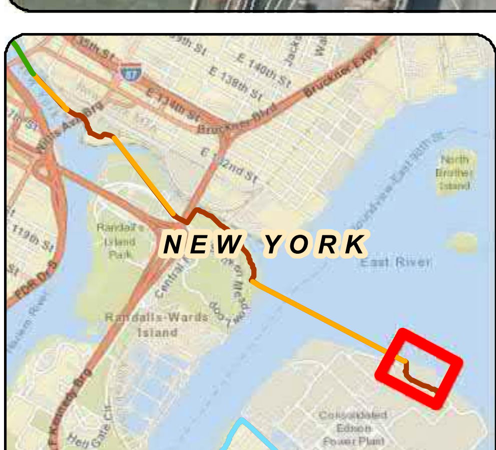

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Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Randalls Island Preferred Alternative

Sheet 9 of 9

Prepared by: AECOM 6/1/2022

DATA SOURCES: ESRI, NETWORK MAPPING 2010, NYSDOT, OPRHP, TDI, TRC

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Appendix B – Boring Logs

BORING CONTRACTOR: ADT	AECOM	SHEET 1 OF 3
DRILLER: Dom Pepe		PROJECT NAME: CHPE -
SOILS ENGINEER: Michael Izdebski		PROJECT NO.: 60323056
		HOLE NO.: **BR-1**
		START DATE: 02/02/22
	BORING LOG	FINISH DATE: 02/03/22
LOCATION:		OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	DRILL RIG: CME-75
~10' bgs visual from neighboring river	TYPE	FJS	Cali Split Spoon	Tri-Cone RB	NQ	BORING TYPE: SPT/CORE
WLM read 8.5' in casing with drill rod	SIZE I.D.	4"	2.5"	--	1 7/8"	BORING O.D.: 4"/3"
displacement	SIZE O.D.	4.5"	3"	3 7/8"	3"	SURFACE ELEV.: 9.6' (NAVD88)
	HAMMER WT.	140 lbs	140 lbs			NORTHING 231769.522
	HAMMER FALL	30"	30"			EASTING 1004985.704

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.(2)	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
											SW		0': Fill
1.0											-		1': Boulder
											SW		2': Brown f-c SAND, some Gravel, little
2.0						Hand cleared from 0'-5'.							organics, trace brick, some Silt, moist
3.0		3'-5'									SW		3': Brown f-c SAND, little Silt, trace f angular
		S-1											Gravel, moist
4.0		TR-1 (3-5')											
5.0												SAND and GRAVEL	
		5'-7'		24"	12"	7	9	13	10	14	SW		5': Brown f-m SAND, little Silt, trace f-m
6.0		S-2											rounded Gravel, moist
7.0													
		7'-9'		24"	9"	7	9	9	24	12	SW		7': Brown f to c SAND, some f-m angular
8.0		S-3											Gravel, moist
											SP		8.5': Brown f to c+ SAND, trace f to m
9.0													subrounded Gravel, moist
		9'-11'		24"	0"	27	10	13	14	15			
10.0													
11.0													
		11'-13'		24"	0"	12	10	12	12	14			
12.0													
13.0													
		13'-15'		24"	6"	7	14	12	13	17	SP		13': Brown f-m SAND
14.0		S-4										SAND	
		TR-2 (14.5-15.0											
15.0													
		15'-17'		24"	16"	13	12	12	17	16	SP		15': SAA
16.0		S-5											
		TR-3(16.5-17.0)											
17.0													
18.0													
19.0													
												Gneiss	19': Inferred bedrock 19' bgs.
20.0													

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: Ncorr=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 2 OF 3
		PROJECT NAME: CHPE -
DRILLER: Dom Pepe		PROJECT NO.: 60323056
		HOLE NO.: BR-1
SOILS ENGINEER: Michael Izdebski		START DATE: 02/02/22
	BORING LOG	FINISH DATE: 02/03/22
LOCATION:		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)	N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-25'		60"	30"	Recovery = 55%				20': Highly fractured grey Gneiss, strong.
21.0		R-1				RQD = 47%				*Coring rate sped up from 22'-23'*
22.0										22': Intensely fractured gold Schist, strong, light foliation
23.0										
24.0										24': Highly fractured grey Gneiss
25.0										
		25'-30'		60"	58"	Recovery = 97%				25': Highly fractured grey gneiss.
26.0		R-2				RQD = 79%				Large quartz vein from 26.7-27.8'
		TR-4(27.10-27.75)								
27.0										
28.0										
29.0										
30.0										
		30'-33'		36"	36"	Recovery = 100%				30': Moderately fractured grey Gneiss
31.0		R-3				RQD=100%				
32.0										
33.0		33'-35'		24"	24"	Recovery = 100%			Fordham Gneiss	
		R-4				RQD= 65%				33': Highly fracture grey Gneiss
34.0										
35.0										
		35'-40'		60"	56.5"	Recovery = 94%				35.65': SAA, but pink/grey and moderately fractured
36.0		R-5				RQD= 91%				
		TR-5(38.10-38.85)								
37.0										
38.0										
39.0										
40.0										
		40'-45'		60"	50"	Recovery = 83%				
41.0		R-6				RQD = 78%				41': Highly fractured grey Gneiss
		TR-6(42.0-42.55)								
42.0										
43.0										
44.0										
45.0										

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE
PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 3 OF 3
DRILLER: Dom Pepe		PROJECT NAME: CHPE -
		PROJECT NO.: 60323056
		HOLE NO.: BR-1
SOILS ENGINEER: Michael Izdebski		START DATE: 02/02/22
	BORING LOG	FINISH DATE: 02/03/22
LOCATION:		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)	N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		45'-50'		60"	60"	Recovery = 100%				45.3': Moderately fractured pink/grey Gneiss
46.0		R-7				RQD = 100%				
47.0										
48.0										
49.0										
										49.3': Grey gneiss
50.0										
		50'-55'		60"	60"	Recovery = 100%				50.3': Moderately fractured pink/grey gneiss
51.0		R-8				RQD= 92%				
52.0										52': Grey gneiss. Lightly fractured.
53.0										
54.0										
55.0										
		55'-60'		60"	60"	Recovery = 100%				
56.0		R-9				RQD= 79%				
57.0										
										57.3': Pink gneiss
58.0									Fordham Gneiss	57.9: Grey gneiss
										58.2: Pink gneiss
59.0										59.1: Grey gneiss
60.0										
		60'-65'		60"	59"	Recovery = 98%				60': f SAND and SILT
61.0		R-10				RQD= 93%				
										61.7: Moderately fractured, pink Gneiss
62.0										
63.0										
64.0										
65.0										
		65'-70'		60"	59"	Recovery = 98%				
66.0		R-11				RQD=98%				
67.0										
68.0										
										68.5': Grey gneiss, moderately fractured.
69.0										
										BR-1 terminated 70' bgs and grouted to surface.
70.0										

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

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SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 1 OF 3
DRILLER: Chris Chaillou		PROJECT NAME: CHPE -
SOILS ENGINEER/GEOLOGIST: Michael Izdebski	**Boring Log**	PROJECT NO.: 60323056
		HOLE NO.: **BR-2**
		START DATE: 06/09/21
		FINISH DATE: 06/09/21
LOCATION: Randall's Island, NY, MP 0.59		OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	DRILL RIG: CME LC-55
Groundwater ~10 ft. bgs	TYPE	Flush Joint Steel	California Modified	Tricone Roller Bit	NQ	BORING TYPE: SPT
	SIZE I.D.	4"	2.5"	- -	1 7/8"	BORING O.D.: 4.5"
	SIZE O.D.	4.5"	3"	3 7/8"	3"	SURFACE ELEV.: 9.2' (NAVD88)
	HAMMER WT.	140 lbs	140 lbs			Northing: 231170.855
	HAMMER FALL	30"	30"			Easting: 1005447.706

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.(2)	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
1.0												Gravelly Fill with asphalt and brick	Brown fine to coarse SAND, some fine to coarse gravel, trace silt; angular
2.0													2.0'; Light brown fine to coarse SAND, some silt, little little fine to coarse gravel; rounded, some brick
3.0		3'-5'											
4.0											-		3.5'; Asphalt, brick, large angular cobbles, little sand
5.0		5'-7'	S-1	24"	4"	18	10	7	5	11			SAA
6.0													6'; Angular GRAVEL, little fine to coarse sand, trace silt
7.0		7'-9'		24"	0"	10	5	5	4	7			No recovery
8.0													
9.0		9'-11'	S-2	24"	3"	4	2	2	2	3		Sand and Gravel	Fine (+) to coarse GRAVEL, little fine to coarse sand, trace organics; angular
10.0													
11.0		11'-13'	--	24"	6"	12	9	6	4	10	SW		Fine to corase SAND, little fine gravel TR-1; 11.0'-11.5'
12.0													
13.0		13'-15'	S-3	24"	4"	3	3	6	8	6	ML	Clayey Silt	Gray clayey SILT, little fine to coarse sand, trace fine to coarse gravel; angular
14.0													
15.0		15'-17'	S-4	24"	3"	4	5	6	5	7	SW	Sand and Gravel	Gray fine to coarse SAND, little fine to coarse gravel, trace organics; angular
16.0													
17.0													
18.0													
19.0													
20.0													

NOTES:
(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.
(2) Correction factor: $Ncorr=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

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SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 2 OF 3
DRILLER: Chris Chaillou		PROJECT NAME: CHPE -
SOILS ENGINEER: Michael Izdebski		PROJECT NO.: 60323056
		HOLE NO.: **BR-2**
		START DATE: 06/09/21
	Boring Log	FINISH DATE: 06/09/21
LOCATION: Randall's Island, NY, MP 0.59		OFFSET: N/A

DEPT	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'	S-5	24"	12"	19	14	15	14	19	GW	S	Fine to coarse GRAVEL, little fine to coarse sand; subangular
21.0											ML		21.5'; Light gray clayey SILT, little fine to coarse sand, little fine to coarse gravel; subrounded
22.0													TR-2; 21.5'-22'
23.0													
24.0													
		24.5'-29.5'		60"	7"							Inferred boulders and cobble fragments (possible till)	Drill refusal - beging coring
25.0													Coarse GRAVEL (inferred boulder/cobble fragments)
26.0	0.5												
27.0													
28.0													
29.0													
		29.5'-31'		18"	6"								
30.0													
31.0													
		31'-34.5'		42"	10"								SAA
32.0													
33.0													
34.0													
35.0													
		35'-37'		0"	0"	50/0"							No recovery
36.0													
37.0													
		37'-42'		60"	7"								Rounded gravel chunks (inferred boulder and cobble fragments)
38.0													
39.0													
	0.5												
40.0													
41.0													
42.0													
		42'-44'	S-6	6"	6"								Brown fine to coarse SAND, trace gravel
43.0													
44.0													
45.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE

PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 3 OF 3
DRILLER: Chris Chaillou		PROJECT NAME: CHPE -
SOILS ENGINEER: Michael Izdebski		PROJECT NO.: 60323056
		HOLE NO.: **BR-2**
		START DATE: 06/09/21
	Boring Log	FINISH DATE: 06/09/21
LOCATION: Randall's Island, NY, MP XX		OFFSET: N/A

DEPT	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
												Boulders and Cobbles	
44.0													
		44.5'-46.5'	S-7	15"	15"	63	85	72/3"	-	-	MH		Brown SILT, little fine to coarse sand, trace gravel (till)
45.0													TR-3; 44.5'-45.0'
46.0													
47.0													
48.0													
49.0												Till	
50.0													
		50'-52'	S-8	22"	22"	50	75	75	90/4"	98	MH		SAA
51.0													
													TR-4; 51.0'-51.3'
52.0													
													Boring terminated at 52', grouted to surface
53.0													
54.0													
55.0													
56.0													
57.0													
58.0													
59.0													
60.0													
61.0													
62.0													
63.0													
64.0													
65.0													
66.0													
67.0													
68.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	**Boring Log** (AECOM)	SHEET 1 OF 1
DRILLER: Chris Chaillou		PROJECT NAME: CHPE -
SOILS ENGINEER/GEOLOGIST: Michael Izdebski		PROJECT NO.: 60323056
		HOLE NO.: **BR-3**
		START DATE: 06/08/21
		FINISH DATE: 06/08/21
LOCATION: Randall's Island, NY, MP 0.86		OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	DRILL RIG: CME LC-55
Groundwater ~10 ft. bgs	TYPE	Flush Joint Steel	California Modified	Tricone Roller Bit	NQ	BORING TYPE: SPT
	SIZE I.D.	4"	2.5"	- -	1 7/8"	BORING O.D.: 4.5"
	SIZE O.D.	4.5"	3"	3 7/8"	3"	SURFACE ELEV.: 10.4' (NAVD88)
	HAMMER WT.	140 lbs	140 lbs			NORTHING: 230106.946
	HAMMER FALL	30"	30"			EASTING: 1006207.642

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.(2)	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
						Hand Cleared						Gravelly Sand/Fill	Brown fine to coarse SAND, some fine to coarse gravel, trace clayey silt, trace organics (FILL)
1.0													
2.0													
3.0		3'-5'	S-1										TR-1; 3'-6'
4.0													4'; Gray fine to coarse(+) SAND, some fine to coarse gravel; angular
5.0													
6.0		6'-8'	S-2	24"	7"	5	3	3	2	4			Brown fine to coarse SAND, some silt, little fine to coarse (+) gravel; subrounded
7.0													7'; Gray coarse (+) to fine SAND, some fine to medium gravel; angular
8.0		8'-10'	S-3	24"	15"	3	2	3	4	3		Sand and Gravel	Black coarse angular GRAVEL, trace fine to coarse sand
9.0													
10.0		10'-12'	S-4	24"	5"	6	8	6	3	9	SW		Black fine to coarse SAND, some fine to medium gravel; angular
11.0													
12.0		12'-14'	S-5	24"	12"	2	2	1	1	2			SAA
13.0											OH	Silty Clay	12.5'; Gray silty CLAY, little organics TR-2; 13.0'-13.5'
14.0		14'-16'	S-6	24"	2"	23	18	18	11	23			
15.0											SP/SM	Sand	15.5'; Brown fine to medium SAND, some silty clay, little fine to coarse gravel; sunrounded
16.0													
17.0													
18.0													
19.0													
20.0													

NOTES:
(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.
(2) Correction factor: $Ncorr=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

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SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 2 OF 2
DRILLER: Chris Chaillou		PROJECT NAME: CHPE -
SOILS ENGINEER: Michael Izdebski		PROJECT NO.: 60323056
		HOLE NO.: **BR-3**
		START DATE: 06/08/21
	Boring Log	FINISH DATE: 06/08/21
LOCATION: Randall's Island, NY, MP 0.86		OFFSET: N/A

DEPT	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)	N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'		5"	5"	50/5"				Brown fine to coarse SAND, some fine to coarse gravel;
21.0								SP/SM	Sand	subangular
22.0										
23.0									MANHATTAN SCHIST	
24.0										
25.0										
		25'-30'	R-1	60"	51.5"	RQD= 34"/60"= 56.7%				Lightly fractured, moderately weathered, white-grey low
26.0										grade SCHIST; hard, oxidation staining present in most fractures
27.0										
28.0										TR-3; 27.8'-28.35'
29.0										
30.0										
		30'-35'	R-2	60"	40.5"	RQD=4"/60"=7%				Dark gray SCHIST, moderately fractured, moderately
31.0										weathered, very hard, oxidation staining
32.0										
33.0										TR-4; 33.5'-34.10'
34.0										
35.0										34.4'; White-gray-orange SCHIST, moderately fractured, moderately weathered, oxidation staining, hard
		35'-40'	R-3	60"	nr	RQD=49"/60"=82%				
36.0										
37.0										36.3'; SAA Schist, lower grade, slightly fractured
38.0										
39.0										TR-5; 38.7'-39.25'
40.0										
41.0										Boring terminated at 40' bgs, grouted to surface
42.0										
43.0										
44.0										
45.0										

NOTES:

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SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 1 OF 4
DRILLER: Dom Pepe		PROJECT NAME: CHPE -
SOILS ENGINEER: Michael Izdebski	BORING LOG	PROJECT NO.: 60323056
		HOLE NO.: **BR-4**
		START DATE: 02/04/22
		FINISH DATE: 02/04/22
LOCATION:		OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	
River is 11.6' bgs	TYPE	FJS	Cali Split Spoon	Tri-Cone RB	NQ	DRILL RIG: CME-75
Approximate WL of 10-12'	SIZE I.D.	4"	2.5"	--	1 7/8"	BORING TYPE: SPT/CORE
	SIZE O.D.	4.5"	3"	3 7/8"	3"	BORING O.D.: 4"/3"
	HAMMER WT.	140 lbs	140 lbs			SURFACE ELEV.: 10.5' (NAVD88)
	HAMMER FALL	30"	30"			NORTHING: 232421.112
						EASTING: 1003933.709

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.(2)	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
												Fill	0': Br f-c subangular Gravel, some Silt, some Sand, trace organics
1.0													
2.0						Hand cleared from 0'-5'.							
3.0		3'-5'											
		S-1											
4.0													
5.0													
		5'-7'		24"	16"	13	12	21	22	21	SW		
6.0		S-2											6': Brown f-c+ SAND a, and f-c subrounded GRAVEL, some Silt, trace brick
		TR-1 (6.0-6.5)											
7.0													6.5': Br f-c SAND, little Gravel, little brick, little Silt (fill)
		7'-9'		24"	24"	13	23	17	17	26	SW		
8.0		S-3											
9.0													
		9'-11'		3"	3"	50/3"				X	-	Wood	9': Wood (~1')
10.0													
11.0												Weathered Rock	
		11'-13'		24"	9"	8	10	23	5	21	-		11' Weathered rock, some Silt, little Sand, trace wood
12.0		S-4											
13.0													
		13'-15'		24"	9"	16	10	22	22	21	-		13': SAA
14.0		S-5											
		TR-2 (14.0-14.5)											
15.0													
		15'-17'		24"	1"	10	45	38	15	54	-		15': Weathered rock at tip
16.0													
17.0													
18.0													
19.0													
20.0													

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: $Ncorr=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 2 OF 4
DRILLER: Dom Pepe		PROJECT NAME: CHPE -
		PROJECT NO.: 60323056
		HOLE NO.: BR-4
SOILS ENGINEER: Michael Izdebski		START DATE: 02/04/22
	BORING LOG	FINISH DATE: 02/04/22
LOCATION:		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'		24"	5"	6	11	11	12	14	-	Weathered Rock	20': Weathered rock (Schist)
21.0		S-6											
22.0													
23.0													
24.0													
25.0													
		25'-27'		24"	24"	1	2	2	3	3	OH	Organic Clay	25': Dark grey Silty CLAY, little organics, faint odor, low ppm hit (inferred natural)
26.0		S-7											
		TR-3(26.0-26.5)											
27.0													
28.0													
29.0													
30.0													
		30'-32'		24"	14"	3	5	5	7	7	SP	SAND	30': Brown f-m SAND
31.0		S-8											
		TR-4 (31.0-31.5)											
32.0													
33.0													
34.0													
35.0													
		35'-37'		24"	15"	5	5	5	5	7	SP		35': Brown f-m SAND
36.0		S-9											
37.0													
38.0													
39.0													
40.0													
		40'-42'		24"	16"	3	4	4	5	5	SW		40': Br f-c+ SAND, trace rounded Gravel
41.0		S-10											
42.0													
43.0													
44.0													
45.0													

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: Ncorr=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM		SHEET 3 OF 4
			PROJECT NAME: CHPE -
DRILLER: Dom Pepe			PROJECT NO.: 60323056
			HOLE NO.: BR-4
SOILS ENGINEER: Michael Izdebski			START DATE: 02/04/22
	BORING LOG		FINISH DATE: 02/04/22
LOCATION:			OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		45'-47'		24"		4	6	6	10	8	ML	FINES	45': Red/Brown SILT and CLAY
46.0		S-11											
47.0													
48.0													
49.0													
50.0													
		50'-52'		24"		9	12	21	15	21	SP	SANDS	50': Brown f-m SAND
51.0		S-12											
52.0													
53.0													
54.0													
55.0													
		55'-57'		24"	24"	7	11	9	11	13	SP		55': SAA
56.0		S-13 (55-56)									ML	FINES	56': Red SILT and CLAY
		S-14(56-57)											
57.0													
58.0													
59.0													
60.0													
		60'-62'		24"	24"	9	13	10	10	15	ML		60': f SAND and SILT
61.0		S-15(60-61.5)											
		S-16(61.5-62)									CH		61.5: Silty CLAY, little f SAND
62.0													
63.0													
64.0													
65.0													
		65'-67'		24"	24"	6	10	16	18	17	SP	SANDS	65': Brown f-m SAND
66.0		S-17											
67.0													
68.0													
69.0													
70.0													

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: Ncorr=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR:	AECOM	SHEET 4 OF 4
SOILS ENGINEER:		PROJECT NAME: CHPE -
DRILLER:		PROJECT NO.: 60323056
LOCATIC Dom Pepe		HOLE NO.: BR-4
SOILS ENGINEER:		START DATE: 02/04/22
RATE Michael Izdebski	BORING LOG	FINISH DATE: 02/04/22
LOCATION:		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		70'-72'		24"	24"	12	12	13	13	16	SP	SANDS	70': Brown f-m SAND
71.0		S-18											
72.0													
73.0													
74.0												Till	
75.0													
		75'-77'		24"	8"	21	30	35	40	42	SW		75': f-c SAND, some f-c GRAVEL, Dense (Inferred Till)
76.0		S-19											
		TR-5 (76.5-77.0)											
77.0													
78.0													
79.0													
80.0													
		80'-82'		11"	9"	38	50/5"			X	SW		80': SAA (Till)
81.0		S-20											
82.0													
													BR-4 completed at 82' bgs and grouted to surface.

NOTES:
(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.
(2) Correction factor: $N_{corr}=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 1 OF 4
DRILLER: Chris Chaillou		PROJECT NAME: CHPE -
SOILS ENGINEER/GEOLOGIST: Michael Izdebski	**Boring Log**	PROJECT NO.: 60323056
		HOLE NO.: **RA-1**
		START DATE: 06/10/21
		FINISH DATE: 06/10/21
LOCATION: Randall's Island, NY, MP 1.39		OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	DRILL RIG: CME LC-55
Groundwater ~10 ft. bgs	TYPE	Flush Joint Steel	California Modified	Tricone Roller Bit	NQ	BORING TYPE: SPT
	SIZE I.D.	4"	2.5"	- -	1 7/8"	BORING O.D.: 4.5"
	SIZE O.D.	4.5"	3"	3 7/8"	3"	SURFACE ELEV.: 12.0' (NAVD88)
	HAMMER WT.	140 lbs	140 lbs			NORTHING: 228681.708
	HAMMER FALL	30"	30"			EASTING: 1007966.689

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.(2)	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
												Sand and Gravel, some brick (FILL)	Brown fine to coarse SAND, little silt, little gravel, trace organics
1.0													
2.0													2'; SAA with bricks and asphalt
3.0		3'-5'	S-1										Building fragments with little fine to coarse SAND TR-1; 3'-5'
4.0													
5.0		5'-7'	S-2	13"	6"	3	10	50/5"	-	-	SP-SW		Brown fine to coarse SAND, some gravel, trace silt; angular
6.0													6'; Boulders/cobbles (inferred)
7.0		7'-9'		24"	0"	4	6	4	12	7			No recovery
8.0													
9.0		9'-11'		24"	0"	13	10	12	9	14			No recovery
10.0													
11.0		11'-13'	S-3	24"	9"	10	4	4	6	5	SP-SW		Coarse (+) to fine SAND, some fine to medium gravel; angular
12.0													TR-2; 12.5'-13'
13.0		13'-15'		22"	1"	10	8	9	50/4"	11	SP-SW		SAA, coarse gravel in tip of spoon
14.0													
15.0		15'-17'	S-4	6"	7"	23	50/0"	-	-	-	SP-SW		Coarse to fine SAND, some fine to medium gravel, some brick; angular TR-3; 15.0'-15.5'
16.0													
17.0													
18.0													
19.0													
20.0													

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: Ncorr=N*$(2.0^2-1.375^2)$in./$(3.0^2-2.4^2)$in. = N*0.65.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 2 OF 4
DRILLER: Chris Chaillou		PROJECT NAME: CHPE -
SOILS ENGINEER: Michael Izdebski		PROJECT NO.: 60323056
		HOLE NO.: **RA-1**
		START DATE: 06/10/21
	Boring Log	FINISH DATE: 06/10/21
LOCATION: Randall's Island, NY, MP 1.39		OFFSET: N/A

DEPT	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'	S-5	24"	12"	4	18	14	17	21	SP-SW	Sand and Gravel with brick (FILL)	Fine to coarse (+) GRAVEL and brick, little fine to coarse sand, trace silt
21.0													
22.0													
23.0													
24.0													
25.0		25'-27'	S-6	24"	4"	12	12	6	5	12	SP-GP	Sand and Gravel	Gray fine to coarse SAND and fine to coarse gravel, little silt; subrounded
26.0													
27.0													
28.0													
29.0													
30.0													
		30'-32'		0"	0"	50/0"	-	-	-	-	-	FORDHAM GNEISS	No recovery
31.0													
32.0		32'-35'	R-1	36"	36"	RQD=93%				-	-		Black gneiss; hard, very slightly fractured, slight weathering
33.0													
34.0													
35.0													
		35'-40'	R-2	60"	59"	RQD=96%				-	-		SAA, slightly higher grade
36.0													
37.0													
38.0													
39.0													
40.0													
		40'-45'	R-3	60"	61"	RQD=98%				-	-		SAA *Extra ~1" of recovery from previous run, TR foam cut short to fit entire run in one row TR-5; 42.05'-42.7'
41.0													
42.0													
43.0													
44.0													
45.0													

NOTES: Most water lost until after the 25'-27' sample

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

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SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 3 OF 4
DRILLER: Chris Chaillou		PROJECT NAME: CHPE -
SOILS ENGINEER: Michael Izdebski		PROJECT NO.: 60323056
		HOLE NO.: **RA-1**
		START DATE: 06/10/21
	Boring Log	FINISH DATE: 06/10/21
LOCATION: Randall's Island, NY, MP XX		OFFSET: N/A

DEPT	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)	N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
45.0		45'-50'	R-4	60"	62"	RQD=64%	-	-		SAA, slightly fractured, vertical fracturing
46.0										
47.0										
48.0										
49.0										
50.0		50'-55'	R-5	60"	59"	RQD=90%	-	-		Black gneiss; very slightly fractured, hard, lightly weathered
51.0										TR-6; 50.75'-51.3'
52.0										
53.0										
54.0										
55.0		55'-60'	R-6	60"	61.5"	RQD=95%	-	-	FORDHAM GNEISS	SAA
56.0										
57.0										
58.0										
59.0										
60.0		60'-65'	R-7	60"	60"	RQD=100%	-	-		SAA TR-7; 61.9'-62.7'
61.0										
62.0										
63.0										
64.0										
65.0		65'-70'	R-8	60"	60"	RQD=92%	-	-		SAA, unweathered
66.0										
67.0										
68.0										
69.0										
70.0										

NOTES:

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SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT DRILLER: Chris Chaillou SOILS ENGINEER: Michael Izdebski	AECOM **Boring Log**	SHEET 4 OF 4 PROJECT NAME: CHPE - PROJECT NO.: 60323056 HOLE NO.: **RA-1** START DATE: 06/10/21 FINISH DATE: 06/10/21
LOCATION: Randall's Island, NY, MP XX		OFFSET: N/A

DEPT	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)	N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
70.0		70'-75'	R-9	60"	60"	RQD=94%	-	-	FORDHAM GNEISS	SAA TR-8; 71.35'-71.9'
71.0										
72.0										
73.0										
74.0										
75.0		75'-80'	R-10	60"	60"	RQD=90%	-	-		SAA; vertical fracture ~79.5' TR-9; 75.0'-75.5'
76.0										
77.0										
78.0										
79.0										
80.0										RA-1 completed at 80' bgs, grouted to surface
81.0										
82.0										
83.0										
84.0										
85.0										
86.0										
87.0										
88.0										
89.0										
90.0										
91.0										
92.0										
93.0										
94.0										
95.0										

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	**AECOM**	SHEET 1 OF 4
DRILLER: George Raymond, Eddie Cordera		PROJECT NAME: CHPE -
SOILS ENGINEER: Michael Izdebski		PROJECT NO.: 60323056
		HOLE NO.: **RA-2**
		START DATE: 03/07/22
	BORING LOG	FINISH DATE: 03/16/22
LOCATION: Con Ed Astoria Generating Complex - MP 2.11		OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	
WL ~ 10'-25' bgs	TYPE	FJS	Cali Split Spoon	Tri-Cone RB	NQ	DRILL RIG: CME-85
(Tidally influenced)	SIZE I.D.	4"	2.5"	--	1 7/8"	BORING TYPE: SPT
	SIZE O.D.	4.5"	3"	3 7/8"	3"	BORING O.D.: 4"
	HAMMER WT.	140 lbs	140 lbs			SURFACE ELEV.: 12.2' (NAVD88)
	HAMMER FALL	30"	30"			NORTHING: 226849.034
						EASTING: 1011267.966

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.(2)	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
													0': Conrete
1.0													0.5: Br angular GRAVEL, some f-c
													Sand, little Silt, trace organics, some
2.0						Hand cleared from 0'-5'.							cobbles
													2': Br SAND and GRAVEL, some Silt, moist
3.0		3'-5'											Brick chunk, Cinder block chunk (Fill)
													3': Boulder
4.0													
5.0													
		5'-7'		24"	18"	5	9	14	14	15			5': Black f-c SAND, little f-c subangular
6.0		S-1											Gravel, little Silt, trace brick, cinder, ash (Fill)
		TR-1(5.5-6.0)											
7.0													
		7'-9'		24"	8"	8	7	6	5	8			7': SAA
8.0		S-2											
9.0												FILL	
		9'-11'		24"	5"	3	3	3	3	4			9': SAA
10.0		S-3											
11.0													
		11'-13'		24"	10"	4	3	3	4	4			11': Black f-c SAND, some f-c Gravel,
12.0		S-4											little Silt, Brick Cinder, Ash (Fill)
13.0													
		13'-15'		24"	3"	5	3	3	2	4			13': SAA
14.0		S-5											
15.0													
		15'-17'		24"	12"	10	3	2	3	3			15': SAA
16.0		S-6											
17.0													
18.0													
19.0													
20.0													

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: $Ncorr=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	PROJECT NAME: CHPE -
DRILLER: George Raymond, Eddie Cordera		PROJECT NO.: 60323056
		HOLE NO.: RA-2
SOILS ENGINEER: Michael Izdebski		START DATE: 03/07/22
	BORING LOG	FINISH DATE: 03/16/22
LOCATION: Con Ed Astoria Generating Complex - MP 2.11		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'		24"	12"	5	4	7	9	7	GP		20': c+ to f angular GRAVEL, brown
21.0		S-7											Sandy wash liquid
22.0													
23.0													
24.0													
25.0													
		25'-27'		24"	6"	21	15	8	10	15	GP	GRAVEL	25': m-c GRAVEL
26.0		S-8											
27.0													
28.0													
29.0													
30.0													
		30'-32'		24"	5"	50	12	9	8	14	GW		30': f-c GRAVEL, little f-c Sand
31.0		S-9											
32.0													
33.0												SAND and GRAVEL	
34.0													
35.0													
		35'-37'		24"	8"	10	6	3	2	6	SW		35': Black SAND and Gravel, little Silt
36.0		S-10											
		TR-2(36.5-37.0)									OH		36.5': Black SILTY CLAY, trace organics,
37.0													trace Sand, trace fm Gravel
38.0												Organic CLAY	
39.0													
40.0													
		40'-42'		19"	17"	2	12	44	50/1"	36	OH		40': SAA
41.0		S-11A(40.0-40.5)											
		S-11B(41.5-42.0)											
42.0		TR-3(41.0-41.5)									SW	TILL	41.5': Br f-c SAND, f-c Gravel (Till)
		TR-4(41.5-42.0)											suspected rock at tip.
43.0												DECOMPOSED GNEISS	
44.0													
45.0													

NOTES:

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SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT		SHEET 3 OF 4
DRILLER: George Raymond, Eddie Cordera	AECOM	PROJECT NAME: CHPE -
		PROJECT NO.: 60323056
		HOLE NO.: RA-2
SOILS ENGINEER: Michael Izdebski		START DATE: 03/07/22
	BORING LOG	FINISH DATE: 03/16/22
LOCATION: Con Ed Astoria Generating Complex - MP 2.11		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		45'-47'		12"	12"	32	36	50/0"			SW	DECOMPOSED GNEISS	45': Grey f-c SAND, some f-c angular Gravel, little Silt (Presumed decomposed Gneiss.
46.0		S-12											
47.0													
48.0													
49.0													
50.0													
		50'-52'		0"	0"	50/0"							50': Highly fractured grey Gneiss
51.0													
		50'-55'		60"	44"	Recovery = 73%						GNEISS	
52.0		R-1				RQD= 38%							
53.0													
54.0													
55.0													
		55'-60'		60"	56"	Recovery = 93%							55': Moderately fractured grey Gneiss
56.0		R-2				RQD= 81%							
57.0													
58.0													
59.0													
60.0													
		60'-65'		60"	60"	Recovery = 100%							60': SAA. Mechanical break 64.5'.
61.0		R-3				RQD = 83%							
		TR-5(60.65-61.10)											
62.0													
63.0													
64.0													
65.0													
		65'-70'		60"	60"	Recovery= 100%							65': SAA
66.0		R-4				RQD= 90%							
		TR-6(68.60-69.10)											66.9': Intrustion of high quartz/feldspar concentration. Lightly fractured. Hard.
67.0													
68.0													
69.0													
70.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 4 OF 4
DRILLER: George Raymond, Eddie Cordera		PROJECT NAME: CHPE -
		PROJECT NO.: 60323056
		HOLE NO.: RA-2
SOILS ENGINEER: Michael Izdebski		START DATE: 03/07/22
	BORING LOG	FINISH DATE: 03/16/22
LOCATION: Con Ed Astoria Generating Complex - MP 2.11		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)	N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	ICATION OF SOILS
		70'-75'		60"	60"	Recovery = 100%				SAA
71.0		R-5				RQD= 100%				
						Note: 60" recovery includes approx. 12" left in hole and recovered in R-6. See note below.				
72.0										72.4': Grey gneiss, moderatly fractured
73.0										
										73.5': Quartz, feldspar intrusion, lightly fractured, hard
64.0									GNEISS	
75.0										
		75'-78.5'		43"	43"	Recovery = 100%				75.85': Grey gneiss, moderately fractured
76.0		R-6				RQD = 100%				
						Note: 43" recovery excludes approx. 12" of extra core left in hole from R-5. See note above.				
77.0										
78.0										
79.0										
										RA-2 terminated 78.5' bgs, grouted to surface.
80.0										
81.0										
82.0										
83.0										
84.0										
85.0										
86.0										
87.0										
88.0										
89.0										
90.0										
91.0										
92.0										
93.0										
94.0										
95.0										

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 1 OF 2
DRILLER: George Raymond		PROJECT NAME: CHPE -
SOILS ENGINEER: Michael Izdebski		PROJECT NO.: 60323056
		HOLE NO.: **RA-3**
		START DATE: 03/24/22
	BORING LOG	FINISH DATE: 04/01/22
LOCATION: Con Ed Astoria Generating Complex - MP 2.21		OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	DRILL RIG: CME-85
Groundwater not observed	TYPE	FJS	Cali Split Spoon	Tri-Cone RB	NQ	BORING TYPE: SPT
	SIZE I.D.	4"	2.5"	--	1 7/8"	BORING O.D.: 4"/3"
	SIZE O.D.	4.5"	3"	3 7/8"	3"	SURFACE ELEV.: 8.0' (NAVD88)
	HAMMER WT.	140 lbs	140 lbs			NORTHING: 226450.189
	HAMMER FALL	30"	30"			EASTING: 1011554.926

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.(2)	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
												FILL	0': f-c SAND, some Silt, little f-c Gravel,
1.0													trace organics
2.0						Hand cleared from 0'-5'.							
3.0		3'-5'											
		S-1											3': SAA, Black color, faint burnt odor
4.0		TR-1 (3.0-5.0)											3.5': Black f-c SAND, some Silt, little f-c
													Gravel
5.0													
		5'-7'		24"	12"	7	10	11	11	14	GW		5': Black f-c GRAVEL and SAND, little Silt
6.0		S-2											burnt odor, 0 ppm (Fill)
		TR-2 (6.0-6.5)											
7.0													
		7'-9'		24"	5"	13	7	3	2	2	GW		7': SAA
8.0		S-3											
9.0													
		9'-11'		24"	1"	15	7	6	2	8	GP		9': m angular GRAVEL in tip
10.0		S-4											
11.0													
		11'-13'		24"	1"	2	1	2	1	2	GW		11': Brown f-m angular GRAVEL, little
12.0		S-5											f-c Sand, little Silt, some organics
13.0													
		13'-15'		24"	14"	2	1	2	1	2	MH	Silty CLAY	13': Grey CLAYEY SILT, some organics,
14.0		S-6											some f-c Gravel little f-c Sand
		TR-3 (14.5-15.0)											14.5': Grey SILTY CLAY, little organics
15.0													
		15'-17'		24"	X	WOH	WOH	2	3	1	MH		15': SAA
16.0		S-7											
17.0													
18.0													
19.0													
20.0													

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: $Ncorr=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 2 OF 2
DRILLER: George Raymond		PROJECT NAME: CHPE -
		PROJECT NO.: 60323056
		HOLE NO.: RA-3
SOILS ENGINEER: Michael Izdebski		START DATE: 03/24/22
	BORING LOG	FINISH DATE: 04/01/22
LOCATION: Con Ed Astoria Generating Complex - MP 2.21		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'		24"	0"	14	13	12	14	16		SAND	no recovery
21.0													
22.0													
23.0													
24.0													
25.0													
		25'-27'		20"	18"	18	32	48	50/2"	52	SW		25': Brown f-c SAND
26.0		S-8 (26.0-27.0)											
		S-9 (26.0-26.5)										TILL	26': Brown f-c SAND and GRAVEL, some
27.0		TR-4 (26.0-26.5)											Silt, Hard (Till)
28.0													
29.0													
30.0													
		30'-32'		0"	0"	50/0"						GNEISS	no recovery
31.0													
32.0		31.8'-34.0':		26"	26"	Recovery = 100%							31.8': Very highly fractured Gneiss,thick
		R-1				RQD = 53%							quartz and K feldspar veins present.
33.0													
34.0		34'-39'		60"	60"	Recovery = 100%							34': SAA
		R-2				RQD= 40%							
35.0		TR-5(35.35-35.85)											
													RA-3 terminated 39' bgs and grouted
36.0													to surface.
37.0													
38.0													
39.0													
40.0													
41.0													
42.0													
43.0													
44.0													
45.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 1 OF 3
		PROJECT NAME: CHPE -
DRILLER: George Raymond		PROJECT NO.: 60323056
		HOLE NO.: **RA-4**
SOILS ENGINEER: Michael Izdebski		START DATE: 03/24/22
	BORING LOG	FINISH DATE: 04/01/22
LOCATION: Con Ed Astoria Generating Complex - MP 2.3		OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	
WL ~ 11.7'	TYPE	FJS	Cali Split Spoon	Tri-Cone RB	NQ	DRILL RIG: CME-85
	SIZE I.D.	4"	2.5"	--	1 7/8"	BORING TYPE: SPT
	SIZE O.D.	4.5"	3"	3 7/8"	3"	BORING O.D.: 4"/3"
	HAMMER WT.	140 lbs	140 lbs			SURFACE ELEV.: 13.4' (NAVD88)
	HAMMER FALL	30"	30"			NORTHING: 226260.878
						EASTING: 1011955.673

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.(2)	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
												SAND and GRAVEL (FILL)	0': Asphalt
1.0											SW		0.5': Brown f-c SAND, little Gravel, little Silt, trace organics, trace brick, cobbles ~3-5'.
2.0						Hand cleared from 0'-5'.							
3.0		3'-5' S-1 TR-1 (3.0-5.0)											
4.0													
5.0		5'-7' S-2		24"	5"	5	4	5	7	6	SW		5': Brown f-c SAND, little f Gravel, little Silt
6.0													
7.0		7'-9' S-3		24"	5"	8	6	5	6	3	SW		7': SAA, coarse Gravel fragment in tip
8.0													
9.0		9'-11' S-4 TR-2(10.0-10.5)		24"	15"	12	20	14	37	22	SW		9': Br f-c SAND, some Silt, little f-c Gravel
10.0													
11.0		11'-13'		24"	2"	50/4"					SW	BOULDER	11': SAA, gneiss chunk in tip 11.5' Presumed boulder
12.0													
13.0		13'-15' S-5		- -									Atttempted to run core. *S-5 is few fragments of gneiss. Advance to 15' and resume SPT
14.0													
15.0		15'-17' S-6		24"	5"	1	1	11	27	8	GW	SAND and GRAVEL (FILL)	15': Grey f-c angular GRAVEL, some f-c Sand, little Silt, trace Brick (Potentially crushed boulder remnants)
16.0													
17.0													*Note: Lost all fluid return at 17 ft. Advanced 4" casing. The bottom 5' of casing broke off downhole and driller was unable to retrieve it. Installed new drive shoe and advanced casing, bypassing the broken 5 ft. section which was abandoned between approximately 15-20' bgs.*
18.0													
19.0													
20.0													

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: $N_{corr}=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

(3) Driller was experiencing difficulty maintaining a seal on this hole and was losing water frequently.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 2 OF 3
		PROJECT NAME: CHPE -
DRILLER: George Raymond		PROJECT NO.: 60323056
		HOLE NO.: RA-4
SOILS ENGINEER: Michael Izdebski		START DATE: 03/24/22
	BORING LOG	FINISH DATE: 04/01/22
LOCATION: Con Ed Astoria Generating Complex - MP 2.3		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'		24"	2"	4	4	2	3	4		SAND and GRAVEL (FILL?)	Grey f-c SAND, little f-m Gravel, trace brick
21.0		S-7											
22.0													** Sample S-7 was collected after 4" casing was readvanced. Sample interval may have been previously disturbed by broken casing and sample may not be representative.*
23.0													
24.0													
25.0		25'-27'		24"	4"	7	13	11	8	16	SW		25': Grey f-c SAND and GRAVEL some Silt (Wash?)
26.0		S-8											
27.0											SW	SAND	26.5: Brown f-m SAND, little Slt, trace Gravel
28.0													
29.0													
30.0		30'-32'		24"	12"	12	12	13	10	16	SW		30': Brown f-c SAND, trace Silt
31.0		S-9											
		TR-3(31.0-31.5)									SW		31.5': Brown f-m SAND, little silt
32.0													
33.0													
34.0													
35.0		35'-37'		24"	18"	20	20	25	28	30	SW		35': Brown f-c SAND, trace Silt, fines down to brown f-m SAND, little Silt at 36.5'
36.0		S-10(35.0-36.0)											
		S-11(36.0-37.0)											
37.0		TR-4(36.0-36.5)											
38.0													
39.0													
40.0		40'-42'		24"	2"	20	37	30	24	44	SW		40': Large subrounded GRAVEL piece, little f-c SAND
41.0													
42.0													
43.0													
44.0													
45.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM	SHEET 3 OF 3
DRILLER: George Raymond		PROJECT NAME: CHPE -
		PROJECT NO.: 60323056
		HOLE NO.: RA-4
SOILS ENGINEER: Michael Izdebski		START DATE: 03/24/22
	BORING LOG	FINISH DATE: 03/31/22
LOCATION: Con Ed Astoria Generating Complex - MP 2.3		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		45'-47'		24"	20"	21	28	27	24	36	SW	SAND	45': f-m SAND
46.0		S-12 (45.0-46.0)											
		S-13 (46.0-47.0)									SW		46': f-c+ SAND
47.0		TR-5 (46.0-46.5)									SW		46.5': f+-m SAND
48.0													RA-4 terminated 47' bgs, grouted borehole to surface, including section of lost 4" casing.
49.0													
50.0													
51.0													
52.0													
53.0													
54.0													
55.0													
56.0													
57.0													
58.0													
59.0													
60.0													
61.0													
62.0													
63.0													
64.0													
65.0													
66.0													
67.0													
68.0													
69.0													
70.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

Appendix C - Rock Core Photographic Log

ROCK CORE PHOTOGRAPHIC LOG

AECOM Project No: **60323056**
Project Name: **CHPE Geotechnical Investigation**
Location: **Bronx, Randall's Island to AGC Receiving Pit Segment, Bronx and Queens Co's, NY**

AECOM

Boring No.	Depth (ft.)
BR-1	20.0 – 40.0

Boring No.	Depth (ft.)
BR-1	40.0-60.0

Note: Black foam inserts represent core pieces that were removed for geotechnical and/or thermal resistivity laboratory testing