HDD Design Summary Report
Crossings HDD 51 to HDD 61
in Segment 6 – Package 4A

Ballston Spa to Glenville
Saratoga & Schenectady County, New York

CHA Project Number: 066076

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1.0 INTRODUCTION

1.1 PURPOSE

The Champlain Hudson Power Express (CHPE) consists of installing a pair of HVDC electrical transmission cables with an associated telecommunications line from Canada to New York City. 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 170 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 environment. This Design Summary Report addresses the design for the HDD crossings in Segment 6 – Package 4A from Ballston Spa to Glenville. These crossings are designated HDD 51 through HDD 61, inclusive of A and B designations.

The purposes of this Design Summary Report are to provide the following:

- Review of the existing geological, hydrogeological, and geotechnical conditions for HDD 51 through HDD 61 for total of 18 crossings (2 per site) in Segment 6 – Package 4A.
- Provide a descriptive narrative of the HDD Crossings in support of the attached design drawings and technical specifications.
- Present stress and inadvertent release analyses that support the proposed designs.
- Evaluate construction considerations including inadvertent return mitigation.

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. Segment 6 – Package 4A is located in approximately a 10.2-mile section of the route in Saratoga & Schenectady County, New York.

A Project Locus Map and a plan showing the locations of the HDD 51 through HDD 61 crossings are presented in Appendix B.

The HDD crossing 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
51	40001+97	40022+12	1907/2018	Road/Rail/Wetland
52	40060+84	40087+80	2701	Wetland
53	40098+47	40106+61	815	Road (Rail Bridge)/Stream
53A	40227+56	40233+76	625/627	Culvert/Stream (Rail Bridge)
59	40409+11	40420+63	1124/1159	Culvert
59A	40425+37	40443+60	1826	Road/Rail
59B	40489+82	40498+10	829	Rail/Wetland
60	40511+60	40524+98	1332/1335	Wetland/Streams (Rail Bridge)
61	40527+60	40534+42	684/689	D.O.T Road

3.0 BACKGROUND

The underground construction of two HVDC electrical transmission cables is proposed to be housed in individual 10-inch-diameter DR 9 HDPE conduits distance dependent on depth and soil Thermal Resistivity (TR) values provided by NKT and as shown on drawing plans. A third, 2-inch-diameter DR 9 conduit will be bundled with one of the 10-inch diameter conduits for a telecommunications line. Longer and deeper bores may require an 8-inch-diameter conduit composed of the stronger, fusible PVC (FPVC) with an appropriate wall thickness (typically DR 14 or DR 17) to resist tensile stresses during installation and collapse-related long-term. The 8-inch conduit would typically be bundled with a 3-inch diameter HDPE for the telecommunications line, such as HDD#59A. This is checked and determined on a case-by-case basis and design sizes are shown on the design drawings shown in Appendix E. The conduits are to be installed in 16 to 22-inch final ream diameter bore holes. Using the 8-inch FPVC may permit a slightly smaller, 12-to-16-inch final ream diameter bore hole. The proposal is to install the cables at least 25 feet below congested areas, roads, railroads, under/around other obstructions, 15 to 25 feet below wetland and small streams, and 35 to 45 feet below open bodies (i.e., ponds, lakes, canals, and rivers) of water using HDD methods. HDD is a widely used trenchless construction method to install conduits with

limited disturbance to the ground around the bore alignment, minimal ground surface impacts above the alignment, and to minimize the potential of inadvertent releases of drilling fluids while boring. The goal for using HDD methods is to install the conduits while controlling and minimizing the amount of impact to congested areas, existing underground obstructions, and to the adjacent wetlands to the extent possible.

4.0 SITE CONDITIONS

4.1.1 Project Datum and Topography

HDD #51

HDD #51 consists of horizontally curved bores approximately 1907 feet and 2018 feet long. Both the bores are located on the west side of CP Rail railroad tracks and Oak Street in Ballston, NY, at approximately latitude 43.0025°N and longitude 73.8385°W. The HDD bores will pass under multiple reinforced concrete culvert pipes (RCP), various additional existing underground utilities, wetlands and will cross underneath East High St and Ballston Spa Industrial railway track. The ground surface elevations along the HDD path gently undulates between El. 284 and El. 293 (reference datum NAVD 1988). The bores of this HDD are intersecting in plan (stacked), conduits over and under each other, due to limited clearance between the RR bridge structure over E. High Street and the adjacent home, near Plan and Profile Station 40008+50. This intersected in plan was extended to eliminate private easements for homes on Kaleen Drive extending to Plan and Profile Station 40016+62.

HDD #52

HDD #52 consists of two HDD bores approximately 2701 feet long. Both bores are west of the CP Rail railroad tracks in Ballston, NY, and cross underneath NY designated wetlands, at approximately latitude 42.9871°N and longitude 73.8442°W. Both HDD bores run on the west side of the railroad tracks for entire drill. The ground surface elevations along the HDD path gently undulates between El. 294 and El. 297 (reference datum NAVD 1988).

HDD #53

HDD #53 consists of two straight (in plan view) HDD bores approximately 815 feet long that run on the west side of CP Rail railroad tracks and cross underneath Route 67 and a Stream in Ballston, NY, at approximately latitude 42.9771°N and longitude 73.8476°W. The HDD bores will pass approximately 34 feet underneath existing water and gas utility, 37 feet below the Route 67 and approximately 20 feet below the estimated mudline (assuming a 5' water depth). The ground surface elevations along the path of HDD #53 gently undulates from approximately El. 296 to El. 295 aside from the dip to the water level which is at approximately El. 266 (reference datum NAVD 1988).

HDD #53A

HDD #53A consists of two straight HDD bores approximately 625 feet and 627 feet long that runs on the west side of the CP Rail railroad tracks, a parallel to gas transmission line, and adjacent to a repurposed bike rail trail bridge in Ballston, NY. Both bores remain on west side of the tracks for the entire run. The HDD bores will pass approximately 17 feet below the estimated mudline (assuming a 5' water depth), at approximately latitude 42.9438°N and longitude 73.8633°W. The ground surface elevation at entry and exit of bore alignment is approximately El. 276, while at the center it dips down to the water level at El. 271 (reference datum NAVD 1988).

HDD #59

HDD #59 consists of two straight HDD bores, with one approximately 1124 feet long and the other approximately 1159 feet long that passes along the west side of Ballston Lake Road and run parallel to a gas transmission line in Ballston, NY, at approximately latitude 42.8969°N and longitude 73.8841°W. HDD bores remain on the west side of CP Railroad railway tracks for the entire run. The bores will pass approximately 20 feet below proposed mudline (5' depth assumed). The ground surface elevation at the entry point is approximately El. 270 and exit point is approximately El. 260, while most of the run it stays at El. 258 (reference datum NAVD 1988).

HDD #59A

HDD #59A consists of horizontal curved HDD bores, approximately 1826 feet long that cross Blue Barns Road, route 110, and run parallel to a gas transmission line in Ballston, NY, at approximately latitude 42.8912°N and longitude 73.8897°W. HDD bores start on the west side of CP Railroad

railway tracks and crosses to the east side. The ground surface elevations along the HDD path gently undulates between El. 269 and El. 259 (reference datum NAVD 1988).

HDD #59B

HDD #59B consists of two straight HDD bores, approximately 829 feet long that parallels 3,200 feet west of Blue Barns Road, 2,700 feet east of Hetcheltown Road, run approximately 8 degrees skewed to a gas transmission line in Ballston, NY, at approximately latitude 42.8771°N and longitude 73.8988°W. HDD bores start on the east side of CP Railroad railway tracks and crosses to the west side. The bores will pass approximately 35 feet beneath railroad tracks and approximately 28 feet below NY designated wetlands. The ground surface elevations along the HDD path gently undulates between El. 252 and El. 241 (reference datum NAVD 1988).

HDD #60

HDD #60 consists of two HDD bores with a horizontal curve, approximately 1332 feet and 1335 feet long that crosses a gas transmission line approximately 1,400 feet north of Glenridge Road and then passes under the Alplaus Kill River in Ballston, NY. Both bores run on the west side of CP Rail railroad tracks at approximately latitude 42.8720°N and longitude 73.9002°W. HDD bores remain on the west side of CP Railroad railway tracks for the entire run. The ground surface elevations along the HDD path gently undulates between El. 233 and El. 236, aside from dipping to a water level at approximately El. 221 (reference datum NAVD 1988).

HDD #61

HDD #61 consists of two straight HDD bores, one approximately 684 feet long and the other approximately 689 feet long, that runs on the west side of CP Rail railroad tracks and cross underneath a Glenridge and Hetcheltown Roads in Ballston, NY, at approximately latitude 42.8681°N and longitude 73.9027°W. The HDD bores will cross underneath an existing storm and gas line, pass approximately 25 feet below the pavement, and will remain on the west side of railway tracks for the entire drill. The ground surface elevations along the HDD path gently undulates between El. 230 and El. 240 (reference datum NAVD 1988).

4.1.2 Geotechnical Data

HDD #51

Subsurface investigations were conducted in 2013 by TRC, 2022 by Terracon and 2022 by Kiewit for Transmission Developers, Inc. There are five borings to date at HDD #51: B158.87-1, KB-158.9, K-159.1, B159.1-1 and KB-158.8, which reach depths of 20.8, 60, 35, 14.5, and 15 feet below grade, respectively. There appears to be a 13.5-foot layer of medium dense fill over a 6.5-foot layer of loose to medium dense silty sand, over a 0.8-foot layer of very dense weathered rock in boring B158.87-1. There appears to be a 2-foot layer of loose fill over a 6-foot layer of compact low plasticity silt, over a 2-foot layer of very dense weathered rock, over a 50-foot layer of shale bedrock in boring KB-158.9. There appears to be a 2-foot layer of loose fill over a 2-foot layer of very stiff low plasticity clay, over a 3-foot layer of very dense weathered rock, over a 7.5-foot layer of shale bedrock in boring B-159.1-1. There appears to be a 4-foot layer of very loose to loose fill over a 12-foot layer of very dense weathered rock, over a 19-foot layer of shale bedrock in boring K-159.1. There appears to be 2.4-foot layer of loose fill over a 2.6-foot layer of dense weathered rock, over a 10-foot layer of shale bedrock in boring KB-158-8. The majority of the drill path looks to be through layers of dense weathered rock and shale. Due to the length of the proposed HDD alignment, and the varying thickness of the soil layers observed onsite, the BoreAid analysis will be based on non-horizontal layering corresponding to all five soil borings. The Geotechnical Data Report for this location is provided in Appendix C.

Based on the borings, the soil profile for the HDD #51 BoreAid analysis will be divided into three (3) layers: medium dense poorly graded sand (SP), very dense poorly graded gravels (GP) and shale bedrock. The soil profiles used for BoreAid analyses for the HDD in this segment are presented in Appendix D.

HDD #52

Subsurface investigations were conducted in 2021 by AECOM, and 2022 by Kiewit for Transmission Developers, Inc. There are eight borings to date at HDD #52: K-159.9, BM-1B, K-160.0, K-160.1, K-160.2, B160.3-1, K-160.4 and BM-1E, which reached depths of 35, 35.2, 35, 35, 34.5, 14.5, 35 and 25 feet below grade, respectively. There appears to be a 6-foot layer of loose fill, over a 9-foot layer of silty sand, over a 20-foot layer of shale bedrock in boring K-159.9. There

appears to be a 5-foot layer of elastic sand, over a 10-foot layer of poorly graded sand, over a 5-foot layer of elastic sand, over a 15.2-foot layer of shale bed rock in boring BM-1B. There appears to be a 6-foot layer of loose fill, over a 10-foot layer of silty sand, over a 19-foot layer of shale bedrock in boring K-160.0. There appears to be a 6-foot layer of loose fill, over a 7.5-foot layer of silty sand, over a 1.5-foot layer of dense weathered rock, over a 20-foot layer of shale bedrock in boring K-160.1. There appears to be a 6-foot layer of loose fill, over an 8-foot layer of silty sand, over a 3-foot layer of interbedded sandstone and shale, over a 17.5-foot layer of shale bedrock in boring K-160.2. There appears to be a 4-foot layer of loose fill, over a 5.5-foot layer of silty sand, over a 5-foot layer of shale bedrock in boring B160.3-1. There appears to be a 6-foot layer of loose fill, over a 9-foot layer of silty sand, over a 20-foot layer of shale bedrock in boring K-160.4. There appears to be a 3-foot layer of loose fill, over a 22-foot layer of shale bedrock in boring BM-1E. The borings were similar and the BoreAid analysis will be based on the layering observed in boring K-160.1. The Geotechnical Data Report for this location is provided in Appendix C.

Based on the borings, the soil profile for the HDD #52 BoreAid analysis will be divided into three (3) layers: loose silty sand (SM), very dense well graded sand (SW), and shale bedrock. The soil profiles used for BoreAid analyses for the HDD in this segment are presented in Appendix D.

HDD #53

Subsurface investigations were conducted in 2022 by Atlantic Testing Laboratories, Ltd. for Transmission Developers, Inc. There are two borings to date at HDD #53: KB-160.6 and B160.7-1, which reached depths of 82 and 25 feet below grade. There appears to be a 0.3-foot layer of loose fill, over a 4.5-foot layer of silty sand, over a 2.2-foot layer of weathered rock, over a 75-foot layer of shale bedrock in boring KB-160.6. There appears to be a 4-foot layer of silt, over a 9.5-foot layer of silty sand, over a 1.5-foot layer of silt, over a 10-foot layer shale bedrock in boring B160.7-1. The borings were similar; therefore, the BoreAid analysis soil layering will be based on the observations in boring KB-160.6. The Geotechnical Data Report for this location is provided in Appendix C.

Based on the borings drilled for this project, the soil profile for the HDD #53 BoreAid analysis will be divided into four (4) layers: loose silt (ML), medium dense silty sand (SM), and dense

weathered rock (ML), and shale bedrock. The soil profiles used for BoreAid analyses for the HDD in this segment are presented in Appendix D.

HDD #53A

Subsurface investigations were conducted in 2022 by Terracon for Transmission Developers, Inc. There are two borings to date at HDD #53A: KB-163.1 and KB-163.2, which extend to depths of 45 feet below grade. There appears to be a 0.5-foot layer of medium dense fill over a 6-foot layer of silty sand, over a 1.5-foot layer of dense weathered rock, over a 37-foot layer of shale bedrock in boring KB-163.1. There appears to be a 0.5-foot layer of medium dense fill over a 15.3-foot layer of medium silty sand, over a 4.2-foot layer of dense weathered rock, over a 25-foot layer of shale bedrock in boring KB-163.2. The BoreAid analysis will be based on the soil layering observed in boring KB-163.2, which contains soils more susceptible to frack out failure. The Geotechnical Data Report for this location is provided in Appendix C.

Based on the borings, the soil profile for the HDD #53A BoreAid analysis will be divided int four (4) layers: medium dense fill (SP), medium dense silty sand (SM), dense weathered rock (GP) and shale bedrock. The soil profiles used for BoreAid analyses for the HDD in this segment are presented in Appendix D.

HDD #59

Subsurface investigations were conducted in 2013 by TRC, 2022 by Terracon, and 2022 by Kiewit for Transmission Developers, Inc. There are four borings to date at HDD #59: B166.5-1, BM-3C, K-166.8 and KB-166.5, which reached depths of 13, 40.3, 20 and 35 feet below grade. There appears to be a 4-foot layer of loose fill over a 2-foot layer of very dense low plasticity silt, over a 2-foot layer of very dense weathered rock, over a 5-foot layer of shale bedrock in boring B166.5-1. There appears to be a 3-foot layer of loose well graded sand over a 4-foot layer of hard low plasticity silt, over a 2-foot layer of very dense weathered rock, over a 31.3-foot layer of shale bedrock in boring BM-3C. There appears to be a 1-foot layer of medium dense fill over a 4-foot layer of very dense weathered rock, over a 15-foot layer of shale bedrock in boring K-166.8. There appears to be a 2-foot layer of medium dense fill over a 2-foot layer of very dense clayey sand, over a 31-foot layer of shale bedrock in boring KB-166.5. Due to the length of the proposed HDD alignment, and the varying thickness of the four main soil layers observed onsite, the BoreAid

analysis will be based on non-horizontal layering corresponding to all four soil borings. The Geotechnical Data Report for this location is provided in Appendix C

Based on the borings, the soil profile for the HDD #59 BoreAid analysis will consist of four (4) layers: medium dense poorly graded sand (SP), stiff low plasticity clay (CL), very dense weathered rock (GP) and shale bedrock. The soil profiles used for BoreAid analyses for the HDD in this segment are presented in Appendix D.

HDD #59A

Subsurface investigations were conducted in 2013 by TRC, 2021 by AECOM and 2022 by Terracon for Transmission Developers, Inc. There are five borings to date at HDD #59A: K-166.8, B166.9-1, B167.1-1, BM-3C and BM-4, which reached depths of 20, 14, 18, 40.3 and 16 feet below grade. There appears to be 1-foot layer of medium dense fill over a 4-foot layer of dense weathered rock, over a 15-foot layer of shale bedrock in boring K-166.8. There appears to be 4-foot layer of loose fill over a 10-foot layer of shale bedrock in boring B166.9-1. There appears to be 6-foot layer of loose fill over a 7-foot layer of hard low plasticity clay, over a 5-foot layer of shale bedrock in boring B167.1-1. There appears to be 3-foot layer of well graded sand over a 4-foot layer of hard low plasticity silt, over a 2-foot layer of very dense weathered rock, over a 31.3-foot layer of shale bedrock in BM-3C. There appears to be 3-foot layer of loose poorly graded sand over a 13-foot layer of shale bedrock in BM-4. The Geotechnical Data Report for this location is provided in Appendix C.

Based on the borings, the soil profile for the HDD #59A BoreAid analysis will consist of four (4) layers: medium dense fill (SP), medium stiff low plasticity clay (CL), dense weathered rock (GM) and shale bedrock. The soil profiles used for BoreAid analyses for the HDD in this segment are presented in Appendix D.

HDD #59B

Subsurface investigations were conducted in 2023 by Terracon. There are two borings to date at HDD #59B: KB-168.1 and KB-168.2, which extend to depths of 50 feet below grade. There appears to be a 2-foot layer of loose poorly graded sand over a 3.8-foot layer of medium dense poorly graded sand, over a 4.2-foot layer of very dense weathered rock, over a 40-foot layer of

shale bedrock in boring KB-168.1. There appears to be a 4-foot layer of loose sandy topsoil over a 6-foot layer of medium dense silty sand, over a 5-foot layer of very dense weathered rock, over a 35-foot layer of shale bedrock in boring KB-168.2. Due to the length of the proposed HDD alignment, and the varying thickness of the five main soil layers observed onsite, the BoreAid analysis will be based on non-horizontal layering corresponding to the two soil borings. The Geotechnical Data Report for this location is provided in Appendix C.

Based on the layering observed in the two borings conducted along the alignment, the soil profile for the HDD #59B BoreAid analysis will be divided into five (5) layers: loose fill (SP), medium dense poorly graded sand (SP), medium dense silty sand (SM), very dense weathered rock (GP), and shale bedrock. The soil profiles used for BoreAid analyses for the HDD in this segment are presented in Appendix D.

HDD #60

Subsurface investigations were conducted in 2013 by TRC and 2022 by Terracon for Transmission Developers, Inc. There are three borings to date at HDD #60: K-168.6, B168.64-1, and K-168.7, which extend to depths of 61.8 feet, 50 feet, and 60.9 feet below grade. There appears to be 10-foot layer of loose fill over a 5-foot layer of loose silty sand, over a 2-foot layer of medium stiff low plasticity clay, over a 44.8-foot layer of dense glacial till in boring K-168.6. There appears to be 4-foot layer of very dense fill over a 4-foot layer of very loose silty sand, over a 6-foot layer of very loose low plasticity silt, over a 3.5-foot layer of very dense low plasticity clay, over a 32.5-foot layer of very dense glacial till in boring B168.64-1. There appears to be an 8-foot layer of medium dense fill over a7-foot layer of loose low plasticity silt, over a 5-foot layer of soft low plasticity clay, over a 40.9-foot layer of dense glacial till in boring K-168.7. The BoreAid analyses will be based on non-horizontal layering corresponding to borings K-168.6, B168.64-1 and K-168.7. The Geotechnical Data Report for this location is provided in Appendix C.

Based on the layering observed in the three borings conducted along the alignment, the soil profile for the HDD#60 BoreAid analysis will be divided into three (3) layers: loose silty sand (SM), medium stiff high plasticity clay (CH), and dense glacial till (SM).

HDD #61

Subsurface investigations were conducted in 2013 by TRC and 2022 by Terracon for Transmission Developers, Inc. There are three borings to date at HDD #61: B168.86-1, K-168.8 and K-168.9, which extend to depths of 29.4, 40.7 and 42 feet below grade, respectively. There appears to be a 2-foot layer of medium dense fill over a 11.5-foot layer of medium stiff low plasticity silt, over a 10-foot layer of medium dense poorly graded sand, over a 5.9-foot layer of dense glacial till in boring B168.86-1. There appears to be a 6-foot layer of medium dense fill over a 4-foot layer of loose silty sand, over a 10-foot layer of soft low plasticity clay, over a 20.7-foot layer of dense glacial till in boring K-168.8. There appears to be a 12-foot layer of medium stiff fill over a 12-foot layer of medium dense silty sand, over an 18-foot layer of dense glacial till in boring K-168.9. The soil conditions observed within borings K-168.8 and K-168.9 were generally consistent. Due to the varying thickness of the three to four main soil layers observed in those two borings, the BoreAid analysis will be based on non-horizontal layering corresponding to the two applicable soil borings, K-168.8 and K-168.9. The Geotechnical Data Report for this location is provided in Appendix C.

Based on the borings, the soil profile for the HDD #61 BoreAid analysis will be divided into four (4) layers: medium dense poorly graded sand (SP), medium dense silty sand (SM), soft low plasticity clay (CL) and medium dense silty sand (SM). The soil profiles used for BoreAid analyses for the HDD in this segment are presented in Appendix D.

5.0 DESIGN SUMMARY

The HDD construction process in soils generally consists of three steps:

Step 1: Drill a small diameter (approximately 7 to 9 inches diameter) pilot hole along the preplanned bore path. During the pilot hole boring, the location of the drill bit is tracked to confirm that it is following the planned path. If the drilling is observed to start to deviate from the planned path, corrections are made using a "bent" lead drilling section and controlled rotation of drill pipe string. The drill bit is designed to cut through the soil in combination with pressurized drilling fluid assisting the cutting of the soil, and transport of the cuttings to the entry pit for removal. The drilling fluid is generally a combination of bentonite (a clay mineral) and water, combined with NSF certified additives to support sides of the borehole and to better carry the cuttings to the entry

pit at lower pressures and velocities. The drilling fluids used under waterbodies and wetland areas are required in the project specifications to be "non-toxic and environmentally friendly". Once the pilot bore reaches the exit point, the next step of the process, hole enlargement begins.

Step 2: Enlarge the pilot hole to the diameter required for insertion of the conduits. This is accomplished by using successively larger reaming bits pulled through the pilot bore to gradually enlarge the bore from about 8 inches diameter to 16 to 22 inches diameter to accommodate in this case a HDPE conduit about 10 inches in diameter in one bore and a bundle of two conduits, one 10 inches diameter and the other 2 inches diameter, that are to be pulled into the enlarged bore hole. We estimate that one and possibly a second reaming pass will be used to create the 16 to 22inch diameter borehole. This pulling in of a bundle of conduits is sometimes referred to as a slick bore. During this step, the borehole is still filled with drilling fluid to support the sides of the bore hole in preparation for Step 3, the insertion of the conduit.

Step 3: Pull the conduits into the enlarged hole. While the pilot hole and reaming operations are ongoing, the contractor will also be fabricating the conduits to be installed. The conduits come in about 40-foot-long sections and need to be fusion butt welded, debeaded internally, and arranged for the pullback into to the borehole. Ideally, the complete conduit (or bundle of conduits) will be welded (and bundled) into one long length for insertion. The goal is usually to pull the bundle into the bore in one, continuous, smooth, around the clock, operation. However, depending on work area and access constraints, sometimes the pipe is assembled in 2 or 3 lengths that are then joined (welded), "on the fly" as the conduit (bundle) is slowly pulled into the borehole. As the conduit (bundle) is pulled into the hole it may be ballasted with clean water, and some of the drilling fluid supporting the sides of the hole is displaced by the conduit and collected for eventual disposal. Upon completion of the conduit installation, the conduit will be allowed to relax and come to equilibrium in the hole, and the conduit will be cleaned and capped as described in the HDD technical specifications.

5.1 GEOMETRY AND LAYOUT

The HDD profiles are generally defined by the following parameters:

- Entry point location;
- Exit point location;

- Entry angle;
- Exit angle;
- Horizontal and vertical radius of Curvature;
- Lengths of tangent sections;
- Length of crossing;
- Depth of crossing and depth of cover;
- Site constraints and obstructions; and
- Available work and layout areas

The proposed bore paths 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 provided in Appendix E.

The design drawings that summarize the proposed HDD installations are in Appendix E. The HDD technical specifications are found in Section 33057.13 of the Technical Specifications. Inadvertent release prevention and mitigation plans for each HDD crossing are provided as separate documents.

The site conditions posed various challenges in developing a design that is both constructible and minimizes the potential for negative environmental impacts. The proposed design has entry and exit pits areas constrained by available easements and traffic constraints. Available work areas may limit the lengths of the conduit that can be pre-assembled, necessitating having to pre-assemble the bundle several segments that will have to be welded together during the pull back. Work zone requirements are shown in Appendix A. HDD specific work areas at the entry and exit ends of the bores are noted on the drawings in Appendix E. In addition, space and easement constraints will require that during pullback, the above ground sections of the conduit will not be straight and will require rollers to accommodate a horizontal bend. Conduit assembly is expected to be performed at the ends of the alignment shown on the drawings in Appendix E for HDD specific work areas. In some cases, the limited work area at the one end of the HDD alignment, may require that the drilling and reaming prior to pullback be performed by the HDD rig located at the one end of the alignment, but the HDD rig may need to be relocated to the other end of the alignment for the pullback/conduit installation phase of the work. In addition, for some longer bores in soft/weak ground conditions, the intersection bore method may be used to better control the risk of inadvertent drilling fluid releases.

5.2 SUBSURFACE MODEL DEVELOPMENT

A subsurface model was developed based on the boring logs as approximate representation of subsurface conditions along the proposed HDD alignment. BoreAid Version 5.0.14 (2015) modeling software (a product of Vermeer) was used to model the HDD. Geotechnical input parameters of the soil were estimated as described below.

The internal friction angles (AASHTO LRFD, Ed. 7) were estimated using the Standard Penetrations Test (SPT) blow counts. The shear modulus (G) of each layer was estimated using soil density or consistency based on SPT blow count (N-value) and representative soil layer descriptions were used to estimate Young's Modulus (E) using Hunt (1986). The shear modulus was estimated using the relationship $G = E/[2(1+\nu)]$, taking Poison's Ratio (ν) equal to 0.3. Dry and saturated unit weights were selected based on soil type using Table 2-8 from the Manual on Estimating Soil Properties for Foundation Design (EPRI 1990). For cohesive soils, cohesion was estimated based on empirical correlations with SPT blow counts (EPRI 1990). Tables for soil properties used for the HDDs in Segment 6 – Package 4A are presented in Appendix F.

5.2.1 BoreAid Analysis

For the BoreAid analyses, the pipe configuration analyzed was for a pipe with a dimension ratio (DR) of 9 unless stress and deflection calculations indicated a need for a larger diameter conduit with a thicker, (larger DR) or a change to the stronger FPVC material. The designs do not include consideration of ballast or rollers unless the analyses indicated a need for such actions to manage installation stresses. The following conduit configurations were used in the modeling analyses:

1. An individual 10-inch-diameter DR 9 HDPE or 8-inch FPVC of DR 17 conduit for the conductor, and
2. A bundle consisting of a 10-inch-diameter DR 9 HDPE conduit and a 2-inch-diameter DR 9 HDPE conduit or an 8-inch FPVC of DR 17 with a 3-inch-diameter DR 7 HDPE conduit.

The stresses and deflections of the pipe are evaluated and compared to allowable values as shown on the BoreAid runs presented in Appendix D.

In addition, a run where 2-inch-diameter DR 9 or 3-inch diameter DR 7 HDPE conduit is modeled alone was performed to check installation stresses in that conduit. If a 2-inch HDPE DR 9 is run

and the contractors means, and methods are to substitute 3-inch HDPE DR7 the HDD subcontractor must run and submit their analysis.

The BoreAid software does not list IPS PVC 8-inch DR 17 as a data entry option, therefore where DR 17 FPVC was needed, the analyses were performed for IPS 8-inch DR 18. If the DR 18, which is a slightly thinner walled than the DR 17, model indicated adequate factors of safety relative to deformations and stresses, then the DR 17 is assumed to be feasible conduit for the design. Cases where the DR 18 did not show adequate factors of safety, the use of DR 17 pipe was checked using the based on safe pull stresses from the Underground Solutions technical literature and via hand calculations to check collapse related stresses using the methodology from JM Eagle technical bulletin and Handbook of PVC pipe CH 7. These calculations are included with the BoreAid modeling of DR 18 pipe in Appendix C where applicable.

5.2.2 Inadvertent Return and Hydro-fracture Analysis

BoreAid modeling software was used to perform inadvertent return analyses for each HDD alignment. The bore path alignment was selected and checked so that the allowable bore pressures are greater than the static and circulating pressures throughout most of the alignment except at the ends. The allowable pressures are related to in-situ ground and water stresses around the bore hole, and the strength of the ground. The Limiting Formation Pressure Figure from BoreAid indicates a generally acceptable factor of safety against the potential for inadvertent return along the proposed bore paths except at the ends.

Based on the bore path selection process, areas with the greatest potential for an inadvertent return were examined and adjusted during the design process to further limit the risks associated with an inadvertent return when possible. The entry and exit points exhibited the greatest potential for inadvertent returns. The depth of the entry/exit pits should be considered by the Contractor to increase the effective soil stress and provide a storage volume for returns to and near the entry and exit points. Note that while the potential for inadvertent return has been reduced through the design process, inadvertent returns are still possible through existing fissures in the soil or rock, shrinkage cracks, weak soils, or porous deposits of coarse gravel.

Fractures within and/or inadvertent releases through the surrounding soils may cause loss of drilling fluid pressures or inadvertent return of drilling fluid into the wetlands. The areas of greatest

concern are reduced soil cover over the bore alignment and where there is a risk of release to the wetlands. The contractor will be required to institute pre-emptive measures in this area to mitigate the effects of a release in the event that one should occur. Such measures may include containment booms and a standby vacuum truck to collect any released drilling fluids immediately. Ground heave or settlement from inadvertent release also pose risks to structures such as roadways. The HDD alignment was designed with geometries to providing enough soil cover to reduce the risk of inadvertent return. The Inadvertent Release Contingency Plan details additional methods for mitigating inadvertent returns.

5.3 LIMITATIONS

The structural analysis and inadvertent return mitigation analysis were performed using the proposed design bore paths and typically anticipated equipment and means and methods. The HDD subcontractor must submit structural and inadvertent return mitigation calculations and analysis for each bore path, including their final bore path geometry reflecting its specific equipment and contractor's specific means, methods, drilling fluids, and proposed final contractor refined final planned alignment. It is important to note that the Kiewit Design Team's analysis has been done without consideration for point loading due to unpredictable subsurface features such as encountering rocks, boulders, or other extremely dense material that may damage the conduit. The risk of such damage is low yet has been reported on some projects in recent years.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 RISK AWARENESS AND ASSESSMENT

The risks to be aware of during HDD include: inadvertent returns or fluid loss; any potential obstructions blocking or causing large deviations from the planned bore path; and electromagnetic effects on the HDD steering equipment from nearby high voltage power lines.

6.2 SITE ANALYSIS

A site analysis must be performed prior to commencing HDD operations. Considerations might need to be taken for items such as for site access, construction of HDD entry and exit pits, and layout area for equipment and supplies.

6.3 EROSION CONTROL

The proposed bore path crosses under roads, parking lots, water, stormwater and gas and electric utility lines, as well as under streams/wetlands, bodies of water, and railroads. The soil erosion control drawing will show where primary soil erosion control measures are required. The technical specifications and Inadvertent Release Contingency Plan both detail the requirements for both primary and secondary sediment and erosion control measures to be followed in case of an inadvertent return, which ultimately could deposit the fine bentonite sediment into the stream or wetland or bodies of water if not controlled. Construction of the entry and exit pits, and related work area will be close to the stream/wetlands. Silt fence, straw bales, and other soil erosion control measures will be required to be installed as shown in the construction drawings. Secondary control measures are to be readily accessible at or near the work areas in accordance with the project specifications and Inadvertent Release Contingency Plan.

6.4 SURVEILLANCE AND MONITORING

During installation of the pipe by HDD, monitoring the stream, wetlands, waterbodies and bore alignment for indications of potential inadvertent returns or inadvertent releases will be necessary. The contractor will have primary responsibility for this monitoring and associated response and reporting in real-time. This will be accomplished as detailed in the Inadvertent Release Contingency Plan. Continuous visual inspection of the entire path is the most significant method of detection. However, an experienced drill crew can often prevent a return by monitoring drilling fluid pressures. A loss of pressure may indicate an inadvertent release has occurred. Regardless of the level of preparation, inspection, monitoring, etc., inadvertent returns are not always possible to predict or prevent. However, a significant effort can minimize the possibility but not eliminate it.

6.5 REWORK OR BORE ABANDONMENT

During any stage of the drilling and reaming process there exists risk of hole failure, mechanical failure, or a combination of the two that can render a hole not viable. Depending on the experience and the judgment of the drilling crew, a hole may be reworked by grouting the geotechnical instability and then attempting to bore through the consolidated material. In the event an individual

bore hole is abandoned grouting the hole shall occur, typically high yield bentonite, water and drill spoil. This will limit slurry communication between the abandoned bore path and a parallel bore attempt or to limit settlement at the surface that may impact structures. If the bore path to be abandoned passes under a railroad or in the Theoretical Zone of Influence of the railroad the abandoned hole shall be filled with cement-bentonite mix to ensure settlement is eliminated or limited. Also see the IRCP document section 4.3 and 8.0.

7.0 REFERENCES

American Association of State Highway and Transportation Officials. (2014). AASHTO LRFD bridge design specifications, Seventh edition, U.S. customary units. Washington, DC: American Association of State Highway and Transportation Officials.

Mayne, P.W., and Kulhawy, F.H. (1990). Manual on Estimating Soil Properties for Foundation Design. Electric Power Research Institute (EPRI).

Hunt, R.E. (1986). Geotechnical Engineering Analysis and Evaluation, McGraw-Hill Book Company, New York.

Appendix A

Work Zones

Introduction:

In general, HDD requires ample space for both entry and exit operations, work area, or Work zones. The HDD contractor or subcontractor ideally wants to consolidate all operations within these footprints. The exit Work zone also includes a narrower extension for the assembly of the full length pull back string of conduit or pipe. The size of these desired Work zones is driven by rig size in Table 1.

TYPICAL HDD ENTRY AND EXIT WORKSPACE		
SYSTEM DESCRIPTION	ENTRY WORKSPACE	EXIT WORKSPACE
MAXI (24″-48″)	150′ X 350′	150′ X 250′
MIDI (12″-<24″)	150′ X 250′	100′ X 200′
MINI (2″-<12″)	VARIES PER SITE	VARIES PER SITE

TABLE 1

An example of an entry Work zones is shown in Figure 1a below.

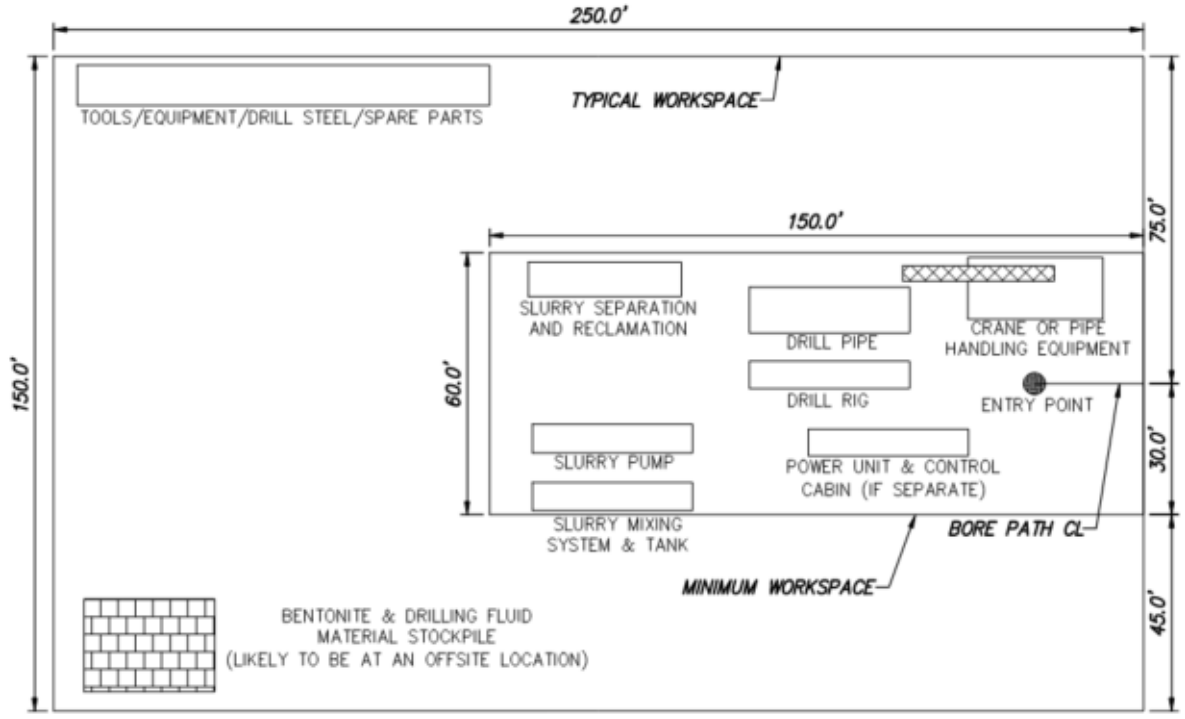


FIGURE 1a: Typical Entry Work Zone Configuration

An example of an exit Work zones is shown in Figure 1b below.

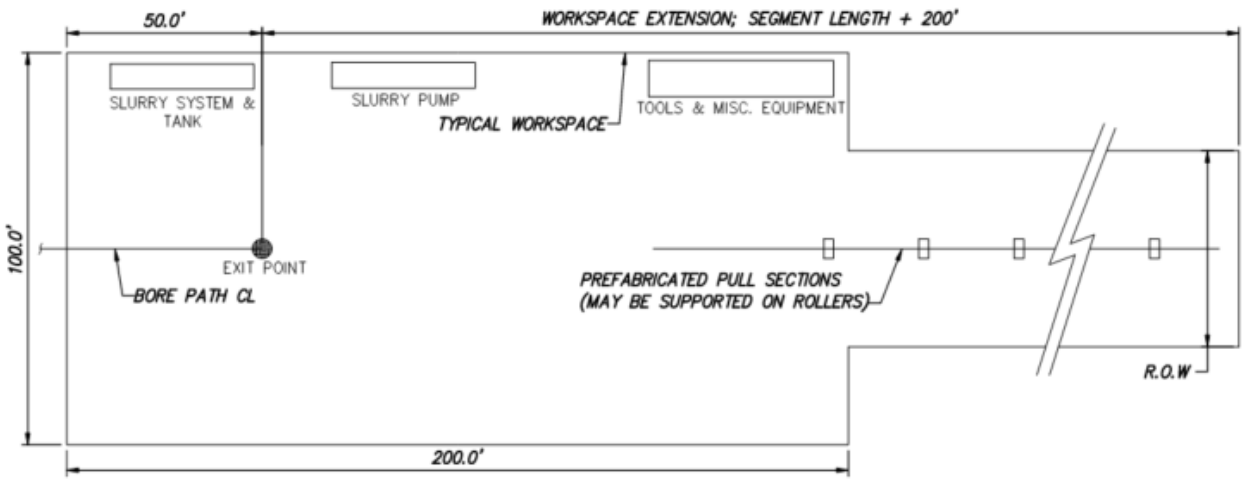


FIGURE 1b: Typical Exit Work Zone Configuration

Work zones should also be able to facilitate contingencies for space to recover a failed bore hole and a new offset bore, the ability swap entry for exit, or in some cases rigs on both ends.

CHPE Project Limitations:

Available Work zone areas for the Champlain Hudson Power Express Project (CHPE) are constrained because the project occupies a narrow existing corridor and is essential in a linear brown field. This is complicated by the rail corridor which precedes most forms of environmental regulations, and it traverses numerous wetlands or other sensitive areas which affects available Work zone areas.

We have assumed the majority of HDDs will be accommodated by a Mini or Midi HDD class machine and support equipment, <12-inch diameter and 1500 feet individual bores.

1. Ideally, an Entry workspace approximately 20 to 25 feet wide x 150 to 200 feet long for a small rig with a mounted pipe rack and self-contained power unit and operator control cabin on the rig; a separate mud mixing and pumping unit, plus a separate mud processing and separation unit support by equipment arranged linearly. Since each crossing is a pair two, 20 x 150 Work zones are equivalent to a 40 x 150 overall work area, and we have assumed the support equipment will be set once for both HDDs. It is also assumed existing roads or access roads will parallel one side of a Work zone.

2. Ideally, an exit workspace approximately 15 to 20 feet wide and between 60% and 110% of the bore length is needed to layout and assemble the conduit for pullback.

A somewhat smaller entry Work zones may be possible depending on drill rig specifics and the availability of nearby areas for support equipment support operations. The project will have remote yards. Small work areas tend to reduce access and efficiency of operations, raise costs, but are necessitated by the specific project and site constraints.

See Figure 1c below covers general considerations and typical workspace configurations drafted for the CHPE Project.

GROUND TYPE	RIG SIZE	BORE LENGTH (ft)	WORK AREA (ft^2)	NOMINAL FOOTPRINT (ft x ft)
SOIL	Large/Maxi	>2,500	37,500*	150 x 250*
	Medium/Midi	1000-2500	15,000*	100 x 150*
	Small/Mini	<1000	3,000*	30 x 100*
ROCK	Large/Maxi	>2,500	37,500*	150 x 250*
	Small/Mini & Medium/Midi	1000-2500	15,000*	100 x 150*
PIPE ASSEMBLY	ALL	ALL	**	25 x (conduit length + 50)**

Notes:

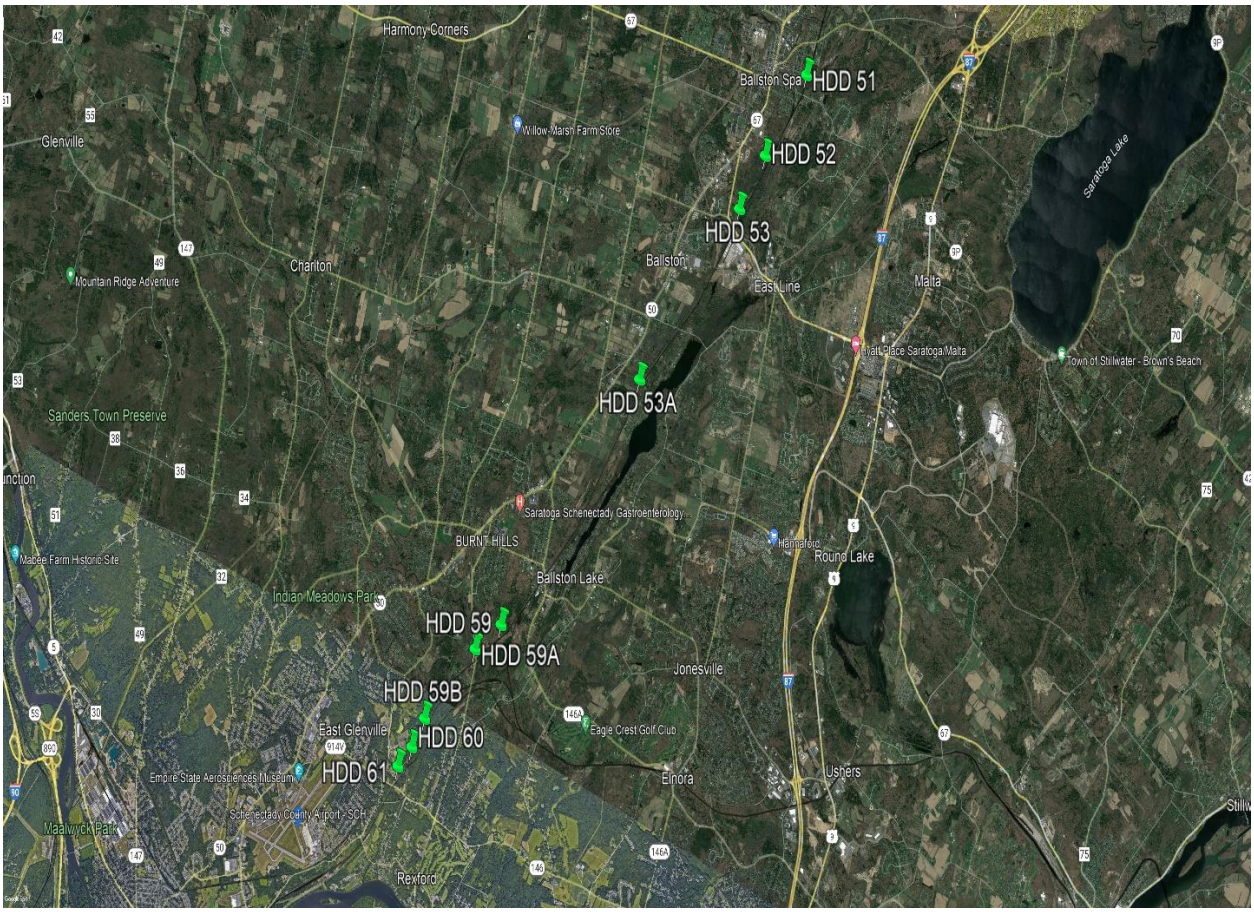
* The entry and exit workspaces typically need space for a drill rig and support equipment such as a pipe rack, power unit operator control cabin, a mud mixing and pumping unit, plus a separate mud processing and separation unit support equipment arranged linearly in line may be possible. Somewhat smaller work areas may be possible depending on drill rig specifics and availability of nearby areas for support equipment and support operations. Often need to coordinate final work areas with selected contractor's specific operations. Smaller work areas tend to reduce access and efficiency of operations.

** For HDD conduit bundle assembly and pullback, need a corridor equal to at least 1/3 to ½ of the length of the total bundle length and minimum 20 feet wide, typically at the exit end. Best if corridor equals the full length of the total bundle length plus about 50 ft

FIGURE 1c

Appendix B

Locus Map


HDD 51
HDD 52
HDD 53
HDD 53A
HDD 59
HDD 59A
HDD 59B
HDD 60
HDD 61
Harmony Corners
Ballston Spa
Willow-Marsh Farm Store
Glenville
Saratoga Lake
Charlton
Ballston
East Line
Malta
Mountain Ridge Adventure
Hyatt Place Saratoga/Malta
Town of Stillwater - Brown's Beach
Sanders Town Preserve
Saratoga Schenectady Gastroenterology
BURNT HILLS
Hannaford
Round Lake
MacGee Farm Historic Site
Ballston Lake
Indian Meadows Park
Jonesville
East Glenville
Eagle Crest Golf Club
Empire State Aerosciences Museum
Schenectady County Airport - SCH
Elnora
Ushers
Maalwyck Park
Rexford

Appendix C

HDD Geotechnical Data Report for CHPE Segment 6 – Package 4A HDDs

Kiewit

MEMORANDUM

DATE: April 13, 2023

TO: Antonio Marruso, P.E.; CHA Consulting, Inc.

FROM: Matthew Hawley, P.E.; Kiewit Engineering (NY) Corp. MKH
Jaren Knighton; Kiewit Engineering (NY) Corp.

SUBJECT: Geotechnical Data: Segment 6 – Package 4A – HDD Crossing 51 – Revision 1
Champlain Hudson Power Express Project
Ballston Spa, New York

Kiewit Engineering is providing the attached geotechnical data for use in the horizontal direction drill (HDD) design for the Champlain Hudson Power Express project in Upstate New York. This HDD crossing is located in Ballston Spa, New York. The approximate station for the start of HDD crossing Number 51 is STA 39994+00 (43.0025°N, 73.8384°W).

The geotechnical data at this HDD crossing is attached. The available data is taken from the previous investigation by TRC and the recent investigations by Terracon and Kiewit, referenced below.

- TRC, Geotechnical Data Report, Champlain Hudson Power Express, Canadian Pacific Railway Borings MP 113.1-177.1, dated March 29, 2013.
- Terracon, Results of Field Exploration, Champlain Hudson Power Express, Ballston – Clifton Park – Glenville, NY, dated June 22, 2022.
- Kiewit Engineering (NY) Corp., Package 4A Phase 4 Borings, Champlain Hudson Power Express, New York, dated January 20, 2023.
- Terracon Field Exploration and Laboratory Testing Results, Champlain-Hudson Power Express Project-Package 3, 4A and 4B, Fort Edward to Schenectady, dated April 11, 2023.

Contact us if you have questions or require additional information.

HDD 51
Borings B158.87-1, B159.1-1, K-159.1, KB-158.8, KB-158.9
Segment 6 - Design Package 4A

CHPE Segment 6 Package 4A
Soil Boring Coordinates and Elevations

Firm	Boring	Northing (feet)	Easting (feet)	Ground Surface Elevation (feet)
TRC*	A162.1-1	1502786.734	664476.477	284.0
	B158.87-1	1519228.136	669050.444	288.3
	B159.1-1	1517722.124	668720.464	291.0
	B159.5-1	1516012.300	668217.400	295.8
	B160.3-1	1511903.990	667182.915	294.6
	B160.7-1	1509749.417	666636.945	295.0
	B161.4-1	1506284.600	665799.100	288.0
	B163.3-1	1496630.400	662351.700	280.2
	B164.4-1	1490795.529	661205.362	267.5
	B165.5-1	1485722.400	659432.900	277.6
	B165.8-1	1484324.089	658853.809	275.4
	B166.5-1	1480752.600	656954.600	263.5
	B166.9-1	1479253.700	655902.600	265.4
	B167.1-1	1478553.300	655364.300	261.0
	B168.0-1	1474529.400	653290.100	251.4
	B168.64-1	1471082.866	652655.655	245.2
	B168.86-1	1470035.900	652059.906	231.6
AECOM**	BM-1	1500593.800	663479.000	283.4
	BM-1B	1513675.554	667631.458	293.5
	BM-1C	1508115.700	666263.900	291.9
	BM-1D	1504574.200	665267.500	283.4
	BM-1E	1511220.853	667016.761	294.1
	BM-2	1494386.900	661852.400	271.4
	BM-2A	1498788.900	662752.200	279.1
	BM-2B	1492715.315	661511.300	269.7
	BM-3	1487269.097	659995.860	275.1
	BM-3A	1488755.829	660606.619	270.8
	BM-3B	1482501.900	658059.300	273.6
	BM-3C	1480192.269	656553.384	263.2
	BM-4	1477890.500	654882.600	260.5

Notes:

- Northings and Eastings are provided in NAD83 New York State Plane East Zone.
- Elevations are referenced to the NAVD88 datum.

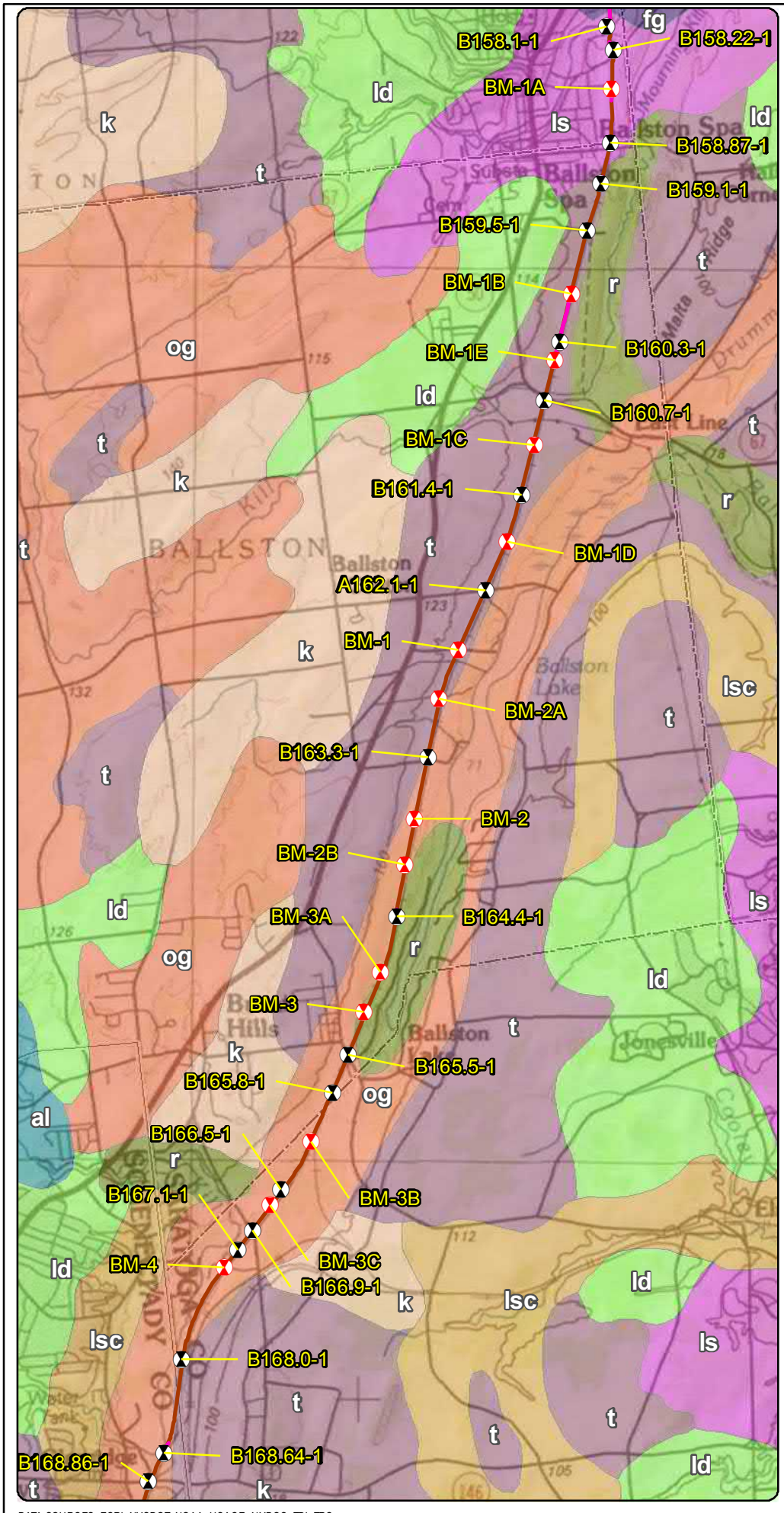
* TRC boring coordinates as shown in Table 1-6 in AECOM report (reference below). Boring elevations estimated from November 2021 topographic survey by Williams Aerial.

** AECOM boring coordinates and elevations as shown in Table 1-6 in AECOM report.

*** Kiewit boring coordinates and elevations are noted on the boring logs.

Reference:

AECOM, Geotechnical Data Report, Upland Segments: Putnam Station, Washington County, to Cementon, Green County, NY, Champlain Hudson Power Express, dated May 28, 2021.



LEGEND

- 2021 Boring Location
- Previous (2013) Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

Surficial Geology

- al - Recent alluvium
- fg - Fluvial sand and/or gravel
- k - Kame deposits
- ld - Lacustrine delta
- ls - Lacustrine sand
- lsc - Lacustrine silt and clay
- og - Outwash sand and gravel
- r - Bedrock
- t - Till

N

0.5 0.25 0 0.5 Miles

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

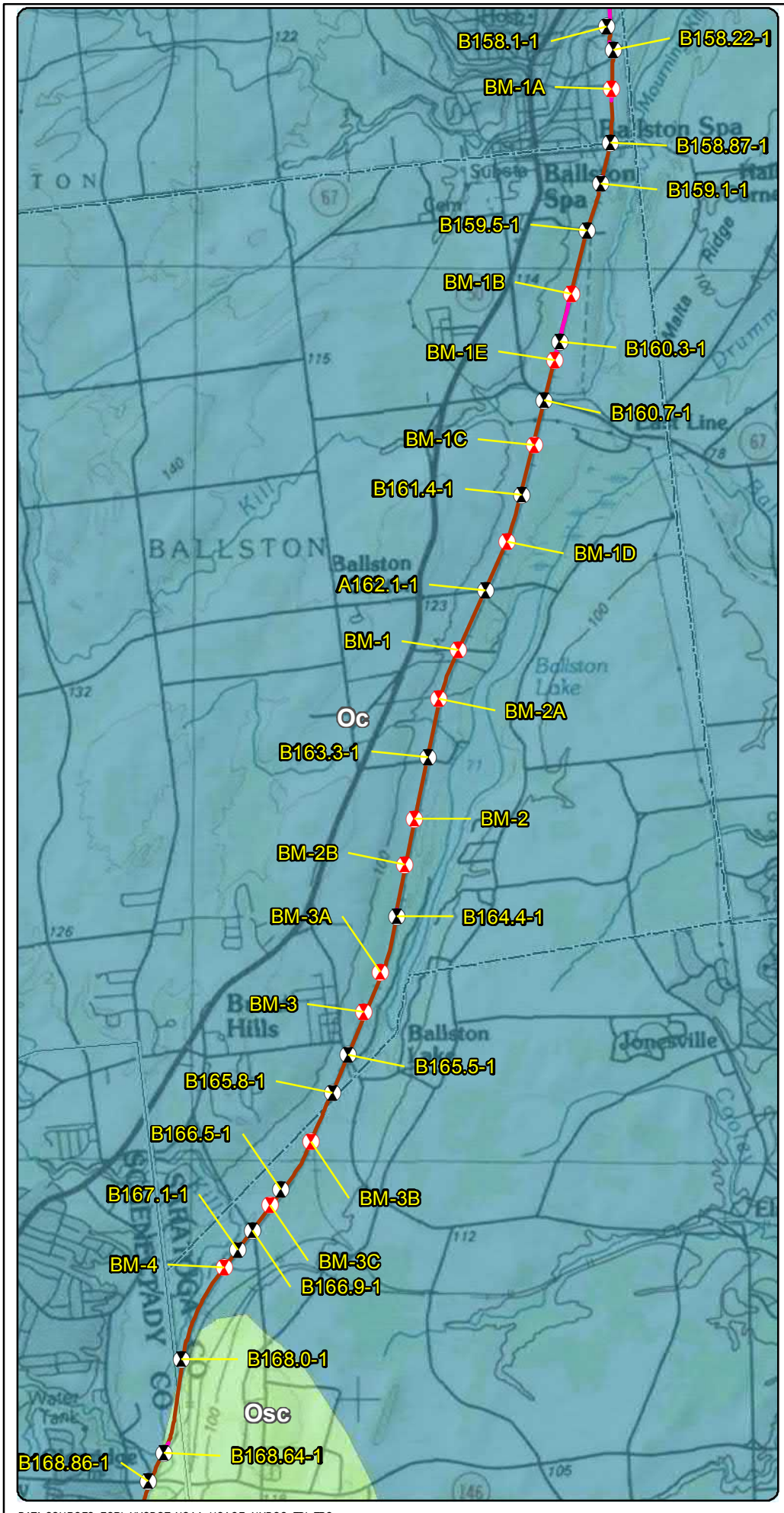
Surficial Geology and Geotechnical Borings Ballston to Mohawk River Figure 3-6

Prepared on 5/5/2021

by: AECOM

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

Y:\Projects\CHPE\Route\Consensus_Alternative_Routes\MXD\Alt 5_Routes_DZ_201909Boring_Locations\Maps_for_May_2021_Report\Ballston_to_Mohawk_Boring_Locations_Surficial_May_2021_Report.mxd



LEGEND

- 2021 Boring Location
- Previous (2013) Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

Bedrock Geology

- Oc - Canajoharie Shale
- Osc - Schenectady Formation

* Schenectady Formation includes: graywacke, sandstone, siltstone, shale

N

0.5 0.25 0 0.5 Miles

Transmission

Champlain Hudson Power Express Project

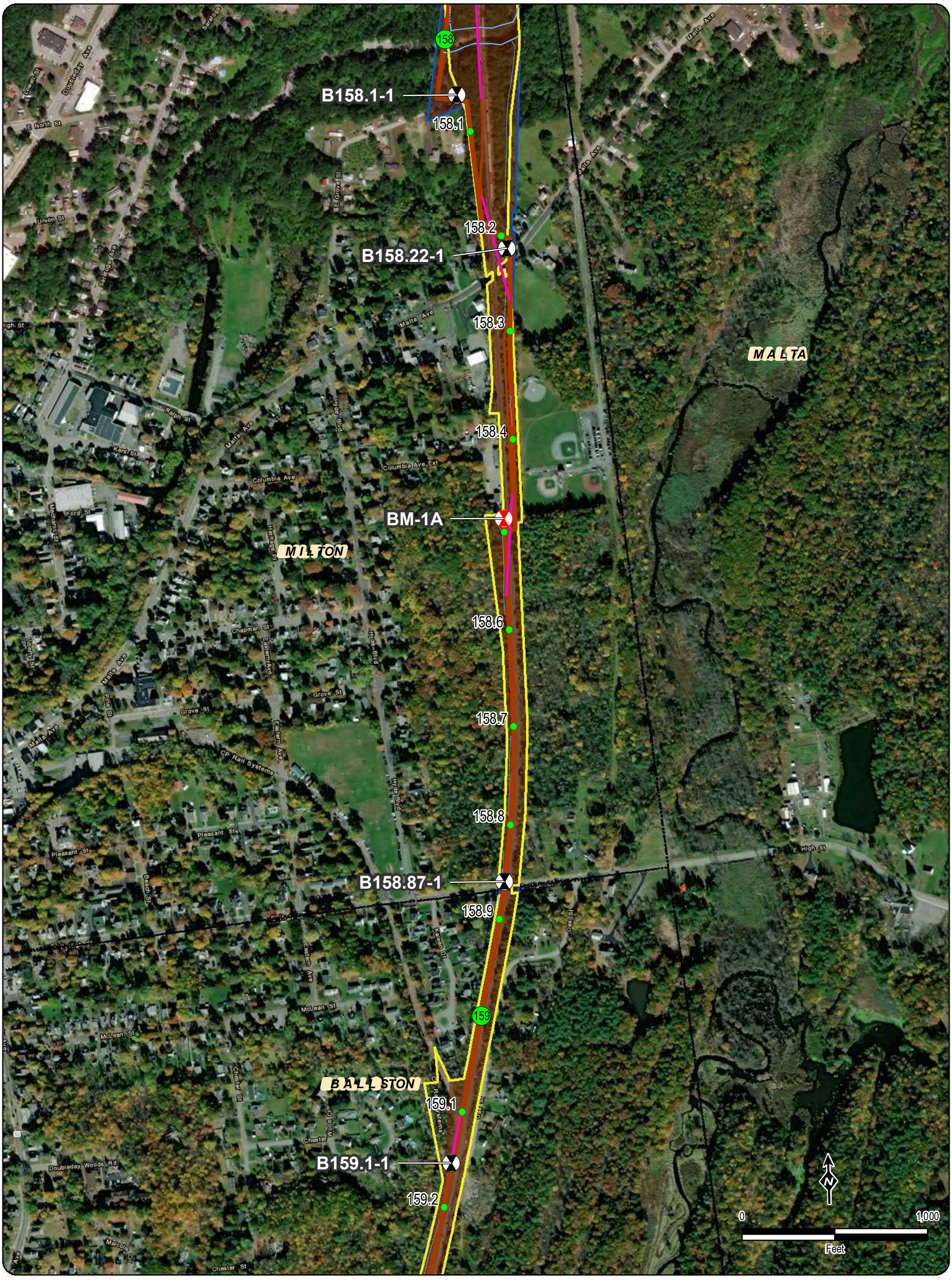
Champlain Hudson Power Express Inc.

Bedrock Geology and Geotechnical Borings Ballston to Mohawk River
Figure 4-6

Prepared on 5/5/2021
by: AECOM

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

Y:\Projects\CHPE\IRoute\Consensus_Alternative_Routes\MXD\Alt 5_Routes_DZ_20190\Boring_Locations\Maps_for_May_2021_Report\Ballston_to_Mohawk_Boring_Locations_Bedrock_May_2021_Report.mxd



LEGEND

- 111.8 Certified Milepost - Tenths
- 135 Certified Milepost
- 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
- 2021 Boring Location
- Previous (2013) Boring Location
- Streams/Ditches
- Railroad ROW
- Deviation Zone
- Deviation Zone Outside ROW
- Preferred Alternative Deviation Zone
- Preferred Alternative Deviation Zone Outside ROW
- Town Boundary
- Village Boundary
- State Park (OPRHP)

Parcel Ownership: TOWN NAME

Road Name: Village Name

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

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Ballston to Mohawk River

Figure A-6

Sheet 1 of 9

Prepared by: AECOM 5/19/2021

Y:\Projects\CHPEI\Route\Consensus_Alternative_Routes\MXD\Alt_5_Routes_DZ_201909\Boring_Locations\Maps_for_May_2021_Report\BallstonToMohawk_Boring_Locations_Mapset_May_2021_Report.mxd

TEST BORING LOG

BORING	**B158.87-1**
G.S. ELEV.	N/A
FILE	195651
SHEET	1 OF 1

PROJECT: TDI CHAMPLAIN HUDSON POWER EXPRESS

LOCATION: CP RAILROAD ROW, NY

GROUNDWATER DATA			
FIRST ENCOUNTERED 13.5 '			
DEPTH	HOUR	DATE	ELAPSED TIME

METHOD OF ADVANCING BOREHOLE				
a	FROM	0.0 '	TO	2.0 '
d	FROM	2.0 '	TO	20.3 '

DRILLER	T. FARRELL
HELPER	J. LANGDON
INSPECTOR	N/A
DATE STARTED	02/28/2013
DATE COMPLETED	02/28/2013

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-1	6 8 6 6		***BROWN F/M SANDY SILT, SM WOOD (FILL)***		
				2.0		
	S-2	6 7 6 7				
5	S-3	4 5 4 4			14.0	
	S-4	7 9 10 25		***YELLOW BROWN SILTY F/MC SAND, SM F/ GRAVEL (FILL)***		
10	S-5	50/.2				
▽				13.5		
15	S-6	12 4 4			15.6	
				BROWN SILT AND F/M/C SAND, TR F/ GRAVEL		
	S-7	6 7 7				
20	S-8	50/.3		20.0		
				20.8 ***GRAY F/C GRAVEL-SIZED ROCK FRAGMENTS***		AUGER REFUSAL
				END OF BORING AT 20.8'		
25						
30						
35						

DRN.	KR
CKD.	PWK

NEW PROJECTS TEST BORING LOG 195651_TDI_CP.GPJ SITE BLAUVELT.GDT 3/27/13

TEST BORING LOG

PROJECT: TDI CHAMPLAIN HUDSON POWER EXPRESS

LOCATION: CP RAILROAD ROW, NY

BORING	**B159.1-1**
G.S. ELEV.	N/A
FILE	195651
SHEET	1 OF 1

GROUNDWATER DATA			
FIRST ENCOUNTERED NR			
DEPTH	HOUR	DATE	ELAPSED TIME
3.0'	16:35	1/14	0 HR

METHOD OF ADVANCING BOREHOLE				
a	FROM	0.0 '	TO	6.1 '
d	FROM	6.1 '	TO	7.0 '
c_2	FROM	7.0 '	TO	14.5 '

DRILLER	J. MEHALICK
HELPER	M. KERLIN
INSPECTOR	C. POPPE
DATE STARTED	01/14/2013
DATE COMPLETED	01/14/2013

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-1	2 3 3 3		***BROWN CLAY, SM F/ SAND, TR-SM F/ GRAVEL (FILL)***	23.5	
	S-2	3 4 12 21		2.0 ***BROWN CLAY, TR-SM SAND***	26.9	
5	S-3	27 42 50/0.2		4.0 ***GRAY F/C GRAVEL-SIZED ROCK FRAGMENTS, SM CLAY***		
	S-4	50/0.1		7.0 ***DARK GRAY MODERATELY WEATHERED, SOFT TO MEDIUM HARD SHALE, VERY CLOSE 0 TO 30 DEGREE FRACTURING***		
	R-1	REC =100% RQD =0%		9.5 ***DARK GRAY MODERATELY WEATHERED, MEDIUM HARD SHALE, VERY CLOSE TO CLOSE 0 TO 30 DEGREE FRACTURING***		
10	R-2	REC =100% RQD =0%		14.5		
15				***END OF BORING AT 14.5'***		
20						
25						
30						
35						

DRN.	CMP
CKD.	PWK

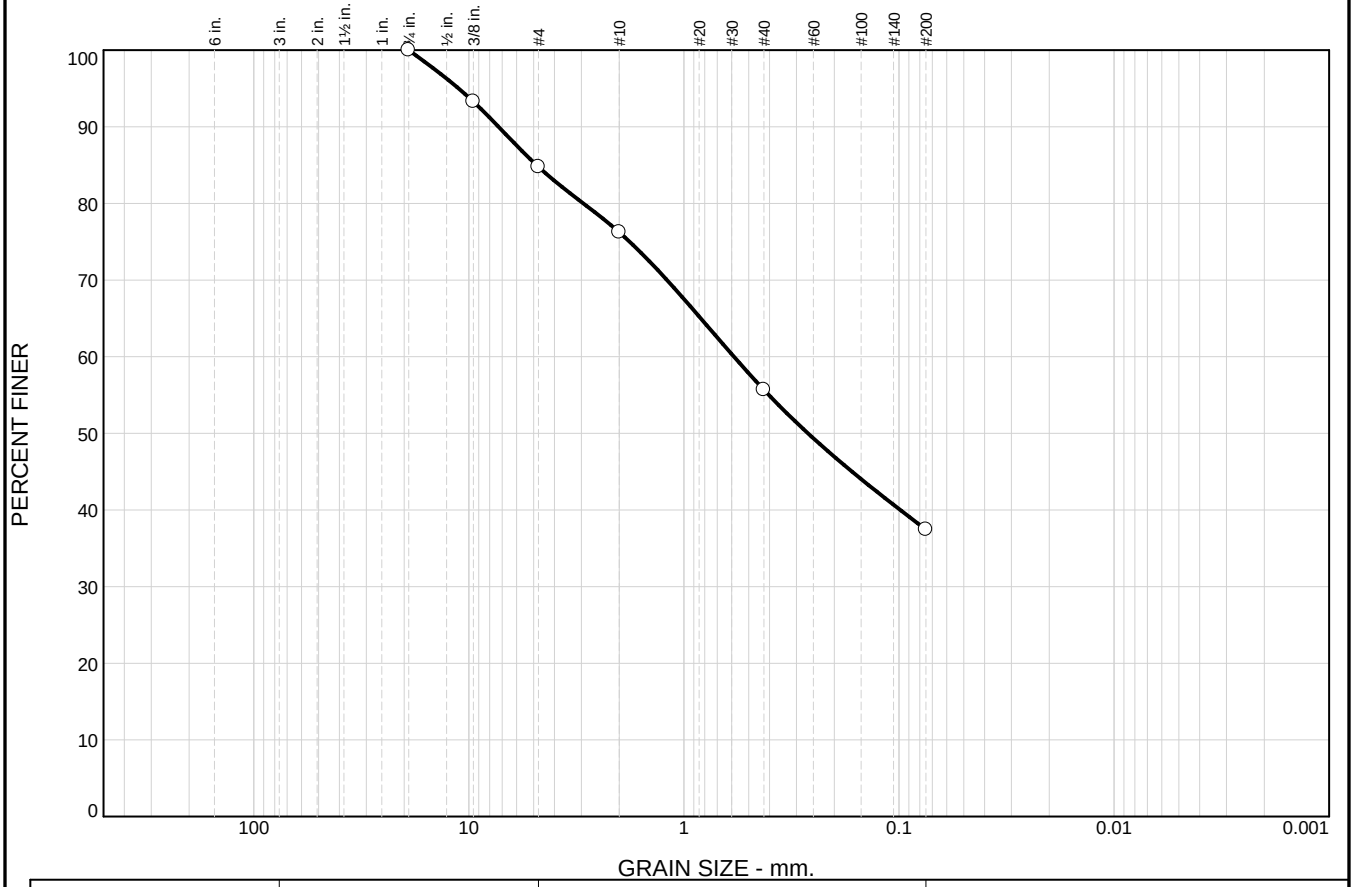
NEW PROJECTS TEST BORING LOG 195651_TDI_CP.GPJ SITE BLAUVELT.GDT 3/28/13

SUMMARY OF LABORATORY TEST DATA

Project Name: TDI Champlain Hudson Power Express – CP
Client Name: Transmission Developers, Inc.
TRC Project #: 195651

SAMPLE IDENTIFICATION			Soil Group (USCS System)	GRAIN SIZE DISTRIBUTION				PLASTICITY				Specific Gravity	Moisture Content (%)	Unit Weight (pcf)	Compressive Strength (tsf)	Organic Content (%)
Boring #	Sample #	Depth (ft)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index)					
	S-5	8.0-10.0	-	-	-	-	-	-	-	-	-	-	29.9	-	-	-
	S-6	13.5-15.0	-	-	-	-	-	-	-	-	-	-	25.4	100.1	-	-
	S-8	23.5-25.0	-	-	-	-	-	-	-	-	-	-	23.5	-	-	-
B158.22-1	S-2	2.0-4.0	-	-	-	-	-	-	-	-	-	-	26.9	-	-	-
	S-5	8.0-10.0	SM	24.9	53.2	21.9		-	-	-	-	-	7.0	-	-	-
	R-1	18.9-19.3	-	-	-	-		-	-	-	-	-	-	166.8	255	-
B158.87-1	S-3	4.0-6.0	SM	15.2	47.4	37.4		-	-	-	-	-	14.0	-	-	-
	S-6	13.5-15.0	SM	6.8	47.6	45.6		-	-	-	-	-	15.6	-	-	-
B159.1-1	S-1	0.0-2.0	-	-	-	-	-	-	-	-	-	-	23.5	-	-	-
	S-2	2.0-4.0	-	-	-	-	-	-	-	-	-	-	26.9	-	-	-
	R-2	12.9-13.1	-	-	-	-	-	-	-	-	-	-	-	167.1	-	-
B159.5-1	R-3	12.9-13.2	-	-	-	-	-	-	-	-	-	-	-	165.5	-	-
B160.3-1	S-3	4.0-6.0	-	-	-	-	-	-	-	-	-	-	8.3	132.4	-	-

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	15.2	8.6	20.5	18.3	37.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_U
○			4.8449	0.5853	0.2649					

Material Description	USCS	AASHTO
○ BROWN SILTY M/F/C SAND, SM F/ GRAVEL	SM	

Project No. 195651 **Client:** TDI CHAMPLAIN HUDSON POWER EXPRESS - CP

Project: TRANSMISSION DEVELOPERS, INC.

○ **Source of Sample:** B158.87-1 **Depth:** 4.0-6.0 FT **Sample Number:** S-3

TRC Engineers, Inc.

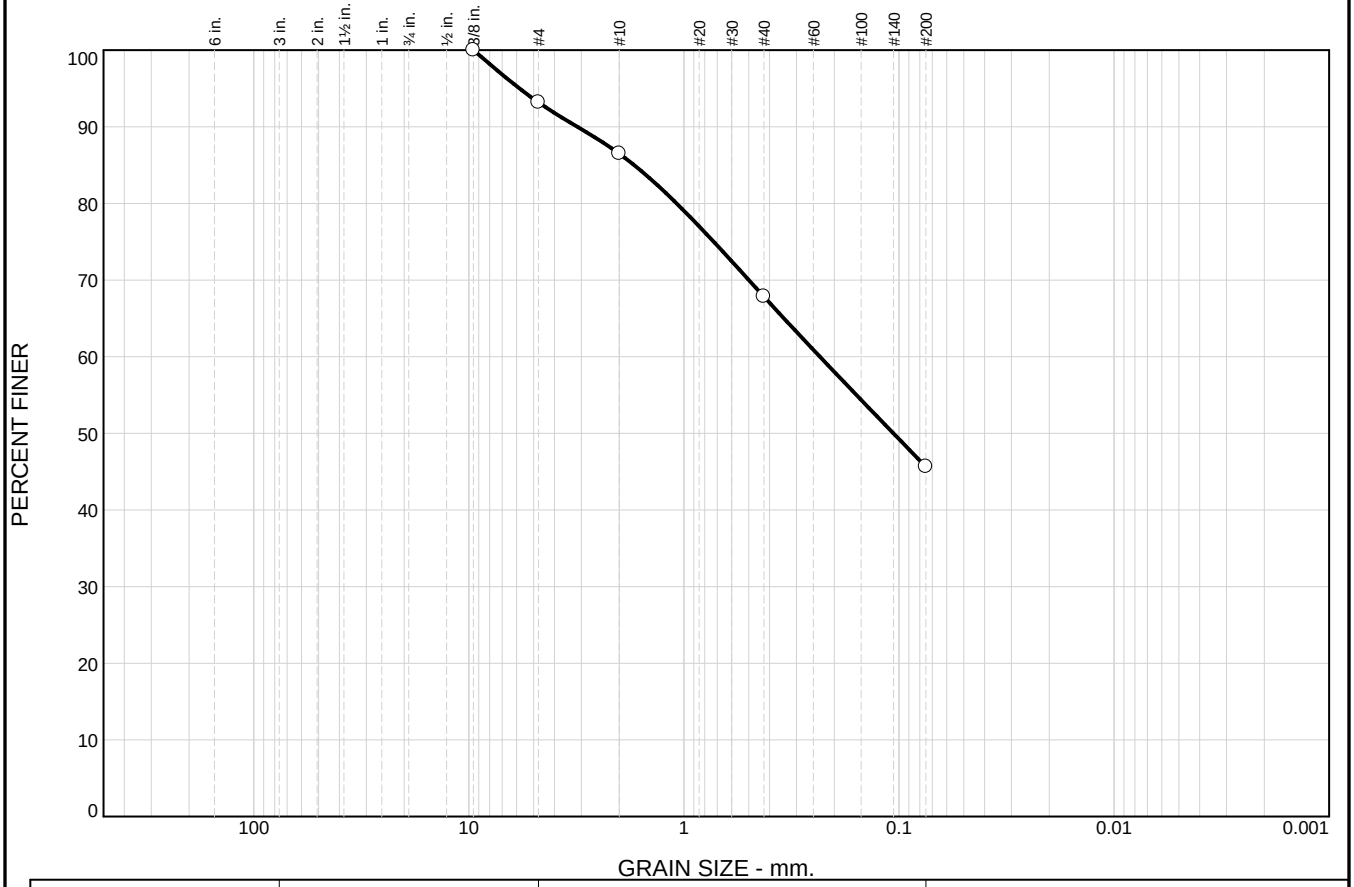
Mt. Laurel, NJ

Remarks:
○SAMPLE DESCRIPTION BASED ON VISUAL IDENTIFICATION AND LABORATORY ANALYSIS

Figure 79

Tested By: TBT 03/13/13 **Checked By:** _____

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	6.8	6.7	18.7	22.2	45.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			1.7030	0.2332	0.1061					

Material Description	USCS	AASHTO
○ BROWN SILT AND F/M/C SAND, TR F/ GRAVEL	SM	

Project No. 195651 **Client:** TDI CHAMPLAIN HUDSON POWER EXPRESS - CP

Project: TRANSMISSION DEVELOPERS, INC.

○ **Source of Sample:** B158.87-1 **Depth:** 13.5-15.0 FT **Sample Number:** S-6

TRC Engineers, Inc.

Mt. Laurel, NJ

Remarks:
○SAMPLE DESCRIPTION BASED ON VISUAL IDENTIFICATION AND LABORATORY ANALYSIS

Figure 80

Tested By: TBT 03/13/13 **Checked By:** _____

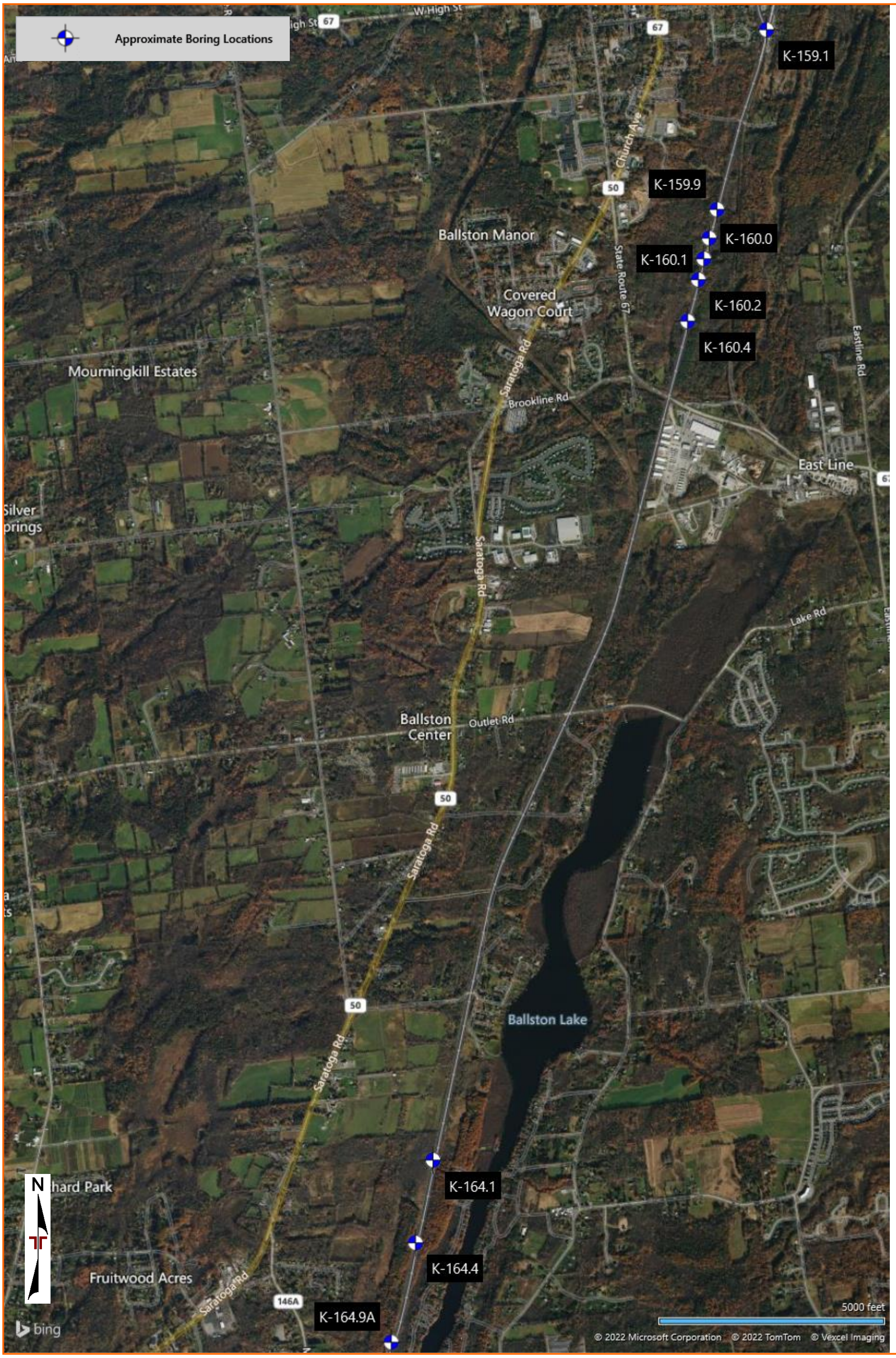


DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED
BY MICROSOFT BUNG MAPS

PHOTOGRAPHY LOG

Rock Core – Boring K-159.1

Rock Core – Boring K-159.9

BORING LOG NO. K-159.1

PROJECT: Champlain-Hudson Power Express Design Package 4a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

LOCATION See Exploration Plan

Latitude: 42.9982° Longitude: -73.8396°

Surface Elev.: 290.89 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	RECOVERY (In.)	FIELD TEST RESULTS
0.4	290.5	**BALLAST**		
		FILL - SILTY SAND WITH GRAVEL, black, very loose to loose	14	3-5-3-1 N=8
			14	2-1-1-12 N=2
4.0	287	**WEATHERED ROCK**, black, very dense	12	16-35-50/4"
			0	50/2"
			3	50/3"
16.0	275	**SHALE**, slightly weathered, close fractured, very poor RQD, gray		REC = 95% RQD = 7%
20.0	271	**SHALE**, slightly weathered, close to moderate fractured, poor RQD, gray		REC = 100% RQD = 28%
25.0	266	**SHALE**, slightly weathered, very close to moderate fractured, good RQD, gray		REC = 100% RQD = 83%

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by Kiewit

Notes:

Logged by JCH
Hammer Efficiency Summary:
Energy Transfer Ratio: 91.3% +/-2.7%
Hammer Efficiency Correction (CE):1.52

WATER LEVEL OBSERVATIONS

overnight

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 03-28-2022 | Boring Completed: 03-29-2022

Drill Rig: CME 750x | Driller: J. Lamm

Project No.: JB215256A

BORING LOG NO. K-159.1

PROJECT: Champlain-Hudson Power Express Design Package 4a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

LOCATION See Exploration Plan

Latitude: 42.9982° Longitude: -73.8396°

Surface Elev.: 290.89 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SHALE, slightly weathered, very close to moderate fractured, good RQD, gray *(continued)*									
	30.0	261	30								
		SHALE, slightly weathered, close to moderate fractured, excellent RQD, gray					REC = 96% RQD = 100%				
	35.0	256	35								
		Boring Terminated at 35 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by Kiewit

Notes:

Logged by JCH
Hammer Efficiency Summary:
Energy Transfer Ratio: 91.3% +/-2.7%
Hammer Efficiency Correction (CE):1.52

WATER LEVEL OBSERVATIONS

▽ *overnight*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 03-28-2022 | Boring Completed: 03-29-2022

Drill Rig: CME 750x | Driller: J. Lamm

Project No.: JB215256A

Client
Kiewit Engineering Corp

Project
Champlain-Hudson Power Express Project

Project No. JB215256

Splitting Tensile Strength of Intact Rock Core Specimens, ASTM D3967

Boring	K-159.1	**Material Description**	Shale
Sample No		**Equipment Used**	Tinius Olsen (120,000lbs)
Depth (ft)	20-25	**TICCS ID/Serial No.**	C-48999, 118285
Lab No	5073	**Calibration Date**	11/2/2021

	TENSILE STRENGTH				
Sample No.	1	2	3	4	5
Diameter (in)	1.98	1.98	1.98	1.98	1.98
Length (in)	0.7	0.73	0.54	0.61	0.7
Length Diameter Ratio	0.35	0.37	0.27	0.31	0.35
Rate of Loading	0.007	0.0073	0.0054	0.0061	0.007
Moisture Condition	1.02%	1.02%	1.02%	1.02%	1.02%
Maximum Applied Load (lbf)	1664	1022	1454	1308	2503
Splitting Tensile Strength (psi)	764.7	450.4	866.2	689.8	1150.3

	TENSILE STRENGTH				
Sample No.	6	7	8	9	10
Diameter (in)	1.98	1.98	1.98	1.98	1.98
Length (in)	0.69	0.58	0.62	0.7	0.69
Length Diameter Ratio	0.35	0.29	0.31	0.35	0.35
Rate of Loading	0.0052	0.0065	0.006	0.007	0.0069
Moisture Condition	0.90%	0.90%	0.90%	0.90%	0.90%
Maximum Applied Load (lbf)	787	1145	1011	1162	1431
Splitting Tensile Strength (psi)	366.9	635.1	524.6	534.0	667.2

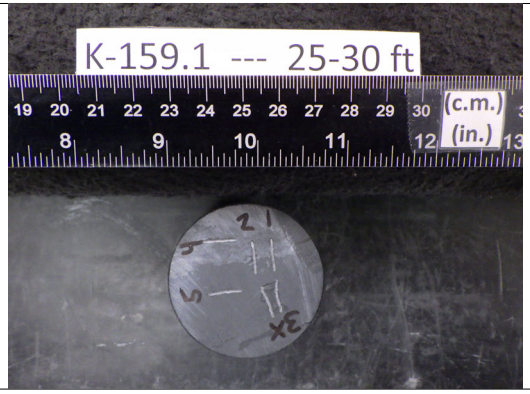
Client:	Terracon Consultants, Inc.				
Project:	Champlain-Hudson Power Express				
Location:				Project No:	GTX-315284
Boring ID:	K-159.1	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	---	Test Date:	06/17/22	Checked By:	smd
Depth :	25-30 ft	Test Id:	670476		
Test Comment:	---				
Visual Description:	---				
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-159.1	---	25-30 ft	1	1.4	1.9	1.65	
			2	2.4	2.1	2.25	
			3	1.1	1.3	1.20	
			4	0.8	1.4	1.10	
			5	1.4	1.0	1.20	
			Average CAIs			1.48	
			Average CAI *			1.95	
				CERCHAR Abrasiveness Index Classification		**Medium abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 40/42 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:



Package 4A Phase 4 Borings

Champlain Hudson Power Express

New York

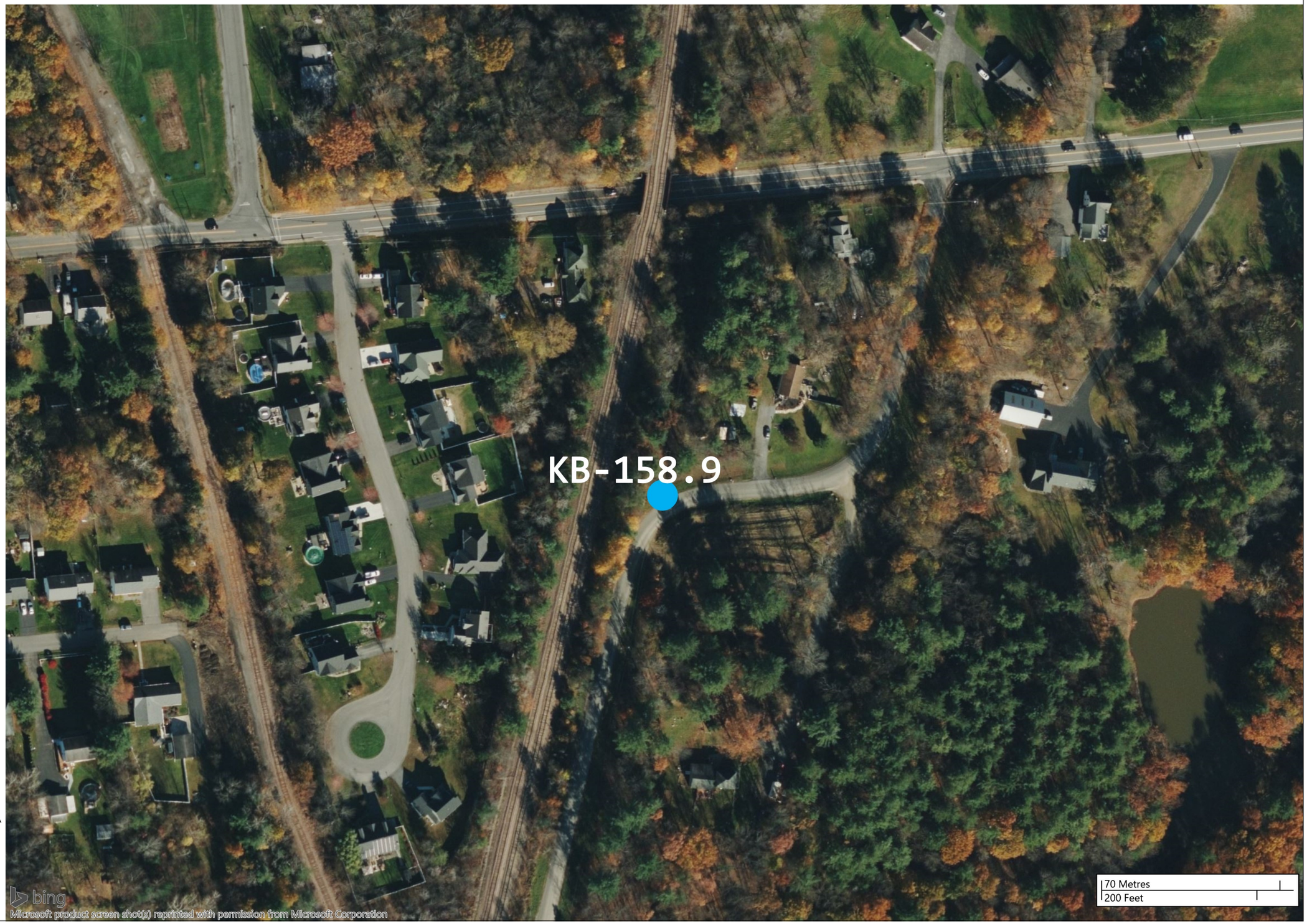
PROJECT NUMBER 20001480

CREATED BY Kiewit

DATE 01/19/2023

Legend Key

- Kiewit Borings



EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: KB-158.9

PROJECT NUMBER	20001480	**LOGGED BY**	S. Ahmad	**COORDINATES**	N 1518803.98 E 669086.77
START DATE	12/14/2022	**DRILLER/RIG**	John / Geoprobe 7822DT	**GROUND ELEV.**	286.2 ft
FINISH DATE	12/15/2022	**DRILL CONTRACTOR**	ADT Inc.	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
0	284.2	FILL: SAND with Gravel (SP), dark gray, loose, moist		1	50%		7-5-5-4 (10)	Boring advanced with 4" ID Mud Rotary
		Sandy SILT (ML), brown, medium dense to dense, moist, fine to coarse sand, few fine gravel		2	75%		11-13-15-14 (28)	
5				3	71%		17-19-17-23 (36)	
				4	58%		32-22-22-28 (44)	
	278.2	Weathered rock, dark gray, medium dense to dense, wet, sampled as shale fragments		5	33%		22-26-50/4"	
10	276.2	SHALE, gray, very closely spaced discontinuities, laminated, very poor RQD, fresh		1	86% / 8			15 minute core run
15				2	97% / 20			15 minute core run
20		closely spaced discontinuities, fair RQD		3	100% / 66			20 minute core run
25		closely to moderately spaced discontinuities		4	100% / 77			12 minute core run
30		closely spaced discontinuities, poor RQD		5	100% / 48			20 minute core run
35								

Legend

- SPT N Value
- MC (%)
- PL & LL (%)
- Fines Content (%)

20 40 60 80

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: KB-158.9

PROJECT NUMBER	20001480	**LOGGED BY**	S. Ahmad	**COORDINATES**	N 1518803.98 E 669086.77
START DATE	12/14/2022	**DRILLER/RIG**	John / Geoprobe 7822DT	**GROUND ELEV.**	286.2 ft
FINISH DATE	12/15/2022	**DRILL CONTRACTOR**	ADT Inc.	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Material Description	Sample Type	Core Run No.	Recovery % / RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
40		SHALE, gray, moderately spaced discontinuities, laminated, good RQD, fresh		6	100% / 82			20 minute rock core
		excellent RQD		7	100% / 92			15 minute core run UCS = 6,292 psi
45		good RQD		8	100% / 85			20 minute core run
50		moderately to widely spaced discontinuities, excellent RQD		9	100% / 100			20 minute rock core
55		moderately spaced discontinuities		10	100% / 96			20 minute rock core
60	226.2	Boring Terminated at 60ft						
65								
70								

Legend

- ▲ SPT N Value
- ● MC (%)
- — PL & LL (%)
- ⊠ Fines Content (%)

20 40 60 80

Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

KB-158.9 - Runs 1 through 4

KB-158.9 - Runs 5 through 8

Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

KB-158.9 - Runs 9 through 10

Summary of Laboratory Results

BORING ID	Depth (Ft.)	Water Content (%)
KB-149.6	60-62	22.7
KB-158.9	2-4	24.5
KB-165.5A	2	13.6
KB-165.5B	2-4	14.3

PROJECT: Lab Testing

SITE: Champlain to Hudsdon Power Express

Terracon
30 Corporate Cir Ste 201
Albany, NY

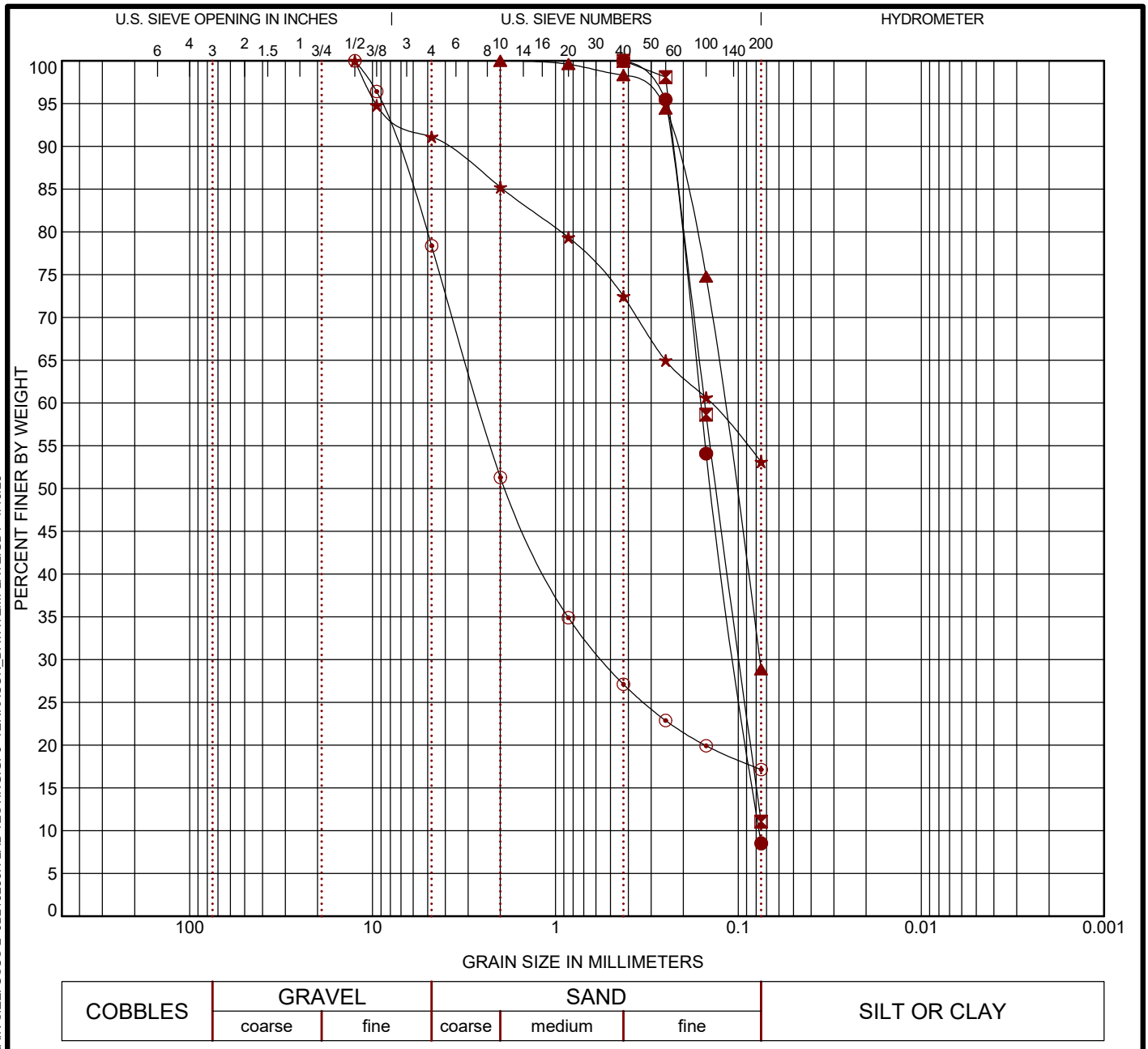
PROJECT NUMBER: JB215256H

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

EXHIBIT: B-2

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



Boring ID	Depth (Ft)	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
KB-149.6	35 - 37	POORLY GRADED SAND with SILT (SP-SM)	24.7				0.87	2.10
KB-149.6	45 - 47	POORLY GRADED SAND with SILT (SP-SM)	20.0				0.87	2.07
KB-149.6	60 - 62	SILTY SAND (SM)	22.7					
KB-158.9	2 - 4	SANDY SILT (ML)	24.5					
KB-165.5A	2	SILTY SAND with GRAVEL (SM)	13.6					

Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
KB-149.6	35 - 37	0.425	0.161	0.104	0.077	0.0	0.0	91.5		8.5	
KB-149.6	45 - 47	0.425	0.153	0.099		0.0	0.0	88.9		11.1	
KB-149.6	60 - 62	2	0.12	0.076		0.0	0.0	71.1		28.9	
KB-158.9	2 - 4	12.5	0.142			0.0	8.9	38.0		53.1	
KB-165.5A	2	12.5	2.641	0.549		0.0	21.6	61.2		17.1	

PROJECT: Lab Testing

SITE: Champlain to Hudsdon Power Express

Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215256H

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

EXHIBIT: B-9

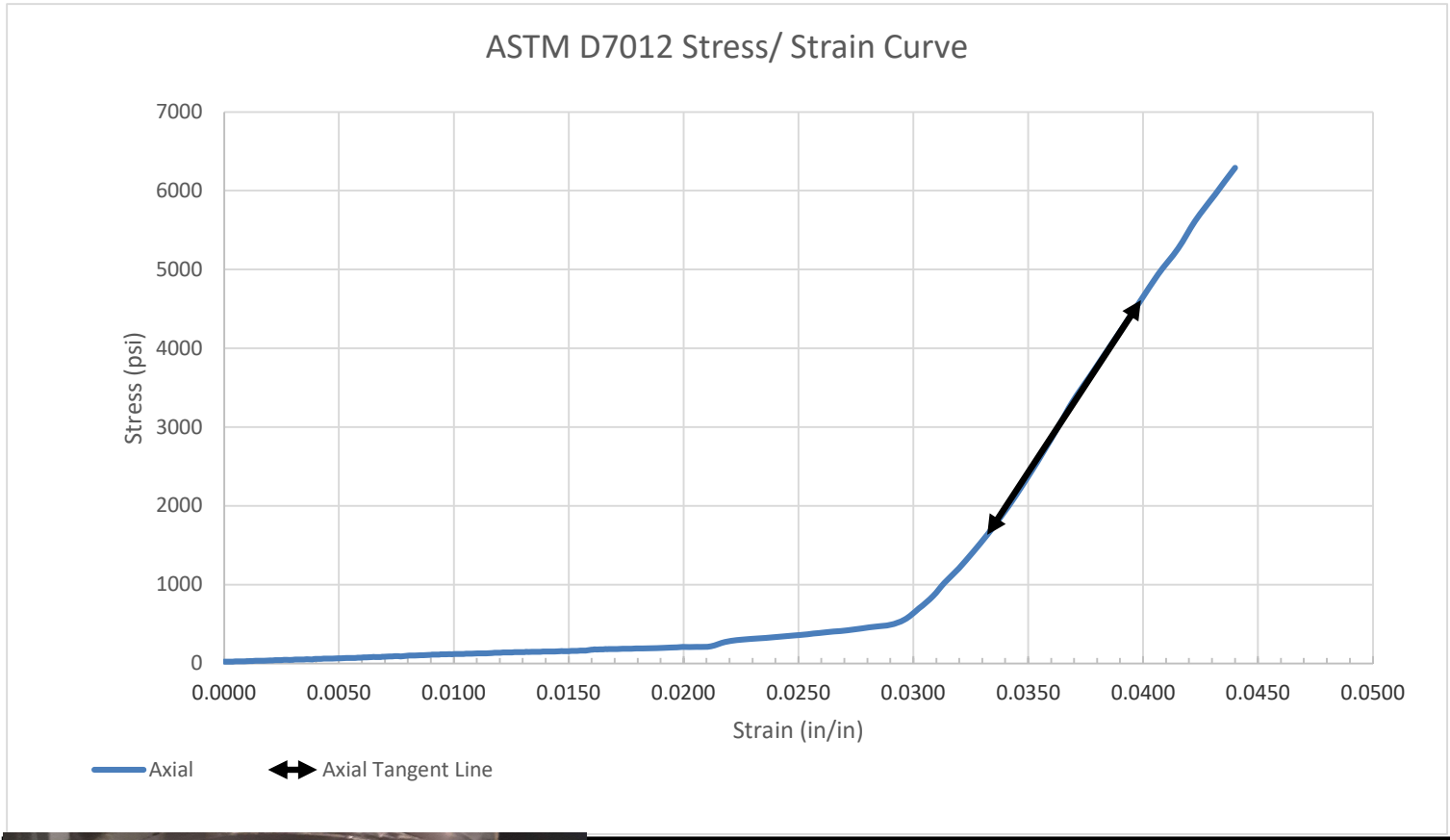
LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 JB215256H LAB TESTING.GPJ TERRACON_DATATEMPLATE.GDT 1/19/23

Rock Core D7012 Method C

Client
Kiewit Engineering Corp

Project
Lab Testing

Project No. JB215256H



SAMPLE LOCATION			
Site:	JB215256H		
Description:	Shale		
Boring:	KB-158.9	Depth (feet):	43.0

SPECIMEN INFORMATION			
Sample No.:	RC-1	Mass (g):	554.44
Length (in.):	4.06	Diameter (in.):	2.00
L/D Ratio:	2.030	Density (pcf):	165.598

TEST RESULTS	
Failure Load (lbs):	19373
Failure Strain (in/in):	0.048
Unconfined Compressive Strength (psi):	6,292
Elastic Modulus, E, (ksi):	445
Time of Failure (min):	02:15
Rate of Loading (in/sec):	0.04
Moisture Content Post-break:	1.79%

Rock Core D7012 Method C

Client
Kiewit Engineering Corp

Project
Lab Testing

Project No. JB215256H

Equipment:

	TICCS ID:
Calipers	W-44049
Scale	B-71466
Dial Indicator	C-70608
Compression (spherically seated)	C-48999

Samples were prepared and tested in accordance with ASTM D4543 and D7012. Deviations, if any, are noted below:
Notes:

Per ASTM D4543, this specimen has not met the requirements for perpendicularity, by exceeding 0.250º.
Per ASTM D4543, this specimen has not met the requirements for flatness, by exceeding 0.001 inches.
Per ASTM D4543, this specimen has not met the requirements for parallelism, by exceeding 0.25º.

Per ASTM D4543, this specimen has not met the requirements for flatness, by exceeding 0.001 inches.

Per ASTM D4543 and ASTM D7012, the desired specimen length to diameter are between 2.0:1 and 2.5:1. According to ASTM D7012 Section 8.2.1, this specimen, although not meeting all requirements of ASTM D4543 is acceptable for testing. However, the results reported may differ from results obtained from a test specimen that meets the requirements of D4543.

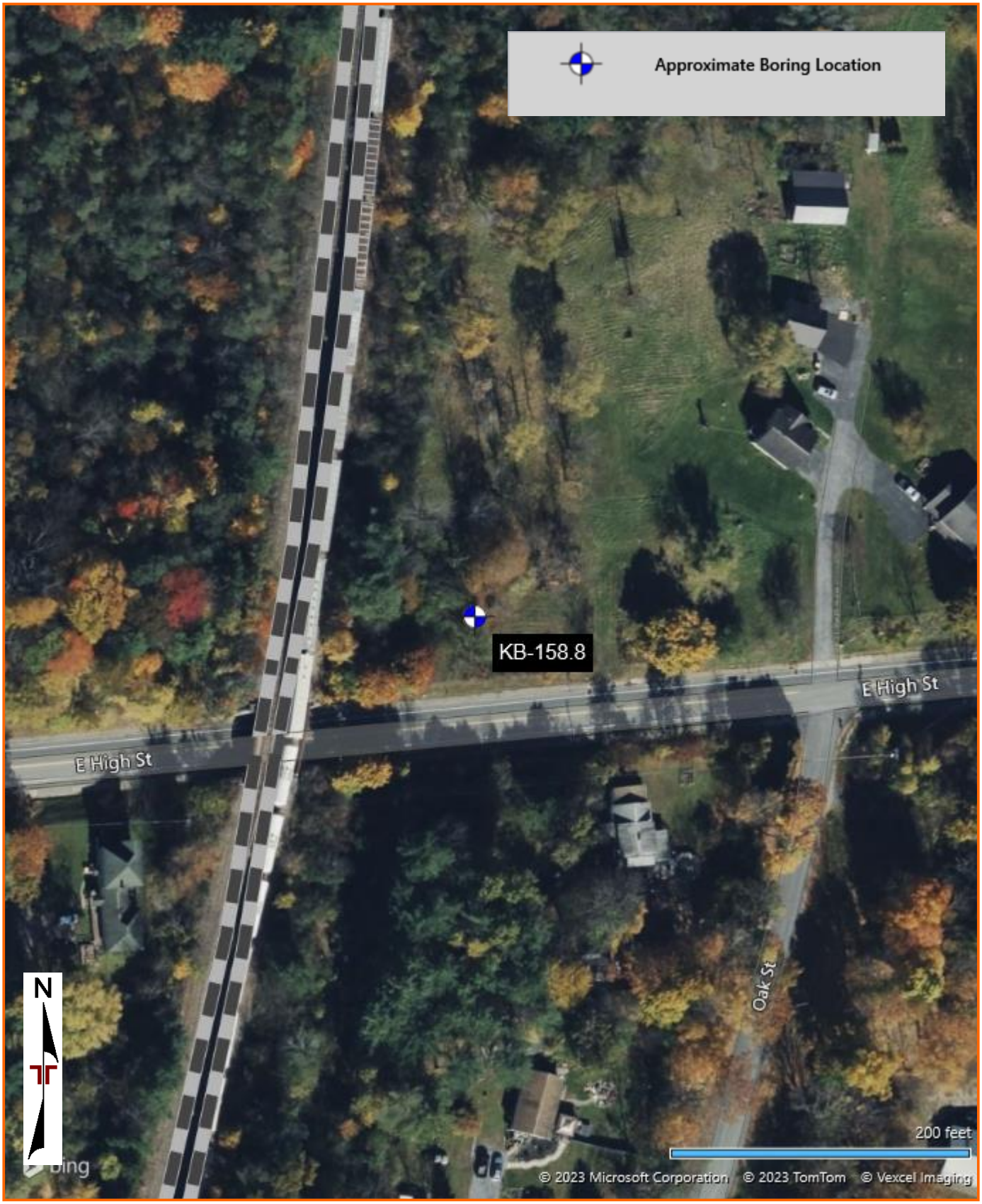


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

BORING LOG NO. KB-158.8

PROJECT: Phase 4 Borings

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

SITE: Champlain to Hudson HDD Crossings

LOCATION See Exploration Plan

Latitude: 43.0017° Longitude: -73.8380°

Surface Elev.: 279.52 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.4	279.1	**TOPSOIL**
		FILL - LEAN CLAY, roots and rootlets noted, brown
2.4	277.1	
		WEATHERED ROCK, gray, dense
5.0	274.5	
		SHALE, highly weathered, very close to close fractured,very poor RQD, gray
10.0	269.5	
		SHALE, highly weathered, very close to close fractured, poor RQD, gray
15.0	264.5	
		Boring Terminated at 15 Feet

DEPTH (Ft.)	FIELD TEST RESULTS	RECOVERY (In.)
	2-3-4-4 N=7	
	11-16-24-50 N=40	
5	REC=100% RQD=8%	
10	REC=100% RQD=33%	
15		

GRAPHIC LOG | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
0-5' 4" Casing
0-5' 3 7/8" Tricone Drill Bit
5'-15' NX Core Barrel

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Hammer Efficiency Summary:
Energy Transfer Ratio: 89.1% +/-4.4%
Hammer Efficiency Correction (CE): 1.49
Logged by JCH/DO

WATER LEVEL OBSERVATIONS

No free water encountered

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 02-17-2023 | Boring Completed: 02-17-2023

Drill Rig: Mobil B-57 | Driller: J. Swope

Project No.: JB215256J

Kiewit

MEMORANDUM

DATE: January 19, 2023

TO: Antonio Marruso, P.E.; CHA Consulting, Inc.

FROM: Matthew Hawley, P.E.; Kiewit Engineering (NY) Corp. MKH
Jaren Knighton; Kiewit Engineering (NY) Corp.

SUBJECT: Geotechnical Data: Segment 6 – Package 4A – HDD Crossing 52 – Revision 1
Champlain Hudson Power Express Project
Ballston Spa, New York

Kiewit Engineering is providing the attached geotechnical data for use in the horizontal direction drill (HDD) design for the Champlain Hudson Power Express project in Upstate New York. This HDD crossing is located south of Ballston Spa, New York. The approximate station for the start of HDD crossing Number 52 is STA 40053+50 (42.9869°N, 73.8439°W).

The geotechnical data at this HDD crossing is attached. The available data is from the previous investigation by AECOM and TRC and from a recent investigation by Terracon, referenced below.

- AECOM, Geotechnical Data Report, Upland Segments, Champlain Hudson Power Express, dated May 28, 2021.
- TRC, Geotechnical Data Report, Champlain Hudson Power Express, Canadian Pacific Railway Borings MP 113.1-177.1, dated March 29, 2013.
- Terracon, Results of Field Exploration, Champlain Hudson Power Express, Ballston – Clifton Park – Glenville, NY, dated June 22, 2022

Contact us if you have questions or require additional information.

HDD 52
Borings K-159.9, BM-1B, K-160.0, K-160.1, K-160.2, B160.3-1, K-160.4, BM-1E
Segment 6 - Design Package 4A

CHPE Segment 6 Package 4A
Soil Boring Coordinates and Elevations

Firm	Boring	Northing (feet)	Easting (feet)	Ground Surface Elevation (feet)
TRC*	A162.1-1	1502786.734	664476.477	284.0
	B158.87-1	1519228.136	669050.444	288.3
	B159.1-1	1517722.124	668720.464	291.0
	B159.5-1	1516012.300	668217.400	295.8
	B160.3-1	1511903.990	667182.915	294.6
	B160.7-1	1509749.417	666636.945	295.0
	B161.4-1	1506284.600	665799.100	288.0
	B163.3-1	1496630.400	662351.700	280.2
	B164.4-1	1490795.529	661205.362	267.5
	B165.5-1	1485722.400	659432.900	277.6
	B165.8-1	1484324.089	658853.809	275.4
	B166.5-1	1480752.600	656954.600	263.5
	B166.9-1	1479253.700	655902.600	265.4
	B167.1-1	1478553.300	655364.300	261.0
	B168.0-1	1474529.400	653290.100	251.4
	B168.64-1	1471082.866	652655.655	245.2
	B168.86-1	1470035.900	652059.906	231.6
AECOM**	BM-1	1500593.800	663479.000	283.4
	BM-1B	1513675.554	667631.458	293.5
	BM-1C	1508115.700	666263.900	291.9
	BM-1D	1504574.200	665267.500	283.4
	BM-1E	1511220.853	667016.761	294.1
	BM-2	1494386.900	661852.400	271.4
	BM-2A	1498788.900	662752.200	279.1
	BM-2B	1492715.315	661511.300	269.7
	BM-3	1487269.097	659995.860	275.1
	BM-3A	1488755.829	660606.619	270.8
	BM-3B	1482501.900	658059.300	273.6
	BM-3C	1480192.269	656553.384	263.2
	BM-4	1477890.500	654882.600	260.5

Notes:

- Northings and Eastings are provided in NAD83 New York State Plane East Zone.
- Elevations are referenced to the NAVD88 datum.

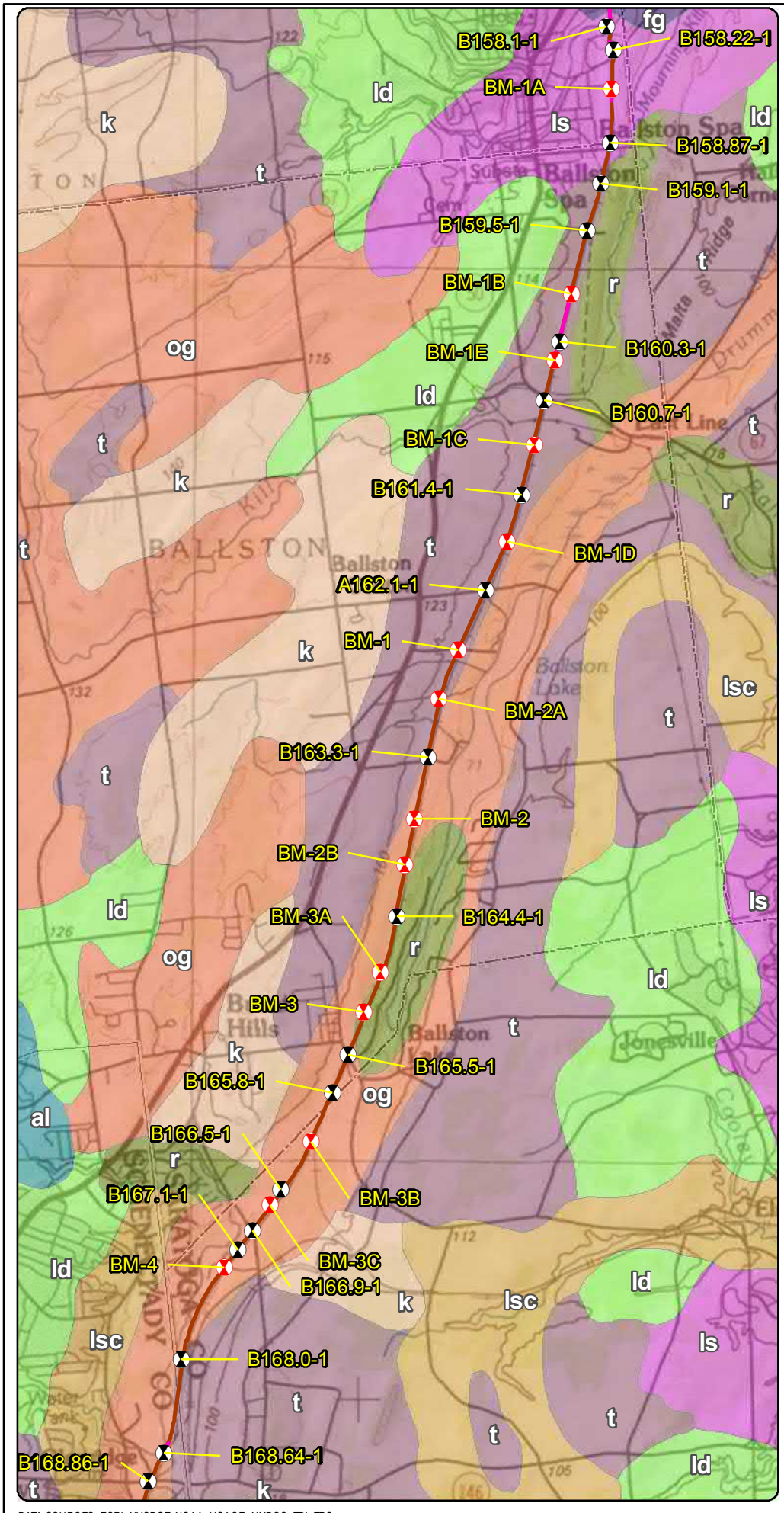
* TRC boring coordinates as shown in Table 1-6 in AECOM report (reference below). Boring elevations estimated from November 2021 topographic survey by Williams Aerial.

** AECOM boring coordinates and elevations as shown in Table 1-6 in AECOM report.

*** Kiewit boring coordinates and elevations are noted on the boring logs.

Reference:

AECOM, Geotechnical Data Report, Upland Segments: Putnam Station, Washington County, to Cementon, Green County, NY, Champlain Hudson Power Express, dated May 28, 2021.



LEGEND

- 2021 Boring Location
- Previous (2013) Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

Surficial Geology

- al - Recent alluvium
- fg - Fluvial sand and/or gravel
- k - Kame deposits
- ld - Lacustrine delta
- ls - Lacustrine sand
- lsc - Lacustrine silt and clay
- og - Outwash sand and gravel
- r - Bedrock
- t - Till

N

0.5 0.25 0 0.5 Miles

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

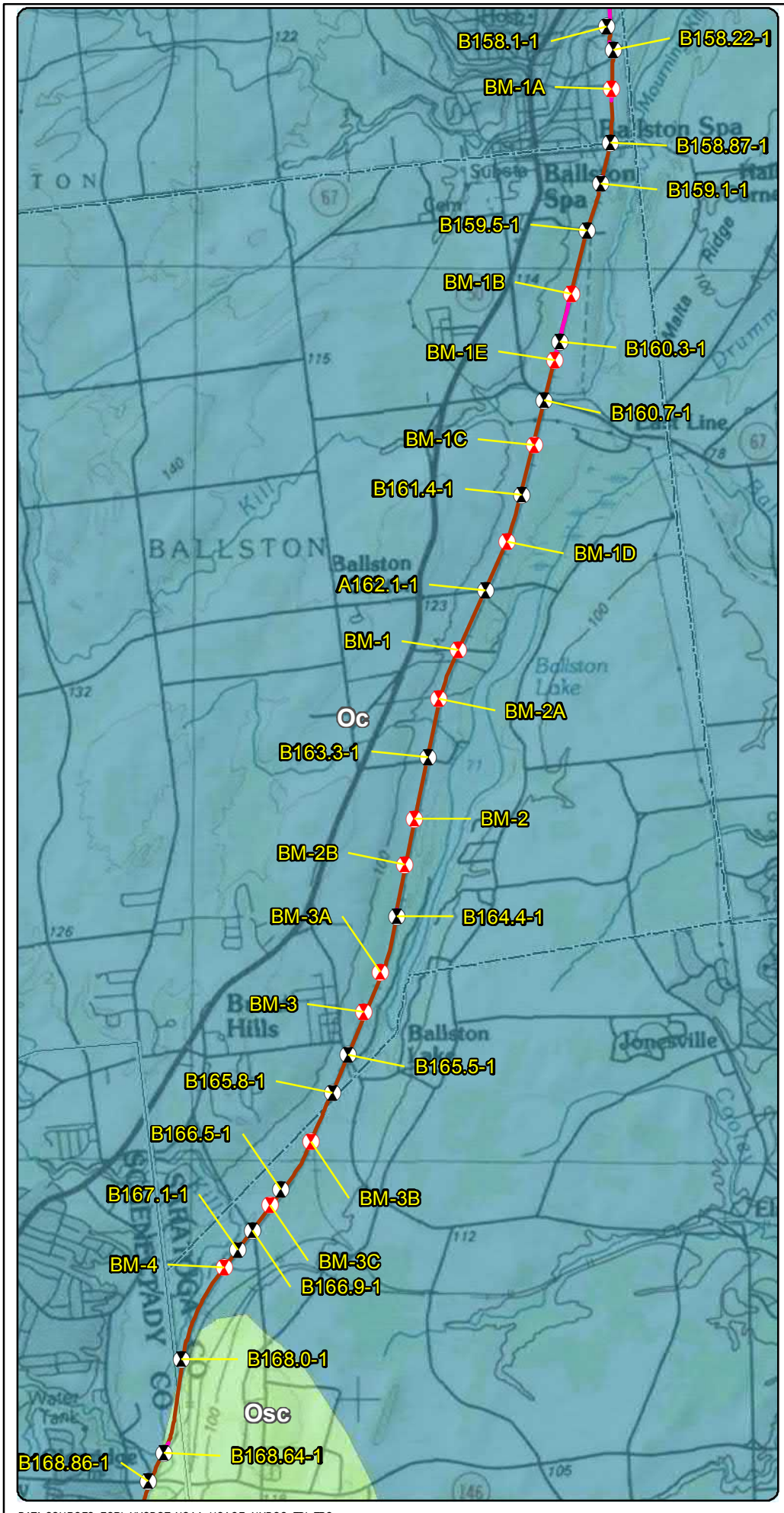
Surficial Geology and Geotechnical Borings Ballston to Mohawk River Figure 3-6

Prepared on 5/5/2021

by: AECOM

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

Y:\Projects\CHPE\Route\Consensus_Alternative_Routes\MXD\Alt 5_Routes_DZ_201909Boring_Locations\Maps_for_May_2021_Report\Ballston_to_Mohawk_Boring_Locations_Surficial_May_2021_Report.mxd



LEGEND

- 2021 Boring Location
- Previous (2013) Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

Bedrock Geology

- Oc - Canajoharie Shale
- Osc - Schenectady Formation

* Schenectady Formation includes: graywacke, sandstone, siltstone, shale

N

0.5 0.25 0 0.5 Miles

Transmission

Champlain Hudson Power Express Project

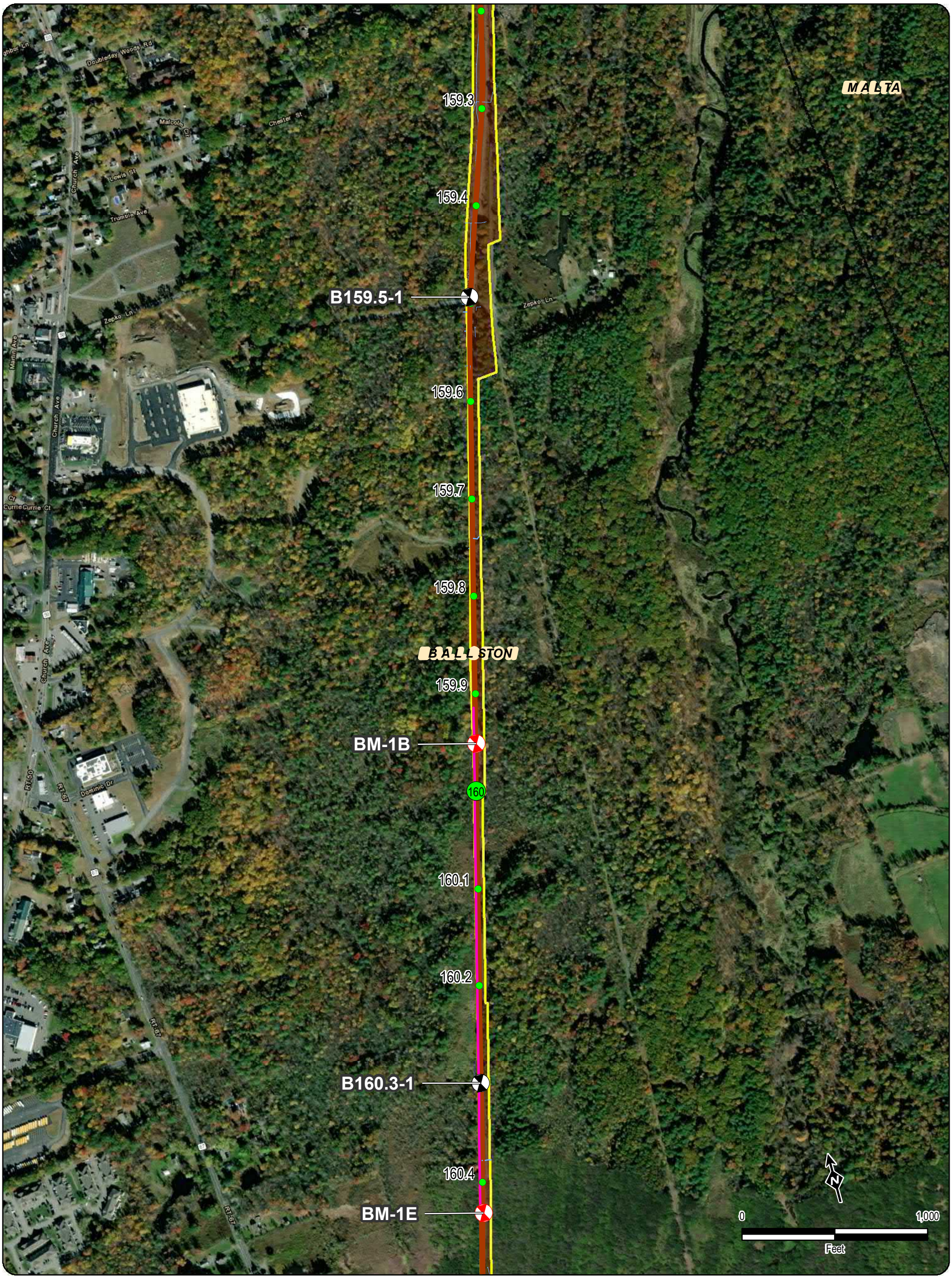
Champlain Hudson Power Express Inc.

Bedrock Geology and Geotechnical Borings Ballston to Mohawk River
Figure 4-6

Prepared on 5/5/2021
by: AECOM

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

Y:\Projects\CHPE\IRoute\Consensus_Alternative_Routes\MXD\Alt 5_Routes_DZ_20190\Boring_Locations\Maps_for_May_2021_Report\Ballston_to_Mohawk_Boring_Locations_Bedrock_May_2021_Report.mxd



LEGEND

- 111.8 Certified Milepost - Tenths
- 135 Certified Milepost
- 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
- 2021 Boring Location
- Previous (2013) Boring Location

- Streams/Ditches
- Railroad ROW
- Deviation Zone
- Deviation Zone Outside ROW
- Preferred Alternative Deviation Zone
- Preferred Alternative Deviation Zone Outside ROW
- Town Boundary
- Village Boundary
- State Park (OPRHP)

Parcel Ownership: TOWN NAME

Road Name: Village Name

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Ballston to Mohawk River

Figure A-6

Sheet 2 of 9

Prepared by: AECOM 5/19/2021

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

Y:\Projects\CHPE\Route\Consensus_Alternative_Routes\MXD\Alt_5_Routes_DZ_201909\Boring_Locations\Maps_for_May_2021_Report\Ballston_to_Mohawk_Boring_Locations_M

BORING CONTRACTOR: ADT			AECOM											SHEET 1 OF 2	
DRILLER: Francisco Martinez														PROJECT NAME: CHPE -	
														PROJECT NO.: 60323056	
SOILS ENGINEER/GEOLOGIST: Alexandra Golden and Mike Izdebski			**BORING LOG**											HOLE NO.: **BM-1B**	
														START DATE: 3/4/21	
LOCATION: MP - 159.95 (CP Rail)														FINISH DATE: 3/5/21	
GROUND WATER OBSERVATIONS				CASING		SAMPLER		DRILL BIT		CORE BARREL				OFFSET: N/A	
No water observed			TYPE	Flush Joint Steel		California Modified		Tricone Roller Bit		NQ				DRILL RIG: Geoprobe 7822DT	
			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.: 4.5"/3"	
			HAMMER WT.	140 lbs		140 lbs								SURFACE ELEV.:	
			HAMMER FALL	30"		30"								LONGITUDE:	
														LATITUDE:	

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	SAMPLE 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'-5'		60"	60"	Hand Cleared					MH	SILT	Gray SILT, trace clay, trace fine-medium gravel, trace organics; subangular gravel, stiff
1.0													
2.0													
3.0													
		3'-5'	S-1										TR-1; (3.0'-5.0')
4.0													
5.0													
		5'-7'	S-2	24"	24"	6	5	14	19	12	SP	SAND & GRAVEL (dense till)	Brown fine-medium SAND, some silt, trace fine-medium gravel; subangular/subrounded gravel, medium dense
6.0													
7.0													
		7'-9'	S-3	24"	24"	23	49	48	47	63	SP		Brown fine SAND, trace silt, little fine-medium-coarse gravel; dry, dense
8.0													
9.0													
		9'-11'	S-4	16"	16"	47	50	50/4"		65	SP		9.0': SAA
10.0													TR-2; (9.5'-10.0')
11.0													
		11'-'13'	S-5	2"	0"	50/2"							No recovery, drill to 13'
12.0													
13.0													
		13'-15'	R-1	24"	7"								Boulder fragments
14.0													
15.0													
		15'-17'	S-6	24"	24"	21	40	48	49	57	MH		Dark gray SILT, trace clay, fine-coarse gravel; subangular, hard, dry
16.0													
17.0													
18.0													
19.0													
													Incurred Rock at 20' 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: $N_{corr}=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

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

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

DRILLER: Francisco Martinez

SOILS ENGINEER: Alexandra Golden and Mike Izdebski

LOCATION: MP - 159.95 (CP Rail)

AECOM

BORING LOG

SHEET 2 OF 2

PROJECT NAME: CHPE -

PROJECT NO.: 60323056

HOLE NO.: **BM-1B**

START DATE: 3/4/21

FINISH DATE: 3/5/21

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
	11 min	20'-25'	R-2	60"	60"	RQD: 60" = 100%				Dark gray shale, thinly laminated, moderately-slightly fractured, 6 pieces, TR-3; (20.0'-20.6')
21.0										
	12 min									
22.0										
	11 min									
23.0										
	10 min									
24.0										
	7 min									
25.0										
	55 min/5 ft	25'-30'	R-3	60"	59"	RQD: 58" = 96%				Dark gray shale, thinly laminated, very compact, hard, unweathered; numerous bedding plane partings
26.0										
27.0										TR-4; (28.4'-28.9')
28.0										
									SHALE	
29.0										
30.0										
	15 min	30'-35'	R-4	60"	60"	RQD: 68%				SAA, slightly less compact
31.0										34.15': Soft, slightly decomposed
	15 min									34.4': Return to prior strata, vertical fracture
32.0										
	15 min									
33.0										
	7 min									
34.0										
	8 min									
35.0										
36.0										BM-1B terminated at 35.2' bgs, grouted 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.

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 2	
DRILLER: Francisco Martinez													PROJECT NAME: CHPE -	
SOILS ENGINEER/GEOLOGIST: Michael Izdebski			**BORING LOG**										PROJECT NO.: 60323056	
LOCATION: Ballston Mohawk (CP Rail) MP-160.43													HOLE NO.: **BM-1E**	
													START DATE: 3/9/21	
													FINISH DATE: 3/9/21	
													OFFSET: N/A	
GROUND WATER OBSERVATIONS				CASING	SAMPLER	DRILL BIT	CORE BARREL						DRILL RIG: Geoprobe 7822DT	
No water observed			TYPE	Flush Joint Steel	California Modified	Tricone Roller Bit	NQ						BORING TYPE: SPT/Core	
			SIZE I.D.	4"	2.5"	- -	1 7/8"						BORING O.D.: 4.5"/3"	
			SIZE O.D.	4.5"	3"	3 7/8"	3"						SURFACE ELEV.:	
			HAMMER WT.	140 lbs	140 lbs								LONGITUDE:	
			HAMMER FALL	30"	30"								LATITUDE:	

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	SAMPLE 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'-5'				Hand Cleared							
1.0													
2.0													
													TR-1; (3.0'-5.0')
3.0													
		3'-5'	S-1										3.0': Dark gray shale fragments, little fine-coarse sand, some silt and clay; moist
4.0													3.0': Suspected shale bedrock, drill down to 5', bedrock not confirmed
5.0													
		5'-7'	S-2	24"	6"	49	50/1"	-	-	-	-		Dark gray fine-coarse shale fragments, little fine-coarse sand, trace clayey-silt
6.0													
													Drill to 7.5'
7.0													
8.0		7.5'	S-3	24"	1"	50/1"	-	-	-	-	-		Refusal; dark gray fine-coarse shale fragments, little fine-coarse sand, trace silt
9.0													Drill to 10.5', begin coring
10.0													
	4 min	10'-15'	R-1	60"	36"	RQD: 0" = 0%							Dark gray thinly laminated shale, significant fracturing and partings on bedding planes; moderately soft, unweathered
11.0													
	17 min												
12.0													
	15 min												
13.0													
	8 min												
14.0													
	10 min												
15.0													
	11 min	15'-20'	R-2	60"	42"	RQD: 0" = 0%							SAA
16.0													
	6 min												
17.0													
	15 min												
18.0													
	25 min												
19.0													
	18 min												
20.0													

SHALE

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

DRILLER: Francisco Martinez

SOILS ENGINEER: Michael Izdebski

LOCATION: Ballston Mohawk (CP Rail) MP-160.43

AECOM

BORING LOG

SHEET 2 OF 2

PROJECT NAME: CHPE -

PROJECT NO.: 60323056

HOLE NO.: **BM-1E**

START DATE: 3/9/21

FINISH DATE: 3/9/21

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
	10 min	20'-25'	R-3	61"	61"	RQD: 35.75" = 59%				Dark gray thinly laminated Shale, moderately hard/competent, moderate fracturing along bedding planes
21.0										
	8 min									
22.0										
	2 min								SHALE	TR-2; (22.65'-23.20')
23.0										
	4 min									
24.0										
	3 min									
25.0										
										BM-1E terminated at 25.1' bgs, grouted to surface
26.0										
27.0										
28.0										
29.0										
30.0										
31.0										
32.0										
33.0										
34.0										
35.0										
36.0										
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.

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%

TEST BORING LOG

PROJECT: TDI CHAMPLAIN HUDSON POWER EXPRESS

LOCATION: CP RAILROAD ROW, NY

BORING	**B160.3-1**
G.S. ELEV.	N/A
FILE	195651
SHEET	1 OF 1

GROUNDWATER DATA			
FIRST ENCOUNTERED 0.0 '			
DEPTH	HOUR	DATE	ELAPSED TIME

METHOD OF ADVANCING BOREHOLE				
a	FROM	0.0 '	TO	4.0 '
d	FROM	4.0 '	TO	9.5 '
c_2	FROM	9.5 '	TO	14.5 '

DRILLER	T. FARRELL
HELPER	J. LANGDON
INSPECTOR	C. POPPE
DATE STARTED	02/13/2013
DATE COMPLETED	02/13/2013

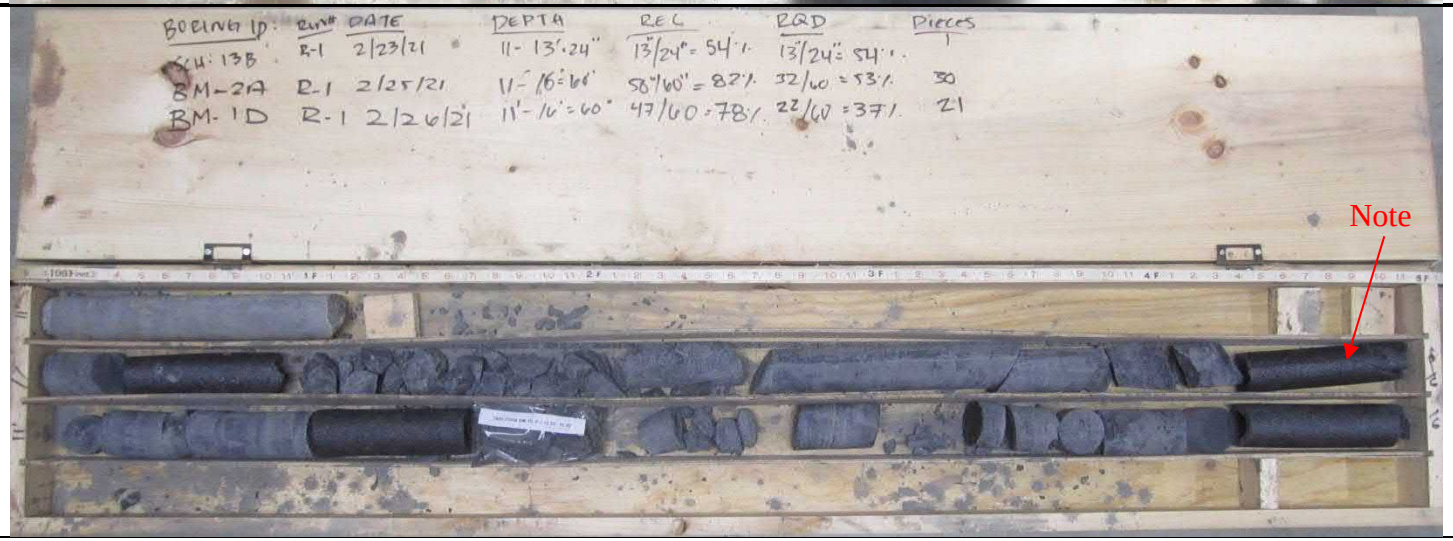
DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-1	8 5 2 2		***BLACK TO BROWN F/M/C SANDY SILT, TR TO SM ROCK FRAGMENTS (FILL)***		
	S-2	4 6 10 8		4.0		
5	S-3	18 32 24 35		***BROWN TO GRAY SILTY F/M/C TR F/ GRAVEL-SIZED ROCK FRAGMENTS, TR CLAY***	8.3	
	S-4	34 40 50/0.2				
	S-5	35 39 50/0.4		9.5	4.9	
10	R-1	REC =70% RQD =10%		***GRAY, MODERATELY TO SEVERELY WEATHERED, SOFT SHALE, VERY CLOSE TO CLOSE, 0 TO 45 DEGREE FRACTURES***		
15				14.5 ***END OF BORING AT 14.5'***		
20						
25						
30						
35						

DRN.	JPB
CKD.	PWK

NEW PROJECTS TEST BORING LOG 195651_TDI_CP.GPJ SITE BLAUVELT.GDT 3/27/13

ROCK CORE PHOTOGRAPHIC LOG

AECOM Project No: **60323056**
Project Name: **CHPE – Upstate New York Upland Geotechnical Investigation**
Location: **Ballston - Mohawk Segment**

Boring No.	Depth (ft.)	
BM-1B	20.0 – 35.2	
Boring No.	**Depth (ft.)**	
BM-1D BM-2A	11.0 – 16.0 11.0 – 16.0	

Note: Black foam inserts represent core pieces that were removed for geotechnical and/or thermal resistivity laboratory testing

ROCK CORE PHOTOGRAPHIC LOG

AECOM Project No: **60323056**
Project Name: **CHPE – Upstate New York Upland Geotechnical Investigation**
Location: **Ballston - Mohawk Segment**

Boring No.	Depth (ft.)
BM-1E	10.0 - 25.1

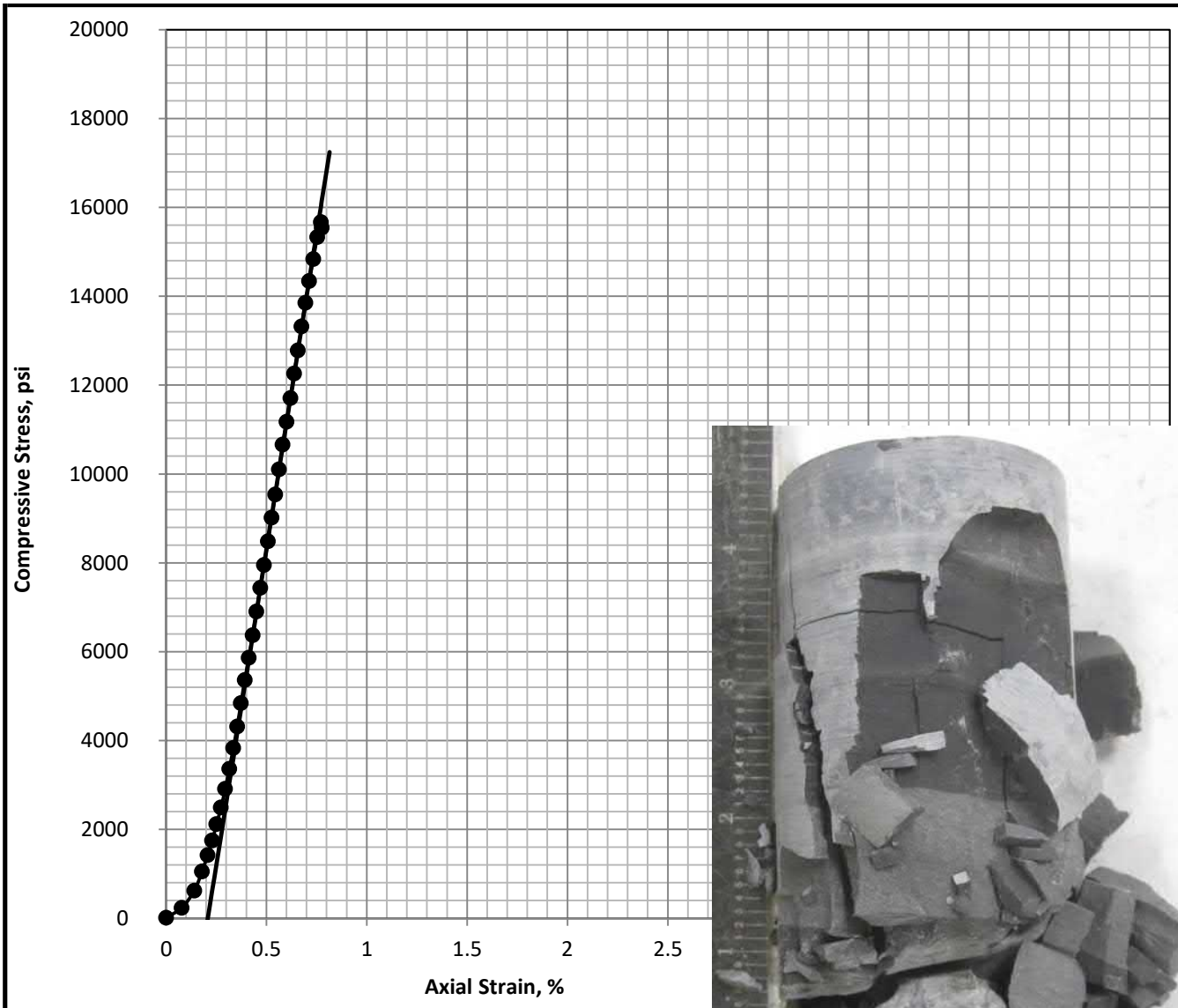
Boring No.	Depth (ft.)
BM-2B	8.0 – 28.0

Note: Black foam inserts represent core pieces that were removed for geotechnical and/or thermal resistivity laboratory testing

Aquifer
CHPE - Ballston-Mohawk River Borings
SUMMARY OF ROCK TESTING

SAMPLE IDENTIFICATION			STATE PROPERTIES			ENGINEERING PROPERTY TESTS				
Boring	Run	Depth	WATER CONTENT (1) (%)	TOTAL UNIT WGT. (pcf)	DRY UNIT WGT. (pcf)	TEST TYPE (2)	HARDNESS Mohs' HARDNESS (-)	UNCONFINED COMPRESSION TESTS (ASTM D7012) COMPRESSIVE STRENGTH (psi)	AXIAL STRAIN @ FAILURE (%)	ESTIMATED (5) ELASTIC MODULUS (psi)
BM-1B	R-2	20-25				M	3.0			
BM-1B	R-2	27.95-28.35	1.0	171	169	UC		13560	0.63	2E+06
BM-1D	R-1	11-16				M	3-4			
BM-1D	R-1	14-14.4	1.1	170	168	UC		12530	0.53	2E+06
BM-1E	R-3	20-25				M	4.0			
BM-1E	R-3	24.6-25	0.9	169	168	UC		15670	0.56	3E+06
BM-2B	R-1	8-13				M	3.0			
BM-2B	R-1	11.0-11.4	1.3	169	167	UC		11590	0.52	2E+06
BM-2B	R-4	23-28				M	3.0			
BM-2B	R-4	24.45-24.85	1.3	169	167	UC		11750	0.54	2E+06
BM-3	R-1	3-8				M	4.0			
BM-3	R-1	6.3-6.7	1.0	169	167	UC		14200	0.70	2E+06
BM-3	R-4	18-23				M	4.0			
BM-3	R-4	19.65-20.05	1.2	168	166	UC		14180	0.78	2E+06
BM-3A	R-3	8-13				M	3.0			
BM-3A	R-3	9-9.4	1.2	169	167	UC		13030	0.66	2E+06
BM-3A	R-5	18.1-23.1				M	3-4			
BM-3A	R-5	19.1-19.5	1.4	168	166	UC		12010	0.68	2E+06
BM-3B	R-2	10-15				M	4.0			
BM-3B	R-2	12.2-12.6	0.7	169	168	UC		16540	0.42	4E+06
BM-3C	R-2	14-19				M	4-5			
BM-3C	R-2	17.65-18.05	1.0	170	168	UC		15870	0.62	3E+06
BM-3C	R-4	24-29				M	3.0			
BM-3C	R-4	25.5-25.9	1.0	168	167	UC		14750	0.63	2E+06
BM-4	R-1	3-8				M	3.0			
BM-4	R-1	5.35-5.75	1.2	170	168	UC		12870	0.59	2E+06
BM-4	R-2	8-13				M	3.0			
BM-4	R-2	8.25-8.65	1.2	169	167	UC		6660	0.43	2E+06

Notes: (1) Water contents determined after trimming and shearing.
(2) Test Type Abbreviations: M: Mohs Hardness, UC: UC Compression test with estimated elastic moduli
(5) Modulus estimated based on corrected gross deformations.



FAILURE PHOTO

Specimen Information

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (inch)	Diameter (inch)
0.85	169	168	4.270	1.973

Specimen meets ASTM D4543 shape tolerances

Test Summary

Strain Rate (%/min)	Corrected Strain to Peak (%)	q_u (psi)	Estimated (shown) Elastic Modulus (psi)
0.11	0.56	15670	3E+06

Test by: DM
Test Date: Apr-02-21
Reviewed by: GET

Aquifer	**CHPE - Ballston-Mohawk River Borings**	**COMPRESSIVE STRESS VS STRAIN UNCONFINED COMPRESSIVE STRENGTH TEST**
TerraSense, LLC Project # 7853-21004		**Boring: BM-1E Run: R-3 Depth 24.6-25 ft.**

SUMMARY OF LABORATORY TEST DATA

Project Name: TDI Champlain Hudson Power Express – CP
Client Name: Transmission Developers, Inc.
TRC Project #: 195651

SAMPLE IDENTIFICATION			Soil Group (USCS System)	GRAIN SIZE DISTRIBUTION				PLASTICITY				Specific Gravity	Moisture Content (%)	Unit Weight (pcf)	Compressive Strength (tsf)	Organic Content (%)
Boring #	Sample #	Depth (ft)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index)					
	S-5	8.0-10.0	-	-	-	-	-	-	-	-	-	-	29.9	-	-	-
	S-6	13.5-15.0	-	-	-	-	-	-	-	-	-	-	25.4	100.1	-	-
	S-8	23.5-25.0	-	-	-	-	-	-	-	-	-	-	23.5	-	-	-
B158.22-1	S-2	2.0-4.0	-	-	-	-	-	-	-	-	-	-	26.9	-	-	-
	S-5	8.0-10.0	SM	24.9	53.2	21.9		-	-	-	-	-	7.0	-	-	-
	R-1	18.9-19.3	-	-	-	-		-	-	-	-	-	-	166.8	255	-
B158.87-1	S-3	4.0-6.0	SM	15.2	47.4	37.4		-	-	-	-	-	14.0	-	-	-
	S-6	13.5-15.0	SM	6.8	47.6	45.6		-	-	-	-	-	15.6	-	-	-
B159.1-1	S-1	0.0-2.0	-	-	-	-	-	-	-	-	-	-	23.5	-	-	-
	S-2	2.0-4.0	-	-	-	-	-	-	-	-	-	-	26.9	-	-	-
	R-2	12.9-13.1	-	-	-	-	-	-	-	-	-	-	-	167.1	-	-
B159.5-1	R-3	12.9-13.2	-	-	-	-	-	-	-	-	-	-	-	165.5	-	-
B160.3-1	S-3	4.0-6.0	-	-	-	-	-	-	-	-	-	-	8.3	132.4	-	-

SUMMARY OF LABORATORY TEST DATA

Project Name: TDI Champlain Hudson Power Express – CP
Client Name: Transmission Developers, Inc.
TRC Project #: 195651

SAMPLE IDENTIFICATION			Soil Group (USCS System)	GRAIN SIZE DISTRIBUTION				PLASTICITY				Specific Gravity	Moisture Content (%)	Unit Weight (pcf)	Compressive Strength (tsf)	Organic Content (%)
Boring #	Sample #	Depth (ft)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index)					
	S-4	6.0-8.0	SM	34.5	48.3	17.2		-	-	-	-	-	4.9	-	-	-
	S-5	8.0-9.4														
	R-1	11.7-12.1	-	-	-	-		-	-	-	-	-	-	173.1	800	-
B160.7-1	S-3	4.0-6.0	SM	10.0	47.8	42.2		-	-	-	-	-	15.5	-	-	-
	S-4	6.0-8.0														
	R-1	15.0-15.2	-	-	-	-	-	-	-	-	-	-	-	167.3	-	-
	R-2	23.5-23.8	-	-	-	-	-	-	-	-	-	-	-	164.3	-	-
B161.4-1	S-1	0.0-2.0	-	-	-	-	-	-	-	-	-	-	9.5	-	-	-
	S-3	4.0-6.0	CL	-	-	-	-	25	17	8	-0.3	-	14.3	-	-	-
A162.1-1	S-2	2.0-4.0	-	-	-	-	-	-	-	-	-	-	15.3	-	-	-
	S-4	6.0-8.0	-	-	-	-	-	-	-	-	-	-	8.2	-	-	-
	S-5	8.0-10.0	-	-	-	-	-	-	-	-	-	-	7.9	-	-	-
	R-1	15.7-16.0	-	-	-	-	-	-	-	-	-	-	-	176.8	-	-

TRC Engineers, Inc.
Soil Mechanics Laboratory

Unconfined Compression Strength Test of Rock Core

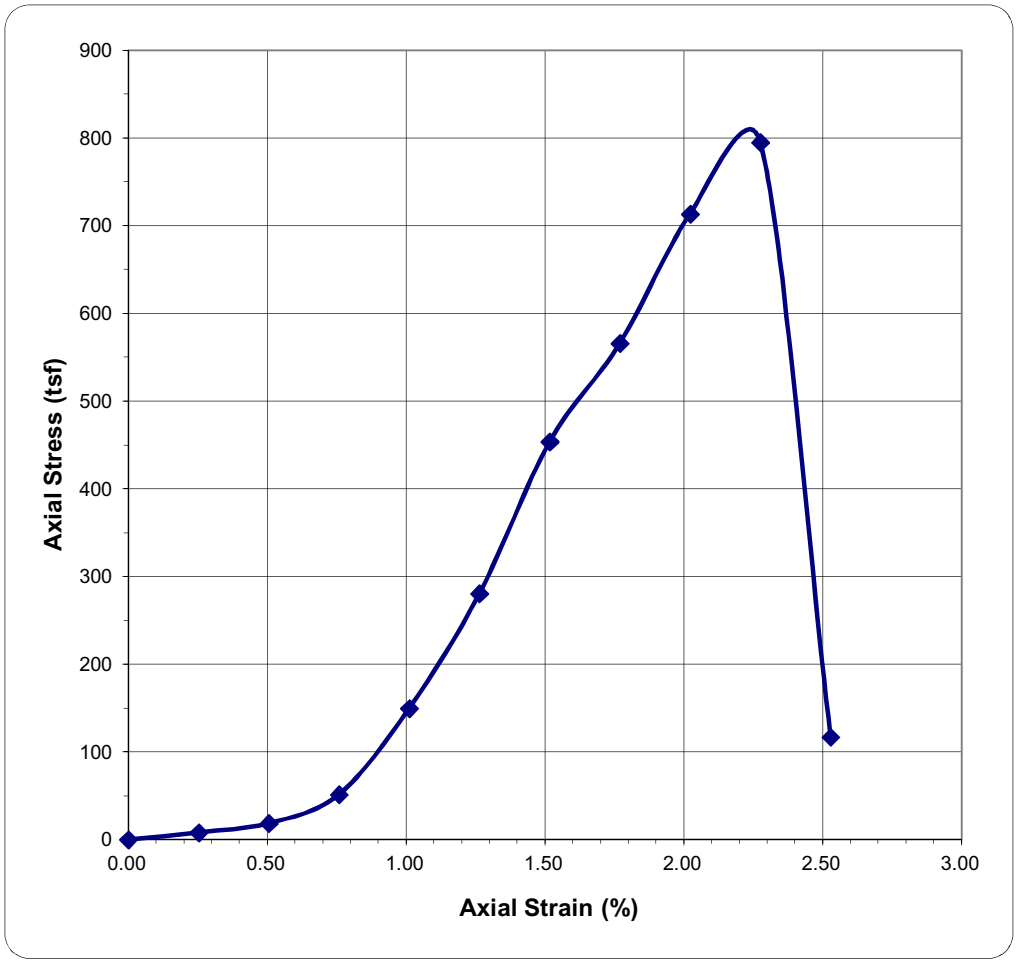
Project Name: TDI
Project No.: 195651
Boring No.: B160.3-1
Sample No: R-1
Depth (ft): 11.7-12.1
Elevation (ft):

Average Sample Diameter (in.): 1.980
Cross Sectional Area (sq. in.) 3.079
Average Sample Height (in.): 3.955
Sample Mass-Dry (g): 553.24
Unit Weight (PCF) 173.1

Sample Description: GRAY SHALE

Test Data

Strain Dial (in.)	Load (lb)	Strain (%)	Stress (tsf)
0.000	0	0.00	0
0.010	350	0.25	8
0.020	800	0.51	19
0.030	2200	0.76	51
0.040	6400	1.01	150
0.050	12000	1.26	281
0.060	19400	1.52	454
0.070	24200	1.77	566
0.080	30500	2.02	713
0.090	34000	2.28	795
0.100	5000	2.53	117



Failure Conditions:

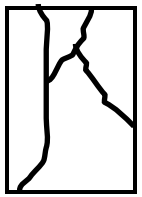


FIGURE: 121

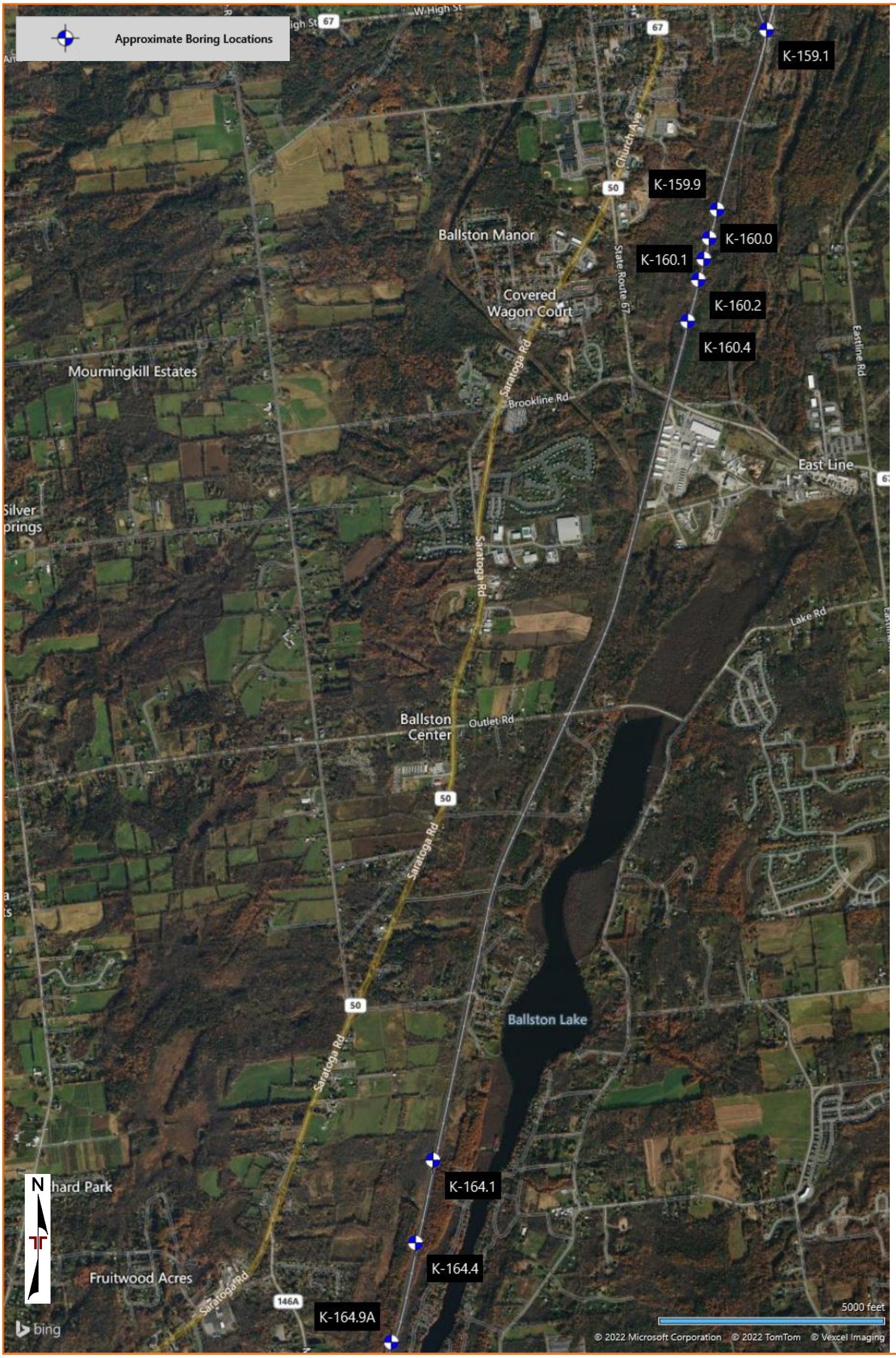


DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED
BY MICROSOFT BUNG MAPS

BORING LOG NO. K-159.9

PROJECT: Champlain-Hudson Power Express Design Package 4a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

LOCATION See Exploration Plan

Latitude: 42.9874° Longitude: -73.8437°

Surface Elev.: 301.97 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
FILL - SILTY SAND, trace gravel, brown, loose			0	1-2-2-4 N=4			
			12	3-4-5-3 N=9			
		5	12	2-3-4-3 N=7	15.9		33
6.0	296						
SILTY SAND WITH GRAVEL (SM), brown, dense, (GLACIAL TILL)			23	6-15-22-33 N=37			
8.0	294						
SILTY SAND (SM), gray, dense to very dense, (GLACIAL TILL)			24	22-24-23-34 N=47	8.0		50
		10	24	33-35-43-43 N=78			
15.0	287	15					
SHALE, slightly weathered, very close to close fractured, poor RQD, gray				REC = 91% RQD = 43%			
20.0	282	20					
SHALE, slightly weathered, close to moderate fractured, good RQD, gray				REC = 96% RQD = 76%			
25.0	277	25					
SHALE, slightly weathered, close to wide fractured, excellent RQD, gray				REC = 100% RQD = 100%			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by Kiewit

Notes:

Logged by MO
Hammer Efficiency Summary:
Energy Transfer Ratio: 91.3% +/-2.7%
Hammer Efficiency Correction (CE):1.52

WATER LEVEL OBSERVATIONS

No measurable groundwater prior to grouting

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 04-06-2022 | Boring Completed: 04-06-2022

Drill Rig: CME 750x | Driller: J. Lamm

Project No.: JB215256A

BORING LOG NO. K-159.9

PROJECT: Champlain-Hudson Power Express Design Package 4a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

LOCATION See Exploration Plan

Latitude: 42.9874° Longitude: -73.8437°

Surface Elev.: 301.97 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS
	SHALE, slightly weathered, close to wide fractured, excellent RQD, gray *(continued)*				
30.0	272	30			
	SHALE, slightly weathered, close to moderate fractured, good RQD, gray				REC = 100% RQD = 81%
35.0	267	35			
	Boring Terminated at 35 Feet				

GRAPHIC LOG | WATER LEVEL OBSERVATIONS | LABORATORY HP (tsf) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by Kiewit

Notes:

Logged by MO
Hammer Efficiency Summary:
Energy Transfer Ratio: 91.3% +/-2.7%
Hammer Efficiency Correction (CE):1.52

WATER LEVEL OBSERVATIONS

No measurable groundwater prior to grouting

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 04-06-2022 | Boring Completed: 04-06-2022

Drill Rig: CME 750x | Driller: J. Lamm

Project No.: JB215256A

BORING LOG NO. K-160.0

PROJECT: Champlain-Hudson Power Express Design Package 4a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

LOCATION See Exploration Plan

Latitude: 42.9856° Longitude: -73.8443°

Surface Elev.: 294.06 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.3	294	**BALLAST**
		FILL - SILTY SAND WITH GRAVEL, black, loose
2.0	292	
		FILL - POORLY GRADED SAND WITH SILT AND GRAVEL, brown, loose
6.0	288	
		SILTY SAND (SM), gray and brown, dense to very dense, (GLACIAL TILL)
16.0	278	
		SHALE, slightly weathered, close to moderate fractured, good RQD, gray
20.0	274	
		SHALE, slightly weathered, close to moderate fractured, excellent RQD, gray
25.0	269	
		SHALE, slightly weathered, close to moderate fractured, excellent RQD, gray

DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
	8	1-2-2-1 N=4		
	10	4-3-3-2 N=6	15.0	9
5	14	1-2-4-5 N=6		
	14	13-23-27-44 N=50	11.1	23
10	NR	47-50/4"		
15				
		REC = 100% RQD = 85%		
20				
		REC = 95% RQD = 95%		
25				
		REC = 100% RQD = 100%		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by Kiewit

Notes:

Logged by JCH
Hammer Efficiency Summary:
Energy Transfer Ratio: 91.3% +/-2.7%
Hammer Efficiency Correction (CE):1.52
NR = Not Recorded

WATER LEVEL OBSERVATIONS

No measurable groundwater prior to grouting

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 04-05-2022 | Boring Completed: 04-06-2022

Drill Rig: CME 750x | Driller: J. Lamm

Project No.: JB215256A

BORING LOG NO. K-160.0

PROJECT: Champlain-Hudson Power Express Design Package 4a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

LOCATION See Exploration Plan

Latitude: 42.9856° Longitude: -73.8443°

Surface Elev.: 294.06 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SHALE, slightly weathered, close to moderate fractured, excellent RQD, gray *(continued)*									
30.0	264		30								
		SHALE, slightly weathered, close to moderate fractured, excellent RQD, gray					REC = 100% RQD = 100%				
35.0	259		35								
		Boring Terminated at 35 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by Kiewit

Notes:

Logged by JCH
Hammer Efficiency Summary:
Energy Transfer Ratio: 91.3% +/-2.7%
Hammer Efficiency Correction (CE):1.52

WATER LEVEL OBSERVATIONS

No measurable groundwater prior to grouting

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 04-05-2022 | Boring Completed: 04-06-2022

Drill Rig: CME 750x | Driller: J. Lamm

Project No.: JB215256A

BORING LOG NO. K-160.1

PROJECT: Champlain-Hudson Power Express Design Package 4a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

LOCATION See Exploration Plan

Latitude: 42.9844° Longitude: -73.8448°

Surface Elev.: 294.21 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
0.4	294	**BALLAST**						
		FILL - POORLY GRADED SAND WITH GRAVEL, black, very loose to loose			8	1-1-2-3 N=3		
3.0	291				12	6-3-2-1 N=5		
		FILL - POORLY GRADED SAND, trace gravel, brown and gray, loose	5		18	2-2-4-6 N=6		
6.0	288				20	11-16-19-20 N=35		
		SILTY SAND (SM), cobbles and boulders noted, gray, dense to very dense, (GLACIAL TILL)			20	14-24-24-37 N=48	8.5	48
			10		NR	32-50-50/4"		
13.5	280.5							
		WEATHERED ROCK, gray, very dense						
15.0	279		15					
		SHALE, slightly weathered, close to moderate fractured, fair RQD, gray				REC = 83% RQD = 68%		
20.0	274		20					
		SHALE, slightly weathered, close to moderate fractured, excellent RQD, gray				REC = 100% RQD = 91%		
25.0	269		25					
		SHALE, slightly weathered, close to moderate fractured, excellent RQD, gray				REC = 100% RQD = 100%		

ATTERBERG LIMITS: LL-PL-PI

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by Kiewit

Notes:

Logged by JCH
Hammer Efficiency Summary:
Energy Transfer Ratio: 91.3% +/-2.7%
Hammer Efficiency Correction (CE):1.52
NR = Not Recorded

WATER LEVEL OBSERVATIONS

No measurable groundwater prior to grouting

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 04-04-2022 | Boring Completed: 04-04-2022

Drill Rig: CME 750x | Driller: J. Lamm

Project No.: JB215256A

BORING LOG NO. K-160.1

PROJECT: Champlain-Hudson Power Express Design Package 4a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

LOCATION See Exploration Plan

Latitude: 42.9844° Longitude: -73.8448°

Surface Elev.: 294.21 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS
30.0	264	**SHALE**, slightly weathered, close to moderate fractured, excellent RQD, gray *(continued)*	30		
35.0	259	**SHALE**, slightly weathered, close to moderate fractured, good RQD, gray			REC = 95% RQD = 86%
		Boring Terminated at 35 Feet	35		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by Kiewit

Notes:

Logged by JCH
Hammer Efficiency Summary:
Energy Transfer Ratio: 91.3% +/-2.7%
Hammer Efficiency Correction (CE):1.52

WATER LEVEL OBSERVATIONS

No measurable groundwater prior to grouting

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 04-04-2022 | Boring Completed: 04-04-2022

Drill Rig: CME 750x | Driller: J. Lamm

Project No.: JB215256A

BORING LOG NO. K-160.2

PROJECT: Champlain-Hudson Power Express Design Package 4a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

LOCATION See Exploration Plan

Latitude: 42.9830° Longitude: -73.8452°

Surface Elev.: 294.07 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
0.3	294	**BALLAST**				
2.0	292	**FILL - SILTY SAND WITH GRAVEL**, bricks and ash noted, black, loose	14	1-3-4-7 N=7		
6.0	288	**FILL - SILTY SAND**, trace clay, gray, loose	14	5-3-2-7 N=5		
			8	2-3-3-4 N=6		
14.0	280	**SILTY SAND (SM)**, gray, medium dense to very dense, (GLACIAL TILL)	20	9-11-16-22 N=27	7.8	45
			18	18-27-32-30 N=59		
17.0	277	**WEATHERED ROCK**, gray, very dense				
20.0	274	**SHALE**, slightly weathered, very close to moderate fractured, poor RQD, gray		REC = 97% RQD = 47%		
25.0	269	**SHALE**, slightly weathered, very close to close fractured, good RQD, gray		REC = 100% RQD = 75%		
		SHALE, slightly weathered, very close to close fractured, good RQD, gray		REC = 95% RQD = 78%		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by Kiewit

Notes:

Logged by JCH
Hammer Efficiency Summary:
Energy Transfer Ratio: 91.3% +/-2.7%
Hammer Efficiency Correction (CE):1.52

WATER LEVEL OBSERVATIONS

No measurable groundwater prior to grouting

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 03-30-2022 | Boring Completed: 04-01-2022

Drill Rig: CME 750x | Driller: J. Lamm

Project No.: JB215256A

BORING LOG NO. K-160.2

PROJECT: Champlain-Hudson Power Express Design Package 4a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

LOCATION See Exploration Plan

Latitude: 42.9830° Longitude: -73.8452°

Surface Elev.: 294.07 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
29.5	264.5									
SHALE, slightly weathered, very close to close fractured, good RQD, gray *(continued)*										
		30				REC = 93% RQD = 85%				
SHALE, slightly weathered, very close to close fractured, good RQD, gray										
34.5	259.5									
Boring Terminated at 34.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by Kiewit

Notes:

Logged by JCH
Hammer Efficiency Summary:
Energy Transfer Ratio: 91.3% +/-2.7%
Hammer Efficiency Correction (CE):1.52

WATER LEVEL OBSERVATIONS

No measurable groundwater prior to grouting

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 03-30-2022 | Boring Completed: 04-01-2022

Drill Rig: CME 750x | Driller: J. Lamm

Project No.: JB215256A

BORING LOG NO. K-160.4

PROJECT: Champlain-Hudson Power Express Design Package 4a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

LOCATION See Exploration Plan

Latitude: 42.9805° Longitude: -73.8461°

Surface Elev.: 294.55 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.4	294	**BALLAST**									
		FILL - SILTY GRAVEL WITH SAND, black, loose				8	1-2-4-2 N=6				
						1	3-3-2-3 N=5				
			5			14	3-3-4-5 N=7				
6.0	288.5										
		SILTY SAND WITH GRAVEL (SM), gray, medium dense to very dense, (GLACIAL TILL)		▽		20	6-10-12-22 N=22		9.4		17
			10			7	22-50/4"				
15.0	279.5		15								
		SHALE, slightly weathered, very close to moderate fractured, good RQD, gray					REC = 91% RQD = 75%				
20.0	274.5		20								
		SHALE, slightly weathered, very close to close fractured, fair RQD, gray					REC = 100% RQD = 53%				
25.0	269.5		25								
		SHALE, slightly weathered, very close to close fractured, good RQD, gray					REC = 100% RQD = 83%				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by Kiewit

Notes:

Logged by JCH
Hammer Efficiency Summary:
Energy Transfer Ratio: 91.3% +/-2.7%
Hammer Efficiency Correction (CE):1.52

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 03-29-2022 | Boring Completed: 03-30-2022

Drill Rig: CME 750x | Driller: J. Lamm

Project No.: JB215256A

BORING LOG NO. K-160.4

PROJECT: Champlain-Hudson Power Express Design Package 4a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

LOCATION See Exploration Plan

Latitude: 42.9805° Longitude: -73.8461°

Surface Elev.: 294.55 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SHALE, slightly weathered, very close to close fractured, good RQD, gray *(continued)*									
	30.0	264.5	30								
		SHALE, slightly weathered, very close to close fractured, good RQD, gray					REC = 100% RQD = 83%				
	35.0	259.5	35								
		Boring Terminated at 35 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by Kiewit

Notes:

Logged by JCH
Hammer Efficiency Summary:
Energy Transfer Ratio: 91.3% +/-2.7%
Hammer Efficiency Correction (CE):1.52

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 03-29-2022 | Boring Completed: 03-30-2022

Drill Rig: CME 750x | Driller: J. Lamm

Project No.: JB215256A

PHOTOGRAPHY LOG

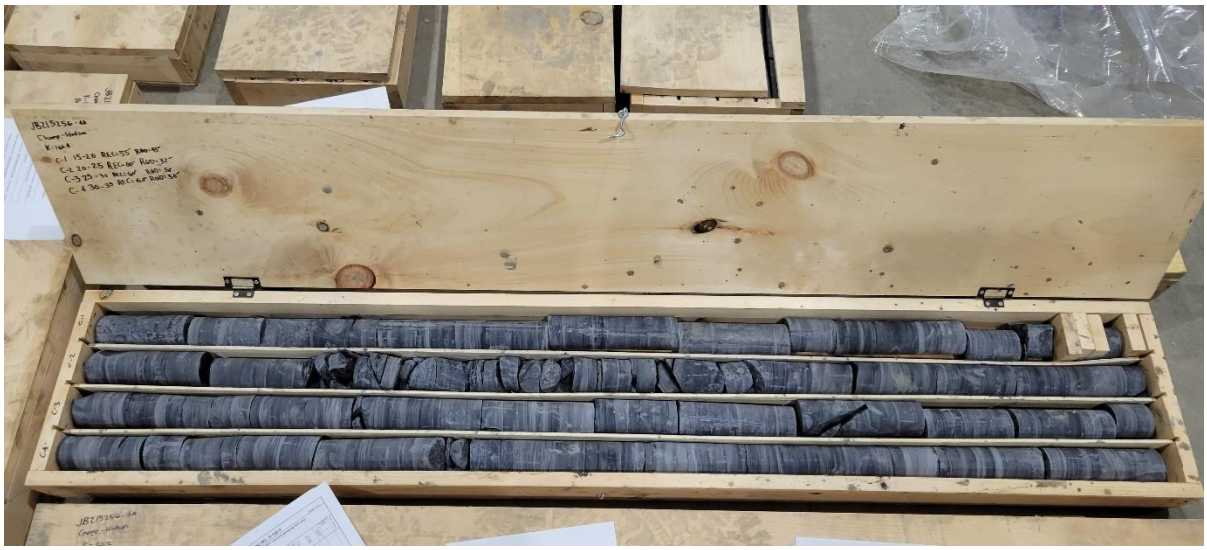
Rock Core – Boring K-159.1

Rock Core – Boring K-159.9

Rock Core – Boring K-160.0

Rock Core – Boring K-160.1

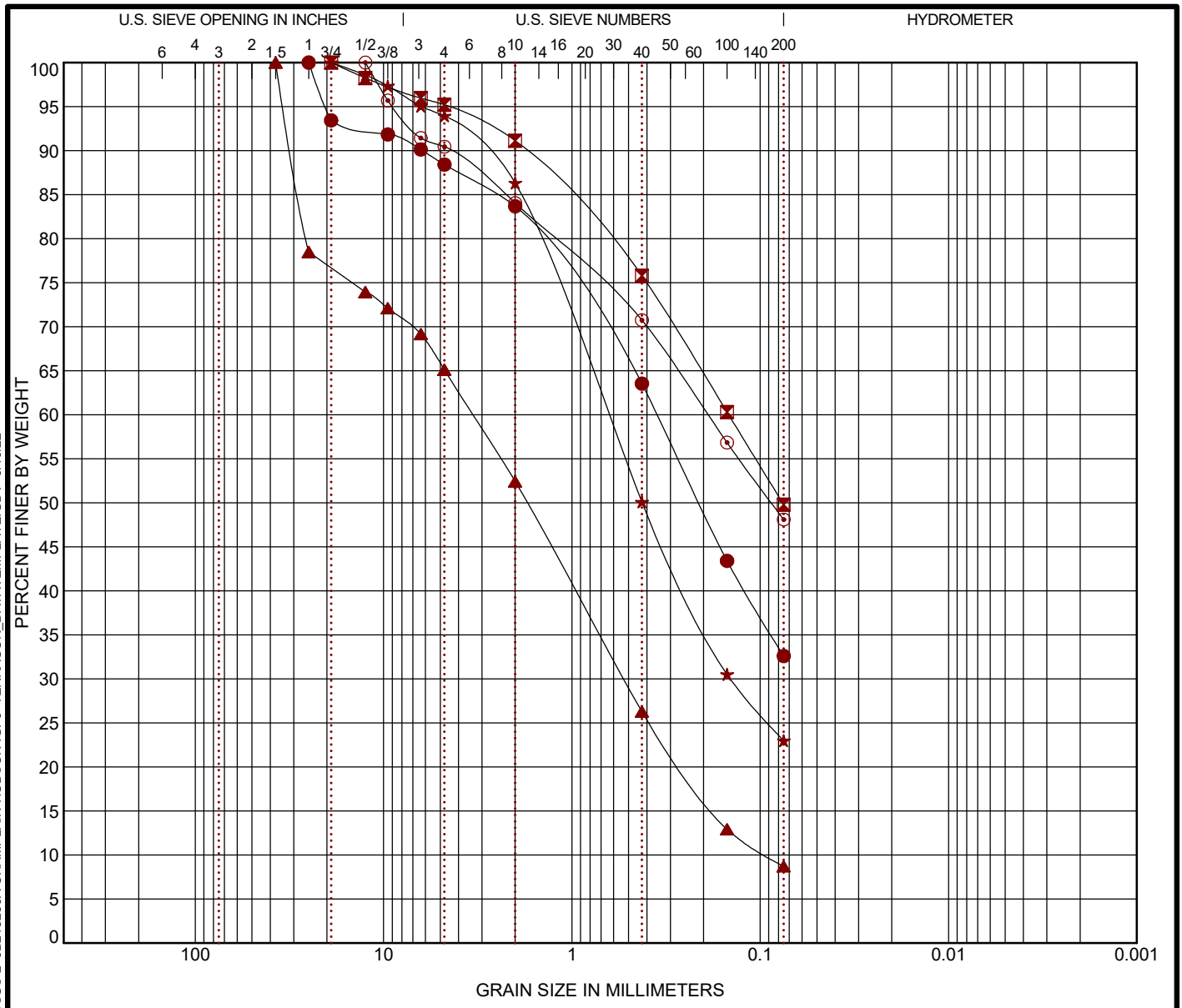
Rock Core – Boring K-160.2



Rock Core – Boring K-160.4

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	K-159.9	4 - 6	SILTY SAND (SM)	15.9					
⊠	K-159.9	8 - 10	SILTY SAND (SM)	8.0					
▲	K-160.0	2 - 4	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	15.0				0.90	36.15
★	K-160.0	8 - 10	SILTY SAND (SM)	11.1					
⊙	K-160.1	8 - 10	SILTY SAND (SM)	8.5					

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	K-159.9	4 - 6	25	0.354			0.0	11.6	55.8		32.6	
⊠	K-159.9	8 - 10	19	0.147			0.0	4.8	45.4		49.8	
▲	K-160.0	2 - 4	37.5	3.353	0.53	0.093	0.0	34.9	56.4		8.7	
★	K-160.0	8 - 10	19	0.649	0.143		0.0	6.1	71.0		23.0	
⊙	K-160.1	8 - 10	12.5	0.19			0.0	9.6	42.3		48.1	

PROJECT: Champlain-Hudson Power Express
Design Package 4a

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215256A

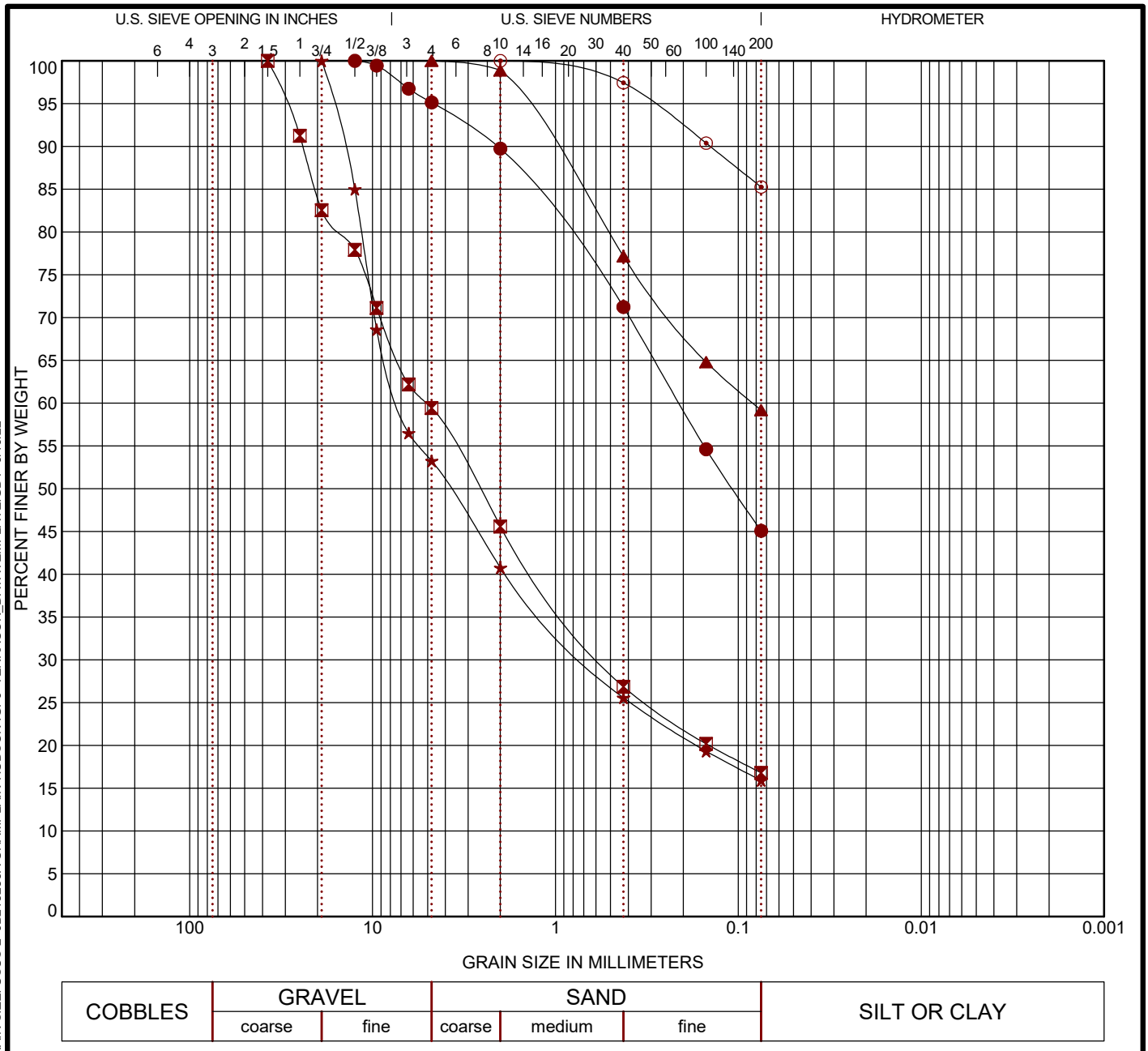
CLIENT: Kiewit Engineering (NY) Corp.

EXHIBIT: B-1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 JB215256A CHAMPLAIN-HUDSON .GPJ TERRACON_DATATEMPLATE.GDT 6/10/22

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	K-160.2	6 - 8	SILTY SAND (SM)	7.8					
⊠	K-160.4	6 - 8	SILTY SAND with GRAVEL (SM)	9.4					
▲	K-164.9B	4 - 5.5	SANDY LEAN CLAY (CL)	35.1	42	24	18		
★	K-165.1	6 - 8	SILTY GRAVEL with SAND (GM)	9.3	NP	NP	NP		
⊙	K-165.8	4 - 6	LEAN CLAY (CL)	26.7	36	23	13		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	K-160.2	6 - 8	12.5	0.21			0.0	4.9	50.1		45.1	
⊠	K-160.4	6 - 8	37.5	5.042	0.551		0.0	40.6	42.6		16.8	
▲	K-164.9B	4 - 6	4.75	0.083			0.0	0.0	40.8		59.2	
★	K-165.1	6 - 8	19	7.137	0.668		0.0	46.8	37.3		15.9	
⊙	K-165.8	4 - 6	2				0.0	0.0	14.7		85.3	

PROJECT: Champlain-Hudson Power Express
Design Package 4a

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215256A

CLIENT: Kiewit Engineering (NY) Corp.

EXHIBIT: B-2

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 JB215256A CHAMPLAIN-HUDSON .GPJ TERRACON_DATATEMPLATE.GDT 6/10/22

Summary of Laboratory Results

BORING ID	Depth (Ft.)	Organic Content (%)
K-160.1	4-6	0.8
K-165.8	2-4	75.5
K-168.6	4-6	7.4

PROJECT: Champlain-Hudson Power Express
Design Package 4a

SITE: Champlain to Hudson HDD Crossings
Ballston - Clifton Park - Glenville, NY

Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215256A

CLIENT: Kiewit Engineering (NY) Corp.

EXHIBIT: B-1

Client

Kiewit Engineering (NY) Corp
Lone Tree, CO

Project

Champlain-Hudson Power Express Project
JB215256

Date Received: 4/25/2022

Results from Corrosion Testing

Sample Location	K-160.1
Sample Depth (ft.)	6'-8'
pH Analysis, ASTM G 51	6.89
Water Soluble Sulfate (SO4), ASTM C 1580 (ppm)	3
Sulfides, AWWA 4500-S D, (mg/kg)	Nil
Chlorides, ASTM D 512, (ppm)	15
Red-Ox, ASTM G 200, (mV)	+494
Total Salts, AWWA 2520 B, (mg/kg)	343
Resistivity (Saturated), ASTM G 57, (ohm-cm)	5180

Analyzed By: Kyle Lemcke
Laboratory Supervisor

Client
Kiewit Engineering Corp

Project
Champlain-Hudson Power Express Project

Project No. JB215256

Splitting Tensile Strength of Intact Rock Core Specimens, ASTM D3967

Boring	K-160.0	**Material Description**	Shale
Sample No		**Equipment Used**	Tinius Olsen (120,000lbs)
Depth (ft)	20-25	**TICCS ID/Serial No.**	C-48999, 118285
Lab No	5068	**Calibration Date**	11/2/2021

	TENSILE STRENGTH				
Sample No.	1	2	3	4	5
Diameter (in)	1.97	1.97	1.97	1.97	1.97
Length (in)	0.061	0.059	0.069	0.071	0.063
Length Diameter Ratio	0.03	0.03	0.04	0.04	0.03
Rate of Loading	0.0061	0.0059	0.0069	0.0071	0.0063
Moisture Condition	0.90%	0.90%	0.90%	0.90%	0.90%
Maximum Applied Load (lbf)	4069	3735	2136	1705	2888
Splitting Tensile Strength (psi)	21567.1	20467.9	10008.9	7764.3	14821.5

	TENSILE STRENGTH				
Sample No.	6	7	8	9	
Diameter (in)	1.97	1.97	1.97	1.97	
Length (in)	0.052	0.065	0.06	0.07	
Length Diameter Ratio	0.03	0.03	0.03	0.04	
Rate of Loading	0.0052	0.0065	0.006	0.007	
Moisture Condition	0.90%	0.90%	0.90%	0.90%	
Maximum Applied Load (lbf)	787	1145	1011	1162	
Splitting Tensile Strength (psi)	4893.3	5695.4	5448.0	5367.1	

GeoTesting EXPRESS

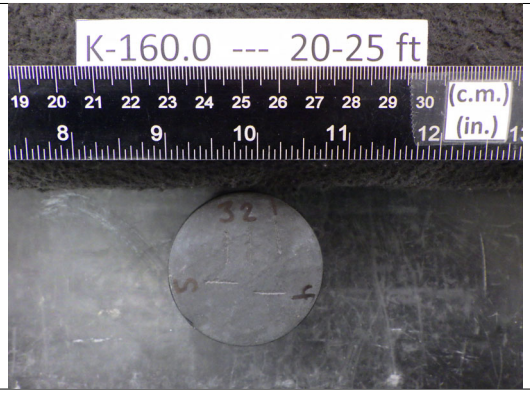
Client:	Terracon Consultants, Inc.				
Project:	Champlain-Hudson Power Express				
Location:				Project No:	GTX-315284
Boring ID:	K-160.0	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	---	Test Date:	06/17/22	Checked By:	smd
Depth :	20-25 ft	Test Id:	670478		
Test Comment:	---				
Visual Description:	---				
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-160.0	---	20-25 ft	1	0.5	0.6	0.55	
			2	0.4	0.9	0.65	
			3	1.3	1.6	1.45	
			4	0.7	0.7	0.70	
			5	0.5	0.8	0.65	
			Average CAIs			0.8	
			Average CAI *			1.27	
				CERCHAR Abrasiveness Index Classification		**Low abrasiveness**	

Notes

Test Surface: Saw Cut
Moisture Condition: As Received
Apparatus Type: Original CERCHAR
Stylus Hardness: Rockwell Hardess 40/42 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:



Kiewit

MEMORANDUM

DATE: January 19, 2023

TO: Antonio Marruso, P.E.; CHA Consulting, Inc.

FROM: Matthew Hawley, P.E.; Kiewit Engineering (NY) Corp. MKH
Jaren Knighton; Kiewit Engineering (NY) Corp.

SUBJECT: Geotechnical Data: Segment 6 – Package 4A – HDD Crossing 53
Champlain Hudson Power Express Project
Ballston Spa, New York

Kiewit Engineering is providing the attached geotechnical data for use in the horizontal direction drill (HDD) design for the Champlain Hudson Power Express project in Upstate New York. This HDD crossing is located south of Ballston Spa, New York. The approximate station for the start of HDD crossing Number 53 is STA 40091+00 (42.9769°N, 73.8477°W).

The geotechnical data at this HDD crossing is attached. The available data is from the previous investigation by TRC and from a recent investigation by Terracon, referenced below.

- TRC, Geotechnical Data Report, Champlain Hudson Power Express, Canadian Pacific Railway Borings MP 113.1-177.1, dated March 29, 2013.
- Terracon Consultants-NY, Inc., Results of Field Exploration, Champlain-Hudson Power Express – Additional HDD Borings – Phase 3, Fort Ann to Coxsackie, NY, dated November 3, 2022

Contact us if you have questions or require additional information.

HDD 53
Borings B-160.7-1, KB-160.6
Segment 6 - Design Package 4A

CHPE Segment 6 Package 4A
Soil Boring Coordinates and Elevations

Firm	Boring	Northing (feet)	Easting (feet)	Ground Surface Elevation (feet)
TRC*	A162.1-1	1502786.734	664476.477	284.0
	B158.87-1	1519228.136	669050.444	288.3
	B159.1-1	1517722.124	668720.464	291.0
	B159.5-1	1516012.300	668217.400	295.8
	B160.3-1	1511903.990	667182.915	294.6
	B160.7-1	1509749.417	666636.945	295.0
	B161.4-1	1506284.600	665799.100	288.0
	B163.3-1	1496630.400	662351.700	280.2
	B164.4-1	1490795.529	661205.362	267.5
	B165.5-1	1485722.400	659432.900	277.6
	B165.8-1	1484324.089	658853.809	275.4
	B166.5-1	1480752.600	656954.600	263.5
	B166.9-1	1479253.700	655902.600	265.4
	B167.1-1	1478553.300	655364.300	261.0
	B168.0-1	1474529.400	653290.100	251.4
	B168.64-1	1471082.866	652655.655	245.2
	B168.86-1	1470035.900	652059.906	231.6
AECOM**	BM-1	1500593.800	663479.000	283.4
	BM-1B	1513675.554	667631.458	293.5
	BM-1C	1508115.700	666263.900	291.9
	BM-1D	1504574.200	665267.500	283.4
	BM-1E	1511220.853	667016.761	294.1
	BM-2	1494386.900	661852.400	271.4
	BM-2A	1498788.900	662752.200	279.1
	BM-2B	1492715.315	661511.300	269.7
	BM-3	1487269.097	659995.860	275.1
	BM-3A	1488755.829	660606.619	270.8
	BM-3B	1482501.900	658059.300	273.6
	BM-3C	1480192.269	656553.384	263.2
	BM-4	1477890.500	654882.600	260.5

Notes:

- Northings and Eastings are provided in NAD83 New York State Plane East Zone.
- Elevations are referenced to the NAVD88 datum.

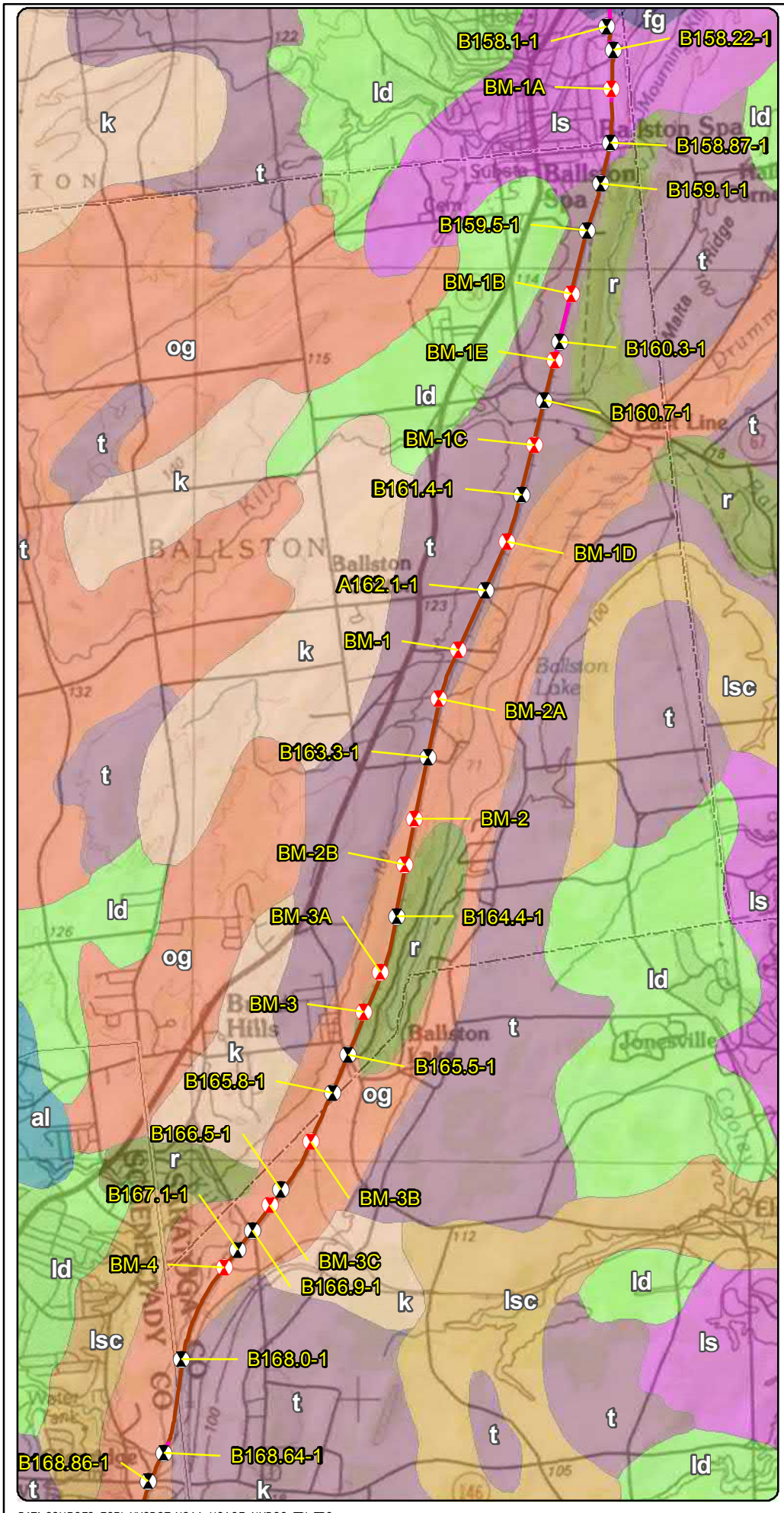
* TRC boring coordinates as shown in Table 1-6 in AECOM report (reference below). Boring elevations estimated from November 2021 topographic survey by Williams Aerial.

** AECOM boring coordinates and elevations as shown in Table 1-6 in AECOM report.

*** Kiewit boring coordinates and elevations are noted on the boring logs.

Reference:

AECOM, Geotechnical Data Report, Upland Segments: Putnam Station, Washington County, to Cementon, Green County, NY, Champlain Hudson Power Express, dated May 28, 2021.



LEGEND

- 2021 Boring Location
- Previous (2013) Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

Surficial Geology

- al - Recent alluvium
- fg - Fluvial sand and/or gravel
- k - Kame deposits
- ld - Lacustrine delta
- ls - Lacustrine sand
- lsc - Lacustrine silt and clay
- og - Outwash sand and gravel
- r - Bedrock
- t - Till

N

0.5 0.25 0 0.5 Miles

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

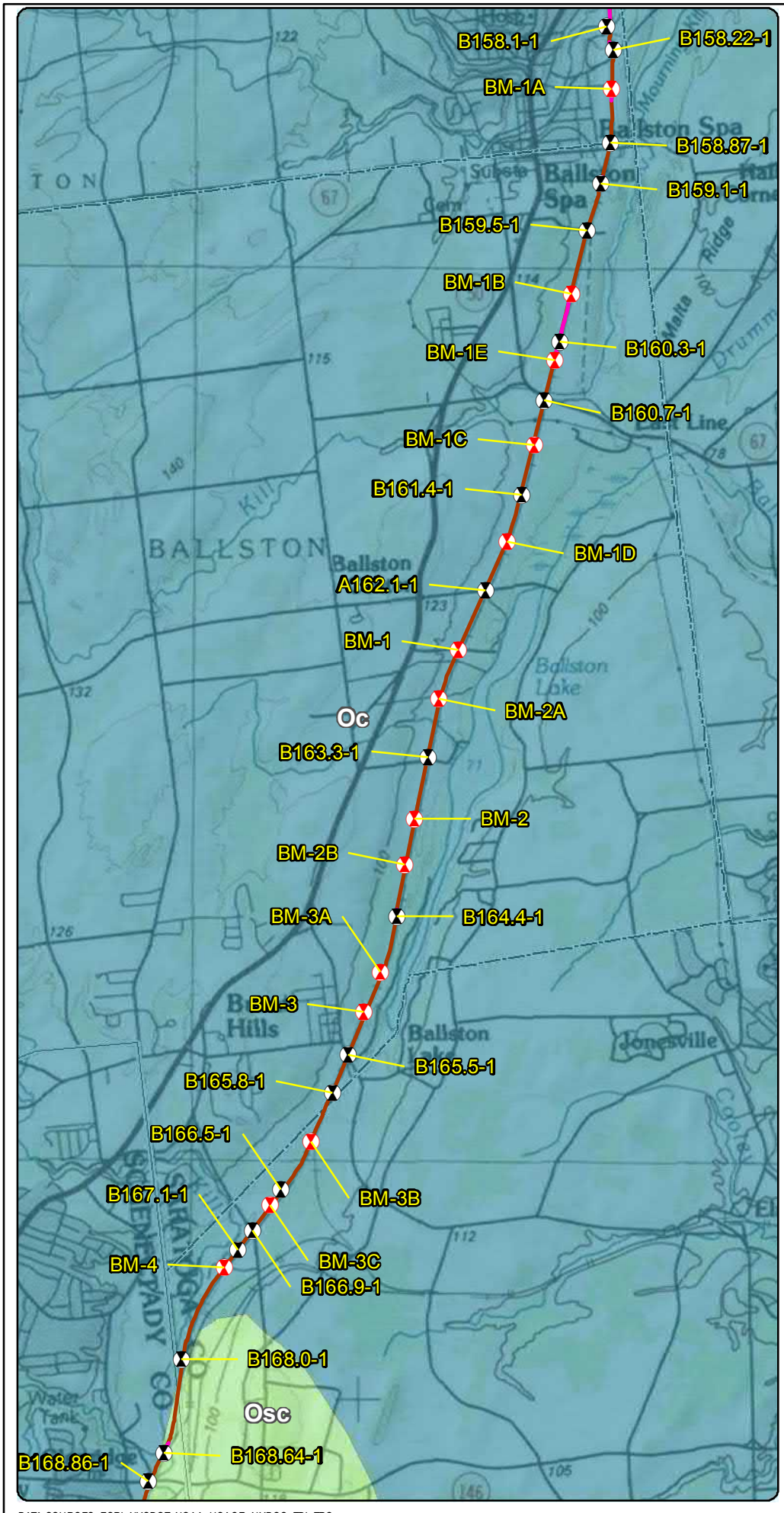
Surficial Geology and Geotechnical Borings Ballston to Mohawk River Figure 3-6

Prepared on 5/5/2021

by: AECOM

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

Y:\Projects\CHPE\Route\Consensus_Alternative_Routes\MXD\Alt 5_Routes_DZ_201909Boring_Locations\Maps_for_May_2021_Report\Ballston_to_Mohawk_Boring_Locations_Surficial_May_2021_Report.mxd



LEGEND

- 2021 Boring Location
- Previous (2013) Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

Bedrock Geology

- Oc - Canajoharie Shale
- Osc - Schenectady Formation

* Schenectady Formation includes: graywacke, sandstone, siltstone, shale

N

0.5 0.25 0 0.5 Miles

Transmission

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

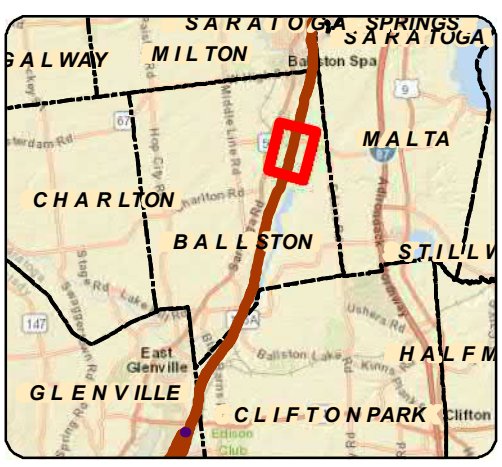
Bedrock Geology and Geotechnical Borings Ballston to Mohawk River
Figure 4-6

Prepared on 5/5/2021
by: AECOM

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

Y:\Projects\CHPE\IRoute\Consensus_Alternative_Routes\MXD\Alt 5_Routes_DZ_20190\Boring_Locations\Maps_for_May_2021_Report\Ballston_to_Mohawk_Boring_Locations_Bedrock_May_2021_Report.mxd

BM-1E
160.5
160.6
160.7
B160.7-1
160.8
160.9
161
BM-1C
161.1
161.2
161.3
B161.4-1
161.5
161.6
161.7
BALLSTON
Rolling Brook Dr
Brookline Rd
Tiffault Rd
RT-67
Underpass Rd
Sherman Way
Everson Way
Jovan Ct
McCrea Hill Rd
Curtis Park Rd
0
1,000
Feet



LEGEND

- 111.8 Certified Milepost - Tenths
- 135 Certified Milepost
- 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
- 2021 Boring Location
- Previous (2013) Boring Location
- Streams/Ditches
- Railroad ROW
- Deviation Zone
- Deviation Zone Outside ROW
- Preferred Alternative Deviation Zone
- Preferred Alternative Deviation Zone Outside ROW
- Town Boundary
- Village Boundary
- State Park (OPRHP)

Parcel Ownership: TOWN NAME
Road Name: Village Name

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Ballston to Mohawk River

Figure A-6

Sheet 3 of 9

Prepared by: AECOM 5/19/2021

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

Y:\Projects\CHPEI\Route\Consensus_Alternative_Routes\MXD\Alt_5_Routes_DZ_201909\Boring_Locations\Maps_for_May_2021_Report\Ballston_to_Mohawk_Boring_Locations_Mapset_May_2021_Report.mxd

TEST BORING LOG

PROJECT: TDI CHAMPLAIN HUDSON POWER EXPRESS

LOCATION: CP RAILROAD ROW, NY

BORING	**B160.7-1**
G.S. ELEV.	N/A
FILE	195651
SHEET	1 OF 1

GROUNDWATER DATA			
FIRST ENCOUNTERED DRY			
DEPTH	HOUR	DATE	ELAPSED TIME

METHOD OF ADVANCING BOREHOLE				
a	FROM	0.0 '	TO	4.0 '
d	FROM	4.0 '	TO	15.0 '
c_2	FROM	15.0 '	TO	25.0 '

DRILLER	T. FARRELL
HELPER	J. LANGDON
INSPECTOR	C. POPPE
DATE STARTED	02/14/2013
DATE COMPLETED	02/14/2013

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-1	2 2 5 8		***BROWN SILT, TR TO SM F/ SAND, TR GRAVEL AND ROCK FRAGMENTS***		
	S-2	8 7 10 13		4.0		
5	S-3	5 8 37 20		***BROWN F/ SANDY CLAY, TR SILT, TR GRAVEL***	15.5	
	S-4	10 8 14 22		8.0		
10	S-5	15 20 31 35		***BROWN SILTY F/M/C SAND, SM F/C GRAVEL-SIZED ROCK FRAGMENTS***		
				13.5		
	S-6	35 40 50/0.3		***GRAY SILT, SM F/C GRAVEL-SIZED ROCK FRAGMENTS, TR F/ SAND (DECOMPOSED ROCK)***		
15				15.0		
	R-1	REC =100% RQD =0%		***GRAY, MODERATELY WEATHERED, SOFT SHALE, VERY CLOSE TO CLOSE, 0 TO 45 DEGREE FRACTURES***		
20						
	R-2	REC =100% RQD =0%		25.0		
25				***END OF BORING AT 25'***		
30						
35						

DRN.	JPB
CKD.	PWK

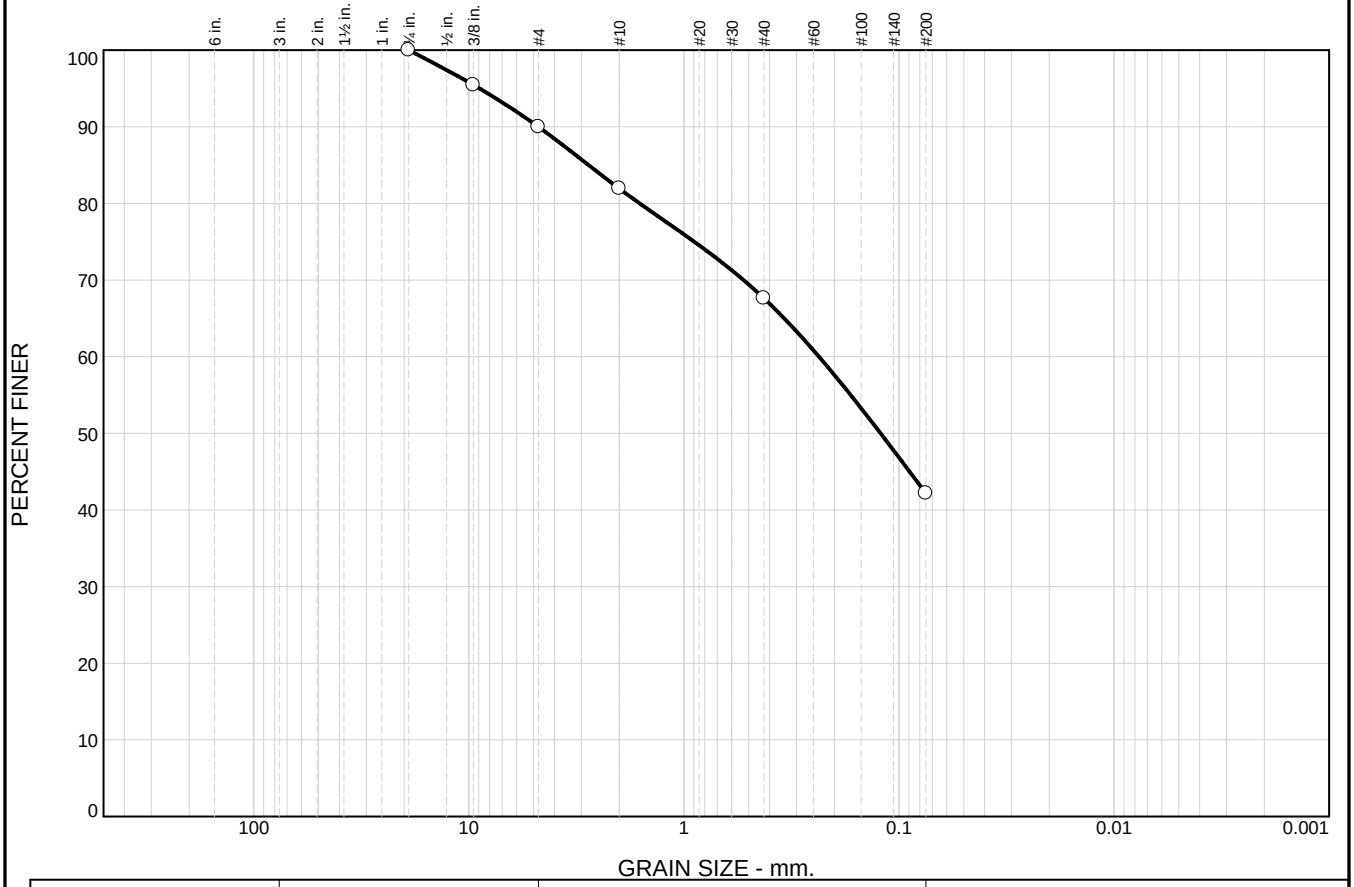
NEW PROJECTS TEST BORING LOG 195651_TDI_CP.GPJ SITE BLAUVELT.GDT 3/27/13

SUMMARY OF LABORATORY TEST DATA

Project Name: TDI Champlain Hudson Power Express – CP
Client Name: Transmission Developers, Inc.
TRC Project #: 195651

SAMPLE IDENTIFICATION			Soil Group (USCS System)	GRAIN SIZE DISTRIBUTION				PLASTICITY				Specific Gravity	Moisture Content (%)	Unit Weight (pcf)	Compressive Strength (tsf)	Organic Content (%)
Boring #	Sample #	Depth (ft)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index)					
	S-4	6.0-8.0	SM	34.5	48.3	17.2		-	-	-	-	-	4.9	-	-	-
	S-5	8.0-9.4														
	R-1	11.7-12.1	-	-	-	-		-	-	-	-	-	-	173.1	800	-
B160.7-1	S-3	4.0-6.0	SM	10.0	47.8	42.2		-	-	-	-	-	15.5	-	-	-
	S-4	6.0-8.0														
	R-1	15.0-15.2	-	-	-	-	-	-	-	-	-	-	-	167.3	-	-
	R-2	23.5-23.8	-	-	-	-	-	-	-	-	-	-	-	164.3	-	-
B161.4-1	S-1	0.0-2.0	-	-	-	-	-	-	-	-	-	-	9.5	-	-	-
	S-3	4.0-6.0	CL	-	-	-	-	25	17	8	-0.3	-	14.3	-	-	-
A162.1-1	S-2	2.0-4.0	-	-	-	-	-	-	-	-	-	-	15.3	-	-	-
	S-4	6.0-8.0	-	-	-	-	-	-	-	-	-	-	8.2	-	-	-
	S-5	8.0-10.0	-	-	-	-	-	-	-	-	-	-	7.9	-	-	-
	R-1	15.7-16.0	-	-	-	-	-	-	-	-	-	-	-	176.8	-	-

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	10.0	8.1	14.3	25.4	42.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			2.7762	0.2356	0.1218					

Material Description	USCS	AASHTO
○ BROWN SILTY F/M/C SAND, TR F/ GRAVEL, TR CLAY	SM	

Project No. 195651 **Client:** TDI CHAMPLAIN HUDSON POWER EXPRESS - CP

Project: TRANSMISSION DEVELOPERS, INC.

○ **Source of Sample:** B160.7-1 **Depth:** 4.0-8.0 FT **Sample Number:** S-3 & S-4

TRC Engineers, Inc.

Mt. Laurel, NJ

Remarks:

○SAMPLE DESCRIPTION BASED ON VISUAL IDENTIFICATION AND LABORATORY ANALYSIS

Figure 82

Tested By: BMH 02/21/13 **Checked By:** _____

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

BORING LOG NO. KB-160.6

PROJECT: CHPE - Additional HDD Borings - Phase 3

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

SITE: Fort Ann to Coxsackie, NY

LOCATION See Exploration Plan

Latitude: 42.976430° Longitude: -73.848032°

Surface Elev.: 295.6899 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.3	295.4	**TOPSOIL**
		SILTY SAND (SM), brown, medium dense, (Glacial Till)
4.8	290.9	**WEATHERED SHALE**, gray, very dense
7.0	288.7	**SHALE**, slightly weathered, extremely close to very close fractured, very poor RQD, gray
12.0	283.7	**SHALE**, slightly weathered, extremely close to very close fractured, fair RQD, gray
17.0	278.7	**SHALE**, unweathered, extremely close to moderate fractured, excellent RQD, gray
27.0	268.7	

DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	14	3-4-7-7 N=11			
	22	9-9-10-14 N=19	12.2		37
5	15	14-29-50/3"			
		REC= 100% RQD = 0%			
10					
		REC= 100% RQD =71%			
15					
20		REC= 100% RQD =100%			
25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 HSA, and 3" casing

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Logged by JCH/JL
Hammer Efficiency Summary:
Energy Transfer Ratio: 84.7% +/-5.0%
Hammer Efficiency Correction (CE): 1.41

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 08-03-2022 | Boring Completed: 08-05-2022

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215256G

BORING LOG NO. KB-160.6

PROJECT: CHPE - Additional HDD Borings - Phase 3

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

SITE: Fort Ann to Coxsackie, NY

LOCATION See Exploration Plan

Latitude: 42.976430° Longitude: -73.848032°

Surface Elev.: 295.6899 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	FIELD TEST RESULTS
		SHALE, unweathered close to moderate fractured, fair RQD, gray *(continued)*	
		vertical fracture from 30.8' to 32'	REC = 98% RQD =69%
37.0	258.7	**SHALE**, unweathered, very close to moderate fractured, fair RQD, gray	REC= 100% RQD = 68%
47.0	248.7	**SHALE**, unweathered, close to moderate fractured, excellent RQD, gray	
		vertical fracture from 52' to 53'	REC= 100% RQD = 98%

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 HSA, and 3" casing

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Logged by JCH/JL
Hammer Efficiency Summary:
Energy Transfer Ratio: 84.7% +/-5.0%
Hammer Efficiency Correction (CE): 1.41

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 08-03-2022 | Boring Completed: 08-05-2022

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215256G

BORING LOG NO. KB-160.6

PROJECT: CHPE - Additional HDD Borings - Phase 3

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

SITE: Fort Ann to Coxsackie, NY

LOCATION See Exploration Plan

Latitude: 42.976430° Longitude: -73.848032°

Surface Elev.: 295.6899 (Ft.)

DEPTH	ELEVATION (Ft.)		FIELD TEST RESULTS
57.0	238.7	**SHALE**, unweathered, close to moderate fractured, excellent RQD, gray	REC= 100% RQD =98%
67.0	228.7	**SHALE**, unweathered, close to moderate fractured, excellent RQD, gray	REC = 100% RQD = 94%
77.0	218.7	**SHALE**, unweathered, close to moderate fractured, excellent RQD, gray	REC= 100% RQD =100%
82.0	213.7	***Boring Terminated at 82 Feet***	

DEPTH (Ft.) 60 65 70 75 80

WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4 HSA, and 3" casing

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Logged by JCH/JL
Hammer Efficiency Summary:
Energy Transfer Ratio: 84.7% +/-5.0%
Hammer Efficiency Correction (CE): 1.41

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 08-03-2022 | Boring Completed: 08-05-2022

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215256G

Summary of Laboratory Results

BORING ID	Depth (Ft.)	Water Content (%)	Organic Content (%)
KB-115.5	2-4	13.4	3.4
KB-115.5	15-17	70.8	
KB-117.6-1.6D	3-5	4.0	
KB-117.6-1.6D	20-22	22.7	
KB-117.6-1.6D	35-37	26.2	
KB-117.6-1.6D	49-51	15.3	
KB-122.9	4-6	23.1	
KB-122.9	15-17	18.6	
KB-122.9	25-27	77.9	
KB-122.9	45-47	74.8	
KB-123.0	2-4	10.9	
KB-123.0	20-22	68.3	
KB-123.0	35-37	51.0	
KB-123.0	50-52	45.9	
KB-123.0	65-67	34.5	
KB-132.1A	4-6	27.5	
KB-132.1A	15-17	38.1	
KB-132.1A	30-32	34.0	
KB-132.3A	4-6	12.1	
KB-132.3A	15-17	45.2	
KB-132.3A	30-32	37.2	
KB-132.5A	4-6	17.4	
KB-132.5A	30-32	38.8	
KB-132.5A	45-47	38.2	
KB-135.7	2-4	36.6	
KB-135.7	15-17	41.9	
KB-135.7	30-32	34.8	
KB-135.8	2-4	5.6	
KB-135.8	15-17	42.7	
KB-135.8	30-32	36.8	
KB-135.8	40-42	28.3	
KB-160.6	2-4	12.2	
KB-163.1	4-6	11.7	
KB-163.2	8-10	12.1	
KB-169.0-3.3	6-8	12.0	
KB-169.0-3.3	25-27	11.5	
KB-169.0-3.3	35-37	8.4	
KB-177.1	10-12	8.9	
KB-177.1	25-27	11.5	
KB-177.1	40-42	11.2	
KB-177.1	50-52	5.7	
KB-182.7B	6-8	31.5	

PROJECT: CHPE - Additional HDD Borings - Phase 3

SITE: Fort Ann to Coxsackie, NY

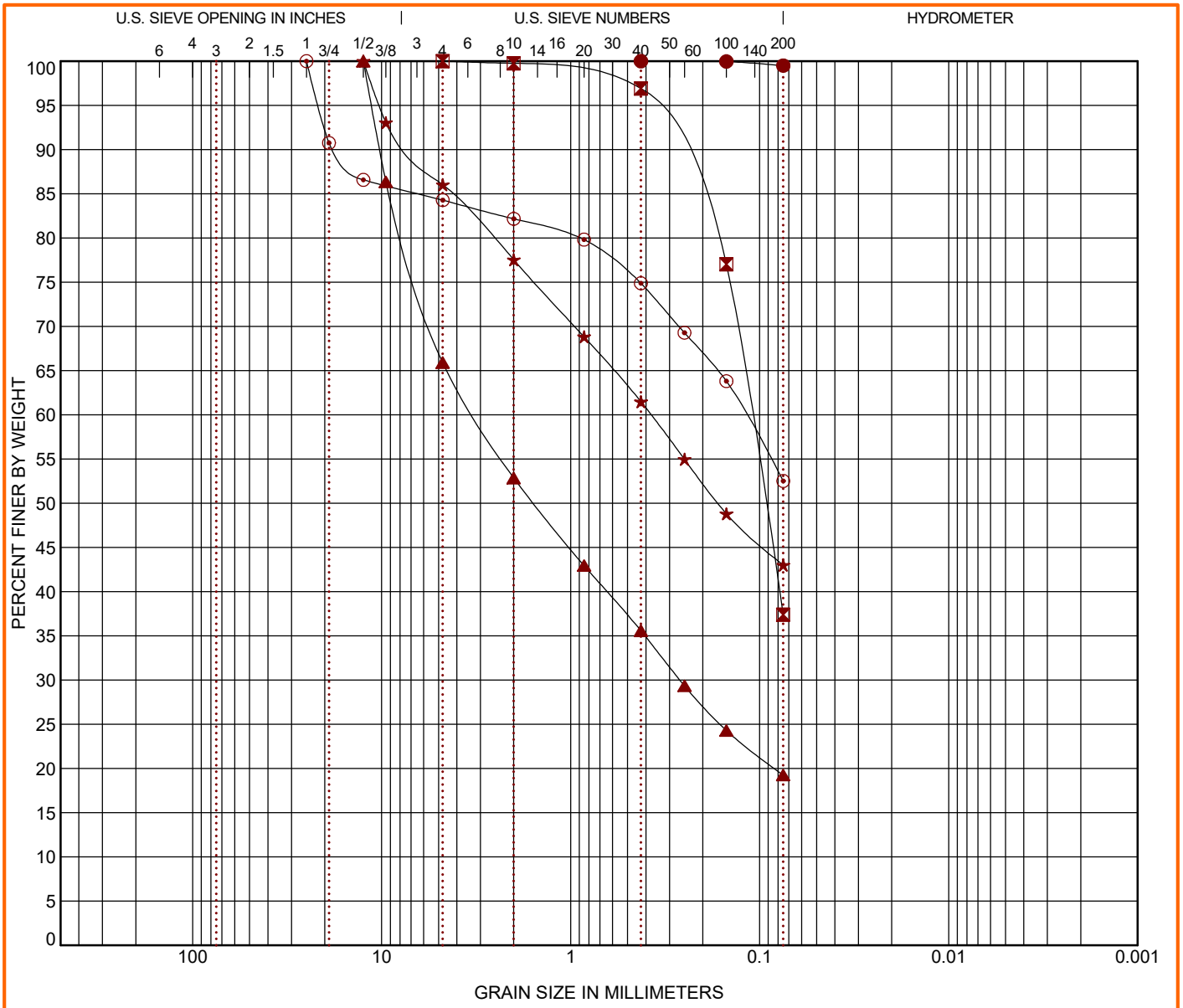
Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215256G

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	KB-135.8	40 - 42	LEAN CLAY (CL)	28.3	28	17	11		
⊠	KB-160.6	2 - 4	SILTY SAND (SM)	12.2					
▲	KB-163.1	4 - 6	SILTY SAND with GRAVEL (SM)	11.7					
★	KB-163.2	8 - 10	SILTY SAND (SM)	12.1					
⊙	KB-169.0-3.3	6 - 8	SILTY SAND with GRAVEL (SM)	12.0					

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	KB-135.8	40 - 42	0.425				0.0	0.0	0.5		99.5	
⊠	KB-160.6	2 - 4	4.75	0.111			0.0	0.0	62.6		37.4	
▲	KB-163.1	4 - 6	12.5	3.213	0.264		0.0	34.1	46.6		19.3	
★	KB-163.2	8 - 10	12.5	0.376			0.0	14.0	43.0		43.0	
⊙	KB-169.0-3.3	6 - 8	25	0.119			0.0	15.7	31.8		52.5	

PROJECT: CHPE - Additional HDD Borings - Phase 3

PROJECT NUMBER: JB215256G

SITE: Fort Ann to Coxsackie, NY

Terracon
30 Corporate Cir Ste 201
Albany, NY

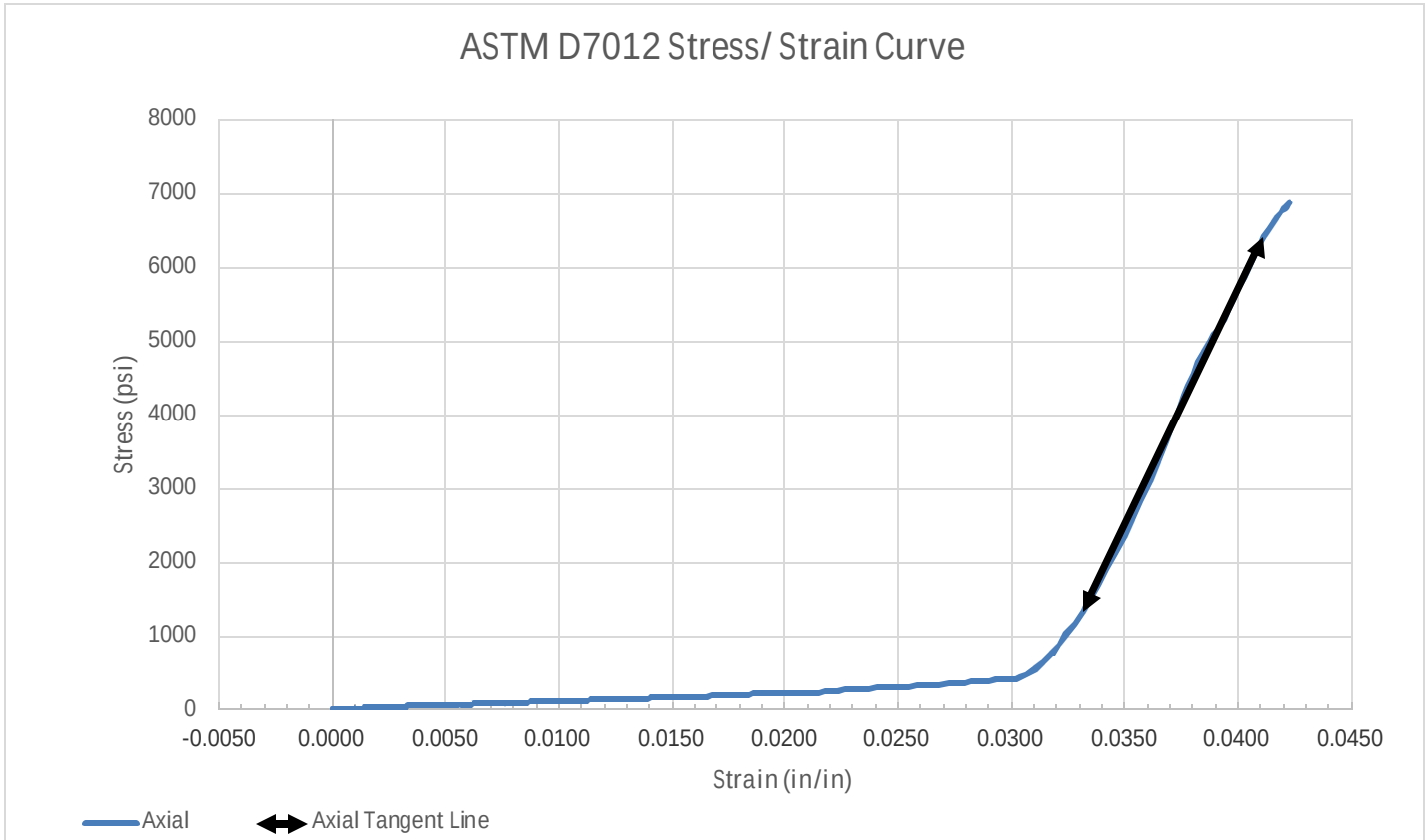
CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

Rock Core D7012 Method C

Client
Kiewit Engineering Corp

Project
Champlain-Hudson Power Express Project

Project No. JB215256



SAMPLE LOCATION

Site:	Champlain-Hudson Power Express Project		
Description:	Shale		
Boring:	KB-160.6	Depth (feet):	57.0-67.0

SPECIMEN INFORMATION

Sample No.:		Mass (g):	535.63
Length (in.):	3.97	Diameter (in.):	1.97
L/D Ratio:	2.015	Density (pcf):	168.628

TEST RESULTS

Failure Load (lbs):	20962
Failure Strain (in/in):	0.043
Unconfined Compressive Strength (psi):	6,877
Elastic Modulus, E, (ksi):	638
Time of Failure (min):	03:04
Rate of Loading (in/sec):	0.04
Moisture Content Post-break:	1.13%

Rock Core D7012 Method C

Client
Kiewit Engineering Corp

Project
Champlain-Hudson Power Express Project

Project No. JB215256

Equipment:	TICCS ID:
Calipers	W-44049
Scale	B-71466
Dial Indicator	C-70608
Compression (spherically seated)	C-48999

Samples were prepared and tested in accordance with ASTM D4543 and D7012. Deviations, if any, are noted below:
Notes:

Per ASTM D4543, this specimen has not met the requirements for perpendicularity, by exceeding 0.250º.
Per ASTM D4543, this specimen has not met the requirements for flatness, by exceeding 0.001 inches.
Per ASTM D4543, this specimen has not met the requirements for parallelism, by exceeding 0.25º.
Per ASTM D4543, this specimen has not met the requirements for flatness, by exceeding 0.001 inches.
Per ASTM D4543 and ASTM D7012, the desired specimen length to diameter are between 2.0:1 and 2.5:1. According to ASTM D7012 Section 8.2.1, this specimen, although not meeting all requirements of ASTM D4543 is acceptable for testing. However, the results reported may differ from results obtained from a test specimen that meets the requirements of D4543.

Client
Kiewit Engineering Corp

Project
Champlain-Hudson Power Express Project

Project No. JB215256

Splitting Tensile Strength of Intact Rock Core Specimens, ASTM D3967

Boring	KB-160.6	**Material Description**	Shale
Sample No		**Equipment Used**	Tinius Olsen (120,000lbs)
Depth (ft)	57.0-67.0	**TICCS ID/Serial No.**	C-48999, 118285
Lab No	7754	**Calibration Date**	11/2/2021

	TENSILE STRENGTH				
Lab No.	1	2	3	4	5
Diameter (in)	1.97	1.97	1.97	1.97	1.97
Length (in)	0.72	0.62	0.64	0.61	0.54
Length Diameter Ratio	0.37	0.31	0.32	0.31	0.27
Rate of Loading	0.072	0.062	0.064	0.061	0.054
Moisture Condition	1.00%	1.00%	1.00%	1.00%	100.00%
Maximum Applied Load (lbf)	3580	1699	2509	1676	1664
Splitting Tensile Strength (psi)	1607.6	886.0	1267.5	888.3	996.3

	TENSILE STRENGTH				
Lab No.	6	7	8	9	10
Diameter (in)	1.97	1.97	1.97	1.97	1.97
Length (in)	0.58	0.62	0.7	0.64	0.69
Length Diameter Ratio	0.29	0.31	0.36	0.32	0.35
Rate of Loading	0.058	0.062	0.07	0.064	0.069
Moisture Condition	1.00%	1.00%	1.00%	1.00%	1.00%
Maximum Applied Load (lbf)	884	2398	2906	2579	1594
Splitting Tensile Strength (psi)	492.8	1250.5	1342.2	1302.9	746.9

GeoTesting EXPRESS

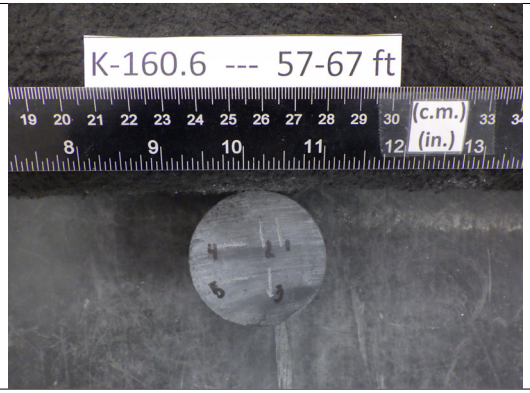
Client:	Terracon Consultants, Inc.				
Project:	Champlain-Hudson Power Express				
Location:				Project No:	GTX-315284
Boring ID:	KB-160.6	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	---	Test Date:	09/12/22	Checked By:	jsc
Depth :	57'-67'	Test Id:	683875		
Test Comment:	---				
Visual Description:	---				
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-160.6	---	57-67 ft	1	0.4	0.6	0.50	
			2	0.3	1.0	0.65	
			3	1.1	0.2	0.65	
			4	0.6	0.2	0.40	
			5	0.6	1.2	0.90	
			Average CAIs			0.62	
			Average CAI *			1.09	
				CERCHAR Abrasiveness Index Classification		**Medium 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:



Rock Core – Boring KB-135.7

Rock Core – Boring KB-160.6 Runs 1 through 3

Rock Core – Boring KB-160.6 Runs 4 and 5

Rock Core – Boring KB-160.6 Runs 6 and 7

Rock Core – Boring KB-160.6 Runs 8 and 9

Rock Core – Boring KB-163.1 Runs 1 and 2

Kiewit

MEMORANDUM

DATE: January 19, 2023

TO: Antonio Marruso, P.E.; CHA Consulting, Inc.

FROM: Matthew Hawley, P.E.; Kiewit Engineering (NY) Corp. MKH
Jaren Knighton; Kiewit Engineering (NY) Corp.

SUBJECT: Geotechnical Data: Segment 6 – Package 4A – HDD Crossing 53A
Champlain Hudson Power Express Project
Ballston Spa, New York

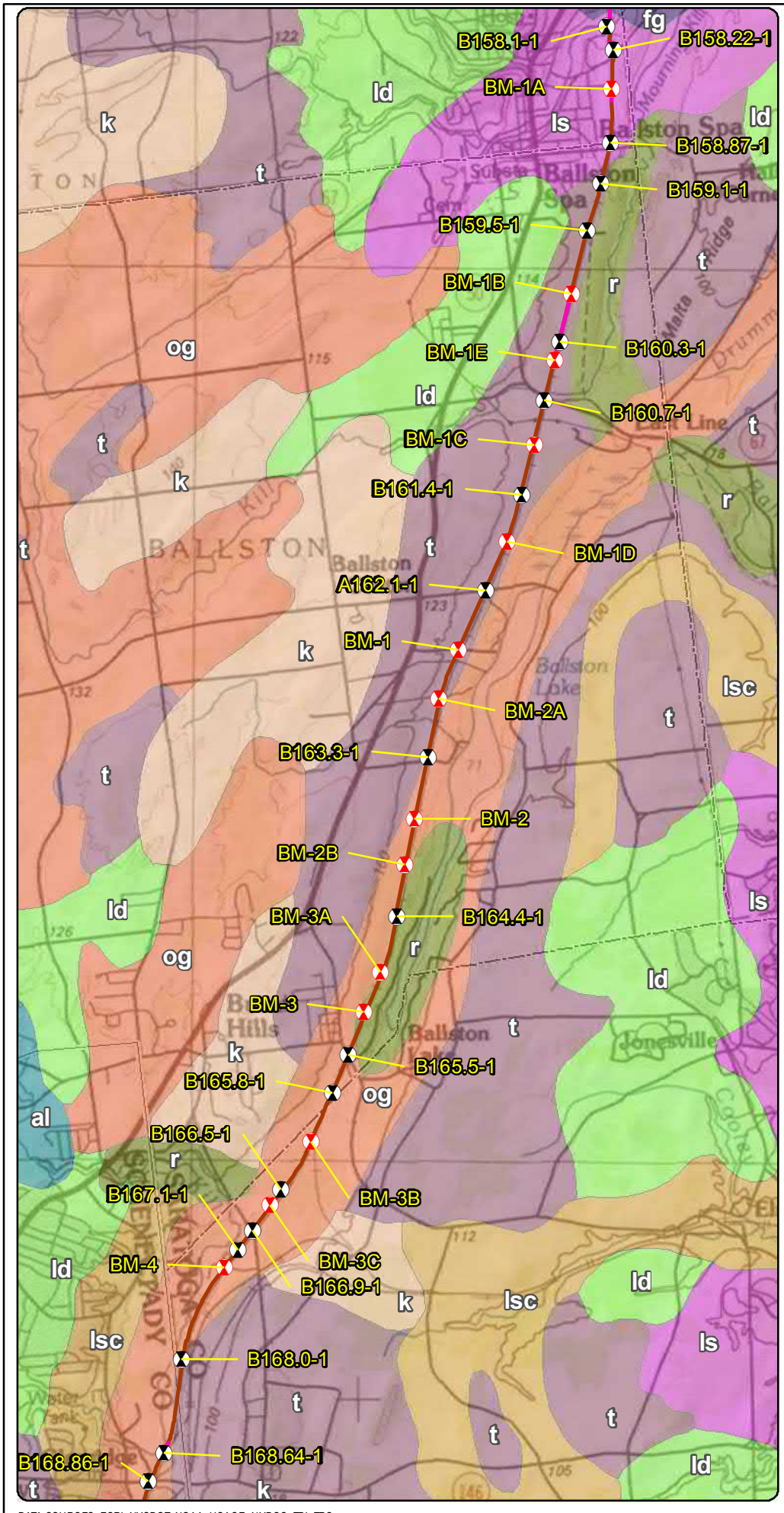
Kiewit Engineering is providing the attached geotechnical data for use in the horizontal direction drill (HDD) design for the Champlain Hudson Power Express project in Upstate New York. This HDD crossing is located south of Ballston Spa, New York. The approximate station for the start of HDD crossing Number 53A is STA 40220+00 (42.9438°N, 73.8631°W).

The geotechnical data at this HDD crossing is attached. The available data is from the previous investigation by Terracon, referenced below.

- Terracon Consultants-NY, Inc., Results of Field Exploration, Champlain-Hudson Power Express – Additional HDD Borings – Phase 3, Fort Ann to Coxsackie, NY, dated November 3, 2022.

Contact us if you have questions or require additional information.

HDD 53A
Borings KB-163.1, KB-163.2
Segment 6 - Design Package 4A



LEGEND

- 2021 Boring Location
- Previous (2013) Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

Surficial Geology

- al - Recent alluvium
- fg - Fluvial sand and/or gravel
- k - Kame deposits
- ld - Lacustrine delta
- ls - Lacustrine sand
- lsc - Lacustrine silt and clay
- og - Outwash sand and gravel
- r - Bedrock
- t - Till

N

0.5 0.25 0 0.5 Miles

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

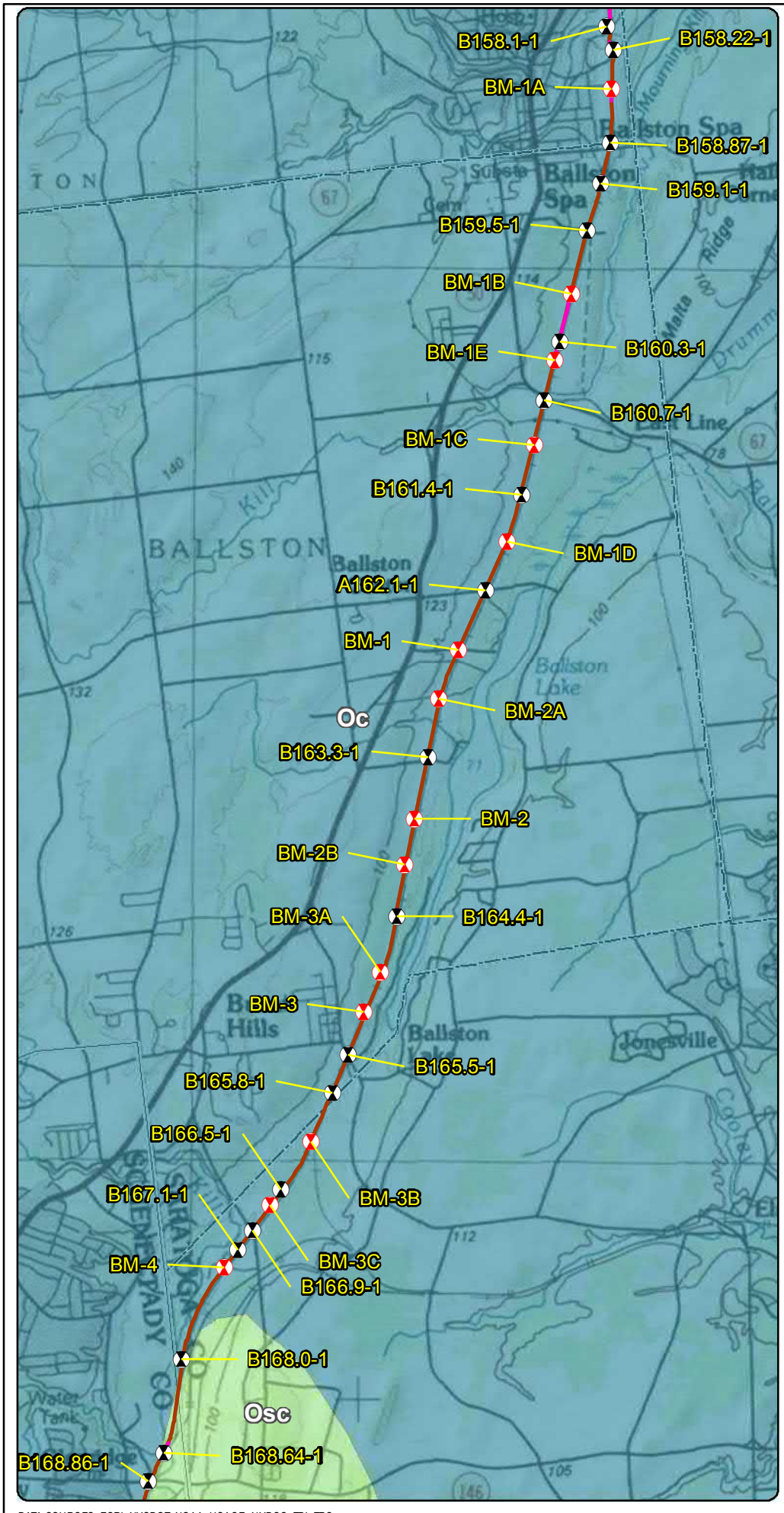
Surficial Geology and Geotechnical Borings Ballston to Mohawk River Figure 3-6

Prepared on 5/5/2021

by: AECOM

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

Y:\Projects\CHPE\Route\Consensus_Alternative_Routes\MXD\Alt 5_Routes_DZ_201909Boring_Locations\Maps_for_May_2021_Report\Ballston_to_Mohawk_Boring_Locations_Surficial_May_2021_Report.mxd



LEGEND

- 2021 Boring Location
- Previous (2013) Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

Bedrock Geology

- Oc - Canajoharie Shale
- Osc - Schenectady Formation

* Schenectady Formation includes: graywacke, sandstone, siltstone, shale

N

0.5 0.25 0 0.5 Miles

Transmission

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

Bedrock Geology and Geotechnical Borings Ballston to Mohawk River
Figure 4-6

Prepared on 5/5/2021
by: AECOM

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

Y:\Projects\CHPE\IRoute\Consensus_Alternative_Routes\MXD\Alt 5_Routes_DZ_20190\Boring_Locations\Maps_for_May_2021_Report\Ballston_to_Mohawk_Boring_Locations_Bedrock_May_2021_Report.mxd

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

BORING LOG NO. KB-163.1

PROJECT: CHPE - Additional HDD Borings - Phase 3

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

SITE: Fort Ann to Coxsackie, NY

LOCATION See Exploration Plan

Latitude: 42.943364° Longitude: -73.862799°

Surface Elev.: 272.8456 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.5	272.3	**FILL - SILTY SAND WITH GRAVEL**, black
		SILTY SAND WITH GRAVEL (SM), brown, medium dense, (GLACIAL TILL)
6.5	266.3	**WEATHERED ROCK**, gray, very dense
8.0	264.8	**SHALE**, slightly weathered, close to moderate fractured, fair RQD, gray
18.0	254.8	**SHALE**, slightly weathered, close to moderate fractured, good RQD, gray
28.0	244.8	

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		20	8-10-8-8 N=18			
		21	5-6-10-9 N=16			
5		16	6-7-8-11 N=15	11.7		19
		0.8	11-50/4"			
10			REC= 100% RQD = 73%			
15						
20			REC= 100% RQD =78%			
25						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3" casing with tricone roller bit

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Logged by AB
Hammer Efficiency Summary:
Energy Transfer Ratio: 84.7% +/-5.0%
Hammer Efficiency Correction (CE): 1.41

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 08-08-2022 | Boring Completed: 08-08-2022

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215256G

BORING LOG NO. KB-163.1

PROJECT: CHPE - Additional HDD Borings - Phase 3

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

SITE: Fort Ann to Coxsackie, NY

LOCATION See Exploration Plan

Latitude: 42.943364° Longitude: -73.862799°

Surface Elev.: 272.8456 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SHALE, slightly weathered, close to moderate fractured, fair RQD, gray	30				REC= 100% RQD =57%			
38.0	234.8		35							
		SHALE, slightly weathered, close to moderate fractured, good RQD, gray	40				REC = 100% RQD = 86%			
45.0	227.8		45							
		Boring Terminated at 45 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3" casing with tricone roller bit

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Logged by AB
Hammer Efficiency Summary:
Energy Transfer Ratio: 84.7% +/-5.0%
Hammer Efficiency Correction (CE): 1.41

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 08-08-2022 | Boring Completed: 08-08-2022

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215256G

BORING LOG NO. KB-163.2

PROJECT: CHPE - Additional HDD Borings - Phase 3

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

SITE: Fort Ann to Coxsackie, NY

LOCATION See Exploration Plan

Latitude: 42.942182° Longitude: -73.863320°

Surface Elev.: 275.5275 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
0.5	275	**FILL - POORLY GRADED SAND WITH GRAVEL**, black						
		SILTY SAND (SM), brown, medium dense to very dense, (GLACIAL TILL)			12	5-6-7-9 N=13		
					17	8-7-8-8 N=15		
			5		20	3-8-7-11 N=15		
					20	13-11-6-4 N=17		
		grades to gray			20	4-6-9-9 N=15	12.1	43
			10					
15.8	259.7		15		9	33-50/4"		
		WEATHERED ROCK, black, very dense						
20.0	255.5		20					
		SHALE, slightly weathered, extremley close to close fractured, poor RQD, gray				REC = 100% RQD = 45%		
25.0	250.5		25					
		SHALE, slightly weathered, very close to moderate fractured, good RQD, gray						

ATTERBERG LIMITS: LL-PL-PI

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3" and 4" casing with tricone roller bit from 15.8' to 20'

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Logged by AB
Hammer Efficiency Summary:
Energy Transfer Ratio: 84.7% +/-5.0%
Hammer Efficiency Correction (CE): 1.41

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 08-09-2022 | Boring Completed: 08-10-2022

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215256G

BORING LOG NO. KB-163.2

PROJECT: CHPE - Additional HDD Borings - Phase 3

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

SITE: Fort Ann to Coxsackie, NY

LOCATION See Exploration Plan

Latitude: 42.942182° Longitude: -73.863320°

Surface Elev.: 275.5275 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SHALE, slightly weathered, very close to moderate fractured, good RQD, gray *(continued)*		30	REC = 100% RQD = 76%			
35.0	240.5	35				
SHALE, slightly weathered, close to moderate fractured, excellent RQD, gray		40	REC = 97% RQD = 80%			
45.0	230.5	45				
Boring Terminated at 45 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3" and 4" casing with tricone roller bit from 15.8' to 20'

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were provided by others.

Notes:

Logged by AB
Hammer Efficiency Summary:
Energy Transfer Ratio: 84.7% +/-5.0%
Hammer Efficiency Correction (CE): 1.41

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 08-09-2022 | Boring Completed: 08-10-2022

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Project No.: JB215256G

Rock Core – Boring KB-160.6 Runs 8 and 9

Rock Core – Boring KB-163.1 Runs 1 and 2