Champlain Hudson Power Express

HDD Design Summary Report
Crossings HDD 111.B to HDD 123
in Segment 11 – Package 7A

Catskill to Germantown
Greene County, New York

TTR Project Number: 204-3701

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1.0 INTRODUCTION

1.1 PURPOSE

The Champlain Hudson Power Express (CHPE) project 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. Tetra Tech Rooney, Inc. (TTR) is designing 22 Horizontal Directional Drills (HDD) in Segment 11 – Package 7A near Catskill. HDD methods will be used to route the crossings below congested areas, railroads, under/around obstructions (e.g., existing infrastructure or utilities), and below wetlands and bodies of water to minimize impacts to the environment. This Design Summary Report addresses the design for the HDD crossings in Segment 11 - Package 7A from Catskill to Germantown. These crossings are designated HDD 111.B through HDD 123.

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

- Review of the existing geological, hydrogeological, and geotechnical conditions for HDD 111.B through HDD 123 for total of 22 crossings (2 per site) in Segment 11 – Package 7A. A copy of the geotechnical reports and HDD design drawings can be found in Appendix B and D respectively.
- Provide a descriptive narrative of the HDD Crossings in support of the attached design drawings and technical specifications.
- Present stress and inadvertent return analyses that support the proposed designs. Calculation can be found in Appendix C.
- 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 338 miles in length, extending from the south end of Lake Champlain to Astoria, NY. Segment 11 - Package 7A is located in approximately an 8.5-mile section of the route in Greene County, New York.

A Project Overview Map and a plan showing the locations of the HDD 111.B through HDD 123 crossings are presented in Appendix A.

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

Table 1: HDD Locations, Lengths, and Description

HDD #	Start Station	End Station	HDD Length, ft	Obstruction Crossed
111.B	70002+15	70009+80	765	Pond
111.B.2	70002+15	70009+80	765	Pond
112	70036+25	70045+85	960	Pond
112.2	70036+25	70045+85	960	Pond
113	70055+20	70061+30	610	Railroad and Highway
113.2	70055+20	70061+30	610	Railroad and Highway
115	70085+30	70098+80	1,350	Water Body
115.2	70085+15	70098+77	1,362	Water Body
117	70112+45	70119+80	735	Railroad
117.2	70113+70	70121+60	790	Railroad
118	70137+25	70145+75	850	Road
118.2	70137+20	70145+80	860	Road
119	70160+25	70168+65	840	Wetland
119.2	70160+25	70168+65	840	Wetland
120	70172+35	70187+05	1,470	Drainage Channel
120.2	70172+35	70187+05	1,470	Drainage Channel
121	70311+00	70328+40	1,740	Road and Wetland
121.2	70311+00	70328+40	1,740	Road and Wetland
122	70339+60	70350+40	1,100	Railroad
122.2	70339+60	70350+40	1,100	Railroad
123	70372+00	70380+50	850	Private Plant
123.2	70372+00	70380+50	850	Private Plant

3.0 BACKGROUND

The underground construction of two HVDC electrical transmission cables is proposed to be housed in individual 8-inch diameter FPVC SDR 17 or 10-inch diameter DR 9 HDPE casings spaced approximately 15 to 25 feet apart (*spacing dependent on depth and TR values provided by NKT).* A third, 3-inch diameter DR 9 HDPE pipe will be bundled with one of the 8 or 10-inch diameter casings for a telecommunications line. The pipes are to be installed in 13 to 21-inch final ream diameter drill holes. The minimum design guidelines are to install the cables at least 25 feet

below congested areas, roads, railroads, under/around other obstructions, 15 to 25 feet below wetland, and 35 to 45 feet below open bodies of water using HDD methods. HDD is a widely used trenchless construction method to install conduits with limited disturbance to the ground around the drill alignment, minimal ground surface impacts above the alignment, and to minimize the potential of inadvertent releases of drilling fluids while drilling. 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 HDD DESIGN DESCRIPTIONS

Below is a brief description of the HDD crossings found in Segment 11 - Package 7A. The design drawings are included in Appendix D.

4.1.1 HDD #111.B

HDD #111.B is 765 feet long and runs parallel to the CHG&E transmission line corridor just east of the railroad right of way. This HDD begins at El. 112 feet and traverses under relatively flat terrain before passing under a pond, near station 70006+00. The HDD exits at El. 120 feet (reference datum NAVD 1988).

4.1.2 HDD #112

HDD #112 is 960 feet long and runs parallel to the CSX railway just east of the railroad right of way. This HDD begins at El. 111 feet and traverses relatively flat terrain before passing under a pond, near station 70040+00. The terrain then climbs over the final 250 feet of the drill, exiting on a hillside at El. 132 feet (reference datum NAVD 1988).

4.1.3 HDD #113

HDD #113 is 610 feet long and crosses under the CSX railway at a 14 degree angle while also crossing under the NY-23 bridge that spans the RR. The surface terrain in this area gradually ascends upward throughout the path of the HDD which enters at El. 97 feet and exits at El. 110 feet (reference datum NAVD 1988).

4.1.4 HDD #115

HDD #115 is a long drill which begins in the DPG Enterprize used car dealership parking lot and then extends under Catskill creek, paralleling the Route 9W bridge, exiting in the open space adjacent to the Main Street/Route 9W on ramp, near station 70085+00. The total length of the HDD is 1,350 feet with a short 203-foot horizontal curve in the center of the drill path. The surface terrain descends gradually on both sides of the river before dropping off into Catskill Creek. The entry point begins at El. 34 feet and exits at El. 51 feet (reference datum NAVD 1988). Equivalent pipe dimensional stress calculations for this drill yielded an unacceptable result for unconstrained collapse with the standard HDPE pipe size thus conduit piping design parameters were updated to 8" SDR 17 FPVC.

4.1.5 HDD #117

HDD #117 is 735 feet long and crosses under the CSX railway at a 9 degree angle. The terrain is mostly flat for the entire drill alignment with the HDD entry at El. 101 feet and exit at El. 101 feet (reference datum NAVD 1988).

4.1.6 HDD #118

HDD #118 begins in the Hoebowl Bowling Center parking lot and crosses under Route 9W exiting along the hillside adjacent to N&S Supply of Catskill. The total length of the HDD is 850 feet with a short 186-foot horizontal curve in the center of the drill path. The surface terrain in this location declines gradually from the Hoebowl Bowling Center to the N&S Supply of Catskill while traversing the side slope adjacent to the CSX railroad. The HDD begins at El. 134 feet and terminates at El. 123 feet (reference datum NAVD 1988).

4.1.7 HDD #119

HDD #119 is 840 feet long and crosses a stream / wetland as well as runs parallel to the CSX railway. The drill path is straight and proceeds under a relatively flat existing grade which ascends slightly towards the end of the drill. The HDD begins at El. 95 feet and terminates at El. 116 feet (reference datum NAVD 1988). Equivalent pipe dimensional stress calculations for this drill yielded an unacceptable result for unconstrained collapse with the standard HDPE pipe size thus conduit piping design parameters were updated to 8" SDR 17 FPVC.

4.1.8 HDD #120

HDD #120 is 1,470 feet long and runs parallel to the CSX railway just east of the railroad right of way. The HDD bypasses two CSX culverts. The drill path is straight and proceeds under two low points adjacent to the CSX culverts. This HDD begins at El. 120 feet and terminates at El. 122 feet (reference datum NAVD 1988). Equivalent pipe dimensional stress calculations for this drill yielded an unacceptable result for unconstrained collapse with the standard HDPE pipe size thus conduit piping design parameters were updated to 8" SDR 17 FPVC.

4.1.9 HDD #121

HDD #121 is 1,740 feet long and runs parallel to the CSX railway just east of the railroad right of way. The HDD bypasses one facility access road in addition to a wetland and steep terrain. The drill path has a short 40-foot horizontal curve in the center of the drill path. Elevation changes substantially for the first 850 feet of the drill and then levels off, maintaining a flat profile for the majority of the HDD. The HDD begins at El. 96 feet and terminates at El. 91 feet (reference datum NAVD 1988). Equivalent pipe dimensional stress calculations for this drill yielded an unacceptable result for unconstrained collapse with the standard HDPE pipe size thus conduit piping design parameters were updated to 8" SDR 17 FPVC.

4.1.10 HDD #122

HDD #122 is 1,100 feet long and crosses under several abandoned rail lines that have been disconnected from the CSX railway. Elevation changes substantially near the beginning of the drill and levels off, maintaining a flat profile for the majority of the HDD. The HDD begins at El. 91 feet and terminates at El. 106 feet (reference datum NAVD 1988).

4.1.11 HDD #123

HDD #123 is 850 feet long and runs parallel to the CSX railway just east of the railroad right of way. The HDD is straight and crosses under an abandoned factory service bay adjacent to the CSX railway. The terrain is nearly flat with the HDD entry at El. 108 feet and exit at El. 113 feet (reference datum NAVD 1988).

4.2 GEOTECHNICAL DATA

Below is a summary of the geotechnical borings that were reviewed in the design of each of the HDD crossings found in Segment 11 - Package 7A. The Geotechnical reports are included in Appendix B.

4.2.1 HDD #111.B

At this time, no geotechnical borings are available for HDD #111.B. There are two planned Geotechnical borings that will be completed prior to construction once a construction access road is able to be constructed and landowner access permissions have been granted. For the purposes of the BoreAid analyses Geotechnical Boring KB-219.4 (from HDD #111.A) was used as it was the closest Geotechnical boring to HDD #111.B and it covered the full depth of the HDD profile. Boring KB-219.4 is located approximately 2,200 feet north of HDD #111.B. KB-219.4 was performed by Kiewit on 2/16/2023 and terminated 80 feet deep. For the first 15 feet of the boring, the soil was primarily composed of sandy silt and silty gravel with sand before transitioning into Rock (Weathered Rock, Shale, and Greywacke) which composed the remainder of the bore path. The Geotechnical report for this HDD and test data is provided in Appendix B.

Based on the borings, the soil profile for the HDD #111.B BoreAid analyses will be divided into three [3] layers: Sandy Silt (SM), Silty Gravel (GM), and Sedimentary Rock. The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.

4.2.2 HDD #112

Three Geotechnical bores (KB-220.5, K-220.6, and SC-5) are located along the proposed HDD #112 alignment. After reviewing and comparing these samples, geotechnical boring SC-5 was selected to be used in the BoreAid analysis as it best represented the complete soil strata for the HDD alignment. Consideration was taken for the other geotechnical borings in the design of the HDD. Specifically, geotechnical boring KB-220.5 was referenced to extend the bottom rock layer the full depth of the HDD profile. The bore depth of this analysis extends down to 40 ft and terminated in an interbedded shale and sandstone layer. The first 5 feet of the bore is sand and the majority of the between layers are silt interspersed with sand, before transitioning into a

shale and sandstone rock layer for the remaining 8 feet of the bore. The Geotechnical report for this HDD and test data is provided in Appendix B.

Based on the borings, the soil profile for the HDD #112 BoreAid analyses will be divided into seven [7] layers: Sand (SP), Silt (ML), Sand (SM), Silt (ML), Sedimentary Rock, Gravel (GM) and Sedimentary Rock. The chosen test bore did not reach the full depth of the drill path; however, the other test holes corroborated that the sedimentary rock layer continued for the full depth of the HDD profile thus a final layer of sedimentary rock was added to complete the soil strata used in the IR analysis. The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.

4.2.3 HDD #113

Two Geotechnical bores (KB-220.9 and SC-6) are located along the proposed HDD #113 alignment. The other borings listed in Appendix B (K-221.0 and B221.0-1) are located outside the extents of the HDD alignment and are provided as reference only for the geology in the area. After reviewing and comparing these samples, geotechnical boring KB-220.9 was selected to be used in the BoreAid analysis as it best represented the complete soil strata for the HDD alignment and covered the full depth of the HDD profile. Consideration was taken for the other Geotechnical borings in the design of the HDD. KB-220.9 was performed on the south side of the drill path by Kiewit on 12/20/2022 and reached a total depth of 57 feet. After penetrating through a 2-foot-deep layer of silty sand the bore continued into fat clay and lean clay layers before passing through a silt layer for the remainder of the bore path. The Geotechnical report for this HDD and test data is provided in Appendix B.

Based on the borings, the soil profile for the HDD #113 BoreAid analyses will be divided into four [4] layers: Sand (SM), Clay (CH), Clay (CL), and Silt (ML). The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.

4.2.4 HDD #115

Two Geotechnical bores (KB-221.3 and KB-221.4) are located along the proposed HDD #115 alignment. The other borings listed in Appendix B (CU-2, B221.14-1, B221.2-1, B221.4-1, CU-2A, and B221.5-1) are located outside the extents of the HDD alignment and are provided as reference only for the geology in the area. After reviewing and comparing these samples,

geotechnical boring KB-221.3 was selected to be used in the BoreAid analysis as it best represented the complete soil strata for the HDD alignment and covered the full depth of the HDD profile. Consideration was taken for the other Geotechnical borings in the design of the HDD. KB-221.3 was performed by Kiewit on 9/20/2022 at the north end of the drill location and terminated 85 feet deep. For the first 16 feet of the boring, the soil was primarily composed of clayey gravel, sandy clay, and clayey silt before transitioning into Shale which composed the remainder of the bore path. The Geotechnical report for this HDD and test data is provided in Appendix B.

Based on the borings, the soil profile for the HDD #115 BoreAid analyses will be divided into five [5] layers: Clayey Gravel (GC), Sandy Clay (CL), Clayey Silt (ML), Clayey Gravel (GC), and Sedimentary Rock. The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.

4.2.5 HDD #117

Three Geotechnical bores (K-221.8, B221.8-1, and KB-221.8B) are located along the proposed HDD #117 alignment. The other boring listed in Appendix B (K-221.7) is located outside the extents of the HDD alignment and is provided as reference only for the geology in the area. After reviewing and comparing these samples, geotechnical boring KB-221.8B was selected to be used in the BoreAid analysis as it best represented the complete soil strata for the HDD alignment and covered the full depth of the HDD profile. Consideration was taken for the other Geotechnical borings in the design of the HDD. KB-221.8B was performed by Kiewit on 1/17/2023 in the middle of the drill location. The KB-221.8B bore hole terminated 82 feet deep. For the first 2 feet of the boring, the soil was comprised of fill material from the Railroad before transitioning to a clay layer followed by silt layers for the remainder of the bore path. The Geotechnical report for this HDD and test data is provided in Appendix B.

Based on the borings, the soil profile for the HDD #117 BoreAid analyses will be divided into six [6] layers: Fill – Sand with Gravel (SP), Clay (CL), Silt (ML), Silt (ML), Silt (MH), and Silt (ML). The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.

4.2.6 HDD #118

Four Geotechnical bores (KB-222.2, K-222.3, B222.34-1, and K-222.4) are located along the proposed HDD #118 alignment. After reviewing and comparing these samples, geotechnical borings KB-222.2 were selected to be used in the BoreAid analysis as it best represented the complete soil strata for the HDD alignment and covered the full depth of the HDD profile. Consideration was taken for the other Geotechnical borings in the design of the HDD. The Soils Assistant was used in BoreAid to build the complete soil strata for HDD #118 as borings K-222.3 and K-222.4 displayed very similar soil layers as KB-222.2, but at differing depths. KB-222.2 was drilled on the northern side of the drill path and terminates at a depth of 70 feet. After passing through a 3-foot-deep layer of silty sand fill the bore continues into a region of silt and clay which persists down to 49 feet of depth at which point the bore enters a 4 foot thick band of weathered rock. Once out of the weathered rock the remainder of the drill path is composed of Graywacke. The Geotechnical report for this HDD and test data is provided in Appendix B.

Based on the borings, the soil profile for the HDD #118 BoreAid analyses will be divided into four [4] layers: Gravel (GW), Silt, (MH), Clay (CL), and Sedimentary Rock. The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.

4.2.7 HDD #119

Two Geotechnical bores (K-222.7 & KB-222.8) are located along the proposed HDD #119 alignment. The other borings listed in Appendix B (B222.6-1, KB-222.6A and K-222.6) are located outside the extents of the HDD alignment and are provided as reference only for the geology in the area. After reviewing and comparing these samples, geotechnical boring KB-222.8 was selected to be used in the BoreAid analysis as it best represented the complete soil strata for the HDD alignment and covered the full depth of the HDD profile. Consideration was taken for the other Geotechnical borings in the design of the HDD. KB-222.8 terminates its analysis at a total depth of 90 feet and is positioned on the southern end of the HDD path. The boring is comprised primarily of alternating Clay and Silt layers. The Geotechnical report for this HDD and test data is provided in Appendix B.

Based on the borings, the soil profile for the HDD #119 BoreAid analyses will be divided into six [6] layers: Clay (CL), Silt (MH), Clay (CH), Silt (ML), Silt (MH), and Clay (CL). The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.

4.2.8 HDD #120

Four Geotechnical bores (B222.9-1, K-223.0, KB-223.1A, and K-223.1) are located along the proposed HDD #120 alignment. After reviewing and comparing these samples, geotechnical boring KB-223.1A was selected to be used in the BoreAid analysis as it best represented the complete soil strata for the HDD alignment and covered the full depth of the HDD profile. Consideration was taken for the other Geotechnical borings in the design of the HDD. The KB-223.1A analysis was performed on the middle of the HDD path and reached a final depth of 85 feet. The first 25 feet of the bore path consisted of Fat Clay, after which the soil transitioned to Silt for the next 20 feet, followed by 2 feet of Lean Clay, 10 feet of Weathered Rock, and finally Graywacke for the remainder of the boring. The Geotechnical report for this HDD and test data is provided in Appendix B.

Based on the borings, the soil profile for the HDD #120 BoreAid analyses will be divided into five [5] layers: Clay (CH), Silt (MH), Clay (CL), Sedimentary Rock, and Sedimentary Rock. The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.

4.2.9 HDD #121

One Geotechnical bore (CU-5) is located along the proposed HDD #121 alignment. The other borings listed in Appendix B (B225.8-1 & K-225.9) are located outside the extents of the HDD alignment and are provided as reference only for the geology in the area. At this time there are two additional planned Geotechnical borings (KB-225.6 & KB-225.8) that will be completed once landowner access permissions have been granted. After reviewing and comparing these samples, geotechnical boring K-225.9 was selected to be used in the BoreAid analysis as it best represented the complete soil strata for the HDD alignment. Consideration was taken for the other geotechnical borings in the design of the HDD. K-225.9 was performed by Kiewit on 3/10/2022 at the south end of the drill location and terminated 45 feet deep. For the first 10 feet of the boring, the soil was primarily composed of silty gravel, clay, and silt before transitioning

into alternating clay layers which composed the remainder of the bore path. The Geotechnical report for this HDD and test data is provided in Appendix B.

Based on the borings, the soil profile for the HDD #121 BoreAid analyses will be divided into nine [9] layers: Gravel (GM), Clay (CL), Silt (ML), Silt (ML), Clay (CH), Clay (CH), Clay (CL), Clay (CH), and Sedimentary Rock. The chosen test bore did not reach the full depth of the drill path; however, the next closest test bore KB-226.1 (from HDD #122) supported that a Rock layer continued below the Clay layers. Thus, a final layer of Sedimentary Rock was added to complete the soil strata used in the IR analysis. The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.

4.2.10 HDD #122

Five Geotechnical bores (KB-226.1, B226.1-1, K-226.2A, K-226.2B, and B226.2-1) are located along the proposed HDD #122 alignment. After reviewing and comparing these samples, geotechnical boring KB-226.1 was selected to be used in the BoreAid analysis as it best represented the complete soil strata for the HDD alignment and covered the full depth of the HDD profile. Consideration was taken for the other Geotechnical borings in the design of the HDD. KB-226.1 was completed in the middle of the HDD path and reached a total depth of 60 feet. The first 15 feet of the bore path consisted of Silt, after which the soil transitioned to Fat Clay for the next 22 feet, followed by Graywacke for the remainder of the boring. The Geotechnical report for this HDD and test data is provided in Appendix B.

Based on the borings, the soil profile for the HDD #122 BoreAid analyses will be divided into three [3] layers: Silt (MH), Clay (CH), and Sedimentary Rock. The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.

4.2.11 HDD #123

Three Geotechnical bores (B226.6-1, K-226.7, and KB-226.8A) are located along the proposed HDD #123 alignment. The other borings listed in Appendix B (CU-5A, K-226.8, and K-227.0) are located outside the extents of the HDD alignment and are provided as reference only for the geology in the area. After reviewing and comparing these samples, geotechnical boring KB-226.8A was selected to be used in the BoreAid analysis as it best represented the complete soil strata for the HDD alignment and covered the full depth of the HDD profile. Consideration was

taken for the other Geotechnical borings in the design of the HDD. KB-226.8A terminates its analysis at a total depth of 60 feet and is positioned on the southern end of the HDD path. The initial 3 feet of material was primarily Silty Gravel with railroad ballast, after which the soil transitioned to Silt for the next 15 feet, followed by Clay for 10 feet, and finally Silt for the remainder of the boring. The Geotechnical report for this HDD and test data is provided in Appendix B.

Based on the borings, the soil profile for the HDD #123 BoreAid analyses will be divided into five [5] layers: Gravel (GM), Clay (CL), Silt (MH), Clay (CH), and Silt (MH). The soil profiles used in the BoreAid analyses for this HDD are presented in Appendix C.

5.0 DESIGN SUMMARY

5.1 HDD SEQUENCE

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

Step 1: Drill a small diameter (approximately 6 to 12 inches diameter) pilot hole along the preplanned drill 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 inert biodegradable additives to support sides of the drillhole and to better carry the cuttings to the entry pit at lower pressures and velocities. The drilling fluids typically used under waterbodies and wetland areas are typically required in the project specifications to be BMP's state "NSF certified". Once the pilot drill 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 is typically referred to as reaming. This is accomplished by using successively larger reaming bits pulled or pushed through the pilot hole to gradually enlarge the drill from the smaller diameter pilot hole

to a size able to accommodate the HDPE conduits. We estimate that one and possibly a second reaming pass will be used to create the 16 to 24 inch-diameter reamed drill hole.

Step 3: Pull the conduits into the enlarged hole. While the pilot hole and reaming operations are going on, 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, de-beaded, and arranged for the pullback into the drillhole. 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 drill 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 drillhole. As the conduit (bundle) is pulled into the hole it is usually 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.

5.2 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.
- Available work and layout areas.

The proposed drill paths entry angle, exit angle, and a vertical and horizontal design radius of curvature for each HDD crossing in this segment are shown in the design drawings in Appendix D. The HDD technical specifications are found in Section 330507.13 of the Technical Specifications.

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 into several smaller segments. Those pre-assembled segments will then have to be welded together during the pullback. HDD specific work areas at the entry and exit ends of the bores are noted on the drawings in Appendix D. 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 D. 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 HDD's in soft/weak ground conditions, the intersection HDD method may be used to better control the risk of inadvertent drilling fluid releases.

5.3 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 5.1.08 (2017) modeling software (a product of Vermeer) was used to model the HDD. Geotechnical soil input parameters reflect the default BoreAid values for each soil type. These soil properties were found to be conservative assumptions for the selected soil types and were in the typical published ranges. Values for all soil properties are listed in in the BoreAid HDD simulation outputs in Appendix C.

5.3.1 BoreAid Analysis

For the BoreAid analyses, the below conduit configurations will be used:

1) The following section is assumed to not be ballasted with water during pullback.

    a. An individual 10-inch diameter DR 9 HDPE casing or 8-inch diameter SDR 18 FPVC casing

Note: The actual FPVC pipe that will be used is an 8-inch diameter SDR 17 FPVC casing. BoreAid does not provide the option to select SDR 17, so SDR 18 was used in the BoreAid

analysis as it is the next closest dimension ratio available and provides a conservative analysis for the SDR 17 that will be installed.

2) The following bundled pull is assumed to be ballasted with water during pullback to create a near neutral buoyancy.

    a. A bundle consisting of a 10-inch diameter DR 9 or 8-inch diameter SDR 18 FPVC casing and a 3-inch diameter DR 9 HDPE casing

The stresses and deflections of the pipe are evaluated and compared to allowable values as shown on the BoreAid runs presented in Appendix C. In addition to analyzing each individual casing being installed, for all bundled pull sections, a secondary calculation was completed to evaluate a single "equivalent" pipe that is representative of the bundle diameter and stiffness. The BoreAid analyses for the single "equivalent" pipe concluded that all bundled pull sections would need to be ballasted with water during pullback to bring the Unconstrained Collapse buckling pressure within allowable limits. As a result, a note has been added to the HDD drawings stating, "Drill Contractor shall utilize buoyancy control measures (internal water used for ballast) during pullback for all bundled casings".

5.3.2 HDD Inadvertent Return and Hydraulic Fracture Analysis

BoreAid modeling software was used to perform inadvertent return analyses for each HDD alignment. The drill path alignment was selected and checked so that the allowable drill 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 drill hole, and the strength of the ground. The Limiting Formation Pressure Figure, indicate a generally acceptable factor of safety against the potential for inadvertent return along the proposed drill paths except at the ends.

Based on the drill 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 generally exhibit 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 hydraulic fracturing (frac-out) of 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 drill 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 frac-out and inadvertent returns 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 Return Contingency Plan details additional methods for mitigating inadvertent returns.

5.4 LIMITATIONS

The structural analysis and inadvertent return mitigation analysis were performed using the proposed design drill paths and typically anticipated equipment and means and methods. The HDD subcontractor must submit structural and inadvertent return mitigation calculations and analysis for each drill path, including their final drill 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, but 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 drill path and electromagnetic effects of the HDD steering equipment from nearby high voltage power lines.

6.2 SITE ANALYSIS

What does the site look like and what considerations might need to be taken for site access, construction of HDD entry and exit pits, and layout area for equipment and supplies. Careful consideration of all necessary jobsite activities should be analyzed from the perspective of the site conditions, terrain and nearby structures.

6.3 EROSION CONTROL

The proposed drill 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 exit pit will be close to the stream/wetlands. Silt fence, hay 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 drill alignment for indications of potential inadvertent returns 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.

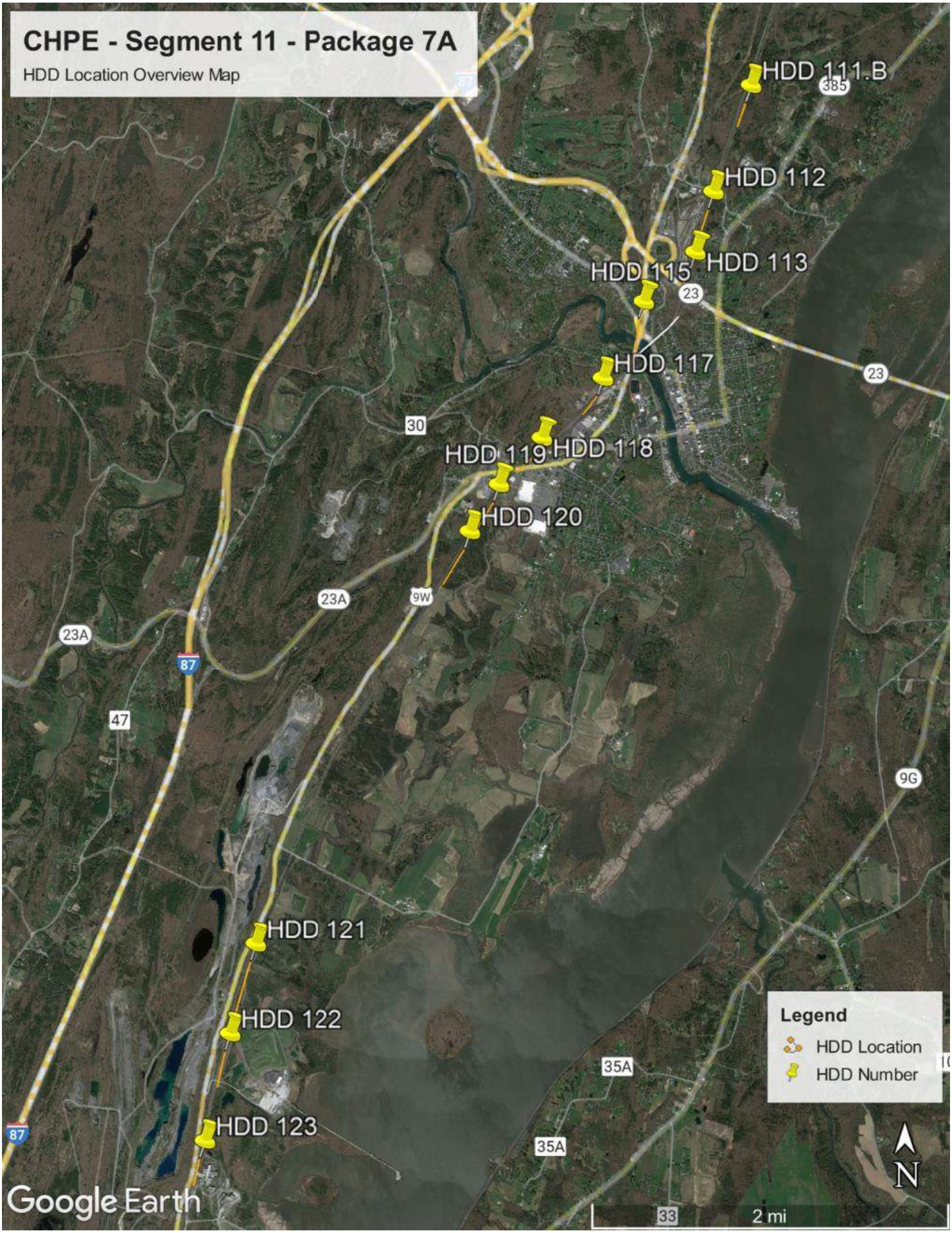
However, an experienced drill crew can often prevent a return by monitoring drilling fluid pressures. A loss of pressure may indicate an inadvertent return has occurred. Regardless of the level of preparation, inspection, monitoring, etc., inadvertent returns are not always possible to predict or prevent. However, a significant effort can minimize the possibility but not eliminate it.

7.0 REFERENCES

- *American Association of State Highway and Transportation Official*s. (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.
- PRCI - Complex HDD Analysis Model - *Installation of Pipelines by Horizontal Directional Drilling*, An Engineering Design Guide, J.D. Hair, 2015
- *Pipeline Rules of Thumbs Handbook*, Seventh Edition, E.W. McAllister Editor, 2009
- *Plastic Pipe Institute (PPI), 2007.* Handbook of Polyethylene Pipe*, 2nd Edition. Plastic Pipe Institute (PPI).*
- ASCE, 2005. *Pipeline Design for Installation by Horizontal Directional Drilling.* American Society of Civil Engineers, ASCE Manuals and Reports on Engineering Practice No. 108.
- *US Army Corp of Engineers, 1998.* Technical Report CPAR-GL-98-1*, Final Report, Appendix B, April 1998*
- NASTT, 2017*, Horizontal Directional Drilling (HDD) Good Practices Guidelines – 4th Edition*
- *Horizontal Directional Drilling (HDD)*: Utility and Pipeline Applications (Civil Engineering) 1st Edition, David Willoughby

Appendix A

Overview Map


CHPE - Segment 11 - Package 7A
HDD Location Overview Map
HDD 111.B
HDD 112
HDD 113
HDD 115
HDD 117
HDD 118
HDD 119
HDD 120
HDD 121
HDD 122
HDD 123
87
385
23
30
9W
23A
47
9G
35A
33
Legend
HDD Location
HDD Number
N
2 mi
Google Earth

Appendix B

HDD Geotechnical Reports

Kiewit

MEMORANDUM

DATE: June 2, 2023

TO: Zachary Bauer; Tetra Tech Rooney

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

SUBJECT: Geotechnical Data: Segment 11 - Package 7A - HDD Crossing 111B
Champlain Hudson Power Express Project
Catskill, 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 north of Catskill, New York. The approximate station for the north end of HDD crossing number 111B is STA 70002+00 (42.2440° N, 73.8589° W).

The geotechnical data near this HDD crossing is attached. The available data is taken from the investigation by Terracon, referenced below. Additional exploration is planned for this location once landowner access permissions are granted and access roads are installed.

- Terracon Consultants-NY, Inc., Results of Field Exploration, Champlain-Hudson Power Express – Phase 4 HDD Borings – Package 6 and 7A – Rev 1, Schenectady to Selkirk, NY, dated April 25, 2023.

Contact us if you have questions or require additional information.

HDD 111B
Borings KB-219.4
Segment 10 - Design Package 6

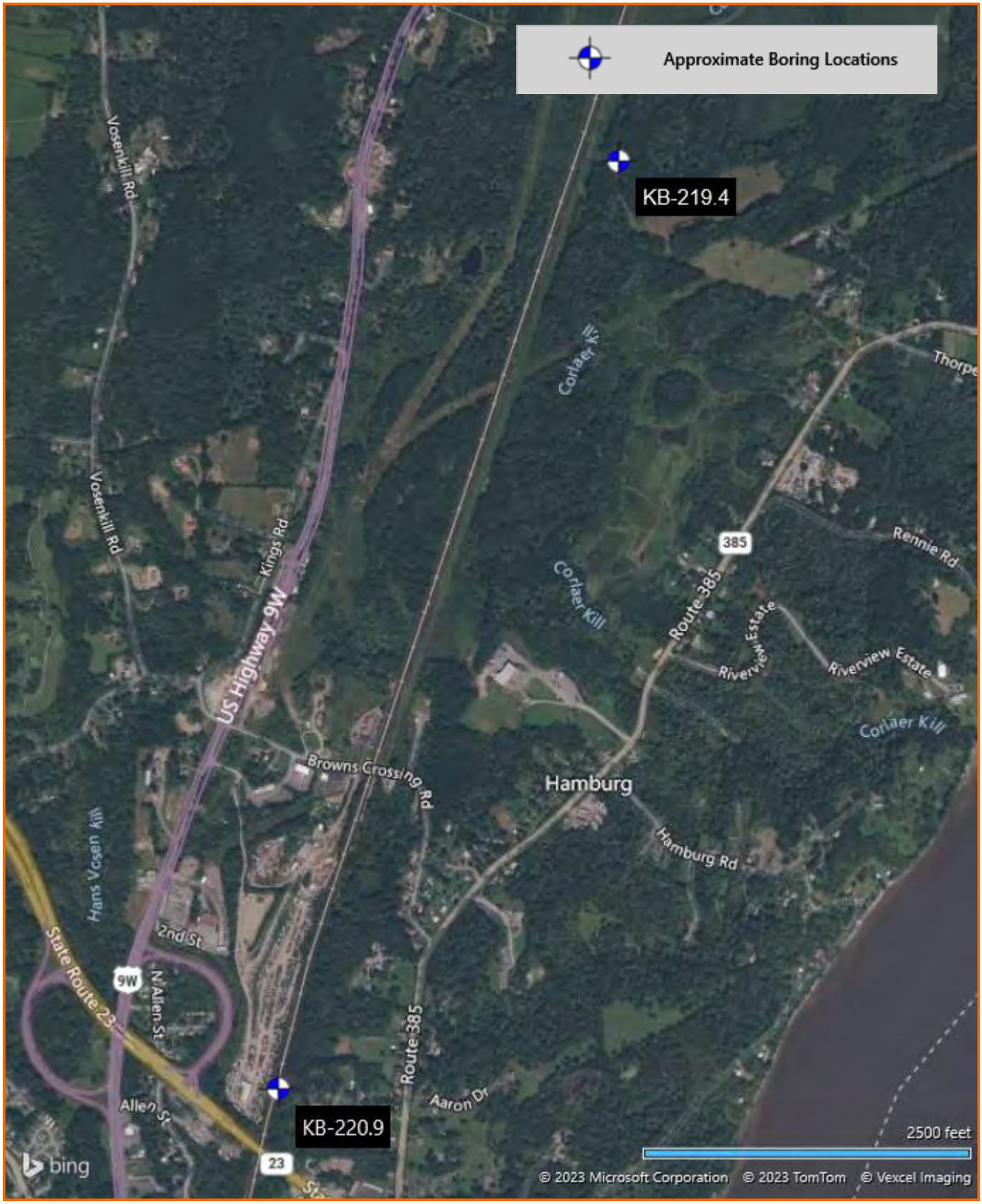


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Rock Core – Boring KB-207.1 Run 13 through Run 15

Rock Core – Boring KB-219.4 Run 1 through Run 4

Rock Core – Boring KB-219.4 Run 5 through Run 8

Rock Core – Boring KB-219.4 Run 9 through Run 12

BORING LOG NO. KB-219.4

PROJECT: Phase 4 Borings

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

SITE: Champlain to Hudson HDD Crossings

LOCATION See Exploration Plan

Latitude: 42.2497° Longitude: -73.8558°

Surface Elev.: 120.73 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.3	120.4	**TOPSOIL**
		FILL - SANDY SILT, orange and brown
4.0	116.7	**SILTY GRAVEL WITH SAND (GM)**, occasional cobbles and boulders, brown, medium dense to dense, (GLACIAL TILL)
15.0	105.7	**WEATHERED ROCK**, gray, very dense
20.0	100.7	**SHALE**, occasional calcite veins, unweathered, close to wide fractured with near vertical fractures, good RQD, gray
25.0	95.7	

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		10	1-2-3-3 N=5			
		20	5-6-8-8 N=14			
5		20	6-5-8-8 N=13			
		22	10-10-14-38 N=24	11.8		32
		12	25-17-20-15 N=37			
10		12	18-16-8-7 N=24			
15			50/0"			
20			REC=100% RQD=85%			
25						

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

Hammer Type: Automatic

Advancement Method:
0-15' 4" Casing
15-20' Mud Rotary
20' -75' NQ 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: 02-15-2023 | Boring Completed: 02-16-2023

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

Project No.: JB215256J

BORING LOG NO. KB-219.4

PROJECT: Phase 4 Borings

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

SITE: Champlain to Hudson HDD Crossings

LOCATION See Exploration Plan

Latitude: 42.2497° Longitude: -73.8558°

Surface Elev.: 120.73 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	FIELD TEST RESULTS
30.0	90.7	**SHALE**, occasional calcite veins, inter bedded with greywacke, unweathered, very close to wide fractured, good RQD, gray	REC=95% RQD=78%
35.0	85.7	**SHALE**, occasional calcite veins, unweathered, close to wide fractured, excellent RQD, gray	REC=100% RQD=90%
40.0	80.7	**GREYWACKE**, occasional calcite veins, inter bedded with shale, unweathered, very close to wide fractured with occasional high angled fractures, excellent RQD, gray	REC=100% RQD=96%
45.0	75.7	**SHALE**, occasional calcite veins, inter bedded with greywacke, unweathered, close to moderate fractured, good RQD, gray	REC=100% RQD=80%
50.0	70.7	**SHALE**, occasional calcite veins, inter bedded with greywacke, unweathered, close to moderate fractured, fair RQD, gray	REC=100% RQD=53%

GRAPHIC LOG | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | 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:
0-15' 4" Casing
15-20' Mud Rotary
20' -75' NQ 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.

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WATER LEVEL OBSERVATIONS

No free water encountered

Terracon
30 Corporate Cir Ste 201
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Boring Started: 02-15-2023 | Boring Completed: 02-16-2023

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

Project No.: JB215256J

BORING LOG NO. KB-219.4

PROJECT: Phase 4 Borings

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

SITE: Champlain to Hudson HDD Crossings

LOCATION See Exploration Plan

Latitude: 42.2497° Longitude: -73.8558°

Surface Elev.: 120.73 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	FIELD TEST RESULTS
55.0	65.7	**GREYWACKE**, occasional calcite veins, inter bedded with shale, unweathered, very close to close fractured with occasional high angled fractures, good RQD, gray	REC=100% RQD=78%
60.0	60.7	**SHALE**, occasional calcite veins, inter bedded with greywacke, unweathered, close to moderate fractured with occasional high angled fractures, excellent RQD, gray	REC=100% RQD=95%
65.0	55.7	**GREYWACKE**, occasional calcite veins, inter bedded with shale, unweathered, wide fractured with occasional high angled fractures, excellent RQD, gray	REC=100% RQD=100%
70.0	50.7	**GREYWACKE**, occasional calcite veins, unweathered, extremely close to wide fractured with occasional high angled fractures, good RQD, gray	REC=96% RQD=78%
75.0	45.7	**SHALE**, occasional calcite veins, unweathered, extremely close to moderate fractured with occasional high angled fractures, good RQD, gray	REC=100% RQD=70%

GRAPHIC LOG | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | RECOVERY (In.) | FIELD TEST RESULTS | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

55 60 65 70 75

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

Hammer Type: Automatic

Advancement Method:
00-15' 4" Casing
15-20' Mud Rotary
20' -75' NQ 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: 02-15-2023 | Boring Completed: 02-16-2023

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

Project No.: JB215256J

BORING LOG NO. KB-219.4

PROJECT: Phase 4 Borings

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

SITE: Champlain to Hudson HDD Crossings

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 42.2497° Longitude: -73.8558° Surface Elev.: 120.73 (Ft.) DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SHALE, occasional calcite veins, inter bedded with greywacke, unweathered, very close to close fractured with occasional high angled fractures, fair RQD, gray					REC=100% RQD=60%			
	80.0 40.7	80							
	Boring Terminated at 80 Feet								

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

Hammer Type: Automatic

Advancement Method:
00-15' 4" Casing
15-20' Mud Rotary
20' -75' NQ 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: 02-15-2023 | Boring Completed: 02-16-2023

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

Project No.: JB215256J

Summary of Laboratory Results

BORING ID	Depth (Ft.)	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Organic Content (%)
KB-206.8	4-6	29.4	50	26	24	
KB-206.8	15-17	32.9	40	23	17	
KB-206.8	35-37	11.0	17	13	4	
KB-207.0	4-6	23.7	42	30	12	
KB-207.1	4-6	15.1				
KB-209.7	4-6	30.3	64	32	32	2.8
KB-209.7	15-17	38.8	64	32	32	
KB-209.7	25-27	38.8	54	25	29	
KB-209.7	40-42	38.8	45	25	20	
KB-211.4B	4-6	32.8	58	32	26	
KB-211.4B	15-17	48.0	55	31	24	
KB-211.4B	40-42	36.7	63	32	31	
KB-214.4	4-6	33.7	65	33	32	
KB-214.4	15-17	37.6	57	29	28	
KB-214.4	30-32	49.7	45	30	15	
KB-219.4	6-8	11.8				
KB-220.9	4-6	31.0	50	27	23	
KB-220.9	20-22	39.6	47	26	21	
KB-220.9	45-47	33.6	42	27	15	

PROJECT: Phase 4 Borings

PROJECT NUMBER: JB215256J

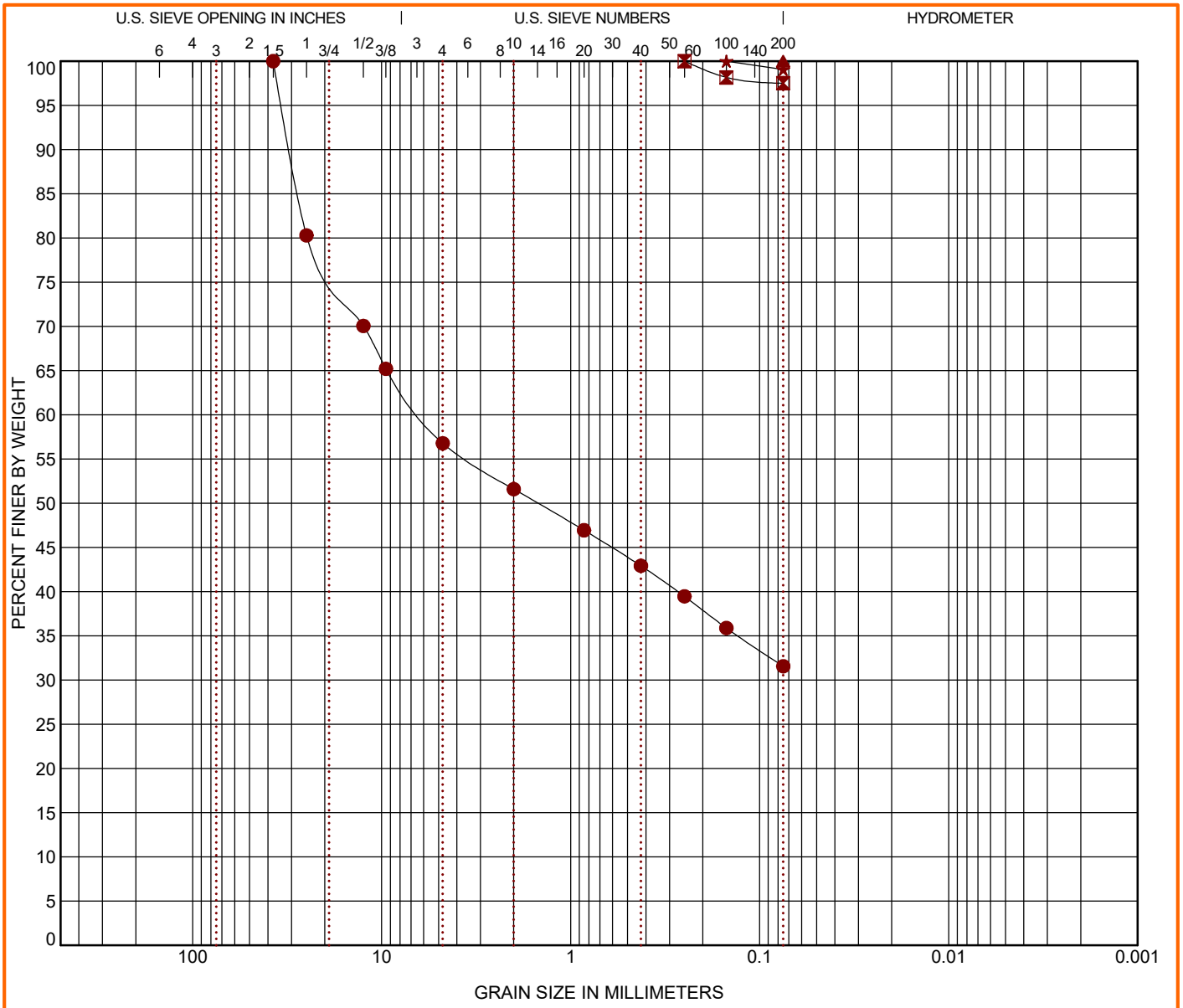
SITE: Champlain to Hudson HDD Crossings

Terracon
30 Corporate Cir Ste 201
Albany, NY

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-219.4	6 - 8	SILTY GRAVEL with SAND (GM)	11.8					
⊠	KB-220.9	4 - 6	FAT CLAY (CH)	31.0	50	27	23		
▲	KB-220.9	20 - 22	LEAN CLAY (CL)	39.6	47	26	21		
★	KB-220.9	45 - 47	SILT (ML)	33.6	42	27	15		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	KB-219.4	6 - 8	37.5	6.191			0.0	43.2	25.2		31.6	
⊠	KB-220.9	4 - 6	0.25				0.0	0.0	2.5		97.5	
▲	KB-220.9	20 - 22	0.075				0.0	0.0	0.0		100.0	
★	KB-220.9	45 - 47	0.15				0.0	0.0	0.9		99.1	

PROJECT: Phase 4 Borings

PROJECT NUMBER: JB215256J

SITE: Champlain to Hudson HDD Crossings

Terracon
30 Corporate Cir Ste 201
Albany, NY

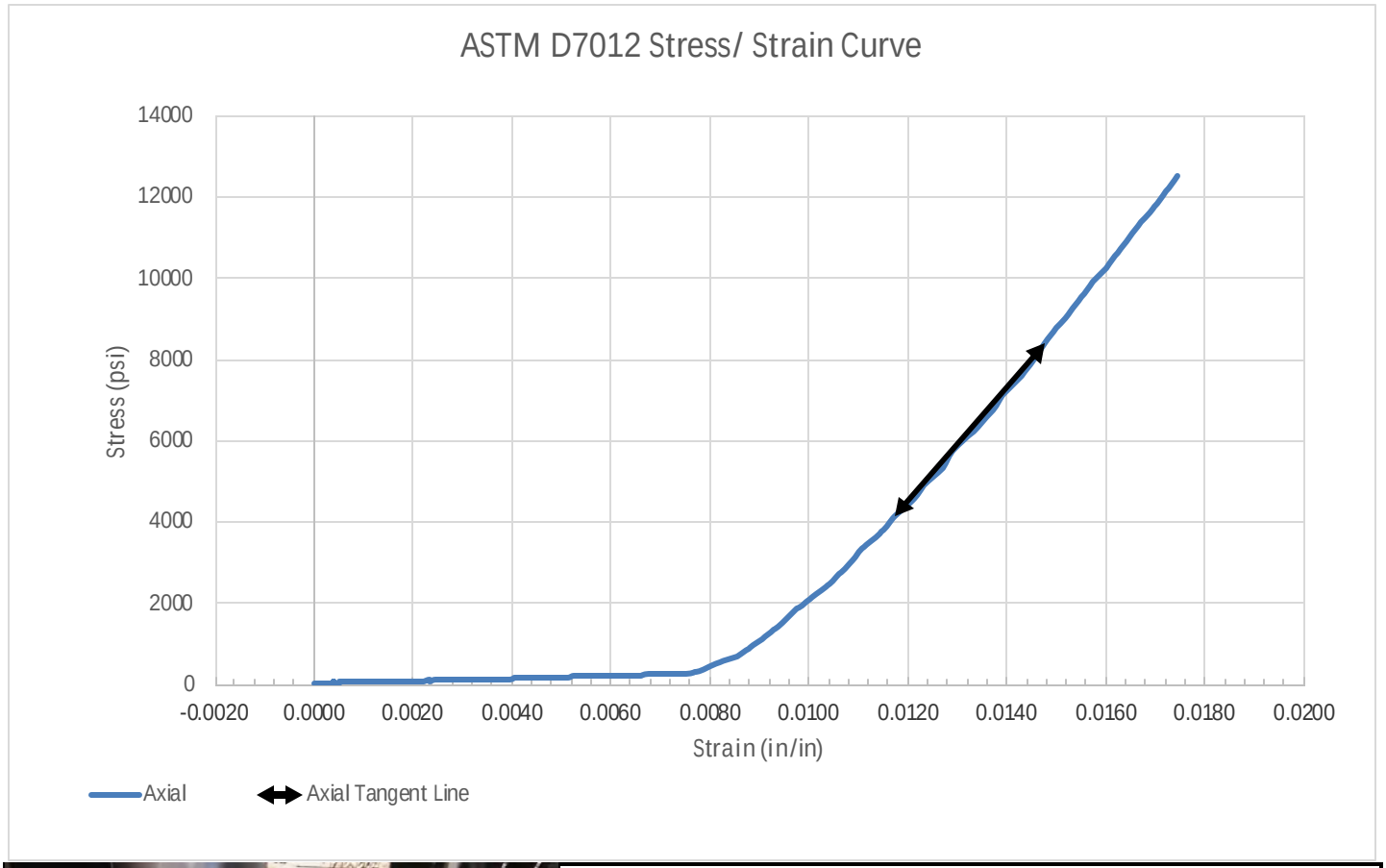
CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

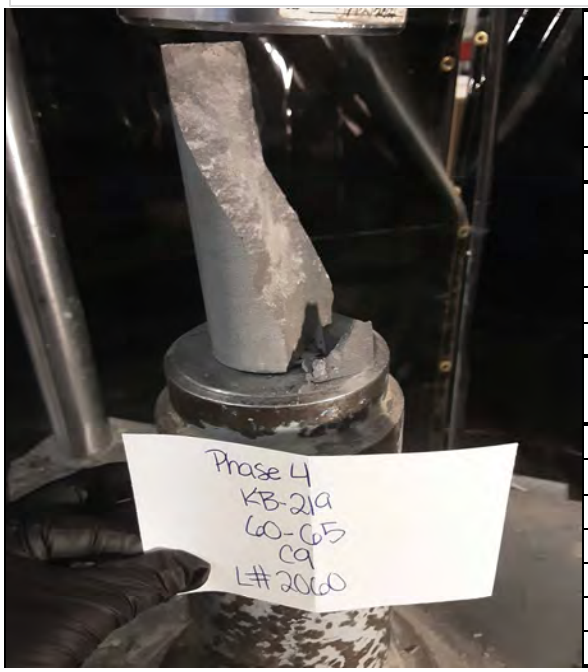
Rock Core D7012 Method C

Client
Kiewit Engineering

Project
Phase 4 Borings

Project No. JB215256J





SAMPLE LOCATION			
Site:	Phase 4 Borings		
Description:	Greywacke		
Boring:	KB-219.4	Depth (feet):	60.0-65.0

SPECIMEN INFORMATION			
Sample No.:	C-9	Mass (g):	564.96
Length (in.):	4.12	Diameter (in.):	1.98
L/D Ratio:	2.08	Density (pcf):	169.66

TEST RESULTS	
Failure Load (lbs):	38578
Failure Strain (in/in):	0.020
Unconfined Compressive Strength (psi):	12,529
Elastic Modulus, E, (ksi):	1403
Time of Failure (min):	03:20
Rate of Loading (in/sec):	0.04
Moisture Content Post-break:	0.40%

Rock Core D7012 Method C

Client	Project
Kiewit Engineering	Phase 4 Borings
	Project No. JB215256J

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 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

Project
Phase 4 Borings

Project No. JB215256J

Splitting Tensile Strength of Intact Rock Core Specimens, ASTM D3967

Boring	KB-219.4	**Material Description**	Greywacke
Sample No	C-9	**Equipment Used**	Tinius Olsen (120,000lbs)
Depth (ft)	60.0-65.0	**TICCS ID/Serial No.**	C-48999, 118285
Lab No	2060	**Calibration Date**	11/2/2022

	TENSILE STRENGTH				
Lab No.	1	2	3	4	5
Diameter (in)	1.98	1.98	1.98	1.98	--
Length (in)	0.64	0.68	0.68	0.70	--
Length Diameter Ratio	0.32	0.34	0.34	0.35	--
Rate of Loading	0.0064	0.0068	0.0068	0.0070	--
Moisture Condition	0.43%	0.43%	0.43%	0.43%	--
Maximum Applied Load (lbf)	4851	6229	4557	4142	--
Splitting Tensile Strength (psi)	2438.3	2946.8	2155.8	1903.5	--

	TENSILE STRENGTH				
Lab No.	6	7	8	9	10
Diameter (in)	--	--	--	--	--
Length (in)	--	--	--	--	--
Length Diameter Ratio	--	--	--	--	--
Rate of Loading	--	--	--	--	--
Moisture Condition	--	--	--	--	--
Maximum Applied Load (lbf)	--	--	--	--	--
Splitting Tensile Strength (psi)	--	--	--	--	--

Client:	Terracon Consultants, Inc.		
Project:	Champlain-Hudson Power Express		
Location:	---		Project No: GTX-316884
Boring ID: KB-219.4	Sample Type: cylinder		Tested By: tlm
Sample ID: ---	Test Date: 03/09/23		Checked By: smd
Depth : 60'-65'	Test Id: 707603		
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
KB-219.4	---	60-65 ft	1	0.2	0.2	0.20	
			2	0.3	0.4	0.35	
			3	0.3	0.4	0.35	
			4	0.2	0.2	0.20	
			5	0.3	0.4	0.35	
			Average CAIs			0.29	
			Average CAI *			0.77	
					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: December 16, 2022

TO: Zachary Bauer; Tetra Tech Rooney

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

SUBJECT: Geotechnical Data: Segment 11 – Package 7A – HDD Crossing 112 – Revision 1
Champlain Hudson Power Express Project
Catskill, 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 north of Catskill, New York. The approximate station for the start of HDD crossing number 112 is STA 70036+00 (42.2354° N, 73.8631° W).

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

- AECOM, Geotechnical Data Report, Upland Segments, Champlain Hudson Power Express, dated May 28, 2021.
- Kiewit Engineering (NY) Corp., Package 7A Phase 3 Borings, Champlain Hudson Power Express, New York, dated December 8, 2022.
- Terracon Consultants-NY, Inc., Results of Field Exploration, Champlain-Hudson Power Express – Package 7a, Catskill, NY, dated May 23, 2022.

Contact us if you have questions or require additional information.

HDD 112
Borings SC-5, K-220.6
KB-220.5
Segment 11 - Design Package 7A

CHPE Segment 11 - Package 7A
HDD Soil Boring Coordinates and Elevations

Firm	Boring	Northing (feet)	Easting (feet)	Ground Surface Elevation (feet)
TRC*	B221.0-1	1237452.6	663787.2	99.6
	B221.2-1	1236173.4	663261.8	115.0
	B221.4-1	1235622.5	662622.3	22.4
	B221.5-1	1235006.9	662058.8	95.5
	B221.6-1	1234675.8	661633.8	98.3
	B221.8-1	1234265.3	661277.2	99.4
	B222.34-1	1232191.5	659098.9	133.5
	B222.6-1	1231252.6	658182.3	113.7
	B222.9-1	1229751.0	657274.3	121.4
	B225.8-1	1215861.0	650622.7	91.0
	B226.1-1	1214654.4	650328.3	105.9
	B226.2-1	1214120.5	650254.4	108.5
	B226.6-1	1211894.7	649689.7	112.1
AECOM**	CU-1	1237028.6	663123.9	19.7
	CU-2	1236042.7	662897.0	24.8
	CU-2A	1235325.9	662268.9	38.1
	CU-5A	1210523.7	649411.8	118.4
	SC-5	1239310.3	664321.6	110.2
	SC-6	1237781.0	663919.8	101.6

Notes:

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

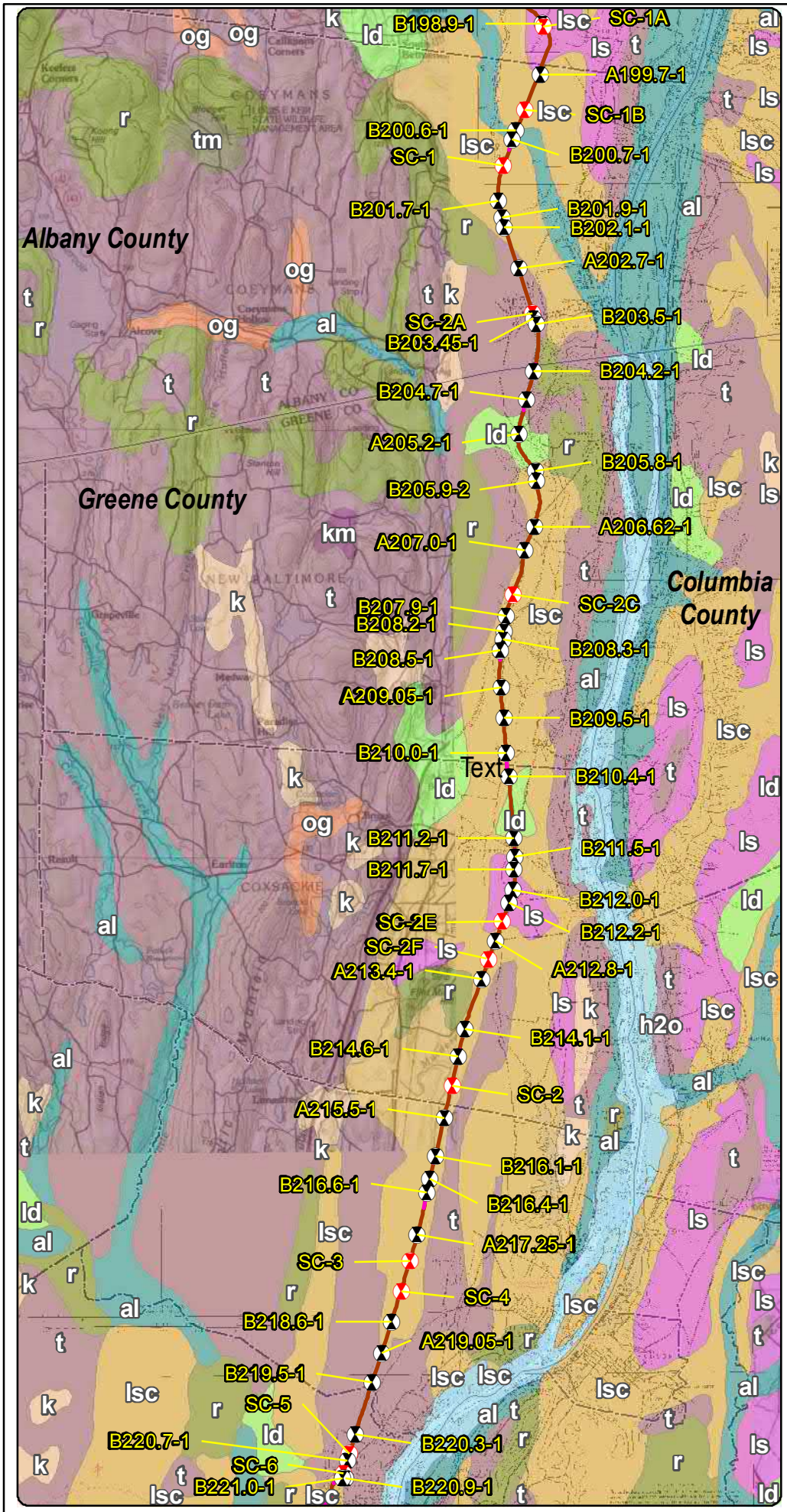
* TRC boring coordinates as shown in Table 1-6 in AECOM report (reference below). Boring elevations estimated from November 2021 topographic survey by Williams Aerial.

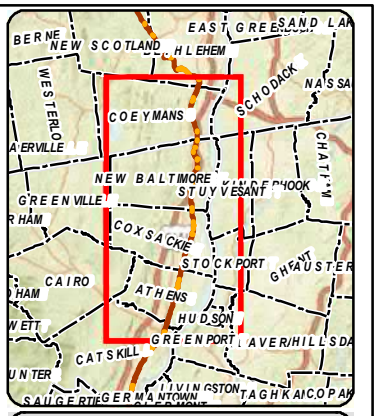
** AECOM boring coordinates and elevations as shown in Table 1-6 in AECOM report.

*** 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
- h2o - Water
- k - Kame deposits
- km - Kame moraine
- ld - Lacustrine delta
- ls - Lacustrine sand
- lsc - Lacustrine silt and clay
- og - Outwash sand and gravel
- r - Bedrock
- t - Till
- tm - Till moraine

N

1 0.5 0 1 Miles

Transmission Developments Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

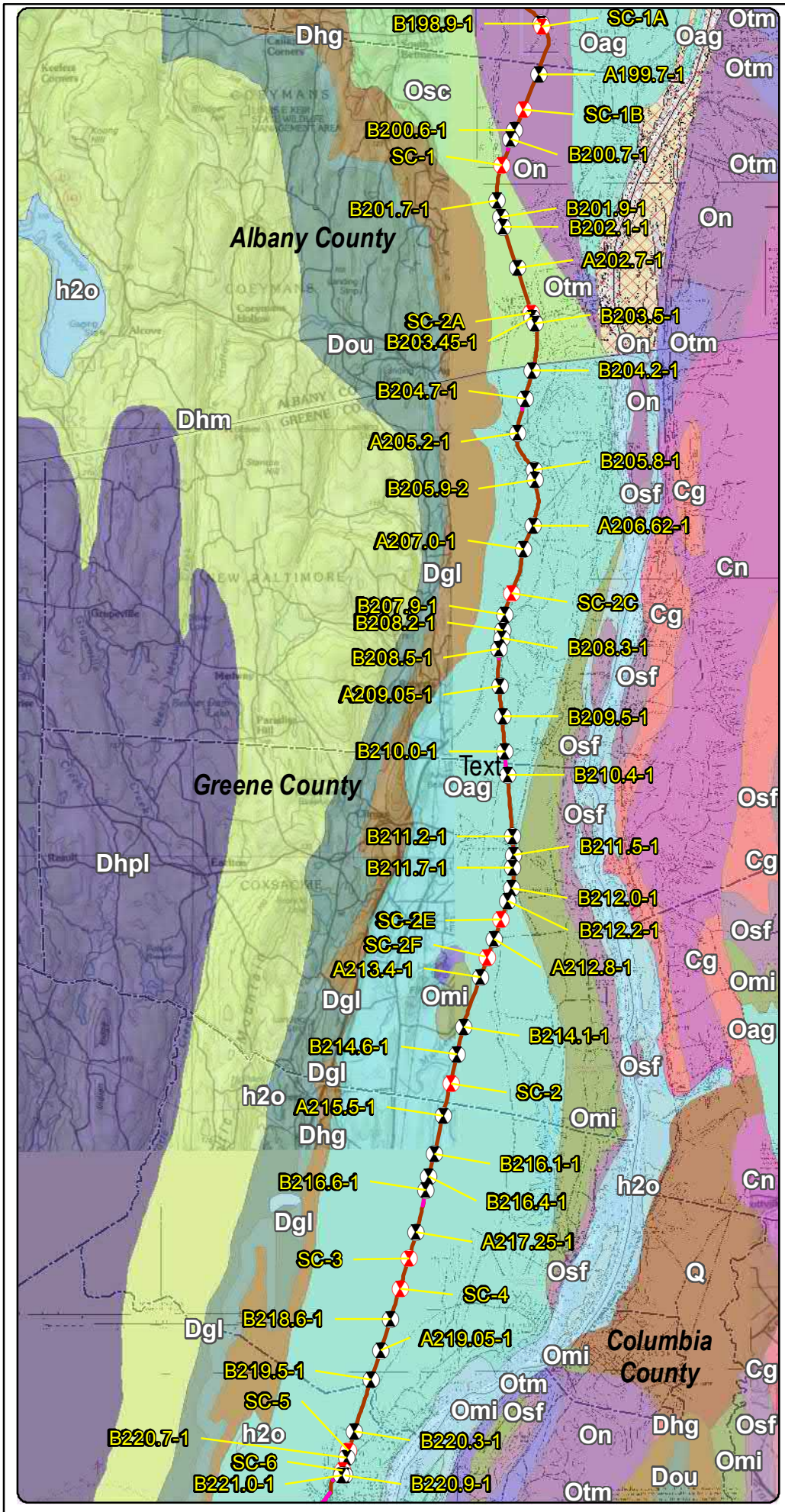
Surficial Geology and Geotechnical Borings Selkirk to Catskill Figure 3-10

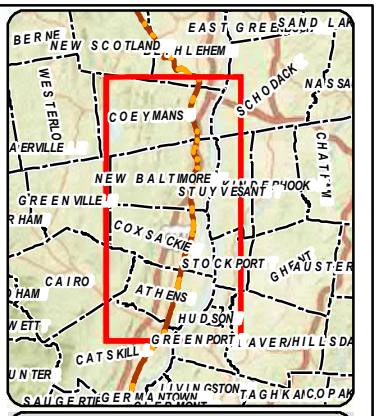
Prepared on 5/3/2021

by: AECOM

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

Y:\Projects\CHPE\Route\Consensus_Alternative_Routes\MXD\Alt_5_Routes_DZ_20190909Boring_Locations\Maps_for_May_2021_Report\Selkirk_to_Catskill_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

- Cg - Germantown Formation
- Cn - Nassau Formation
- Dgl - Glenerie Formation
- Dhg - Port Ewen Formation
- Dhm - Undiff Lower Hamilton Group
- Dhpl - Plattekill Formation
- Dou - Onondaga Limestone
- No Label
- Oag - Austin Glen Form (graywacke, shale)
- Omi - Mount Merino Formation
- On - Normanskill Shale
- Osc - Schenectady Formation
- Osf - Stuyvesant Falls Formation
- Otm - Taconic Melange
- Q - Glacial and Alluvial Deposits
- h2o - Water

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

N

1 0.5 0 1 Miles

Transmission

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

Bedrock Geology and Geotechnical Borings Selkirk to Catskill Figure 4-10

Prepared on 5/18/2021

by: AECOM

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

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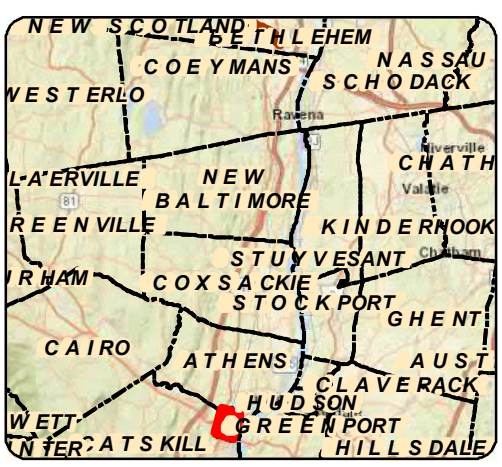

LEGEND

- 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

Selkirk to Catskill

Figure A-10

Sheet 18 of 18

Prepared by: AECOM 5/19/2021

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BORING CONTRACTOR: ADT	AECOM		SHEET 1 OF 2
			PROJECT NAME: CHPE -
DRILLER: Chris Chaillou			PROJECT NO.: 60323056
			HOLE NO.: **SC-5**
SOILS ENGINEER/GEOLOGIST: Chris French	**BORING LOG**		START DATE: 1/27/21
			FINISH DATE: 1/27/21
LOCATION: Catskill, NY MP - 220.59 (CSX Rail)			OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	DRILL RIG: CME LC-55
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		SP-SW	SAND	0.0': Black fine to coarse SAND, little angular-subangular gravel, little silt; medium dense, moist
1.0										
2.0										
3.0										
		3'-5'	S-1							TR-1; (3.0'-5.0')
4.0										
5.0									SILT	4.5': Black SILT, trace fine sand; medium stiff, moist
		5'-7'	S-2	24"	15"	9 7 10 13	11	ML	Clayey SILT	Brown clayey SILT, trace fine sand; medium stiff, moist
6.0										
7.0										
		7'-9'	S-3	24"	12"	9 10 7 6	11	ML		SAA
8.0										TR-2; (8.0'-8.5')
9.0										
		9'-11'	S-4	24"	9"	12 9 7 12	10	SM	Silty SAND	Brown with red/brown mottling fine to coarse SAND, some silt, little subangular-subrounded gravel, trace clay; dense, moist (weathered till)
10.0										
11.0										
		11'-'13'	S-5	24"	18"	4 11 12 16	15	SM/ML		SAA
12.0										TR-3; (12.0'-12.5')
13.0										12.7': Brown clayey SILT; stiff, moist
		13'-15'	S-6	23"	22"	WOH 9 9 54/5"	12	ML	Clayey SILT	Brown clayey SILT; medium stiff, moist
14.0										
15.0										
16.0										Casing set at 16', begin coring at 16'
	4	16.0'-19.5'	R-1	42"	25"	RQD: n/a			SANDSTONE (possible boulder - till)	Gray sandstone, fine grained, heavily mechanically jointed, unweathered
17.0										
18.0										
19.0										
20.0	3.2	19.5'-21.0'	R-2	18"	11"	RQD: n/a				SAA

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: Chris Chaillou

SOILS ENGINEER: Chris French

AECOM

BORING LOG

LOCATION: Catskill, NY MP - 220.59 (CSX Rail)

SHEET 2 OF 2

PROJECT NAME: CHPE -

PROJECT NO.: 60323056

HOLE NO.: **SC-5**

START DATE: 1/27/21

FINISH DATE: 1/27/21

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
21.0									SANDSTONE (possible boulders/till)	Started to penetrate soft materials at 21'. Attempted 2" split spoon at 23' (no recovery)
22.0										
23.0										
		23'-23.5'	S-7	6"	0"	82				No Recovery
24.0										Advance casing to 25.0' - attempt core.
25.0										
	2	25.0'-30.0'	R-3	60"	18"	RQD: n/a				Sandstone - possible boulder fragments
26.0										TR-4; (25.1'-25.7')
27.0								GM	Silty GRAVEL (till)	
28.0										
29.0										
30.0										
		30'-32'	S-7	13"	13"	22 37 50/1"	-			30.0': Gray angular GRAVEL, some clayey silt, little fine to coarse sand; dense, wet
31.0										TR-5; (30.0'-31.0' 2" split spoon)
32.0										
	3.15	32'-37'	R-4	60"	59"%	RQD: 42" = 70%			Interbedded SHALE and SANDSTONE	32.0': Interbedded shale (gray) and sandstone (gray), sandstone is fine grained, moderate mechanical jointing, slight fracturing at 45° - 50°, unweathered, few quartzite healed fractures parallel to bedding plane
33.0										
34.0										TR-6; (33.9'-34.8')
35.0										
36.0										
37.0										
	2.2	37'-40'	R-5	36"	22"	RQD: 11" = 31%				SAA
38.0										
39.0										
40.0										
41.0										SC-5 termianted at 40', grouted to surface
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%

ROCK CORE PHOTOGRAPHIC LOG

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

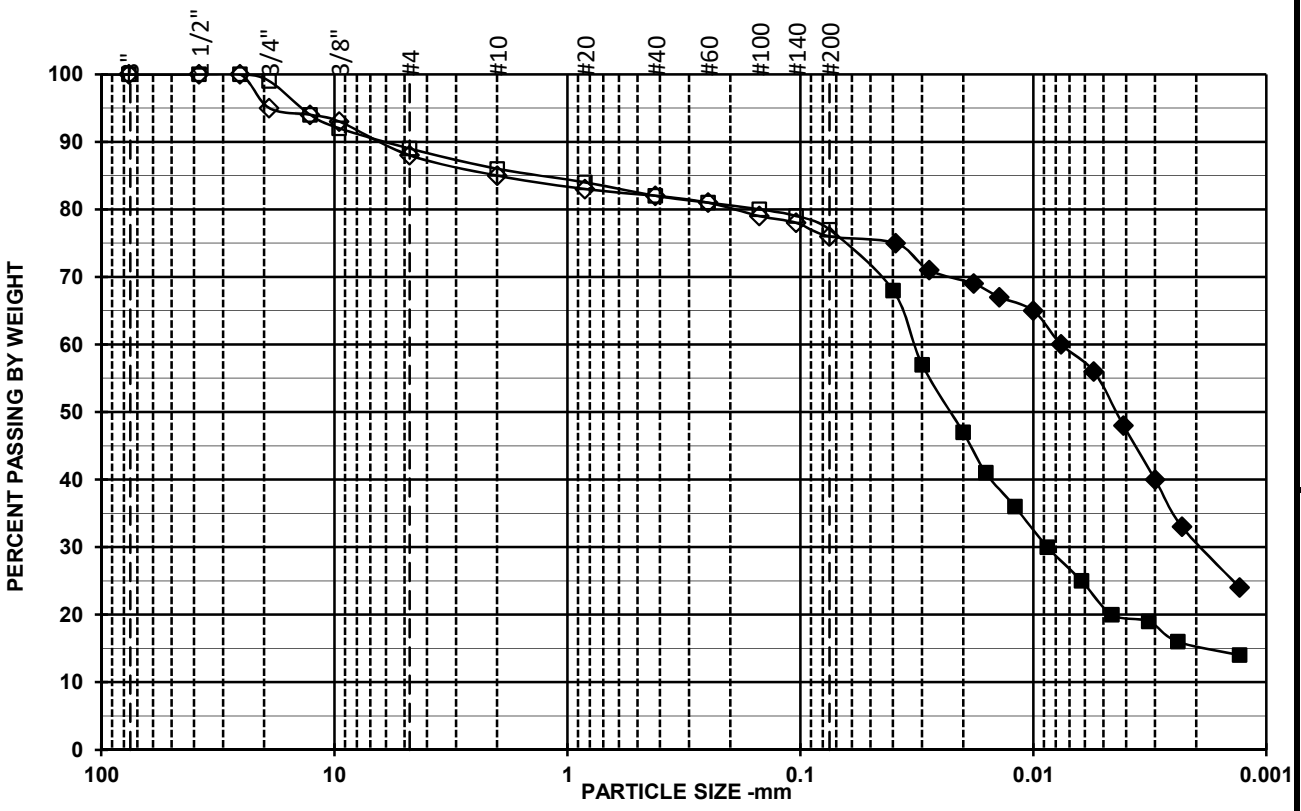
Boring No.	Depth (ft.)	
SC-2F	7.0-16.0	
SC-5	16.0-40.0	

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

Aquifer
CHPE - Selkirk Catskill Borings
LABORATORY SOIL TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS							REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 μm (%)	
SC-1	S-2	5-7	28.2	54	23	31	CH	99.4	45	
SC-1	S-4	9-11	25.8	44	22	22	CL	96.8	44	
SC-1A	S-3	7-9	11.7				SM	34.1	4	
SC-1A	S-8	20-22	22.6				SM	37.8	3	
SC-1A	S-10	30-32	35.3	37	19	18	CL	99.9	44	
SC-2C	S-2	5-7	5.8				GP-GM	8		
SC-2C	S-7	15-17	19.1	36	19	17	GC	35	14	
SC-2C	S-9	24-29	5.0	15	10	5	GC-GM	21	5	
SC-2E	S-2	5-7	38.1	61	25	36	CH	99.5	85	
SC-2E	S-5	11-13	39.5	47	23	24	CL	99.8	64	
SC-3	S-2	5-7	32.9	76	28	48	CH	99.4	93	
SC-3	S-8	20-22	62.4	55	24	31	CH	100	76	
SC-3	S-10	30-32	7.4				GW-GM	5	3	
SC-5	S-2	5-7	20.7	28	18	10	CL	77	15	
SC-5	S-6	13-15	24.9	40	21	19	CL	76	31	
SC-6	S-3	7-9	29.5	49	24	25	CL	99.9	50	
SC-6	S-8	20-22	35.2	49	23	26	CL	100	63	
SC-6	S-10	30-32	34.9	43	21	22	OL	99.9	62	

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	20.7	28	18	10	CL		Brown, Lean clay with sand, Insufficient sample size	04/08/21
◇	24.9	40	21	19	CL		Brown, Lean clay with sand, Insufficient sample size	04/08/21
○								

Aquifer

TerraSense, LLC #7853-21008

CHPE - Selkirk Catskill Borings

Symbol	□	◇	○
Boring	SC-5	SC-5	
Sample	S-2	S-6	
Depth	5-7	13-15	
% +3"	0	0	
% Gravel	11	12	
% SAND	12	12	
%C SAND	3	3	
%M SAND	4	3	
%F SAND	5	6	
% FINES	77	76	
D_{100} (mm)	25.4	25.4	
D_{60} (mm)	0.032	0.008	
D_{30} (mm)	0.009	0.002	
D_{10} (mm)			
Cc			
Cu			

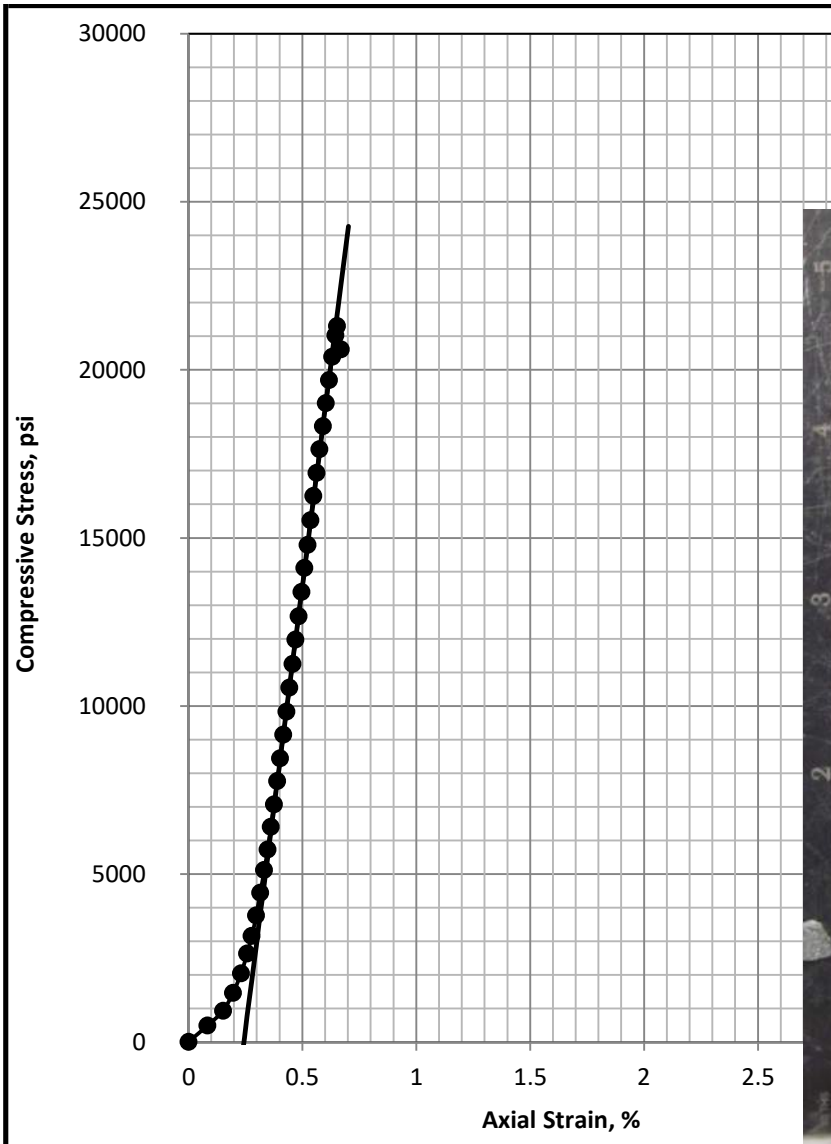
Sieve Size/ID #	Percent Finer Data		
6"	100	100	
4"	100	100	
3"	100	100	
1 1/2"	100	100	
1"	100	100	
3/4"	99	95	
1/2"	94	94	
3/8"	92	93	
#4	89	88	
#10	86	85	
#20	84	83	
#40	82	82	
#60	81	81	
#100	80	79	
#140	79	78	
#200	77	76	
5μ m	21	53	
2μ m	15	31	
1μ m	13	20	

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

Aquifer
CHPE Selkirk Catskill Borings
SUMMARY OF ROCK TESTING

SAMPLE IDENTIFICATION			STATE PROPERTIES			ENGINEERING PROPERTY TESTS				
Boring (Sample)	Run	Depth (ft)	WATER CONTENT (1) (%)	TOTAL UNIT WGT. (pcf)	DRY UNIT WGT. (pcf)	TEST TYPE (2)	Mohs HARDNESS (-)	UNCONFINED COMPRESSION TESTS (ASTM D7012)		
								COMPRESSIVE STRENGTH (psi)	AXIAL STRAIN @ FAILURE (%)	ESTIMATED (5) ELASTIC MODULUS (psi)
SC-2F	R-1	10.6-11	0.6	168	167	UC		17520	0.31	6E+06
SC-2F	R-1	11.4-11.8				M	7			
SC-5	R-1	16.1-16.5	0.4	169	168	UC		21310	0.41	5E+06
SC-5	R-1	16.8-17.1				M	6-7			
SC-5	R-4	32.2-32.6	0.6	170	169	UC		14630	0.37	4E+06
SC-5	R-4	32.8				M	4			
(MP208.58)						M	7			
(MP 208.63)			0.5	166	165	UC		6910	0.26	3E+06
(MP208.63)						M	6			
(MP 208.65)			0.5	167	166	UC		12670	0.27	5E+06
(MP208.65)						M	7			

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.



Specimen Information

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (inch)	Diameter (inch)
0.43	169	168	4.349	1.965

Specimen meets ASTM D4543 shape tolerances

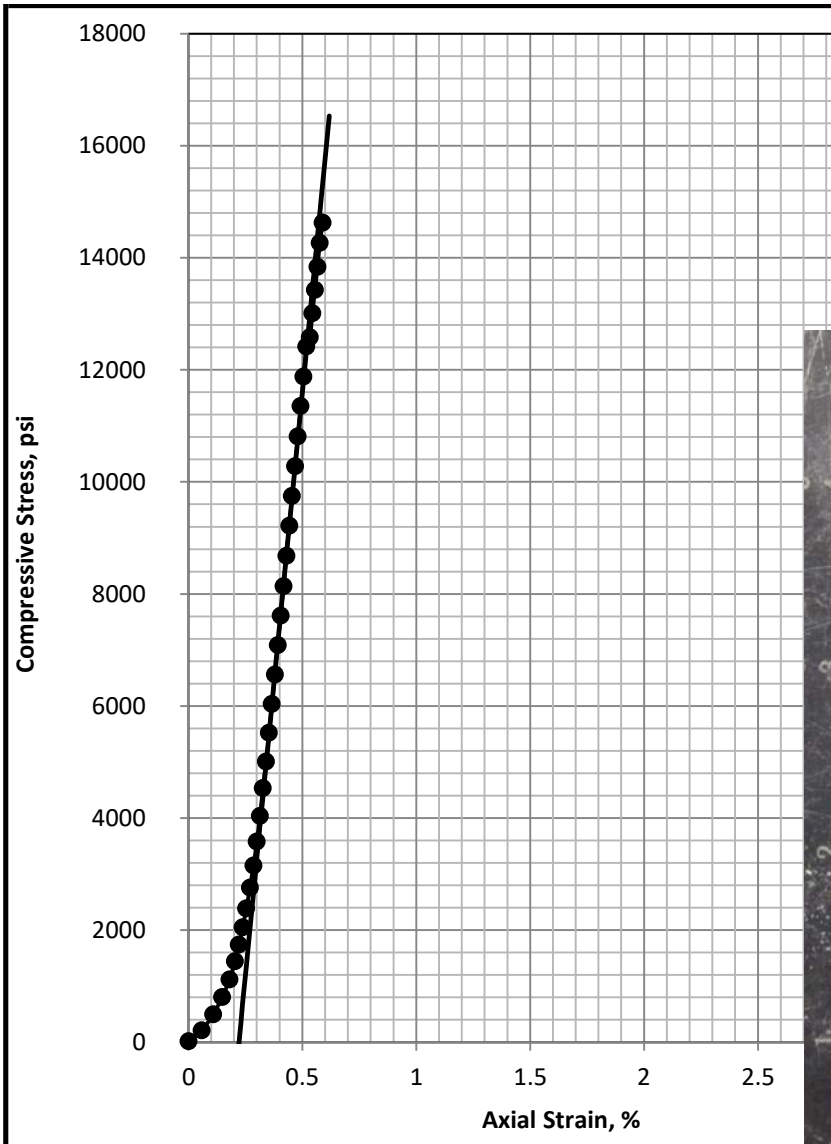
FAILURE PHOTO

Test Summary

Strain Rate (%/min)	Corrected Strain Strain to Peak (%)	q_u (psi)	Estimated (shown) Elastic Modulus (psi)
0.11	0.41	21310	5E+06

Test by: DM
Test Date: Apr-13-21
Reviewed by: GET

Aquifer	**CHPE Selkirk Catskill Borings**	**COMPRESSIVE STRESS VS STRAIN UNCONFINED COMPRESSIVE STRENGTH TEST**
TerraSense, LLC Project # 7853-21008		**Boring: SC-5 Run: R-1 Depth 16.1-16.5 ft.**



Specimen Information

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (inch)	Diameter (inch)
0.62	170	169	4.427	1.962

Specimen does not meet ASTM D4543 shape tolerances for side straightness

FAILURE PHOTO

Test Summary

Strain Rate (%/min)	Corrected Strain to Peak (%)	q_u (psi)	Estimated (shown) Elastic Modulus (psi)
0.13	0.37	14630	4E+06

Test by: DM
Test Date: Apr-13-21
Reviewed by: GET

Aquifer	**CHPE Selkirk Catskill Borings**	**COMPRESSIVE STRESS VS STRAIN UNCONFINED COMPRESSIVE STRENGTH TEST**
TerraSense, LLC Project # 7853-21008		**Boring: SC-5 Run: R-4 Depth 32.2-32.6 ft.**

Terracon GeoReport

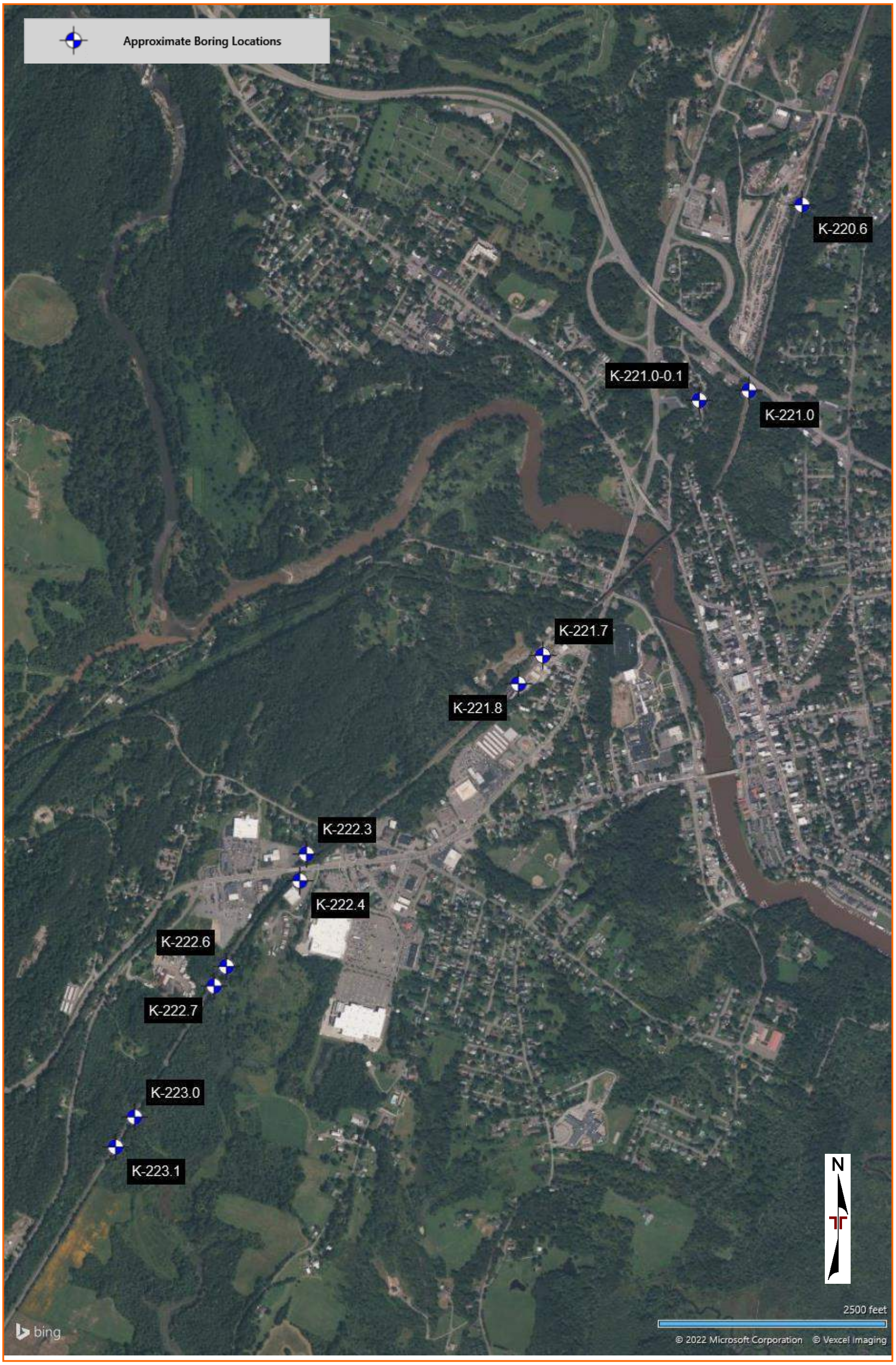


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

BORING LOG NO. K-220.6

PROJECT: Champlain-Hudson Power Express Package 7a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Catskill, NY

LOCATION See Exploration Plan

Latitude: 42.234306° Longitude: -73.863847°

Surface Elev.: 112.26 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
FILL - CINDERS, ASH AND GRAVEL, black, loose to medium dense					10	6-6-3-4 N=9			
					13	7-9-7-5 N=16			
4.0	108.5								
FILL - LEAN CLAY, with gravel and occasional bricks noted, brown, stiff		5			12	3-3-7-17 N=10			
6.0	106.5								
FILL - SILTY GRAVEL WITH SAND, occasional bricks noted, brown, medium dense					12	12-7-7-9 N=14	9.9	NP	22
8.0	104.5								
FILL - LEAN CLAY, with gravel and occasional bricks noted, brown, stiff					0.5	7-6-3-5 N=9			
		10			0.5	6-6-6-8 N=12			
13.0	99.5								
FILL - WELL GRADED SAND WITH SILT AND GRAVEL, occasional bricks noted, brown, loose			▽		5	2-3-3-3 N=6	16.6	NP	12
		15							
18.0	94.5								
WEATHERED ROCK, gray, very dense						50/0"			
20.0	92.5	20							
GRAYWACKE, highly weathered, close to moderate fractured, fair RQD, gray						REC = 66% RQD = 55%			
25.0	87.5	25							

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

Hammer Type: Automatic

Advancement Method:
4 1/4" 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 LC
Hammer Efficiency Summary:
Energy Transfer Ratio: 89.1% +/- 4.4%
Hammer Efficiency Correction (CE): 1.49

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 03-16-2022 | Boring Completed: 03-16-2022

Drill Rig: Mobile B-57 | Driller: L. Spicher

Project No.: JB215256D

BORING LOG NO. K-220.6

PROJECT: Champlain-Hudson Power Express Package 7a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Catskill, NY

LOCATION See Exploration Plan

Latitude: 42.234306° Longitude: -73.863847°

Surface Elev.: 112.26 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	30.0	82.5	30				REC = 22% RQD = 0%			

GRAYWACKE, highly weathered, very close to moderate fractured, very poor RQD, gray

Boring Terminated at 30 Feet

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

Hammer Type: Automatic

Advancement Method:
4 1/4" 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 LC
Hammer Efficiency Summary:
Energy Transfer Ratio: 89.1% +/- 4.4%
Hammer Efficiency Correction (CE): 1.49

WATER LEVEL OBSERVATIONS

While drilling

Terracon
30 Corporate Cir Ste 201
Albany, NY

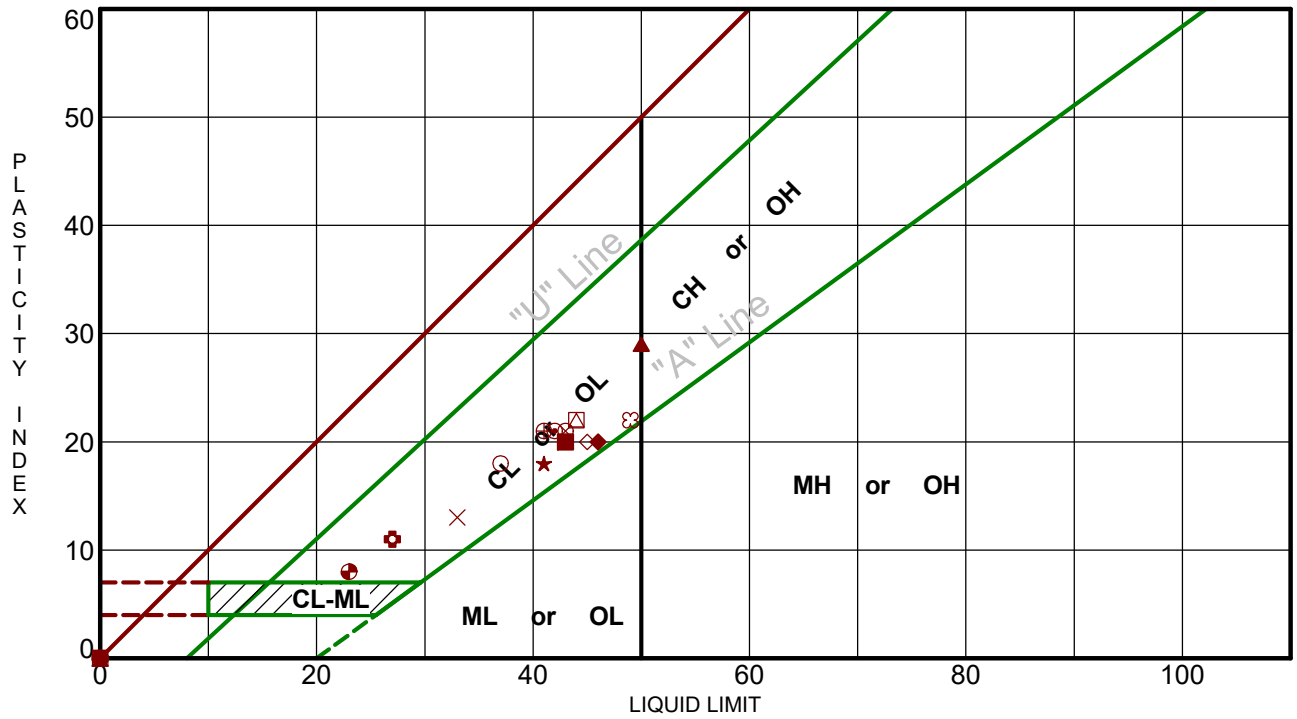
Boring Started: 03-16-2022 | Boring Completed: 03-16-2022

Drill Rig: Mobile B-57 | Driller: L. Spicher

Project No.: JB215256D

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	K-220.6	6 - 8	NP	NP	NP	22.1	GM	SILTY GRAVEL with SAND
⊠	K-220.6	13 - 15	NP	NP	NP	11.9	SW-SM	WELL-GRADED SAND with SILT and GRAVEL
▲	K-221.0	8 - 10	50	21	29	73.4	CH	FAT CLAY with SAND
★	K-221.0	23 - 25	41	23	18	89.8	CL	LEAN CLAY
⊙	K-221.7	10 - 12	42	21	21	93.6	CL	LEAN CLAY
✿	K-221.7	33 - 35	27	16	11	58.8	CL	SANDY LEAN CLAY
○	K-221.8	8 - 10	37	19	18	91.3	CL	LEAN CLAY
△	K-221.8	35 - 37	44	22	22	79.7	CL	LEAN CLAY with SAND
⊗	K-222.3	6 - 8	43	22	21	59.8	CL	SANDY LEAN CLAY
⊕	K-222.3	10 - 12	41	20	21	69.6	CL	SANDY LEAN CLAY
□	K-222.4	10 - 12	44	22	22	87.3	CL	LEAN CLAY
⊛	K-222.6	15 - 17	NP	NP	NP	6.5	GW-GM	WELL-GRADED GRAVEL with SILT and SAND
◕	K-222.6	35 - 37	23	15	8	86.7	CL	LEAN CLAY
☆	K-222.7	10 - 12	NP	NP	NP	25.3	GM	SILTY GRAVEL with SAND
❀	K-222.7	25 - 27	49	27	22	76.3	CL	LEAN CLAY with SAND
■	K-223.0	10 - 12	43	23	20	58.5	CL	SANDY LEAN CLAY
◆	K-223.0	25 - 27	46	26	20	84.9	CL	LEAN CLAY with SAND
◇	K-223.1	15 - 17	45	25	20	71.3	CL	LEAN CLAY with SAND
×	K-223.1	29 - 31	33	20	13	98.3	CL	LEAN CLAY

PROJECT: Champlain-Hudson Power Express
Package 7a

SITE: Champlain to Hudson HDD Crossings
Catskill, NY

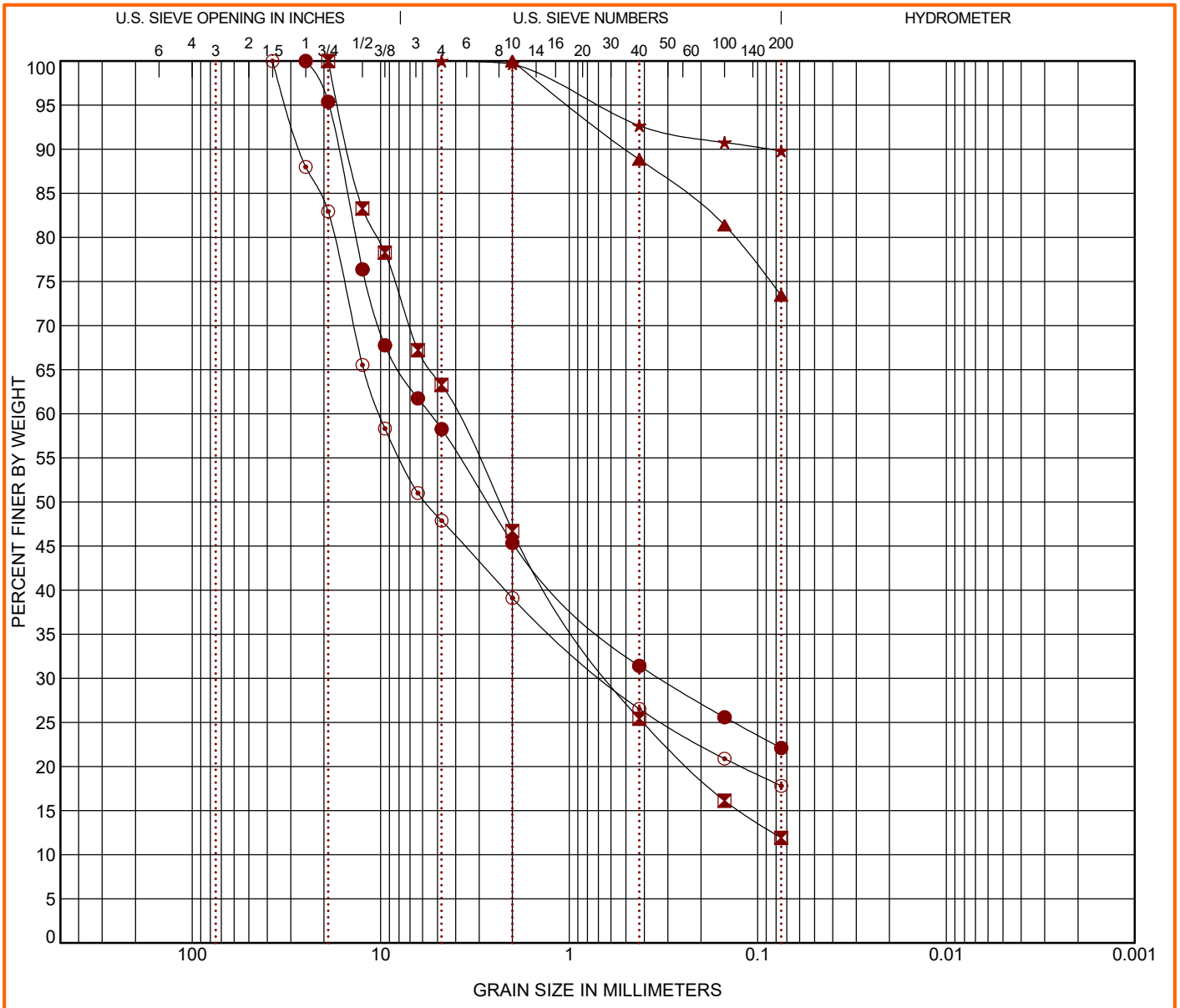
Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215256D

CLIENT: Kiewit Engineering (NY) Corp.

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-220.6	6 - 8	SILTY GRAVEL with SAND (GM)	9.9	NP	NP	NP		
⊠	K-220.6	13 - 15	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	16.6	NP	NP	NP	1.60	73.20
▲	K-221.0	8 - 10	FAT CLAY with SAND (CH)	32.4	50	21	29		
★	K-221.0	23 - 25	LEAN CLAY (CL)	30.9	41	23	18		
⊙	K-221.0-0.1	8 - 10	SILTY GRAVEL with SAND (GM)	12.0					

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	K-220.6	6 - 8	25	5.489	0.33		0.0	41.7	36.2		22.1	
⊠	K-220.6	13 - 15	19	4.006	0.593		0.0	36.7	51.4		11.9	
▲	K-221.0	8 - 10	2				0.0	0.0	26.6		73.4	
★	K-221.0	23 - 25	4.75				0.0	0.0	10.2		89.8	
⊙	K-221.0-0.1	8 - 10	37.5	10.125	0.651		0.0	52.1	30.1		17.8	

PROJECT: Champlain-Hudson Power Express Package 7a

SITE: Champlain to Hudson HDD Crossings Catskill, NY

Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215256D

CLIENT: Kiewit Engineering (NY) Corp.

GeoTesting EXPRESS

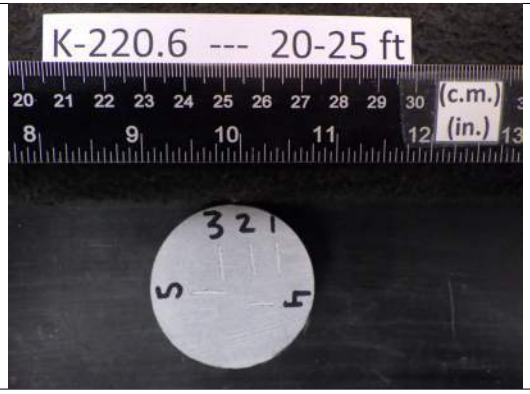
Client:	Terracon Consultants, Inc.				
Project:	Champlain-Hudson Power Express				
Location:				Project No:	GTX-315284
Boring ID:	K-220.6	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	---	Test Date:	04/29/22	Checked By:	smd
Depth :	20-25 ft	Test Id:	664262		
Test Comment:	---				
Visual Description:	---				
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-220.6	---	20-25 ft	1	0.6	0.3	0.45	
			2	0.5	1.2	0.85	
			3	0.6	0.7	0.65	
			4	0.2	0.7	0.45	
			5	0.8	0.7	0.75	
			Average CAIs			0.63	
			Average CAI *			1.10	
				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:

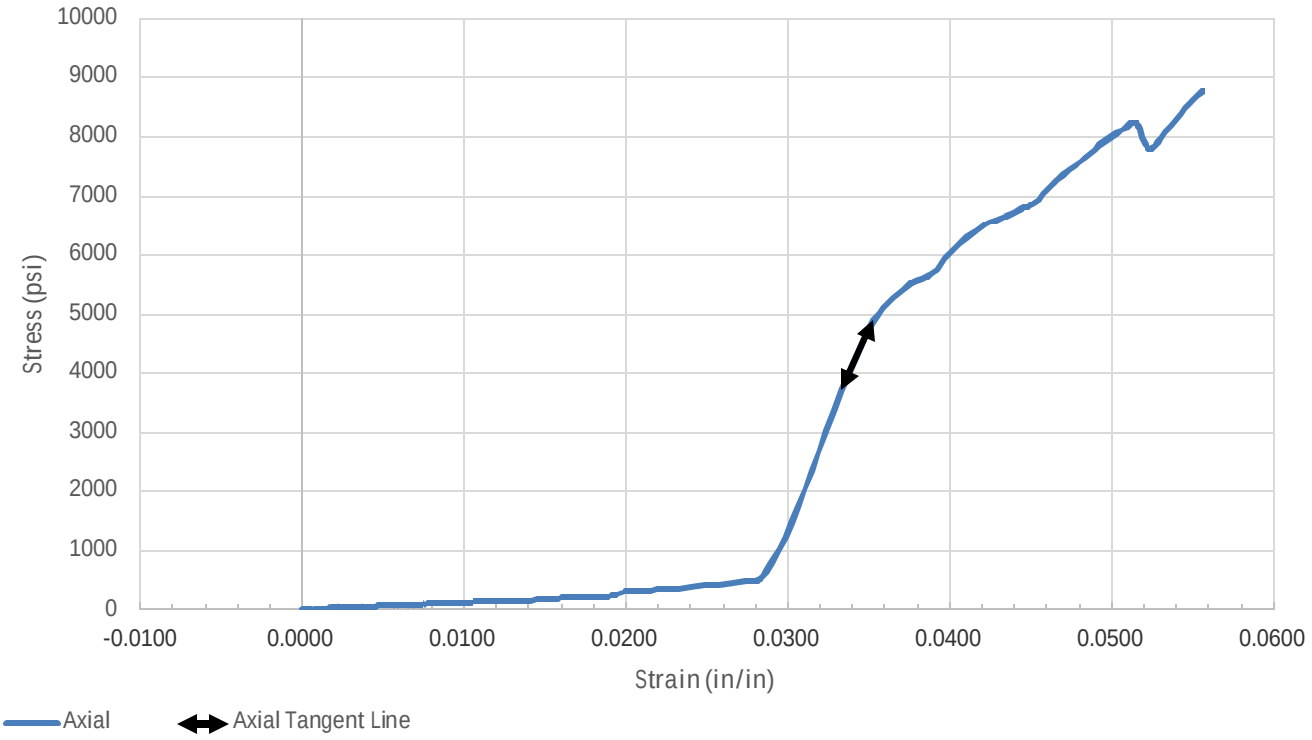


Rock Core D7012 Method C

Client
Kiewit Engineering Corp

Project
Champlain-Hudson Power Express Project

Project No. JD215256



SAMPLE LOCATION

Site:	Kiewit Engineering Power Express		
Description:	Calcareous Meta Sandstone		
Boring:	K-220.6	Depth (feet):	20-25

SPECIMEN INFORMATION

Sample No.:		Mass (g):	552
Length (in.):	4.09	Diameter (in.):	1.97
L/D Ratio:	2.076	Density (pcf):	168.683

TEST RESULTS

Failure Load (lbs):	26760
Failure Strain (in/in):	0.057
Unconfined Compressive Strength (psi):	8,780
Elastic Modulus, E, (ksi):	598
Time of Failure (min):	03:19
Rate of Loading (in/sec):	0.04
Moisture Content Post-break:	0.63%

Rock Core D7012 Method C

Client
Kiewit Engineering Corp

Project
Champlain-Hudson Power Express Project

Project No. JD215256

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 straightness, by exceeding 0.02 inches.
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.

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.

PHOTOGRAPHY LOG

Rock Core – Boring K-220.6 (samples pulled for testing)

Rock Core – Boring K-221.0-0.1(Runs 1 to 4)

Package 7A Phase 3 Borings

Champlain Hudson Power Express

New York

PROJECT NUMBER 20001480

CREATED BY Kiewit

DATE 12/08/2022

Legend Key

- Kiewit Borings (Phase 3)

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: KB-220.5

PROJECT NUMBER	20001480	**LOGGED BY**	J. Knighton	**COORDINATES**	N 1239852.30 E 664422.09
START DATE	09/14/2022	**DRILLER/RIG**	T. Van Ness / CME-75	**GROUND ELEV.**	117.7 ft
FINISH DATE	09/16/2022	**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		FILL: Silty SAND with Gravel (SM), brown, loose to dense, fine to coarse, moist			75%		12-13-27-25 (40)	Boring advanced with 3-7/8" Mud Rotary
					50%		31-19-12-10 (31)	
5					38%		3-2-6-5 (8)	
		Rock stuck in shoe at 6 - 8 ft			10%		2-7-9-10 (16)	
					62%		6-9-10-12 (19)	
10	107.7	Weathered rock			52%		14-21-31-50/5" (52)	
	104.7	Graywacke, gray, closely to moderately spaced discontinuities, poor RQD, moderately weathered, with highly weathered veins						Roller bit to 15 ft Set 3" casing to 16 ft
15				1	77% 42			
20								Barrel plugged at 20.5 ft
		Closely spaced discontinuities, very poor RQD, moderately to highly weathered		2	70% 32			
25	92.7	Shale, dark gray, very closely to closely spaced discontinuities, high angle joints, very poor RQD, slightly to highly weathered		3	54% 24			
30								

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-220.5

PROJECT NUMBER	20001480	**LOGGED BY**	J. Knighton	**COORDINATES**	N 1239852.30 E 664422.09
START DATE	09/14/2022	**DRILLER/RIG**	T. Van Ness / CME-75	**GROUND ELEV.**	117.7 ft
FINISH DATE	09/16/2022	**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
35		Shale, dark gray, very closely to closely spaced discontinuities, high angle joints, very poor RQD, slightly to highly weathered		4	78% 43			
		With calcareous veins and voids at 33 ft						
		Gray, closely to moderately spaced discontinuities, fair RQD, moderately weathered		5	99% 70			
40	77.7	Graywacke, dark gray, with some shale lenses and occasional calcite fractures, poor to fair RQD, slightly weathered		6	96% 53			
45				7	96% 70			
50								UCS = 9826 psi
				8	97% 66			
55								
				9	98% 71			
60								

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-220.5

PROJECT NUMBER	20001480	**LOGGED BY**	J. Knighton	**COORDINATES**	N 1239852.30 E 664422.09
START DATE	09/14/2022	**DRILLER/RIG**	T. Van Ness / CME-75	**GROUND ELEV.**	117.7 ft
FINISH DATE	09/16/2022	**DRILL CONTRACTOR**	ADT Inc.	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
			Graywacke, dark gray, with some shale lenses and occasional calcite fractures, poor to fair RQD, slightly weathered		10	100% / 74			
65	52.7		Boring Terminated at 65 ft						Potential artesian conditions, water slowly coming out of casing the morning of 9/16/22
70									
75									
80									
85									
90									

Legend

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

20 40 60 80

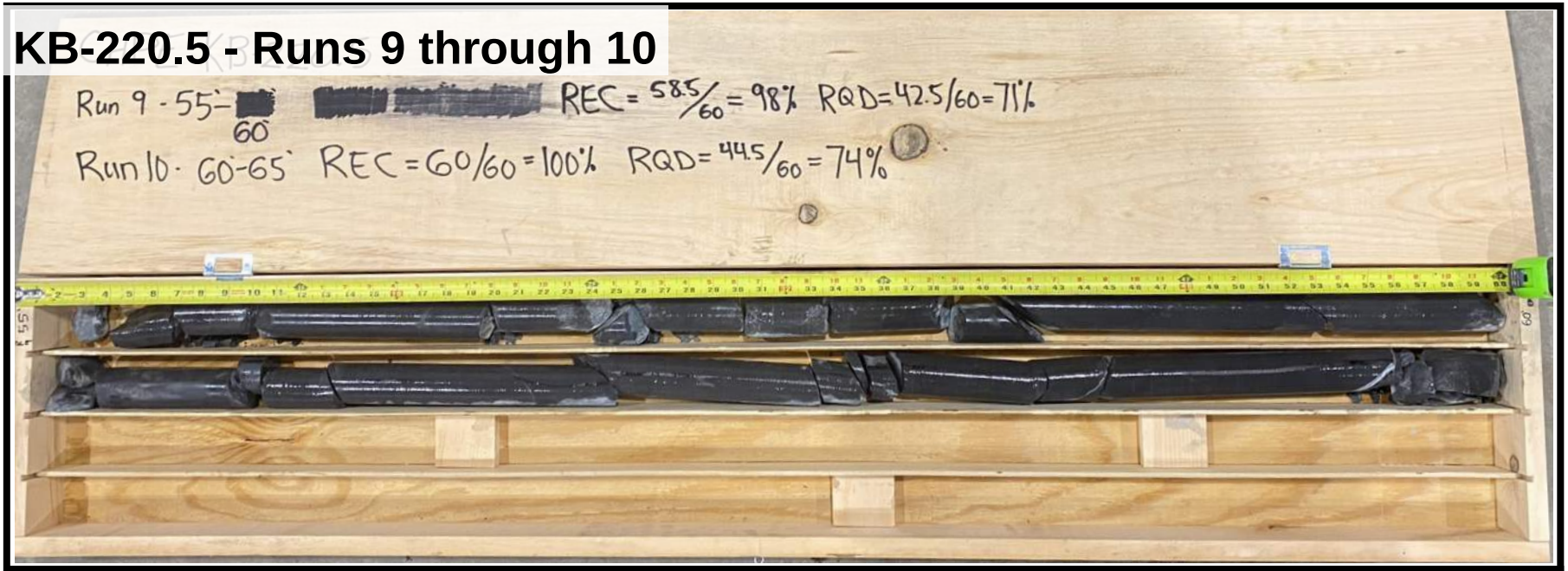
Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

KB-220.5 - Runs 1 through 4

KB-220.5 - Runs 5 through 8

Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

KB-220.5 - Runs 9 through 10



Summary of Laboratory Results

BORING ID	Depth (Ft.)	Water Content (%)
KB-183.6	8	11.5
KB-183.8	4-6	12.7
KB-184.0	4-6	19.9
KB-184.0	10-12	14.1
KB-187.5	10-12	15.9
KB-187.5	20-22	9.2
KB-187.5	30-32	14.1
KB-187.5	40-42	12.2
KB-187.5	45-47	10.9
KB-187.5	60-62	7.5
KB-187.7	10-12	6.3
KB-187.7	20-22	24.3
KB-187.7	35-37	7.2
KB-187.7	55-57	6.6
KB-190.8	4-6	10.9
KB-190.8	15-17	22.7
KB-191.7	4-6	24.0
KB-191.7	10-12	28.2
KB-191.7	25-27	33.6
KB-192.8A	8-10	29.1
KB-192.8A	20-22	30.3
KB-192.8A	40-42	19.6
KB-193.9	4-6	30.2
KB-193.9	10-12	35.1
KB-193.9	15-17	36.0
KB-193.9	35-37	56.2
KB-194.0	4-6	37.9
KB-194.0	15-17	49.1
KB-194.0	25-27	49.4
KB-194.0	35-37	11.2
KB-220.5	8-10	14.2
KB-221.0A	4-6	30.5
KB-221.0A	8-10	9.0
KB-221.0A	15-17	6.1
KB-221.0A	25-27	6.1
KB-221.0A	35-37	6.8
KB-221.3	8	17.8
KB-221.4	4-6	14.8
KB-221.4	8-10	10.5
KB-222.2	7-9	37.9
KB-222.2	25-27	36.9
KB-222.2	40-42	38.2

PROJECT: LAB Testing

SITE: Champlain- Hudson Power Express

Terracon
30 Corporate Cir Ste 201
Albany, NY

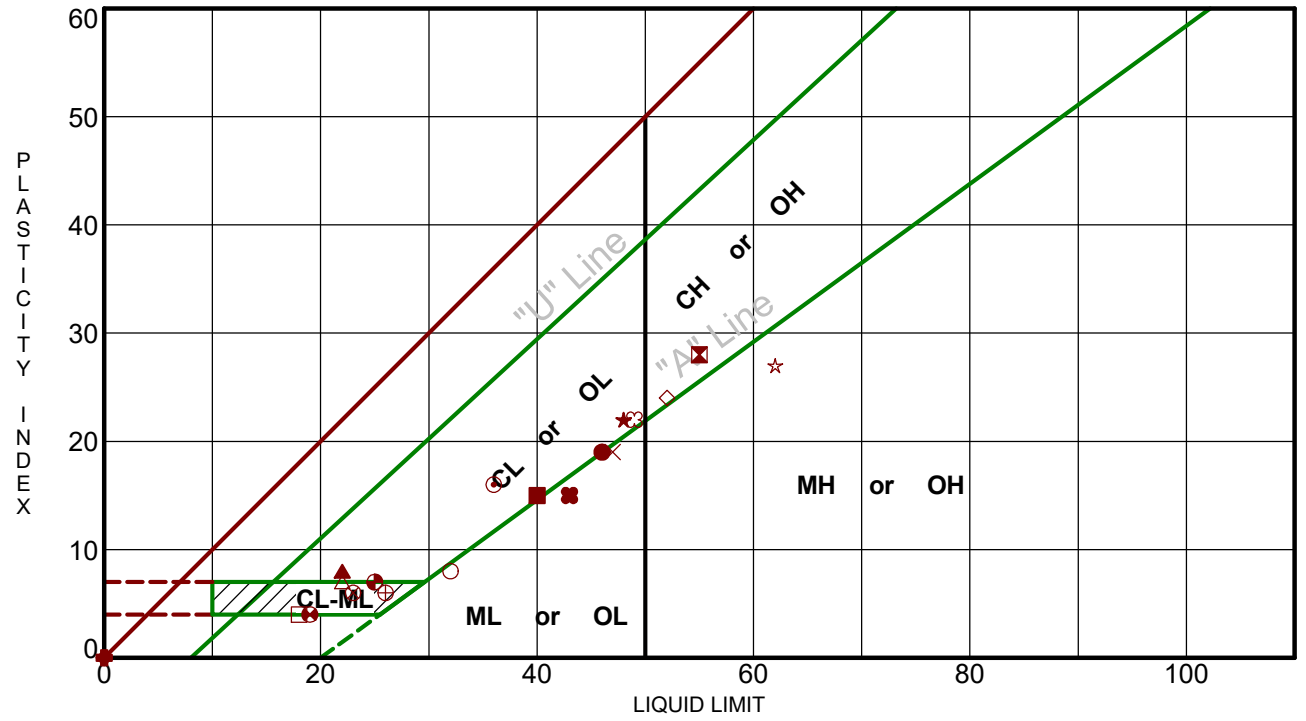
PROJECT NUMBER: JB215256H

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

EXHIBIT: B-1

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
KB-193.9	15 - 17	46	27	19	70.4	CL	LEAN CLAY with SAND
KB-193.9	35 - 37	55	27	28	96.8	CH	FAT CLAY
KB-194.0	4 - 6	22	14	8	81.9	CL	LEAN CLAY with SAND
KB-194.0	15 - 17	48	26	22	85.2	CL	LEAN CLAY
KB-194.0	25 - 27	36	20	16	97.0	CL	LEAN CLAY
KB-194.0	35 - 37	NP	NP	NP	14.7	SM	SILTY SAND with GRAVEL
KB-220.5	8 - 10	32	24	8	26.2	SM	SILTY SAND with GRAVEL
KB-221.0A	4 - 6	22	15	7	89.6	CL-ML	SILTY CLAY
KB-221.0A	8 - 10	23	17	6	11.7	GP-GC	POORLY GRADED GRAVEL with SILTY CLAY and SAND
KB-221.0A	15 - 17	26	20	6	11.8	GP-GC	POORLY GRADED GRAVEL with SILTY CLAY and SAND
KB-221.0A	25 - 27	18	14	4	25.9	GC-GM	SILTY, CLAYEY GRAVEL with SAND
KB-221.0A	35 - 37	19	15	4	21.0	SC-SM	SILTY, CLAYEY SAND with GRAVEL
KB-221.3	8	25	18	7	13.7	GC-GM	SILTY, CLAYEY GRAVEL with SAND
KB-222.2	7 - 9	62	35	27	100.0	MH	ELASTIC SILT
KB-222.2	25 - 27	49	27	22	94.8	CL	LEAN CLAY
KB-222.2	40 - 42	40	25	15	90.4	CL	LEAN CLAY
KB-222.6A	15 - 17	NP	NP	NP	7.4	GP-GM	POORLY GRADED GRAVEL with SAND and SILT
KB-222.6A	35 - 37	52	28	24	87.3	CH	FAT CLAY
KB-222.6A	50 - 52	47	28	19	96.5	ML	SILT
KB-222.6A	65 - 67	43	28	15	99.3	ML	SILT

PROJECT: LAB Testing

SITE: Champlain- Hudson Power Express

Terracon
30 Corporate Cir Ste 201
Albany, NY

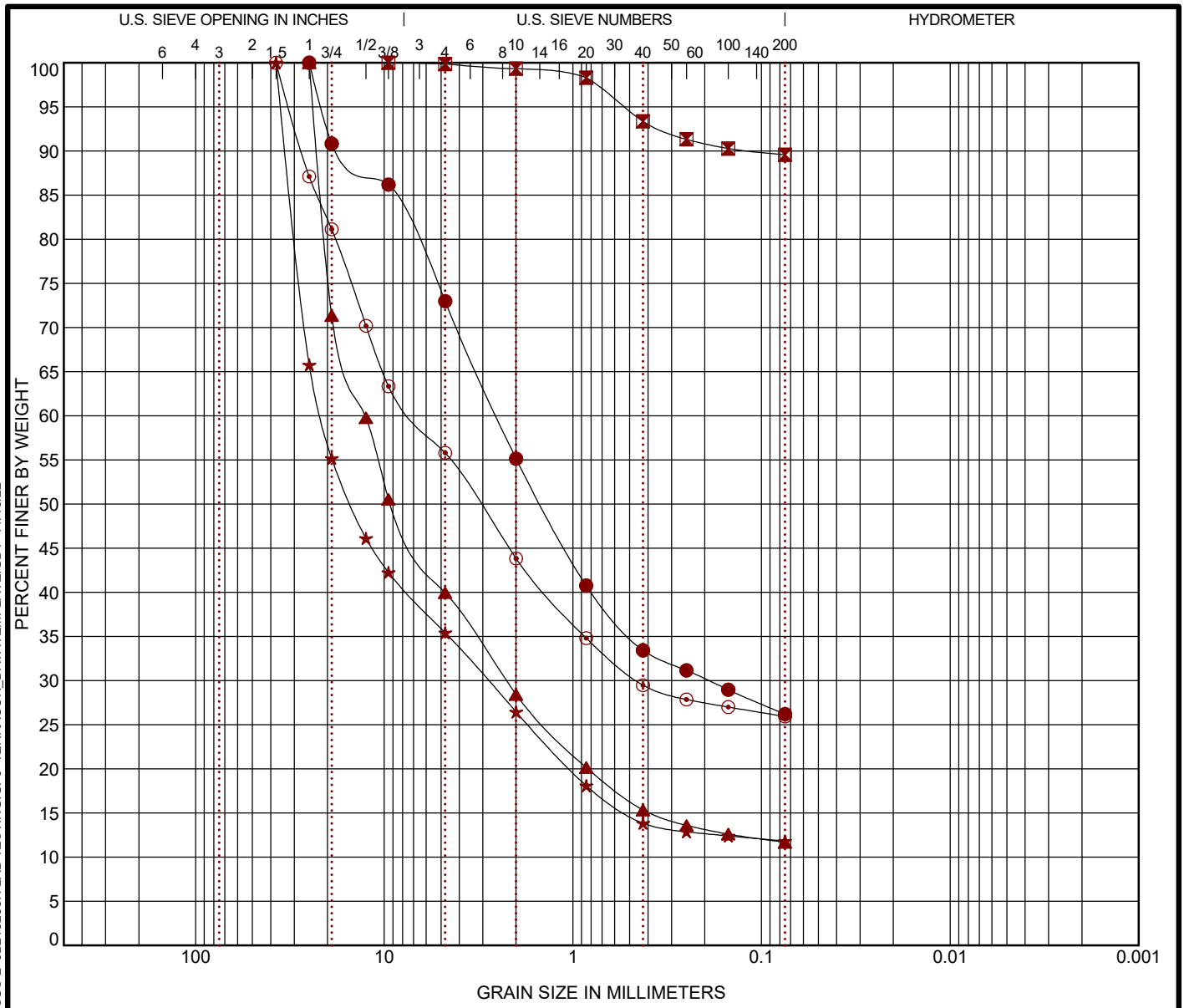
PROJECT NUMBER: JB215256H

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

EXHIBIT: B-2

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	KB-220.5	8 - 10	SILTY SAND with GRAVEL (SM)	14.2	32	24	8		
⊠	KB-221.0A	4 - 6	SILTY CLAY (CL-ML)	30.5	22	15	7		
▲	KB-221.0A	8 - 10	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	9.0	23	17	6	18.57	581.32
★	KB-221.0A	15 - 17	POORLY GRADED GRAVEL with SILTY CLAY and SAND (GP-GC)	6.1	26	20	6	44.15	2579.87
⊙	KB-221.0A	25 - 27	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	6.1	18	14	4		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	KB-220.5	8 - 10	25	2.532	0.191		0.0	27.0	46.8		26.2	
⊠	KB-221.0A	4 - 6	9.5				0.0	0.2	10.3		89.6	
▲	KB-221.0A	8 - 10	25	12.6	2.252		0.0	60.0	28.3		11.7	
★	KB-221.0A	15 - 17	37.5	21.528	2.816		0.0	64.6	23.6		11.8	
⊙	KB-221.0A	25 - 27	37.5	6.99	0.455		0.0	44.2	29.9		25.9	

PROJECT: LAB Testing

SITE: Champlain- Hudson Power Express

Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215256H

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

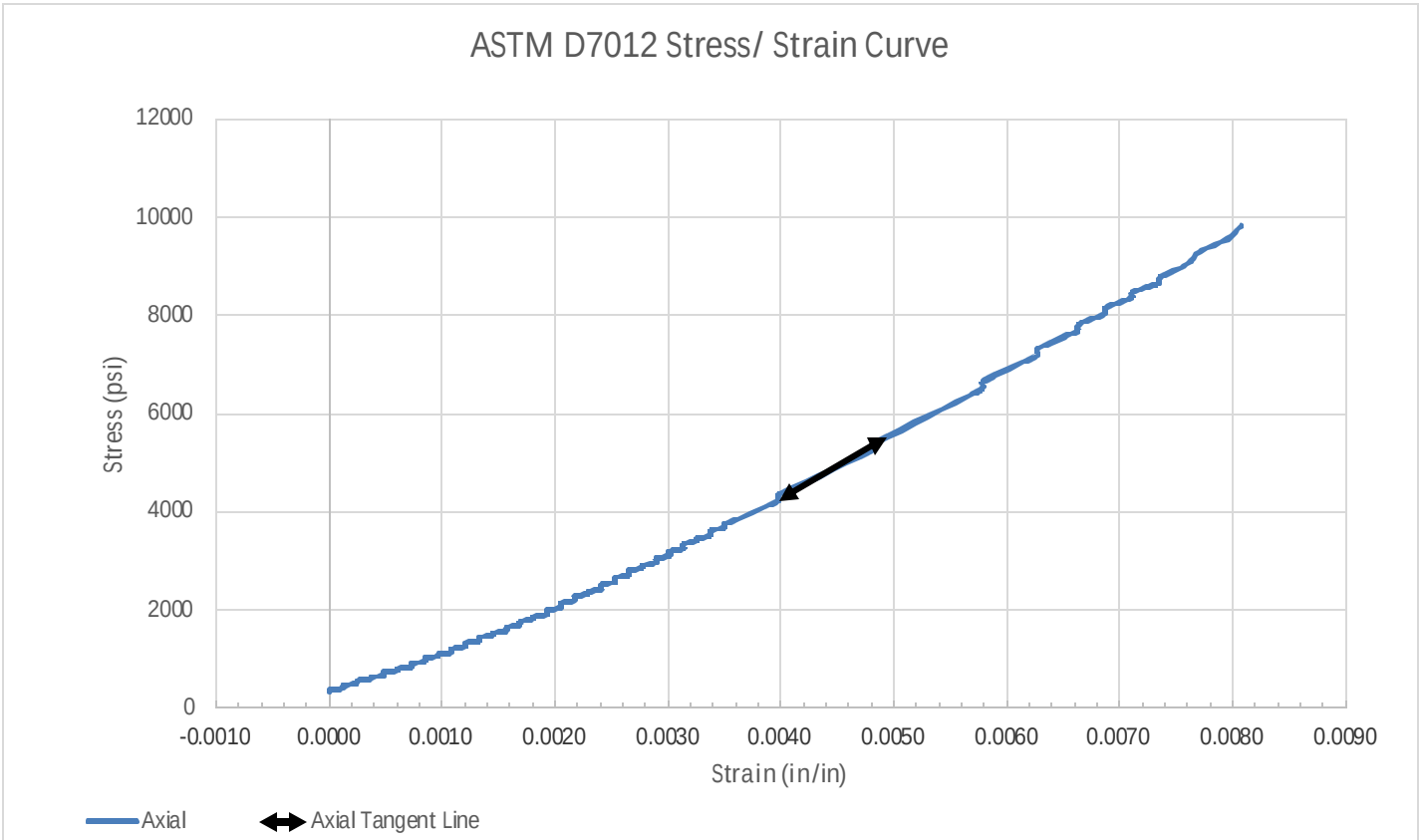
EXHIBIT: B-7

Rock Core D7012 Method C

Client
Kiewit Engineering (NY) Corp

Project
LAB Testing

Project No. JB215256H



SAMPLE LOCATION

Site:	LAB Testing		
Description:	Greywacke		
Boring:	KB-220.5	Depth (feet):	50.0-55.0

SPECIMEN INFORMATION

Sample No.:	RC8	Mass (g):	440.95
Length (in.):	4.17	Diameter (in.):	1.75
L/D Ratio:	2.38	Density (pcf):	167.48

TEST RESULTS

Failure Load (lbs):	23635
Failure Strain (in/in):	0.009
Unconfined Compressive Strength (psi):	9,826
Elastic Modulus, E, (ksi):	1348
Time of Failure (min):	02:03
Rate of Loading (in/sec):	0.04
Moisture Content Post-break:	0.27%

Rock Core D7012 Method C

Client	Project
Kiewit Engineering (NY) Corp	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 shall have a minimum diameter of 1.875 inches, or as directed by the client.
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.

Kiewit

MEMORANDUM

DATE: March 15, 2023

TO: Zachary Bauer; Tetra Tech Rooney

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

SUBJECT: Geotechnical Data: Segment 11 – Package 7A – HDD Crossing 113 – Revision 2
Champlain Hudson Power Express Project
Catskill, 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 north of Catskill, New York. The approximate station for the start of HDD crossing number 113 is STA 70055+00 (42.2305° N, 73.8650° W).

The geotechnical data at this HDD crossing is attached. The available data is taken from the previous investigation by AECOM and TRC and the recent investigations 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 177.6-228.2, dated March 15, 2013.
- Terracon Consultants-NY, Inc., Results of Field Exploration, Champlain-Hudson Power Express – Package 7a, Catskill, NY, dated May 23, 2022.
- Terracon Consultants-NY, Inc., Results of Field Exploration, Champlain-Hudson Power Express-Phase 4 HDD Borings – Package 6 and 7A, Schenectady to Selkirk, dated February 8, 2023.

Contact us if you have questions or require additional information.

HDD 113
Borings SC-6, B221.0-1,
K-221.0, KB-220.9
Segment 11 - Design Package 7A

CHPE Segment 11 - Package 7A
HDD Soil Boring Coordinates and Elevations

Firm	Boring	Northing (feet)	Easting (feet)	Ground Surface Elevation (feet)
TRC*	B221.0-1	1237452.6	663787.2	99.6
	B221.2-1	1236173.4	663261.8	115.0
	B221.4-1	1235622.5	662622.3	22.4
	B221.5-1	1235006.9	662058.8	95.5
	B221.6-1	1234675.8	661633.8	98.3
	B221.8-1	1234265.3	661277.2	99.4
	B222.34-1	1232191.5	659098.9	133.5
	B222.6-1	1231252.6	658182.3	113.7
	B222.9-1	1229751.0	657274.3	121.4
	B225.8-1	1215861.0	650622.7	91.0
	B226.1-1	1214654.4	650328.3	105.9
	B226.2-1	1214120.5	650254.4	108.5
	B226.6-1	1211894.7	649689.7	112.1
AECOM**	CU-1	1237028.6	663123.9	19.7
	CU-2	1236042.7	662897.0	24.8
	CU-2A	1235325.9	662268.9	38.1
	CU-5A	1210523.7	649411.8	118.4
	SC-5	1239310.3	664321.6	110.2
	SC-6	1237781.0	663919.8	101.6

Notes:

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

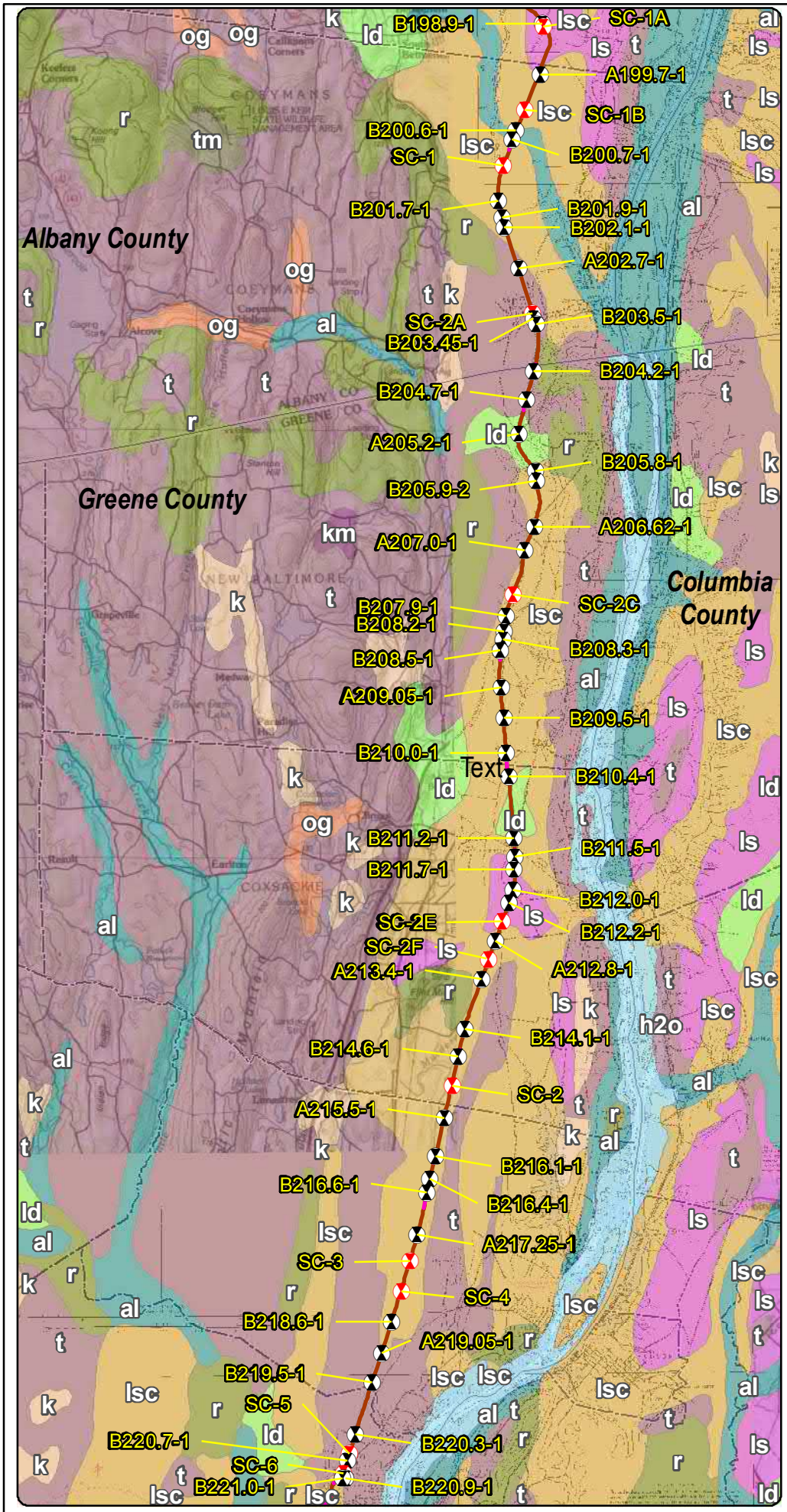
* TRC boring coordinates as shown in Table 1-6 in AECOM report (reference below). Boring elevations estimated from November 2021 topographic survey by Williams Aerial.

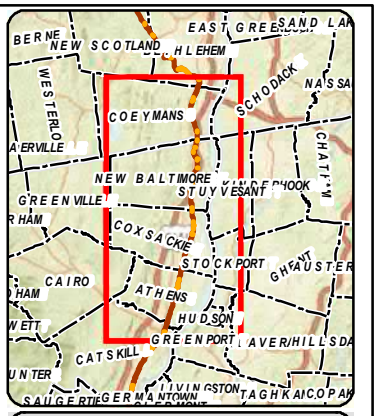
** AECOM boring coordinates and elevations as shown in Table 1-6 in AECOM report.

*** 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
- h2o - Water
- k - Kame deposits
- km - Kame moraine
- ld - Lacustrine delta
- ls - Lacustrine sand
- lsc - Lacustrine silt and clay
- og - Outwash sand and gravel
- r - Bedrock
- t - Till
- tm - Till moraine

N

1 0.5 0 1 Miles

Transmission Developments Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

Surficial Geology and Geotechnical Borings Selkirk to Catskill Figure 3-10

Prepared on 5/3/2021

by: AECOM

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

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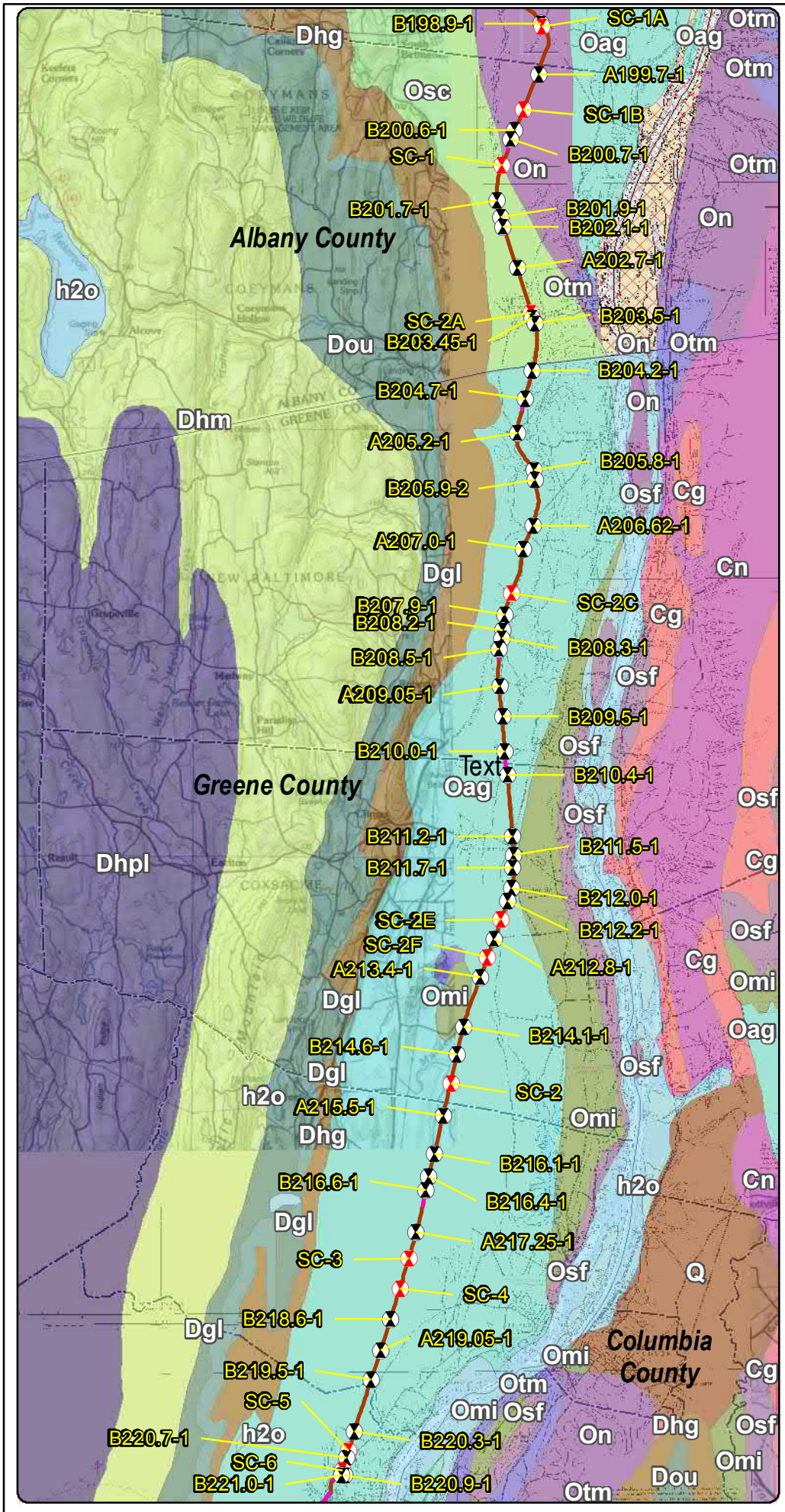

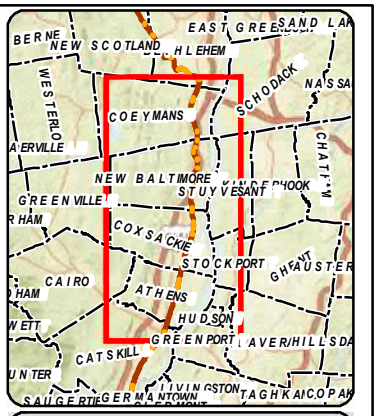

LEGEND

- 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

- Cg - Germantown Formation
- Cn - Nassau Formation
- Dgl - Glenerie Formation
- Dhg - Port Ewen Formation
- Dhm - Undiff Lower Hamilton Group
- Dhpl - Plattekill Formation
- Dou - Onondaga Limestone
- No Label
- Oag - Austin Glen Form (graywacke, shale)
- Omi - Mount Merino Formation
- On - Normanskill Shale
- Osc - Schenectady Formation
- Osf - Stuyvesant Falls Formation
- Otm - Taconic Melange
- Q - Glacial and Alluvial Deposits
- h2o - Water

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

N

1 0.5 0 1 Miles

Transmission

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

Bedrock Geology and Geotechnical Borings Selkirk to Catskill Figure 4-10

Prepared on 5/18/2021

by: AECOM

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

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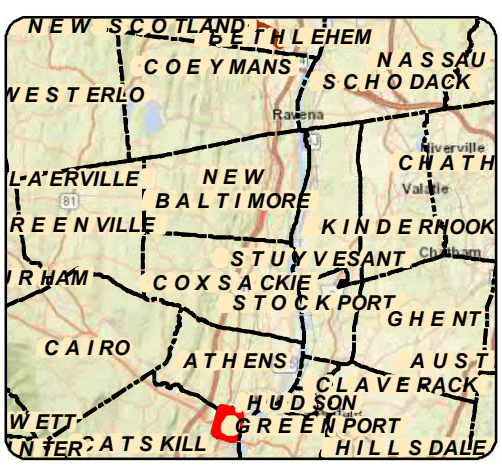

LEGEND

- 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

Selkirk to Catskill

Figure A-10

Sheet 18 of 18

Prepared by: AECOM 5/19/2021

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BORING CONTRACTOR: ADT

DRILLER: Chris Chaillou

SOILS ENGINEER/GEOLOGIST: Chris French

LOCATION: Catskill, NY MP - 220.9 (CSX Rail)

AECOM

BORING LOG

SHEET 1 OF 2

PROJECT NAME: CHPE -

PROJECT NO.: 60323056

HOLE NO.: **SC-6**

START DATE: 1/28/21

FINISH DATE: 1/28/21

OFFSET: N/A

DRILL RIG: CME LC-55

BORING TYPE: SPT

BORING O.D.: 4.5"

SURFACE ELEV.:

LONGITUDE:

LATITUDE:

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL
Water at 30' (inferred)	TYPE	Flush Joint Steel	California Modified	Tricone Roller Bit	
	SIZE I.D.	4"	2.5"	- -	
	SIZE O.D.	4.5"	3"	3 7/8"	
	HAMMER WT.	140 lbs	140 lbs		
	HAMMER FALL	30"	30"		

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					SP-SW	Gravelly SAND	0.0': Black fine to coarse SAND, some angular gravel, trace silt; frozen
1.0													
													1.0': Brown and tan silty CLAY; medium stiff, moist
2.0													
3.0													
		3'-5'	S-1								CL		TR-1; (3.0'-5.0')
4.0													
5.0													
		5'-7'	S-2	24"	24"	10	15	21	24	23	CL		Brown silty CLAY; stiff, moist
6.0													
7.0													
		7'-9'	S-3	24"	24"	41	35	34	33	45	CL		Brown silty CLAY; very stiff, moist
8.0													
													TR-2; (8.0'-8.5')
9.0													
		9'-11'	S-4	24"	13"	6	8	9	19	11	CL		Brown CLAY and silt; stiff, moist
10.0													
												Silty CLAY	
11.0													
		11'-'13'	S-5	24"	24"	10	15	19	21	22	CL		Brown CLAY and silt; very stiff, moist
12.0													
13.0													
		13'-15'	S-6	24"	24"	6	13	14	17	18	CL		Brown silty CLAY; stiff, moist
14.0													
15.0													
		15'-17'	S-7	24"	21"	15	22	20	20	27	CL		SAA
16.0													
													TR-3; (16.0'-16.5')
17.0													
18.0													
19.0													
20.0													

NOTES:

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

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

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: Chris Chaillou

SOILS ENGINEER: Chris French

AECOM

BORING LOG

SHEET 2 OF 2

PROJECT NAME: CHPE -

PROJECT NO.: 60323056

HOLE NO.: **SC-6**

START DATE: 1/28/21

FINISH DATE: 1/28/21

LOCATION: Catskill, NY MP - 220.9 (CSX Rail)

OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'	S-8	24"	24"	6	8	9	12	11	CL		Gray and Brown silty CLAY; stiff, moist
21.0													
22.0													
23.0													
24.0													
25.0													
		25'-27'	S-9	24"	24"	5	6	7	8	8	CL		Gray silty CLAY; medium stiff, moist
26.0													TR-4; (26.0'-26.5')
27.0													
28.0													
29.0													
30.0													
		30'-32'	S-10	24"	24"%	WOH	4%	5	8	6	CH	Silty CLAY	Gray silty CLAY; soft, wet
31.0													
32.0													
33.0													
34.0													
35.0													
		35'-37'	S-11	24"	24"	WOH	1	2	8	2	CH		SAA
36.0													36.8': Gray SILT and clay; soft, wet
37.0													TR-5; (36.0'-36.5')
38.0													
		38'-40'	S-12	24"	24"	WOH	5	5	6	7	CH		Gray CLAY and silt; soft, wet
39.0													
40.0													
													SC-6 terminated at 40', grouted to surface
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: CSX RAILROAD ROW, NY

BORING	**B221.0-1**
G.S. ELEV.	N/A
FILE	195651
SHEET	1 OF 1

GROUNDWATER DATA			
FIRST ENCOUNTERED NR			
DEPTH	HOUR	DATE	ELAPSED TIME
DRY	NR	11/27	0 HR

METHOD OF ADVANCING BOREHOLE				
a	FROM	0.0 '	TO	10.0 '
d	FROM	10.0 '	TO	20.0 '

DRILLER	R.CARUSO
HELPER	C. SMART
INSPECTOR	N/A
DATE STARTED	11/27/2012
DATE COMPLETED	11/27/2012

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-1	5 7 6 5			7.6	
	S-2	4 4 2 2				
5	S-3	2 2 3 3				
	S-4	5 4 3 4				
	S-5	4 4 4 4		***DARK GRAY C/F GRAVEL, SM M/C/F SAND, TR SILT (FILL)***	4.2	
10						
15	S-6	7 9 12				
				18.5		
	S-7	10 14 16		***GRAY CLAY, TR TO SM SILT*** 20.0		
20				***END OF BORING AT 20'***		
25						
30						
35						

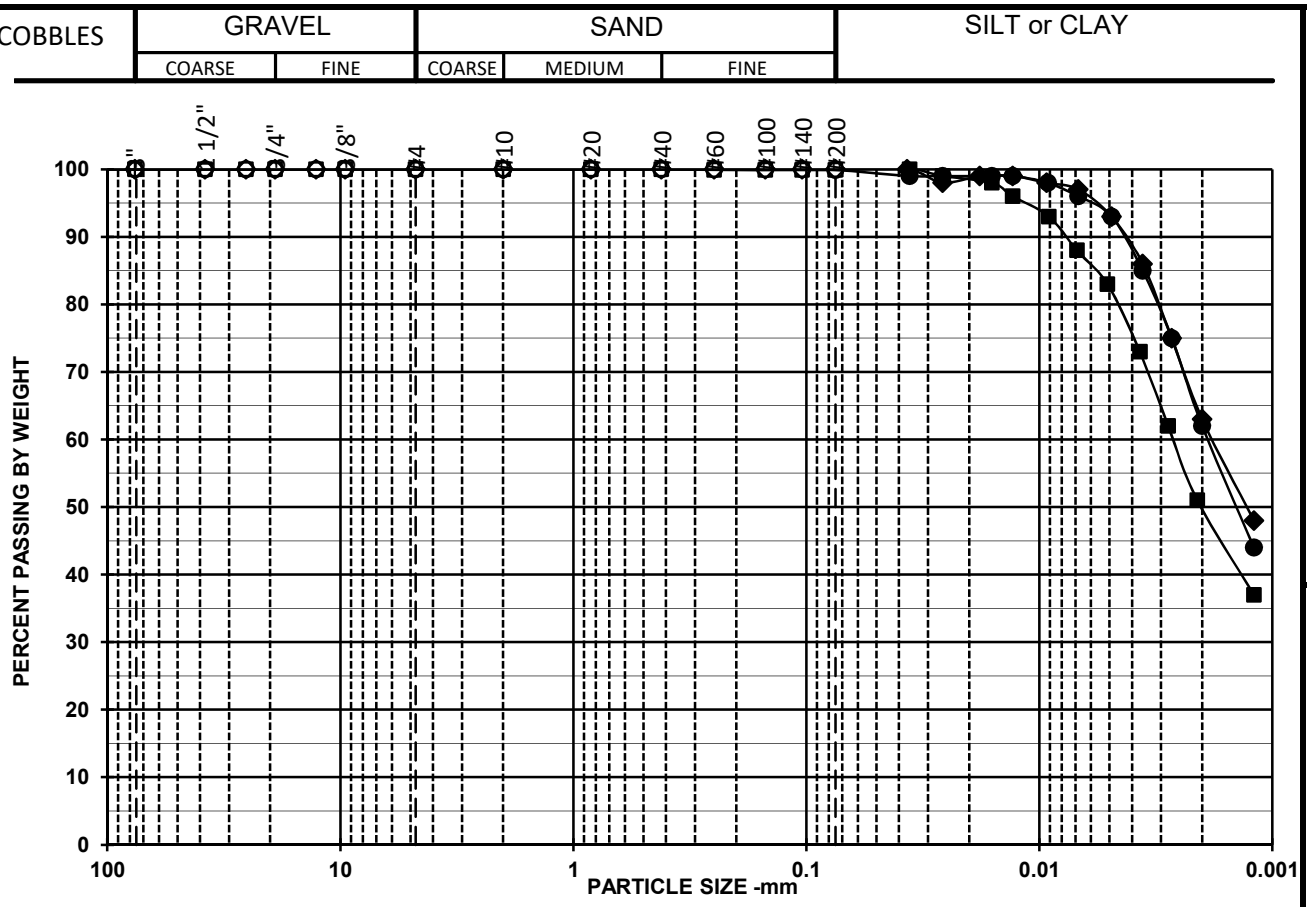
DRN.	TBT
CKD.	PWK

NEW PROJECTS TEST BORING LOG 195651_TDI_CSX.GPJ SITE BLAUVELT.GDT 3/12/13

Aquifer
CHPE - Selkirk Catskill Borings
LABORATORY SOIL TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS							REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 μm (%)	
SC-1	S-2	5-7	28.2	54	23	31	CH	99.4	45	
SC-1	S-4	9-11	25.8	44	22	22	CL	96.8	44	
SC-1A	S-3	7-9	11.7				SM	34.1	4	
SC-1A	S-8	20-22	22.6				SM	37.8	3	
SC-1A	S-10	30-32	35.3	37	19	18	CL	99.9	44	
SC-2C	S-2	5-7	5.8				GP-GM	8		
SC-2C	S-7	15-17	19.1	36	19	17	GC	35	14	
SC-2C	S-9	24-29	5.0	15	10	5	GC-GM	21	5	
SC-2E	S-2	5-7	38.1	61	25	36	CH	99.5	85	
SC-2E	S-5	11-13	39.5	47	23	24	CL	99.8	64	
SC-3	S-2	5-7	32.9	76	28	48	CH	99.4	93	
SC-3	S-8	20-22	62.4	55	24	31	CH	100	76	
SC-3	S-10	30-32	7.4				GW-GM	5	3	
SC-5	S-2	5-7	20.7	28	18	10	CL	77	15	
SC-5	S-6	13-15	24.9	40	21	19	CL	76	31	
SC-6	S-3	7-9	29.5	49	24	25	CL	99.9	50	
SC-6	S-8	20-22	35.2	49	23	26	CL	100	63	
SC-6	S-10	30-32	34.9	43	21	22	OL	99.9	62	

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	29.5	49	24	25	CL		Brown, Lean clay	04/08/21
◇	35.2	49	23	26	CL		Brownish gray, Lean clay	04/08/21
○	34.9	43	21	22	OL		Gray, Organic clay	04/08/21

Aquifer #602201207

TerraSense, LLC #7853-21008

CHPE - Selkirk Catskill Borings PO

Symbol	□	◇	○
Boring	SC-6	SC-6	SC-6
Sample	S-3	S-8	S-10
Depth	7-9	20-22	30-32
% +3"	0	0	0
% Gravel	0	0	0
% SAND	0.1	0	0.1
%C SAND	0	0	0
%M SAND	0	0	0
%F SAND	0.1	0	0.1
% FINES	99.9	100	99.9
D_{100} (mm)	0.841	0.075	0.841
D_{60} (mm)	0.003	0.002	0.002
D_{30} (mm)			
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100	100.0
4"	100.0	100	100.0
3"	100.0	100	100.0
1 1/2"	100.0	100	100.0
1"	100.0	100	100.0
3/4"	100.0	100	100.0
1/2"	100.0	100	100.0
3/8"	100.0	100	100.0
#4	100.0	100	100.0
#10	100.0	100	100.0
#20	100.0	100	100.0
#40	100.0	100	100.0
#60	99.9	100	100.0
#100	99.9	100	100.0
#140	99.9	100	100.0
#200	99.9	100	99.9
5μ m	82	93	93
2μ m	50	63	62
1μ m	32	43	38

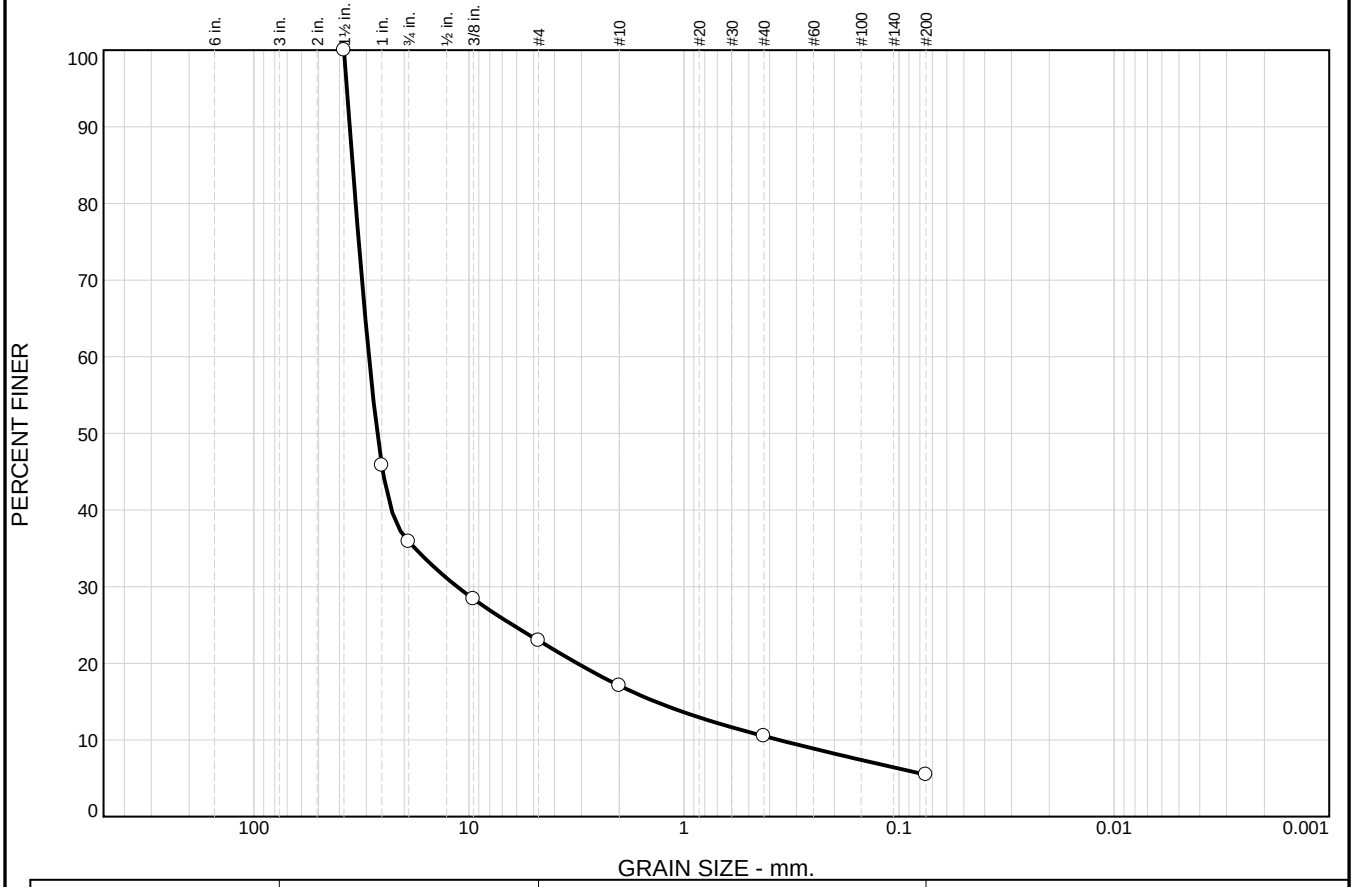
PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

SUMMARY OF LABORATORY TEST DATA

Project Name: TDI Champlain Hudson Power Express – CSX
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	-	-	-	-	-	-	-	-	-	-	20.7	88.6	-	-
	S-6	13.5-15.0	-	-	-	-	-	-	-	-	-	-	18.2	-	-	-
	S-7	18.5-20.0	-	-	-	-	-	-	-	-	-	-	21.4	-	-	-
B221.0-1	S-1	0.0-2.0	-	-	-	-	-	-	-	-	-	-	7.6	-	-	-
	S-3	4.0-6.0	GW	77.0	17.5	5.5		-	-	-	-	-	4.2	-	-	-
	S-4	6.0-8.0														
	S-5	8.0-10.0														
B221.14-1	S-1	0.0-2.0	-	-	-	-	-	-	-	-	-	-	21.3	-	-	-
	S-3	4.0-6.0	-	-	-	-	-	-	-	-	-	-	6.3	-	-	-
	S-4	6.0-8.0	GW-GM	58.7	31.3	10.0		-	-	-	-	-	6.4	-	-	-
	S-5	8.0-10.0														

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	64.1	12.9	5.9	6.6	5.0	5.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			34.7080	29.1773	26.6607	11.3379	1.3566	0.3617	12.18	80.66

Material Description	USCS	AASHTO
○ DARK GRAY C/F GRAVEL, SM M/C/F SAND, TR SILT	GW	

Project No. 195651 **Client:** TRANSMISSION DEVELOPERS INC.

Project: TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX

○ **Sample Source:** B221.0-1 **Depth:** 4.0-10.0 FT **Sample No.:** S-3, S-4, & S-5

TRC Engineers, Inc.

Mt. Laurel, NJ

Remarks:

○SAMPLE DESCRIPTION BASED ON VISUAL IDENTIFICAITON AND LABORATORY ANALYSIS

Figure 117

Tested By: TBT 01/10/13 **Checked By:** JPB 03/12/13

Terracon GeoReport

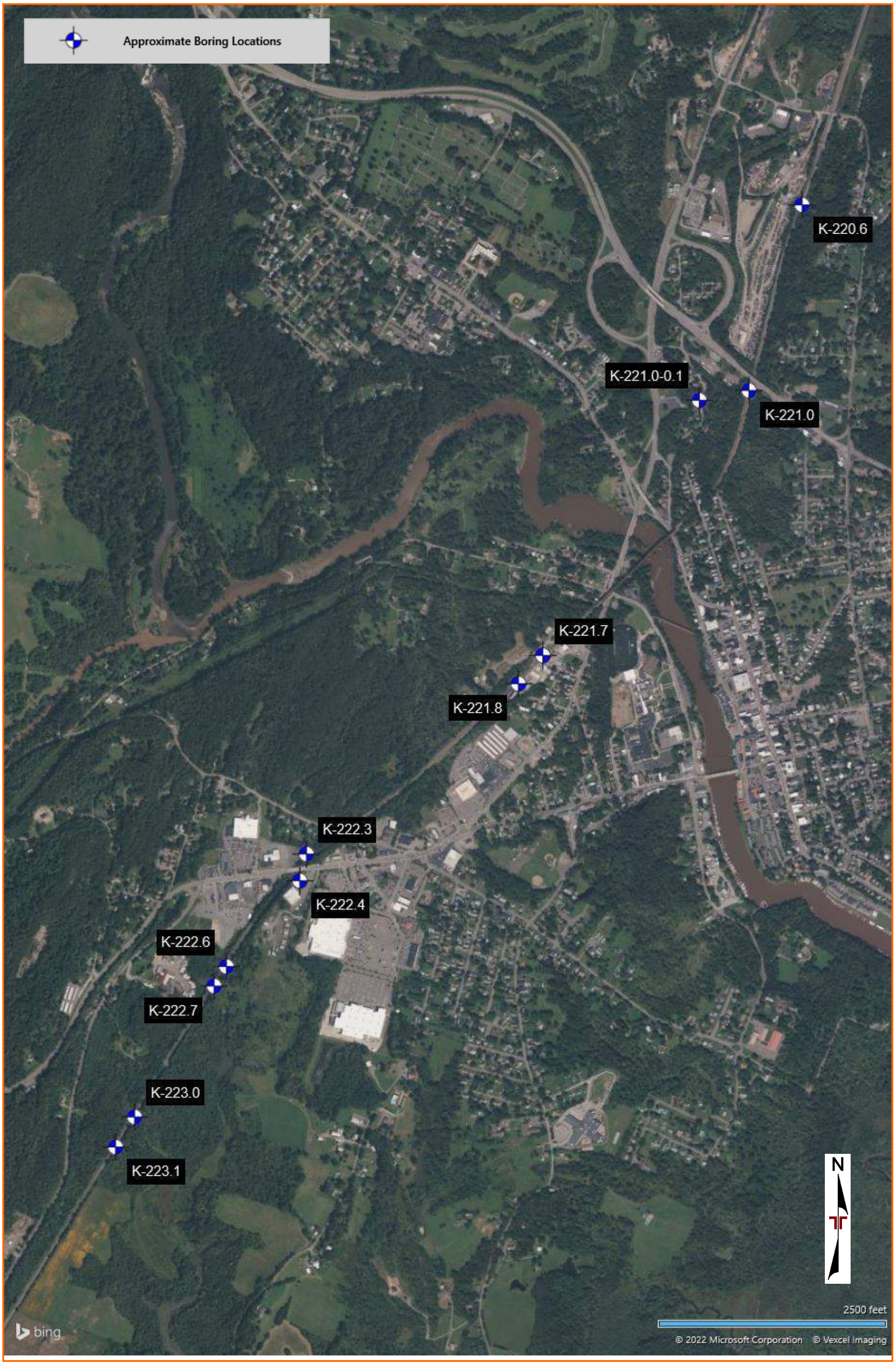


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

BORING LOG NO. K-221.0

PROJECT: Champlain-Hudson Power Express Package 7a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings
Catskill, NY

LOCATION See Exploration Plan

Latitude: 42.228733° Longitude: -73.866003°

Surface Elev.: 99.19 (Ft.)

DEPTH	ELEVATION (Ft.)	DESCRIPTION	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0	99	**FILL - SAND AND GRAVEL**, black, loose	3	2-2-3-6 N=5			
			2	2-2-3-3 N=5			
4.0	95	**SILT AND CLAY (CL-ML)**, brown, medium stiff to very stiff	4	2-2-4-5 N=6			
			13	5-7-9-8 N=16			
8.0	91	**FAT CLAY WITH SAND (CH)**, brown, stiff to very stiff	22	2-4-6-7 N=10	32.4	50-21-29	73
			12	5-8-10-12 N=18			
			22	2-5-6-9 N=11			
			24	2-4-5-6 N=9			
23.0	76	**LEAN CLAY (CL)**, brown, very soft	24	3-3-6-7 3" Split Spoon	30.9	41-23-18	90

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

Hammer Type: Automatic

Advancement Method:
4 1/4" 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 LC
Hammer Efficiency Summary:
Energy Transfer Ratio: 89.1% +/- 4.4%
Hammer Efficiency Correction (CE): 1.49
WOH = Weight of Hammer

WATER LEVEL OBSERVATIONS

No measurable groundwater prior to grouting

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 03-15-2022 | Boring Completed: 03-15-2022

Drill Rig: Mobile B-57 | Driller: L. Spicher

Project No.: JB215256D

BORING LOG NO. K-221.0

PROJECT: Champlain-Hudson Power Express Package 7a

CLIENT: Kiewit Engineering (NY) Corp.

SITE: Champlain to Hudson HDD Crossings Catskill, NY

LOCATION See Exploration Plan

Latitude: 42.228733° Longitude: -73.866003°

Surface Elev.: 99.19 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	LEAN CLAY (CL), brown, very soft *(continued)*				With Ring Sampler			
				24	WOH-WOH-WOH-2			
30.0	69	30						
	LEAN CLAY (CL), gray, very soft							
				24	WOH-WOH-WOH-1	36.0		
		35						
				24	WOH-WOH-WOH-2			
40.0	59	40						
	Boring Terminated at 40 Feet							

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

Hammer Type: Automatic

Advancement Method:
4 1/4" 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 LC
Hammer Efficiency Summary:
Energy Transfer Ratio: 89.1% +/- 4.4%
Hammer Efficiency Correction (CE): 1.49
WOH = Weight of Hammer

WATER LEVEL OBSERVATIONS

No measurable groundwater prior to grouting

Terracon
30 Corporate Cir Ste 201
Albany, NY

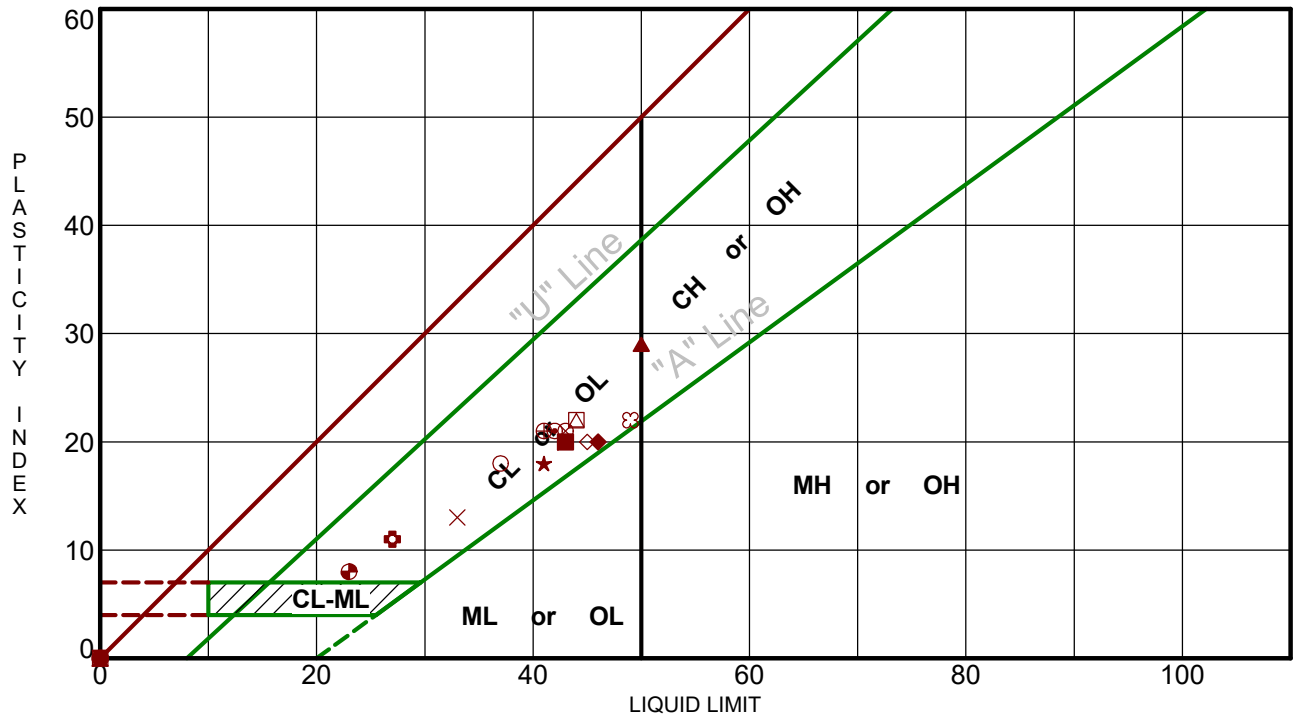
Boring Started: 03-15-2022 | Boring Completed: 03-15-2022

Drill Rig: Mobile B-57 | Driller: L. Spicher

Project No.: JB215256D

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	K-220.6	6 - 8	NP	NP	NP	22.1	GM	SILTY GRAVEL with SAND
⊠	K-220.6	13 - 15	NP	NP	NP	11.9	SW-SM	WELL-GRADED SAND with SILT and GRAVEL
▲	K-221.0	8 - 10	50	21	29	73.4	CH	FAT CLAY with SAND
★	K-221.0	23 - 25	41	23	18	89.8	CL	LEAN CLAY
⊙	K-221.7	10 - 12	42	21	21	93.6	CL	LEAN CLAY
✿	K-221.7	33 - 35	27	16	11	58.8	CL	SANDY LEAN CLAY
○	K-221.8	8 - 10	37	19	18	91.3	CL	LEAN CLAY
△	K-221.8	35 - 37	44	22	22	79.7	CL	LEAN CLAY with SAND
⊗	K-222.3	6 - 8	43	22	21	59.8	CL	SANDY LEAN CLAY
⊕	K-222.3	10 - 12	41	20	21	69.6	CL	SANDY LEAN CLAY
□	K-222.4	10 - 12	44	22	22	87.3	CL	LEAN CLAY
⊛	K-222.6	15 - 17	NP	NP	NP	6.5	GW-GM	WELL-GRADED GRAVEL with SILT and SAND
◕	K-222.6	35 - 37	23	15	8	86.7	CL	LEAN CLAY
☆	K-222.7	10 - 12	NP	NP	NP	25.3	GM	SILTY GRAVEL with SAND
❀	K-222.7	25 - 27	49	27	22	76.3	CL	LEAN CLAY with SAND
■	K-223.0	10 - 12	43	23	20	58.5	CL	SANDY LEAN CLAY
◆	K-223.0	25 - 27	46	26	20	84.9	CL	LEAN CLAY with SAND
◇	K-223.1	15 - 17	45	25	20	71.3	CL	LEAN CLAY with SAND
×	K-223.1	29 - 31	33	20	13	98.3	CL	LEAN CLAY

PROJECT: Champlain-Hudson Power Express
Package 7a

SITE: Champlain to Hudson HDD Crossings
Catskill, NY

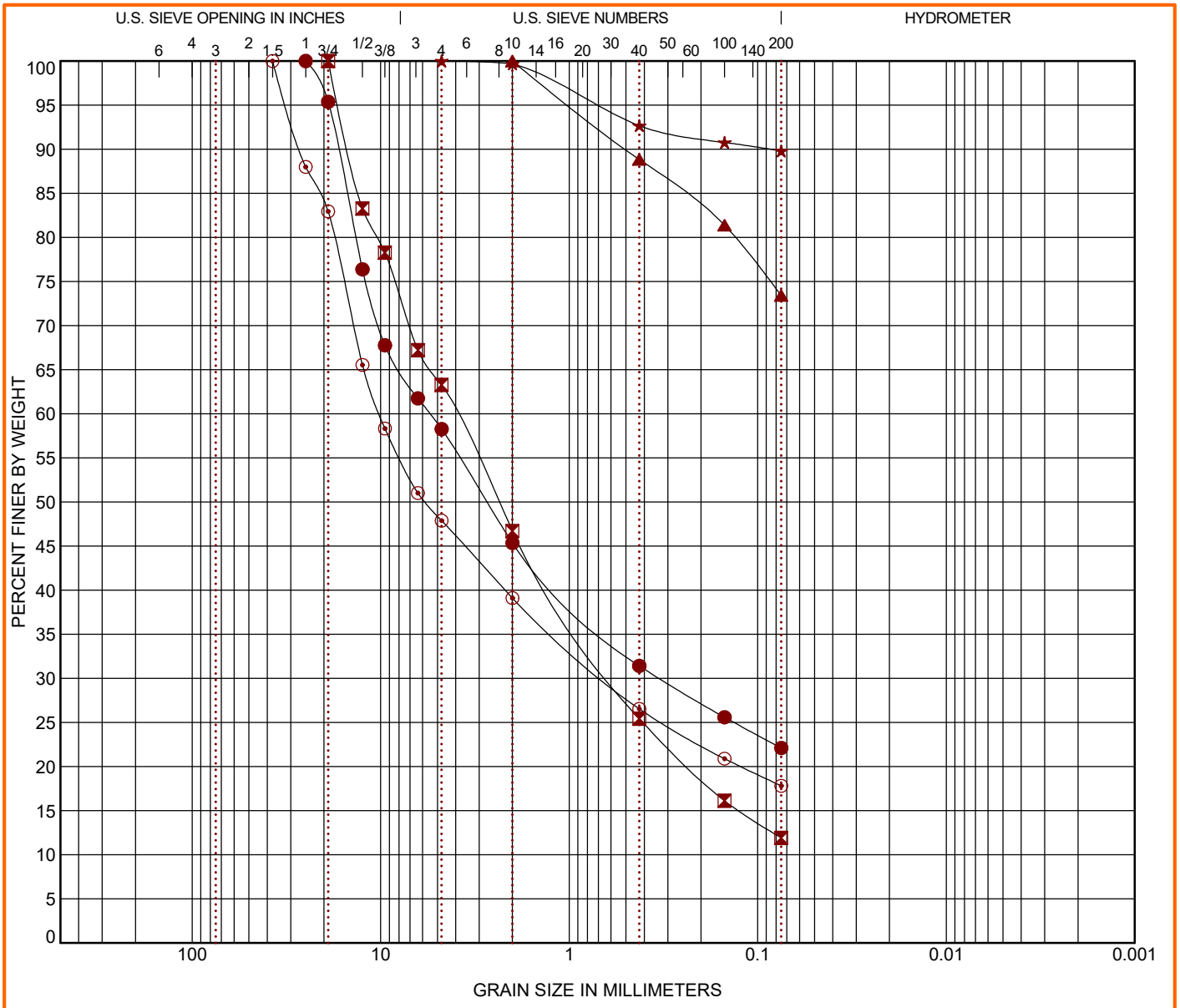
Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215256D

CLIENT: Kiewit Engineering (NY) Corp.

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-220.6	6 - 8	SILTY GRAVEL with SAND (GM)	9.9	NP	NP	NP		
⊠	K-220.6	13 - 15	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	16.6	NP	NP	NP	1.60	73.20
▲	K-221.0	8 - 10	FAT CLAY with SAND (CH)	32.4	50	21	29		
★	K-221.0	23 - 25	LEAN CLAY (CL)	30.9	41	23	18		
⊙	K-221.0-0.1	8 - 10	SILTY GRAVEL with SAND (GM)	12.0					

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	K-220.6	6 - 8	25	5.489	0.33		0.0	41.7	36.2		22.1	
⊠	K-220.6	13 - 15	19	4.006	0.593		0.0	36.7	51.4		11.9	
▲	K-221.0	8 - 10	2				0.0	0.0	26.6		73.4	
★	K-221.0	23 - 25	4.75				0.0	0.0	10.2		89.8	
⊙	K-221.0-0.1	8 - 10	37.5	10.125	0.651		0.0	52.1	30.1		17.8	

PROJECT: Champlain-Hudson Power Express Package 7a

SITE: Champlain to Hudson HDD Crossings Catskill, NY

Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215256D

CLIENT: Kiewit Engineering (NY) Corp.

SITE LOCATION

Champlain-Hudson Power Express- Phase 4 HDD Borings – Package 6 and 7A
Schenectady through Selkirk, NY
February 8, 2023 ■ Terracon Project No. JB215256J

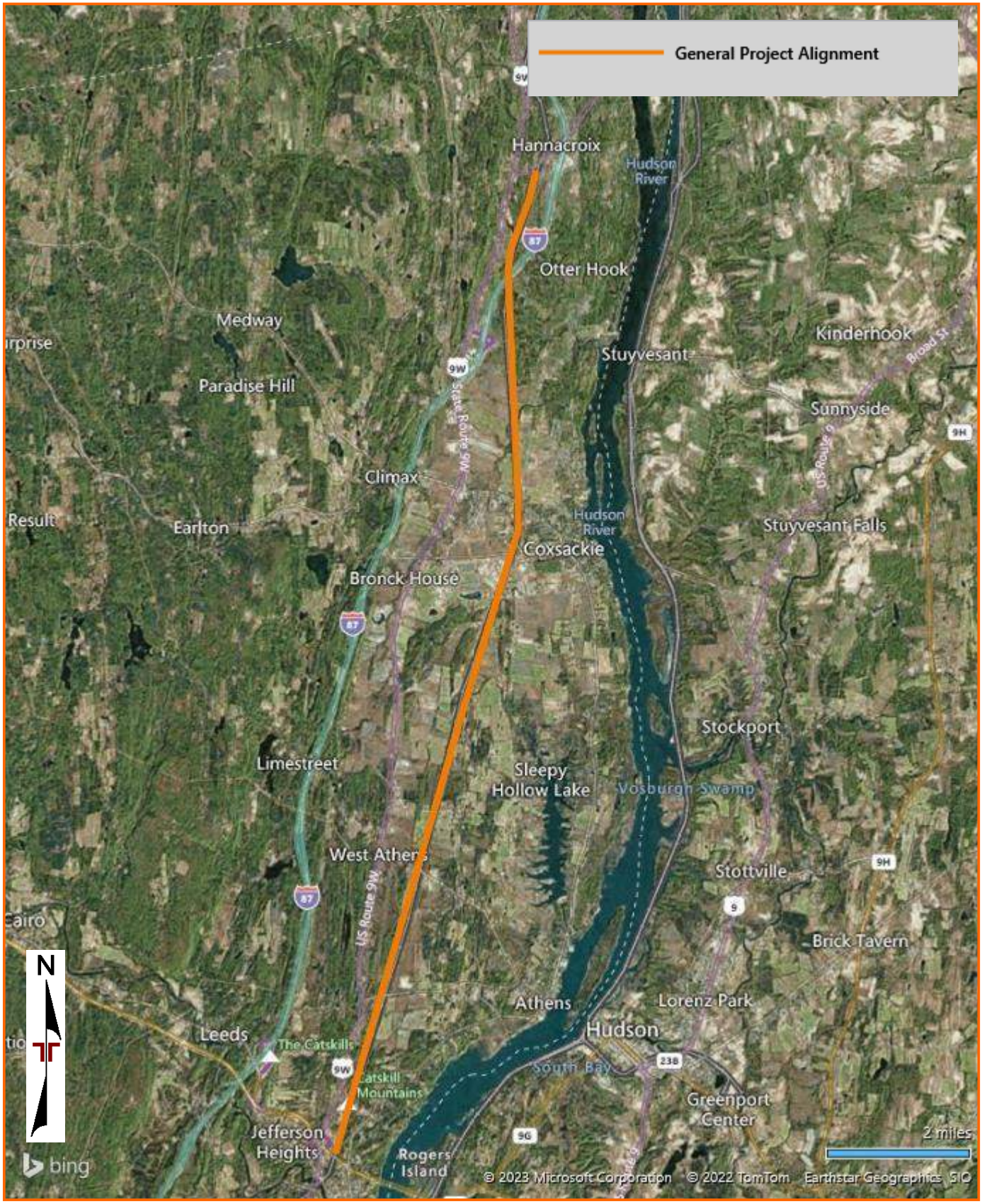


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

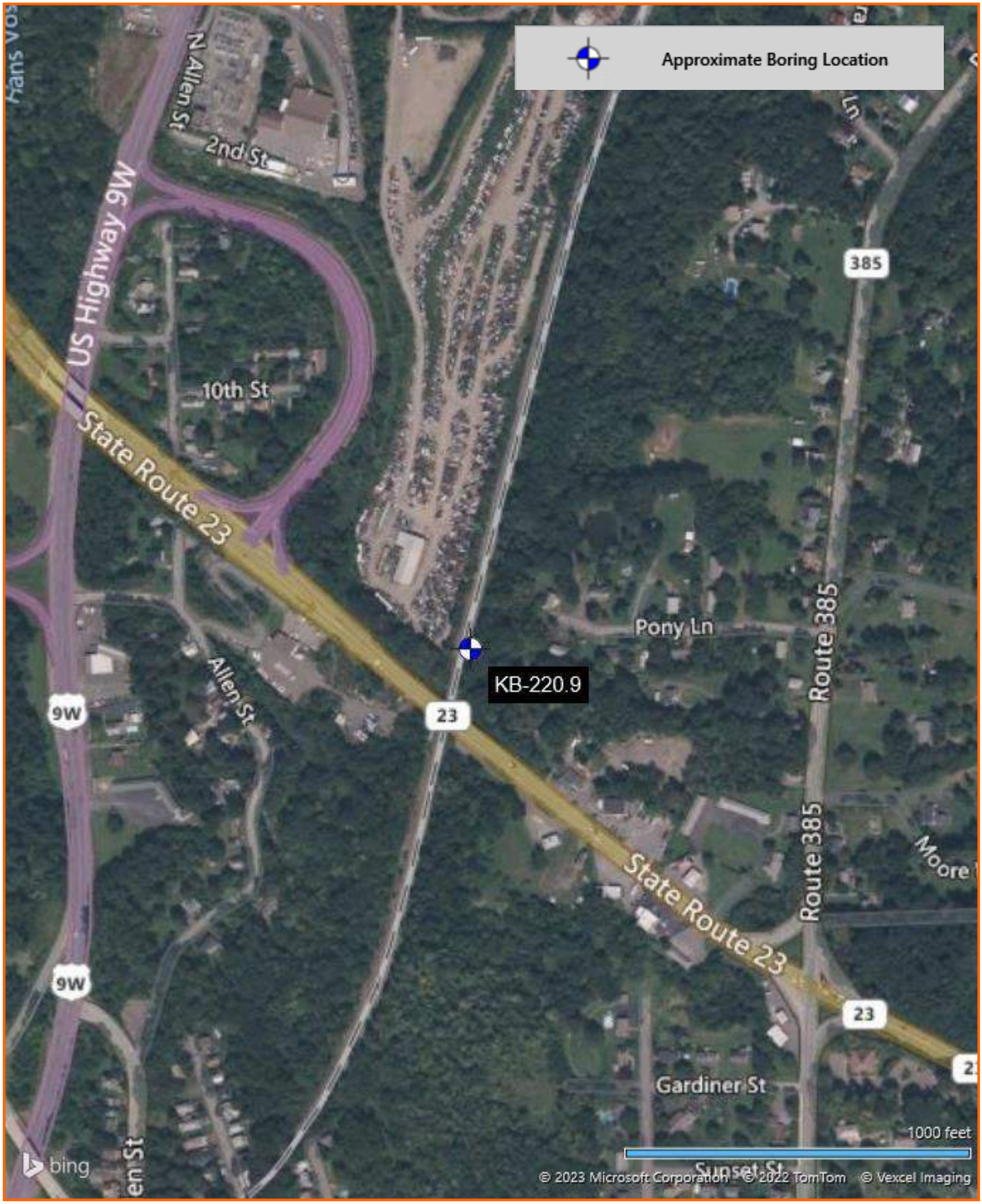


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

BORING LOG NO. KB-220.9

PROJECT: Phase 4 Borings

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

SITE: Champlain to Hudson HDD Crossings

LOCATION See Exploration Plan

Latitude: 42.2296° Longitude: -73.8656°

Surface Elev.: 102.6 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1.9	100.7	**FILL - SILTY SAND**, black		14	1-4-3-5 N=7			
		FAT CLAY (CH), varved silt and clay, brown, medium stiff to very stiff		20	4-3-3-4 N=6			
			5	18	3-3-6-7 N=9	31.0	50-27-23	98
		grades with fine sand partings		24	12-11-12-14 N=23			
				24	14-15-13-14 N=28			
			10					
			15	24	2-4-5-4 N=9			
20.0	82.6	**LEAN CLAY (CL)**, varved silt and clay, gray, very soft to soft	20	24	WH-2-2-3 N=4	39.6	47-26-21	100
			25					

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

Advancement Method:
0-10' 4" Casing
10'-57' Mud Rotary

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: 84.8% +/-3.7%
Hammer Efficiency Correction (CE): 1.41
Logged by AEB
WH = Weight of hammer
WR = Weight of rods

WATER LEVEL OBSERVATIONS

No free water encountered

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 12-15-2022 | Boring Completed: 12-20-2022

Drill Rig: Acker Renegade | Driller: L. Spicher

Project No.: JB215256J

BORING LOG NO. KB-220.9

PROJECT: Phase 4 Borings

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

SITE: Champlain to Hudson HDD Crossings

LOCATION See Exploration Plan

Latitude: 42.2296° Longitude: -73.8656°

Surface Elev.: 102.6 (Ft.)

DEPTH ELEVATION (Ft.)

GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
LEAN CLAY (CL), varved silt and clay, gray, very soft to soft *(continued)*								
				24	WH/18"-2			
	30			24	WH/12"-1-3 N=1			
	35			24	WH/18"-5			
	40			24	WH/18"-6 3" Split Spoon With Ring Samplers			
45.0 57.6								
SILT (ML), varved silt and clay, gray, very soft	45			24	WR/12"-WH/12"	33.6	42-27-15	99
	50							

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

Advancement Method:
0-10' 4" Casing
10'-57' Mud Rotary

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: 84.8% +/-3.7%
Hammer Efficiency Correction (CE): 1.41
Logged by AEB
WH = Weight of hammer
WR = Weight of rods

WATER LEVEL OBSERVATIONS

No free water encountered

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 12-15-2022 | Boring Completed: 12-20-2022

Drill Rig: Acker Renegade | Driller: L. Spicher

Project No.: JB215256J

BORING LOG NO. KB-220.9

PROJECT: Phase 4 Borings

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

SITE: Champlain to Hudson HDD Crossings

LOCATION See Exploration Plan

Latitude: 42.2296° Longitude: -73.8656°

Surface Elev.: 102.6 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILT (ML), varved silt and clay, gray, very soft *(continued)*								
					24	WR/18"-WH			
		55							
					24	WR/18"-3			
57.0	45.6								
	Boring Terminated at 57 Feet								

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

Advancement Method:
0-10' 4" Casing
10'-57' Mud Rotary

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: 84.8% +/-3.7%
Hammer Efficiency Correction (CE): 1.41
Logged by AEB
WH = Weight of hammer
WR = Weight of rods

WATER LEVEL OBSERVATIONS

No free water encountered

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 12-15-2022 | Boring Completed: 12-20-2022

Drill Rig: Acker Renegade | Driller: L. Spicher

Project No.: JB215256J

Summary of Laboratory Results

BORING ID	Depth (Ft.)	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
KB-206.8	4-6	29.4	50	26	24
KB-206.8	15-17	32.9	40	23	17
KB-206.8	35-37	11.0	17	13	4
KB-207.0	4-6	23.7	42	30	12
KB-207.1	4-6	15.1			
KB-211.4B	4-6	32.8	58	32	26
KB-211.4B	15-17	48.0	55	31	24
KB-211.4B	40-42	36.7	63	32	31
KB-214.4	4-6	33.7	65	33	32
KB-214.4	15-17	37.6	57	29	28
KB-214.4	30-32	49.7	45	30	15
KB-220.9	4-6	31.0	50	27	23
KB-220.9	20-22	39.6	47	26	21
KB-220.9	45-47	33.6	42	27	15

PROJECT: Phase 4 Borings

PROJECT NUMBER: JB215256J

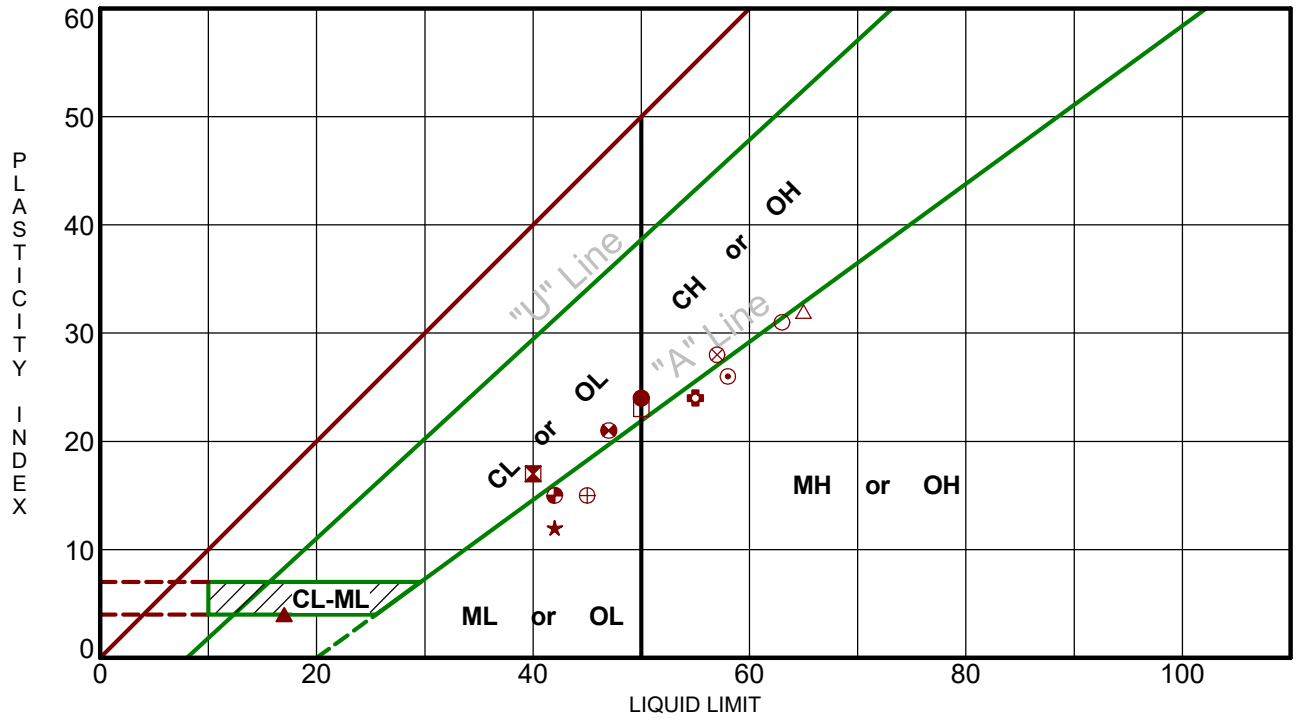
SITE: Champlain to Hudson HDD Crossings

Terracon
30 Corporate Cir Ste 201
Albany, NY

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

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	KB-206.8	4 - 6	50	26	24	87.8	CH	FAT CLAY
⊠	KB-206.8	15 - 17	40	23	17	99.4	CL	LEAN CLAY
▲	KB-206.8	35 - 37	17	13	4	37.5	SC-SM	SILTY, CLAYEY SAND with GRAVEL
★	KB-207.0	4 - 6	42	30	12	86.9	ML	SILT
⊙	KB-211.4B	4 - 6	58	32	26	53.8	MH	SANDY ELASTIC SILT
✿	KB-211.4B	15 - 17	55	31	24	82.0	MH	ELASTIC SILT with SAND
○	KB-211.4B	40 - 42	63	32	31	96.7	MH	ELASTIC SILT
△	KB-214.4	4 - 6	65	33	32	84.2	MH	ELASTIC SILT with SAND
⊗	KB-214.4	15 - 17	57	29	28	94.7	CH	FAT CLAY
⊕	KB-214.4	30 - 32	45	30	15	93.2	ML	SILT
□	KB-220.9	4 - 6	50	27	23	97.5	CH	FAT CLAY
⊛	KB-220.9	20 - 22	47	26	21	100.0	CL	LEAN CLAY
◕	KB-220.9	45 - 47	42	27	15	99.1	ML	SILT

PROJECT: Phase 4 Borings

PROJECT NUMBER: JB215256J

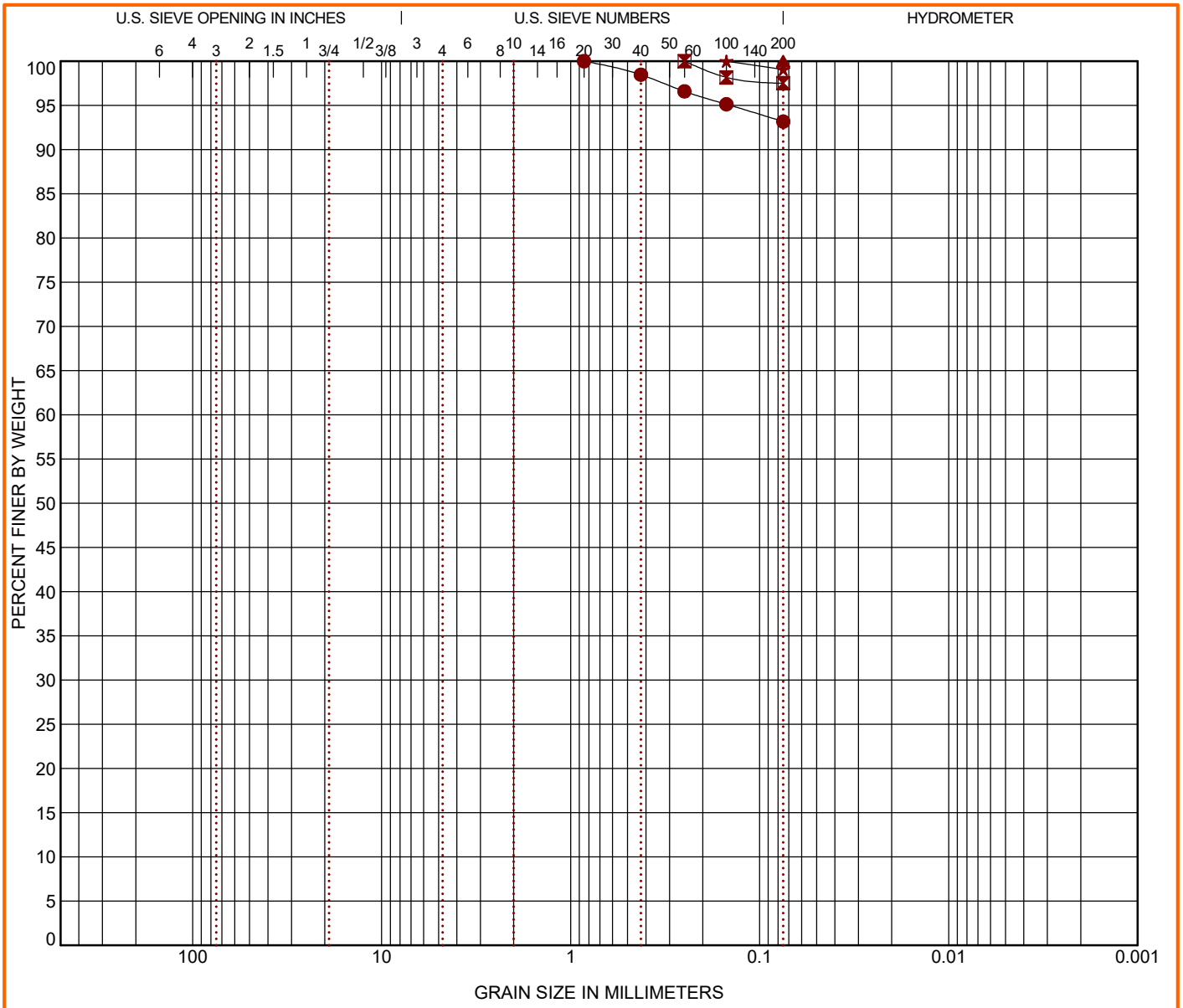
SITE: Champlain to Hudson HDD Crossings

Terracon
30 Corporate Cir Ste 201
Albany, NY

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-214.4	30 - 32	SILT (ML)	49.7	45	30	15		
⊠	KB-220.9	4 - 6	FAT CLAY (CH)	31.0	50	27	23		
▲	KB-220.9	20 - 22	LEAN CLAY (CL)	39.6	47	26	21		
★	KB-220.9	45 - 47	SILT (ML)	33.6	42	27	15		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	KB-214.4	30 - 32	0.85				0.0	0.0	6.8		93.2	
⊠	KB-220.9	4 - 6	0.25				0.0	0.0	2.5		97.5	
▲	KB-220.9	20 - 22	0.075				0.0	0.0	0.0		100.0	
★	KB-220.9	45 - 47	0.15				0.0	0.0	0.9		99.1	

PROJECT: Phase 4 Borings

PROJECT NUMBER: JB215256J

SITE: Champlain to Hudson HDD Crossings

Terracon
30 Corporate Cir Ste 201
Albany, NY

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

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 JB215256J PHASE 4 BORINGS.GPJ TERRACON_DATATEMPLATE.GDT 2/2/23

Kiewit

MEMORANDUM

DATE: December 16, 2022

TO: Zachary Bauer; Tetra Tech Rooney

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

SUBJECT: Geotechnical Data: Segment 11 – Package 7A – HDD Crossing 115 – Revision 1
Champlain Hudson Power Express Project
Catskill, New York

Kiewit Engineering is providing this memorandum for use in the horizontal direction drill (HDD) design for the Champlain Hudson Power Express project in Upstate New York. HDD crossing 115 is located northwest of Catskill, New York. This HDD crosses under the Catskill Creek at approximately STA 70090+00 (42.2244° N, 73.8702° W).

The geotechnical data at this HDD crossing is attached. The available data is taken from the previous investigations by AECOM and TRC and the recent investigation by Kiewit, 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 177.6-228.2, dated March 15, 2013.
- Kiewit Engineering (NY) Corp., Package 7A Phase 3 Borings, Champlain Hudson Power Express, New York, dated December 8, 2022.

Contact us if you have questions or require additional information.

HDD 115
Borings CU-2, B221.14-1, B221.2-1, B221.4-1, CU-2A, B221.5-1, KB-221.3, KB-221.4
Segment 11 - Design Package 7A

CHPE Segment 11 - Package 7A
HDD Soil Boring Coordinates and Elevations

Firm	Boring	Northing (feet)	Easting (feet)	Ground Surface Elevation (feet)
TRC*	B221.0-1	1237452.6	663787.2	99.6
	B221.14-1	1236613.7	663529.1	95 (approx.)**
	B221.2-1	1236173.4	663261.8	115.0
	B221.4-1	1235622.5	662622.3	22.4
	B221.5-1	1235006.9	662058.8	95.5
	B221.6-1	1234675.8	661633.8	98.3
	B221.8-1	1234265.3	661277.2	99.4
	B222.34-1	1232191.5	659098.9	133.5
	B222.6-1	1231252.6	658182.3	113.7
	B222.9-1	1229751.0	657274.3	121.4
	B225.8-1	1215861.0	650622.7	91.0
	B226.1-1	1214654.4	650328.3	105.9
	B226.2-1	1214120.5	650254.4	108.5
	B226.6-1	1211894.7	649689.7	112.1
AECOM***	CU-1	1237028.6	663123.9	19.7
	CU-2	1236042.7	662897.0	24.8
	CU-2A	1235325.9	662268.9	38.1
	CU-5A	1210523.7	649411.8	118.4
	SC-5	1239310.3	664321.6	110.2
	SC-6	1237781.0	663919.8	101.6

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.

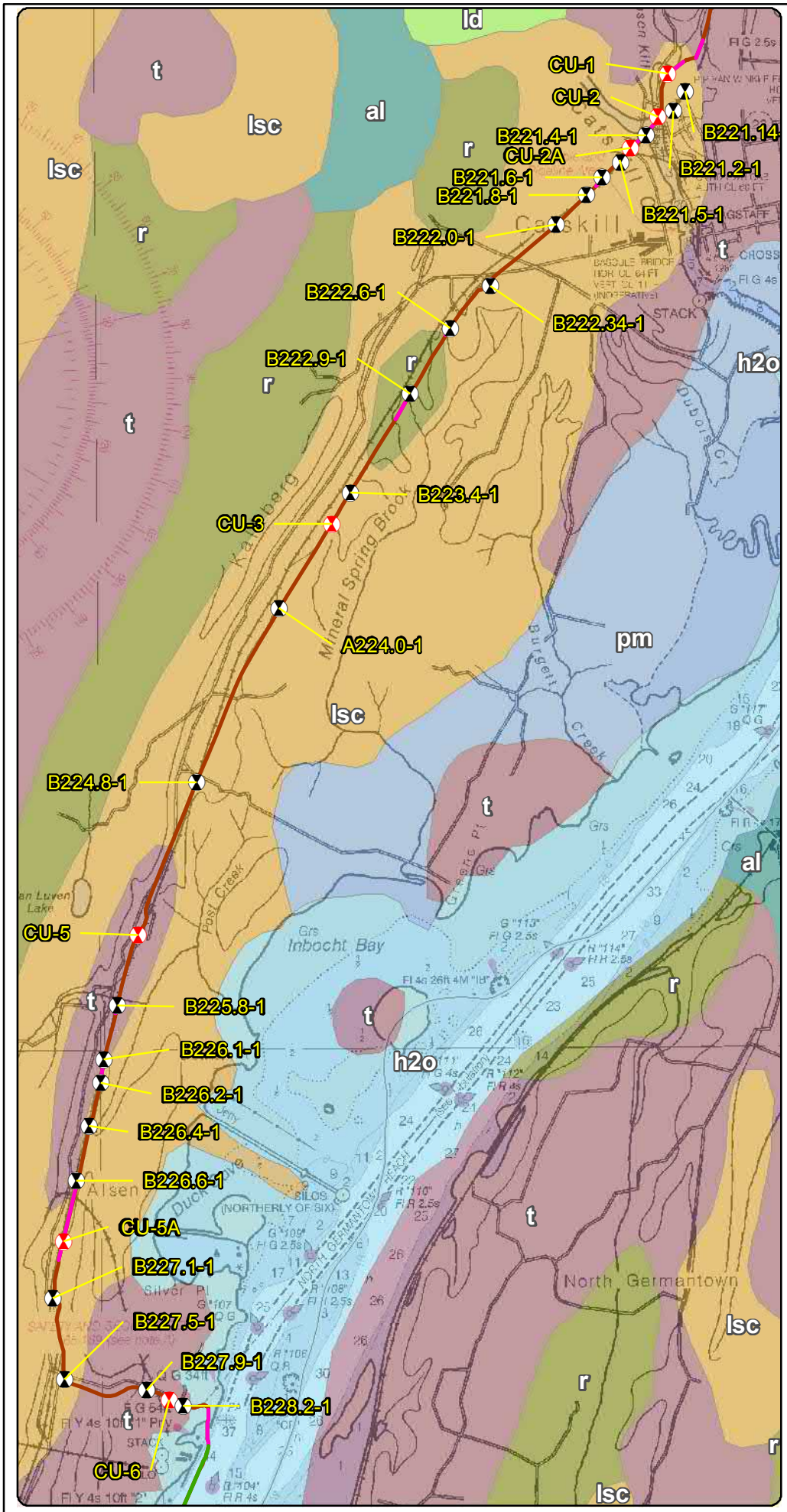
** Coordinates for B221.14-1 taken from TRC report. Elevation estimated from Google Earth.

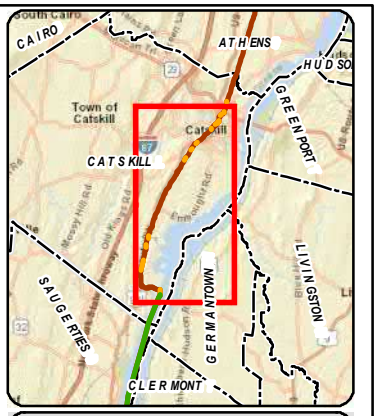
*** AECOM boring coordinates and elevations as shown in Table 1-6 in AECOM report.

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

References:

- AECOM, Geotechnical Data Report, Upland Segments: Putnam Station, Washington County, to Cementon, Green County, NY, Champlain Hudson Power Express, dated May 28, 2021.
- TRC, Geotechnical Data Report, Champlain Hudson Power Express, Canadian Pacific Railway Borings MP 177.6-228.2, dated March 15, 2013.





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
- h2o - Water
- ld - Lacustrine delta
- lsc - Lacustrine silt and clay
- pm - Swamp deposits
- r - Bedrock
- t - Till

N

0.3 0.15 0 0.3 Miles

Transmission

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

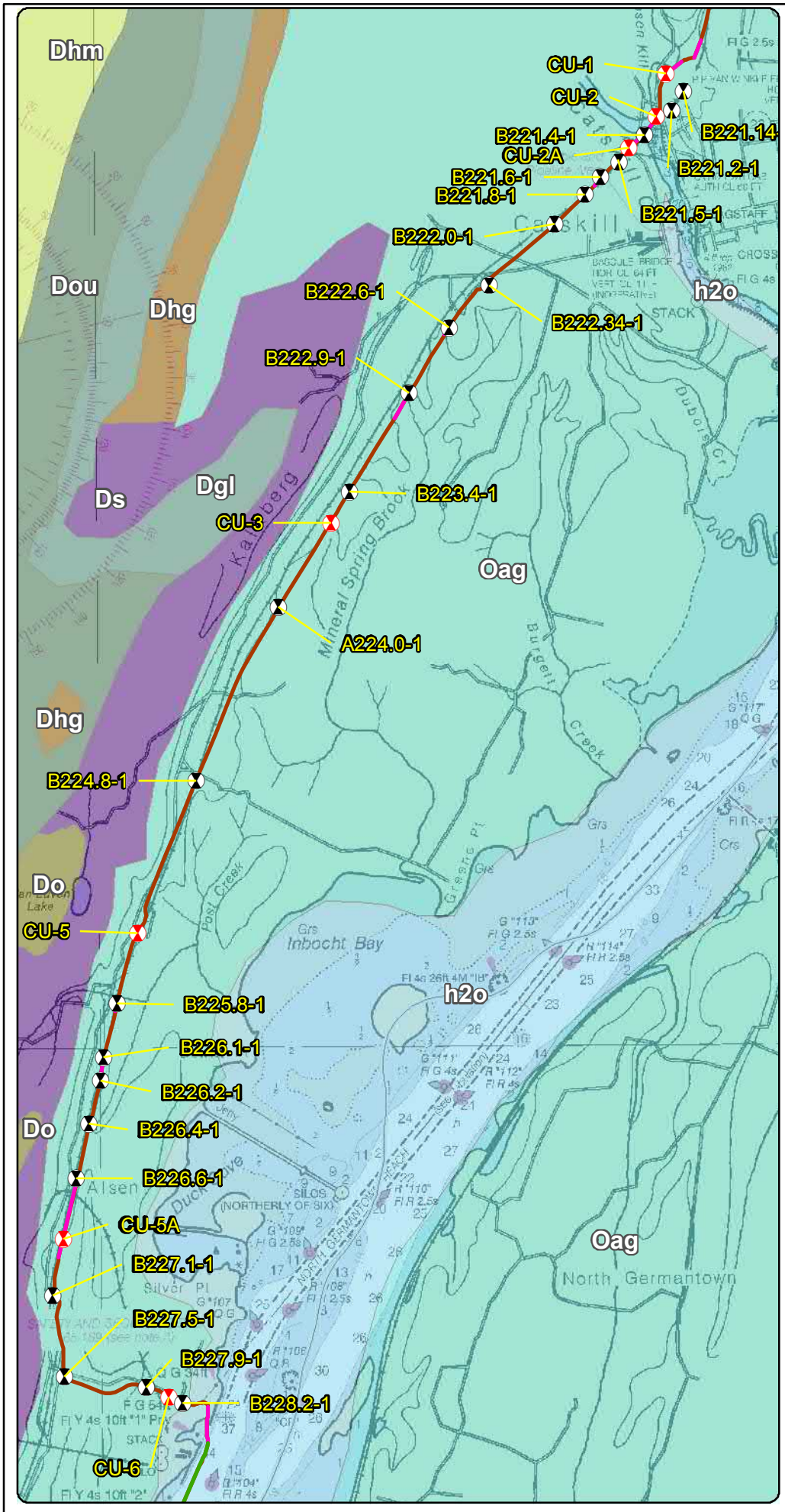
Surficial Geology and Geotechnical Borings Catskill to Upland Figure 3-11

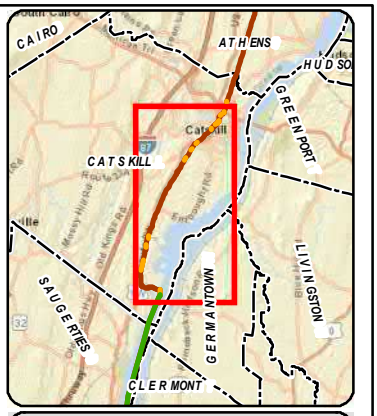
Prepared on 5/3/2021

by: AECOM

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

Y:\Projects\CHPE\Route\Consensus_Alternative_Routes\MXD\Alt 5_Routes_DZ_20190\Boring_Locations\Maps_for_May_2021_Report\Catskill_to_Upland_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

- Dgl - Glenerie Formation
- Dhg - Port Ewen Formation
- Dhm - Undiff Lower Hamilton Group
- Do - Oriskany Sandstone
- Dou - Onondaga Limestone
- Ds - Cashaqua Shale
- Oag - Austin Glen Form (graywacke, shale)
- h2o - Water

N

0.3 0.15 0 0.3 Miles

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

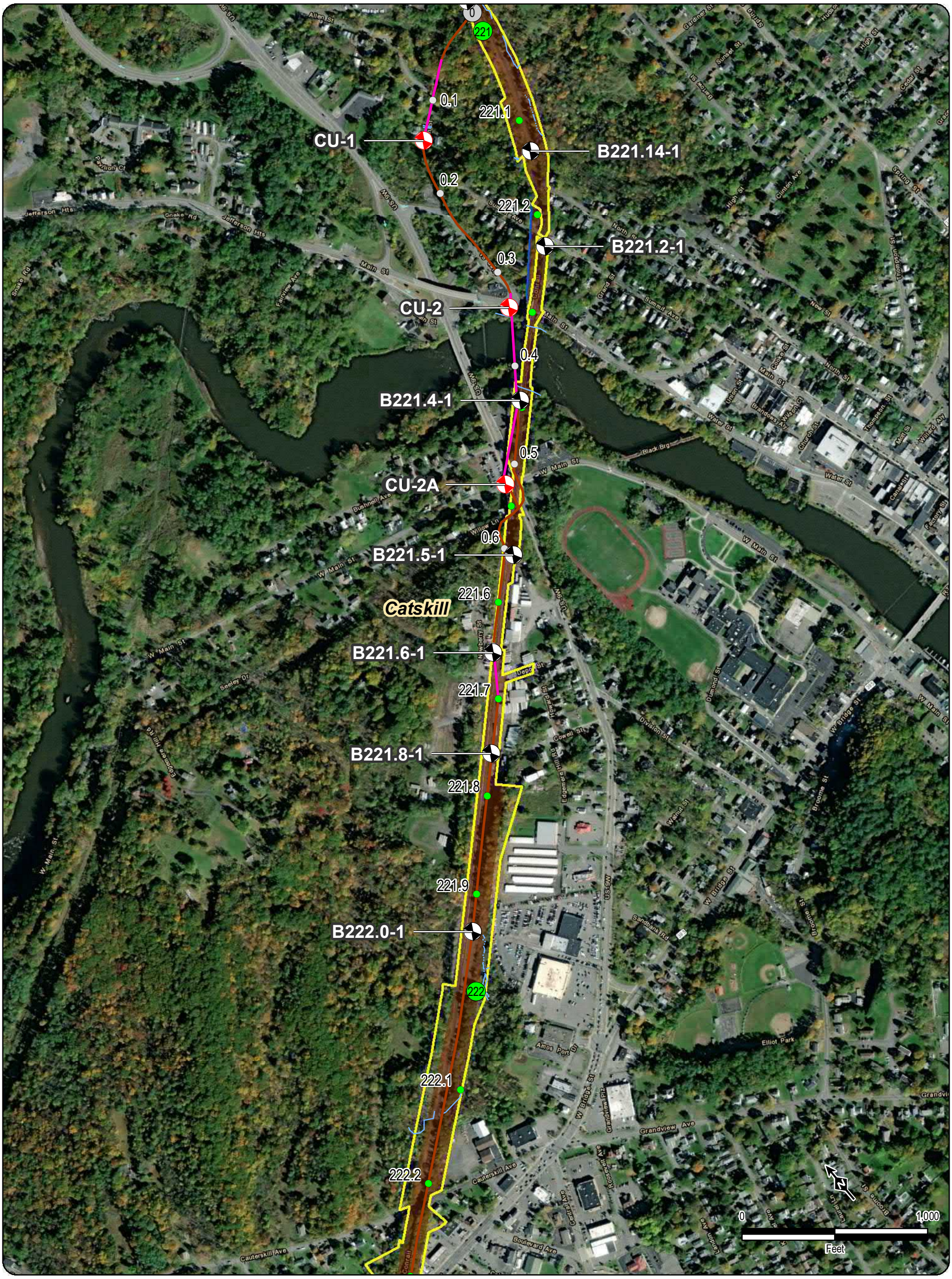
Bedrock Geology and Geotechnical Borings Catskill to Upland Figure 4-11

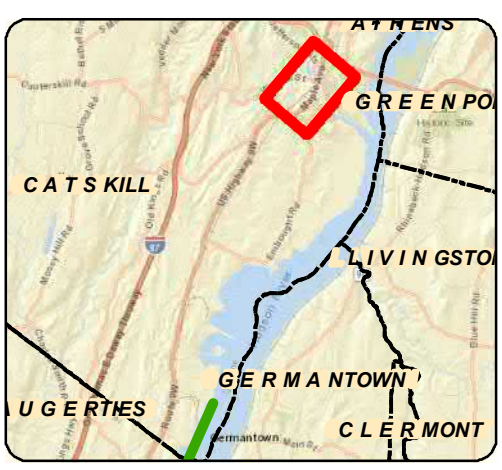
Prepared on 5/18/2021

by: AECOM

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

Y:\Projects\CHPE\IRoute\Consensus_Alternative_Routes\MXD\Alt 5_Routes_DZ_201909Boring_Locations\Maps_for_May_2021_Report\Catskill_to_Upland_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

Catskill to Upland

Figure A-11

Sheet 1 of 6

Prepared by: AECOM 5/20/2021

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\Catskill_to_Upland_Boring_Locations_Mapset_May_2021_Report.mxd

BORING CONTRACTOR: ADT			AECOM										SHEET 1 OF 3	
DRILLER: Chris Chaillou													PROJECT NAME: CHPE -	
													PROJECT NO.: 60323056	
													HOLE NO.: **CU-2**	
SOILS ENGINEER/GEOLOGIST: Chris French			**BORING LOG**										START DATE: 2/10/2021	
													FINISH DATE: 2/10/2021	
LOCATION: Catskill, NY, MP - 0.33													OFFSET: N/A	
GROUND WATER OBSERVATIONS				CASING	SAMPLER	DRILL BIT	CORE BARREL	DRILL RIG: CME LC-55						
Water at 15' (inferred)			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					SM	Silty SAND	Black fine-coarse SAND, little silt, trace subangular-subrounded gravel; frozen
1.0													
											SM		1.2'; SAA; dense, moist
2.0											SM		3.1'; Brown fine-coarse SAND, some silt, trace angular-subrounded gravel; dense, moist
3.0													TR-1; (3.0'-5.0')
		3'-5'	S-1										
4.0													
5.0													
		5'-7'	S-2	24"	12"	9	8	8	9	10	SP	SAND	Black coarse SAND, some fine-medium sand, trace silt; loose, moist
6.0													
7.0													
		7'-9'	S-3	24"	3"	9	6	6	8	4	SP		SAA
8.0													
9.0													
		9'-11'	S-4	24"	7"	5	7	6	8	8	SM	Silty SAND	Brown fine-coarse SAND, little silt, trace subrounded gravel; medium dense, moist. Brick in shoe.
10.0													
11.0													
		11'-'13'	S-5	24"	8"	6	6	7	10	8	SM/ML		SAA
12.0													
												Clayey SILT	11.2'; Brown clayey SILT; medium stiff, moist
13.0													
		13'-15'	S-6	24"	17"	5	4	5	5	6	ML		Gray clayey SILT, little fine sand; soft, moist
14.0													
													TR-2; (14.0'-14.5')
15.0													
		15'-17'	S-7	24"	18"	3	3	6	4	6	SM	Silty SAND	Gray fine SAND, some medium-coarse sand, little silt; medium dense, saturated
16.0													
17.0													
18.0													
19.0													
20.0													

NOTES:

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

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

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: Chris Chaillou

SOILS ENGINEER: Chris French

LOCATION: Catskill, NY, MP - 0.33

AECOM

BORING LOG

SHEET 2 OF 3

PROJECT NAME: CHPE -

PROJECT NO.: 60323056

HOLE NO.: **CU-2**

START DATE: 2/10/2021

FINISH DATE: 2/10/2021

OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'	S-8	24"	16"	3	3	8	8	7	SM		SAA
21.0												Silty SAND	TR-3; (21.0'-21.5')
22.0													
23.0													
24.0													
25.0													
		25'-27'	S-9	24"	24"	WOH	2	6	7	5	ML		Brown clayey SILT; medium stiff, moist
26.0													
27.0													
28.0													
29.0													
30.0													
		30'-32'	S-10	24"	12"	7	8	13	32	14	ML	Clayey SILT	Gray clayey SILT; stiff, moist
31.0													
32.0													
33.0													
34.0													
35.0													
		35'-37'	S-11	24"	15"	20	29	30	28	38	SM/GM		Gray fine-coarse SAND, little silt, little angular-subrounded gravel; dense, moist
36.0													TR-4; (36.0'-36.5')
37.0													
38.0													
39.0													
40.0													
		40'-42'	S-12	6"	6"	131	-	-	-	-	SM/GM	Gravelly SAND	Gray fine-coarse SAND, some angular gravel, little silt; very dense, moist (till)
41.0													TR-5; (40.0'-40.5')
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

DRILLER: Chris Chaillou

SOILS ENGINEER: Chris French

LOCATION: Catskill, NY, MP - 0.33

AECOM

BORING LOG

SHEET 3 OF 3

PROJECT NAME: CHPE -

PROJECT NO.: 60323056

HOLE NO.: **CU-2**

START DATE: 2/10/2021

FINISH DATE: 2/10/2021

OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		45'-47'	S-13	5.5"	2"	110/5.5"	-	-	-	-	GM/SM	Sandy GRAVEL	Gray GRAVEL and silty sand; very dense, moist
46.0													
47.0													
48.0													
49.0													
50.0													
		50'-50.1'	S-14	2"	0"	57/2"	-	-	-	-	-	SANDSTONE w/ Interbedded Shale	Spoon refusal, no recovery - bedrock inferred @ 50.1'
51.0													
	3.1	51'-55.9'	R-1	58"	54"	RQD: 32.5" = 56%							Gray sandstone, very fine grained, moderately jointed, unweathered, quartizite, sealed fracture at 54.7'. Fractures at 45°-50°
52.0													
53.0													TR-6; (51.2'-52.1')
54.0													Interbedded shale at 51.9'-52.1', 52.8'-53.2' and 53.8'-54.5'
55.0													
56.0													
	4.1	55.9'-60.0'	R-2	50"	46"	RQD: 15.5" = 31%							Heavily jointed; interbedded shale at 57.3'-58.0' and 58.5'-59.2'
57.0													
58.0													
59.0													
60.0													
													CU-2 terminated at 60', grouted to surface
61.0													
62.0													
63.0													
64.0													
65.0													
66.0													
67.0													
68.0													
69.0													
70.0													

NOTES:

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

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 DMJM Harris 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 3
			PROJECT NAME: CHPE -
DRILLER: Francisco Martinez			PROJECT NO.: 60323056
			HOLE NO.: **CU-2A**
SOILS ENGINEER/GEOLOGIST: Jillian Kosinski	**BORING LOG**		START DATE: 2/3/21
			FINISH DATE: 2/3/21
LOCATION: Catskill, NY - Rt. 9 W and West Main St. Bypass MP - 0.53			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		BORING TYPE: SPT
	SIZE I.D.	4"	2.5"	- -		BORING O.D.: 4.5"
	SIZE O.D.	4.5"	3"	3 7/8"		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						Asphalt	0.0'; Asphalt
1.0											SM	Clayey SILT	0.5'; Brown clayey SILT, some fine sand, trace subangular gravel; moist, medium dense
2.0													TR-1; (3.0'-4.5')
3.0		3'-4.5'	B-1										
4.0													
5.0													
		5'-7'	S-1	24"	9"	11	8	14	22	14	SM	Silty SAND	Brown medium-coarse SAND, some clayey silt, trace fine sand; moist, medium dense
6.0													
7.0													
		7'-9'	S-2	24"	24"	24	19	20	32	13	SP		SAA, trace fine-coarse gravel (0.4"-2"); medium dense
8.0													
9.0											SP	Gravelly SAND	TR-2; (8.0'-8.5')
		9'-11'	S-3	24"	18"	40	60	55	49	75			Brown coarse SAND, fine-coarse gravel, some clayey silt, little fine-medium sand; wet, very dense
10.0													
11.0													
		11'-'13'	S-4	24"	3"	12	8	3	3	7	SP		SAA, loose (recovery in sampler tip only)
12.0													
13.0													
		13'-15'	S-5	24"	24"	4	4	4	4	5	CL	Silty CLAY	Gray silty CLAY, little fine-coarse sand, trace fine-medium gravel; moist, medium stiff
14.0													13.4'; Gray silty CLAY; moist, medium stiff
15.0													TR-3; (14.0'-14.5')
		15'-17'	S-6	24"	24"	3	2	2	3	3	CL		SAA; soft
16.0													
17.0													
18.0													
19.0													
20.0													

NOTES:

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

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

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: Jillian Kosinski

AECOM

BORING LOG

SHEET 2 OF 3

PROJECT NAME: CHPE -

PROJECT NO.: 60323056

HOLE NO.: **CU-2A**

START DATE: 2/3/21

FINISH DATE: 2/3/21

LOCATION: Catskill, NY - Rt. 9 W and West Main St. Bypass MP - 0.53

OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'	S-7	24"	0"	3	3	4	4	5	-		No recovery; same grey silty clay on sample barrel, may have fallen out, medium stiff
21.0													
22.0													
23.0													
24.0													
25.0													
		25'-27'	S-8	24"	24"	4	3	3	3	4	CL		Gray silty CLAY; wet, soft
26.0													
27.0													
28.0													
29.0													
30.0													
		30'-32'	S-9	24"	24"	4	5	5	5	7	CL		SAA; medium stiff
31.0													TR-4; (31.5'-32.0')
32.0												Silty CLAY	
33.0													
34.0													
35.0													
		35'-37'	S-10	24"	24"	1	3	4	4	5	CL		SAA; medium stiff
36.0													
37.0													
38.0													
39.0													
40.0													
		40'-42'	S-11	24"	24"	WOH	3	3	3	4	CL		SAA; soft
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

DRILLER: Francisco Martinez

SOILS ENGINEER: Jillian Kosinski

AECOM

BORING LOG

LOCATION: Catskill, NY - Rt. 9 W and West Main St. Bypass MP - 0.53

SHEET 3 OF 3

PROJECT NAME: CHPE -

PROJECT NO.: 60323056

HOLE NO.: **CU-2A**

START DATE: 2/3/21

FINISH DATE: 2/3/21

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
		45'-47'	S-12	24"	24"	3	6	6	7	8	CL		Gray silty CLAY; medium stiff
46.0													TR-5; (46.0'-46.5')
47.0													
48.0													
49.0													
50.0													
		50'-52'	S-13	24"	24"	3	4	6	8	7	CL	Silty CLAY	SAA; medium stiff
51.0													
52.0													
53.0													
54.0													
55.0													
		55'-57'	S-14	24"	24"	WOH	4	7	13	7	CL		SAA
56.0											SM/GM	Sandy Silty CLAY (till)	56.5'; Gray silty CLAY, little coarse sand, little subangular fine-medium gravel (3/8"-0.75"), moist, medium stiff
57.0													
58.0													
		58'-60'	S-15	24"	15"	25	25	24	28	32	SM/GM		Gray CLAY and silt, some fine-coarse sand, little subrounded fine-coarse gravel, dense, slightly moist
59.0													TR-6; (59.5'-60.0')
60.0													
													Boring terminated at 60' bgs, grouted to surface
61.0													
62.0													
63.0													
64.0													
65.0													
66.0													
67.0													
68.0													
69.0													
70.0													

NOTES:

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

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 DMJM Harris 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%

ROCK CORE PHOTOGRAPHIC LOG

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

Boring No.	Depth (ft.)
CU-1	20.0-40.0

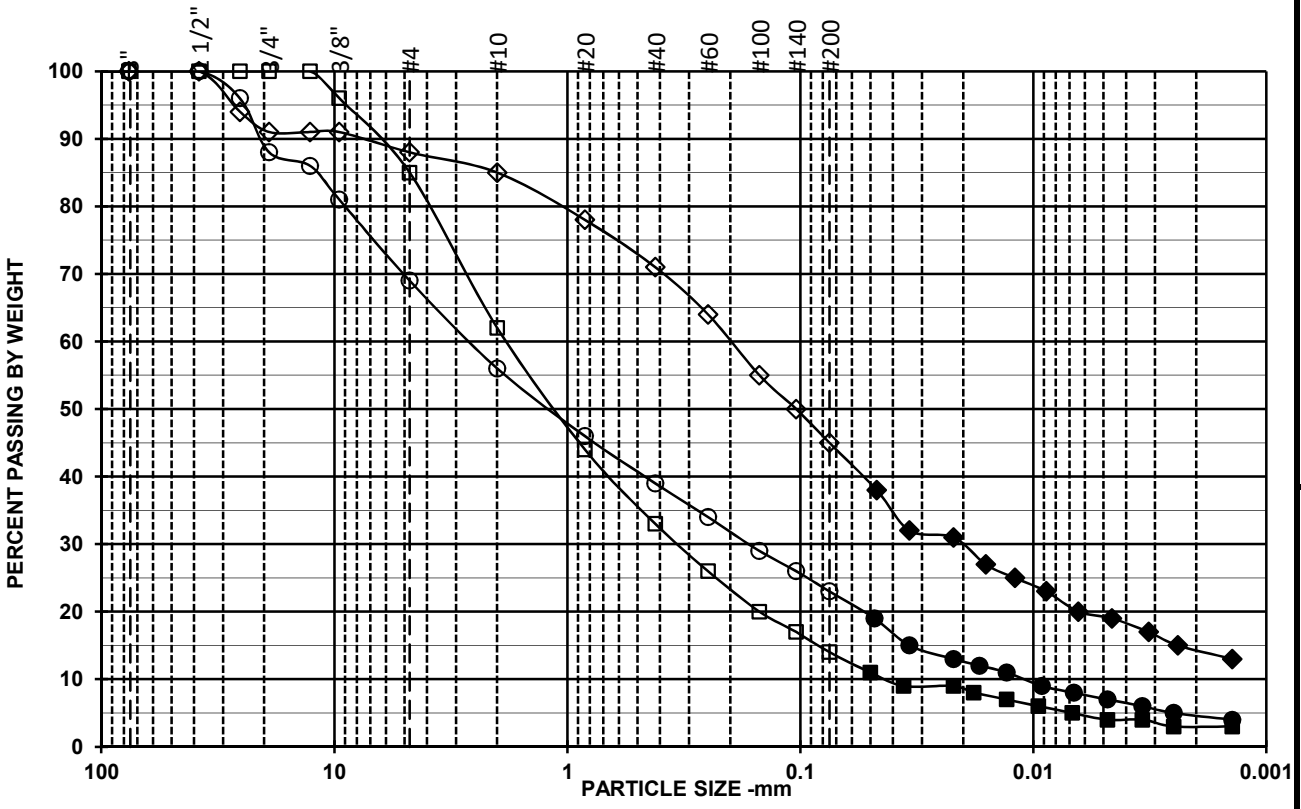
Boring No.	Depth (ft.)
CU-2	51.0-60.0

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

Aquifer
CHPE - Catskill Upland Borings
LABORATORY SOIL TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS							REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 μm (%)	
CU-1	S-3	7-9	7.5				SM	33	9	
CU-1	S-6	13-15	9.0				SM	16	4	
CU-2	S-2	5-7	22.1				SM	14	3	
CU-2	S-6	13-15	20.6	34	20	14	SC	45	14	
CU-2	S-11	35-37	7.0				SM	23	5	
CU-2A	S-6	15-17	59.4	53	23	30	CH	99	87	
CU-2A	S-9	30-32	35.4	37	20	17	CL	99.6	46	
CU-2A	S-14	55-57	25.1	28	17	11	CL	85	28	
CU-4	S-2	5-7	28.9	60	26	34	CH	95.7	77	
CU-4	S-4	9-11	33.0				GC	31	22	
CU-5A	S-4	9-11	33.7	64	25	39	CH	99	90	
CU-5A	S-8	20-22	29.8	59	25	34	CH	99.4	58	
CU-5A	S-11	35-37	37.8	48	23	25	CL	100	68	
CU-6	S-2	5-5.5	9.4				SM	20	7	
CU-6	S-5	11-13	9.8				SM	15	4	

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	22.1				SM		Gray, Silty sand with gravel	04/29/21
◇	20.6	34	20	14	SC		Gray, Clayey sand, Insufficient sample size	04/29/21
○	7.0				SM		Gray, Silty sand with gravel, Insufficient sample size	04/29/21

Aquifer

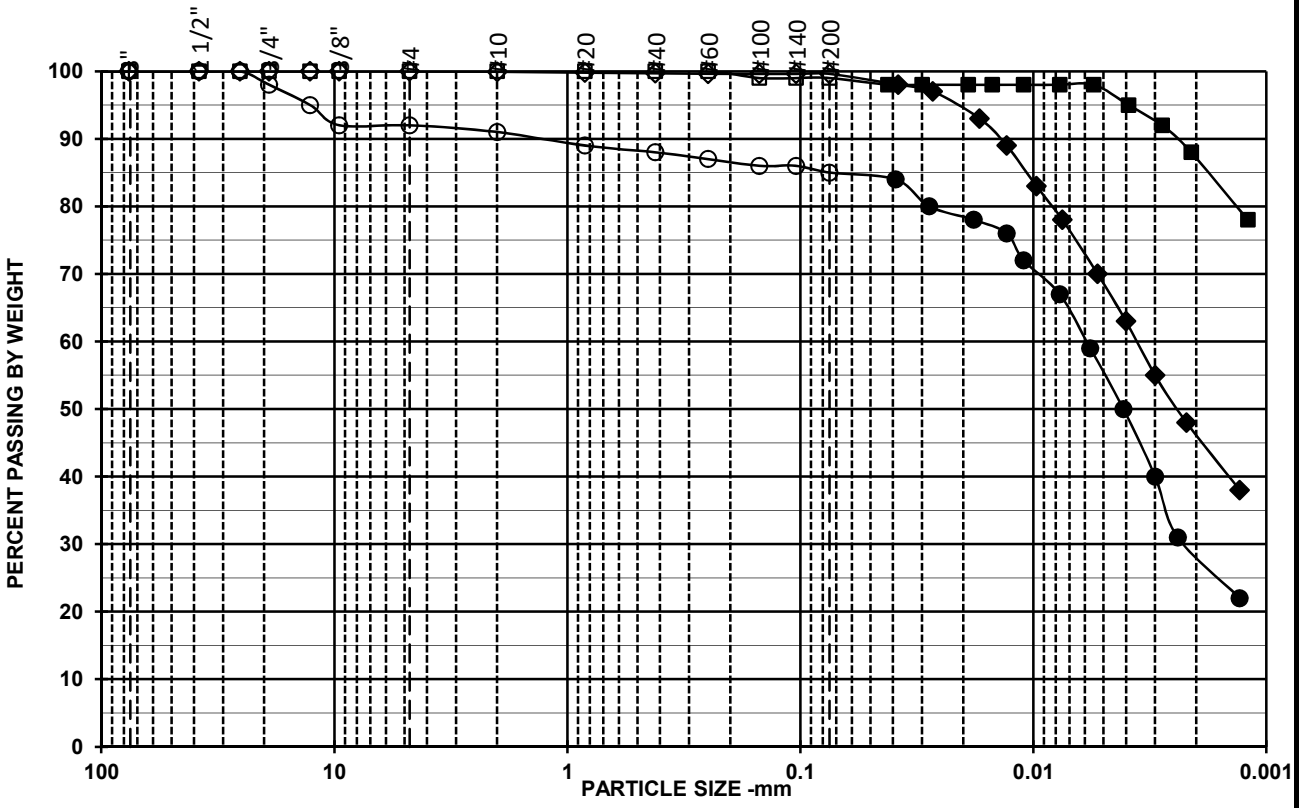
TerraSense, LLC #7853-21007

CHPE - Catskill Upland Borings

Symbol	□	◇	○
Boring	CU-2	CU-2	CU-2
Sample	S-2	S-6	S-11
Depth	5-7	13-15	35-37
% +3"	0	0	0
% Gravel	15	12	31
% SAND	71	43	46
%C SAND	23	3	13
%M SAND	29	14	17
%F SAND	19	26	16
% FINES	14	45	23
D_{100} (mm)	19.1	38.1	38.1
D_{60} (mm)	1.82	0.199	2.61
D_{30} (mm)	0.34	0.02	0.17
D_{10} (mm)	0.042		0.011
Cc	1.5		1
Cu	43.3		237.3

Sieve Size/ID #	Percent Finer Data		
6"	100	100	100
4"	100	100	100
3"	100	100	100
1 1/2"	100	100	100
1"	100	94	96
3/4"	100	91	88
1/2"	100	91	86
3/8"	96	91	81
#4	85	88	69
#10	62	85	56
#20	44	78	46
#40	33	71	39
#60	26	64	34
#100	20	55	29
#140	17	50	26
#200	14	45	23
5μ m	4	19	7
2μ m	3	14	5
1μ m	3	12	3

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	59.4	53	23	30	CH		Gray, Fat clay	05/03/21
◇	35.4	37	20	17	CL		Gray, Lean clay	05/03/21
○	25.1	28	17	11	CL		Gray, Lean clay with gravel, Insufficient sample size	05/03/21

Aquifer

TerraSense, LLC #7853-21007

CHPE - Catskill Upland Borings

Symbol	□	◇	○
Boring	CU-2A	CU-2A	CU-2A
Sample	S-6	S-9	S-14
Depth	15-17	30-32	55-57
% +3"	0	0	0
% Gravel	0	0	8
% SAND	1	0.4	7
%C SAND	0	0.1	1
%M SAND	0	0.2	3
%F SAND	1	0.1	3
% FINES	99	99.6	85
D_{100} (mm)	2	4.75	25.4
D_{60} (mm)		0.004	0.006
D_{30} (mm)			0.002
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100	100.0	100
4"	100	100.0	100
3"	100	100.0	100
1 1/2"	100	100.0	100
1"	100	100.0	100
3/4"	100	100.0	98
1/2"	100	100.0	95
3/8"	100	100.0	92
#4	100	100.0	92
#10	100	99.9	91
#20	100	99.8	89
#40	100	99.7	88
#60	100	99.6	87
#100	99	99.6	86
#140	99	99.6	86
#200	99	99.6	85
5μ m	97	69	55
2μ m	87	46	28
1μ m	75	33	18

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

Aquifer
CHPE - Catskill Upland Borings
SUMMARY OF ROCK TESTING

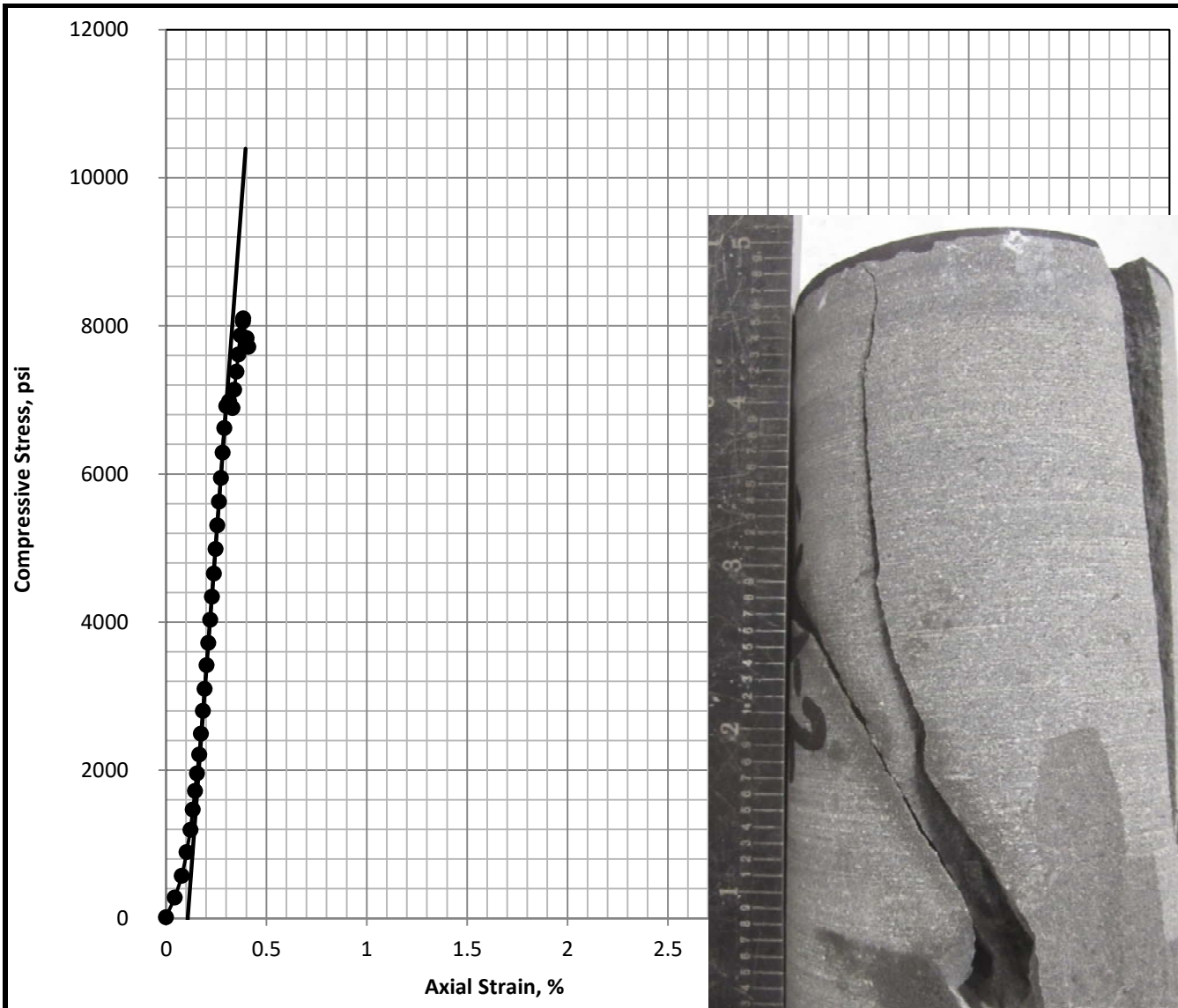
SAMPLE IDENTIFICATION			STATE PROPERTIES			ENGINEERING PROPERTY TESTS					REMARKS
Boring	Run	Depth	WATER CONTENT (1) (%)	TOTAL UNIT WGT. (pcf)	DRY UNIT WGT. (pcf)	TEST TYPE (2)	Mohs HARDNESS (-)	UNCONFINED COMPRESSION TESTS (ASTM D7012)			
								COMPRESSIVE STRENGTH (psi)	AXIAL STRAIN @ FAILURE (%)	ESTIMATED (5) ELASTIC MODULUS (psi)	
CU-1	R-1	20.5-20.9				M	4				
CU-1	R-1	20.95-21.35	0.4	169	168	UC		21660	0.41	6E+06	
CU-1	R-3	32.4-32.6				M	3				
CU-1	R-3	32.7-33.1	0.6	169	168	UC		11100	0.30	4E+06	
CU-2	R-1	53				M	7				
CU-2	R-1	53.7-54.1	0.5	169	168	UC		8100	0.28	4E+06	
CU-6	R-1	13.6-13.9				M	5				
CU-6	R-1	13.1-13.5	0.3	169	168	UC		20750	0.36	6E+06	

(2) Test Type Abbreviations: M: Mohs Hardness, UC: UC Compression test with estimated elastic moduli

(3) Diametral orientation across core along bedding/foliation plane, axial perpendicular to bedding/foliation plane, as applicable.

(4) Compressive Strength determined using generalized "K" factor in ASTM D5731

(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)
0.46	169	168	4.489	1.967

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	0.28	8100	4E+06

Test by: DM
Test Date: Apr-07-21
Reviewed by: GET

Aquifer	**CHPE - Catskill Upland Borings**	**COMPRESSIVE STRESS VS STRAIN UNCONFINED COMPRESSIVE STRENGTH TEST**
TerraSense, LLC Project # 7853-21007		**Boring: CU-2 Run: R-1 Depth 53.7-54.1 ft.**

TEST BORING LOG

PROJECT: TDI CHAMPLAIN HUDSON POWER EXPRESS

LOCATION: CSX RAILROAD ROW, NY

BORING	**B221.14-1**
G.S. ELEV.	N/A
FILE	195651
SHEET	1 OF 1

GROUNDWATER DATA			
FIRST ENCOUNTERED NR			
DEPTH	HOUR	DATE	ELAPSED TIME
DRY	NR	11/26	0 HR

METHOD OF ADVANCING BOREHOLE				
a	FROM	0.0 '	TO	10.0 '
d	FROM	10.0 '	TO	25.0 '

DRILLER	R.CARUSO
HELPER	C. SMART
INSPECTOR	C. POPPE
DATE STARTED	11/26/2012
DATE COMPLETED	11/26/2012

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-1	5 4 4 3		***BLACK M/C SAND, TR TO SM SILT, TR TO SM F/ GRAVEL-SIZED ROCK FRAGMENTS (FILL)***	21.3	
	S-2	3 2 2 2		4.0		
5	S-3	3 3 3 3		***BROWN F/ GRAVELLY M/C SAND, TR SILT (FILL)*** 6.0	6.3	
	S-4	4 5 4 1				
10	S-5	4 5 5 6		***DARK BROWN C/M/F SANDY F/C GRAVEL, TR SILT (FILL)***	6.4	
				13.5		
15	S-6	29 9 8		***GRAY F/C GRAVEL-SIZED ROCK FRAGMENTS, SM M/C SAND, TR SILT (PROBABLE FILL)***	17.9	
				18.5		
20	S-7	10 7 7		***GRAY SILT, TR TO SM CLAY, TR TO SM F/ SAND, TR TO SM F/ GRAVEL***		
	S-8	7 20 12		25.0	14.7	
25				***END OF BORING AT 25'***		
30						
35						

DRN.	TBT
CKD.	PWK

NEW PROJECTS TEST BORING LOG 195651_TDI_CSX.GPJ SITE BLAUVELT.GDT 3/12/13

TEST BORING LOG

PROJECT: TDI CHAMPLAIN HUDSON POWER EXPRESS

LOCATION: CSX RAILROAD ROW, NY

BORING	**B221.2-1**
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				
d	FROM	0.0 '	TO	2.2 '
c_2	FROM	2.2 '	TO	11.2 '

DRILLER	P. PLANTIER
HELPER	M. NAGEY
INSPECTOR	C. POPPE
DATE STARTED	02/15/2013
DATE COMPLETED	02/15/2013

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-1	2 4 4 3		***GRAY GRAVEL-SIZED ROCK FRAGMENTS (FILL)***		
	S-2	50/0.2		2.2		
	R-1	REC =100% RQD =0%				
5	R-2	REC =100% RQD =50%		***GRAY, MODERATELY WEATHERED, MEDIUM TO MODERATELY HARD SHALE, VERY CLOSE TO CLOSE 0 TO 45 DEGREE FRACTURES***		
10	R-3	REC =92% RQD =62%		11.2		
				END OF BORING AT 11.2'		
15						
20						
25						
30						
35						

DRN.	JPB
CKD.	PWK

NEW PROJECTS TEST BORING LOG 195651_TDI_CSX.GPJ SITE BLAUVELT.GDT 3/12/13

TEST BORING LOG

PROJECT: TDI CHAMPLAIN HUDSON POWER EXPRESS

LOCATION: CSX RAILROAD ROW, NY

BORING	**B221.4-1**
G.S. ELEV.	N/A
FILE	195651
SHEET	1 OF 1

GROUNDWATER DATA			
FIRST ENCOUNTERED NR			
DEPTH	HOUR	DATE	ELAPSED TIME
3.0'	15:45	11/26	0 HR

METHOD OF ADVANCING BOREHOLE				
a	FROM	0.0 '	TO	10.0 '
d	FROM	10.0 '	TO	13.9 '
c2	FROM	13.9 '	TO	24.7 '

DRILLER	R.CARUSO
HELPER	C. SMART
INSPECTOR	C. POPPE
DATE STARTED	11/26/2012
DATE COMPLETED	11/26/2012

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-1	3 4 5 9			27.0	
	S-2	12 5 5 5		***BROWN SILT, SM F/ GRAVEL-SIZED ROCK FRAGMENTS, TR TO SM F/ SAND***		
5	S-3	4 7 6 5				
	S-4	4 5 8 19		8.0	10.0	
	S-5	20 34 37 50/0.0				
10				***BROWN SILTY F/M/C SAND, SM F/ GRAVEL***		
	S-6	50/0.1		13.6		
	R-1	REC =73% RQD =45%		14.7 ***GRAY, SLIGHTLY TO MODERATELY WEATHERED, HARD, GRAYWACKE, CLOSE TO VERY CLOSE 0 TO 45 DEGREE FRACTURES***		
15				***GRAY, SLIGHTLY WEATHERED, HARD, GRAYWACKE, CLOSE, 0 TO 45 DEGREE FRACTURES***		
	R-2	REC =100% RQD =94%		19.7		
20				***GRAY, SLIGHTLY TO VERY SLIGHTLY WEATHERED, HARD, GRAYWACKE, WIDE FRACTURES***		
	R-3	REC =100% RQD =100%		24.7		
25				***END OF BORING AT 24.7'***		
30						
35						

DRN.	TBT
CKD.	PWK

NEW PROJECTS TEST BORING LOG 195651_TDI_CSX.GPJ SITE BLAUVELT.GDT 3/12/13

TEST BORING LOG

PROJECT: TDI CHAMPLAIN HUDSON POWER EXPRESS

LOCATION: CSX RAILROAD ROW, NY

BORING	**B221.5-1**
G.S. ELEV.	N/A
FILE	195651
SHEET	1 OF 2

GROUNDWATER DATA			
FIRST ENCOUNTERED NR			
DEPTH	HOUR	DATE	ELAPSED TIME
39.2'	0	12/16	0 HR

METHOD OF ADVANCING BOREHOLE				
a	FROM	0.0 '	TO	10.0 '
d	FROM	10.0 '	TO	50.0 '

DRILLER	R. CARUSO
HELPER	C. SMART
INSPECTOR	N/A
DATE STARTED	12/15/2012
DATE COMPLETED	12/16/2012

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
	S-1	6 6 7 4		***BLACK F/ GRAVELLY M/F/C SAND, SM SILT (FILL)***	12.8	
	S-2	5 4 4 4		2.0 ***BROWN SILT, SM F/M/C SAND (FILL)*** 4.0		
5	S-3	4 6 8 5			21.9	
	S-4	4 5 8 7		***BROWN CLAY, TR SILT, TR F/ SAND***		
10	S-5	8 12 17 13			34.3	
				13.5		
15	S-6	2 2 4		***BROWN SILT, TR CLAY***	36.9	
				18.5		
20	S-7	3 3 3		***GRAY SILT, TR TO SM CLAY***		
				23.5		
25	S-8	3 3 3			47.1	
				GRAY CLAY, TR SILT, TR M/F SAND		
30	S-9	WOH 2			38.2	
35	S-10	WOH				

DRN.	TBT
CKD.	PWK

NEW PROJECTS TEST BORING LOG 195651_TDI_CSX.GPJ SITE BLAUVELT.GDT 3/12/13

TEST BORING LOG

PROJECT: TDI CHAMPLAIN HUDSON POWER EXPRESS
LOCATION: CSX RAILROAD ROW, NY

BORING	**B221.5-1**
G.S. ELEV.	N/A
FILE	195651
SHEET	2 OF 2

DEPTH		A	B	C	DESCRIPTION	Wn	REMARKS
40		S-11	2 1 2			44.7	
					GRAY CLAY, TR SILT, TR M/F SAND		
45		S-12	WOH 1 2			34.3	
50		S-13	1 1 1		50.0	42.8	
					END OF BORING AT 50'		
55							
60							
65							
70							
75							

SUMMARY OF LABORATORY TEST DATA

Project Name: TDI Champlain Hudson Power Express – CSX
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	-	-	-	-	-	-	-	-	-	-	20.7	88.6	-	-
	S-6	13.5-15.0	-	-	-	-	-	-	-	-	-	-	18.2	-	-	-
	S-7	18.5-20.0	-	-	-	-	-	-	-	-	-	-	21.4	-	-	-
B221.0-1	S-1	0.0-2.0	-	-	-	-	-	-	-	-	-	-	7.6	-	-	-
	S-3	4.0-6.0	GW	77.0	17.5	5.5		-	-	-	-	-	4.2	-	-	-
	S-4	6.0-8.0														
	S-5	8.0-10.0														
B221.14-1	S-1	0.0-2.0	-	-	-	-	-	-	-	-	-	-	21.3	-	-	-
	S-3	4.0-6.0	-	-	-	-	-	-	-	-	-	-	6.3	-	-	-
	S-4	6.0-8.0	GW-GM	58.7	31.3	10.0		-	-	-	-	-	6.4	-	-	-
	S-5	8.0-10.0														

SUMMARY OF LABORATORY TEST DATA

Project Name: TDI Champlain Hudson Power Express – CSX
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-6	13.5-15.0	-	-	-	-	-	-	-	-	-	-	17.9	-	-	-
	S-8	23.5-25.0	-	-	-	-	-	-	-	-	-	-	14.7	-	-	-
B221.2-1	R-2	4.4-4.0	-	-	-	-	-	-	-	-	-	-	-	169.8	-	-
	R-3	9.0-9.8	-	-	-	-	-	-	-	-	-	-	-	169.2	412	-
B221.4-1	S-1	0.0-2.0	-	-	-	-	-	-	-	-	-	-	27.0	-	-	12.7
	S-4	6.0-8.0	-	-	-	-	-	-	-	-	-	-	10.0	-	-	-
	R-2	14.7-15.3	-	-	-	-	-	-	-	-	-	-	-	168.1	475	-
	R-3	19.7-20.4	-	-	-	-	-	-	-	-	-	-	-	167.7	680	-
B221.5-1	S-1	0.0-2.0	SM	35.6	45.4	19.0		-	-	-	-	-	12.8	-	-	-
	S-3	4.0-6.0	-	-	-	-	-	-	-	-	-	-	21.9	-	-	-
	S-4	6.0-8.0	CH	0.0	2.5	8.6	88.9	55	29	26	0.2	2.87	34.3	-	-	-

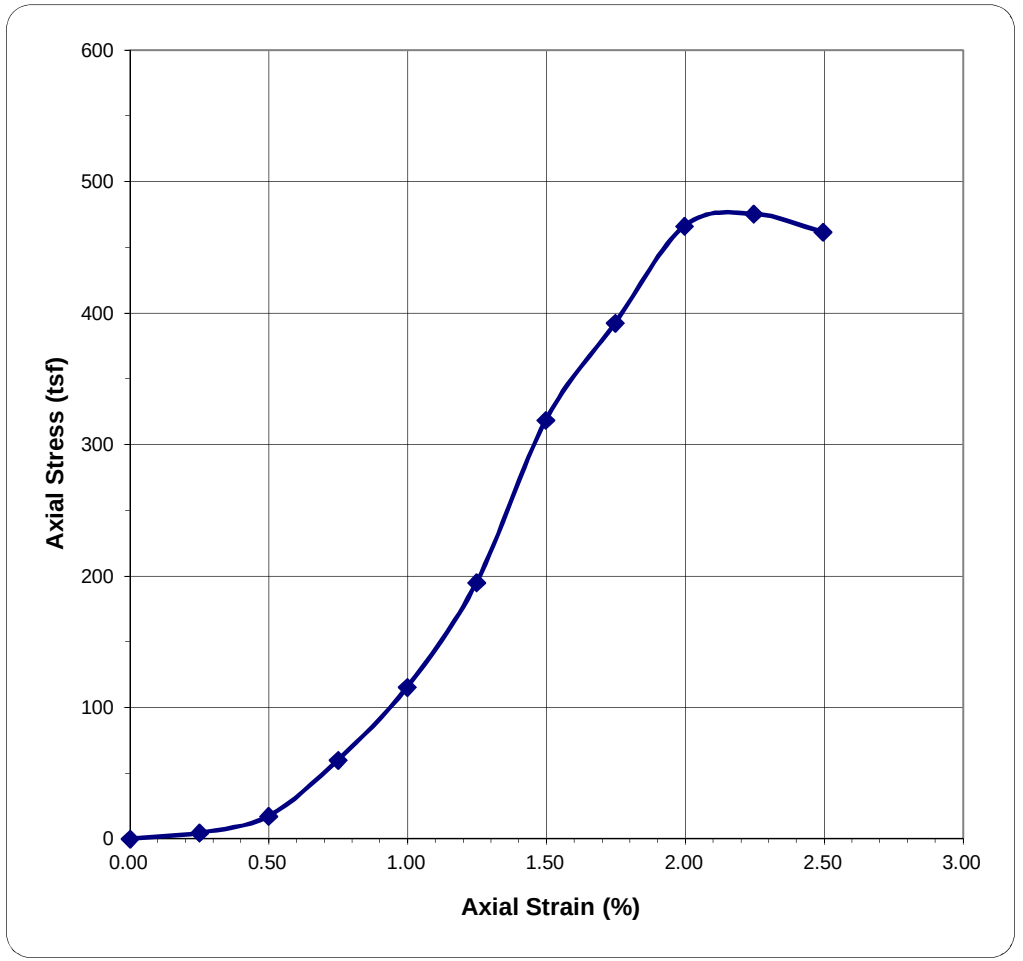
TRC Engineers, Inc.
Soil Mechanics Laboratory

Unconfined Compression Strength Test of Rock Core

Project Name:	TDI				
Project No.:	195651	**Average Sample Diameter (in.):**	1.993	**Sample Description:**	
Boring No.:	B221.4-1	**Cross Sectional Area (sq. in.)**	3.120	GRAY GRAYWACKE	
Sample No:	R-2	**Average Sample Height (in.):**	4.008		
Depth (ft):	14.7-15.3	**Sample Mass-Dry (g):**	551.73		
Elevation (ft):		**Unit Weight (PCF)**	168.1		

Test Data

Strain Dial (in.)	Load (lb)	Strain (%)	Stress (tsf)
0.000	0	0.00	0
0.010	200	0.25	5
0.020	750	0.50	17
0.030	2600	0.75	60
0.040	5000	1.00	115
0.050	8450	1.25	195
0.060	13800	1.50	318
0.070	17000	1.75	392
0.080	20200	2.00	466
0.090	20600	2.25	475
0.100	20000	2.50	462



Failure Conditions:

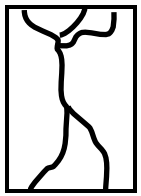


FIGURE: 155

TRC Engineers, Inc.
Soil Mechanics Laboratory

Unconfined Compression Strength Test of Rock Core

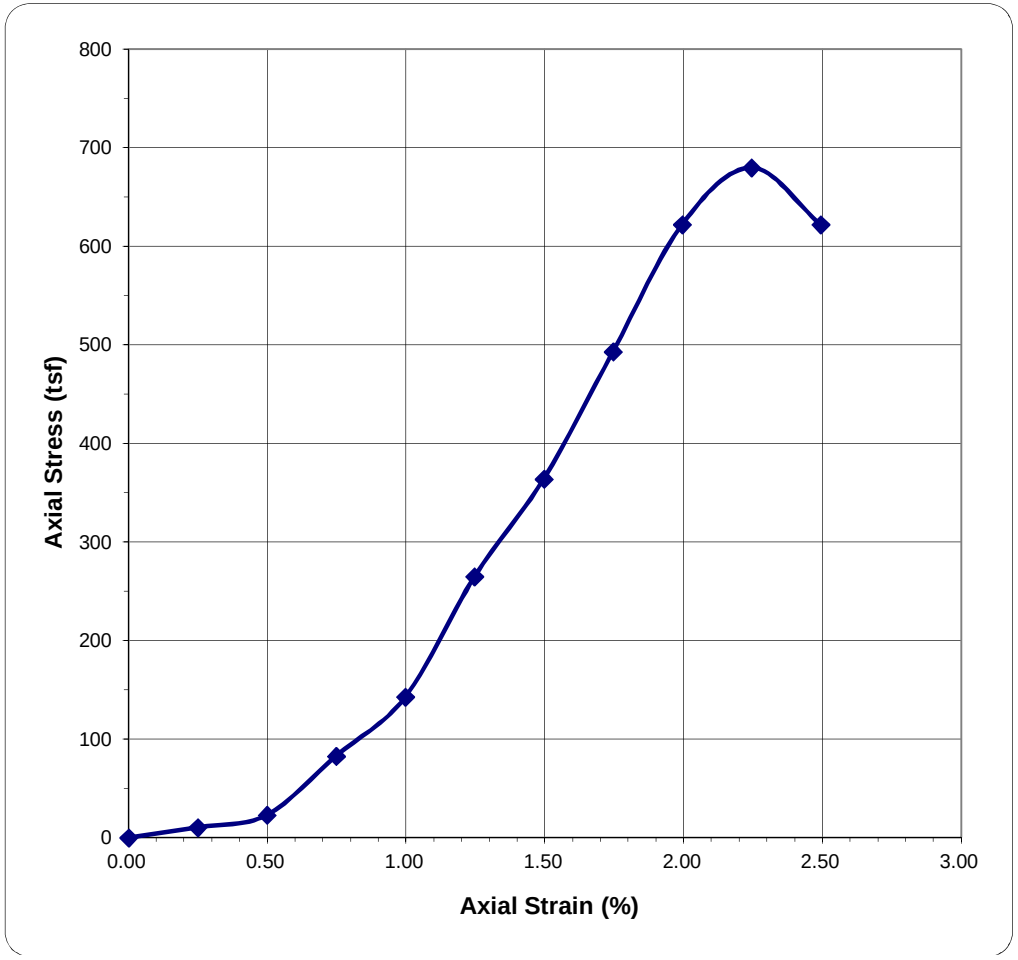
Project Name: TDI
Project No.: 195651
Boring No.: B221.4-1
Sample No: R-3
Depth (ft): 19.7-20.4
Elevation (ft):

Average Sample Diameter (in.): 1.995
Cross Sectional Area (sq. in.) 3.126
Average Sample Height (in.): 4.010
Sample Mass-Dry (g): 551.69
Unit Weight (PCF) 167.7

Sample Description: GRAY GRAYWACKE

Test Data

Strain Dial (in.)	Load (lb)	Strain (%)	Stress (tsf)
0.000	0	0.00	0
0.010	450	0.25	10
0.020	1000	0.50	23
0.030	3600	0.75	83
0.040	6200	1.00	143
0.050	11500	1.25	265
0.060	15800	1.50	364
0.070	21400	1.75	493
0.080	27000	2.00	622
0.090	29500	2.24	679
0.100	27000	2.49	622



Failure Conditions:

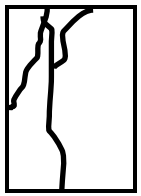


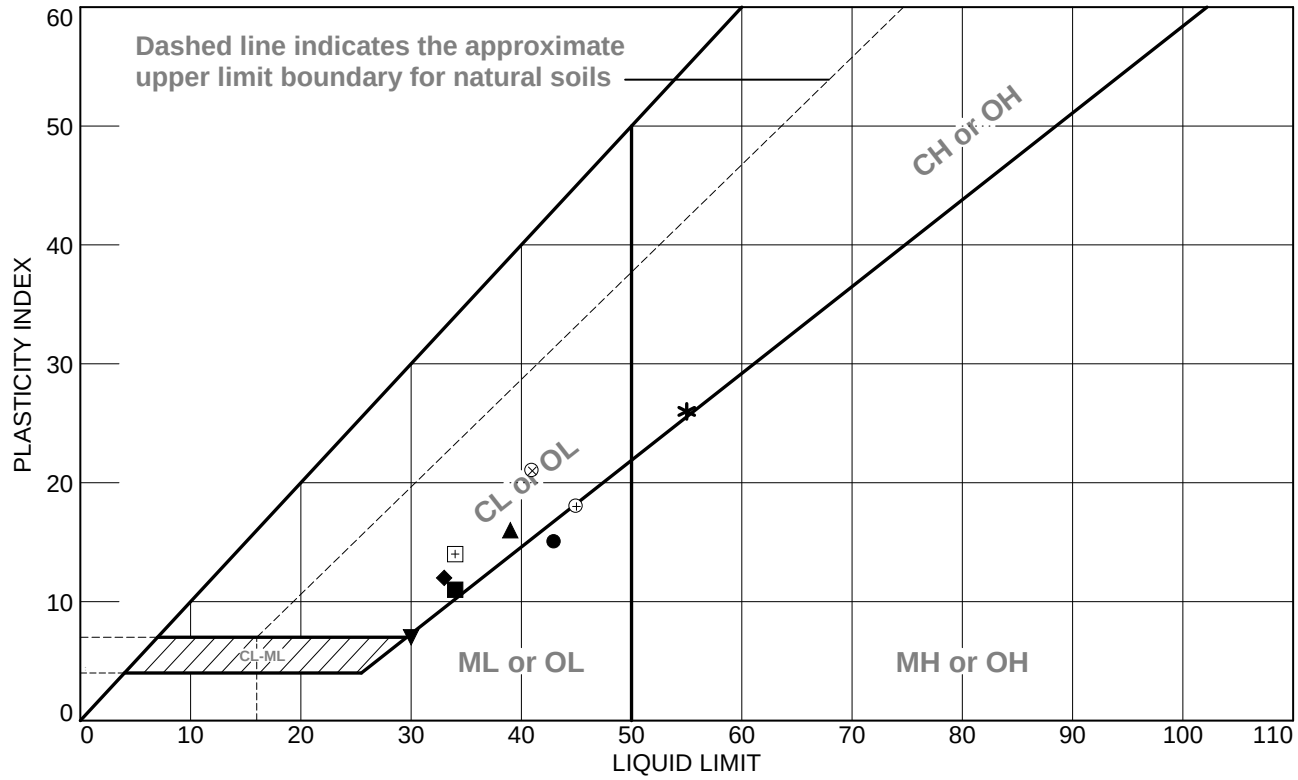
FIGURE: 156

SUMMARY OF LABORATORY TEST DATA

Project Name: TDI Champlain Hudson Power Express – CSX
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-6	13.5-15.0	-	-	-	-	-	-	-	-	-	-	17.9	-	-	-
	S-8	23.5-25.0	-	-	-	-	-	-	-	-	-	-	14.7	-	-	-
B221.2-1	R-2	4.4-4.0	-	-	-	-	-	-	-	-	-	-	-	169.8	-	-
	R-3	9.0-9.8	-	-	-	-	-	-	-	-	-	-	-	169.2	412	-
B221.4-1	S-1	0.0-2.0	-	-	-	-	-	-	-	-	-	-	27.0	-	-	12.7
	S-4	6.0-8.0	-	-	-	-	-	-	-	-	-	-	10.0	-	-	-
	R-2	14.7-15.3	-	-	-	-	-	-	-	-	-	-	-	168.1	475	-
	R-3	19.7-20.4	-	-	-	-	-	-	-	-	-	-	-	167.7	680	-
B221.5-1	S-1	0.0-2.0	SM	35.6	45.4	19.0		-	-	-	-	-	12.8	-	-	-
	S-3	4.0-6.0	-	-	-	-	-	-	-	-	-	-	21.9	-	-	-
	S-4	6.0-8.0	CH	0.0	2.5	8.6	88.9	55	29	26	0.2	2.87	34.3	-	-	-

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

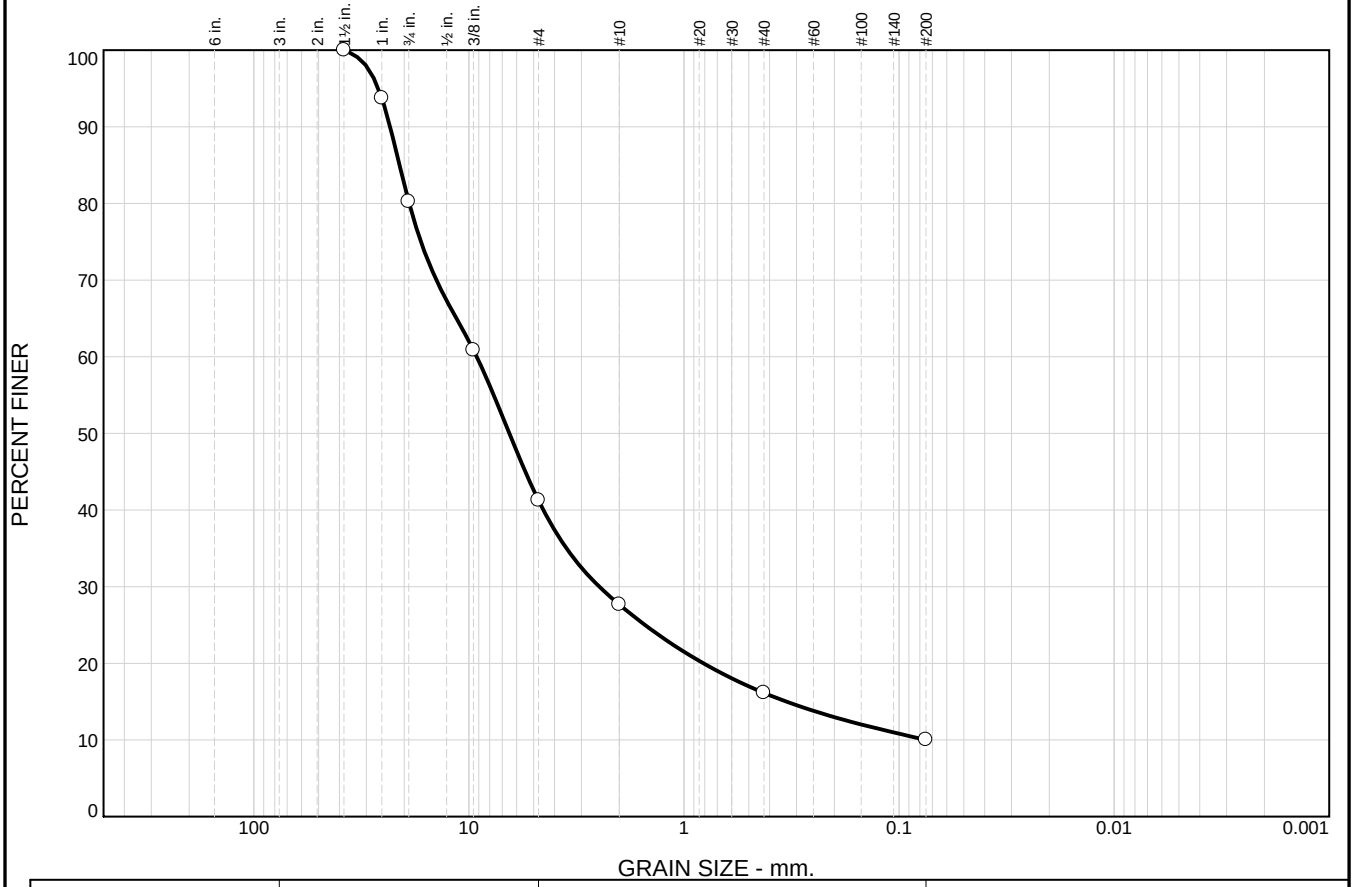
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	A219.05-1	S-6	13.5-15.0 FT	36.0	28	43	15	ML
■	B219.5-1	S-7	18.5-20.0 FT	28.3	23	34	11	CL
▲	B220.3-1	S-6	13.5-15.0 FT	34.8	23	39	16	CL
◆	B220.3-1	S-7 & S-8	18.5-25.0 FT	26.9	21	33	12	CL
▼	B220.7-1	S-4 & S-5	6.0-10.0 FT	15.4	23	30	7	ML
✱	B221.5-1	S-4 & S-5	6.0-10.0 FT	34.3	29	55	26	CH
⊕	B221.5-1	S-9	28.5-30.0 FT	38.2	27	45	18	CL/ML
⊞	B221.6-1	S-3, S-4, & S-5	4.0-10.0 FT	38.8	20	34	14	CL
⊗	B221.8-1	S-5	8.0-10.0 FT	40.2	20	41	21	CL

TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: TRANSMISSION DEVELOPERS INC.
Project: TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX

Project No.: 195651 **Figure** 8

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	19.8	38.9	13.6	11.6	6.1	10.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			21.0085	9.1993	6.4842	2.4759	0.3338			

Material Description	USCS	AASHTO
○ DARK BROWN C/M/F SANDY F/C GRAVEL, TR SILT	GW-GM	

Project No. 195651 **Client:** TRANSMISSION DEVELOPERS INC.

Project: TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX

○ **Sample Source:** B221.14-1 **Depth:** 6.0-10.0 FT **Sample No.:** S-4 & S-5

TRC Engineers, Inc.

Mt. Laurel, NJ

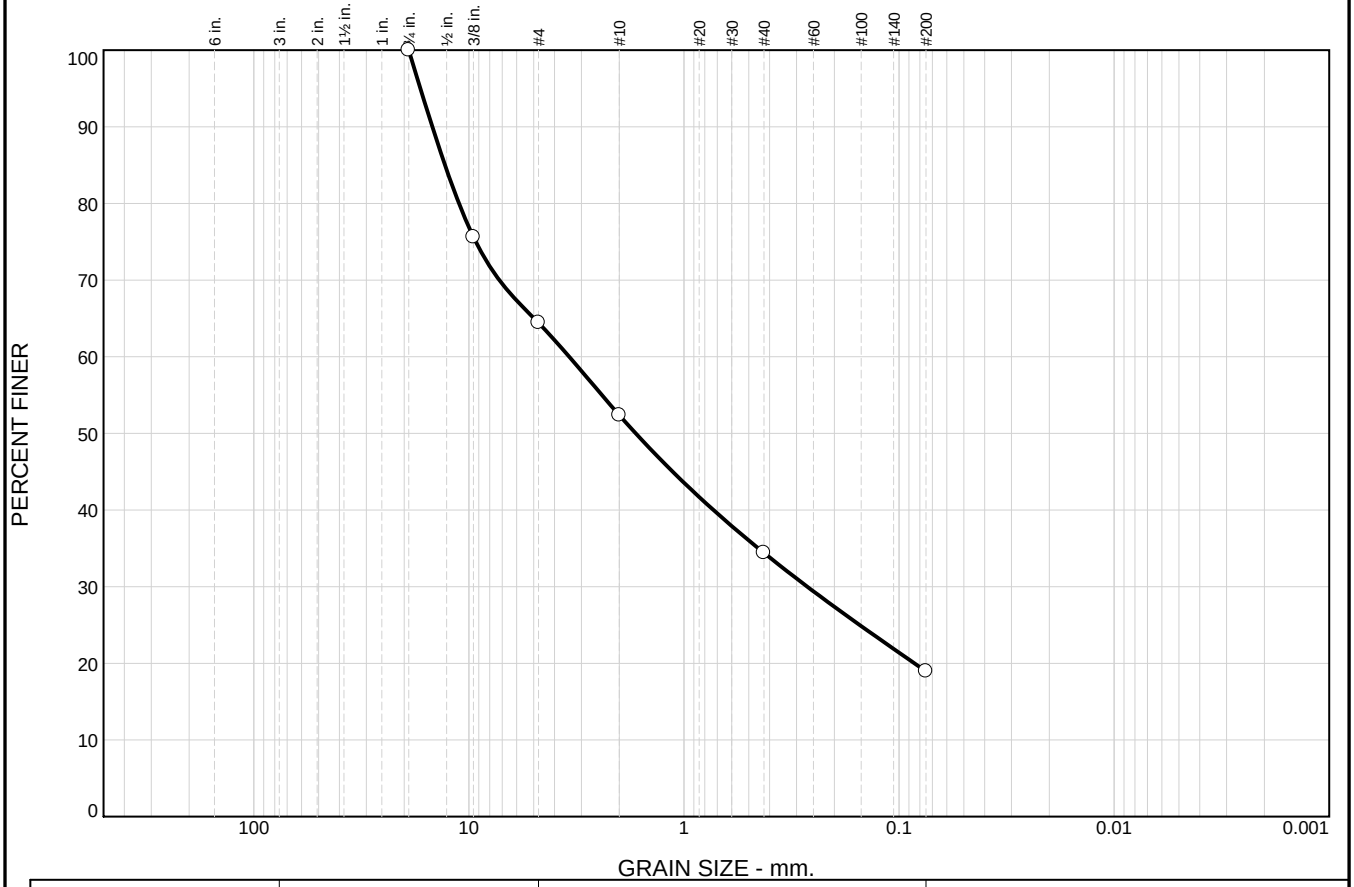
Remarks:

○SAMPLE DESCRIPTION BASED ON VISUAL IDENTIFICATION AND LABORATORY ANALYSIS

Figure 124

Tested By: TBT 01/10/13 **Checked By:** JPB 03/12/13

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	35.6	12.0	18.0	15.4	19.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			12.9160	3.4157	1.6771	0.2672				

Material Description	USCS	AASHTO
○ BLACK F/ GRAVELLY M/F/C SAND, SM SILT	SM	

Project No. 195651 **Client:** TRANSMISSION DEVELOPERS INC.

Project: TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX

○ **Source of Sample:** B221.5-1 **Depth:** 0.0-2.0 FT **Sample Number:** S-1

TRC Engineers, Inc.

Mt. Laurel, NJ

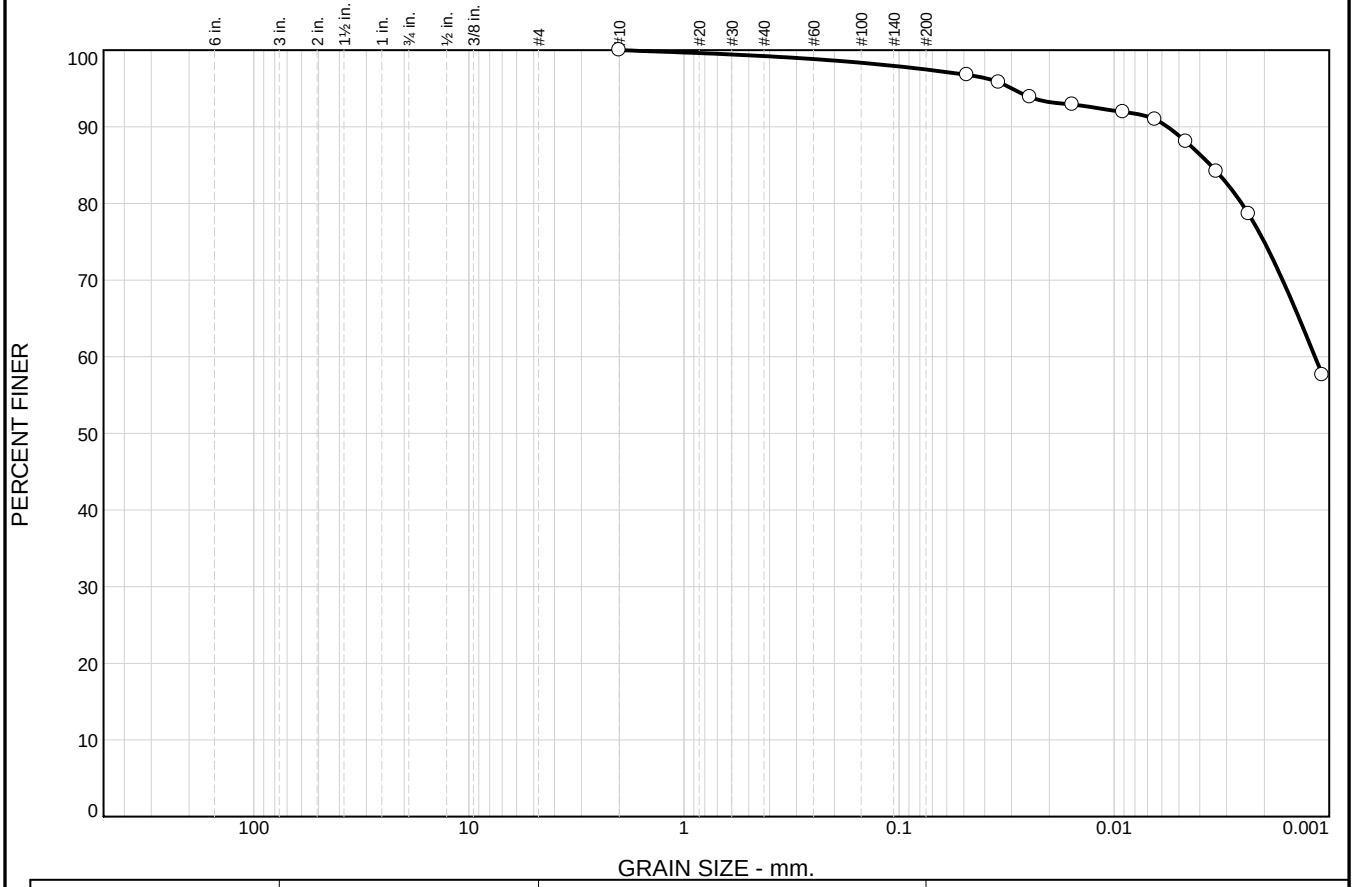
Remarks:

○SAMPLE DESCRIPTION BASED ON VISUAL IDENTIFICATION AND LABORATORY ANALYSIS

Figure 118

Tested By: BMH 01/24/13 **Checked By:** JPB 03/12/13

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.8	1.7	8.6	88.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○	55	29	0.0036	0.0012						

Material Description	USCS	AASHTO
○ BROWN CLAY, TR SILT, TR F/ SAND	CH	A-7-6(31)

Project No. 195651 **Client:** TRANSMISSION DEVELOPERS INC.

Project: TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX

○ **Sample Source:** B221.5-1 **Depth:** 6.0-10.0 FT **Sample No.:** S-4 & S-5

TRC Engineers, Inc.

Mt. Laurel, NJ

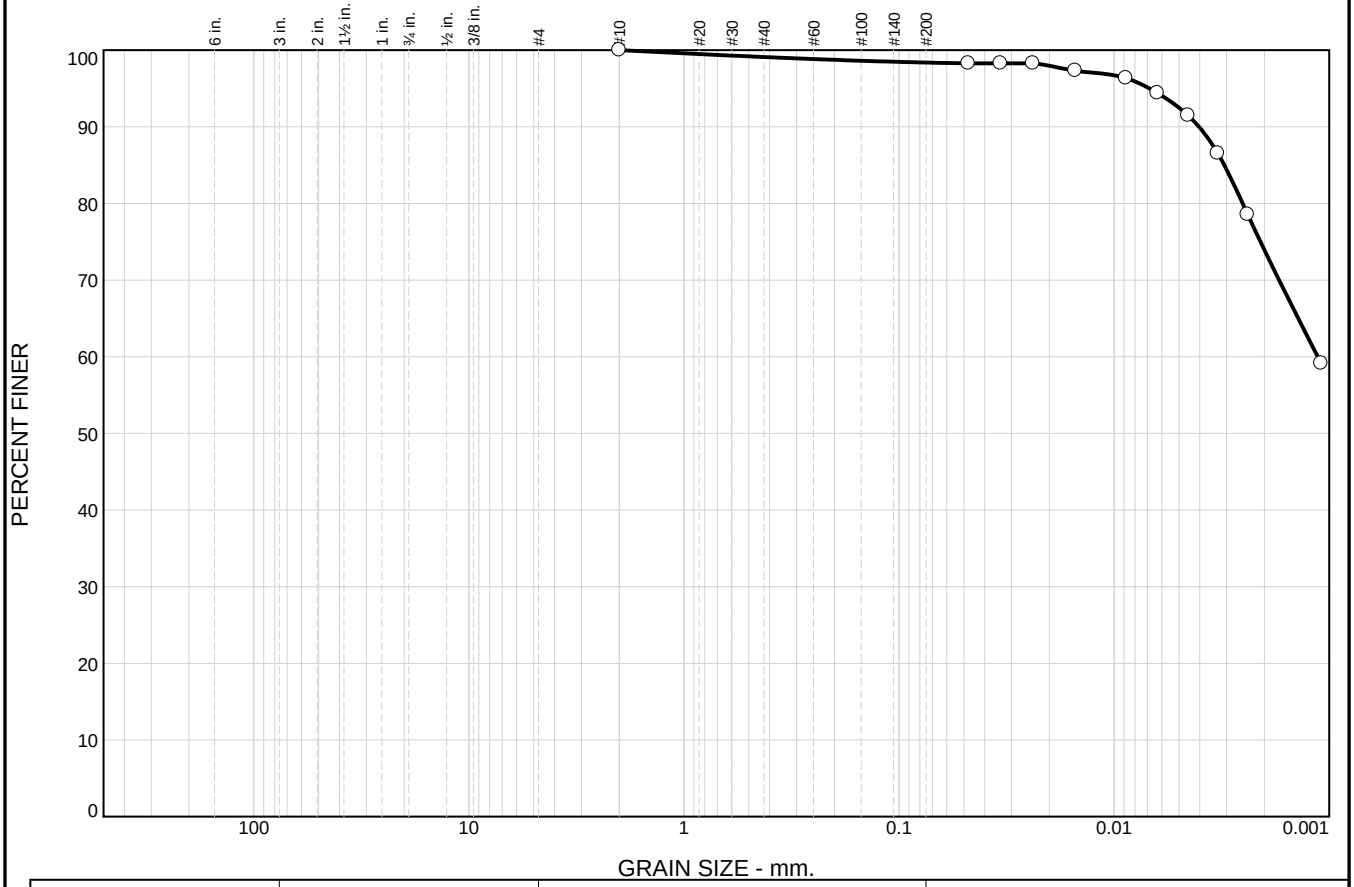
Remarks:

○SAMPLE DESCRIPTION BASED ON VISUAL IDENTIFICATION AND LABORATORY ANALYSIS

Figure 119

Tested By: TBT 02/11/12 **Checked By:** JPB 03/12/13

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.9	0.7	5.9	92.5

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			0.0031	0.0011						

Material Description	USCS	AASHTO
○ GRAY CLAY, TR SILT, TR M/F SAND		

Project No. 195651 **Client:** TRANSMISSION DEVELOPERS INC.

Project: TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX

○ **Source of Sample:** B221.5-1 **Depth:** 38.5-40.0 FT **Sample Number:** S-11

TRC Engineers, Inc.

Mt. Laurel, NJ

Remarks:

○SAMPLE DESCRIPTION BASED ON VISUAL IDENTIFICATION AND LABORATORY ANALYSIS

Figure 120

Tested By: TBT 02/11/12 **Checked By:** JPB 03/12/13

TRC Engineers, Inc.
Soil Mechanics Laboratory

Unconfined Compression Strength Test of Rock Core

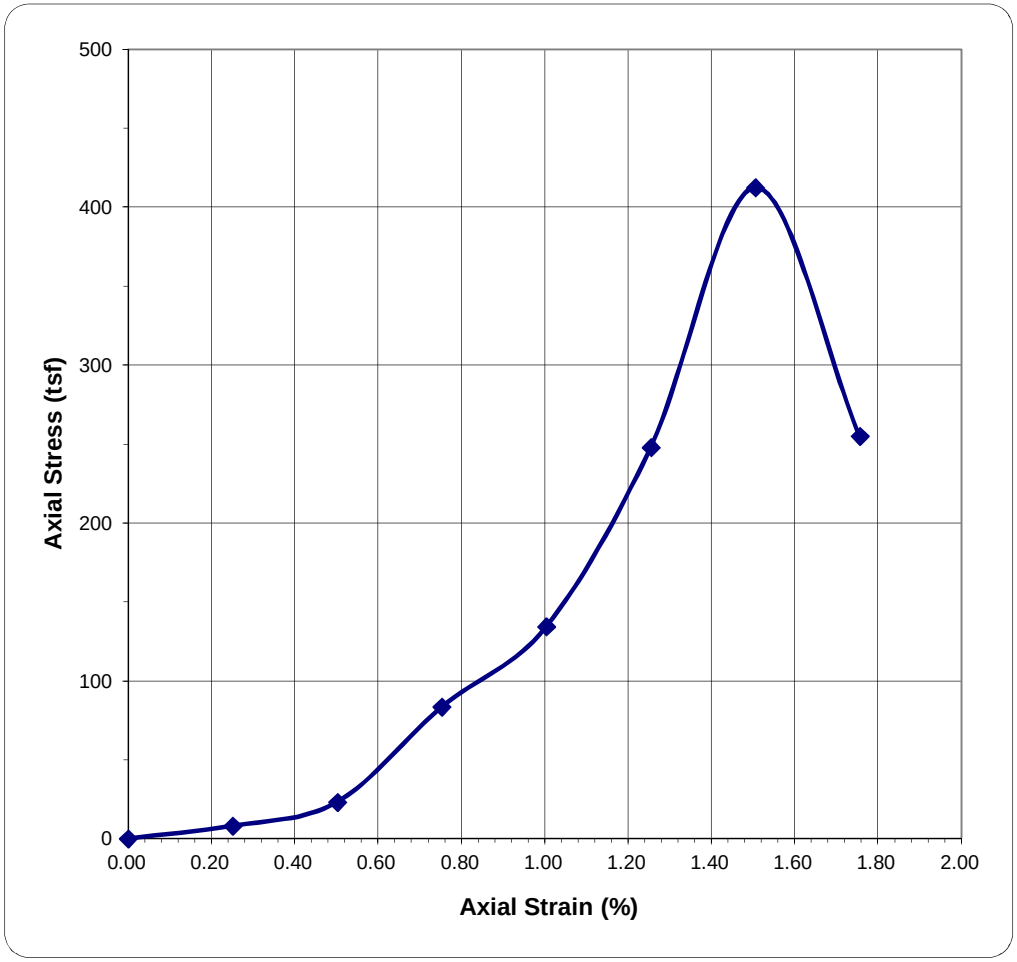
Project Name: TDI
Project No.: 195651
Boring No.: B221.2-1
Sample No: R-3
Depth (ft): 9.0-9.8
Elevation (ft):

Average Sample Diameter (in.): 1.989
Cross Sectional Area (sq. in.) 3.107
Average Sample Height (in.): 3.985
Sample Mass-Dry (g): 550.03
Unit Weight (PCF) 169.2

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	1000	0.50	23
0.030	3600	0.75	83
0.040	5800	1.00	134
0.050	10700	1.25	248
0.060	17800	1.51	412
0.070	11000	1.76	255



Failure Conditions:

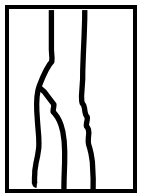


FIGURE: 154

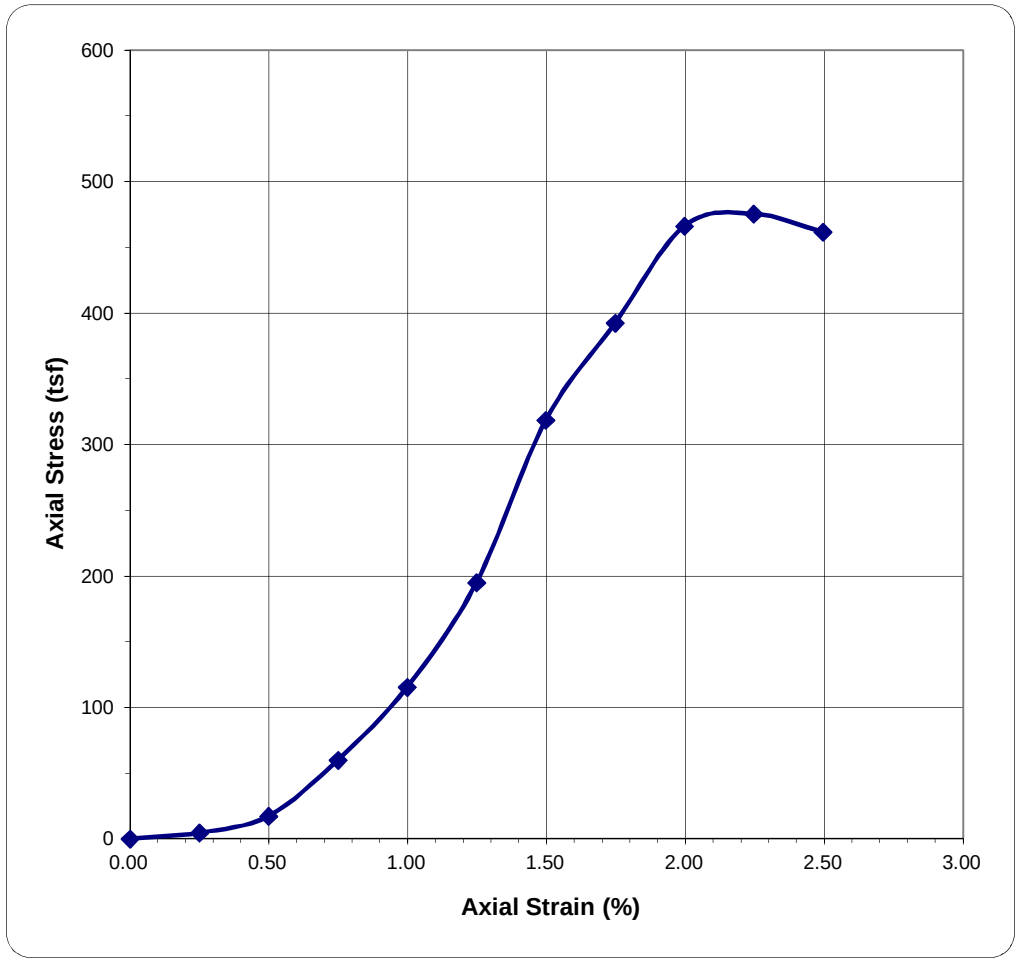
TRC Engineers, Inc.
Soil Mechanics Laboratory

Unconfined Compression Strength Test of Rock Core

Project Name:	TDI				
Project No.:	195651	**Average Sample Diameter (in.):**	1.993	**Sample Description:**	
Boring No.:	B221.4-1	**Cross Sectional Area (sq. in.)**	3.120	GRAY GRAYWACKE	
Sample No:	R-2	**Average Sample Height (in.):**	4.008		
Depth (ft):	14.7-15.3	**Sample Mass-Dry (g):**	551.73		
Elevation (ft):		**Unit Weight (PCF)**	168.1		

Test Data

Strain Dial (in.)	Load (lb)	Strain (%)	Stress (tsf)
0.000	0	0.00	0
0.010	200	0.25	5
0.020	750	0.50	17
0.030	2600	0.75	60
0.040	5000	1.00	115
0.050	8450	1.25	195
0.060	13800	1.50	318
0.070	17000	1.75	392
0.080	20200	2.00	466
0.090	20600	2.25	475
0.100	20000	2.50	462



Failure Conditions:

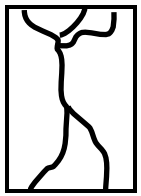


FIGURE: 155

TRC Engineers, Inc.
Soil Mechanics Laboratory

Unconfined Compression Strength Test of Rock Core

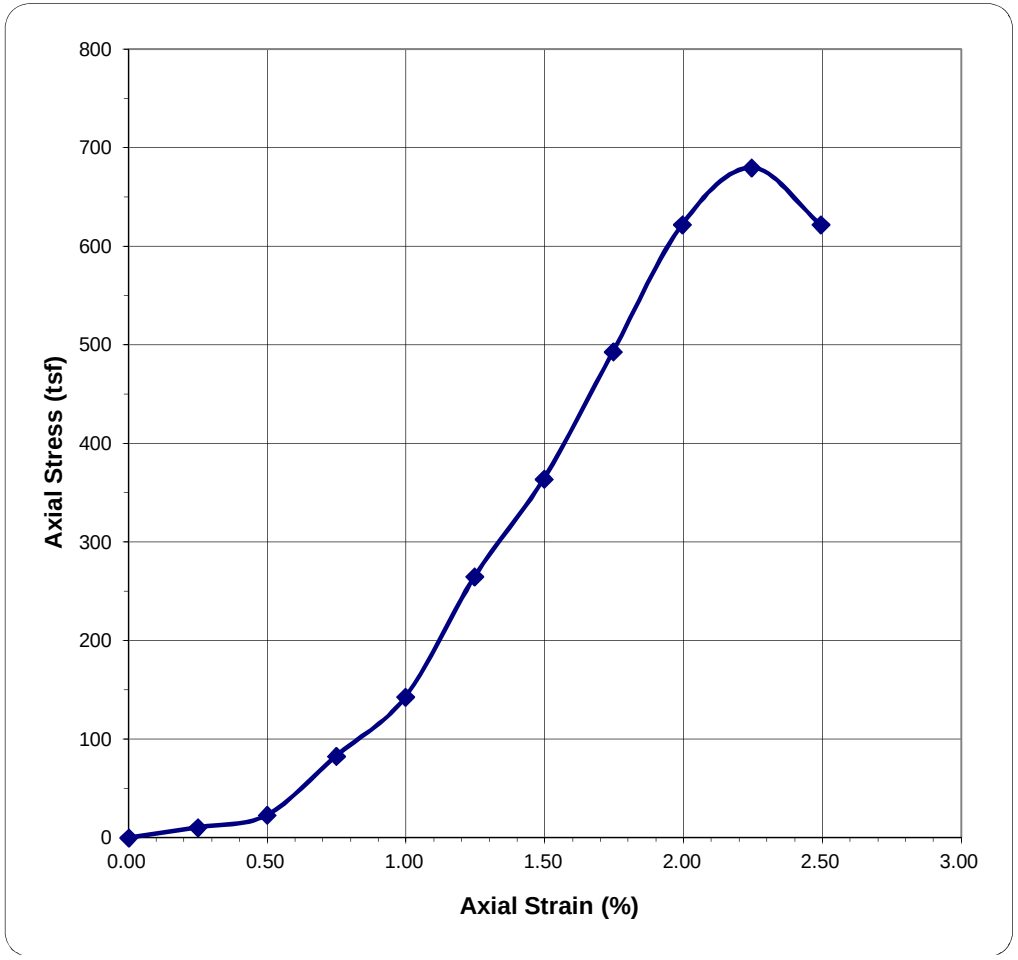
Project Name: TDI
Project No.: 195651
Boring No.: B221.4-1
Sample No: R-3
Depth (ft): 19.7-20.4
Elevation (ft):

Average Sample Diameter (in.): 1.995
Cross Sectional Area (sq. in.) 3.126
Average Sample Height (in.): 4.010
Sample Mass-Dry (g): 551.69
Unit Weight (PCF) 167.7

Sample Description: GRAY GRAYWACKE

Test Data

Strain Dial (in.)	Load (lb)	Strain (%)	Stress (tsf)
0.000	0	0.00	0
0.010	450	0.25	10
0.020	1000	0.50	23
0.030	3600	0.75	83
0.040	6200	1.00	143
0.050	11500	1.25	265
0.060	15800	1.50	364
0.070	21400	1.75	493
0.080	27000	2.00	622
0.090	29500	2.24	679
0.100	27000	2.49	622



Failure Conditions:

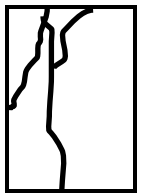


FIGURE: 156

Package 7A Phase 3 Borings

Champlain Hudson Power Express

New York

PROJECT NUMBER 20001480

CREATED BY Kiewit

DATE 12/08/2022

Legend Key

- Kiewit Borings (Phase 3)

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: KB-221.3

PROJECT NUMBER	20001480	**LOGGED BY**	Rafael Salas Jr	**COORDINATES**	N 1236204.17 E 662544.15
START DATE	09/20/2022	**DRILLER/RIG**	Tim / CME-75	**GROUND ELEV.**	24.4 ft
FINISH DATE	09/22/2022	**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	23.9	6" Topsoil						Boring advanced with 3.25" Mud Rotary
		FILL: Clayey GRAVEL (GC), coarse, moist, subangular to angular			66%		1-6-5-4 (11)	
	22.4	Sandy CLAY with Gravel (CL), brown, fine to medium coarse, moist, subangular to angular gravel			38%		3-10-9-5 (19)	
5		Coarse gravel, moist			25%		14-10-4-7 (14)	
	18.4	Clayey SILT (ML), reddish brown, loose, moist, low to medium plasticity			50%		12-5-5-6 (10)	
	16.4	Silty Clayey GRAVEL with Sand (GC-GM), reddish brown, dense, fine to coarse gravel, moist, low to medium plasticity			75%		2-3-4-9 (7)	
10		Color change at 11 ft to grayish brown			75%		10-16-16-12 (32)	
15	9.4	Shale, gray to dark gray, closely spaced discontinuities, with fractures filled with calcite, trace fine sandstone lenses, fresh to slightly weathered			100%		50/1"	
20				1	94% 62			76 minute core run
25								
30								

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-221.3

PROJECT NUMBER	20001480	**LOGGED BY**	Rafael Salas Jr	**COORDINATES**	N 1236204.17 E 662544.15
START DATE	09/20/2022	**DRILLER/RIG**	Tim / CME-75	**GROUND ELEV.**	24.4 ft
FINISH DATE	09/22/2022	**DRILL CONTRACTOR**	ADT Inc.	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
35			Shale, gray to dark gray, closely spaced discontinuities, with fractures filled with calcite, trace fine sandstone lenses, fresh to slightly weathered		2	90% 57			114 minute core run
			Occasional calcite veins						
			Fine sandstone lens at 37.4 to 38 ft						
40					3	100% 75			77 minute core run
45									
50					4	98% 95			62 minute core run
			Fine sandstone lens at 52.8 to 56.4 ft						
55									
60									

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-221.3

PROJECT NUMBER	20001480	**LOGGED BY**	Rafael Salas Jr	**COORDINATES**	N 1236204.17 E 662544.15
START DATE	09/20/2022	**DRILLER/RIG**	Tim / CME-75	**GROUND ELEV.**	24.4 ft
FINISH DATE	09/22/2022	**DRILL CONTRACTOR**	ADT Inc.	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
65			Shale, gray to dark gray, closely spaced discontinuities, with fractures filled with calcite, occasional near vertical joints, fresh to slightly weathered		5	99% 88			70 minute core run
70					6	100% 93			72 minute core run
75			Interbedded with sandstone/siltstone, moderately to very closely spaced discontinuities						UCS = 8726 psi
80					7	100% 64			85 minute core run
85			Moderately spaced discontinuities						
90									

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-221.3

PROJECT NUMBER	20001480	**LOGGED BY**	Rafael Salas Jr	**COORDINATES**	N 1236204.17 E 662544.15
START DATE	09/20/2022	**DRILLER/RIG**	Tim / CME-75	**GROUND ELEV.**	24.4 ft
FINISH DATE	09/22/2022	**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
95		Shale, gray to dark gray, moderately spaced discontinuities, with fractures filled with calcite, fresh to slightly weathered		8	100% / 82			74 minute core run
		Interbedded with sand layers, more closely spaced discontinuities, slightly weathered						
100				9	92% / 53			92 minute core run
105		Moderately spaced discontinuities						
				10	100% / 95			27 minute core run
110	-85.6	Boring Terminated at 110 ft						
115								
120								

Legend

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

20 40 60 80

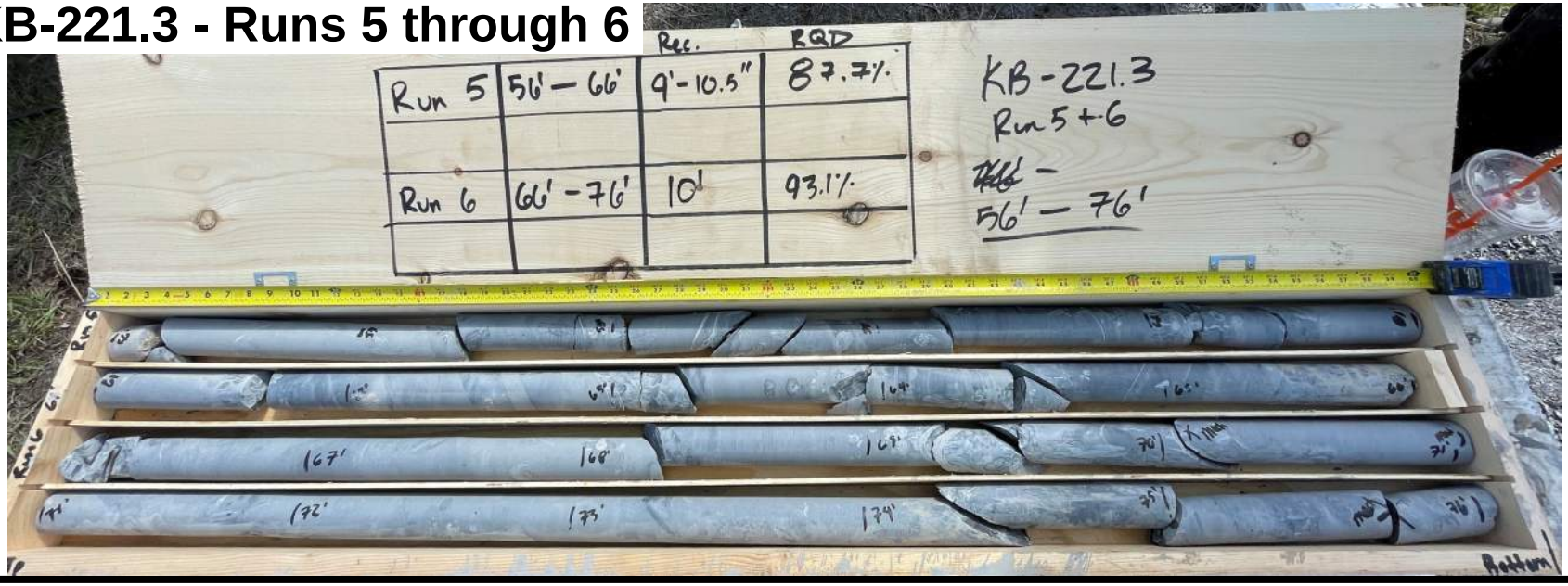
Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

KB-221.3 - Runs 1 through 2

KB-221.3 - Runs 3 through 4

Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

KB-221.3 - Runs 5 through 6



KB-221.3 - Runs 7 through 8

Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

KB-221.3 - Runs 9 through 10

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: KB-221.4

PROJECT NUMBER	20001480	**LOGGED BY**	Shabbaz Ahmad	**COORDINATES**	N 1235655.06 E 662500.45
START DATE	10/06/2022	**DRILLER/RIG**	Tim / CME-75	**GROUND ELEV.**	23.9 ft
FINISH DATE	10/07/2022	**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	23.4	6" Topsoil						Boring advanced with 3.25" ID HSA
		Silty SAND (SM), dark grey to brown, dense to medium dense, fine to coarse gravel, moist, subangular			79%		7-11-14-13 (25)	
					62%		8-10-8-8 (18)	
		Loose, brown, mottled red clay observed						
5					54%		2-2-5-4 (7)	
		Dense, brown to gray						
					50%		9-11-31-17 (42)	
					53%		25-45-66-50/3" (111)	
10	13.9	Gravel with Silt (GM), gray to dark gray, very dense, fine to coarse gravel, dry, angular to subangular Moderately cemented, moist, with shale fragments			100%		30-50/2"	
	9.9	Shale/Siltstone, gray, laminated, moderately spaced discontinuities, high angle joints, very poor RQD, slightly weathered, occasional quartz and calcite veins						Rock coring started (no recovery for first 5')
15				1	36% / 33			
20								
		Poor RQD, moderately weathered						
25				2	92% / 45			30 minute core run
		Fair RQD, slightly weathered						
30								

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-221.4

PROJECT NUMBER	20001480	**LOGGED BY**	Shabbaz Ahmad	**COORDINATES**	N 1235655.06 E 662500.45
START DATE	10/06/2022	**DRILLER/RIG**	Tim / CME-75	**GROUND ELEV.**	23.9 ft
FINISH DATE	10/07/2022	**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
		Shale/Siltstone, gray, laminated, moderately spaced discontinuities, high angle joints, fair RQD, slightly weathered, occasional quartz and calcite veins		3	100% 37			
	-10.1	Sandstone/Siltstone, gray, extremely closely to closely spaced discontinuities, poor RQD, slightly weathered, with vertical joints in sandstone portion		4	92% 40			
35								
40		Shale lenses at 40.5 ft and 43 ft, extremely closely to widely spaced discontinuities, good RQD		5	94% 68			
45		Shale lens at 47 ft		6	98% 82			
50								
55		Occasional shale lenses at 57.5-61.2 ft, occasional near vertical joints, fair RQD, moderately weathered		7	91% 54			
60								

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-221.4

PROJECT NUMBER	20001480	**LOGGED BY**	Shabbaz Ahmad	**COORDINATES**	N 1235655.06 E 662500.45
START DATE	10/06/2022	**DRILLER/RIG**	Tim / CME-75	**GROUND ELEV.**	23.9 ft
FINISH DATE	10/07/2022	**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
		Sandstone/Siltstone, gray, extremely closely to widely spaced discontinuities, fair RQD, slightly weathered, occasional near vertical joints						
	-40.1	Shale, gray, laminated, widely spaced discontinuities, good RQD, unweathered, with occasional siltstone/sandstone lenses						
65								
				8	98% 81			
70								
		Closely to widely spaced discontinuities						
75								
				9	100% 95			UCS = 7620 psi
80								
		Interbedded with sandstone, very closely to moderately spaced discontinuities, , excellent RQD, slightly weathered						
85								
				10	100% 96			
90								

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-221.4

PROJECT NUMBER	20001480	**LOGGED BY**	Shabbaz Ahmad	**COORDINATES**	N 1235655.06 E 662500.45
START DATE	10/06/2022	**DRILLER/RIG**	Tim / CME-75	**GROUND ELEV.**	23.9 ft
FINISH DATE	10/07/2022	**DRILL CONTRACTOR**	ADT Inc.	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
95			Sandstone lenses at 94-96.2 ft, good RQD						
					11	100% 82			
100									
			Very poor RQD, unweathered		12	100% 0			
105	-81.1		Boring Terminated at 105 ft						
110									
115									
120									

Legend

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

20 40 60 80

Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

KB-221.4 - Runs 1 through 3

RQD=45%

KB-221.4 - Runs 4 through 6

RQD=40%

Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

KB-221.4 - Runs 7 through 8

KB-221.4 - Runs 9 through 10

Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

KB-221.4 - Runs 11 through 12

Summary of Laboratory Results

BORING ID	Depth (Ft.)	Water Content (%)
KB-183.6	8	11.5
KB-183.8	4-6	12.7
KB-184.0	4-6	19.9
KB-184.0	10-12	14.1
KB-187.5	10-12	15.9
KB-187.5	20-22	9.2
KB-187.5	30-32	14.1
KB-187.5	40-42	12.2
KB-187.5	45-47	10.9
KB-187.5	60-62	7.5
KB-187.7	10-12	6.3
KB-187.7	20-22	24.3
KB-187.7	35-37	7.2
KB-187.7	55-57	6.6
KB-190.8	4-6	10.9
KB-190.8	15-17	22.7
KB-191.7	4-6	24.0
KB-191.7	10-12	28.2
KB-191.7	25-27	33.6
KB-192.8A	8-10	29.1
KB-192.8A	20-22	30.3
KB-192.8A	40-42	19.6
KB-193.9	4-6	30.2
KB-193.9	10-12	35.1
KB-193.9	15-17	36.0
KB-193.9	35-37	56.2
KB-194.0	4-6	37.9
KB-194.0	15-17	49.1
KB-194.0	25-27	49.4
KB-194.0	35-37	11.2
KB-220.5	8-10	14.2
KB-221.0A	4-6	30.5
KB-221.0A	8-10	9.0
KB-221.0A	15-17	6.1
KB-221.0A	25-27	6.1
KB-221.0A	35-37	6.8
KB-221.3	8	17.8
KB-221.4	4-6	14.8
KB-221.4	8-10	10.5
KB-222.2	7-9	37.9
KB-222.2	25-27	36.9
KB-222.2	40-42	38.2

PROJECT: LAB Testing

SITE: Champlain- Hudson Power Express

Terracon
30 Corporate Cir Ste 201
Albany, NY

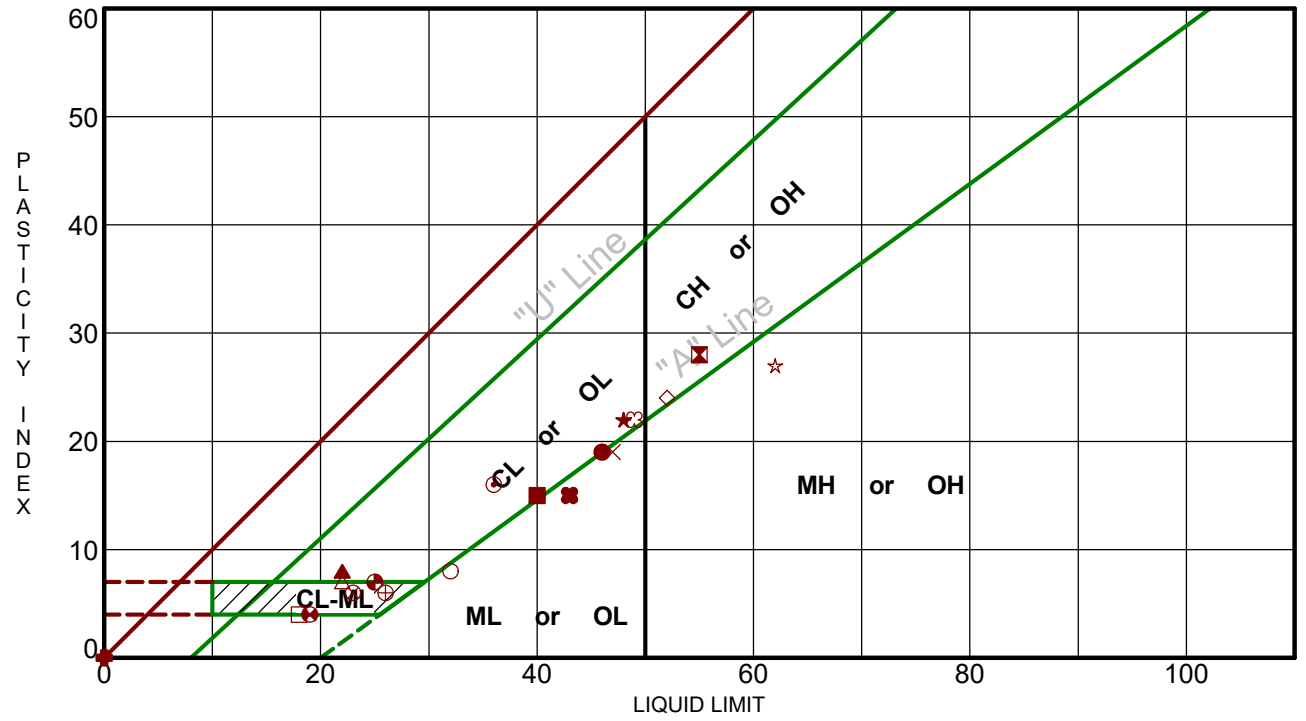
PROJECT NUMBER: JB215256H

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

EXHIBIT: B-1

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
KB-193.9	15 - 17	46	27	19	70.4	CL	LEAN CLAY with SAND
KB-193.9	35 - 37	55	27	28	96.8	CH	FAT CLAY
KB-194.0	4 - 6	22	14	8	81.9	CL	LEAN CLAY with SAND
KB-194.0	15 - 17	48	26	22	85.2	CL	LEAN CLAY
KB-194.0	25 - 27	36	20	16	97.0	CL	LEAN CLAY
KB-194.0	35 - 37	NP	NP	NP	14.7	SM	SILTY SAND with GRAVEL
KB-220.5	8 - 10	32	24	8	26.2	SM	SILTY SAND with GRAVEL
KB-221.0A	4 - 6	22	15	7	89.6	CL-ML	SILTY CLAY
KB-221.0A	8 - 10	23	17	6	11.7	GP-GC	POORLY GRADED GRAVEL with SILTY CLAY and SAND
KB-221.0A	15 - 17	26	20	6	11.8	GP-GC	POORLY GRADED GRAVEL with SILTY CLAY and SAND
KB-221.0A	25 - 27	18	14	4	25.9	GC-GM	SILTY, CLAYEY GRAVEL with SAND
KB-221.0A	35 - 37	19	15	4	21.0	SC-SM	SILTY, CLAYEY SAND with GRAVEL
KB-221.3	8	25	18	7	13.7	GC-GM	SILTY, CLAYEY GRAVEL with SAND
KB-222.2	7 - 9	62	35	27	100.0	MH	ELASTIC SILT
KB-222.2	25 - 27	49	27	22	94.8	CL	LEAN CLAY
KB-222.2	40 - 42	40	25	15	90.4	CL	LEAN CLAY
KB-222.6A	15 - 17	NP	NP	NP	7.4	GP-GM	POORLY GRADED GRAVEL with SAND and SILT
KB-222.6A	35 - 37	52	28	24	87.3	CH	FAT CLAY
KB-222.6A	50 - 52	47	28	19	96.5	ML	SILT
KB-222.6A	65 - 67	43	28	15	99.3	ML	SILT

PROJECT: LAB Testing

SITE: Champlain- Hudson Power Express

Terracon
30 Corporate Cir Ste 201
Albany, NY

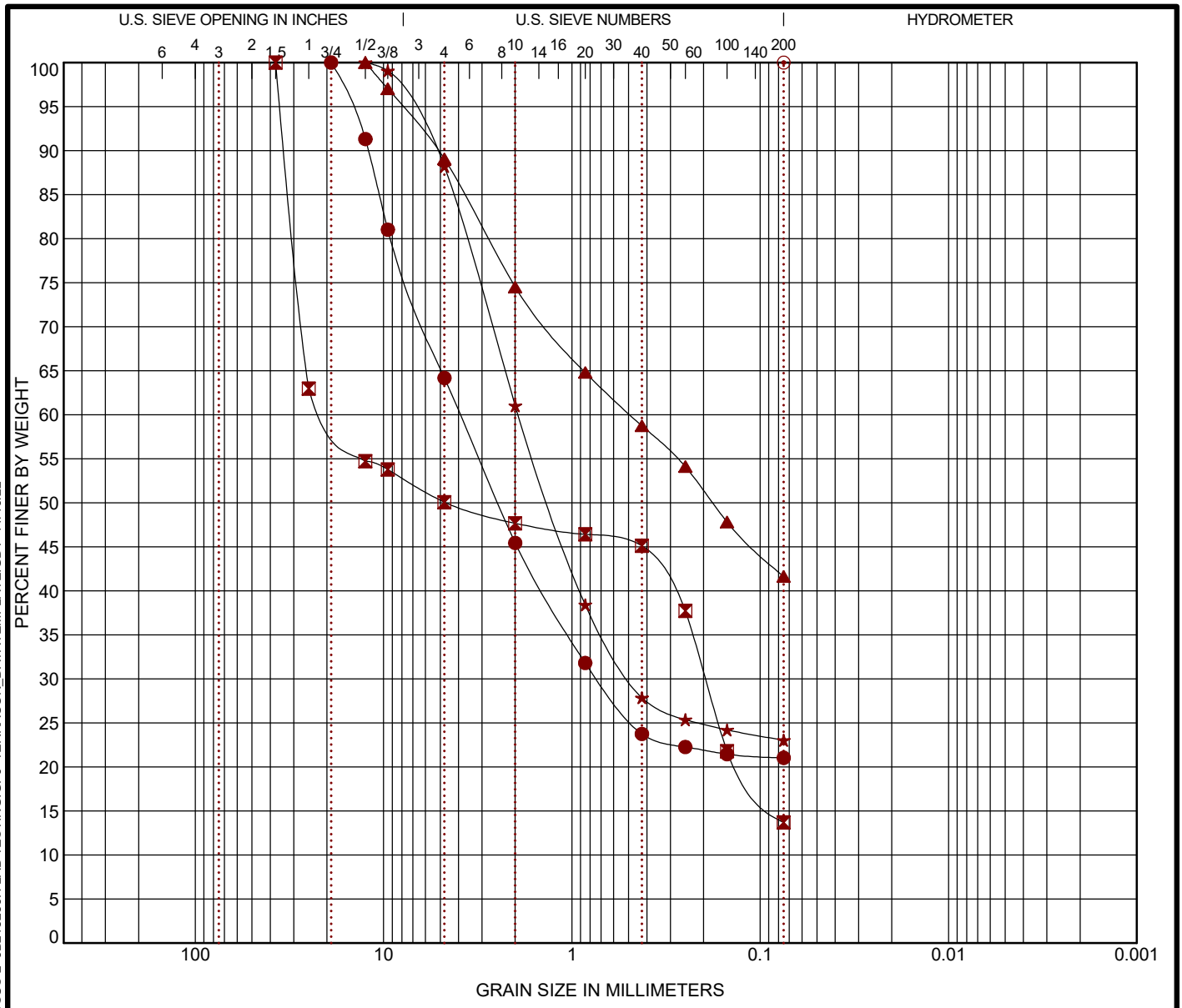
PROJECT NUMBER: JB215256H

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

EXHIBIT: B-2

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	KB-221.0A	35 - 37	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	6.8	19	15	4		
⊠	KB-221.3	8	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	17.8	25	18	7		
▲	KB-221.4	4 - 6	SILTY SAND (SM)	14.8					
★	KB-221.4	8 - 10	SILTY SAND (SM)	10.5					
⊙	KB-222.2	7 - 9	ELASTIC SILT (MH)	37.9	62	35	27		

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	KB-221.0A	35 - 37	19	3.917	0.728		0.0	35.8	43.1		21.0	
⊠	KB-221.3	8	37.5	19.495	0.195		0.0	49.9	36.4		13.7	
▲	KB-221.4	4 - 6	12.5	0.491			0.0	10.9	47.4		41.6	
★	KB-221.4	8 - 10	12.5	1.924	0.489		0.0	11.8	65.2		23.0	
⊙	KB-222.2	7 - 9	0.075				0.0	0.0	0.0		100.0	

PROJECT: LAB Testing

SITE: Champlain- Hudson Power Express

Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215256H

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

EXHIBIT: B-8

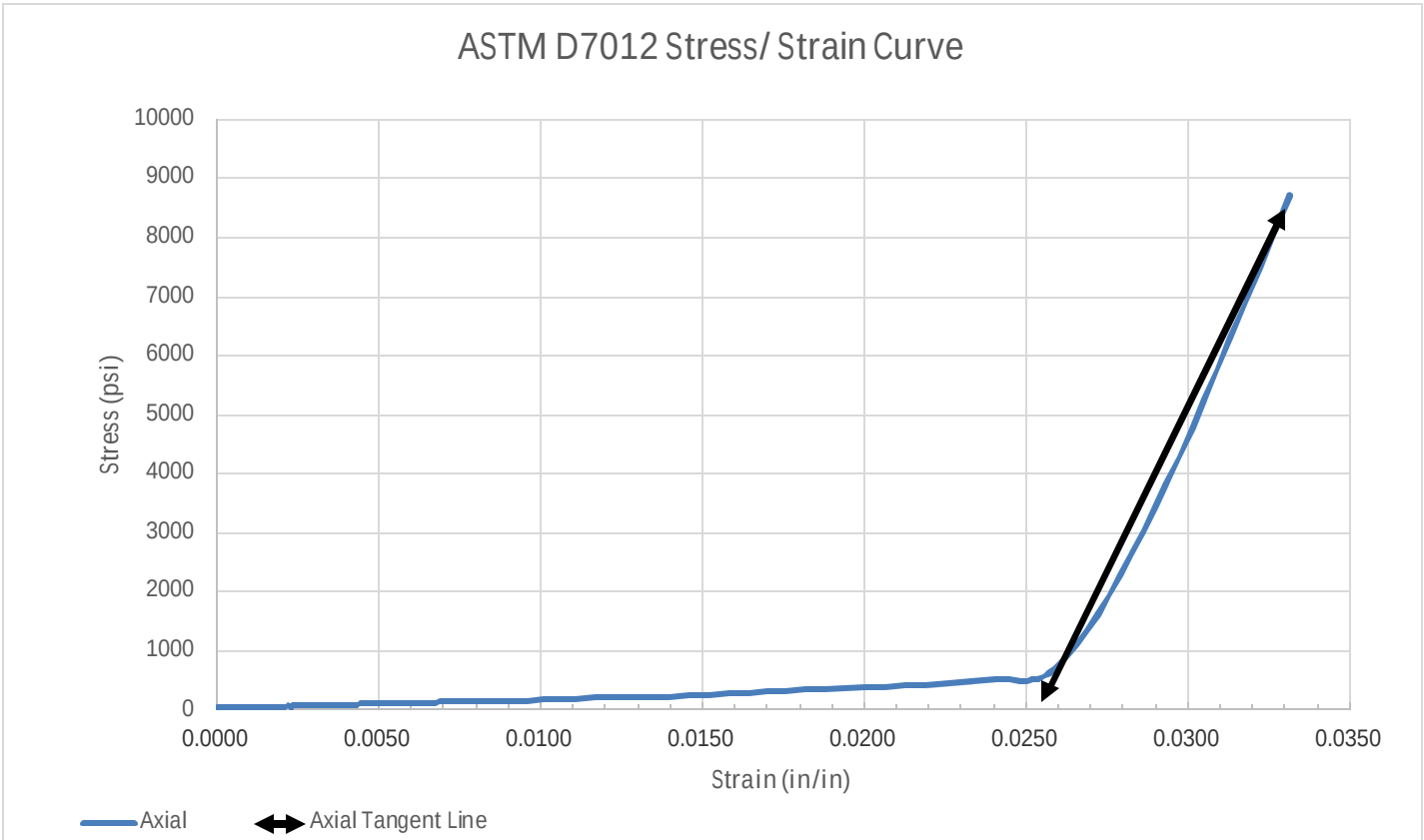
LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 JB215256H LAB TESTING.GPJ TERRACON_DATATEMPLATE.GDT 11/16/22

Rock Core D7012 Method C

Client
Kiewit Engineering (NY) Corp

Project
LAB Testing

Project No. JB215256H



SAMPLE LOCATION

Site:	LAB Testing		
Description:	Shale Interbedded with Sandstone/Siltstone		
Boring:	221.3	Depth (feet):	76-86

SPECIMEN INFORMATION

Sample No.:		Mass (g):	432.26
Length (in.):	4.09	Diameter (in.):	1.74
L/D Ratio:	2.35	Density (pcf):	169.32

TEST RESULTS

Failure Load (lbs):	20750
Failure Strain (in/in):	0.036
Unconfined Compressive Strength (psi):	8,726
Elastic Modulus, E, (ksi):	1114
Time of Failure (min):	01:23
Rate of Loading (in/sec):	0.04
Moisture Content Post-break:	0.94%

Rock Core D7012 Method C

Client
Kiewit Engineering (NY) 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 shall have a minimum diameter of 1.875 inches, or as directed by the client.
Per ASTM D4543, this specimen has not met the requirements for straightness, by exceeding 0.02 inches.
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.

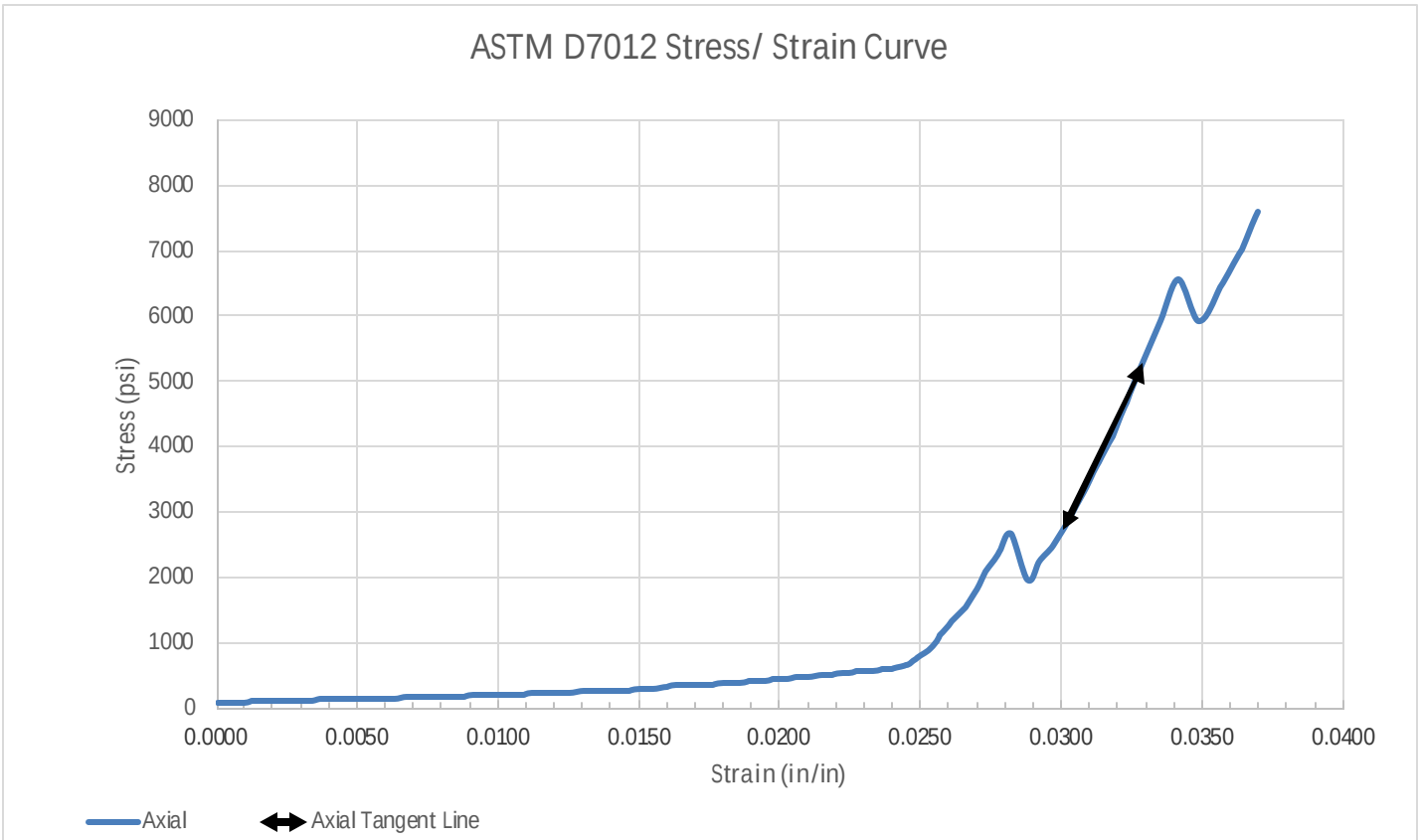
According to ASTM D7012 Section 8.2.1, this specimen, although not meeting all requirements of ASTM D4543 is acceptable for testing. However, the results reported may differ from results obtained from a test specimen that meets the requirements of D4543.

Rock Core D7012 Method C

Client
Kiewit Engineering (NY) Corp

Project
LAB TESTING

Project No. JB215256H



SAMPLE LOCATION			
Site:	LAB TESTING		
Description:	Shale		
Boring:	KB-221.4	Depth (feet):	79

SPECIMEN INFORMATION			
Sample No.:		Mass (g):	436.46
Length (in.):	4.05	Diameter (in.):	1.75
L/D Ratio:	2.31	Density (pcf):	170.69

TEST RESULTS	
Failure Load (lbs):	18328
Failure Strain (in/in):	0.041
Unconfined Compressive Strength (psi):	7,620
Elastic Modulus, E, (ksi):	897
Time of Failure (min):	01:23
Rate of Loading (in/sec):	0.04
Moisture Content Post-break:	0.70%

Rock Core D7012 Method C

Client	Project
Kiewit Engineering (NY) Corp	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 shall have a minimum diameter of 1.875 inches, or as directed by the client.
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 (NY) Corp

Project
LAB Testing

Project No. JB215256H

Splitting Tensile Strength of Intact Rock Core Specimens, ASTM D3967

Boring	221.3	**Material Description**	Shale Interbedded with Sandstone/Siltstone
Sample No	RC-7	**Equipment Used**	Tinius Olsen (120,000lbs)
Depth (ft)	76-86	**TICCS ID/Serial No.**	C-48999, 118285
Lab No	9520	**Calibration Date**	11/2/2021

	TENSILE STRENGTH				
Lab No.	1	2	3	4	5
Diameter (in)	1.75	1.75	1.75	1.75	1.75
Length (in)	0.67	0.6	0.63	0.69	0.55
Length Diameter Ratio	0.38	0.34	0.36	0.39	0.31
Rate of Loading	0.067	0.06	0.063	0.069	0.055
Moisture Condition	0.94%	0.94%	0.94%	0.94%	0.94%
Maximum Applied Load (lbf)	2457	3511	2311	3793	1845
Splitting Tensile Strength (psi)	1334.7	2129.8	1335.1	2000.8	1220.9

	TENSILE STRENGTH				
Lab No.	6	7	8	9	10
Diameter (in)	1.75	--	--	--	--
Length (in)	0.74	--	--	--	--
Length Diameter Ratio	0.42	--	--	--	--
Rate of Loading	0.074	--	--	--	--
Moisture Condition	0.94%	--	--	--	--
Maximum Applied Load (lbf)	2317	--	--	--	--
Splitting Tensile Strength (psi)	1139.6	--	--	--	--

Client
Kiewit Engineering (NY) Corp

Project
LAB TESTING

Project No. JB215256H

Splitting Tensile Strength of Intact Rock Core Specimens, ASTM D3967

Boring	KB-221.4	**Material Description**	Shale
Sample No	RC-9	**Equipment Used**	Tinius Olsen (120,000lbs)
Depth (ft)	79	**TICCS ID/Serial No.**	C-48999, 118285
Lab No	9825	**Calibration Date**	11/1/2022

	TENSILE STRENGTH				
Lab No.	1	2	3	4	5
Diameter (in)	1.74	1.74	1.74	1.74	1.74
Length (in)	0.67	0.66	0.55	0.57	0.54
Length Diameter Ratio	0.39	0.38	0.32	0.33	0.31
Rate of Loading	0.067	0.066	0.055	0.033	0.054
Moisture Condition	0.70%	0.70%	0.70%	0.70%	0.70%
Maximum Applied Load (lbf)	4240	4061	3168	3168	4897
Splitting Tensile Strength (psi)	2316.6	2252.4	2108.5	2034.5	3319.6

	TENSILE STRENGTH				
Lab No.	6	7	8	9	10
Diameter (in)	1.74	1.74	1.74	1.74	1.74
Length (in)	0.52	0.58	0.64	0.58	0.63
Length Diameter Ratio	0.30	0.33	0.37	0.33	0.36
Rate of Loading	0.052	0.058	0.064	0.058	0.063
Moisture Condition	0.70%	0.70%	0.70%	0.70%	0.70%
Maximum Applied Load (lbf)	2114	1702	4811	4125	4799
Splitting Tensile Strength (psi)	1488.2	1074.2	2751.7	2603.4	2788.4

GeoTesting EXPRESS

Client:	Terracon Consultants, Inc.				
Project:	Champlain-Hudson Power Express				
Location:				Project No:	GTX-315284
Boring ID:	KB-221.3	Sample Type:	cylinder	Tested By:	tlm
Sample ID:	---	Test Date:	10/25/22	Checked By:	smd
Depth :	76'-86'	Test Id:	689778		
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
KB-221.3	---	76-86 ft	1	0.9	0.5	0.70	
			2	0.5	0.8	0.65	
			3	1.1	1.2	1.15	
			4	0.9	0.8	0.85	
			5	0.8	1.0	0.90	
			Average CAIs			0.85	
			Average CAI *			1.32	
				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:

Kiewit

MEMORANDUM

DATE: March 15, 2023

TO: Zachary Bauer; Tetra Tech Rooney

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

SUBJECT: Geotechnical Data: Segment 11 - Package 7A - HDD Crossing 117 – Revision 1
Champlain Hudson Power Express Project
Catskill, 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 west of Catskill, New York. The approximate station for the start of HDD crossing number 117 is to be determined (42.2203° N, 73.8753° 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 177.6-228.2, dated March 15, 2013.
- Terracon Consultants-NY, Inc., Results of Field Exploration, Champlain-Hudson Power Express – Package 7a, Catskill, NY, dated May 23, 2022.
- Kiewit Engineering (NY) Corp., Package 7A Phase 4 Borings, Champlain Hudson Power Express, NY, dated February 17, 2023.

Contact us if you have questions or require additional information.

HDD 117
Borings K-221.8,
B221.8-1, KB-221.8B
Segment 11 - Design Package 7A

CHPE Segment 11 - Package 7A
HDD Soil Boring Coordinates and Elevations

Firm	Boring	Northing (feet)	Easting (feet)	Ground Surface Elevation (feet)
TRC*	B221.0-1	1237452.6	663787.2	99.6
	B221.2-1	1236173.4	663261.8	115.0
	B221.4-1	1235622.5	662622.3	22.4
	B221.5-1	1235006.9	662058.8	95.5
	B221.6-1	1234675.8	661633.8	98.3
	B221.8-1	1234265.3	661277.2	99.4
	B222.34-1	1232191.5	659098.9	133.5
	B222.6-1	1231252.6	658182.3	113.7
	B222.9-1	1229751.0	657274.3	121.4
	B225.8-1	1215861.0	650622.7	91.0
	B226.1-1	1214654.4	650328.3	105.9
	B226.2-1	1214120.5	650254.4	108.5
	B226.6-1	1211894.7	649689.7	112.1
AECOM**	CU-1	1237028.6	663123.9	19.7
	CU-2	1236042.7	662897.0	24.8
	CU-2A	1235325.9	662268.9	38.1
	CU-5A	1210523.7	649411.8	118.4
	SC-5	1239310.3	664321.6	110.2
	SC-6	1237781.0	663919.8	101.6

Notes:

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

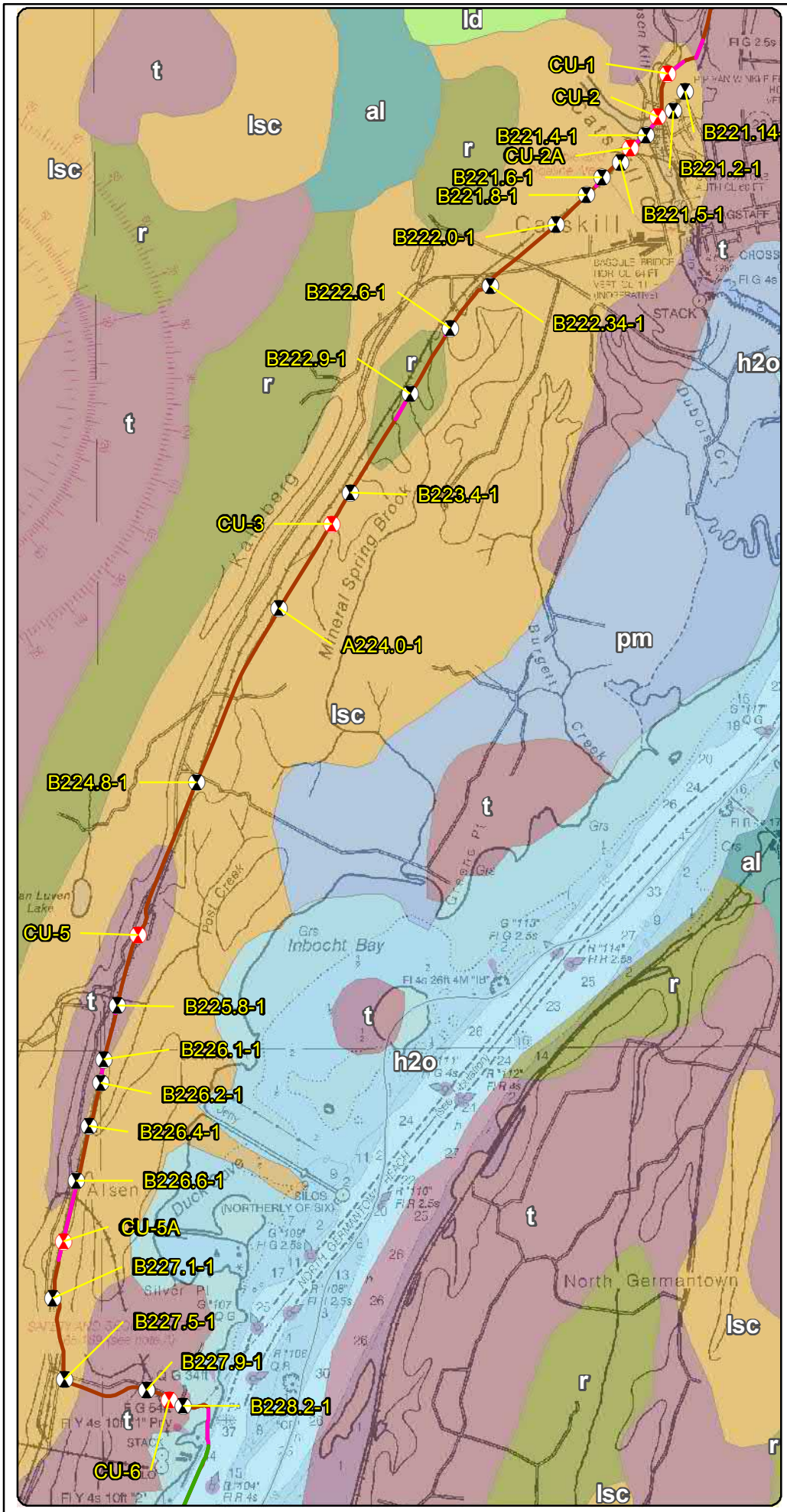
* TRC boring coordinates as shown in Table 1-6 in AECOM report (reference below). Boring elevations estimated from November 2021 topographic survey by Williams Aerial.

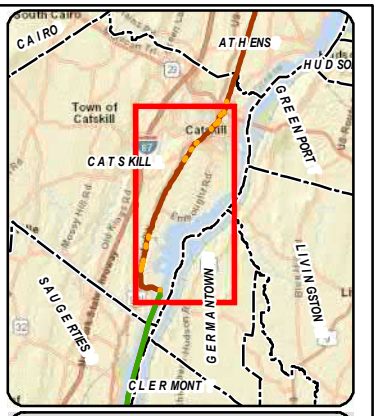
** AECOM boring coordinates and elevations as shown in Table 1-6 in AECOM report.

*** 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
- h2o - Water
- ld - Lacustrine delta
- lsc - Lacustrine silt and clay
- pm - Swamp deposits
- r - Bedrock
- t - Till

N

0.3 0.15 0 0.3 Miles

Transmission

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

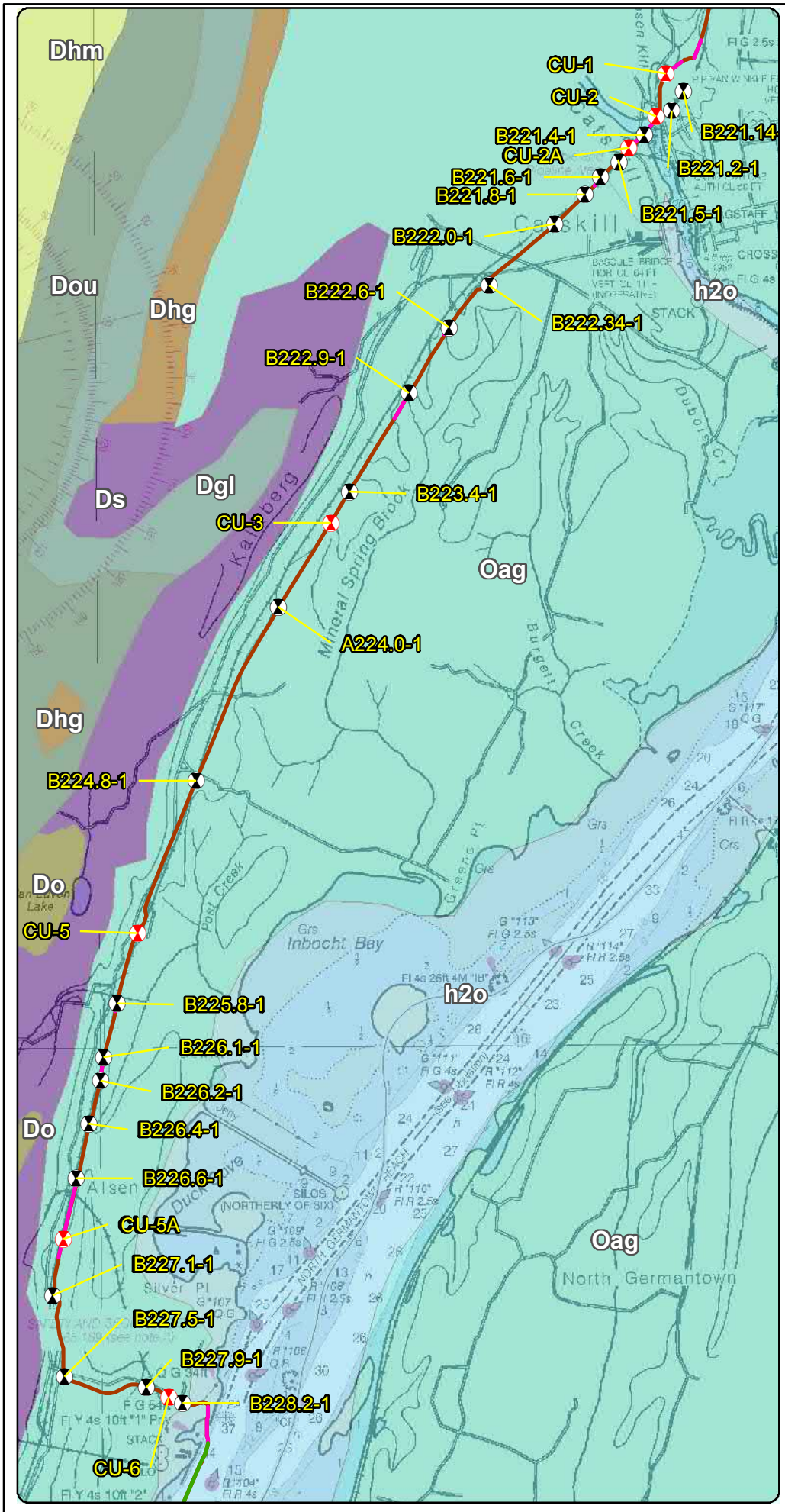
Surficial Geology and Geotechnical Borings Catskill to Upland Figure 3-11

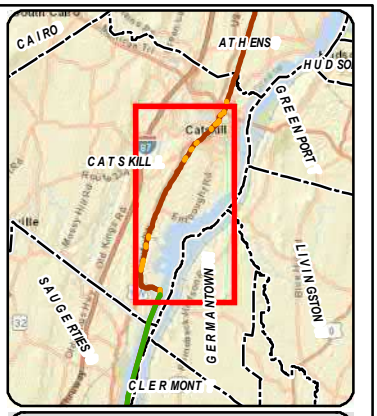
Prepared on 5/3/2021

by: AECOM

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

Y:\Projects\CHPE\Route\Consensus_Alternative_Routes\MXD\Alt 5_Routes_DZ_20190\Boring_Locations\Maps_for_May_2021_Report\Catskill_to_Upland_Boring_Locations_Surficial_May_2021_Report.mxd





LEGEND

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

Bedrock Geology

- Dgl - Glenerie Formation
- Dhg - Port Ewen Formation
- Dhm - Undiff Lower Hamilton Group
- Do - Oriskany Sandstone
- Dou - Onondaga Limestone
- Ds - Cashaqua Shale
- Oag - Austin Glen Form (graywacke, shale)
- h2o - Water

N

0.3 0.15 0 0.3 Miles

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

Bedrock Geology and Geotechnical Borings Catskill to Upland Figure 4-11

Prepared on 5/18/2021

by: AECOM

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

Y:\Projects\CHPE\IRoute\Consensus_Alternative_Routes\MXD\Alt 5_Routes_DZ_201909Boring_Locations\Maps_for_May_2021_Report\Catskill_to_Upland_Boring_Locations_Bedrock_May_2021_Report.mxd