

GEOTECHNICAL DESIGN REPORT

September 29, 2021

BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET

Blue Hill
Hancock County
Maine

PREPARED FOR

**Maine Department of
Transportation**

16 State House Station
Augusta, ME 04333

PREPARED BY

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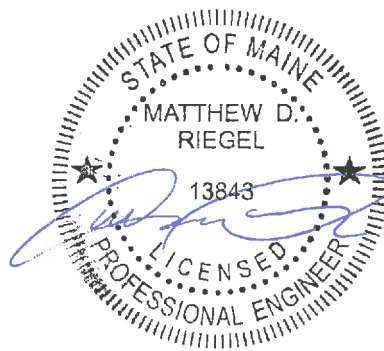
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1.0 PROJECT DESCRIPTION AND SCOPE

1.1 Project Background

The following summarizes the geotechnical investigation and design completed by HNTB for the improvement of the Blue Hill Falls Bridge over Salt Pond Outlet in Blue Hill, Maine. The existing single-span structure carries State Route 175 and Falls Bridge Road, a north-south two-lane roadway with one travel lane in each direction, over the Salt Pond Outlet. The Salt Pond resides west of the bridge while the Mt Desert Narrows is to the east side of the bridge. A project location plan is included in **Figure 1**.

The existing bridge is approximately 103 feet-long with concrete abutments with mortared granite block front and side faces on either side of the strait. The embankments behind the abutments are retained by existing dry stacked granite masonry walls. The existing abutments and masonry walls are founded on bedrock, fill stone, and existing soils.

The superstructure will be replaced along the existing alignment with a single-span New England Bulb Tee (NEBT) superstructure raised from the existing vertical alignment. The North and South abutments will be rehabilitated with the existing South Abutment underpinned with micropiles socketed into bedrock and the North Abutment remaining as a shallow foundation bearing on bedrock. A new approach span will be constructed on each approach to span over the existing granite masonry retaining walls supported by the rehabilitated abutments and new micropile supported grade beams. The proposed structure will widen the roadway from 20'-0" curb to curb to 25'-0" curb to curb and will raise the vertical profile.

Approach work with full depth reconstruction and drainage improvements will be constructed beyond the approach spans. Embankment with side slopes of 2H:1V will be used where possible and stabilized with riprap stone fill where side slopes are steepened up to 1.5H:1V. On the Salt Pond side of the north embankment, stacked stone will be utilized to replicate the existing condition at a 1.75H:1V slope.

A temporary bridge will be used by the Contractor on the Salt Pond side of the bridge to minimize traffic impacts to Route 175. In addition to the temporary bridge a full road closure is allowed for a total of up to 60 days over several closure periods with traffic maintained on an off-site detour. Periods of one lane of alternating one-way traffic and temporary traffic signals before and after the installation and removal of the temporary bridge may also be utilized. Following completion of this work the roadways will be reopened, the falsework will be removed, temporary bridge and temporary work trestle removed, and the reconstruction of Blue Hill Falls Bridge will be completed.

1.2 Scope of Services

HNTB has performed the following scope of services in support of this design:

- Reviewed historical geotechnical data for the project site.
- Implemented a subsurface investigation and laboratory testing program to gather additional information where needed.

- Analyzed the resulting data collected to identify subsurface conditions that impact the design and construction of the project.
- Prepared geologic subsurface profiles summarizing geotechnical data from the borings and laboratory testing.
- Established geotechnical engineering design parameters based on the available borings and laboratory testing.
- Conducted geotechnical analyses, including external stability assessments for existing masonry stone block gravity walls and south abutment.
- Performed analysis and provided recommendations for micropile foundations.

1.3 Survey Control

All horizontal locations reported herein are based on the North American Datum of 1983 (NAD 83), Maine 2000 West Zone. The project elevation datum and elevations referenced are in feet and reference the North American Vertical Datum of 1988 (NAVD 88). Boring locations were field located with elevations estimated based on topographic survey data.

2.0 GEOLOGY AND SITE CONDITIONS

2.1 Site Geology

The existing geologic mapping utilized for this assessment includes surficial and bedrock geology mapping prepared by the Maine Geological Survey (MGS) and are included in **Figure 2** and **Figure 3**, respectively. MGS surficial geology mapping identifies soil overburden in the area of the project as till, said to consist of a heterogeneous mixture of silt, clay, and stones with the possibility of boulders deposited by glacial ice. Bedrock geology mapping shows the site is within the Ellsworth Formation, consisting of foliated fine-grained Phyllite.

2.2 Existing Site Conditions

At the bridge location, the State Route 175 roadway is generally oriented in a north/south direction and under the upward sloped surrounding terrain area on an embankment supported by masonry stone block gravity retaining walls. The roadway is carried over the Salt Pond outlet on a single-span simply supported bridge. The bridge superstructure is a cast-in-place concrete tied-arch structure with cast-in-place concrete deck, bituminous wearing surface, and concrete bridge rail. The bridge is supported by concrete gravity abutments with granite block facing. The span length from south to north is approximately 103 feet, and average structure width is approximately 26 feet out to out. The north abutment bears upon phyllite bedrock and the south abutment bears on sloping bedrock and till material. The existing bridge has no skew. The top of roadway elevation varies from approximate elevation 14 to 15 feet.

The surrounding terrain is slightly forested with the Mt Desert Narrows immediately to the east and the Salt Pond to the west. The northern approach features rock outcrops on the mainland and on the eastern

end of the strait within the water body. The southern approach features large rounded alluvial and till deposits on the shore portion of the approach.

East of the north approach is a historically sensitive site which consists of a pre-historic Native American burial ground. This site was not and will not be impacted by the work performed on the project.

3.0 SUBSURFACE EXPLORATIONS

3.1 General

Preliminary phase subsurface investigations were led by Maine DOT and include the 100-series of borings and power auger probes. The secondary and final design phase subsurface investigations, which include the 200-series borings and 300 to 500-series borings, were performed by New England Boring Contractors of Derry, NH under the supervision of Schonewald Engineering Associates of Cumberland, Maine on behalf of HNTB. The borings were advanced in general accordance with ASTM 1586 by cased wash boring methods or just the core barrel and drill string, using 4.5-inch (HW-size) and 3.0-inch (NW-size) inside diameter steel casing. Standard Penetration Testing (SPT) was performed by driving a standard 1-3/8 inch ID split spoon sampler with a 140-pound hammer dropped 30 inches to obtain samples at 5 foot intervals, where possible. Each sample was removed from the sampler in the field, examined, and classified in accordance with the Burmister Soil Identification System. The subsurface investigation focused heavily on defining the extents of the existing masonry stone block gravity retaining walls, concrete gravity abutments with granite stone facing, and their bearing materials. When coring through the existing bridge abutments and retaining walls, no split spoon samples were performed. Split spoon samples were taken at the ends of the approaches or in the center of the roadway, away from the existing structures.

The number of hammer blows required to advance the sampler through each 6-inch interval using the hammer was recorded and is provided on each boring log. The uncorrected SPT N-value is defined as the total number of blows required to advance the sampler through the second and third six-inch interval of any given 24-inch sample. All SPT N-values discussed in this report have been corrected to reflect a hammer efficiency of 60 percent unless noted otherwise on the boring logs.

Based on the data collected by HNTB and Maine DOT a soil profile was prepared, and a geotechnical assessment completed to determine design parameters for foundation and retaining wall analysis. A boring location plan is included as **Figure 4**. Details regarding each phase of subsurface investigation are presented below in the following sections.

3.2 Preliminary Design Phase Geotechnical Subsurface Exploration

The preliminary phase subsurface exploration program consisted of one series of seven (7) soil borings and 31 power auger probe holes. The initial 100-series borings were performed between December 1st 2010 and January 3rd, 2011. Borings BB-BHF-101 and its offset hole BB-BHF-101A were drilled at the southern abutment, and BB-BHF-104 and BB-BHF-105 were drilled along the proposed south abutment at its west and east ends. Boring BB-BHF-103 was drilled at the proposed north abutment at its west end. Boring BB-

BHF-102 and its offset hole BB-BHF-102A were drilled at the north approach. All borings were observed and logged by a representative from Maine Department of Transportation.

The preliminary subsurface investigation borings were advanced to depths ranging from 7.5 to 38.7 feet below ground surface (BGS). Borings BB-BHF-101, BB-BHF-101A, BB-BHF-103, BB-BHF-104, and BB-BHF-105 were advanced from a CME 45C all-terrain drill rig utilizing an automatic hammer with a hammer efficiency factor of 0.84. Borings BB-BHF-102 and BB-BHF-102A were performed with a Mobile B-53 Truck mounted drill rig utilizing a rope and cathead system. Boring BB-BHF-102 and its offset hole BB-BHF-102A were abandoned at 7.5 and 8 feet due to roller bit failure. All other borings were advanced through the abutment and retaining wall structure to the top of rock or refusal material. Structure and rock coring was done using either a 2.0-inch ID NQ-2 size or BX size core barrel.

The as-drilled boring locations for the preliminary phase investigation are summarized below in Table 3.2. Details of the sampling methods used, field data obtained, and descriptions of the soil, bedrock and groundwater conditions encountered are presented on the boring logs provided in **Appendix A1**.

Table 3.2: Summary of 100-Series Phase Subsurface Exploration

| Boring No. | Station* | Offset | Ground Surface Elevation | Depth of Boring (feet) | Location/Purpose |
|-------------|----------|--------|--------------------------|------------------------|---------------------------|
| BB-BHF-101 | 18+15.1 | 5.4 LT | 15 | 6.5 | South Approach, East Side |
| BB-BHF-101A | 18+17.7 | 6.4 LT | 14.9 | 38.7 | South Approach, East Side |
| BB-BHF-102 | 16+95.0 | 5.0 RT | 14.3 | 8 | North Approach, West Side |
| BB-BHF-102A | 16+92.3 | 5.2 RT | 14.3 | 7.5 | North Approach, West Side |
| BB-BHF-103 | 17+03.3 | 5.3 RT | 14.5 | 22.6 | North Abutment, West Side |
| BB-BHF-104 | 18+06.4 | 5.1 LT | 14.8 | 26 | South Abutment, East Side |
| BB-BHF-105 | 18+09.4 | 5.9 RT | 14.7 | 27.2 | South Abutment, West Side |

*Note that the stationing and offsets were converted from the baseline used in 2011 to the final design baseline.

3.3 Secondary Design Phase Geotechnical Subsurface Exploration

A secondary design phase subsurface exploration consisting two (2) soil borings was performed between April 24th and April 25th, 2017. This phase of borings is numbered in the 200-series. Boring BB-BHF-201 was drilled at the north approach retaining walls and BB-BHF-202 was drilled further north past the end of the retaining wall structure. All borings were observed and logged by a representative from Schonewald Engineering Associates.

These subsurface investigation borings were advanced to depths ranging from 29 to 40 feet below ground surface (BGS). The 200-series borings were advanced from an all-terrain mounted Mobile B-53 drill rig utilizing a rope and cathead. Both borings were advanced to the top of rock. Rock coring was accomplished using a 2.0-inch ID NQ-2 size core barrel. A hammer efficiency of 0.6 was used for these borings.

The as-drilled boring locations for the preliminary phase investigation are summarized below in Table 3.3. Details of the sampling methods used, field data obtained, and descriptions of the soil, bedrock and groundwater conditions encountered are presented on the boring logs provided in **Appendix A2**.

Table 3.3: Summary of 200-Series Phase Subsurface Exploration

| Boring No. | Station | Offset | Ground Surface Elevation | Depth of Boring (feet) | Location/Purpose |
|------------|---------|---------|--------------------------|------------------------|---------------------------|
| BB-BHF-201 | 16+79.8 | 5.0 RT | 14.5 | 40 | North Approach, West Side |
| BB-BHF-202 | 16+00.4 | 11.0 RT | 16 | 29 | North Approach, West Side |

3.4 Final Design Phase Geotechnical Subsurface Exploration

A final design phase subsurface exploration program consisting of twelve (12) soil borings was performed in two mobilizations between May 18th to May 22nd, 2020 and between April 19th and May 21st, 2021. Final design phase borings are numbered in the 300-series to 500-series. Borings BB-BHF-301 and BB-BHF-502 were drilled at the south approach on the west side. Boring BB-BHF-302 was drilled at the south approach on the east side. Borings BB-BHF-303 and BB-BHF-304 were at the south abutment on the east side. Borings BB-BHF-306 and BB-BHF-403 were drilled at the north approach on the west side. Borings BB-BHF-307, BB-BHF-404, BB-BHF-501, and BB-BHF-503 were drilled at the north approach on the east side. Boring BB-BHF-305 was drilled at the north abutment on the west side. All borings were observed and logged by a representative from Schonewald Engineering Associates.

The final subsurface investigation borings were advanced to depths ranging from 28.9 to 48.9 feet below ground surface (BGS). Borings were advanced from an all-terrain mounted Mobile B-53 drill rig using an automatic hammer with a measured hammer efficiency factor of 0.818.

Borings were advanced to top of rock, as indicated by roller bit refusal and subsequently advanced into rock by coring. The majority of borings encountered the concrete and granite construction of the bridge abutment and retaining walls. These structural blocks and underlying rock were cored using a NQ2 or HQ size core barrel. The recovery and rock quality designation (RQD) of each core was recorded and is included on the boring logs. Rock core photographs for the final phase subsurface investigation are presented in **Appendix A3**.

The as-drilled boring locations for the final phase investigation are summarized below in Table 3.3. Details of the sampling methods used, field data obtained, and descriptions of the soil, bedrock and groundwater conditions encountered are presented on the boring logs provided in **Appendix A3**.

Table 3.3: Summary of 300-500-Series Subsurface Investigation

| Boring No. | Station | Offset | Ground Surface Elevation | Depth of Boring (feet) | Location/Purpose |
|------------|---------|---------|--------------------------|------------------------|---------------------------|
| BB-BHF-301 | 18+24.2 | 11.0 RT | 15.1 | 33.1 | South Approach, West Side |

| Boring No. | Station | Offset | Ground Surface Elevation | Depth of Boring (feet) | Location/Purpose |
|------------|---------|---------|--------------------------|------------------------|---------------------------|
| BB-BHF-302 | 16+72.7 | 11.0 LT | 15.1 | 48.9 | South Approach, East Side |
| BB-BHF-303 | 18+05.4 | 6.0 RT | 14.4 | 48.1 | South Abutment, East Side |
| BB-BHF-304 | 18+09.3 | 5.0 LT | 14.4 | 46 | South Abutment, East Side |
| BB-BHF-305 | 17+03.3 | 4.8 LT | 14.4 | 40 | North Abutment, East Side |
| BB-BHF-306 | 16+90.1 | 11.0 RT | 15.1 | 45.5 | North Approach, West Side |
| BB-BHF-307 | 16+90.5 | 11.0 LT | 15.1 | 35.9 | North Approach, East Side |
| BB-BHF-403 | 16+72.7 | 11.0 RT | 15.3 | 33.3 | North Approach, West Side |
| BB-BHF-404 | 16+72.7 | 11.0 LT | 15.3 | 28.9 | North Approach, East Side |
| BB-BHF-501 | 18+42.0 | 7.0 LT | 15.0 | 40.7 | North Approach, East Side |
| BB-BHF-502 | 18+39.5 | 6.0 RT | 15.0 | 42.5 | South Approach, West Side |
| BB-BHF-503 | 16+47.0 | 3.0 LT | 15.0 | 26.5 | North Approach, East Side |

4.0 LABORATORY TEST RESULTS

Upon completion of each subsurface investigation program, a laboratory testing program was performed to verify the visual-manual field classifications and to aid in determination of the engineering soil properties. Laboratory testing was performed by GeoTesting Express, Inc. of Acton, Massachusetts and Thielsch Engineering of Cranston, Rhode Island. The focus of the laboratory testing was on the rock cores obtained during the final phase of investigations.

4.1 Soil Testing

Laboratory soil testing in the 100 series borings consisted of nine (9) standard grain size analyses with natural water content and fifteen (15) unconfined compressive strength tests on concrete cores. For the 200 series borings, two (2) unconfined compressive strength tests were performed on bedrock cores. Finally, the 500 series borings had three (3) unconfined compressive strength tests were performed on bedrock cores. The soil testing was performed in accordance with the following ASTM Standards:

| | |
|---------------------|-------------------------------------|
| Moisture Content | AASHTO T265-93 and/or ASTM D2216-98 |
| Grain Size Analysis | AASHTO T88-93 and/or ASTM D2216-98 |

The laboratory soil testing results are included in **Appendix A1** for series 100 exploration borings.

4.2 Rock & Concrete Testing

Laboratory rock testing consisted of five (5) unconfined compressive strength tests. Intact rock core specimens were tested for compressive strength and elastic modulus in accordance with ASTM D7012-D. Intact concrete core specimens were tested for compressive strength in accordance with AASHTO T22. A summary of the laboratory tests is presented in Table 4.2.1 for concrete and Table 4.2.2 for rock, and the

complete laboratory results are presented in **Appendix A1** for series 100 concrete cores, **Appendix A2** for series 200 rock cores, and **Appendix A3** for series 300-500 rock cores.

Table 4.2.1: Summary of Concrete Test Results

| Boring No. | Sample No. | Depth (ft) | Unconfined Compressive Strength (psi) |
|------------|------------|-------------|---------------------------------------|
| BB-BHF-103 | R1 | 1.0 – 1.3 | 5890 |
| BB-BHF-103 | R2 | 3.4 – 3.7 | 6540 |
| BB-BHF-103 | R2 | 4.2 – 4.5 | 5060 |
| BB-BHF-103 | R5 | 18.0 – 18.1 | 6144 |
| BB-BHF-103 | R6 | 18.8 – 19.0 | 5470 |
| BB-BHF-104 | R1 | 2.4 – 2.7 | 5680 |
| BB-BHF-104 | R2 | 4.9 – 5.1 | 6140 |
| BB-BHF-104 | R5 | 19.7 – 19.9 | 7450 |
| BB-BHF-104 | R6 | 22.4 – 22.6 | 5054 |
| BB-BHF-104 | R6 | 22.6 – 22.8 | 8900 |
| BB-BHF-105 | R2 | 4.5 – 5.1 | 4170 |
| BB-BHF-105 | R4 | 13.9 – 14.3 | 6980 |
| BB-BHF-105 | R4 | 14.3 – 14.6 | 5520 |
| BB-BHF-105 | R5 | 21.6 – 22.0 | 6610 |
| BB-BHF-105 | R5 | 22.0 – 22.3 | 5970 |

Table 4.2.2: Summary of Rock Test Results

| Boring No. | Sample No. | Depth (ft) | Total Unit Weight (pcf) | Unconfined Compressive Strength (psi) | Axial Strain at Failure (%) | Estimated Elastic Modulus (psi) |
|------------|------------|---------------|-------------------------|---------------------------------------|-----------------------------|---------------------------------|
| BB-BHF-201 | R1 | 22.6 - 23.2 | 170.2 | 11,258 | 0.35 | 3.55E+06 |
| BB-BHF-202 | R1 | 11.4 - 12.1 | 189.3 | 19,338 | 0.39 | 4.70E+06 |
| BB-BHF-501 | R2 | 37.9 - 38.28 | 169 | 13,049 | - | 7.37E+06 |
| BB-BHF-502 | R5 | 39.97 - 40.35 | 170 | 11,877 | - | 7.03E+06 |
| BB-BHF-503 | R4 | 20.28 - 20.66 | 167 | 9,149 | - | 4.10E+06 |

5.0 SUBSURFACE CONDITIONS

5.1 Generalized Subsurface Stratification

A thorough review of the boring logs and laboratory test results was conducted to establish the general stratigraphy of the site. The purpose of “stratifying” a site is to group similar soil materials that have the

same geologic origin and to identify the bedrock surface across the project. Stratification not only aids in visualizing the subsurface conditions, but also facilitates computations since the soil material throughout a particular stratum usually exhibits similar engineering characteristics, e.g., strength and compressibility.

It should be noted that the strata boundaries shown on the logs have been inferred using available subsurface data. The interpretation of soil and groundwater conditions at the project site are based on information obtained at the boring locations only. This information has been used as the basis for the conclusions and recommendations contained in this report. Significant variations at areas not explored by the project borings may require reevaluation of the findings and conclusions contained herein if found during construction.

Based on the available subsurface data, the following general subsurface strata were identified:

- **Fill:** The bridge site is overlain with up to 18 feet of loose to medium dense granular fill consisting of varying portions of sand, gravel, and fines. The fill is found retained between and at the ends of the retaining walls on both approaches.
- **Concrete and Granite Block:** The approaches near the bridge consist of stacked dry-laid granite block walls with a concrete curb/wall top – the concrete and granite was cored through in the majority of the approach borings advanced. These structures have a wider base and taper off at the top. On the northern approach, shim material was encountered between the granite blocks and bedrock.
- **Till Deposits (Glacial Till):** Beneath the fill or bridge structure, a Till stratum was encountered generally consisting of brown, gravelly sand with some silt and trace coarse sand. This stratum was observed to have a thickness ranging from approximately 20 feet at the south approach. The thickness of the layer at the north approach varied from not being present to 11 feet thick, including some borings which showed up to 4 feet of till below the existing granite block walls. The stratum was found to be very dense, split spoon sampler refusal material.
- **Phyllite Bedrock:** Bedrock was encountered in all borings except for borings BB-BHF-301. The bedrock at this site varies between the north and south approaches separated by the water passage. Rock is approximately 17 to 20 feet deep on the northern approach. Borings on the southern approach encountered rock deeper varying from 26 to 32 feet below roadway surface. Bedrock encountered at the site generally consists of hard, slightly to moderately weathered, aphanitic to fine grained, light green-gray Phyllite bedrock. Rock Quality Designation (RQD) values ranged from 0 to 100 percent and averaged approximately 42 percent. Note that the 100 and 200 series of borings originally classified some of the bedrock as being Gneiss, but that has since been adjusted to be Phyllite of the Ellsworth Formation, except for Gneiss boulders which were encountered on the project site.

An interpretive subsurface profile was prepared along the Route 175 centerline and is included for reference in **Figure 5**.

Based on a review of boring data and as-built drawings, the north abutment bears directly on bedrock while the north approach retaining walls of the existing bridge bear on shim stone and either bedrock or a thin layer of till. The south abutment and approach walls bear on decomposed rock or till.

5.2 Groundwater

Due to the proximity to the Salt Pond outlet, groundwater was noted to be directly related to tidal behavior. No groundwater readings were established during the subsurface investigations.

6.0 DESIGN OF BRIDGE FOUNDATIONS

6.1 General Design Considerations

Geotechnical design recommendations for the abutment, grade beam foundations, and retaining walls associated with the Blue Hill Falls Bridge project are discussed in the following sections. Recommendations have been developed in accordance with the AASHTO LRFD Bridge Design Specifications (AASHTO LRFD), Eighth Edition and the 2003 MaineDOT Bridge Design Guide (BDG) with June 2018 updates.

6.1.1 Bridge Substructure Geometry

The proposed substructure for the main span configuration consists of new cast-in-place concrete fixed-expansion abutment caps supported by rehabilitated concrete gravity wall abutments with granite stone masonry facing. The south abutment will be underpinned with micropiles to support the demands of the proposed superstructure. The embankment behind the abutments is retained by existing dry-laid granite masonry block gravity walls. To account for the new vertical alignment and to avoid imparting any additional load on the existing retaining walls, approach spans will bridge over the embankment walls and be supported by the abutments at one end and new grade beams at the other. The bearings and girders sit on stepped pedestals at the top of the new cast-in-place abutment cap, which sits directly on the rehabilitated concrete gravity abutment.

6.1.2 Assessment of Corrosion Potential

The project is located in a tidally influenced zone with saltwater exposure. None of the new foundation elements are directly exposed to open water and proposed micropiles at the south abutment will be below the buried zone. Proposed grade beam micropiles are set back from the abutments, buried in soil, and are subject to groundwater wetting and drying cycles and are considered to be part of the inter-tidal zone. A sacrificial steel thickness will be applied to steel foundation elements based on corrosion rates as provided in FHWA Manual NHI-05-042, "Design and Construction of Driven Pile Foundations". For design purposes the exterior steel surface thickness has been reduced around the perimeter of the micropiles by 0.1 inches at the abutment and 0.16 inches at the grade beam micropile. This is based on a corrosion rate of 0.001 and 0.0016 inches per year for a design life of 100 years.

6.2 Foundation Type Selection

The goal of the new and retrofitted foundation selection was to identify means of support that limit impacts

to the existing systems which are to remain in place. The existing bridge and embankment retaining walls were originally installed on bedrock with feet of shimestones filling in the gaps to the north or on decomposed rock/till material to the south. When it was identified that portions of the south abutment and all of the south embankment retaining walls were founded on soil instead of bedrock, the team had to account for the more sensitive conditions and potential impacts that a raise in grade may cause. Since the existing bridge abutments and embankment retaining walls have been in place for nearly 100 years and the existing structure does not exhibit signs of scour or instability, it is reasonable to assume that the subsurface conditions are stable under current loading.

Micropiles were considered as a solution which would limit impacts during construction to the existing structures and can be employed within a limited footprint. Micropiles are grouted to the underlying bedrock during installation and therefore operate satisfactorily in conditions with little soil cover, unlike driven piles which need sufficient soil depth above rock to develop lateral fixity. Micropiles can be installed with tighter tolerances than driven piles, provide good axial compressive and tensile resistance to help offset the eccentric loading at the south abutment, and can be installed with low vibrations through existing substructure elements.

To reduce the risk of drilling through the existing south abutment during micropile installation, oversized core holes will be performed prior to the micropiles being installed. If the micropiles were to be installed directly through the existing concrete, the contractor would be required to utilize a high energy down-the-hole-hammer. This hammer would impart significant energy and vibrations into the south abutment. To operate the hammer, the micropile contractor would also have to inject pressurized air and water, both of which are not preferred. These hammers use very high drilling pressures which could easily permeate through the existing concrete and masonry facing and create issues below the existing structures by displacing the bearing materials, which could lead to the destabilization of the existing systems. Pre-coring holes through the full height of the abutment at each micropile location was deemed necessary to mitigate potential damage to the existing abutments and facing and to simplify micropile construction.

Pre-cored holes performed by a specialty concrete coring contractor will safely and accurately remove vertical cores through the full height of the existing south abutment. The core barrels are expected to remove sections of concrete/masonry stone in two or three foot lengths. Specialty tooling, which fits in the same space as the core barrel, is used to break and remove the cores from the hole as work progresses. Past project experience and discussions with concrete coring specialty contractors affirmed that the coring work is low vibration and low impact. The pre-coring operation can also core through differing strength materials such as the front facing granite stone blocks and the existing concrete without having issue. This allows for the pre-cored holes to move closer to the bridge bearing centerline near the front face of abutment, reducing the bearing load eccentricity on the foundations.

Micropiles were also considered to be the preferred deep foundation solution system for the grade beams supporting the ends of the jump spans. Shallow bedrock on the north side project would prove difficult to achieve lateral fixity for a driven pile solution. Additionally, the need to minimize the excavation of existing soils due to their sensitive historical nature precluded a shallow footing on bedrock from being utilized. The foundations for the grade beam are also in close proximity to the existing embankment retaining walls on

both sides of the bridge. With the sensitive nature of those existing stone masonry block walls in mind, a micropile foundation would be preferred to the high impact energy of a driven pile. As noted previously, the micropiles are much more capable of maintaining their plan deviation tolerances when compared to driven piles which is another reason to install them when the foundations are close to the existing walls.

The rehabilitated abutments and new grade beams will carry a precast concrete span to bridge over the existing retaining walls. This approach allows for an increase in vertical profile and wider roadway while not increasing vertical load on the existing retaining structures.

6.3 Foundation Design Approach

6.3.1 Design Methodology

The analysis of micropile foundations was performed in accordance with AASHTO LRFD Section 10. Pile groups were analyzed using the computer program FB-Multiplier version 5.6 by BSI., Strength-I, Strength-III, Strength-V, and Service-I load components for braking, centrifugal force, temperature, and combined minimum and maximum vertical load were determined for the south abutment (Abutment 2) at the bearing/girder elevation and resolved and combined at the bottom of the existing abutment elevation in line with the main span bearing centerline for application to the pile group models. The pile design for Abutment 2 accounted for the earth pressure behind the new substructure concrete. The portion of the existing abutment which was to remain was assumed to take the remaining existing lateral earth pressure and also its own dead load. Water freely drains through the existing embankment stone masonry retaining walls so no additional water pressure was evaluated behind the abutment. Micropiles at the grade beams were evaluated for Strength-I, Strength-V, Service-I, and Extreme-I load combinations. Loads at the grade beams were reconciled at the center of gravity for the pile cap.

Maximum pile Strength-limit-state axial demands and bending moments, as well as Service-limit-state foundation displacements and rotations, were extracted from the FB-Multiplier analysis for evaluation. Single-pile Strength loads were compared to calculated factored structural resistances for a single pile, including a check of combined axial compression and bending resistance. Combined stress analysis of micropile casings assumed a section modulus reduction equivalent to $\frac{1}{2}$ of the casing wall thickness to account for weaknesses at threaded casing joints. Micropile bond lengths were evaluated based on factored compression and tension loading. Service-condition deflections and rotations of the pile cap were extrapolated up to the bearing/girder elevation to estimate Service-limit-state structure deflections, and the foundations were optimized to limit these deflections to under 1 inch at the bearing elevation.

6.3.2 Subsurface Material Properties

Geotechnical design parameters for soil and rock were developed for each stratum based on material descriptions, standard published correlations, and engineering judgment. A summary of soil and rock design properties at the proposed bridge abutments and approaches, as interpreted from available borings and laboratory testing, are presented in Table 6.3.2 and Table 6.3.3 below.

Table 6.3.2: Engineering Properties of Soil and Rock at North Approach

| Layer | \overline{N}_{160} (bpf) | γ (pcf) | ϕ' (deg.) | S_u (psf) | k_{aw} (pci) | k_{bw} (pci) | G (ksi) | E (ksi) |
|----------------------|-------------------------------|-------------------|-------------------|----------------|-------------------|-------------------|------------|------------|
| 1 – Fill | 6 | 109 | 31 | --- | 60 | 40 | 0.82 | 1.98 |
| 2 – Till Deposits | 70 | 125 | 42 | --- | 275 | 190 | 3.63 | 1.67 |
| 3 – Phyllite Bedrock | --- | 176 | --- | --- | --- | --- | 2113 | 5.21E+3 |

*Subsurface properties do not include existing structure material encountered in borings.

Table 6.3.3: Engineering Properties of Soil and Rock at South Approach

| Layer | \overline{N}_{160} (bpf) | γ (pcf) | ϕ' (deg.) | S_u (psf) | k_{aw} (pci) | k_{bw} (pci) | G (ksi) | E (ksi) |
|----------------------|-------------------------------|-------------------|-------------------|----------------|-------------------|-------------------|------------|------------|
| 1 – Fill | 17 | 117 | 34 | --- | 115 | 70 | 1.39 | 3.43 |
| 2 – Till Deposits | 70 | 125 | 42 | --- | 275 | 190 | 3.9 | 10.93 |
| 3 – Phyllite Bedrock | --- | 169 | --- | --- | --- | --- | 2272 | 5.57E+3 |

*Subsurface properties do not include existing structure material encountered in borings.

- Where:
- \overline{N}_{60} = Average SPT-N value of stratum, corrected for hammer efficiency, in blows per foot.
 - \overline{N}_{160} = Average SPT-N value of stratum, corrected for hammer efficiency and effective overburden pressure, in blows per foot.
 - γ = Total unit weight of soil, based on grain size and relative density per Bowles 4th Edition, Table 3-4 and FB-MultiPier Soil Parameter Tables.
 - ϕ = Internal friction angle of soil, per multiple SPT-N value correlations. *Drained friction angle for clays calculated per FHWA GEC No. 5, Figure 74. Values increased by 3 degrees due to overconsolidation.
 - S_u = Undrained shear strength of soil, per plasticity correlations and in-situ vane shear testing.
 - k = Subgrade modulus, based on FB-MultiPier Help Manual and NAVFAC DM7.01 as presented in the FB-MultiPier Soil Parameter Table. AW above water, BW below water.
 - G= Shear modulus, taken as $E/[2(1+\mu)]$ per Bowles 5th Edition, pg. 121, equation (a).
 - E= Elastic modulus, based on grain size and relative density as presented in AASHTO LRFD 8th Ed. Table C10.4.6.3-1. Used for elastic settlement of cohesionless soils.

For the phyllite bedrock, unconfined compression test results typically performed well above the base line reference values. For the selected foundation types, the design sensitivity to variations within the ranges observed will be minimal, therefore typical values were assigned to this layer per “AASHTO Standard Specifications for Highway Bridges”, 17th Edition, Section 4.4.8. A design unconfined compression strength of intact rock of 5 ksi is recommended as this limits the bedrock design strength to the strength of the micropile grout. Additional rock property recommendations specifically applicable to axial analysis are provided in subsequent sections below.

6.3.3 Lateral Earth Pressure

Due to the sensitive nature of the existing stone masonry block retaining walls and the need to minimize impacts on the walls, no additional lateral earth pressure should be permitted to act on the system despite the raising the roadway profile up to 5.8 feet. The existing concrete curb, rail, and wall top and the existing pavement will be removed, and a reinforced concrete tub will be placed between the rehabilitated abutments and new grade beams. This will fill the space of the profile raise and will bridge over the existing fill between the retaining walls without increasing the dead load. There will be an air gap between the concrete tub and

the approach spans which will prevent the approach walls from carrying the approach span weight. To ensure that there is not a buildup of water within this structure, 4 inch diameter weep drains are installed at 4 foot center to center longitudinal spacing.

Lateral earth pressures were developed in accordance with section 3.6 of the Maine DOT Bridge Design Guide with updates to 2018. Soil Type 4 was utilized for the typical earth pressures on the bridge abutments. Soil type 4 is a granular underwater backfill with a 32° friction angle, soil total unit weight of 125 pcf, coefficient of friction of concrete to soil ($\tan\delta$) of 0.45, and interface friction angle for concrete to soil of 24°.

Lateral earth pressure loading at the abutment is broken up into two components, fill behind the newly constructed substructure and the fill that will be in contact with the portions of the existing abutment to remain. The section at the south abutment which is in contact with the new concrete cap will have the earth pressures taken by the micropiles.

6.3.4 Design Loads & Micropile Geometry

FB-Multiplier models were prepared for the south abutment and each of the grade beam locations. Since the micropiles at the south abutment are being installed through oversized pre-cored holes through the existing concrete and masonry block gravity abutment, and considering the annular spacing between micropile and pre-cored hole will be grouted, the micropile cap was modeled as a rigid system. Due to the system rigidity, the critical section of the micropiles will be at the bottom of the existing abutment, so the cap was modeled at the bottom of the abutment elevation -6.0 feet. Micropiles will be fully supported and braced by grout and concrete above this elevation. The four-foot-thick grade beams at the ends of the jump spans were also treated as rigid pile caps based on recommendations from the structural designer. Bottom of cap elevations for the north and south grade beam are 9.47 and 12.77, respectively. Subsurface conditions were modeled based on the greatest depth of bedrock at each foundation. The combined controlling resultant load combinations for the south abutment and both grade beams is summarized in Table 6.3.4 below for reference.

Table 6.3.4: Combined Foundation Design Loads

| Structure | Load Case | FX | FY | FZ | MX | MY | MZ |
|-----------------------|---|--------|--------|--------|--------|--------|--------|
| | | (kips) | (kips) | (kips) | (k-ft) | (k-ft) | (k-ft) |
| Abutment 2 (south) | Str I – Max Resist, Max Overturn Mom. | 0 | 7.8 | 2064 | -1037 | 2225 | 0 |
| | Str I – Max Resist, Min Overturn Mom. | 0 | -54.7 | 2061 | -4214 | 2225 | 0 |
| | Str I – Min Resist, Max Overturn Mom. | 0 | 32.0 | 1098 | -1485 | 0 | 0 |
| | Str I – Min Resist, Min Overturn Mom. | 0 | -8.51 | 1096 | -2367 | 0 | 0 |
| | Str III – Min Resist, Min Overturn Mom. | 37.6 | 11.5 | 1570 | -2483 | 260 | 0 |
| | Str III – Min Resist, Min Overturn Mom. | 37.6 | 12.0 | 1095 | -1606 | 260 | 0 |
| | Str V – Max Resist, Max Overturn Mom. | 44.7 | 70.0 | 1479 | -441 | 1862 | 0 |
| | Str V – Min Resist, Min | 44.7 | -40.2 | 1951 | -4070 | 1862 | 0 |

| Structure | Load Case | FX | FY | FZ | MX | MY | MZ |
|-------------------------|---------------------------------------|--------|--------|--------|--------|--------|--------|
| | | (kips) | (kips) | (kips) | (k-ft) | (k-ft) | (k-ft) |
| | Overturn Mom. | | | | | | |
| | Srv I - Max Resist, Max Overturn Mom. | 44.7 | 57.2 | 1522 | -891 | 1460 | 0 |
| | Srv I - Min Resist, Max Overturn Mom. | 44.7 | -15.0 | 1522 | -2816 | 1460 | 0 |
| Grade Beam 1 (north) | Str I - Max Resist, Max Overturn Mom. | 0 | 183 | 1365 | 496 | 1600 | 0 |
| | Str I - Max Resist, Min Overturn Mom. | 0 | -42.9 | 736 | -74.2 | 0 | 0 |
| | Str I - Min Resist, Max Overturn Mom. | 0 | 129 | 1045 | 353 | 0 | 0 |
| | Str I - Min Resist, Min Overturn Mom. | 0 | -42.9 | 736 | -45.5 | 0 | 0 |
| | Str V - Max Resist, Max Overturn Mom. | 13.6 | 174 | 1292 | 472 | 1318 | 0 |
| | Str V - Min Resist, Min Overturn Mom. | 13.6 | 24.1 | 990 | 100 | 1318 | 0 |
| | Srv I - Max Resist, Max Overturn Mom. | 13.6 | 146 | 1009 | 404 | 998 | 0 |
| | Ext I - Max Resist, Max Overturn Mom. | 0 | 90.6 | 918 | 332 | 457 | 0 |
| Grade Beam 2 (south) | Str I - Max Resist, Max Overturn Mom. | 0 | 149 | 887 | 247 | 1242 | 0 |
| | Str I - Max Resist, Min Overturn Mom. | 0 | -11.2 | 443 | -44.2 | 0 | 0 |
| | Str I - Min Resist, Max Overturn Mom. | 0 | 95.6 | 638 | 185 | 0 | 0 |
| | Str I - Min Resist, Min Overturn Mom. | 0 | -11.2 | 443 | -41.0 | 0 | 0 |
| | Str V - Max Resist, Max Overturn Mom. | 7.6 | 139 | 830 | 237 | 975 | 0 |
| | Str V - Min Resist, Min Overturn Mom. | 7.6 | 53.1 | 640 | 41.3 | 975 | 0 |
| | Srv I - Max Resist, Max Overturn Mom. | 7.6 | 111 | 643 | 205 | 726 | 0 |
| | Ext I - Max Resist, Max Overturn Mom. | 0 | 58.1 | 572 | 161 | 355 | 0 |

Where: Y=Perpendicular to Abutment, X=Parallel to Abutment, Z=Vertical
 Moments given about axis, following right-hand rule.

South abutment pile configuration was generally controlled by the existing abutment geometry, bearing locations, and by efforts to overcome the eccentricities created by the bearing locations. Grade beam geometry was only limited by the existing masonry stone block gravity retaining walls. The proposed foundations needed to be arranged such that they will not impact the masonry stone block gravity retaining walls, which restricted the ability to utilize battered micropiles.

6.4 Foundation Recommendations

Based on the aforementioned criteria and analyses, the recommended micropile foundation configurations for the south abutment (Abutment 2) and the grade beams are as follows.

Abutment 2 shall consist of two rows of vertical micropiles, with 5 more closely spaced micropiles in the front row and the 3 more widely spaced micropiles in the back row due to the eccentric loading imparting higher demands on the front row. All of the micropiles installed in the south abutment will be installed through pre-cored 14" OD holes. Large diameter coring is only performed vertically, therefore all abutment piles are vertical (not battered). A total of eight micropiles are recommended for the south abutment. The front row of piles shall be spaced transverse to roadway at 6 feet center to center while the back row pile spacing is 12 feet center to center. The recommended distance between the two rows is 4.25 feet.

Both the north and south grade beams (Grade Beam 1 and Grade Beam 2) shall consist of five micropiles with staggered spacing. Transverse spacing relative to roadway centerline is 8 feet center to center with a 2.5 feet stagger longitudinally. Pre-cored holes are not required for the grade beam micropiles as existing structures are not anticipated within the grade beam limits.

The micropiles shall consist of 11.875" OD x 0.582" wall thickness minimum, 80 ksi (API 5CT, N80) outer casing seated a minimum of 1 foot below top of rock, filled with 5,000 psi Portland cement grout, and having a single central No. 18 ASTM A615 Grade 75 continuously threaded central reinforcing bar running the full length of the pile. A summary of the FB-Multiplier analysis of the micropiles is presented in Table 6.4A. Foundation Layout plans for Abutment 2, Grade Beam 1, and Grade Beam 2 are included as **Figure 6**. Micropile details are included as **Figure 7**.

Micropiles shall continue uncased below top of rock in order to establish a grout-to-bedrock bond zone. A presumptive ultimate grout-to-ground bond strength of 21.6 ksf is recommended for the phyllite bedrock and shall be confirmed by verification load tests on two sacrificial micropiles. Applying a Strength-state resistance factor of 0.70 for axial geotechnical resistance and assuming a bond zone diameter of 10.25 inches, an estimated micropile bond zone length of 10 feet is required in sound rock. Micropile axial resistances and estimated micropile quantities are summarized in Table 6.4B.

Table 6.4A: FB-Multiplier Analysis Summary Per Pile

| Structure | Pile Type | Limit State | Maximum Factored Axial Compression Load (kips) | Maximum Bending Moment (kip-ft) | Deflection At Pile Cap (in) | D/C |
|----------------------|----------------------|--------------|--|---------------------------------|-----------------------------|------|
| Abutment 2 (South) | 11.875" OD Micropile | Service-I | 283 | 17.9 | 0.15 | - |
| | | Strength-I | 396 | 22.9 | - | 0.45 |
| | | Strength-III | 202 | 13.5 | - | 0.17 |
| | | Strength-V | 330 | 20.9 | - | 0.40 |
| Grade Beam 1 (North) | 11.875" OD Micropile | Service-I | 225 | 91.1 | 0.29 | - |
| | | Strength-I | 313 | 122 | - | 0.78 |
| | | Strength-V | 290 | 114 | - | 0.75 |
| | | Extreme-I | 189 | 51.5 | 0.12 | 0.33 |
| Grade Beam 2 (South) | 11.875" OD | Service-I | 171 | 90.2 | 0.46 | - |
| | | Strength-I | 247 | 130 | - | 0.76 |

| Structure | Pile Type | Limit State | Maximum Factored Axial Compression Load (kips) | Maximum Bending Moment (kip-ft) | Deflection At Pile Cap (in) | D/C |
|-----------|-----------|-------------|--|---------------------------------|-----------------------------|------|
| | Micropile | Strength-V | 224 | 119 | - | 0.73 |
| | | Extreme-I | 122 | 37.8 | 0.13 | 0.24 |

Table 6.4B: Micropile Axial Resistance & Estimated Quantities

| Structure | Axial Geotechnical Resistance per Pile (kips) | | Average Top of Rock Elev. (ft) | Average Est. Tip Elev. (feet) | Pile Cutoff Elev. (feet) | Average Estimated Micropile Length (feet) | Number of Micropiles | Estimated Micropile Length per Structure (ft) |
|--------------|---|----------|--------------------------------|-------------------------------|--------------------------|---|----------------------|---|
| | Nominal | Factored | | | | | | |
| Abutment 2 | 563 | 394 | -12.6 | -23.6 | 9.30 | 32.9 | 8 | 263.2 |
| Grade Beam 1 | 447 | 313 | -2.5 | -13.5 | 11.62 | 25.12 | 5 | 125.6 |
| Grade Beam 2 | 352 | 247 | -16.0 | -27.0 | 15.00 | 42.00 | 5 | 210.0 |

Final axial design of micropiles shall be verified by the micropile specialty contractor during construction, based on the contractor designed verification load tests' results and contractor selected means and methods. This resistance value was utilized for sizing of the micropile array.

7.0 EVALUATION OF APPROACH EMBANKMENT RETAINING WALLS

7.1 General Design Considerations

The existing stone masonry block walls that currently retain the embankment leading to the bridge abutments are to remain in place and unchanged. These retaining walls have been in place for nearly 100 years and have freely allowed for water to flow through them during ebb and flow of tides. A design assumption has been made that the embankment between the retaining walls is not going to be materially changed more than it already has. Borings did not reveal any defects that would otherwise lead us to the conclusion that the walls are in good condition and functional. Any fine-grained soils which may wash out of the wall backfill material during tidal ebb and flow have already been removed from the system. Generally, the north approach retaining walls are founded either directly on shimstone or a thin till layer which resides on the bedrock. The south approach retaining walls are typically founded on till or decomposed bedrock. Despite the increase in vertical profile across both sides of the embankments, the proposed structural design has taken measures to prevent increase of the load on the existing retaining walls. Any additional rehabilitation or reconstruction would be very costly and increase the impacts to the hydraulic functionality of the structure, at least temporarily. Horizontal alignment will remain the same, but the roadway will be widened to accommodate two 11 foot wide lanes with 4 foot wide shoulders. There will be no structural connection to the existing retaining walls to accommodate the widening, the

superstructure will span over the walls and be supported on the abutments and grade beams.

7.2 Settlement Assessment

As discussed in section 7.1, there will be no additional fill or load imparted on the embankment soils behind the abutments and the existing retaining walls to remain. By inspection, there will be no settlement incurred by the system.

7.3 External Stability Assessment

Existing stone masonry block walls were evaluated for the final condition to remain based on current LRFD design standards. The tallest section of the stone masonry block wall was evaluated on each side of the bridge. Checks for sliding, overturning, and bearing resistance were performed. For overturning, eccentricity of the footing needed to be within the middle 1/3 for soils and within 0.45 of the footing dimensions for rock. For sliding and bearing resistance, the resistance factors used in analysis are presented in Table 7.3A.

Table 7.3A: Resistance Factors for Retaining Walls

| Structure | Strength Limit State Check | Resistance Factor |
|----------------------------------|----------------------------|-------------------|
| Stone Masonry Block Gravity Wall | Bearing Resistance | 0.45 |
| | Sliding | 0.90 |

As noted previously, the recommended design imparts no additional loading into the retaining wall systems. Normally, the analysis performed for the retaining walls would include a live load surcharge because the walls would be utilized to support the roadway. In this case, due to the proposed tub and jump span configuration, the live load surcharge is omitted. Table 7.3B summarizes the existing retaining wall external stability analyses. Note that this was evaluated at the existing retaining walls and was not the governing load case. The Strength-I min governed over the seismic loading.

Table 7.3B: Summary of Existing Retaining Wall Analysis

| Walls | Start Station | End Station | Max. Height of Wall (ft) | Wall Base Width (ft) | Sliding C/D Ratio | Overturning C/D Ratio | Bearing Resistance C/D ratio | Factored Bearing Resistance (Strength I min) (ksf) | Nominal Bearing Resistance (ksf) |
|----------------|---------------|-------------|--------------------------|----------------------|-------------------|-----------------------|------------------------------|--|----------------------------------|
| North Approach | 16+48.16 | 17+00 | 20 | 10 | 1.04 | 1.33 | 3.14 | 11.24 | 24.98 |
| South Approach | 18+11 | 18+39 | 19 | 10 | 1.03 | 1.09 | 1.36 | 5.98 | 13.29 |

| Walls | Start Station | End Station | Max. Height of Wall (ft) | Wall Base Width (ft) | Sliding C/D Ratio | Overturning C/D Ratio | Bearing Resistance C/D ratio | Factored Bearing Resistance (Strength I min) (ksf) | Nominal Bearing Resistance (ksf) |
|----------------|---------------|-------------|--------------------------|----------------------|-------------------|-----------------------|------------------------------|--|----------------------------------|
| South Abutment | 18+06.9 | 18+06.9 | 15.5 | 7.92 | 2.31 | 2.18 | 1.76 | 8.18 | 18.18 |

8.0 SEISMIC DESIGN RECOMMENDATIONS

8.1 Site Evaluation

Single span bridges need not be analyzed for seismic loads, regardless of their operational classification and geometry as specified in both MaineDOT BDG Section 5.2.5 and AASHTO LRFD Article 4.7.4. However, minimum requirements shall still apply as specified in AASHTO LRFD Articles 4.7.4.4 and 3.10.9 regarding superstructure connections and minimum support lengths. Retaining walls are still evaluated for seismic earth pressures using the Mononobe-Okabe Method of analysis for lateral earth overpressure. This accounts for the seismic inertia forces of the substructure self-weight and the soil on the substructure footings.

8.2 Liquefaction Screening

As part of the seismic assessment, a determination of the liquefaction hazards present at the project site was conducted. Liquefaction is a phenomenon whereby a soil substantially loses strength in response to an applied cyclic stress, typically associated with earthquake loading. This temporary loss of soil strength causes the soil to behave like a liquid, impacting bearing capacity and lateral stiffness. Liquefaction induced ground movement can cause serious damage to structures. Damage may occur during the earthquake itself, or continue to occur or be initiated subsequent to the earthquake in situations where the static factor of safety against lateral movement is reduced to less than unity. Two types of post-liquefaction deformations are possible:

1. Horizontal shear deformation arising from the large shearing strains occurring in zones where the earthquake has induced initial liquefaction.
2. Settlements arising from volume changes that occur on reconsolidation accompanying dissipation of the large excess pore pressures in liquefied zones.

In general, strata meeting the following criteria are typically not susceptible to liquefaction and can be eliminated from the screening:

- Soil with fines content (percent passing through No. 200 sieve) more than 35 percent
- Soils classified as Marine and Lacustrine Silt and Clay
- Layers with SPT-N values greater than 30 blows per foot
- Unsaturated soils above the groundwater table

The conditions at the project site satisfy the above screening criteria and are not susceptible to liquefaction.

9.0 CONSTRUCTION CONSIDERATIONS

9.1 Micropile Construction and Testing Considerations

Due to site constraints, micropile verification and proof load tests are not feasible at the south abutment. To offset these limitations, a minimum of one micropile verification test shall be performed near the north grade beam and one shall be performed near the south grade beam prior to construction of the production micropiles. The verification load tests shall be performed on sacrificial micropiles to verify design grout-to-ground bond strengths and to demonstrate the sufficiency of the chosen installation methods. Verification tests may be conducted using either compression or tension methods. A tension test is preferred, as it requires less time and set up and allows for end bearing to be omitted from the load test results without the need for additional instrumentation.

Construction-phase proof testing is necessary on a minimum of 5% of production micropiles or one micropile per substructure, whichever is greater. One proof load test shall be performed on a production micropile at each grade beam.

The API N-80 micropile casing typically used in micropile construction is mill secondary, or oil industry rejected pipe. Mill secondary pipe is rejected for oil industry use because of stringent tolerances, although it is a high-quality pipe suitable for structural applications. Where “Buy America” requirements associated with federally funded projects are imposed, the use of mill seconds is limited, as mill certification of rejected pipe is not provided and therefore country of origin cannot be adequately documented. This makes it necessary for the Contractor to purchase more expensive “Prime Pipe” in order to receive mill certification. Alternatively, if permitted by the Owner and governing regulations, it may be possible for the Contractor to satisfy “Buy America” requirements without a mill certification if a letter can be provided from the casing supplier certifying that the casing is domestically produced.

To reduce the risk of potentially impacting the existing retaining walls and abutment, micropile installation methods through soils prior to seating the casing in bedrock shall be restricted. The use of a down-the-hole hammer shall be disallowed until the micropile casing is seated a minimum of 1 foot into bedrock. The high pressures used with down-the-hole hammer methods have the potential to displace the bearing soils below Abutment 2 and associated retaining walls.

9.2 Temporary Bridge Foundation Considerations

The proposed bridge superstructure will be constructed within the same footprint as the existing bridge. To facilitate construction and allow for contractors to have more flexibility in their schedule, a temporary bridge is anticipated on the Salt Pond side of the alignment. Bedrock depth in the Salt Pond and in the water undulates but is relatively shallow. The temporary bridge will likely require deep foundations socketed in rock due to the lack of overburden support.

The design and layout of the temporary bridge is contingent on the Contractor's means and methods and, therefore, is the responsibility of the Contractor's engineer. However, for proof of concept, preliminary layout, and cost estimating, the falsework is assumed to consist of temporary H-pile foundations placed in pre-drilled rock sockets. Since the H-piles will be set in rock, and potentially cast in concrete, it is anticipated that they will be structurally controlled.

Final design of the temporary bridge and associated foundations shall be performed by the Contractor's engineer. Shop drawings and details, including structural and geotechnical design calculations, shall be signed and sealed by a Professional Engineer licensed in the state of Maine, and shall be submitted to the Engineer for review and approval. Foundation design, quality control, and testing shall be in accordance with the requirements of the AASHTO Guide Design Specifications for Bridge Temporary Works, 2nd Edition, including all current interim revisions at the time of contract. Pile geotechnical resistance shall be based on the Contractor's proposed quality control methods and associated Strength-state geotechnical resistance factors.

9.3 Considerations for Existing Structures to Remain

The existing masonry stone block retaining walls are intended to remain without modification. Any fine grained soil that may be pulled away through the gaps between the blocks during the ebb and flow of tides has already done so. It is not expected that additional soil will be lost in the retaining walls between the embankments and behind the concrete gravity abutments with stone masonry facing. With this in mind, the contractor shall not impact the condition of the existing embankment retaining walls or the concrete gravity abutments with their means and methods. Loading on the walls and abutments should not exceed the current lateral earth pressures plus typical AASHTO live load surcharge from the roadway traffic. Light equipment such as micropile drill rigs, small excavators, dump trucks, etc. may be utilized behind the walls if the contractor visually monitors the condition of the walls and abutments throughout the construction process. The contractor should take extra care when working with the existing structures to remain

10.0 LIMITATIONS OF REPORT

The conclusions and recommendations contained in this report are based upon the subsurface data obtained during this investigation and on details stated in this report. The validity of the conclusions and recommendations contained in this report are necessarily limited by, among other things, the scope of field investigation and by the number of borings. Therefore, given the nature of this subsurface study, there is a possibility that actual conditions encountered will differ from those discussed in this report. Should conditions arise which differ from those described in this report, HNTB should be notified immediately and provided with all information when available regarding subsurface conditions.

As part of the geotechnical recommendations presented in this report, HNTB makes no warranty as to the absence or presence of any environmental hazard or waste present on any property evaluated hereunder and all reports generated here to are qualified as being based upon existing data reasonably available to HNTB and not subject to independent verification. HNTB is not responsible for any latent defects that could not be reasonably discovered during the performance of its services and makes no legal

representations whatsoever concerning any matter, including but not limited to, the ownership of any property or the interpretation of any law. These limitations form a material part of this report and are considered incorporated by reference therein. No warranty for the contents of this report, neither expressed nor implied, is made except that professional services were performed in accordance with generally accepted principles and practices.

11.0 REFERENCES

1. AASHTO. "LRFD Bridge Design Specifications". 8th Edition, 2017.
2. AASHTO. "Standard Specifications for Highway Bridges". 17th Edition, 2002.
3. Bowles, Joseph E. Foundation Analysis and Design. 5th Edition. McGraw-Hill, 1996.
4. Bridge Software Institute. "FB-MultiPier Soil Parameter Table". University of Florida, May 2011.
5. FHWA. "Evaluation of Soil and Rock Properties". Geotechnical Engineering Circular No. 5, FHWA-IF-02-034, 2002.
6. FHWA. "Micropile Design and Construction Reference Manual". FHWA NHI-05-039, 2005.
7. MaineDOT, "Bridge Design Guide". Maine Department of Transportation, Prepared by Guertin Elkerton & Associates, August 2003 with 2018 updates.
8. Naval Facilities Engineering Command. Design Manual 7.02, Foundations & Earth Structures. United States Navy. Alexandria: 1986.

Figures

FIGURE 1. PROJECT LOCATION MAP

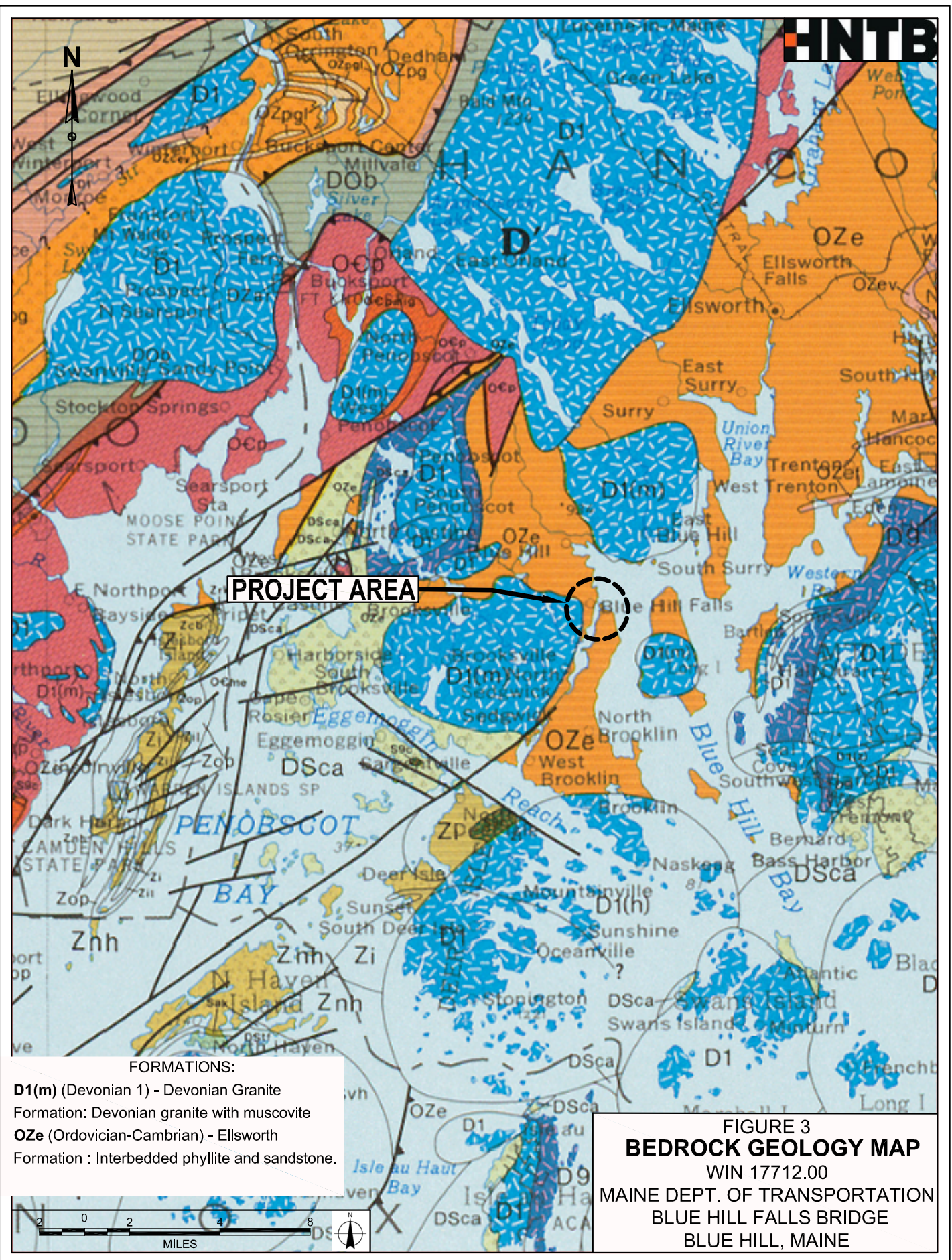
Blue Hill, Falls Bridge #5038, WIN 017712.00
Route 175 over Salt Pond Outlet



Latitude: 44° 22' 26" N, Longitude: 68° 33' 33" W



FIGURE 2
SURFICIAL GEOLOGY MAP
 WIN 17712.00
 MAINE DEPT. OF TRANSPORTATION
 BLUE HILL FALLS BRIDGE
 BLUE HILL, MAINE



PROJECT AREA

FORMATIONS:

- D1(m)** (Devonian 1) - Devonian Granite
Formation: Devonian granite with muscovite
- OZe** (Ordovician-Cambrian) - Ellsworth
Formation : Interbedded phyllite and sandstone.

**FIGURE 3
BEDROCK GEOLOGY MAP**

WIN 17712.00
MAINE DEPT. OF TRANSPORTATION
BLUE HILL FALLS BRIDGE
BLUE HILL, MAINE

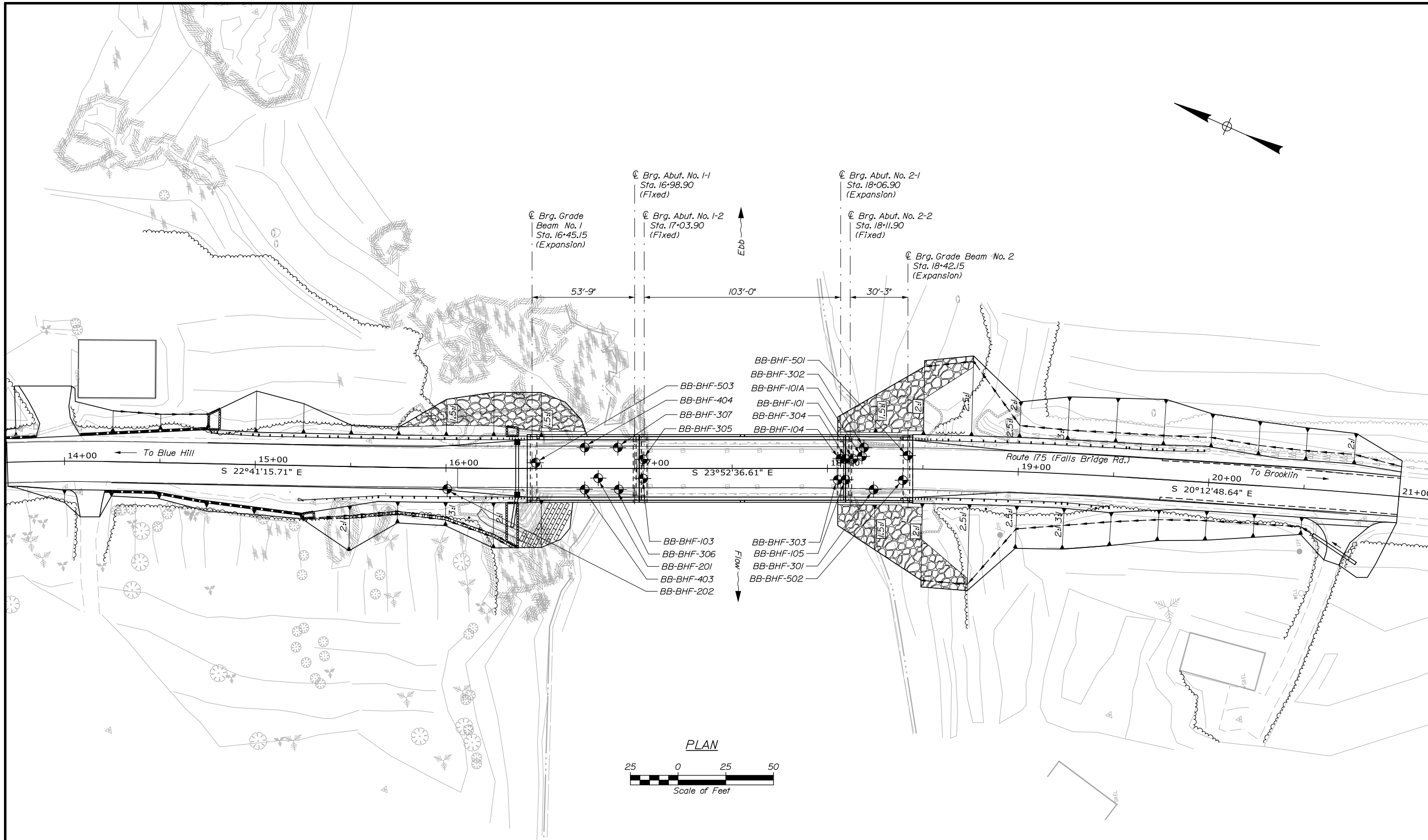
Basemap: Maine Geological Survey, Maine, 1985

Date: 8/19/2021

Username:

Division:

Filename: 008_Boring_Location_Plan.dgn



LEGEND

⊕ CASED WASH BORING

FIGURE 4 - BORING LOCATION PLAN

99% PS&E
August 18, 2021



| | | | |
|--|--|-----------------|--|
| STATE OF MAINE DEPARTMENT OF TRANSPORTATION | | 1771200 | |
| FOR REFERENCE ONLY | | WIN 17712.00 | |
| PROJ. MANAGER A. Lathin | | BRIDGE No. 5038 | |
| DESIGN-DETAILED H. Walton | | BRIDGE PLANS | |
| CHECKED-REVIEWED K. Brophy | | 17712.00 | |
| DESIGN-DETAILED | | 17712.00 | |
| REVISIONS 1 | | 17712.00 | |
| REVISIONS 2 | | 17712.00 | |
| REVISIONS 3 | | 17712.00 | |
| REVISIONS 4 | | 17712.00 | |
| FIELD CHANGES | | 17712.00 | |
| BLUE HILL FALLS BRIDGE SALT POND OUTLET HANCOCK COUNTY | | | |
| BORING LOCATION PLAN | | | |
| SHEET NUMBER | | | |
| 8 | | | |
| OF 67 | | | |

99% PS&E
August 18, 2021

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
1771200
WIN
17712.00
BRIDGE PLANS
Bridge No. 5038

FOR REFERENCE ONLY

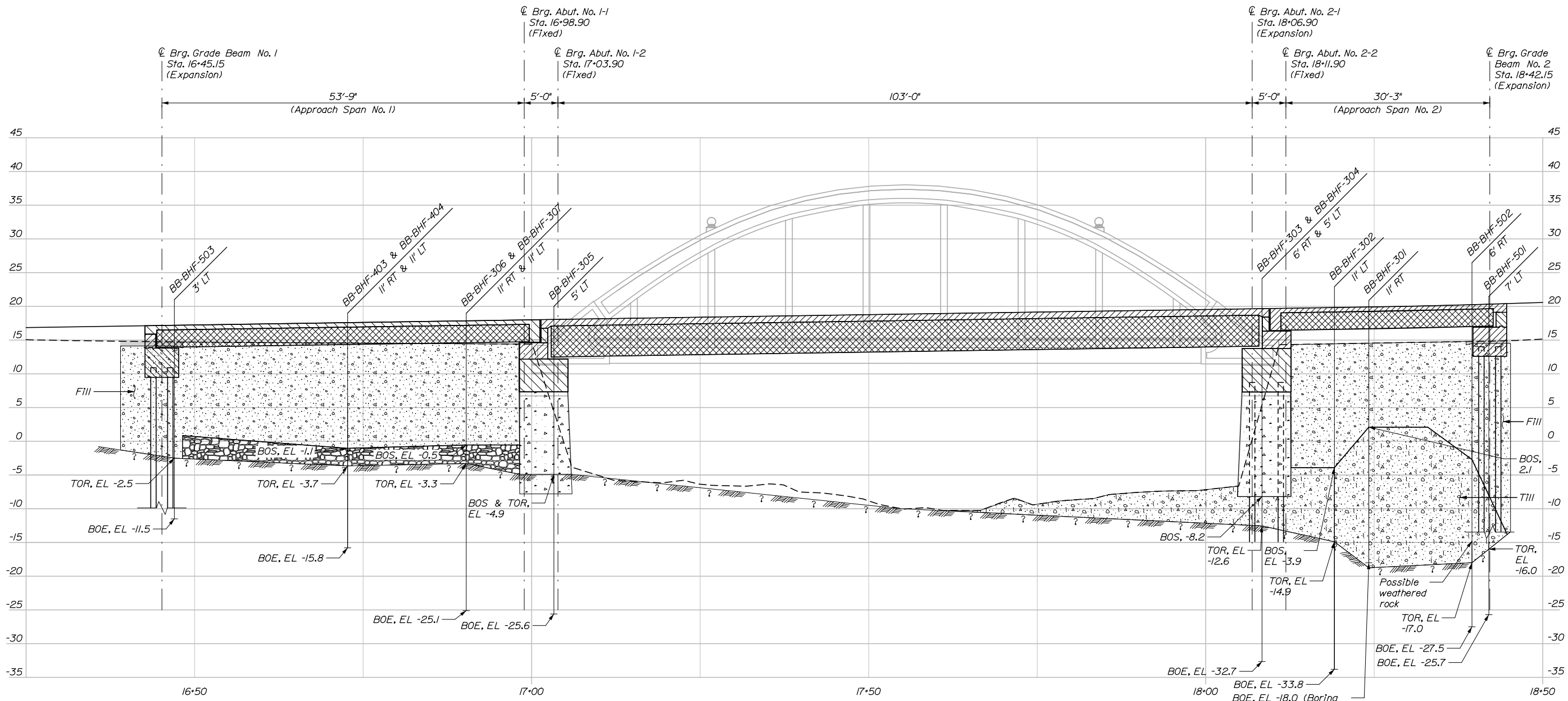
| PROJ. MANAGER | BY | DATE |
|------------------|-----------|-------|
| A. Lefebvre | H. Walton | 08/21 |
| DESIGN-DETAILED | H. Walton | 08/21 |
| CHECKED-REVIEWED | T. Cote | 08/21 |
| DESIGN-DETAILED | | |
| DESIGN-DETAILED | | |
| REVISIONS 1 | | |
| REVISIONS 2 | | |
| REVISIONS 3 | | |
| REVISIONS 4 | | |
| FIELD CHANGES | | |

BLUE HILL FALLS BRIDGE
SALT POND OUTLET
HANCOCK COUNTY
BLUE HILL
INTERPRETIVE
SUBSURFACE PROFILE

SHEET NUMBER

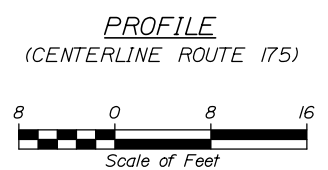
9

OF 67



NOTES:

- This generalized interpretive soil profile is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and have been developed by interpretations of widely spaced explorations and samples. Actual soil transitions may vary and are probably more erratic. For more specific information refer to the exploration logs.
- The borings that occur at the same station with different offsets have been averaged for the purpose of this profile.



LEGEND

Boring No. Offset

Strata Interface

BOS = Bottom of Structure
TOR = Top of Rock

Boring

RQD = Rock Quality Designation For Rock Core Sample

BOE = Bottom of Exploration

FIGURE 5 - INTERPRETIVE SUBSURFACE PROFILE



Date: 8/19/2021

Username:

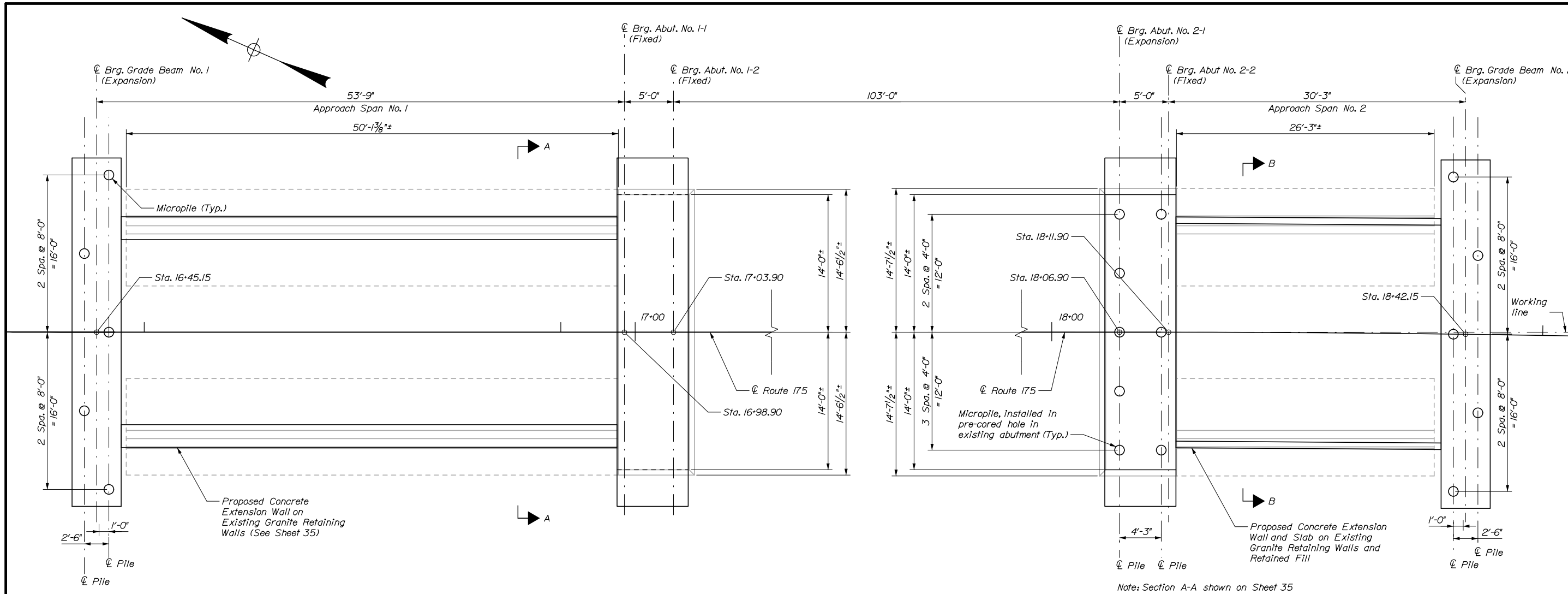
Filename: 009_Interpretive Subsurface Profile.dgn Division:

Date: 8/19/2021

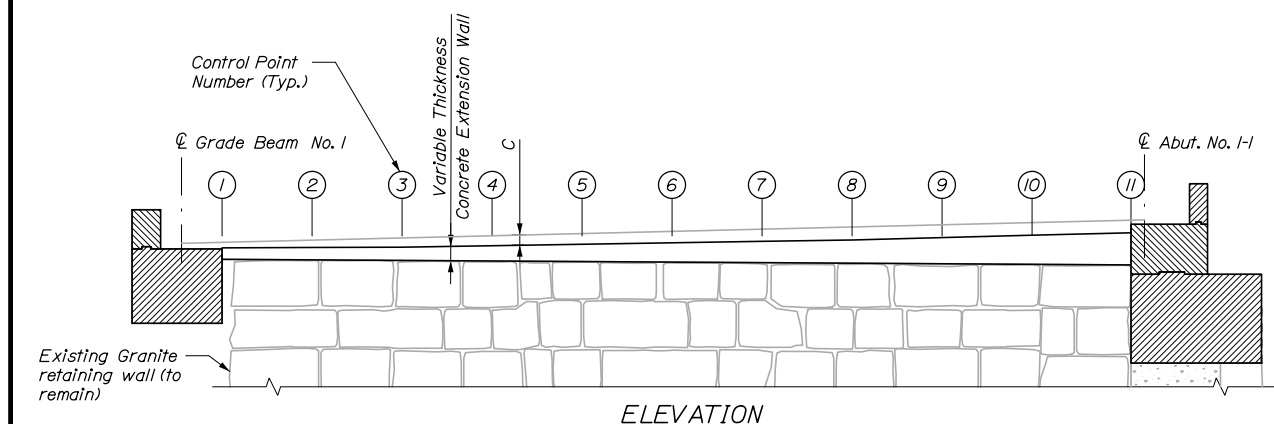
Username:

Division:

Filename: 034_Foundation Plan.dgn

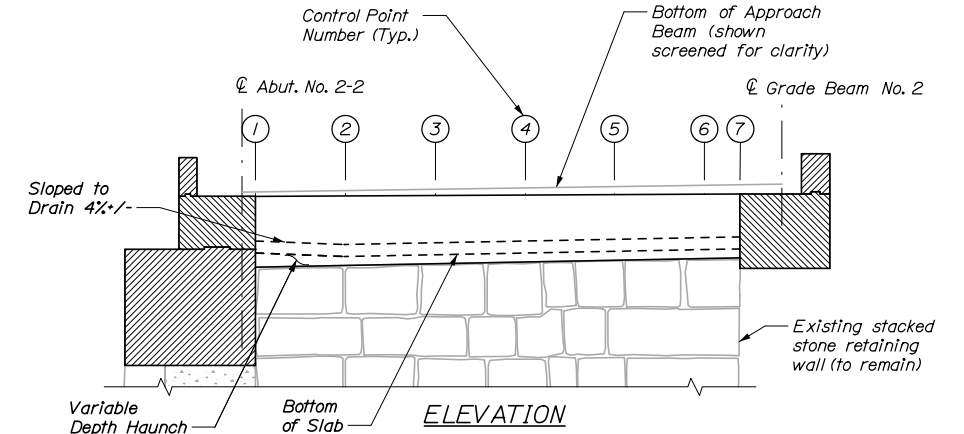


FOUNDATION PLAN



ELEVATION

| Concrete Extension Wall Finished Elevation - Approach 1 | | | | | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Control Point | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Station | 16+47.65 | 16+52.65 | 16+57.65 | 16+62.65 | 16+67.65 | 16+72.65 | 16+77.65 | 16+82.65 | 16+87.65 | 16+92.65 | 16+98.15 |
| Top of Concrete Elevation | 13.76 | 13.73 | 13.71 | 13.72 | 13.81 | 13.89 | 13.98 | 14.07 | 14.24 | 14.41 | 14.59 |



ELEVATION

| Concrete Retaining Wall Finished Elevation - Approach 2 | | | | | | | |
|---|----------|----------|----------|----------|----------|----------|----------|
| Control Point | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Station | 18+12.65 | 18+17.65 | 18+22.65 | 18+27.65 | 18+32.65 | 18+37.65 | 18+39.65 |
| Top of Concrete Elevation | 16.52 | 16.61 | 16.70 | 16.79 | 16.88 | 16.96 | 17.00 |
| Bottom of Slab | 13.18 | 12.98 | 13.07 | 13.14 | 13.23 | 13.32 | 13.35 |

FOR REFERENCE ONLY

| PROJ. MANAGER | A. Lathin | BY | DATE |
|------------------|-----------|------------|-------|
| DESIGN-DETAILED | H. Walton | E. Brasuel | 08/21 |
| CHECKED-REVIEWED | K. Brody | T. Cole | 08/21 |
| DESIGN-DETAILED | - | - | - |
| DESIGN-DETAILED | - | - | - |
| REVISIONS 1 | - | - | - |
| REVISIONS 2 | - | - | - |
| REVISIONS 3 | - | - | - |
| REVISIONS 4 | - | - | - |
| FIELD CHANGES | - | - | - |

SHEET NUMBER

34

OF 67

99% PS&E
August 18, 2021

FIGURE 6 - FOUNDATION LAYOUTS

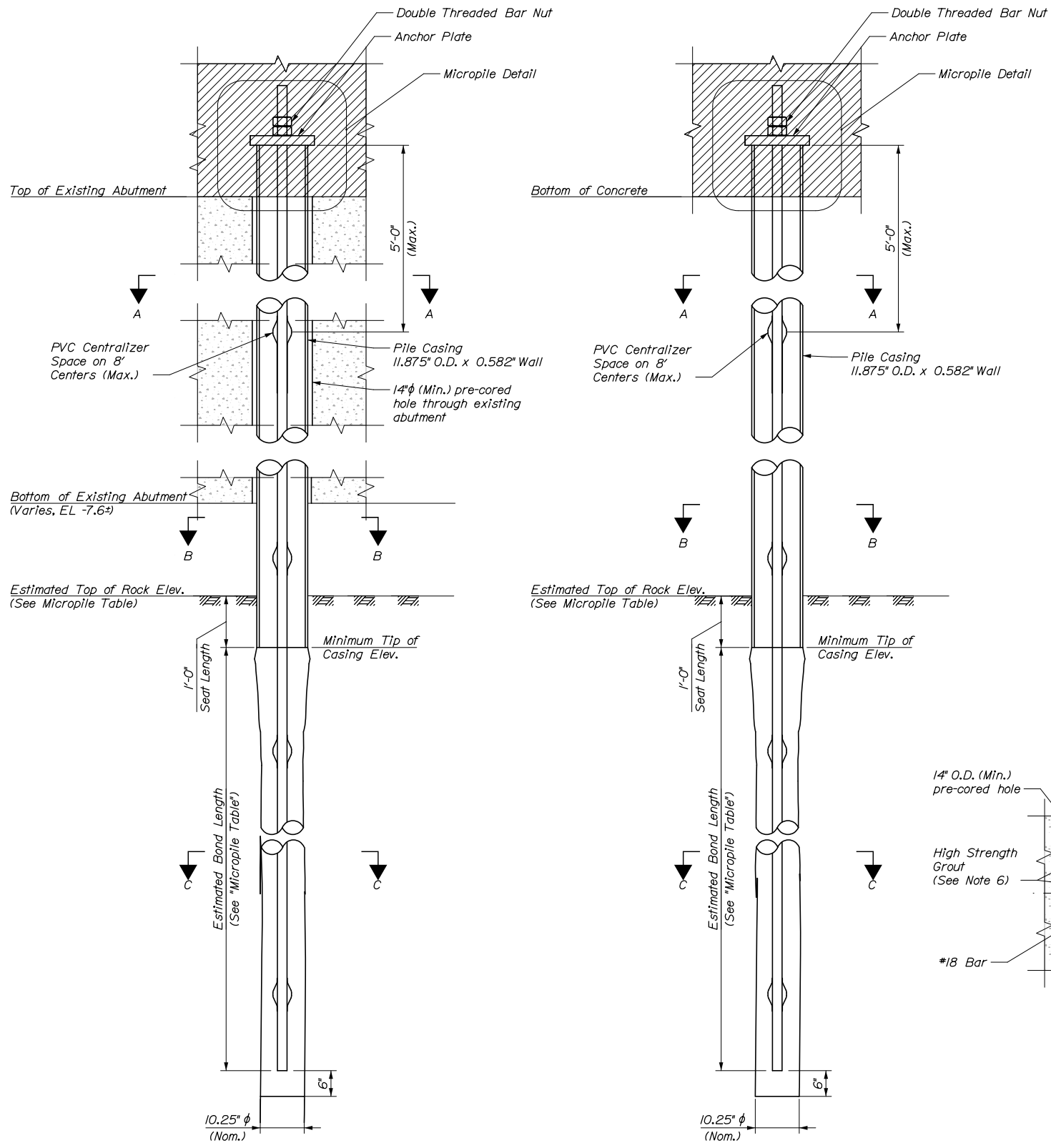


Date: 8/19/2021

Username:

Division:

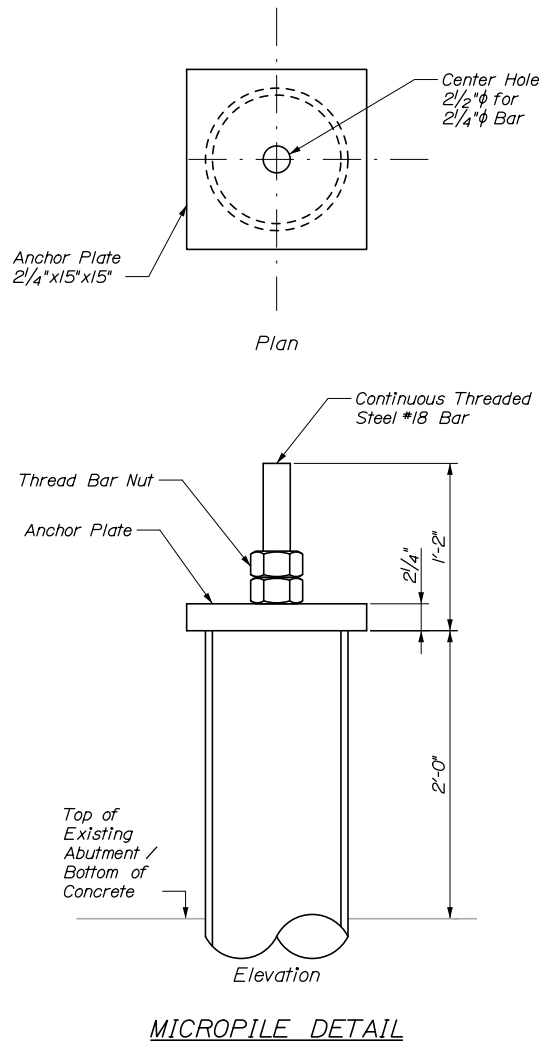
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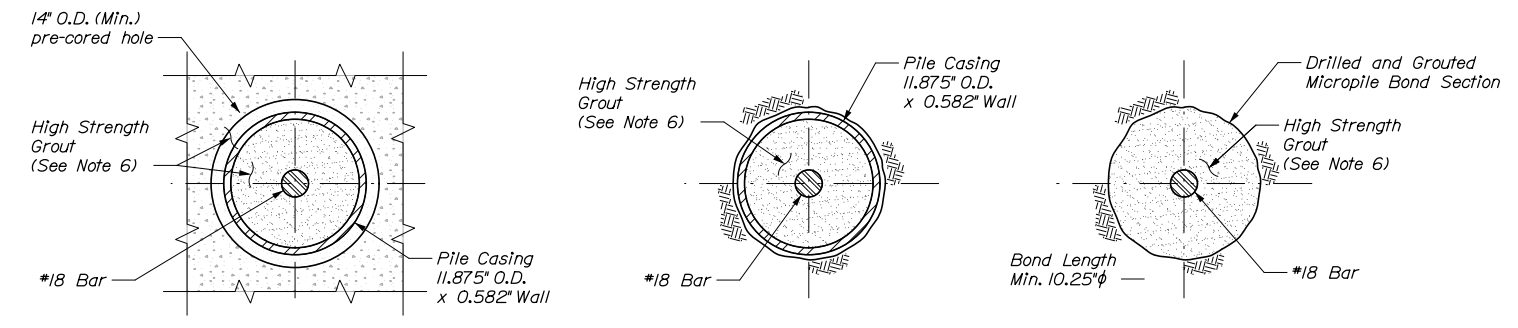
ABUTMENT MICROPILE ELEVATION

GRADE BEAM MICROPILE ELEVATION

99% PS&E
August 18, 2021



MICROPILE DETAIL



SECTION A-A
(Abutment 2)

SECTION B-B
(Cased Zone)
(In Bedrock Shown, in Soil Similar)

SECTION C-C
(Bond Zone in Bedrock)

NOTES:

1. Construct micropiles in accordance with Special Provision Section 501, Micropiles.
2. Bedrock bond zone lengths shall be confirmed by Contractor verification load tests on test piles in accordance with Special Provision Section 501, Micropiles.
3. Casing shall be API 5CT N80 pipe with a minimum yield strength of 80 ksi as approved by the Engineer.
4. Reinforcing bar shall be #18 Continuously Threaded Bar in accordance with ASTM A615 Grade 75. Reinforcing bars shall be galvanized in accordance with ASTM A153.
5. Anchor plate shall meet requirements of ASTM A709 Grade 50 and shall be galvanized per ASTM A123.
6. Micropile grout shall have minimum 28 day compressive strength of 5,000 psi.
7. Micropile casing, threaded bar, anchor plates, and high strength grout shall be included in the unit bid price for Item 501.222, Micropiles.
8. Micropiles shall not be installed closer than 10 feet from an adjacent micropile which has been grouted for a period of less than 24 hours.
9. Following structural repairs to existing granite blocks and repairing granite masonry joints at Abutment 2, and prior to micropile installation, the Contractor shall drill 14-inch min. diameter vertical cores at each Abutment 2 micropile location. Cores shall extend from the top of the existing abutment to the bottom of the existing abutment and shall be located and sized to allow a minimum 1' temporary annulus between existing masonry or concrete and micropile outer casing. Annulus shall be tremie grouted with micropile grout upon completion of micropile installation. Vertical coring for micropiles shall be paid for under Item 501.XX, Pre-Coring Existing Abutment.
10. Top of Rock Elevations indicated in the Micropile Table are estimated based on subsurface investigation data and may vary. Actual Top of Rock Elevation shall be verified at each micropile location during micropile installation. Micropile casing shall be seated a minimum of 1'-0" below top of sound rock.

| Substructure Unit | Required Nominal Resistance | | Factored Design Load (FDL) | | Bottom of Concrete* Elevation | Estimated Top of Rock Elevation | Estimated Bond Zone Length (ft.) |
|-------------------|-----------------------------|---------|----------------------------|---------|-------------------------------|---------------------------------|----------------------------------|
| | Compression | Tension | Compression | Tension | | | |
| Grade Beam 1 | 447 kips | 0 kips | 313 kips | 0 kips | 9.62 | -2.5 | 10 |
| Abutment 2 | 563 kips | 45 kips | 394 kips | 31 kips | 7.30 | -12.6 | 10 |
| Grade Beam 2 | 352 kips | 0 kips | 247 kips | 0 kips | 13.00 | -16.0 | 10 |

*At Abutment 2, bottom of proposed cap given. See boring logs for approximate bottom of existing abutment elevation.

FIGURE 7 - MICROPILE DETAILS



FOR REFERENCE ONLY

| PROJ. MANAGER | BY | DATE |
|------------------|---------------|-------|
| A. Lathin | E. Brusa/lell | 08/21 |
| DESIGN-DETAILED | H. Walton | 08/21 |
| CHECKED-REVIEWED | K. Reidy | 08/21 |
| DESIGN-DETAILED | | |
| DESIGN-DETAILED | | |
| REVISIONS 1 | | |
| REVISIONS 2 | | |
| REVISIONS 3 | | |
| REVISIONS 4 | | |
| FIELD CHANGES | | |

BLUE HILL FALLS BRIDGE
SALT POND OUTLET
HANCOCK COUNTY
BLUE HILL
MICROPILE DETAILS

SHEET NUMBER

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Appendix A

Field and Laboratory Data Reports (By Maine DOT and Schonewald Engineering Associates)

Appendix A1: 100-Series Geotechnical Program

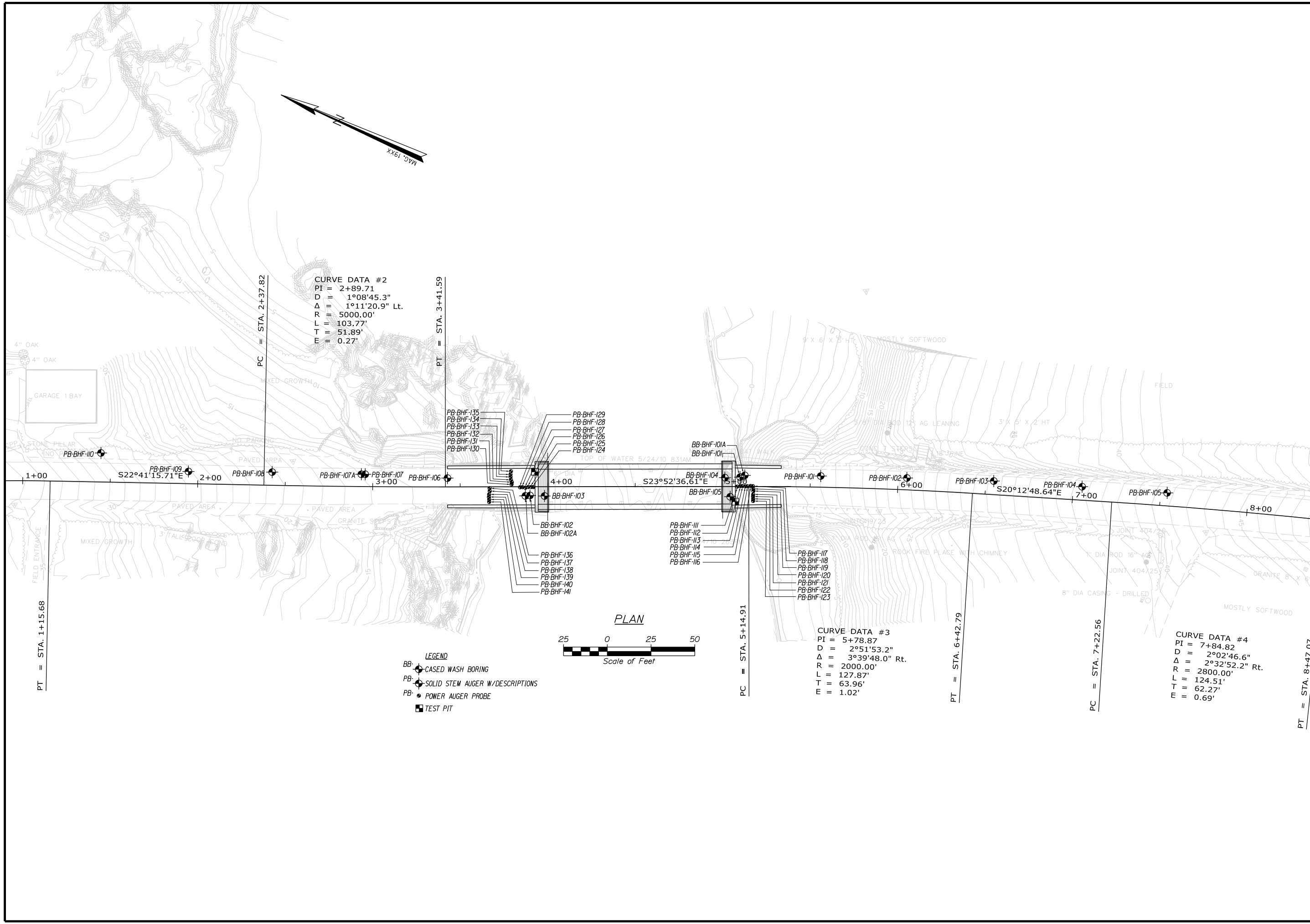
Appendix A2: 200-Series Geotechnical Program

Appendix A3: 300-500-Series Geotechnical Program

Appendix A1

100-Series, Preliminary Geotechnical Program

(By Maine DOT)



| | | | |
|--------------------------|----------|------------------------------|-------------|
| STATE OF MAINE | | DEPARTMENT OF TRANSPORTATION | |
| BLUE HILL FALLS BRIDGE | | STP-1771(200)X | |
| SALT POND | | BRIDGE NO. 5038 | |
| BLUE HILL HANCOCK COUNTY | | PIN 17712.00 | |
| BORING LOCATION PLAN | | BRIDGE PLANS | |
| PROJ. MANAGER | DATE | BY | DATE |
| DESIGN-DETAILED | DEC 2010 | T. WHITE | |
| CHECKED-REVIEWED | | | SIGNATURE |
| DESIGN-DETAILED | | | P.E. NUMBER |
| REVISIONS 1 | | | DATE |
| REVISIONS 2 | | | |
| REVISIONS 3 | | | |
| REVISIONS 4 | | | |
| FIELD CHANGES | | | |
| SHEET NUMBER | | 6 | |
| OF | | 1 | |

| | | |
|--|---|--------------------------------------|
| Driller: MaineDOT | Elevation (ft.): 15.0 | Auger ID/OD: 5" Solid Stem |
| Operator: Giguere/Giles | Datum: NAVE88 | Sampler: Standard Split Spoon |
| Logged By: B. Wilder | Rig Type: CME 45C | Hammer Wt./Fall: 140#/30" |
| Date Start/Finish: 12/1/10; 09:00-10:30 | Drilling Method: Cased Wash Boring | Core Barrel: N/A |
| Boring Location: 5+10, 5.4 Lt. | Casing ID/OD: HW | Water Level*: None Observed |

Hammer Efficiency Factor: 0.84 **Hammer Type:** Automatic Hydraulic Rope & Cathead

Definitions: R = Rock Core Sample S_u = Insitu Field Vane Shear Strength (psf) S_{u(lab)} = Lab Vane Shear Strength (psf)
 D = Split Spoon Sample SSA = Solid Stem Auger T_v = Pocket Torvane Shear Strength (psf) WC = water content, percent
 MD = Unsuccessful Split Spoon Sample attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf)
 U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw field SPT N-value LL = Liquid Limit
 MU = Unsuccessful Thin Wall Tube Sample attempt WOH = weight of 140lb. hammer Hammer Efficiency Factor = Annual Calibration Value PL = Plastic Limit
 V = Insitu Vane Shear Test, PP = Pocket Penetrometer WOR/C = weight of rods or casing N₆₀ = SPT N-uncorrected corrected for hammer efficiency G = Grain Size Analysis
 MV = Unsuccessful Insitu Vane Shear Test attempt WO1P = Weight of one person N₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected C = Consolidation Test

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|--|---------------|-----------------|--------------|--|-----------------|---|--|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 0 | | | | | | | | | 14.55 | | PAVEMENT. —————0.45 | |
| | 1D | 24/18 | 1.00 - 3.00 | 13/13/9/7 | 22 | 31 | | | 12.00 | | Brown, damp, medium dense, gravelly, fine to coarse SAND, trace silt. | G#245516 A-1-b, SM WC=5.0% |
| | 2D | 24/6 | 3.00 - 5.00 | 4/6/10/4 | 16 | 22 | | | | | Brown, moist, medium dense, fine to coarse SAND, some gravel, some silt. | G#245517 A-2-4, SM WC=13.1% |
| 5 | 3D | 16.8/10 | 5.00 - 6.40 | 8/4/30(4.8") | --- | | 125 | | 8.50 | Similar to above, except dense, occasional cobbles. | G#245518 A-4, SM WC=12.3% | |
| | | | | | | | | | | a100 blows for 0.5 ft. | | |
| | | | | | | | | | | Bottom of Exploration at 6.50 feet below ground surface. COBBLE REFUSAL | | |
| 10 | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |

Remarks:

| | | |
|------------------------------------|------------------------------------|-------------------------------|
| Driller: MaineDOT | Elevation (ft.): 14.9 | Auger ID/OD: 5" Solid Stem |
| Operator: Giguere/Giles | Datum: NAVE88 | Sampler: Standard Split Spoon |
| Logged By: B. Wilder | Rig Type: CME 45C | Hammer Wt./Fall: 140#/30" |
| Date Start/Finish: 12/30/10-1/3/11 | Drilling Method: Cased Wash Boring | Core Barrel: NQ-2" |
| Boring Location: 5+12.6, 6.4 Lt. | Casing ID/OD: HW & NW | Water Level*: None Observed |

Hammer Efficiency Factor: 0.84 **Hammer Type:** Automatic Hydraulic Rope & Cathead

Definitions: R = Rock Core Sample S_u = Insitu Field Vane Shear Strength (psf) S_{u(lab)} = Lab Vane Shear Strength (psf)
 D = Split Spoon Sample SSA = Solid Stem Auger T_v = Pocket Torvane Shear Strength (psf) WC = water content, percent
 MD = Unsuccessful Split Spoon Sample attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf) LL = Liquid Limit
 U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw field SPT N-value PL = Plastic Limit
 MU = Unsuccessful Thin Wall Tube Sample attempt WOH = weight of 140lb. hammer Hammer Efficiency Factor = Annual Calibration Value PI = Plasticity Index
 V = Insitu Vane Shear Test, PP = Pocket Penetrometer N₆₀ = SPT N-uncorrected corrected for hammer efficiency G = Grain Size Analysis
 MV = Unsuccessful Insitu Vane Shear Test attempt WO1P = Weight of one person N₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected C = Consolidation Test

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|--|---------------|-----------------|--------------|--------|-----------------|---|--------------------------------|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 25 | | | | | | | | | | | | |
| | | | | | | | | -12.30 | | Top of Bedrock at Elev. -12.3 ft. | | A-4, SM WC=9.4% |
| | R1 | 60/60 | 28.70 - 33.70 | RQD = 13% | | | | -13.80 | | R1:Bedrock: Banded white and grey GNEISS. Banding is sub-horizontal, thin, distorted. Jointing along banding. Several joints dip at 60 to 90 degrees, cutting through banding; a few joint along the layering appear in slaty layer; some with limonite mineralization. Fragmented due to steeply dipping joints and close banding joints. Ellsworth Formation R1:Core Times (min:sec) 28.7-29.7 ft (2:40) 29.7-30.7 ft (3:55) 30.7-31.7 ft (2:52) 31.7-32.7 ft (2:07) 32.7-33.7 ft (2:45) 100% recovery | 28.70 | |
| 30 | | | | | | | | | | | | |
| | R2 | 60/60 | 33.70 - 38.70 | RQD = 17% | | | | -18.80 | | R2:Bedrock: Similar to R1, except five 30-80 degree joints. R2:Core Times (min:sec) 33.7-34.7 ft (5:00) 34.7-35.7 ft (2:25) 35.7-36.7 ft (3:10) 36.7-37.7 ft (2:55) 37.7-38.7 ft (2:15) 100% recovery | 33.70 | |
| 35 | | | | | | | | | | | | |
| | | | | | | | | -23.80 | | Bottom of Exploration at 38.70 feet below ground surface. | 38.70 | |
| 40 | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

Remarks:

| | | |
|--|---|--------------------------------------|
| Driller: Maine Test Boring | Elevation (ft.): 14.3 | Auger ID/OD: 5" Solid Stem |
| Operator: Rich/Jason | Datum: NAVE88 | Sampler: Standard Split Spoon |
| Logged By: B. Wilder | Rig Type: Mobile B-53 Track | Hammer Wt./Fall: 140#/30" |
| Date Start/Finish: 12/3/10; 09:30-11:30 | Drilling Method: Cased Wash Boring | Core Barrel: N/A |
| Boring Location: 3+89.9, 5.0 Rt. | Casing ID/OD: HW | Water Level*: None Observed |

Hammer Efficiency Factor: _____ **Hammer Type:** Automatic Hydraulic Rope & Cathead

Definitions: R = Rock Core Sample S_u = Insitu Field Vane Shear Strength (psf) S_{u(lab)} = Lab Vane Shear Strength (psf)
 D = Split Spoon Sample SSA = Solid Stem Auger T_v = Pocket Torvane Shear Strength (psf) WC = water content, percent
 MD = Unsuccessful Split Spoon Sample attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf)
 U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw field SPT N-value LL = Liquid Limit
 MU = Unsuccessful Thin Wall Tube Sample attempt WOH = weight of 140lb. hammer Hammer Efficiency Factor = Annual Calibration Value PL = Plastic Limit
 V = Insitu Vane Shear Test, PP = Pocket Penetrometer WOR/C = weight of rods or casing N₆₀ = SPT N-uncorrected corrected for hammer efficiency G = Grain Size Analysis
 MV = Unsuccessful Insitu Vane Shear Test attempt WO1P = Weight of one person N₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected C = Consolidation Test

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|--|---------------|-----------------|--------------|-------|-----------------|--|-------------------------------------|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 0 | | | | | | | SSA | 13.90 | | PAVEMENT. ————0.40 | G#245522 A-1-b, SW-SM WC=6.4% | |
| | 1D | 24/14 | 1.00 - 3.00 | 11/15/10/14 | 25 | 0 | | | | Brown, moist, medium dense, gravelly, fine to coarse SAND, trace silt, occasional cobbles. | | |
| | | | | | | | | | | Cobbles from 3.0-4.0 ft bgs. | | |
| 5 | | | | | | | ↙ | | | Similar to above. | G#245523 A-1-a, SW-SM WC=8.4% | |
| | 2D | 18/5 | 5.00 - 6.50 | 2/2/50 | 52 | 0 | 150 | | a85 RC | a85 blows for 0.65 ft bgs. Roller Coned ahead to 8.0 ft bgs. Boulder from 6.5-7.5 ft bgs. | | |
| | | | | | | | | | | Cobble from 7.6-7.9 ft bgs. | | |
| | | | | | | | | 6.30 | | Bottom of Exploration at 8.00 feet below ground surface. Roller Cone broke off in hole, moved to BB-BHF-102A | | |
| 10 | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |

Remarks:

| | | |
|--|---|--------------------------------------|
| Driller: Maine Test Boring | Elevation (ft.): 14.3 | Auger ID/OD: 5" Solid Stem |
| Operator: Rich/Jason | Datum: NAVE88 | Sampler: Standard Split Spoon |
| Logged By: B. Wilder | Rig Type: Mobile B-53 Track | Hammer Wt./Fall: 140#/30" |
| Date Start/Finish: 12/3/10; 09:30-11:30 | Drilling Method: Cased Wash Boring | Core Barrel: N/A |
| Boring Location: 3+87.2, 5.2 Rt. | Casing ID/OD: HW | Water Level*: None Observed |

Hammer Efficiency Factor: _____ **Hammer Type:** Automatic Hydraulic Rope & Cathead

Definitions: R = Rock Core Sample S_u = Insitu Field Vane Shear Strength (psf) S_{u(lab)} = Lab Vane Shear Strength (psf)
 D = Split Spoon Sample SSA = Solid Stem Auger T_v = Pocket Torvane Shear Strength (psf) WC = water content, percent
 MD = Unsuccessful Split Spoon Sample attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf) LL = Liquid Limit
 U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw field SPT N-value PL = Plastic Limit
 MU = Unsuccessful Thin Wall Tube Sample attempt WOH = weight of 140lb. hammer Hammer Efficiency Factor = Annual Calibration Value PI = Plasticity Index
 V = Insitu Vane Shear Test, PP = Pocket Penetrometer WOR/C = weight of rods or casing N₆₀ = SPT N-uncorrected corrected for hammer efficiency G = Grain Size Analysis
 MV = Unsuccessful Insitu Vane Shear Test attempt WO1P = Weight of one person N₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected C = Consolidation Test

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. | | |
|-------------|--------------------|-----------------|--------------------|--|---------------|-----------------|--------------|------|-----------------|--|--------------------------------|--|---|------|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | | | |
| 0 | | | | | | | SSA | | | See BB-BHF-102 for material description. | | | | |
| 5 | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | |
| | | | | | | | | 6.80 | | | | | Bottom of Exploration at 7.50 feet below ground surface. Auger teeth broke off in hole, pulled out. | 7.50 |

Remarks:

| | | |
|---|-----------------------|----------------------|
| Driller: MaineDOT | Elevation (ft.): 14.5 | Auger ID/OD: N/A |
| Operator: Giguere/Giles | Datum: NAVE88 | Sampler: N/A |
| Logged By: B. Wilder | Rig Type: CME 45C | Hammer Wt./Fall: N/A |
| Date Start/Finish: 12/2/10; 08:30-14:00 | Drilling Method: N/A | Core Barrel: BX |
| Boring Location: 3+98.2, 5.3 Rt. | Casing ID/OD: N/A | Water Level*: N/A |

Hammer Efficiency Factor: _____ **Hammer Type:** Automatic Hydraulic Rope & Cathead

Definitions: R = Rock Core Sample S_u = Insitu Field Vane Shear Strength (psf) S_{u(lab)} = Lab Vane Shear Strength (psf)
D = Split Spoon Sample SSA = Solid Stern Auger T_v = Pocket Torvane Shear Strength (psf) WC = water content, percent
MD = Unsuccessful Split Spoon Sample attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf) LL = Liquid Limit
U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw field SPT N-value PL = Plastic Limit
MU = Unsuccessful Thin Wall Tube Sample attempt WOH = weight of 140lb. hammer Hammer Efficiency Factor = Annual Calibration Value PI = Plasticity Index
V = Insitu Vane Shear Test, PP = Pocket Penetrometer WOR/C = weight of rods or casing N₆₀ = SPT N-uncorrected corrected for hammer efficiency G = Grain Size Analysis
MV = Unsuccessful Insitu Vane Shear Test attempt WO1P = Weight of one person N₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected C = Consolidation Test

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|--|---------------|-----------------|--------------|--|-----------------|--|--|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 0 | R1 | 25.2/22 | 0.00 - 2.10 | | | | | | 12.40 | R1: CONCRETE. R1:Core Times (min:sec) 0.0-1.0 ft (8:45) 1.0-2.0 ft (6:00) 2.0-2.1 ft (1:30) 88% Recovery Core Blocked | CS#210250 5890.0 psi | |
| | R2 | 60/48 | 2.10 - 7.10 | | | | | | 2.10 | R2: CONCRETE. R2:Core Times (min:sec) 2.1-3.1 ft (10:20) 3.1-4.1 ft (3:30) 4.1-5.1 ft (3:30) 5.1-6.1 ft (4:15) #207575 see Remarks | CS#207574 6540.0 psi CS#245376 5060.0 psi | |
| 5 | | | | | | | | | 8.50 | | | |
| | R3 | 60/57 | 7.10 - 12.10 | | | | | | 7.40 | R2: Continued: GRANITE BLOCKS. 6.1-7.1 ft (4:50) 80% Recovery | 6.00 | |
| | | | | | | | | | 7.10 | R3: GRANITE BLOCKS. R2:Core Times (min:sec) 7.1-8.1 ft (5:55) 8.1-9.1 ft (9:30) 9.1-10.1 ft (7:00) 10.1-11.1 ft (7:50) 11.1-12.1 ft (7:45) 95% Recovery | 7.10 | |
| 10 | | | | | | | | | 2.40 | R4: GRANITE BLOCKS. R4:Core Times (min:sec) 12.1-13.1 ft (7:20) 13.1-14.1 ft (4:50) 14.1-15.1 ft (5:10) 15.1-16.1 ft (5:35) 16.1-17.1 ft (5:40) 93% Recovery | 12.10 | |
| | R4 | 60/56 | 12.10 - 17.10 | | | | | | -2.60 | R5: GRANITE BLOCKS. R5:Core Times (min:sec) 17.1-18.1 ft (11:30) | 17.10 | |
| | R5 | 18/14 | 17.10 - 18.60 | | | | | | -3.50 | R5: Continued: CONCRETE. 18.1-18.6 ft (3:40) 78% Recovery | 18.00 | |
| | R6 | 48/45 | 18.60 - 22.60 | | | | | | -4.10 | R6: CONCRETE. R6:Core Times (min:sec) 18.6-19.6 ft (6:30) | 18.60 | |
| | | | | | | | | | -4.50 | R6: Continued: Bedrock: White and grey banded GNEISS, dipping at approx. 15 degrees. Concrete sits directly on the Gneiss. All joints follow the banding; fresh. 19.6-20.6 ft (8:50) 20.6-21.6 ft (8:45) | 19.00 | |
| 20 | | | | | | | | | -8.10 | | | |
| 25 | | | | | | | | | | | | |

Remarks:
Cored through Bridge Abutments and Granite Blocks to Bedrock.
Sample not tested due to sample falling apart while being trimmed with the saw.
CS = Concrete Core Compressive Strengths, see Laboratory Testing Summary Sheet for core depths.

| | | |
|---|-----------------------|----------------------|
| Driller: MaineDOT | Elevation (ft.): 14.8 | Auger ID/OD: N/A |
| Operator: Giguere/Giles | Datum: NAVE88 | Sampler: N/A |
| Logged By: B. Wilder | Rig Type: CME 45C | Hammer Wt./Fall: N/A |
| Date Start/Finish: 12/3/10; 07:30-14:00 | Drilling Method: N/A | Core Barrel: BX |
| Boring Location: 5+01.3, 5.1 Lt. | Casing ID/OD: N/A | Water Level*: N/A |

Hammer Efficiency Factor: **Hammer Type:** Automatic Hydraulic Rope & Cathead

Definitions: R = Rock Core Sample S_u = Insitu Field Vane Shear Strength (psf) S_{u(lab)} = Lab Vane Shear Strength (psf)
D = Split Spoon Sample SSA = Solid Stern Auger T_v = Pocket Torvane Shear Strength (psf) WC = water content, percent
MD = Unsuccessful Split Spoon Sample attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf)
U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw field SPT N-value LL = Liquid Limit
MU = Unsuccessful Thin Wall Tube Sample attempt WOH = weight of 140lb. hammer Hammer Efficiency Factor = Annual Calibration Value PL = Plasticity Limit
V = Insitu Vane Shear Test, PP = Pocket Penetrometer N₆₀ = SPT N-uncorrected corrected for hammer efficiency G = Grain Size Analysis
MV = Unsuccessful Insitu Vane Shear Test attempt WO1P = Weight of one person N₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected C = Consolidation Test


| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|--|---------------|-----------------|--------------|--|-----------------|-------------|--|---|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 0 | R1 | 48/41 | 0.00 - 4.00 | | | | | | | | R1: CONCRETE. R1:Core Times (min:sec) 0.0-1.0 ft (5:00) 1.0-2.0 ft (5:00) 2.0-3.0 ft (3:00) 3.0-4.0 ft (5:00) 85% Recovery | CS#245379 5680.0 psi |
| 5 | R2 | 36/21 | 4.00 - 7.00 | | | | | | 10.80 | | R2: CONCRETE. R2:Core Times (min:sec) 4.0-5.0 ft (3:00) | 4.00 CS#245380 6140.0 psi |
| | | | | | | | | | 9.80 | | R2: Contuned: GRANITE BLOCKS. 5.0-6.0 ft (4:00) 6.0-7.0 ft (4:00) 58% Recovery | 5.00 |
| | R3 | 60/54 | 7.00 - 12.00 | | | | | | 7.80 | | R3: GRANITE BLOCKS. R3:Core Times (min:sec) 7.0-8.0 ft (6:00) 8.0-9.0 ft (6:00) 9.0-10.0 ft (3:00) 10.0-11.0 ft (5:00) 11.0-12.0 ft (5:00) 90% Recovery | 7.00 |
| 10 | | | | | | | | | | | | |
| | R4 | 60/53 | 12.00 - 17.00 | | | | | | 2.80 | | R4: GRANITE BLOCKS. R4:Core Times (min:sec) 12.0-13.0 ft (7:00) 13.0-14.0 ft (3:00) 14.0-15.0 ft (5:00) 15.0-16.0 ft (3:00) 16.0-17.0 ft (6:00) 88% Recovery | 12.00 |
| 15 | | | | | | | | | | | | |
| | R5 | 60/40 | 17.00 - 22.00 | | | | | | -2.20 | | R5: GRANITE BLOCKS. R5:Core Times (min:sec) 17.0-8.0 ft (12:00) 18.0-19.0 ft (36:00) 19.0-20.0 ft (15:00) 20.0-21.0 ft (5:00) | 17.00 |
| 20 | | | | | | | | | | | | |
| | | | | | | | | | -6.20 | | R5: Contuned: CONCRETE. 21.0-22.0 ft (3:00) 67% Recovery | 21.00 |
| | R6 | 48/27 | 22.00 - 26.00 | | | | | | -7.20 | | R6: CONCRETE. R6: Core Times (min:sec) 22.0-23.0 ft (2:00) 23.0-24.0 ft (3:00) 24.0-25.0 ft (3:00) | 22.00 CS#210248 5040.0 psi CS#210249 8900.0 psi |
| 25 | | | | | | | | | | | | |

Remarks:
Cored through Bridge Abutments and Granite Blocks to Bedrock.
CS = Concrete Core Compressive Strengths, see Laboratory Testing Summary Sheet for core depths.

| | | |
|---|-----------------------|----------------------|
| Driller: MaineDOT | Elevation (ft.): 14.8 | Auger ID/OD: N/A |
| Operator: Giguere/Giles | Datum: NAVE88 | Sampler: N/A |
| Logged By: B. Wilder | Rig Type: CME 45C | Hammer Wt./Fall: N/A |
| Date Start/Finish: 12/3/10; 07:30-14:00 | Drilling Method: N/A | Core Barrel: BX |
| Boring Location: 5+01.3, 5.1 Lt. | Casing ID/OD: N/A | Water Level*: N/A |

Hammer Efficiency Factor: _____ **Hammer Type:** Automatic Hydraulic Rope & Cathead

Definitions: R = Rock Core Sample S_u = Insitu Field Vane Shear Strength (psf) S_{u(lab)} = Lab Vane Shear Strength (psf)
 D = Split Spoon Sample SSA = Solid Stem Auger T_v = Pocket Torvane Shear Strength (psf) WC = water content, percent
 MD = Unsuccessful Split Spoon Sample attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf) LL = Liquid Limit
 U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw field SPT N-value PL = Plastic Limit
 MU = Unsuccessful Thin Wall Tube Sample attempt WOH = weight of 140lb. hammer Hammer Efficiency Factor = Annual Calibration Value PI = Plasticity Index
 V = Insitu Vane Shear Test, PP = Pocket Penetrometer WOR/C = weight of rods or casing N₆₀ = SPT N-uncorrected corrected for hammer efficiency G = Grain Size Analysis
 MV = Unsuccessful Insitu Vane Shear Test attempt WO1P = Weight of one person N₆₀ = (Hammer Efficiency Factor/60%) * N-uncorrected C = Consolidation Test

| Sample Information | | | | | | | | | | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|--------------------|------------|-----------------|--------------------|---|---------------|-----------------|--------------|-----------------|---|---|--------------------------------|--|
| Depth (ft.) | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | Elevation (ft.) | | | | |
| 25 | | | | | | | | -10.20 |  | 25.00 Top of Bedrock (?) at Elev. -10.2 R6: Contuned: PHYLLITE and white and grey, banded GNEISS with subhorizontal layering and at least one Granite fragment. Bottom 6.5" is siliceous, steeply dipping banded Gneiss. May not be of the Ellsworth Formation and may be boulder(s). 25.0-26.0 ft (1:30) 50% Rcovery 26.00 Bottom of Exploration at 26.00 feet below ground surface. | | |
| | | | | | | | | -11.20 | | | | |
| 30 | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

Remarks:
 Cored through Bridge Abutments and Granite Blocks to Bedrock.
 CS = Concrete Core Compressive Strengths, see Laboratory Testing Summary Sheet for core depths.

| | | |
|--|------------------------------|----------------------------|
| Driller: MaineDOT | Elevation (ft.): 14.7 | Auger ID/OD: 5" Solid Stem |
| Operator: Giguere/Giles | Datum: NAVE88 | Sampler: N/A |
| Logged By: B. Wilder | Rig Type: CME 45C | Hammer Wt./Fall: N/A |
| Date Start/Finish: 12/30/10; 08:00-13:00 | Drilling Method: Core Barrel | Core Barrel: NQ-2" |
| Boring Location: 5+04.3, 5.9 Rt. | Casing ID/OD: N/A | Water Level*: N/A |

Hammer Efficiency Factor: 0.84 **Hammer Type:** Automatic Hydraulic Rope & Cathead
 Definitions: R = Rock Core Sample S_U = Insitu Field Vane Shear Strength (psf) S_{U(lab)} = Lab Vane Shear Strength (psf)
 D = Split Spoon Sample SSA = Solid Stem Auger T_V = Pocket Torvane Shear Strength (psf) WC = water content, percent
 MD = Unsuccessful Split Spoon Sample attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf)
 U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw field SPT N-value
 MU = Unsuccessful Thin Wall Tube Sample attempt WOH = weight of 140lb. hammer Hammer Efficiency Factor = Annual Calibration Value
 V = Insitu Vane Shear Test, PP = Pocket Penetrometer WOR/C = weight of rods or casing N₆₀ = SPT N-uncorrected corrected for hammer efficiency
 MV = Unsuccessful Insitu Vane Shear Test attempt WO1P = Weight of one person N₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected
 LL = Liquid Limit PL = Plasticity Index
 G = Grain Size Analysis C = Consolidation Test


| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|--|---------------|-----------------|--------------|--|-----------------|---|--|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 0 | R1 | 30/30 | 0.10 - 2.60 | | | | | | 14.60 | Augered to 0.1 ft bgs. R1: CONCRETE. R1: Core Tims (min:sec) 0.1-1.1 ft (3:00) 1.1-2.1 ft (2:00) 2.1-2.6 ft (3:00) 100% Recovery | 0.10 | |
| | R2 | 62.4/60 | 2.60 - 7.80 | | | | | | 12.10 | | 2.60 | |
| 5 | | | | | | | | | | R2: CONCRETE. R2: Core Tims (min:sec) 2.6-3.6 ft (2:40) 3.6-4.6 ft (3:00) 4.6-5.6 ft (2:45) 5.6-6.6 ft (2:20) 6.6-7.8 ft (2:50) 97% Recovery | | |
| | R3 | 60/60 | 7.80 - 12.80 | | | | | | 6.90 | | 7.80 | |
| 10 | | | | | | | | | | R3: CONCRETE. R3: Core Tims (min:sec) 7.8-8.8 ft (1:45) 8.8-9.8 ft (2:00) 9.8-10.8 ft (2:00) 10.8-11.8 ft (2:00) 11.8-12.8 ft (2:10) 100% Recovery | | |
| | R4 | 60/58 | 12.80 - 17.80 | | | | | | 1.90 | | 12.80 | |
| 15 | | | | | | | | | | R4: CONCRETE. R4: Core Tims (min:sec) 12.8-13.8 ft (2:00) 13.8-14.8 ft (2:15) 14.8-15.8 ft (2:00) 15.8-16.8 ft (2:05) 16.8-17.8 ft (4:00) 97% Recovery | | |
| | R5 | 54/54 | 17.80 - 22.30 | | | | | | -3.10 | | 17.80 | |
| 20 | | | | | | | | | | R5: CONCRETE. R5: Core Tims (min:sec) 17.8-18.8 ft (3:00) 18.8-19.8 ft (5:00) 19.8-20.8 ft (4:20) 20.8-21.8 ft (3:10) 21.8-22.3 ft (1:30) 100% Recovery | | |
| | 1D | 24/12 | 22.50 - 24.50 | 11/11/17/30 | 28 | 39 | | | -7.80 | | 22.50 | |
| 25 | | | | | | | | | | Brown, wet, medium dense, fine to coarse SAND, some silt, some gravel, (Till). | CS#245382 4170.0 psi | |
| | R6 | 27.6/8 | 24.90 - 27.20 | | | | | | | Roller Coned ahead to 24.9 ft bgs. | CS#245383 6980.0 psi CS#245384 5520.0 psi | |
| | | | | | | | | | | | CS#210246 6610.0 psi CS#210247 5970.0 psi G#245524 A-4, SM WC=9.4% | |

Remarks:
CS = Concrete Core Compressive Strengths, see Laboratory Testing Summary Sheet for core depths.

| | | |
|--|------------------------------|----------------------------|
| Driller: MaineDOT | Elevation (ft.): 14.7 | Auger ID/OD: 5" Solid Stem |
| Operator: Giguere/Giles | Datum: NAVE88 | Sampler: N/A |
| Logged By: B. Wilder | Rig Type: CME 45C | Hammer Wt./Fall: N/A |
| Date Start/Finish: 12/30/10; 08:00-13:00 | Drilling Method: Core Barrel | Core Barrel: NQ-2" |
| Boring Location: 5+04.3, 5.9 Rt. | Casing ID/OD: N/A | Water Level*: N/A |

Hammer Efficiency Factor: 0.84 **Hammer Type:** Automatic Hydraulic Rope & Cathead

Definitions: R = Rock Core Sample S_u = Insitu Field Vane Shear Strength (psf) S_u(lab) = Lab Vane Shear Strength (psf)
 D = Split Spoon Sample SSA = Solid Stem Auger T_v = Pocket Torvane Shear Strength (psf) WC = water content, percent
 MD = Unsuccessful Split Spoon Sample attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf) LL = Liquid Limit
 U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw field SPT N-value PL = Plastic Limit
 MU = Unsuccessful Thin Wall Tube Sample attempt WOH = weight of 140lb. hammer Hammer Efficiency Factor = Annual Calibration Value PI = Plasticity Index
 V = Insitu Vane Shear Test, PP = Pocket Penetrometer N₆₀ = SPT N-uncorrected corrected for hammer efficiency G = Grain Size Analysis
 MV = Unsuccessful Insitu Vane Shear Test attempt WO1P = Weight of one person N₆₀ = (Hammer Efficiency Factor/60%) * N-uncorrected C = Consolidation Test

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|--|---------------|-----------------|--------------|--------|-----------------|---|---|---|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 25 | | | | | | | | | -10.20 |  | R6: COBBLES, GRAVEL or Boulder Fragments. R6: Core Times (min:sec) 24.9-25.9 ft (2:00) 25.9-26.9 ft (2:00) 26.9-27.2 ft (3:00) 28% Recovery | |
| | | | | | | | | -12.50 | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

Remarks:
 CS = Concrete Core Compressive Strengths, see Laboratory Testing Summary Sheet for core depths.

KEY TO SYMBOLS

Symbol Description

Strata symbols



Paving



Description not given for:
"03"



Variable sand
and silt mix



Granite



Description not given for:
"YB"



Metamorphic
rocks



Description not given for:
"03B"



EXTRA: semi-random triangle
pattern

Misc. Symbols

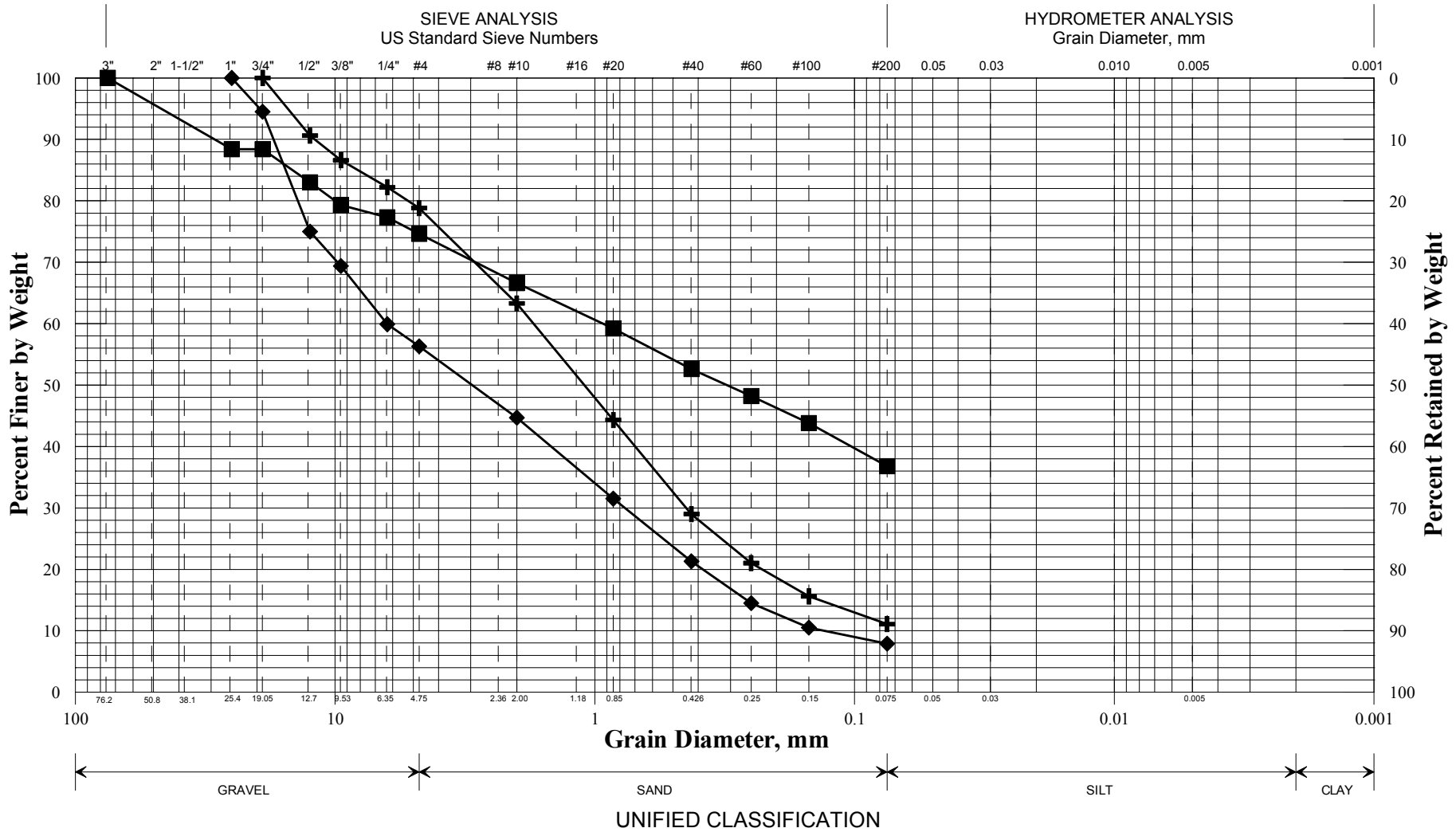


Description not given for:
"DOWNAROW"

Notes:

1. Exploratory borings were drilled on 12/30/10; 08:00-13:00 using a 4-inch diameter continuous flight power auger.
2. No free water was encountered at the time of drilling or when re-checked the following day.
3. Boring locations were taped from existing features and elevations extrapolated from the final design schematic plan.
4. These logs are subject to the limitations, conclusions, and recommendations in this report.
5. Results of tests conducted on samples recovered are reported on the logs.

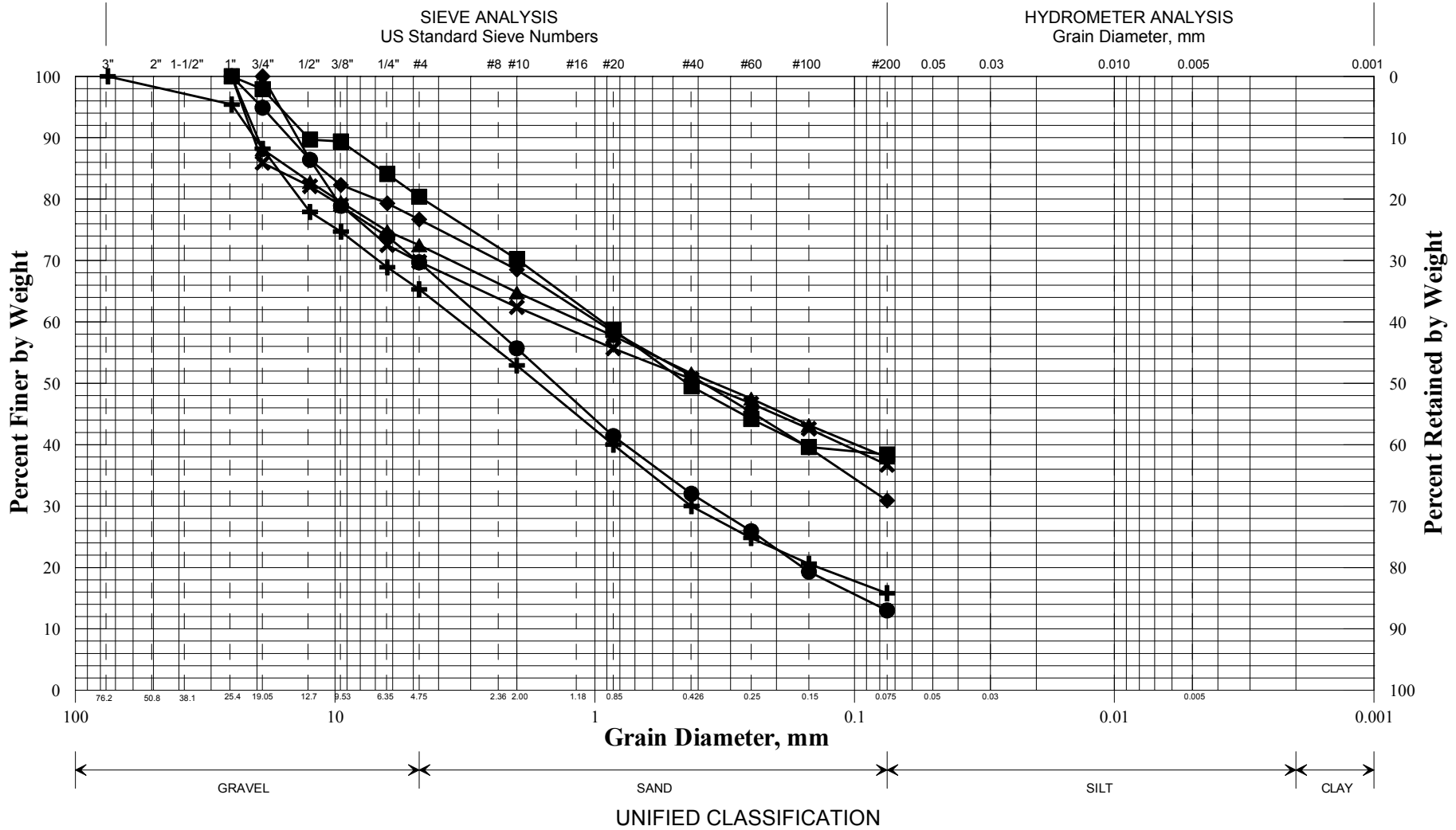
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



| | Boring/Sample No. | Station | Offset, ft | Depth, ft | Description | W, % | LL | PL | PI |
|---|-------------------|---------|------------|-----------|---------------------------------|------|----|----|----|
| + | BB-BHF-102/1D | 3+89.9 | 5.0 RT | 1.0-3.0 | SAND, some gravel, little silt. | 6.4 | | | |
| ◆ | BB-BHF-102/2D | 3+89.9 | 5.0 RT | 5.0-6.5 | Gravelly SAND, trace silt. | 8.4 | | | |
| ■ | BB-BHF-105/1D | 5+04.3 | 5.9 RT | 22.5-24.5 | Silty SAND, some gravel. | 9.4 | | | |
| ● | | | | | | | | | |
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| × | | | | | | | | | |

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|------------------|-----------|
| PIN | |
| 017712.00 | |
| Town | |
| Blue Hill | |
| Reported by/Date | |
| WHITE, TERRY A | 2/11/2011 |

State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



| | Boring/Sample No. | Station | Offset, ft | Depth, ft | Description | W, % | LL | PL | PI |
|---|-------------------|---------|------------|-----------|---------------------------------|------|----|----|----|
| + | HB-BHF-101/D | 5+10 | 5.4 LT | 1.0-3.0 | SAND, some gravel, little silt. | 5.0 | | | |
| ◆ | HB-BHF-101/2D | 5+10 | 5.4 LT | 3.0-5.0 | SAND, some silt, some gravel. | 13.1 | | | |
| ■ | HB-BHF-101/3D | 5+10 | 5.4 LT | 5.0-6.4 | Silty SAND, little gravel. | 12.3 | | | |
| ● | HB-BHF-101A/1D | 5+12.6 | 6.4 LT | 16.0-18.0 | SAND, some gravel, little silt. | 33.3 | | | |
| ▲ | HB-BHF-101A/2D | 5+12.6 | 6.4 LT | 19.0-21.0 | SILT, some sand, some gravel. | 10.8 | | | |
| × | HB-BHF-101A/3D | 5+12.6 | 6.4 LT | 24.5-26.0 | SILT, some sand, some gravel. | 9.4 | | | |

| | |
|------------------|----------|
| PIN | |
| 017712.00 | |
| Town | |
| Blue Hill | |
| Reported by/Date | |
| WHITE, TERRY A | 2/7/2011 |

Appendix A2

200-Series, Geotechnical Program

(By Schonewald Engineering Associates)



**GEOTECHNICAL FIELD AND LABORATORY DATA
200-SERIES TEST BORING PROGRAM
FALLS BRIDGE REPLACEMENT
BLUE HILL, MAINE
MaineDOT WIN 17712.00**

PREPARED FOR:

HNTB Corporation
Westbrook, Maine

PREPARED BY:

Isabel V. (Be) Schonewald, P.E.
Schonewald Engineering Associates, Inc. (SchonewaldEA)
129 Middle Road
Cumberland, Maine 04021
Be@SchonewaldEngineering.com

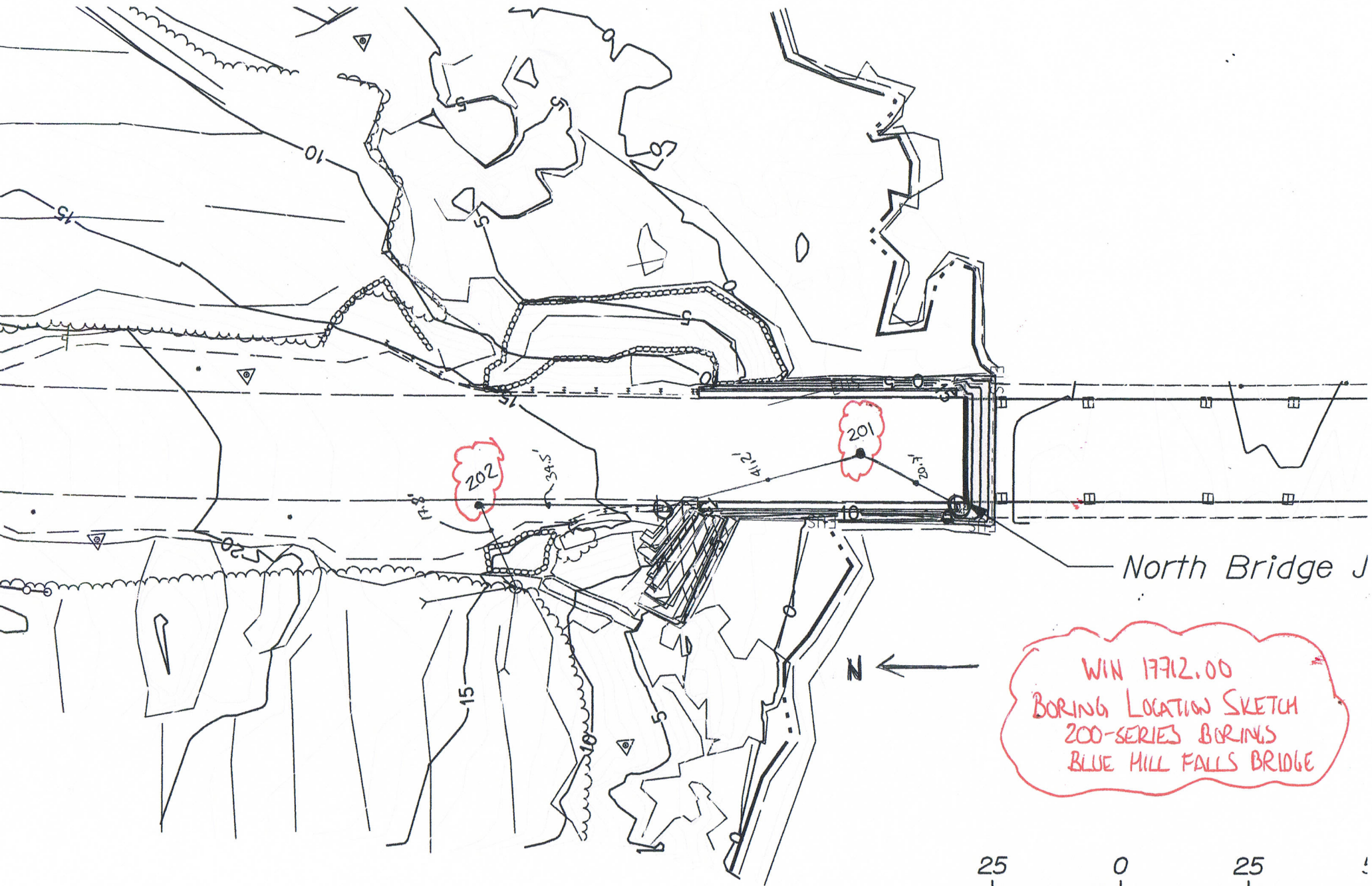
June 2017

SchonewaldEA Project No. 16-012

CONTENTS

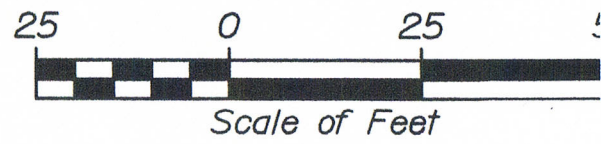
BORING LOCATION SKETCH
SUBSURFACE EXPLORATION LOGS
ROCK CORE PHOTOGRAPHS
ROCK LABORATORY TEST REPORT

BORING LOCATION SKETCH



North Bridge J

WIN 17712.00
BORING LOCATION SKETCH
200-SERIES BORINGS
BLUE HILL FALLS BRIDGE





SUBSURFACE EXPLORATION LOGS



PROJECT: MaineDOT Blue Hill Falls Bridge

Boring No.: BB-BLF-201

LOCATION: Blue Hill, Maine

WIN: 17712.00

| | | |
|--|--|---|
| Driller: New England Boring Contractors | Elevation (ft.): 14.5 (est'd) | Core Barrel: NQ2 (wireline) |
| Operator: Schaefer / Titus / Royal | Datum: NAVD88 | Sampler: standard split-spoon |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (track) | Hammer Wt./Fall: 140 lbs / 30 in |
| Date Start/Finish: 4/24/17: 0900-1530 | Drilling Method: cased wash boring | Hammer Type: rope and cathead |
| Boring Location: see remarks | Casing ID/OD: HW to 15 ft; NW (spun) to 18.5 ft | Hammer Efficiency: .6 |
| | Auger ID/OD: SSA to 5 ft | Water Level*: -- |

IN-SITU SAMPLING AND TESTING:
 D = Split Spoon Sample
 MD = Unsuccessful Split Spoon Sample attempt
 U = Thin Wall Tube Sample
 MU = Unsuccessful Thin Wall Tube Sample attempt
 V = Insitu Vane Shear Test
 MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
 N-uncorrected = N value
 N₆₀ = N value corrected for hammer efficiency
 hammer efficiency = calculated hammer efficiency
 S_u = Insitu Field Vane Shear Strength (psf)
 R = Rock Core Sample
 RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
 WOH = weight of 140lb. hammer
 WOR = weight of rods
 -- = not recorded

BOREHOLE ADVANCEMENT METHOD:
 SSA=solid stem auger/HSA=hollow stem auger/RC=roller cone

LABORATORY TEST RESULTS:
 LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
 WC = water content, percent
 #200 = percent fines from grain size analysis
 UCT qp = peak compressive strength of rock

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Lab. Testing Results |
|-------------|--------------------|-----------------|--------------------|---|---------------|------|--------------|-----|-----------------|---|--------------------------------|----------------------|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N-60 | Casing Blows | | | | | |
| 0 | | | | | | | | SSA | 13.7 | 10 inches HMA | | |
| | 1D | 24/11 | 1.0 - 3.0 | 12-14-7-3 | 21 | 21 | | | | 1D: Light brown, dry to damp, m. dense, fine to coarse SAND, some Silt, little to some fine Gravel; somewhat layered. FILL | | |
| | | | | | | | | | | 3.0 ft: Material becomes boney, indicative of rubble fill, based on drilling behavior. | | |
| 5 | 2D | 24/6 | 5.0 - 7.0 | 3-4-5-10 | 9 | 9 | 16 | | | 2D: Brown, damp to moist, loose, fine to coarse Sandy GRAVEL, little Silt. FILL | | |
| | | | | | | | 34 | | | | | |
| | | | | | | | 62 | | | | | |
| | | | | | | | 34 | | | | | |
| 10 | 3D | 24/3 | 10.0 - 12.0 | 7-3-7-3 | 10 | 10 | 22 | | | 3D: Grey, loose, GRAVEL, little to some fine to coarse Sand, trace Silt. FILL | | |
| | | | | | | | 30 | | | | | |
| | | | | | | | 43 | | | | | |
| | | | | | | | 90 | | | | | |
| 15 | 4D | 3/2 | 15.5 - 15.8 | 60/3" | | | | RC | | 4D: Brown, GRAVEL, trace Sand, trace Silt with shell fragments. FILL | | |
| | | | | | | | | | | 15.8 to 16.7 ft: boulder | | |
| | | | | | | | | | -4.0 | 18.5 ft: possible top of weathered rock based on drilling behavior. | | |
| 20 | R1 | 60/59 | 20.0 - 25.0 | RQD: 54" = 90% | | | | | -5.5 | R1: Hard, typically fresh, aphanitic to fine grained, white and grey banded GNEISS with highly undulating foliation. Moderately spaced, typically low angle breaks along foliations; undulating, rough, typically fresh and open; one drill break. Core times: 1:50/ 1:45/ 1:40/ 1:40/ 1:50 min:sec/ft. | | |
| | lab | | | 22.6 - 23.2 ft | | | | | | | UCT qp: 1,621 ksf | |
| 25 | | | | | | | | | | | | |

Remarks:
 Location:
 Refer to boring location plan
 Offset: 0.8 ft west of existing centerline
 Ties: 20.7 ft from clearance/height sign; 41.2 ft from reflector sign.



PROJECT: MaineDOT Blue Hill Falls Bridge

Boring No.: BB-BLF-201

LOCATION: Blue Hill, Maine

WIN: 17712.00

| | | |
|--|--|---|
| Driller: New England Boring Contractors | Elevation (ft.): 14.5 (est'd) | Core Barrel: NQ2 (wireline) |
| Operator: Schaefer / Titus / Royal | Datum: NAVD88 | Sampler: standard split-spoon |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (track) | Hammer Wt./Fall: 140 lbs / 30 in |
| Date Start/Finish: 4/24/17: 0900-1530 | Drilling Method: cased wash boring | Hammer Type: rope and cathead |
| Boring Location: see remarks | Casing ID/OD: HW to 15 ft; NW (spun) to 18.5 ft | Hammer Efficiency: .6 |
| | Auger ID/OD: SSA to 5 ft | Water Level*: -- |

IN-SITU SAMPLING AND TESTING:
 D = Split Spoon Sample
 MD = Unsuccessful Split Spoon Sample attempt
 U = Thin Wall Tube Sample
 MU = Unsuccessful Thin Wall Tube Sample attempt
 V = Insitu Vane Shear Test
 MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
 N-uncorrected = N value
 N₆₀ = N value corrected for hammer efficiency
 hammer efficiency = calculated hammer efficiency
 S_u = Insitu Field Vane Shear Strength (psf)
 R = Rock Core Sample
 RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
 WOH = weight of 140lb. hammer
 WOR = weight of rods
 -- = not recorded

BOREHOLE ADVANCEMENT METHOD:
 SSA=solid stem auger/HSA=hollow stem auger/RC=roller cone

LABORATORY TEST RESULTS:
 LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
 WC = water content, percent
 #200 = percent fines from grain size analysis
 UCT_{qp} = peak compressive strength of rock

| Depth (ft.) | Sample Information | | | | | | | | | Graphic Log | Visual Description and Remarks | Lab. Testing Results |
|-------------|--------------------|-----------------|--------------------|---|---------------|------|--------------|-----------------|-------|--------------------------------|--|----------------------|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-unconnected | N-60 | Casing Blows | Elevation (ft.) | | | | |
| 25 | R2 | 60/54 | 25.0 - 30.0 | RQD: 48" = 80% | | | | | | [Graphic Log: Hatched pattern] | R2: same as R1, with one open fracture (drop) from 26.7 to 27.1 ft. Core times: 1:50/ 1:10/ 1:30/ 1:25/ 1:25 min:sec/ft. | |
| 30 | R3 | 60/60 | 30.0 - 35.0 | RQD: 49" = 82% | | | | | | | R3: same as R1, except one moderately dipping break, cross foliation. Breaks at 33.6, 34.7 and 34.8 ft open with mud infilling. Core times: 1:10/ 1:45/ 1:40/ 1:45/ 1:45 min:sec/ft. | |
| 35 | R4 | 60/54 | 35.0 - 40.0 | RQD: 36" = 60% | | | | | | | R4: same as R1; highly fractured with mud infilling below 38.5 ft. Core times: 1:25/ 1:25/ 1:40/ 2:00/ 1:30 min:sec/ft. | |
| 40 | | | | | | | | | -25.5 | | Bottom of Exploration at 40.0 feet below ground surface. | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

Remarks:
 Location:
 Refer to boring location plan
 Offset: 0.8 ft west of existing centerline
 Ties: 20.7 ft from clearance/height sign; 41.2 ft from reflector sign.

| | | | | | |
|--------------------|--------------------------------|------------------|---------------------------|--------------------|----------------------|
| Driller: | New England Boring Contractors | Elevation (ft.): | 16 ft (est'd) | Core Barrel: | NQ2 (wireline) |
| Operator: | Schaefer / Titus / Royal | Datum: | NAVD88 | Sampler: | standard split-spoon |
| Logged By: | Schonewald | Rig Type: | Mobile Drill B-53 (track) | Hammer Wt./Fall: | 140 lbs / 30 in |
| Date Start/Finish: | 4/25/17: 0830-1230 | Drilling Method: | cased wash boring | Hammer Type: | rope and cathead |
| Boring Location: | see remarks | Casing ID/OD: | NW (spun) to 9.0 ft | Hammer Efficiency: | 0.6 |
| | | Auger ID/OD: | SSA to 5 ft | Water Level*: | -- |

IN-SITU SAMPLING AND TESTING:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt

ADDITIONAL DEFINITIONS:
N-uncorrected = N value
N₆₀ = N value corrected for hammer efficiency
hammer efficiency = calculated hammer efficiency
S_u = Insitu Field Vane Shear Strength (psf)
R = Rock Core Sample
RQD = Rock Quality Designation (%)

ADDITIONAL DEFINITIONS:
WOH = weight of 140lb. hammer
WOR = weight of rods
-- = not recorded

BOREHOLE ADVANCEMENT METHOD:
SSA=solid stem auger/HSA=hollow stem auger/RC=roller cone

LABORATORY TEST RESULTS:
LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index
WC = water content, percent
#200 = percent fines from grain size analysis
UCT qp = peak compressive strength of rock

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Lab. Testing Results |
|-------------|--------------------|-----------------|--------------------|---|---------------|------|--------------|--|-----------------|---|--------------------------------|----------------------|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N-60 | Casing Blows | | | | | |
| 0 | 1D | 24/18 | 0.0 - 2.0 | 16-11-8-7 | 19 | 19 | SSA | | | 1D: Brown, dry to damp, m. dense, fine to coarse SAND, some Silt, little to some Gravel; somewhat layered. FILL | | |
| 5 | 2D | 24/14 | 5.0 - 7.0 | 3-2-3-2 | 5 | 5 | RC | | | 2D: Brown, damp to moist, loose, Silty fine to medium SAND, little Gravel, trace coarse Sand; appears undisturbed. NATIVE (?) | | |
| 10 | R1 | 60/60 | 9.0 - 14.0 | RQD: 45" = 75% | | | | | | 8.8 ft: Possible top of weathered rock. | | |
| | lab | | | 11.4 - 12.1 ft | | | | | | | UCT qp: 2,785 ksf | |
| 15 | R2 | 60/56 | 14.0 - 19.0 | RQD: 34" = 57% | | | | | | R2: Same as R1, except no cracks and breaks typically moderately dipping and along foliation with mud infilling typical; highly fractured from 16.2 to 17.7 ft; one drill break. Core times: 2:10/ 2:05/ 1:55/ 1:45/ 1:45 min:sec/ft. | | |
| 20 | R3 | 60/60 | 19.0 - 24.0 | RQD: 44" = 73% | | | | | | R3: Same as R1, with low angle and moderately dipping breaks along foliation and mud infilling typical; highly fractured from 20.4 to 20.8 ft and 21.4 to 21.7 ft. Core times: 1:25/ 1:30/ 1:45/ 2:05/ 2:10 min:sec/ft. | | |
| 25 | R4 | 60/60 | 24.0 - 29.0 | RQD: 60" = 100% | | | | | | R4: Same rock as R1; no breaks. Core times: 2:05/ 2:15/ 2:15/ 2:25/ 2:50 min: sec/ft. | | |

Remarks:
Location:
Refer to boring location plan
Offsets: 11.7 ft west of existing centerline; 1.0 ft off EP; 7.5 ft north of utility pole
Ties: 17.8 ft from utility pole; 34.5 ft from reflector sign.



SCHONEWALD
ENGINEERING
ASSOCIATES, INC.

PROJECT: MaineDOT Blue Hill Falls Bridge

LOCATION: Blue Hill, Maine

Boring No.: BB-BLF-202

WIN: 17712.00

| | | |
|--|--|---|
| Driller: New England Boring Contractors | Elevation (ft.): 16 ft (est'd) | Core Barrel: NQ2 (wireline) |
| Operator: Schaefer / Titus / Royal | Datum: NAVD88 | Sampler: standard split-spoon |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (track) | Hammer Wt./Fall: 140 lbs / 30 in |
| Date Start/Finish: 4/25/17: 0830-1230 | Drilling Method: cased wash boring | Hammer Type: rope and cathead |
| Boring Location: see remarks | Casing ID/OD: NW (spun) to 9.0 ft | Hammer Efficiency: 0.6 |
| | Auger ID/OD: SSA to 5 ft | Water Level*: -- |

| | | | |
|--|---|--|--|
| IN-SITU SAMPLING AND TESTING: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample attempt V = Insitu Vane Shear Test MV = Unsuccessful Insitu Vane Shear Test attempt | ADDITIONAL DEFINITIONS: N-uncorrected = N value N_{60} = N value corrected for hammer efficiency hammer efficiency = calculated hammer efficiency S_u = Insitu Field Vane Shear Strength (psf) R = Rock Core Sample RQD = Rock Quality Designation (%) | ADDITIONAL DEFINITIONS: WOH = weight of 140lb. hammer WOR = weight of rods . = . = -- = not recorded | BOREHOLE ADVANCEMENT METHOD: SSA=solid stem auger/HSA=hollow stem auger/RC=roller cone LABORATORY TEST RESULTS: LL=Liquid Limit / PL=Plastic Limit / PI=Plasticity Index WC = water content, percent #200 = percent fines from grain size analysis UCT _{qp} = peak compressive strength of rock |
|--|---|--|--|

| Depth (ft.) | Sample Information | | | | | | | | | Graphic Log | Visual Description and Remarks | Lab. Testing Results |
|-------------|--------------------|-----------------|--------------------|---|---------------|------|--------------|-----------------|--|-------------|--|----------------------|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N-60 | Casing Blows | Elevation (ft.) | | | | |
| 25 | | | | | | | | | | | Bottom of Exploration at 29.0 feet below ground surface. | |
| 26 | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | |
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| 50 | | | | | | | | | | | | |

Remarks:
 Location:
 Refer to boring location plan
 Offsets: 11.7 ft west of existing centerline; 1.0 ft off EP; 7.5 ft north of utility pole
 Ties: 17.8 ft from utility pole; 34.5 ft from reflector sign.

ROCK CORE PHOTOGRAPHS



Photo 1: Core box containing dried core from test boring BB-BHF-201:
Left side of core box (top 2.5-foot portion of cores).

Slots from top to bottom:

- 1) BB-BHF-201, R1 (20 to 25 ft);
- 2) BB-BHF-201, R2 (25 to 30 ft).



Photo 2: Core box containing dried core from test boring BB-BHF-201:
Right side of core box (bottom 2.5-foot portion of cores).

Slots from top to bottom:

- 1) BB-BHF-201, R1 (20 to 25 ft);
- 2) BB-BHF-201, R2 (25 to 30 ft).

ROCK CORE PHOTOGRAPHS
200-SERIES TEST BORINGS
FALLS BRIDGE
BLUE HILL, MAINE
MaineDOT WIN 17712.00

Sheet No.:

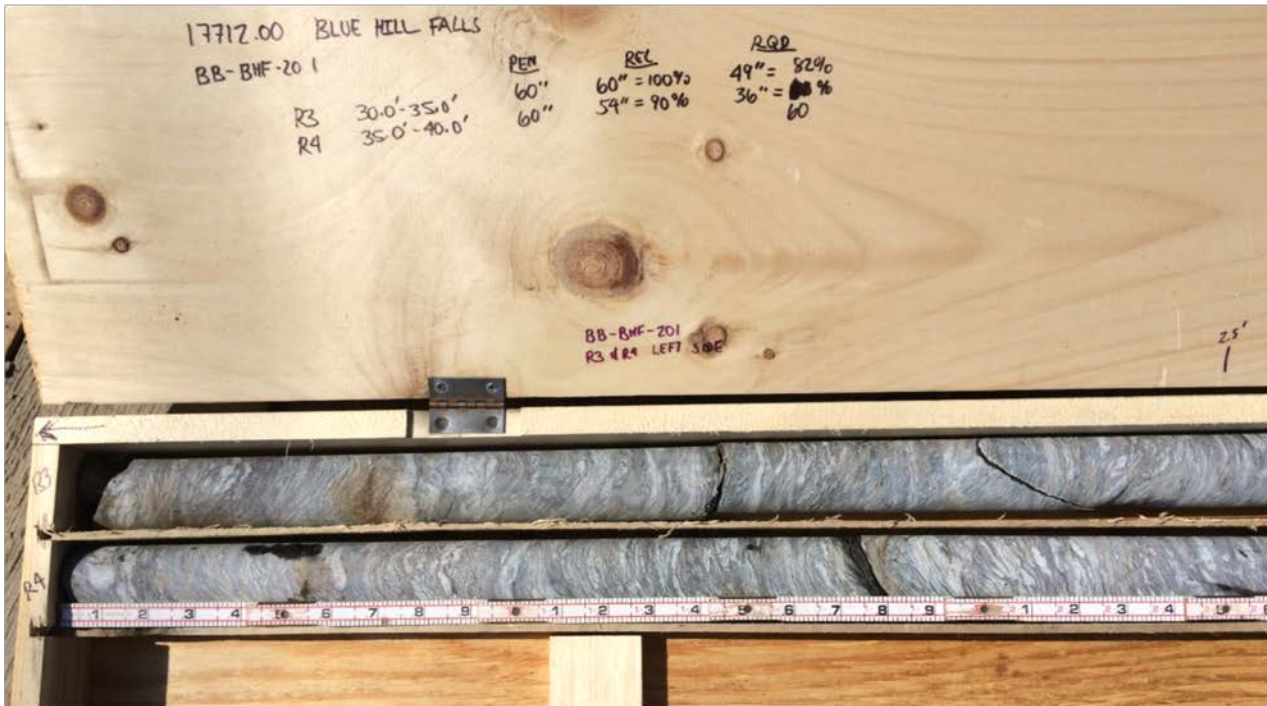


Photo 3: Core box containing dried core from test boring BB-BHF-201:
Left side of core box (top 2.5-foot portion of cores).
Slots from top to bottom:
1) BB-BHF-201, R3 (30 to 35 ft);
2) BB-BHF-201, R4 (35 to 40 ft).



Photo 4: Core box containing dried core from test boring BB-BHF-201:
Right side of core box (bottom 2.5-foot portion of cores).
Slots from top to bottom:
1) BB-BHF-201, R3 (30 to 35 ft);
2) BB-BHF-201, R4 (35 to 40 ft).



Photo 5: Core box containing dried core from test boring BB-BHF-202:

Left side of core box (top 2.5-foot portion of cores).

Slots from top to bottom:

- 1) BB-BHF-202, R1 (9 to 14 ft);
- 2) BB-BHF-202, R2 (14 to 19 ft).

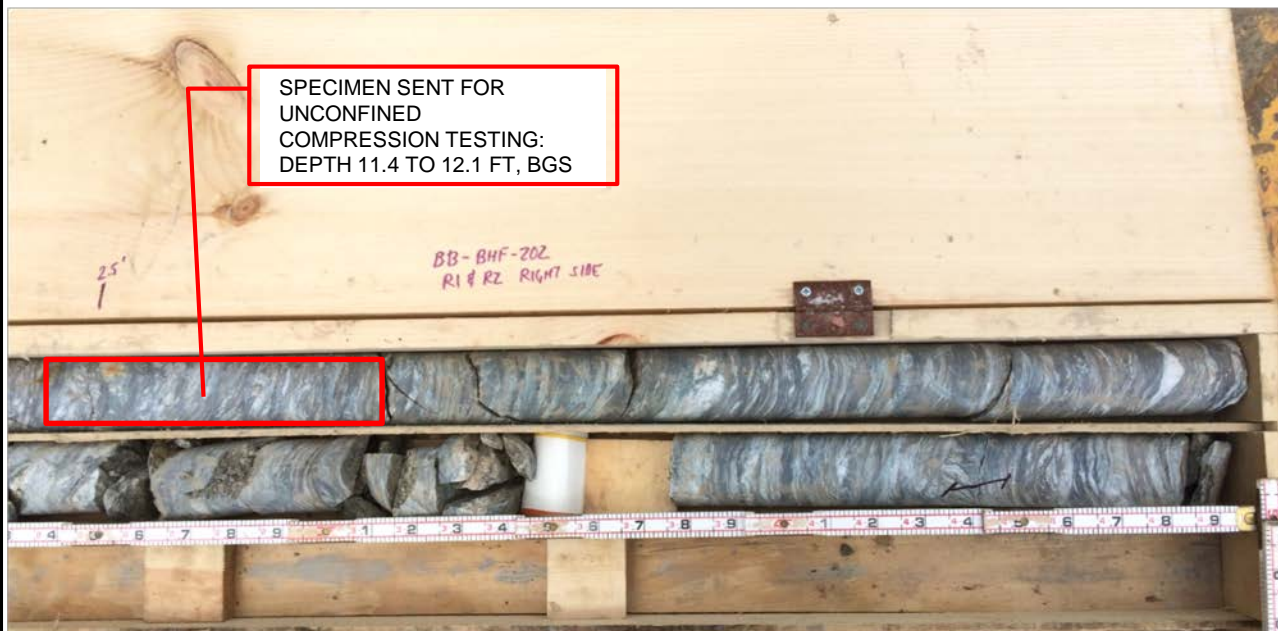


Photo 6: Core box containing dried core from test boring BB-BHF-202:

Right side of core box (bottom 2.5-foot portion of cores).

Slots from top to bottom:

- 1) BB-BHF-202, R1 (9 to 14 ft);
- 2) BB-BHF-202, R2 (14 to 19 ft).



Photo 7: Core box containing dried core from test boring BB-BHF-202:
Left side of core box (top 2.5-foot portion of cores).

Slots from top to bottom:

- 1) BB-BHF-202, R3 (19 to 24 ft);
- 2) BB-BHF-202, R4 (24 to 29 ft).



Photo 8: Core box containing dried core from test boring BB-BHF-202:
Right side of core box (bottom 2.5-foot portion of cores).

Slots from top to bottom:

- 1) BB-BHF-202, R3 (19 to 24 ft);
- 2) BB-BHF-202, R4 (24 to 29 ft).

ROCK CORE PHOTOGRAPHS
200-SERIES TEST BORINGS
FALLS BRIDGE
BLUE HILL, MAINE
MaineDOT WIN 17712.00

Sheet No.:



ROCK LABORATORY TEST REPORT

LABORATORY TESTING DATA SHEET



Project Name Maine DOT Blue Hill Falls Bridge
 Project No. 16-012
 Project Manager Be Schonewald

Location Blue Hill, ME
 Assigned By Be Schonewald
 Report Date 05.19.17

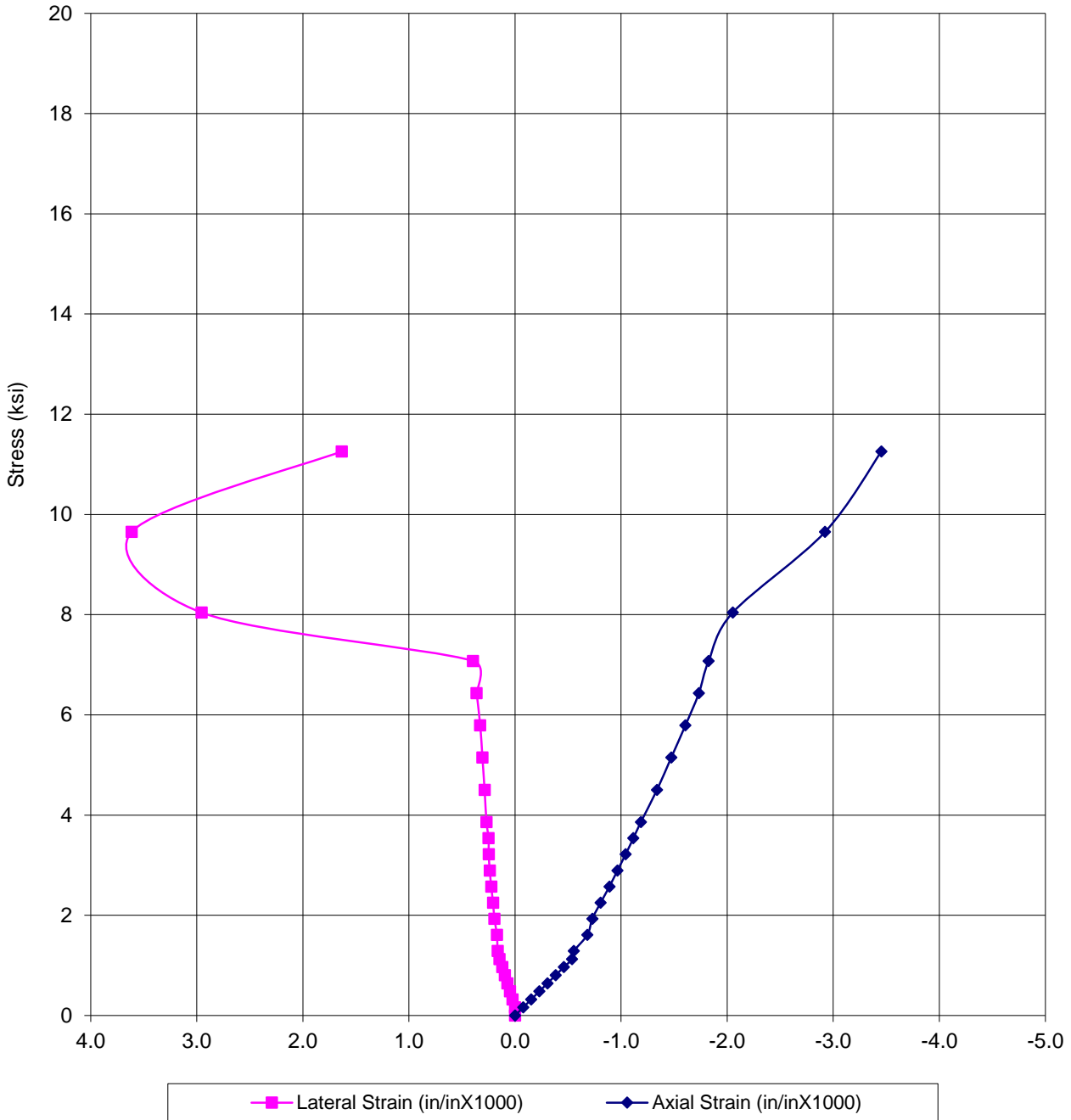
Reviewed By _____
 Date Reviewed 05.20.17

| Boring No. | Sample No. | Depth Ft. | Lab No. | Sample Data | | | | | | Compression Tests | | | | | | | | Rock Formation or Description or Remarks | | | |
|--|------------|-----------|---------|----------------|--------|-------|------------------|--|----------|-------------------|------------------|--------------|---|---------------------|---------------------|--------------|---------------------|--|---------------------|--|--|
| | | | | Moh's Hardness | Do in. | L in. | (1) Unit Wt. PCF | (2) Wet Density PCF | Bulk Gs. | (3) Other Tests | (4) Strength PSI | (5) Strain % | (6) Conf. Stress | (7) E sec PSI EE+06 | (8) Poisson's Ratio | σ PSI | I ₅₀ PSI | | | | |
| BB-BHF-201 | R1 | 22.6-23.2 | 1 | | 1.990 | 4.685 | 170.2 | | | | U | 11,258 | 0.345 | | 3.55 | 0.26 | | | See Specimen Photos | | |
| BB-BHF-202 | R1 | 11.4-12.1 | 2 | | 1.989 | 4.735 | 189.3 | | | | U | 19,338 | 0.392 | | 4.70 | 0.20 | | | See Specimen Photos | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | | | |
| (1) Volume Determined By Measuring Dimensions (2) Determined by Measuring Dimensions and Weight of Saturated Sample | | | | | | | | (3) P=Petrographic PLD=Point Load (diametrical), PLA= Point Load (Axial) ST= Splitting Tensile U= Unconfined Compressive Strength (4) Taken at Peak Deviator Stress | | | | | (5) Strain at Peak Deviator Stress (6) Represents Confining Stress on Triaxial Tests (7) Represents Secant Modulus at 50% of Total Failure Stress (8) Represents Secant Poisson's Ratio at 50% of Total Failure Stress | | | | | | | | |



195 Frances Avenue
 Cranston, RI 02910
 401-467-6454

MaineDOT Blue Hill Falls Bridge
Blue Hill, ME



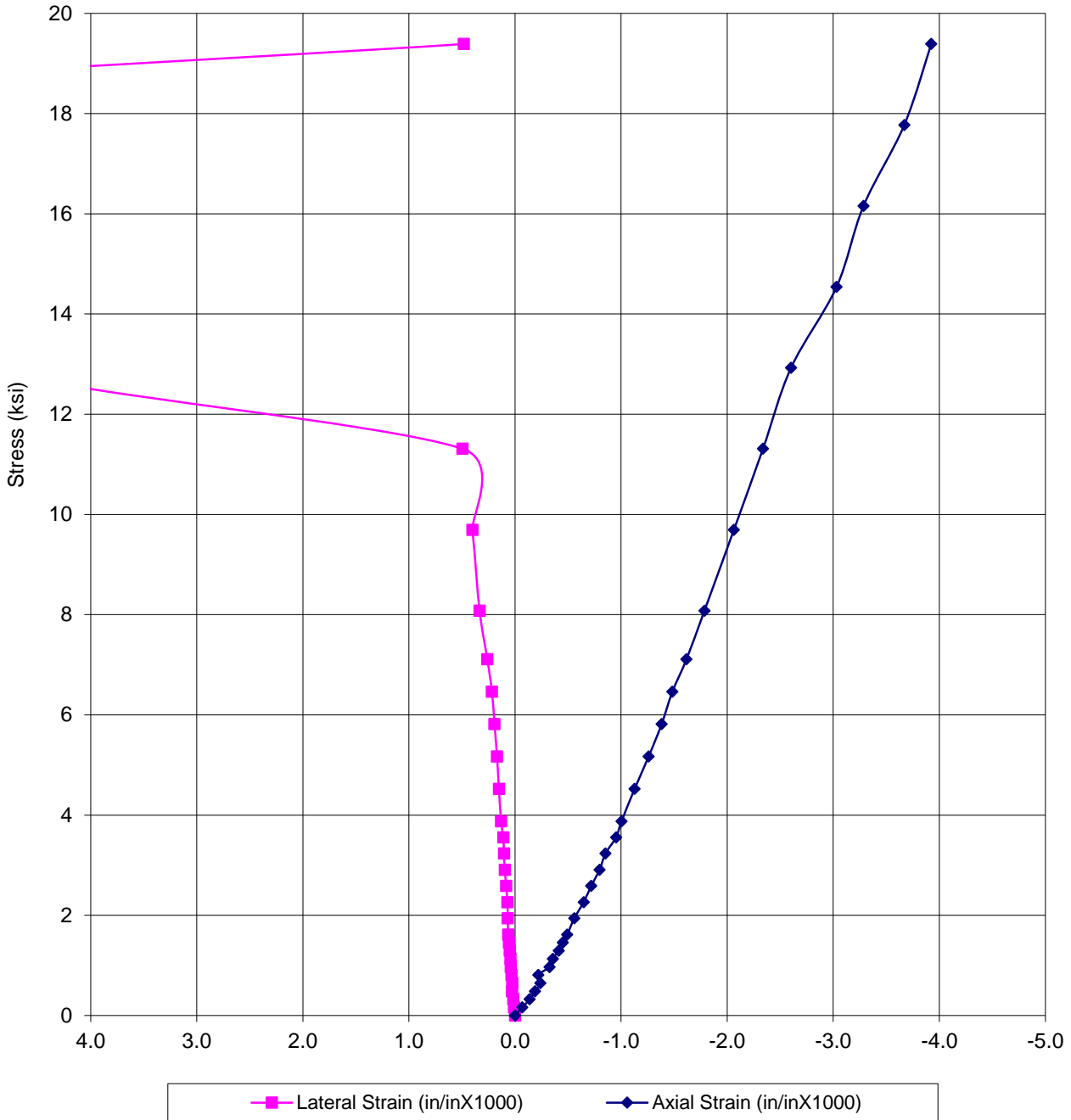
Rock Unconfined Compression Testing - ASTM D7012

Boring No. BB-BHF-201
Sample No. R-1
Depth: 22.6-23.2

File No. 16-012
Date: 05.17.17
Test No. R-1



**MaineDOT Blue Hill Falls Bridge
Blue Hill, ME**



Rock Unconfined Compression Testing - ASTM D7012

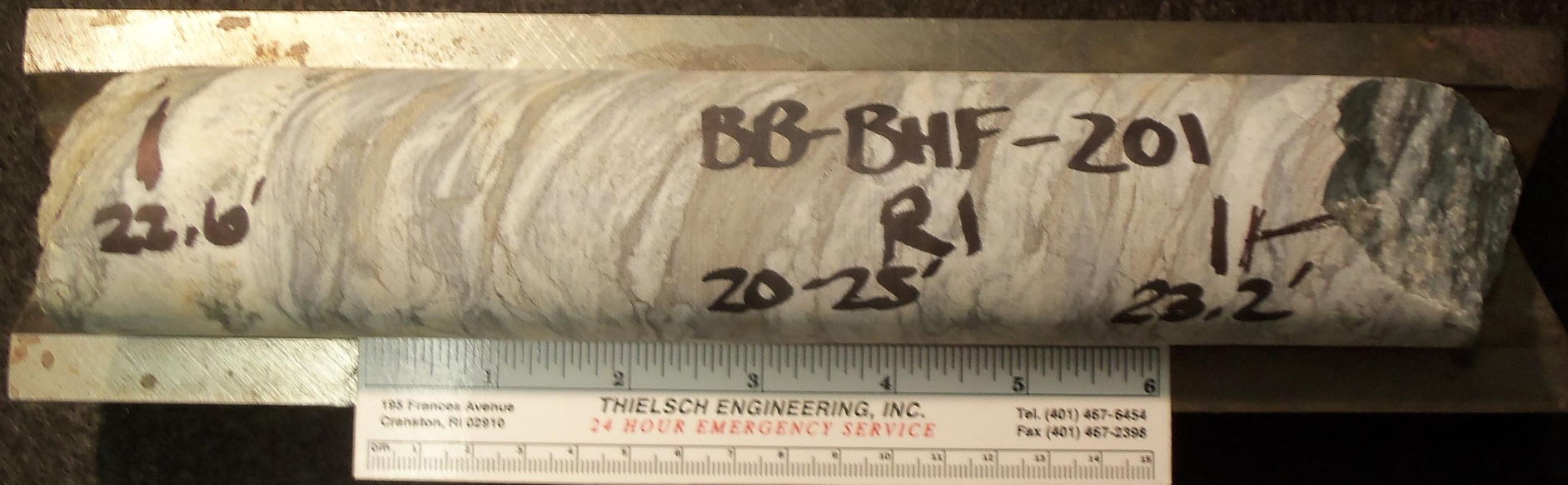
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 Sample No. R-1
 Depth: 11.4-12.1

File No. 16-012
 Date: 05.17.17
 Test No. R-2



MEDOT Blue Hill Falls
Blue Hill, ME

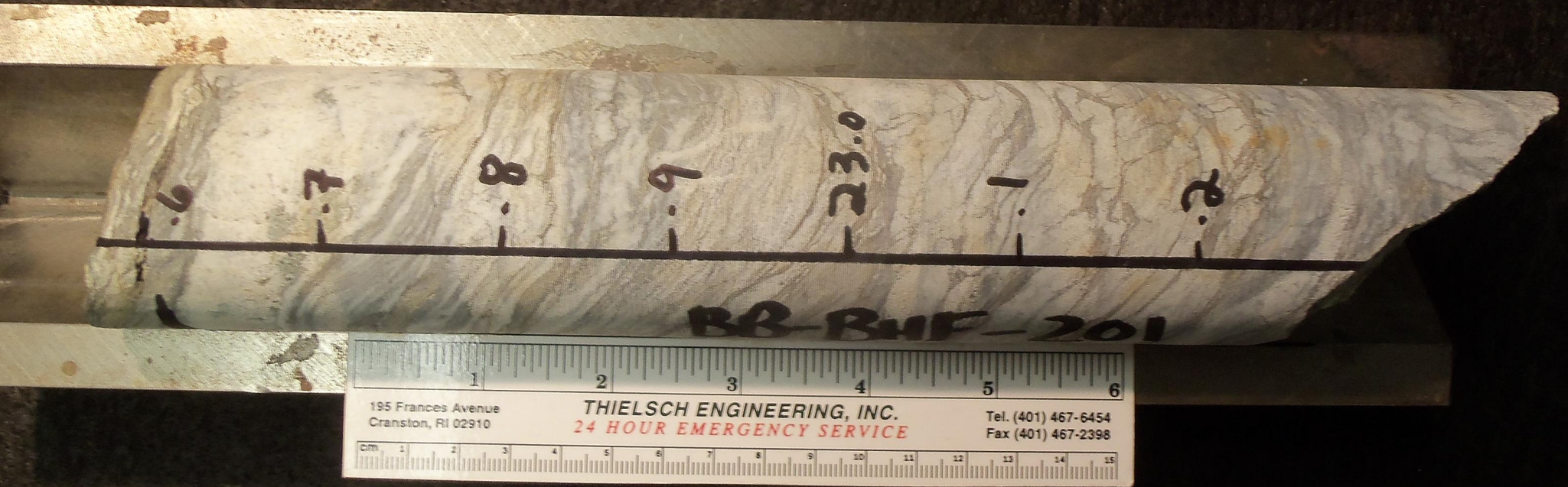
Schonewaldea Project #: 16-012
MaineDOT WIN #: 17712.00



| Boring No. | Sample No. | Depth |
|-------------------|------------|-------------------|
| <u>BB-BHF-201</u> | <u>R-1</u> | <u>22.6-23.2'</u> |

MEDOT Blue Hill Falls
Blue Hill, ME

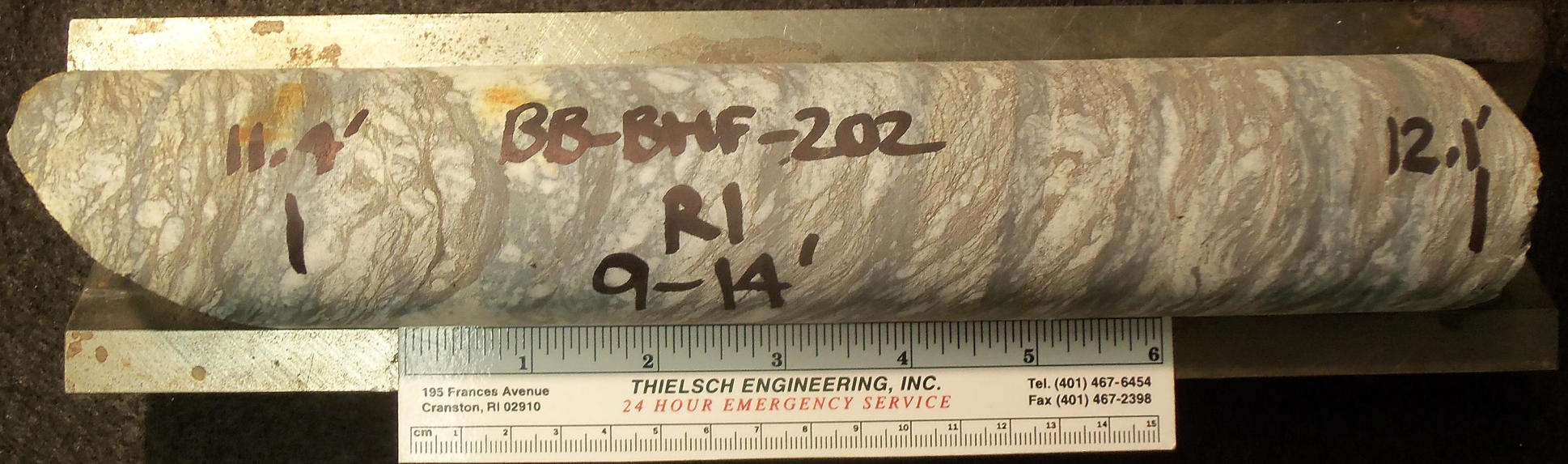
SchonewaldEA Project #: 16-012
MaineDOT WIN #: 17712.00



| Boring No. | Sample No. | Depth |
|-------------------|------------|-------------------|
| <u>BB-BHF-201</u> | <u>R-1</u> | <u>22.6-23.2'</u> |

MEDOT Blue Hill Falls
Blue Hill, ME

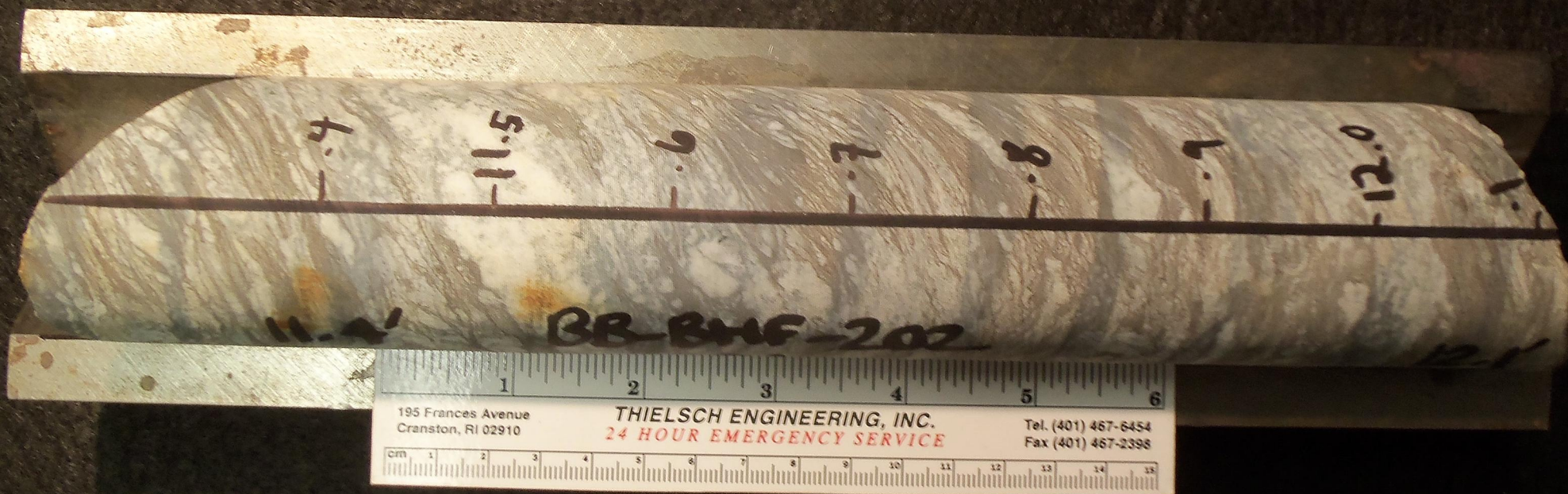
SchonewaldEA Project #: 16-012
MaineDOT WIN #: 17712.00



| Boring No. | Sample No. | Depth |
|-------------------|------------|-------------------|
| <u>BB-BHF-202</u> | <u>R-1</u> | <u>11.4-12.1'</u> |

MEDOT Blue Hill Falls
Blue Hill, ME

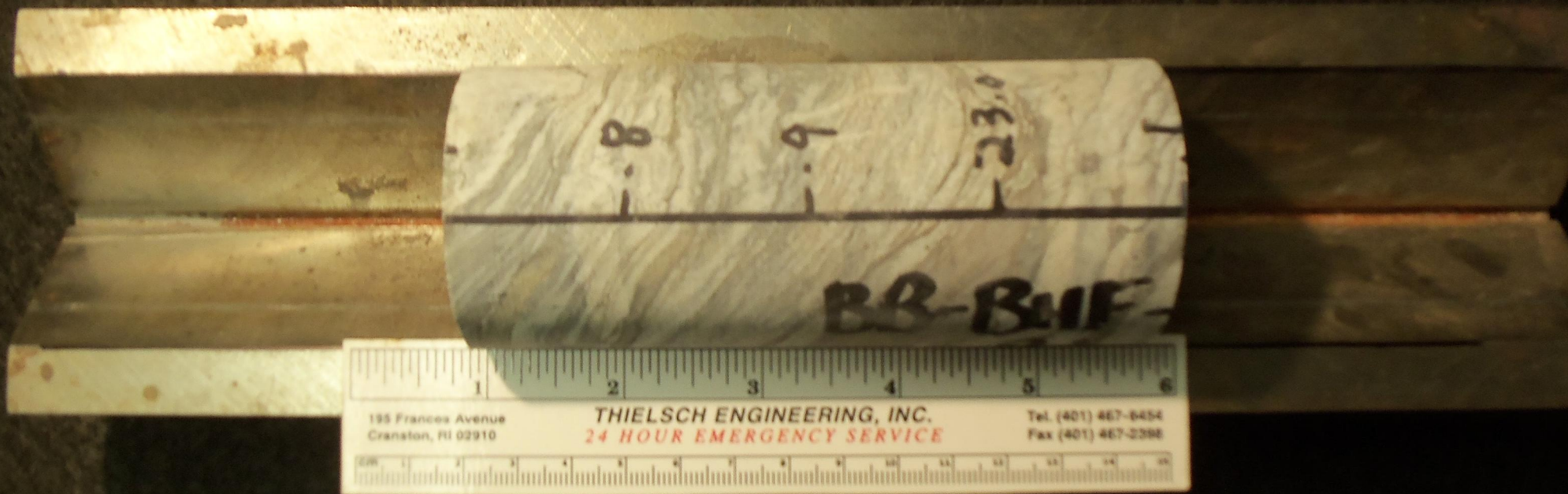
SchonewaldEA Project #: 16-012
MaineDOT WIN #: 17712.00



| Boring No. | Sample No. | Depth |
|-------------------|------------|-------------------|
| <u>BB-BHF-202</u> | <u>R-1</u> | <u>11.4-12.1'</u> |

MEDOT Blue Hill Falls
Blue Hill, ME

SchonewaldeEA Project #: 16-012
MaineDOT WIN #: 17712.00



195 Frances Avenue
Cranston, RI 02910

THIELSCH ENGINEERING, INC.
24 HOUR EMERGENCY SERVICE

Tel. (401) 467-6454
Fax (401) 467-2398

Boring No.

Sample No.

Depth

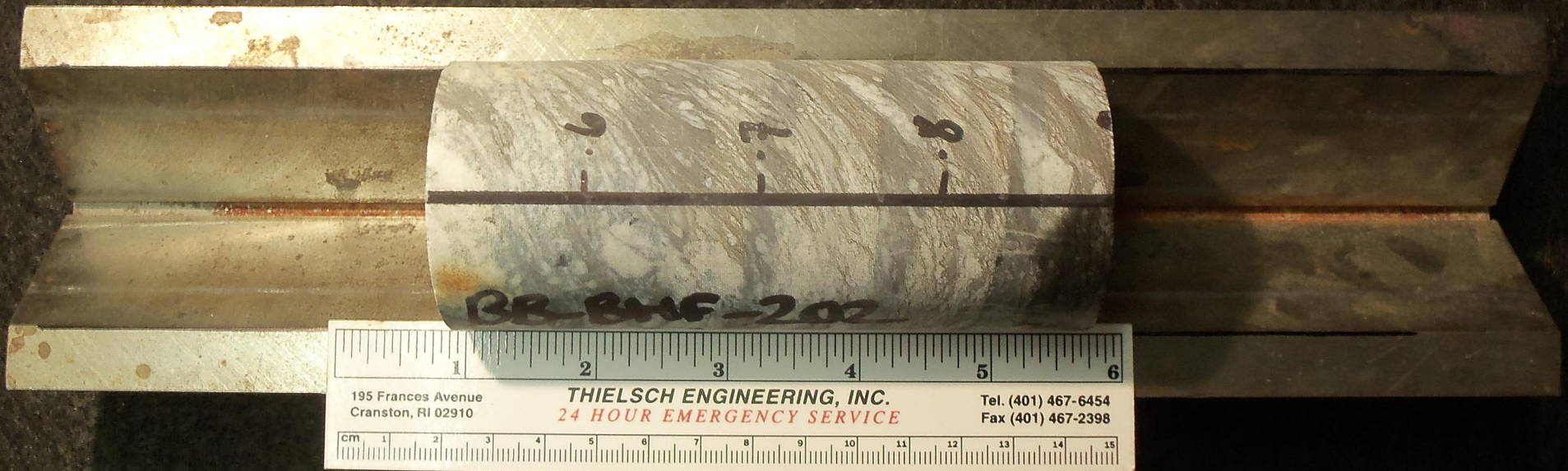
BB-BHF-201

R-1

22.6-23.2'

MEDOT Blue Hill Falls
Blue Hill, ME

SchonewaldEA Project #: 16-012
MaineDOT WIN #: 17712.00



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Boring No.

Sample No.

Depth

BB-BHF-202

R-1

11.4-12.1'

MEDOT Blue Hill Falls
Blue Hill, ME

SchonewaldEA Project #: 16-012
MaineDOT WIN #: 17712.00



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| Boring No. | Sample No. | Depth |
|-------------------|------------|-------------------|
| <u>BB-BHF-201</u> | <u>R-1</u> | <u>22.6-23.2'</u> |

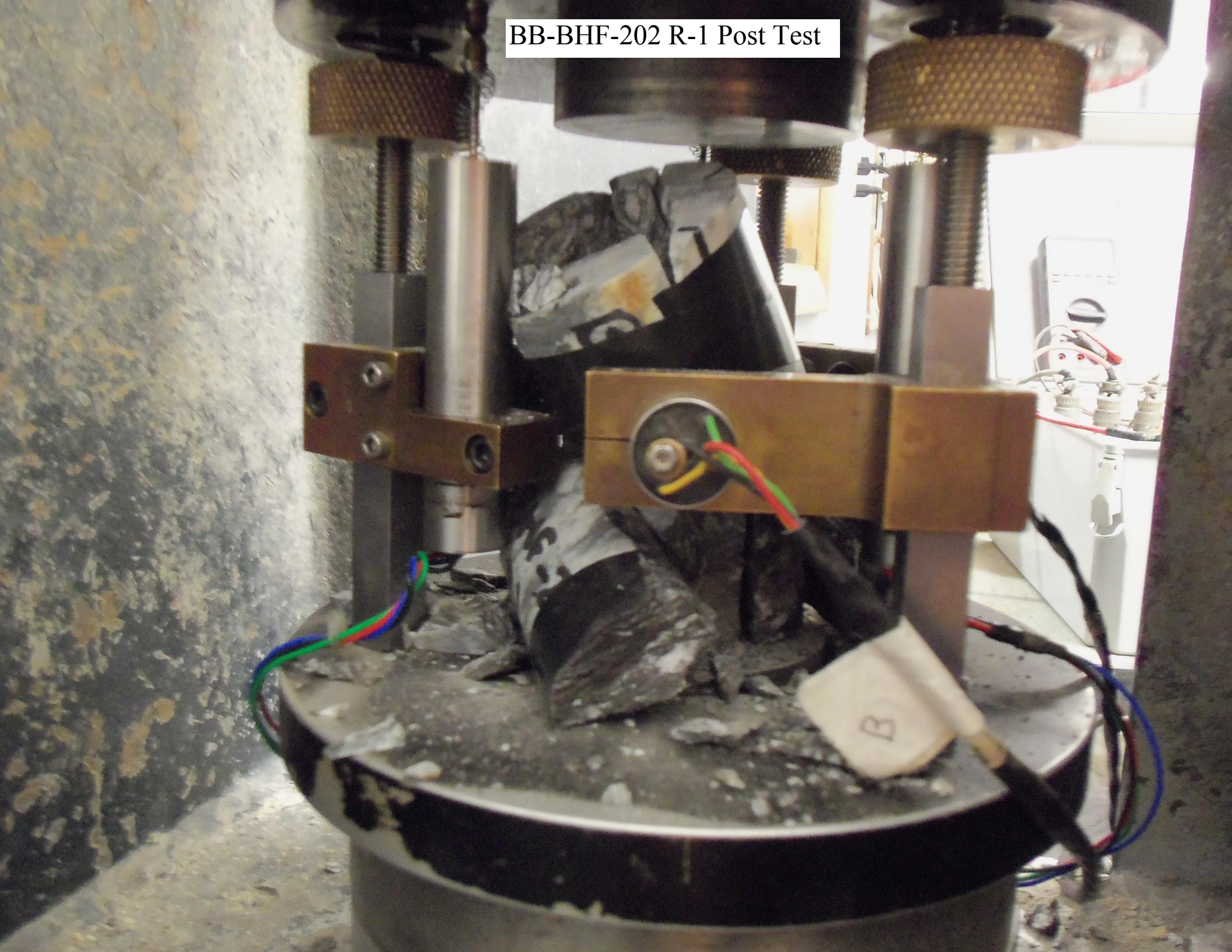
MEDOT Blue Hill Falls
Blue Hill, ME

SchonewaldEA Project #: 16-012
MaineDOT WIN #: 17712.00



| Boring No. | Sample No. | Depth |
|-------------------|------------|-------------------|
| <u>BB-BHF-201</u> | <u>R-1</u> | <u>22.6-23.2'</u> |

BB-BHF-202 R-1 Post Test



Appendix A3

300-500-Series, Geotechnical Program

(By Schonewald Engineering Associates)



**FIELD AND LABORATORY DATA REPORT
300- THROUGH 500-SERIES GEOTECHNICAL PROGRAMS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00**

PREPARED FOR:

HNTB Corporation
South Portland, Maine

PREPARED BY:

Isabel V. (Be) Schonewald, P.E.
Schonewald Engineering Associates, Inc. (SchonewaldEA)
129 Middle Road
Cumberland, Maine 04021
Be@SchonewaldEngineering.com

A handwritten signature in black ink, appearing to read 'Isabel V. Schonewald', is positioned to the right of the typed name.

July 2021

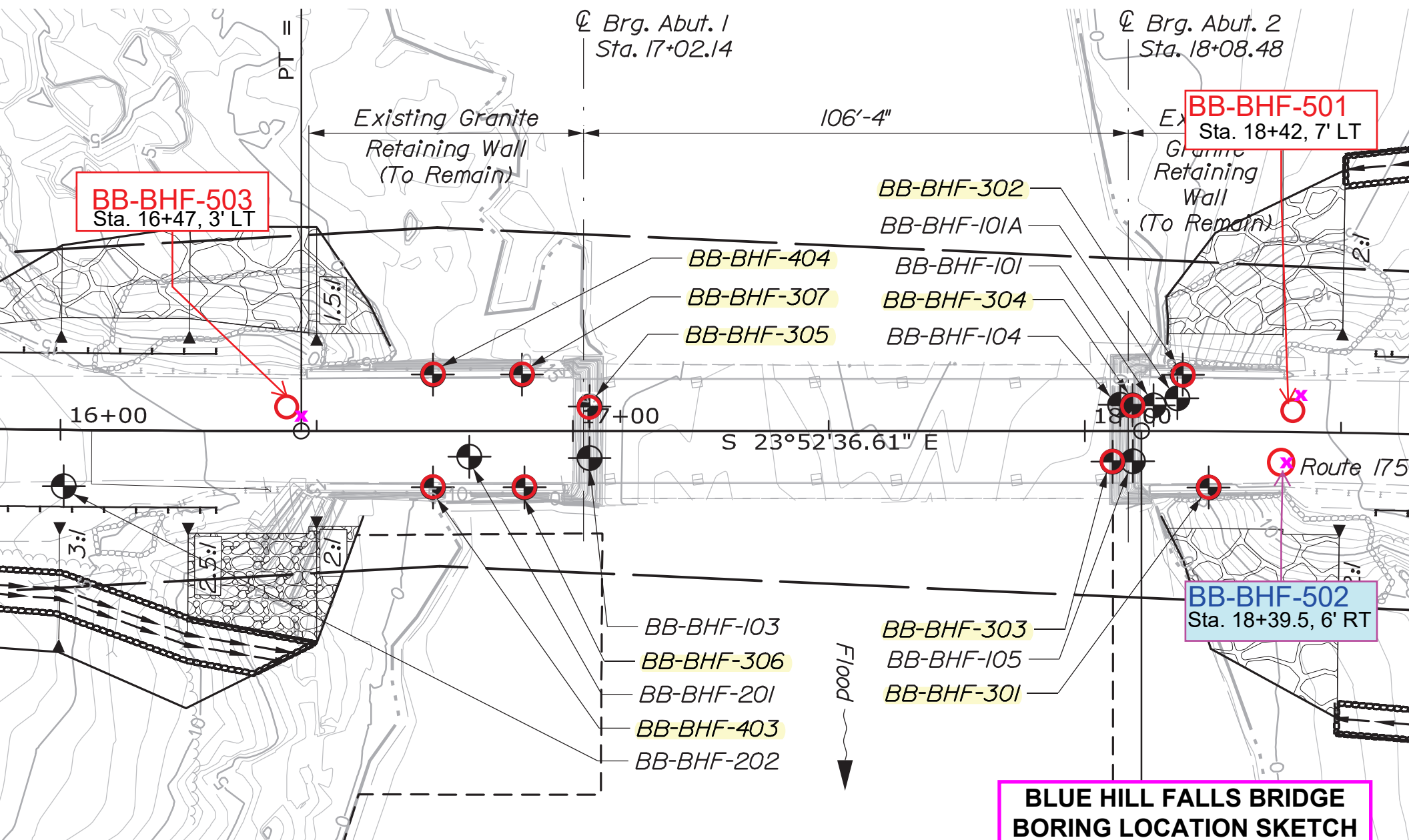
SchonewaldEA Project No. 20-112

**FIELD AND LABORATORY DATA REPORT
300- THROUGH 500-SERIES GEOTECHNICAL PROGRAMS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00**

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| LOGS OF 300- THROUGH 500-SERIES BORINGS | 4-27 |
| PHOTOGRAPHS OF (BEDROCK) CORE OBTAINED IN 300- THROUGH 500-SERIES BORINGS | 29-51 |
| RESULTS OF LABORATORY TESTS ON ROCK CORE SPECIMENS FROM 500-SERIES BORINGS | 53-61 |

BORING LOCATION SKETCH OF 500-SERIES BORINGS



BB-BHF-503
Sta. 16+47, 3' LT

BB-BHF-501
Sta. 18+42, 7' LT

BB-BHF-502
Sta. 18+39.5, 6' RT

**BLUE HILL FALLS BRIDGE
BORING LOCATION SKETCH
500-SERIES BORINGS**

1" = 25'+/-

LOGS OF 300- THROUGH 500-SERIES BORINGS

| | | |
|--|---|---|
| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond Location: Blue Hill, Maine | Boring No.: BB-BHF-301 WIN: 17712.00 |
|--|---|---|

| | | |
|---|--|---|
| Driller: New England Boring Contractors | Elevation (ft.): 15.1 ft (est'd) | Auger ID/OD: n/a |
| Operator: Enos/Lovefield | Datum: NAVD88 | Sampler: n/a |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: n/a |
| Date Start/Finish: 5/18/20; 0855 - 5/18/20; 1225 | Drilling Method: NQ wireline coring | Core Barrel: NQ wireline (core dia 1.875") |
| Boring Location: Sta. 18+24.2, 11.0 ft RT | Casing ID/OD: NQ rods (2.38"/2.75") | Water Level*: tidal; direct connection |

| | | |
|--|---|---|
| Hammer Efficiency Factor: | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> | |
| Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected |
| T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test | | |

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|--|-----------------|--|--|---|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 0 | R1 | 60/51 | 0.0 - 5.0 | RQD: NOT APPLY | | | NQ | | 12.1 | R1: CONCRETE TO GRANITE BLOCK | | |
| | | | | | | | | | | 3.0 | granite block at 3.0 ft; material lost at transition | |
| 5 | R2 | 67/62 | 5.0 - 10.6 | RQD: NOT APPLY | | | | | | | R2: GRANITE BLOCK Drill through 3 granite blocks, each 18 to 24 inches thick, with 1- to 2-inch drops between blocks | |
| | | | | | | | | | | | | |
| 10 | R3 | 60/60 | 10.6 - 15.6 | RQD: NOT APPLY | | | | | 2.1 | R3: GRANITE BLOCK TO SOIL one granite block | | |
| | | | | | | | | | | 13.0 | Change at 13.0 ft; bottom of structure; cobbles and boulder with soil; boulder: granite, different than granite block; cobble: phyllite; remainder gravel and cobbles; rock type varies, including some weathered granite; all rounded to subrounded. Core times: 2:41/ 2:38/ 1:58/ 5:17/ 4:39 min:sec/ft | |
| 15 | R4 | 60/13 | 15.6 - 20.6 | RQD: NOT APPLY | | | | | | | R4: SOIL very little recovery; soil with occasional cobbles; appears to be TILL Core times: 1:46/ 1:42/ 0:36/ 0:55/ 1:19 min:sec/ft | |
| | | | | | | | | | | | 20.6 to 33.1 ft: spin NQ core barrel using NJ rod, therefore, no core; penetrates fast, little resistance; suggests soil | |
| 25 | | | | | | | | | | | | |

Remarks:

| | | |
|--|--|-------------------------------|
| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond | Boring No.: BB-BHF-301 |
| | Location: Blue Hill, Maine | WIN: 17712.00 |

| | | |
|---|--|---|
| Driller: New England Boring Contractors | Elevation (ft.): 15.1 ft (est'd) | Auger ID/OD: n/a |
| Operator: Enos/Lovefield | Datum: NAVD88 | Sampler: n/a |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: n/a |
| Date Start/Finish: 5/18/20; 0855 - 5/18/20; 1225 | Drilling Method: NQ wireline coring | Core Barrel: NQ wireline (core dia 1.875") |
| Boring Location: Sta. 18+24.2, 11.0 ft RT | Casing ID/OD: NQ rods (2.38"/2.75") | Water Level*: tidal; direct connection |

| | |
|--|---|
| Hammer Efficiency Factor: | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> |
| Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140 lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person |
| | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected |
| | T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test |

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|--|-----------------|-------------|--------------------------------|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 25 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |
| 33.1 | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

Remarks:

| | | |
|--|---|---|
| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond Location: Blue Hill, Maine | Boring No.: BB-BHF-302 WIN: 17712.00 |
|--|---|---|

| | | |
|---|--|--|
| Driller: New England Boring Contractors | Elevation (ft.): 15.1 ft (est'd) | Auger ID/OD: SSA (4.5" OD) |
| Operator: Enos/ Lovefield | Datum: NAVD88 | Sampler: standard split-spoon |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: 140 lbs / 30 inches |
| Date Start/Finish: 5/21/20; 0845 - 5/22/20; 1010 | Drilling Method: wireline coring (HQ3 over NQ) | Core Barrel: core dia: HQ3=2.406" / NQ= |
| Boring Location: Sta. 16+72.7, 11.0 ft LT | Casing ID/OD: HQ rods (3.06/3.5") / NW (3.0/3.5") | Water Level*: tidal; direct connection |

| | | |
|--|---|--|
| Hammer Efficiency Factor: .842 | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> | |
| Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _u (lab) = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected |
| T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test | | |

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|--|-----------------|-------------|--|---|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 0 | | | | | | | | | | | Pilot hole 1.0 ft into concrete | |
| | R1 | 60/60 | 1.0 - 6.0 | RQD: NOT APPLY | | | | | | | R1: CONCRETE TO GRANITE BLOCK | |
| | | | | | | | | | 12.5 | | change to granite block at 2.6 ft | |
| | | | | | | | | | | | shim stone within major void 3.9 to 5.0 ft. | |
| 5 | | | | | | | | | | | | |
| | R2 | 60/60 | 6.0 - 11.0 | RQD: NOT APPLY | | | | | | | R2: GRANITE BLOCK | |
| | | | | | | | | | | | 0.2-foot gap between granite blocks at 8.1 ft | |
| 10 | | | | | | | | | | | tight between granite blocks at 10.2 ft | |
| | R3 | 35/29 | 11.0 - 13.9 | RQD: NOT APPLY | | | | | | | R3: GRANITE BLOCK | |
| | | | | | | | | | | | weathered granite 11.9 to 12.3 ft | |
| | R4 | 20/11 | 13.9 - 15.6 | RQD: NOT APPLY | | | | | | | void (possibly shim gravel) 13.0 to 13.9 ft | |
| | | | | | | | | | | | R4: GRANITE BLOCKS | |
| 15 | | | | | | | | | | | void (possibly shim gravel) 14.6 to 15.6 ft | |
| | R5 | 65/45 | 15.6 - 21.0 | RQD: NOT APPLY | | | | | | | attempt split-spoon sample; unable to get split-spoon to 15.6 ft due to cave-in | |
| | | | | | | | | | | | R5: GRANITE BLOCK TO SOIL | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | 1D | 24/8 | 21.0 - 23.0 | 11-14-14-18 | 28 | 39 | 44 | | | | Brown, medium dense, fine to medium Sandy SILT, some gravel, trace coarse sand. (TILL) | |
| | | | | | | | | | | | Roller cone to 25 ft | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |

Remarks:

| | | |
|--|---|---|
| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond Location: Blue Hill, Maine | Boring No.: BB-BHF-302 WIN: 17712.00 |
|--|---|---|

| | | |
|---|--|--|
| Driller: New England Boring Contractors | Elevation (ft.): 15.1 ft (est'd) | Auger ID/OD: SSA (4.5" OD) |
| Operator: Enos/ Lovefield | Datum: NAVD88 | Sampler: standard split-spoon |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: 140 lbs / 30 inches |
| Date Start/Finish: 5/21/20; 0845 - 5/22/20; 1010 | Drilling Method: wireline coring (HQ3 over NQ) | Core Barrel: core dia: HQ3=2.406" / NQ= |
| Boring Location: Sta. 16+72.7, 11.0 ft LT | Casing ID/OD: HQ rods (3.06/3.5") / NW (3.0/3.5") | Water Level*: tidal; direct connection |

| | | |
|--|--|--|
| Hammer Efficiency Factor: .842 | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> | |
| Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140 lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _u (lab) = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected |
| | | T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test |

| Depth (ft.) | Sample Information | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|-----------------|-------------|---|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | |
| 25 | 2D | 16/14 | 25.0 - 26.3 | 20-20-50/4" | -- | | 87 | | | Brown, Gravelly SILT, some fine to medium sand, trace coarse sand. (TILL) Switch to NQ wireline at 25.0 ft | |
| 30 | R6 | 29/24 | 30.0 - 32.4 | RQD: 0" = 0% | | | | -14.9 | | Top of Bedrock at Elev. -14.9 ft. R6: Light and dark greenish grey, aphanitic to fine grained, PHYLLITE with evident typically highly undulating, low angle relic bedding, occasional cross-bedding cracks; hard, typically fresh. Low angle to moderately dipping, close breaks; undulating, rough, typically discolored and open with occasional mud infilling. Highly broken 30.0 to 31.4 ft. (ELLSWORTH FORMATION) Core times: 3:28/ 2:57/ -- min:sec/ft. ROCK QUALITY = VERY POOR | |
| | R7 | 48/45 | 32.4 - 36.4 | RQD: 17" = 35% | | | | | | R7: Similar to R6. Highly broken 32.8 to 33.5 and 35.0 to 36.4 ft. Core times: 1:59/ 2:12/ 1:41/ 2:06 min:sec/ft ROCK QUALITY = POOR | |
| 35 | R8 | 30/21 | 36.4 - 38.9 | RQD: 4" = 13% | | | | | | R8: Similar to R6. Highly broken 37.0 to 38.9 ft. Core times: 2:31/ 3:23/ 1:46 min:sec/ft ROCK QUALITY = VERY POOR | |
| | R9 | 60/60 | 38.9 - 43.9 | RQD: 23" = 38% | | | | | | R9: Similar to R6, except fresh, with occasional weathered calcisilicate foliations; low and high angle, close breaks, typically discolored with occasional mud infilling. Highly broken 38.9 to 39.3 ft. Core times: 3:02/ 3:59/ 3:48/ 3:55/ 4:36 min:sec/ft. ROCK QUALITY = POOR | |
| 45 | R10 | 60/60 | 43.9 - 48.9 | RQD: 39" = 65% | | | | | | R10: Similar to R6, except fresh; close to moderately spaced breaks, occasionally discolored with occasional mud infilling. Wide, mud-filled fractures at 47.3 to 47.5 and 47.8 to 47.9 ft. Core times: 2:02/ 2:07/ 2:00/ 3:35/ 1:39 min:sec/ft. ROCK QUALITY = FAIR | |
| 50 | | | | | | | | -33.8 | | Bottom of Exploration at 48.9 feet below ground surface. | |

Remarks:

| | | |
|--|---|---|
| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond Location: Blue Hill, Maine | Boring No.: BB-BHF-303 WIN: 17712.00 |
|--|---|---|

| | | |
|---|--|--|
| Driller: New England Boring Contractors | Elevation (ft.): 14.4 ft (est'd) | Auger ID/OD: SSA (4.5" OD) |
| Operator: Schaefer/ Titus | Datum: NAVD88 | Sampler: standard split-spoon |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 truck (NEBC #B-24) | Hammer Wt./Fall: 140 lbs / 30 inches |
| Date Start/Finish: 5/20/20; 1150 - 5/21/20; 1450 | Drilling Method: wireline coring (HQ over NQ) | Core Barrel: HQ(core dia 2.5")/NQ(core) |
| Boring Location: Sta. 18+5.4, 6.0 ft RT | Casing ID/OD: HQ rods (3.06/3.5") / NW (3.0/3.5") | Water Level*: tidal; direct connection |

| | | |
|--|--|---|
| Hammer Efficiency Factor: .938 | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> | |
| Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140 lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected |
| T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test | | |

| Depth (ft.) | Sample Information | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|-----------------|-------------|---|---|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | |
| 25 | | | | | | | | -13.2 | | Top of Bedrock at Elev. -13.2 ft. | |
| | R6 | 40/39 | 29.0 - 32.3 | RQD: 4" = 10% | | | | | | R6: Light and dark greenish grey, aphanitic to fine grained, PHYLLITE with evident typically highly undulating and moderately dipping relic bedding, some weathered calcisilicate beds, and occasional thin cross bedding cracks; hard, slightly weathered. Low angle to moderately dipping, typically close breaks; undulating, rough, typically discolored and open with mud infilling. Highly broken with mud-filled seams from 30.6 to 31.7 ft. (ELLSWORTH FORMATION) Core times: 2:35/ 3:30/ 3:10/ -- min:sec/ft. ROCK QUALITY = VERY POOR | |
| 30 | | | | | | | | | | R7: Similar to R6. Highly broken with mud-filled seams from 32.3 to 32.6 and 33.1 to 33.6 ft. Core times: 2:00/ -- min:sec/ft ROCK QUALITY = POOR | |
| | R7 | 21/21 | 32.3 - 34.1 | RQD: 6" = 29% | | | | | | R8: Similar to R6. Core times: --/ -- min:sec/ft. ROCK QUALITY = VERY POOR | |
| 35 | | | | | | | | | | R9: Similar to R6. Highly broken with mud-filled seams from 36.4 to 38.1 and 39.5 to 40.1 ft; and a vertical fracture from 37.4 to 37.9 ft. Core times: 2:00/ 1:55/ 1:55/ -- min:sec/ft. ROCK QUALITY = VERY POOR | |
| | R8 | 16/16 | 35.1 - 36.4 | RQD: 0" = 0% | | | | | | R10: Similar to R6. Highly broken with mud-filled seams from 42.9 to 43.7 ft. Core times: 2:00/ 2:25/ 2:30/ 2:05/ -- min:sec/ft. ROCK QUALITY = FAIR | |
| | R9 | 43/43 | 36.4 - 40.0 | RQD: 9" = 21% | | | | | | R11: Similar to R6. Highly broken with mud-filled seams from 46.9 to 48.1 ft. Core times: 2:50/ 2:10/ 2:15/ -- min:sec/ft. ROCK QUALITY = VERY POOR | |
| 40 | | | | | | | | | | R10: Similar to R6. Highly broken with mud-filled seams from 42.9 to 43.7 ft. Core times: 2:00/ 2:25/ 2:30/ 2:05/ -- min:sec/ft. ROCK QUALITY = FAIR | |
| | R10 | 58/58 | 40.0 - 44.8 | RQD: 32" = 55% | | | | | | R11: Similar to R6. Highly broken with mud-filled seams from 46.9 to 48.1 ft. Core times: 2:50/ 2:10/ 2:15/ -- min:sec/ft. ROCK QUALITY = VERY POOR | |
| 45 | | | | | | | | | | R11: Similar to R6. Highly broken with mud-filled seams from 46.9 to 48.1 ft. Core times: 2:50/ 2:10/ 2:15/ -- min:sec/ft. ROCK QUALITY = VERY POOR | |
| | R11 | 40/36 | 44.8 - 48.1 | RQD: 0" = 0% | | | | | | Bottom of Exploration at 48.1 feet below ground surface. | |
| 50 | | | | | | | | -33.7 | | | |

Remarks:

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|--|--|-------------------------------|
| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond | Boring No.: BB-BHF-304 |
| | Location: Blue Hill, Maine | WIN: 17712.00 |

| | | |
|---|--|---|
| Driller: New England Boring Contractors | Elevation (ft.): 14.4 ft (est'd) | Auger ID/OD: SSA (4.5" OD) |
| Operator: Schaefer/ Titus | Datum: NAVD88 | Sampler: standard split-spoon |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 truck (NEBC #B-24) | Hammer Wt./Fall: 140 lbs / 30 inches |
| Date Start/Finish: 5/19/20; 0810 - 5/20/20; 1130 | Drilling Method: wireline coring (HQ over NQ) | Core Barrel: HQ(core dia 2.5")/NQ(core |
| Boring Location: Sta. 18+9.3, 5.0 ft LT | Casing ID/OD: HQ rods (3.06/3.5") / NW (3.0/3.5") | Water Level*: tidal; direct connection |

| | |
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| Hammer Efficiency Factor: .938 | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> |
| Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140 lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person |
| | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected |
| | T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test |

| Depth (ft.) | Sample Information | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|-----------------|-------------|---|---|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | |
| 25 | | | | | | | | | | | |
| | 1D | 3/3 | 26.0 - 26.3 | 70/3" | - | | NW | -11.9 | | HQ wireline plugged at 26.0 ft; pull HQ; hole caved to 25.7 ft; spin NW casing to 26.0 ft and sample. ID: Brown, GRAVEL, some fine to coarse sand, little to some silt. (TILL) | |
| | R6 | 36/34 | 27.0 - 30.0 | RQD: 4" = 11% | | | NQ2 | | | Top of Bedrock at Elev. -11.9 ft. Spin NW casing to 27.0 ft. No drops 26.3 to 27.0 ft. Commence coring at 27.0 ft. | |
| 30 | | | | | | | | | | R6: Light and dark greenish grey, aphanitic to fine grained, PHYLLITE with evident typically highly undulating and moderately dipping relic bedding, with occasional weathered calcisilicate beds; hard, slightly weathered. Low angle, typically close breaks; undulating, rough, typically discolored and open. (ELLSWORTH FORMATION) | |
| | R7 | 60/54 | 31.0 - 36.0 | RQD: 20" = 33% | | | | | | Core times: 2:50/ 3:45/ 4:35 min:sec/ft. ROCK QUALITY = VERY POOR | |
| | | | | | | | | | | End of day: pull NQ wireline; spin NW to 31.0 ft to open road. R7: Similar to R6. | |
| 35 | | | | | | | | | | Core times: 3:00/ -- (jam)/ 2:20/ 2:30/ 2:45 min:sec/ft ROCK QUALITY = POOR | |
| | R8 | 60/60 | 36.0 - 41.0 | RQD: 4" = 7% | | | | | | R8: Similar to R6. | |
| | | | | | | | | | | Core times: 2:15/ -- (jam)/ 1:50/ 2:55/ 2:40 min:sec/ft ROCK QUALITY = VERY POOR | |
| 40 | | | | | | | | | | R9: Similar to R6. | |
| | R9 | 60/60 | 41.0 - 46.0 | RQD: 8" = 13% | | | | | | Core times: 2:05/ 2:15/ 2:40/ -- (jam)/ 3:30 min:sec/ft ROCK QUALITY = VERY POOR | |
| 45 | | | | | | | | | | Bottom of Exploration at 46.0 feet below ground surface. | |
| 50 | | | | | | | | | | | |

Remarks:

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| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond Location: Blue Hill, Maine | Boring No.: BB-BHF-305 WIN: 17712.00 |
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| | | |
|---|---|---|
| Driller: New England Boring Contractors | Elevation (ft.): 14.4 ft (est'd) | Auger ID/OD: n/a |
| Operator: Schaefer/ Titus | Datum: NAVD88 | Sampler: n/a |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 truck (NEBC #B-24) | Hammer Wt./Fall: n/a |
| Date Start/Finish: 5/18/20; 0840 - 5/18/20; 1345 | Drilling Method: NQ wireline coring | Core Barrel: NQ wireline (core dia 1.875") |
| Boring Location: Sta. 17+3.3, 4.8 ft LT | Casing ID/OD: NQ rods (2.38"/2.75") | Water Level*: tidal; direct connection |

Hammer Efficiency Factor: _____ **Hammer Type:** Automatic Hydraulic Rope & Cathead

Definitions: R = Rock Core Sample S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf)
 D = Split Spoon Sample SSA = Solid Stem Auger S_{u(lab)} = Lab Vane Undrained Shear Strength (psf) WC = Water Content, percent
 MD = Unsuccessful Split Spoon Sample Attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf) LL = Liquid Limit
 U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw Field SPT N-value PL = Plastic Limit
 MU = Unsuccessful Thin Wall Tube Sample Attempt WOH = Weight of 140lb. Hammer Hammer Efficiency Factor = Rig Specific Annual Calibration Value PI = Plasticity Index
 V = Field Vane Shear Test, PP = Pocket Penetrometer WOR/C = Weight of Rods or Casing N₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency G = Grain Size Analysis
 MV = Unsuccessful Field Vane Shear Test Attempt WO1P = Weight of One Person N₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected C = Consolidation Test

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|------|--------------------------------|--|--------------------------------|---|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 0 | R1 | 28/28 | 0.0 - 2.3 | RQD: not apply | | | NQ | | | R1: WEATHERED CONCRETE concrete crumbled. | | |
| | R2 | 26/26 | 2.3 - 4.5 | RQD: not apply | | | | | | R2: WEATHERED CONCRETE concrete crumbled. | | |
| 5 | R3 | 54/54 | 5.5 - 10.0 | RQD: not apply | | | | | | R3: CONCRETE | | |
| | | | | | | | | | | R4: CONCRETE with one rebar | | |
| 10 | R4 | 60/60 | 10.0 - 15.0 | RQD: not apply | | | | | | black wash water (possibly organics) noted from 11.6 to 11.9 ft. | | |
| 15 | R5 | 60/60 | 15.0 - 20.0 | RQD: not apply | | | | | R5: CONCRETE OVERLYING BEDROCK | | | |
| 20 | R6 | 60/60 | 20.0 - 25.0 | RQD: 34" = 57% | | | | -5.3 | | Top of Bedrock at Elev. -5.3 ft. Appears to be a clean contact between structure and bedrock at 19.7 ft. R6: Light and dark greenish grey, aphanitic to fine grained, PHYLLITE with evident typically highly undulating and moderately dipping relic bedding, with occasional weathered calcisilicate beds; hard, fresh. Typically moderately dipping, close to moderately spaced breaks; undulating, rough, fresh to discolored and open with occasional mud infilling. (ELLSWORTH FORMATION) Core times: 3:30/ 3:20/ 3:35/ 3:30/ 4:20 min:sec/ft. ROCK QUALITY = FAIR | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |

Remarks:

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| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond | Boring No.: BB-BHF-305 |
| | Location: Blue Hill, Maine | WIN: 17712.00 |

| | | |
|---|---|---|
| Driller: New England Boring Contractors | Elevation (ft.): 14.4 ft (est'd) | Auger ID/OD: n/a |
| Operator: Schaefer/ Titus | Datum: NAVD88 | Sampler: n/a |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 truck (NEBC #B-24) | Hammer Wt./Fall: n/a |
| Date Start/Finish: 5/18/20; 0840 - 5/18/20; 1345 | Drilling Method: NQ wireline coring | Core Barrel: NQ wireline (core dia 1.875") |
| Boring Location: Sta. 17+3.3, 4.8 ft LT | Casing ID/OD: NQ rods (2.38"/2.75") | Water Level*: tidal; direct connection |

| | |
|--|---|
| Hammer Efficiency Factor: | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> |
| Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140 lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person |
| | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected |
| | T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test |

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|--|-----------------|-------------|--|---|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 25 | R7 | 60/60 | 25.0 - 30.0 | RQD: 47" = 78% | | | | | | | R7: Similar to R6. Mud-filled fracture 28.2 to 28.3 ft. Core times: 4:50/ 3:35/ 3:05/ 3:05/ 2:55 min:sec/ft ROCK QUALITY = GOOD | |
| 30 | R8 | 60/60 | 30.0 - 35.0 | RQD: 46" = 77% | | | | | | | R8: Similar to R6. Core times: 2:50/ 2:30/ 2:10/ 2:15/ 2:00 min:sec/ft ROCK QUALITY = GOOD | |
| 35 | R9 | 60/60 | 35.0 - 40.0 | RQD: 42" = 70% | | | | | | | R9: Similar to R6. Core times: 1:30/ 2:30/ 2:20/ 2:10/ 2:50 min:sec/ft ROCK QUALITY = FAIR | |
| 40 | | | | | | | | | -25.6 | | Bottom of Exploration at 40.0 feet below ground surface. | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

Remarks:

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| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond Location: Blue Hill, Maine | Boring No.: BB-BHF-306 WIN: 17712.00 |
|--|---|---|

| | | |
|---|--|---|
| Driller: New England Boring Contractors | Elevation (ft.): 15.1 ft (est'd) | Auger ID/OD: n/a |
| Operator: Enos/Lovefield | Datum: NAVD88 | Sampler: n/a |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: n/a |
| Date Start/Finish: 5/19/20; 0840 - 5/19/20; 1355 | Drilling Method: NQ wireline coring | Core Barrel: NQ wireline (core dia 1.875") |
| Boring Location: Sta. 16+90.1, 11.0 ft RT | Casing ID/OD: NQ rods (2.38"/2.75") | Water Level*: tidal; direct connection |

| | | |
|--|--|--|
| Hammer Efficiency Factor: | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> | |
| <small> Definitions: R = Rock Core Sample S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf) D = Split Spoon Sample SSA = Solid Stem Auger S_u(lab) = Lab Vane Undrained Shear Strength (psf) WC = Water Content, percent MD = Unsuccessful Split Spoon Sample Attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf) LL = Liquid Limit U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw Field SPT N-value PL = Plastic Limit MU = Unsuccessful Thin Wall Tube Sample Attempt WOH = Weight of 140lb. Hammer Hammer Efficiency Factor = Rig Specific Annual Calibration Value PI = Plasticity Index V = Field Vane Shear Test, PP = Pocket Penetrometer WOR/C = Weight of Rods or Casing N₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency G = Grain Size Analysis MV = Unsuccessful Field Vane Shear Test Attempt WO1P = Weight of One Person N₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected C = Consolidation Test </small> | | |

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|--|-----------------|--|--------------------------------|---|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 0 | R1 | 66/62 | 0.0 - 5.5 | RQD: not apply | | | | | 12.7 | R1: CONCRETE TO GRANITE BLOCK transition to granite block at 2.4 ft | | |
| 5 | R2 | 60/56 | 5.5 - 10.5 | RQD: not apply | | | | | | R2: GRANITE BLOCK shim stone 5.9 to 6.3 ft weathered granite 7.5 to 8.0 ft | | |
| 10 | R3 | 66/53 | 10.5 - 16.0 | RQD: not apply | | | | | | R3: GRANITE BLOCK minor void (drop) 12.3 to 12.6 ft; possibly shim gravel major void (drop) 13.6 to 14.5 ft; possibly shim gravel | | |
| 15 | R4 | 48/6 | 16.0 - 20.0 | RQD: not apply | | | | | -1.3 | R4: GRANITE BLOCK TO SOIL TO BEDROCK multiple drops; typically 4 to 6 in drops Core times: 0:57/ 1:48/ 0:58/ 1:49 min:sec/ft bottom of structure at approximately 16.4 ft | | |
| 20 | R5 | 62/60 | 20.0 - 25.2 | RQD: 33" = 53% | | | | | -4.7 | Top of Bedrock at Elev. -4.7 ft. R5: Light and dark greenish grey, aphanitic to fine grained, PHYLLITE with evident typically highly undulating and moderately dipping relic bedding; hard, slightly weathered. Typically moderately dipping, close to moderately spaced breaks; undulating, rough, fresh to discolored and open with occasional mud infilling. (ELLSWORTH FORMATION) Core times: 2:14/ 2:09/ 2:03/ 2:02/ 2:13 min:sec/ft. ROCK QUALITY = FAIR | | |
| 25 | | | | | | | | | | | | |

Remarks:

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|--|--|-------------------------------|
| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond | Boring No.: BB-BHF-306 |
| | Location: Blue Hill, Maine | WIN: 17712.00 |

| | | |
|---|--|---|
| Driller: New England Boring Contractors | Elevation (ft.): 15.1 ft (est'd) | Auger ID/OD: n/a |
| Operator: Enos/Lovefield | Datum: NAVD88 | Sampler: n/a |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: n/a |
| Date Start/Finish: 5/19/20; 0840 - 5/19/20; 1355 | Drilling Method: NQ wireline coring | Core Barrel: NQ wireline (core dia 1.875") |
| Boring Location: Sta. 16+90.1, 11.0 ft RT | Casing ID/OD: NQ rods (2.38"/2.75") | Water Level*: tidal; direct connection |

| | | | |
|--|--|---|--|
| Hammer Efficiency Factor: Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140 lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected | T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test |
|--|--|---|--|

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|-------|-----------------|---|--------------------------------|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 25 | R6 | 72/60 | 25.2 - 31.2 | RQD: 20" = 28% | | | | | | R6: Similar to R5, except fresh to slightly weathered. Highly broken 25.2 to 28.3 ft. Core times: 1:14/ 1:13/ 4:27/ 3:40/ 2:29/ 3:02 min:sec/ft. ROCK QUALITY = POOR | | |
| 30 | R7 | 60/60 | 31.2 - 36.2 | RQD: 32" = 53% | | | | | | R7: Similar to R6. Vertical fracture 32.1 to 33.4 ft. Highly broken along vertical fracture 35.5 to 36.2 ft. Core times: 2:11/ 2:05/ 2:44/ 1:43/ 1:41 min:sec/ft. ROCK QUALITY = FAIR | | |
| 35 | R8 | 60/60 | 36.2 - 41.2 | RQD: 25" = 42% | | | | | | R8: Similar to R6, Highly broken along vertical fracture 36.2 to 38.6 ft. Appears to be more crystalline below 39.4 ft. Core times: 2:50/ 2:50/ 2:02/ 2:25/ 2:37 min:sec/ft ROCK QUALITY = POOR | | |
| 40 | R9 | 51/49 | 41.2 - 45.5 | RQD: 38" = 75% | | | | | | R9: Similar to R6, except more crystalline; low angle, moderately to widely spaced breaks. Mud-filled open fracture at 44.5 ft. Core times: 2:27/ 2:33/ 3:03/ 4:00/ 2:38 min:sec/ft ROCK QUALITY = FAIR | | |
| 45 | | | | | | | | -30.4 | | Bottom of Exploration at 45.5 feet below ground surface. | | |
| 50 | | | | | | | | | | | | |

Remarks:

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| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond Location: Blue Hill, Maine | Boring No.: BB-BHF-307 WIN: 17712.00 |
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| | | |
|---|--|---|
| Driller: New England Boring Contractors | Elevation (ft.): 15.1 ft (est'd) | Auger ID/OD: n/a |
| Operator: Enos/Lovefield | Datum: NAVD88 | Sampler: n/a |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: n/a |
| Date Start/Finish: 5/20/20; 0815 - 5/20/20; 1200 | Drilling Method: NQ wireline coring | Core Barrel: NQ wireline (core dia 1.875") |
| Boring Location: Sta. 16+90.5, 11.0 ft LT | Casing ID/OD: NQ rods (2.38"/2.75") | Water Level*: tidal; direct connection |

| | | |
|--|---|---|
| Hammer Efficiency Factor: | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> | |
| Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected |
| T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test | | |

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|--|-----------------|---|--------------------------------|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 0 | R1 | 60/58 | 0.0 - 5.0 | RQD: not apply | | | NQ | | 13.7 | R1: CONCRETE TO GRANITE BLOCK | | |
| | | | | | | | | | | transition to granite block at 1.4 ft | | |
| 5 | R2 | 63/58 | 5.0 - 10.3 | RQD: not apply | | | | | 0.2 | R2: GRANITE BLOCK | | |
| | | | | | | | | | | shim stone (broken) 6.8 to 7.2 ft | | |
| 10 | R3 | 55/49 | 10.3 - 14.9 | RQD: not apply | | | | | -1.9 | R3: GRANITE BLOCK | | |
| | | | | | | | | | | weathered /broken granite 10.7 to 11.1 ft | | |
| 15 | R4 | 72/54 | 14.9 - 20.9 | RQD: not apply | | | | | -17.0 | R4: GRANITE BLOCK TO BEDROCK | | |
| | | | | | | | | | | bottom of structure (large granite block) at approximately 14.9 ft; material lost from core 14.9 to 17.0 ft; drilling behavior suggests cobbles and/or shim stones; no drops noted. | | |
| | R4A | 43/43 | 17.0 - 20.6 | RQD: 26" = 61% | BDRC | | | | | Top of Bedrock at Elev. -1.9 ft. | | |
| | | | | | | | | | | (RQD is for bedrock portion (R4A) of core run R4) | | |
| 20 | R5 | 60/58 | 20.9 - 25.9 | RQD: 26" = 43% | | | | | | R4A: Light and dark greenish grey, aphanitic to fine grained, PHYLLITE with evident typically highly undulating and moderately dipping relic bedding; hard, typically fresh. Low angle to moderately dipping, close to moderately spaced breaks; undulating, rough, fresh to discolored and open with occasional mud infilling. (ELLSWORTH FORMATION) | | |
| | | | | | | | | | | Core times (16.9 to 20.9 ft): 2:48/ 2:14/ 2:12/ 2:33 min:sec/ft. | | |
| | | | | | | | | | | ROCK QUALITY = FAIR | | |
| | | | | | | | | | | R5: Similar to R4A. Weathered and highly broken 20.9 to 21.4 and 22.6 to 23.5 ft. | | |
| | | | | | | | | | | Core times: 1:37/ 2:37/ 2:17/ 4:06/ 2:17 min:sec/ft. | | |
| | | | | | | | | | | ROCK QUALITY = POOR | | |

Remarks:

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| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond | Boring No.: BB-BHF-307 |
| | Location: Blue Hill, Maine | WIN: 17712.00 |

| | | |
|---|--|---|
| Driller: New England Boring Contractors | Elevation (ft.): 15.1 ft (est'd) | Auger ID/OD: n/a |
| Operator: Enos/Lovefield | Datum: NAVD88 | Sampler: n/a |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: n/a |
| Date Start/Finish: 5/20/20; 0815 - 5/20/20; 1200 | Drilling Method: NQ wireline coring | Core Barrel: NQ wireline (core dia 1.875") |
| Boring Location: Sta. 16+90.5, 11.0 ft LT | Casing ID/OD: NQ rods (2.38"/2.75") | Water Level*: tidal; direct connection |

| | | | |
|--|--|---|--|
| Hammer Efficiency Factor: Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140 lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected | T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test |
|--|--|---|--|

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|--|-----------------|-------------|--|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 25 | R6 | 60/60 | 25.9 - 30.9 | RQD: 50" = 83% | | | | | | | R6: Similar to R4A. Core times: 1:34/ 2:04/ 2:30/ 1:32/ 1:37 min:sec/ft. ROCK QUALITY = GOOD | |
| 30 | R7 | 60/54 | 30.9 - 35.9 | RQD: 37" = 62% | | | | | | | | R7: Similar to R4A. Core times: 3:32/ 1:55/ 2:14/ 1:36/ 1:40 min:sec/ft. ROCK QUALITY = FAIR |
| 35 | | | | | | | | | -20.8 | | Bottom of Exploration at 35.9 feet below ground surface. | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

Remarks:

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| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond Location: Blue Hill, Maine | Boring No.: <u>BB-BHF-403</u> WIN: <u>17712.00</u> |
|--|---|---|

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|--|---|--|
| Driller: New England Boring Contractors | Elevation (ft.): 15.3 ft (est'd) | Auger ID/OD: n/a |
| Operator: Enos/Lovefield | Datum: NAVD88 | Sampler: n/a |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: n/a |
| Date Start/Finish: 5/22/20; 1055 - 5/22/20; 1350 | Drilling Method: NQ wireline coring | Core Barrel: NQ wireline (core dia 1.875") |
| Boring Location: Sta. 16+72.7, 11.0 ft RT | Casing ID/OD: NQ rods (2.38"/2.75") | Water Level*: tidal; direct connection |

Hammer Efficiency Factor: _____ Hammer Type: Automatic Hydraulic Rope & Cathead

Definitions: R = Rock Core Sample S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf)
D = Split Spoon Sample SSA = Solid Stem Auger S_{u(lab)} = Lab Vane Undrained Shear Strength (psf) WC = Water Content, percent
MD = Unsuccessful Split Spoon Sample Attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf) LL = Liquid Limit
U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw Field SPT N-value PL = Plastic Limit
MU = Unsuccessful Thin Wall Tube Sample Attempt WOH = Weight of 140lb. Hammer Hammer Efficiency Factor = Rig Specific Annual Calibration Value PI = Plasticity Index
V = Field Vane Shear Test, PP = Pocket Penetrometer WOR/C = Weight of Rods or Casing N₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency G = Grain Size Analysis
MV = Unsuccessful Field Vane Shear Test Attempt WO1P = Weight of One Person N₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected C = Consolidation Test

| Depth (ft.) | Sample Information | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|-----------------|--|--------------------------------|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | |
| 0 | R1 | 60/58 | 0.0 - 5.0 | RQD: not apply | | | NQ | | R1: CONCRETE AND GRANITE concrete to 2.4 ft | | |
| | | | | | | | | 12.9 | half concrete / half granite 2.4 to 3.4 ft | | |
| | | | | | | | | 11.9 | concrete 3.4 to 4.0 ft | | |
| | | | | | | | | 11.3 | top of granite block at 4.0 ft | | |
| 5 | R2 | 60/56 | 5.0 - 10.0 | RQD: not apply | | | | | R2: GRANITE BLOCK | | |
| | | | | | | | | | shim stones 8.7 to 10.0 ft | | |
| 10 | R3 | 60/53 | 10.0 - 15.0 | RQD: not apply | | | | | R3: GRANITE BLOCK | | |
| | | | | | | | | | shim stone/weathered zone 11.8 to 12.2 ft | | |
| | | | | | | | | | weathered surface with barnacles on granite core, shim stones, and muscles 13.1 to 14.4 ft | | |
| 15 | R4 | 58/39 | 15.0 - 19.8 | RQD: not apply | | | | | void (drop) 14.4 to 14.9 ft | | |
| | | | | | | | | | R4: SHIM STONES/COBBLES TO SOIL | | |
| | | | | | | | | | shim stones and cobbles 15.0 to approximately 17.9 ft | | |
| | | | | | | | | -2.6 | apparent soil - silty till | | |
| 20 | R5 | 74/64 | 19.8 - 26.0 | RQD: 22" = 30% | | | | | R5: SOIL TO BEDROCK | | |
| | | | | | | | | -4.9 | Top of Bedrock at Elev. -4.9 ft. | | |
| | | | | | | | | | R5: Light and dark greenish grey, aphanitic to fine grained, PHYLLITE with evident typically highly undulating and moderately dipping relic bedding, occasional quartzite inclusions, occasional weathered calcisicate beds, and occasional thin cross bedding cracks; hard, fresh to slightly weathered. Low and high angle, typically close breaks; undulating, rough, typically discolored and open with rare mud infilling. Highly broken 21.7 to 22.9 ft. (ELLSWORTH FORMATION) | | |

Remarks:

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| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond | Boring No.: BB-BHF-403 |
| | Location: Blue Hill, Maine | WIN: 17712.00 |

| | | |
|---|--|---|
| Driller: New England Boring Contractors | Elevation (ft.): 15.3 ft (est'd) | Auger ID/OD: n/a |
| Operator: Enos/Lovefield | Datum: NAVD88 | Sampler: n/a |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: n/a |
| Date Start/Finish: 5/22/20; 1055 - 5/22/20; 1350 | Drilling Method: NQ wireline coring | Core Barrel: NQ wireline (core dia 1.875") |
| Boring Location: Sta. 16+72.7, 11.0 ft RT | Casing ID/OD: NQ rods (2.38"/2.75") | Water Level*: tidal; direct connection |

| | |
|--|---|
| Hammer Efficiency Factor: | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> |
| Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140 lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person |
| | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected |
| | T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test |

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|-------|-----------------|---|--------------------------------|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 25 | | | | | | | | | | Core times: 1:35/ 2:04/ 2:34/ 5:41/ 2:14/ 2:22/ -- min:sec/ft. ROCK QUALITY = POOR R6: Similar to R5. Highly broken 26.0 to 26.5 and 27.9 to 29.0 ft. Core times: 1:55/ 2:28/ 2:24 min:sec/ft. ROCK QUALITY = VERY POOR | | |
| | R6 | 36/33 | 26.0 - 29.0 | RQD: 0" = 0% | | | | | | | | |
| 30 | | | | | | | | | | R7: Similar to R5. Highly broken 29.0 to 31.8 ft. Core times: 3:51/ 1:58/ 1:28/ 1:47/ -- min:sec/ft. ROCK QUALITY = VERY POOR | | |
| | R7 | 52/40 | 29.0 - 33.3 | RQD: 4" = 8% | | | | | | | | |
| | | | | | | | | -18.0 | | Bottom of Exploration at 33.3 feet below ground surface. | | |
| 35 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

Remarks:

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| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond | Boring No.: BB-BHF-404 |
| | Location: Blue Hill, Maine | WIN: 17712.00 |

| | | |
|---|--|---|
| Driller: New England Boring Contractors | Elevation (ft.): 15.3 ft (est'd) | Auger ID/OD: n/a |
| Operator: Enos/Lovefield | Datum: NAVD88 | Sampler: n/a |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: n/a |
| Date Start/Finish: 5/20/20; 1230 - 5/20/20; 1520 | Drilling Method: NQ wireline coring | Core Barrel: NQ wireline (core dia 1.875") |
| Boring Location: Sta. 16+72.7, 11.0 ft LT | Casing ID/OD: NQ rods (2.38"/2.75") | Water Level*: tidal; direct connection |

| | | | |
|--|---|--|---|
| Hammer Efficiency Factor: Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person | S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf) $S_{u(lab)}$ = Lab Vane Undrained Shear Strength (psf) q_p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N_{60} = SPT N-uncorrected Corrected for Hammer Efficiency N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected | T_v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test |
|--|---|--|---|

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|------|-----------------|---|--------------------------------|--|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 0 | R1 | 60/48 | 0.0 - 5.0 | RQD: not apply | | | | | | R1: CONCRETE sound condition to 2.3 ft; remainder poor condition half concrete / half granite 2.3 to 3.1 ft | | |
| 5 | R2 | 72/57 | 5.0 - 11.0 | RQD: not apply | | | | 10.3 | | R2: GRANITE BLOCK 1-inch gap between blocks at 7.2 ft large gap 9.2 to 10.3 ft; possibly shim gravel shim stone 10.3 to 11.4 ft (bottom of R2 and top of R3) | | |
| 10 | R3 | 60/48 | 11.0 - 16.0 | RQD: not apply | | | | | | R3: GRANITE BLOCKS AND SHIM MATERIAL shim stone (weathered granite) 13.2 to 13.4 ft | | |
| 15 | R4 | 60/58 | 16.0 - 21.0 | RQD: not apply | | | | | | shim stone (weathered granite) 14.7 to 14.8 ft several drops 14.8 to 16.0 ft | | |
| | R4A | 40/40 | 17.7 - 21.0 | RQD: 28" = 70% | BDRC | | | -2.4 | | R4: SHIM MATERIAL TO BEDROCK Top of Bedrock at Elev. -2.4 ft. (RQD is for bedrock portion (R4A) of core run R4) R4A: Light and dark greenish grey, aphanitic to fine grained, PHYLLITE with evident typically highly undulating and moderately dipping relic bedding, occasional quartzite inclusions; hard, typically fresh. Low angle to moderately dipping, close to moderately spaced breaks; undulating, rough, typically discolored and open with occasional mud infilling (ELLSWORTH FORMATION) Core times (16.0 to 21.0 ft): 2:16/ 2:11/ 2:38/ 2:33/ 2:24 min:sec/ft. ROCK QUALITY = FAIR R5: Similar to R4A. Highly broken with thick mud infilling 24.0 to 24.7 ft. Core times: 2:03/ 1:37/ 1:34/ -- min:sec/ft ROCK QUALITY = FAIR | | |
| 20 | R5 | 44/43 | 21.0 - 24.7 | RQD: 23" = 52% | | | | | | | | |
| 25 | R6 | 50/49 | 24.7 - 28.9 | RQD: 22" = 44% | | | | | | | | |

Remarks:

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| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond Location: Blue Hill, Maine | Boring No.: BB-BHF-501 WIN: 17712.00 |
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| Driller: New England Boring Contractors | Elevation (ft.): 15 ft (est'd) | Auger ID/OD: SSA (4.5" OD) |
| Operator: Enos/ McDougal | Datum: NAVD88 | Sampler: standard split-spoon |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: 140 lbs / 30 inches |
| Date Start/Finish: 4/20/21; 0820-1330 | Drilling Method: cased wash boring | Core Barrel: NQ2 wireline-core dia 1.875" |
| Boring Location: Sta 18+42, 7 ft LT | Casing ID/OD: HW (4.0/4.5) / NW (3.0/3.5") | Water Level*: tidal; direct connection |

| | | |
|--|---|---|
| Hammer Efficiency Factor: .818 | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> | |
| Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected |
| T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test | | |

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|--|-----------------|---|--------------------------------|---|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 0 | | | | | | | | | 14.5 | 6 inches HMA | 0.5 | |
| | 1D | 24/12 | 2.0 - 4.0 | 8-6-5-4 | 11 | 15 | | | | Tan-light brown, damp, medium dense, fine to coarse SAND, little fine gravel, trace to little silt. FILL | | |
| 5 | 2D | 24/14 | 4.0 - 6.0 | 3-2-2-3 | 4 | 5 | ✓ | | | Brown, damp to moist, very loose, fine to medium SAND, some fine gravel, some silt. FILL | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 10 | 3D | 12/4 | 9.0 - 10.0 | 33-35-bounce | -- | | | | 37 | Grey and white, GRAVEL, some fine to coarse sand, trace to little silt. FILL | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 15 | 4D | 24/5 | 14.0 - 16.0 | 15-8-5-5 | 13 | 18 | | | 50 | Brown, medium dense, fine to coarse SANDY GRAVEL, little to some silt; appears to be disturbed. TILL FILL | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 20 | 5D | 11/6 | 19.0 - 19.9 | 86-100/5" | -- | | | | | Brown, very dense, fine to coarse SAND, some gravel, little to some silt. TILL FILL | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 25 | | | | | | | ✓ | | -8.0 | 23.0 ft: Smooth grind with roller cone. 23.5 ft: Attempt coring; break through; pieces of 3 cobbles with till between retrieved from core barrel; not boxed. | | |
| | | | | | | | NW spin | | | | | |

Remarks:
 Hammer calibrated on 8/26/20.

| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | | | | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond Location: Blue Hill, Maine | | | | Boring No.: BB-BHF-501 WIN: 17712.00 | | | | | | | |
|--|--------------------|--------------------------------|--------------------|--|---------------|-------------------------------------|--------------|---|-----------------|------------------------------|---|--|--|--|--|
| Driller: | | New England Boring Contractors | | Elevation (ft.): | | 15 ft (est'd) | | Auger ID/OD: | | SSA (4.5" OD) | | | | | |
| Operator: | | Enos/ McDougal | | Datum: | | NAVD88 | | Sampler: | | standard split-spoon | | | | | |
| Logged By: | | Schonewald | | Rig Type: | | Mobile Drill B-53 (NEBC ATV Rig 23) | | Hammer Wt./Fall: | | 140 lbs / 30 inches | | | | | |
| Date Start/Finish: | | 4/20/21; 0820-1330 | | Drilling Method: | | cased wash boring | | Core Barrel: | | NQ2 wireline-core dia 1.875" | | | | | |
| Boring Location: | | Sta 18+42, 7 ft LT | | Casing ID/OD: | | HW (4.0/4.5) / NW (3.0/3.5") | | Water Level*: | | tidal; direct connection | | | | | |
| Hammer Efficiency Factor: .818 | | | | Hammer Type: | | | | Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> | | | | | | | |
| Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | | | | R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140 lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person | | | | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _{u(lab)} = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected | | | | T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test | | | |
| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. | | | |
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | | | | |
| 25 | 6D | 24/13 | 26.0 - 28.0 | 43-34-73-84 | 107 | 146 | | | | | Dark grey, very dense, Gravelly fine to medium SAND, some silt, trace coarse sand. TILL | | | | |
| | | | | | | | | | | | 29.0 ft: Attempt SPT/sample; unable to penetrate. | | | | |
| 30 | R1 | 55/55 | 31.1 - 35.7 | RQD: 17" = 31% | | | | | -16.0 | | Top of Bedrock at Elev. -16 ft. R1: Light and medium grey, aphanitic to fine grained, PHYLLITE with evident typically thin, highly undulating relic bedding; hard, typically fresh. Typically moderately dipping, typically closely spaced breaks; undulating, rough, typically discolored and open; shiny. (ELLSWORTH FORMATION) Core times: 2:10/ 1:40/ 1:35/ 1:40/ -- min:sec/ft. ROCK QUALITY = POOR | | | | |
| 35 | R2 | 60/60 | 35.7 - 40.7 | RQD: 11" = 18% | | | | | | | R2: Similar to R1, except very closely to closely spaced breaks; open to moderately wide with occasional mud infilling of wider breaks. Core times: 1:30/ 1:25/ 1:30/ 1:25/ 1:35 min:sec/ft ROCK QUALITY = VERY POOR | | | | |
| | | | | sample 37.9-38.3 | | | | | | | | GTX# n/a qp=1,879 ksf | | | |
| 40 | | | | | | | | | -25.7 | | Bottom of Exploration at 40.7 feet below ground surface. | | | | |
| 45 | | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | | |

Remarks:
Hammer calibrated on 8/26/20.

| | | |
|--|---|---|
| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond Location: Blue Hill, Maine | Boring No.: BB-BHF-502 WIN: 17712.00 |
|--|---|---|

| | | |
|---|--|--|
| Driller: New England Boring Contractors | Elevation (ft.): 15 ft (est'd) | Auger ID/OD: SSA (4.5" OD) |
| Operator: Enos/ McDougal | Datum: NAVD88 | Sampler: standard split-spoon |
| Logged By: Schonewald | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | Hammer Wt./Fall: 140 lbs / 30 inches |
| Date Start/Finish: 4/20/21; 1340 - 4/21/21; 1350 | Drilling Method: cased wash boring | Core Barrel: NQ2 wireline-core dia 1.875" |
| Boring Location: Sta 18+39.5, 6 ft RT | Casing ID/OD: HW (4.0/4.5) / NW (3.0/3.5") | Water Level*: tidal; direct connection |

| | | |
|---------------------------------------|--|--|
| Hammer Efficiency Factor: .818 | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> | |
|---------------------------------------|--|--|

Definitions: R = Rock Core Sample S_u = Peak/Remolded Field Vane Undrained Shear Strength (psf) T_v = Pocket Torvane Shear Strength (psf)
 D = Split Spoon Sample SSA = Solid Stem Auger S_{u(lab)} = Lab Vane Undrained Shear Strength (psf) WC = Water Content, percent
 MD = Unsuccessful Split Spoon Sample Attempt HSA = Hollow Stem Auger q_p = Unconfined Compressive Strength (ksf) LL = Liquid Limit
 U = Thin Wall Tube Sample RC = Roller Cone N-uncorrected = Raw Field SPT N-value PL = Plasticity Limit
 MU = Unsuccessful Thin Wall Tube Sample Attempt WOH = Weight of 140 lb. Hammer Hammer Efficiency Factor = Rig Specific Annual Calibration Value PI = Plasticity Index
 V = Field Vane Shear Test, PP = Pocket Penetrometer WOR/C = Weight of Rods or Casing N₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency G = Grain Size Analysis
 MV = Unsuccessful Field Vane Shear Test Attempt WO1P = Weight of One Person N₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected C = Consolidation Test

| Depth (ft.) | Sample Information | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/ AASHTO and Unified Class. |
|-------------|--------------------|-----------------|--------------------|--|---------------|-----------------|--------------|--|-----------------|-------------|--|---|
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (/6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | |
| 25 | | | | | | | | | | | | |
| 30 | | | | | | | | | -14.8 | | 29.8 ft: Attempt SPT/sample; unable to penetrate. Possible weathered bedrock in tip of spoon. | |
| | R1 | 20/19 | 32.0 - 33.7 | RQD: 0" = 0% | | | | | -17.0 | | Top of Bedrock at Elev. -17 ft. R1-R4: Light and medium grey, aphanitic to fine grained, PHYLLITE with evident typically thin, highly undulating relic bedding; hard, fresh to slightly weathered. Typically moderately dipping, typically very closely spaced breaks; undulating, rough, typically discolored and open with occasional mud infilling; shiny. (ELLSWORTH FORMATION) Core times (R1-R4): 3:55/ --/ 3:30/ --/ 3:25/ -- min:sec/ft. ROCK QUALITY = VERY POOR | |
| | R2 | 25/23 | 33.7 - 35.8 | RQD: 0" = 0% | | | | | | | | |
| 35 | R3 | 17/8 | 35.8 - 37.2 | RQD: 0" = 0% | | | | | | | | |
| | R4 | 4/4 | 37.2 - 37.5 | RQD: 0" = 0% | | | | | | | | |
| | R5 | 60/60 | 37.5 - 42.5 | RQD: 24" = 40% | | | | | | | R5: Similar to R1 through R4, except core is fresh and breaks are moderately dipping to high angle, typically closely spaced; undulating, rough, typically fresh and partially open to open with minor mud infilling; breaks typically along relic bedding; shiny. Core times: --/ 3:10/ 2:55/ 3:15/ 3:30/ -- min:sec/ft. ROCK QUALITY = POOR | |
| 40 | | | sample 40.0-40.4 | | | | | | | | | GTX# n/a qp=1,710 ksf |
| | | | | | | | | | -27.5 | | Bottom of Exploration at 42.5 feet below ground surface. | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

Remarks:
 Hammer calibrated on 8/26/20.

| Maine Department of Transportation Soil/Rock Exploration Log US CUSTOMARY UNITS | | | | Project: Blue Hill Falls Bridge #5083 Route 175 over Salt Pond Location: Blue Hill, Maine | | | | Boring No.: BB-BHF-503 WIN: 17712.00 | | | | | | | |
|--|--------------------|-----------------|--------------------|---|---------------|-----------------|--------------|--|--|-----------------|--|--|--|--|--|
| Driller: New England Boring Contractors | | | | Elevation (ft.): 15 ft (est'd) | | | | Auger ID/OD: SSA (4.5" OD) | | | | | | | |
| Operator: Enos/ McDougal | | | | Datum: NAVD88 | | | | Sampler: standard split-spoon | | | | | | | |
| Logged By: Schonewald | | | | Rig Type: Mobile Drill B-53 (NEBC ATV Rig 23) | | | | Hammer Wt./Fall: 140 lbs / 30 inches | | | | | | | |
| Date Start/Finish: 4/19/21; 0920-1430 | | | | Drilling Method: cased wash boring | | | | Core Barrel: NQ2 wireline-core dia 1.875" | | | | | | | |
| Boring Location: Sta 16+47, 3 ft LT | | | | Casing ID/OD: HW (4.0/4.5) / NW (3.0/3.5") | | | | Water Level*: tidal; direct connection | | | | | | | |
| Hammer Efficiency Factor: .818 | | | | Hammer Type: Automatic <input checked="" type="checkbox"/> Hydraulic <input type="checkbox"/> Rope & Cathead <input type="checkbox"/> | | | | | | | | | | | |
| Definitions: D = Split Spoon Sample MD = Unsuccessful Split Spoon Sample Attempt U = Thin Wall Tube Sample MU = Unsuccessful Thin Wall Tube Sample Attempt V = Field Vane Shear Test, PP = Pocket Penetrometer MV = Unsuccessful Field Vane Shear Test Attempt | | | | R = Rock Core Sample SSA = Solid Stem Auger HSA = Hollow Stem Auger RC = Roller Cone WOH = Weight of 140lb. Hammer WOR/C = Weight of Rods or Casing WO1P = Weight of One Person | | | | S _u = Peak/Remolded Field Vane Undrained Shear Strength (psf) S _u (lab) = Lab Vane Undrained Shear Strength (psf) q _p = Unconfined Compressive Strength (ksf) N-uncorrected = Raw Field SPT N-value Hammer Efficiency Factor = Rig Specific Annual Calibration Value N ₆₀ = SPT N-uncorrected Corrected for Hammer Efficiency N ₆₀ = (Hammer Efficiency Factor/60%)*N-uncorrected | | | | T _v = Pocket Torvane Shear Strength (psf) WC = Water Content, percent LL = Liquid Limit PL = Plastic Limit PI = Plasticity Index G = Grain Size Analysis C = Consolidation Test | | | |
| Depth (ft.) | Sample Information | | | | | | | | | Elevation (ft.) | Graphic Log | Visual Description and Remarks | Laboratory Testing Results/AASHTO and Unified Class. | | |
| | Sample No. | Pen./Rec. (in.) | Sample Depth (ft.) | Blows (6 in.) Shear Strength (psf) or RQD (%) | N-uncorrected | N ₆₀ | Casing Blows | | | | | | | | |
| 0 | | | | | | | SSA | 14.1 | | | 10-1/2 inches HMA | | | | |
| | 1D | 24/2 | 2.0 - 4.0 | WOR/12"-2-2 | 2 | 3 | | | | | Weathered asphalt changing to Brown, damp, very loose, Silty fine to coarse SAND, some gravel. Driller notes that top 12 inches of sample was very loose, not a void. FILL | | | | |
| 5 | 2D | 24/4 | 4.0 - 6.0 | 4-1-15-4 | 16 | 22 | ∇ | | | | Brown, damp, (very loose to medium dense), Gravelly fine to coarse SAND, some silt. FILL | | | | |
| | | | | | | | 88 | | | | | | | | |
| | | | | | | | 107 | | | | | | | | |
| | | | | | | | 40+ HW spin | | | | Casing walking to east as driven; driller pulls casing and switches to spin shoe. | | | | |
| 10 | 3D | 15/8 | 9.0 - 10.3 | 33-49-50/3" | >99 | | NW spin | | | | Dark grey, (dry), very dense, fine to coarse Sandy GRAVEL, little to some silt; appears to be weathered bedrock. | | | | |
| | R1 | 49/40 | 10.4 - 14.5 | RQD: not apply | | | NQ2 | | | | R1: Phyllite boulders from 10.4 to 11.6 and 11.6 to 13.9 ft; void (likely soil-filled) 13.9 to 14.5 ft | | | | |
| | | | | | | | | | | | | | | | |
| 15 | R2 | 11/4 | 14.5 - 15.4 | RQD: not apply | | | | | | | R2: Phyllite pieces from 14.5 to 14.8 ft; void 14.8 to 15.3 ft; Phyllite pieces from 15.3 to 15.4 ft. | | | | |
| | R3 | 7/0 | 15.4 - 16.0 | RQD: not apply | | | ∇ | | | | R3: no recovery; likely soil. | | | | |
| | 4D | 18/8 | 16.0 - 17.5 | 4-5-86-bounce | 91 | 124 | NW spin | | | | Dark grey, (loose to very dense), fine to coarse Sandy GRAVEL, little to some silt, with shell fragments; bottom 3 inches appears to be weathered bedrock. | | | | |
| | R4 | 60/57 | 17.5 - 22.5 | RQD: 30" = 50% | | | NQ2 | -2.5 | | | Top of Bedrock at Elev. -2.5 ft. | | | | |
| | | | | | | | | | | | R4: Light and medium grey, aphanitic to fine grained, PHYLLITE with evident typically thin, highly undulating relic bedding; hard, typically fresh. Typically moderately dipping, typically closely spaced breaks; undulating, rough, typically discolored and open with occasional mud infilling; shiny. (Pieces of core bit mixed in with rock core suggesting bit shattered.) | | | | |
| 20 | | | | sample 20.3-20.7 | | | | | | | (ELLSWORTH FORMATION) Core times: 7:30/ 4:00/ 4:15/ 3:50/ 2:50 min:sec/ft. ROCK QUALITY = POOR | | | | |
| | R5 | 48/29 | 22.5 - 26.5 | RQD: 5" = 10% | | | | | | | R5: Similar to R4, except more broken likely due to issues with core bit; more pieces of core bit mixed in with rock core suggesting bit shattered, which was confirmed when wireline core barrel pulled out. Core times: 7:45/ 1:55/ 2:05/ 3:40 min:sec/ft. ROCK QUALITY = VERY POOR | | | | |
| 25 | | | | | | | | | | | | | | | |
| Remarks: Hammer calibrated on 8/26/20. | | | | | | | | | | | | | | | |
| Stratification lines represent approximate boundaries between soil types; transitions may be gradual. | | | | | | | | | | | | | | | |
| * Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made. | | | | | | | | | | | | | | | |
| Page 1 of 2 Boring No.: BB-BHF-503 | | | | | | | | | | | | | | | |

**PHOTOGRAPHS OF (BEDROCK) CORE OBTAINED IN
300- THROUGH 500-SERIES BORINGS**



Core box containing dried core from test boring BB-BHF-301 (Box 1 of 1); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R2;
- 3) R2 bottom and R3;
- 4) R3 bottom and R4.



Core box containing dried core from test boring BB-BHF-301 (Box 1 of 1); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R2;
- 3) R3;
- 4) Empty.



Core box containing dried core (H size) from test boring BB-BHF-302 (Box 1 of 3); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R2;
- 3) R4.



Core box containing dried core (H size) from test boring BB-BHF-302 (Box 1 of 3); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R1 and R2 top;
- 2) R2 and R3 all;
- 3) R5.



Core (H-size) from test boring BB-BHF-302 – bottom piece of R5.

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:

2 of 23

(-302, Box 1)



Core box containing dried core from test boring BB-BHF-302 (Box 2 of 3); left side of core box (top portion of cores).

Slots from top to bottom:

- 1) R6 and R7 top;
- 2) R7 and R8;
- 3) Empty;
- 4) Empty (not visible in photo).



Core box containing dried core from test boring BB-BHF-302 (Box 2 of 3); right side of core box (bottom portion of cores).

Slots from top to bottom:

- 1) R7;
- 2) R8;
- 3) Empty;
- 4) Empty (not visible in photo).

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00



Core box containing dried core from test boring BB-BHF-302 (Box 3 of 3); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R9;
- 2) R10;
- 3) Empty;
- 4) Empty (not visible in photo).



Core box containing dried core from test boring BB-BHF-302 (Box 3 of 3); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R9;
- 2) R10;
- 3) Empty;
- 4) Empty (not visible in photo).



Core box containing dried core (H size) from test boring BB-BHF-303 (Box 1 of 3); left side of core box (top portion of cores). Slots from top to bottom:
 1) R1;
 2) R2.



Core box containing dried core (H size) from test boring BB-BHF-303 (Box 1 of 3); right side of core box (bottom portion of cores). Slots from top to bottom:
 1) R1;
 2) R2.

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00



Core box containing dried core (H size) from test boring BB-BHF-303 (Box 2 of 3); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R3;
- 2) R4;
- 3) R5.



Core box containing dried core (H size) from test boring BB-BHF-303 (Box 2 of 3); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R3;
- 2) R4;
- 3) R5 / Empty.

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CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:
6 of 23
(-303, Box 2)



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Core box containing dried core from test boring BB-BHF-303 (Box 3 of 3); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R6;
- 2) R8 and R9 top;
- 3) R9 bottom and R10;
- 4) R10 bottom and R11.



Core box containing dried core from test boring BB-BHF-303 (Box 3 of 3); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R6 bottom and R7;
- 2) R9;
- 3) R10;
- 4) R11.

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:

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(-303, Box 3)



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ASSOCIATES, INC.

Core box containing dried core (H size) from test boring BB-BHF-304 (Box 1 of 3); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R2;
- 3) R3.



Core box containing dried core (H size) from test boring BB-BHF-304 (Box 1 of 3); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R2;
- 3) R3.

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:

8 of 23

(-304, Box 1)

WIN 17712.00
BB-BHF-304 BOX2

| | | | | |
|---------|-------------|-----|---------|---------|
| (HQ) R4 | 15.0'-20.0' | 60" | 60" | 30"=60% |
| (HQ) R5 | 20.0-26.0 | 72" | 30"=42% | 13"=18% |
| (NQ) R6 | 27.0-32.0 | 36" | 34"=94% | 4"=11% |

BB-BHF-304 BOX2
LT (TOP)

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ASSOCIATES, INC.



Core box containing dried core from test boring BB-BHF-304 (Box 2 of 3); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R4 (H size);
- 2) R5 (H size);
- 3) R6 bottom (N size).



Core box containing dried core from test boring BB-BHF-304 (Box 2 of 3); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R4 (H size);
- 2) R5 (H size) and R6 (N size);
- 3) Empty.

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:

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(-304, Box 2)

WIN 17712.00
BB-BHF-304 BOX 3

| | | | | |
|----|---------|------------|------------|------------|
| R7 | 31'-36' | 60" | 54"=70% | 20"=33% |
| R8 | 36'-41' | 60" | 60" | 4"=7% |
| R9 | 41'-46' | 60" | 60" | 8"=13% |
| | | <u>PEN</u> | <u>PER</u> | <u>RQD</u> |

BB-BHF-304 BOX 3
LT (TOP)

25'



Core box containing dried core from test boring BB-BHF-304 (Box 3 of 3); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R7;
- 2) R8;
- 3) R9;
- 4) Empty.



Core box containing dried core from test boring BB-BHF-304 (Box 3 of 3); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R7;
- 2) R8;
- 3) R9;
- 4) Empty.

CORE PHOTOGRAPHS

BRIDGE #5038

BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET

BLUE HILL, MAINE

MAINEDOT WIN 17712.00

Sheet No.:

10 of 23

(-304, Box 3)



Core box containing dried core from test boring BB-BHF-305 (Box 1 of 2); left side of core box (top portion of cores).

Slots from top to bottom:

- 1) R1 and R2 top;
- 2) R2 bottom and R3;
- 3) R4;
- 4) R5.



Core box containing dried core from test boring BB-BHF-305 (Box 1 of 2); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R2;
- 2) R3;
- 3) R4;
- 4) R5.

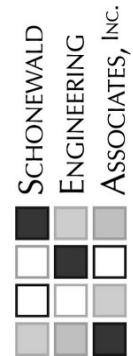


CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:

11 of 23

(-305, Box 1)



Core box containing dried core from test boring BB-BHF-305 (Box 2 of 2); left side of core box (top portion of cores).

Slots from top to bottom:

- 1) R6;
- 2) R7;
- 3) R7 bottom and R8;
- 4) R9.



Core box containing dried core from test boring BB-BHF-305 (Box 2 of 2); right side of core box (bottom portion of cores).

Slots from top to bottom:

- 1) R6;
- 2) R7;
- 3) R8;
- 4) R9.

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:

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(-305, Box 2)



Core box containing dried core from test boring BB-BHF-306 (Box 1 of 2); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R1 bottom and R2;
- 3) R3;
- 4) R5.



Core box containing dried core from test boring BB-BHF-306 (Box 1 of 2); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R2;
- 3) R3 and R4;
- 4) R5.



Core box containing dried core from test boring BB-BHF-306 (Box 2 of 2); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R6;
- 2) R7;
- 3) R8;
- 4) R9.



Core box containing dried core from test boring BB-BHF-306 (Box 2 of 2); right side of core box (bottom portion of cores). Slots from top to bottom:

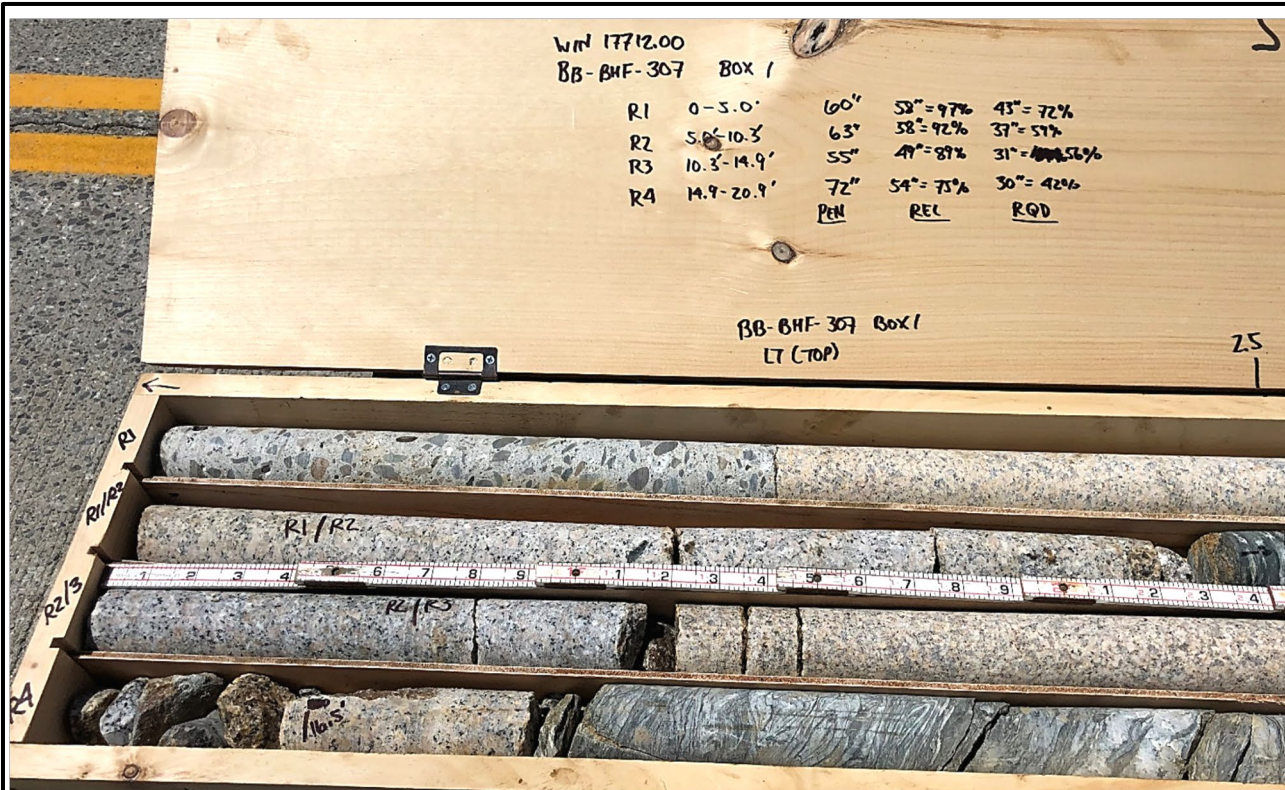
- 1) R6;
- 2) R7;
- 3) R8;
- 4) R9.

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:

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(-306, Box 2)



Core box containing dried core from test boring BB-BHF-307 (Box 1 of 2); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R1 bottom and R2;
- 3) R2 bottom and R3;
- 4) R4.



Core box containing dried core from test boring BB-BHF-307 (Box 1 of 2); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R2;
- 3) R3;
- 4) R4.

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:

15 of 23

(-307, Box 1)



Core box containing dried core from test boring BB-BHF-307 (Box 2 of 2); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R5;
- 2) R6;
- 3) R7;
- 4) Empty.



Core box containing dried core from test boring BB-BHF-307 (Box 2 of 2); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R5;
- 2) R6;
- 3) R7;
- 4) Empty.



Core box containing dried core from test boring BB-BHF-403 (Box 1 of 2); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R2;
- 3) R3;
- 4) R4.



Core box containing dried core from test boring BB-BHF-403 (Box 1 of 2); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R2;
- 3) R3;
- 4) R4.



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Core box containing dried core from test boring BB-BHF-403 (Box 2 of 2); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R5;
- 2) R5 bottom and R6;
- 3) R7;
- 4) Empty.

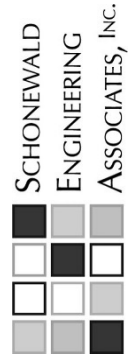


Core box containing dried core from test boring BB-BHF-403 (Box 2 of 2); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R5;
- 2) R6 bottom and R7;
- 3) Empty;
- 4) Empty (not visible in photo).

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:
18 of 23
(-403, Box 2)



Core box containing dried core from test boring BB-BHF-404 (Box 1 of 2); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R2;
- 3) R3;
- 4) R4.

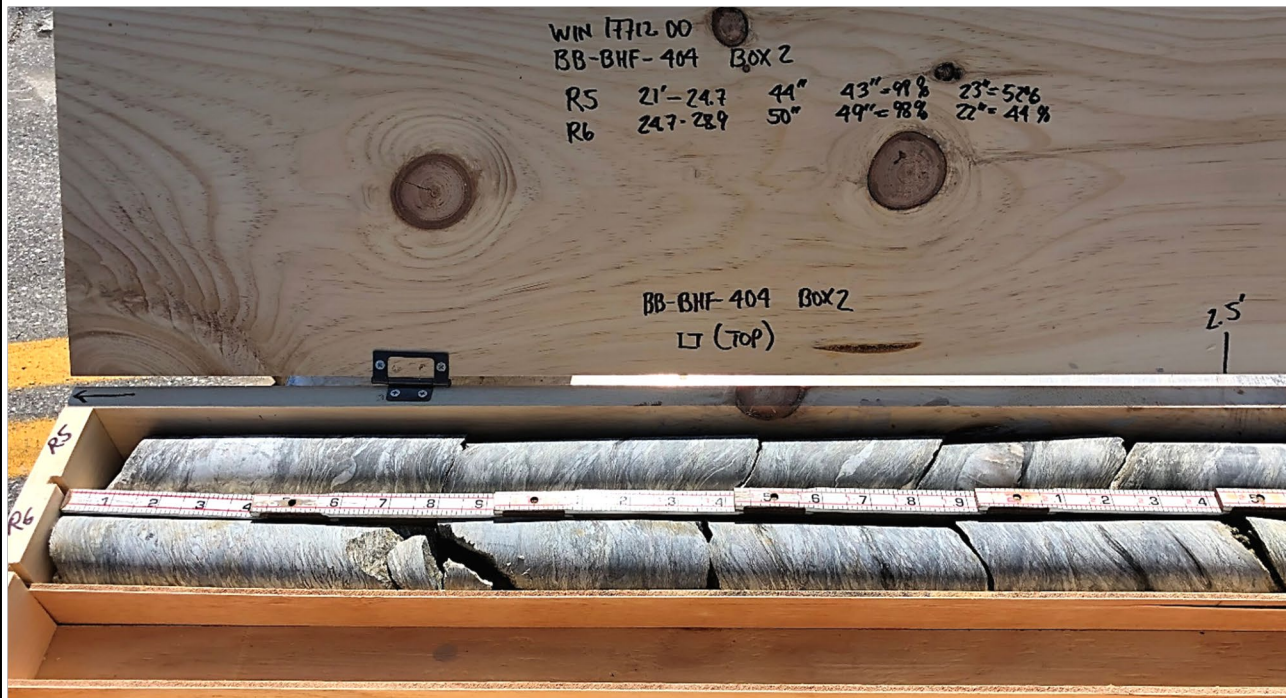


Core box containing dried core from test boring BB-BHF-404 (Box 1 of 2); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R2;
- 3) R3;
- 4) R4.

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:
19 of 23
 (-404, Box 1)



Core box containing dried core from test boring BB-BHF-404 (Box 2 of 2); left side of core box (top portion of cores).

Slots from top to bottom:

- 1) R5;
- 2) R6;
- 3) Empty;
- 4) Empty (not visible in photo).



Core box containing dried core from test boring BB-BHF-404 (Box 2 of 2); right side of core box (bottom portion of cores).

Slots from top to bottom:

- 1) R5;
- 2) R6;
- 3) Empty;
- 4) Empty (not visible in photo).

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00



Core box containing dried core from test boring BB-BHF-501 (Box 1 of 1); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R1;
- 2) R2;
- 3) Empty;
- 4) Empty (not visible in photo).



Core box containing dried core from test boring BB-BHF-501 (Box 1 of 1); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) R1 and top of R2;
- 2) R2;
- 3) Empty;
- 4) Empty (not visible in photo).



Core box containing dried core from test boring BB-BHF-502 (Box 1 of 1); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R1 and R2;
- 2) R5;
- 3) Empty;
- 4) Empty (not visible in photo).



Core box containing dried core from test boring BB-BHF-502 (Box 1 of 1); right side of core box (bottom portion of cores). Slots from top to bottom:

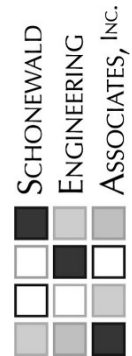
- 1) Bottom of R2 thru top of R5;
- 2) R5;
- 3) Empty;
- 4) Empty (not visible in photo).

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:

22 of 23

(-502, Box 1)



Core box containing dried core from test boring BB-BHF-503 (Box 1 of 1); left side of core box (top portion of cores). Slots from top to bottom:

- 1) R1 (boulders);
- 2) R4;
- 3) R5;
- 4) Empty.



Core box containing dried core from test boring BB-BHF-503 (Box 1 of 1); right side of core box (bottom portion of cores). Slots from top to bottom:

- 1) Bottom of R1 thru R3 (boulder, cobbles, and soil);
- 2) R4;
- 3) Empty;
- 4) Empty (not visible in photo).

CORE PHOTOGRAPHS
BRIDGE #5038
BLUE HILL FALLS BRIDGE OVER SALT POND OUTLET
BLUE HILL, MAINE
MAINEDOT WIN 17712.00

Sheet No.:

23 of 23

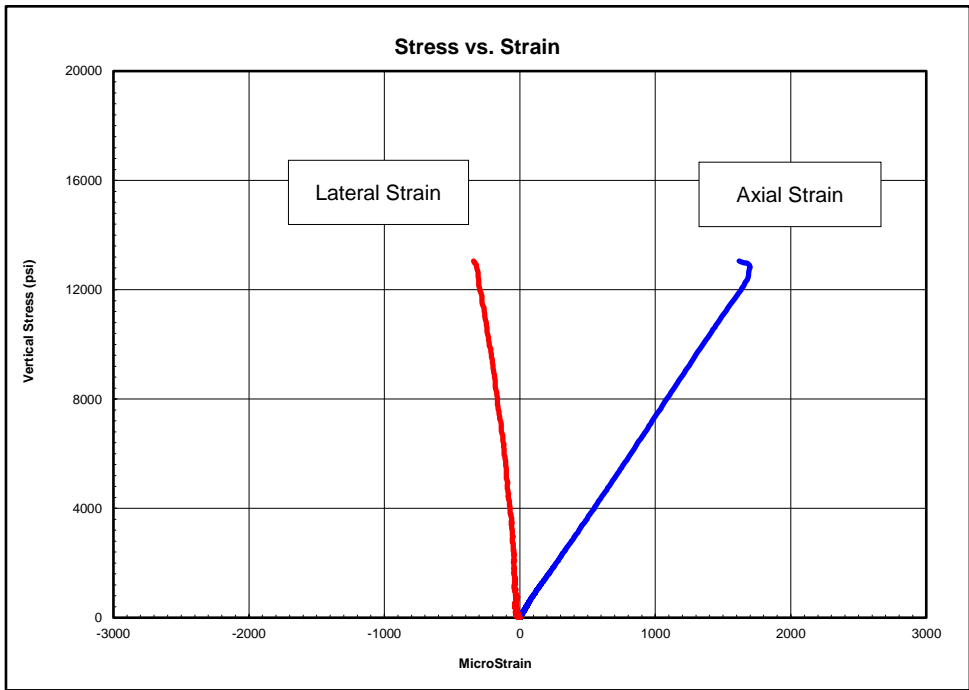
(-503, Box 1)

**RESULTS OF LABORATORY TESTS ON ROCK CORE SPECIMENS
FROM 500-SERIES BORINGS**



| | |
|---------------------|--|
| Client: | Schonewald Engineering Associates, Inc. |
| Project Name: | Blue Hill Falls Bridge |
| Project Location: | Blue Hills, ME |
| GTX #: | 313656 |
| Test Date: | 5/21/2021 |
| Tested By: | kdp |
| Checked By: | smd |
| Boring ID: | BB-BHF-501 |
| Sample ID: | R2 |
| Depth, ft: | 37.9-38.28 |
| Sample Type: | rock core |
| Sample Description: | See photographs Intact material and discontinuity failure |

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 13,049 psi

| Stress Range, psi | Young's Modulus, psi | Poisson's Ratio |
|-------------------|----------------------|-----------------|
| 1300-4800 | 7,170,000 | 0.11 |
| 4800-8300 | 7,490,000 | 0.19 |
| 8300-11700 | 7,370,000 | 0.24 |

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature. The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes. Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed. Calculations assume samples are isotropic, which is not necessarily the case.



| | | | |
|---------------------|--|-------------|-----------|
| Client: | Schonwald Engineering Associates, Inc. | Test Date: | 5/20/2021 |
| Project Name: | Blue Hill Falls Bridge | Tested By: | kdp |
| Project Location: | Blue Hills, ME | Checked By: | smd |
| GTX #: | 313656 | | |
| Boring ID: | BB-BHF-501 | | |
| Sample ID: | R2 | | |
| Depth: | 37.9-38.28 ft | | |
| Visual Description: | See photographs | | |

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

| BULK DENSITY | | | | Average | | DEVIATION FROM STRAIGHTNESS (Procedure S1) | |
|------------------------------------|---|---|--|---------|------|--|--|
| Specimen Length, in: | 1 | 2 | | 4.49 | 4.49 | Maximum gap between side of core and reference surface plate: Is the maximum gap \leq 0.02 in.? YES | |
| Specimen Diameter, in: | | | | 1.98 | 1.99 | Maximum difference must be < 0.020 in. Straightness Tolerance Met? YES | |
| Specimen Mass, g: | | | | 617.97 | | | |
| Bulk Density, lb/ft ³ : | | | | 169 | | | |
| Length to Diameter Ratio: | | | | 2.3 | | | |
| | | | | | | Minimum Diameter Tolerance Met? YES | |
| | | | | | | Length to Diameter Ratio Tolerance Met? YES | |

| END FLATNESS AND PARALLELISM (Procedure FP1) | | | | | | | | | | | | | | | |
|--|--|----------|----------|----------|----------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| END 1 | -0.875 | -0.750 | -0.625 | -0.500 | -0.375 | -0.250 | -0.125 | 0.000 | 0.125 | 0.250 | 0.375 | 0.500 | 0.625 | 0.750 | 0.875 |
| Diameter 1, in | -0.00060 | -0.00050 | -0.00040 | -0.00030 | -0.00020 | -0.00010 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00010 | 0.00010 | 0.00010 | 0.00020 |
| Diameter 2, in (rotated 90°) | -0.00010 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| | Difference between max and min readings, in: 0° = 0.00080 90° = 0.00010 | | | | | | | | | | | | | | |
| END 2 | -0.875 | -0.750 | -0.625 | -0.500 | -0.375 | -0.250 | -0.125 | 0.000 | 0.125 | 0.250 | 0.375 | 0.500 | 0.625 | 0.750 | 0.875 |
| Diameter 1, in | -0.00040 | -0.00030 | -0.00020 | -0.00010 | 0.00000 | 0.00010 | 0.00020 | 0.00030 | 0.00040 | 0.00050 | 0.00060 | 0.00070 | 0.00080 | 0.00090 | 0.00100 |
| Diameter 2, in (rotated 90°) | 0.00010 | 0.00010 | 0.00010 | 0.00010 | 0.00010 | 0.00010 | 0.00010 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| | Difference between max and min readings, in: 0° = 0.0006 90° = 0.0001 Maximum difference must be < 0.0020 in. Difference = \pm 0.00040 Flatness Tolerance Met? YES | | | | | | | | | | | | | | |

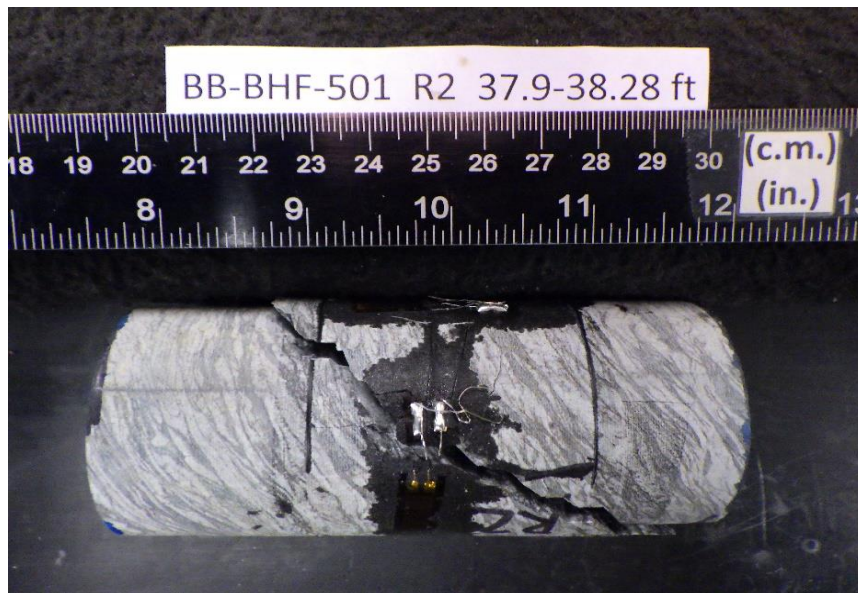
| | | |
|--|---|---|
| <p align="center">End 1 Diameter 1 $y = 0.00040x - 0.00011$</p> | <p align="center">End 1 Diameter 2 $y = 0.00002x - 0.00001$</p> | <p>DIAMETER 1</p> <p>End 1: Slope of Best Fit Line: 0.00040 Angle of Best Fit Line: 0.02308</p> <p>End 2: Slope of Best Fit Line: 0.00035 Angle of Best Fit Line: 0.01981</p> <p>Maximum Angular Difference: 0.00327</p> <p align="center">Parallelism Tolerance Met? YES Spherically Seated</p> |
| <p align="center">End 2 Diameter 1 $y = 0.00035x - 0.00004$</p> | <p align="center">End 2 Diameter 2 $y = -0.00008x + 0.00004$</p> | |

| PERPENDICULARITY (Procedure P1) | | | | | | (Calculated from End Flatness and Parallelism measurements above) | |
|---------------------------------|----------------|-------|---------|---------------------------------|---|---|--|
| END 1 | Diameter (in.) | Slope | Angle° | Perpendicularity Tolerance Met? | Maximum angle of departure must be \leq 0.25° | | |
| Diameter 1, in | 0.00080 | 1.985 | 0.00040 | 0.023 | YES | | |
| Diameter 2, in (rotated 90°) | 0.00010 | 1.985 | 0.00005 | 0.003 | YES | Perpendicularity Tolerance Met? YES | |
| END 2 | Diameter (in.) | Slope | Angle° | Perpendicularity Tolerance Met? | | | |
| Diameter 1, in | 0.00060 | 1.985 | 0.00030 | 0.017 | YES | | |
| Diameter 2, in (rotated 90°) | 0.00010 | 1.985 | 0.00005 | 0.003 | YES | | |

| | |
|-------------------|--|
| Client: | Schnowald Engineering Associates, Inc. |
| Project Name: | Blue Hill Falls Bridge |
| Project Location: | Blue Hills, ME |
| GTX #: | 313656 |
| Test Date: | 5/21/2021 |
| Tested By: | kdp |
| Checked By: | smd |
| Boring ID: | BB-BHF-501 |
| Sample ID: | R2 |
| Depth, ft: | 37.9-38.28 |



After cutting and grinding

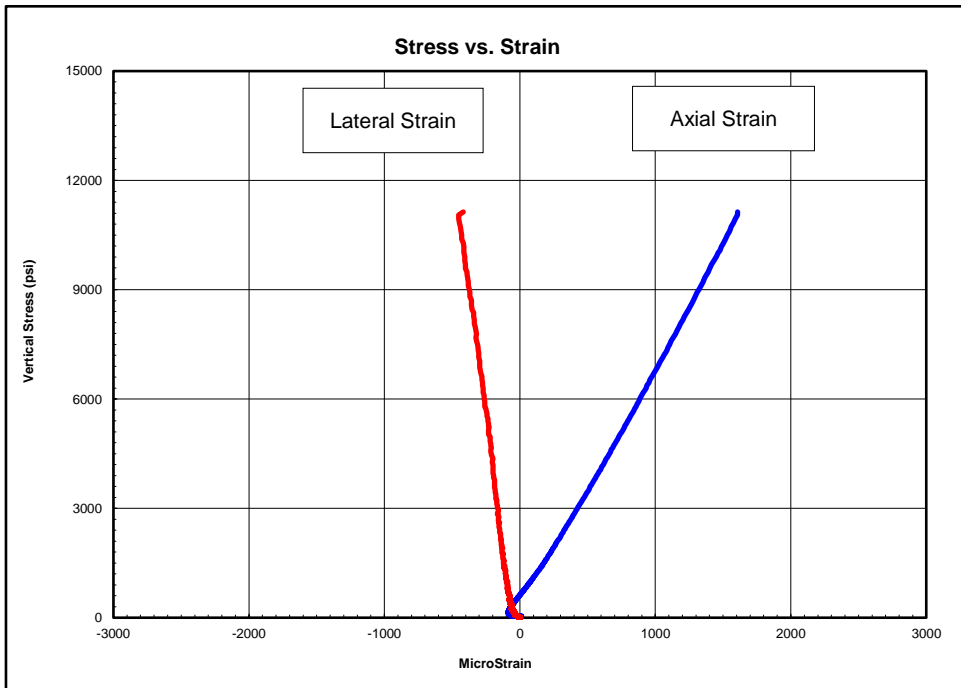


After break



| | |
|---------------------|--|
| Client: | Schonewald Engineering Associates, Inc. |
| Project Name: | Blue Hill Falls Bridge |
| Project Location: | Blue Hills, ME |
| GTX #: | 313656 |
| Test Date: | 5/21/2021 |
| Tested By: | kdp |
| Checked By: | smd |
| Boring ID: | BB-BHF-502 |
| Sample ID: | R5 |
| Depth, ft: | 39.97-40.35 |
| Sample Type: | rock core |
| Sample Description: | See photographs Intact material and discontinuity failure |

**Compressive Strength and Elastic Moduli of Rock
by ASTM D7012 - Method D**



Peak Compressive Stress: 11,877 psi

| Stress Range, psi | Young's Modulus, psi | Poisson's Ratio |
|-------------------|----------------------|-----------------|
| 1200-4400 | 6,090,000 | 0.19 |
| 4400-7500 | 6,730,000 | 0.24 |
| 7500-10700 | 7,030,000 | 0.28 |

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature. The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes. Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed. Calculations assume samples are isotropic, which is not necessarily the case.

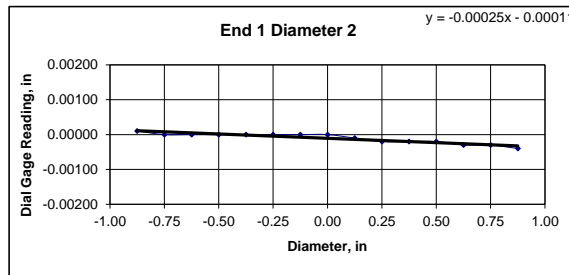
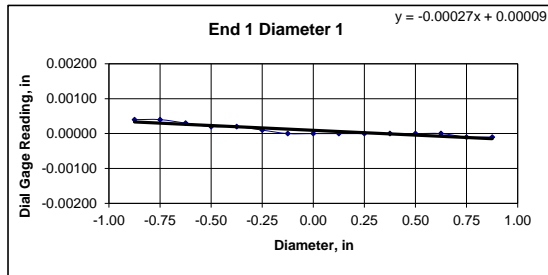


| | | | |
|---------------------|--|-------------|-----------|
| Client: | Schonwald Engineering Associates, Inc. | Test Date: | 5/20/2021 |
| Project Name: | Blue Hills Falls Bridge | Tested By: | kdp |
| Project Location: | Blue Hills, ME | Checked By: | smd |
| GTX #: | 313656 | | |
| Boring ID: | BB-BHF-502 | | |
| Sample ID: | R5 | | |
| Depth: | 39.97-40.35 ft | | |
| Visual Description: | See photographs | | |

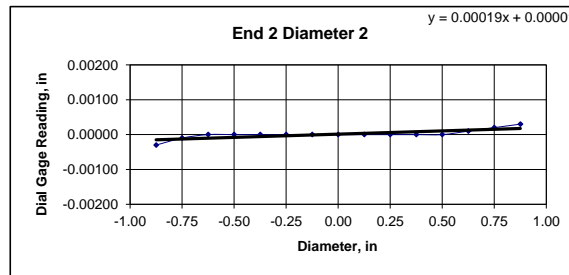
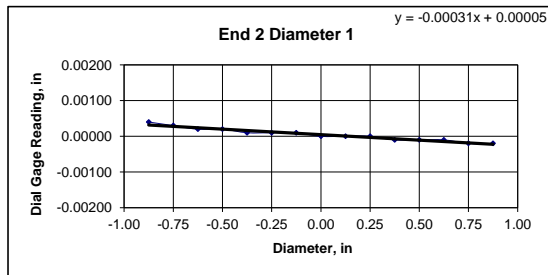
UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

| | | | | | | | |
|------------------------------------|--------|--|------------|---|--|--|--|
| BULK DENSITY | | | | DEVIATION FROM STRAIGHTNESS (Procedure S1) | | | |
| | 1 | 2 | Average | Maximum gap between side of core and reference surface plate: Is the maximum gap \leq 0.02 in.? YES | | | |
| Specimen Length, in: | 4.41 | 4.41 | 4.41 | Maximum difference must be < 0.020 in. Straightness Tolerance Met? YES | | | |
| Specimen Diameter, in: | 1.98 | 1.98 | 1.98 | | | | |
| Specimen Mass, g: | 607.54 | | | | | | |
| Bulk Density, lb/ft ³ : | 170 | | | | | | |
| Length to Diameter Ratio: | 2.2 | | | | | | |
| | | Minimum Diameter Tolerance Met? | YES | | | | |
| | | Length to Diameter Ratio Tolerance Met? | YES | | | | |

| | | | | | | | | | | | | | | | |
|---|--|----------|---------|---------|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|----------|
| END FLATNESS AND PARALLELISM (Procedure FP1) | | | | | | | | | | | | | | | |
| END 1 | -0.875 | -0.750 | -0.625 | -0.500 | -0.375 | -0.250 | -0.125 | 0.000 | 0.125 | 0.250 | 0.375 | 0.500 | 0.625 | 0.750 | 0.875 |
| Diameter 1, in | 0.00040 | 0.00040 | 0.00030 | 0.00020 | 0.00020 | 0.00010 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | -0.00010 | -0.00010 |
| Diameter 2, in (rotated 90°) | 0.00010 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | -0.00010 | -0.00020 | -0.00020 | -0.00030 | -0.00030 | -0.00030 | -0.00040 |
| | Difference between max and min readings, in: 0° = 0.00050 90° = 0.00050 | | | | | | | | | | | | | | |
| END 2 | -0.875 | -0.750 | -0.625 | -0.500 | -0.375 | -0.250 | -0.125 | 0.000 | 0.125 | 0.250 | 0.375 | 0.500 | 0.625 | 0.750 | 0.875 |
| Diameter 1, in | 0.00040 | 0.00030 | 0.00020 | 0.00020 | 0.00010 | 0.00010 | 0.00010 | 0.00000 | 0.00000 | 0.00000 | -0.00010 | -0.00010 | -0.00010 | -0.00020 | -0.00020 |
| Diameter 2, in (rotated 90°) | -0.00030 | -0.00010 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00010 | 0.00020 | 0.00030 |
| | Difference between max and min readings, in: 0° = 0.0006 90° = 0.0006 Maximum difference must be < 0.0020 in. Difference = \pm 0.00030 Flatness Tolerance Met? YES | | | | | | | | | | | | | | |



| | |
|-----------------------------------|--|
| DIAMETER 1 | |
| End 1: | Slope of Best Fit Line: 0.00027 Angle of Best Fit Line: 0.01572 |
| End 2: | Slope of Best Fit Line: 0.00031 Angle of Best Fit Line: 0.01768 |
| Maximum Angular Difference: | 0.00196 |
| Parallelism Tolerance Met? | YES |
| Spherically Seated | |



| | |
|-----------------------------------|--|
| DIAMETER 2 | |
| End 1: | Slope of Best Fit Line: 0.00025 Angle of Best Fit Line: 0.01424 |
| End 2: | Slope of Best Fit Line: 0.00019 Angle of Best Fit Line: 0.01064 |
| Maximum Angular Difference: | 0.00360 |
| Parallelism Tolerance Met? | YES |
| Spherically Seated | |

| | | | | | |
|--|---|----------------|---------|--------|---------------------------------|
| PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above) | | | | | |
| END 1 | Difference, Maximum and Minimum (in.) | Diameter (in.) | Slope | Angle° | Perpendicularity Tolerance Met? |
| Diameter 1, in | 0.00050 | 1.980 | 0.00025 | 0.014 | YES |
| Diameter 2, in (rotated 90°) | 0.00050 | 1.980 | 0.00025 | 0.014 | YES |
| | Maximum angle of departure must be \leq 0.25° Perpendicularity Tolerance Met? YES | | | | |
| END 2 | | | | | |
| Diameter 1, in | 0.00060 | 1.980 | 0.00030 | 0.017 | YES |
| Diameter 2, in (rotated 90°) | 0.00060 | 1.980 | 0.00030 | 0.017 | YES |

| | |
|-------------------|--|
| Client: | Schnowald Engineering Associates, Inc. |
| Project Name: | Blue Hill Falls Bridge |
| Project Location: | Blue Hills, ME |
| GTX #: | 313656 |
| Test Date: | 5/21/2021 |
| Tested By: | kdp |
| Checked By: | smd |
| Boring ID: | BB-BHF-502 |
| Sample ID: | R5 |
| Depth, ft: | 39.97-40.35 |



After cutting and grinding

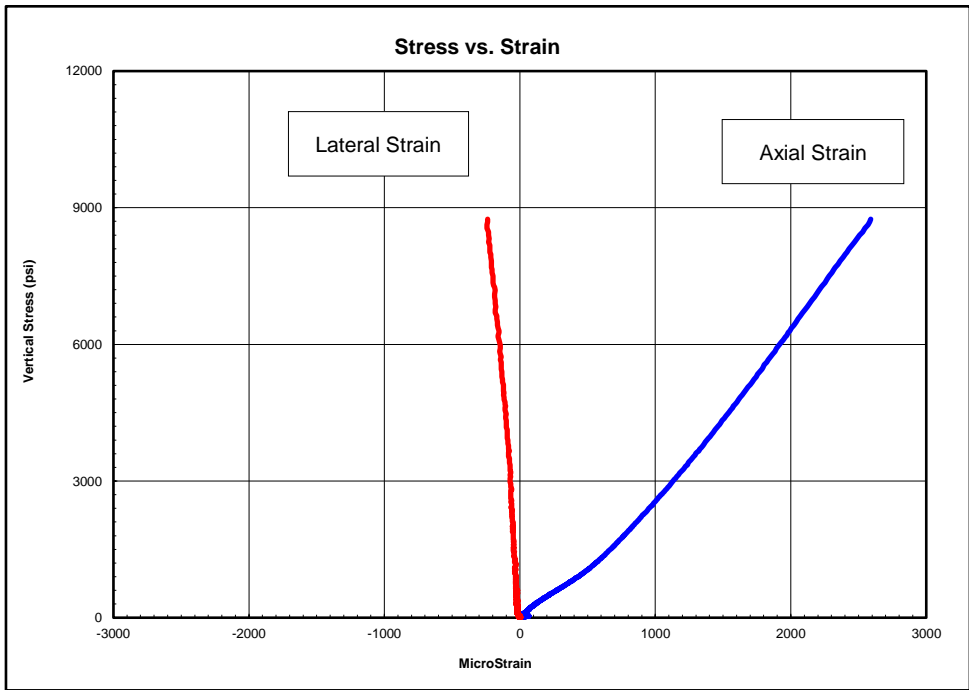


After break



| | |
|---------------------|--|
| Client: | Schonewald Engineering Associates, Inc. |
| Project Name: | Blue Hill Falls Bridge |
| Project Location: | Blue Hills, ME |
| GTX #: | 313656 |
| Test Date: | 5/21/2021 |
| Tested By: | kdp |
| Checked By: | smd |
| Boring ID: | BB-BHF-503 |
| Sample ID: | R4 |
| Depth, ft: | 20.28-20.66 |
| Sample Type: | rock core |
| Sample Description: | See photographs Intact material and discontinuity failure |

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 9,149 psi

| Stress Range, psi | Young's Modulus, psi | Poisson's Ratio |
|-------------------|----------------------|-----------------|
| 900-3400 | 3,060,000 | 0.06 |
| 3400-5800 | 3,840,000 | 0.11 |
| 5800-8200 | 4,100,000 | 0.14 |

Notes: Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature. The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes. Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed. Calculations assume samples are isotropic, which is not necessarily the case.



| | | | |
|---------------------|---|-------------|-----------|
| Client: | Schonewald Engineering Associates, Inc. | Test Date: | 5/20/2021 |
| Project Name: | Blue Hill Falls Bridge | Tested By: | kdp |
| Project Location: | Blue Hills, ME | Checked By: | smd |
| GTX #: | 313656 | | |
| Boring ID: | BB-BHF-503 | | |
| Sample ID: | R4 | | |
| Depth: | 20.28- 20.66 ft | | |
| Visual Description: | See photographs | | |

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

| | | | | | | | |
|------------------------------------|--------|--|------------|---|--|--|--|
| BULK DENSITY | | | | DEVIATION FROM STRAIGHTNESS (Procedure S1) | | | |
| | 1 | 2 | Average | Maximum gap between side of core and reference surface plate: Is the maximum gap \leq 0.02 in.? YES | | | |
| Specimen Length, in: | 4.37 | 4.37 | 4.37 | Maximum difference must be $<$ 0.020 in. Straightness Tolerance Met? YES | | | |
| Specimen Diameter, in: | 1.98 | 1.98 | 1.98 | | | | |
| Specimen Mass, g: | 592.26 | | | | | | |
| Bulk Density, lb/ft ³ : | 167 | | | | | | |
| Length to Diameter Ratio: | 2.2 | | | | | | |
| | | Minimum Diameter Tolerance Met? | YES | | | | |
| | | Length to Diameter Ratio Tolerance Met? | YES | | | | |

| | | | | | | | | | | | | | | | |
|---|--|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|
| END FLATNESS AND PARALLELISM (Procedure FP1) | | | | | | | | | | | | | | | |
| END 1 | -0.875 | -0.750 | -0.625 | -0.500 | -0.375 | -0.250 | -0.125 | 0.000 | 0.125 | 0.250 | 0.375 | 0.500 | 0.625 | 0.750 | 0.875 |
| Diameter 1, in | 0.00040 | 0.00030 | 0.00020 | 0.00020 | 0.00020 | 0.00020 | 0.00010 | 0.00000 | 0.00000 | -0.00010 | -0.00010 | -0.00030 | -0.00040 | -0.00060 | -0.00070 |
| Diameter 2, in (rotated 90°) | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| | Difference between max and min readings, in: 0° = 0.00110 90° = 0.00000 | | | | | | | | | | | | | | |
| END 2 | -0.875 | -0.750 | -0.625 | -0.500 | -0.375 | -0.250 | -0.125 | 0.000 | 0.125 | 0.250 | 0.375 | 0.500 | 0.625 | 0.750 | 0.875 |
| Diameter 1, in | 0.00060 | 0.00050 | 0.00040 | 0.00030 | 0.00020 | 0.00010 | 0.00000 | 0.00000 | 0.00000 | -0.00010 | -0.00020 | -0.00030 | -0.00040 | -0.00050 | -0.00050 |
| Diameter 2, in (rotated 90°) | -0.00010 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| | Difference between max and min readings, in: 0° = 0.0011 90° = 0.0001 Maximum difference must be $<$ 0.0020 in. Difference = \pm 0.00055 Flatness Tolerance Met? YES | | | | | | | | | | | | | | |

| | | |
|--|--|---|
| | | <p>DIAMETER 1</p> <p>End 1: Slope of Best Fit Line: 0.00056 Angle of Best Fit Line: 0.03225</p> <p>End 2: Slope of Best Fit Line: 0.00062 Angle of Best Fit Line: 0.03552</p> <p>Maximum Angular Difference: 0.00327</p> <p>Parallelism Tolerance Met? YES Spherically Seated</p> |
| | | |
| | | <p>DIAMETER 2</p> <p>End 1: Slope of Best Fit Line: 0.00000 Angle of Best Fit Line: 0.00000</p> <p>End 2: Slope of Best Fit Line: 0.00002 Angle of Best Fit Line: 0.00115</p> <p>Maximum Angular Difference: 0.00115</p> <p>Parallelism Tolerance Met? YES Spherically Seated</p> |

| | | | | | | | |
|--|---------------------------------------|----------------|---------|--------|---------------------------------|---|--|
| PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above) | | | | | | Maximum angle of departure must be \leq 0.25° | |
| END 1 | Difference, Maximum and Minimum (in.) | Diameter (in.) | Slope | Angle° | Perpendicularity Tolerance Met? | | |
| Diameter 1, in | 0.00110 | 1.980 | 0.00056 | 0.032 | YES | | |
| Diameter 2, in (rotated 90°) | 0.00000 | 1.980 | 0.00000 | 0.000 | YES | Perpendicularity Tolerance Met? YES | |
| END 2 | | | | | | | |
| Diameter 1, in | 0.00110 | 1.980 | 0.00056 | 0.032 | YES | | |
| Diameter 2, in (rotated 90°) | 0.00010 | 1.980 | 0.00005 | 0.003 | YES | | |

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|-------------------|--|
| Client: | Schnowald Engineering Associates, Inc. |
| Project Name: | Blue Hill Falls Bridge |
| Project Location: | Blue Hills, ME |
| GTX #: | 313656 |
| Test Date: | 5/21/2021 |
| Tested By: | kdp |
| Checked By: | smd |
| Boring ID: | BB-BHF-503 |
| Sample ID: | R4 |
| Depth, ft: | 20.28-20.66 |



After cutting and grinding



After break