SANBORN HEAD

Geotechnical Engineering Report

11 RANDOLPH ROAD

Randolph, Massachusetts

Prepared for Bluewater Property Group

File No. 5425.00

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EXECUTIVE SUMMARY

This geotechnical engineering report has been prepared for the proposed 120,000 square-feet warehouse project located at 11 Randolph Road in Randolph, Massachusetts (the Site). The Site location is shown on the Locus Plan on Figure 1.

This report includes relevant subsurface information obtained by Sanborn Head in September and October 2022 and provides recommendations for foundation design, retaining wall design, and earthwork procedures for use during Site work.

The key findings of our report are as follows:

- We recommend that the proposed warehouse buildings be supported by conventional spread footings bearing on the existing natural, inorganic, granular soil, or new compacted structural fill placed over the existing natural soil or bedrock. Foundation design recommendations are provided in Section 5.0 of this report.

- Fills on the order of 16 feet and cuts up to 24 feet are expected to achieve the proposed finished grade.

- Bedrock excavation by blasting and/or mechanical methods (i.e. hoe-ramming) may be necessary to efficiently remove bedrock within the proposed warehouse building footprint and pavement areas including deeper utilities at the western and southwestern portions of the Site. The excavated bedrock is expected to be suitable for reuse as Blast Rock Fill and Processed Rock Fill (Choke Stone) as well as base course and other materials, provided the rock is processed to meet the gradation requirements as specified in Table 1.

- Where bedrock is removed below the proposed slab (to a depth of 5 feet below proposed finished floor), we recommend perimeter drains be installed to intercept, collect and convey groundwater that may become perched on top of the bedrock surface.

1.0 INTRODUCTION

This geotechnical engineering report has been prepared for the proposed warehouse building development project located at 11 Randolph Road in Randolph, Massachusetts. The objectives of our work were to assess the subsurface conditions in the proposed development area and provide geotechnical engineering recommendations related to the design of building foundations and retaining walls, as well as recommended earthwork procedures for the site work. This report is subject to the limitations in Appendix A.

1.1 Site Description

The Site primarily consists of undeveloped, wooded uplands surrounded by multiple lowland wetland areas. The entrance to the Site, off of existing Randolph Road, has been partially cleared and used for equipment storage. The existing topography varies significantly with multiple on-Site hills and wetland areas. High elevation areas are located at the southwest and southern areas of the Site, with a maximum on-Site elevation of approximately elevation (El.) 155 feet; the topography slopes down to between approximate El. 120 feet towards the western wetland area and El. 110 feet towards the northern and eastern wetland areas.

Referenced elevations are based an existing conditions plan prepared by DiPrete Engineering, dated October 11, 2022, and reproduced on Figure 2. Elevations in the report reference the North American Vertical Datum of 1988 (NAVD88).

1.2 Project Description

Based on the current provided information, it is our understanding that the proposed project consists of a 120,000 square-feet warehouse with a finished floor elevation (FFE) of El. 133.5 feet, associated surface parking, loading dock areas, retaining walls, and stormwater management features. Based on the preliminary proposed grading, this will require up to 16 feet of fill placement and up to 24 feet of cut into existing soil and/or bedrock. We note that future Site development changes may adjust the FFE and/or maximum cut depths and fill heights.

The proposed structure locations are shown on a Site layout plan prepared by DiPrete Engineering, dated October 11, 2022, and reproduced on Figure 2.

2.0 SUBSURFACE EXPLORATION PROGRAM

2.1 Geotechnical and Stormwater Test Pits

Between September 7 and October 20, 2022, Commonwealth Construction & Utilities, Inc. of Watertown, Massachusetts, excavated eighteen (18) geotechnical test pits (designated SH-TP-1 through SH-TP-18) and eleven (11) stormwater test pits (designated SW-TP-1 through SW-TP-12 ; SW-TP-7 was omitted due to accessibility constraints) at the Site. The test pits were advanced under the observation of Sanborn Head to depths ranging between approximately 1.5 and 15.0 feet below ground surface (bgs).

The test pits were observed and logged by Sanborn Head personnel on a full-time basis. The encountered soils were classified using the Modified Burmister System for the geotechnical test

pits (SH-TP series), and the United States Department of Agriculture (USDA) Textural Classification System for the stormwater test pits (SW-TP series). Logs of the stormwater test pits were prepared by a Soil Evaluator certified in Massachusetts from Sanborn Head. Both geotechnical and stormwater test pit logs and are included in Appendix B. The locations of the test pits are shown on Figure 2.

2.2 Geotechnical Test Borings

Between September 19 and October 3, 2022, G&M Subsurface, LLC of North Dighton, Massachusetts, advanced thirteen (13) test borings (designated SH-1 through SH-12; SH-11 was omitted due to accessibility) at the Site. The test borings were advanced using hollow-stem auger, drive and wash, and rock core drilling methods under the observation of Sanborn Head to depths ranging between approximately 2.5 and 23.5 feet bgs. Bedrock core samples (NX size) were collected from test boring SH-5A, where bedrock was encountered and significant building and parking lot area cuts are anticipated. Test borings SH-8 through SH-12 were completed as 'rock probes' for the purpose of observing depth of rock information at various locations throughout the Site; therefore, no sampling occurred at these locations, and only approximate soil stratigraphy and depths were recorded.

With the exception of SH-8 through SH-12 as noted above, Standard Penetration Tests (SPTs) were completed and split-spoon soil samples were obtained in general accordance with ASTM International Standard D1586.

The test borings were observed and logged by Sanborn Head personnel on a full-time basis. Soil samples were field classified based on visual estimates of grain size distribution and plasticity. Additional soil characteristics such as density and consistency (based on Standard Penetration Test data), color and moisture were noted on the logs included in Appendix B. Soil samples were classified using the Modified Burmister System and a legend is also provided in Appendix B that describes the classification system. The locations of the test borings are shown on Figure 2.

2.3 Locations

The locations of explorations observed by Sanborn Head were located in the field using a Global Positioning System (GPS) receiver. Ground surface elevations were estimated from topographic contours on the plan prepared by DiPrete Engineering. The locations of the subsurface explorations should be considered accurate to the degree implied by the method used.

3.0 GEOTECHNICAL LABORATORY TESTING

To evaluate the engineering properties of the soils at the Site, eight (8) soil samples of the natural glacial till from test pits across the Site were submitted to a geotechnical laboratory for grain size distribution (sieve) analysis in accordance with ASTM D6913. Of these samples, six (6) samples were also submitted for USDA Textural Classification which included hydrometer testing in accordance with ASTM D7928. Additionally, two (2) samples were submitted for Proctor Compaction (Method C – Modified Proctor) (ASTMD1557). The soil laboratory tests were completed by GeoTesting Express, Inc. of Acton, MA and copies of the laboratory reports are included in Appendix C.

4.0 SUBSURFACE CONDITIONS

In general, the soil stratigraphy of the Site consists of organic topsoil and subsoil, overlying glacial till, overlying competent bedrock. It should be noted that multiple large boulders/glacial erratics (as large as 6 feet in diameter) were observed at or near the ground surface throughout the Site.

The following paragraphs provide a general description of the subsurface conditions observed within the explorations. The subsurface conditions encountered at individual explorations are summarized on the exploration logs provided in Appendix B.

4.1 Topsoil and Subsoil

Organic topsoil typically 2 to 10 inches thick was observed at the existing ground surface throughout the Site. The topsoil typically consists of dark brown, fine to coarse sand with little silt, trace to little gravel, and varying amounts of organic particles/fragments. Thicker topsoil was commonly observed near the wetland areas at the northeastern portion of the Site (SW-TP-1 through SW-TP-3, SW-TP-6, SW-TP-8, and SW-TP-12) up to 2.5 feet bgs.

Below the topsoil strata an approximately 0.6 to 4.2 feet thick subsoil layer was observed, typically consisting of light brown, fine to coarse sand with some to little silt, trace to little gravel, trace cobbles, trace boulders, and varying amounts of root matter.

4.2 Sand Layer

Below the topsoil strata in test pit SH-TP-1, an approximately 13.0-feet thick layer of sand was encountered within a lowland area of the Site. The material consists of tan, fine to coarse sand with little silt, little gravel, trace cobbles, and trace boulders (the quantity of which increased with depth).

4.3 Glacial Till

Natural glacial till was generally observed below topsoil and subsoil throughout the upland areas of the Site. The glacial till typically consists of tan, fine to coarse sand with some to little gravel, little to some silt, and varying quantities of cobbles and boulders ranging from 1 to 6 feet in diameter. SPT N-values for encountered natural glacial till typically range from 32 to greater than 100, indicating the material is generally dense to very dense.

4.4 Bedrock

During explorations, competent bedrock was encountered across the Site from 1.5 to 18.5 feet bgs (corresponding to approximately El. 108.5 feet to El. 149.0 feet and generally sloping from southwest radially to the north and east). Based on the bedrock coring completed at SH-5A, the bedrock generally consists of hard, moderately weathered, gray, fine- to medium-grained Diorite with moderate fracturing. According to the USGS Geology of the Conterminous United States, bedrock in this area is expected to be comprised of Dedham Granite and Diorite.

It should be anticipated that the actual bedrock surface undulates, and the top of bedrock surface may vary over short distances at highlighted by bedrock elevation data collected at SH-5, SH-5A, SH-5B, SH-8 and SH-TP-13 located in the western corner of the proposed building.

4.5 Groundwater

Groundwater was generally not encountered during the subsurface exploration program, with the exception of SW-TP-9 and SW-TP-10 where groundwater was observed at 3.0 and 7.7 feet bgs (corresponding to approximately 3 to 6 inches above the top of bedrock), respectively. At explorations SW-TP-1, SW-TP-2, SW-TP-5, and SH-7 slight redoximorphic features were observed. These observations are interpreted as evidence of seasonal high groundwater (SHGW) in SW-TP-1, SW-TP-5, and SH-7 at approximately 1-foot above competent bedrock; however, the observation at SW-TP-2 is not interpreted as evidence of SHGW, but rather a discontinuity in hydraulic conductivity at the interface of subsoil and glacial till lenses. Consequently, due to the undulating ground surface and underlying bedrock, groundwater elevations are highly variable across the Site and presumed to be at or near the top of bedrock. Groundwater appears to flow downhill towards the surrounding wetlands to the north/east/southeast along the bedrock slope.

It should be noted that groundwater levels will vary based on seasonal fluctuations in precipitation, and conditions during construction may differ from the time the groundwater measurements were made.

5.0 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

The following paragraphs present our geotechnical engineering recommendations related to design of proposed building foundations, the floor slab-on-grade, and retaining walls, and earthwork procedures for subgrade preparation. Our recommendations are based on the proposed Site plan prepared by DiPrete Engineering, dated October 11, 2022.

5.1 Engineering Evaluation of Subsurface Conditions

The following paragraphs provide our engineering evaluation of subsurface conditions and their impact on design and construction:

- ***Building Foundations*** – We recommend that the proposed warehouse building be supported by conventional spread footings bearing on the existing natural, inorganic, granular soil, or new compacted Structural Fill placed over the natural soil or bedrock. To limit the potential for differential settlement, the proposed warehouse buildings should not be supported by a combination of footings bearing directly on bedrock and footings bearing on soil. A minimum 12-inch-thick compacted soil cushion should be placed immediately below proposed footing and above the top of bedrock.

- ***Unsuitable Organic Soils*** – Organic topsoil and subsoil containing organic matter such as tree roots, tree stumps, buried topsoil/peat, and vegetation debris, should be considered unsuitable material below the proposed warehouse building, floor slabs and pavement areas. Topsoil and subsoil containing roots should be removed down to a subgrade consisting of inorganic, granular soil. Topsoil and subsoil containing less than 5 percent

organic material may be re-used deeper than 10 feet below finished grade in parking areas, provided it is also located outside the limits of the zone of influence for footings for buildings and retaining walls, and stormwater infiltration areas. Other organic soils may be re-used in proposed landscaped areas or hauled off-site.

- ***Bedrock Excavation***– A large volume of bedrock excavation, as well as surficial boulders is anticipated for this project. Bedrock excavation is expected to construct the proposed southwestern portion of the proposed building and parking areas and the northwestern stormwater basin.

  Excavation of weathered bedrock can likely be completed with conventional excavation equipment. However, in the deeper cut areas, blasting will be required for efficient excavation of competent bedrock. Bedrock should be removed to at least 5 feet below the proposed slab finished floor elevation, and at least 12 inches below the bottom of footings, pavement sections, retaining walls, and proposed invert elevations for utility pipes. Refer to Figure 3 for the anticipated depths and elevations of the top of weathered bedrock and competent bedrock.

  Blasting operations in Massachusetts are regulated by the Massachusetts Fire Safety Code (527 CMR 1.00) which requires, but is not limited to: pre-blast surveys, preparation of a blasting plan, performing the work within regulatory limits for vibration and overpressure (noise), field monitoring of same using seismographs, and maintaining logs of the drilling and blasting work. You should assume that a blasting permit will be required from the City of Randolph Fire Department. The design of the Blasting Plan will need to consider the proximity of the residential areas to the south and existing buildings to the north, as well as any sensitive receptors nearby.

- ***Processed Rock for Reuse***– Due to the presence and quantity of boulders (including large glacial erratics) and large volume of bedrock removal, we recommend processing excavated rock materials on-site to avoid (or reduce) the need to import select materials for base course material. The excavated bedrock/boulders could be used as fill material provided it is processed/sized to meet the Material Specifications in Table 1.

- ***Reuse of Excavated Soil as Compacted Fill*** – To limit the need to ship materials off-site and maintain the project cut-fill balance, excavated soils that meet the material specifications in Table 1 for Structural Fill may be reused as compacted fill below the base course layer in building and pavement areas. Excavated soils may be amended with processed rock to meet material specifications. Excavated materials that meet the material specifications in Table 1 for Common Fill may be reused as compacted fill below the base course in pavement areas.

- ***Subgrade Preparation and Compaction During Construction*** – The on-site material has variable sand and silt content. Where the silt content is high, the soil will be sensitive to moisture, difficult to compact when wet, and likely to become unstable when subject to repetitive loads from construction activities. As such, we recommend that a 3- to 4-inch-

thick layer of compacted ¾-inch Crushed Stone be placed below footing areas to protect the subgrade from disturbance during construction.

5.2 Building Foundation Design

5.2.1 Spread Footing Design

We recommend that the proposed warehouse buildings be supported by spread footings bearing on Structural Fill or natural, inorganic glacial till, as defined herein. Spread footings for the proposed warehouse buildings should be proportioned based on a net allowable bearing pressure of 4 kips per square foot (ksf).

The footings should bear on either a subgrade consisting of proof-compacted natural, inorganic, granular soil, or Structural Fill compacted to 95 percent of its maximum dry density as determined by ASTM D1557, Method C (Modified Proctor) placed over bedrock or the natural, inorganic granular subgrade. Structural Fill is defined as Processed Rock Fill, On-Site Fill, Granular Fill, or Gravel Fill as specified in Table 1.

Continuous wall footings should be at least 24 inches wide and individual column footings should be at least 36 inches wide. The granular subgrade is considered frost susceptible, and as such, the bearing surface of spread footings in areas exposed to freezing temperatures should be at least 4 feet below finished exterior grade for frost protection. Interior footings, in areas not exposed to freezing temperatures, should be founded at least 2 feet below finished floor grade, while also providing at least 12 inches of cover between finished grade and the top of footing, whichever is deeper.

It is estimated that foundations constructed in accordance with the recommendations presented herein will undergo total post-construction settlement of less than 1-inch. Post-construction differential settlement between column footings is estimated to be less than ½-inch, but will depend on the live load distribution and location.

5.2.2 Slab-on-Grade Design

The proposed warehouse building floor slab should be designed as a slab-on-grade bearing on at least six (6) inches of base course that meets the material specifications for Gravel Fill as specified in Table 1. The base course material should be compacted to at least 95 percent of its maximum dry density as determined by ASTM D1557, Method C (Modified Proctor). If the earthwork recommendations herein are followed, a modulus of subgrade reaction of at least 150 pounds per cubic inch (pci) should be achieved. Insulation and a subslab vapor barrier should be then installed as required by the building code.

5.2.3 Seismic Design Criteria

For seismic design of the proposed buildings, it is recommended that the site be classified as Seismic Site Class “C” as defined in the Massachusetts State Building Code, 9th Edition. Table 1604.11 of the state code provides earthquake response accelerations for the maximum considered earthquake for each town in Massachusetts.

For the Town of Randolph, Massachusetts the earthquake response accelerations are Ss of 0.198 and S1 of 0.066. The recommended design spectral response accelerations are SDS = 0.172 and SD1 = 0.066. In addition, it is our opinion that soils at the site are not susceptible to liquefaction.

5.2.4 Lateral Earth Pressures

Below grade walls restrained from rotation, with a horizontal backfill surface, and no groundwater should be designed based on an "at-rest" lateral earth pressure of 60 pounds per cubic foot (pcf).

Below grade walls which are unrestrained at the top and allowed to rotate at least 0.002 times the height of the wall may be designed based on an "active" lateral earth pressure of 40 pcf. Below grade walls should also be designed to resist lateral earth pressure from a seismic event as required by Section 1605.3.1 of the Massachusetts State Building Code.

A coefficient of friction of 0.50 is recommended for cast-in-place concrete on granular soil. This should be considered an ultimate strength value, and an appropriate factor of safety should be applied for the sliding analysis.

5.2.5 Foundation Drains

Provided that bedrock is removed at least 5 feet below the proposed slab finished floor elevation, we do not consider subslab drains to be necessary; however, we recommend that perimeter foundation drains be installed adjacent to exterior footings to control perched groundwater that may be present on top of the bedrock during wet periods of the year. The foundation drains should consist of 4-inch diameter perforated pipe surrounded by at least 12 inches of ¾-inch Crushed Stone wrapped with non-woven geotextile as specified in the project Material Specification (Table 1).

5.3 Slope Design

5.3.1 Cut and Fill Slope Design

We recommend that cut and fill slopes be designed with a slope angle of two and a half horizontal to one vertical (2.5H:1V), or flatter if the slope face is to be seeded to establish vegetative cover. Vegetative cover should be established on the slope surface as soon as practical after final grading to reduce erosion and the potential for sloughing failures. Cut or fill slopes steeper than 2.5H:1V should be stabilized with Riprap at least 18 inches thick, underlain by Geotextile for Riprap as specified in Table 1. Slope angles steeper than 1.5H:1V in soil are not recommended. Inboard slopes of stormwater basins should be graded to a slope angle of 3H:1V, or flatter and seeded to establish vegetative cover.

Where excavations can be sloped, they should be sloped in accordance with Occupational Safety and Health Administration (OSHA) requirements for a Class "C' soil, which can be cut at a maximum of one vertical to one and one-half horizonal (1V:1.5H), up to a maximum excavation depth of 20 feet. These recommendations assume no surcharge loads (i.e., stockpiles,

construction equipment, etc.) at the top of the excavations or seepage (e.g., cuts below the groundwater table).

5.3.2 Bedrock Cut Design

For bedrock cut slopes, we recommend that the bedrock face be sloped at a 1H:6V slope angle. The bedrock slope face should be pre-spilt to control the location of the slope face. As bedrock removal progresses, the bedrock face should be cleaned using an appropriate sized excavator to remove loose and fractured bedrock from the top and face of the cut slope. During excavation, the bedrock cut will be evaluated by the project geotechnical engineer, or their representative for overall stability and additional efforts to stabilize localized areas of fractured bedrock. A typical bedrock rock cut detail, including setbacks for soil removal at the crest and rock fall zone at the toe, is shown on Figure 4.

Surface water swales or curbing should be provided at the crest of soil cut and fill slopes to intercept and divert runoff from the slope face. Additionally, a drain and swale should be constructed at the base of the proposed bedrock cut face to intercept groundwater that may become perched on the bedrock.

5.3.3 Stormwater Basin Construction

It is our recommendation that constructed berms/embankments (currently proposed for the eastern portion of the stormwater basin) should include a low permeability core to successfully retain impounded stormwater. It should be noted that based on the subsurface conditions observed in our field exploration program (i.e., glacial till with major granular constituents), it is not expected that the existing site materials would be considered "low permeability," therefore, the importing of low permeability soils should be budgeted.

5.4 Site Retaining Wall Design

We anticipate that segmental retaining walls can be used for the proposed retaining walls in fill areas to support roadway construction, and as an alternative to steep slopes. Retaining walls greater than 4 feet in height are required to be designed by a registered Professional Engineer licensed to practice in Massachusetts.

A segmental retaining wall system consists of a mortarless block face fastened to geogrid that extends into the granular backfill to create a zone of reinforced earth, which together behaves as a gravity wall. Geogrid elements typically extend behind the wall approximately 0.7 times the height of the wall for level backfill and approximately 0.7 to 0.9 times the height of the wall for sloping backfill. Segmental retaining walls are not designed to withstand hydrostatic pressure (water buildup) behind the wall and surface runoff should be diverted away from the retaining wall area. Drains and weepholes should be provided behind the retaining wall faces. Foundation drains should be installed behind the retaining walls in accordance with manufacturer's recommendations. The drains should discharge to the ground surface adjacent to the retaining walls or to an on-site stormwater management system. Maintaining adequate drainage behind retaining walls is critical to their long-term performance. We should be provided the opportunity for a technical review of the retaining wall drawings when they become available.

5.4.1 Segmental Retaining Walls

Site retaining walls in proposed fill areas may be constructed as segmental walls with geogrid reinforcement in the backfill zone. We recommend that segmental retaining walls be designed based on the following criteria:

Material	Moist Unit Weight (pcf)	Internal Friction Angle (degrees)	Cohesion (psf)
Reinforced Fill (Engineered Fill)	130	35	0
Retained Soil (On-Site Soil)	125	32	0
Foundation Soil (On-Site Soil)	125	32	0
Backfill Slope Angle Behind Wall – 2H:1V or flatter. Traffic Surcharge Design Load Behind Wall – 250 psf Min. Factor of Safety Against Overturning – 2.0 Min. Factor of Safety Against Sliding – 1.5 Min. Factor of Safety Against Geogrid Tensile Overstress – 1.5 Min. Factor of Safety Against Geogrid Pullout from Soil – 1.5 Seismic Design Load – Per Massachusetts State Building Code. Net Allowable Soil Bearing Pressure – Not to exceed 4,000 psf			

5.5 Construction Recommendations and Earthwork Procedures

5.5.1 Blasting Requirements

Bedrock excavation by blasting may be necessary for efficient removal of bedrock. We recommend that bedrock be excavated to at least 2 feet below proposed finished grade in pavement areas. Where subslab utilities are anticipated, bedrock should be excavated to at least 5 feet below proposed finished floor elevation in building areas to allow subsequent installation of subslab utilities.

Blasting operations in Massachusetts are regulated by the Massachusetts Fire Safety Code (527 CMR 1.00) which requires, but is not limited to: pre-blast surveys, preparation of a blasting plan, performing the work within regulatory limits for vibration and overpressure (noise), field monitoring of same using seismographs, and maintaining logs of the drilling and blasting work. You should assume that a blasting permit will be required from the City of Randolph Fire Department. The design of the Blasting Plan will need to consider the proximity of the residential areas to the south and existing buildings to the north, as well as any sensitive receptors nearby.

To the extent practical, blasting should be completed prior to the construction of the building foundations, finishes, and retaining walls so as to limit vibration of the proposed structures. Blasting should not be conducted within 7 days after concrete has been poured, unless approved by the Engineer.

Competent bedrock is expected to be suitable for making crushed stone products if an on-site crushing operation were to be used. Blasted competent bedrock could be processed to make base course materials to be used directly below asphalt pavement and the interior building

floor slab, plus stone fill for stabilization of soil cut slopes. Processing bedrock on-site would avoid (or at least reduce) the need to import select materials for base course material.

5.5.2 Building Area and Footing Subgrade Preparation During Construction

The following paragraphs describe the recommended earthwork procedures for preparation of the building areas and footing subgrades during construction.

- In proposed building areas, the surface should be cleared of vegetation and grubbed, and existing unsuitable topsoil, subsoil containing roots, and buried topsoil/peat should be removed down to a natural, inorganic soil subgrade to a distance of 10 feet beyond the building lines and outside of the zone of influence of the footings in deeper fill areas. The zone of influence is defined as the area projecting downward and outward from the bottom of footing at a one horizontal to one vertical (1H:1V) slope angle.

- After removal of surface materials and prior to placing new fill, the exposed natural soil subgrade should be proof-compacted with at least 6 passes of a 10-ton smooth drum vibratory roller under the observation of a qualified geotechnical engineer, or their representative. Any soft or loose zones identified by the proof compaction should be evaluated by excavation and replaced with compacted fill as necessary. Proof compaction may be waived by the project geotechnical engineer in the field if, in their opinion, the proof compaction will cause disturbance to the subgrade.

- Any areas of existing fill within the proposed building footprint should be removed down to a natural, inorganic soil subgrade. Prior to placing new fill, the exposed soil subgrade should be proof-compacted with at least 6 passes of a 10-ton smooth drum vibratory roller under the observation of a qualified geotechnical engineer, or their representative. Proof compaction may be waived by the project geotechnical engineer in the field if, in their opinion, the proof compaction will cause disturbance to the subgrade.

- Where bedrock is encountered at proposed footing locations, it should be removed to at least 12 inches below the proposed bottom of footing and backfilled up to the underside of the footing using compacted Structural Fill, or a cushion of ¾-inch Crushed Stone compacted until firm and stable in the opinion of the Geotechnical Engineer in the field.

- If boulders or blasted rock fragments are encountered within the soil at subgrade elevation for any footings, the boulders/rock shall be removed with care so as not to excessively disturb the surrounding soils, any disturbed soils shall be removed and the area shall be backfilled with compacted Structural Fill.

- Where additional fill is necessary to achieve the proposed grades in proposed building areas, Structural Fill should be spread in loose lifts not exceeding 12 inches thick and compacted to 95 percent of its maximum dry density as determined by ASTM D1557, Method C (Modified Proctor). If weather conditions are favorable, glacial till that meets the specifications for On-Site Fill may be used as compacted fill in the building area provided the compaction requirements above can be achieved; otherwise, we anticipate processed

rock materials from on-Site or off-Site sources may be needed to continue earthwork during periods of inclement weather and/or seasons with frequent freeze-thaw cycles.

- Footings should be excavated to expose a subgrade consisting of natural inorganic soils, or compacted Structural Fill placed as described above. To stabilize the soil subgrade in footing areas during construction, we recommend that footing areas be over-excavated by 3 to 4 inches and backfilled up to the bottom of footing elevation with ¾-inch Crushed Stone and compacted until visually firm and stable. Material specifications for ¾-inch Crushed Stone are provided in Table 1. Crushed Stone should be compacted with at least 6 passes of a hand operated vibratory plate compactor with a dynamic weight of at least 1,000 pounds, or equivalent effort.

- Fill should not be placed, and footings should not be constructed, over a subgrade with standing water or that is frozen. If there is standing water on the subgrade, the water should be removed from the surface and any soft and yielding soils should be removed or allowed to dry prior to placement of additional fill or concrete. If the subgrade is frozen, the soil that is frozen should be removed, or thawed and recompacted, prior to placement of fill or concrete.

5.5.3 Subsurface Utility Construction

It is anticipated that bedrock excavation in trenches will be required to install deeper utilities in portions of the site. It is recommended that bedrock be removed to at least 12 inches below the proposed invert of utility pipe, and that utilities be backfilled with bedding material as specified on the site plans by others. Fill placed within five (5) feet horizontally of proposed utilities should consist of On-Site Fill, Gravel Fill, Granular Fill, or Processed Rock Fill in order to facilitate excavation during installation. Blast Rock Fill should not be used within 5 feet horizontally of proposed utilities for ease of construction and protection of the installed pipe(s).

5.5.4 Temporary Dewatering

Temporary excavation dewatering in excavations during periods of heavy precipitation or snow melt may be needed. Temporary dewatering should be performed as needed so that the earthwork, utility construction, and foundation construction is completed in the dry. We anticipate that dewatering may be accomplished by pumping from filtered sumps installed in low points of the excavations. Discharge water should be managed in accordance with local, state and federal government requirements and the requirements of the project-specific stormwater pollution prevention plan (SWPPP).

6.0 CONSTRUCTION MONITORING

We recommend that Sanborn Head be provided the opportunity to review the design plans and specifications to see that the recommendations of this report have been properly incorporated. We further recommend that we be retained during site work to observe earthwork operations and blasting, perform quality control testing on compacted fill, observe foundation subgrade preparation and retaining wall construction, and assist in the development of design changes should subsurface conditions differ from those anticipated prior to the start of construction.

Table

TABLE 1
MATERIAL SPECIFICATIONS
11 Randolph Road
Randolph, Massachusetts

Structural Fill to be used for general raises in grade below the building and pavement areas and shall consist of Gravel Fill, Granular Fill, On-Site Fill, or Processed Rock Fill, as described below:

Gravel Fill to be used as the base course layer beneath the interior floor slab-on-grade, base course layer below pavement, as backfill behind reinforced concrete retaining walls, and as backfill against foundation walls shall be free from ice and snow, roots, surface coatings, sod, loam, clay, rubbish, and other deleterious or organic matter, and shall conform to the gradation requirements for MassDOT Item M1.03.1, Gravel Borrow, Type B, reproduced from the MassDOT Specifications, latest edition, as follows:

Sieve Size	Percent Passing by Weight
3 inch	100
1-1/2 inch	70-100
3/4 inch	50-85
No. 4	30-60
No. 200	0-10

Granular Fill imported fill to be used for general raise-in-grade in proposed building and pavement areas shall be free from ice, snow, roots, surface coatings, sod, loam, clay, rubbish, and other deleterious matter, and shall be well-graded within the following gradation requirements:

Sieve Size	Percent Passing by Weight
4 inch	100
No. 4	30-90
No. 40	10-50
No. 200	0-12

On-Site Fill to be used for general raise-in-grade in proposed building, pavement, and landscape areas shall consist of natural inorganic soil from on-site sources free of ice, snow, roots, surface coatings, sod, loam, clay, debris and other deleterious material and shall meet the following gradation requirements:

Sieve Size	Percent Passing by Weight
6 inch	100
No. 4	30-90
No. 40	10-60
No. 200	0-35

Processed Rock Fill (Choke Stone) to be used for general raise-in-grade in proposed building and pavement areas as the first later of fill over the surface of compacted Blast Rock Fill to limit the migration of soil particles down into the Blast Rock Fill. Processed Rock Fill shall be well-graded rock fragments that were crushed on-site from blasted material or from reprocessing existing boulders and/or blast rock fill. Processed Rock Fill shall meet these gradation requirements:

Sieve Size	Percent Passing by Weight
6 inch	100
1-1/2 inch	70-100
3/4 inch	50-85
No. 4	30-60
No. 200	0-10

Common Fill to be used for general raise-in-grade fill in proposed pavement areas more than 3 feet below finished and landscaped areas shall consist of inorganic soil from on-site cut areas with a maximum particle size of 8 inches and less than 50 percent passing the No. 200 sieve. The material shall be free from ice, snow, roots, surface coatings, sod, loam, clay, rubbish, and other organics or deleterious matter (i.e. plastic, metal, foam insulation, rubber).

Base Course for Pavement (Subbase) to be used as the base course layer directly beneath the asphalt binder course in pavement areas shall conform to the material and gradation requirements for one of the following MassDOT Items in MassDOT Specifications, latest edition: Dense Graded Crushed Stone (Item M2.01.7), Processed Gravel for Subbase (Item M1.03.1), or Reclaimed Pavement Borrow Material (Item M1.09.0). The gradation requirements are reproduced as follows:

Sieve Size	Percent Passing By Weight		
	Item M2.01.7	Item M1.03.1	M1.09.0
3 inch	---	100	100
2 inch	100	---	---
1-1/2 inch	70-100	70-100	70-100
3/4 inch	50-85	50-85	50-85
No. 4	30-55	30-60	30-60
No. 50	8-24	---	8-24
No. 200	3-10	0-10	0-10

Crushed Stone to be used to stabilize footing subgrades, as drainage stone around perforated pipe, and as specified on the Drawings shall consist of hard durable processed crushed stone that meets the requirements for MassDOT Item M2.01.4, in MassDOT Specifications, latest edition. The gradation requirements are reproduced as follows:

Sieve Size	Percent Passing By Weight			
	1/2 Inch Stone	3/4 Inch Stone	1-1/2 Inch Stone	4-Inch Stone
6 inch	---	---	---	100
4 inch	---	---	---	25-90
2 inch	---	---	100	---
1-1/2 inch	---	---	95-100	0-10
1 inch	---	100	35-70	---
3/4 inch	---	90-100	0-25	---
5/8 inch	100	---	---	---
1/2 inch	85-100	10-50	---	---
3/8 inch	15-45	0-20	---	---
No. 4	0-15	0-5	---	---
No. 8	0-5	---	---	---

Blast Rock Fill shall be well-graded blasted rock formed and processed when on-site rock is removed by blasting or chipping methods, with a maximum size no larger than eighteen (18") inches (in maximum lift thickness of 24 to 30 inches). Well-graded means that at least thirty percent (30%) is less than twelve inches (12") in size, and at least ten percent (10%) is less than three inches (3") in size. The Contractor shall vary drilling and blasting procedures, select materials sources and/or use mechanical means such as a hoe ram to reduce fragment sizes in order to meet these gradation requirements.

Blast Rock Fill may be placed to within 32 inches of finish grade in pavement and landscaped areas and to within eighteen inches (18") of inverts or utility lines. The first lift over the top of Blast Rock Fill shall be a Choke Stone layer 12 inches thick which shall be a well-graded mixture with a maximum stone size less than 3 inches. Compaction shall be by minimum of 10 passes of a D-8 bulldozer or no fewer than 6 passes of a self-propelled vibratory drum roller in each direction (i.e., north-south and east-west). The minimum dynamic load applied by the roller shall be twenty five thousand pounds (25,000 lbs.).

Blast Rock Fill shall not be placed within a five foot (5') horizontal distance on either side of any proposed utility line. The intent is to leave a zone of Structural Fill that can later be excavated for installation of utilities. Also, large rock fragments should be kept away from the utility pipes.

Riprap shall consist of sound, durable, angular shaped stones, free from structural defects with approximately one reasonably flat side for the top surface that meets the material specifications for Stone for Pipe Ends, MassDOT Item M2.02.3. Each stone shall weigh not less than 50 pounds and at least 75 percent of the volume shall consist of stones weighing not less than 500 pounds each. The remainder of the stones shall be so graded that when placed with the larger stones the entire mass will be compact.

Bedding Sand to be used as bedding around underground utilities and as specified on the Drawings shall consist of a hard durable sand and shall be free from ice and snow, roots, sod and other deleterious matter. Sand shall conform to the material and gradation requirements for Sand Borrow, Type B, MassDOT Item M1.04.0 in MassDOT Specifications. The gradation requirements are reproduced as follows:

Sieve Size	Percent Passing by Weight
3/8 inch	100
No. 200	0-10

Perimeter Foundation Drain:

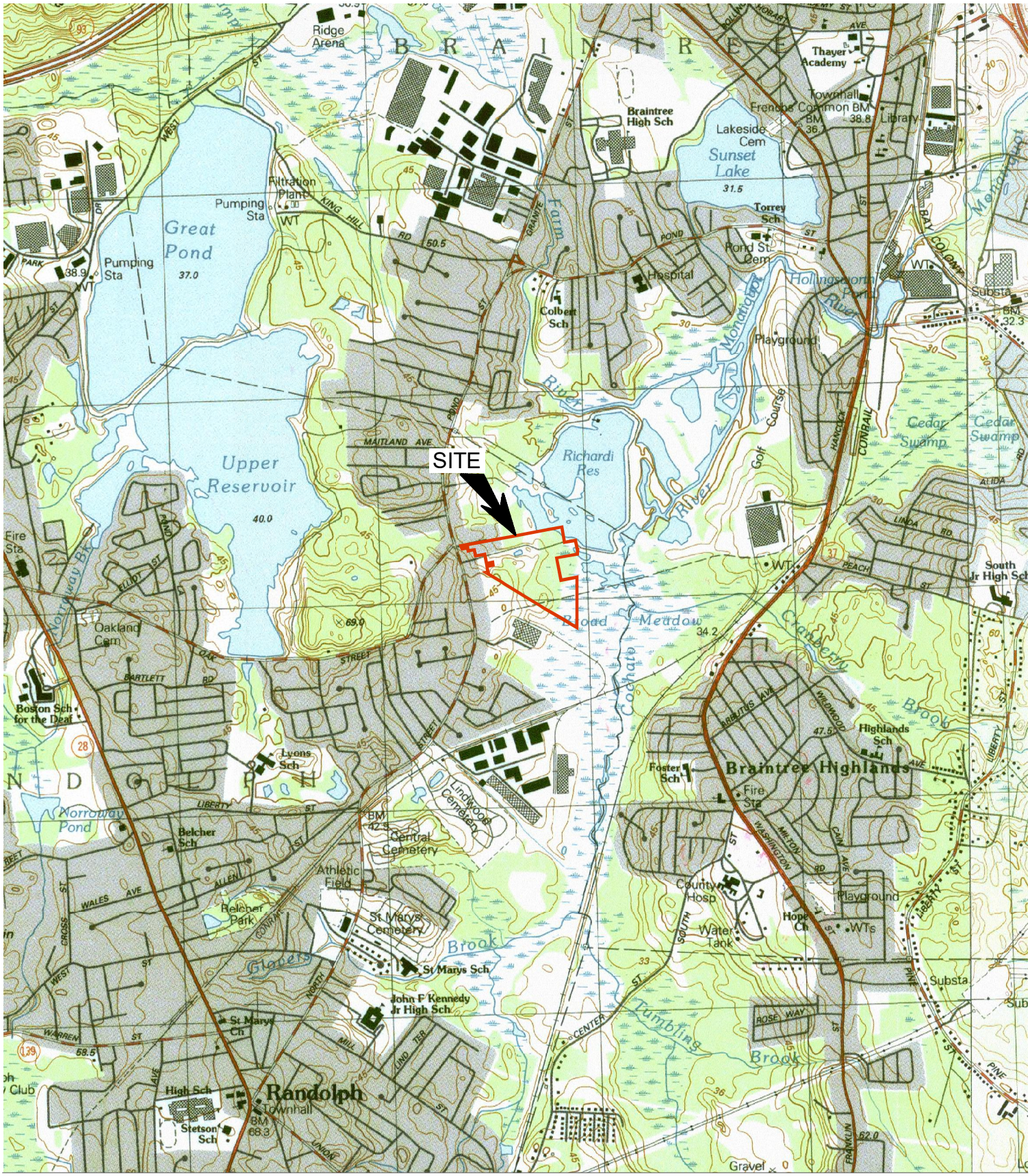
Perforated Pipe for 4-inch diameter perimeter foundation drains shall consist of perforated Schedule 40 polyvinyl chloride (PVC) plastic pipe. The perforations shall be ¼-inch in diameter and spaced 90 degrees apart radially and 6 inches apart axially. The pipe shall meet the material specifications set forth in ASTM D1785-91, Standard Specification for PVC Plastic Pipe, Schedules 40, 80 and 120. Alternatively, perforated pipe may consist of a double-walled high density corrugated pipe perforated on all sides (120 degrees radially) such as ADS N-12 or equivalent.

Geotextiles for Buildings and Roadways:

Geotextile shall consist of a non-woven polypropylene fabric having a Puncture Resistance (ASTM D4833) of at least 65 pounds, a Permittivity (ASTM D4491) of at least 130 gal/min/sf, and an Apparent Opening Size (ASTM D4751) of 0.15 to 0.22 millimeters such as Mirafi 140N, or Contech C-40NW, or approved equivalent.

Geotextile for Riprap shall consist of a non-woven polypropylene fabric with a Puncture Resistance (ASTM D4833) of at least 110 pounds and an Apparent Opening Size (ASTM D4751) of 0.22 millimeters, or less, such as Mirafi 180N, or Contech C-80NW, or approved equivalent.

Figures



NOTES:
Base map was taken from the "Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Information Technology Division"
7.5 minute USGS Quadrangle Maps: Randolph, MA, REV: 1998

Drawn By: D. Dombrowsky
Designed By: J. McCarthy
Reviewed By: L. Williams
Project No: 5425.00
Date: November 2022

SCALE: 1:25,000

SANBORN HEAD

Figure 1

Locus Plan

Geotechnical Engineering Services

11 Randolph Road
Randolph, Massachusetts

NOTES:

1. THE BASE MAP AND PROPOSED SITE FEATURE WERE DRAWN FROM A PLAN TITLED, "2954-003-PRAP-DATA-20230425-EXPORT", PREPARED BY DIPRETE ENGINEERING OF CRANSTON, RHODE ISLAND, RECEIVED ON 5/3/2023.
2. BORINGS DESIGNATED SH-1 THROUGH SH-12 WERE ADVANCED BY G&M SUBSURFACE, LLC OF NORTH DIGHTON, MA AND OBSERVED BY SANBORN HEAD ON SEPTEMBER 19 THROUGH OCTOBER 3, 2022.
3. STORMWATER AND GEOTECHNICAL TEST PITS DESIGNATED SW-TP-1 THROUGH SW-TP-6, SW-TP-8 THROUGH SW-TP-12 AND SH-TP-1 THROUGH SH-TP-18 WERE EXCAVATED BY COMMONWEALTH CONSTRUCTION & UTILITIES, INC. OF WATERTOWN, MA AND OBSERVED BY SANBORN HEAD BETWEEN SEPTEMBER 7 AND OCTOBER 20, 2022.
4. APPROXIMATE LOCATIONS OF EXPLORATIONS WERE MARKED IN THE FIELD USING A GLOBAL POSITIONING SYSTEM (GPS) RECEIVER AND SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

LEGEND:

- APPROXIMATE SITE BOUNDARY
- SH-1 — APPROXIMATE LOCATION AND DESIGNATION OF BORING OBSERVED BY SANBORN HEAD (SEPTEMBER 2022)
- SH-TP-1 — APPROXIMATE LOCATION AND DESIGNATION OF GEOTECHNICAL TEST PIT OBSERVED BY SANBORN HEAD (SEPTEMBER AND OCTOBER 2022)
- SW-TP-1 — APPROXIMATE LOCATION AND DESIGNATION OF STORMWATER TEST PIT OBSERVED BY SANBORN HEAD (SEPTEMBER AND OCTOBER 2022)

SANBORN HEAD

GRAPHICAL SCALE
100' 50' 0' 100' 200'

NO.	DATE	DESCRIPTION	BY
1	5/5/2023	UPDATED BASEMAP / SITE FEATURES	JTM

DRAWN BY: D. DOMBROWSKY
DESIGNED BY: J. MCCARTHY
REVIEWED BY: L. WILLIAMS
PROJECT MGR: L. WILLIAMS
PIC: L. NORTON
DATE: NOVEMBER 2022

GEOTECHNICAL ENGINEERING SERVICES
11 RANDOLPH ROAD
RANDOLPH, MASSACHUSETTS

EXPLORATION LOCATION PLAN

PROJECT NUMBER: 5425.00

FIGURE NUMBER: 2

NOTES:

1. THE BASE MAP AND PROPOSED SITE FEATURE WERE DRAWN FROM A PLAN TITLED, "2954-003-PRAP-DATA-20230425-EXPORT", PREPARED BY DIPRETE ENGINEERING OF CRANSTON, RHODE ISLAND, RECEIVED ON 5/3/2023.
2. BORINGS DESIGNATED SH-1 THROUGH SH-12 WERE ADVANCED BY G&M SUBSURFACE, LLC OF NORTH DIGHTON, MA AND OBSERVED BY SANBORN HEAD ON SEPTEMBER 19 THROUGH OCTOBER 3, 2022
3. STORMWATER AND GEOTECHNICAL TEST PITS DESIGNATED SW-TP-1 THROUGH SW-TP-6, SW-TP-8 THROUGH SW-TP-12 AND SH-TP-1 THROUGH SH-TP-18 WERE EXCAVATED BY COMMONWEALTH CONSTRUCTION & UTILITIES, INC. OF WATERTOWN, MA AND OBSERVED BY SANBORN HEAD BETWEEN SEPTEMBER 7 AND OCTOBER 20, 2022.
4. APPROXIMATE LOCATIONS OF EXPLORATIONS WERE MARKED IN THE FIELD USING A GLOBAL POSITIONING SYSTEM (GPS) RECEIVER AND SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
5. APPROXIMATE TOP OF BEDROCK CONTOURS ARE BASED ON ONE INTERPOLATION OF THE AVAILABLE SUBSURFACE DATA. THE TOP OF BEDROCK CONTOURS ARE BASED ON WIDELY SPACED EXPLORATIONS AND ACTUAL CONDITIONS SHOULD BE EXPECTED TO VARY FROM THIS PLAN. OTHER INTERPRETATIONS OF THE SUBSURFACE DATA ARE POSSIBLE.

LEGEND:

	APPROXIMATE SITE BOUNDARY
SH-1	APPROXIMATE LOCATION AND DESIGNATION OF BORING OBSERVED BY SANBORN HEAD (SEPTEMBER 2022)
SH-TP-1	APPROXIMATE LOCATION AND DESIGNATION OF GEOTECHNICAL TEST PIT OBSERVED BY SANBORN HEAD (SEPTEMBER AND OCTOBER 2022)
SW-TP-1	APPROXIMATE LOCATION AND DESIGNATION OF STORMWATER TEST PIT OBSERVED BY SANBORN HEAD (SEPTEMBER AND OCTOBER 2022)
[113]	ESTIMATED TOP OF BEDROCK ELEVATION (FT.)
120	APPROXIMATE BEDROCK ELEVATION CONTOUR

SANBORN HEAD

GRAPHICAL SCALE
50' 25' 0' 50' 100'

NO.	DATE	DESCRIPTION	BY
1	5/5/2023	UPDATED BASEMAP / SITE FEATURES	JTM

DRAWN BY: D. DOMBROWSKY
DESIGNED BY: J. MCCARTHY
REVIEWED BY: L. WILLIAMS
PROJECT MGR: L. WILLIAMS
PIC: L. NORTON
DATE: NOVEMBER 2022

GEOTECHNICAL ENGINEERING SERVICES
11 RANDOLPH ROAD
RANDOLPH, MASSACHUSETTS

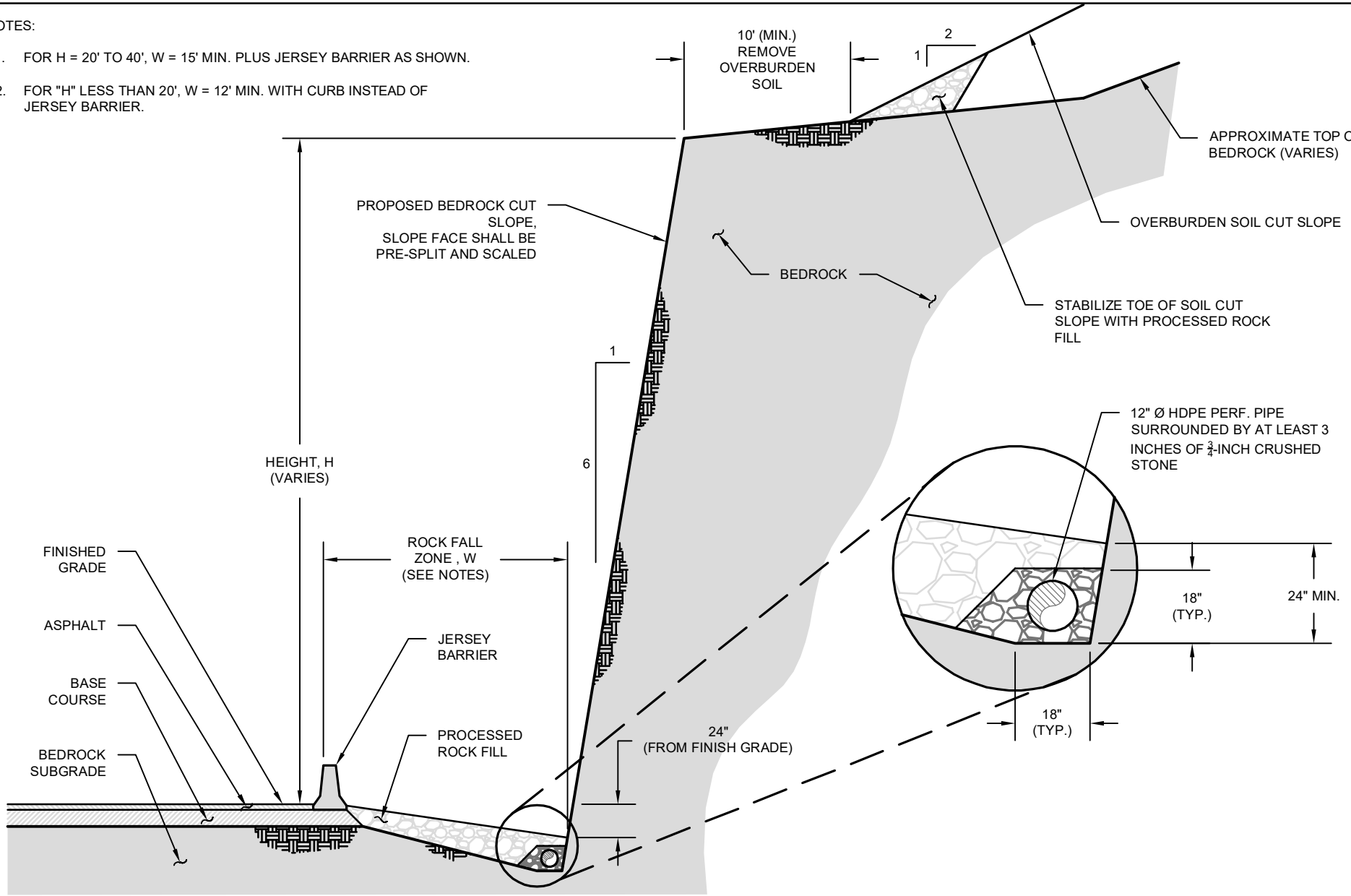
PRELIMINARY
BEDROCK SURFACE PLAN

PROJECT NUMBER: 5425.00

FIGURE NUMBER: 3

NOTES:

1. FOR H = 20' TO 40', W = 15' MIN. PLUS JERSEY BARRIER AS SHOWN.
2. FOR "H" LESS THAN 20', W = 12' MIN. WITH CURB INSTEAD OF JERSEY BARRIER.



TYPICAL BEDROCK CUT SLOPE DETAIL

NOT TO SCALE

SANBORN HEAD

DRAWN BY:	D. DOMBROWSKY
DESIGNED BY:	J. MCCARTHY
REVIEWED BY:	L. WILLIAMS
PROJECT MGR:	L. WILLIAMS
PIC:	L. NORTON
DATE:	NOVEMBER 2022

GEOTECHNICAL ENGINEERING SERVICES
11 RANDOLPH ROAD
RANDOLPH, MASSACHUSETTS

TYPICAL BEDROCK CUT
SLOPE DETAIL

PROJECT NUMBER: 5425.00

SHEET NUMBER: 4

FILE:P:\5400s\5425.00\Graphics Files\CADGT-NOV22\GT Fig SLOPE DET.dwg
LAYOUT: FIG4
USER: ddombrowsky
PLOT DATE: 11-10-22 6:03 AM

Appendix A

Limitations

APPENDIX A
LIMITATIONS

Explorations

1. The analyses, recommendations, and design submitted in this report are based in part on the data obtained from subsurface explorations by Sanborn Head. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.
2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and have been developed by interpretation of widely spaced explorations and samples; actual soil transitions may be more or less gradual than indicated. For specific information, refer to the test boring logs.
3. Water level readings have been made in the drill holes at the times and under the conditions stated on the exploration logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from those occurring at the time measurements were made.

Review

4. In the event that any changes in the nature, design, or location of the proposed water storage tank are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of the report modified or verified in writing by Sanborn Head.

Construction

5. It is recommended that this firm be retained to provide soil engineering services during the excavation and earthwork construction phases of the work. This is to observe compliance with the design concepts, specifications, or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Report

6. This report has been prepared for the exclusive use of Bluewater Property Group for the proposed warehouse building at 11 Randolph Road in Randolph, Massachusetts, in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.
7. This geotechnical engineering report has been prepared for this project by Sanborn Head for design purposes only. Contractors using this report to prepare a bid for site work, acknowledge that its scope is limited to design considerations only.

Appendix B

Subsurface Exploration Logs

Description and Classification of Soil

1. Density or Consistency: The density or consistency of a soil sample is based on the Standard Penetration Test N-value according to the following table:

Density of Granular Soil	SPT N-Value		Consistency of Cohesive Soil
Very Loose	0-4	<2	Very Soft
Loose	5-10	2-4	Soft
Medium Dense	11-30	5-8	Medium Stiff
Dense	31-50	9-15	Stiff
Very Dense	>50	16-30	Very Stiff
		>30	Hard

The Standard Penetration Resistance, or N-value in blows per foot, is the sum of the blows recorded over the second and third 6-inch interval.

A number followed by "/3" indicates the distance that the sampler advanced. For example "100/4" indicates that 100 blows of a 140 pound hammer falling 30 inches advanced the sampler 4 inches. "WOR/24" indicates the weight of the drilling rods without the hammer caused the sampler to advance 24 inches.

"WOH" indicates the static weight of the 140 pound hammer and the drilling rods attached to the split spoon sampler were sufficient to cause the sampler to advance.

"WOR" indicates the static weight of the drilling rods attached to the split spoon sampler was sufficient to cause the sampler to advance.

2. Color: The color of a soil sample is based on visual observation.

3. Soil Components

A. Description: The components of a soil sample are described by visually estimating the percentage of each component by weight of the total sample using a Modified Burmister System.

i. Major Component: The major soil component is written with upper case letters for granular soil (e.g., SAND, GRAVEL) and a combination of upper and lower case letters for fine grained soil (e.g., Silty CLAY, Clayey SILT).

ii. Minor Component: The minor soil components are written with the first letter of each soil type in upper case, and the remaining letters in lower case (e.g., Gravel, Silt). The minor components are identified and prefaced in the description based on the following percentages:

Preface	Percentage
and	35-50
some	20-35
little	10-20
trace	0-10

iii. Note: The actual percentages of gravel soil may differ from that measured when sampling with a standard split spoon sampler because of the relatively small sampler diameter. Also, it is not possible to identify the presence of boulders and cobbles using a standard split spoon sampler.

B. Definitions

i. Granular Soil: A granular soil sample is defined by the following particle sizes as referenced to a standard sieve:

Material	Description	Standard Sieve Limit	
		Upper	Lower
Boulders	C-sized	--	36 inch
	B-sized	36 inch	24 inch
	A-sized	24 inch	12 inch
Cobbles	--	12 inch	3 inch
Gravel	coarse	3 inch	3/4 inch
	fine	3/4 inch	No. 4
Sand	coarse	No. 4	No. 10
	medium	No. 10	No. 40
	fine	No. 40	No. 200

ii. Fine Grained Soil: The degree of plasticity of fine-grained soils is defined as follows:

Material	Degree of Plasticity	Plasticity Index (PI)	Smallest Thread Diameter (in.)
SILT	Non-Plastic	0	None
Clayey SILT	Slight	1 to 5	1/4
SILT & CLAY	Low	5 to 10	1/8
CLAY & SILT	Medium	10 to 20	1/16
Silty CLAY	High	20 to 40	1/32
CLAY	Very High	40+	1/64

iii. Organic Soil: An organic soil sample is classified by observation of the sample structure as follows:

Material	Description
TOPSOIL	Surficial soils that support plant life and which contain organic matter.
SUBSOIL	Soil underlying the topsoil which may contain roots or plant fibers.
PEAT	Deposits of plant remains in which the original plant fibers or root structure are visible.
ORGANIC SILT	Deposit of plant remains in which the original plant fibers or root structure have decomposed.

iv. Non-Soil Constituents: Non-soil constituents (artificial or anthropogenic material, organic materials, cobbles and boulders) are described as follows:

The following terminology is used to denote size ranges of non-soil constituents such as man-made objects or fill material:

Descriptive Term	Size Range	Comparative Term
Specks	< No. 200 Sieve	Silt and Clay fines
Particles	No. 200 Sieve to No. 4 Sieve	Sand
Fragments	No. 4 Sieve to 3 in.	Gravel
Pieces	3 in. to 12 in.	Cobbles
Blocks	> 12 in.	Boulders

The following terminology is used to describe the frequency that a non-soil constituent is observed by estimating the percentage of the constituent by weight of the total sample:

Descriptor	Percentage
very few	0-5
few	5-10
common	10-20
frequent	20-35
numerous	35-50

4. Moisture Content: The moisture content of a soil sample is based on the observable presence of water according to the following table:

Dry	Moisture is not apparent, dusty.
Moist	No visible water.
Wet	Visible free water.

5. Other Pertinent Characteristics: Pertinent characteristics observed in a soil sample should be noted according to the following table:

Soil Structure Produced by Deposition of Sediments	
Stratified	Random soil deposits of varying components of color.
Varved	Alternating soil deposits of varying thickness (i.e., clays or silts).
Stratum	Soil deposit > 12 inches thick.
Layer	Soil deposit 3 inches to 12 inches thick.
Seam	Soil deposit 1/8 inch to 3 inches thick.
Parting/Lens	Soil deposit <1/8 inch thick.

Description and Classification of Bedrock

Rock descriptions indicated on the test boring logs are based on visual-manual observation of the rock core samples obtained. Rock core is generally described and classified as illustrated in the following example:

> Hard to Very Hard[1], slightly weathered[2], grey-green[3], fine grained[4], RHYOLITE[5]; with joints[6] spaced 4 to 12" apart and dipping[6] from near horizontal to approximately 60°, open crack[6] in core at 14.4', moderately fractured[7].
> RQD = 58%.[8]

1. HARDNESS

VERY HARD:	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of a geologist's pick.
HARD:	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
MODERATELY HARD:	Can be scratched with knife or pick. Gauges or grooves to ¼-inch deep can be excavated by hard blow or a geologist's pick. Hand specimens can be detached by moderate blow.
MEDIUM HARD:	Can be grooved or gauged 1/16-inch deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-inch maximum size by hard blows of the point of a geologist's pick.
SOFT:	Can be gauged or grooved readily with knife of pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
VERY SOFT:	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-inch or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail. Can often be indented with moderate finger pressure.

2. WEATHERING CHARACTERISTICS:

COMPLETELY WEATHERED:	Rock reduced to soil. Rock "fabric" not discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.
VERY SEVERELY WEATHERED:	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
SEVERELY WEATHERED:	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. Some fragments of strong rock are usually left.
MODERATELY WEATHERED:	Significant portions of rock show discoloration and weathering effects. Rock has a dull sound under hammer and shows significant loss of strength as compared with fresh rock.
SLIGHTLY WEATHERED:	Rock generally fresh, joints stained and discoloration extends into rock up to 1 inch. Joints may contain clay.
VERY SLIGHTLY WEATHERED:	Rock generally fresh, joints stained, some joints may show thin clay coatings.
FRESH:	Rock fresh, crystals, bright, few joints may show slight staining. Rock rings under hammer if crystalline.

3. COLOR: VISUAL PERCEPTION.

4. TEXTURE

The description of the average or predominant mineralogic grain size diameter of igneous and metamorphic rocks and the constituent grain size diameter of sedimentary and metasedimentary rocks.

VERY FINE-GRAINED:	Too small to be seen with the unaided eye
FINE-GRAINED:	Visible with unaided eye to 1/16 inch diameter
MEDIUM-GRAINED:	1/16 inch to ¼ inch diameter
COARSE-GRAINED:	Greater than ¼ inch

5. ROCK TYPE

The geologic name for a rock processing a specific set of lithologic, compositional, and/or textured characteristics.

6. ROCK STRUCTURE

BEDDING:	Compositional and textural layering in sedimentary rocks; the term may be used with caution to describe layering in metamorphic and/or volcanic rocks (flow banding).
FOLIATION:	Any planar fabric homogeneously distributed throughout the rock mass at the scale of observation. Bedding is foliation (primary). Most foliation in rock is secondary. Joints and/or fractures usually are not foliation.
PARTING:	A plane or surface along which a rock is readily separated or is naturally divided into layers.
FRACTURE:	Any break in a rock, whether or not it is associated with displacement, due to mechanical failure by stress.
CRACK:	A partial or incomplete fracture.
JOINT:	A planar or near planar fracture occurring without displacement parallel to the fracture surfaces.
SHEAR:	A fracture occurring with minor displacement parallel to the adjacent fracture surfaces.
FAULT:	A fracture occurring with significant movement parallel to the adjacent fracture surfaces.

FAULT/SHEAR ZONE: A zone containing numerous faults or shears.

Bedding Thickness and Joint Spacing

Bedding	Joints	Perpendicular Distance
Very Thin	Very Close	Less than 2 inches
Thin	Close	2 inches to 1 foot
Medium	Moderately Close	1 foot to 3 feet
Thick	Wide	3 feet to 10 feet
Massive	Very Wide	More than 10 feet

Bedding / Joint Angle

Description	Angle
Horizontal	0° to 5°
Shallow or Low Angle	5° to 35°
Moderately Dipping	35° to 55°
Steep or High Angle	55° to 85°
Vertical	85° to 90°

7. ROCK CONTINUITY

Any fracture in rock other than bedding plane partings.

EXTREMELY FRACTURED:	Drill core stem less than 1 inch
MODERATELY FRACTURED:	Drill core stem 1 inch to 4 inches
SLIGHTLY FRACTURED:	Drill core stem 4 inches to 8 inches
SOUND:	Drill core stem greater than 8 inches

8. ROCK QUALITY DESIGNATION (RQD)

A relative indication of the frequency of naturally occurring fractures observed along a specified length of rock core. RQD values are determined only for rock core 2 inches (N) in diameter. RQD is defined as the sum in inches of all pieces of rock core 4 inches or greater in length, divided by the length in inches of the core run. If the core is broken by handling or drilling procedures, the pieces are fitted together and counted as one piece, provided they constitute the required 4-inch length. Where the recovery for a core run is greater than 100 percent, RQD values are adjusted to account for the portion of the core left in the hole from the previous run. The length of the core sections is determined by measuring down the centerline of the core.

Appendix B.1

Geotechnical Test Pit Logs

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-1

Ground Elevation: 119 ± feet
Datum: NAVD 1988

Date: 09/09/22
Time Started: 12:44
Time Finished: 13:25

Logged By: M. Dundon
Checked By: L. Norton

Weather: Sunny, 70°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/09/22	---	No Groundwater Encountered		13.5'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Murphy
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Brown/gray, fine to coarse SAND, little Silt, little Gravel, few Organic particles/fragments. Moist. TOPSOIL.	0			
		0.5	Tan, fine to coarse SAND, little Silt, little Gravel, trace Cobbles. Moist.	0.5	E	0	
12					M	3A	
		13.5	Test pit terminated at 13.5 feet due to limited reach.	13.5			

Excavation Effort

E	Easy
M	Moderate
D	Difficult

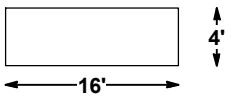
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

Sheet: 1 of 1

TEST PIT \\WESSERV2\SHDATA\5400S\5425.00\WORK\LOGS\5425.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2010 SANBORN HEAD V2.GDT 11/10/22

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-2

Ground Elevation: 135 ± feet
Datum: NAVD 1988

Date: 09/07/22
Time Started: 07:19
Time Finished: 08:15

Logged By: M. Dundon
Checked By: L. Norton

Weather: Cloudy, 65°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/07/22	---	No Groundwater Encountered		15'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Murphy
Reach: 15 ft

Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Brown, fine to coarse SAND, little Gravel, little Silt, few Organic particles/fragments. Moist. TOPSOIL.	0			
		0.5	Light brown, fine to coarse SAND, some Silt, trace Gravel, few Organic particles/fragments. Moist. SUBSOIL.	0.5	E	0	
2		2	Tan, fine to coarse SAND, some Gravel, little Silt, trace Cobbles. Moist. TILL.	2	M	7B-5C	
14					D	3C	
		15	Test pit terminated at 15 feet due to limited reach.	15			

Excavation Effort

E	Easy
M	Moderate
D	Difficult

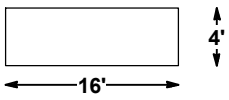
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

Sheet: 1 of 1

TEST PIT \\WESSERV2\SHDATA\5400S\5425.00\WORK\LOGS\5425.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2010 SANBORN HEAD V2.GDT 11/10/22

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-3

Ground Elevation: 127 ± feet
Datum: NAVD 1988

Date: 09/07/22
Time Started: 09:48
Time Finished: 10:45

Logged By: M. Dundon
Checked By: L. Norton

Weather: Cloudy, 65°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/07/22	---	No Groundwater Encountered		13'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Murphy
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Dark brown, fine to coarse SAND, little Silt, trace Gravel, few Organic particles/fragments. Moist. TOPSOIL.	0			
		0.5	Light brown, fine to coarse SAND, some Silt, trace Gravel, few Organic particles/fragments. Moist. SUBSOIL.	0.5	E	0	
2		2	Tan, fine to coarse SAND, some Gravel, little Silt, trace Cobbles. Moist. TILL.	2			
4							
6							
8					D	3A-1B	
		9					Bedrock ledge encountered at approximately 9 feet bgs.
10							
12							
			Test pit terminated at 13 feet due to probable bedrock.	13			
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

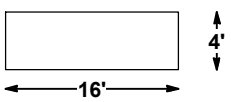
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-4

Ground Elevation: 141 ± feet
Datum: NAVD 1988

Date: 09/09/22
Time Started: 11:50
Time Finished: 12:30

Logged By: M. Dundon
Checked By: L. Norton

Weather: Sunny, 65°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/09/22	---	No Groundwater Encountered		3.5'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Murphy
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Brown, fine to coarse SAND, little Silt, little Gravel, few Organic particles/fragments. Moist. TOPSOIL.	0			
		0.5	Light brown, fine to coarse SAND, some Silt, little Gravel, few Organic particles/fragments. Moist. SUBSOIL.	0.5	E	0	
2		2	Tan, fine to coarse SAND, some Gravel, little Silt, trace Cobbles. Moist. TILL.	2	D	4A	
		3.5	Test pit terminated at 3.5 feet due to probable bedrock.	3.5			
4							
6							
8							
10							
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

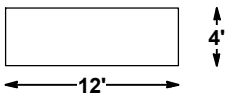
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-5

Ground Elevation: 128 ± feet
Datum: NAVD 1988

Date: 09/07/22
Time Started: 08:28
Time Finished: 09:20

Logged By: M. Dundon
Checked By: L. Norton

Weather: Cloudy, 65°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/07/22	---	No Groundwater Encountered		13.5'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Murphy
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0		0			
		0.2	Brown, fine to coarse SAND, little Silt, little Gravel, few Organic particles/fragments. Moist. TOPSOIL.	0.2	E	0	
			Light brown, fine to coarse SAND, some Silt, trace Gravel, few Organic particles/fragments. Moist. SUBSOIL.				
		1.5	Tan, fine to coarse SAND, some Gravel, little Silt, trace Cobbles. Moist. TILL.	1.5	M	4B-2C	
		9	Tan, fine to coarse SAND, some Gravel, little Cobbles, little Silt. Moist. TILL.	9	D		
		13.5	Test pit terminated at 13.5 feet due to probable bedrock.	13.5			

Excavation Effort

E	Easy
M	Moderate
D	Difficult

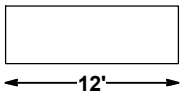
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

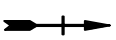
Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow



SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-6

Ground Elevation: 116 ± feet
Datum: NAVD 1988

Date: 09/07/22
Time Started: 10:55
Time Finished: 11:52

Logged By: M. Dundon
Checked By: L. Norton

Weather: Cloudy, 65°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/07/22	---	No Groundwater Encountered		14.5'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Murphy
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Dark brown, fine to coarse SAND, little Silt, trace Gravel, few Organic particles/fragments. Moist. TOPSOIL.	0			
		0.5	Light brown, fine to coarse SAND, some Silt, trace Gravel, few Organic particles/fragments. Moist. SUBSOIL.	0.5	E	0	
2							
		3	Tan, fine to coarse SAND, some Gravel, little Silt, trace Cobbles. Moist. TILL.	3			Redoximorphic features encountered at approximately 3 feet bgs.
4							
6					M		
8							
		9		9		3B-2C	Bedrock ledge encountered at approximately 9 feet bgs.
10							
12					D		
14							
		14.5	Test pit terminated at 14.5 feet due to probable bedrock.	14.5			
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

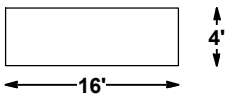
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



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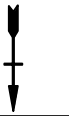


SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-7

Ground Elevation: 152 ± feet
Datum: NAVD 1988

Date: 09/07/22
Time Started: 12:35
Time Finished: 13:17

Logged By: M. Dundon
Checked By: L. Norton

Weather: Cloudy, 70°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/07/22	---	No Groundwater Encountered		5'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Murphy
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Brown, fine to coarse SAND, little Silt, little Gravel, few Organic particles/fragments. Moist. TOPSOIL.	0			
		0.5	Light brown, fine to coarse SAND, some Silt, little Gravel, few Organic particles/fragments. Moist. SUBSOIL.	0.5	E	0	
2		2	Tan, fine to coarse SAND, some Gravel, little Silt, little Cobbles. Moist. TILL.	2	D	4A-7B	
4							
		5	Test pit terminated at 5 feet due to probable bedrock.	5			
6							
8							
10							
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

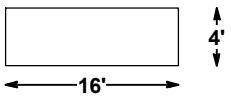
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

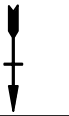
Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow



SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-8

Ground Elevation: 133 ± feet
Datum: NAVD 1988

Date: 09/07/22
Time Started: 12:03
Time Finished: 12:38

Logged By: M. Dundon
Checked By: L. Norton

Weather: Cloudy, 70°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/07/22	---	No Groundwater Encountered		5'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Murphy
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Dark brown, fine to coarse SAND, little Silt, trace Gravel, few Organic particles/fragments. Moist. TOPSOIL.	0	E	0	
		0.5	Light brown, fine to coarse SAND, some Silt, trace Gravel, very few Organic particles/fragments. Moist. SUBSOIL.	0.5	M	2A	
2							
		3	Tan, fine to medium SAND, some Gravel, little Silt, trace Cobbles. Moist. TILL.	3	D		
4							
		5	Test pit terminated at 5 feet due to probable bedrock.	5			
6							
8							
10							
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

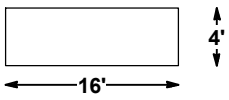
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

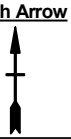
Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow



SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-9

Ground Elevation: 144 ± feet
Datum: NAVD 1988

Date: 09/09/22
Time Started: 09:55
Time Finished: 10:35

Logged By: M. Dundon
Checked By: L. Norton

Weather: Overcast, 65°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/09/22	---	No Groundwater Encountered		10'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Murphy
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Dark brown, fine to coarse SAND, little Silt, little Gravel, few Organic particles/fragments. Moist. TOPSOIL.	0			
		0.3	Light brown, fine to coarse SAND, some Silt, little Gravel, few Organic particles/fragments. Moist. SUBSOIL.	0.3	E	0	
2							
4		4.5	Tan, fine to coarse SAND, some Silt, some Gravel, trace Cobbles. Moist. TILL.	4.5	M	6A-1B	
6							
8		8			D		Bedrock ledge encountered at approximately 8 feet.
10			Test pit terminated at 10 feet due to probable bedrock.	10			
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

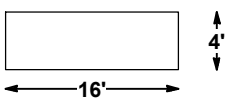
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-10

Ground Elevation: 134 ± feet
Datum: NAVD 1988

Date: 09/09/22
Time Started: 09:15
Time Finished: 09:45

Logged By: M. Dundon
Checked By: L. Norton

Weather: Overcast, 65°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
09/09/22	---	No Groundwater Encountered		4'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Murphy
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0		0			
		0.3	Dark brown, fine to coarse SAND, little Silt, trace Gravel, few Organic particles/fragments. Moist. TOPSOIL.	0.3	E	0	
			Light brown, fine to coarse SAND, some Silt, trace Gravel, few Organic particles/fragments. Moist. SUBSOIL.		M		
2		2	Tan, fine to coarse SAND, some Gravel, little Silt, trace Cobbles. Moist. TILL.	2	D	4A	
4		4	Test pit terminated at 4 feet due to probable bedrock.	4			
6							
8							
10							
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

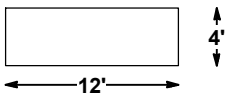
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

TEST PIT \\WESSERV2\SHDATA\5400S\5425.00\WORK\LOGS\5425.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2010 SANBORN HEAD V2.GDT 11/10/22

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-11

Ground Elevation: 142 ± feet
Datum: NAVD 1988

Date: 10/20/22
Time Started: 07:35
Time Finished: 08:10

Logged By: A. Baker
Checked By: L. Norton

Weather: Clear, 50°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
10/20/22	---	No Groundwater Encountered		12'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Wallace
Reach: 15 ft

Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Dark brown, fine to coarse SAND, some Silt, common Root particles, trace Gravel. Moist. TOPSOIL.	0	E		
		0.8	Red/light brown, fine to coarse SAND, some Silt, little Gravel. Moist. SUBSOIL.	0.8			
2							
		3.5	Tan, fine to coarse SAND, some Gravel, little Silt, trace Cobbles. Moist. TILL.	3.5		1A	
4							
6					M		
8							
10		10	Tan, fine to coarse SAND, some Gravel, some Cobbles, little Silt. Moist. TILL.	10	D	12B	
12		12	Test pit terminated at 12 feet due to limited reach.	12			
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

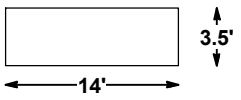
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

TEST PIT \\WESSERV2\SHDATA\5400S\5425.00\WORK\LOGS\5425.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2010 SANBORN HEAD V2.GDT 11/10/22

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-12

Ground Elevation: 145 ± feet
Datum: NAVD 1988

Date: 10/20/22
Time Started: 09:00
Time Finished: 09:15

Logged By: A. Baker
Checked By: L. Norton

Weather: Clear, 45°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
10/20/22	---	No Groundwater Encountered		7.5'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Wallace
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0		0			
		0.3	Dark brown, fine to coarse SAND, little Silt, trace Gravel, few Root particles/fragments. Moist. TOPSOIL.	0.3	E	0	
			Red/brown, fine to coarse SAND, some Silt, trace Gravel, few Root fragments. Moist. SUBSOIL.				
2		2.3	Tan, fine to coarse SAND, little Cobbles, little Gravel, little Silt. Moist. TILL.	2.3	M	3B 1C	
4							
6					D	1C	
		7.5	Test pit terminated at 7.5 feet due to probable bedrock.	7.5			
8							
10							
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

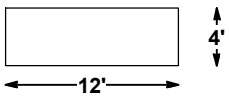
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-13

Ground Elevation: 148 ± feet
Datum: NAVD 1988

Date: 10/20/22
Time Started: 08:15
Time Finished: 08:35

Logged By: A. Baker
Checked By: L. Norton

Weather: Clear, 40°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
10/20/22	---	No Groundwater Encountered		7.4'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Wallace
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Dark brown, fine to coarse SAND, little Silt, common Root particles, trace Gravel. Moist.	0	E	0	
		0.5	Red/brown, fine to coarse SAND, little Gravel, little Silt, trace Cobbles, few Root particles. Moist. SUBSOIL.	0.5			
2		2	Tan, fine to coarse SAND, some Gravel, little Silt, little Cobbles. Moist. TILL.	2	M	3B 1C	
4							
6					D		
		7.4	Test pit terminated at 7.4 feet due to probable bedrock.	7.4			
8							
10							
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

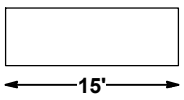
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

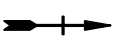
Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow



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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-14

Ground Elevation: 154 ± feet
Datum: NAVD 1988

Date: 10/20/22
Time Started: 08:40
Time Finished: 09:00

Logged By: A. Baker
Checked By: L. Norton

Weather: Clear, 45°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
10/20/22	---	No Groundwater Encountered		5'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Wallace
Reach: 15 ft

Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0		0			
		0.3	Dark brown, fine to coarse SAND, frequent Root particles, little Silt, trace Gravel. Moist. TOPSOIL.	0.3	E	0	
			Red/brown, fine to coarse SAND, some Silt, little Gravel, few Root particles. Moist. SUBSOIL.				
2		1.8	Tan, fine to coarse SAND, little Cobbles, little Gravel, little Silt. Moist. TILL.	1.8	M	1A 2B	
4							
		5	Test pit terminated at 5 feet due to probable bedrock.	5			
6							
8							
10							
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

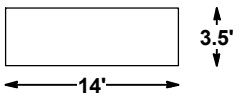
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-15

Ground Elevation: 144 ± feet
Datum: NAVD 1988

Date: 10/20/22
Time Started: 09:15
Time Finished: 09:35

Logged By: A. Baker
Checked By: L. Norton

Weather: Clear, 45°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
10/20/22	---	No Groundwater Encountered		6.5'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Wallace
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0		0			
		0.3	Dark brown, fine to coarse SAND, little Silt, trace Gravel, few Root particles/fragments. Moist. TOPSOIL.	0.3			
			Light brown, fine to coarse SAND, some Silt, little Gravel, common Root particles. Moist. SUBSOIL.		E	0	
2		2.8		2.8			
			Light brown/tan, fine to coarse SAND, some Gravel, little Silt, trace Cobbles. Moist. TILL.		M	4A	
4							
6		6.5		6.5			
			Test pit terminated at 6.5 feet due to probable bedrock.				
8							
10							
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

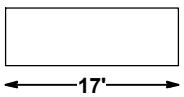
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

Sheet: 1 of 1

TEST PIT \\WESSERV2\SHDATA\5400S\5425.00\WORK\LOGS\5425.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2010 SANBORN HEAD V2.GDT 11/10/22

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-16

Ground Elevation: 121 ± feet
Datum: NAVD 1988

Date: 10/20/22
Time Started: 09:50
Time Finished: 10:05

Logged By: A. Baker
Checked By: L. Norton

Weather: Clear, 45°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
10/20/22	---	No Groundwater Encountered		4.5'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Wallace
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0		0			
		0.3	Dark brown, fine to coarse SAND, frequent Root particles, little Silt, trace Gravel. Moist. TOPSOIL.	0.3	E	0	
			Red/light brown, fine to coarse SAND, some Silt, little Gravel, very few Root particles. Moist. SUBSOIL.				
2		2	Light brown/tan, fine to coarse SAND, some Gravel, little Cobbles, little Silt. Moist. TILL.	2	D	14A 7B	
4		4.5	Test pit terminated at 4.5 feet due to probable bedrock.	4.5			
6							
8							
10							
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

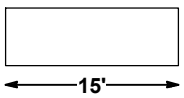
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

Sheet: 1 of 1

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-17

Ground Elevation: 120 ± feet
Datum: NAVD 1988

Date: 10/20/22
Time Started: 10:00
Time Finished: 10:30

Logged By: A. Baker
Checked By: L. Norton

Weather: Clear, 50°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
10/20/22	---	No Groundwater Encountered		3.3'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Wallace
Reach: 15 ft

Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Dark brown, fine to coarse SAND, little Silt, trace Gravel, few Root particles/fragments. Moist. TOPSOIL.	0	M	5A 4B	
		0.5	Brown, fine to coarse SAND, some Silt, little Gravel, few Root particles. Moist. SUBSOIL.	0.5			
2							
		3.3	Test pit terminated at 3.3 feet due to probable bedrock.	3.3			
4							
6							
8							
10							
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

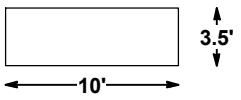
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Test Pit No. SH-TP-18

Ground Elevation: 130 ± feet
Datum: NAVD 1988

Date: 10/20/22
Time Started: 10:35
Time Finished: 10:50

Logged By: A. Baker
Checked By: L. Norton

Weather: Clear, 50°F

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Test Pit	Stab. Time
10/20/22	---	No Groundwater Encountered		8.5'	5 Minutes

Excavation Equipment

Contractor: Commonwealth Const. and Utilities
Operator: M. Wallace
Reach: 15 ft
Make: Komatsu
Model: PC 160LC
Bucket Capacity: 1 CY

Depth (ft)	Field Testing Data	Strata Depth (ft)	Geologic Description	Strata Depth (ft)	Excv. Effort	Boulder Qty & Class	Remarks
0		0	Dark brown, fine to coarse SAND, little Silt, trace Gravel, few Root particles/fragments. Moist. TOPSOIL.	0			
		0.5	Red/brown, fine to coarse SAND, some Silt, little Gravel, few Root particles. Moist. SUBSOIL.	0.5	E	2A	
2							
		3	Tan/light brown, fine to coarse SAND, some Gravel, little Silt, trace Cobbles. Moist. TILL.	3	D	7A 3B 1C	
4							
6							
8		8.5	Test pit terminated at 8.5 feet due to boulders and reach.	8.5			
10							
12							
14							
16							
18							
20							

Excavation Effort

E	Easy
M	Moderate
D	Difficult

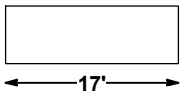
Boulder Size Classification

12" - 24"	A
24" - 36"	B
36" and larger	C

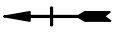
Soil Description
Minor Component Proportions

trace	0 - 10%
little	10 - 20%
some	20 - 35%
and	35 - 50%

Test Pit Plan



North Arrow



Appendix B.2

Stormwater Test Pit Logs

Deep Observation Hole

Site Name:	Randolph, MA	Date:	9/8/2022
Site Address:	11 Randolph Road	Time:	11:00
Project No.:	5425.00		
Ground Surface Elev. (ft.):	123	Weather :	Sunny, 70°F
Test Pit Number:	SW-TP-1	Logged by:	M. Dundon / L. Norton
		Soil Evaluator #:	SE13281

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 12	A	10YR 4/1	-	-	-	Loamy Sand	10	5	Weak Granular	Very Friable	
12 - 36	B_W	10YR 6/2	24	10YR 5/8	20	Sandy Loam	10	5	Massive	Friable	
36 -	R	-	-	-	-	-	-	-	-	-	
-											
-											
-											
-											

Test Pit Termination Depth (in.): 36 **Reason for Termination:** Refusal on probable bedrock.

Groundwater Observations:				**In-Situ Testing:**			
Depth to water weeping from pit face (in.):	NE			Percolation Test:	N/A	Depth (in.):	N/A
Depth to standing water in hole (in.):	NE	Stabilization Time:	<5min	Permeameter Test:	N/A	Depth (in.):	N/A
Depth to estimated seasonal high groundwater [ESHGW] (in.):	24	Basis for ESHGW:	Soil Mottling	Falling Head Test:	N/A	Depth (in.):	N/A
				Other Test:	N/A	Depth (in.):	N/A

Additional Notes:

1. 'NE' denotes that groundwater was 'not encountered' during excavation.
2. 'N/A' indicates that observation or testing method was 'not applicable'.

Deep Observation Hole

Site Name:	Randolph, MA	Date:	9/8/2022
Site Address:	11 Randolph Road	Time:	10:30
Project No.:	5425.00		
Ground Surface Elev. (ft.):	123	Weather :	Sunny, 70°F
Test Pit Number:	SW-TP-2	Logged by:	M. Dundon / L. Norton
		Soil Evaluator #:	SE13281

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 24	A	10YR 3/1	-	-	-	Sandy Loam	5	-	Weak Granular	Very Friable	
24 - 36	B_W	10YR 5/1	36	10YR 5/8	5	Gravelly Sandy Loam	20	10	Massive	Very Friable	1
36 - 120	C_D	10YR 6/3	-	-	-	Gravelly Sandy Loam	20	10	Massive	Friable	
120 -	R	-	-	-	-	-	-	-	-	-	
-											
-											
-											

Test Pit Termination Depth (in.): 120 **Reason for Termination:** Refusal on probable bedrock.

Groundwater Observations:				**In-Situ Testing:**			
Depth to water weeping from pit face (in.):	NE			Percolation Test:	N/A	Depth (in.):	N/A
Depth to standing water in hole (in.):	NE	Stabilization Time:	<5min	Permeameter Test:	N/A	Depth (in.):	N/A
Depth to estimated seasonal high groundwater [ESHGW] (in.):	120	Basis for ESHGW:	Top of Rock	Falling Head Test:	N/A	Depth (in.):	N/A
				Other Test:	N/A	Depth (in.):	N/A

Additional Notes:

1. Redoximorphic features not interpreted as seasonal high groundwater; observed at layer interface.
2. 'NE' denotes that groundwater was 'not encountered' during excavation.
3. 'N/A' indicates that observation or testing method was 'not applicable'.

Deep Observation Hole

Site Name:	Randolph, MA	Date:	9/8/2022
Site Address:	11 Randolph Road	Time:	9:15
Project No.:	5425.00		
Ground Surface Elev. (ft.):	122	Weather :	Sunny, 70°F
Test Pit Number:	SW-TP-3	Logged by:	M. Dundon / L. Norton
		Soil Evaluator #:	SE13281

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 12	A	10YR 3/3	-	-	-	Sandy Loam	10	5	Weak Granular	Very Friable	
12 - 30	B_W	10YR 5/6	-	-	-	Gravelly Loam	15	5	Massive	Friable	
30 - 162	C_D	10YR 6/3	-	-	-	Gravelly, Cobbly Sandy Loam	15	10	Massive	Friable	
162 -	R	-	-	-	-	-	-	-	-	-	
-											
-											
-											

Test Pit Termination Depth (in.): 162 **Reason for Termination:** Refusal on probable bedrock.

Groundwater Observations:				**In-Situ Testing:**			
Depth to water weeping from pit face (in.):	NE			Percolation Test:	N/A	Depth (in.):	N/A
Depth to standing water in hole (in.):	NE	Stabilization Time:	<5min	Permeameter Test:	N/A	Depth (in.):	N/A
Depth to estimated seasonal high groundwater [ESHGW] (in.):	162	Basis for ESHGW:	Top of Rock	Falling Head Test:	N/A	Depth (in.):	N/A
				Other Test:	N/A	Depth (in.):	N/A

Additional Notes:

1. 'NE' denotes that groundwater was 'not encountered' during excavation.
2. 'N/A' indicates that observation or testing method was 'not applicable'.

Deep Observation Hole

Site Name:	Randolph, MA	Date:	9/8/2022
Site Address:	11 Randolph Road	Time:	12:30
Project No.:	5425.00		
Ground Surface Elev. (ft.):	129	Weather :	Sunny, 70°F
Test Pit Number:	SW-TP-4	Logged by:	M. Dundon / L. Norton
		Soil Evaluator #:	SE13281

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 2	A	10YR 4/1	-	-	-	Sandy Loam	5	<5	Weak Granular	Very Friable	
2 - 18	B_W	10YR 6/2	-	-	-	Gravelly Sandy Loam	15	10	Massive	Very Friable	
18 -	R	-	-	-	-	-	-	-	-	-	
-											
-											
-											
-											

Test Pit Termination Depth (in.): 18 **Reason for Termination:** Refusal on probable bedrock.

Groundwater Observations:				**In-Situ Testing:**			
Depth to water weeping from pit face (in.):	NE			Percolation Test:	N/A	Depth (in.):	N/A
Depth to standing water in hole (in.):	NE	Stabilization Time:	<5min	Permeameter Test:	N/A	Depth (in.):	N/A
Depth to estimated seasonal high groundwater [ESHGW] (in.):	18	Basis for ESHGW:	Top of Rock	Falling Head Test:	N/A	Depth (in.):	N/A
				Other Test:	N/A	Depth (in.):	N/A

Additional Notes:

1. 'NE' denotes that groundwater was 'not encountered' during excavation.
2. 'N/A' indicates that observation or testing method was 'not applicable'.

Deep Observation Hole

Site Name:	Randolph, MA	Date:	9/9/2022
Site Address:	11 Randolph Road	Time:	7:20
Project No.:	5425.00		
Ground Surface Elev. (ft.):	130	Weather :	Cloudy, 65°F

SANBORN HEAD

Logged by: M. Dundon / L. Norton

Test Pit Number: SW-TP-5 Soil Evaluator #: SE13281

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 3	A	10YR 4/1	-	-	-	Loam	5	5	Weak Granular	Very Friable	
6 - 30	B_W	10YR 5/4	-	-	-	Gravelly Sandy Loam	15	10	Massive	Friable	
30 - 84	C_D	10YR 7/3	72	10YR 5/8	25	Gravelly, Cobbly Sandy Loam	20	10	Massive	Friable	
84 -	R	-	-	-	-	-	-	-	-	-	
-											
-											
-											

Test Pit Termination Depth (in.): 84 **Reason for Termination:** Refusal on probable bedrock.

Groundwater Observations:				**In-Situ Testing:**			
Depth to water weeping from pit face (in.):	NE			Percolation Test:	N/A	Depth (in.):	N/A
Depth to standing water in hole (in.):	NE	Stabilization Time:	<5min	Permeameter Test:	N/A	Depth (in.):	N/A
Depth to estimated seasonal high groundwater [ESHGW] (in.):	72	Basis for ESHGW:	Soil Mottling	Falling Head Test:	N/A	Depth (in.):	N/A
				Other Test:	N/A	Depth (in.):	N/A

Additional Notes:

1. 'NE' denotes that groundwater was 'not encountered' during excavation.
2. 'N/A' indicates that observation or testing method was 'not applicable'.

Deep Observation Hole

Site Name:	Randolph, MA	Date:	9/8/2022
Site Address:	11 Randolph Road	Time:	8:25
Project No.:	5425.00		
Ground Surface Elev. (ft.):	122	Weather :	Sunny, 68°F
Test Pit Number:	SW-TP-6	Logged by:	M. Dundon / L. Norton
		Soil Evaluator #:	SE13281

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 18	A	10YR 3/1	-	-	-	Gravelly Sandy Loam	15	5	Weak Granular	Very Friable	
18 - 42	B_W	10YR 6/3	-	-	-	Very Gravelly Loam	25	10	Massive	Friable	
42 - 120	C_D	10YR 6/4	-	-	-	Very Gravelly Sandy Loam	30	10	Massive	Friable	
120 -	R	-	-	-	-	-	-	-	-	-	
-											
-											
-											

Test Pit Termination Depth (in.): 120 **Reason for Termination:** Refusal on probable bedrock.

Groundwater Observations:				**In-Situ Testing:**			
Depth to water weeping from pit face (in.):	NE			Percolation Test:	N/A	Depth (in.):	N/A
Depth to standing water in hole (in.):	NE	Stabilization Time:	<5min	Permeameter Test:	N/A	Depth (in.):	N/A
Depth to estimated seasonal high groundwater [ESHGW] (in.):	120	Basis for ESHGW:	Top of Rock	Falling Head Test:	N/A	Depth (in.):	N/A
				Other Test:	N/A	Depth (in.):	N/A

Additional Notes:

1. 'NE' denotes that groundwater was 'not encountered' during excavation.
2. 'N/A' indicates that observation or testing method was 'not applicable'.

Deep Observation Hole

Site Name:	Randolph, MA	Date:	10/20/2022
Site Address:	11 Randolph Road	Time:	13:30
Project No.:	5425.00		
Ground Surface Elev. (ft.):	127	Weather :	Clear, 55°F
Test Pit Number:	SW-TP-8	Logged by:	A. Baker / L. Norton
		Soil Evaluator #:	SE13281

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 30	A	10 YR 3/2	-	-	-	Sandy Loam	<5	<5	Weak Granular	Very Friable	
30 - 40	B_W	10 YR 6/6	-	-	-	Sandy Loam	5	5	Massive	Friable	
40 - 70	C_D	10 YR 6/3	-	-	-	Gravelly Sandy Loam	15	10	Massive	Friable	1
70 -	R	-	-	-	-	-	-	-	-	-	
-											
-											
-											

Test Pit Termination Depth (in.): 70 **Reason for Termination:** Refusal on probable bedrock.

Groundwater Observations:				**In-Situ Testing:**			
Depth to water weeping from pit face (in.):	NE			Percolation Test:	N/A	Depth (in.):	N/A
Depth to standing water in hole (in.):	NE	Stabilization Time:	<5min	Permeameter Test:	N/A	Depth (in.):	N/A
Depth to estimated seasonal high groundwater [ESHGW] (in.):	70	Basis for ESHGW:	Top of Rock	Falling Head Test:	N/A	Depth (in.):	N/A
				Other Test:	N/A	Depth (in.):	N/A

Additional Notes:

1. Two 12-inch diameter Boulders encountered.
2. 'NE' denotes that groundwater was 'not encountered' during excavation.
3. 'N/A' indicates that observation or testing method was 'not applicable'.

Deep Observation Hole

Site Name:	Randolph, MA	Date:	10/20/2022
Site Address:	11 Randolph Road	Time:	11:05
Project No.:	5425.00		
Ground Surface Elev. (ft.):	124	Weather :	Clear, 55°F
Test Pit Number:	SW-TP-9	Logged by:	A. Baker / L. Norton
		Soil Evaluator #:	SE13281

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 5	A	7.5 YR 2.5/2	-	-	-	Sandy Loam	<5	<5	Weak Granular	Very Friable	
5 - 39	C_D	2.5 YR 5/3	-	-	-	Sandy Loam	10	10	Massive	Friable	1
39 -	R	-	-	-	-	-	-	-	-	-	
-											
-											
-											
-											

Test Pit Termination Depth (in.): 39 **Reason for Termination:** Refusal on probable bedrock.

Groundwater Observations:				**In-Situ Testing:**			
Depth to water weeping from pit face (in.):	36			Percolation Test:	N/A	Depth (in.):	N/A
Depth to standing water in hole (in.):	NE	Stabilization Time:	<5min	Permeameter Test:	N/A	Depth (in.):	N/A
Depth to estimated seasonal high groundwater [ESHGW] (in.):	36	Basis for ESHGW:	Weeping from Pit Face	Falling Head Test:	N/A	Depth (in.):	N/A
				Other Test:	N/A	Depth (in.):	N/A

Additional Notes:

1. Approximately six 10 to 18-inch diameter Boulders encountered.
2. 'NE' denotes that groundwater was 'not encountered' during excavation.
3. 'N/A' indicates that observation or testing method was 'not applicable'.

Deep Observation Hole

Site Name:	Randolph, MA	Date:	10/20/2022
Site Address:	11 Randolph Road	Time:	11:51
Project No.:	5425.00		
Ground Surface Elev. (ft.):	121	Weather :	Clear, 55°F
Test Pit Number:	SW-TP-10	Logged by:	A. Baker / L. Norton
		Soil Evaluator #:	SE13281

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 3	A	7.5 YR 3/1	-	-	-	Sandy Loam	<5	<5	Weak Granular	Very Friable	
3 - 12	B_W	10 YR 5/8	-	-	-	Loam	10	<5	Massive	Friable	
26 - 98	C_D	2.5 YR 5/3	-	-	-	Very Gravelly Sandy Loam	25	10	Massive	Friable	1
98 -	R	-	-	-	-	-	-	-	-	-	
-											
-											
-											

Test Pit Termination Depth (in.): 98 **Reason for Termination:** Refusal on probable bedrock.

Groundwater Observations:				**In-Situ Testing:**			
Depth to water weeping from pit face (in.):	92			Percolation Test:	N/A	Depth (in.):	N/A
Depth to standing water in hole (in.):	96	Stabilization Time:	<5min	Permeameter Test:	N/A	Depth (in.):	N/A
Depth to estimated seasonal high groundwater [ESHGW] (in.):	92	Basis for ESHGW:	Weeping from Pit Face	Falling Head Test:	N/A	Depth (in.):	N/A
				Other Test:	N/A	Depth (in.):	N/A

Additional Notes:

1. Multiple 12 to 36-inch diameter Boulders encountered.
2. 'NE' denotes that groundwater was 'not encountered' during excavation.
3. 'N/A' indicates that observation or testing method was 'not applicable'.

Deep Observation Hole

Site Name:	Randolph, MA	Date:	10/20/2022
Site Address:	11 Randolph Road	Time:	12:35
Project No.:	5425.00		
Ground Surface Elev. (ft.):	123	Weather :	Clear, 55°F
Test Pit Number:	SW-TP-11	Logged by:	A. Baker / L. Norton
		Soil Evaluator #:	SE13281

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 8	A	10 YR 3/2	-	-	-	Loamy Sand	5	<5	Weak Granular	Very Friable	
8 - 40	B_W	10 YR 5/6	-	-	-	Sandy Loam	10	5	Massive	Friable	
40 - 124	C_D	10 YR 6/4	-	-	-	Gravelly Sandy Loam	15	10	Massive	Friable	1
124 -	R	-	-	-	-	-	-	-	-	-	
-											
-											
-											

Test Pit Termination Depth (in.): 124 **Reason for Termination:** Refusal on probable bedrock.

Groundwater Observations:				**In-Situ Testing:**			
Depth to water weeping from pit face (in.):	NE			Percolation Test:	N/A	Depth (in.):	N/A
Depth to standing water in hole (in.):	NE	Stabilization Time:	<5min	Permeameter Test:	N/A	Depth (in.):	N/A
Depth to estimated seasonal high groundwater [ESHGW] (in.):	124	Basis for ESHGW:	Top of Rock	Falling Head Test:	N/A	Depth (in.):	N/A
				Other Test:	N/A	Depth (in.):	N/A

Additional Notes:

1. Multiple 8 to 24-inch diameter Boulders encountered.
2. 'NE' denotes that groundwater was 'not encountered' during excavation.
3. 'N/A' indicates that observation or testing method was 'not applicable'.

Deep Observation Hole

Site Name:	Randolph, MA	Date:	10/20/2022
Site Address:	11 Randolph Road	Time:	13:45
Project No.:	5425.00		
Ground Surface Elev. (ft.):	121	Weather :	Clear, 55°F
Test Pit Number:	SW-TP-12	Logged by:	A. Baker / L. Norton
		Soil Evaluator #:	SE13281

Depth (inches)	Soil Horizon or Layer	Soil Matrix Color (Moist)	Redoximorphic Features			Soil Texture (NRCS)	Coarse Fragments (% by Volume)		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles			
0 - 30	A	10 YR 3/2	-	-	-	Sandy Loam	5	<5	Weak Granular	Very Friable	
30 - 72	C_D	10 YR 6/6	-	-	-	Gravelly Sandy Loam	15	5	Massive	Very Friable	
72 -	R	-	-	-	-	-	-	-	-	-	
-											
-											
-											
-											

Test Pit Termination Depth (in.): 72 **Reason for Termination:** Refusal on probable bedrock.

Groundwater Observations:				**In-Situ Testing:**			
Depth to water weeping from pit face (in.):	NE			Percolation Test:	N/A	Depth (in.):	N/A
Depth to standing water in hole (in.):	NE	Stabilization Time:	<5min	Permeameter Test:	N/A	Depth (in.):	N/A
Depth to estimated seasonal high groundwater [ESHGW] (in.):	72	Basis for ESHGW:	Top of Rock	Falling Head Test:	N/A	Depth (in.):	N/A
				Other Test:	N/A	Depth (in.):	N/A

Additional Notes:

1. 'NE' denotes that groundwater was 'not encountered' during excavation.
2. 'N/A' indicates that observation or testing method was 'not applicable'.

Appendix B.3

Geotechnical Test Boring Logs

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-1

Ground Elevation: 136 ± feet
Datum: NAVD 1988

Drilling Method: ATV-Mounted Geoprobe 7822DT Drill Rig and Hollow Stem Augers
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: G & M Subsurface
Foreman: B. Williams
Date Started: 09/19/22 **Date Finished: 09/19/22**
Logged By: A. Baker **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/19/22	---	No Groundwater Encountered			13'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0	S-1	0 - 2	5 6 3 3	24/16			-----0'-----	S-1 (0 to 2'): Loose, light brown, fine to coarse SAND, little Silt, little Gravel. Moist. SUBSOIL.	
							SUBSOIL		
2							-----2'-----		
4									
	S-2	5 - 7	19 75 69 73	24/19				S-2 (5 to 7'): Very dense, tan, fine to coarse SAND, little Silt, little Gravel. Moist. TILL.	
6									
							GLACIAL TILL		
8									
10	S-3	10 - 12	19 21 25 14	24/18				S-3 (10 to 12'): Dense, tan, fine to coarse SAND, little Gravel, little Silt. Moist. TILL.	
12									
							-----13'-----	Boring terminated at 13 feet due to auger refusal on probable bedrock.	
14									
16									
18									
20									
22									
24									

BORING LOG \\WESSERV2\SHDATA\5400S\5425.00\WORK\LOGS\5425.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/10/22

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-2

Ground Elevation: 130 ± feet
Datum: NAVD 1988

Drilling Method: ATV-Mounted Geoprobe 7822DT Drill Rig and Hollow Stem Augers
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: G & M Subsurface
Foreman: B. Williams
Date Started: 09/19/22 **Date Finished: 09/19/22**
Logged By: A. Baker **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/19/22	---	No Groundwater Encountered			3.5'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0	S-1	0 - 2	1 2 3 5	24/13			-----0'-----	S-1 (0 to 2'): Loose, brown/light brown, fine to coarse SAND, little Silt, little Gravel. Moist. TOPSOIL/SUBSOIL.	
2							TOPSOIL/ SUBSOIL		
4							-----3.5'-----	Boring terminated at 3.5 feet due to auger refusal on probable bedrock.	
6									
8									
10									
12									
14									
16									
18									
20									
22									
24									

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-3

Ground Elevation: 123 ± feet
Datum: NAVD 1988

Drilling Method: ATV-Mounted Geoprobe 7822DT Drill Rig and Hollow Stem Augers
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: G & M Subsurface
Foreman: B. Williams
Date Started: 09/19/22 **Date Finished: 09/19/22**
Logged By: A. Baker **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/19/22	---	No Groundwater Encountered			11'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0	S-1	0 - 2	1 3 5 9	24/7			-----0'-----	S-1 (0 to 2'): Loose, brown, fine to coarse SAND, some Silt, common Root particles, trace Gravel. Moist. TOPSOIL/SUBSOIL.	
2							TOPSOIL/ SUBSOIL -----2'-----		
4									
6	S-2	5 - 7	35 36 26 57	24/14			GLACIAL TILL	S-2 (5 to 7'): Very dense, tan, fine to coarse SAND, some Gravel, little Silt. Moist. TILL.	S-2: Rock in spoon tip.
8									
10	S-3	10 - 11	12 60	12/4				S-3 (10 to 11'): Very dense, tan, fine to coarse SAND, some Gravel, little Silt. Moist. TILL.	
12							-----11'-----	Boring terminated at 11 feet due to split spoon refusal on probable bedrock.	
14									
16									
18									
20									
22									
24									

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-4

Ground Elevation: 140 ± feet
Datum: NAVD 1988

Drilling Method: ATV-Mounted Geoprobe 7822DT Drill Rig and Hollow Stem Augers
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: G & M Subsurface
Foreman: B. Williams
Date Started: 09/20/22 **Date Finished: 09/20/22**
Logged By: A. Baker **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/20/22	---	No Groundwater Encountered			6.3'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0	S-1	0 - 2	1 1 2 16	24/4			-----0'-----	S-1 (0 to 2'): Very loose, brown, fine to coarse SAND, little Silt, trace Gravel. Moist. TOPSOIL.	
							TOPSOIL		
2							-----2'-----		
4	S-2	4 - 6	6 9 43 97	24/16			GLACIAL TILL	S-2 (4 to 6'): Very dense, tan, fine to coarse SAND, little Gravel, little Silt. Moist. TILL.	
6							-----6.3'-----	Boring terminated at 6.3 feet due to auger refusal on probable bedrock.	
8									
10									
12									
14									
16									
18									
20									
22									
24									

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-5

Ground Elevation: 147 ± feet
Datum: NAVD 1988

Drilling Method: ATV-Mounted Geoprobe 7822DT Drill Rig and Hollow Stem Augers
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: G & M Subsurface
Foreman: B. Williams
Date Started: 09/20/22 **Date Finished: 09/20/22**
Logged By: A. Baker **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/20/22	---	No Groundwater Encountered			7'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0	S-1	0 - 2	1 3 6 8	24/10			-----0'-----	S-1A (0 to 1'): Loose, brown, fine to coarse SAND, frequent Root particles, little Silt, trace Gravel. Moist. TOPSOIL.	
							TOPSOIL		
							-----1'-----	S-1B (1 to 2'): Loose, light brown/tan, fine to coarse SAND, little Gravel, little Silt. Moist. SUBSOIL.	
2							SUBSOIL		
							-----2'-----		
4	S-2	4 - 6	33 41 63 57	24/20			GLACIAL TILL	S-2 (4 to 6'): Very dense, tan, fine to coarse SAND, some Silt, trace Gravel. Moist. TILL.	
6									
							-----7'-----	Boring terminated at 7 feet due to auger refusal on probable boulder.	
8									
10									
12									
14									
16									
18									
20									
22									
24									

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-5A

Ground Elevation: 149 ± feet
Datum: NAVD 1988

Drilling Method: Drive & Wash, 2 15/16" O.D. Roller Bit, 2 7/8" O.D. 5' Length Core Barrel, GeoProbe 7822DT Track Mounted

Sampling Method: 2" O.D. Split Spoon, Automatic Hammer/ 2" O.D. Core Barrel

Drilling Company: G & M Subsurface

Foreman: S. Canning

Date Started: 10/04/22 **Date Finished: 10/04/22**

Logged By: A. Grochmal **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
10/04/22	---	No Groundwater Encountered			23.5'	

Depth (ft)	Drill Rate (min/ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen/ Rec (ft)	Sample Information: Field Testing Data	Stratum: Log	Stratum: Description	Geologic Description	Remarks
0							-----0'-----	(0 to 13.5'): Boring advanced as a soil probe without sampling to refusal at approximately 13.5 feet bgs. Refer to log for SH-5 for Geologic Description.	
2									
4									
6									Wash water changed color from brown to gray/brown at approximately 5.5 feet bgs indicating presence of probable boulders.
8									
10									
12									
14	2.5	C-1	13.5 - 18.5	60.0/ 14.0			-----13.5'-----	C-1 (13.5 to 18.5'): BOULDERS. REC=23%.	Roller bit refusal at approximately 13.5 feet bgs. Casing set for rock coring.
	2.5								
16	1.7						BOULDERS		
	1.6								
18	5.1								
	0.9	C-2	18.5 - 23.5	60.0/ 10.0			-----18.5'-----	C-2 (18.5 to 23.5'): Hard, moderately weathered, gray, fine to medium-grained, DIORITE, Moderately fractured. REC=17%. RQD=0%.	
20	3.7								
	3.1						DIORITE		
22	3.4								
	5.4								
							-----23.5'-----	Boring terminated at 23.5 feet.	
24									

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-5B

Ground Elevation: 143 ± feet
Datum: NAVD 1988

Drilling Method: ATV-Mounted Geoprobe 7822DT Drill Rig and Drive and Wash
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: G & M Subsurface
Foreman: S. Canning
Date Started: 10/03/22 **Date Finished: 10/03/22**
Logged By: A. Grochmal **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
10/04/22	---	No Groundwater Encountered			23.5'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----	(0 to 10'): Boring advanced as a soil probe without sampling to approximately 10 feet bgs. Refer to log for SH-5 for Geologic Description.	Wash water changed color from brown to gray/brown at approximately 6 feet bgs indicating presence of probable boulders.
10	S-1	10 - 12	35 46 45 61	24/20			-----10'-----	S-1 (10 to 12'): Very dense, olive gray, fine to coarse SAND and Gravel, little Silt. Moist. TILL.	
12	S-2	12 - 13.5	58 52 100	18/18			GLACIAL TILL	S-2 (12 to 13.5'): Very dense, olive gray, fine to coarse SAND and Gravel, little Silt. Moist. TILL.	
14							-----13.5'-----	Boring terminated at 13.5 feet due to roller bit refusal on probable bedrock.	
16									
18									
20									
22									
24									

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SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-6

Ground Elevation: 141 ± feet
Datum: NAVD 1988

Drilling Method: ATV-Mounted Geoprobe 7822DT Drill Rig and Hollow Stem Augers
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: G & M Subsurface
Foreman: B. Williams
Date Started: 09/20/22 **Date Finished: 09/20/22**
Logged By: A. Baker **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/20/22	---	No Groundwater Encountered			5.7'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0	S-1	0 - 2	1 1 2 5	24/8			-----0'-----	S-1A (0 to 0.8'): Very loose, dark brown, fine to coarse SAND, some Silt, common Root particles, trace Gravel. Moist. TOPSOIL.	
							TOPSOIL		
							-----0.8'-----		
							SUBSOIL	S-1B (0.8 to 2'): Very loose, red/brown, fine to coarse SAND, little Silt, trace Gravel. Moist. SUBSOIL.	
2							-----2'-----		
							GLACIAL TILL		
4	S-2	5 - 5.7	9 60/2"	8/6				S-2 (5 to 5.7'): Very dense, tan, fine to coarse SAND, little Silt, trace Gravel. Moist. TILL.	S-2: Rock in spoon tip.
							-----5.7'-----		
6								Boring terminated at 5.7 feet due to auger refusal on probable bedrock.	
8									
10									
12									
14									
16									
18									
20									
22									
24									

BORING LOG \\WESSERV2\SHDATA\5400S\5425.00\WORK\LOGS\5425.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/10/22

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-7

Ground Elevation: 122 ± feet
Datum: NAVD 1988

Drilling Method: ATV-Mounted Geoprobe 7822DT Drill Rig and Hollow Stem Augers
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: G & M Subsurface
Foreman: B. Williams
Date Started: 09/19/22 **Date Finished: 09/19/22**
Logged By: A. Baker **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/19/22	---	No Groundwater Encountered			7.5'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0	S-1	0 - 2	2 2 3 13	24/12			-----0'-----	S-1 (0 to 2'): Loose, brown, fine to coarse SAND, some Silt, common Root particles, trace Gravel. Moist. TOPSOIL/SUBSOIL.	
							TOPSOIL/ SUBSOIL		
2							-----2'-----		
4							GLACIAL TILL		
	S-2	5 - 7	6 10 22 39	24/14				S-2 (5 to 7'): Dense, tan, fine to coarse SAND, little Gravel, little Silt. Moist. TILL.	
6									Redoximorphic features observed at approximately 6.5 feet.
							-----7.5'-----	Boring terminated at 7.5 feet due to auger refusal on probable bedrock.	
8									
10									
12									
14									
16									
18									
20									
22									
24									

BORING LOG \\WESSERV2\SHDATA\5400S\5425.00\WORK\LOGS\5425.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/10/22

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-8

Ground Elevation: 152 ± feet
Datum: NAVD 1988

Drilling Method: ATV-Mounted Geoprobe 7822DT Drill Rig and Hollow Stem Augers
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: G & M Subsurface
Foreman: B. Williams
Date Started: 09/20/22 **Date Finished: 09/20/22**
Logged By: A. Baker **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/20/22	---	No Groundwater Encountered			4.2'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'----- TOPSOIL -----0.5'-----	(0 to 0.5'): Fine to coarse SAND, some Silt, common Root particles, trace Gravel. Moist. TOPSOIL.	Boring advanced as a soil probe without sampling to refusal at approximately 4.2 feet bgs. Geologic Description based on visual estimation of soil cuttings.
2							SUBSOIL	(0.5 to 3'): Tan, fine to coarse SAND, little Silt, little Gravel. Moist. SUBSOIL.	
							-----3'-----		
4							GLACIAL TILL -----4.2'-----	(3 to 4'): Tan, fine to coarse SAND, some Silt, some Gravel. Moist. TILL.	
								Boring terminated at 4.2 feet due to auger refusal on probable bedrock.	
6									
8									
10									
12									
14									
16									
18									
20									
22									
24									

BORING LOG \\WESSERV2\SHDATA\5400S\5425.00\WORK\LOGS\5425.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/10/22

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-9

Ground Elevation: 146 ± feet
Datum: NAVD 1988

Drilling Method: ATV-Mounted Geoprobe 7822DT Drill Rig and Hollow Stem Augers
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: G & M Subsurface
Foreman: B. Williams
Date Started: 09/20/22 **Date Finished: 09/20/22**
Logged By: A. Baker **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/20/22	---	No Groundwater Encountered			5.5'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		Boring advanced as a soil probe without sampling to refusal at approximately 5.5 feet bgs. Geologic Description based on visual estimation of soil cuttings.
							TOPSOIL	(0 to 1'): Brown, fine to coarse SAND, some Silt, common Root particles, trace Gravel. Moist. TOPSOIL.	
							-----1'-----		
2							SUBSOIL	(1 to 2.5'): Brown, fine to coarse SAND, some Gravel, little Silt. Moist. SUBSOIL.	
							-----2.5'-----	(2.5 to 4'): Light brown, fine to coarse SAND, little Gravel, little Silt. Moist. TILL.	
4							GLACIAL TILL	(4 to 5.5'): Light brown, fine to coarse SAND, some Gravel, little Silt. Moist. TILL.	
							-----5.5'-----	Boring terminated at 5.5 feet due to auger refusal on probable bedrock.	
6									
8									
10									
12									
14									
16									
18									
20									
22									
24									

BORING LOG \\WESSERV2\SHDATA\5400S\5425.00\WORK\LOGS\5425.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/10/22

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-10

Ground Elevation: 140 ± feet
Datum: NAVD 1988

Drilling Method: ATV-Mounted Geoprobe 7822DT Drill Rig and Hollow Stem Augers
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: G & M Subsurface
Foreman: B. Williams
Date Started: 09/20/22 **Date Finished: 09/20/22**
Logged By: A. Baker **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/20/22	---	No Groundwater Encountered			5.5'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		Boring advanced as a soil probe without sampling to refusal at approximately 5.5 feet bgs. Geologic Description based on visual estimation of soil cuttings.
							TOPSOIL	(0 to 1'): Brown, fine to coarse SAND, some Silt, common Root particles, trace Gravel. Moist. TOPSOIL.	
							-----1'-----	(1 to 5.5'): Tan, fine to coarse SAND, some Gravel, little Silt. Moist. TILL.	
2							GLACIAL TILL		
4									
							-----5.5'-----	Boring terminated at 5.5 feet due to auger refusal on probable bedrock.	
6									
8									
10									
12									
14									
16									
18									
20									
22									
24									

BORING LOG \\WESSERV2\SHDATA\5400S\5425.00\WORK\LOGS\5425.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/10/22

SANBORN HEAD

Sanborn, Head & Associates, Inc.

Project: 11 Randolph Road
Location: Randolph, MA
Project No.: 5425.00

Log of Boring SH-12

Ground Elevation: 127 ± feet
Datum: NAVD 1988

Drilling Method: ATV-Mounted Geoprobe 7822DT Drill Rig and Hollow Stem Augers
Sampling Method: 2" O.D. Split Spoon, Automatic Hammer
Drilling Company: G & M Subsurface
Foreman: B. Williams
Date Started: 09/20/22 **Date Finished: 09/20/22**
Logged By: A. Baker **Checked By: L. Norton**

Groundwater Readings

Date	Time	Depth to Water	Ref. Pt.	Depth of Casing	Depth of Hole	Stab. Time
09/20/22	---	No Groundwater Encountered			2.5'	

Depth (ft)	Sample Information: Sample No.	Depth (ft)	Spoon Blows per 6 in	Pen/ Rec (in)	Field Testing Data	Stratum: Log	Description	Geologic Description	Remarks
0							-----0'-----		
							TOPSOIL	(0 to 1'): Brown, fine to coarse SAND, some Silt, frequent Root particles, trace Gravel. Moist. TOPSOIL.	Boring advanced as a soil probe without sampling to refusal at approximately 2.5 feet bgs. Geologic Description based on visual estimation of soil cuttings.
							-----1'-----		
2							GLACIAL TILL	(1 to 2.5'): Tan, fine to coarse SAND, some Gravel, little Silt. Moist. TILL.	
							-----2.5'-----	Boring terminated at 2.5 feet due to auger refusal on probable boulders.	
4									
6									
8									
10									
12									
14									
16									
18									
20									
22									
24									

BORING LOG \\WESSERV2\SHDATA\5400S\5425.00\WORK\LOGS\5425.00 LOGS.GPJ 2017 SANBORN HEAD V1.GLB 2017 SANBORN HEAD V1.GDT 11/10/22

Appendix C

Geotechnical Laboratory Results

GeoTesting EXPRESS

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-1	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	24-36"	Test Id:	685783		
Test Comment:	---				
Visual Description:	Moist, brown silty sand				
Sample Comment:	---				

USDA Textural Classification

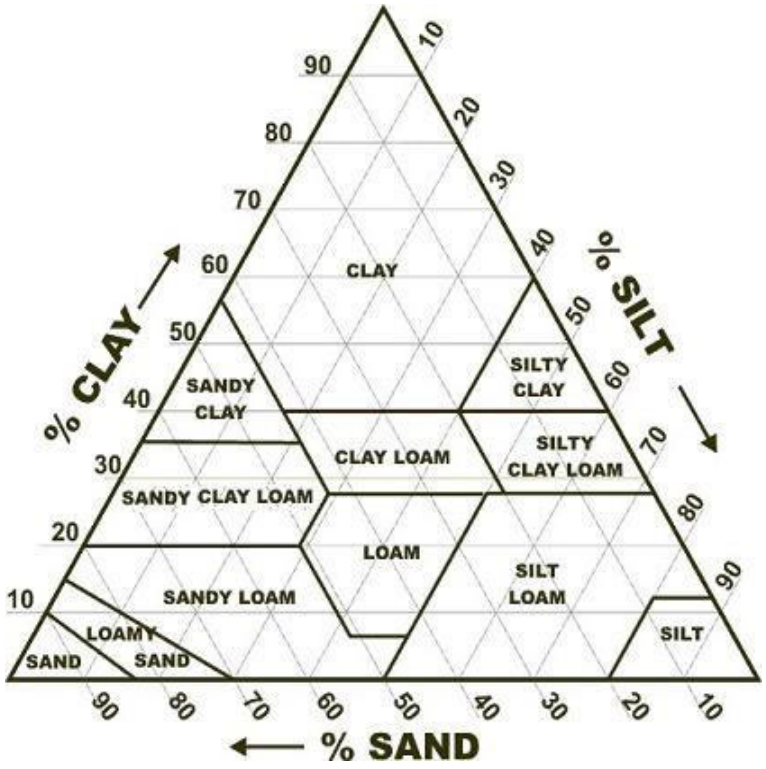
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
SW-TP-1	-	24-36"	52	47	1	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

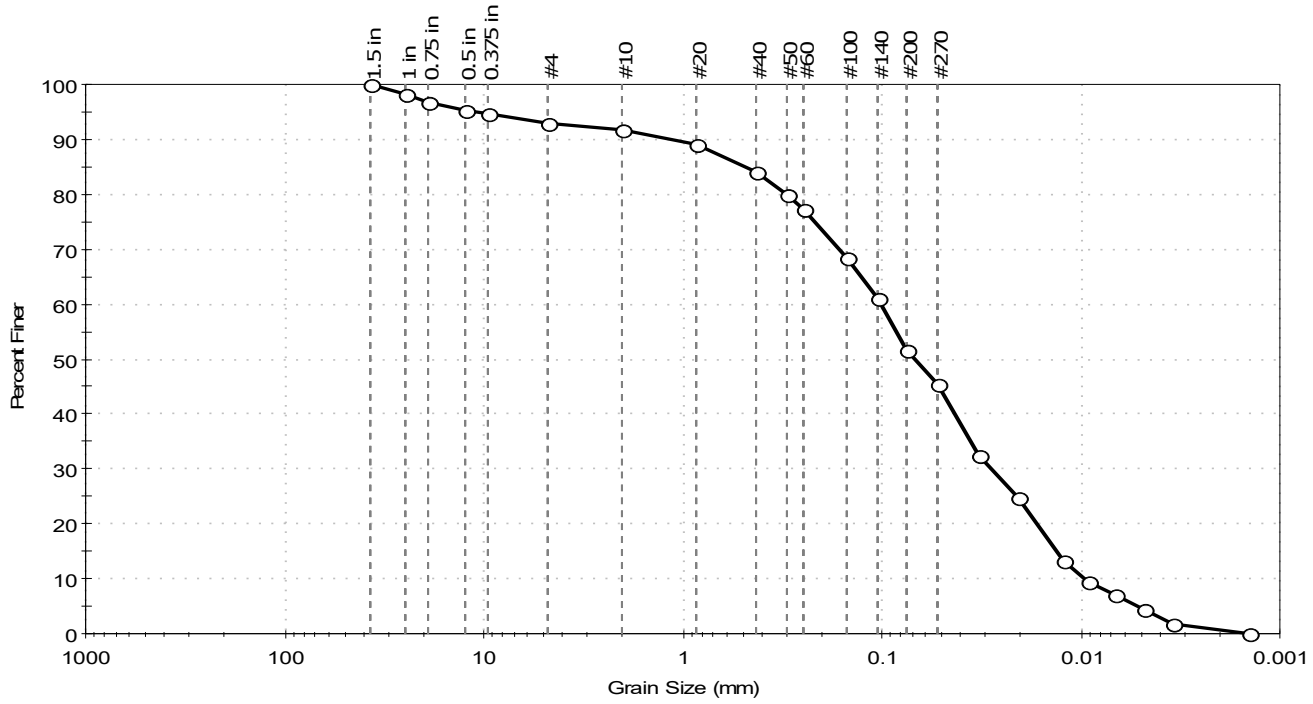
Clay: material passing 0.002 mm diameter



GeoTesting EXPRESS

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-1	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	24-36"	Test Id:	685777		
Test Comment:	---				
Visual Description:	Moist, brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	7.0	41.5	51.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	98		
0.75 in	19.00	97		
0.5 in	12.50	95		
0.375 in	9.50	95		
#4	4.75	93		
#10	2.00	92		
#20	0.85	89		
#40	0.42	84		
#50	0.30	80		
#60	0.25	77		
#100	0.15	69		
#140	0.11	61		
#200	0.075	52		
#270	0.053	45		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0329	32		
---	0.0209	25		
---	0.0123	13		
---	0.0093	10		
---	0.0067	7		
---	0.0048	4		
---	0.0034	2		
---	0.0014	0		

Coefficients

D_{85} = 0.4905 mm	D_{30} = 0.0285 mm
D_{60} = 0.1016 mm	D_{15} = 0.0133 mm
D_{50} = 0.0688 mm	D_{10} = 0.0096 mm
C_u = 10.583	C_c = 0.833

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

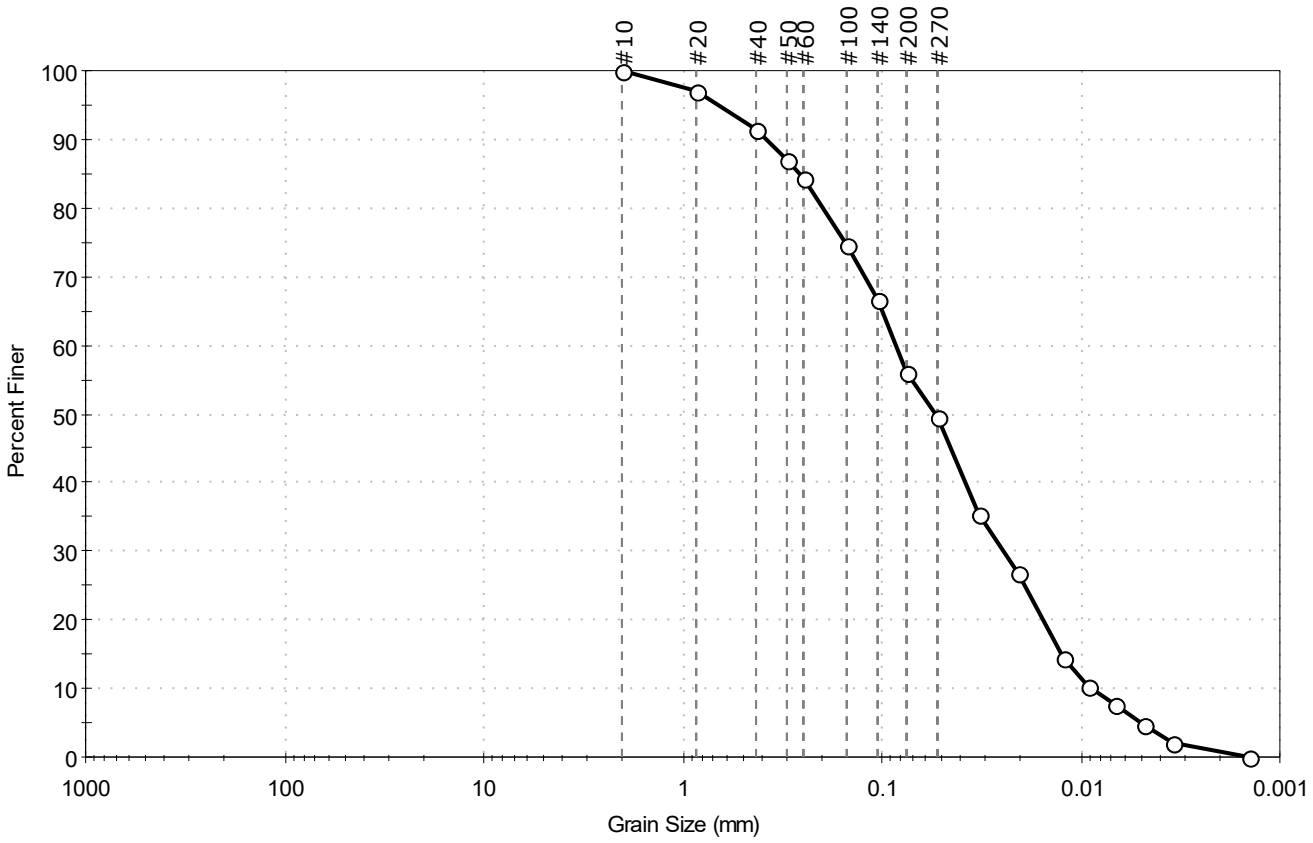
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-1	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	24-36"	Test Id:	685777		
Test Comment:	Only minus No. 10 sieve for USDA classification				
Visual Description:	Moist, brown silty sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.0	43.9	56.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	97		
#40	0.42	91		
#50	0.30	87		
#60	0.25	84		
#100	0.15	75		
#140	0.11	67		
#200	0.075	56		
#270	0.053	49		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0329	35		
---	0.0209	27		
---	0.0123	15		
---	0.0093	10		
---	0.0067	8		
---	0.0048	5		
---	0.0034	2		
---	0.0014	0		

Coefficients

D_{85} = 0.2626 mm	D_{30} = 0.0246 mm
D_{60} = 0.0853 mm	D_{15} = 0.0125 mm
D_{50} = 0.0546 mm	D_{10} = 0.0089 mm
C_u = 9.584	C_c = 0.797

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-2	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	36-120"	Test Id:	685782		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

USDA Textural Classification

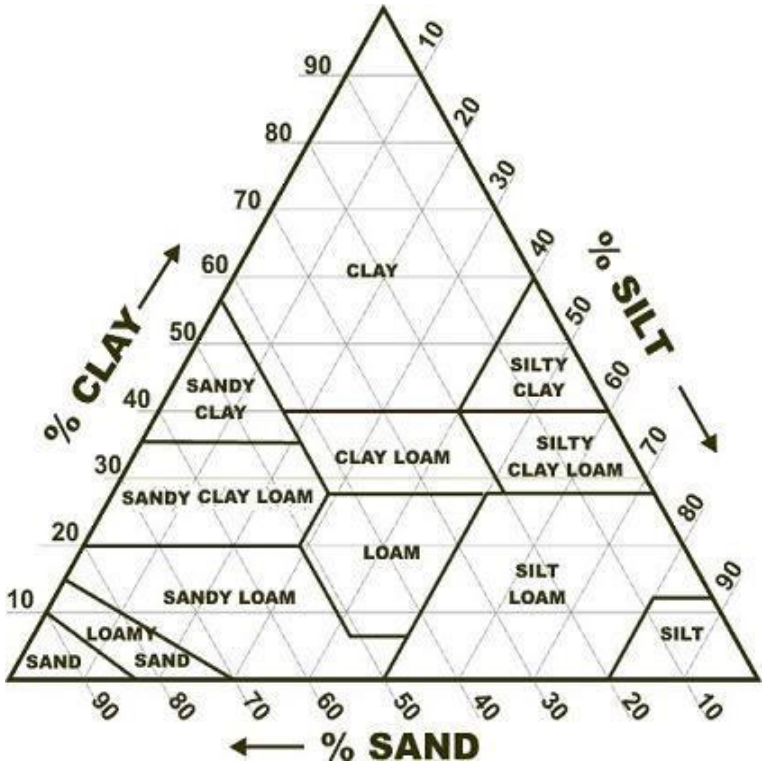
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
SW-TP-2	-	36-120"	71	28	1	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

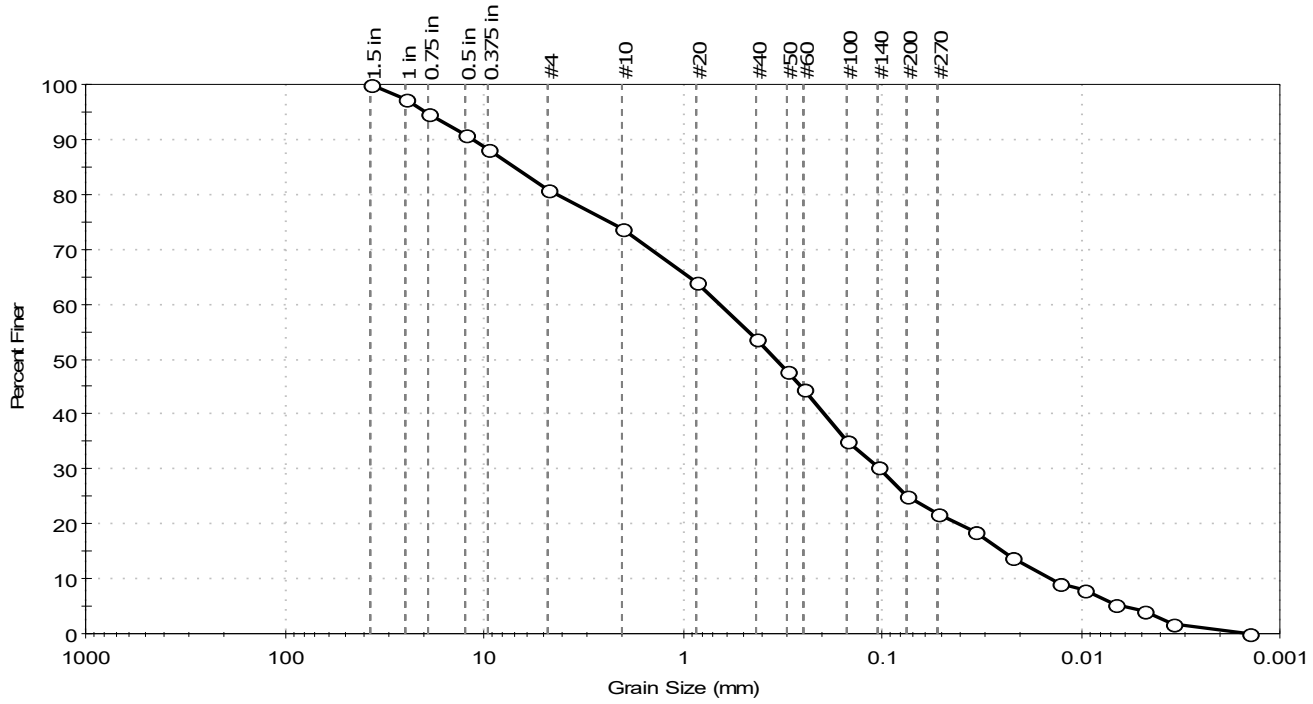
Clay: material passing 0.002 mm diameter



GeoTesting EXPRESS

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-2	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	36-120"	Test Id:	685776		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	19.2	55.6	25.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	97		
0.75 in	19.00	95		
0.5 in	12.50	91		
0.375 in	9.50	88		
#4	4.75	81		
#10	2.00	74		
#20	0.85	64		
#40	0.42	54		
#50	0.30	48		
#60	0.25	44		
#100	0.15	35		
#140	0.11	30		
#200	0.075	25		
#270	0.053	22		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0343	19		
---	0.0224	14		
---	0.0128	9		
---	0.0095	8		
---	0.0068	5		
---	0.0048	4		
---	0.0035	2		
---	0.0014	0		

Coefficients

D_{85} = 7.0408 mm	D_{30} = 0.1036 mm
D_{60} = 0.6491 mm	D_{15} = 0.0247 mm
D_{50} = 0.3410 mm	D_{10} = 0.0143 mm
C_u = 45.392	C_c = 1.156

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

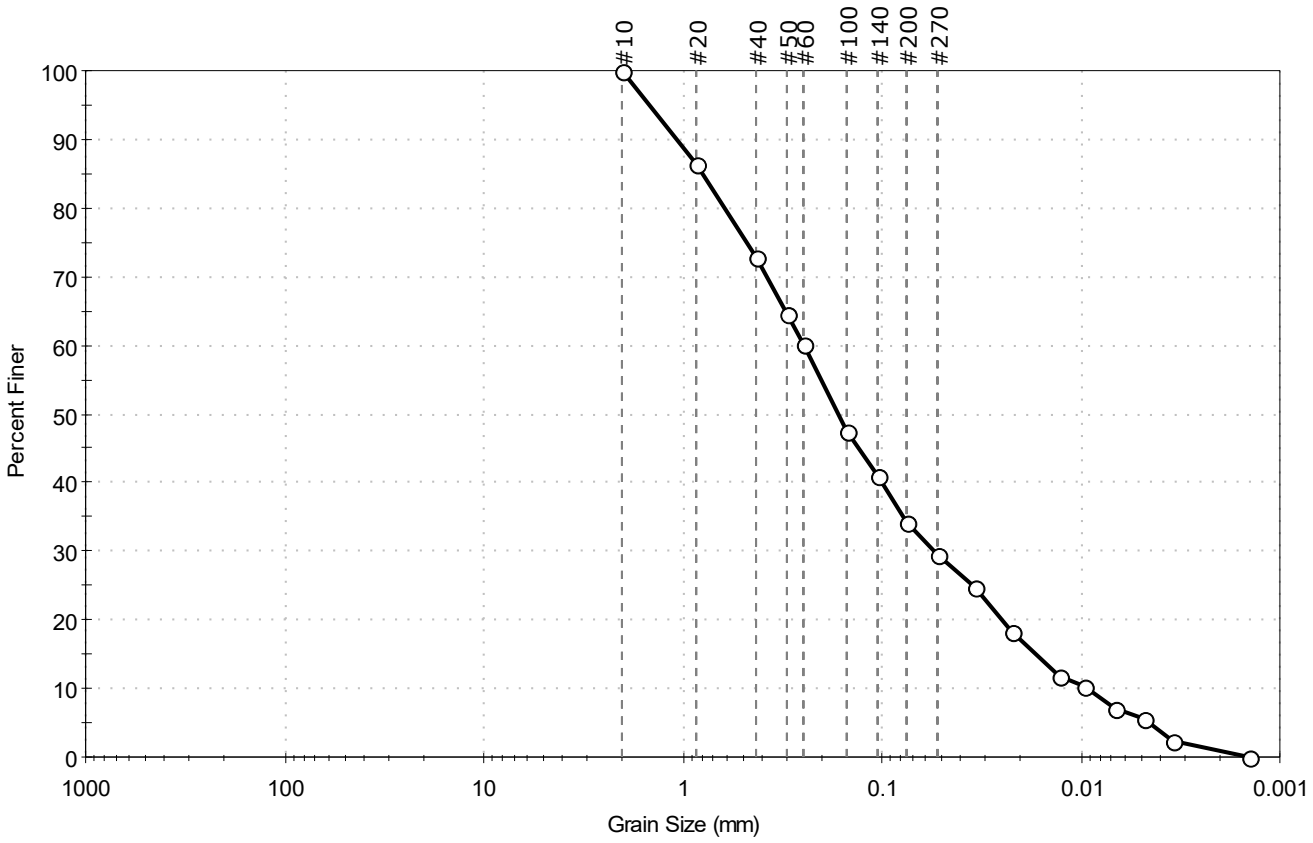
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-2	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	36-120"	Test Id:	685776		
Test Comment:	Only minus No. 10 sieve for USDA classification				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.0	65.9	34.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	87		
#40	0.42	73		
#50	0.30	65		
#60	0.25	60		
#100	0.15	47		
#140	0.11	41		
#200	0.075	34		
#270	0.053	30		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0343	25		
---	0.0224	18		
---	0.0128	12		
---	0.0095	10		
---	0.0068	7		
---	0.0048	6		
---	0.0035	2		
---	0.0014	0		

Coefficients

D_{85} =0.7855 mm	D_{30} =0.0546 mm
D_{60} =0.2483 mm	D_{15} =0.0167 mm
D_{50} =0.1661 mm	D_{10} =0.0092 mm
C_u =26.989	C_c =1.305

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-3	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	30-162"	Test Id:	685786		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

USDA Textural Classification

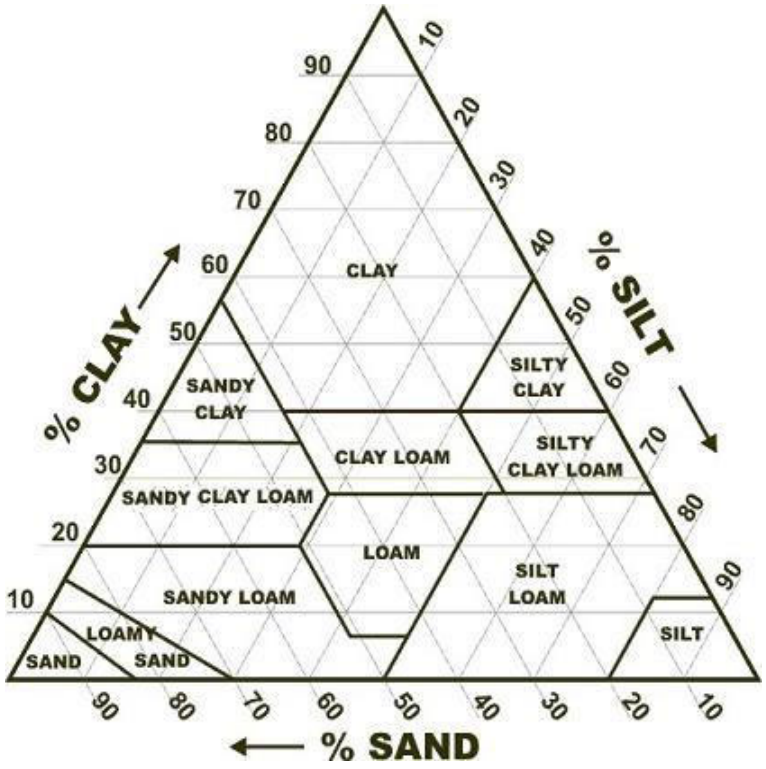
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
SW-TP-3	-	30-162"	65	32	3	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

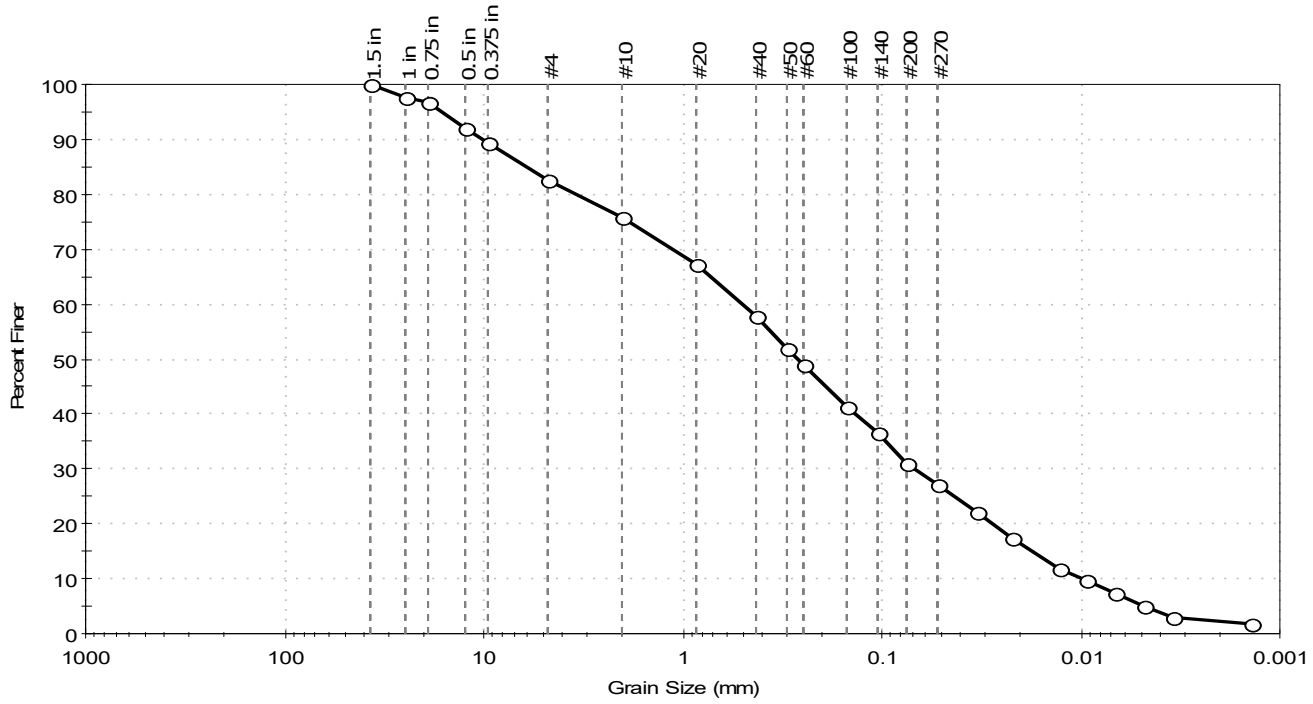
Clay: material passing 0.002 mm diameter



GeoTesting EXPRESS

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-3	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	30-162"	Test Id:	685780		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	17.4	51.5	31.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	98		
0.75 in	19.00	97		
0.5 in	12.50	92		
0.375 in	9.50	90		
#4	4.75	83		
#10	2.00	76		
#20	0.85	67		
#40	0.42	58		
#50	0.30	52		
#60	0.25	49		
#100	0.15	41		
#140	0.11	37		
#200	0.075	31		
#270	0.053	27		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0330	22		
---	0.0222	18		
---	0.0129	12		
---	0.0094	10		
---	0.0067	7		
---	0.0048	5		
---	0.0034	3		
---	0.0014	2		

Coefficients

D_{85} = 6.0288 mm D_{30} = 0.0680 mm
D_{60} = 0.4991 mm D_{15} = 0.0174 mm
D_{50} = 0.2672 mm D_{10} = 0.0099 mm
C_u = 50.414 C_c = 0.936

Classification

ASTM N/A

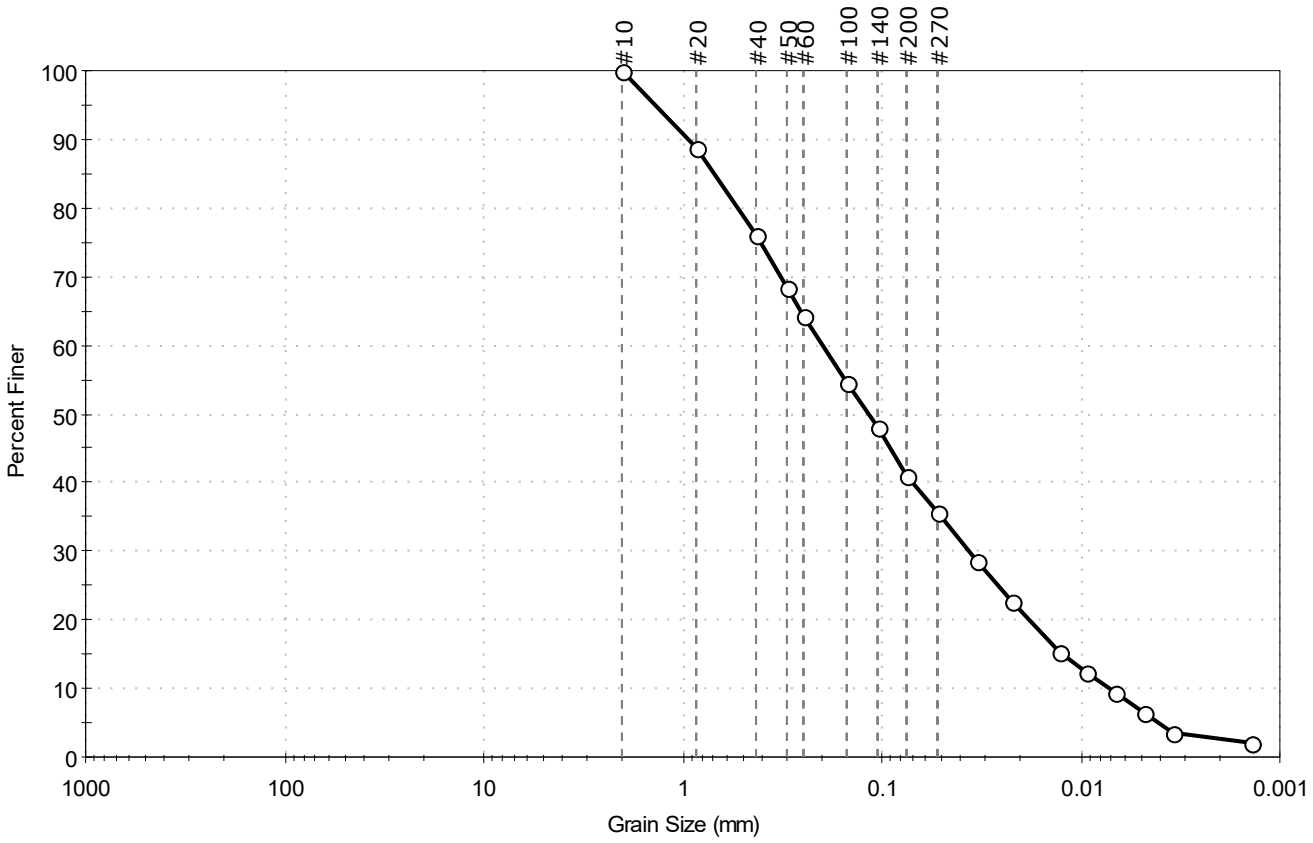
AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR
Sand/Gravel Hardness : HARD
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-3	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	30-162"	Test Id:	685780		
Test Comment:	Only minus No. 10 sieve for USDA classification				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.0	59.0	41.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	89		
#40	0.42	76		
#50	0.30	68		
#60	0.25	64		
#100	0.15	55		
#140	0.11	48		
#200	0.075	41		
#270	0.053	36		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0330	29		
---	0.0222	23		
---	0.0129	15		
---	0.0094	12		
---	0.0067	10		
---	0.0048	7		
---	0.0034	4		
---	0.0014	2		

Coefficients

D_{85} =0.6945 mm	D_{30} =0.0363 mm
D_{60} =0.1993 mm	D_{15} =0.0124 mm
D_{50} =0.1169 mm	D_{10} =0.0071 mm
C_u =28.070	C_c =0.931

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-4	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	2-18"	Test Id:	685781		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

USDA Textural Classification

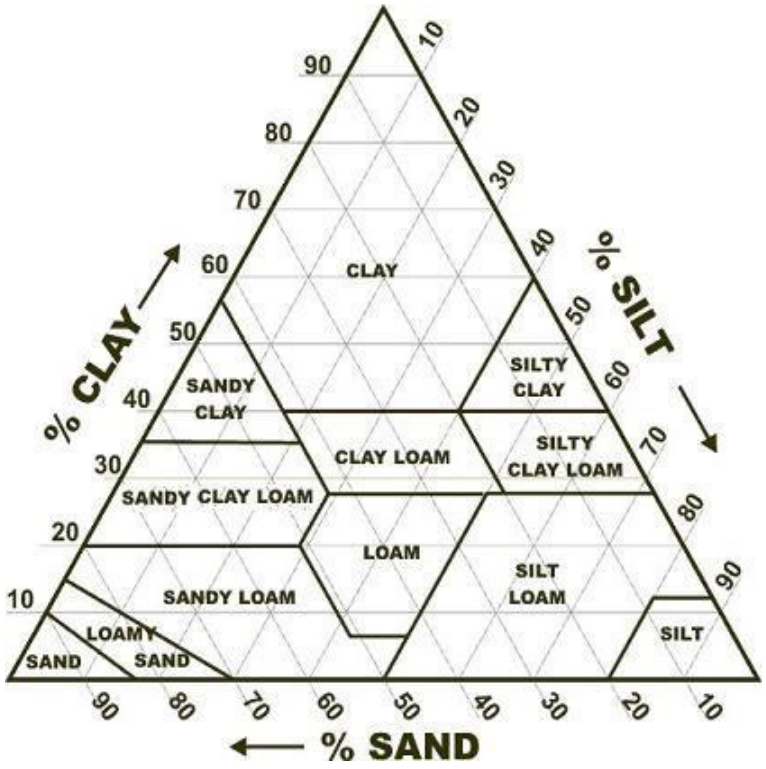
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
SW-TP-4	-	2-18"	67	32	1	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

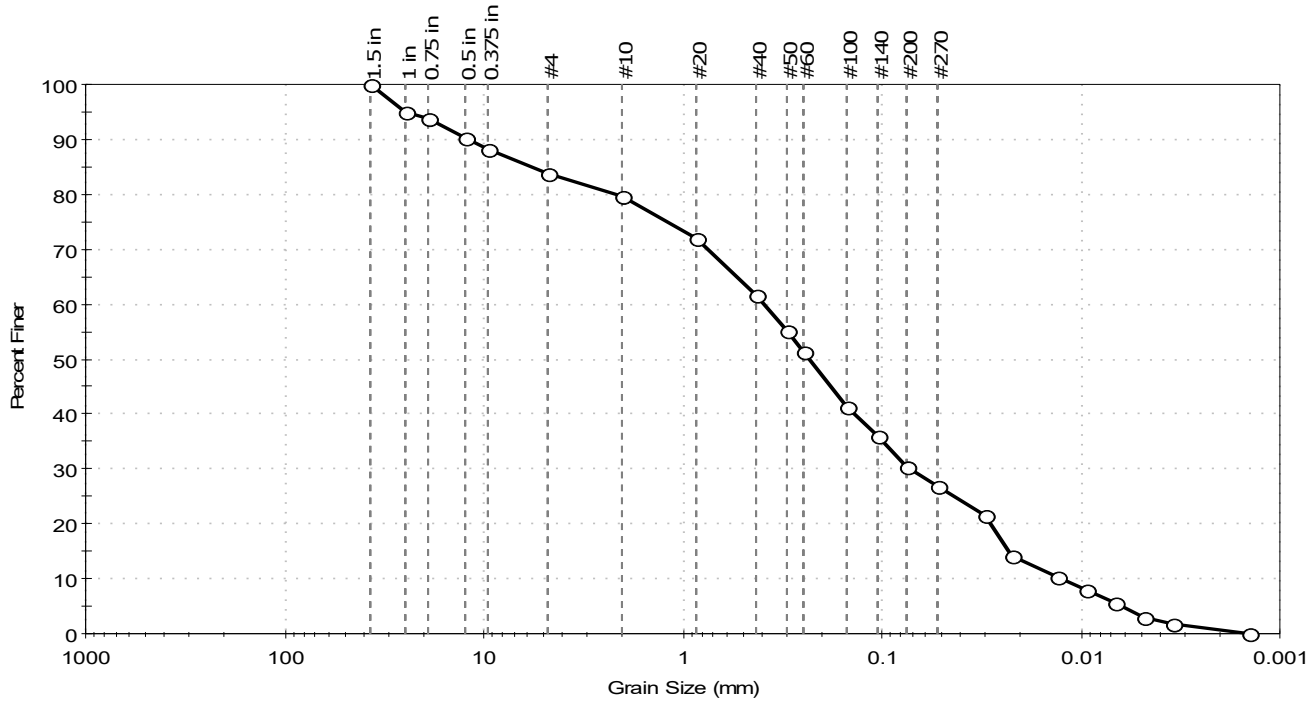
Clay: material passing 0.002 mm diameter



GeoTesting EXPRESS

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-4	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	2-18"	Test Id:	685775		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	16.3	53.4	30.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	95		
0.75 in	19.00	94		
0.5 in	12.50	90		
0.375 in	9.50	88		
#4	4.75	84		
#10	2.00	80		
#20	0.85	72		
#40	0.42	62		
#50	0.30	55		
#60	0.25	51		
#100	0.15	41		
#140	0.11	36		
#200	0.075	30		
#270	0.053	27		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0301	22		
---	0.0221	14		
---	0.0132	10		
---	0.0094	8		
---	0.0068	6		
---	0.0049	3		
---	0.0035	2		
---	0.0014	0		

Coefficients

D_{85} = 5.7867 mm	D_{30} = 0.0730 mm
D_{60} = 0.3878 mm	D_{15} = 0.0230 mm
D_{50} = 0.2327 mm	D_{10} = 0.0124 mm
C_u = 31.274	C_c = 1.108

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

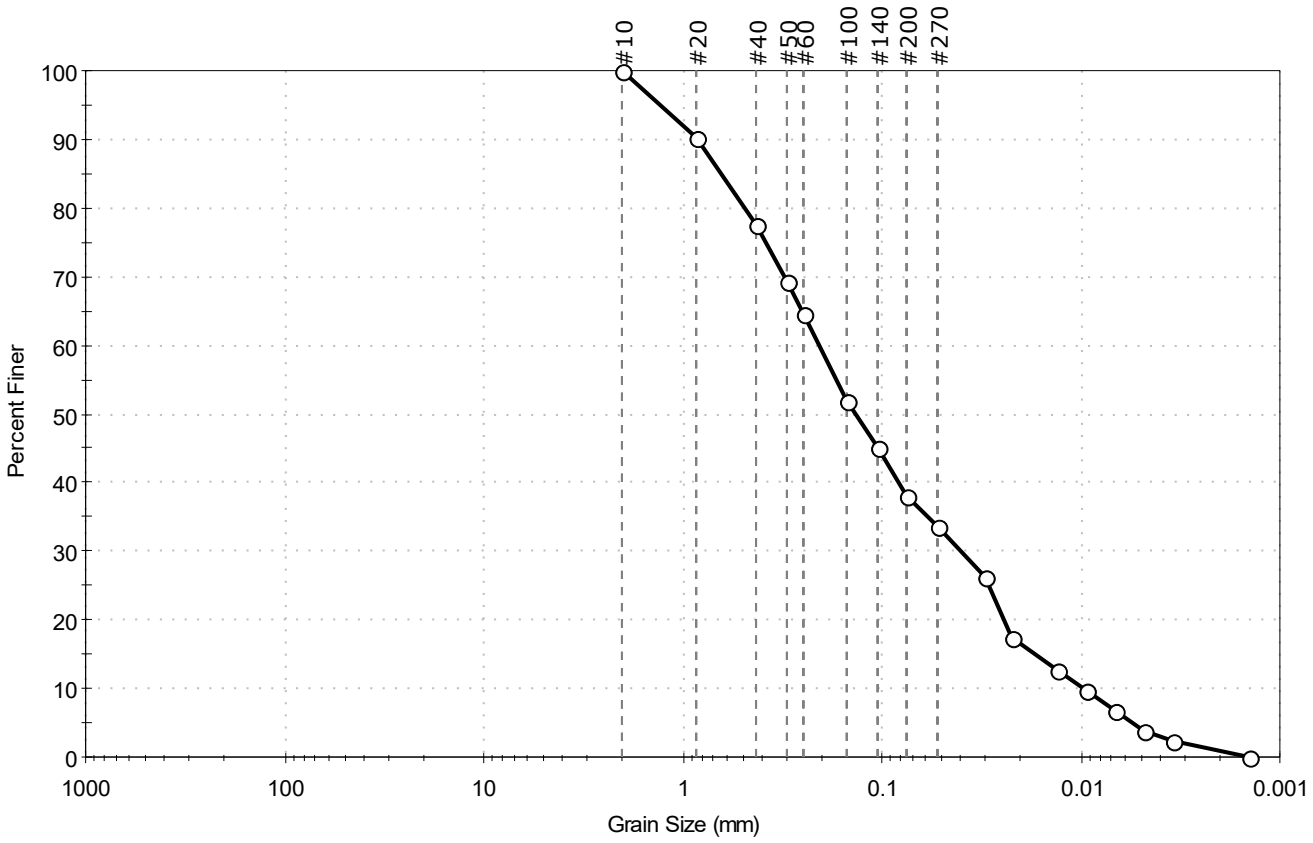
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-4	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	2-18"	Test Id:	685775		
Test Comment:	Only minus No. 10 sieve for USDA classification				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.0	62.0	38.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	90		
#40	0.42	78		
#50	0.30	69		
#60	0.25	65		
#100	0.15	52		
#140	0.11	45		
#200	0.075	38		
#270	0.053	34		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0301	26		
---	0.0221	17		
---	0.0132	13		
---	0.0094	10		
---	0.0068	7		
---	0.0049	4		
---	0.0035	2		
---	0.0014	0		

Coefficients

D_{85} = 0.6350 mm	D_{30} = 0.0400 mm
D_{60} = 0.2073 mm	D_{15} = 0.0170 mm
D_{50} = 0.1352 mm	D_{10} = 0.0096 mm
C_u = 21.594	C_c = 0.804

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-5	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	30-84"	Test Id:	685785		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

USDA Textural Classification

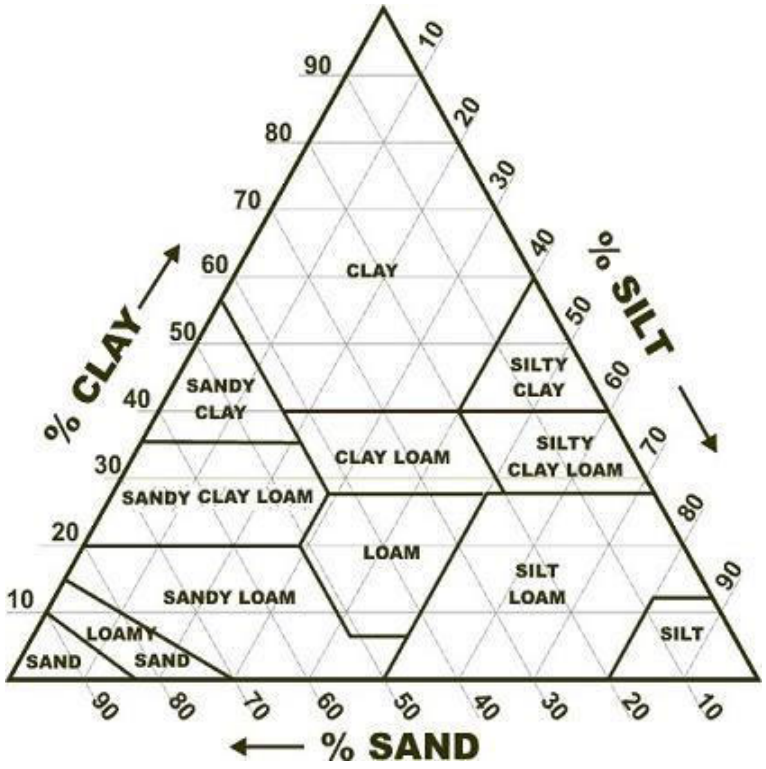
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
SW-TP-5	-	30-84"	67	32	1	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

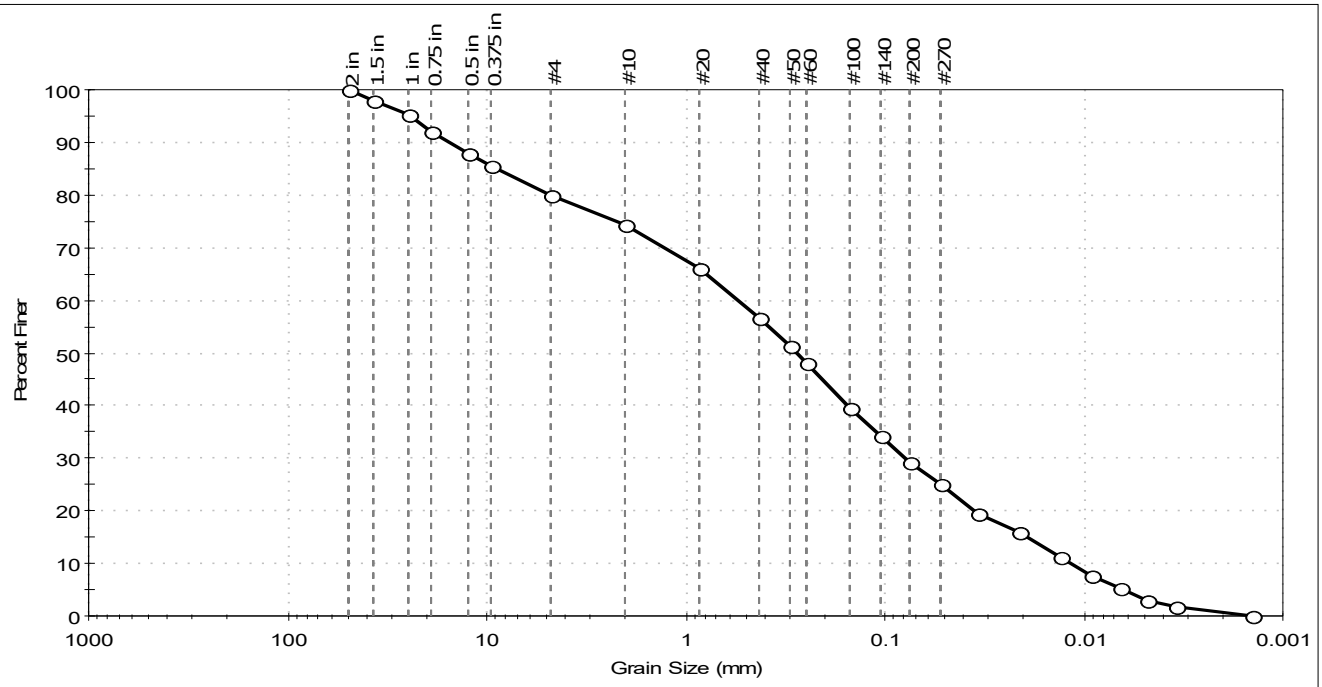
Clay: material passing 0.002 mm diameter



GeoTesting EXPRESS

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-5	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	30-84"	Test Id:	685779		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	19.9	50.8	29.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	98		
1 in	25.00	95		
0.75 in	19.00	92		
0.5 in	12.50	88		
0.375 in	9.50	86		
#4	4.75	80		
#10	2.00	74		
#20	0.85	66		
#40	0.42	57		
#50	0.30	51		
#60	0.25	48		
#100	0.15	39		
#140	0.11	34		
#200	0.075	29		
#270	0.053	25		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0345	19		
---	0.0211	16		
---	0.0131	11		
---	0.0092	8		
---	0.0067	5		
---	0.0049	3		
---	0.0034	2		
---	0.0014	0		

Coefficients

D_{85} = 8.8583 mm
D_{30} = 0.0788 mm
D_{60} = 0.5415 mm
D_{15} = 0.0192 mm
D_{50} = 0.2804 mm
D_{10} = 0.0116 mm
C_u = 46.681
C_c = 0.989

Classification

ASTM N/A

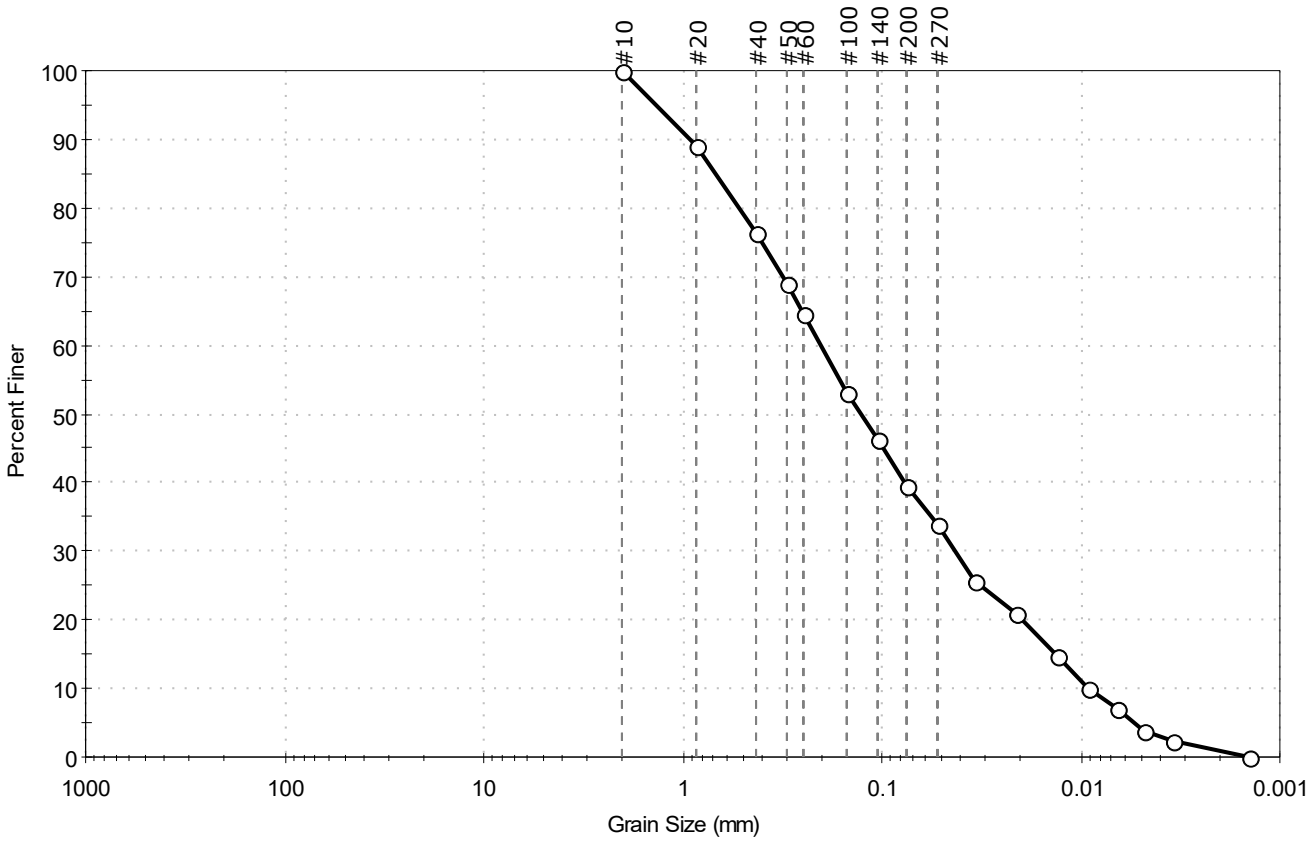
AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR
Sand/Gravel Hardness : HARD
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-5	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	30-84"	Test Id:	685779		
Test Comment:	Only minus No. 10 sieve for USDA classification				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.0	60.5	39.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	89		
#40	0.42	76		
#50	0.30	69		
#60	0.25	65		
#100	0.15	53		
#140	0.11	46		
#200	0.075	39		
#270	0.053	34		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0345	26		
---	0.0211	21		
---	0.0131	15		
---	0.0092	10		
---	0.0067	7		
---	0.0049	4		
---	0.0034	2		
---	0.0014	0		

Coefficients

D_{85} =0.6814 mm	D_{30} =0.0432 mm
D_{60} =0.2036 mm	D_{15} =0.0133 mm
D_{50} =0.1282 mm	D_{10} =0.0091 mm
C_u =22.374	C_c =1.007

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-6	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	42-120"	Test Id:	685784		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

USDA Textural Classification

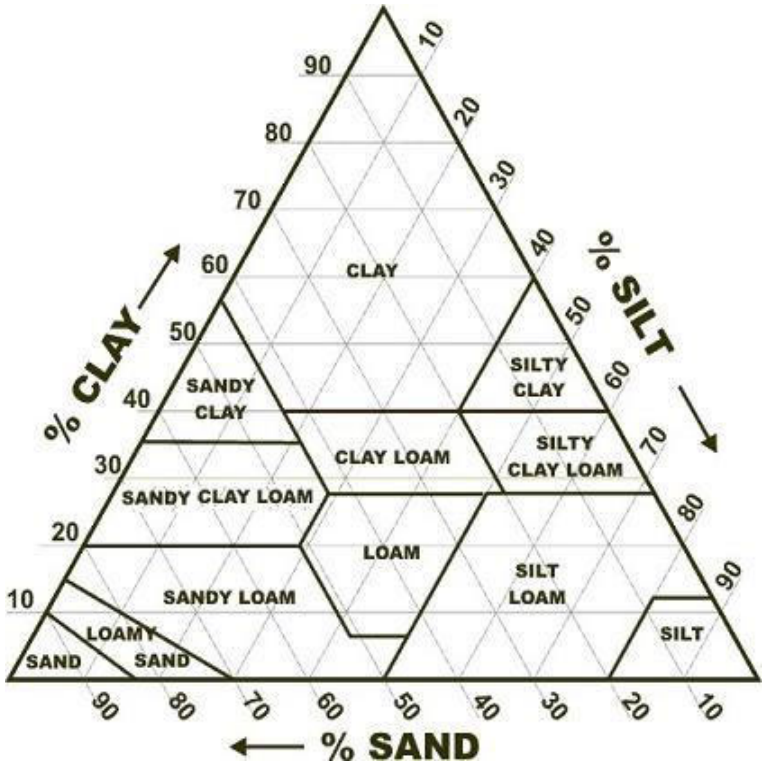
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
SW-TP-6	-	42-120"	69	28	3	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

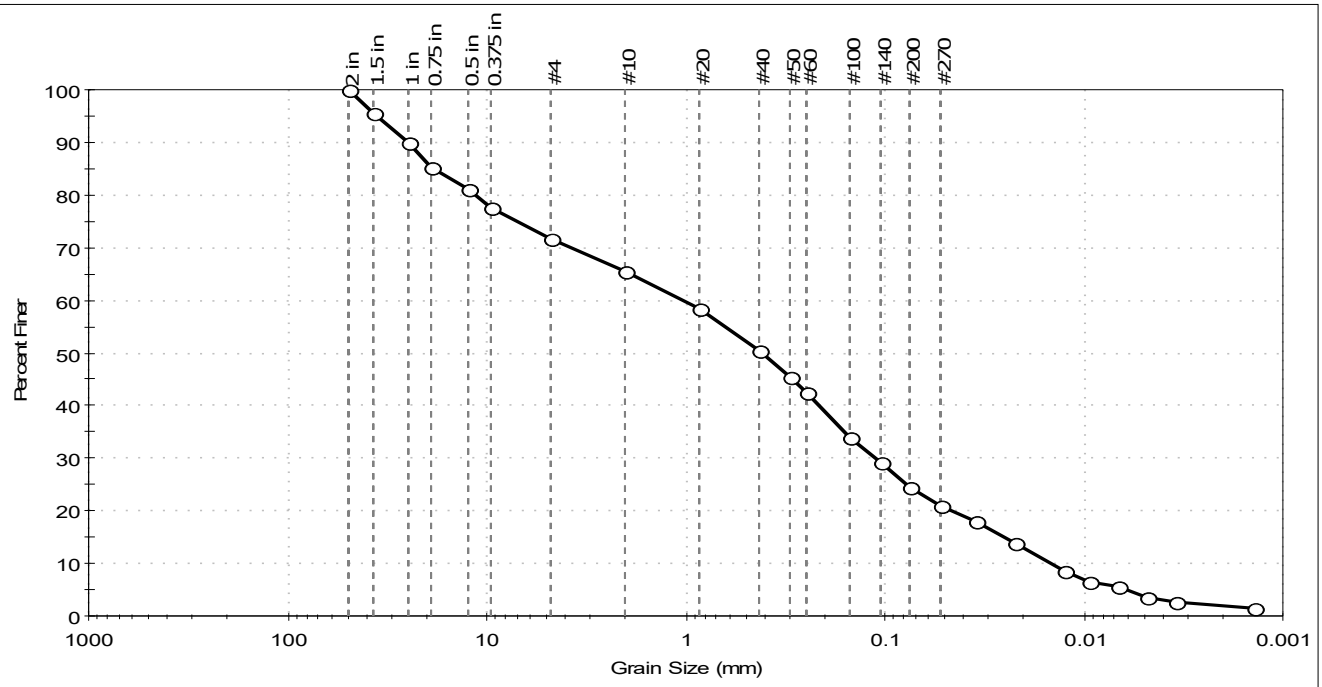
Silt: material passing 0.05 mm and retained on 0.002 mm diameter

Clay: material passing 0.002 mm diameter



Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-6	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	42-120"	Test Id:	685778		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	28.2	47.2	24.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	96		
1 in	25.00	90		
0.75 in	19.00	85		
0.5 in	12.50	81		
0.375 in	9.50	78		
#4	4.75	72		
#10	2.00	65		
#20	0.85	58		
#40	0.42	50		
#50	0.30	46		
#60	0.25	43		
#100	0.15	34		
#140	0.11	29		
#200	0.075	25		
#270	0.053	21		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0347	18		
---	0.0223	14		
---	0.0125	9		
---	0.0095	7		
---	0.0067	6		
---	0.0048	4		
---	0.0034	3		
---	0.0014	2		

Coefficients

D_{85} = 18.4971 mm	D_{30} = 0.1131 mm
D_{60} = 1.0331 mm	D_{15} = 0.0255 mm
D_{50} = 0.4117 mm	D_{10} = 0.0145 mm
C_u = 71.248	C_c = 0.854

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

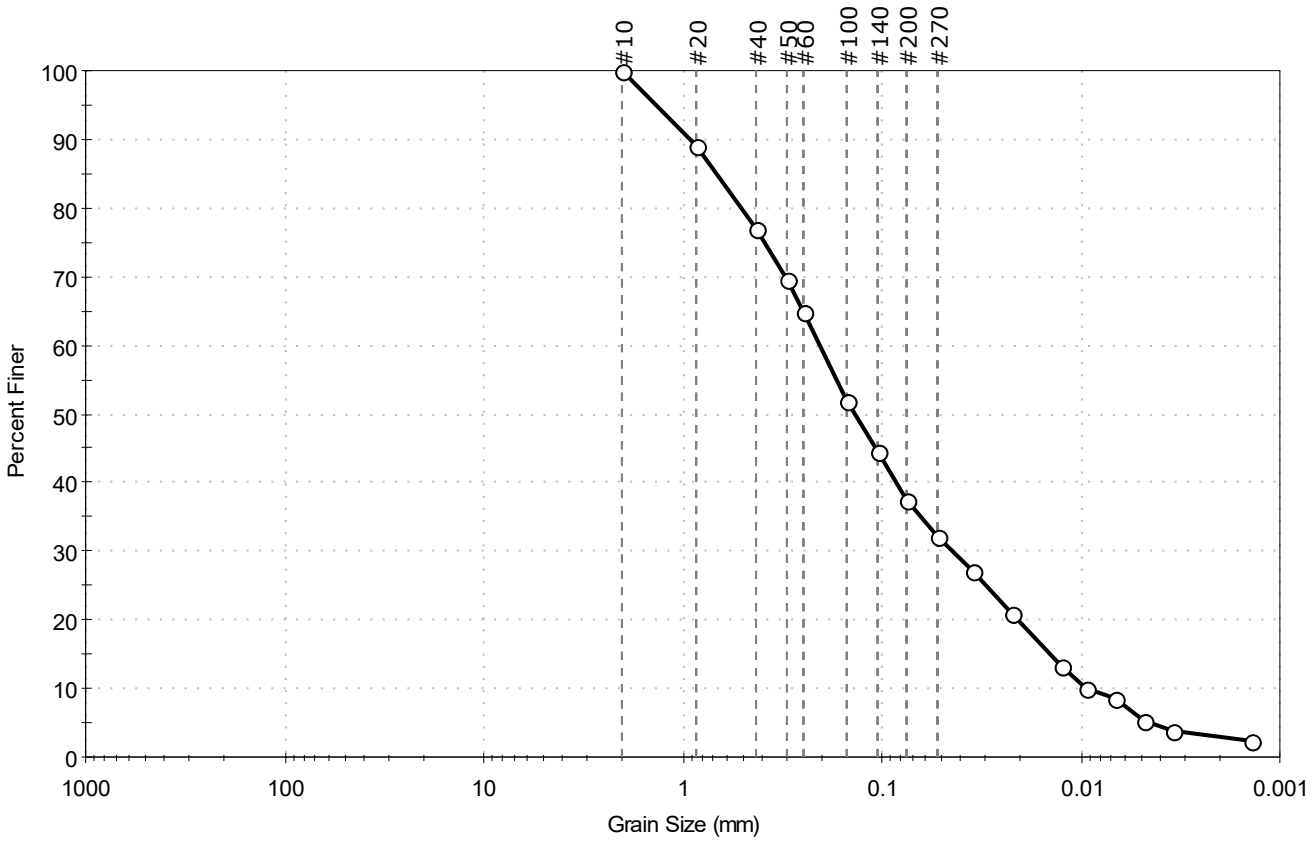
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SW-TP-6	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/26/22	Checked By:	bfs
Depth :	42-120"	Test Id:	685778		
Test Comment:	Only minus No. 10 sieve for USDA classification				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	0.0	62.5	37.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	89		
#40	0.42	77		
#50	0.30	70		
#60	0.25	65		
#100	0.15	52		
#140	0.11	44		
#200	0.075	38		
#270	0.053	32		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0347	27		
---	0.0223	21		
---	0.0125	13		
---	0.0095	10		
---	0.0067	9		
---	0.0048	5		
---	0.0034	4		
---	0.0014	2		

Coefficients

D_{85} =0.6695 mm	D_{30} =0.0441 mm
D_{60} =0.2054 mm	D_{15} =0.0142 mm
D_{50} =0.1370 mm	D_{10} =0.0092 mm
C_u =22.326	C_c =1.029

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

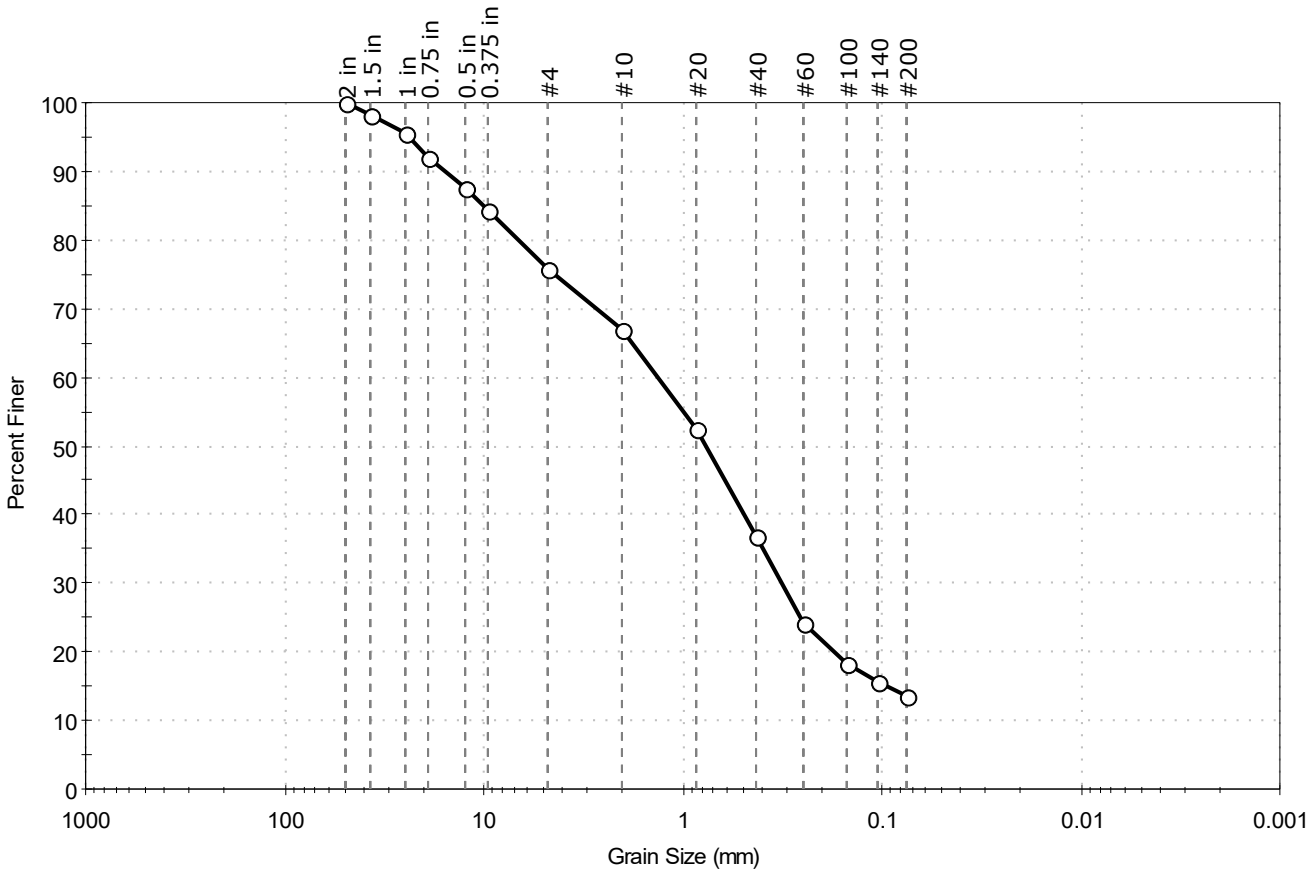
Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SH-TP-7	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/20/22	Checked By:	bfs
Depth :	2'-5'	Test Id:	685788		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	24.2	62.2	13.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	98		
1 in	25.00	95		
0.75 in	19.00	92		
0.5 in	12.50	88		
0.375 in	9.50	84		
#4	4.75	76		
#10	2.00	67		
#20	0.85	52		
#40	0.42	37		
#60	0.25	24		
#100	0.15	18		
#140	0.11	16		
#200	0.075	14		

Coefficients

D_{85} = 9.9978 mm
D_{30} = 0.3186 mm
D_{60} = 1.3241 mm
D_{15} = 0.0960 mm
D_{50} = 0.7625 mm
D_{10} = N/A
C_u = N/A
C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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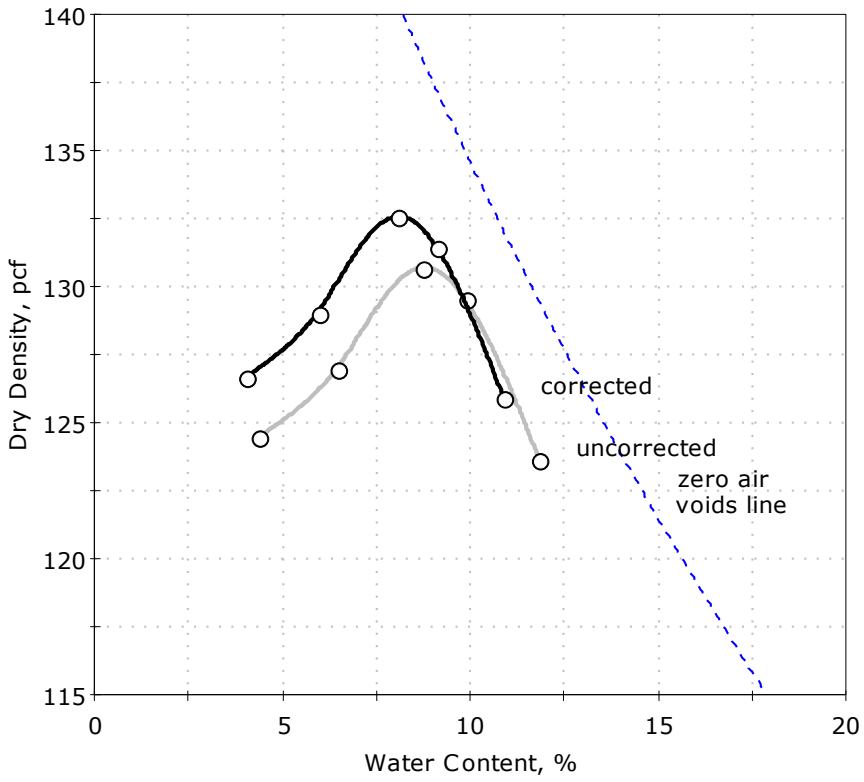
Edited on 11/4/2022 to display correct Boring ID

GeoTesting EXPRESS

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SH-TP-7	Sample Type:	bag	Tested By:	cwd
Sample ID:	-	Test Date:	09/19/22	Checked By:	bfs
Depth :	2'-5'	Test Id:	685790		
Test Comment:	---				
Visual Description:	Moist, brown silty sand with gravel				
Sample Comment:	---				

Compaction Report - ASTM D1557



Data Points	Point 1	Point 2	Point 3	Point 4	Point 5
Dry density, pcf	124.5	127.0	130.7	129.5	123.7
Moisture Content, %	4.4	6.5	8.7	9.9	11.8

Method : C

Preparation : DRY

As received Moisture :6 %

Rammer : Mechanical

Zero voids line based on assumed specific gravity of 2.75

Maximum Dry Density= 130.7 pcf

Optimum Moisture= 8.8 %

Oversize Correction (8% > 3/4 inch Sieve)

Corrected Maximum Dry Density= 132.6 pcf

Corrected Optimum Moisture= 8.1 %

Assumed Average Bulk Specific Gravity = 2.55

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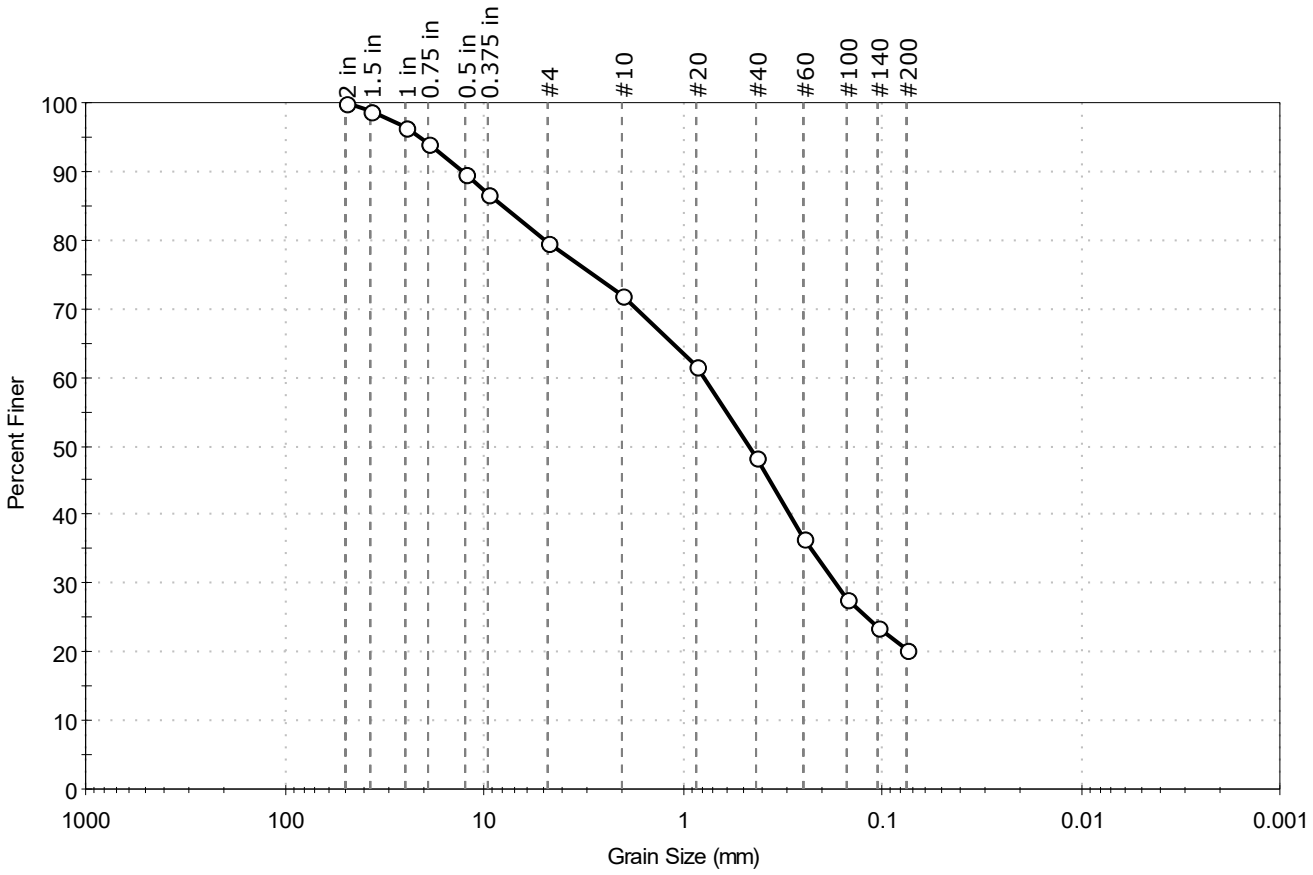
GeoTesting EXPRESS

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SH-TP-9	Sample Type:	bag	Tested By:	ckg
Sample ID:	-	Test Date:	09/20/22	Checked By:	bfs
Depth :	3'-10'	Test Id:	685787		
Test Comment:	---				
Visual Description:	Moist, pale brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	20.2	59.5	20.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	99		
1 in	25.00	96		
0.75 in	19.00	94		
0.5 in	12.50	90		
0.375 in	9.50	87		
#4	4.75	80		
#10	2.00	72		
#20	0.85	62		
#40	0.42	48		
#60	0.25	37		
#100	0.15	28		
#140	0.11	24		
#200	0.075	20		

Coefficients

D_{85} = 7.9116 mm
D_{30} = 0.1709 mm
D_{60} = 0.7746 mm
D_{15} = N/A
D_{50} = 0.4613 mm
D_{10} = N/A
C_u = N/A
C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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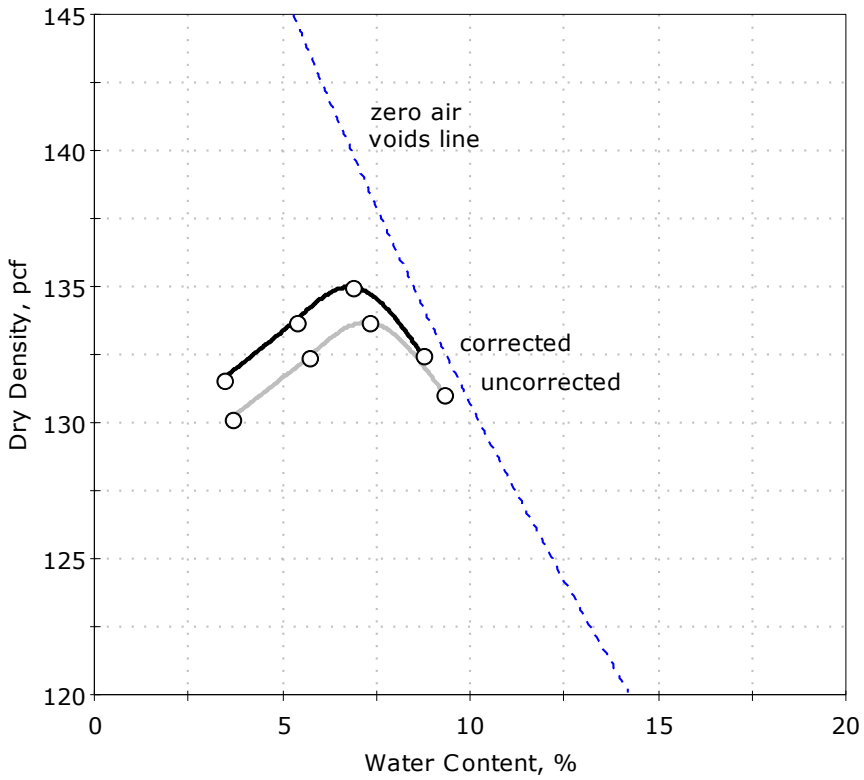
GeoTesting EXPRESS

Client:	Sanborn, Head & Associates, Inc.				
Project:	BMG Randolph				
Location:				Project No:	GTX-316092
Boring ID:	SH-TP-9	Sample Type:	bag	Tested By:	cwd
Sample ID:	-	Test Date:	09/20/22	Checked By:	bfs
Depth :	3'-10'	Test Id:	685789		
Test Comment:	---				
Visual Description:	Moist, pale brown silty sand with gravel				
Sample Comment:	---				

Compaction Report - ASTM D1557



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	130.2	132.4	133.7	131.1
Moisture Content, %	3.6	5.7	7.3	9.3

Method : C

Preparation : DRY

As received Moisture :3 %

Rammer : Mechanical

Zero voids line based on assumed specific gravity of 2.65

Maximum Dry Density= 133.7 pcf

Optimum Moisture= 7.2 %

Oversize Correction (6% > 3/4 inch Sieve)

Corrected Maximum Dry Density= 135.0 pcf

Corrected Optimum Moisture= 6.8 %

Assumed Average Bulk Specific Gravity = 2.55

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