O'Reilly, Talbot & Okun
ENGINEERING ASSOCIATES

J2060-03-01
October 25, 2023

Ms. Mary Anne Antonellis, Director
M.N. Spear Memorial Library
10 Cooleyville Road
PO Box 256
Shutesbury, Massachusetts 01072

Re: Geotechnical Engineering Recommendations
Shutesbury Public Library
66 Leverett Road
Shutesbury, Massachusetts

Dear Ms. Antonellis,

O'Reilly, Talbot & Okun Associates, Inc. (OTO) is pleased to provide this letter report summarizing our geotechnical engineering recommendations for the proposed new public library in Shutesbury, Massachusetts. A Site Locus is provided as Figure 1. A Site Plan is provided as Figure 2.

Our geotechnical recommendations are based upon the investigations performed during this study, as well as information gathered by OTO during both a preliminary geotechnical study in 2010 and a Limited Environmental Site Assessment (ESA) in 2021. In addition, OTO reviewed an Underground Injection Control (UIC) Closure Report prepared by Fuss & O'Neill (F&O) in 2022.

Our services consisted of a review of published geologic information and the previous studies, observation of the soil borings and test pits performed for this study, engineering analyses, and preparation of this report. This report is subject to the attached limitations.

PROJECT DESCRIPTION

The project Site is located at 66 Leverett Road in Shutesbury, Massachusetts. The Site is bounded by a residential property to the east, Leverett Road followed by the Shutesbury Highway Department to the north, and wooded land to the west and south. The location of the Site is shown on Figure 1.

The Site currently consists of grass-covered areas with few trees. However, the western and southern portions of the Site are densely wooded. The ground surface of the grass-covered area slopes gently upward from approximate elevation 1,170 feet at Leverett Road to 1,180 feet near the southern tree line. We understand a former garage building (located to the northeast of the proposed building) with an approximate footprint of 1,500 square feet was demolished, and its slab removed, sometime in 2021. The floor drain and drain pipe components remained in place and were investigated under a UIC closure study by F&O in 2022. That study indicated that no further response actions regarding the UIC structure were warranted.

Project plans call for construction of an approximately 4,400 square foot (footprint) library building with associated parking areas and access roads. In addition, a stormwater detention basin will be constructed to the north of the proposed library building and a stormwater infiltration gallery to the southeast. The locations of the former garage and the proposed structures are shown on Figure 2.

We assume that the proposed library building will be a single-story, wood-framed structure. We understand that the building will be slab on grade with a finish floor elevation near the existing ground surface at approximate elevation 1,177 feet. Therefore, we anticipate cuts on the order of five feet or less will be required to construct the building.

We expect structural loads will be supported on both isolated column and continuous strip footings. Structural loads are unknown at this time. However, it is expected that maximum column loads will be less than 50 kips and that bearing walls will carry a load of five kips per linear foot, or less. We have assumed that floor loads may be relatively high in stack areas. The design team should confirm these assumptions.

SUBSURFACE EXPLORATIONS

Geotechnical subsurface investigations consisted of four backhoe test pits and six soil borings. In addition, we reviewed soil borings that were performed as part of an environmental study in 2021. The conditions encountered in these borings (B-1 through B-10) were consistent with the geotechnical investigations. The location of each boring and test pit is shown on Figure 2. However, the environmental borings are not discussed in detail within this report. For additional details, please refer to our “Limited Subsurface Assessment” report, dated October 5, 2021.

Soil Borings

The six geotechnical soil borings were performed by Seaboard Environmental Drilling of Chicopee, Massachusetts. Each boring was performed using a truck mounted drill rig and advanced using hollow stem auger drilling techniques. After drilling, bore holes were backfilled with soil cuttings. Boring logs are attached.

Soil borings SL-101 and SL-102 were performed within the proposed building footprint on October 3, 2023. The borings were extended to refusal at a depth of 16 feet below ground surface, corresponding to elevations between 1,163 and 1,162 feet. The proposed boring locations were adjusted in the field due to uneven terrain and landscaping, as areas of the Site were inaccessible with the truck mounted drill rig.

Borings SL-1 through SL-4. were performed to the northwest of the current proposed library building during a preliminary geotechnical study on June 23, 2010. The borings were extended to refusal at a depth of between 18 and 21.5 feet below ground surface, corresponding to elevations between 1,153.5 and 1,155.5 feet.

An OTO field representative observed and logged each boring. Soil samples were described according to a modified version of the Burmister Soil Classification System.

Soil samples were collected using a two-inch diameter split spoon sampler, driven 24 inches with a 140-pound safety hammer falling 30 inches (American Society for Testing and Materials Test Method D1586 “Standard Test Method for Penetration Test and Split-

Barrel Sampling of Soils"). The number of blows required to drive the sampler each six inches was recorded. The standard penetration resistance, or N-value, is the number of blows required to drive the sampler the middle 12 inches. Soil properties, such as strength and density, are related to the N-value. We note that the N-value collected in the field is corrected to account for differing hammer efficiencies, sampler type, borehole diameter, and depth. Typically, the field N-values are corrected to a standard 60% hammer efficiency, known as N_{60}. The N-values presented on the boring logs are field values, which are not adjusted for hammer efficiency. However, adjusted N_{60} values were used in our engineering calculations and analysis.

Test Pits

Four test pits were performed on October 3, 2023 by the Shutesbury Department of Public Works. The test pits were performed using a CAT 420XE backhoe equipped with a 0.25 cubic yard bucket.

Test pits TP-1 and TP-2 were performed within or near the proposed stormwater infiltration gallery to the southeast of the proposed library. Test pits TP-3 and TP-4 were performed within or near the proposed stormwater detention basin to the north of the proposed library. The test pits were performed to observe the nature of near surface soils and examine historic groundwater levels. An OTO representative observed and logged each test pit. Test pit logs are attached.

SUBSURFACE CONDITIONS

Subsurface conditions were interpreted based upon the explorations performed for this study and conditions documented in our 2010 preliminary geotechnical report. Subsurface conditions consisted of a surface layer of topsoil underlain by fine to medium sand and silt. Soil conditions are generally favorable for the proposed development.

Soil Conditions

Approximately four to eight inches of topsoil was encountered at the ground surface in each of the borings and test pits. The topsoil consisted of brown, fine sand and silt with little medium sand, little organics (roots), and trace amounts of coarse sand and gravel.

Non-engineered fill was encountered in test pit TP-3 to an approximate depth of 6.5 feet below ground surface, corresponding to elevation 1,169.5 feet. The fill consisted of dark brown, fine to medium sand with trace amounts of gravel and little silt, coarse sand, and debris (brick, concrete, ash).

Sandy native soils were encountered immediately beneath the surficial topsoil and non-engineered fill layers. These soils generally consisted of medium dense to very dense, fine to medium sand with little silt and varying amounts of coarse sand and gravel.

Test pits TP-1 through TP-4 were terminated within this layer at a depth of 9.5 to 11 feet below ground surface, corresponding to approximate elevations 1169.5 to 1161.5 feet.

Borings SL-101 and SL-102 were terminated at a depth of 16 feet below ground surface, corresponding to approximate elevations 1,163 and 1,162 feet, respectively. Auger refusal

was encountered in borings SL-1 through SL-4 at a depth of between 18 and 21.5 feet below the ground surface, corresponding to approximate elevations 1,153.5 to 1,155.5 feet. Auger refusal was likely within the very dense soil layer.

Groundwater Conditions

Saturated soils were encountered in each of the soil borings and test pits at a depth of 2 to 15 feet below ground surface, corresponding to approximate elevations 1,177 to 1,161 feet. It is unclear whether the saturated soils are indicative of groundwater or a result of limited vertical infiltration (perched water). Regardless, wet soils may be encountered during construction and the building should be designed to control groundwater and surface water infiltration.

SIGNIFICANT GEOTECHNICAL ISSUES

The significant geotechnical issues for the proposed construction addressed in this report include the following: foundation bearing capacity and settlement; seismic design considerations; surface water and groundwater control; and the suitability of on-Site materials for use as engineered fill.

DESIGN RECOMMENDATIONS

The following recommendations are provided for the construction assumed in this report. These recommendations may need to be revised if the building location and/or slab elevations change during design.

The recommendations in this report refer to the 9th Edition of the Massachusetts State Building Code (MSBC), which includes amendments to the 2015 International Building Code (IBC). We note that the 10th Edition of the MSBC is expected to become effective in 2024. However, the effective date and the concurrency period have not been announced. We recommend that information provided in this report be reviewed and updated if the final version of the new building code is published and becomes effective, and if this project falls outside of the concurrency period.

Former Garage Building

We understand that the former garage building was removed in 2021 and that a remaining floor drain and drain pipe was investigation in 2022. Furthermore, we understand that no former utilities or structures were located with the footprint of the proposed building. However, we note that abandoned buried utilities containing asbestos (such as electrical conduit insulation or transite pipe) associated with the former garage building may be encountered during Site preparation and excavations. Furthermore, former structures (pipes, conduits, foundations walls) may contain or be covered with materials containing asbestos. Such materials should be handled in accordance with MassDEP's asbestos regulations (310 CMR 7.15). We recommend that suspect materials be managed appropriately and tested by a Department of Labor Standards (DLS) certified asbestos inspector prior to disturbances.

Non-Engineered Fill

No significant amounts of non-engineered fill was observed within the two borings performed within or near the footprint of the new building. Non-engineered fill was encountered to a depth of 6.5 feet below ground surface in test pit TP-3, which was located within the proposed stormwater detention basin (to the north of the proposed building footprint). Furthermore, non-engineered fill within the footprint of the proposed building (if encountered) should be removed and replaced with engineered fill.

Foundation Recommendations

The proposed building can be founded on normal spread footing foundations bearing on compacted native soils or engineered fill. Provided the recommendations presented in this section are followed, a maximum allowable bearing pressure of 4,500 pounds per square foot may be used for the design of exterior and isolated column footings. If wet soils are encountered at the footing level, the footing subgrade should be over-excavated by six inches and six inches of Crushed Stone should be placed to protect the footing subgrade from disturbance.

Any non-engineered fill, asphalt, and topsoil layers should be removed from beneath the building footprint. Any unsuitable soils should be replaced with compacted Sand and Gravel or Crushed Stone. In addition, we recommend that the entire building footprint be thoroughly proof compacted to treat any near surface loose areas. The Sand and Gravel fill beneath the footings should meet the grain size distribution characteristics outlined in Table 3.

We estimate that settlement of footings and slabs bearing on dense native soils or compacted engineered fill should be small and largely elastic in nature. Maximum settlements should be less than one half inch and should occur relatively quickly after load application (during construction).

Exterior footings should be embedded a minimum of 48 inches below the lowest adjacent grade for frost protection. Interior footings should bear at least two feet below the surrounding floor slab. Strip footings, beneath the load bearing walls, should be at least 18 inches wide. Isolated column footings should be at least 24 inches wide. All other applicable requirements of the Massachusetts State Building Code (MSBC) should be followed.

Footings should not be placed on frozen soils. Footing excavations should be free of loose or disturbed materials. Any boulders or cobbles larger than four inches in diameter should be removed from within one foot of the bottom of the footings and replaced with Sand and Gravel or Crushed Stone. The footing subgrades should be densified immediately prior to placement of footing concrete with at least three passes with a vibrating plate compactor. If loose materials are present in the excavations, they shall be recompacted to form a firm, dense bearing surface.

Concrete Slabs

We recommend that concrete floor slabs bear on at least 12 inches of compacted Sand and Gravel or Crushed Stone to provide uniform support and a capillary moisture break.

The subgrade should also be free of large boulders or cobbles, if encountered. The Sand and Gravel or Crushed Stone fill beneath the concrete slabs should meet the grain size distribution characteristics outlined in Table 3.

The subgrade within the footprint of the proposed building should be stripped of topsoil and any asphalt or non-engineered fill. Prior to the placement of any engineered fill, we recommend that the building footprint be thoroughly densified to treat any loose areas that may be present. If non-engineered fill, soft, or disturbed areas are present, these materials should be removed and recompacted or replaced with compacted Sand and Gravel or Crushed Stone. Fill supporting slabs should be placed in accordance with the recommendations presented on Sheet 1.

Groundwater and Surface Water Control

Wet soils were observed at a depth of 2 to 15 feet below ground surface, corresponding to approximate elevations 1,177 to 1,161 feet. Therefore, we recommend that the proposed building include perimeter drainage to control groundwater and surface water infiltration. The perimeter drainage system can consist of perforated PVC pipe installed in a Crushed Stone trench and wrapped in a non-woven geotextile fabric.

If wet soils are encountered during excavations for footings and utilities, it should be possible to dewater these excavations by trenching or using sump pumps. Furthermore, the contractor should establish and maintain proper drainage of soils during construction. The silty soils present at the Site are susceptible to moisture, due to the high percentage of fines within the soil mass. If these soils become wet during construction, they will become soft and easily disturbed.

Seismic Considerations

Earthquake loadings must be considered under requirements in Section 1613 and 1806 of the 9th Edition (October 2017) of the Massachusetts State Building Code (MSBC), which is based upon the International Building Code 2015 (IBC) with Massachusetts amendments. Note that the IBC refers to ASCE-7 (2010), *Minimum Design Loads for Buildings and Other Structures*.

Section 1613 of the IBC covers lateral forces imposed on structures from earthquake shaking and requires that every structure be designed and constructed to resist the effects of earthquake motions in accordance with ASCE-7. Lateral forces are dependent on the type and properties of soils present beneath the Site, along with the geographic location. Per Table 1604.11, the maximum considered earthquake spectral response acceleration at short periods (S_s) and at 1-sec (S_1) was determined for Shutesbury, Massachusetts.

Soil properties are represented through Site Classification. Procedures for the Site-specific determination of Site Classification are provided in Chapter 20 of ASCE-7. We evaluated Site Classification using one of the parameters allowed, Standard Penetration Resistance (N-value), using values obtained from the 2010 and 2023 soil borings. Furthermore, the Site coefficients F_a and F_v were determined according to Tables 1613.3.3(1) and 1613.3.3(2) of the IBC (2015), using both the S_s and S_1 values and the Site Class. Seismic design parameters are provided in Table 1.

Table 1
Seismic Design Parameters

Parameter	Value
S_s	0.174
S_1	0.067
Site Class	C
F_a	1.2
F_v	1.7

Section 1806.4 relates to the liquefaction potential of the underlying soils. The liquefaction potential was evaluated for saturated Site soils. The liquefaction potential was evaluated for saturated Site soils, using Figure 1806.4b of the MSBC. Liquefiable layers were not identified in the soil borings. In addition, loose soil layers below the maximum depth explored are not anticipated.

Exterior Slabs and Pavements

This section provides recommendations for exterior entryways, slabs, and sidewalks, as well as flexible pavements.

Entryways and Sidewalks

Exterior concrete slabs, such as those at entryways and sidewalks adjacent to the building should be designed to mitigate differential frost movement between adjacent slabs, doorways, and pavements. To address this concern, we recommend that concrete slabs at entryways be underlain by four feet of non-frost susceptible Sand and Gravel fill. Where exterior slabs butt against hard surfaces, we recommend that for the area beyond the edges of the slab, the bottom of Sand and Gravel fill should transition gradually upward at a slope of 3H:1V or flatter (zone of influence). A typical detail (not for construction) showing an entryway fill area is shown on Sheet 2.

We recommend that concrete sidewalks that are outside the zone of influence of the building and entryways, as well as areas where differential frost movement would not cause a tripping hazard, bear on at least 12 inches of imported, compacted Sand and Gravel to provide uniform support and a capillary moisture break. Fill should be placed in accordance with the recommendations for compaction provided on Sheet 1. Subgrades should also be free of large boulders. We recommend that the entire subgrade of the sidewalk be proof compacted with a heavy vibrating roller to treat any loose areas. In addition, we recommend that the design team incorporate drainage into the sidewalk areas to remove water from the subgrade, in order to limit frost and the resulting vertical movement of sidewalks. The Sand and Gravel fill beneath the concrete slabs and sidewalks should meet the grain size distribution characteristics described in Table 3.

Flexible Pavement Design

We anticipate that the proposed pavements will likely experience loads from light passenger vehicles and occasional heavier vehicles. The proposed flexible asphalt design section is provided in Table 2.

Table 2
Pavement Design Sections

Layer	Thickness
Asphalt Finish Course	1.5 inches
Asphalt Binder Course	1.5 inches
Gravel Base Course	12 inches

We recommend that the pavement subgrade be proof compacted to treat any loose areas. Table 3 presents recommendations for gradation requirements for the Gravel Base Course material. Please note that the Gravel Base Course matches the MassDOT Highway Division specification M1.03.1 for Processed Gravel for Subbase.

We note that the near surface silty soils present at the Site are poorly drained, are susceptible to disturbances during construction, and have the potential to cause frost heaves to occur in pavements. We recommend that pavements be pitched to promote surface water runoff. In addition, subsurface drainage should be provided to prevent water from accumulating on the surface during construction, and beneath pavement sections after installation.

Earthwork Considerations

We anticipate that earthwork for this project will include Site grading, excavations for footings; placement of compacted engineered fill beneath the building, floor slab, and pavements (as needed); and the treatment of the existing soils to address any localized loose areas that may be present.

Engineered Fill Recommendations

Four engineered fill types are recommended:

- Sand and Gravel for use immediately below slabs, pavements, and sidewalks
- Crushed Stone for use immediately below footings and slabs (if needed), in drainage systems, and as an alternative to Sand and Gravel
- Gravel Base Course for use beneath pavements
- Granular Fill for use in landscaped areas and as miscellaneous fill

Grain size distribution requirements are presented in Table 3. On-Site soils do not appear to meet requirements for reuse as engineered fill. If the contractor elects to use the on-Site material as fill, we recommend that representative samples be collected, and grain size distribution analyses be performed to obtain approval by the engineer.

Please note that the Sand and Gravel specification is approximately that for MassDOT Highway Division specification M1.03.0 for Type B Gravel Borrow.

Table 3
Grain Size Distribution Requirements

Size	Sand and Gravel	Gravel Base Course	Granular Fill	Crushed Stone
	Percent Finer by Weight			
3 inch	100	100	100	---
1 ½ inch	---	70-100	---	---
1 inch	---	---	---	100
¾ inch	---	50-85	---	90-100
½ inch	50-85	---	---	10-50
⅜ inch	---	---	---	0-20
No. 4	40-75	30-60	---	0-5
No. 10	---	---	30-90	---
No. 40	10-35	---	10-70	---
No. 200	0-10	0-10	0-15	---

Compaction Recommendations

Fill, debris, and topsoil should be removed from beneath the building footprint and should not be reused as fill beneath structures. To avoid point loads, any cobbles or boulders larger than four inches in diameter encountered at the subgrade should also be removed. Prior to the placement of any engineered fill, we recommend that the entire building footprint be thoroughly proof compacted. Proof compaction should be accomplished by a minimum of six passes with a 6,000-pound vibratory roller. To facilitate compaction, the moisture content of the on-Site material should be maintained at or near the optimum moisture content as determined by ASTM D1557.

Compacted fill should be placed in lifts ranging in thickness between 6 and 12 inches depending on the size and type of equipment. Recommended degrees of compaction and compaction means and methods are presented on Sheet 1.

Compaction within five feet of foundation walls should be performed using a hand-operated roller or vibratory plate compactor. If the new walls are to be backfilled on both sides, placement and compaction of engineered fill should proceed on both sides of the wall so that the difference in top of fill on either side does not exceed two feet.

Sloping and Earth Support

We do not anticipate that significant shoring, underpinning, or sloping will be necessary to construct the proposed building. Any temporary earth support or underpinning should be the responsibility of the contractor. Prior to construction, we recommend that the contractor evaluate the need for temporary earth support systems. The unconsolidated native soils encountered at the Site are estimated to be Type C soils for slope stability purposes. The maximum allowable slope for excavations of Type C soils is 1H:1V (45°). All excavations should conform to current OSHA requirements.

6.0 FINAL DESIGN AND CONSTRUCTION PHASE SERVICES

It is recommended that O'Reilly, Talbot & Okun Associates, Inc. (OTO) be retained during final design to prepare and/or review appropriate specification sections and drawings, if necessary. During construction phases, we recommend that OTO be retained to provide engineering support, including documentation of subgrade conditions and preparation.

Environmental Assessments have been completed for this Site. Any environmental conditions reported as part of those assessments should be evaluated regarding potential impacts to the proposed construction and recommendations in this report. Any impacted soil and/or groundwater that is encountered during construction will need to be managed in accordance with the appropriate regulations.

We appreciated the opportunity to be of service on this project. If you have any questions, please do not hesitate to contact the undersigned.

Sincerely yours,
O'Reilly, Talbot & Okun Associates, Inc.

Dustin A. Humphrey, P.E.
Sr. Project Manager

Ashley L. Sullivan, P.E.
Principal

Attachments: Limitations
Figure 1: Site Locus
Figure 2: Site Plan
Sheet 1: General Compaction Guidelines
Sheet 2: Typical Foundation Section
2023 Boring Logs
2010 Boring Logs
Test Pit Logs
Test Pit Photographs

LIMITATIONS

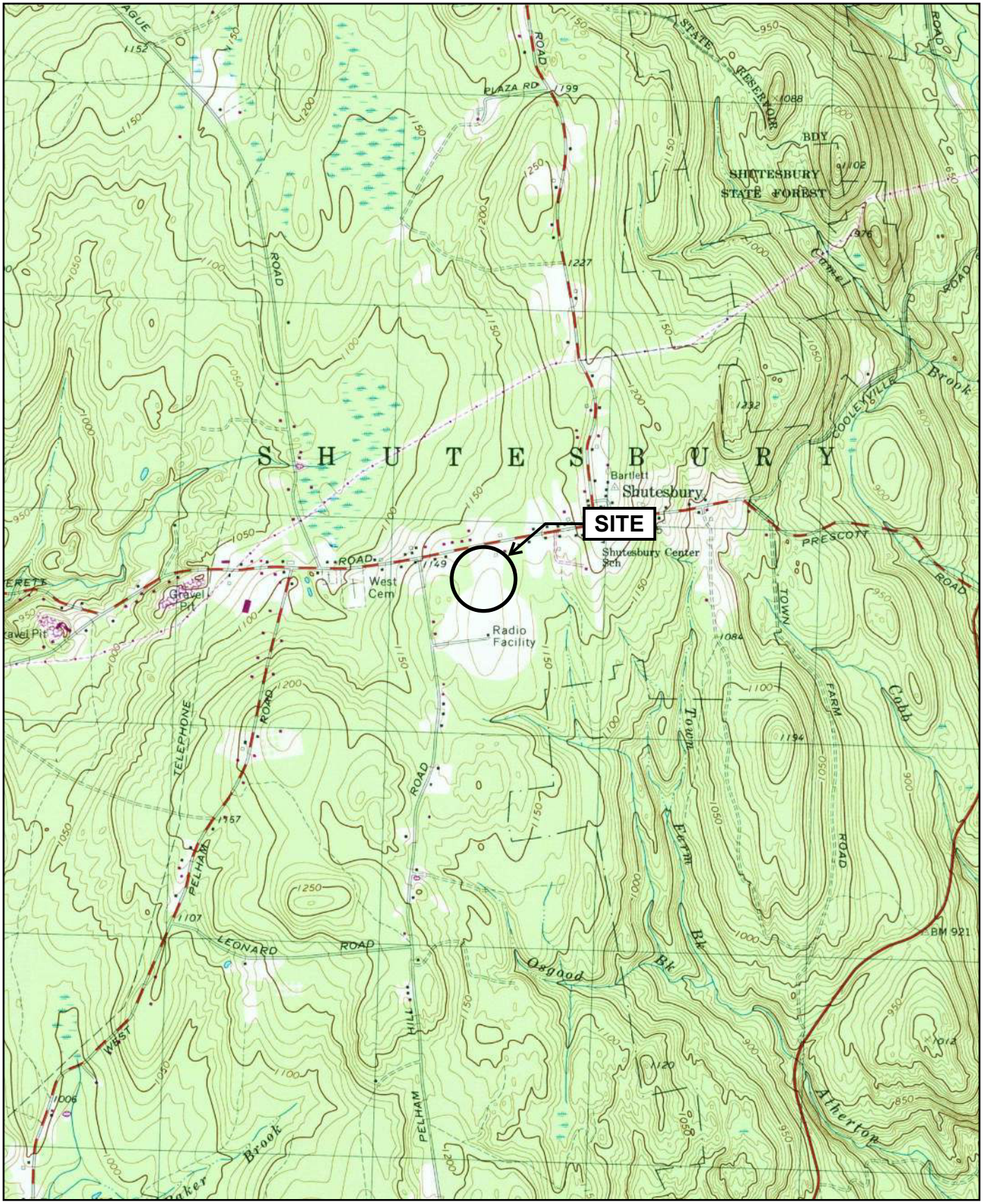
1. The observations presented in this report were made under the conditions described herein. The conclusions presented in this report were based solely upon the services described in the report and not on scientific tasks or procedures beyond the scope of the project or the time and budgetary constraints imposed by the client. The work described in this report was carried out in accordance with the Statement of Terms and Conditions attached to our proposal.

2. The analysis and recommendations submitted in this report are based in part upon the data obtained from widely spaced subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it may be necessary to reevaluate the recommendations of this report.

3. 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 interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the boring logs.

4. In the event that any changes in the nature, design or location of the proposed structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by O'Reilly, Talbot & Okun Associates Inc. It is recommended that we be retained to provide a general review of final plans and specifications.

5. Our report was prepared for the exclusive benefit of our client. Reliance upon the report and its conclusions is not made to third parties or future property owners.



0 1000 FEET

0 0.5 1.0 MILES

0 0.5 1 KILOMETERS

1:25,000 SCALE NATIONAL GEODETIC VERTICAL DATUM 1929 10 FOOT CONTOUR INTERVAL

O:\J2060\2060 Town of Shutesbury\03-01 New MN Spear Library Leverett Rd Shutesbury, MA - Geotech\Report and Figures\Figure 1 - Site Locus.pdf

O'Reilly, Talbot & Okun
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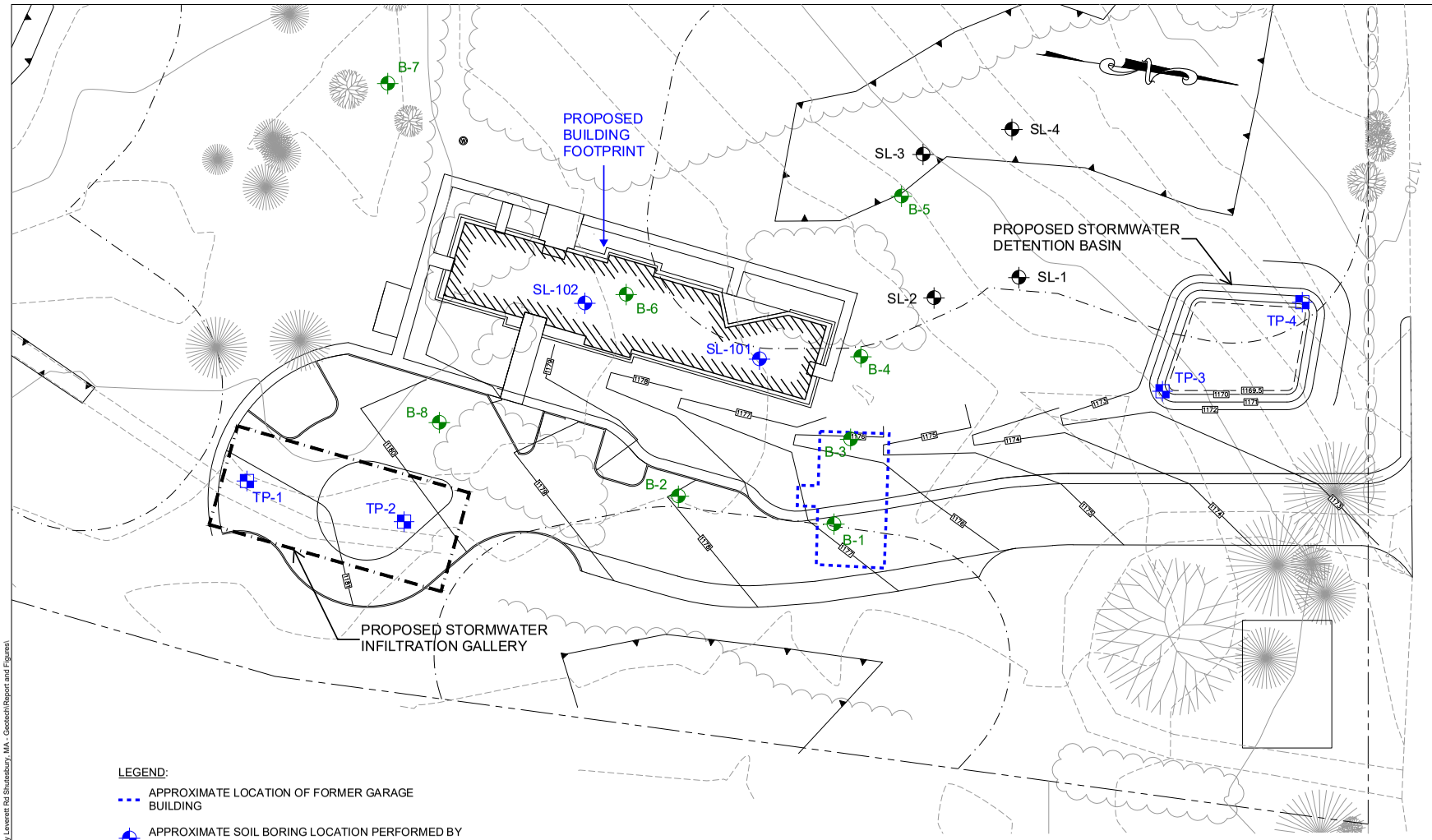
SHUTESBURY, MASSACHUSETTS

SITE LOCUS

Topographic Map Quadrant: SHUTESBURY, MA
Map Version: 1964
Current As Of: 1979
Date: SEPTEMBER 2023

PROJECT No. J2060-03-01

FIGURE No. 1



LEGEND:

- APPROXIMATE LOCATION OF FORMER GARAGE BUILDING
- APPROXIMATE SOIL BORING LOCATION PERFORMED BY SEABOARD DRILLING ON 10/03/2023, OBSERVED BY OTO
- APPROXIMATE TEST PIT LOCATION PERFORMED BY SHUTESBURY DPW ON 10/03/2023, OBSERVED BY OTO
- APPROXIMATE SOIL BORING LOCATION PERFORMED BY SEABOARD DRILLING ON 06/23/2010, OBSERVED BY OTO
- APPROXIMATE SOIL BORING LOCATION PERFORMED BY MARTIN GEOENVIRONMENTAL DRILLING ON 09/16/2021, OBSERVED BY OTO

NOTES:

1. BASE PLAN PROVIDED TO OTO IN ELECTRONIC FORMAT, TITLED "GEOTECHNICAL INVESTIGATION PLAN" (SHEET C4.1), BY OUDENS ELLO ARCHITECTURE, LLC AND FUSS & O'NEILL, INC., DATED JULY 12, 2023.
2. APPROXIMATE SAMPLE LOCATIONS ARE SHOWN ACCORDING TO TAPED MEASUREMENTS TAKEN FROM EXISTING SITE FEATURES AND GPS COORDINATES OBTAINED IN THE FIELD USING A MOBILE DEVICE
3. ALL DATA IS TO BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHODS USED IN THE DEVELOPMENT OF THIS PLAN

SCALE IN FEET
1" = 40'
0' 20' 40' 80'

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DESIGNED BY: PJC
DRAWN BY: SLR
CHECKED BY:
DATE: 10/06/2023
REV. DATE:

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SHUTESBURY, MASSACHUSETTS

SITE PLAN

PROJECT NO.
J2060-03-01

FIGURE NO.
2

Table 1-1
Degree of Compaction Recommendations

Location	Minimum Compaction
Below Structures (Foundations and Slabs)	95%
Below Pavements/Sidewalks/Exterior Slabs	95%
Against Basement Walls/Retaining Walls	92%
Utility Trenches	95%
General Landscaped Areas	90%

Notes.
1. Percentage of the maximum dry density as determined by Modified Proctor ASTM D1557, Method C.
2. When location falls into two or more categories, the engineer should be notified to determine appropriate compaction efforts and/or methods.
3. Crushed stone should be compacted in lifts of 12 inches to form a dense matrix using either traditional compaction methods (vibratory plate and/or roller) or tamping with an excavator bucket in deep excavations. It is generally not necessary to perform laboratory or field density testing on crushed stone.

Table 1-2
General Guidelines for Compaction Means and Methods

Compaction Method	Maximum Stone Size (Inches Diameter)	Maximum Lift Thickness (Inches)		Minimum Number of Passes	
		Below Structures & Pavement	Non-Critical Areas	Below Structures & Pavement	Non-Critical Areas
Hand-operated Vibratory Plate and confined spaces	3	6	8	6	4
Hand-operated vibratory drum roller (less than 1000 pounds)	3	6	8	6	4
Hand-operated vibratory drum roller (at least 1,000 pounds)	6	8	10	6	4
Light vibratory drum roller (minimum 3000 pounds)	6	10	14	6	4
Heavy vibratory drum roller (minimum 6000 pounds)	6	12	18	6	4

Note: The contractor should reduce or stop drum vibration if pumping of the subgrade is observed.

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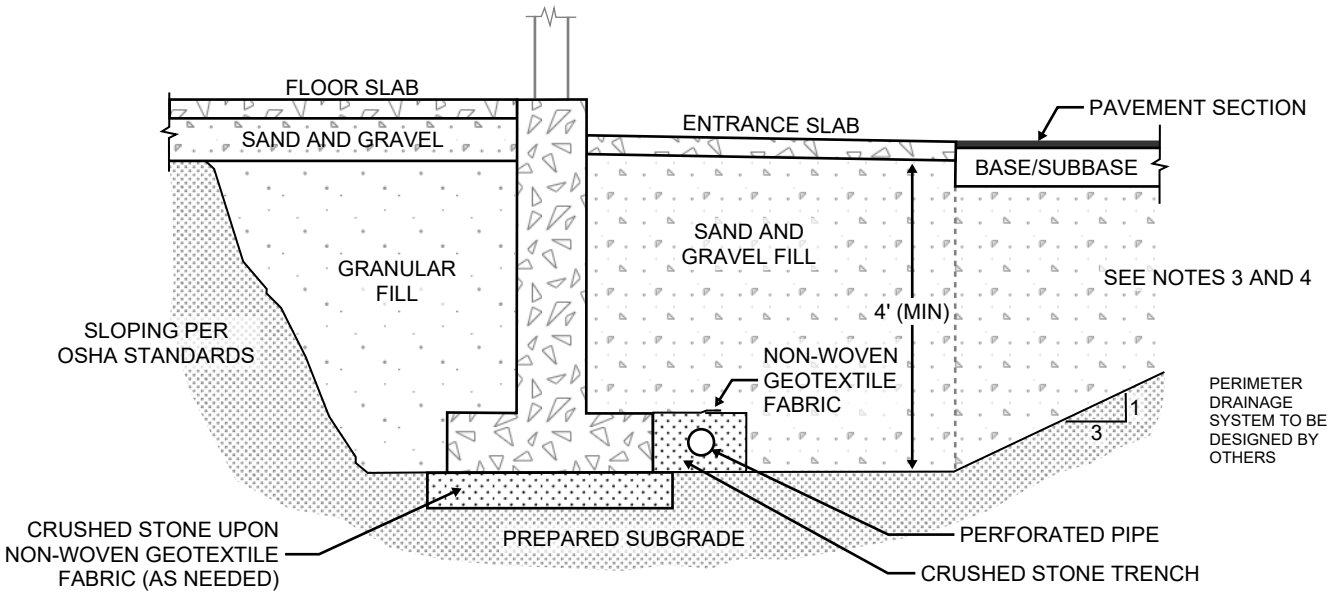
GENERAL COMPACTION GUIDELINES

DESIGNED BY: ALS
DRAWN BY: DAH
CHECKED BY: MJT
DATE: 11/09/2016
REV. DATE: 07/11/2022

PROJECT No. J2060-03-01
SHEET No. 1



TYPICAL FOUNDATION SECTION
SLAB ON GRADE FOOTING WITH ENTRANCE SLAB

NOTES:

1. NOT FOR CONSTRUCTION, FOR ILLUSTRATION PURPOSES ONLY
2. FOR ADDITIONAL INFORMATION, REFER TO OTO's GEOTECHNICAL REPORT DATED OCTOBER 2023
3. UNPAVED AREAS SHALL INCLUDE LOAM CAP AND SHOULD BE GRADED TO DIRECT SURFACE FLOW AWAY FROM BUILDING
4. PERMEABLE BACKFILL SHALL BE USED IN AREAS WITH UNDERDRAIN SYSTEMS

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TYPICAL FOUNDATION SECTION

DESIGNED BY: ALS
DRAWN BY: DAH
CHECKED BY: MJT
DATE: 11/9/2016
REV. DATE:

PROJECT No. J2060-03-01
SHEET No. 2

O'Reilly, Talbot & Okun
ENGINEERING ASSOCIATES

BORING LOGS

SUMMARY OF THE BURMISTER SOIL CLASSIFICATION SYSTEM (MODIFIED)

RELATIVE DENSITY (of non-plastic soils) OR CONSISTENCY (of plastic soils)

STANDARD PENETRATION TEST (SPT)
Method: Samples were collected in accordance with ASTM D1586, using a 2" diameter split spoon sampler driven 24 inches. If samples were collected using direct push methodology (Geoprobe), SPTs were not performed and relative density/consistency were not reported. N-Value: The number of blows with a 140 lb. hammer required to drive the sampler the middle 12 inches. WOR: Weight Of Rod (depth dependent) WOH: Weight Of Hammer (140 lbs.)

COHESIONLESS SOILS		COHESIVE SOILS	
BLOWS/FOOT (SPT N-Value)	RELATIVE DENSITY	BLOWS/FOOT (SPT N-Value)	CONSISTENCY
0-4	Very loose	<2	Very soft
4-10	Loose	2-4	Soft
10-30	Medium dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
>50	Very dense	15-30	Very stiff
*Based upon uncorrected field N-values		>30	Hard

MATERIAL: (major constituent identified in CAPITAL letters)

COHESIONLESS SOILS		
MATERIAL	FRACTION	GRAIN SIZE RANGE
GRAVEL	Coarse	3/4" to 3"
	Fine	1/4" to 3/4"
SAND	Coarse	1/16" to 1/4"
	Medium	1/64" to 1/16"
	Fine	Finest visible & distinguishable particles
SILT/CLAY	see adjacent table	Cannot distinguish individual particles
COBBLES	3" to 6" in diameter	
BOULDERS	> 6" in diameter	
Note: Boulders and cobbles are observed in test pits and/or auger cuttings.		

COHESIVE SOILS		
SMALLEST DIAMETER	PLASTICITY	IDENTITY
None	Non-plastic	**SILT**
1/4" (pencil)	Slight	**Clayey SILT**
1/8"	Low	**SILT & CLAY**
1/16"	Medium	**CLAY & SILT**
1/32"	High	**Silty CLAY**
1/64"	Very High	**CLAY**
Wetted sample is rolled in hands to smallest possible diameter before breaking.		

ORGANIC SILT: Typically gray to dark gray, often has strong H2S odor. May contain shells or shell fragments. Light weight.

Fibrous PEAT: Light weight, spongy, mostly visible organic matter, water squeezed readily from sample. Typically near top of layer.

Fine grained PEAT: Light weight, spongy, little visible organic matter, water squeezed from sample. Typically below fibrous peat.

DEBRIS: Detailed contents described in parentheses (wood, glass, ash, crushed brick, metal, etc.)

BEDROCK: Underlying rock beneath loose soil, can be weathered (easily crushed) or competent (difficult to crush).

ADDITIONAL CONSTITUENTS

TERM	% OF TOTAL
and	35-50%
some	20-35%
little	10-20%
trace	1-10%

COMMON TERMS

Glacial till: Very dense/hard, heterogeneous mixture of sand, silt, clay, sub-angular gravel. Deposited at base of glaciers, which covered all of New England.

Varved clay: Fine-grained, post-glacial lake sediments characterized by alternating layers (or varves) of silt, sand and clay.

Fill: Material used to raise ground, can be engineered or non-engineered.

COMMON FIELD MEASUREMENTS

Torvane: Undrained shear strength is estimated using an E285 Pocket Torvane (TV). Values in tons/ft2.

Penetrometer: Unconfined compressive strength is estimated using a Pocket Penetrometer (PP). Values in tons/ft2.

RQD: Rock Quality Designation is determined by measuring total length of pieces of core 4" or greater and dividing by the total length of the run, expressed as %. 100-90% excellent; 90-75% good; 75-50% fair; 50-25% poor; 25-0% very poor.

PID: Soil screened for volatile organic compounds (VOCs) using a photoionization detector (PID) referenced to benzene in air. Readings in parts per million by volume.

O'Reilly, Talbot & Okun
ENGINEERING ASSOCIATES

LOG OF BORING SL-101

PROJECT	Proposed Shutesbury Library			CONTRACTOR	Seaboard Environmental Drilling		
JOB NUMBER	2060-03-01	FINAL DEPTH (ft)	16.0	DRILLING EQUIPMENT	B-53 Truck Mounted Rig		
LOCATION	Shutesbury, MA	SURFACE ELEV (ft)	1179.0	FOREMAN	Mike	CASING	
START DATE	10/03/2023	DISTURBED SAMPLES	6	HELPER	Louie	CASE DIAMETER	N/A
FINISH DATE	10/03/2023	UNDISTURBED SAMPLES	0	BIT TYPE	Hollow Stem Auger	HAMMER WGT	N/A
ENGINEER/SCIENTIST	Shannon Raymond	WATER LEVEL		ROD TYPE	A (1 5/8" O.D.)	HAMMER DROP	N/A
BORING LOCATION	Northern Portion of Proposed Building	FIRST (ft)	N/E	SAMPLER	2" O.D. Split Spoon	ROCK CORING INFORMATION	
		LAST (ft)	N/A	HAMMER TYPE	Safety	TYPE	N/A
		TIME (hr)	N/A	HAMMER WGT/DROP	140 lb / 30" Wire Line	SIZE	N/A

DEPTH (ft)/ SAMPLES	SAMPLES: PENETR. RESIST. (bl / 6 in)	SAMPLES: REC. (in)	SAMPLES: TYPE/ NO.	SAMPLES: FIELD TEST DATA	SAMPLE DESCRIPTION (MODIFIED BURMISTER)	PROFILE DEPTH (ft) ELEV.	REMARKS
	1/8/6/6	16/24	S-1 (0'-2')		Top 5" : Medium dense, dark brown, fine SAND, some silt, little medium sand, trace coarse sand, little organics (roots), moist (TOPSOIL)	TOPSOIL	
					Middle 3" : Medium dense, dark brown, fine SAND, some to little silt, little medium sand, trace coarse sand, trace gravel, trace organics (roots), moist	FINE SAND / FINE TO MEDIUM SAND	
					Bottom 8" : Medium dense, brown, fine to medium SAND, little to trace silt, trace coarse sand, trace gravel, moist (wet in bottom 2" ; trace rust staining throughout)		1. , 2.
	10/16/30/46	18/24	S-2 (2'-4')		Dense, light grey brown, fine to medium SAND, little to trace coarse sand, trace (+) silt, trace gravel, wet (trace rust staining throughout)		3.
5'						5.0 ▼ 1174.0	
	16/18/20/17	15/24	S-3 (5'-7')		Dense, grey, fine to medium SAND, little silt, little to trace coarse sand, trace gravel, damp	TILL	5.
							4.
10'							
	50 for 3"	0/3	S-4 (10'-10.2')		No Recovery ; upon likely gravel		
	14/50 for 5"	8/11	S-5 (12'-12.9')		Very dense, grey, fine to medium SAND, little silt, little to trace coarse sand, trace gravel, moist		
15'							
	31/50 for 5"	8/11	S-6 (15'-15.9')		Very dense, grey, fine to medium SAND, little silt, little to trace coarse sand, trace gravel, moist	16.0 ▼ 1163.0	6. , 7.
					End of Exploration at 16', upon dense soils		
20'							
25'							

Remarks:

1. Auger grinding between 2 and 5 feet below ground surface, upon likely gravel and cobbles.
2. Perched groundwater observed at 2 feet.
3. Auger significantly grinding between 4 and 4.5 feet, upon likely cobble or gravel.
4. Auger grinding between 9 and 10 feet, 10 and 15 feet, and 15 and 16 feet, upon likely gravel and dense soils.
5. Slow drilling occurred between 5 and 15 feet, due to dense soils.
6. Auger significantly grinding at 16 feet, upon likely dense soils.
7. Auger refusal at 16 feet, upon likely dense soils.

PROJECT NO.
2060-03-01

LOG OF BORING
SL-101

O'Reilly, Talbot & Okun
ENGINEERING ASSOCIATES

LOG OF BORING SL-102

PROJECT	Proposed Shutesbury Library			CONTRACTOR	Seaboard Environmental Drilling		
JOB NUMBER	2060-03-01	FINAL DEPTH (ft)	16.0	DRILLING EQUIPMENT	B-53 Truck Mounted Rig		
LOCATION	Shutesbury, MA	SURFACE ELEV (ft)	1178.0	FOREMAN	Mike	CASING	
START DATE	10/03/2023	DISTURBED SAMPLES	6	HELPER	Louie	CASE DIAMETER	N/A
FINISH DATE	10/03/2023	UNDISTURBED SAMPLES	0	BIT TYPE	Hollow Stem Auger	HAMMER WGT	N/A
ENGINEER/SCIENTIST	Shannon Raymond	WATER LEVEL		ROD TYPE	A (1 5/8" O.D.)	HAMMER DROP	N/A
BORING LOCATION	Southern Portion of Proposed Building	FIRST (ft)	N/E	SAMPLER	2" O.D. Split Spoon	ROCK CORING INFORMATION	
		LAST (ft)	N/A	HAMMER TYPE	Safety	TYPE	N/A
		TIME (hr)	N/A	HAMMER WGT/DROP	140 lb / 30" Wire Line	SIZE	N/A

DEPTH (ft)/ SAMPLES	SAMPLES: PENETR. RESIST. (bl / 6 in)	SAMPLES: REC. (in)	SAMPLES: TYPE/ NO.	SAMPLES: FIELD TEST DATA	SAMPLE DESCRIPTION (MODIFIED BURMISTER)	PROFILE DEPTH (ft) ELEV.	REMARKS
	1/3/4/11	15/24	S-1 (0'-2')		Top 4" : Loose, dark brown, fine SAND, some silt, little medium sand, trace coarse sand trace (-) gravel, little organics (roots), moist (TOPSOIL)	TOPSOIL	
					Middle 4" : Loose, dark brown, fine to medium SAND, some to little silt, trace coarse sand, trace organics (roots), damp	FINE TO MEDIUM SAND	
					Bottom 7" : Loose, brown, fine to medium SAND, little to trace coarse sand, trace (+) silt, moist (wet in bottom 2" ; trace rust staining throughout)		1. , 2.
	18/30/36/37	18/24	S-2 (2'-4')		Very dense, light grey brown, fine to medium SAND, little to trace coarse sand, trace silt, trace fine gravel, wet (little rust staining throughout)		
5'						5.0 ▼ 1173.0	
	14/27/28/37	15/24	S-3 (5'-7')		Very dense, grey, fine to medium SAND, little silt, little to trace coarse sand, trace (-) fine gravel, moist (trace rust staining throughout)	TILL	3. , 5.
	25/30/36/31	12/24	S-4 (8'-10')		Very dense, grey, fine to medium SAND, little silt, little coarse sand, trace (+) gravel, moist (trace rust staining throughout)		4.
10'							
	32/40/50 for 5"	14/17	S-5 (10'-11.4')		Very dense, grey, fine to medium SAND, little silt, little coarse sand, trace (+) gravel, moist		
15'							
	49/50 for 2"	8/8	S-6 (15'-15.7')		Very dense, grey, fine to medium SAND, little silt, little coarse sand, trace (+) gravel, moist	16.0 ▼ 1162.0	6. , 7.
					End of Exploration at 16', upon dense soils		
20'							
25'							

Remarks:

1. Auger grinding between 2 and 5 feet below ground surface, upon likely gravel and cobbles.
2. Perched groundwater observed at 2 feet.
3. Auger grinding between 5 and 8 feet, 8 and 15 feet, upon likely gravel and dense soils.
4. Auger significantly grinding at 8 feet, 9 feet, and between 14 and 14.5 feet, upon likely gravel and dense soils.
5. Slow drilling occurred between 5 and 15 feet, due to dense soils.
6. Auger significantly grinding at 16 feet, upon likely dense soils.
7. Auger refusal at 16 feet, upon likely dense soils.

PROJECT NO.
2060-03-01

LOG OF BORING
SL-102

O'REILLY, TALBOT & OKUN ASSOCIATES, INC.

ENVIRONMENTAL AND GEOTECHNICAL ENGINEERING CONSULTANTS

LOG OF BORING SL-1

PROJECT : M.N. Spear Library, Leverett Road		LOCATION: Shutesbury, MA	PROJECT NO. : 0762-02-01
DRILLING CONTRACTOR Seaboard Environmental Drilling	FOREMAN Jeff HELPER Ronnie	DATE STARTED 06/23/2010	DATE FINISHED 06/23/2010
DRILLING EQUIPMENT B-53 Truck Mounted Rig		COMPLETION DEPTH 20.5'	GROUND SURFACE ELEV. DATUM Approx. 1176 feet
TYPE BIT Hollow Stem Auger	SIZE &TYPE OF CORE BARREL	No. Samples 6	UNDIST.
CASING		TIME	FIRST / COMPL. / 4 HR.
CASING HAMM. WEIGHT	DROP	WATER LEVEL (FT.)	- / / 4
SAMPLER: 2" O.D. Split Spoon	Rod A 1 5/8" O.D.	BORING	
SAMPLER Safety HAMMER	WEIGHT 140 lbs. DROP 30" (Wire Line)	LOCATION North of proposed building ENGINEER/GEOLOGIST Sean Carr	

SAMPLES	DEPTH FT.	SAMPLES: PENETR. RESIST. BL/6 IN.	SAMPLES: REC. IN.	SAMPLES: TYPE/ NO.	DESCRIPTION	SOIL DESCRIPTION	REMARKS
		1/1/2/3	12/24	S-1 (0'-2')	Top 6": Very loose, brown, SILT and fine SAND, little fibrous organics, trace gravel, moist (TOPSOIL) Bottom 6": Loose, light brown, SILT, some to little fine sand, trace gravel, moist	TOPSOIL FINE SAND	
		7/13/13/13	15/24	S-2 (2'-4')	Medium dense, white-brown, fine SAND, some to little silt, little to trace gravel, moist		1.
	5	14/21/20/19	18/24	S-3 (5'-7')	Dense, light gray, fine SAND, little silt, little to trace medium to coarse sand, trace fine gravel, moist		
	10	23/38/39/ 50 for 3"	20/24	S-4 (10'-12')	Very dense, light gray, fine SAND, some to little silt, trace (+) medium to coarse sand, trace (-) gravel, trace (-) cobbles, moist		2.
	15	45/ 50 for 4"	6/12	S-5 (15'-15.5')	Very dense, light gray with rust mottling, fine SAND, some to little silt, trace (+) gravel, trace (-) medium sand, moist		
	20	59/ 50 for 0"	4/12	S-6 (20'-21')	Very dense, light gray, fine SAND, little silt, trace (+) medium to coarse sand, trace (-) gravel, trace (-) cobbles, moist Auger Refusal at 20.5' End of Exploration		
	25						

Remarks:
1. Drill grinding at 4'
2. Cobble in spoon at approximately 11'

O'REILLY, TALBOT & OKUN ASSOCIATES, INC.

ENVIRONMENTAL AND GEOTECHNICAL ENGINEERING CONSULTANTS

LOG OF BORING SL-2

PROJECT : M.N. Spear Library, Leverett Road		LOCATION: Shutesbury, MA	PROJECT NO. : 0762-02-01
DRILLING CONTRACTOR Seaboard Environmental Drilling	FOREMAN Jeff HELPER Ronnie	DATE STARTED 06/23/2010	DATE FINISHED 06/23/2010
DRILLING EQUIPMENT B-53 Truck Mounted Rig		COMPLETION DEPTH 21'	GROUND SURFACE ELEV. DATUM Approx. 1176 feet
TYPE BIT Hollow Stem Auger	SIZE &TYPE OF CORE BARREL	No. Samples 6	UNDIST.
CASING		TIME	FIRST / COMPL. / 3 HR.
CASING HAMM. WEIGHT	DROP	WATER LEVEL (FT.)	15' / / 3
SAMPLER: 2" O.D. Split Spoon	Rod A 1 5/8" O.D.	BORING LOCATION Northeast portion of proposed building	
SAMPLER HAMMER Safety	WEIGHT 140 lbs. / DROP 30" (Wire Line)	ENGINEER/GEOLOGIST Sean Carr	

SAMPLES	DEPTH FT.	SAMPLES: PENETR. RESIST. BL/6 IN.	SAMPLES: REC. IN.	SAMPLES: TYPE/ NO.	DESCRIPTION	SOIL DESCRIPTION	REMARKS
		1/2/3/4	14/24	S-1 (0'-2')	Top 7": Very loose, brown, SILT and fine SAND, little fibrous organics, trace medium to coarse sand, trace (-) gravel, moist (TOPSOIL) Bottom 7": Loose, light brown, fine SAND, little silt, little medium to coarse sand, moist	TOPSOIL FINE SAND	
		11/21/29/33	16/24	S-2 (2'-4')	Dense, light gray with rust mottling, fine SAND, little silt, little to trace subangular gravel, trace medium to coarse sand, moist		
	5						
		20/30/19/20	19/24	S-3 (5'-7')	Dense, light gray with rust mottling, fine SAND, little silt, trace (+) gravel, trace (+) cobbles, trace (+) medium to coarse sand, moist		1.
	10						
		22/15/30/30	12/24	S-4 (10'-12')	Dense, light gray, fine SAND, little silt, trace medium to coarse sand, trace sub-angular gravel, moist		
	15					15'	
		50 for 5"	2/6	S-5 (15'-15.5')	Very dense, dark brown, FRACTURED ROCK, appears wet at 15'	FRACTURED 16' ROCK FINE SAND	2.
	20						
		25/ 50 for 1"	6/12	S-6 (20'-21')	Very dense, light gray, fine to medium SAND, little silt, little to trace fine gravel, wet		
					Auger Refusal at 21' End of Exploration		
	25						

Remarks:

1. Drill grinding at approximately 6'
2. Drill grinding and bouncing at 15'

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ENVIRONMENTAL AND GEOTECHNICAL ENGINEERING CONSULTANTS

LOG OF BORING SL-3

PROJECT : M.N. Spear Library, Leverett Road		LOCATION: Shutesbury, MA	PROJECT NO. : 0762-02-01
DRILLING CONTRACTOR Seaboard Environmental Drilling	FOREMAN Jeff HELPER Ronnie	DATE STARTED 06/23/2010	DATE FINISHED 06/23/2010
DRILLING EQUIPMENT B-53 Truck Mounted Rig		COMPLETION DEPTH 21.5'	GROUND SURFACE ELEV. DATUM Approx. 1175 feet
TYPE BIT Hollow Stem Auger	SIZE &TYPE OF CORE BARREL	No. Samples 7	UNDIST.
CASING		TIME	FIRST / COMPL. / 2 HR.
CASING HAMM. WEIGHT	DROP	WATER LEVEL (FT.)	7' / / 3
SAMPLER: 2" O.D. Split Spoon	Rod A 1 5/8" O.D.	BORING LOCATION Northwest corner of proposed building	
SAMPLER HAMMER Safety	WEIGHT 140 lbs. / DROP 30" (Wire Line)	ENGINEER/GEOLOGIST Sean Carr	

SAMPLES	DEPTH FT.	SAMPLES: PENETR. RESIST. BL/6 IN.	SAMPLES: REC. IN.	SAMPLES: TYPE/ NO.	DESCRIPTION	SOIL DESCRIPTION	REMARKS
X		1/2/3/3	14/24	S-1 (0'-2')	Top 7": Very loose, brown, SILT and fine SAND, little fibrous organics, trace medium to coarse sand, trace (-) gravel, moist (TOPSOIL) Bottom 7": Loose, light brown, fine SAND, some to little silt, trace medium to coarse sand, moist	TOPSOIL FINE SAND	
X		8/14/16/19	15/24	S-2 (2'-4')	Dense, light gray, fine SAND, little silt, trace (+) medium to coarse sand, trace (+) sub-angular gravel, moist		
	5						
X		18/27/20/29	0/24	S-3 (5'-7')	No Recovery		
		6/12/12/15	16/24	S-4 (7'-9')	Medium dense, light gray with rust mottling, fine SAND, little silt, trace medium to coarse sand, trace (-) sub-angular gravel, wet		
	10						1.
X		19/21/39/ 50 for 4"	14/24	S-5 (10'-12')	Very dense, light gray with rust mottling, fine SAND, little silt, little cobbles, trace medium to coarse sand, wet		2.
							3.
	15						
X		29/33/ 50 for 5"	15/18	S-6 (15'-16.5')	Very dense, light gray, fine SAND, little silt, little to trace sub-angular gravel, trace cobbles, trace (-) medium to coarse sand, wet		
	20						
X		51/ 50 for 4"	6/12	S-7 (20'-21')	Very dense, light gray and brown, fine SAND, some fragmented rock, trace silt, trace gravel, moist		
					Auger Refusal at 21.5' End of Exploration		
	25						

Remarks:

1. Drill grinding at approximately 10'
2. Cobbles in spoon from 10.5-11'
3. Drill bouncing at approximately 14'

O'REILLY, TALBOT & OKUN ASSOCIATES, INC.

ENVIRONMENTAL AND GEOTECHNICAL ENGINEERING CONSULTANTS

LOG OF BORING SL-4

PROJECT : M.N. Spear Library, Leverett Road		LOCATION: Shutesbury, MA	PROJECT NO. : 0762-02-01
DRILLING CONTRACTOR Seaboard Environmental Drilling	FOREMAN Jeff HELPER Ronnie	DATE STARTED 06/23/2010	DATE FINISHED 06/23/2010
DRILLING EQUIPMENT B-53 Truck Mounted Rig		COMPLETION DEPTH 18'	GROUND SURFACE ELEV. DATUM Approx. 1173 feet
TYPE BIT Hollow Stem Auger	SIZE &TYPE OF CORE BARREL	No. Samples 7	UNDIST.
CASING		TIME	FIRST / COMPL. / HR.
CASING HAMM. WEIGHT	DROP	WATER LEVEL (FT.)	3 / 3 /
SAMPLER: 2" O.D. Split Spoon	Rod A 1 5/8" O.D.	BORING LOCATION North of northwest corner of proposed building	
SAMPLER HAMMER Safety	WEIGHT 140 lbs. / DROP 30" (Wire Line)	ENGINEER/GEOLOGIST Sean Carr	

SAMPLES	DEPTH FT.	SAMPLES: PENETR. RESIST. BL/6 IN.	SAMPLES: REC. IN.	SAMPLES: TYPE/ NO.	DESCRIPTION	SOIL DESCRIPTION	REMARKS
		1/2/2/3	15/24	S-1 (0'-2')	Top 8": Very loose, brown, SILT and fine SAND, little fibrous organics, trace medium to coarse sand, trace (-) gravel, moist (TOPSOIL) Bottom 7": Loose, light brown, fine SAND, some silt, trace medium to coarse sand, moist	TOPSOIL FINE SAND	
		7/12/16/16	16/24	S-2 (2'-4')	Medium dense, light gray, fine SAND, little silt, trace (+) medium to coarse sand, trace (+) sub-angular gravel, wet		
	5						1.
		11/ 50 for 2"	0/12	S-3 (5'-6')	No Recovery		
		49/27/19/19	8/24	S-4 (7'-9')	Dense, light gray, fine to medium SAND, little silt, trace (-) coarse sand, trace (-) sub-angular gravel, wet		
	10						2.
		26/21/24/40	20/24	S-5 (10'-12')	Dense, light gray, fine SAND, little silt, little to trace sub-angular gravel, trace medium to coarse sand, wet		
							3.
	15						
		34/30/ 50 for 5"	10/18	S-6 (15'-16.5')	Very dense, light gray, fine SAND, little silt, little to trace gravel, trace (+) medium to coarse sand, wet		
		100 for 0"	0/6	S-7 (18'-18.5')	No Recovery		
					Auger Refusal at 18' End of Exploration		
	20						
	25						

Remarks:

1. Drill grinding/bouncing at approximately 5'
2. Drill cleared 1' of blow in before sampling 10'-12'
3. Drill bouncing at approximately 14'

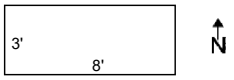
O'Reilly, Talbot & Okun
ENGINEERING ASSOCIATES

LOG OF TEST PIT TP-1

PROJECT	Proposed Shutesbury Library			CONTRACTOR	Shutesbury DPW
JOB NO.	2060-03-01	DATE	10/03/2023	OPERATOR	Dave
LOCATION	Shutesbury, MA.	WEATHER	Sunny, 50°F	BACKHOE	CAT 420XE
TEST PIT LOCATION	South Portion of Proposed Stormwater System in Southeastern Area of Site	START TIME	08:15	CAPACITY (cy)	1/4
		FINISH TIME	08:45	GS ELEV. (ft)	1179.0
		OTO STAFF	Shannon Raymond	FINAL DEPTH (ft)	9.5

DEPTH (ft)	SOIL DESCRIPTION	EXCAV. EFFORT	BOULDERS/ COBBLES COUNT	BOULDERS/ COBBLES CLASS	SAMPLE NO.	FIELD TEST DATA	REMARKS
	Forest Duff	E					
	Dark brown, fine SAND, some to little silt, little medium sand, trace coarse sand, some organics (roots, leaves), damp (TOPSOIL)		3	C			
1'							
	Orange brown, fine to medium SAND, little silt, little coarse sand, trace (-) gravel, trace organics (roots), moist (some rust staining throughout)	E					
2'							
	Light brown, fine to medium SAND, little to trace coarse sand, trace (-) silt, trace gravel, trace organics (roots), moist (little rust staining throughout)	M	5	C			1. 2.
3'							
	Light brown grey, fine to medium SAND, little to trace coarse sand, little to trace gravel, trace (+) silt, moist (trace rust staining throughout)	M	10 4	C S	S-1 (5'-8')		
4'							
5'		D					
6'							
7'							
8'							
	Grey, fine to medium SAND, little silt, little to trace coarse sand, little to trace gravel, moist (trace rust staining throughout)	D	15 3	C S			
9'							
	End of Exploration at 9.5'						
10'							
11'							

TEST PIT PLAN



EXCAVATION EFFORT

Easy	E
Moderate	M
Difficult	D
Very Difficult	V

BOULDER/COBBLE CLASS

Type	Size	Abbr.
Cobble	3" - 6"	C
Small	6" - 18"	S
Medium	18" - 36"	M
Large	36" and Larger	L

PROPORTIONS USED

Term	Relative Quantity
and	35% - 50%
some	20% - 35%
little	10% - 20%
trace	10% or less

GROUNDWATER CONDITIONS

GW Encountered?:	N/E
GW Depth (ft):	N/A
GW Elevation (ft):	N/A
Elapsed Time (min):	N/A

Remarks:
1. Perched water observed at between 2 and 2.5 feet below ground surface.
2. Test pit walls began caving in at 2.5 feet.

PROJECT NO.

2060-03-01

LOG OF TEST PIT

TP-1

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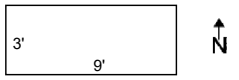
ENGINEERING ASSOCIATES

LOG OF TEST PIT TP-2

PROJECT	Proposed Shutesbury Library			CONTRACTOR	Shutesbury DPW
JOB NO.	2060-03-01	DATE	10/03/2023	OPERATOR	Dave
LOCATION	Shutesbury, MA.	WEATHER	Sunny, 60°F	BACKHOE	CAT 420XE
TEST PIT LOCATION	North Portion of Proposed Stormwater System in Southeastern Area of Site	START TIME	09:20	CAPACITY (cy)	1/4
		FINISH TIME	10:00	GS ELEV. (ft)	1178.0
		OTO STAFF	Shannon Raymond	FINAL DEPTH (ft)	11.0

DEPTH (ft)	SOIL DESCRIPTION	EXCAV. EFFORT	BOULDERS/ COBBLES COUNT	BOULDERS/ COBBLES CLASS	SAMPLE NO.	FIELD TEST DATA	REMARKS
	Forest Duff	E					
	Dark brown, fine to medium SAND, some to little silt, trace coarse sand, little organics (roots, leaves), moist (TOPSOIL)						
1'	Orange brown, fine to medium SAND, little silt, little to trace coarse sand, trace gravel, trace organics (roots), moist (some rust staining throughout)	M	3	C			
2'	Light grey, fine to medium SAND, little coarse sand, little to trace silt, trace (+) gravel, trace organics (roots to 2 feet), moist (trace rust staining throughout)						1.
3'							
	Grey, fine to medium SAND, little coarse sand, little silt, trace (+) gravel, moist (trace rust staining throughout)						
4'		D	7 2 1	C S M			
5'							
6'							
7'		D	12 3 1	C S M			
8'							
9'							
10'							
11'							
	End of Exploration at 11'						

TEST PIT PLAN



EXCAVATION EFFORT

Easy	E
Moderate	M
Difficult	D
Very Difficult	V

BOULDER/COBBLE CLASS

Type	Size	Abbr.
Cobble	3" - 6"	C
Small	6" - 18"	S
Medium	18" - 36"	M
Large	36" and Larger	L

PROPORTIONS USED

Term	Relative Quantity
and	35% - 50%
some	20% - 35%
little	10% - 20%
trace	10% or less

GROUNDWATER CONDITIONS

GW Encountered?:	N/E
GW Depth (ft):	N/A
GW Elevation (ft):	N/A
Elapsed Time (min):	N/A

Remarks:
1. Perched water observed at ground surface, and at between 2 and 2.5 feet below ground surface.

PROJECT NO.

2060-03-01

LOG OF TEST PIT

TP-2

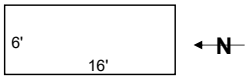
O'Reilly, Talbot & Okun
ENGINEERING ASSOCIATES

LOG OF TEST PIT TP-3

PROJECT	Proposed Shutesbury Library			CONTRACTOR	Shutesbury DPW
JOB NO.	2060-03-01	DATE	10/03/2023	OPERATOR	Dave
LOCATION	Shutesbury, MA.	WEATHER	Sunny, 60°F	BACKHOE	CAT 420XE
TEST PIT LOCATION	Southeast Portion of Prop. Stormwater System in North Area of Site	START TIME	10:30	CAPACITY (cy)	1/4
		FINISH TIME	11:00	GS ELEV. (ft)	1176.0
		OTO STAFF	Shannon Raymond	FINAL DEPTH (ft)	9.5

DEPTH (ft)	SOIL DESCRIPTION (← N … S →)	EXCAV. EFFORT	BOULDERS/COBBLES COUNT	BOULDERS/COBBLES CLASS	SAMPLE NO.	FIELD TEST DATA	REMARKS
0	Dark brown, fine to medium SAND, little silt, little to trace coarse sand, trace (-) fine gravel, little organics (roots), damp (TOPSOIL)	E	5	C			
			2	S			
1'	Light brown, fine to medium SAND, little coarse sand, little to trace gravel, trace silt, trace organics (roots), damp						
2'	Dark brown to very dark brown, fine to medium SAND, little silt, little coarse sand, trace (+) gravel, little debris (brick, concrete, ash), damp	M	20	C			
			3	S			
3'			2	M			
4'	Dark brown, fine to medium SAND, little silt, little coarse sand, trace gravel, damp						
	Orange brown, fine to medium SAND, little silt, little to trace coarse sand, trace gravel, moist (some rust staining throughout)						
5'	Grey, fine to medium SAND, little coarse sand, little silt, little to trace gravel, moist (trace rust staining throughout)	D	5	C			1.
6'		D	7	C			
			2	S			
7'	End of Exploration at 6.5'						
8'							
9'							
10'	End of Exploration at 9.5'						
11'							
	End of Exploration at 11'						

TEST PIT PLAN



EXCAVATION EFFORT

Easy	E
Moderate	M
Difficult	D
Very Difficult	V

BOULDER/COBBLE CLASS

Type	Size	Abbr.
Cobble	3" - 6"	C
Small	6" - 18"	S
Medium	18" - 36"	M
Large	36" and Larger	L

PROPORTIONS USED

Term	Relative Quantity
and	35% - 50%
some	20% - 35%
little	10% - 20%
trace	10% or less

GROUNDWATER CONDITIONS

GW Encountered?:	N/E
GW Depth (ft):	N/A
GW Elevation (ft):	N/A
Elapsed Time (min):	N/A

Remarks:
1. Perched water observed in north end of test pit at 4 feet below ground surface.

PROJECT NO.

2060-03-01

LOG OF TEST PIT

TP-3

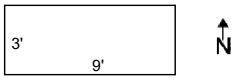
O'Reilly, Talbot & Okun
ENGINEERING ASSOCIATES

LOG OF TEST PIT TP-4

PROJECT	Proposed Shutesbury Library			CONTRACTOR	Shutesbury DPW
JOB NO.	2060-03-01	DATE	10/03/2023	OPERATOR	Dave
LOCATION	Shutesbury, MA.	WEATHER	Sunny, 70°F	BACKHOE	CAT 420XE
TEST PIT LOCATION	Southeast Portion of Prop. Stormwater System in North Area of Site	START TIME	11:30	CAPACITY (cy)	1/4
		FINISH TIME	12:10	GS ELEV. (ft)	1171.0
		OTO STAFF	Shannon Raymond	FINAL DEPTH (ft)	9.5

DEPTH (ft)	SOIL DESCRIPTION (W ← → E)	EXCAV. EFFORT	BOULDERS/COBBLES COUNT	BOULDERS/COBBLES CLASS	SAMPLE NO.	FIELD TEST DATA	REMARKS
0'	Dark brown, fine SAND, some to little silt, little medium sand, little coarse sand, trace (-) fine gravel, some organics (roots), moist	E					
1'	Dark brown, fine SAND, some to little silt, little medium sand, little coarse sand, some organics (roots), moist	E	5	C			
2'	Brown, fine to medium SAND, little silt, little to trace coarse sand, trace (-) gravel, trace organics (roots), damp						
3'	Light brown grey, fine to medium SAND, little coarse sand, little to trace silt, trace (+) gravel, trace organics (roots to 3'), moist (trace rust staining in top 3')	M	10 2	C S			1.
4'							
5'	Light grey, fine to medium SAND, little coarse sand, little to trace silt, trace (+) gravel, damp	D	5	C	S-1 (5'-9')		
6'							
7'		D					
8'							
9'							
10'	End of Exploration at 9.5'						
11'							

TEST PIT PLAN



EXCAVATION EFFORT

Easy .....E
Moderate .....M
Difficult .....D
Very Difficult V

BOULDER/COBBLE CLASS

Type	Size	Abbr.
Cobble	3" - 6"	C
Small	6" - 18"	S
Medium	18" - 36"	M
Large	36" and Larger	L

PROPORTIONS USED

Term	Relative Quantity
and	35% - 50%
some	20% - 35%
little	10% - 20%
trace	10% or less

GROUNDWATER CONDITIONS

GW Encountered?: N/E
GW Depth (ft): N/A
GW Elevation (ft): N/A
Elapsed Time (min): N/A

Remarks:
1. Perched water observed at 3 feet below ground surface.

PROJECT NO.

2060-03-01

LOG OF TEST PIT

TP-4

Photograph 1 : TP-1

Photograph 2 : TP-1

Photograph 3 : TP-1

Photograph 4 : TP-1

Photograph 5 : TP-2

Photograph 6 : TP-2

Photograph 7 : TP-2

Photograph 8 : TP-2

Photograph 9 : TP-2

Photograph 10 : TP-3

Photograph 11 : TP-3

Photograph 12 : TP-3

Photograph 13 : TP-3

Photograph 14 : TP-3

Photograph 15 : TP-3

Photograph 16 : TP-3

Photograph 17 : TP-4

Photograph 18 : TP-4