Terracon GeoReport

Geotechnical Engineering Report

Proposed Solar Power Facility
Waterford, Connecticut
May 22, 2018
Terracon Project No. J2185052

Prepared for:
BL Companies
Meriden, Connecticut

Prepared by:
Terracon Consultants, Inc.
Rocky Hill, Connecticut

terracon.com

Terracon

Environmental ■ Facilities ■ Geotechnical ■ Materials

BL Companies
355 Research Parkway
Meriden, Connecticut 06450

Attn: Mr. Michael Sullivan
P: (203) 630 1406
E: msullivan@blcompanies.com

Re: Geotechnical Engineering Report
Proposed Solar Power Facility
47-57 Oil Mill Road
Waterford, Connecticut
Terracon Project No. J2185052

Dear Mr. Sullivan:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PJ185052 dated April 17, 2018. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations for the proposed project. An environmental assessment was not part of this project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Jared C. Hall, G.I.T.
Field Geologist

Brian D. Opp, P.E.
Geotechnical Department Manager

REPORT TOPICS

Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon GeoReport logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
SITE LOCATION AND EXPLORATION PLANS
EXPLORATION RESULTS (Boring Logs and Laboratory Data)
SUPPORTING INFORMATION (General Notes, Unified Soil Classification System, and Description of Rock Properties)

REPORT SUMMARY

Topic [1]	Overview Statement [2]
Project Description	The construction of an approximately photovoltaic power facility consisting of approximately 62,700 panels over 152.2-acres. A 50-foot buffer will be constructed along the perimeter of the wetlands throughout the site.
Geotechnical Characterization	Native silty sands, occasional cobbles and boulders, underlain by bedrock. Bedrock was encountered in B-1 at a depth of 10 feet below existing grade. Probable bedrock was encountered in B-2 and B-4 through B-8 at depths of 10 to 20 feet. Groundwater was encountered while drilling at depths ranging from at grade to about 13 feet below existing grade while drilling in B-2 through B-5 and B-8.
Deep Foundations	Due to the presence of cobbles/boulders and bedrock, refusal to pile driving is anticipated to occur regularly across the site during the installation of production piles. In addition to piles encountering refusal to driving due to the presence of cobbles/boulders and/or bedrock, we anticipate the piles will likely rotate vertically and horizontally during driving as cobbles/boulders are encountered and the pile glances off of these large particles. If the minimum pile embedment depth cannot be obtained using conventional pile driving methods, an alternative would be to either underdrill no deeper than 6 inches short of their design depth or predrill oversize holes at each pile location to the minimum embedment depth prior to installation of the pile. Cement grout (controlled low-strength material [CLSM]) could also be considered to act as backfill material with the use of predrilled holes. Otherwise, alternative means of foundation support should be considered.
Shallow Foundations	As an alternative to deep foundation systems the panels may be supported on ballast foundations bearing on the ground surface.
Earthwork	Clearing and grubbing, minor grading.
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a PDF, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Geotechnical Engineering Report

Proposed Solar Power Facility
47-57 Oil Mill Road
Waterford, Connecticut

Terracon Project No. J2185052
May 22, 2018

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Solar Power Facility to be located at 47-57 Oil Mill Road in Waterford, Connecticut. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Slab design and construction
- Seismic considerations
- Foundation design and construction

The geotechnical engineering scope of services for this project included the advancement of eight test borings (B-1 through B-8) to depths ranging from approximately 10 to 22 feet below ground surface.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and as separate graphs in the **Exploration Results** section of this report.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	Approximately 140-acre site located south of Oil Mill Road, east of its intersection with Parkway North, in the town of Waterford, Connecticut. (See Exhibit D)
Existing Improvements	Overhead electric transmission right of way in the central portion of the site, elsewhere the site is wooded.

Item	Description
Current Ground Cover	Forest mat.
Existing Topography [1]	The provided '*Site Plan'* depicts the site as being hilly terrain overall sloping downward toward the north. Additionally, wetland areas are depicted in areas other than the proposed solar arrays, in the central, northwestern, and eastern portions of the site.
Geology	The *Surficial Materials Map of Connecticut, 1992,* depicts soils within the vicinity of the site consist of a thin layer of glacial till. The *Bedrock Geological Map of Connecticut, 1985,* identifies that bedrock, at depth, underlying the site consists of gneiss and schist.

1. *'Site Plan'* by BL Companies of Meriden, Connecticut, Project No. 17D3515, Sheet No. SP-1, dated February 28, 2018.

CORROSIVITY

The table below lists the results of laboratory soluble sulfate, soluble chloride, pH, and conductivity testing performed on samples obtained from B-4 and B-7 at depths of about 5 to 7 and 2 to 4 feet, respectively. We have provided the inverse of the conductivity test results, electrical resistivity in Ω*cm, for your convenience. The reporting limits provided below represent the calibrated detection capabilities of the laboratory's testing equipment. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Corrosivity Test Results Summary						
Boring Location	**Sample Depth (feet)**	**Soluble Sulfate (mg/kg)** [1]	**Soluble Chloride (mg/kg)** [1]	**Conductivity (µmho/cm)** [2]	**Resistivity (Ω*cm)** [3]	**pH**
B-4	5-7	5.2	Not Detected	23	43,480	7.1
B-7	2-4	6.9	Not Detected	11	90,910	5.5

1. Reporting Limit = 1.1 mg/kg
2. Reporting Limit = 2.0 µmho/cm
3. Calculated from Conductivity

These test results are provided to assist in determining the type and degree of corrosion protection that may be required. We recommend a certified corrosion engineer be employed to determine the need for corrosion protection and to design appropriate protective measures, if required.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed in the project planning stage. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	*'Site Plan'* by BL Companies of Meriden, Connecticut, Project No. 17D3515, Sheet No. SP-1, dated February 28, 2018.
Project Description	The construction of an approximately photovoltaic power facility consisting of approximately 62,700 panels over 152.2-acres. A 50-foot buffer will be constructed along the perimeter of the wetlands throughout the site.
Array Construction	Rack-mounted solar panels supported by driven galvanized steel piles.
Maximum Loads	**Solar Panel Loads:** ■ Downforce: 1 to 2.5 kips (assumed) ■ Uplift: 2.5 kips (assumed) (does not consider frost heave) ■ Lateral: 2.5 kips at 4 to 7 feet above grade (assumed) **Equipment Slab Loads:** ■ 150 pounds per square foot (psf)
Grading/Slopes	Cuts and fills, up to about 3 feet, are anticipate for site development. Permanent cut slopes are not anticipated.
Access Roads	18-foot wide gravel access roads proposed throughout the array.

GEOTECHNICAL CHARACTERIZATION

Subsurface Profile

Subsurface conditions at the boring locations can be generalized as follows:

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density
Surface	1 to 2	Forest mat: brown, friable and contained significant organic matter	N/A
Subsoil	2	Silty sand (SM), orange to brown. Encountered in B-1.	Loose

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density
1	5 to 15	Silty sand (SM), trace to with gravel, occasional cobbles and boulders, brown to gray.	Medium dense to very dense
2 [1]	Extends beyond the limits of our explorations	Granitic gneiss, white and gray, completely weathered.	N/A

1. Encountered in B-1 and B-4.

Based on our exploration results, as well as our experience in the region, it is our opinion Stratum 1 is consistent with the mapped glacial till. B-3 terminated without refusal in the native sand and gravel at a depth of approximately 22 feet below ground surface. B-2 and B-4 through B-8 terminated upon auger refusal on a probable bedrock at depths of 10 to 20 feet. B-1 encountered weathered bedrock at a depth of 3.5 feet and was further advanced using the solid-stem auger until auger refusal on competent bedrock at a depth of 10 feet.

Conditions encountered at each exploration location are indicated on the individual exploration logs shown in the **Exploration Results** section and are attached to this report. Stratification boundaries on the exploration logs represent the approximate location of changes in soil / rock types*; in-situ*, the transition between materials may be gradual.

Groundwater Conditions

Groundwater was encountered while drilling from the ground surface to depths of about 13 feet in B-2 through B-5 and B-8, as tabulated below.

Boring Number	Approximate Depth to Groundwater while Drilling (feet)
B-2	0
B-3	5
B-4	1
B-5	2
B-8	13

Groundwater was not observed in the remaining borings while drilling or for the short duration the borings could remain open. However, this does not necessarily mean the borings terminated above groundwater, or the water levels summarized above are stable groundwater levels. Due to the low permeability of the soils encountered in the borings, a relatively long period may be necessary for a groundwater level to develop and stabilize in a borehole. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Additionally, groundwater may become temporarily perched above siltier portions of the native material and bedrock. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

In-Situ Electrical Resistivity Testing

On May 7, 2018, a Terracon field engineer completed two *in-situ* electrical resistivity tests (ER-1 and ER-2) in general accordance with ASTM G57 by the Wenner four probe method using a Megger DET5/4r earth resistivity meter. Each test consisted of two perpendicular arrays with electrode "A" spacings of about 5, 10, 20, 30, and 40 feet. The approximate locations and orientations of the resistivity lines are shown on the attached **Exploration Plan**. The results of our resistivity tests are tabulated below.

	Resistivity (ohm-cm)	
Electrode Spacing (feet)	**ER-1 (North – South)**	**ER-1 (East – West)**
5	212,565	251,825
10	179,435	308,315
20	106,090	240,140
30	85,600	160,285
40	90,390	146,305

	Resistivity (ohm-cm)	
Electrode Spacing (feet)	**ER-1 (Northeast – Southwest)**	**ER-1 (Northwest - Southeast)**
5	102,740	132,710
10	166,415	256,035
20	245,120	219,460
30	259,675	183,840
40	251,250	148,605

GEOTECHNICAL OVERVIEW

Based on our exploration results, subsurface conditions generally consist of medium dense to very dense native silty sands, occasional cobbles and boulders, underlain by bedrock. The depth to bedrock was variable throughout the site. Probable bedrock was encountered in B-2 and B-5 through B-8 at depths of about 10 to 20 feet below the ground surface. Completely weathered bedrock was encountered in B-1 and B-4 at depths of 3.5 and 13 feet and competent bedrock at depths of 10 and 15 feet, respectively.

Due to the presence of cobbles/boulders and bedrock, refusal to pile driving is anticipated to occur regularly across the site. We highly recommend a pile driving program be implemented to confirm the anticipated difficult pile driving conditions.

In addition to piles encountering refusal to driving due to the presence of cobbles/boulders and/or bedrock, we anticipate the piles will likely rotate vertically and horizontally during driving as cobbles/boulders are encountered and the pile glances off of these large particles. Pinching between cobbles/boulders is also a concern.

In areas of driven pile refusal, pile locations could be over-drilled to just above their design depth to remove potential obstructions in the upper portions of the native soils. The holes would then be backfilled with the cuttings less the cobbles and boulders as they are culled from the material. Depending on the depth of pre-drilling, this method will reduce the possibility for refusal as the depth of pre-drilling increases and the depth of native soils is reduced. As the depth of native soils are reduced between the bottom of the pre-drilled oversized hole and the design depth, the potential for pile driving refusal is reduced. We recommend all pre-drilled holes be drilled no deeper than 6 inches short of their design depth. Cement grout (controlled low-strength material [CLSM]) may be used as backfill around the piles. Terracon is available to provide further consultation for these potential foundation and/or alternatives upon request. A full discussion of our pile recommendations can be found in the **Pile Foundations** section.

The soils on this site are frost susceptible and therefore can exert a heaving force on the piles. If the anchorage of the foundations and the deadweight of the structures are not sufficient to resist these forces, they can cause uplift to structures. In cold weather climates, design to resist frost heave forces exerted on foundations is often the limiting factor in the foundation design. Specifically, pile lengths will need to be long enough to counteract potential heave forces in the seasonal frost zone.

Geotechnical engineering recommendations for piles driven to a minimum five-foot depth are outlined below. The recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and our current understanding of the proposed project.

As an alternative to deep foundation systems, the proposed solar panels may be supported at grade on ballast foundations bearing on the native silty sand. We recommend lightly-loaded equipment, i.e. ancillary equipment, inverters, transformers, etc., be supported on slabs deriving support from an at least 12-inch thick layer of Non-Frost Susceptible (NFS) Fill placed over the native silty sands or fill placed for site grading, the surface of which should be thoroughly compacted, as described in our **Ballast Foundations and Equipment Slabs** section.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations made during subgrade preparation; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations in the completed subgrade; and for construction / installation of foundations

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork will include clearing and grubbing, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria as necessary to render the site in the state considered in our geotechnical engineering evaluation for foundations, equipment slabs, and roadways.

Site Preparation

Forest mat / topsoil, organic subsoil (subsoil with visible roots), and any otherwise unsuitable materials should be removed prior to placing fill. The exposed subgrade should be proofrolled with at least six passes of a minimum 10-ton (static weight) vibratory roller compactor. Unsuitable material at the subgrade level should be removed and replaced with compacted Structural Fill. Fill may then be placed to attain the required grade.

Reuse of Onsite Materials

Based on available data, it is our opinion the native silty sand may be selectively reused as Common and Structural Fill, provided it is mixed with imported granular material such that it is close to meeting our gradation requirements provided in the table below. Reused material must be placed at moisture contents suitable for compaction purposes and be compacted to the densities recommended below. Cobbles and boulders should be culled from the material prior to reuse. Portions of the native silty sand contain relatively higher concentrations of fines which may make reuse less desirable, as these materials will be moisture sensitive and difficult to maintain at moisture levels suitable for compaction, particularly during periods of wet weather.

Fill Material Types

Fill and backfill should meet the following material property requirements.

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Structural Fill [2]	GW, GW-GM, SW, SW-SM, SP, GP	All locations and elevations. Imported Structural Fill should meet the gradation requirements in Note 2 (below). Cobbles and boulders should be culled prior to reuse.
Common Fill [3]	Varies	Common Fill may be used for general site grading. Common Fill should not be used under settlement or frost-sensitive structures. Cobbles and boulders should be culled prior to reuse.
Non-Frost Susceptible (NFS) Fill [4]	GW, GP, SW, SP	All locations and elevations.
Crushed Stone	GP	For use on wet subgrades, as a replacement for Structural and NFS Fill (if desired), and as drainage fill. Should be uniform ¾-inch angular crushed stone wrapped in a geotextile separation fabric (Mirafi 140N, or similar).
Lean Concrete	Not applicable	Can be used to level subgrades between foundations and native soils. Lean concrete should be flowable, self-compacting concrete with a compressive strength between 300 and 2,000 psi.

1. Compacted fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used. Fill should not be placed on a frozen subgrade.
2. Imported Structural Fill should meet the following gradation specifications:

	Percent Passing by Weight
Sieve Size	**Structural Fill**
6″	100
3″	70 to 100
2″	(100)*
¾″	45 to 95
No. 4	30 to 90
No. 10	25 to 80
No. 40	10 to 50
No. 200	0 to 12

* Maximum 2-inch particle size within 12 inches of the underside of concrete elements

3. Common Fill should have a maximum particle size of 6 inches and no more than 25 percent by weight passing the No. 200 sieve.
4. Non-Frost Susceptible Fill should contain less than 5 percent material passing No. 200 sieve size.

Fill Compaction Requirements

Placed fill should meet the following compaction requirements.

Item	Description
Maximum fill lift thickness	■ 12 inches or less in loose thickness when heavy, self-propelled compaction equipment is used. ■ 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used.
Compaction Requirements [1]	95 percent maximum dry density (as determined by modified Proctor testing ASTM D1557, Method C)
Moisture Content – Granular Material	Workable moisture levels.

1. We recommend fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested, as required, until the specified moisture and compaction requirements are achieved.

Utility Trench Backfill

Trench excavations should be made with sufficient working space to permit construction, including backfill placement and compaction. As utility trenches can provide a conduit for groundwater flow, trenches should be backfilled with material that approximately matches the permeability characteristics of the surrounding soil. Should higher permeability fill be used in trenches, consideration should be given to installing seepage collars and/or check dams to reduce the likelihood of migration of water through the trenches.

Grading and Drainage

Adequate drainage should be provided at the site to reduce the likelihood of an increase in moisture content of the foundation soils. Surface drainage would likely consist of limited swales to control erosion and flow of runoff towards the equipment.

Earthwork Construction Considerations

Excavation penetrating the bedrock (if any) may require the use of specialized heavy-duty equipment, together with ripping or jack-hammering to advance the excavation and facilitate rock break-up and removal. Consideration should be given to obtaining a unit price for difficult excavation in the contract documents for the project.

Unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Should unstable subgrade conditions develop, stabilization measures will need to be employed.

Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, wet, or disturbed, the affected material should be removed, or should be scarified, moisture conditioned, and recompacted.

As a minimum, temporary excavations should be sloped or braced, as required by Occupational Safety and Health Administration (OSHA) regulations, to provide stability and safe working conditions. The contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations, as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, State, and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; backfilling of excavations in the completed subgrade; and just prior to construction of foundations.

PILE FOUNDATIONS

We recommend the proposed photovoltaic panels be supported on driven piles advanced into the native silty sands. However, due to cobbles, boulders, and shallow bedrock, piles may refuse above their minimum embedment depth. Pre-drilling oversized holes short of their design depth to remove cobbles and boulders may be considered to drive piles to design depth. Design recommendations and construction considerations for our recommended methods are presented below.

Driven Pile Design Recommendations

The panels may be supported on driven steel piles, which should be structurally designed to resist compression, uplift, and bending forces. We recommend the piles be driven to a depth of 5 feet below finished grade (BFG), at a minimum, to achieve the required resistance. Greater embedment depths are anticipated to resist frost heave forces. The project Structural Engineer should determine the actual pile embedment depths. Corrosion protection should be applied to the steel piles, as required.

The soils on this site are frost susceptible and therefore can exert a heaving force on the piles. If the anchorage of the foundations and the deadweight of the structures are not sufficient to resist these forces, they can cause uplift to structures. In cold weather climates, design to resist frost heave forces exerted on foundations is often the limiting factor in the foundation design. Specifically, pile lengths will need to be long enough to counteract potential heave forces in the

seasonal frost zone. The seasonal frost zone for this site is 3½ feet, and therefore, the upper 3½ feet of soils should be ignored for use in resisting uplift or frost heave loading. Fully thawed soils in the upper 3½ feet are suitable for resistance of compression and lateral loads, but at the reduced values provided in the table below. The parameters in the table below have already been reduced to account for their reduced strength condition under spring thaw conditions.

Based on our review of soils samples and available published soil maps of the area, we recommend that a frost heave force of 1,000 psf acting along the pile perimeter to a depth of about 3½ feet below the ground surface should be considered. Lateral capacity of vertically installed driven piles is primarily dependent on the type and relative density/consistency of the soil against which the pile is pushed by the horizontal load. Driven piles should not exceed a lateral deflection of ½ inch at the ground surface.

We anticipate that the design length of the pile will be primarily dependent on the embedment/lateral capacity required to resist live loading, such as the combination of wind and ice loads. Technical specifications should be prepared that require material and installation detail submittals, and proof of experience in pile installation. A summary of our design parameters is provided in the table below.

Description	Value
Net Allowable End Bearing Capacity [1]	
Native silty sands / weathered rock	6 ksf
Competent Bedrock	10 ksf
Ultimate Skin Friction [2]	
Native silty sands (<3.5 ft) (Uplift Condition under fully thawed conditions)	250 psf
Native silty sands (<3.5 ft.) (Compression Condition under fully thawed conditions)	750 psf
Native silty sands / weathered rock (>3.5 ft)	1.5 ksf
L-Pile Material Type	
Native silty sands / weathered rock	Sand (Reese)
Competent bedrock	Weak Rock
Soil / Rock modulus parameter (k) [3]	
Native silty sands (wet) <3.5 ft (>3.5 ft)	40 pci (125 pci)
Native silty sands (dry) <3.5 ft (>3.5 ft)	60 pci (225 pci)
Weathered rock	225 pci
Angle of Internal Friction	
Native silty sands	34 degrees
Weathered rock	40 degrees
Competent bedrock	45 degrees

Description	Value
Estimated *In-situ* Soil / Rock Unit Weight	
Native silty sands	125 pcf
Weathered rock	140 pcf
Competent bedrock	145 pcf
Approximate Groundwater Depth (4/26/18 to 4/27/18)	0 to 13 feet
Minimum Depth for Frost Protection	42 inches

1. A factor of safety of 3 has been applied to end bearing.
2. Applicable to compression and uplift loading. The uplift capacity of the pile will be based on side friction and the dead weight of the piles. A factor of safety of at least 2 should be applied to the side resistance.
3. For use with L-Pile program.

We anticipate and recommend a pile load test program will be developed to better assess the ultimate skin friction and L-Pile parameters for design of the pile embedment depths on this project. If compression loading will control the design embedment depths of the piles, we would also recommend compression load testing be performed as part of the pile load test program. The design values obtained from a pile load test program are anticipated to be less conservative than the values provided in this report, and the factor of safety is also expected to be reduced. Design values from a pile load test program will be contingent upon obtaining a minimum drive time for each pile driven based on a specific hammer and equipment used during the driving of the piles during the pile load test program. If a different pile hammer and equipment are used by the contractor during construction, the minimum drive time will be adjusted accordingly.

Driven Pile Construction Considerations

Based on the field exploration and laboratory testing, it is our opinion on-site soils are not suitable for driven pile installation; and that areas of the site may encounter shallow bedrock and/or frequent boulders and difficulty or additional effort could be required for pile installation.

Underdrilling Considerations

In areas of driven pile refusal on cobbles and boulders, it may be appropriate to predrill a hole at the pile location to a depth less than the design depth of the pile. We recommend all pre-drilled holes be drilled no deeper than 6 inches short of their design depth. The predrilled hole may then be backfilled with the cuttings, provided cobbles and boulders are culled from the material. Underdrilling increases the likelihood of piles being driven to design depth; however, it does not completely eliminate the possibility of refusal. Additionally, the cuttings used as backfill would have reduced strength, as tabulated below.

Description	Value
Net Allowable End Bearing Capacity [1]	
Native silty sands / weathered rock	6 ksf
Competent Bedrock	10 ksf
Ultimate Skin Friction [2]	
Backfill cuttings (<3.5 ft) (Uplift Condition under fully thawed conditions)	125 psf
Backfill cuttings (<3.5 ft.) (Compression Condition under fully thawed conditions)	375 psf
Backfill cuttings (>3.5 ft)	750psf
Native silty sands / weathered rock (>3.5 ft)	1.5 ksf
L-Pile Material Type	
Backfill cuttings / Native silty sands / weathered rock	Sand (Reese)
Competent bedrock	Weak Rock
Soil / Rock modulus parameter (k) [3]	
Backfill cuttings (wet) <3.5 ft (>3.5 ft)	40 pci (60 pci)
Backfill cuttings (dry) <3.5 ft (>3.5 ft)	60 pci (90 pci)
Native silty sands (wet) <3.5 ft (> 3.5 ft)	40 pci (125 pci)
Native silty sands (dry) <3.5 ft (>3.5 ft)	60 pci (225 pci)
Weathered rock	225 pci
Angle of Internal Friction	
Backfill cuttings	32 degrees
Native silty sands	34 degrees
Weathered rock	40 degrees
Competent bedrock	45 degrees
Estimated *In-situ* Soil / Rock Unit Weight	
Backfill cuttings	120 pcf
Native silty sands	125 pcf
Weathered rock	140 pcf
Competent bedrock	145 pcf
Approximate Groundwater Depth (4/26/18 to 4/27/18)	0 to 13 feet
Minimum Depth for Frost Protection	42 inches

1. A factor of safety of 3 has been applied to end bearing.
2. Applicable to compression and uplift loading. The uplift capacity of the pile will be based on side friction and the dead weight of the piles. A factor of safety of at least 2 should be applied to the side resistance.
3. For use with L-Pile program.

Oversize Holes Design Recommendations

As an alternative to driven piles and pre-drilling oversized holes short of their design depth, an oversized hole drilled to the full design depth (overdrilling) may be advanced to the minimum embedment depth prior to the installation of piles and setting the pile in the hole. For this approach, the hole is to be backfilled using cement grout, i.e. controlled low-strength material (CLSM). This method may be appropriate in areas of shallow bedrock and/or frequent obstructions. Design parameters for oversize holes are provided below.

Description	Value
Net Allowable End Bearing Capacity [1]	
Native silty sands / weathered rock	6 ksf
Competent Bedrock	10 ksf
Ultimate Bond Resistance [2]	
Native silty sands / weathered rock (<3.5 ft)	Ignore
Native silty sands / weathered rock (>3.5 ft)	15 psi
Competent Bedrock	200 psi
L-Pile Material Type	
Native silty sands / weathered rock	Sand (Reese)
Competent bedrock	Weak Rock
Soil / Rock modulus parameter (k) [3]	
Native silty sands (wet) <3.5 ft (>3.5 ft)	40 pci (125 pci)
Native silty sands (dry) <3.5 ft (>3.5 ft)	60 pci (225 pci)
Weathered rock	225 pci
Angle of Internal Friction	
Native silty sands	34 degrees
Weathered rock	40 degrees
Competent Bedrock	45 degrees
Uniaxial Compressive Strength (psi) [3]	8,500 psi
Competent Bedrock	
Initial Modulus of Rock Mass (psi) [3]	1,100,000 psi
Competent Bedrock	
RQD	75
Competent Bedrock	
Strain Factor	0.00005
Competent Bedrock	
Estimated *In-situ* Soil/Rock Unit Weight	
Native silty sands	125 pcf
Weathered rock	140 pcf
Competent bedrock	145 pcf
Approximate Groundwater Depth (4/26/18 to 4/27/18)	0 to 13 feet

Description	Value
Minimum Depth for Frost Protection	42 inches
Minimum Drilled Hole Diameter	18 inches

1. The allowable end bearing capacity is based on the shaft terminating at least 18 inches below frost depth, i.e. minimum embedment of 5 feet. The allowable end bearing capacity assumes that loose material at the base of the shaft has been removed and that the base has not been disturbed or made unstable by an unbalanced hydrostatic pressure.
2. Applicable to compression and uplift loading. Contribution to pile capacity from above the frost depth of 3.5 feet should be ignored. The uplift capacity of the pile will be based on side friction and the dead weight of the piles. A factor of safety of at least 2 should be applied to the side resistance.
3. For use with L-Pile program.

The base of the oversize hole should be in the native silty sands or bedrock. The oversize hole will be designed to resist tension loads. Technical specifications should be prepared that require material and installation detail submittals, proof of experience in oversize hole installation, and concrete placement methods.

Oversize Hole Construction Considerations

Drilling to design depth should be possible with conventional single-flight power augers on the majority of the site; however, specialized drilling equipment may be required for very hard bedrock layers.

The drilled hole should be aligned vertically. The drilling method or combination of methods selected by the contractor should be submitted for review by Terracon, prior to mobilization of drilling equipment. Temporary casing may be required to reduce the likelihood of caving of the hole. If oversized holes extend below the groundwater table, drilling mud may also be required to stabilize the hole. Cobbles and boulders, which may impede the installation of oversize holes, were encountered throughout the site. Concrete should be placed by directing the concrete down the center of the hole in order to reduce the likelihood of hitting the pile and segregating. Groundwater, if encountered, should be removed prior to placing concrete.

SEISMIC CONSIDERATIONS

Description	Value
Code Used [1]	Connecticut State Building Code (SBC)
Site Class [2]	C
Maximum considered earthquake ground motions (5 percent damping) [3]	0.058 (1.0 second spectral response) 0.161 (0.2 second spectral response)
Liquefaction potential in event of an earthquake	Not susceptible

1. The CT SBC incorporates the Seismic Design Category approach from the *2015 International Building Code (IBC)*.
2. The *IBC* uses a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope requested does not include the required 100-foot soil profile determination; the borings performed for this report extended to a maximum depth of 22 feet. However, we expect that soils at least as dense as those encountered above a depth of 22 feet, or bedrock, will extend to at least 100 feet.
3. (Appendix N) Municipality – Specific Structural Design Parameters, per the 2016 CT SBC.

BALLAST FOUNDATIONS AND EQUIPMENT SLABS

As an alternative to deep foundation systems (i.e. driven steel piles, underdrilling, oversized holes), the photovoltaic panels may be supported at the ground surface using ballast foundations in a manner similar to the equipment slabs.

Lightly-loaded ancillary equipment supported on slabs and ballast foundations should be underlain by at least a 12-inch thickness of NFS Fill placed on proofrolled native silty sands or fill placed during site grading. Crushed Stone, wrapped in a geotextile separation fabric, may be used in place of NFS Fill, if desired.

Design recommendations and construction considerations for the recommended ballast foundations and equipment cabinet foundation systems are presented in the following table and paragraphs.

Ballast and Slab Design Parameters

Photovoltaic panels may be supported with precast ballasted foundations deriving support from the native silty sands or on NFS Fill placed over the native silty sands. In areas beneath proposed ballasted foundations, fill should be compacted to at least 95 percent of the maximum modified Proctor dry density (ASTM D1557, Method C). The native material is capable of supporting the imposed loads.

Item	Description
Slab Support	Minimum 12-inch thick layer of compacted NFS or Crushed Stone on proofrolled native silty sands or fill placed during site grading.
Estimated Modulus of Subgrade Reaction [1]	225 pounds per square inch per in (psi/in) for point loading.
Coefficient of Sliding Friction [2]	0.5 (ultimate)
Portland Cement Concrete [3]	Reinforced Portland Cement Concrete

1. Modulus of Subgrade Reaction considers the 12-inch thick layer of NFS or Crushed Stone.
2. A factor of safety of 1.5 should be applied to the sliding resistance
3. Minimum compressive strength of 4,000 psi with fiber mesh. Air entraining admixtures should be used for concrete exposed to freezing.

We recommend the 12-inch thick layer of compacted NFS beneath the slabs to provide both a uniform bearing surface and a capillary break. Slab foundations will move due to freeze-thaw effects. Consideration should be given to placing the NFS deeper, to a greater proportion of the frost depth (42 inches), depending on the tolerance for movement.

Ballast and Slab Construction Considerations

On most sites, the site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed by foundation excavations, construction traffic, rainfall, etc. As a result, the subgrade may not be suitable for placement of NFS Fill, and corrective action will be required.

We recommend the area underlying the slabs be rough graded and then proofrolled with a vibratory roller or heavy plate compactor prior to final grading and placement of NFS Fill. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas previously filled or backfilled. Areas where unsuitable or unstable conditions are located should be repaired by removing and replacing the affected material with properly compacted NFS material.

ROADWAYS

General Comments

On most project sites, the site grading is accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations occur, rainfall and surface water cause saturation, heavy traffic from concrete trucks and other delivery vehicles disturb the subgrade and many surface irregularities are filled in with

loose soils to improve trafficability. As a result, the roadway subgrades, initially prepared early in the project, should be carefully evaluated as the time for roadway construction approaches.

Prior to placement of roadway surfaces, the prepared subgrade should be proof-rolled using a loaded tandem-axle dump truck. Areas where unsuitable conditions are located should be repaired by replacing the materials with properly compacted fill. If significant precipitation occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed again by qualified personnel prior to placing the geotextile, recommended below. The subgrade should be in its finished form at the time of the final review.

The access road area subgrades should be properly sloped to direct water from beneath the drive area gravel section toward the edge, and/or down gradient. Collected water should be channeled away from the access road. Adequate sloping of the gravel surface will minimize the potential for ponding of water on or within proximity to the drive area, which will shorten the life of the gravel drive.

Gravel Access Road Design Recommendations

The gravel roadway design should consist of a 12-inch thickness of well-graded crushed stone, ranging in size from about ½-inch to 1¾-inch, placed over a prepared subgrade, as described in further detail below. A heavy-duty geotextile (Mirafi 500x, or similar) should be placed over the native sands prior to placing the crushed stone. The gravel roadway design is based on the assumption that the majority of the loading will occur during the construction phase of the project. After the proposed structures have been constructed or installed, we anticipate only occasional loads from lightly-loaded maintenance vehicles. A gravel road is prone to damage from oversized or heavily-loaded vehicles. Maintenance of the gravel road will be required. The level of maintenance will generally depend upon the amount of use. The gravel road may need occasional repairs if traveled upon by heavily-loaded vehicles.

Future performance of the gravel roadway constructed on the site will be partially dependent upon maintaining stable moisture content of the subgrade soil. The performance may be enhanced by reducing excess moisture that can reach the subgrade soils. The roadway surface and subgrade should be sloped to provide positive drainage at all times. In this regard the following recommendations are offered.

- Slope the finished ground surface adjacent to the roads at a minimum 2% grade away from the roadways.
- The subgrade and roadway surfaces should be constructed and maintained with a minimum 2% cross slope (crown) to promote proper surface drainage.
- Provide appropriate edge drainage.
- Provide swales and drainage
- Provide erosion protection over sloped surfaces and swales

Gravel Access Road Construction Considerations

The roadway subgrade, if prepared early in the project, should be carefully evaluated as the time for construction approaches. We recommend the roadway area be stripped of existing topsoil/organic subsoil, or otherwise unsuitable material, rough graded, and compacted with a heavy roller compactor without vibration, before being proof-rolled with a loaded tandem-axle dump truck. Particular attention should be paid to high traffic areas that were rutted and disturbed, and areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by replacing the materials with properly compacted fill. When proof-rolling/subgrade stabilization has been completed to the satisfaction of Terracon, the geotextile fabric may be placed followed by the crushed stone.

GENERAL COMMENTS

As the project progresses, we address assumptions by incorporating information provided by the design team, if any. Revised project information that reflects actual conditions important to our services is reflected in the final report. The design team should collaborate with Terracon to confirm these assumptions and to prepare the final design plans and specifications. This facilitates the incorporation of our opinions related to implementation of our geotechnical recommendations. Any information conveyed prior to the final report is for informational purposes only and should not be considered or used for decision-making purposes.

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in the final report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our scope of services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third party beneficiaries intended. Any third party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties.

Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Planned Location
8	10 to 22	Solar Array Area

Exploration Layout and Elevations: Terracon personnel provided the exploration layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet). Elevations were not provided to Terracon prior to the preparation of this report.

Subsurface Exploration Procedures: Terracon advanced 8 test borings (B-1 through B-8) on April 26 and 27, 2018. The borings were advanced using an all-terrain vehicle (ATV)-mounted Diedrich D-50 drill rig using 4-inch diameter continuous solid-stem augers. In general, four samples were obtained in the upper 10 feet of the borings and at intervals of 5 feet thereafter.

In the split barrel sampling procedure, which was used to take soil samples in the test borings, the number of blows required to advance a standard 2 inch O.D. split barrel sampler typically the middle 12 inches of the total 24-inch penetration by means of a 140-pound autohammer with a free fall of 30 inches is the Standard Penetration Test (SPT) resistance value “N”. This “N” value is used to estimate the in-situ relative density of cohesionless soils and consistency of cohesive soils.

The soil samples were placed in labeled glass jars and taken to our laboratory for further review and classification by a Terracon geotechnical engineer. Information provided on the exploration logs attached to this report includes soil/rock descriptions, relative density and/or consistency evaluations, exploration depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings prior to the drill crew leaving the site.

Field logs of the explorations were prepared by a Terracon field engineer. These logs included visual classifications of the materials encountered during drilling as well as interpretation by our field engineer of the subsurface conditions between samples. Final exploration logs included with this report represent further interpretation by the geotechnical engineer of the field logs and incorporate, where appropriate, modifications based on laboratory classification and testing of the samples.

In-Situ **Electrical Resistivity Testing:** Two electrical resistivity test, consisting of perpendicular arrays, were performed in general accordance with ASTM G57 using the Wenner Four-Pin Method. Electrode “a” spacings of 5, 10, 20, 30, and 40 feet were used.

Laboratory Testing

Descriptive classifications of the soils indicated on the boring logs are in accordance with the General Notes, the Unified Soil Classification System (USCS), and Description of Rock Properties. USCS symbols are also shown. A brief description of the USCS is attached to this report. Classification was generally by visual/manual procedures, aided by laboratory testing.

Laboratory testing was performed on representative samples of the native sands recovered from our explorations and consisted of the following:

- Two (2) grain size distribution tests (ASTM D422)
- Two (2) moisture content determinations (ASTM D2216)
- Two (2) suite of chemical laboratory tests for corrosivity
    - Conductivity (SM 2510 B Mod.)
    - Chlorides (EPA 300.0)
    - Sulfates (EPA 300.0)
    - pH Analysis (EPA 9045D)

The moisture contents are included on the individual boring logs. The corrosivity test results can be found in the **Corrosivity** section. The grain size distribution tests are presented in the **Exploration Results** section.

SITE LOCATION AND EXPLORATION PLANS

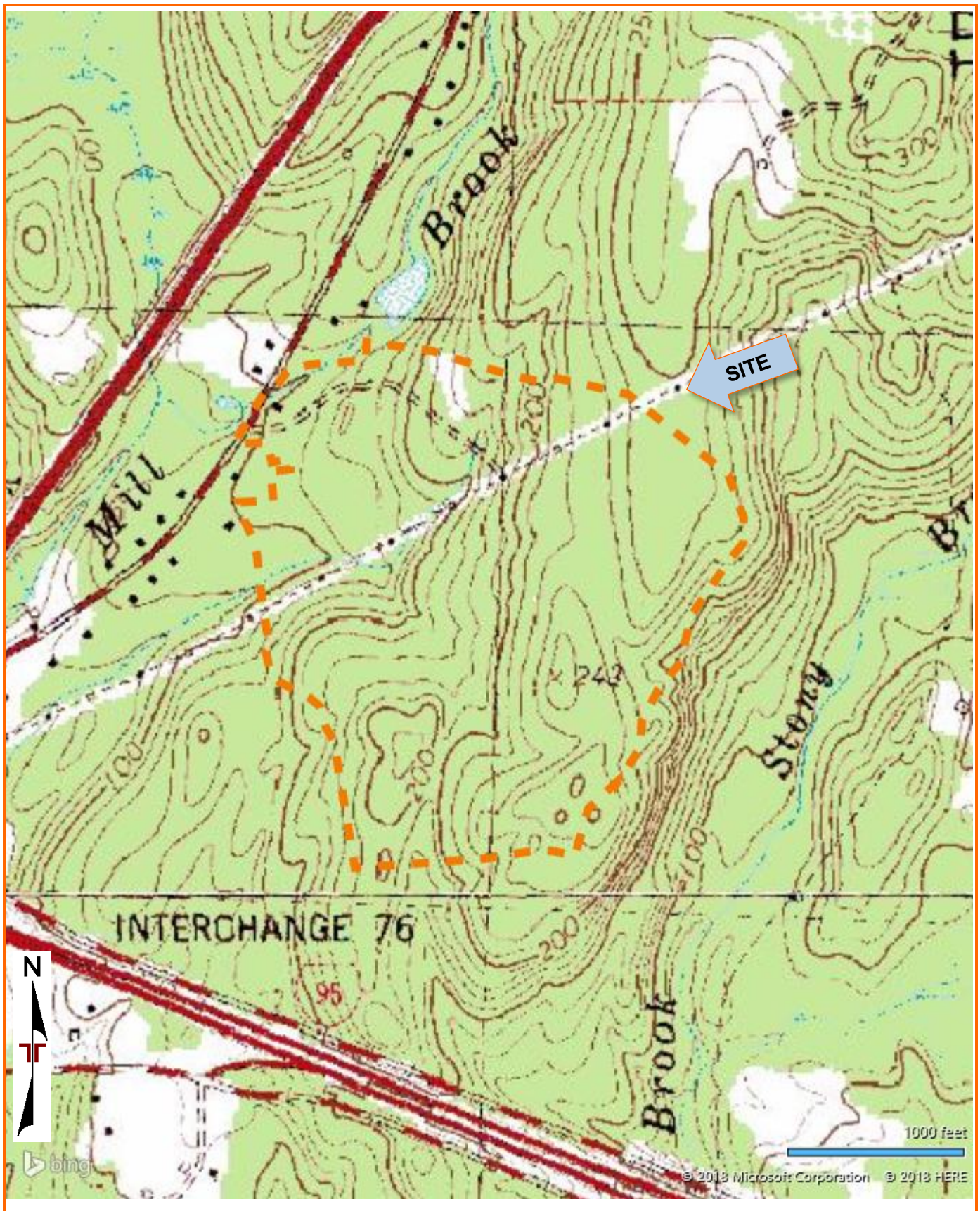


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

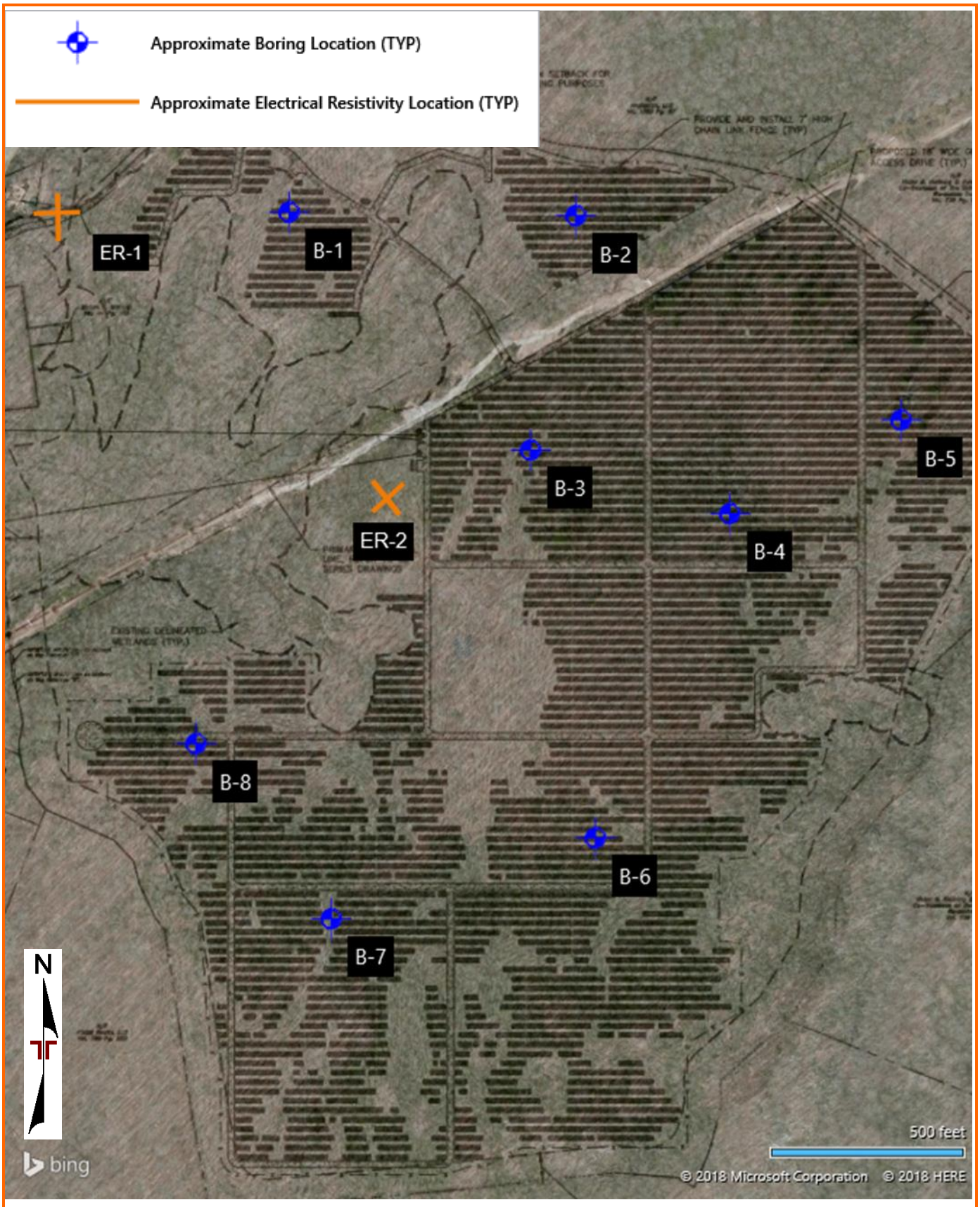


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS
'*SITE PLAN*' BY BL COMPANIES OF MERIDEN, CONNECTICUT, PROJECT NO. 17D3515, SHEET NO. SP-1, DATED FEBRUARY 28, 2018.

EXPLORATION RESULTS

BORING LOG NO. B-1

PROJECT: Proposed Solar Power Facility

CLIENT: BL Companies
Meriden, Connecticut

SITE: 47-57 Oil Mill Road
Waterford, Connecticut

LOCATION See Exploration Plan

Approximate Surface Elev: 145 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS
	FOREST MAT				
1.0	144+/-				
	SILTY SAND (SM), trace roots, brown, loose, **(SUBSOIL)**			8	1-1-3-4 N=4
2.0	143+/-				
	SILTY SAND (SM), trace gravel, gray, dense			10	20-17-21-50/2" N=38
3.5	141.5+/-				
	COMPLETLEY WEATHERED GRANITIC GNEISS, gray to white, very dense	5		2	50/2"
				4	50/4"
10.0	135+/-	10			
	Auger Refusal on Competent Bedrock at 10 Feet				

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with a 2" O.D. split spoon driven by an autohammer.

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 04-25-2018 | Boring Completed: 04-25-2018
Drill Rig: Diedrich D-50 | Driller: C.Johnston
Project No.: J2185052

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J2185052 PROPOSED SOLAR PO.GPJ TERRACON_DATATEMPLATE.GDT 5/18/18

BORING LOG NO. B-2

PROJECT: Proposed Solar Power Facility

CLIENT: BL Companies
Meriden, Connecticut

SITE: 47-57 Oil Mill Road
Waterford, Connecticut

LOCATION See Exploration Plan

Approximate Surface Elev: 210 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
FOREST MAT							
1.5	208.5+/-				10	WOH-1-WOH-1 N=1	
SILTY SAND (SM), orange to brown, very loose to medium dense							
3.0	207+/-				20	5-6-10-14 N=16	
SILTY SAND (SM), trace gravel, brown, medium dense to dense		5			15	17-15-17-18 N=32	11
					24	18-20-22-20 N=42	
9.0	201+/-						
SILTY SAND (SM), with gravel, occasional cobbles and boulders, brown, dense to very dense		10			12	11-12-29-39 N=41	
		15			16	12-22-22-50/5" N=44	
20.9	189+/-	20			10	27-50/5"	
Sampler Refusal on Probable Bedrock at 20.9 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with a 2" O.D. split spoon driven by an autohammer.

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

See Supporting Information for explanation of symbols and abbreviations.

Notes:
WOH - Weight of Hammer

WATER LEVEL OBSERVATIONS

At grade while drilling.

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 04-25-2018 | Boring Completed: 04-25-2018
Drill Rig: Diedrich D-50 | Driller: C.Johnston
Project No.: J2185052

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J2185052 PROPOSED SOLAR PO.GPJ TERRACON_DATATEMPLATE.GDT 5/18/18

BORING LOG NO. B-3

PROJECT: Proposed Solar Power Facility

CLIENT: BL Companies
Meriden, Connecticut

SITE: 47-57 Oil Mill Road
Waterford, Connecticut

LOCATION See Exploration Plan

Approximate Surface Elev: 205 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	RECOVERY (In.)	FIELD TEST RESULTS
		FOREST MAT		
1.0	204+/-	**SILTY SAND (SM)**, orange to brown, very loose to loose	8	WOH-2-1-1 N =3
3.0	202+/-	**SILTY SAND (SM)**, trace gravel, occasional cobbles, orange to brown, medium dense to very dense	18	2-3-12-17 N=15
			12	20-20-19-50 N=39
			1	50/2"
9.0	196+/-	**SILTY SAND (SM)**, with gravel, brown, dense	24	13-17-16-18 N=33
			18	14-21-27-28 N=48
			14	10-16-22-23 N=38
22.0	183+/-	***Boring Terminated at 22 Feet***		

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with a 2" O.D. split spoon driven by an autohammer.

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

See Supporting Information for explanation of symbols and abbreviations.

Notes:
WOH = Weight of Hammer

WATER LEVEL OBSERVATIONS

▽ *5 feet while drilling.*

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 04-25-2018 | Boring Completed: 04-25-2018
Drill Rig: Diedrich D-50 | Driller: C.Johnston
Project No.: J2185052

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J2185052 PROPOSED SOLAR PO.GPJ TERRACON_DATATEMPLATE.GDT 5/18/18

BORING LOG NO. B-4

PROJECT: Proposed Solar Power Facility

CLIENT: BL Companies
Meriden, Connecticut

SITE: 47-57 Oil Mill Road
Waterford, Connecticut

LOCATION See Exploration Plan

Approximate Surface Elev: 225 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
		FOREST MAT		▽			1-WOH-WOH-2	
2.0	223+/-	**SILTY SAND (SM)**, brown, medium dense				18	10-10-15-18 N=25	
4.0	221+/-	**SILTY SAND (SM)**, trace gravel, brown, medium dense	5			18	11-13-16-17 N=29	
						12	15-15-12-13 N=27	
10.0	215+/-	**SILTY SAND (SM)**, with gravel, occasional cobbles and boulders, brown, very dense	10			10	16-38-50/5"	
13.0	212+/-	**COMPLETELY WEATHERED GRANTIC GNEISS**, gray to white						
15.0	210+/-	***Auger Refusal on Competent Bedrock at 15 Feet***	15					

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with a 2" O.D. split spoon driven by an autohammer.

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

See Supporting Information for explanation of symbols and abbreviations.

Notes:
WOH = Weight of Hammer

WATER LEVEL OBSERVATIONS

▽ *1 foot while drilling.*

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 04-25-2018 | Boring Completed: 04-25-2018
Drill Rig: Diedrich D-50 | Driller: C.Johnston
Project No.: J2185052

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J2185052 PROPOSED SOLAR PO.GPJ TERRACON_DATATEMPLATE.GDT 5/18/18

BORING LOG NO. B-5

PROJECT: Proposed Solar Power Facility

CLIENT: BL Companies
Meriden, Connecticut

SITE: 47-57 Oil Mill Road
Waterford, Connecticut

LOCATION See Exploration Plan

Approximate Surface Elev: 250 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
FOREST MAT							
2.0	248+/-		▽		18	WOH-1-WOH-1 N=1	
SILTY SAND (SM), orange to brown, loose							
4.0	246+/-				18	2-2-6-11 N=8	14
SILTY SAND (SM), trace gravel, brown, very dense		5					
					15	20-21-30-29 N=51	
					24	45-48-42-35 N=90	
10.0	240+/-						
SILTY SAND (SM), with gravel, occasonial cobbles and boulders, brown, very dense		10			15	15-23-33-48 N=56	
		15				50/5"	
20.0	230+/-	20					
Auger Refusal on Probable Bedrock at 20 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with a 2" O.D. split spoon driven by an autohammer.

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

See Supporting Information for explanation of symbols and abbreviations.

Notes:
WOH = Weight of Hammer

WATER LEVEL OBSERVATIONS

▽ *2 feet while drilling.*

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 04-26-2018 | Boring Completed: 04-26-2018
Drill Rig: Diedrich D-50 | Driller: C.Johnston
Project No.: J2185052

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J2185052 PROPOSED SOLAR PO.GPJ TERRACON_DATATEMPLATE.GDT 5/18/18

BORING LOG NO. B-6

PROJECT: Proposed Solar Power Facility

CLIENT: BL Companies
Meriden, Connecticut

SITE: 47-57 Oil Mill Road
Waterford, Connecticut

LOCATION See Exploration Plan

Approximate Surface Elev: 235 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
		FOREST MAT						
1.5	233.5+/-							
2.0	233+/-	**SILTY SAND (SM)**, orange to brown, medium dense						
		SILTY SAND (SM), with gravel, occasonial cobbles, gray, dense to very dense				18	2-1-2-12 N=3	
						12	13-16-18-22 N=34	
			5			20	11-16-23-24 N=39	
						18	27-31-21-35 N=52	
			10			18	19-17-21-25 N=38	
			15			8	35-50/5"	
19.0	216+/-							
		Auger Refusal on Probable Bedrock at 19 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with a 2" O.D. split spoon driven by an autohammer.

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 04-26-2018 | Boring Completed: 04-26-2018
Drill Rig: Diedrich D-50 | Driller: C.Johnston
Project No.: J2185052

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J2185052 PROPOSED SOLAR PO.GPJ TERRACON_DATATEMPLATE.GDT 5/18/18

BORING LOG NO. B-7

PROJECT: Proposed Solar Power Facility

CLIENT: BL Companies
Meriden, Connecticut

SITE: 47-57 Oil Mill Road
Waterford, Connecticut

LOCATION See Exploration Plan

Approximate Surface Elev: 215 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
	FOREST MAT							
	1.5	213.5+/-				16	3-2-3-3 N=5	
	SILTY SAND (SM), orange to brown, loose					24	3-3-5-8 N=8	
	4.0	211+/-						
	SILTY SAND (SM), trace grave, occasonial cobbles, brown, very dense		5			20	29-41-44-35 N=85	
						8	25-50/3"	
	10.0	205+/-	10					
	Auger Refusal on Probable Bedrock at 10 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with a 2" O.D. split spoon driven by an autohammer.

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 04-26-2018 | Boring Completed: 04-26-2018

Drill Rig: Diedrich D-50 | Driller: C.Johnston

Project No.: J2185052

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J2185052 PROPOSED SOLAR PO.GPJ TERRACON_DATATEMPLATE.GDT 5/18/18

BORING LOG NO. B-8

PROJECT: Proposed Solar Power Facility

CLIENT: BL Companies
Meriden, Connecticut

SITE: 47-57 Oil Mill Road
Waterford, Connecticut

LOCATION See Exploration Plan

Approximate Surface Elev: 180 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
		FOREST MAT						
1.0	179+/-							
		SILTY SAND (SM), brown, loose to dense				10	WOH-2-2-2 N=4	
						15	13-17-15-16 N=32	
5.0	175+/-		5					
		SILTY SAND (SM), trace gravel, brown, dense to very dense				18	12-17-17-16 N=34	
						14	16-27-25-19 N=52	
9.0	171+/-							
		SILTY SAND (SM), with gravel, occasional cobbles and boulders, gray, very dense	10			20	16-24-32-40 N=56	
				▽				
			15			4	50/4"	
20.0	160+/-							
		Auger Refusal on Probable Bedrock at 20 Feet	20					

Stratification lines are approximate. In-situ, the transition may be gradual.
Samples taken with a 2" O.D. split spoon driven by an autohammer.

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

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

See Supporting Information for explanation of symbols and abbreviations.

Notes:
WOH = Weight of Hammer

WATER LEVEL OBSERVATIONS

▽ *13 feet while drilling.*

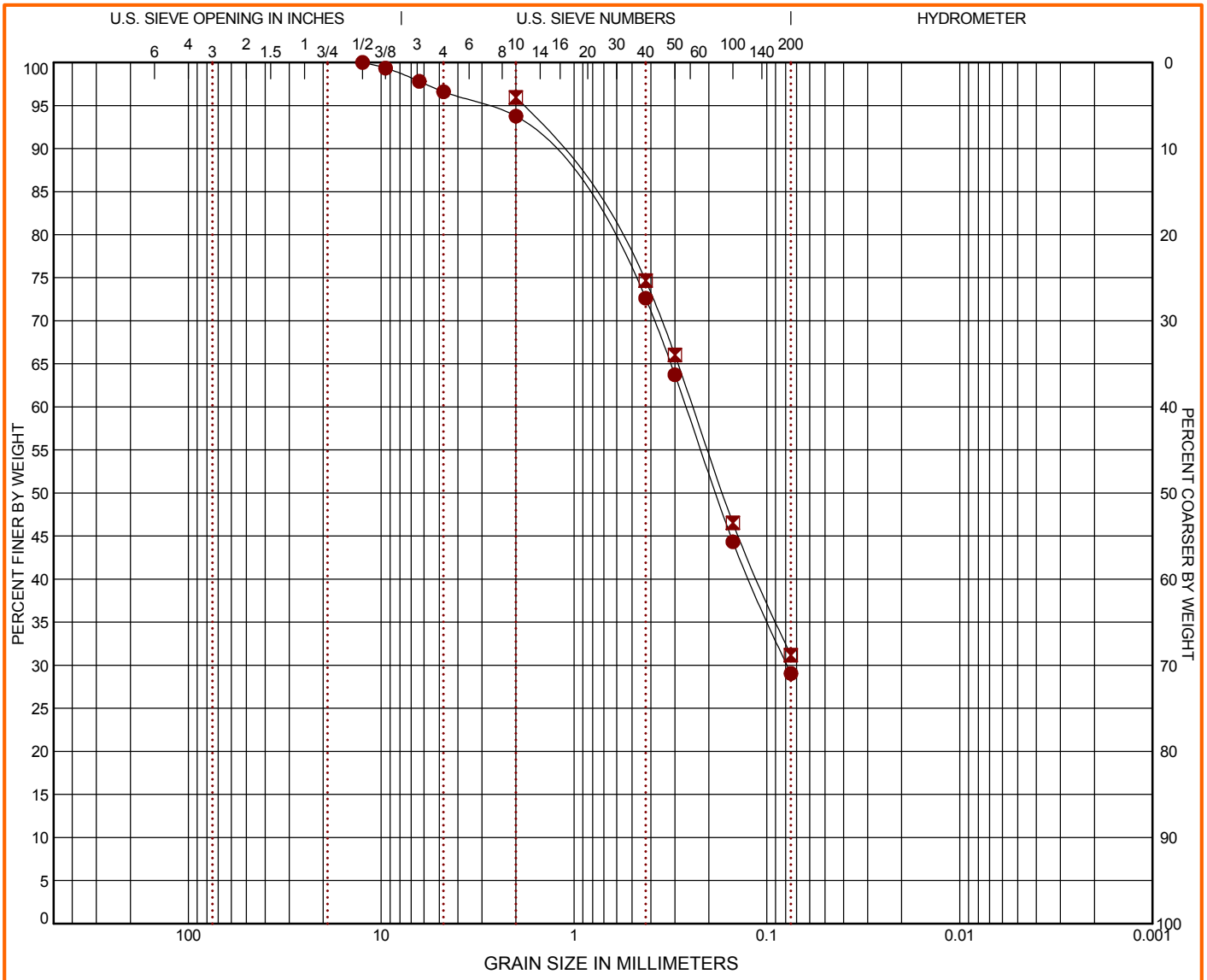
Terracon
201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 04-26-2018 | Boring Completed: 04-26-2018
Drill Rig: Diedrich D-50 | Driller: C.Johnston
Project No.: J2185052

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL J2185052 PROPOSED SOLAR PO.GPJ TERRACON_DATATEMPLATE.GDT 5/18/18

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	B-2	5 - 7	0.0	3.4	67.5		29.1		SM
⊠	B-5	2 - 4			64.8		31.2		SM

GRAIN SIZE	●	⊠	
D_{60}	0.263	0.242	
D_{30}	0.078		
D_{10}			

COEFFICIENTS	●	⊠	
C_C			
C_U			

● Sieve	● % Finer	⊠ Sieve	⊠ % Finer	Sieve	% Finer
1/2"	100.0	#10	95.95		
3/8"	99.34	#40	74.67		
1/4"	97.81	#50	66.03		
#4	96.59	#100	46.53		
#10	93.76	#200	31.17		
#40	72.63				
#50	63.73				
#100	44.34				
#200	29.05				

●	SILTY SAND (SM)
⊠	SILTY SAND (SM)

●	Native silty sand
⊠	Native silty sand

PROJECT: Proposed Solar Power Facility

PROJECT NUMBER: J2185052

SITE: 47-57 Oil Mill Road
Waterford, Connecticut

Terracon
201 Hammer Mill Rd
Rocky Hill, CT

CLIENT: BL Companies
Meriden, Connecticut

GRAIN SIZE: USCS 1 J2185052 PROPOSED SOLAR PO.GPJ TERRACON_DATATEMPLATE.GDT 5/22/18

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT.

SUPPORTING INFORMATION

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Proposed Solar Power Facility ■ Waterford, Connecticut

5/22/2018 ■ Terracon Project No. J2185052

Terracon GeoReport

SAMPLING	WATER LEVEL	FIELD TESTS
Split Spoon	**Water Initially Encountered** **Water Level After a Specified Period of Time** **Water Level After a Specified Period of Time** Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**N** Standard Penetration Test Resistance (Blows/Ft.) **(HP)** Hand Penetrometer **(T)** Torvane **(DCP)** Dynamic Cone Penetrometer **UC** Unconfined Compressive Strength **(PID)** Photo-Ionization Detector **(OVA)** Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL		RELATIVE PROPORTIONS OF FINES	
Descriptive Term(s) of other constituents	Percent of Dry Weight	**Descriptive Term(s) of other constituents**	**Percent of Dry Weight**
Trace	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12

GRAIN SIZE TERMINOLOGY		PLASTICITY DESCRIPTION	
Major Component of Sample	**Particle Size**	**Term**	**Plasticity Index**
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 75mm)	Low	1 - 10
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sieve (4.75mm to 0.075mm	High	> 30
Silt or Clay	Passing #200 sieve (0.075mm)		

UNIFIED SOIL CLASSIFICATION SYSTEM

Proposed Solar Power Facility ■ Waterford, Connecticut

May 22, 2018 ■ Terracon Project No. J2185052

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or 1 > Cc > 3 [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or 1 > Cc > 3 [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay [K, L, M, N] / Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay [K, L, M, P] / Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

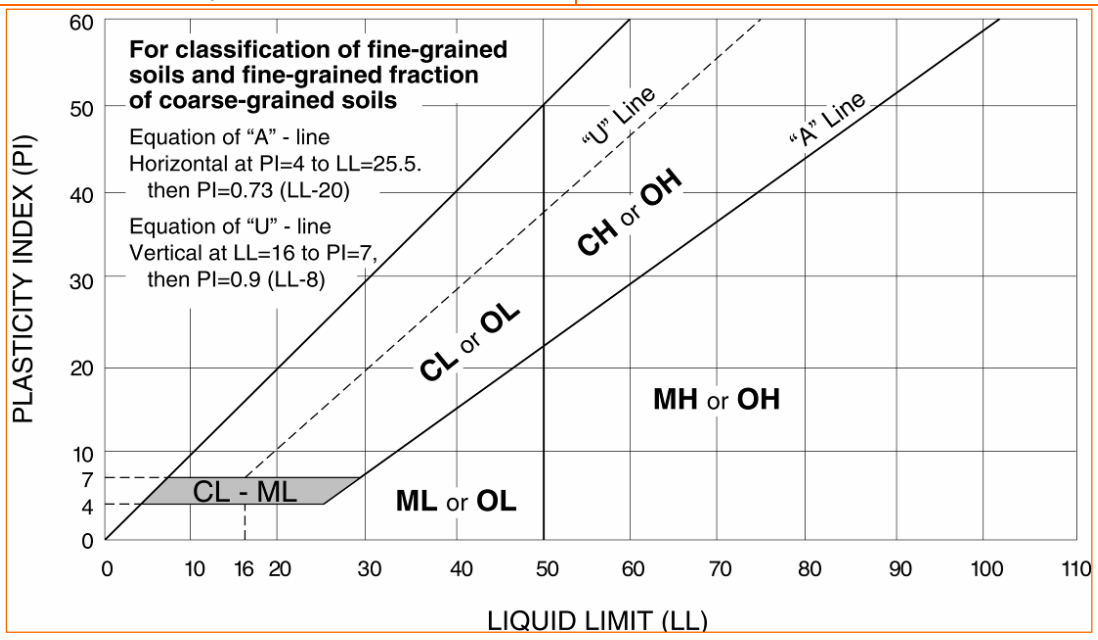
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



DESCRIPTION OF ROCK PROPERTIES

Proposed Solar Power Facility ■ Waterford, Connecticut

May 22, 2018 ■ Terracon Project No. J2185052

WEATHERING	
Term	**Description**
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
Moderately weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

STRENGTH OR HARDNESS		
Description	**Field Identification**	**Uniaxial Compressive Strength, psi (MPa)**
Extremely weak	Indented by thumbnail	40-150 (0.3-1)
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	150-700 (1-5)
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	700-4,000 (5-30)
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	4,000-7,000 (30-50)
Strong rock	Specimen requires more than one blow of geological hammer to fracture it	7,000-15,000 (50-100)
Very strong	Specimen requires many blows of geological hammer to fracture it	15,000-36,000 (100-250)
Extremely strong	Specimen can only be chipped with geological hammer	>36,000 (>250)

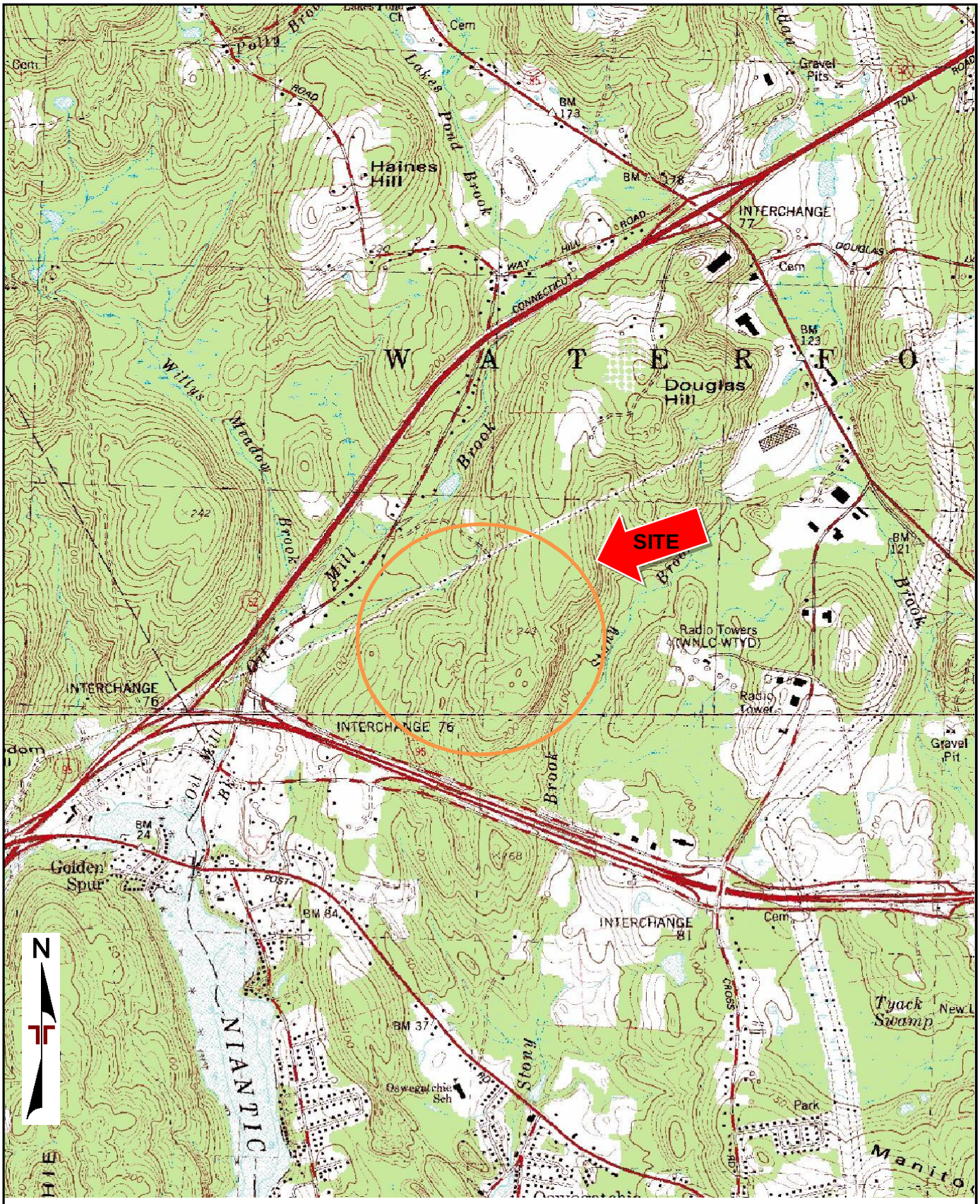
DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		**Bedding Spacing (May Include Foliation or Banding)**	
Description	**Spacing**	**Description**	**Spacing**
Extremely close	< ¾ in (<19 mm)	**Laminated**	< ½ in (<12 mm)
Very close	¾ in – 2-1/2 in (19 - 60 mm)	**Very thin**	½ in – 2 in (12 – 50 mm)
Close	2-1/2 in – 8 in (60 – 200 mm)	**Thin**	2 in – 1 ft. (50 – 300 mm)
Moderate	8 in – 2 ft. (200 – 600 mm)	**Medium**	1 ft. – 3 ft. (300 – 900 mm)
Wide	2 ft. – 6 ft. (600 mm – 2.0 m)	**Thick**	3 ft. – 10 ft. (900 mm – 3 m)
Very Wide	6 ft. – 20 ft. (2.0 – 6 m)	**Massive**	> 10 ft. (3 m)

Discontinuity Orientation (Angle): Measure the angle of discontinuity relative to a plane perpendicular to the longitudinal axis of the core. (For most cases, the core axis is vertical; therefore, the plane perpendicular to the core axis is horizontal.) For example, a horizontal bedding plane would have a 0-degree angle.

ROCK QUALITY DESIGNATION (RQD) [1]	
Description	**RQD Value (%)**
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

1. The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.

Reference: U.S. Department of Transportation, Federal Highway Administration, Publication No FHWA-NHI-10-034, December 2009
Technical Manual for Design and Construction of Road Tunnels – Civil Elements



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
QUADRANGLES INCLUDE: MONTVILLE, CT (1/1/1983) and NIANTIC, CT (1/1/1983).

Project Manager:	BDO
Drawn by:	BDO
Checked by:	SCL
Approved by:	SCL

Project No.	J2185052
Scale:	1"=2,000'
File Name:	J2185052
Date:	MAR 2019

Terracon
201 Hammer Mill Rd
Rocky Hill, CT 06067-3768

SITE LOCATION MAP

Proposed Solar Power Facility, Waterford, CT
117 Oil Mill Road
Waterford, CT

Exhibit
A-1

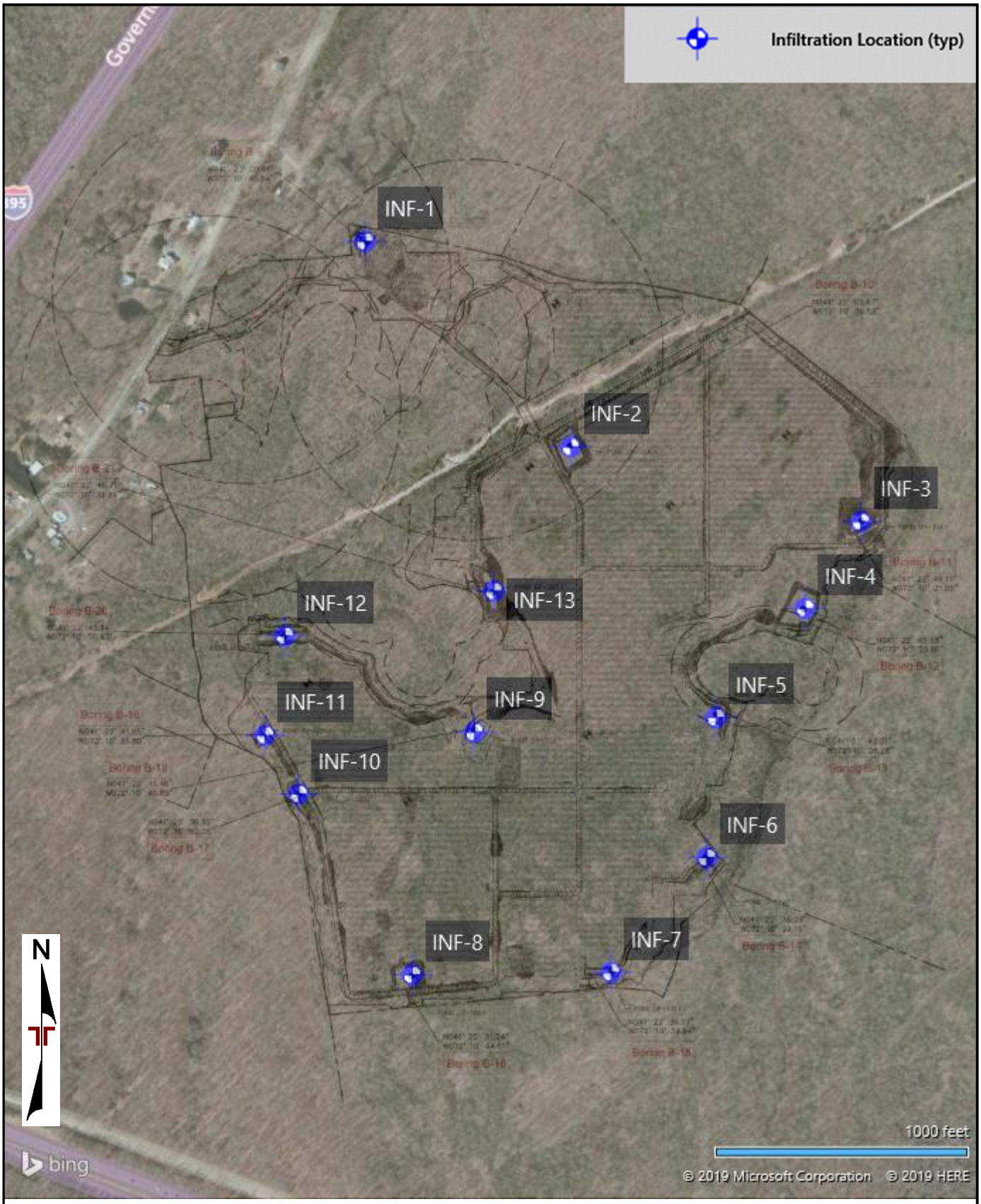


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

BASED ON THE SITE PLAN TITLED *'SWMB – GEOTECH BORING LOCATIONS'*, SHEET No. EXH-1, DATED JULY 30, 2018, BY BL COMPANIES AND AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Project Manager:	BDO
Drawn by:	BDO
Checked by:	SCL
Approved by:	SCL

Project No.	J218505
Scale:	AS SHOWN
File Name:	J2185052
Date:	MAR 2019

Terracon
201 Hammer Mill Rd
Rocky Hill, CT 06067-3768

TEST LOCATION PLAN

Proposed Solar Power Facility, Waterford, CT
117 Oil Mill Road
Waterford, CT

Exhibit
A-2

PROBE LOG NO. INF-1

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3835° Longitude: -72.1796°

Approximate Surface Elev.: 130 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.5	**FOREST MAT**	129.5+/-				
	1.5	**SILTY SAND (SM)**, trace roots, brown, **(SUBSOIL)**	128.5+/-				
		SILTY SAND (SM), with gravel, gray		2" PVC Installed for Infiltration test	5		
	6.0		124+/-				
		COMPLETLEY WEATHERED GRANITIC GNEISS, gray to black					
	10.0		120+/-		10		
		Probe Terminated at 10 Feet					

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

Advancement Method:
3 1/4-inch I.D. continuous flight hollow stem augers.

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon

Probe Started: 02-22-2019	Probe Completed: 02-22-2019
Drill Rig: Diedrich D-50	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19

PROBE LOG NO. INF-2

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3813° Longitude: -72.1766°

Approximate Surface Elev.: 220 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.5	**FOREST MAT**	219.5+/-				
		SILTY SAND (SM), trace roots, brown, **(SUBSOIL)**				▽	
	2.0		218+/-				
		SILTY SAND (SM), with gravel, gray		2" PVC Installed for Infiltration test	5		
	10.0		210+/-		10		
		Probe Terminated at 10 Feet					

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

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon

Probe Started: 02-22-2019	Probe Completed: 02-22-2019
Drill Rig: Diedrich D-50	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19

PROBE LOG NO. INF-3

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3805° Longitude: -72.1724°

Approximate Surface Elev.: 230 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.5	**FOREST MAT**	229.5+/-				
		SILTY SAND (SM), trace roots, brown, **(SUBSOIL)**					
	2.0		228+/-				
		SILTY SAND (SM), with gravel, gray		2" PVC Installed for Infiltration test	5		
	10.0		220+/-		10		
		Probe Terminated at 10 Feet					

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

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Probe Started: 02-28-2019	Probe Completed: 02-28-2019
Drill Rig: Diedrich D-50	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-5

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19

PROBE LOG NO. INF-4

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3795° Longitude: -72.1732°

Approximate Surface Elev.: 200 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.5	**FOREST MAT**	199.5+/-				
		SILTY SAND (SM), trace roots, brown, **(SUBSOIL)**					
	2.0		198+/-				
		SILTY SAND (SM), with gravel, gray		2" PVC Installed for Infiltration test	5		
	10.0		190+/-		10		
		Probe Terminated at 10 Feet					

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

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Probe Started: 02-28-2019	Probe Completed: 02-28-2019
Drill Rig: Diedrich D-50	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19

PROBE LOG NO. INF-5

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3783° Longitude: -72.1745°

Approximate Surface Elev.: 220 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.5	**FOREST MAT**	219.5+/-				
		SILTY SAND (SM), trace roots, brown, **(SUBSOIL)**					
	2.0		218+/-				
		SILTY SAND (SM), with gravel, gray		2" PVC Installed for Infiltration test	5		
	10.0		210+/-		10		
		Probe Terminated at 10 Feet					

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

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Probe Started: 02-28-2019	Probe Completed: 02-28-2019
Drill Rig: Diedrich D-50	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19

PROBE LOG NO. INF-6

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3768° Longitude: -72.1747°

Approximate Surface Elev.: 235 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.5	**FOREST MAT**	234.5+/-				
	1.5	**SILTY SAND (SM)**, trace roots, brown, **(SUBSOIL)**	233.5+/-	2" PVC Installed for Infiltration test			
	2.0	**SILTY SAND (SM)**, with gravel, gray	233+/-				
		Auger Refusal on Probable Boulder at 2 Feet					

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

Advancement Method:
2-inch diameter hand auger

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Probe Started: 03-01-2019	Probe Completed: 03-01-2019
Drill Rig:	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19

PROBE LOG NO. INF-7

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3756° Longitude: -72.176°

Approximate Surface Elev.: 240 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.5	**FOREST MAT**	239.5+/-				
	1.5	**SILTY SAND (SM)**, trace roots, brown, **(SUBSOIL)**	238.5+/-	2" PVC Installed for Infiltration test			
	2.0	**SILTY SAND (SM)**, with gravel, gray	238+/-				
		Auger Refusal on Probable Bedrock at 2 Feet					

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

Advancement Method:
2-inch diameter hand auger

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Probe Started: 03-01-2019	Probe Completed: 03-01-2019
Drill Rig:	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-9

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19

PROBE LOG NO. INF-8

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3755° Longitude: -72.1789°

Approximate Surface Elev.: 190 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.5	**FOREST MAT**	189.5+/-				
		SILTY SAND (SM), trace roots, brown, **(SUBSOIL)**					
	2.0		188+/-	2" PVC Installed for Infiltration test			
		SILTY SAND (SM), with gravel, gray					
	3.6		186.5+/-				
		Auger Refusal on Probable Bedrock at 3.58 Feet					

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

Advancement Method:
2-inch diameter hand auger

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Probe Started: 03-01-2019	Probe Completed: 03-01-2019
Drill Rig:	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-10

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19

PROBE LOG NO. INF-9

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3782° Longitude: -72.178°

Approximate Surface Elev.: 195 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.5	**FOREST MAT**	194.5+/-				
		SILTY SAND (SM), trace roots, brown, **(SUBSOIL)**					
	2.5		192.5+/-				
		SILTY SAND (SM), with gravel, gray		2" PVC Installed for Infiltration test	5		
	10.0		185+/-		10		
		Probe Terminated at 10 Feet					

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

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Probe Started: 02-22-2019	Probe Completed: 02-22-2019
Drill Rig: Diedrich D-50	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19

PROBE LOG NO. INF-10

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3775° Longitude: -72.1806°

Approximate Surface Elev.: 190 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.5	**FOREST MAT**	189.5+/-				
		SILTY SAND (SM), trace roots, brown, **(SUBSOIL)**		2" PVC Installed for Infiltration test			
	2.0		188+/-				
	2.6	**COMPLETLEY WEATHERED GRANITIC GNEISS**, gray to black	187.5+/-				
		Auger Refusal on Competent Bedrock at 2.58 Feet					

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

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Probe Started: 02-26-2019	Probe Completed: 02-26-2019
Drill Rig: Diedrich D-50	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-12

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19

PROBE LOG NO. INF-11

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3781° Longitude: -72.181°

Approximate Surface Elev.: 170 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.5	**FOREST MAT**	169.5+/-				
	1.5	**SILTY SAND (SM)**, trace roots, brown, **(SUBSOIL)**	168.5+/-				
		COMPLETLEY WEATHERED GRANITIC GNEISS, gray to black		2" PVC Installed for Infiltration test			
	4.0		166+/-				
		Auger Refusal on Competent Bedrock at 4 Feet					

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

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Probe Started: 02-27-2019	Probe Completed: 02-27-2019
Drill Rig: Diedrich D-50	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-13

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19

PROBE LOG NO. INF-12

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3792° Longitude: -72.1807°

Approximate Surface Elev.: 160 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.5	**FOREST MAT**	159.5+/-				
	1.5	**SILTY SAND (SM)**, trace roots, brown, **(SUBSOIL)**	158.5+/-				
		SILTY SAND (SM), with gravel, gray		2" PVC Installed for Infiltration test	5		
	10.0		150+/-		10		
		Probe Terminated at 10 Feet					

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

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Probe Started: 02-27-2019	Probe Completed: 02-27-2019
Drill Rig: Diedrich D-50	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-14

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19

PROBE LOG NO. INF-13

PROJECT: Photovoltaic Installation

CLIENT: BL Companies
Meriden, Connecticut

SITE: 117 Oil Mill Road
Waterford, Connecticut

LOCATION See Exhibit A-2

Latitude: 41.3797° Longitude: -72.1777°

Approximate Surface Elev.: 190 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE
	0.8	189+/-				
FOREST MAT						
SILTY SAND (SM), trace roots, brown, **(SUBSOIL)**	4.0	186+/-				
SILTY SAND (SM), with gravel, gray			2" PVC Installed for Infiltration test	5		
	10.0	180+/-		10		
Probe Terminated at 10 Feet						

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

Advancement Method:
4-inch diameter continuous flight solid stem augers.

Abandonment Method:

Notes:

See addendum report for description of field procedures.
See Appendix B for explanation of symbols and abbreviations.
Elevations were interpolated from topographic maps.

WATER LEVEL OBSERVATIONS

No free water observed

Terracon

Probe Started: 02-22-2019	Probe Completed: 02-22-2019
Drill Rig: Diedrich D-50	Driller: C.Johnston
Project No.: J2185052	Exhibit: A-15

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL J2185052 INFILTRATION TESTING.GPJ TERRACON_DATATEMPLATE.GDT 3/21/19