Preliminary Geotechnical Engineering Report

East Point Solar Site
US Route 20 and Beech Road
Sharon Springs, New York

August 8, 2019

Terracon Project No. JB185149

Prepared for:
NextEra Energy Resources
Juno Beach, Florida

Prepared by:
Terracon Consultants-NY Inc.
Watervliet, New York

August 8, 2019

NextEra Energy Resources
700 Universe Boulevard
Juno Beach, Arizona 33408

Attn: Mr. Joe Cartaya
Phone: (561) 694-4529
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Re: **Preliminary Geotechnical Engineering Report**
East Point Solar
US Route 20 and Beech Road
Sharon Springs, New York
Terracon Project No. JB185149

Dear Mr. Cartaya,

Terracon Consultants, Inc. (Terracon) have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with our proposal number PJB185149 last revised on March 7, 2019. This geotechnical engineering report presents the results of the subsurface exploration, laboratory testing, engineering analyses and geotechnical engineering recommendations about the design and construction of the proposed High River Solar 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, NY-Inc.

John T. Odorisio, P.E.
Senior Engineer

Fred A. Dente, P.E.
Principal

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EAST POINT SOLAR
US ROUTE 20 AND BEECH ROAD
SHARON SPRINGS, NEW YORK

Terracon Project No. JB185149
August 8, 2019

1.0 INTRODUCTION

Terracon Consultant, Inc. (Terracon) is pleased to submit this report detailing the geotechnical engineering services performed for the proposed East Point Solar located at the intersection of US Route 20 and Beech Road in Sharon Spring, New York. The Site Location Plan is included in Appendix A of this report. The purpose of these services is to provide subsurface information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Site preparation and earthwork
- Thermal resistivity of trench/backfill
- Unpaved access roads
- Groundwater conditions
- Seismic considerations
- Electrical resistivity for grounding design
- Foundation design and construction

Our geotechnical engineering scope of work for this project included the following:

- 18 test borings drilled to approximate depths between about 3.5 and 21.5 feet below the existing ground surface (bgs) with one rock core extending to a depth of 7 feet below the existing ground surface (bgs);
- Four (4) test pits excavated to approximate depths between about 5.5 and 11.5 feet below the existing ground surface (bgs);
- Four (4) laboratory thermal resistivity dry-out curves;
- Corrosion testing performed on bulk samples obtained at four (4) locations;
- Infiltration testing at 2 locations
- Laboratory testing of soil samples;
- Geotechnical engineering analysis; and
- Preparation of this report.

The locations of the borings and test pits are shown on the Exploration Plan in Appendix A. A log of each boring and test pit is included in Appendix A section of this report. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring and test pit logs and in Appendix B section of this report. The location of the field soil electrical resistivity tests is shown on the Electrical Resistivity Locations Diagram in Appendix C. The field soil electrical resistivity test results are included in Appendix C of this report. The Schoharie County Soil Survey Information is included in Appendix D.

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Proposed project	NextEra East Point Solar is a proposed Solar Photovoltaic Project. Ultimately, the power plant will consist of solar panels installed on steel structures and various other equipment and appurtenances associated with the power plant (e.g. switchgear, transformers, inverters, overhead and underground electrical conveyance, substation, and operations and maintenance (O&M) building).
Proposed construction	We anticipate the proposed project will include the construction of ground-mounted solar panels on steel racks founded on driven W-Section steel beams (W6x9 or similar). Electrical equipment and substation elements are anticipated to be supported on concrete slabs-on-grade, spread footings, or drilled piers.
Maximum loads	Structural loads were not provided, but have been estimated based on our experience on projects using single axis tracker rack systems: ■ Downward: 3.0 kips; ■ Uplift: 2.0 kips; exclusive of heave loads; and ■ Lateral: 3.0 kips. Loading information for equipment were not provided. Substation Structures: TBD
Grading/Slopes	We anticipate that the solar field final grades will generally follow the existing site grades with minimal grading.
Pavements	We anticipate gravel access roads will be constructed throughout the proposed solar array.

2.2 Site Location and Description

Item	Description
Location	The project site is in Sharon Springs, New York on Us Route 20 near its intersection with Bulls Head Road. The latitude and longitude for the approximate center of the site is 42.771175°, - 74.562108°.
Existing improvements	The proposed sites are mainly existing farmland of which portions are wooded.
Current ground cover	The current ground cover consists largely of agricultural farm field as well as some lightly to moderately wooded areas.

Item	Description
Existing topography	According to available USGS topography the site slopes from southwest to northeast from an approximate topographic high elevation of 1600 feet on the south down to an approximate elevation of 1300 feet on the northern end of the project limits.

3.0 EXPLORATION AND TESTING PROCEDURES

3.1 Field Exploration

The field exploration on the project consisted of the following exploration plan. The approximate boring and test pit locations are shown on the Exploration Plan in Appendix A.

Number of Explorations	Type of Exploration	Exploration Nos.	Exploration Depth (ft)	Planned Location
16	Borings	B-1 thru B-16	3.5 to 21.5	Proposed Array Area
2	Borings	SS-1 and SS-2	5 to 5.5	Proposed Substation
4	Test Pits	TP-1 thru TP-4	5.5 to 11.5	Proposed Array Area
2	Infiltration Test Borings*	I-1 and I-2	4	Assumed Drainage Basins

*Infiltration tests were performed in offset probe borings adjacent to borings B-6 and B-9. No logs are included.

Boring Layout and Elevations: Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet). If elevations and a more precise boring layout are desired, we recommend the borings be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a Diedrich D-50 drill rig utilizing 2 1/4-inch inside diameter hollow-stem augers, except where rock coring was performed in boring B-5 through 4.25" inside diameter hollow stem augers. At selected intervals, samples of the subsurface materials were taken at each boring location by driving split-spoon (SPT) in general accordance with ASTM Standards. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the middle 12 inches of a normal 24-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. When an 18-inch sample is taken, the N-value are recorded as the number of blows required to advance the sampling spoon the final 12 inches. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion.

The test pits were excavated using a Volvo EC160C backhoe excavator equipped with a flat bucket utilized to collect approximate topsoil depths and a bucket with approximate 6-inch teeth for the remainder of the excavation process. Bulk samples of subsurface materials were obtained from all the test pits. We observed and recorded groundwater levels during excavation and sampling. The test pits were backfilled with excavated soils upon completion.

Our exploration team prepared field boring and test pit logs as part of the drilling and excavation operations. The sampling depths, penetration distances, and other sampling information were recorded on the field boring and test pit logs. These field logs included visual classifications of the materials encountered during drilling and excavation, and our interpretation of the subsurface conditions between samples. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a geotechnical engineer. Final boring and test pit logs were prepared from the field logs. The final boring and test pit logs represent the geotechnical engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Resistivity Testing: Three (3) field soil electrical resistivity tests were performed by Terracon field engineers, in general accordance with ASTM G57 using the four-pin Wenner method with a Mini-Res earth resistivity meter.

Infiltration Testing: Two boreholes (B-6 and B-9) were advanced to a depth of 10 and 9 feet, respectively below the existing ground surface with offset borings (I-1 and I-2) performed to depths of 4 feet for infiltration testing. PVC pipe was installed for infiltration testing performed in general accordance with NYDEC Stormwater Management Design Manual - Appendix D.

3.2 Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) described in Appendix A. At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

Laboratory tests were conducted on selected soil samples and the test results are presented in the Appendix B section of this report. These results were used for the geotechnical engineering analyses, and the development of foundation recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- Atterberg Limits
- Moisture Content
- Soluble Sulfate
- Total Salts
- Soluble Sulfides
- Soluble Chloride
- Minimum Resistivity
- Sieve Analysis
- Dry Density
- Moisture Density Relationship
- Thermal Resistivity
- pH
- Oxidation-reduction Potential (ORP)

4.0 SUBSURFACE CONDITIONS

4.1 Geological Materials

The Soil Survey for Schoharie County, New York, as prepared by the United States Department of Agriculture (USDA), Soil Conservation Service (now renamed the Natural Resource Conservation Service - NRCS), identifies twenty-three soil types within the approximate boundaries of the proposed array. The soils have been mapped primarily as silt loam of various map units.

The Web Soil Survey (WSS) map of the project area was reviewed and a map encompassing the project area and the Map Unit Description are provided in Appendix D. The WSS presents shallow (typically upper 60 inches) soil stratification information produced and compiled by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS).

It should be noted that the NRCS maps is not intended as a substitute for site-specific geotechnical exploration; rather it is a useful tool in planning a project scope in that it provides information relative to the soil types likely to be encountered. Boundaries between adjacent unit types on the NRCS maps are approximate.

In general, the shallow subsurface conditions identified in the borings conducted for this project generally agree with the NRCS maps of the project site.

4.2 Typical Subsurface Profile

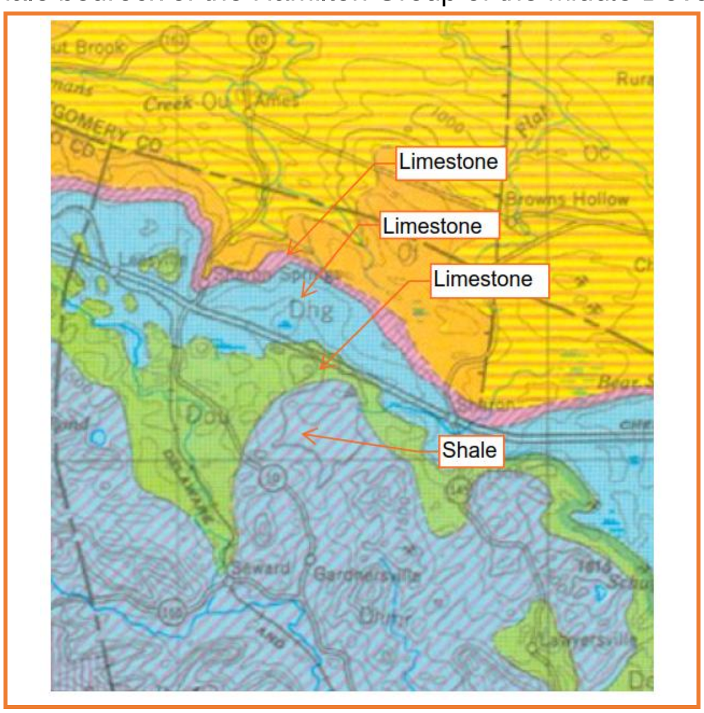
Specific conditions encountered at each boring and test pit location are indicated on the individual boring and test pit logs presented in Appendix A section of this report. Stratification boundaries on the boring and test pit logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Based on conditions encountered in the borings and test pits, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum (feet)	Material Description	Relative Density / Consistency
Stratum 1	1.5 to 21.5 feet (the maximum depth investigated)	Silty Sand and Sandy Silt, with varying amounts of Gravel, cobbles and possible boulders	Loose to Very Dense
Stratum 2	3.5 to 21	Weathered Rock (Shale and Limestone)	Very Dense
Stratum 3	21.5	Bedrock (Limestone and Shale*)	Weak to soft, close to very close fractured

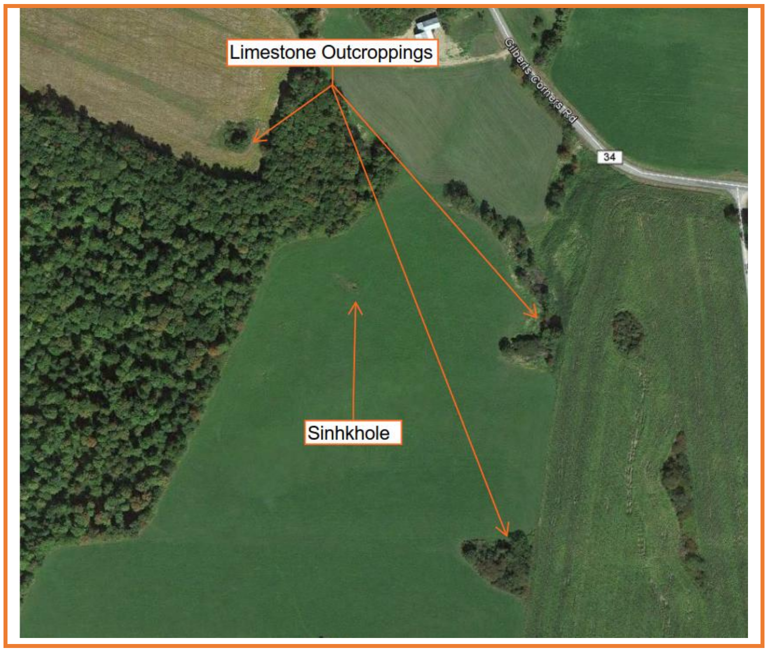
*Only the limestone was cored, shale was visually identified in test pits and boring samples

4.3 Bedrock

As indicated in the figure below, The New York State Geological Survey identifies Four (4) bedrock units beneath the limits of the project site. The northern portion of the site is underlain by Onondaga limestone of the Middle Devonian age, Schoharie Limestone of the Lower Devonian age, and Cobleskill Limestone of the Upper Silurian age. The Southern portion of the site is underlain by shale bedrock of the Hamilton Group of the Middle Devonian age.



The limestone geology in this area is susceptible to the development of sinkholes. A review of available aerial photography, observations made on site, as well as discussions with the manager of the property indicates the presence of sinkholes within the limits of the proposed development. Specifically, near Boring B-4 sinkholes and limestone bedrock outcroppings were encountered. These locations are shown on the aerial photograph below and pictures of the sinkholes and rock outcroppings are presented in the appendix.



The loose soils directly on top of rock encountered in boring B-4 is typical of Karst geology and indicates the potential for additional sinkholes to develop in the vicinity. To fully delineate the limits of the sinkhole potential would require the use of ground penetrating radar, seismic refraction studies or verification through additional borings. The feasibility and reliability of these studies are highly dependent on the specific site conditions, including depth and composition of the overburden.

4.4 Groundwater

Groundwater was encountered in six (6) of the borings and test pits at the time of exploration at depths ranging between about 5.5 to 15 feet below existing grades. These observations represent groundwater conditions at the time of the field exploration and may not be indicative of other times, or at other locations. Groundwater conditions can change with varying seasonal and weather conditions, and other factors.

4.5 Thermal Resistivity Laboratory Testing

Tests were conducted on four (4) bulk samples from depths of 0 to 3 feet below the existing ground surface. The thermal resistivity testing was performed in general accordance with the Institute of Electrical and Electronics Engineers (IEEE) standard. For thermal dry out characterization, the bulk samples were tested "as-is". The dry-out curves were developed from the six (6) bulk sample soil samples compacted to 90% of the maximum density determined in accordance with Standard Proctor criteria (ASTM D698) at the optimum moisture content and dried to 0% moisture while obtaining intermediate moisture contents to develop the dry-out curves. The results of the thermal resistivity testing are presented in Appendix B. The thermal resistivity obtained ranged from 72 to 93°C-cm/W for moist soils and from 210 to 253°C-cm/W for dry soils.

4.6 Field Electrical Resistivity Test Results

Field measurements of soil resistivity were performed in general accordance with ASTM Test Method G 57, and IEEE Standard 81, using the Wenner Four-Electrode Method. The approximate soil resistivity test locations are shown on the electrical resistivity plan in Appendix C. The soil resistivity measurements were performed using a Mini-Res , Memory Earth Resistivity and IP Meter, manufactured by L and R Instruments, Inc. The Wenner arrangement (equal electrode spacing) was used with the "a" spacing of ½, 1, 1½, 2, 3, 5, 7, 10, 15, 20, 30, 45, 70, 100, 150, and 250 at one (1) location within the proposed substation area. Additionally, the Wenner arrangement was used with "a" spacings of 2½, 5, 10, 20 and 50 feet at 2 locations spread throughout the PV array area. The testing was performed in both north-south and east-west orientations at each location. The "a" spacing is generally considered to be the depth of influence of the test. Results of the field soil resistivity measurements are presented in tabular and graphical format in Appendix C. The resistivity ranged from as low as 46 ohm-m to as high as 1287 ohm-m.

4.7 Infiltration Test Results

No information was provided as to the location of proposed stormwater management facilities and as such two locations were selected by Terracon to perform the infiltration testing across the site. Soil test borings were performed for the infiltration testing exploration, the results are summarized as follows:

Infiltration Test Results				
Test Hole	**Adjacent Test Boring**	**Depth (feet)**	**Soil Classification**	**Infiltration Rate (inches/minute)**
I-1	B-6	4	SM	0
I-2	B-9	4	SM	0

The test results are judged representative of the dense glacial till soils encountered at the site.

4.8 Corrosivity

Samples for corrosion testing were obtained from 4 locations. The samples were obtained from depths of approximately 0 to 3 feet below existing ground surface. The samples were tested for pH, water soluble sulfate, sulfides, chlorides, total salts, Red-Ox potential, and electrical resistivity. The results of the Corrosion Series Testing are presented in Appendix B.

The degradation of concrete or cement grout can be caused by chemical agents in the soil that react with concrete to either dissolve the cement paste or precipitate larger compounds within the concrete, causing cracking and flaking. The concentration of water-soluble sulfates in the soils is a good indicator of the potential for chemical attack of concrete or cement grout. The American Concrete Institute (ACI) in their publication ACI Building Code Requirements for Structural Concrete (ACI 318-14) provides guidelines for this assessment. The results of the sulfate tests indicate the potential for deterioration of concrete is mild and no special requirements should be necessary for the concrete mix. We recommend that a corrosion engineer be consulted to recommend appropriate protective measures.

Concrete and the reinforcing steel within it are at risk of corrosion when exposed to water-soluble chloride in the soil. Chloride tests indicate that all seven samples had a measurable concentration. The project structural engineer should review this data to determine if remedial measures are necessary for the concrete reinforcing steel.

Ferrous metal and concrete elements in contact with soil, whether part of a foundation or part of the supported structure, are subject to degradation due to corrosion or chemical attack. Therefore, buried ferrous metal and concrete elements should be designed to resist corrosion and degradation.

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

4.9 Seismic Considerations

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC).

Based on the soil properties encountered at the site and as described on the exploration logs, it is our professional opinion that the Seismic Site Classification for the site will need to be separated between the area underlain with loose silt as indicated in **Section 5.1** below, and the balance of the site.

For the portions of the site **within the loose silt** area it is our opinion that the **Seismic Site Classification is D.** For the balance of the site that is **outside of the loose silt area**, it is our opinion that the **Seismic Site Classification is C**.

Based upon the composition and relative density of the site soils, their liquefaction should not occur in response to earthquake motions.

5.0 PV SOLAR ARRAY FIELD – RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

5.1 Geotechnical Considerations

We consider development of the photovoltaic solar project to be technically feasible from a geotechnical standpoint. Understanding that driven piles are the preferred foundation system for a solar PV project, and the presence of shallow bedrock, cobbles and boulders within the anticipated foundation driving depth, piles driven into the overburden soils can be expected to encounter shallow and possibly premature refusal across most of the site.

Foundations installed near boring B-4, where loose silt soils extend to underlying bedrock, should only be designed using the properties defined as "Loose Silt" in the tables in the following sections. The area delineating the limits of where to use these values is provided in the sketch below.

In those areas of the site where shallow refusal may be encountered, an alternative to driving piles would be to install piles in pre-drilled full-size (oversized) holes. An oversized hole may be advanced to the minimum design embedment depth prior to the installation of piles. For this approach, the pile would be set in the pre-drilled hole and then the hole is backfilled using cement grout.

The proposed structure types and loading information were not available at the time this report was prepared. Settlement and strength parameters were analyzed using soil compressibility properties derived from the SPT values.

As part of the overall quality control program, the time rate of installation (seconds per foot of embedment) should be recorded during production post driving. As a direct extension of the design process, additional “proof” testing should be performed on a representative number of production posts.

Geotechnical engineering recommendations for foundation systems and other earth connected phases of the project are outlined in this report. 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.

The General Comments in **Section 7.0** provides an understanding of the report limitations.

5.2 Solar Panel Support Pile Design Recommendations

5.2.1 Axial Capacity Recommendations

The axial uplift capacity of driven piles may be estimated based on skin friction developed along the perimeter of the pile, while the compression capacity may be estimated using the skin friction and end bearing. When determining embedment depths, the perimeter of a wide flange beam should be taken as twice the sum of the flange width and section depth. The upper 12 inches of soil for each pile should be neglected in all axial compression capacity analyses and the upper 30 inches neglected for axial tension analyses to account for frost heave. The ultimate axial capacity of driven steel piles may be calculated using skin friction and end bearing values as presented in the following table.

The soils on this site are frost-susceptible. The typical frost depth for Sharon Springs, New York for foundation design considerations is 4 feet. Frost heave on pile foundations may be significant. If the anchorage of the foundations and the deadweight of the solar panel equipment are not sufficient to resist these forces, it can cause uplift. Based on our review of soil samples obtained in the exploration, our local experience, and available public data, we recommend that an ultimate adfreeze (frost heave) of 1,500 psf acting along the pile perimeter to a depth of 30 inches below the ground surface be considered.

Description	Approximate Depth to Bottom of Stratum (feet)	Ultimate Uplift and Compression Unit Skin Friction (psf)	Ultimate End Bearing (lbs.)
Loose Silt[1]	16.0	250	--
Glacial Till (1.5 to 21.5 feet)	1.5 to 21.5 (the maximum depth investigated)	750	10,000
Weathered Shale	3.5 to 21	750	15,000
Shale	Varies	NA	40,000
Weathered Limestone	3.5 to 21	750	15,000
Limestone	Varies	NA	50,000

1. Use these values for the area delineated in Section 5.1.

The depth of the above referenced materials is highly variable across the site. It is recommended that the individual boring and test pit logs be utilized to determine the subsurface conditions at the individual pile locations.

For ASD design, we recommend the allowable skin friction and end bearing be determined by applying a minimum factor of safety of at least 1.5 to the ultimate values.

Piles should have a minimum center-to-center spacing of at least 3 times their largest cross-sectional dimension to prevent reduction in the axial capacities due to group effects.

5.2.2 Oversized Holes Design Recommendations

If piles are not able to reach the required penetration because of early refusal upon cobbles or boulders within the glacial till or upon the bedrock, the pile may be installed in an oversized hole drilled to the minimum design embedment. The drill hole diameter should be selected to accommodate the pile size and the cement grout properties. For this approach, the pile would be set in the pre-drilled hole and then the hole backfilled using cement grout with a minimum compressive strength of 1,000 pounds per square inch where the following design parameters for oversized holes are used in their design.

Description	L-Pile™ Soil Model	q_u [1, 3] (psf)	f_s [1, 4] (psf)	S_u (psf)	g' [1,2] (pcf)	Φ' [1]	k [1] (pci)
Loose Silt[5]	Sand (Reese)	--	400	--	110	24	Default
Glacial Till	Sand (Reese)	5,000	750	--	130	38	Default
Weathered Shale/Limestone		12,000	750	--	145	35	Default
Bedrock (Shale)	Weak Rock (Weak Rock Reese)	20,000	1,000	--	--	35	--
Bedrock (Limestone)		50,000	1,200	-	-	35	--

1. Definition of Terms:
S_u: Undrained Shear Strength
f : Internal friction angle,
g: Effective unit weight
K: Horizontal soil modulus of subgrade reaction (L-Pile)
E_{50}: Strain Factor (LPile)
q_u: Ultimate end bearing capacity for soil; Uniaxial compressive strength for rock
fs: Ultimate side resistance
2. Buoyant unit weight values should be used below water table.
3. A minimum factor of safety of at least 3 should be applied to end bearing.
4. Applicable to compression and uplift loading. Contribution to pile capacity from within the frost zone depth of 4 feet should be ignored. A factor of safety of at least 2 should be applied to the side resistance.
5. Use these values for the area delineated in Section 5.1.

5.2.3 Lateral Capacity Recommendations

It is anticipated that the piles will be installed with end bearing either in the glacial till soils or directly on weathered rock or rock. Recommended L-Pile input parameters for preliminary lateral load analysis for driven pile foundations are shown in the following table:

Description	Depth to Bottom of Layer (feet)	L-pile Soil Model	Effective Unit Weight (pcf)	Effective Friction Angle (Ø')	Undrained Cohesion (psf)	Strain Factor ε_{50} (%)
Loose Silt[1]	16	Sand (Reese)	110	24	--	Allow LPILE to choose this value
Glacial Till	4	Sand (Reese)	120	29	--	
Glacial Till	Varies	Sand (Reese)	130	38	--	
Weathered Shale/Limestone	Varies	Sand (Reese)	145	35	--	

1. Use these values for the area delineated in Section 5.1.

5.2.4 Construction Considerations

Based on the field exploration and laboratory testing, it is our opinion that the soils on the site are suitable for pile installation. Possible obstructions (cobbles or boulders) could impede or refuse pile installation within the glacial till soils on site.

A representative of the geotechnical engineer should observe pile driving operations. Each pile should be observed and checked for buckling, crimping and alignment in addition to recording penetration resistance, depth of embedment, and general pile driving operations.

5.3 Pile Design Recommendations for Other Structures

Other structures (i.e. inverters and embedded poles) that are planned to be supported on deep foundation systems similar to the solar panels may require piles to be driven to greater depths or to bedrock to achieve the required axial capacities. The table in **Section 5.2.1** can be used to determine an ultimate skin friction and end bearing values for piles driven to deeper depths. We recommend Terracon be consulted to determine the minimum drive time based on the proposed equipment to be used for driving of the piles.

For allowable strength design, we recommend the allowable skin friction be determined by applying a factor of safety of at least 2 to the ultimate values provided in this section for pile embedded greater than 8 feet. We recommend a factor of safety of at least 2 be applied to the end bearing ultimate value provided in this section for piles embedded greater than 8 feet.

Piles should have a minimum center-to-center spacing of at least 5 times their largest cross-sectional dimension to prevent reduction in the axial capacities due to group effects.

5.4 Drilled Shaft Foundation Design Recommendations for Other Structures

As an alternative to driven piles, other structures (i.e. inverters and embedded poles) can be supported on drilled shaft foundation systems. The other structures within the array field can be supported on drilled shaft foundations with a minimum depth of 4B (where B is the shaft diameter).

Based on the geotechnical engineering analyses, subsurface exploration and laboratory test results, the geotechnical design parameters have been determined for the subsurface profile and are presented in the following sections.

5.4.1 Axial Loading Design Criteria

	Axial Design Parameters						
Soil Type	**Depth to Bottom of Layer (ft)**	**Soil Type (P-y) Curve Model**	**Effective Weight (pcf)**	**Friction Angle Φ^o**	**Undrained Cohesion (psf)**	**Allowable Skin Friction Compression/ Uplift (psf)**	**Allowable End Bearing Capacity (psf)**
Loose Silt[1]	16	Sand (Reese)	110	24	--	150	--
Glacial Till	4	Sand (Reese)	120	29	--	300	--
Glacial Till	Varies	Sand (Reese)	130	38	-	750	5,000
Weathered Shale/Limestone	Varies	Sand (Reese)	145	35	-	750	12,000
Shale	Varies	-	-	-	-	-	20,000
Limestone	Varies	-	-	-	-	-	50,000

1. Use these values for the area delineated in Section 5.1.

The factor of safety utilized for skin friction and bearing capacity is presented in the following table:

Design Parameter	Factor of Safety
Allowable Skin Friction (Compression and Uplift)	2.0
Allowable End Bearing Capacity	3.0

Design of the deep foundations should be completed by the structural engineer using the geotechnical engineering design criteria provided herein. The required foundation size and depth should be determined based upon analyses for vertical loads and overturning moments.

5.4.2 Lateral Loading Design Criteria

Recommended geotechnical parameters for lateral load analysis of the drilled shaft foundations have been developed for use in the computer program L-PILE 2016 and they are presented in the following table:

Lateral Design Parameters						
Soil Type	**Depth to Bottom of Layer (ft)**	**Soil Type (P-y) Curve Model**	**Effective Weight (pcf)**	**Friction Angle Φ' (degrees)**	**Undrained Cohesion (psf)**	**Strain Factor ε_{50} (%)**
Loose Silt[1]	16	Sand (Reese)	110	24	-	Allow LPILE to choose this value
Glacial Till	4	Sand (Reese)	120	29	--	
Glacial Till	Varies	Sand (Reese)	130	38	-	
Weathered Shale/Limestone	Varies	Sand (Reese)	145	35	-	
Shale/Limestone	Varies	-	-	-	-	

1. Use these values for the area delineated in Section 5.1.

All shafts should be reinforced to full-depth for the applied axial, lateral and uplift stresses imposed. For this project, use of a minimum shaft diameter of 12 inches is recommended for the foundations.

Design of the deep foundations should be completed by the structural engineer using the geotechnical engineering design criteria provided herein. The required foundation size and depth should be determined based upon analyses for vertical loads, lateral loads and overturning moments.

5.4.3 Drilled Shaft Construction Considerations

Drilling of foundations to design depths should be possible with conventional drilling equipment using single flight power augers. However, if caving soils are encountered, temporary casing will likely be required to advance the drilled shafts to design depth. Temporary casing should also be used whenever shafts are installed adjacent to any existing structures or improvements, to reduce the potential for ground loss and movement due to drilled shaft excavation. Water, if encountered, should be removed from each shaft hole prior to concrete placement. Casing should be installed for the full shaft depth if downhole inspection and clean out is required. Shaft concrete should be placed immediately after completion of drilling and cleaning. If shaft concrete cannot be placed in dry conditions, a tremie should be used for concrete placement. Due to potential sloughing and raveling, foundation concrete quantities may exceed calculated geometric volumes.

Where casing is used for drilled shaft construction, it should be withdrawn in a slow continuous manner maintaining a sufficient head of concrete to prevent infiltration of water or the creation of voids in the concrete. The concrete should have a relatively high fluidity when placed in cased holes or through a tremie. Concrete with slump in the range of 6 to 8 inches is recommended.

Free-fall concrete placement in drilled shaft excavations will only be acceptable in dry holes and if provisions are taken to avoid striking the concrete on the sides of the hole or reinforcing steel. The use of a bottom-dump hopper, or an elephant's trunk discharging near the bottom of the hole where concrete segregation will be minimized, is recommended.

Shaft bearing surfaces should be cleaned prior to concrete placement. A representative of the geotechnical engineer should inspect the bearing surface and shaft configuration. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

The drilled shaft installation process should be performed under the direction of the Geotechnical Engineer. The Geotechnical Engineer should document the shaft installation process including soil and groundwater conditions encountered, consistency with expected conditions, and details of the installed shaft.

5.5 Mat Foundations for Support of Inverters

5.5.1 General

We understand the main foundation component in the array area will include driven pile foundations for support of solar arrays; however, some lightly-loaded, inverter structures are typically required across the site. In general, small, lightly-loaded, inverter structures may be supported on driven piles or isolated mat/slab foundation systems.

If the site has been prepared in accordance with the requirements noted in **Section 5.6** of this report, the mat/slab foundations should be designed based on the criteria outlined below:

5.5.2 Mat/Slab Foundation Design Recommendations

Design Item	Description/Recommendations
Foundation Type	Mat/Slab Foundations
Bearing Material[1]	12-inch thick base of crushed stone (ASTM Blend 57)
Design Modulus of Subgrade Reaction, k	125 pci
Minimum Width	4 feet
Modulus Correction Factor [2]	$k_c=k((b+1)/2b)^2$
Maximum Design Contact Stress	3,000 psf (Glacial Till Soils) 1,500 psf (Loose Silt)
Total Estimated Settlement	1 inch or less
Differential Settlement	¾-inch over 4 feet

1. Mat slabs supported at grade may be subject to frost heave. If this is a concern the slabs may be designed in accordance with ASCE 32-01: Design and Construction of Frost Protected Shallow Foundations.
2. It is common to reduce the k-value to account for dimensional effects of large loaded areas. Where k_c is the corrected or design modulus value and b is the mat width (short dimension) or tributary loaded area.

Foundations should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in walls is recommended.

Foundation excavations should be observed by the geotechnical engineer. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

Due to the potential for a variable rock surface, there is the potential for foundations to be partially founded on bedrock, natural soils and/or compacted structural fill. If a mixed bearing grade condition exists, **where the bearing surface transitions from bedrock to soil, the rock**

should be undercut at least twelve inches over a length extending back at least ten feet from the transition to soil. The undercut should be backfilled with compacted Imported Structural Fill. This is recommended to create a gradual transition from rock to soil bearing and lessen the impacts of abrupt differential settlement.

5.5.3 Mat/Slab Foundations Construction Considerations

The mat foundation excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the foundation excavations should be removed/reconditioned before foundation concrete is placed.

5.6 Earthwork

5.6.1 General

The site work conditions will be largely dependent on the weather conditions and the contractor's means and methods in controlling surface drainage and protecting the subgrade. The areas where the near surface sandy soils were encountered in the borings should provide acceptable and relatively well-drained subgrade soils for construction. Site preparation where inverter mat foundations will be installed should include clearing and grubbing, installation of a site drainage system (where necessary), and subgrade preparation. Site preparation is not necessary in the PV Array field or where inverters will be supported on driven piles except to improve site drainage where necessary. The following paragraphs present our considerations and recommendations for the PV Array Field portion of the site and subgrade preparation.

The following presents recommendations for site preparation, excavation, subgrade preparation and placement of engineered fills on the project. The recommendations presented for design and construction of earth supported elements including foundations and roadways are contingent upon following the recommendations outlined in this section.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

5.6.2 Site Preparation

Strip and remove existing vegetation, crops, debris, and other deleterious materials from proposed access road areas, and any proposed mat foundations supporting inverters. Trees, tree stumps, and large vegetation should be cleared from the site at the location of mat foundations supporting inverters and roadway areas. Exposed surfaces should be free of mounds and depressions which could prevent uniform compaction in proposed array panel, inverter and access road areas.

Stripped materials consisting of vegetation and organic materials should be wasted from the site. If it is necessary to dispose of organic materials on-site, they should be placed in non-structural areas.

Where proposed inverters will be located, the area should be initially graded to create a relatively level surface to receive fill or be constructed upon, and to provide for a relatively uniform thickness of fill beneath structures (if applicable).

5.6.3 Fill Material Type

Structural Fill should be used as fill/backfill within the proposed mat/slab on grade and pavement areas. The fill should consist of imported sand or sand and gravel. Imported Structural Fill should contain no particles larger than 3 inches and less than 10 percent, by weight, of material finer than a No. 200 mesh sieve. The imported materials should be free of recycled concrete, asphalt, bricks, glass, and pyritic shale rock. Additional laboratory testing will be required to determine if the on-site soils are suitable for use as Structural Fill on site.

5.6.4 Compaction Requirements

The Structural Fill should be placed in uniform loose layers no more than about one-foot thick where heavy vibratory compaction equipment is used. Smaller lifts should be used where hand operated equipment is required for compaction. Each lift should be compacted to no less than 95 percent of the maximum dry density for the soil which is established by the Modified Proctor Compaction Test, ASTM D1557. In landscape areas, the compaction may be reduced to 90 percent of maximum dry density.

5.6.5 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. The site should be graded to shed water and avoid ponding over the subgrade.

5.6.6 Sinkhole Remediation

The remediation for any sinkholes must be assessed based on their size, location, depth of overburden and proximity to any structures or utilities. Sinkholes in areas of relatively shallow overburden are typically remediated by excavating to expose the throat of the sinkhole and "sealing" it with concrete. The excavation may then be backfilled with the on-site soils which should provide a relatively impermeable cap over the area.

If sinkhole activity is found during the site development in areas of deeper overburden, alternate, less effective methods may be utilized in an attempt to "plug" the sinkhole area. If the throat of the sinkhole cannot be located, excavation should be made to a depth determined by the Geotechnical Engineer. Typically, a plug will consist of a layer of geotextile fabric (MIRIFI 500X) placed on the bottom of the excavation. Lifts of gravel, starting with a lift of large (6-8 inch) gravel at the bottom with lifts of decreasing size gravel, up to small gravel (ASTM Blend 57) at the top are placed on top of the geotextile. The top of the last gravel layer should be capped with another layer of geotextile fabric and the excavation can then be backfilled with the on-site soils which should provide a relatively impermeable cap over the area.

5.6.7 Earthwork Construction Considerations

It is anticipated that shallow excavations for the proposed construction can be accomplished with conventional earthmoving equipment.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of the access roads. 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 desiccated, saturated, or disturbed, the affected material should be removed, or these materials should be scarified, moisture conditioned, and re-compacted prior to access road construction.

The individual contractors are responsible for designing and constructing stable, temporary excavations (including utility trenches) as required to maintain stability of both the excavation sides and bottom. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including 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; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations to the completed subgrade.

5.6.8 Construction Observation and Testing

The exposed subgrade and each lift of compacted fill should be tested, evaluated and reworked, as necessary, until approved by the geotechnical engineer's representative prior to placement of additional lifts of fill. We recommend that each lift of fill be tested for density and moisture content at a minimum frequency of one test for every 5,000 square feet of compacted fill in the structure areas. We recommend one density and moisture content test for every 300 linear feet of compacted utility trench backfill. If engineered fill is placed beneath individual structures, we recommend at least one density and moisture content test per each vertical lift per structure.

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 into the completed subgrade, and just prior to construction of building floor slabs.

5.7 Access Roadways

5.7.1 Aggregate Surface Roadway Design Recommendations

We understand that new roadways within the project site will consist of aggregate surfaced roadways. We understand the roadways should support heavy truck traffic during construction equivalent to HS-20 (72,000 pound) vehicle loadings. The post construction vehicle traffic will be comparatively light. Design truck load frequencies during construction and post-construction have not been provided. Pavement sections based upon a more detailed design could be provided if specific traffic loading, frequencies, and desired pavement design life are provided.

Surficial materials below the topsoil at the site primarily consists of mixtures of silt, sand, and gravel. It is expected that the proposed site grades will be established near the existing site grades using small amounts of engineered fill material similar to the surficial soils to level the planned access road areas.

We understand that proposed access roads consist of aggregate sections with no asphalt or concrete surface. Recommendations are presented below for two alternative aggregate sections: one assuming the aggregate section placed over stable, proofrolled native subgrade materials; the second for the case where achieving a stabilized subgrade may be difficult or not possible due to weather conditions at the time of construction.

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 unpaved roadways.

The aggregate sections presented in this report are considered minimal sections based upon the expected traffic and the composite subgrade conditions; however, they are expected to function with periodic maintenance if good drainage is provided and maintained.

5.7.2 Aggregate Section Over Stable Subgrade

Subgrade soils beneath aggregate surfaced roadways should be prepared and constructed as outlined in **Section 5.6** of this report. These subgrades should be prepared immediately prior to the time of aggregate placement to reduce the risk of disturbance due to weather or construction vehicle traffic. If this cannot be done, the subgrades should be reevaluated by a qualified Geotechnical Engineer for disturbance or softening immediately prior to aggregate placement. For subgrades prepared in accordance with **Section 5.6**, we recommend that the aggregate section consist of a minimum 12 inches of NYSDOT Type 2 Subbase Course Aggregate compacted to 95 percent of its maximum dry density as determined by the ASTM D1557 test procedure (Modified Proctor Test). Based on CBR Testing performed on a similar soil types a lab tested CBR value on the order of 4.5 can be expected. For design purpose, we have assumed that the subgrade soils have a minimum CBR value of 3 (2/3rds the anticipated lab CBR value) at the time of construction.

To maintain surface drainage, the subgrade and the pavement surface should have a minimum ¼-inch per foot slope and the final grade adjacent to the road should slope down from pavement edges at a minimum 2 percent.

5.7.3 Aggregate Section Over Weak Subgrades

The requested pervious road could also be established over a relatively weak subgrade with CBR values less than 3, which would allow placement of the roadway section over on-site soils with minimal subgrade preparation activities, without the need for proofrolling with a heavy construction equipment.

For this scenario, we recommend that the aggregate section consist of a minimum of 12 inches of compacted NYSDOT Type 2 Subbase Course Aggregate placed over high-performance geotextile Mirafi RS380i, or equivalent, installed over the existing subgrade. The high-performance geotextile will provide reinforcement strength to the aggregate material and will limit migration from the underlying subgrade, which may contribute to its degradation and loss of strength.

In areas where fill materials are required to level the proposed pavement subgrade, we recommend that these fill materials be compacted at least to the density of the existing subgrade soils.

5.7.4 Access Road Maintenance

Regardless of the design, unsurfaced roadways will display varying levels of wear and deterioration. We recommend implementation of a site inspection program at a frequency of at least once per year to verify the adequacy of the roadways. Preventative measures should be applied as needed for erosion control and regrading. An initial site inspection should be completed approximately three months following construction. For planning purposes, we recommend assuming that over time the placement of additional aggregate material will likely be required to level depressions and long-term rutting. These areas should be filled with additional aggregate rather than scalping of material from adjacent areas.

Shoulder build-up on both sides of proposed roadways should match the road surface elevation and slope outwards at a minimum grade of 10 percent for five feet. Surface drainage should be provided away from the edge of roadways to reduce lateral moisture transmission into the subgrade.

When potholes, ruts, depressions or yielding subgrades develop, they must be repaired prior to applying additional traffic loads. Typical repairs could consist of placing additional Crushed Stone in ruts or depressed areas and, in some cases, complete removal of Crushed Stone surfacing, repair of unstable subgrade, and replacement of the Crushed Stone surfacing. Potholes and depressions should not be filled by blading adjacent ridges or high areas into the depressed areas. New material should be added to the depressed areas as they develop. Failure to make timely repairs will result in more rapid deterioration of the roadways, making more extensive repairs necessary.

5.7.5 Access Roadway Design and 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. 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.

Aggregate surfaced drives, regardless of the section thickness or subgrade preparation measures, will require on-going maintenance and repairs to keep it in a serviceable condition. It is not practical to design a gravel section of sufficient thickness that on-going maintenance will not be required. This is due to the porous nature of the gravel that will allow precipitation and surface water to infiltrate and soften the subgrade soils, and the limited near surface strength of unconfined gravel that makes it susceptible to rutting. When potholes, ruts, depressions or yielding subgrades develop, they must be addressed as soon as possible in order to avoid major repairs.

Maintenance should consist of periodic grading with a road grader. Typical repairs could consist of placing additional gravel in ruts or depressed areas. Potholes and depressions should not be filled by blading adjacent ridges or high areas into the depression areas. New material should be added to the depressed areas as they develop.

6.0 SUBSTATION – RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

6.1 Geotechnical Considerations

We would expect several small structures to house equipment and provide storage to be constructed as part of the substation portion of the project. The proposed structure types and loading information were not available at the time of this report. Settlement potential was analyzed using soil compressibility properties derived from the SPT borings drilled in the planned substation location and assumed structural loads. We estimate total settlements will be less than one inch provided column loads are less than 150 kips and the applied bearing pressure of small isolated slabs or mats is less than about 3,000 psf. Shallow foundation systems for support of lightly-loaded buildings and equipment pads will be acceptable provided these maximum loads are not exceeded. Once loading for these ancillary structures is better known, detailed settlement analyses can be performed to confirm shallow foundation acceptability.

Proposed substation structures may also be supported as direct embed poles or poles supported on drilled shaft foundations designed using the soil properties presented in this report. Drilled shafts should be constructed as straight shafts at least 24 inches in diameter. Settlement of drilled shaft foundations using design properties presented in this report is expected to be less than 0.5 inch.

All building structure foundations should bear on suitable natural soil, or on properly compacted structural fill.

6.2 Spread Footing and Isolated Slab Foundations

6.2.1 General

We understand within the substation that some equipment may be supported on mat/slab foundations, while other building(s) may be supported on shallow footing foundations. Transmission line structures are anticipated to be constructed as poles on drilled shafts or as direct embed poles.

Based on the subsurface conditions encountered in the soil borings and test pits, the proposed substations will be constructed at locations where glacial till soils are underlain by shallow bedrock and not planned near the noted loose silts. These design parameters are provided based on the proposed locations of the substations provided to us.

The following sections present design recommendations and construction considerations for the shallow foundations for proposed lightly loaded structures and related structural elements.

6.2.2 Spread Footing and Mat /Slab Foundation Design Recommendations

Description	Columns	Walls	Mat
Net allowable bearing pressure [1,5]	3,000 psf	3,000 psf	3,000 psf
Modulus of subgrade reaction for slab-on-grade design	125 pounds per square inch per in (psi/in) for point loading conditions		
Bearing material	Foundations should be supported on natural soils or engineered fill		
Minimum dimensions	30 inches	18 inches	4 feet
Minimum embedment below finished grade[2,3]	4 feet		
Approximate total settlement [4]	<1 inch	<1 inch	<1 inch
Estimated differential settlement	< ½ inch between columns	< ½ inch over 40 feet	< ½ inch over 40 feet

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. It assumes any unsuitable soils, if encountered, will be replaced with compacted structural fill.
2. Required for the allowable bearing pressure, frost protection and to reduce the effects of seasonal moisture variations in the subgrade soils.
3. Alternatively, spread footings may be designed in accordance with ASCE 32-01: Design and Construction of Frost Protected Shallow Foundations. Mat slabs may be founded at grade supported on a 12-inch-thick base of crushed stone but may be subject to frost heave. If frost heave is a concern the slabs may be

Description	Columns	Walls	Mat

designed in accordance with ASCE 32-01: Design and Construction of Frost Protected Shallow Foundations.

4. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. Footings should be proportioned to relatively constant dead-load pressure to reduce differential movement between adjacent footings.
5. The allowable bearing pressure may be increased by ⅓ when considering the alternative load combinations of Section 1605.3.2 of the *2012 International Building Code*, however, it should not be increased when loads are determined by the basic allowable stress design load combinations of Section 1605.3.1.

The allowable foundation bearing pressures apply to dead loads plus design live load conditions. The weight of the foundation concrete below grade may be neglected in dead load computations.

Foundation excavations should be observed by the Geotechnical Engineer. If the soil conditions encountered differ significantly from those presented in this report, Terracon should be contacted to provide additional evaluation and supplemental recommendations.

Due to the potential for a variable rock surface, there is the potential for foundations to be partially founded on bedrock, natural soils and/or compacted structural fill. If a mixed bearing grade condition exists, **where the bearing surface transitions from bedrock to soil, the rock should be undercut at least twelve inches over a length extending back at least ten feet from the transition to soil.** The undercut should be backfilled with compacted Imported Structural Fill. This is recommended to create a gradual transition from rock to soil bearing and lessen the impacts of abrupt differential settlement.

6.2.3 Spread Footing Construction Considerations

The bottom of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Extremely wet or dry material or any loose or disturbed material in the bottom of the footing excavations should be removed before foundation concrete is placed.

If unsuitable bearing soils are encountered in footing excavations, the excavations should be extended deeper to suitable soils and the footings could bear directly on those soils at the lower level. Alternatively, the over-excavations could be backfilled with structural fill, clean gravel or lean concrete. Foundation bearing level soils should be compacted to a density of at least 95 percent of the standard Proctor maximum dry density for a minimum depth of 12 inches. More complete foundation design and construction recommendations can be provided as the design of the facility progresses.

6.3 Drilled Shaft Foundation Design

Deep foundations, including drilled shaft foundations and/or direct embedment foundations with concrete backfill, may be utilized for the support of substation structures for the project. Drilled shaft foundations should have a minimum embedment depth of 4B (where B is the shaft diameter).

Based on the geotechnical engineering analyses, subsurface exploration and laboratory test results, the geotechnical design parameters have been determined for the subsurface profile and are presented in the following sections.

6.3.1 Design Parameters

Recommended geotechnical parameters for lateral load analysis of the drilled shaft foundations have been developed for use in the computer program L-PILE 2016, and they are presented in the following table:

Lateral Design Parameters						
Soil Type	**Depth to Bottom of Layer (ft)**	**Soil Type (P-y) Curve Model**	**Effective Weight (pcf)**	**Friction Angle Φ' (degrees)**	**Undrained Cohesion (psf)**	**Strain Factor ε_{50} (%)**
Glacial Till	4	Sand (Reese)	120	29	--	Allow LPILE to choose this value
Glacial Till	Varies	Sand (Reese)	130	38	-	
Weathered Shale/Limestone	Varies	Weak Rock	145	35	-	
Shale/Limestone	Varies	-	-	-	-	

The factor of safety utilized for skin friction and bearing capacity is presented in the following table:

Design Parameter	Factor of Safety
Allowable Skin Friction	2.0
Allowable End Bearing Capacity	3.0

Design of the deep foundations should be completed by the structural engineer using the geotechnical engineering design criteria provided herein. The required foundation size and depth should be determined based upon analyses for vertical loads and overturning moments.

All shafts should be reinforced to full-depth for the applied axial, lateral and uplift stresses imposed. For this project, use of a minimum shaft diameter of 24 inches is recommended for the foundations.

Design of the deep foundations should be completed by the structural engineer using the geotechnical engineering design criteria provided herein. The required foundation size and depth should be determined based upon analyses for vertical loads, lateral loads and overturning moments.

6.3.2 Drilled Shaft Construction Considerations

Drilling of foundations to design depths should be possible with conventional drilling equipment using single flight power augers. Specialized drilling equipment is not considered necessary for this project based on the subsurface conditions encountered in the test borings.

Drilled shaft concrete should be placed soon after completion of drilling and cleaning. Due to potential sloughing and raveling, foundation concrete quantities may exceed calculated geometric volumes.

If casing is used for drilled shaft construction, it should be withdrawn in a slow continuous manner maintaining a sufficient head of concrete to prevent the creation of voids in pier concrete. Drilled shaft concrete should have a relatively high fluidity when placed in cased pier holes or through a tremie. Concrete with a slump in the range of 6 to 8 inches is recommended. If casing is not used for construction, drilled shaft concrete with a slump in the range of 5 to 7 inches is recommended. Due to potential sloughing and raveling, foundation concrete quantities may exceed calculated geometric volumes.

If downhole inspection or cleanout is required, we recommend:

- Casing be installed for the full shaft depth;
- Shaft diameters be a minimum of 24 inches;
- The contractor should check for oxygen deficiency and harmful gases;
- All necessary monitoring and safety precautions as required by OSHA, sate, or local codes, should be strictly enforced.

We recommend that all drilled shaft installations be observed on a full-time basis by Terracon to confirm that soils encountered are consistent with the recommended design parameters.

7.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications, so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings and pile load testing performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The results of the test pile program should be interpreted in consideration of the subsurface conditions at the time when and locations where testing was performed. Inherent variations within near surface soil layers, seasonal groundwater fluctuations, seasonal wet and dry season effects, and site disturbance (due to construction activities including clearing, grubbing, grading, or modifications to site drainage) can significantly affect the geotechnical capacity of short pile foundations. The results of the test pile program should also be interpreted in consideration of the test pile connection method and test pile characteristics including the section properties, surface texture, and installation methods.

The scope of services for this project 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.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A

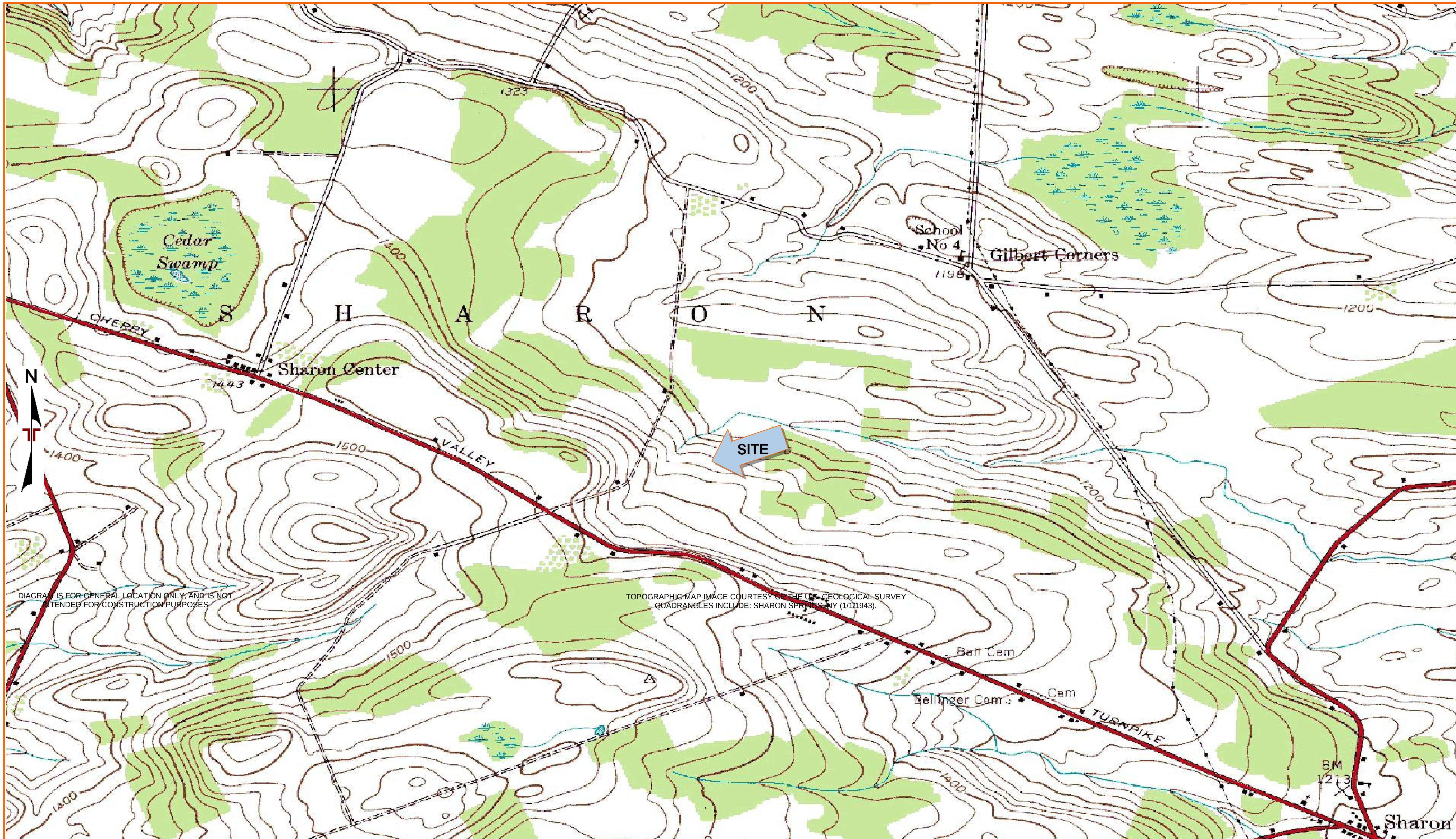
FIELD EXPLORATION

SITE LOCATION

East Point Solar Site ■ Sharon Springs, NY

■ Terracon Project No. JB185149

Terracon GeoReport



EXPLORATION PLAN

East Point Solar Site ■ Sharon Springs, NY

■ Terracon Project No. JB185149

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING		WATER LEVEL		FIELD TESTS	
	Rock Core Grab Sample 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 (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

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification: Group Symbol	Soil Classification: 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 ³ 4 and 1 £ Cc £ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or [Cc<1 or Cc>3.0] [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 ³ 6 and 1 £ Cc £ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or [Cc<1 or Cc>3.0] [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" line [J]		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			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	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			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 ³ 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 ³ 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 ³ 30% plus No. 200 predominantly sand, add "sandy" to group name.

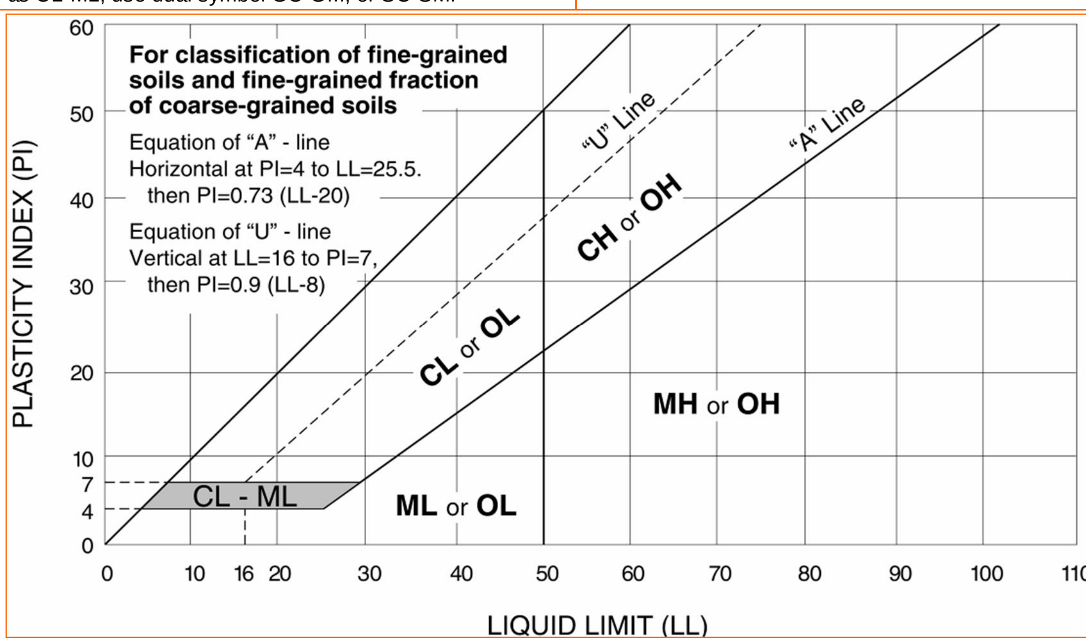
[M] If soil contains ³ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ³ 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

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

BORING LOG NO. B-1

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.7933° Longitude: -74.5699°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.7	**TOPSOIL**						
3.5	**SILT WITH SAND (ML)**, trace gravel and rootlets, brown, moist, very loose			X	9	WH-3-3-3 N=6	
20.0	**GLACIAL TILL: SILTY SAND with GRAVEL (SM)**, occasional cobbles and shale frags, brown to gray, moist, dense to medium dense, grades to gray around 7.5'	5		X	18	15-31-28 N=59	
		10		X	18	12-14-16 N=30	
		15		X	18	9-11-13 N=24	
21.0	**WEATHERED LIMESTONE**, light gray, dry, very dense	20		X	10	30-50/4"	

Boring Terminated at 21 Feet

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-15-2019	Boring Completed: 05-15-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-2

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.7918° Longitude: -74.5661°

DEPTH	Material Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.5	**TOPSOIL**						
3.0	**SILTY SAND (SM)**, trace gravel, light brown, moist, loose			X	12	WH-3-3-3 N=6	
	GLACIAL TILL: SILTY SAND with GRAVEL (SM), brown, moist to wet, dense	5		X	18	21-15-28 N=43	
			▽ / ▽				
		10		X	18	12-15-16 N=31	
		15		X	12	2-3-28 N=31	
20.3		20		X	4	50/4"	

Boring Terminated at 20.5 Feet

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *After 1/2 hour*

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-15-2019	Boring Completed: 05-15-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-3

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.7903° Longitude: -74.5721°

GRAPHIC LOG	DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
	0.8	**TOPSOIL**						
	1.5	**GLACIAL TILL: SILTY GRAVEL (GM)**, trace sand, brown, moist, loose			X	1.7	1-3-5-35 N=8	
	3.4	**WEATHERED LIMESTONE**						
		Auger Refusal at 3.4 Feet						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-16-2019	Boring Completed: 05-16-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-4

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.7864° Longitude: -74.5687°

DEPTH	Material Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.4	**TOPSOIL**						
	SANDY SILT (ML), trace gravel, brown, moist, very loose to loose			X	17	WH-2-2-2 N=4	
		5		X	1	1-1-1-1 N=2	
10.0	**SILT (ML)**, dark brown, moist, loose	10		X	12	0-0-4-5 N=4	
16.0	**WEATHERED LIMESTONE**, wet	15		X	6	3-6-50/2"	
16.5	***Auger Refusal at 16.5 Feet***						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-16-2019

Boring Completed: 05-16-2019

Drill Rig: Diedrich D-50

Driller: J. Lamm

Project No.: JB185149

BORING LOG NO. B-5

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.7832° Longitude: -74.5726°

DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.6	**TOPSOIL**				6	2-50/2"	
2.0	**WEATHERED LIMESTONE**						
7.1	**LIMESTONE**, weathered, weak, very close to close fractured	5			28	REC= 50% RQD = 0%	
	Boring Terminated at 7.1 Feet				1	50/1" Spoon bouncing limtestone dust recovered	

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

Hammer Type: Automatic

Advancement Method:
4 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-16-2019	Boring Completed: 05-16-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-6

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION
Latitude: 42.7845° Longitude: -74.5625°

DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.7	**TOPSOIL**						
	GLACIAL TILL: SILTY SAND with GRAVEL (SM), trace sand, brown, moist, soft			X	20	WH-2-3-3 N=5	
		5		X	18	9-48-18 N=66	
9.5					0	50/0"	
	Auger Refusal at 9.5 Feet						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-17-2019	Boring Completed: 05-17-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-7

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.783° Longitude: -74.5567°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.8	**TOPSOIL**						
3.0	**SILT WITH SAND (ML)**, trace gravel, brown, moist, loose			X	20	WH-2-2-5 N=4	
	GLACIAL TILL: SILTY SAND with GRAVEL (SM), occasional cobbles, brown to gray, moist to dry, dense to very dense, grades to gray around 10' and became dry around 20'	5		X	2	19-21-20 N=41	
		10		X	5	15-16-17 N=33	
		15		X	18	12-15-18 N=33	
21.5		20		X	16	46-24-37 N=61	
	Boring Terminated at 21.5 Feet						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-16-2019	Boring Completed: 05-16-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-8

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.7733° Longitude: -74.5561°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.7	**TOPSOIL**						
3.0	**SANDY SILT WITH GRAVEL (ML)**, trace rootlets, brown, moist, loose			X	20	WH-2-2-3 N=4	
21.5	**GLACIAL TILL: SILTY SAND with GRAVEL (SM)**, brown to gray, moist to dry, medium dense to dense, grades to gray and became dry around 10'	5		X	18	7-12-15 N=27	
		10		X	18	16-19-23 N=42	
		15		X	18	14-23-24 N=47	
		20		X	18	15-18-20 N=38	
	Boring Terminated at 21.5 Feet						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-24-2019	Boring Completed: 05-24-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-9

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION
Latitude: 42.7701° Longitude: -74.548°

DEPTH	Material Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.7	**TOPSOIL**						
	GLACIAL TILL: SILTY SAND with GRAVEL (SM), trace rootlets, occasoinal cobbles, brown, moist, loose to dense			X	20	WH-2-2-3 N=4	
		5		X	16	20-19-17 N=36	
9.0	*Auger Refusal at 9 Feet*						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS
No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-23-2019	Boring Completed: 05-23-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-10

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.7697° Longitude: -74.5646°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.7	**TOPSOIL**						
3.0	**SANDY SILT WITH GRAVEL (ML)**, brown, moist, loose			X	20	WH-2-2-2 N=4	
11.5	**GLACIAL TILL: SILTY SAND with GRAVEL (SM)**, occasional cobbles, brown to gray, moist to dry, dense to very dense, grades to gray and becomes dry around 10'	5		X	18	12-15-18 N=33	
		10		X	18	15-19-50 N=69	
	Auger Refusal at 11.5 Feet						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-20-2019	Boring Completed: 05-20-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-11

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.7782° Longitude: -74.5582°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
	GLACIAL TILL: SILTY SAND with GRAVEL (SM), trace rootlets, brown, moist to wet, loose to medium dense			X	20	WH-2-2-3 N=4	
		5		X	6	5-8-11 N=19	
7.5	**GLACIAL TILL: SILTY SAND with GRAVEL (SM)**, occasional cobbles, brown to gray, moist, very dense to dense, grades to gray around 11'						
		10		X	18	25-28-33 N=61	
		15	▽	X	17	12-15-18 N=33	
		20		X	2	15-19-21 N=40	
21.5	***Boring Terminated at 21.5 Feet***						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

▽ *Upon completion of drilling and sampling*

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-17-2019	Boring Completed: 05-17-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-12

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.7662° Longitude: -74.5817°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.7	**TOPSOIL**						
3.0	**SILT WITH SAND (ML)**, trace gravel, brown, moist, loose			X	17	WH-2-5-5 N=7	
	GLACIAL TILL: SILTY SAND with GRAVEL (SM), occasional cobbles, brown to gray, moist, dense to very dense, grades to gray around 10'	5		X	18	12-15-18 N=33	
15.5		10		X	17	17-20-38 N=58	
16.5	**WEATHERED SHALE**	15		X	18	115-17-38 N=55	
	Auger Refusal at 16.5 Feet						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-20-2019	Boring Completed: 05-20-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-13

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.765° Longitude: -74.5863°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.7	**TOPSOIL**						
3.0	**SANDY SILT (ML)**, trace gravel, brown, moist, loose			X	18	WH-2-3-4 N=5	
13.0	**GLACIAL TILL: SILTY SAND with GRAVEL (SM)**, trace sand, brown, moist, medium dense to very dense	5		X	12	25-10-10 N=20	
		10		X	16	10-17-50/4"	
	Auger Refusal at 13 Feet						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-22-2019	Boring Completed: 05-22-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-14

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.7616° Longitude: -74.5857°

GRAPHIC LOG	DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
	0.7	**TOPSOIL**						
		GLACIAL TILL: SILTY SAND with GRAVEL (SM), occsional cobbles, brown, moist, loose to very dense				17	WH-1-2-3 N=3	
			5			1	50/1"	
	6.4							
		Auger Refusal at 6.4 Feet						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-22-2019	Boring Completed: 05-22-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-15

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.764° Longitude: -74.5809°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.6	**TOPSOIL**						
3.0	**GLACIAL TILL: SILTY SAND with GRAVEL (SM)**, trace gravel, rootlets and shale fragments, brown, moist, loose			X	20	WH-2-3-4 N=5	
21.5	**GLACIAL TILL: SILTY SAND with GRAVEL (SM)**, occasional cobbles and limestone fragments, brown to gray, dry to moist, dense	5		X	18	6-12-18 N=30	
		10		X	18	8-11-15 N=26	
		15		X	18	21-22-25 N=47	
		20		X	18	17-22-24 N=46	

Boring Terminated at 21.5 Feet

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-22-2019	Boring Completed: 05-22-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. B-16

PROJECT: East Point Solar Site

**CLIENT: NextEra Energy Resources LLC
Juno Beach, FL**

**SITE: US Route 20
Sharon Springs, NY**

LOCATION

Latitude: 42.7657° Longitude: -74.5774°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.5	**TOPSOIL**						
3.0	**GLACIAL TILL: SILTY SAND with GRAVEL (SM)**, trace sand and rootlets, brown, moist, loose			X	17	WH-3-3-4 N=6	
15.4	**GLACIAL TILL: SANDY SILT WITH GRAVEL (ML)**, occasional limestone fragments, brown to gray, moist to wet, dense, became gray and wet around 11'	5		X	18	12-13-17 N=30	
		10	▽	X	18	10-17-17 N=34	
		15		X	4	50/4"	

Auger Refusal at 15.4 Feet

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

▽ *Upon completion of drilling and sampling*

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-22-2019
Boring Completed: 05-22-2019
Drill Rig: Diedrich D-50
Driller: J. Lamm
Project No.: JB185149

BORING LOG NO. SS-1

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.7684° Longitude: -74.5447°

GRAPHIC LOG	DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
	0.4	**TOPSOIL**						
		GLACIAL TILL: SILTY SAND with GRAVEL (SM), brown, moist, loose to very dense			X	18	WH-2-3-5 N=5	
	5.2		5		X	1	50/2"	
		Auger Refusal at 5.2 Feet						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-24-2019	Boring Completed: 05-24-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

BORING LOG NO. SS-2

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION
Latitude: 42.7689° Longitude: -74.5441°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
0.5	**TOPSOIL**						
5.2	**GLACIAL TILL: SILTY SAND with GRAVEL (SM)**, trace rootlets, brown, moist, loose to dense			X	21	0-2-2-3 N=4 WH-2-2-3 N=4	
5.4	**WEATHERED LIMESTONE**	5		X	11	35-50/5"	
	Auger Refusal at 5.4 Feet						

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

Hammer Type: Automatic

Advancement Method:
2 1/4" HSA

Abandonment Method:

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of drilling

Terracon
594 Broadway
Watervliet, NY

Boring Started: 05-24-2019	Boring Completed: 05-24-2019
Drill Rig: Diedrich D-50	Driller: J. Lamm
Project No.: JB185149	

TEST PIT LOG NO. TP-1

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

GRAPHIC LOG	LOCATION Latitude: 42.7927° Longitude: -74.568° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
	0.3 **TOPSOIL**						
	GLACIAL TILL: SILTY SAND with gravel (SM), frequent cobbles, brown to gray, moist to wet, grades became gray around 5', cobbles became more frequent as the depth increased	5	▽				
		10					
	11.5						
	Test Pit Refusal at 11.5 Feet						

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

Advancement Method:
Flat bucket for the topsoil and bucket with teeth for the till.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.
Topsoil was separated and placed on the top layer.

Notes:

WATER LEVEL OBSERVATIONS

▽ *During the test pit excavation*

Terracon
594 Broadway
Watervliet, NY

Test Pit Started: 05-15-2019	Test Pit Completed: 05-15-2019
Excavator: Volvo EC160C	Operator: Tom Carter
Project No.: JB185149	

TEST PIT LOG NO. TP-2

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

GRAPHIC LOG	LOCATION Latitude: 42.7851° Longitude: -74.5675°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
	DEPTH						
	0.5 **TOPSOIL**						
	GLACIAL TILL: SILTY SAND with gravel (SM), frequent cobbles, brown, moist	5					
	6.9		▽				
	7.0 **BEDROCK**						
	Test Pit Refusal at 7 Feet						

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

Advancement Method:
Flat bucket for the topsoil and bucket with teeth for the till.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.
Topsoil was separated and placed on the top layer.

WATER LEVEL OBSERVATIONS

▽ *Water perched on bedrock*

Notes:

Terracon
594 Broadway
Watervliet, NY

Test Pit Started: 05-15-2019	Test Pit Completed: 05-15-2019
Excavator: Volvo EC160C	Operator: Tom Carter
Project No.: JB185149	

TEST PIT LOG NO. TP-3

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

LOCATION

Latitude: 42.7711° Longitude: -74.5506°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1.0	**TOPSOIL**						
11.5	**GLACIAL TILL: SILTY GRAVEL with SAND (GM)**, frequent cobbles, brown, moist, some perched water on the cobbles around 6', rock frags and cobbles became frequent at the end of the test pit	5, 10	▽				
11.6	**BEDROCK**						
	Test Pit Refusal at 11.5 Feet						

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

Advancement Method:
Flat bucket for the topsoil and bucket with teeth for the till.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.
Topsoil was separated and placed on the top layer.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Perched water on the large cobbles*

Terracon
594 Broadway
Watervliet, NY

Test Pit Started: 05-15-2019	Test Pit Completed: 05-15-2019
Excavator: Volvo EC160C	Operator: Tom Carter
Project No.: JB185149	

TEST PIT LOG NO. TP-4

PROJECT: East Point Solar Site

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

SITE: US Route 20
Sharon Springs, NY

GRAPHIC LOG	LOCATION Latitude: 42.771° Longitude: -74.5666° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
	0.5 **TOPSOIL**						
	5.5 **GLACIAL TILL: SILTY SAND with GRAVEL (SM)**, frequent cobbles, brown, moist	5					
	Test Pit Refusal at 5.5 Feet						

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

Advancement Method:
Flat bucket for the topsoil and bucket with teeth for the till.

Abandonment Method:
Boring backfilled with soil cuttings upon completion.
Topsoil was separated and placed on the top layer.

Notes:

WATER LEVEL OBSERVATIONS

No measurable groundwater upon completion of test pit

Terracon
594 Broadway
Watervliet, NY

Test Pit Started: 05-15-2019	Test Pit Completed: 05-15-2019
Excavator: Volvo EC160C	Operator: Tom Carter
Project No.: JB185149	

Back-filled sinkhole in soft silt area

Back-filled sinkhole in soft silt area

TP-1 looking north

TP-1 looking south

TP-1 excavation

TP-1 groundwater

TP-2 looking north

TP-2 looking east

TP-2

Bottom of TP-2 excavation on bedrock

TP-3 looking north

TP-3 looking southeast

TP-3

TP-4 looking west

TP-4 looking east

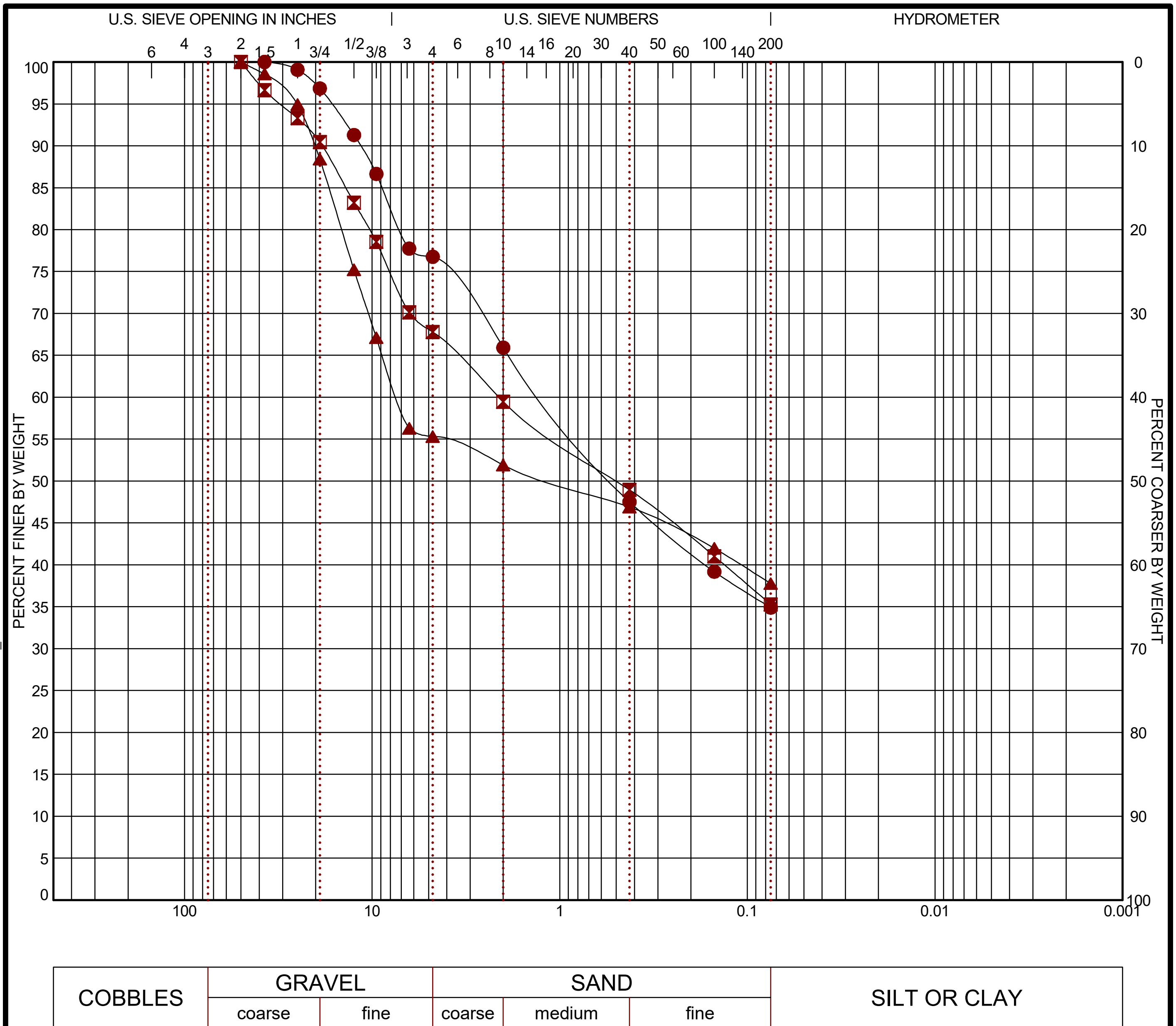
TP-4 on excavation ended on bedrock

APPENDIX B

LABORATORY TESTING

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**TP-1**	**2**	**0.0**	**23.2**	**41.9**		**34.9**		**SM**
☒	**TP-2**	**2**	**0.0**	**32.2**	**32.5**		**35.3**		**SM**
▲	**TP-3**	**2**	**0.0**	**44.7**	**17.5**		**37.8**		**GM**

	GRAIN SIZE ●	GRAIN SIZE ☒	GRAIN SIZE ▲
D_{60}	**1.216**	**2.113**	**7.294**
D_{30}			
D_{10}			
COEFFICIENTS			
C_C			
C_U			

● Sieve	● % Finer	☒ Sieve	☒ % Finer	▲ Sieve	▲ % Finer
1 1/2"	100.0	1 1/2"	100.0	1 1/2"	100.0
1"	99.07	1"	96.64	1"	98.57
3/4"	96.85	3/4"	93.29	3/4"	94.91
1/2"	91.28	1/2"	90.44	1/2"	88.39
3/8"	86.64	3/8"	83.22	3/8"	75.2
#4	77.74	#4	78.52	#4	67.09
#10	76.76	#10	70.13	#10	56.28
#40	65.91	#40	67.79	#40	55.31
#100	47.51	#100	59.47	#100	51.9
#200	39.18	#200	48.95	#200	46.9
	34.9		41.02		41.97
			35.27		37.77

SOIL DESCRIPTION

● SILTY SAND with GRAVEL (SM)

☒ SILTY SAND with GRAVEL (SM)

▲ SILTY GRAVEL with SAND (GM)

REMARKS

●

☒

▲

PROJECT: East Point Solar Site

SITE: US Route 20
Sharon Springs, NY

Terracon
594 Broadway
Watervliet, NY

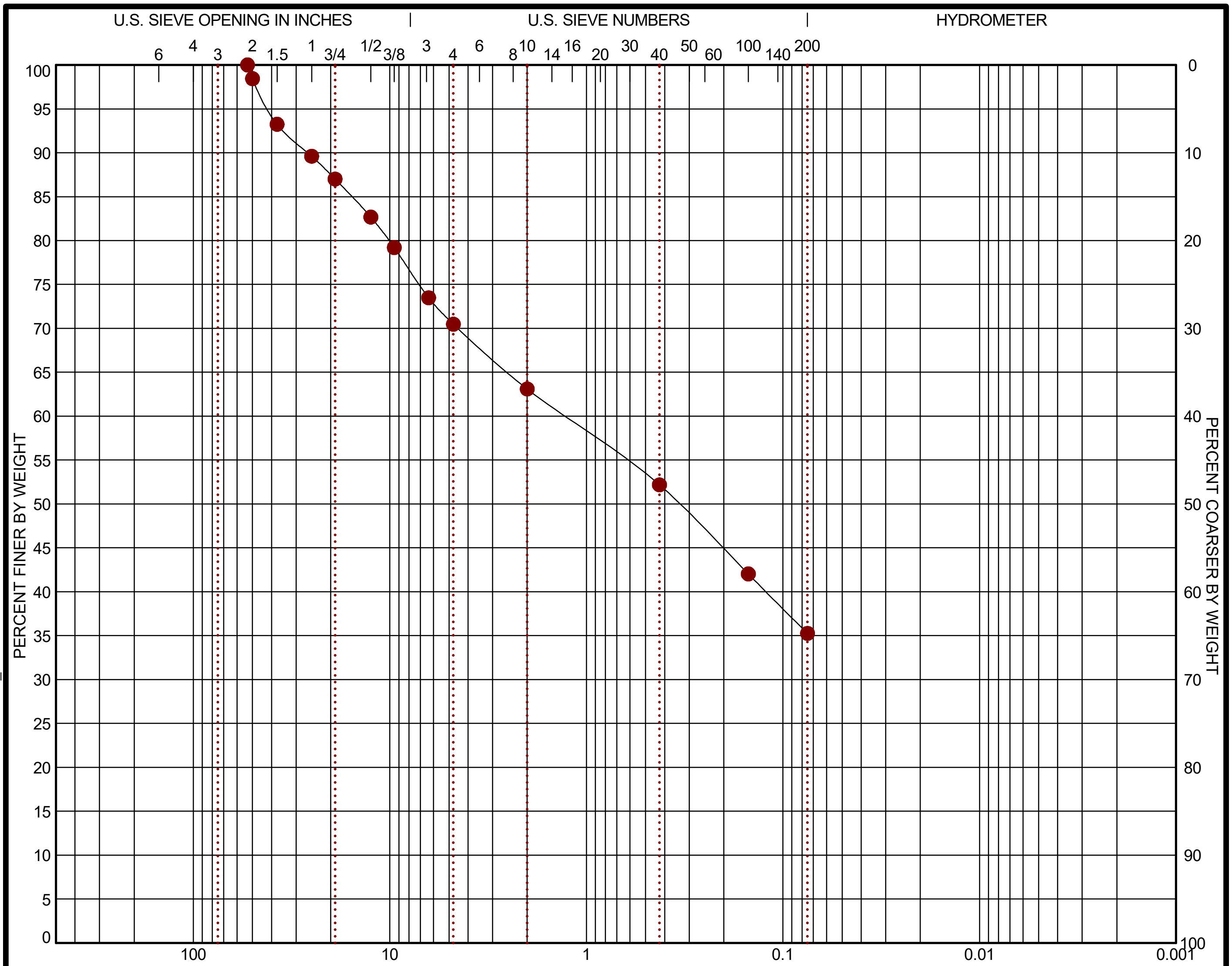
PROJECT NUMBER: JB185149

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

EXHIBIT: B-1

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
●	**TP-4**	**2**	**0.0**	**29.5**	**35.2**		**35.3**		**SM**

	GRAIN SIZE		
	●		
D_{60}	**1.29**		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_C			
C_U			

●					
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
1 1/2"	**100.0**				
1"	**98.44**				
3/4"	**93.24**				
1/2"	**89.6**				
3/8"	**87.0**				
#4	**82.67**				
#10	**79.2**				
#40	**73.48**				
#100	**70.47**				
#200	**63.09**				
	52.18				
	42.03				
	35.26				

SOIL DESCRIPTION
● SILTY SAND with GRAVEL (SM)

REMARKS
●

PROJECT: East Point Solar Site

SITE: US Route 20
Sharon Springs, NY

Terracon
594 Broadway
Watervliet, NY

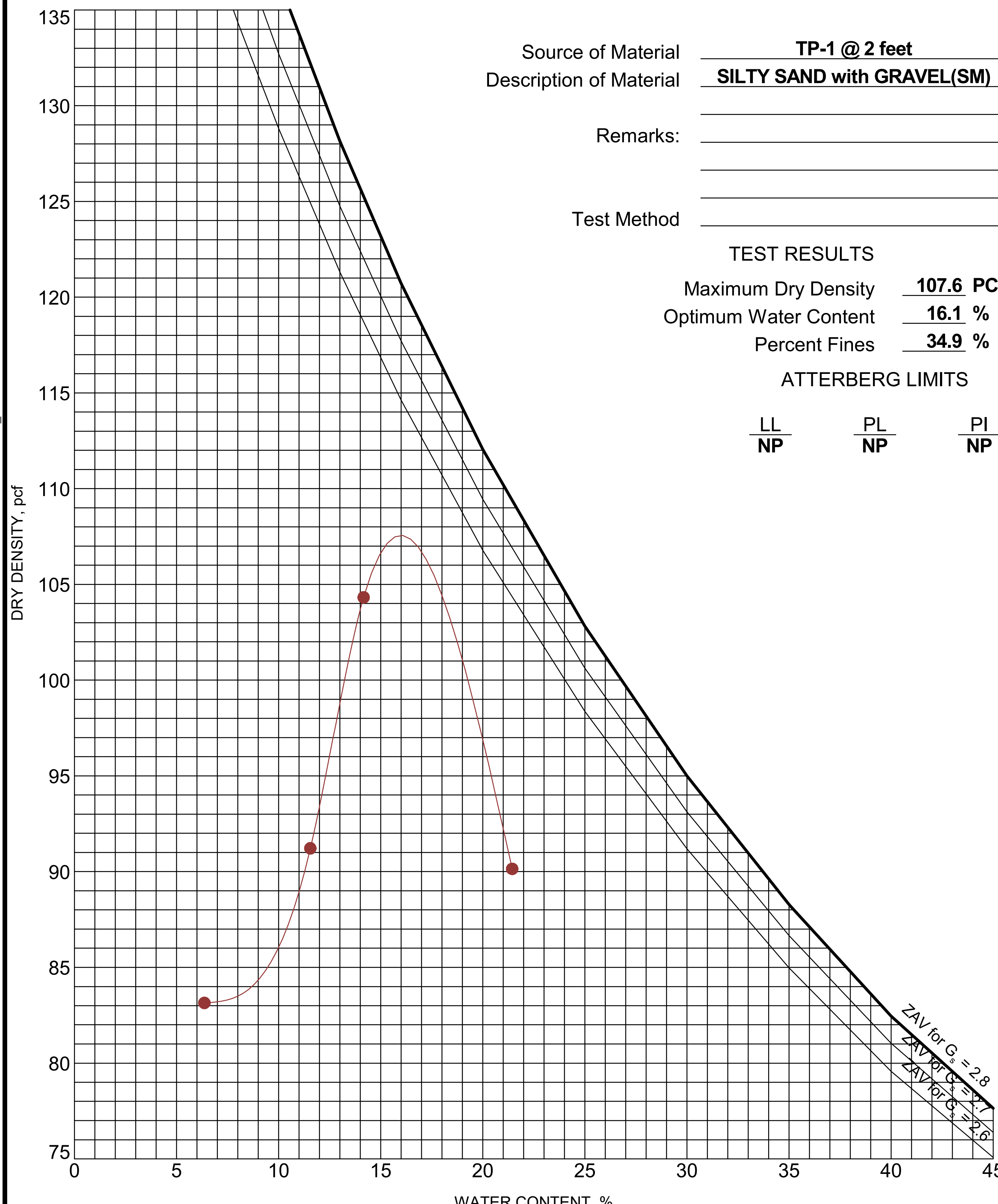
PROJECT NUMBER: JB185149

CLIENT: NextEra Energy Resources LLC
Juno Beach, FL

EXHIBIT: B-2

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **TP-1 @ 2 feet**

Description of Material: **SILTY SAND with GRAVEL(SM)**

Remarks:

Test Method

TEST RESULTS

Maximum Dry Density **107.6 PCF**

Optimum Water Content **16.1 %**

Percent Fines **34.9 %**

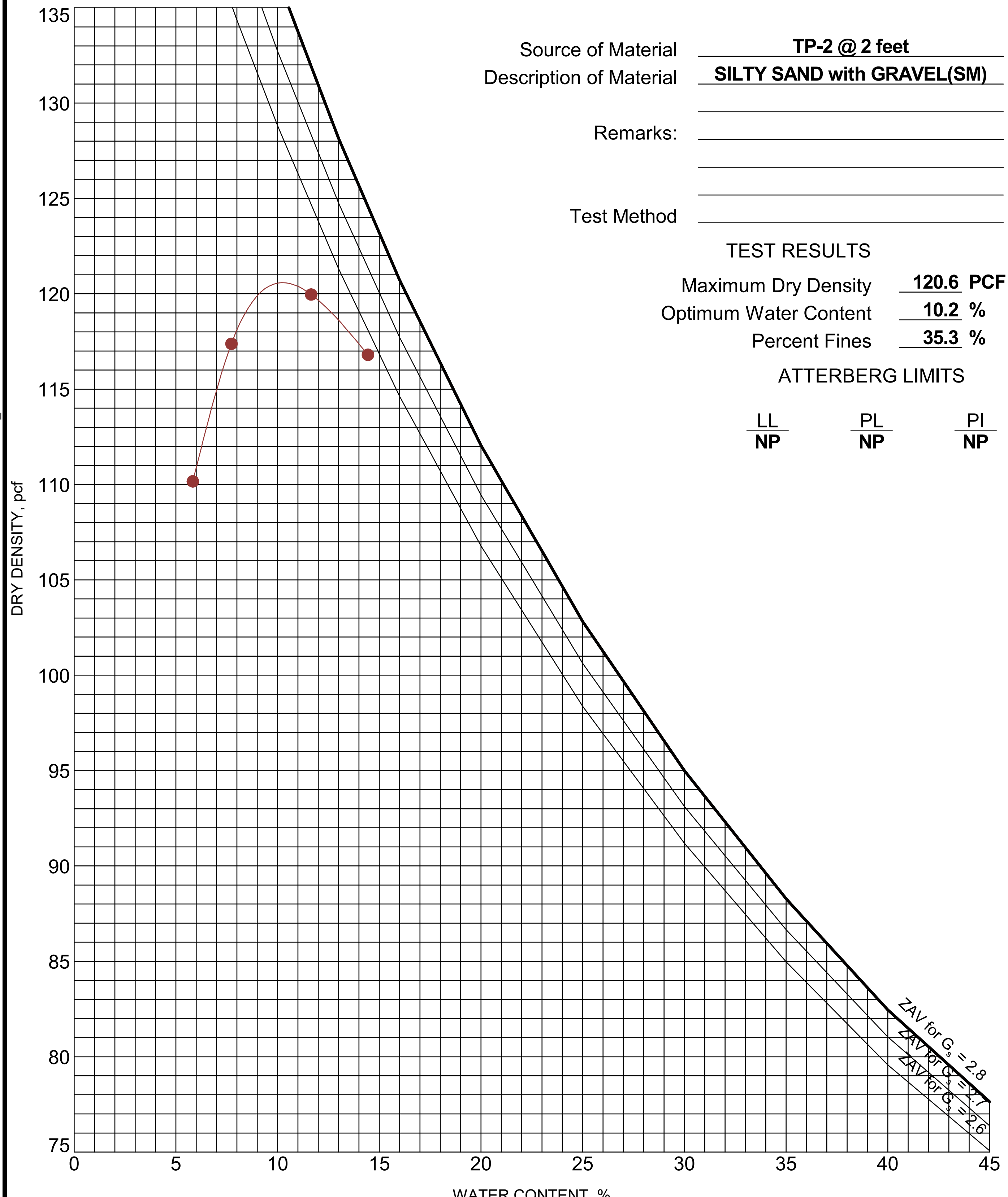
ATTERBERG LIMITS

LL	PL	PI
NP	**NP**	**NP**

PROJECT: East Point Solar Site	Terracon 594 Broadway Watervliet, NY	PROJECT NUMBER: JB185149
SITE: US Route 20 Sharon Springs, NY		CLIENT: NextEra Energy Resources LLC Juno Beach, FL
		EXHIBIT: B-1

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material	**TP-2 @ 2 feet**
Description of Material	**SILTY SAND with GRAVEL(SM)**
Remarks:	
Test Method	

TEST RESULTS

Maximum Dry Density	**120.6**	**PCF**
Optimum Water Content	**10.2**	**%**
Percent Fines	**35.3**	**%**

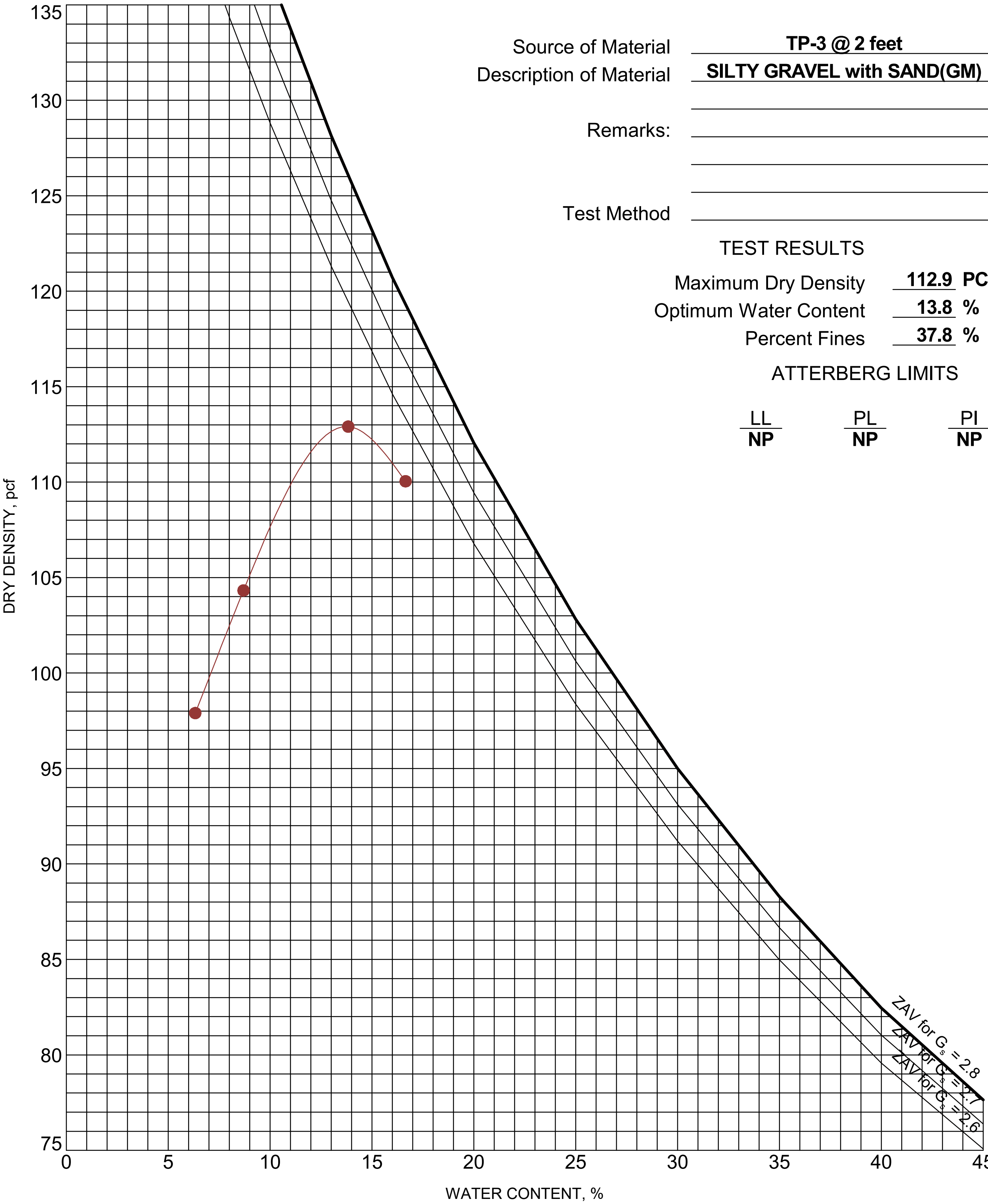
ATTERBERG LIMITS

LL	PL	PI
NP	**NP**	**NP**

PROJECT: East Point Solar Site	**Terracon** 594 Broadway Watervliet, NY	PROJECT NUMBER: JB185149
SITE: US Route 20 Sharon Springs, NY		CLIENT: NextEra Energy Resources LLC Juno Beach, FL
		EXHIBIT: B-2

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material	**TP-3 @ 2 feet**
Description of Material	**SILTY GRAVEL with SAND(GM)**
Remarks:	
Test Method	

TEST RESULTS

Maximum Dry Density	**112.9**	**PCF**
Optimum Water Content	**13.8**	**%**
Percent Fines	**37.8**	**%**

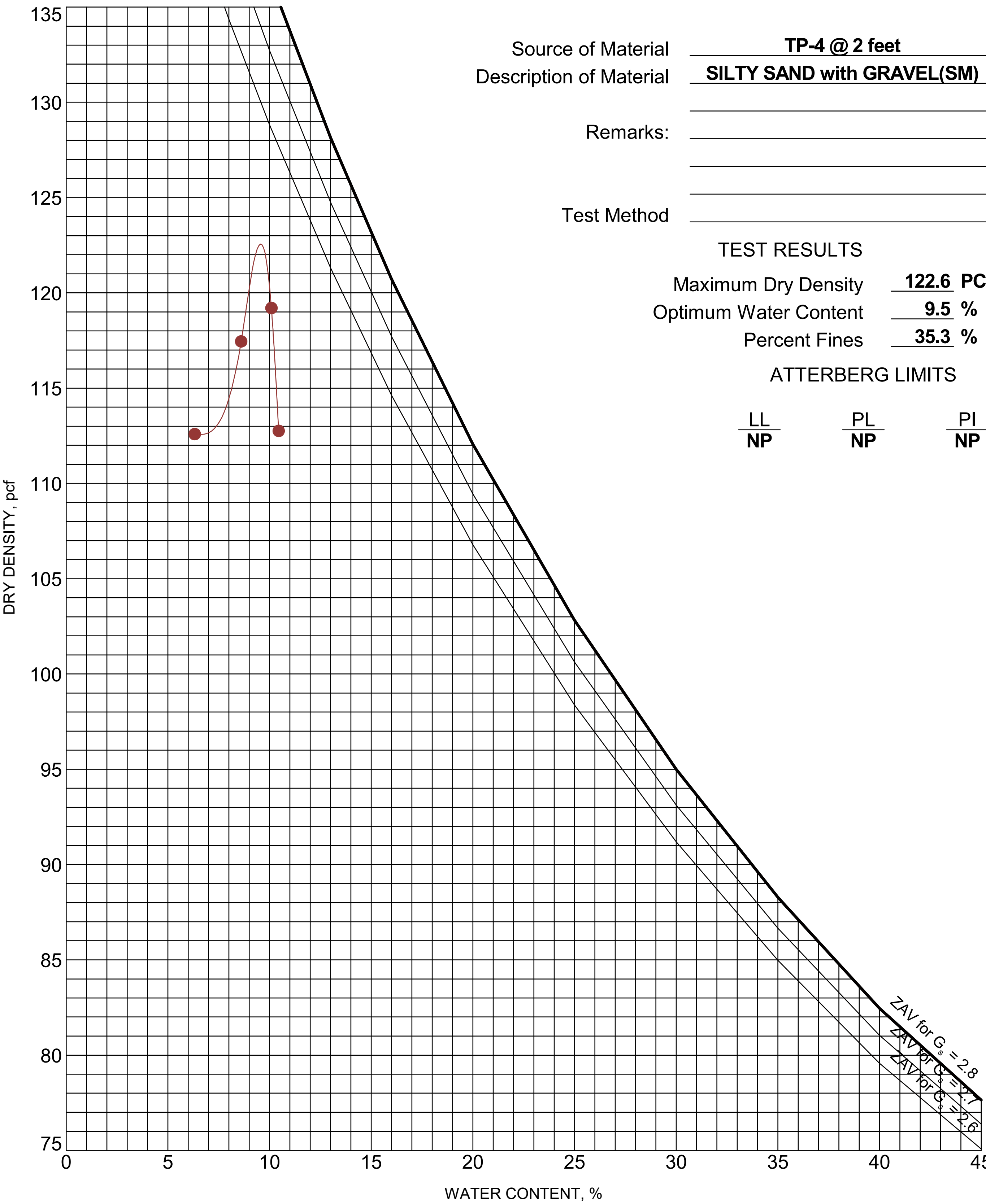
ATTERBERG LIMITS

LL	PL	PI
NP	**NP**	**NP**

PROJECT: East Point Solar Site	Terracon 594 Broadway Watervliet, NY	PROJECT NUMBER: JB185149
SITE: US Route 20 Sharon Springs, NY		CLIENT: NextEra Energy Resources LLC Juno Beach, FL
		EXHIBIT: B-3

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material	**TP-4 @ 2 feet**
Description of Material	**SILTY SAND with GRAVEL(SM)**
Remarks:	
Test Method	

TEST RESULTS

Maximum Dry Density	**122.6**	**PCF**
Optimum Water Content	**9.5**	**%**
Percent Fines	**35.3**	**%**

ATTERBERG LIMITS

LL	PL	PI
NP	**NP**	**NP**

PROJECT: East Point Solar Site	Terracon 594 Broadway Watervliet, NY	PROJECT NUMBER: JB185149
SITE: US Route 20 Sharon Springs, NY		CLIENT: NextEra Energy Resources LLC Juno Beach, FL
		EXHIBIT: B-4

CHEMICAL LABORATORY TEST REPORT

Project Number: JB185149
Service Date: 06/11/19
Report Date: 06/14/19
Task:

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client

NextEra Energy Resources LLC

Project

East Point Solar Site

Sample Submitted By: Terracon (JB) **Date Received:** 6/7/2019 **Lab No.: 19-0639**

Results of Corrosion Analysis

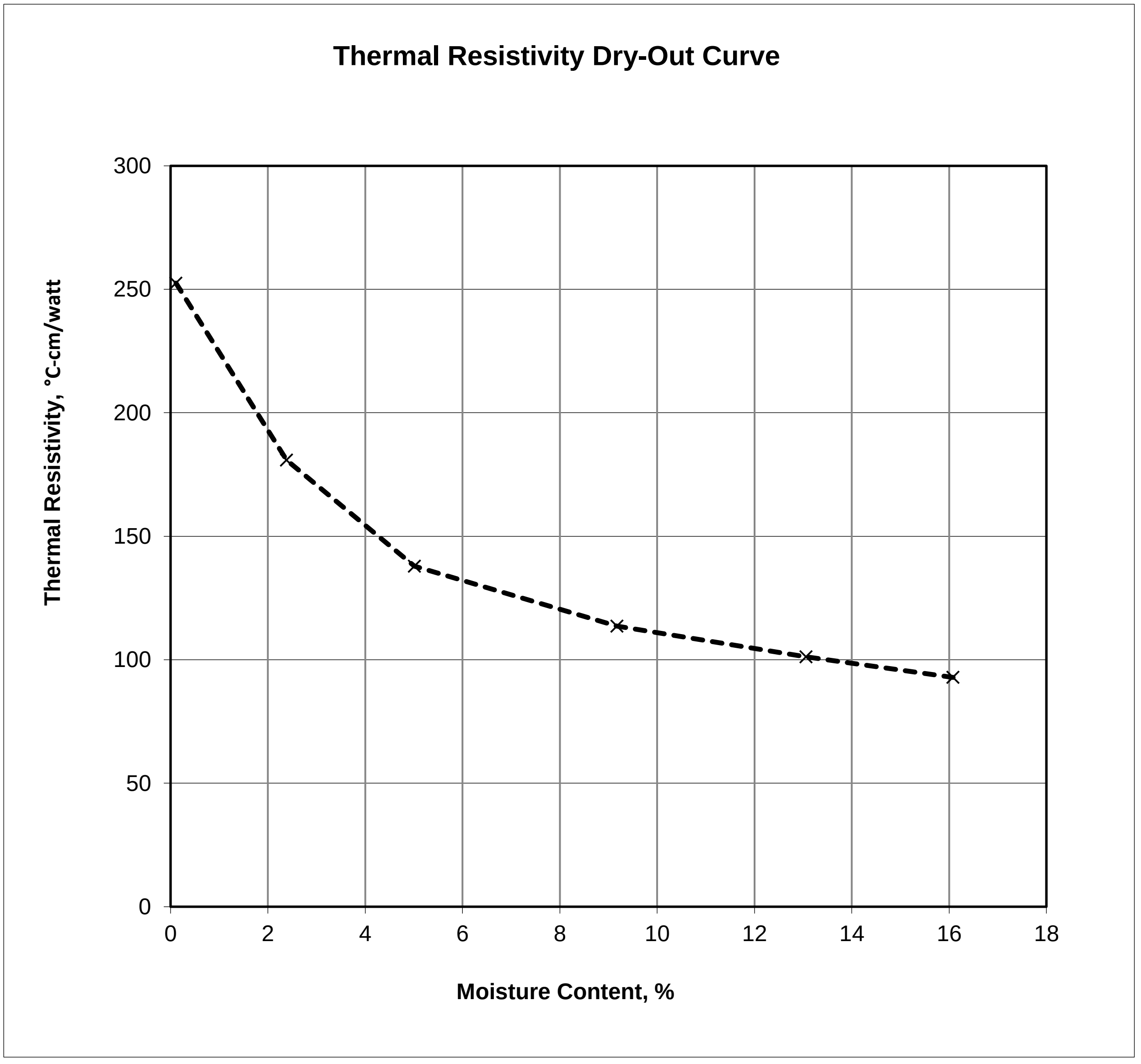
Sample Number				
Sample Location	TP-1	TP-2	TP-3	TP-4
Sample Depth (ft.)				
pH Analysis, AWWA 4500 H	7.53	8.03	7.73	6.97
Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg)	55	55	77	28
Sulfides, AWWA 4500-S D, (mg/kg)	Nil	Nil	Nil	Nil
Chlorides, ASTM D 512, (mg/kg)	30	35	32	23
Red-Ox, AWWA 2580, (mV)	+679	+684	+685	+678
Total Salts, AWWA 2540, (mg/kg)	333	516	513	185
Resistivity, ASTM G 57, (ohm-cm)	4753	6693	6014	9700

Analyzed By:

Trisha Campo
Chemist

Project Name: East Point Solar
Project Number: JB185149
Sample ID: TP-1
Soil Type: SILTY SAND WITH GRAVEL
Standard/Modified Proctor: ASTM D 698-B
Max Dry Density, pcf: 107.6
Optimum Moisture Content, %: 16.1
Target % Compaction: 90
Sample Dry Density, pcf: 97
Sample % Compaction: 90
As-received Moisture Content, %: 2.3

Thermal Resistivity Test Results		
Moisture Content (%)	Thermal Resistivity (°C-cm/watt)	Temperature (°C)
0.1	253	23.3
2.4	181	21.0
5.0	138	20.5
9.2	114	23.3
13.1	101	22.7
16.1	93	23.4

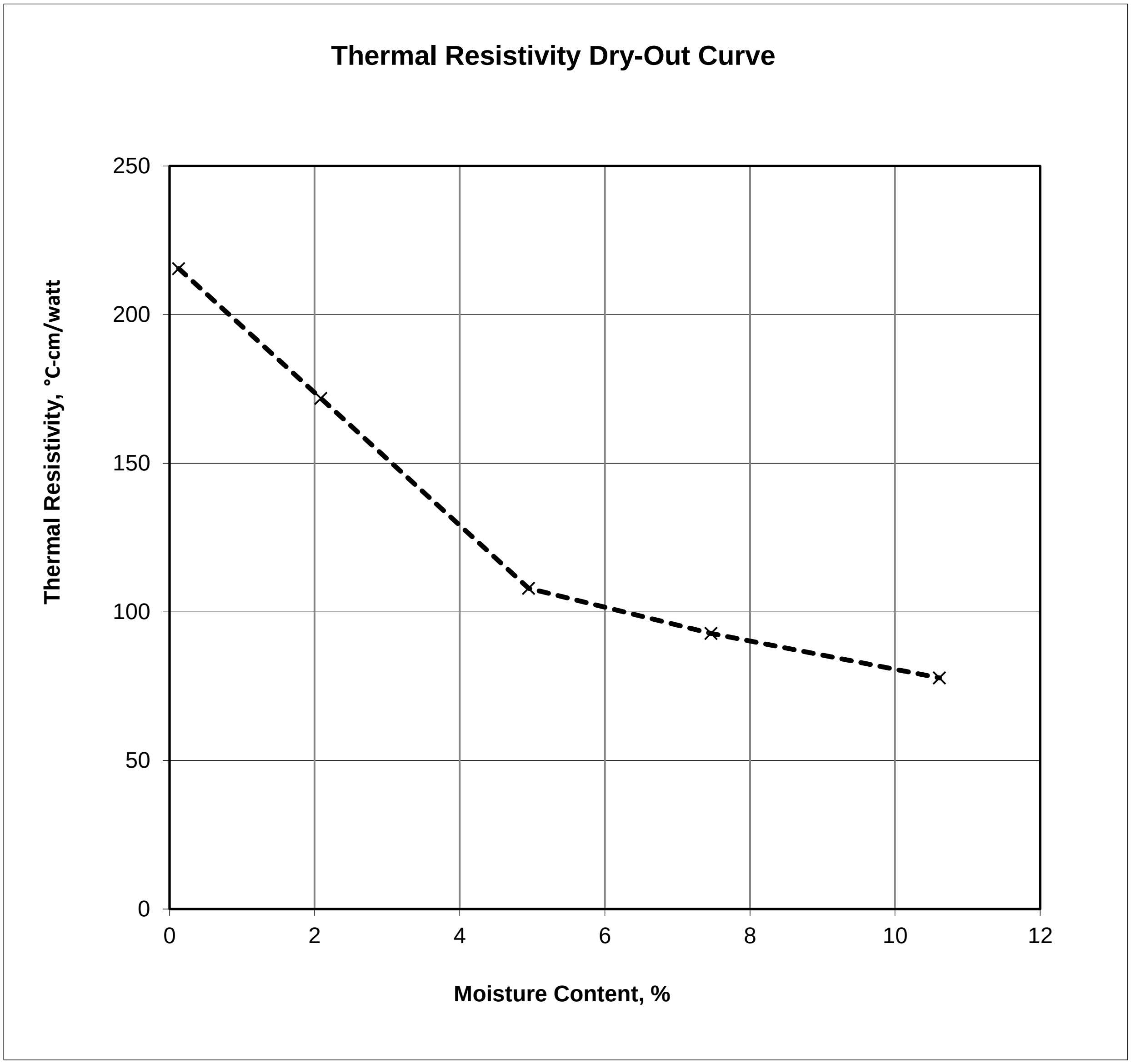


Date: 6/21/19 | Run By: AMM | Reviewed By: BWP

Terracon

Project Name: East Point Solar
Project Number: JB185149
Sample ID: TP-2
Soil Type: SILTY SAND WITH GRAVEL
Standard/Modified Proctor: ASTM D 698-B
Max Dry Density, pcf: 120.6
Optimum Moisture Content, %: 10.2
Target % Compaction: 90
Sample Dry Density, pcf: 109
Sample % Compaction: 90
As-received Moisture Content, %: 1.3

Thermal Resistivity Test Results		
Moisture Content (%)	Thermal Resistivity (°C-cm/watt)	Temperature (°C)
0.1	216	23.5
2.1	172	22.0
4.9	108	21.0
7.5	93	21.1
10.6	78	22.9



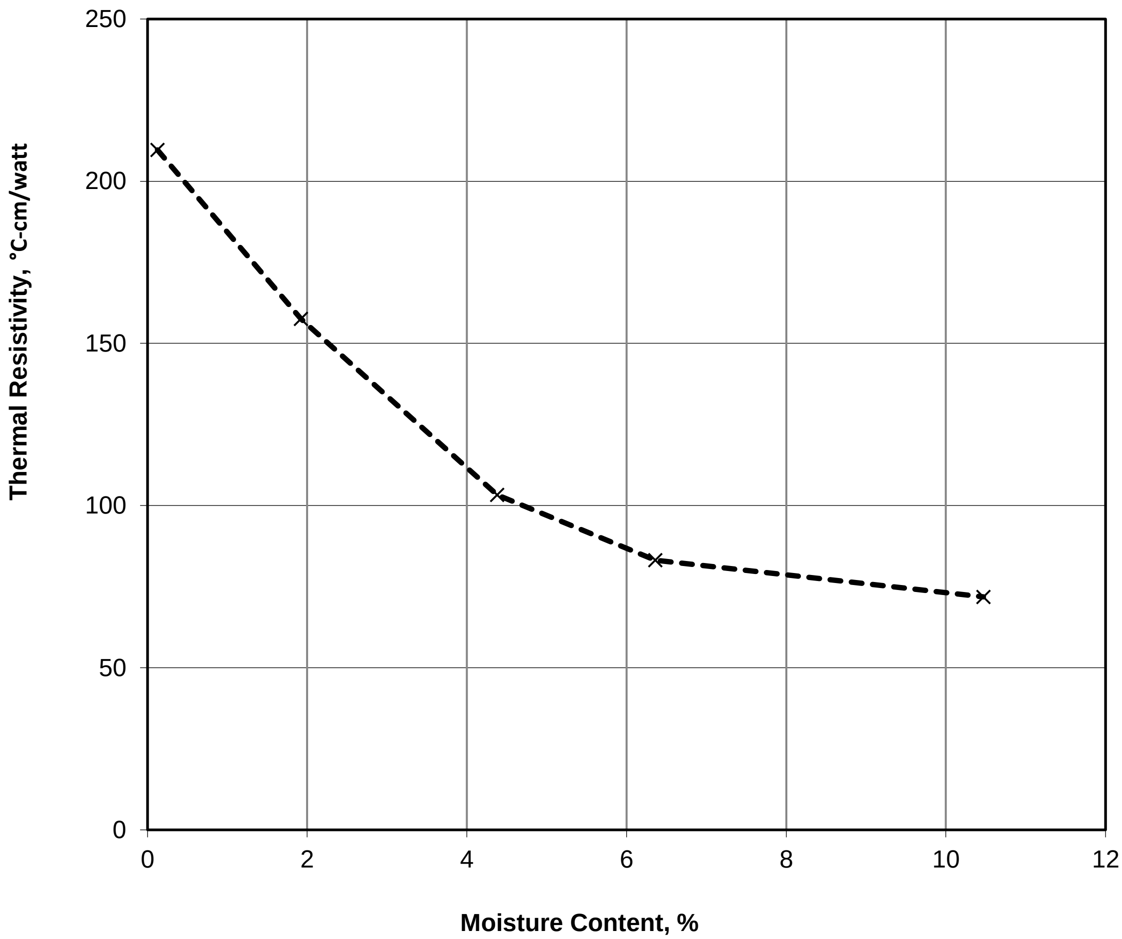
Date: 6/21/19	Run By: AMM	Reviewed By: BWP

Terracon

Project Name: East Point Solar
Project Number: JB185149
Sample ID: TP-4
Soil Type: SILTY SAND WITH GRAVEL
Standard/Modified Proctor: ASTM D 698-B
Max Dry Density, pcf: 122.6
Optimum Moisture Content, %: 9.5
Target % Compaction: 90
Sample Dry Density, pcf: 111
Sample % Compaction: 90
As-received Moisture Content, %: 1.4

Thermal Resistivity Test Results		
Moisture Content (%)	Thermal Resistivity (°C-cm/watt)	Temperature (°C)
0.1	210	22.8
1.9	157	21.6
4.4	103	21.5
6.4	83	21.5
10.5	72	22.3

Thermal Resistivity Dry-Out Curve

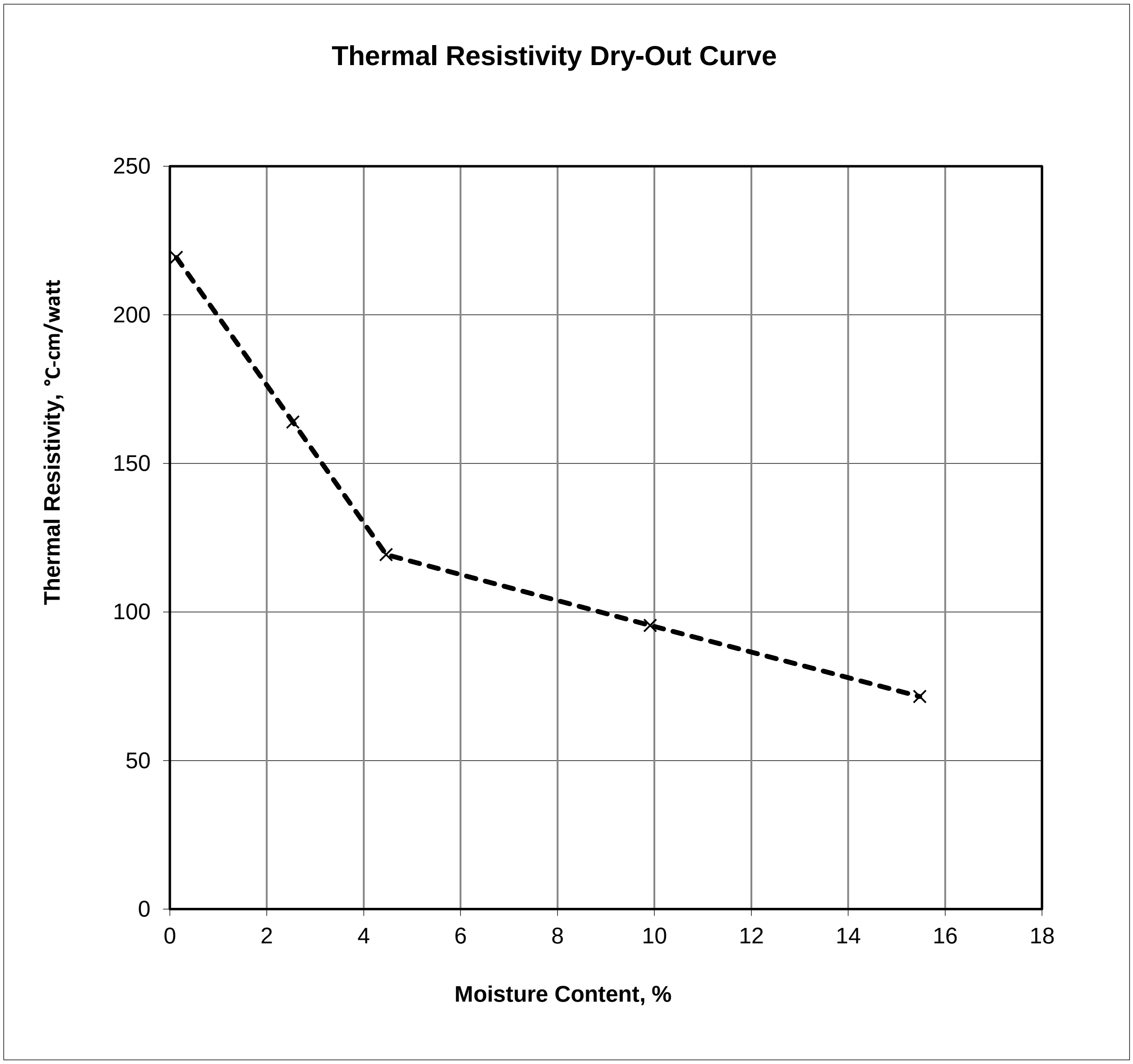


Date: 6/21/19	Run By: AMM	Reviewed By: BWP

Terracon

Project Name: East Point Solar
Project Number: JB185149
Sample ID: TP-3
Soil Type: SILTY SAND WITH GRAVEL
Standard/Modified Proctor: ASTM D 698-B
Max Dry Density, pcf: 112.9
Optimum Moisture Content, %: 13.8
Target % Compaction: 90
Sample Dry Density, pcf: 102
Sample % Compaction: 90
As-received Moisture Content, %: 2.1

Thermal Resistivity Test Results		
Moisture Content (%)	Thermal Resistivity (°C-cm/watt)	Temperature (°C)
0.1	219	22.6
2.5	164	21.2
4.5	119	21.6
9.9	96	21.0
15.5	72	22.3



Date: 6/21/19 | Run By: AMM | Reviewed By: BWP

Terracon

APPENDIX C

FIELD SOIL ELECTRICAL RESISTIVITY TEST DATA

ELECTRICAL RESISTIVITY LOCATION PLAN

East Point Solar Site ■ Sharon Springs, NY

■ Terracon Project No. JB185149

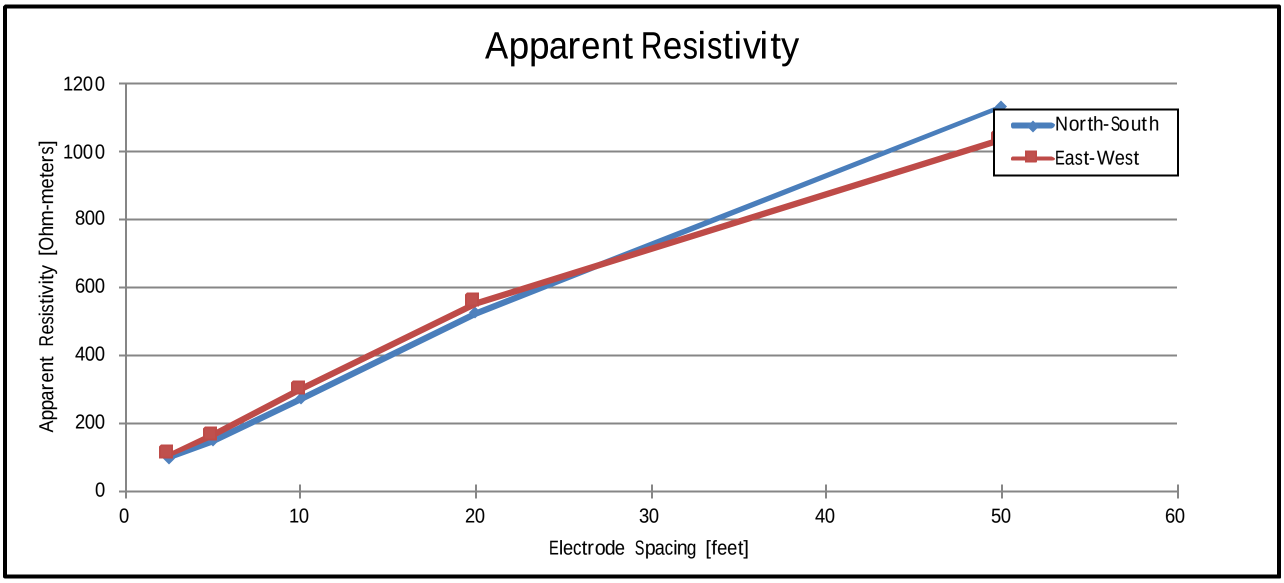
DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Field Soil Electrical Resistivity Test Data

Project	East Point Solar Site	GPS	
Location	Sharon Springs, NY	Surface Soil	Plowed Soil
Project #	JB185149	Instrument	
Test Date	5/30/2019	Test #	1

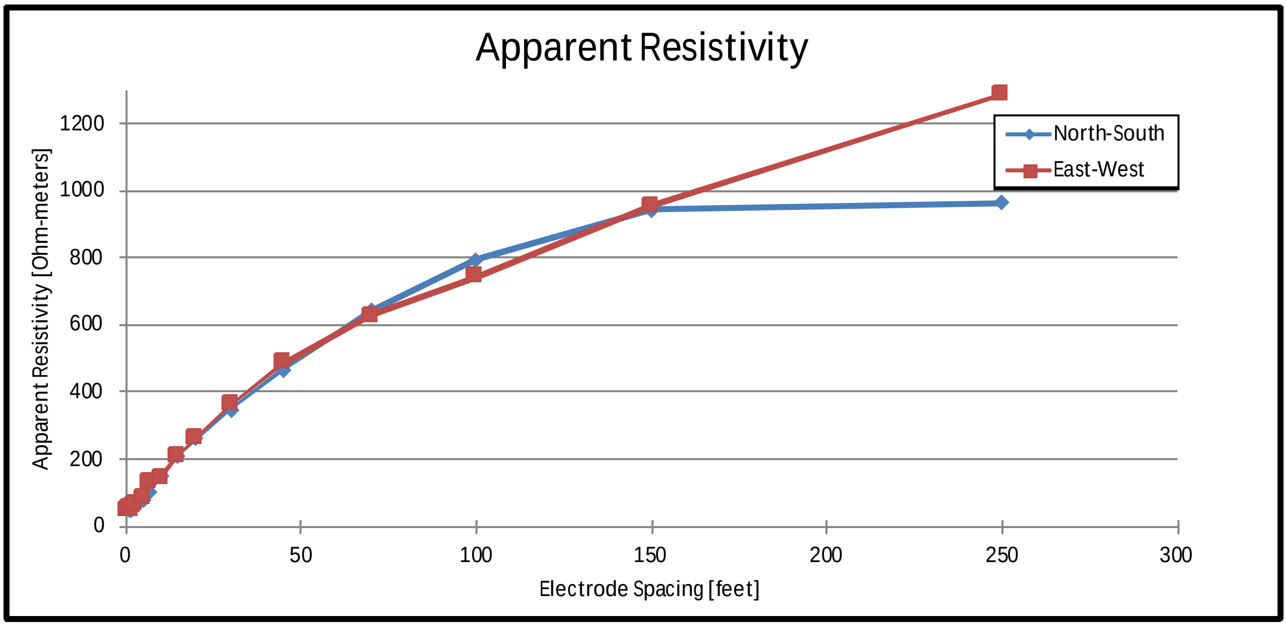
Electrode Spacing		North-South		East-West	
		Measured Resistance	Apparent Resistivity	Measured Resistance	Apparent Resistivity
[feet]	[meters]	[Ohms]	[Ohms-meters]	[Ohms]	[Ohms-meters]
2.5	0.76	20.70	99.11	22.50	107.73
5	1.52	15.36	147.10	16.89	161.77
10	3.05	14.18	271.62	15.63	299.33
20	6.10	13.76	526.92	14.46	553.70
50	15.24	11.85	1,135.09	10.83	1037.23



Field Soil Electrical Resistivity Test Data

Project	East Point Solar Site	GPS	
Location	Sharon Springs, NY	Surface Soil	Plowed Soil
Project #	JB185149	Instrument	
Test Date	5/30/2019	Test #	2

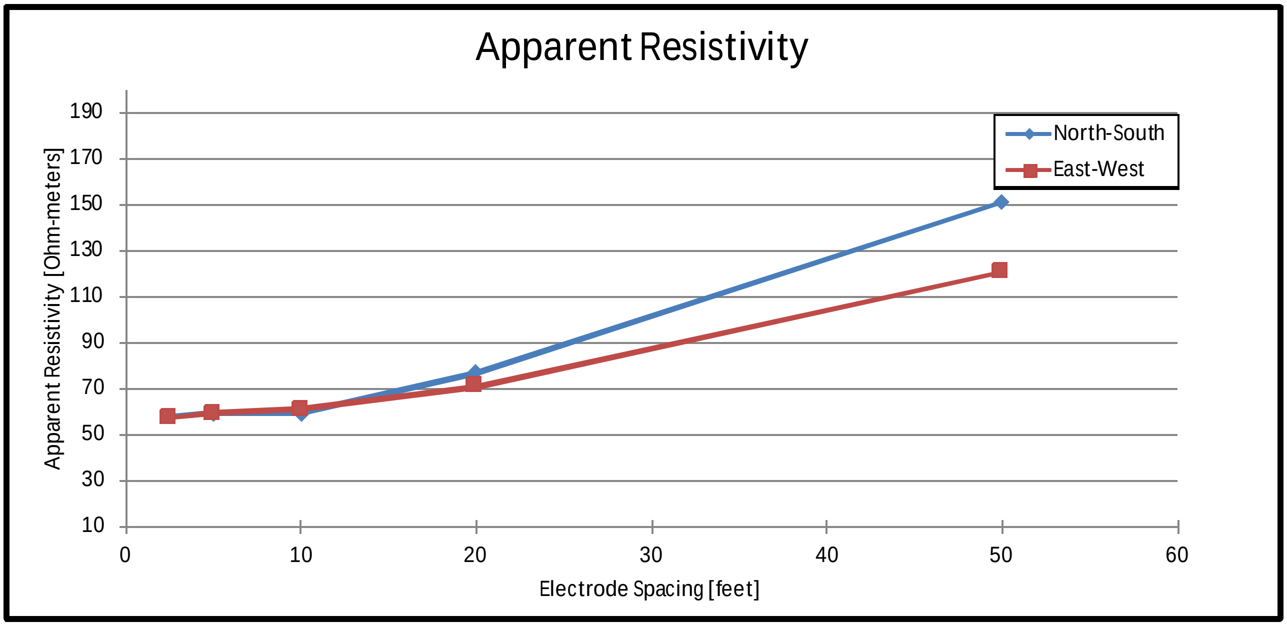
Electrode Spacing		North-South		East-West	
		Measured Resistance	Apparent Resistivity	Measured Resistance	Apparent Resistivity
[feet]	[meters]	[Ohms]	[Ohms-meters]	[Ohms]	[Ohms-meters]
0.5	0.15	64.10	61.38	48.30	46.25
1	0.30	24.80	47.49	29.00	55.54
1.5	0.46	16.62	47.75	17.55	50.40
2	0.61	14.11	54.03	15.25	58.39
3	0.91	10.79	62.00	11.77	67.62
5	1.52	8.46	80.97	8.50	81.43
7	2.13	7.64	102.45	9.79	131.20
10	3.05	7.66	146.77	7.48	143.21
15	4.57	7.36	211.31	7.30	209.82
20	6.10	6.79	260.23	6.91	264.67
30	9.14	6.05	347.65	6.29	361.55
45	13.72	5.41	466.23	5.65	486.57
70	21.34	4.79	641.47	4.67	626.45
100	30.48	4.14	793.43	3.89	744.41
150	45.72	3.29	944.25	3.33	955.45
250	76.20	2.01	962.35	2.69	1287.91



Field Soil Electrical Resistivity Test Data

Project	East Point Solar Site	GPS	
Location	Sharon Springs, NY	Surface Soil	Plowed Soil
Project #	JB185149	Instrument	
Test Date	5/30/2019	Test #	3

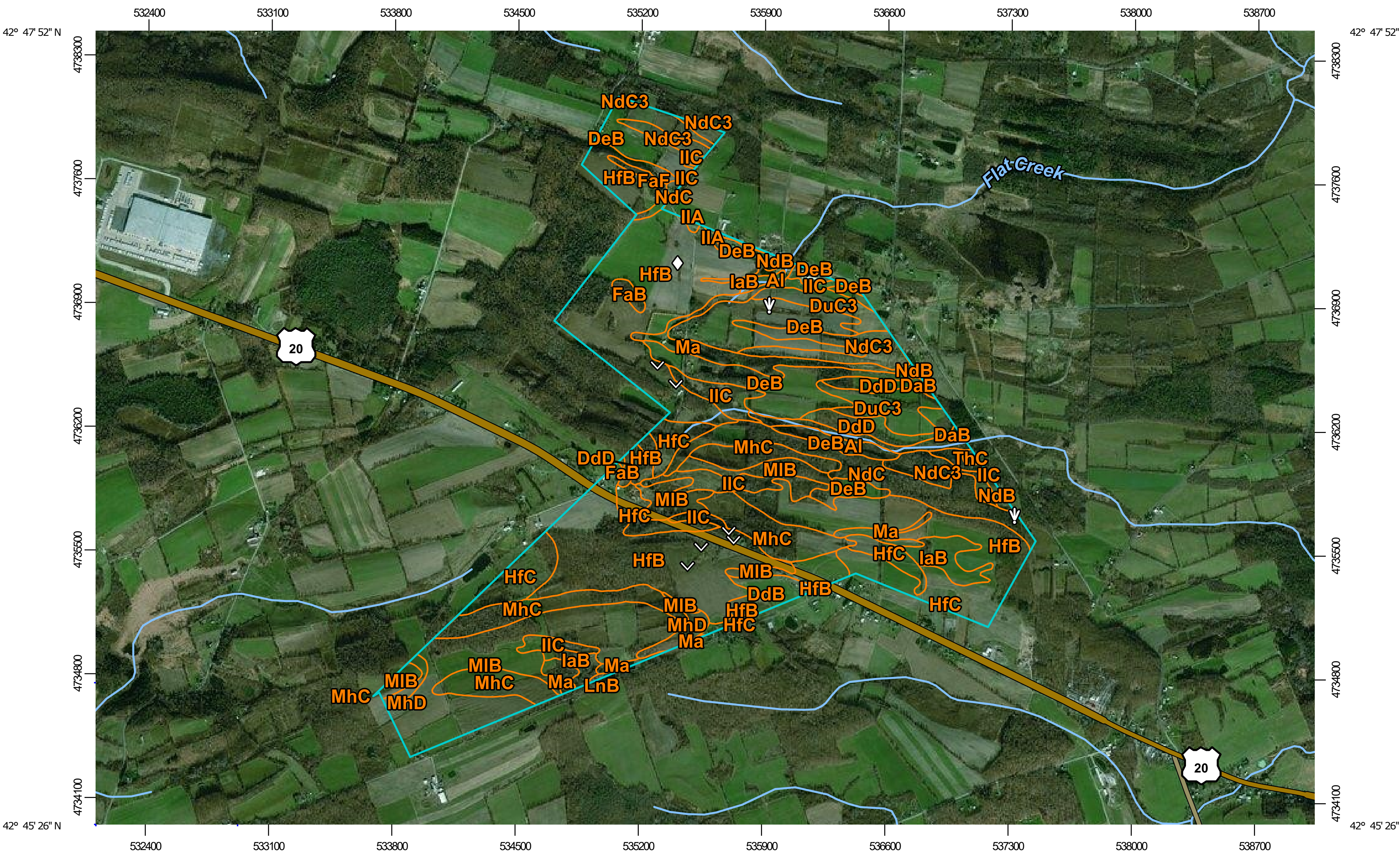
Electrode Spacing		North-South		East-West	
		Measured Resistance	Apparent Resistivity	Measured Resistance	Apparent Resistivity
[feet]	[meters]	[Ohms]	[Ohms-meters]	[Ohms]	[Ohms-meters]
2.5	0.76	12.13	58.09	11.93	57.11
5	1.52	6.16	59.02	6.16	58.97
10	3.05	3.09	59.10	3.18	60.82
20	6.10	2.01	76.83	1.84	70.63
50	15.24	1.58	150.82	1.26	120.65



APPENDIX D

Schoharie County Soils Survey Information

Soil Map—Schoharie County, New York
(Soil Map)



Map Scale: 1:31,600 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 450, 900, 1800, 2700

Feet: 0, 1500, 3000, 6000, 9000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Schoharie County, New York
Survey Area Data: Version 15, Sep 3, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 23, 2014—Sep 23, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Al	Alluvial land	16.3	1.2%
DaB	Darien channery silt loam, 2 to 8 percent slopes	1.4	0.1%
DdB	Darien silt loam, gently undulating, 2 to 8 percent slopes	17.2	1.3%
DdD	Darien silt loam, undulating, 15 to 25 percent slopes	33.4	2.5%
DeB	Darien silt loam, 2 to 8 percent slopes	162.0	12.1%
DuC3	Darien silty clay loam, undulating, 8 to 15 percent slopes, eroded	43.8	3.3%
FaB	Farmington very rocky silt loam, 0 to 10 percent slopes	4.3	0.3%
FaF	Farmington very rocky silt loam, 10 to 70 percent slopes	6.3	0.5%
HfB	Honeoye-Farmington complex, 2 to 10 percent slopes	427.4	32.0%
HfC	Honeoye-Farmington complex, 10 to 20 percent slopes	67.1	5.0%
IaB	Ilion and Appleton soils, 3 to 8 percent slopes	30.3	2.3%
IlA	Ilion and Lyons soils, 0 to 3 percent slopes	1.7	0.1%
IlC	Ilion and Lyons silt loams, 3 to 15 percent slopes	49.0	3.7%
LdB	Lakemont and Madalin silty clay loams, 2 to 6 percent slopes	4.3	0.3%
LnB	Lordstown silt loam, 0 to 8 percent slopes	0.8	0.1%
Ma	Madalin silt loam, over till	44.2	3.3%
MhC	Mohawk and Honeoye soils, 10 to 20 percent slopes	109.1	8.2%
MhD	Mohawk and Honeoye soils, 20 to 30 percent slopes	13.7	1.0%
MlB	Mohawk and Lima soils, 2 to 10 percent slopes	178.0	13.3%
NdB	Nunda channery silt loam, 3 to 10 percent slopes	4.6	0.3%
NdC	Nunda channery silt loam, 10 to 20 percent slopes	62.3	4.7%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
NdC3	Nunda channery silt loam, 10 to 20 percent slopes, eroded	58.1	4.3%
ThC	Tunkhannock and Chenango gravelly silt loams, 5 to 15 percent simple slopes	1.5	0.1%
Totals for Area of Interest		**1,336.9**	**100.0%**

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Some minor components, however, have properties and behavior characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description

Schoharie County, New York

Al—Alluvial land

Map Unit Setting

National map unit symbol: 9wdb
Elevation: 100 to 3,000 feet

Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Fluvaquents and similar soils: 40 percent
Udifluvents and similar soils: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fluvaquents

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium with highly variable texture

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 72 inches: gravelly silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 19.98 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Description of Udifluvents

Setting

Landform: Flood plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium with a wide range of texture

Typical profile

H1 - 0 to 4 inches: gravelly loam
H2 - 4 to 70 inches: gravelly loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 19.98 in/hr)
Depth to water table: About 24 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Wayland

Percent of map unit: 5 percent
Landform: Flood plains
Hydric soil rating: Yes

Tioga

Percent of map unit: 5 percent
Hydric soil rating: No

Muck and peat

Percent of map unit: 5 percent
Landform: Swamps, marshes
Hydric soil rating: Yes

Halsey

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Middlebury

Percent of map unit: 5 percent
Hydric soil rating: No

DaB—Darien channery silt loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9wdy
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Darien and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Darien

Setting

Landform: Drumlinoid ridges, hills, till plains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till derived predominantly from calcareous gray shale

Typical profile

H1 - 0 to 7 inches: channery silt loam
H2 - 7 to 9 inches: channery silt loam
H3 - 9 to 34 inches: channery silty clay loam
H4 - 34 to 60 inches: channery clay loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Madalin

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Nunda

Percent of map unit: 5 percent
Hydric soil rating: No

Burdett

Percent of map unit: 5 percent
Hydric soil rating: No

Ilion

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Lyons

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

DdB—Darien silt loam, gently undulating, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9wf1
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Darien and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Darien

Setting

Landform: Drumlinoid ridges, hills, till plains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till derived predominantly from calcareous gray shale

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 9 inches: silt loam
H3 - 9 to 34 inches: silty clay loam
H4 - 34 to 60 inches: channery clay loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Nunda

Percent of map unit: 5 percent
Hydric soil rating: No

Burdett

Percent of map unit: 5 percent
Hydric soil rating: No

Appleton

Percent of map unit: 5 percent
Hydric soil rating: No

Ilion

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Lyons

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

DdD—Darien silt loam, undulating, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 9wf3
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Darien and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Darien

Setting

Landform: Drumlinoid ridges, hills, till plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till derived predominantly from calcareous gray shale

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 9 inches: silt loam
H3 - 9 to 34 inches: silty clay loam
H4 - 34 to 60 inches: channery clay loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Ilion

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Madalin

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Lyons

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Burdett

Percent of map unit: 5 percent

Hydric soil rating: No

Honeoye

Percent of map unit: 5 percent
Hydric soil rating: No

DeB—Darien silt loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9wf4
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Darien and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Darien

Setting

Landform: Drumlinoid ridges, hills, till plains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till derived predominantly from calcareous gray shale

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 9 inches: silt loam
H3 - 9 to 34 inches: silty clay loam
H4 - 34 to 60 inches: channery clay loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Ilion
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Nunda
Percent of map unit: 5 percent
Hydric soil rating: No

Lyons
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Burdett
Percent of map unit: 5 percent
Hydric soil rating: No

Madalin
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

DuC3—Darien silty clay loam, undulating, 8 to 15 percent slopes, eroded

Map Unit Setting
National map unit symbol: 9wf7
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition
Darien and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Darien

Setting
Landform: Drumlinoid ridges, hills, till plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till derived predominantly from calcareous gray shale

Typical profile

H1 - 0 to 7 inches: silty clay loam
H2 - 7 to 32 inches: silty clay loam
H3 - 32 to 60 inches: channery clay loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 4 to 16 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Langford

Percent of map unit: 5 percent
Hydric soil rating: No

Nunda

Percent of map unit: 5 percent
Hydric soil rating: No

Burdett

Percent of map unit: 5 percent
Hydric soil rating: No

Lyons

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Ilion

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

FaB—Farmington very rocky silt loam, 0 to 10 percent slopes

Map Unit Setting

National map unit symbol: 9wf8
Elevation: 100 to 900 feet
Mean annual precipitation: 34 to 43 inches

Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Farmington and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Farmington

Setting

Landform: Benches, ridges, till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till or congeliturbate derived from limestone, dolomite, shale, and sandstone, and in many places mixed with wind and water deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 20 inches: silt loam
H3 - 20 to 24 inches: unweathered bedrock

Properties and qualities

Slope: 0 to 10 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Honeoye

Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Hydric soil rating: Unranked

Mohawk

Percent of map unit: 5 percent
Hydric soil rating: No

Langford

Percent of map unit: 5 percent
Hydric soil rating: No

Appleton

Percent of map unit: 5 percent
Hydric soil rating: No

FaF—Farmington very rocky silt loam, 10 to 70 percent slopes

Map Unit Setting

National map unit symbol: 9wf9
Elevation: 100 to 900 feet
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Farmington and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Farmington

Setting

Landform: Benches, ridges, till plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till or congeliturbate derived from limestone, dolomite, shale, and sandstone, and in many places mixed with wind and water deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 20 inches: silt loam
H3 - 20 to 24 inches: unweathered bedrock

Properties and qualities

Slope: 10 to 70 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Rock outcrop
Percent of map unit: 5 percent
Hydric soil rating: Unranked

Appleton
Percent of map unit: 5 percent
Hydric soil rating: No

Honeoye
Percent of map unit: 5 percent
Hydric soil rating: No

Mohawk
Percent of map unit: 5 percent
Hydric soil rating: No

Lansing
Percent of map unit: 5 percent
Hydric soil rating: No

HfB—Honeoye-Farmington complex, 2 to 10 percent slopes

Map Unit Setting
National map unit symbol: 2w3nz
Elevation: 260 to 1,780 feet
Mean annual precipitation: 31 to 57 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 100 to 190 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Honeoye and similar soils: 50 percent
Farmington and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Honeoye

Setting
Landform: Till plains, ridges, drumlins

Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous loamy lodgment till derived from limestone, sandstone, and shale

Typical profile

Ap - 0 to 8 inches: silt loam
E - 8 to 10 inches: silt loam
Bt/E - 10 to 14 inches: loam
Bt1 - 14 to 23 inches: loam
Bt2 - 23 to 29 inches: gravelly loam
C - 29 to 79 inches: gravelly loam

Properties and qualities

Slope: 2 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Farmington

Setting

Landform: Drumlins, hills, till plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till or congeliturbate derived from limestone, dolomite, shale, and sandstone, and in many places mixed with wind and water deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 20 inches: silt loam
H3 - 20 to 24 inches: unweathered bedrock

Properties and qualities

Slope: 2 to 10 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock

Natural drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Lima

Percent of map unit: 7 percent
Landform: Drumlins, ridges, till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Lansing

Percent of map unit: 5 percent
Landform: Hills, till plains, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Appleton

Percent of map unit: 5 percent
Landform: Drumlins, ridges, till plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Wassaic

Percent of map unit: 3 percent
Landform: Till plains, benches, ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

HfC—Honeoye-Farmington complex, 10 to 20 percent slopes

Map Unit Setting

National map unit symbol: 2w3p4
Elevation: 380 to 1,840 feet
Mean annual precipitation: 31 to 57 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 100 to 190 days
Farmland classification: Not prime farmland

Map Unit Composition

Honeoye and similar soils: 50 percent
Farmington and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Honeoye

Setting

Landform: Till plains, ridges, drumlins
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous loamy lodgment till derived from limestone, sandstone, and shale

Typical profile

Ap - 0 to 8 inches: silt loam
E - 8 to 10 inches: silt loam
Bt/E - 10 to 14 inches: loam
Bt1 - 14 to 23 inches: loam
Bt2 - 23 to 29 inches: gravelly loam
C - 29 to 79 inches: gravelly loam

Properties and qualities

Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B
Hydric soil rating: No

Description of Farmington

Setting

Landform: Drumlins, hills, till plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till or congeliturbate derived from limestone, dolomite, shale, and sandstone, and in many places mixed with wind and water deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 20 inches: silt loam
H3 - 20 to 24 inches: unweathered bedrock

Properties and qualities

Slope: 10 to 20 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Lima

Percent of map unit: 7 percent
Landform: Ridges, till plains, drumlins
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Lansing

Percent of map unit: 7 percent
Landform: Drumlins, hills, till plains
Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Appleton

Percent of map unit: 3 percent
Landform: Drumlins, ridges, till plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Wassaic

Percent of map unit: 3 percent
Landform: Till plains, benches, ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

IaB—Ilion and Appleton soils, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w5hv
Elevation: 800 to 1,640 feet
Mean annual precipitation: 31 to 57 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 100 to 190 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ilion and similar soils: 40 percent
Appleton and similar soils: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ilion

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy till derived from calcareous dark shale

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 17 inches: silt loam

H3 - 17 to 34 inches: silty clay loam
H4 - 34 to 60 inches: silty clay loam

Properties and qualities
Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Description of Appleton

Setting
Landform: Drumlins, ridges, till plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Calcareous loamy lodgment till derived from limestone, sandstone, and shale

Typical profile
Ap - 0 to 8 inches: silt loam
E - 8 to 16 inches: loam
Bt - 16 to 30 inches: gravelly silt loam
C1 - 30 to 54 inches: gravelly loam
C2 - 54 to 79 inches: gravelly loam

Properties and qualities
Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups
Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Conesus

Percent of map unit: 9 percent
Landform: Hills, till plains, drumlins
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Lyons

Percent of map unit: 6 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Churchville

Percent of map unit: 5 percent
Landform: Lake plains, till plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, rise, talf
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Darien

Percent of map unit: 5 percent
Landform: Drainageways, till plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

IIA—Ilion and Lyons soils, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2trww
Elevation: 1,120 to 1,570 feet
Mean annual precipitation: 31 to 57 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 100 to 190 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ilion and similar soils: 40 percent
Lyons and similar soils: 35 percent
Lyons, frequently ponded, and similar soils: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ilion

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy till derived from calcareous dark shale

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 17 inches: silt loam
H3 - 17 to 34 inches: silty clay loam
H4 - 34 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Description of Lyons

Setting

Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Calcareous loamy lodgment till derived from limestone and shale

Typical profile

Ap - 0 to 10 inches: silt loam
Bg1 - 10 to 19 inches: silt loam
Bg2 - 19 to 25 inches: silty clay loam
BCg - 25 to 34 inches: gravelly silt loam
C - 34 to 79 inches: gravelly loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Available water storage in profile: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Description of Lyons, Frequently Ponded

Setting

Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Calcareous loamy lodgment till derived from limestone and shale

Typical profile

Ap - 0 to 10 inches: mucky silt loam
Bg1 - 10 to 19 inches: silt loam
Bg2 - 19 to 25 inches: silty clay loam
BCg - 25 to 34 inches: gravelly silt loam
C - 34 to 79 inches: gravelly loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None

Frequency of ponding: Frequent
Calcium carbonate, maximum in profile: 40 percent
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Appleton

Percent of map unit: 4 percent
Landform: Till plains, drumlins
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Palms

Percent of map unit: 3 percent
Landform: Swamps, marshes
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Burdett

Percent of map unit: 3 percent
Landform: Till plains, drumlinoid ridges, hills
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

IlC—Ilion and Lyons silt loams, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9wfl
Elevation: 300 to 1,800 feet
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ilion and similar soils: 40 percent
Lyons and similar soils: 35 percent
Minor components: 25 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ilion

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy till derived from calcareous dark shale

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 17 inches: silt loam
H3 - 17 to 34 inches: silty clay loam
H4 - 34 to 60 inches: silty clay loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Rare
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Description of Lyons

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Calcareous loamy till derived from limestone, calcareous shale, and sandstone, with a mantle of silty glaciolacustrine deposits in some places

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 18 inches: fine sandy loam
H3 - 18 to 32 inches: gravelly silt loam
H4 - 32 to 60 inches: gravelly silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Rare
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Madalin

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Peat and muck

Percent of map unit: 5 percent
Landform: Swamps, marshes
Hydric soil rating: Yes

Burdett

Percent of map unit: 5 percent
Hydric soil rating: No

Darien

Percent of map unit: 5 percent
Hydric soil rating: No

Appleton

Percent of map unit: 5 percent
Hydric soil rating: No

LdB—Lakemont and Madalin silty clay loams, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 9wfn
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Lakemont and similar soils: 40 percent
Madalin and similar soils: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lakemont

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Reddish clayey and silty glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: silty clay loam
H2 - 8 to 11 inches: silty clay loam
H3 - 11 to 42 inches: silty clay
H4 - 42 to 60 inches: silty clay

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.02 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Description of Madalin

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Clayey and silty glaciolacustrine deposits

Typical profile

H1 - 0 to 6 inches: silty clay loam

H2 - 6 to 30 inches: silty clay
H3 - 30 to 60 inches: stratified silty clay to silt loam to very fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Ilion

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Peat and muck

Percent of map unit: 5 percent
Landform: Marshes, swamps
Hydric soil rating: Yes

Rhinebeck

Percent of map unit: 5 percent
Hydric soil rating: No

Middlebury

Percent of map unit: 5 percent
Hydric soil rating: No

Odessa

Percent of map unit: 5 percent
Hydric soil rating: No

LnB—Lordstown silt loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2wzmj
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Lordstown and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lordstown

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Mountaintop, interfluve, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till derived from shale and siltstone

Typical profile

Ap - 0 to 7 inches: silt loam
Bw1 - 7 to 17 inches: silt loam
Bw2 - 17 to 26 inches: silt loam
C - 26 to 30 inches: silt loam
2R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 0 to 8 percent
Percent of area covered with surface fragments: 0.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Nassau

Percent of map unit: 5 percent
Landform: Benches, ridges, till plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Orpark

Percent of map unit: 5 percent
Landform: Till plains, benches, ridges
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ma—Madalin silt loam, over till

Map Unit Setting

National map unit symbol: 9wg2
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Madalin, till substratum, and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Madalin, Till Substratum

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Clayey and silty glaciolacustrine deposits

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 30 inches: silty clay
H3 - 30 to 60 inches: gravelly silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Halsey

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Rhinebeck

Percent of map unit: 5 percent
Hydric soil rating: No

Darien

Percent of map unit: 5 percent
Hydric soil rating: No

Middlebury

Percent of map unit: 5 percent
Hydric soil rating: No

Ilion

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

MhC—Mohawk and Honeoye soils, 10 to 20 percent slopes

Map Unit Setting

National map unit symbol: 2w3p5
Elevation: 380 to 1,840 feet
Mean annual precipitation: 31 to 57 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 100 to 190 days
Farmland classification: Not prime farmland

Map Unit Composition

Mohawk and similar soils: 40 percent
Honeoye and similar soils: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mohawk

Setting

Landform: Drumlinoid ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope

Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till that is generally calcareous, derived mainly from black soft shale

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 12 inches: silt loam
H3 - 12 to 41 inches: silty clay loam
H4 - 41 to 60 inches: cobbly silt loam

Properties and qualities

Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Honeoye

Setting

Landform: Drumlins, till plains, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous loamy lodgment till derived from limestone, sandstone, and shale

Typical profile

Ap - 0 to 8 inches: silt loam
E - 8 to 10 inches: silt loam
Bt/E - 10 to 14 inches: loam
Bt1 - 14 to 23 inches: loam
Bt2 - 23 to 29 inches: gravelly loam
C - 29 to 79 inches: gravelly loam

Properties and qualities

Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Appleton

Percent of map unit: 7 percent
Landform: Till plains, drumlins, ridges
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Lansing

Percent of map unit: 7 percent
Landform: Till plains, drumlins, hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Lima

Percent of map unit: 7 percent
Landform: Drumlins, ridges, till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Wassaic

Percent of map unit: 4 percent
Landform: Ridges, till plains, benches
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

MhD—Mohawk and Honeoye soils, 20 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2w3p9
Elevation: 360 to 1,990 feet
Mean annual precipitation: 31 to 57 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 100 to 190 days
Farmland classification: Not prime farmland

Map Unit Composition

Mohawk and similar soils: 40 percent
Honeoye and similar soils: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mohawk

Setting

Landform: Drumlinoid ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till that is generally calcareous, derived mainly from black soft shale

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 12 inches: silt loam
H3 - 12 to 41 inches: silty clay loam
H4 - 41 to 60 inches: cobbly silt loam

Properties and qualities

Slope: 20 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Honeoye

Setting

Landform: Drumlins, till plains, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous loamy lodgment till derived from limestone, sandstone, and shale

Typical profile

Ap - 0 to 8 inches: silt loam
E - 8 to 10 inches: silt loam
Bt/E - 10 to 14 inches: loam
Bt1 - 14 to 23 inches: loam
Bt2 - 23 to 29 inches: gravelly loam
C - 29 to 79 inches: gravelly loam

Properties and qualities

Slope: 20 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Farmington

Percent of map unit: 7 percent
Landform: Hills, till plains, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Lansing

Percent of map unit: 7 percent
Landform: Drumlins, hills, till plains
Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Nunda

Percent of map unit: 6 percent
Landform: Drumlins, hills, till plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Appleton

Percent of map unit: 5 percent
Landform: Till plains, drumlins, ridges
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

MIB—Mohawk and Lima soils, 2 to 10 percent slopes

Map Unit Setting

National map unit symbol: 2w3kj
Elevation: 740 to 1,640 feet
Mean annual precipitation: 31 to 57 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 100 to 190 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Mohawk and similar soils: 40 percent
Lima and similar soils: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mohawk

Setting

Landform: Hills, drumlinoid ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till that is generally calcareous, derived mainly from black soft shale

Typical profile

H1 - 0 to 6 inches: silt loam

H2 - 6 to 12 inches: silt loam
H3 - 12 to 41 inches: silty clay loam
H4 - 41 to 60 inches: cobbly silt loam

Properties and qualities

Slope: 2 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 1.98 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B/D
Hydric soil rating: No

Description of Lima

Setting

Landform: Drumlins, ridges, till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Calcareous loamy lodgment till derived from limestone, sandstone, and shale

Typical profile

Ap - 0 to 9 inches: silt loam
Bt/E - 9 to 12 inches: loam
Bt1 - 12 to 16 inches: loam
Bt2 - 16 to 25 inches: gravelly loam
C - 25 to 79 inches: gravelly loam

Properties and qualities

Slope: 2 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Available water storage in profile: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Appleton

Percent of map unit: 9 percent
Landform: Drumlins, ridges, till plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Honeoye

Percent of map unit: 9 percent
Landform: Drumlins, till plains, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Nunda

Percent of map unit: 5 percent
Landform: Hills, drumlinoid ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Lyons

Percent of map unit: 2 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

NdB—Nunda channery silt loam, 3 to 10 percent slopes

Map Unit Setting

National map unit symbol: 9wgs
Elevation: 400 to 1,600 feet
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Nunda and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nunda

Setting

Landform: Hills, till plains, drumlinoid ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: A silty mantle over loamy till derived from calcareous shale and siltstone

Typical profile

H1 - 0 to 8 inches: channery silt loam
H2 - 8 to 16 inches: channery silt loam
H3 - 16 to 35 inches: channery clay loam
H4 - 35 to 60 inches: channery loam

Properties and qualities

Slope: 3 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 15 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Erie

Percent of map unit: 5 percent
Hydric soil rating: No

Langford

Percent of map unit: 5 percent
Hydric soil rating: No

Darien

Percent of map unit: 5 percent

Hydric soil rating: No

Lansing

Percent of map unit: 5 percent
Hydric soil rating: No

Burdett

Percent of map unit: 5 percent
Hydric soil rating: No

NdC—Nunda channery silt loam, 10 to 20 percent slopes

Map Unit Setting

National map unit symbol: 9wgt
Elevation: 400 to 1,600 feet
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Nunda and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nunda

Setting

Landform: Drumlinoid ridges, hills, till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: A silty mantle over loamy till derived from calcareous shale and siltstone

Typical profile

H1 - 0 to 8 inches: channery silt loam
H2 - 8 to 16 inches: channery silt loam
H3 - 16 to 35 inches: channery clay loam
H4 - 35 to 60 inches: channery loam

Properties and qualities

Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 15 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent

Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Erie

Percent of map unit: 5 percent
Hydric soil rating: No

Burdett

Percent of map unit: 5 percent
Hydric soil rating: No

Langford

Percent of map unit: 5 percent
Hydric soil rating: No

Darien

Percent of map unit: 5 percent
Hydric soil rating: No

Lansing

Percent of map unit: 5 percent
Hydric soil rating: No

NdC3—Nunda channery silt loam, 10 to 20 percent slopes, eroded

Map Unit Setting

National map unit symbol: 9wgv
Elevation: 400 to 1,600 feet
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Nunda and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nunda

Setting

Landform: Hills, till plains, drumlinoid ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Concave

Across-slope shape: Convex
Parent material: A silty mantle over loamy till derived from calcareous shale and siltstone

Typical profile

H1 - 0 to 8 inches: channery silt loam
H2 - 8 to 12 inches: channery silt loam
H3 - 12 to 31 inches: channery clay loam
H4 - 31 to 60 inches: channery loam

Properties and qualities

Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 15 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Lansing

Percent of map unit: 5 percent
Hydric soil rating: No

Erie

Percent of map unit: 5 percent
Hydric soil rating: No

Langford

Percent of map unit: 5 percent
Hydric soil rating: No

Darien

Percent of map unit: 5 percent
Hydric soil rating: No

Burdett

Percent of map unit: 5 percent
Hydric soil rating: No

ThC—Tunkhannock and Chenango gravelly silt loams, 5 to 15 percent simple slopes

Map Unit Setting

National map unit symbol: 9wht

Elevation: 600 to 2,000 feet
Mean annual precipitation: 34 to 43 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Tunkhannock and similar soils: 45 percent
Chenango and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tunkhannock

Setting

Landform: Valley trains, terraces
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Gravelly loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits, derived mainly from reddish sandstone, siltstone, and shale

Typical profile

H1 - 0 to 5 inches: gravelly silt loam
H2 - 5 to 21 inches: gravelly silt loam
H3 - 21 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Chenango

Setting

Landform: Valley trains, terraces
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex

Across-slope shape: Convex
Parent material: Gravelly loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits, derived mainly from sandstone, shale, and siltstone

Typical profile

H1 - 0 to 8 inches: gravelly silt loam
H2 - 8 to 17 inches: gravelly silt loam
H3 - 17 to 22 inches: very gravelly sandy loam
H4 - 22 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Red hook

Percent of map unit: 5 percent
Hydric soil rating: No

Phelps

Percent of map unit: 5 percent
Hydric soil rating: No

Fredon

Percent of map unit: 5 percent
Hydric soil rating: No

Barbour

Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Schoharie County, New York
Survey Area Data: Version 15, Sep 3, 2018