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CONSTRUCTION MANAGEMENT

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VIA EMAIL

October 2, 2023
File No. 01.0177169.10

New Leaf Energy, Inc.
55 Technology Drive, Suite 102
Lowell, Massachusetts 01851

Attn: Lydia Lake, Brandon Smith

Re: Geotechnical Report
Proposed Wind Turbine
4949 Forest Avenue
Oneida, New York

Lydia and Brandon:

In accordance with our agreement executed on August 21, 2023, GZA GeoEnvironmental of New York (GZA) is pleased to present this geotechnical engineering report to New Leaf Energy (NLE; Client) for the above-referenced project. The objectives of our work were to evaluate subsurface conditions, conduct laboratory analysis of soil and rock samples, and develop geotechnical recommendations for design and construction of the proposed wind turbine system for the project team. We anticipate wind turbine foundation design will be performed by a proprietary wind turbine supplier based on this geotechnical report.

This report is subject to the *Limitations* outlined in **Appendix A** and the Terms and Conditions of our agreement.

BACKGROUND

This geotechnical report was prepared as part of our geotechnical engineering services for the site located at 4949 Forest Avenue, Oneida, New York (site). Our understanding of the project was based on:

- Correspondence with the NLE project team;
- Online aerial photography;
- Publicly available soil maps from the United States Department of Agriculture (USDA);
- Natural Resources Conservation Service (NCRS) online data;
- A Site Walk Checklist Photo Log of the site prepared by NLE;
- A plan entitled “Layout and Materials Plan – Sheet C-3.0”, prepared by New Leaf Energy, dated February 9, 2023; and
- Our May 3, 2023 letter addressing the geological considerations at the site and providing a review of publicly available geological maps (attached as **Appendix B**).

Existing Conditions

The site consists of mostly wooded land with areas of open farmland/overgrown previously-cleared land. The proposed development will be located within the existing unwooded portions.

The site can be accessed from an unpaved road that branches off from Forest Avenue to the south. The site is generally bounded by wooded land to the north, east and southeast, and open farm fields to the southwest and west, an overhead electrical transmission line further to the southeast, and by Forest Avenue to the south.

We understand that the presence of karst bedrock formations are well documented in this area of New York. We also understand that local water supply wells depend on the water within the bedrock aquifer that potentially flows through Karst formations. Nearby property owners have expressed concerns regarding the Site's geology and the potential groundwater impacts to springs and wells caused by the construction of the wind turbine foundations.

Proposed Conditions

Based on the plan, one wind turbine is proposed at the northern area of the site. The turbine will be located in a previously cleared area with overgrown vegetation. Based on publicly available aerial survey data, the ground surface elevation at the turbine location ranges from approximately 1247 feet to the west and 1255 feet to the east (WGS84 vertical datum). We understand that the eastern portion will be cut about 8 to 10 feet to match the lower elevation of the western portion of the turbine foundation. The proposed foundation for the wind turbine is not shown on the plans; however, based on our experience with similar wind turbine projects, we anticipate the foundation will consist of a reinforced concrete pad buried below the surface with a concrete pedestal extending to the ground surface where the turbine shaft will connect with a bolted connection.

The turbine area will be accessed by permanent gravel paved access road that approximately follows the alignment of the existing unpaved road that connects to Forest Ave to the south. We anticipate that portions of the existing unpaved road will be improved and widened as part of the development/construction. Temporary gravel construction laydown areas, access roads, and crane pads are proposed near the wind turbine location. Permanent electrical equipment pads are likely proposed in the area of the temporary crane pads.

SCOPE OF SERVICES

To meet the stated objectives, GZA performed the following Scope of Services:

- Coordinated, performed, and documented an exploration program consisting of 3 days of test borings;
- Conducted field electrical resistivity (ER) testing;
- Performed laboratory gradation testing on two soil samples; resistivity/corrosivity testing was performed on one composite soil sample; and unconfined compression testing was performed on two bedrock core samples;
- Evaluated subsurface conditions based on the explorations and laboratory results to develop geotechnical design and construction recommendations; and
- Prepared this report summarizing our analyses and recommendations.

SUBSURFACE EXPLORATIONS

Test Borings

GZA engaged Geosearch, Inc. of Sterling, Massachusetts to perform six (6) test borings (GZ-1 through GZ-6) from September 5 to September 7, 2023 at the proposed wind turbine location and gravel access roadway. Borings GZ-1 and GZ-2 were drilled at the proposed turbine location to depths of 70 and 40 feet below ground surface (bgs), respectively. Borings GZ-3 through GZ-6 were drilled to depths of up to 4.8 feet bgs along the proposed gravel roadway (to split-spoon sampler refusal). The borings were advanced with a track-mounted drilling rig using drive-and-wash drilling techniques.

Standard Penetration Tests (SPTs) with split-spoon samples were generally performed continuously at each of the borings through the overburden soil until split spoon refusal near the top of weathered bedrock or just into sound bedrock. Approximately 65 feet and 30 feet of NX-size rock core was obtained from borings GZ-1 and GZ-2, respectively, to confirm the type and quality of bedrock. Borings GZ-3 through GZ-6 were advanced until split spoon refusal was encountered within weathered bedrock at depths generally less than 4.8 feet bgs. An observation monitoring well was installed in boring GZ-2 upon completion of drilling. The portion of the borehole below the well was backfilled with bentonite clay chips. Please refer to the test boring logs for more information on the well construction. Upon completion, boring GZ-1 was backfilled with low slump grout within the depth of bedrock. Drill cuttings and bentonite chips were backfilled in the borehole from the top of bedrock to ground surface.

A GZA representative observed the test borings, classified the soil and rock samples based on the Modified Burmister Soil Classification System and the International Society for Rock Mechanics (ISRM) Rock Classification System, respectively, and prepared the boring logs attached as **Appendix C**. Photos of the test boring split spoon samples are shown in **Appendix D** and rock core photos from the test borings are shown in **Appendix E**. A handheld GPS unit was used to locate the borings in the field following completion. Refer to **Figure 1** for an exploration location plan depicting approximate exploration locations and a table of exploration coordinates obtained using the handheld GPS unit.

Field Electrical Resistivity Testing

Field electrical resistivity (ER) testing was performed by GZA field personnel on September 6, 2022, with an AMEC 6470-B tester using the Wenner Four-Electrode Method consistent with IEEE 81 and ASTM G57. The survey was conducted along two perpendicular lines (approximately North-South and East-West) within the general vicinity of the proposed wind turbine, as shown on **Figure 1**.

To perform the testing, four electrode probes were driven into the ground along a straight line at equal spacing. A current was applied across the outer two probes and the voltage was measured across the inner two probes. The apparent soil resistivity was calculated based on the distance between the probes, the applied current, and the measured voltage. The measurement depth was approximately equal to the distance between the probes; greater probe spacing provides deeper resistivity measurements. Readings were taken with spacings of 2.7, 5, 10, 20, 30, 40, 75, and 100 feet. The values recorded for each spacing included measured current (mA), measured voltage (mV), measured resistance (Ohms), and apparent resistivity (Ohm-cm). Testing information, measurement data, and ambient site conditions are provided in **Appendix F.**

Note that Field ER test values vary depending on factors including, but not limited to, soil density variation; the presence of coarse gravel, cobbles, and boulders; frost; temperature; and precipitation. Field ER values should be compared to published values for the apparent soil type encountered in the area of the test.

LABORATORY ANALYSES

GZA coordinated geotechnical laboratory testing on select soil samples collected from the site. The testing included gradation testing on two soil samples, and two unconfined compression tests on bedrock core samples. These laboratory test results are included in **Appendix G**.

Corrosivity Testing

One composite soil sample from the test borings was evaluated for corrosivity using a suite of tests. The results from the corrosivity tests are summarized in the Summary of Laboratory Corrosivity Testing table below. Based on the parameters presented in the Comparison of Corrosivity Testing Results table below, steel piles or below grade exposed steel components on this site are not considered to be particularly susceptible to corrosion. Laboratory test results for corrosivity analyses are included in **Appendix H**.

Summary of Laboratory Corrosion Testing	
Resistivity	0.006 Mohm-cm (6,000 ohm-cm)
Sulfate	292 mg/kg
Sulfide	Not Detected
Chloride	Not Detected
Redox Potential	204 mv
pH	7.68

Comparison of Corrosion Testing Results				
Parameter	Corrosive Based on Corrosivity Criteria[1]			Corrosive Based on Laboratory Results Compared to Corrosivity Criteria?
	CalTrans	AASHTO	FHWA	
Electrical Resistivity (ohm-cm)	Below 1,000 ohm-cm	Below 2,000 ohm-cm	Below 3,000 ohm-cm	No
pH	Below 5.5	Below 5.5; or Between 5.5 and 8.5 for organic soils	Below 5 and above 10	No
Sulfate (ppm)	Above 2,000 ppm	Above 1,000 ppm	Above 200 ppm	Yes; based on FHWA Criteria.
Chloride (ppm)	Above 500 ppm	No Criteria	Above 100 ppm	No

SUBSURFACE CONDITIONS

Soil

Based on GZA's test borings, subsurface conditions generally consist of Silt & Clay over Weathered Bedrock and Bedrock. Discussions of subsurface conditions provided below are based on conditions observed within the test borings performed by GZA. Refer to the exploration logs attached in **Appendix C** for detailed subsurface conditions at specific boring locations. The depths, thicknesses, and elevations referenced herein should be considered approximate.

Silt and Clay – Silt and Clay was encountered in each test boring from ground surface to between 0.9 and to 2.5 feet bgs. This stratum was observed to consist of brown Silt and Clay, with a visual estimate (based on weight) of up to 35 percent fine to coarse Sand, up to 35 percent Gravel (but observed at up to 50 percent in boring GZ-3), and less than 10 percent roots and organic material. Standard penetration tests (SPTs) generally ranged from 8 to 20 blows per foot in this stratum. SPTs were limited in this stratum in boring GZ-5 due to only a thin Silt & Clay layer overlying the weathered bedrock.

Weathered Bedrock and Bedrock

Weathered Bedrock was encountered below the Silt and Clay in each of the test borings. The presence of weathered bedrock was generally determined based on its ability to be drilled with the roller cone bit before encountering practical refusal on more sound rock. Where sampled with a split spoon, the *Weathered Bedrock* generally consisted of gray, fine to coarse Gravel, with a visual estimate (based on weight) of up to 35 percent fine to coarse Sand (but observed at up to 50 percent in borings and GZ-1 and GZ-5) and up to 20 percent Silt. Split spoon refusals (SPT N-values exceeding 50 blows per inch or 100 blows per foot) indicate that the weathered bedrock is generally very dense in relative density. The depths to the top of the weathered bedrock and practical refusal on more competent bedrock encountered in the explorations are summarized in the table below:

Exploration No.	Depth to Top of Weathered Bedrock (ft)	Depth of Refusal on Apparent Sound Bedrock (ft)
GZ-1	2.3	5.0
GZ-2	2.0	10
GZ-3	2.0	4.8
GZ-4	2.5	3.8
GZ-5	0.9	1.4
GZ-6	2.0	3.0

Note that the top of sound bedrock may be shallower than the stated 10 feet for boring GZ-2 because a roller bit was used to advance the boring to a 10-foot-depth to help confirm the casing was seated in sound bedrock; therefore rock quality was not observed in the 3 to 10 foot depth range.

Based on a review of bedrock geology maps and other geologic information from the USGS and New York Geologic Survey, regional bedrock geology in the area of the project consists of the Helderberg Group Limestone, which consists of Lower Devonian period Limestone and/or Dolostone formations.

Approximately 65 feet of the bedrock was cored with an NX-sized core barrel at test boring GZ-1 between 5 and 70 feet bgs and approximately 30 feet of bedrock was cored at test boring GZ-2 between 10 and 40 feet bgs. The rock generally consisted of moderately hard, fresh to slightly weathered, gray, fine grained, LIMESTONE with very thin horizontal bedding, and very close to closely spaced horizontal to vertical fractures/joints. The rock appeared to fracture along approximately 1/8-inch-thick horizontal seams of dark gray, fine grained laminations in some core samples. Chert nodules were present throughout the core samples.

As noted on the logs, at each of the two test borings where rock coring was performed, there was little to no water return while coring and each boring contained zones of highly fractured material and/or moderately dipping to vertical fractures within some rock core samples. Increased water loss observed during drilling may have also been caused in part due to difficulties seating the drill casing into sound bedrock. Thin seams of soil (up to 2 inch in thickness) were present within some fractures in each of the two cored test borings (GZ-1 and GZ-2). No evidence of larger voids or karst formations were observed during drilling. The rock recovery and rock quality designation (RQD) of each core run is summarized in the table below:

Exploration No.	Core Run	Core Depths (ft bgs)	Core Recovery (%)	Rock Quality Designation (RQD, %)
GZ-1	C-1	5 to 10	100	10
	C-2	10 to 15	100	18
	C-3	15 to 20	87	18
	C-4	20 to 25	100	65
	C-5	25 to 30	100	77
	C-6	30 to 35	97	67
	C-7	35 to 40	98	58
	C-8	40 to 45	100	38
	C-9	45 to 50	90	37
	C-10	50 to 55	97	55
	C-11	55 to 60	97	57
	C-12	60 to 65	98	30
	C-13	65 to 70	97	45
GZ-2	C-1	10 to 15	92	0
	C-2	15 to 20	97	55
	C-3	20 to 25	93	32
	C-4	25 to 30	100	38
	C-5	30 to 35	100	78
	C-6	35 to 40	100	15

Groundwater

Groundwater was measured in the borings during drilling and in the groundwater wells installed in boring GZ-2. Note that groundwater was not observed within test borings GZ-3 through GZ-6 due to the borings being advanced to depths less than 5 feet bgs. Multiple stabilized readings were made at observation well GZ-2 and the approximate groundwater elevations recorded for this well are summarized in the table below. Refer to the test boring logs in **Appendix B** for more detailed well conditions.

Relevant Borings	Stabilization Time (Elapsed Time)	Approximate Measured Groundwater Depth (ft)	Approximate Measured Groundwater Elevation (ft)
GZ-1	16 hours	53.6	1201.4
GZ-2 (OW)	16 hours	29.9	1217.1
	24 hours	29.5	1217.5
	40 hours	30.0	1217.0

Notes:

1. Groundwater levels measured in the borings during drilling likely do not represent stabilized levels as water is added to the borings during rock coring activity.
2. (OW) indicates that a groundwater monitoring well was installed in boring GZ-2 upon completion. Groundwater elevation range is based on readings taken between September 5 and 7, 2023.
3. Elevations are referenced to the WGS84 datum.

Note that groundwater observations may not represent stabilized groundwater conditions, given the limited stabilization time and relatively low permeability surficial soils, and because drilling water was introduced into the borehole during drilling. Fluctuations in groundwater levels may occur due to variations in season, rainfall, site features and other factors different from those existing at the time of the explorations and measurements. Groundwater in fractured bedrock is controlled by fracture patterns and a surface water and/or groundwater source. GZA recommends multiple groundwater depth readings are performed throughout the year prior to construction to better understand the seasonal groundwater levels and establish a design water table.

GEOTECHNICAL DESIGN RECOMMENDATIONS

The geotechnical design recommendations presented below are based on our evaluation of the available data and are subject to the limitations set forth in **Appendix A**. References to the IBC refer to the International Building Code 2018 with the 2020 New York State Building Code (NYSBC) amendments.

The design of wind turbine foundations is typically governed by the relatively high overturning loads due the applied wind loads. The following sections present GZA's recommendations for the proposed wind turbine foundation. In general, the foundation will be constructed on or within bedrock since weathered bedrock was encountered within 2.3 feet of the ground surface and sound bedrock between 5 and 10 feet of the ground surface at the test borings performed at the proposed turbine location. GZA considered three foundation types: mat foundation, rock anchor foundation, and rock socket foundation. Selection of the foundation type to be adopted should be based on site restrictions, construction cost, and life cycle costs, if different. We have provided a recommended foundation type below; a combination mat foundation bearing on sound, intact bedrock with rock anchors.

WIND TURBINE FOUNDATION

Foundation Type

We recommend that the proposed wind turbine be supported on a combination mat foundation bearing on sound, intact bedrock below the frost depth of 4.5 feet, with rock anchors to resist uplift loads. It is anticipated that the bottom of foundation level will be below the sound rock surface, and that mechanical means (such as blasting or hoe-ramming) will be required to complete the excavations in bedrock. Bedrock removal recommendations are discussed below in the CONSTRUCTION CONSIDERATIONS section of this report. Mat foundations designed to bear on sound, intact bedrock (minimum of 4.5 feet bgs) may be designed for an allowable bearing capacity of 13 ksf based on a factor of safety of 3. Foundations should be designed such that the resultant of the pressure on the base of the foundation is maintained within one-fourth of the foundation base diameter (B/4) of the center of the foundation. It is anticipated that settlement under service loading will be less than ½ inch.

Overburden soil density: Soil unit weight for above the bedrock (both weathered and sound); we recommend using 120 pounds per cubic foot for the existing Silt & Clay.

Poisson ratio: We recommend a Poisson ratio of 0.32 for bearing on sound bedrock.

Shear wave velocity: GZA did not perform testing for shear wave velocity. We could estimate a representative value based on the information we have or readily available public information. However, we are concerned that the estimated shear wave velocity would be used in a way that may not be applicable given that we did not test for it directly. As an example, shear wave velocities measured in Upstate New York limestone have ranged between 5,400 to 10,900 feet per second, with an average in the 8,600 to 9,700 feet per second range. Please advise how this value would be utilized in the designer's calculations. At your request, GZA could perform a cross-hole seismic analysis to provide a shear wave velocity for the bedrock at the site.

Resistance to sliding is anticipated to be developed by friction between the foundation and the bedrock. The use of rock anchors for the wind turbine foundation will enhance and sustain the normal force between the foundation and the bedrock. An ultimate friction factor of 0.7 should be used to estimate sliding resistance between concrete and sound bedrock. A factor of safety of 1.5 should be used for sliding. In the event that the excavated bedrock slope is steeper than 6 horizontal to 1 vertical (6H:1V), GZA should be notified, so that other means of providing sliding resistance may be assessed.

All loose rock should be removed from the exposed bottom of the excavation to sound, intact competent bedrock. Exposed fractures at the subgrade level should be grouted with neat cement grout. If the excavation for the wind turbine foundations show that the bearing surface is partially on bedrock and partially on weathered rock, lower the bearing elevation so the entire bearing area is supported on bedrock. A leveling course of lean concrete or compacted ¾-inch crushed stone, both less than 6 inches in thickness, should be placed over the prepared bedrock subgrade.

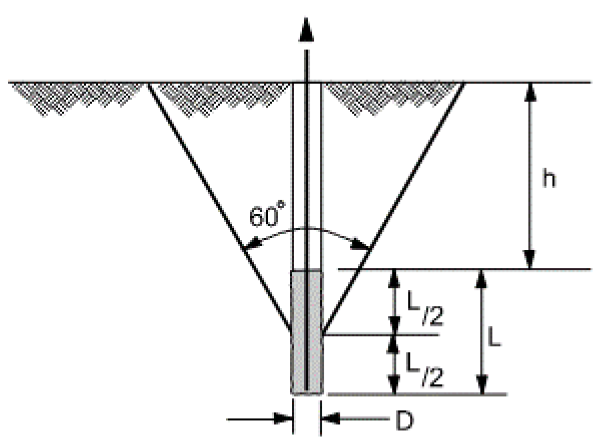
Rock Anchors

We recommend that rock anchors be used to provide uplift and overturning resistance for the proposed foundations. Based on the Post-Tensioning Institute, Recommendations for Prestressed Rock and Soil Anchors (PTI) and our experience with rock anchor design in similar formations, we recommend an allowable grout-rock bond resistance of 75 psi based on a factor of safety of 2.

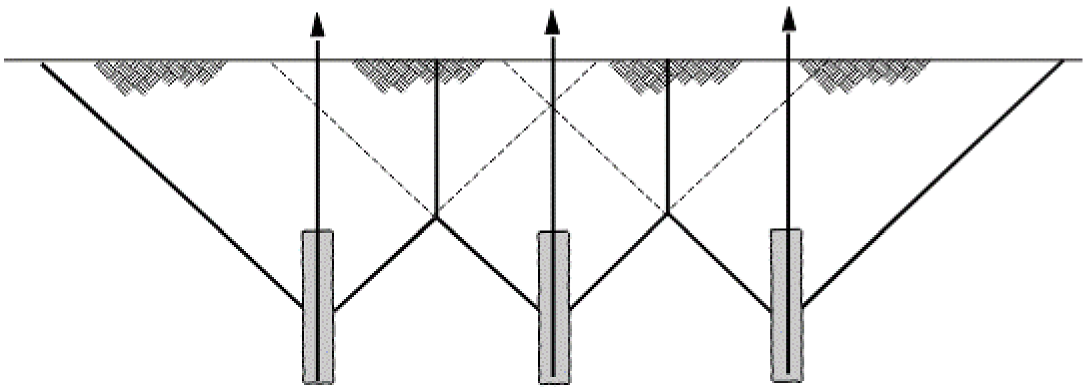
The weight of the bedrock mass engaged by the anchor system may be calculated as the weight of a conical rock mass extending upward from midpoint of the bonded length, to the top of rock, and assuming a cone angle of 60 degrees. A buoyant unit weight of 108 pcf should be used for bedrock assuming that groundwater levels will be at the top of rock, just beneath the bottom of concrete. The available weight of rock mass to resist the uplift loads should be reduced based on the amount of cone overlap. Refer to **Figure a** and **b** below for a schematic depiction of the rock mass. A factor of safety of 2 should be used for the weight of the rock mass.

We recommend that high-strength (150 ksi) deformed bar-type anchors be used rather than wire strand-type. It has been our experience that these are more readily installed and tested, and that the lock-off is more reliable.

The drill hole diameter should provide a minimum of 0.5 inch of grout cover between the anchor and the hole (that is, drill hole diameter at least 1 inch greater than anchor diameter). We anticipate a nominal 6- to 10-inch diameter drill hole may be used for the rock anchors. A double corrosion protection system should be used on the anchors to provide resistance to corrosion.



(a) Geometry of cone



(b) Interaction of cones for overall stability analysis

BACKFILL

Backfill placed between the sides and atop of the new foundations and the excavation limits should consist of compacted Sand-Gravel fill.

FROST DEPTH

For the soil conditions encountered in the test borings, as described above, the depth of frost penetration ("frost depth") was estimated to be 4.5 feet based on the criteria in the U.S. Navy Frost Depth Map included in **Appendix I**, which is greater than the overburden thickness encountered at the two test boring locations. The actual maximum depth of freezing (frost depth) may be more or less than that estimated herein based on factors, including, but not necessarily limited to, extreme temperature fluctuations beyond those assumed in the U.S. Navy Frost Depth Map, variation in groundwater levels, construction conditions, ground cover and snow cover.

SEISMIC CONDITIONS

The subsurface conditions encountered generally consist of less than about 5 feet of overburden soils/weathered bedrock over competent bedrock. Since the overburden soil will be removed prior to foundation construction, we recommend a Site Class B is used for seismic design based on criteria set forth in Section 1613.3 of the IBC 2018, and assuming that the foundations are designed and constructed as recommended herein.

The Site is not susceptible to liquefaction based on criteria set forth in Section 1803.5 of the NYSBC.

ELECTRICAL EQUIPMENT PADS

Based on the plans, we anticipate that electrical equipment pad areas are proposed adjacent to the proposed wind turbine locations. Electrical equipment can be supported on conventional spread footing foundations bearing below the frost zone (4.5 feet below proposed grade) on Weathered Bedrock or Sound Bedrock subgrades, or on compacted Granular Fill placed over these materials; subgrade preparation is discussed further later in this report.

Equipment pads are typically poured eight-inch-thick reinforced concrete that are not designed to tolerate movement from frost, and as an alternative to conventional spread footings, may be supported on non-frost-susceptible soil extending to the frost depth, provided such soil is adequately drained. If Bedrock is encountered above 4.5 feet below the proposed ground surface, the Free Draining Structural Fill and/or ¾-inch Crushed Stone may be placed to the top of bedrock elevation, provided water is unable to pond on top of the bedrock above the frost zone. The bearing zone is defined as a minimum of 1 foot laterally from the outer edge of the pad and extending an additional 1 foot laterally for every 1 foot of excavation depth. Therefore, excavation for the equipment pad areas, should extend to at least 5.5 feet laterally (frost depth plus 1 foot) outside the edge of the equipment pads, in areas where bedrock is not encountered at depths less than 4.5 feet bgs. Where practical, excavations should be performed with a smooth-edged bucket to minimize disturbance to the excavated subgrade.

A base course is recommended below the equipment pads consisting of at least 18 inches of ¾-inch crushed stone underlain by non-woven filter fabric (Mirafi 140N or similar). The filter fabric should envelop the crushed stone so that the crushed stone does not contact adjacent soil. The base course should extend to at least 2 feet laterally beyond the edge of the equipment pad. To help improve drainage, the finished grade within 2 horizontal feet of the pad/mat should be raised by at least 2 feet above surrounding site grades. If the pad area cannot be raised, it may be prudent to install a perimeter drain around the pad areas at the bottom of the Free Draining Structural Fill. The drain should consist of a 4-inch diameter perforated PVC pipe with perforations at the bottom and surrounded on all sides with approximately 4-inches of ¾-inch crushed stone wrapped in filter fabric (Mirafi 140N or similar). The drain should be day-lighted and allowed to drain by gravity. The invert of the drain should be located approximately 4.5 feet (frost depth) below the top of the concrete pad. Site grades in the area of the pads may need to be raised to achieve proper drainage. Surface water runoff should not be allowed to pond within the non-frost-susceptible soil. Non-frost-susceptible soil includes Free Draining Structural Fill (Granular Fill), Sand-Gravel, or Crushed Stone. GZA recommends a modulus of subgrade reaction of 140 pounds per cubic inch (pci) referenced to a 1-foot by 1-foot area for use in design of pads and mat foundations with subgrade prepared as described above.

Provided that footing subgrade preparation is performed in accordance with the recommendations of this report, the recommended maximum net allowable bearing pressure for design of spread footings bearing on Weathered Bedrock, Bedrock or compacted Structural Fill placed over these materials is 4,000 psf.

GZA recommends that lateral loads, if any, be resisted by sliding friction between the base of the spread footings and subgrade soils. Foundations should be designed using a friction factor against base shear of 0.4. The factor of safety against sliding should be at least 1.5.

Strip footings and isolated footings should be at least 18 inches and 24 inches wide in the least lateral dimension, respectively. For frost protection, the footings should bear at least 4.5 feet below final exterior grades. Footing subgrades should be protected from frost. Do not place concrete or fill over a frozen subgrade.

Based on information from NLE, GZA understands equipment pad areas typically require excavation up to about 3 feet below finished grade for placing conduits. Based on the observations made during the test borings, weathered bedrock is expected as shallow as 1 feet bgs and competent bedrock as shallow as 5 feet bgs. As such, depending on the proposed grading at the site, the potential exists for shallow bedrock to be encountered in excavations for utilities and/or equipment pads. To limit the potential for difficult bedrock removal, design details may need be adjusted accordingly (site grading modified, equipment pads may need to be raised, or utility excavations made shallower).

Backfill over the conduits should be compacted Free Draining Granular Fill, provided that the material in contact with the utility is screened to remove particles exceeding 1 inch in diameter and the material does not damage the conduit or inhibit the intended use; or backfilled as otherwise recommended by the conduit manufacturer. The Granular Fill should also extend at least 1 foot outside the conduit on all sides. The Granular Fill should be compacted to at least 92 percent of the maximum dry density at optimum moisture content as determined by ASTM Test D1557, Method C. GZA understands that this 92 percent compaction requirement is in line with criteria typically used for compaction within electrical trenches in equipment pad areas.

UNPAVED SITE ACCESS ROADS

Based on input from NLE, we understand that post-construction site access roads fall into two categories:

1. Fire truck access, anticipated maximum use 2 times per year; and
2. Pickup truck access, anticipated maximum use 4 times per year.

The following unpaved access road cross-section is recommended for new proposed fire truck access roads, in compliance with Appendix D of the International Fire Code (IFC), and assuming H-20 loading with an excavated subgrade consisting of the Silt & Clay, Weathered Bedrock, or sound Bedrock:

	Minimum Thicknesses
Finish Course (Dense-Graded Crushed Stone)	5 inches
Sand-Gravel Base Course	12 inches

Due to the potentially fine-grained surficial soils, GZA recommends the Sand-Gravel Base Course be underlain by a bi-axial geotextile fabric (Mirafi HP-270 or similar). These thicknesses should not be reduced due to shallow bedrock.

The following unpaved access road cross-section is recommended for new proposed pickup-truck-only access roads:

	Minimum Thicknesses
Finish Course (Dense-Graded Crushed Stone)	4 inches
Sand-Gravel Base Course	10 inches

Again, due to the potentially fine-grained surficial soils, GZA recommends the Sand-Gravel Base Course be underlain by a bi-axial geotextile fabric (Mirafi HP-270 or similar). These thicknesses should not be reduced due to shallow bedrock.

Note that these cross-sections are not intended for construction traffic and are subject to seasonal frost heave. In areas of shallow sound bedrock, the final road elevations should be increased to accommodate at least the thicknesses of combined Base Course and Finish Course section listed above to limit the potential freezing action for water accumulating on the bedrock surface. Additional protection from water runoff and potential washout is recommended in these areas.

STORMWATER MANAGEMENT

Based on the plans, we understand that at least three culverts are proposed under the gravel access road. For these culverts and for any additional stormwater features that may be added, including temporary features used during construction, the following should be considered.

In general, stormwater runoff should not be concentrated and should be conveyed through vegetated areas. Detention/retention ponds should be designed and constructed with a synthetic or clay liner approved by the local plan approval authority. Discharge should be routed away from existing sinkholes (if any) and stormwater features should be monitored for the development of potential sinkholes and be remediated immediately.

CONSTRUCTION CONSIDERATIONS

TEMPORARY CRANE SUPPORT PADS

The Silt & Clay soils encountered during our subsurface exploration program are an unsuitable subgrade for the temporary support of the crane used to construct the turbine structures. The overburden Silt & Clay should be over excavated by a minimum depth of 2 feet bgs and replaced with compacted Dense Grade Crushed Stone. In areas of shallow bedrock or shallow weathered bedrock, a minimum of 1 foot of Dense Grade Crushed Stone should be used on top of the bedrock.

ROCK REMOVAL

Removal of bedrock for construction of a deep mat foundation will require the use of either controlled blasting or mechanical hoe-ramming or rock-rippers. Based on information from NLE, we understand the Town permitting authority is concerned that blasting may have the potential to open existing joints within the bedrock, thus creating new fracture zones, and impacting water supply wells in the vicinity. The mechanism for such potential disturbance is via vibrations propagated into the rock mass from the rock removal process.

Simply stated, blasting involves explosive charge placed into drilled holes and detonated such that the pressure caused by the blast splits the rock adjacent to a relieved bedrock face. Vibrations from blasting can be controlled by limiting the charge per delay and charge spacing. Typical blasting is not via detonating several charged holes at once but via detonating a series of charges each with a several milli-second timed delay. In general, the smaller the charge per delay, the lower the induced vibration. Through careful blast design, blasting can be performed very close to a sensitive structure, such as a building within 5 to 10 feet, without damage. A similar blast design philosophy could be applied with success at the proposed wind turbine location to remove bedrock to the foundation subgrade. By limiting the charge per delay and controlling other blast design elements, bedrock removal at the site could advance with limited risk of disturbing the rock mass and impacting the water supply wells in the vicinity.

Based on our review of the boring results, we encountered weathered and fractured limestone in the upper portion of both borings at the proposed turbine location. Our judgement that the upper limestone layer is fractured is based on our observations of the rock core recovered and the low RQDs observed in the collected cores. A low RQD indicates a fractured bedrock. Further evidence of fractured bedrock is the consistent loss of drilling water during drilling; the water was likely lost into fractures in the bedrock. Review of the RQD data in the table above generally indicates the RQD increasing with depth. In our opinion, the fractured bedrock observed to 10 to 15 feet bgs can be removed with mechanical means, such as hoe-ramming, as an alternative to controlled blasting. Again, there is limited risk of disturbing the rock mass and impacting the water supply wells in the vicinity with bedrock removal at the site via hoe-ramming or a rock-ripper attachment to large excavators. These methods will be more time consuming than blasting, but it is our opinion that they are a feasible alternative for mass rock removal at this site. Similarly hoe-ramming or rock grinding could be used for rock removal for new utility installations.

If blasting is considered, damage to structures and annoyance to people is related to the frequency and peak particle velocity, vibrations, and air over-blast pressure caused by blasting. Limits on frequency and peak particle velocity and maximum air over-blast pressure should be set in the construction specifications and monitored during blasting, if chosen. Perform all blasting in compliance with the applicable New York State regulations or local municipal ordinance. Blasters in New York State are required to possess a valid New York State Department of Labor (NYSDOL) issued Blaster Certificate of Competence. In addition, the New York State, Department of Labor (NYSDOL) Regulation 12NYCRR 61 requires a pre-blast survey, blast size restrictions, and vibration monitoring. GZA recommends that the general contractor provide a blasting plan to NLE, for your and GZA approval, that meets applicable requirements and includes pre-blast surveys of structures within at least 150 feet of the proposed blast area.

Whether blasting or mechanical bedrock removal via hoe-ramming or rock grinding is selected, the work should be performed according to a rock removal specification, prepared by GZA, detailing blast design and vibration limit criteria, test blasts, and monitoring of vibrations regardless of the rock removal method.

ROCK ANCHOR TESTING AND LOCK OFF

Rock anchors should be tested in accordance with PTI criteria. We recommend that proof tests be performed on all anchors to at least 1.33 times the design anchor load and that a performance test be performed on at least one anchor per turbine foundation. Anchors should be locked off after successful completion of anchor testing. Testing and lock off should be performed in a manner to avoid unbalanced loading. Final lift off testing should be performed once all anchors have been locked off.

SUBGRADE PREPARATION FOR WIND TURBINE FOUNDATION

Bedrock subgrades, where significant overblast (if any) or extensive fracturing has occurred, should be prepared by removal of all loose rock from the exposed bottom of the excavation to sound bedrock, and natural rock fractures grouted with low slump grout. Where joint spacing is moderate, fill joints with 5,000 psi fluid neat cement grout. Then, a lean concrete (that is, UCS ~ 2.500 psi) can be placed as a leveling course to raise grade to the footing design subgrade. To further limit the migration of soil, stormwater run-off and/or construction related materials into the newly exposed rock, a low profile perimeter berm could be constructed and a filter fabric may be laid over the initial grouted surface prior to the placement of additional low slump concrete. The limits of the lean concrete fill should extend horizontally beyond the limits of the footing on a 1H:1V slope down from the outside edge of the footing. Also, the footing thickness can be increased to bear directly on the top of rock. Subgrade preparation should be observed and documented by a qualified geotechnical engineer or their representative. Quantities of grout and concrete used should be monitored to help limit excess grout from entering bedrock fractures.

SUBGRADE PREPARATION FOR ELECTRICAL EQUIPMENT PADS AND TEMPORARY CRANE SUPPORT PADS

- Excavate Topsoil within the zone of influence of shallow foundations or equipment/crane pads, as defined by a 1-horizontal to 1-vertical (1H:1V) line, sloping downward and outward from 1-foot outside the bottom edge of footings/pads.
- Where practical, final excavation should be undertaken using a smooth-edged bucket to limit disturbance of the subgrade.
- Proof-compact the exposed soil subgrade with at least ten passes of a 10,000-pound (minimum static weight) roller or a heavy plate compactor in confined areas. However, to limit disturbance of predominantly fine-grained soil subgrades, the bottom of the undisturbed excavation should be statically rolled or “heeled” with the excavator bucket in place of using vibratory compaction equipment. Vibratory compaction equipment should be used on subsequent lifts of Structural Fill.
- Fine-grained soils are sensitive to moisture and should be suitably protected if exposed. If fine-grained soils degrade due to exposure, the wet/disturbed soil should be undercut to suitable, stable soil and either the foundation extended to a suitable bearing grade, or the exposed suitable soil subgrade raised with Structural Fill or ¾-inch crushed stone. If ¾-inch crushed stone is used, non-woven filter fabric should envelop the crushed stone when the overall thickness exceeds 6 inches. Construction should be sequenced and planned to limit the time that the subgrades are exposed to potential precipitation and/or freezing temperatures.
- Protect the exposed subgrade from frost at all times during construction. Fill should not be placed over frozen soil. Do not place frozen Structural Fill. Structural fill should be compacted to 95 percent of the maximum dry density.

Subgrade preparations for backfilling, equipment support slabs and crane support pads and access roads must be conducted in such a way as to limit disturbance and allow work “in the dry,” using a smooth-edged excavator bucket, particularly if silty soils are encountered at subgrade level. Care must be taken to slope all working surfaces to facilitate drainage and control surface water. Appropriate dewatering/surface water control procedures should be implemented prior to performing final excavation to subgrade and proof-compaction. Temporary measures to reduce the amount of surface water (from rainfall runoff) flowing into construction areas may include, but not be limited to:

- Construct small berms to divert and/or reduce the amount of surface water flowing over exposed subgrades during construction;
- Maintain general site grading to promote surface run-off and limit ponding; and
- Use a smooth drum compactor in static mode or back drag areas with a smooth bucket to help seal exposed soil surfaces prior to inclement weather.

The Owner and the Contractor should become familiar with and follow all applicable local, state, and federal safety regulations, including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards. Construction site safety generally is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. As a safety measure, it is recommended that all vehicles and soil piles be kept a minimum lateral distance from the edge of excavations equal to no less than the excavation depth. Also, the exposed excavation face should be protected against the elements.

TEMPORARY GROUNDWATER CONTROL

The competent bedrock may be relatively impervious in limited areas. Temporary construction dewatering may be required for deeper excavations, installation of utilities, or to remove storm water/snow melt ponded in the excavation. The Contractor should control water seepage, precipitation, infiltration, and surface water inflow within the excavation at all times to limit disturbance to and maintain integrity of soil and rock surfaces and allow construction in-the-dry.

It is anticipated that dewatering can be accomplished by open pumping from shallow sumps or wells, and temporary ditches and trenches within and around excavations. Wells and sumps should be provided with filters suitable to prevent pumping of fine-grained soil particles, and pumped water should discharge to nearby onsite areas, or discharged offsite in compliance with all applicable permits and regulations. Installation and operation of the Contractor's dewatering system should be integrated with other earthwork operations and in the sequence of excavation and backfilling.

FILL MATERIALS AND PLACEMENT RECOMMENDATIONS

Fill should be placed systematically in horizontal layers not more than 12 inches in thickness prior to compaction. Compaction equipment should preferably consist of large, self-propelled vibratory rollers. Where hand guided compaction equipment, such as a vibratory plate compactor is used, the loose lift thickness should not exceed 6 inches. The fill around footings and select materials below the access road must be compacted to at least 95 percent of the maximum dry density determined in accordance with ASTM D1557.

Recommended gradations for fill materials are provided below.

Sand-Gravel (Gravel) (NYSDOT Type B-3 Material may also be used as Sand-Gravel) should consist of inert material comprised of hard, durable stone (not crushed concrete) and coarse sand, free from trash, ice, snow, tree stumps, roots, organic materials, and other deleterious matter, and conform to the following gradation:

Sieve Size (ASTM D422)	Percent Passing By Weight
2-inch*	100
1/2-inch	50-85
No. 4	40-75
No. 40	10-35
No. 200	0-8

Dense-Graded Crushed Stone (NYSDOT Type B-3 Material may also be used as Crushed Stone) should consist of angular fragments of hard, durable crushed rock (not crushed concrete), free from a detrimental quantity of thin, flat, elongated pieces or be durable crushed gravel stone obtained by artificial crushing of gravel, cobbles, boulders or fieldstone. The crushed stone should be free from trash, ice, snow, tree stumps, roots, organic materials, lumps or balls of clay, and other deleterious matter. Dense-Graded Crushed Stone should conform to the following gradation:

Sieve Size (ASTM D422)	Percent Passing By Weight
2-inch	100
1-1/2-inch	70-100
3/4-inch	50-85
No. 4	30-55
No. 50	8-24
No. 200	3-8

Free Draining Structural Fill (Granular Fill) (NYSDOT Type B-2 Material may also be used as Granular Fill) should be free from crushed concrete, trash, ice, snow, tree stumps, roots, organic materials, and other deleterious matter. Structural Fill should conform to the following gradation requirements:

Sieve Size (ASTM D422)	Percent Passing By Weight
3-inch	100
No. 10	30-95
No. 40	10-70
No. 200	0-10

3/4-inch Crushed Stone should consist of angular fragments of hard, durable crushed rock (not crushed concrete), free from a detrimental quantity of thin, flat, elongated pieces or should be durable crushed gravel stone obtained by artificial crushing of gravel boulders or fieldstone. The crushed stone should be free from trash, ice, snow, tree stumps, roots, organic materials, and other deleterious matter. 3/4-inch Crushed Stone should conform to the following gradation:

Sieve Size (ASTM D422)	Percent Passing By Weight
1-inch	100
3/4-inch	90-100
1/2-inch	10-50
3/8-inch	0-20
No. 4	0-5

REUSE OF ON-SITE MATERIALS

GZA anticipates that the majority of the excavated material at the Site will be rock. The excavated rock can be processed and reused for fill for the proposed access road base course materials and foundation backfill, given that it meets the recommended gradation for its intended use. The overburden soils (Silt & Clay) contain a significant portion of silt and will be sensitive to moisture content, and therefore, difficult to compact to the desired density. We recommend that the overburden soils (Silt & Clay strata) be reused in landscaped areas only (if any).

DESIGN REVIEW AND CONSTRUCTION MONITORING

It is recommended that GZA be given the opportunity to review progress site and structural plans to see that our geotechnical recommendations have been interpreted and implemented as we intended; and to see that our recommendations adequately address final design considerations. In addition, GZA should be retained to prepare or review earthwork and bedrock removal specifications for the construction documents.

Further, we recommend that GZA be retained to provide geotechnical engineering observation and consultation services during construction to observe compliance with design and construction recommendations and specifications. Specifically, these services should include, full-time observation of subgrade preparation, rock anchor installation, grouting, and proof and performance testing of the rock anchors.

GZA also has the capacity to provide vibration monitoring remotely, thereby eliminating the need for on-site personnel during rock removal operations. In addition, the information can be reviewed by the design team in real time on a secure website. GZA can provide additional information upon request.

If groundwater monitoring is needed during construction, GZA can provide consulting services to develop a program including installation of new monitoring wells, as the observation wells installed as part of this program will likely be decommissioned as part of construction.

CLOSING

We trust the information presented herein is sufficient for your use. We have enjoyed working with you on this project and look forward to our assisting you on future projects. Please call us with any questions.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Joseph M. Benoit, P.E. (MA)
Project Manager

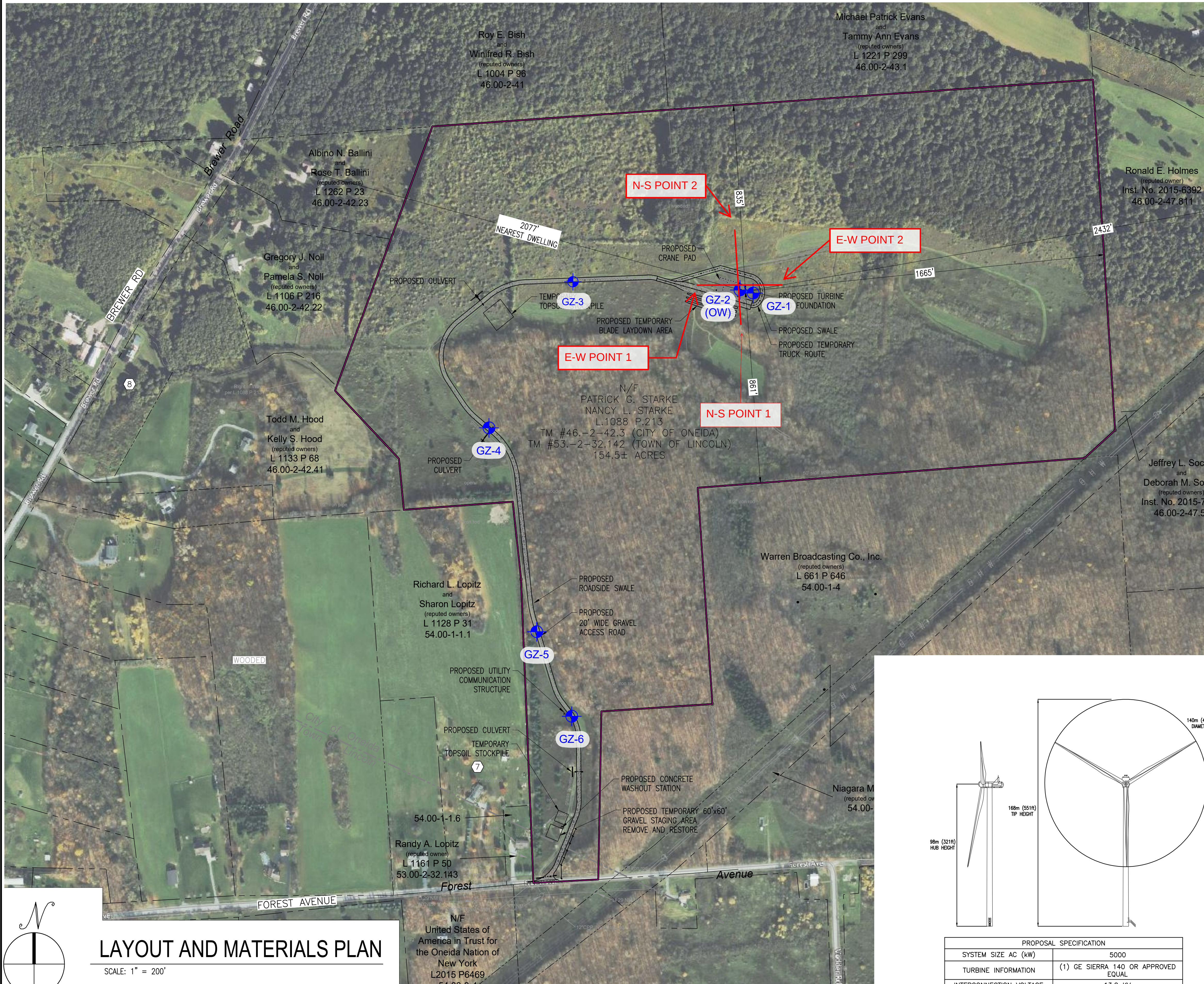
Ernest R. Hanna, P.E.
Consultant/Reviewer

Bruce W. Fairless, P.E.
Principal

Attachments: Figure 1 – Exploration Location Plan
Appendix A – Limitations
Appendix B – GZA May 3, 2023 Letter on Geological Considerations
Appendix C – Test Boring Logs
Appendix D – Test Boring Photos
Appendix E – Rock Core Photographs
Appendix F – Field Electrical Resistivity Testing Results
Appendix G – Geotechnical Laboratory Testing Data
Appendix H – Laboratory Corrosivity Test Results
Appendix I – U.S. Navy Frost Depth Map

J:\170,000-179,999\177169\177169-10.JMB\Report\01.0177169.10_ Oneida Wind Geotech Report.docx

Figure



PROPOSAL SPECIFICATION			
SYSTEM SIZE AC (kW)	5000		
TURBINE INFORMATION	(1) GE SIERRA 140 OR APPROVED EQUAL		
INTERCONNECTION VOLTAGE	13.2 KV		
HUB HEIGHT (FT)	321	BLADE LENGTH (FT)	230

NOTES

1. TEST BORINGS PERFORMED BY GEOSEARCH, INC. OF STERLING, MASSACHUSETTS FROM SEPTEMBER 5 THROUGH SEPTEMBER 7, 2023. OBSERVED AND LOGGED BY GZA PERSONNEL.

2. THE BASE MAP WAS DEVELOPED FROM PLANS OR ELECTRONIC FILES PROVIDED BY NEW LEAF ENERGY, ENTITLED "LAYOUT AND MATERIALS PLAN", DATED 2-9-2023, ORIGINAL SCALE: 1"=200', DRAWING NO. C-3.0.

3. THE LOCATION OF THE TEST BORINGS WERE APPROXIMATELY DETERMINED BY GPS. THIS DATA SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

4. THE GROUND SURFACE ELEVATIONS WERE ESTIMATED FROM THE USGS 3DEP 1M DIGITAL ELEVATION MODEL AND ARE CITED IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) IN UNITS OF FEET.

LEGEND

- GZ-1 (OW) — TEST BORING (OW INDICATES MONITORING WELL INSTALLED)
- SITE BOUNDARY
- + INDICATES ELECTRICAL RESISTIVITY IN-SITU TEST LOCATION (NORTH-SOUTH & EAST-WEST ARRAYS)

Exploration No.	Latitude (WGS84)	Longitude (WGS84)
GZ-1	43.0479613°	-75.6652122°
GZ-2	43.0480024°	-75.6654643°
GZ-3	43.0481634°	-75.6682806°
GZ-4	43.0463562°	-75.6698276°
GZ-5	43.0438233°	-75.6690602°
GZ-6	43.0428285°	-75.6684228°
E-W Alignment Point 1	43.0480186°	-75.6659092°
E-W Alignment Point 2	43.0480649°	-75.6648196°
N-S Alignment Point 1	43.0476322°	-75.6654191°
N-S Alignment Point 2	43.0484795°	-75.6654549°

PROPOSED WIND TURBINE
4949 FOREST AVENUE
ONEIDA, NEW YORK

EXPLORATION LOCATION PLAN

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
NEW LEAF ENERGY, INC.

PROJ MGR: JMB	REVIEWED BY: JMB	CHECKED BY: BWF	FIGURE
DESIGNED BY: RJB	DRAWN BY: RJB	SCALE: NOT TO SCALE	1
DATE: SEPTEMBER 2023	PROJECT NO. 01.0177169.10	REVISION NO.	

Appendix A – Limitations

USE OF REPORT

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the contract documents, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in Proposal for Services and/or Report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the design has been altered in any way, GZA shall be so notified and afforded the opportunity to revise the report,as appropriate, to reflect the unanticipated changed conditions .

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the Report.

SUBSURFACE CONDITIONS

5. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then become evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

6. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein which were made available to GZA at the time of our evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

7. Water level readings have been made in test holes (as described in this Report) and monitoring wells at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this Report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The water table encountered in the course of the work may differ from that indicated in the Report.

8. GZA's services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently, we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.

9. Recommendations for foundation drainage, waterproofing, and moisture control address the conventional geotechnical engineering aspects of seepage control. These recommendations may not preclude an environment that allows the infestation of mold or other biological pollutants.

COMPLIANCE WITH CODES AND REGULATIONS

10. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

COST ESTIMATES

11. Unless otherwise stated, our cost estimates are only for comparative and general planning purposes. These estimates may involve approximate quantity evaluations. Note that these quantity estimates are not intended to be sufficiently accurate to develop construction bids, or to predict the actual cost of work addressed in this Report. Further, since we have no control over either when the work will take place or the labor and material costs required to plan and execute the anticipated work, our cost estimates were made by relying on our experience, the experience of others, and other sources of readily available information. Actual costs may vary over time and could be significantly more, or less, than stated in the Report.

ADDITIONAL SERVICES

12. GZA recommends that we be retained to provide services during any future: site observations, design, implementation activities, construction and/or property development/redevelopment. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

Appendix B – GZA May 3, 2023 Letter on Geological Considerations

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104 West 29th Street
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New York, NY 10001
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F: 212.279.8180
www.gza.com

May 3, 2023
File No. 01.0177169.00

New Leaf Energy, Inc.
55 Technology Drive, Suite 102
Lowell, Massachusetts 01851

Attn: Mr. Brandon Smith

Re: Desktop Assessment of Subsurface Conditions
Proposed Wind Turbine
4949 Forrest Avenue
Oneida, New York

Dear Mr. Smith:

In accordance with your request, GZA GeoEnvironmental of New York (GZA) is pleased to submit this letter to you regarding results of a desktop assessment of subsurface conditions at the proposed wind turbine location (Site). As requested by New Leaf Energy, Inc. (NLE) and on its behalf, we have reviewed our in-house documents from previous work performed at nearby sites, and readily available public geological maps. NLE has identified a concern regarding the Site's geology and the potential to encounter limestone-related karst conditions at the proposed wind turbine location. The presence of limestone and karst features encountered during foundation construction may have an impact on both the turbine foundation and groundwater at local springs and wells.

In doing our desktop assessment, GZA reviewed the following:

1. Custom Soil Resource Report, Madison County, New York, 4949 Forest Avenue; U.S. Department of Agriculture, Natural Resources Conservation Services; July 2021.

2. Surficial Geologic Map of New York, Finger Lakes Sheet; 1986; Compiled and Edited by Mueller, E.H. and Cadwell, D.H.; New York State Museum – Geologic Survey, Map and Chart Series No 40.

3. Geologic Map of New York, 1970, Finger Lakes Sheet; Compiled and Edited by Rickard, L.V. and Fisher, D.W.; New York State Museum and Science Service, Map and Chart Series No 15.

4. Statewide Assessment of Karst Aquifers in New York with an Inventory of Closed-Depression and Focused-Recharge Features, Scientific Investigation Report 2020-5030; Kappel, W.M., Reddy, J.E., and Root, J.C.; U.S. Geologic Survey, U.S. Department of the Interior; 2020.

5. Stratigraphy of the Upper Silurian Salina Group, New York, Pennsylvania, Ohio, Ontario; Rickard, L.V.; New York State Museum and Science Service, Map and Chart Series Number 12; 1969.

The Soil Resource Report identifies surficial soils as Wassaic Silt Loam or Farmington-Wassaic-Rock consisting of silt loam, gravelly silt loam, gravelly silty clay loam and/or unweathered bedrock. Bedrock is anticipated to be within 5-feet of ground surface at the planned wind turbine foundation location. Based on the photo log prepared for the Site by NLE, surficial bedrock was observed near the entrance to the Site in the south. The Geologic Map of New York, Finger Lakes Sheet identifies bedrock in the area as either part of the Coblestone Limestone Formation, consisting of the Bertie Group and Camillus Formation which are predominately shale bedrock; or the Syracuse Formation consisting of dolostone and shale. The presence of limestone and karst conditions is documented in the Statewide Assessment of Karst Aquifers within this general area of New York. Therefore, in our opinion and based on the information reviewed, the surficial bedrock at the wind turbine foundation location is likely a shale and/or dolomite rock type, which is less susceptible than limestone to water erosion and the formation of karst features. These conditions can impact the wind turbine foundation via the formation or presence of voids and depressions. In addition, local wells may depend on the water within the bedrock aquifer that potentially flows through cracks, voids and other open areas of the bedrock.

Foundations for the wind turbine are expected to be a spread foundation consisting of an approximately 60-foot-wide reinforced concrete pad buried below the surface, with a concrete pedestal where the turbine shaft will connect with a bolted connection. We anticipate that the mat will bear at about 10 to 15 feet below the final ground surface. Based on the information reviewed, it is likely that the wind turbine foundation will be founded on bedrock or anchored within bedrock; this condition can be confirmed with a subsurface investigation at the site.

If the wind turbine foundations bear on overburden soils, it is unlikely that foundations would noticeably impact the area's groundwater conditions once backfilled. Also, during construction, temporary measures will be used to reduce the amount of surface water run-off (from rainfall) into and/or from construction areas including, but not be limited to the following:

- Construct small berms to divert and/or reduce the amount of surface water flowing over exposed subgrades during construction;
- Maintain general site grading to promote surface run-off and limit ponding; and
- Use a smooth drum compactor in static mode or back drag areas with a smooth bucket to help seal exposed soil surfaces prior to inclement weather.

To limit potential impacts from the wind turbine foundation construction, and related possible impact to the underlying bedrock and groundwater, we would recommend supporting the wind turbine on a spread (or mat) foundation if near-surface bedrock is encountered during the subsurface investigation. Assuming shallow bedrock is encountered and bedrock removal is required to accommodate the proposed mat foundation depth, a few options may be employed to limit the movement of sediment or grout into possible rock fractures/voids during construction.

- As with most construction sites, the contractor would berm around the excavation to redirect surface water run-off from entering it.
- If voids or large fractures are identified at the bedrock surface indicative of karst conditions, the contractor could pack the void / fracture surface with no-slump concrete.
- Then, we would recommend placement of a geotextile separation blanket at the base of the foundation and placement of concrete above the fabric, this would keep the concrete from entering fractures / voids within the bedrock.

Alternatively, drilled deep foundations or a more-shallow pad foundation with rock anchors may be used to support the proposed wind turbines. If deep foundations are installed within the bedrock, there may be impacts to the groundwater that travels through the karst formations (if present) if a grout slurry is pumped as a part of the deep foundation construction. Deep foundations, such as drilled shafts and rock anchors, will require drilling fluid and grout/concrete to be in contact with the rock. Excessive loss of drilling fluid or grout/concrete may mix with groundwater or impede/block fracture seams in the bedrock. If deep foundations are proposed, the quantities of such material will need to be closely monitored during construction to avoid excessive material use. The comparison of theoretical deep foundation volume versus actual pumped quantities will need to be performed to confirm that excessive grout is not being pumped into the foundation. These measurements will provide quality control so potential impacts to the groundwater can be limited.

To further control impacts, GZA could set-up a monitoring program of existing wells within a certain distance of the work, say 500 feet, where pre-construction and post-construction tests of well water is performed to confirm no impacts.

Surface water impacts should be limited due to the relatively small footprint of the planned project construction and its associated regrading and site clearing. Access roads will be unpaved and allow for water filtration. Surface water impacts to local springs, if any, will more likely be affected by nearby farming and regional activities, which are less regulated than the proposed wind turbine project. Such farming and regional activities are more expansive and have been documented as impacting soil, surface water, and/or groundwater.

The extent of the potential impacts is difficult to quantify at this time and would depend on the results of geotechnical drilling at the turbine location to positively evaluate subsurface conditions (including the depth and type of rock encountered), the flow and depth of water at the site, the extent of the disturbance to the rock from construction, and the number of residences that currently have wells located nearby. The intent and procedures followed would focus on limiting any impact to nearby wells.

We recommend performing two borings at the proposed wind turbine location to further investigate the potential of shallow bedrock and the presence of karst features. If warranted, a geophysical survey may aid in detecting potential karst features at the wind turbine locations.

A stormwater pollution prevention plan (SWPPP) will also help provide adequate control of surface water runoff near disturbed areas and identified karst features or springs that may be impacted by construction. New York State and federal regulations require that a SWPPP and erosion sediment control plan be completed for construction projects that disturb more than 1 acre of land.

We hope that this response to your request is suitable for your needs. GZA looks forward to our continued association on this project.

Sincerely,

GZA GEOENVIRONMENTAL of NY

Joseph Benoit
Project Manager

Bruce W. Fairless, P.E.
Consultant/Reviewer

Ernest R. Hanna, P.E.
Principal

Appendix C – Test Boring Logs

BORING LOGS

BORING LOG LEGEND

GS Elev. = Ground Surface Elevation
NAVD = North American Vertical Datum
NR = No Recovery
S.S. = Split Spoon
Stab. = Stabilization Time for groundwater reading
WOH = Weight of Hammer
WOR = Weight of Rods
U.P. = Undisturbed Tube Sample
UCS = Unconfined Compressive Strength Test performed in the laboratory

SOIL DESCRIPTIONS

Soil samples are described on the exploration logs by the "Modified Burmister Soil Identification System". The following provides a brief description of the Modified Burmister System.

1. Major and minor components of the soil matrix are identified as gravel, sand or fines. The relative amounts of these constituents are proportioned as:

Component	Proportional Term	Percent by Weight of Total
Major		Greater than percentage of other components
Minor	And	35-50
	Some	20-35
	Little	10-20
	Trace	1-10

2. The nature of "fines" is defined by using the following guidelines:

Degree of Plasticity	Identity	Plasticity Index
Non-plastic	SILT	0
Slight	Clayey SILT	1-5
Low	SILT & CLAY	5-10
Medium	CLAY & SILT	10-20
High	Silty CLAY	20-40
Very High	CLAY	40 and Greater

3. For boring logs, relative density or consistency is identified based on standard penetration resistance, using the following table.

Non-Plastic Soils		Plastic Soils	
Blows/ft "N"	Relative Density	Blows/ft "N"	Consistency
0-4	Very Loose	<2	Very Soft
4-10	Loose	2-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
>50	Very Dense	15-30	Very Stiff
		>30	Hard

The soil classification symbol corresponding to the Unified Soil Classification System (USCS) is also presented on the logs for each sample based on ASTM Standards D 2487 (Standard Test Method for Classification of Soils for Engineering Purposes) and D 2488 (Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)). Standard D 2487 is based on laboratory testing results, whereas Standard D 2488 is based on visual and manual field procedures.

BEDROCK DESCRIPTIONS

Rock samples described on the exploration logs are generally based on the International Society of Rock Mechanics (ISRM) System, as generally described on the following page. Each rock sample was generally described using the following guideline, in the order presented:

1. Field hardness: very hard, hard, moderately hard, medium, soft, very soft (where applicable, hardness descriptions have been modified to reflect the laboratory results of unconfined compressive strength testing)
2. Weathering: fresh, very slight, slight, moderate, moderately severe, severe, very severe, complete
3. Rock continuity (fracturing): extremely, moderately, slightly, sound
4. Texture: amorphous, fine, medium, coarse, very coarse
5. Color
6. Rock type
7. Fractures, Bedding, and Foliation, Spacing and Attitude
8. Rock Quality Designation (RQD)

Field Hardness: A measure of resistance to scratching or abrasion.

Very Hard	Cannot be scratched with knife or sharp pick. Breaking of hard specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of a hammer required to detach hand specimen.
Moderately Hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/6 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1 in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with a knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very Soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1 in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Weathering: The action of the elements in altering the color, texture, and composition of the rock matrix.

Fresh	Rock fresh, crystals bright, few points may show staining. Rock rings under hammer if crystalline.
Very Slight	Rock generally fresh, joints stained, some joints may show think clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull an discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; show some clay. Rock has dull sounde under hammer and shows significant loss of strength as compared with fresh rock.
Moderately Severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars are dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick. Rock goes "clunk" when struck.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very Severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" not discernible or discernible only in small locations. Quartz may be present as dikes or stringers.

Rock Continuity: Any break in a rock matrix whether or not it has undergone relative displacement.

Extremely fractured	Drill core stem less than 2 in.
Moderately fractured	Drill core stem 2 in. to 1 ft
Slightly fractured	Drill core stem 1 ft to 2 ft
Sound	Drill core stem greater than 2 ft

Texture: Terminology used to identify size, shape and arrangement of constituent elements.

Amorphous	Too small to be seen with naked eye.
Fine grained	Barely seen with naked eye.
Medium grained	Barely seen with naked eye to 1/8 in.
Coarse grained	1/8 to ¼ in.
Very coarse grained	> ¼ in.

Discontinuities: Surfaces representing breaks or fractures separating the rock mass into discrete units.

Crack	A partial or incomplete fracture.
Fracture	A complete break within a rock mass, with no measurable displacement.
Joint	A simple fracture along which no shear displacement has occurred, but an aperture can be measured. May form joint sets.
Shear	A fracture along which differential movement has taken place parallel to the surface to produce slickensides, striations or polishing. May be accompanied by a zone of fractures between a few to several inches wide.
Fault	A major fracture along which there has been appreciable and measureable displacement, accompanied by gouge and/or a severely fractured adjacent zone, or zones.
Shear zone	A band or zone of planer, sub-parallel, very closely to closely spaced, contiguous shears/joints/fractures.
Fault zone	A zone of planar/irregular, parallel/non-parallel, very close to closely spaced, contiguous shears/joints/fractures with observable displacement.

FRACTURES, BEDDING AND FOLIATION, SPACING AND ATTITUDE

Fractures	Bedding and Foliation	Spacing (1)	Attitude	Angle (deg)
Very close	Very thin	< 2 in	Horizontal	0 -5
Close	Thin	2 in - 1 ft	Sub-horizontal	5 - 35
Moderately close	Moderately thick	1 ft – 3 ft	Moderately dipping	35 - 55
Wide	Thick	3 ft – 10 ft	Sub-vertical	55 - 85
Very wide	Very thick	> 10 ft	Vertical	85 -90

Note 1: Spacing refers to axial length along the rock core measured in the field between natural joints/fractures.

Rock Quality Designation (RQD): indicated in percent and is equal to the sum of the length of the core of pieces 4 in. or longer divided by the length of the core run. RQD should not be reported for severely and completely weathered rock or core runs with length of 2 ft or less recovery.

Rock Recovery: indicated in percent and is equal to the sum of recovered core divided by the length of the core run.

Additional Characteristics to Further Evaluate the Rock include: Name, color, cavities and voids, secondary mineralization, fossils, swelling and slaking properties, etc. Visual-manual descriptions consist of the following factors in the order presented.

Example: Hard, slightly weathered, medium grained, gray ARGILLITE with very thin, moderately dipping foliation: rough to smooth, very close to moderately closely spaced, moderately dipping, iron-oxide stained, joints/fractures.

TEST BORING LOG

GZA GeoEnvironmental of NY *Engineers and Scientists*	New Leaf Energy Geotech Services Wind Turbine Foundation 4949 Forest Avenue Oneida, New York	**EXPLORATION NO.:** GZ-1 **SHEET:** 1 of 4 **PROJECT NO:** 01.0177169.10 **REVIEWED BY:** JMB

Logged By: L. Shea
Drilling Co.: Geosearch, Inc.
Foreman: P. McClenahan

Type of Rig: ATV-Mounted
Rig Model: CME 55LC
Drilling Method: Drive & Wash

Boring Location: See Plan
Ground Surface Elev. (ft.): 1255
Final Boring Depth (ft.): 70
Date Start - Finish: 9/6/2023 - 9/7/2023

H. Datum: NAD83
V. Datum: WGS84

Auger/Casing Type: NW
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 3/3.5

Sampler Type: Split Spoon
Sampler O.D. (in.): 1.375/2
Sampler Length (in.):
Rock Core Size: Automatic

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
9/6/23	1515	44.5	5	5 min.
9/7/23	0700	53.6	5.0	16 hrs.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Description (Depth (ft) / Elev. (ft.))	Equipment Installed
		S-1	0-2	24	10	3 3 5 11	8	S-1: (Top 3"): Dark brown, Clayey SILT, little fine sand, trace Gravel [MC] (Bottom 7"): Brown, SILT & CLAY, some Gravel, little fine to coarse Sand, trace Roots. [MH]	1		0.3' TOPSOIL 1254.7; SILT AND CLAY	No Equipment Installed
2		S-2	2-2.8	9	9	60 50/3"	R	S-2A: (Top 3") Brown, Clayey SILT, little fine to coarse Sand, trace Roots, trace Leaves. [MH] S-2B: (Bottom 6") Gray, GRAVEL and fine to coarse SAND, trace Silt. [GW]	2		2.3' 1252.7; WEATHERED BEDROCK	
4												
		C-1	5-10	60	60			C-1: Moderately hard, slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to vertical fractures. RQD=10%	3, 4, 5		5' 1250.0; BEDROCK	
6	2:27											
	4:10											
8	2:48											
	3:53											
10	3:35	C-2	10-15	60	60			C-2: Moderately hard, slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to subvertical fractures. RQD=18%	6, 7			
	1:41											
12	5:10											
	2:13											
14	2:49											
	2:24	C-3	15-20	60	52			C-3: Moderately hard, slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, subhorizontal to subvertical fractures. RQD=18%	8			
16	2:58											
	2:42											
18	2:46											
	1:34											
20												

REMARKS

1. Ground surface elevation estimated from publicly available aerial survey data. Boring located by handheld GPS unit following drilling.
2. Sampler refusal at 2.8 feet below ground surface (bgs). Casing refusal at approximately 3 feet bgs. Driller used roller cone bit to advance borehole from 3 to 5 feet bgs through likely weathered bedrock. Seated casing at 5 feet bgs.
3. Bedrock coring performed using NX-size core barrel, downward pressure of 500 psi, and 800 rpm.
4. Core barrel jammed after coring approximately 1.5 feet and 3.5 feet of C-1. Lost approximately 150 gallons of water while coring C-1.
5. Highly fractured zone from approximately 5 to 8.8 feet bgs in C-1.
6. Core barrel jammed after coring approximately 1.5 feet of C-2. Lost approximately 100 gallons of water while coring C-2.
7. Highly fractured zones from approximately 10 to 11.4 feet bgs, 11.8 to 12.5 feet bgs and 14 to 15 feet bgs in C-2. Seams of clay within fractures throughout C-2.
8. Core barrel jammed after coring approximately 4.5 feet of C-3. Lost approximately 100 gallons of water while coring C-3.
9. Highly fractured zones from approximately 15 to 15.8 feet bgs and 18.4 to 20 feet bgs in C-3. Seams of clay within fractures throughout C-3.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: GZ-1

TEST BORING LOG

GZA GeoEnvironmental of NY
Engineers and Scientists

New Leaf Energy
Geotech Services Wind Turbine Foundation
4949 Forest Avenue
Oneida, New York

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Description	Equipment Installed
	6:46	C-4	20-25	60	60			C-4: Moderately hard, fresh to slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to vertical fractures. RQD=65%	9			
	1:53								10			
22	1:29								11			
	1:21											
24	1:37											
	2:08	C-5	25-30	60	60			C-5: Moderately hard, fresh to slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal fractures. RQD=77%	12			
26	3:01								13			
	2:28											
28	2:27											
	1:29											
30	2:47	C-6	30-35	60	58			C-6: Moderately hard, fresh to slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to vertical fractures. RQD=67%				
	2:05											
32	2:07										BEDROCK	
	1:35											
34	1:53											
	1:50	C-7	35-40	60	59			C-7: Moderately hard, fresh to slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal fractures. RQD=58%	14			
36	2:17											
	1:12											
38	1:08								15			
	1:46											
40	2:21	C-8	40-45	60	60			C-8: Moderately hard, fresh to slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to vertical fractures. RQD=38%	16			
	2:46											
42	1:57											
	2:01								17			
44	2:16											

REMARKS

10. Lost approximately 75 gallons of water while coring C-4.
11. Highly fractured zones from approximately 20 to 21 feet bgs. Seams of clay within fractures from approximately 22.4 to 22.6 feet bgs and from 23.9 to 24.1 bgs in C-4.
12. Lost approximately 100 gallons of water while coring C-5.
13. Seam of clay within fracture from approximately 26.4 to 26.5 feet bgs in C-5.
14. Lost approximately 125 gallons of water while coring C-6 and C-7.
15. Seam of clay within fracture from approximately 38.4 to 38.6 feet bgs in C-7.
16. Lost approximately 100 gallons of water while coring C-8.
17. Highly fractured zone with vertical fractures from approximately 42.7 to 44.5 feet bgs. Seam of clay within fracture from approximately 42.9 to 43.1 feet bgs in C-8.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

TEST BORING LOG

GZA GeoEnvironmental of NY
Engineers and Scientists

New Leaf Energy
Geotech Services Wind Turbine Foundation
4949 Forest Avenue
Oneida, New York

EXPLORATION NO.: GZ-1
SHEET: 3 of 4
PROJECT NO: 01.0177169.10
REVIEWED BY: JMB

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Depth (ft)	Stratum Description	Elev. (ft.)	Equipment Installed
	2:16	C-9	45-50	60	54			C-9: Moderately hard, slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to vertical fractures. RQD=37%	18					
46	2:16													
	1:27								19					
48	3:02													
	5:53													
50	5:38	C-10	50-55	60	58			C-10: Moderately hard, fresh to slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to moderately dipping fractures. RQD=55%	20					
	2:43													
52	2:30													
	2:39													
54	2:20													
	2:56	C-11	55-60	60	58			C-11: Moderately hard, fresh to slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to moderately dipping fractures. RQD=57%	21					
56	3:04											BEDROCK		
	2:19													
58	2:53													
	2:49													
60	2:21	C-12	60-65	60	59			C-12: Moderately hard, fresh to slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to vertical fractures. RQD=30%	22					
	2:53								23					
62	2:12													
	3:15								24					
64	5:23								25					
	3:52	C-13	65-70	60	58			C-13: Moderately hard, slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to vertical fractures. RQD=45%						
66	3:04								26					
	3:02													
68														

REMARKS

18. Core barrel jammed after coring approximately 4 feet of C-9. Lost approximately 100 gallons of water while coring C-9.
19. Highly fractured one from approximately 45.7 to 47.8 feet bgs in C-9.
20. Lost approximately 75 gallons of water while coring C-10.
21. Lost approximately 75 gallons of water while coring C-11.
22. Vertical fractures from approximately 59.5 to 60 feet bgs.
23. Core barrel jammed after coring approximately 3.5 feet of C-12. Lost approximately 100 gallons water while coring C-12.
24. Highly fractured zone from approximately 62.2 to 63.7 feet bgs in C-12.
25. Core barrel jammed after coring approximately 2.5 feet bgs. Lost approximately 75 gallons of water while coring C-13.
26. Highly fractured zones from approximately 65 to 67.4 feet bgs and 69.1 to 70 feet bgs in C-13.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: GZ-1

TEST BORING LOG

GZA GeoEnvironmental of NY *Engineers and Scientists*	New Leaf Energy Geotech Services Wind Turbine Foundation 4949 Forest Avenue Oneida, New York	EXPLORATION NO.: GZ-1 SHEET: 4 of 4 PROJECT NO: 01.0177169.10 REVIEWED BY: JMB

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Description (Depth (ft.) / Elev. (ft.))	Equipment Installed
70											BEDROCK 70' 1185.0	
								Bottom of boring at 70 feet.	27			
72												
74												
76												
78												
80												
82												
84												
86												
88												
90												
92												

REMARKS

27. End of exploration at 70 feet bgs. Upon completion, borehole backfilled using approximately 55 gallons of low slump grout to 0.5 feet bgs and bentonite chips from 0.5 to 0 feet bgs to match existing ground surface.

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Exploration No.: GZ-1

TEST BORING LOG

GZA GeoEnvironmental of NY
Engineers and Scientists

New Leaf Energy
Geotech Services Wind Turbine Foundation
4949 Forest Avenue
Oneida, New York

EXPLORATION NO.: GZ-2 (OW)
SHEET: 1 of 2
PROJECT NO: 01.0177169.10
REVIEWED BY: JMB

Logged By: L. Shea
Drilling Co.: Geosearch, Inc.
Foreman: P. McClenahan

Type of Rig: ATV-Mounted
Rig Model: CME 55LC
Drilling Method: Drive & Wash

Boring Location: See Plan
Ground Surface Elev. (ft.): 1247
Final Boring Depth (ft.): 40
Date Start - Finish: 9/5/2023 - 9/5/2023

H. Datum: NAD83
V. Datum: WGS84

Auger/Casing Type: HW/NW
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): 4/4.5 / 3/3.5

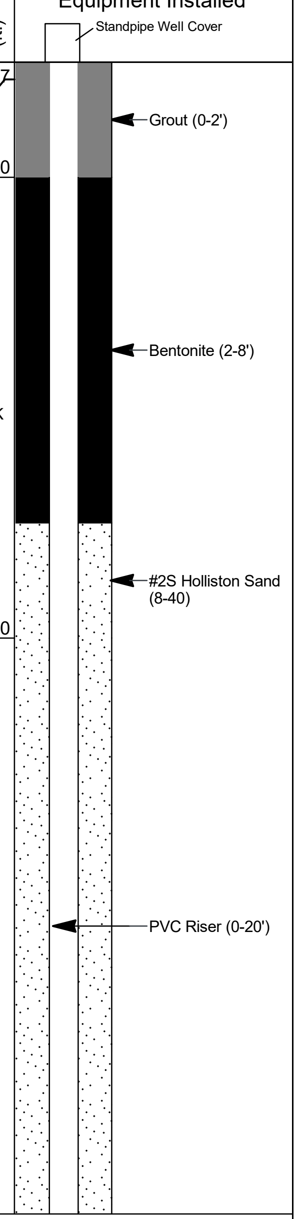
Sampler Type: Split Spoon
Sampler O.D. (in.): 1.375/2
Sampler Length (in.):
Rock Core Size: Automatic

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
9/6/23	0710	29.9		16 hrs.
9/6/23	1515	29.5		24 hrs.
9/7/23	0700	30.0		40 hrs.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Description
0		S-1	0-2	24	11	3 5 7 14	12	S-1: (Top 3"): Dark brown, Clayey SILT, little fine sand, trace Gravel [MC] Brown, SILT & CLAY, little fine to medium Sand, trace Gravel, trace Roots. [MH]	1		0.3' TOPSOIL 1246.7; SILT AND CLAY; 2' 1245.0
2		S-2	2-2.9	11	8	52 50/5"	R	S-2: Very dense, gray, fine to coarse GRAVEL, little fine to coarse Sand, trace Clayey Silt. [GW]	2		WEATHERED BEDROCK; 10' 1237.0
10	1:54, 1:31, 3:35, 6:02, 1:52	C-1	10-15	60	55			C-1: Moderately hard, slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to vertical fractures. RQD=0%	3, 4, 5		BEDROCK
15	3:17, 1:48, 1:07, 1:26, 1:59	C-2	15-20	60	58			C-2: Moderately hard, fresh to slightly weathered, fine grained, gray, LIMESTONE, very thin to thin, horizontal bedding, very close to close, horizontal fractures. RQD=55%	6, 7		BEDROCK

Equipment Installed



REMARKS

1. Ground surface elevation estimated from publicly available aerial survey data. Boring located by handheld GPS unit following drilling.
2. Sampler refusal at 2.9 feet below ground surface (bgs). Casing refusal at approximately 3 feet bgs. Driller used roller cone bit to advance borehole from 3 to 10 feet bgs through likely weathered bedrock. Telescoped NW-size casing through HW-size casing to 10 feet bgs.
3. Bedrock coring performed using NX-size core barrel, downward pressure of 500 psi and 800 rpm.
4. Core barrel jammed after coring approximately 3.5 feet of C-1.
5. Highly fractured zones from 10.4 to 11.4 feet bgs and from 12.5 to 15 feet bgs in C-1.
6. Lost approximately 100 gallons of water while coring C-2.
7. Seams of clay within fractures from 16.8 to 16.9 feet bgs and 23.3 to 25 feet bgs in C-2.
8. Lost approximately 100 gallons of water while coring C-3.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: GZ-2 (OW)

TEST BORING LOG

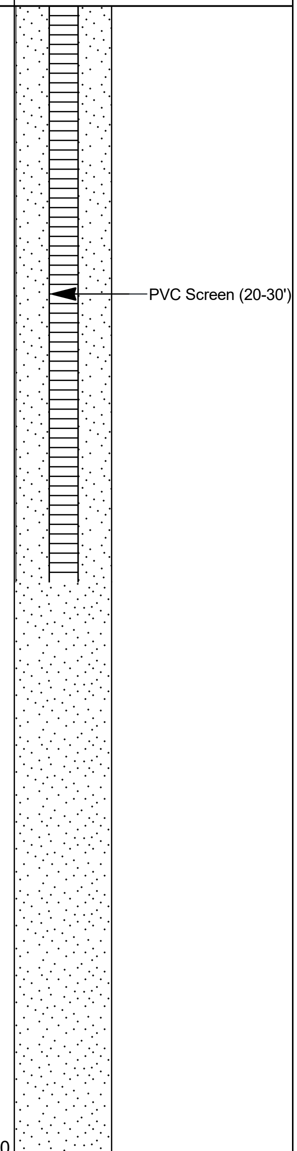
GZA GeoEnvironmental of NY
Engineers and Scientists

New Leaf Energy
Geotech Services Wind Turbine Foundation
4949 Forest Avenue
Oneida, New York

PROJECT NO: 01.0177169.10
REVIEWED BY: JMB

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Description (Depth (ft.) / Elev. (ft.))
20-25 (22, 24)	2:27, 2:24, 2:05, 2:13, 2:43	C-3	20-25	60	56			C-3: Moderately hard, fresh to slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to moderately dipping fractures. RQD=32%	8, 9		BEDROCK
25-30 (26, 28)	2:39, 1:56, 1:22, 1:18, 2:16	C-4	25-30	60	60			C-4: Moderately hard, slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to vertical fractures. RQD=38%	10, 11		
30-35 (30, 32, 34)	2:12, 1:08, 1:44, 2:31, 2:55	C-5	30-35	60	60			C-5: Moderately hard, fresh to slightly weathered, fine grained, gray, LIMESTONE, very thin, horizontal bedding, very close to close, horizontal to subhorizontal fractures. RQD=78%	12, 13		
35-40 (36, 38, 40)	2:01, 1:52, 1:56, 4:32, 2:58	C-6	35-40	60	60			C-6: Moderately hard, slightly weathered, fine grained, gray, LIMESTONE, very thin bedding, very close to close, horizontal to subvertical fractures. RQD=15%	14, 15		40' 1207.0
40-44 (42, 44)								Bottom of boring at 40 feet.	16		

Equipment Installed



REMARKS

9. Highly fractured zone with vertical fractures from 23.3 to 25 feet bgs in C-3.
10. Lost approximately 75 gallons of water while coring C-4.
11. Highly fractured zone from approximately 25.5 to 26.4 feet bgs in C-4. Seams of clay within fractures from approximately 26.8 to 27.3 feet bgs and from 29.4 to 29.6 feet bgs in C-4.
12. Lost approximately 50 gallons of water while coring C-5.
13. Seam of clay within fracture from approximately 33.3 to 33.5 feet bgs in C-5.
14. Core barrel jammed after coring approximately 4 feet of C-6. Lost approximately 75 gallons of water while coring C-6.
15. Highly fractured zones from approximately 35.5 to 36.4 feet bgs and from 38.4 to 38.8 feet bgs. Seams of clay within fractures throughout C-6.
16. End of exploration at 40 feet bgs. Upon completion, a groundwater monitoring well was installed.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

TEST BORING LOG

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4949 Forest Avenue
Oneida, New York

EXPLORATION NO.: GZ-3
SHEET: 1 of 1
PROJECT NO: 01.0177169.10
REVIEWED BY: JMB

Logged By: L. Shea
Drilling Co.: Geosearch, Inc.
Foreman: P. McClenahan

Type of Rig: ATV-Mounted
Rig Model: CME 55LC
Drilling Method: Drive & Wash

Boring Location: See Plan
Ground Surface Elev. (ft.): 1209
Final Boring Depth (ft.): 4.8
Date Start - Finish: 9/7/2023 - 9/7/2023

H. Datum: NAD83
V. Datum: WGS84

Auger/Casing Type: N/A
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): N/A

Sampler Type: Split Spoon
Sampler O.D. (in.): 1.375/2
Sampler Length (in.):
Rock Core Size: N/A

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
9/7/23	0845	NE	0	5 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Description (Depth (ft.) / Elev. (ft.))	Equipment Installed
		S-1	0-2	24	10	2 6 8 10	14	S-1: Medium dense, brown, GRAVEL, some Silt & Clay, little fine to coarse Sand, trace Roots. [GM]	1		GRAVELLY SILT & CLAY 2' 1207.0	No Equipment Installed
2		S-2	2-4	24	10	18 19 26 16	45	S-2: Dense, gray, GRAVEL, little fine to coarse Sand, trace Silt. [GW]			WEATHERED BEDROCK	
4		S-3	4-4.8	9	9	23 50/3"	R	S-3: Very dense, gray, GRAVEL, some fine to coarse Sand, trace Silt. [GW]	2		4.8' 1204.2	
6								Bottom of boring at 4.8 feet.				
8												
10												
12												
14												
16												
18												
20												

REMARKS

1. Ground surface elevation estimated from publicly available aerial survey data. Boring located by handheld GPS unit following drilling.
2. Sampler refusal at 4.8 feet below ground surface (bgs). End of exploration at 4.8 feet bgs. Upon completion, borehole backfilled with bentonite chips to match existing ground surface.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: GZ-3

TEST BORING LOG

GZA GeoEnvironmental of NY
Engineers and Scientists

New Leaf Energy
Geotech Services Wind Turbine Foundation
4949 Forest Avenue
Oneida, New York

EXPLORATION NO.: GZ-4
SHEET: 1 of 1
PROJECT NO: 01.0177169.10
REVIEWED BY: JMB

Logged By: L. Shea
Drilling Co.: Geosearch, Inc.
Foreman: P. McClenahan

Type of Rig: ATV-Mounted
Rig Model: CME 55LC
Drilling Method: Drive & Wash

Boring Location: See Plan
Ground Surface Elev. (ft.): 1197
Final Boring Depth (ft.): 3.8
Date Start - Finish: 9/7/2023 - 9/7/2023

H. Datum: NAD83
V. Datum: WGS84

Auger/Casing Type: N/A
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): N/A

Sampler Type: Split Spoon
Sampler O.D. (in.): 1.375/2
Sampler Length (in.):
Rock Core Size: N/A

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
9/7/23	0915	NE	0	5 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Description	Equipment Installed
0		S-1	0-2	24	10	5 9 11 11	20	S-1: Very stiff, brown, SILT & CLAY, trace fine to coarse Sand, trace Roots. [MH]	1, 2		SILT AND CLAY	No Equipment Installed
2		S-2	2-3.8	22	13	15 27 38 50/4"	65	S-2A: (Top 6") Brown, Clayey SILT & CLAY, little Gravel, little fine to coarse Sand, trace Roots. [MH] S-2B: (Bottom 7") Gray, GRAVEL, little fine to coarse Sand, little Silt. [GW - GM]			2.5' — 1194.5 WEATHERED BEDROCK 3.8' — 1193.2	
4								Bottom of boring at 3.8 feet.	3			
6												
8												
10												
12												
14												
16												
18												
20												

REMARKS

1. Ground surface elevation estimated from publicly available aerial survey data. Boring located by handheld GPS unit following drilling.
2. Rock outcrops observed in the vicinity of GZ-4.
3. Sampler refusal at 3.8 feet below ground surface (bgs). End of exploration at 3.8 feet bgs. Upon completion, borehole backfilled with bentonite chips to match existing ground surface.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: GZ-4

TEST BORING LOG

GZA GeoEnvironmental of NY
Engineers and Scientists

New Leaf Energy
Geotech Services Wind Turbine Foundation
4949 Forest Avenue
Oneida, New York

EXPLORATION NO.: GZ-5
SHEET: 1 of 1
PROJECT NO: 01.0177169.10
REVIEWED BY: JMB

Logged By: L. Shea
Drilling Co.: Geosearch, Inc.
Foreman: P. McClenahan

Type of Rig: ATV-Mounted
Rig Model: CME 55LC
Drilling Method: Drive & Wash

Boring Location: See Plan
Ground Surface Elev. (ft.): 1197
Final Boring Depth (ft.): 1.4
Date Start - Finish: 9/7/2023 - 9/7/2023

H. Datum: NAD83
V. Datum: WGS84

Auger/Casing Type: N/A
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): N/A

Sampler Type: Split Spoon
Sampler O.D. (in.): 1.375/2
Sampler Length (in.):
Rock Core Size: N/A

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
9/7/23	0930	NE	0	5 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Description (Depth (ft.) / Elev. (ft.))	Equipment Installed
		S-1	0-1.4	17	15	7 9 50/5"	R	S-1A: (Top 11") Brown, SILT & CLAY, some Gravel, little fine to coarse Sand, trace Roots. [MH]	1, 2		SILT AND CLAY 0.9' / 1196.1	No Equipment Installed
								S-1B: (Bottom 4") Gray, fine to coarse GRAVEL and fine to coarse SAND, trace Silt. [GW]	3		WEATHERED BEDROCK 1.4' / 1195.6	
								Bottom of boring at 1.4 feet.				

Depth scale (ft): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

REMARKS

1. Ground surface elevation estimated from publicly available aerial survey data. Boring located by handheld GPS unit following drilling.
2. Rock outcrops observed in the vicinity of GZ-5.
3. Sampler refusal at 1.4 feet below ground surface (bgs). End of exploration at 1.4 feet bgs. Upon completion, borehole backfilled with bentonite chips to match existing ground surface.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: GZ-5

TEST BORING LOG

GZA GeoEnvironmental of NY
Engineers and Scientists

New Leaf Energy
Geotech Services Wind Turbine Foundation
4949 Forest Avenue
Oneida, New York

EXPLORATION NO.: GZ-6
SHEET: 1 of 1
PROJECT NO: 01.0177169.10
REVIEWED BY: JMB

Logged By: L. Shea
Drilling Co.: Geosearch, Inc.
Foreman: P. McClenahan

Type of Rig: ATV-Mounted
Rig Model: CME 55LC
Drilling Method: Drive & Wash

Boring Location: See Plan
Ground Surface Elev. (ft.): 1197
Final Boring Depth (ft.): 3
Date Start - Finish: 9/7/2023 - 9/7/2023

H. Datum: NAD83
V. Datum: WGS84

Auger/Casing Type: N/A
Hammer Weight (lb.): 140
Hammer Fall (in.): 30
Auger or Casing O.D./I.D Dia (in.): N/A

Sampler Type: Split Spoon
Sampler O.D. (in.): 1.375/2
Sampler Length (in.):
Rock Core Size: N/A

Groundwater Depth (ft.)

Date	Time	Water Depth	Casing	Stab. Time
9/7/23	1000	NE	0	5 min.

Depth (ft)	Casing Blows/ Core Rate	Sample No.	Sample Depth (ft.)	Pen. (in)	Rec. (in)	Blows (per 6 in.)	SPT Value	Sample Description Modified Burmister	Remark	Field Test Data	Stratum Depth (ft.)	Stratum Description	Stratum Elev. (ft.)	Equipment Installed
		S-1	0-2	24	11	7 9 11 12	20	S-1: Very stiff, brown, SILT & CLAY, some fine to coarse Sand, some Gravel, trace Roots. [MH]	1, 2			SILT AND CLAY		No Equipment Installed
2		S-2	2-3	12	6	26 24 50/0"	R	S-2: Very dense, gray, GRAVEL, some fine to coarse Sand, little Silt. [GW - GM]			2'	WEATHERED BEDROCK	1195.0	
								Bottom of boring at 3 feet.	3		3'		1194.0	
4														
6														
8														
10														
12														
14														
16														
18														
20														

REMARKS

1. Ground surface elevation estimated from publicly available aerial survey data. Boring located by handheld GPS unit following drilling.
2. Rock outcrops observed in the vicinity of GZ-6.
3. Sampler refusal at 3 feet below ground surface (bgs). End of exploration at 3 feet bgs. Upon completion, borehole backfilled with bentonite chips to match existing ground surface.

See log key for explanation of sample descriptions and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Exploration No.: GZ-6

Appendix D – Test Boring Photos

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.:
New Leaf Energy	4949 Forest Avenue, Oneida, New York	01.0177169.10

Photo No.:	Date:
1	9/6/2023

Boring:
GZ-1

Photographer:
Lauren Shea

Depth:
0-2 feet

Photo No.:	Date:
2	9/6/2023

Boring:
GZ-1

Photographer:
Lauren Shea

Depth:
2-2.8 feet

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.:
New Leaf Energy	4949 Forest Avenue, Oneida, New York	01.0177169.10

Photo No.: **3**	Date: 9/5/2022
Boring: GZ-2 **Photographer**: Lauren Shea	
Depth: 0-2 feet	

Photo No.: **4**	Date: 9/5/2023
Boring: GZ-2 **Photographer**: Lauren Shea	
Depth: 2-2.9 feet	

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.:
New Leaf Energy	4949 Forest Avenue, Oneida, New York	01.0177169.10

Photo No.:	Date:
5	9/7/2023

Boring:
GZ-3

Photographer:
Lauren Shea

Depth:
0-2 feet

Photo No.:	Date:
6	9/7/2023

Boring:
GZ-3

Photographer:
Lauren Shea

Depth:
2-4 feet

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.:
New Leaf Energy	4949 Forest Avenue, Oneida, New York	01.0177169.10

Photo No.:	Date:
7	9/7/2023

Boring:
GZ-3

Photographer:
Lauren Shea

Depth:
4-4.8 feet

Photo No.:	Date:
8	9/7/2023

Boring:
GZ-4

Photographer:
Lauren Shea

Depth:
0-2 feet

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.:
New Leaf Energy	4949 Forest Avenue, Oneida, New York	01.0177169.10

Photo No.: 9	Date: 9/7/2023
Boring: GZ-4 **Photographer**: Lauren Shea	
Depth: 2-3.8 feet	

Photo No.: 10	Date: 9/7/2023
Boring: GZ-5 **Photographer**: Lauren Shea	
Depth: 0-1.4 feet	

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.:
New Leaf Energy	4949 Forest Avenue, Oneida, New York	01.0177169.10

Photo No.: 11

Date: 9/7/2022

Boring:
GZ-6

Photographer:
Lauren Shea

Depth:
0-2 feet

Photo No.: 12

Date: 9/7/2023

Boring:
GZ-6

Photographer:
Lauren Shea

Depth:
2-3 feet

Appendix E – Rock Core Photographs

Boring No.	Core Run	Core Depths (ft)		Core Recovery		Rock Quality Designation (RQD, %)
		Top	Bottom	Rec. (in)	%	
--	--	--	--	--	--	--
--	--	--	--	--	--	--
GZ-1	C-1	5	10	60	100	10
GZ-1	C-2	10	15	60	100	18

*Core runs presented in the table correspond to position in the core box (e.g. third row core box = GZ-1, C-1).

Note: Cores in the top two rows that are obscured in the photos below are cores that were obtained from other borings within the project. These photographs are provided under separate cover.

Dry Condition

Wet Condition

	4949 Forest Avenue, Oneida, NY Geotechnical Services - Wind Turbine Foundation	Boring GZ-1
	Rock Core Photographs	

Boring No.	Core Run	Core Depths (ft)		Core Recovery		Rock Quality Designation (RQD, %)
		Top	Bottom	Rec. (in)	%	
GZ-1	C-3	15	20	52	87	18
GZ-1	C-4	20	25	60	100	65
GZ-1	C-5	25	30	60	100	77
GZ-1	C-6	30	35	58	97	67

*Core runs presented in the table correspond to position in the core box (e.g. first row core box = GZ-1, C-3).

Dry Condition

Wet Condition

4949 Forest Avenue, Oneida, NY
Geotechnical Services - Wind Turbine Foundation

Rock Core Photographs

Boring
GZ-1

Boring No.	Core Run	Core Depths (ft)		Core Recovery		Rock Quality Designation (RQD, %)
		Top	Bottom	Rec. (in)	%	
GZ-1	C-7	35	40	59	98	58
GZ-1	C-8	40	45	60	100	38
GZ-1	C-9	45	50	54	90	37
GZ-1	C-10	50	55	58	97	55

*Core runs presented in the table correspond to position in the core box (e.g. first row core box = GZ-1, C-7).

Dry Condition

Wet Condition

GZA	4949 Forest Avenue, Oneida, NY Geotechnical Services - Wind Turbine Foundation	Boring GZ-1
	Rock Core Photographs	

Boring No.	Core Run	Core Depths (ft)		Core Recovery		Rock Quality Designation (RQD, %)
		Top	Bottom	Rec. (in)	%	
GZ-1	C-11	55	60	58	97	57
GZ-1	C-12	60	65	59	98	30
GZ-1	C-13	65	70	58	97	45
--	--	--	--	--	--	--

*Core runs presented in the table correspond to position in the core box (e.g. top row core box = GZ-1, C-11).

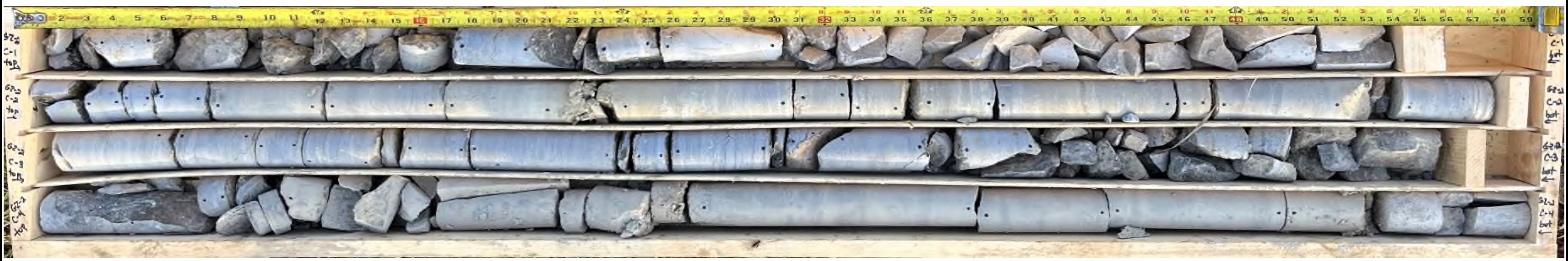
Dry Condition

Wet Condition

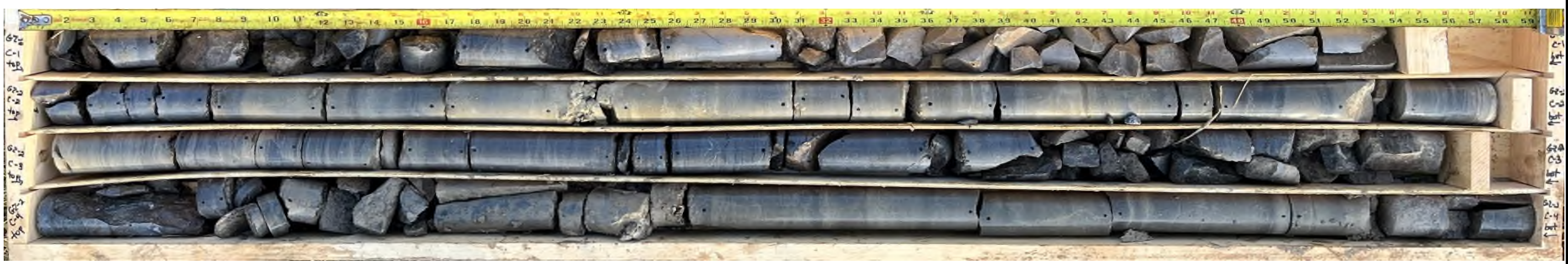
GZA	4949 Forest Avenue, Oneida, NY Geotechnical Services - Wind Turbine Foundation	Boring GZ-1
	Rock Core Photographs	

Boring No.	Core Run	Core Depths (ft)		Core Recovery		Rock Quality Designation (RQD, %)
		Top	Bottom	Rec. (in)	%	
GZ-2	C-1	10	15	55	92	0
GZ-2	C-2	15	20	58	97	55
GZ-2	C-3	20	25	56	93	32
GZ-2	C-4	25	30	60	100	38

*Core runs presented in the table correspond to position in the core box (e.g. top row core box = GZ-2, C-1).



Dry Condition



Wet Condition

4949 Forest Avenue, Oneida, NY
Geotechnical Services - Wind Turbine Foundation

Rock Core Photographs

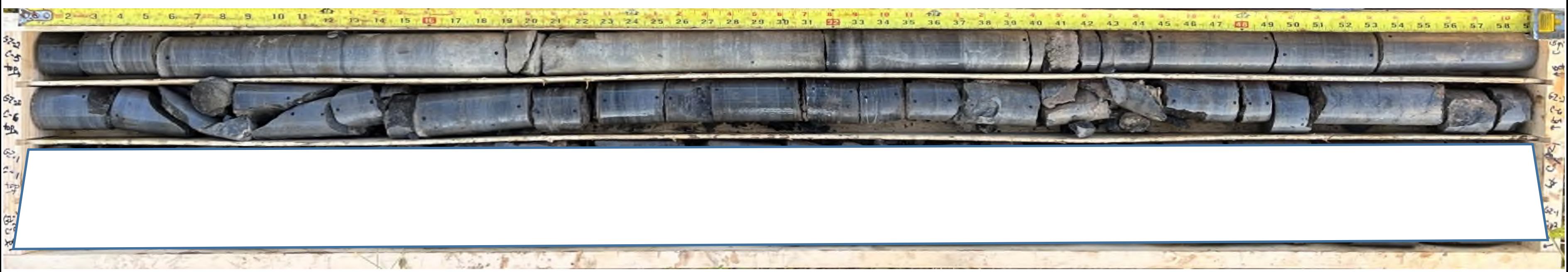
Boring GZ-2

Boring No.	Core Run	Core Depths (ft)		Core Recovery		Rock Quality Designation (RQD, %)
		Top	Bottom	Rec. (in)	%	
GZ-2	C-5	30	35	60	100	78
GZ-2	C-6	35	40	60	100	15
--	--	--	--	--	--	--
--	--	--	--	--	--	--

*Core runs presented in the table correspond to position in the core box (e.g. first row core box = GZ-2, C-5).

Note: Cores in the bottom two rows that are obscured in the photos below are cores that were obtained from other borings within the project. These photographs are provided under separate cover.

Dry Condition



Wet Condition

GZA	4949 Forest Avenue, Oneida, NY Geotechnical Services - Wind Turbine Foundation	Boring GZ-2
	Rock Core Photographs	

Appendix F – Field Electrical Resistivity Testing Results

SUMMARY OF IN-SITU ELECTRICAL RESISTIVITY TESTING
Geotech Services Wind Turbine Foundation
4949 Forest Avenue, Oneida, NY
GZA PROJECT NO.: 01.0177169.10

Test Identification	East-West and North-South Alignments
Test Date	9/6/2023
Company Conducting Test	GZA GeoEnvironmental, Inc.
Test Instrument	AEMC 6470-B
Latest Instrument Calibration Date	9/23/2022
Site Location	4949 Forest Avenue, Oneida, NY
Traverse Details	Performed Near Proposed Wind Turbine
Weather	Sunny, Clear
Temperature	80s (°F)
Humidity	74%
Logged by	Lauren Shea
Ground Conditions	Dry

East-West Alignment

Current / Potential Pin Spacing	Current / Potential Pin Spacing	Current / Potential Pin Spacing	Source Voltage	Max Allowable Pin Depth	Potential Pin Depth	Current Pin Depth	Measured Current	Measured Voltage	Measured Apparent Resistance	Apparent Resistivity (ρ=2πaR)	
"a" (feet)	"a" (cm)	"a" (m)	(V)	"b" (in)	"b" (in)	"b" (in)	(mA)	(mV)	R (Ohms)	(Ohm-cm)	(Ohm-m)
2.7	82	0.8	12	1.62	1.5	1.5	4.4	557	126	65152	652
5	152	1.5	12	3	3	3	6.4	773	116	111077	1111
10	305	3.0	12	6	6	6	12.2	715	58.7	112417	1124
20	610	6.1	12	12	12	12	20.6	731	35.6	136356	1364
50	1524	15.2	12	30	12	12	26.5	382	14.4	137888	1379
100	3048	30.5	12	60	12	12	11.3	116	10.3	197257	1973

Remarks: Performed testing line through proposed wind turbine area. Ground not level.

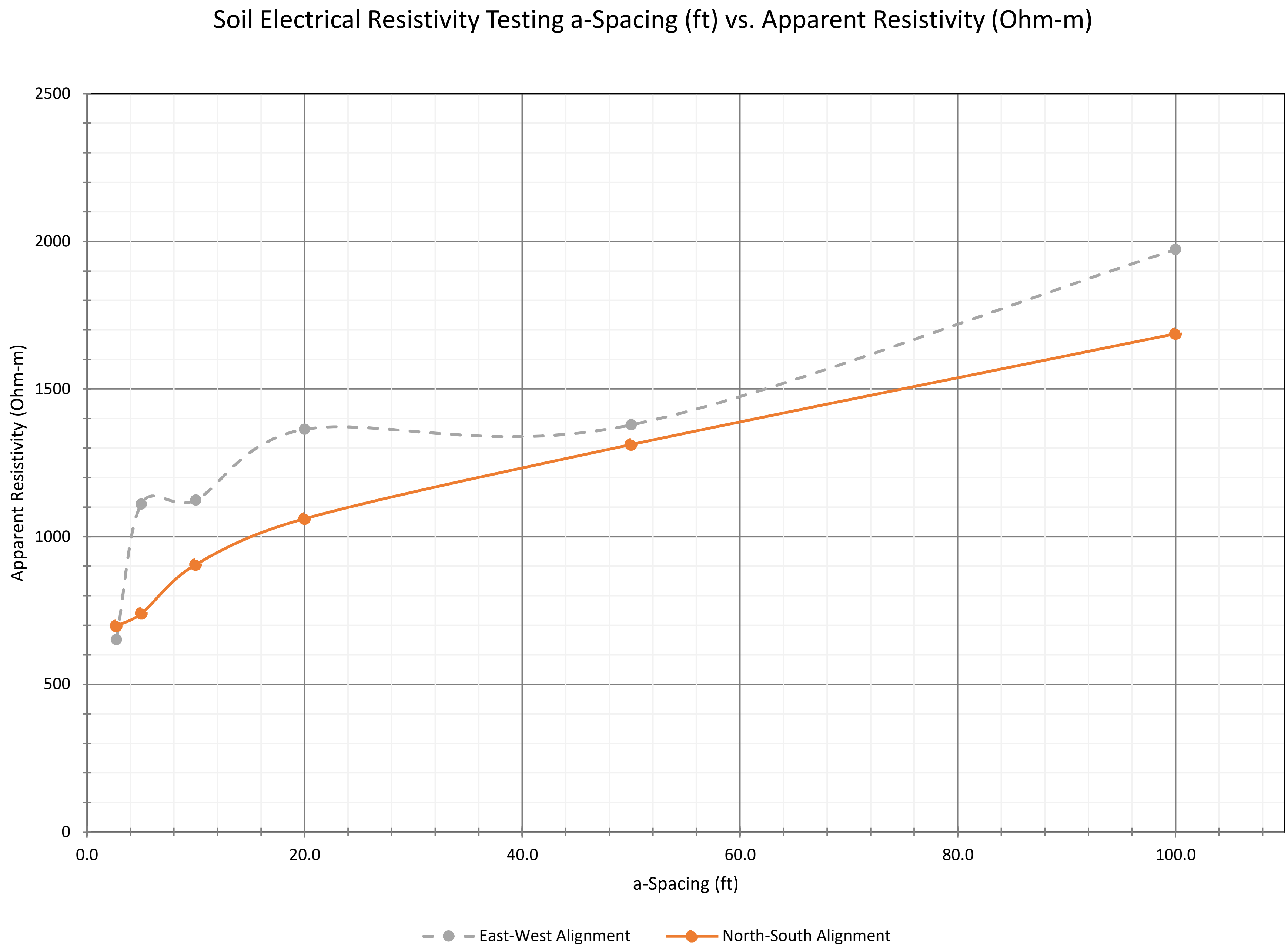
SUMMARY OF IN-SITU ELECTRICAL RESISTIVITY TESTING
Geotech Services Wind Turbine Foundation
4949 Forest Avenue, Oneida, NY
GZA PROJECT NO.: 01.0177169.10

Test Identification	East-West and North-South Alignments
Test Date	9/6/2023
Company Conducting Test	GZA GeoEnvironmental, Inc.
Test Instrument	AEMC 6470-B
Latest Instrument Calibration Date	9/23/2022
Site Location	4949 Forest Avenue, Oneida, NY
Traverse Details	Performed Near Proposed Wind Turbine
Weather	Sunny, Clear
Temperature	80s (°F)
Humidity	74%
Logged by	Lauren Shea
Ground Conditions	Dry

North-South Alignment

Current / Potential Pin Spacing "a" (feet)	Current / Potential Pin Spacing "a" (cm)	Current / Potential Pin Spacing "a" (m)	Source Voltage (V)	Max Allowable Pin Depth "b" (in)	Potential Pin Depth "b" (in)	Current Pin Depth "b" (in)	Measured Current (mA)	Measured Voltage (mV)	Measured Apparent Resistance R (Ohms)	Apparent Resistivity (ρ=2πaR) (Ohm-cm)	Apparent Resistivity (ρ=2πaR) (Ohm-m)
2.7	82	0.8	12	1.62	1.5	1.5	6.1	814	135	69806	698
5	152	1.5	12	3	3	3	10.0	768	77.3	74019	740
10	305	3.0	12	6	6	6	16.6	784	47.3	90585	906
20	610	6.1	12	12	12	12	21.7	601	27.7	106097	1061
50	1524	15.2	12	30	12	12	19.1	262	13.7	131185	1312
100	3048	30.5	12	60	12	12	8.1	71	8.8	168722	1687

Remarks: Performed testing line through proposed wind turbine area.



Soil Electrical Resistivity Testing a-Spacing (ft) vs. Apparent Resistivity (Ohm-m)
2500
2000
1500
1000
500
0
Apparent Resistivity (Ohm-m)
0.0
20.0
40.0
60.0
80.0
100.0
a-Spacing (ft)
East-West Alignment
North-South Alignment

Appendix G – Geotechnical Laboratory Testing Data

Thielsch
DIVISION OF THE RISE GROUP

195 Frances Avenue
Cranston RI, 02910
Phone: (401)-467-6454
Fax: (401)-467-2398
cts.thielsch.com
Let's Build a Solid Foundation

Client Information:	
GZA GeoEnvironmental, Inc.	
Norwood, MA	
Project Manager:	Joseph Benoit
Assigned By:	Joseph Benoit
Collected By:	Lauren Shea

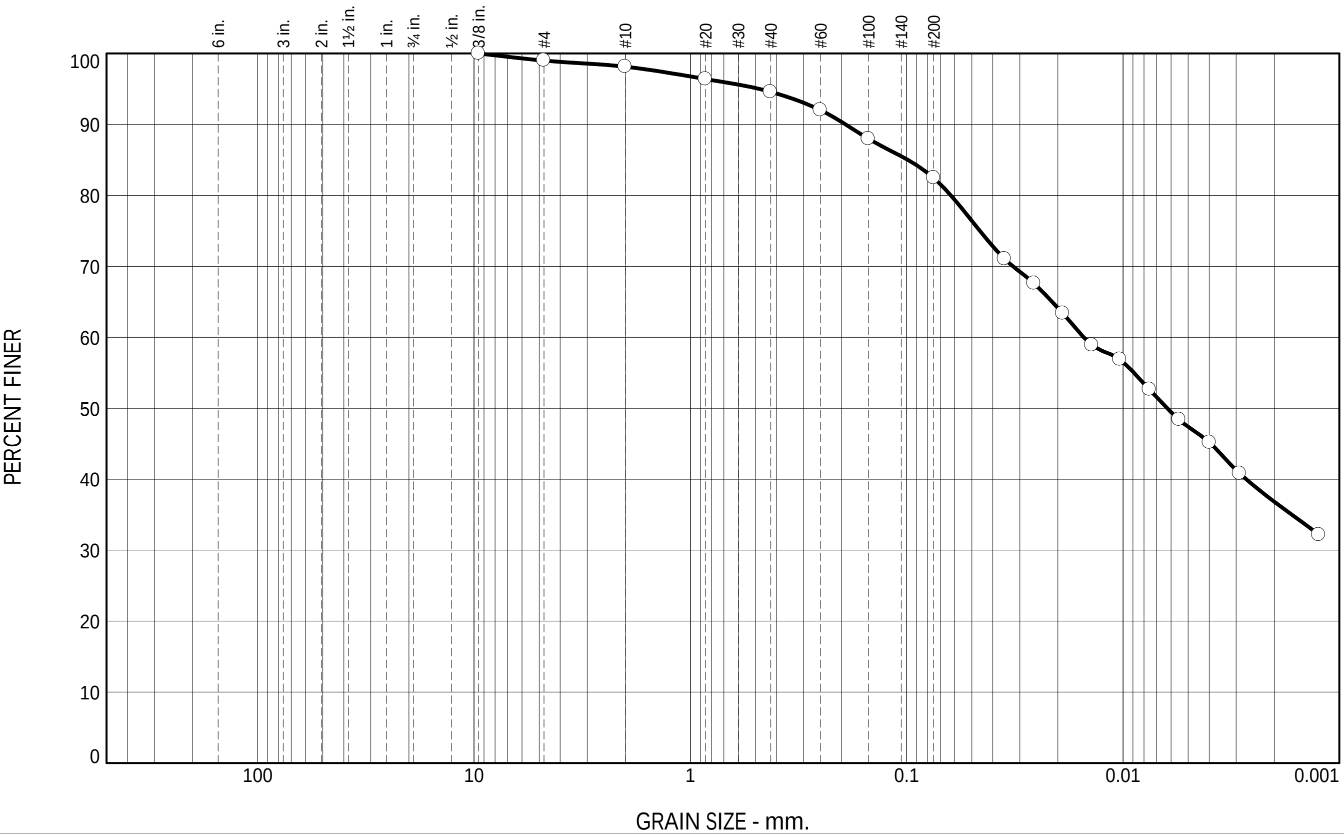
Project Information:	
Geotech Services - Wind Turbine Foundations	
Oneida, NY	
Project Number:	01.0177169.10
Summary Page:	1 of 1
Report Date:	09.18.23

LABORATORY TESTING DATA SHEET, Report No.: 7423-J-138

				Identification Tests									Proctor / CBR / Permeability Tests								
Boring No.	Sample ID	Depth (ft)	Laboratory No.	As Rcvd Moisture Content %	LL %	PL %	OD LL	Gravel %	Sand %	Fines %	Org. %	pH	g_d MAX (pcf) W_{opt} (%)	g_d MAX (pcf) W_{opt} (%) (Corr.)	Dry unit wt. (pcf)	Test Moisture Content %	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	Laboratory Log and Soil Description
				D2216	D4318			D6913			D2974	D4792	D1557								
GZ-2	S-1	0-2	23-S-3785					1.0	16.5	82.5											Brown SILT & CLAY, little f-m Sand, trace fine Gravel
GZ-5	S-1A	0-1.4	23-S-3786					20.5	17.3	62.2											Brown SILT & CLAY, some fine Gravel, little f-m Sand

Date Received: **09.12.23** Reviewed By: ____________ Date Reviewed: **09.19.23**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.0	0.9	3.5	12.1	45.7	36.8

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	99.0		
#10	98.1		
#20	96.4		
#40	94.6		
#60	92.0		
#100	88.0		
#200	82.5		
0.0353 mm.	71.0		
0.0258 mm.	67.6		
0.0190 mm.	63.3		
0.0139 mm.	58.9		
0.0103 mm.	56.9		
0.0075 mm.	52.6		
0.0055 mm.	48.4		
0.0040 mm.	45.1		
0.0029 mm.	40.8		
0.0012 mm.	32.2		

* (no specification provided)

Soil Description

Brown SILT & CLAY, little f-m Sand, trace fine Gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.1916 D_{85}= 0.0988 D_{60}= 0.0152
D_{50}= 0.0062 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Source of Sample: Boring Depth: 0-2'
Sample Number: GZ-2 / S-1

Date: 09.18.23

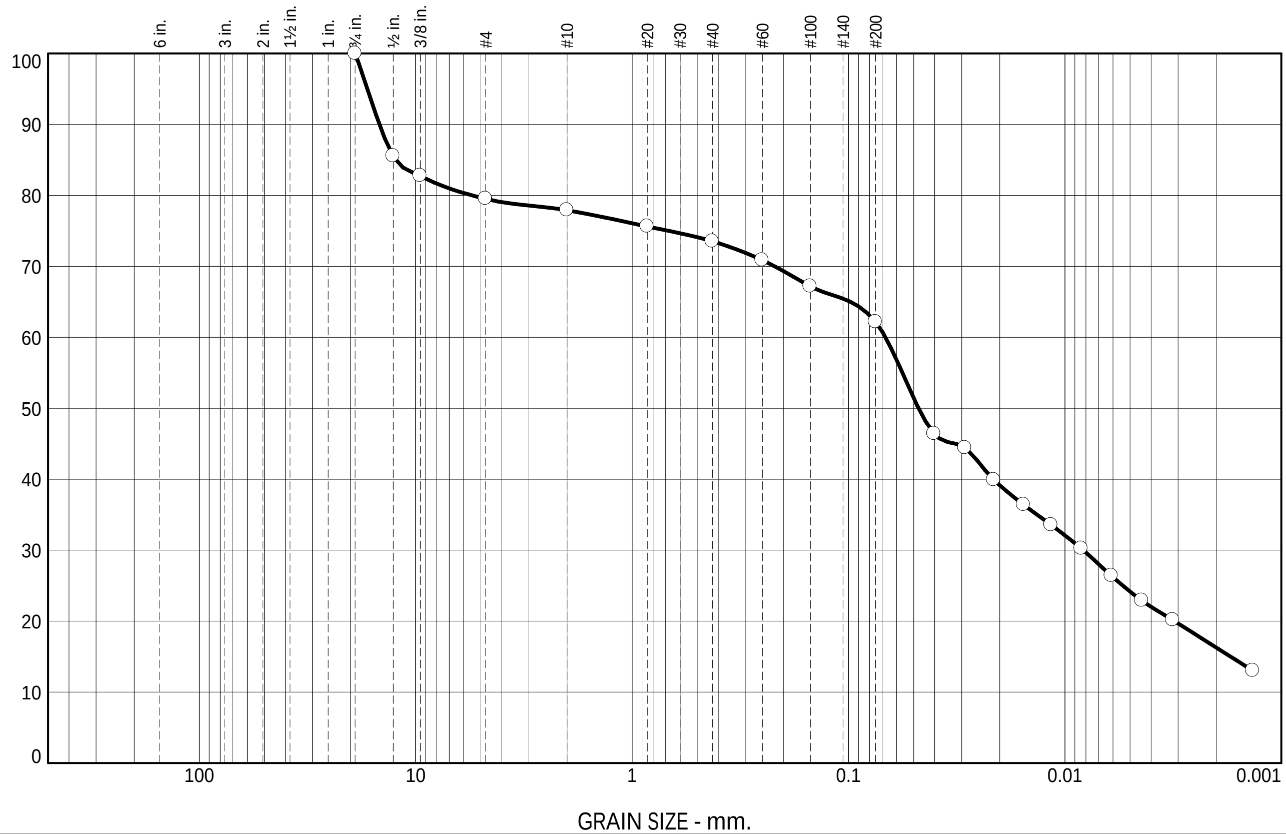
Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental, Inc.
Project: Geotech Services - Wind Turbine Foundations
Oneida, NY
Project No: 01.0177169.10 Figure 23-S-3785

Tested By: ML Checked By: Andrew Vanasse

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	20.5	1.6	4.4	11.3	45.9	16.3

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	85.5		
3/8"	82.8		
#4	79.5		
#10	77.9		
#20	75.6		
#40	73.5		
#60	70.9		
#100	67.2		
#200	62.2		
0.0402 mm.	46.4		
0.0290 mm.	44.4		
0.0213 mm.	39.9		
0.0155 mm.	36.4		
0.0116 mm.	33.6		
0.0084 mm.	30.2		
0.0061 mm.	26.4		
0.0044 mm.	22.9		
0.0032 mm.	20.1		
0.0014 mm.	13.0		

* (no specification provided)

Soil Description

Brown SILT & CLAY, some fine Gravel, little f-m Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 14.7093 D_{85}= 12.3715 D_{60}= 0.0675
D_{50}= 0.0475 D_{30}= 0.0082 D_{15}= 0.0017
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Sample visually classified as plastic. Sample rolled to 1/8".

Source of Sample: Boring Depth: 0-1.4'
Sample Number: GZ-5 / S-1A

Date: 09.18.23

Thielsch Engineering Inc.

Cranston, RI

Client: GZA GeoEnvironmental, Inc.
Project: Geotech Services - Wind Turbine Foundations
Oneida, NY
Project No: 01.0177169.10 Figure 23-S-3786

Tested By: ML Checked By: Andrew Vanasse

Thielsch DIVISION OF THE RISE GROUP	195 Frances Avenue Cranston RI, 02910 Phone: (401)-467-6454 Fax: (401)-467-2398 thielsch.com *Let's Build a Solid Foundation*	Client Information: GZA Geoenvironmental, Inc. Norwood, MA Project Manager: Joseph Beniot Assigned By: Joseph Beniot Collected By: Lauren Shea	Project Information: **Geotech Services - Wind Turbine Foundations** **Oneida, NY** Client Project Number: 01.0177169.10 Summary Page: 1 of 1 Report Date: 09.25.23

LABORATORY TESTING DATA SHEET, Report No.: 7423-J-B014

Boring No.	Sample No.	Depth (ft/in)	Laboratory No.	Specimen Data						Compressive Strength Tests								Rock Formation or Description or Remarks
				Mohs Hard-ness	Diameter (in)	Length (in)	(1) Unit Weight (PCF)	(2) Wet Density (PCF)	Bulk G_s	(3) Other Tests	(4) Strength PSI	(5) Strain %	(6) E sec PSI EE+06	(7) Poisson's Ratio	st PSI	Is_{50} PSI	(8) s_c PSI	
GZ-1	C-4	21.1-21.5	23-S-B662		1.970	4.171	165.6				16870							Light Grey Limestone
Fresh Break																		
GZ-2	C-2	16-16.4	23-S-B663		1.968	4.059	165.7				7057							Light Grey Limestone
Fresh Break																		

(1) Volume Determined By Measuring Dimensions (2) Determined by Measuring Dimensions and Weight of Saturated Sample	Notes	(3) PLD=Point Load (diametrical), PLA= Point Load (Axial) ST= Splitting Tensile U= Unconfined Compressive Strength (4) Taken at Peak Deviator Stress	Notes	(5) Strain at Peak Deviator Stress (6) Represents Secant Modulus at 50% of Total Failure Stress (7) Represents Secant Poisson's Ratio at 50% of Total Failure Stress (8) Estimated UCS from Table 1 of ASTM D5731 for NX cores (Is x 24)

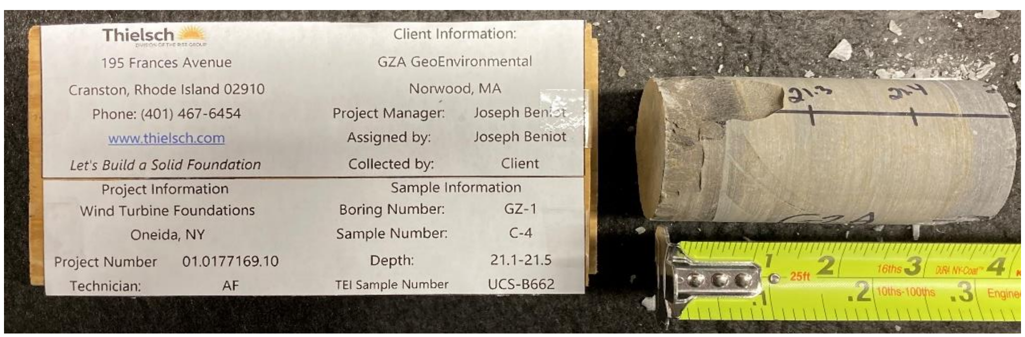
Date Received: **09.14.23** Reviewed By: Date Review **09.26.23**

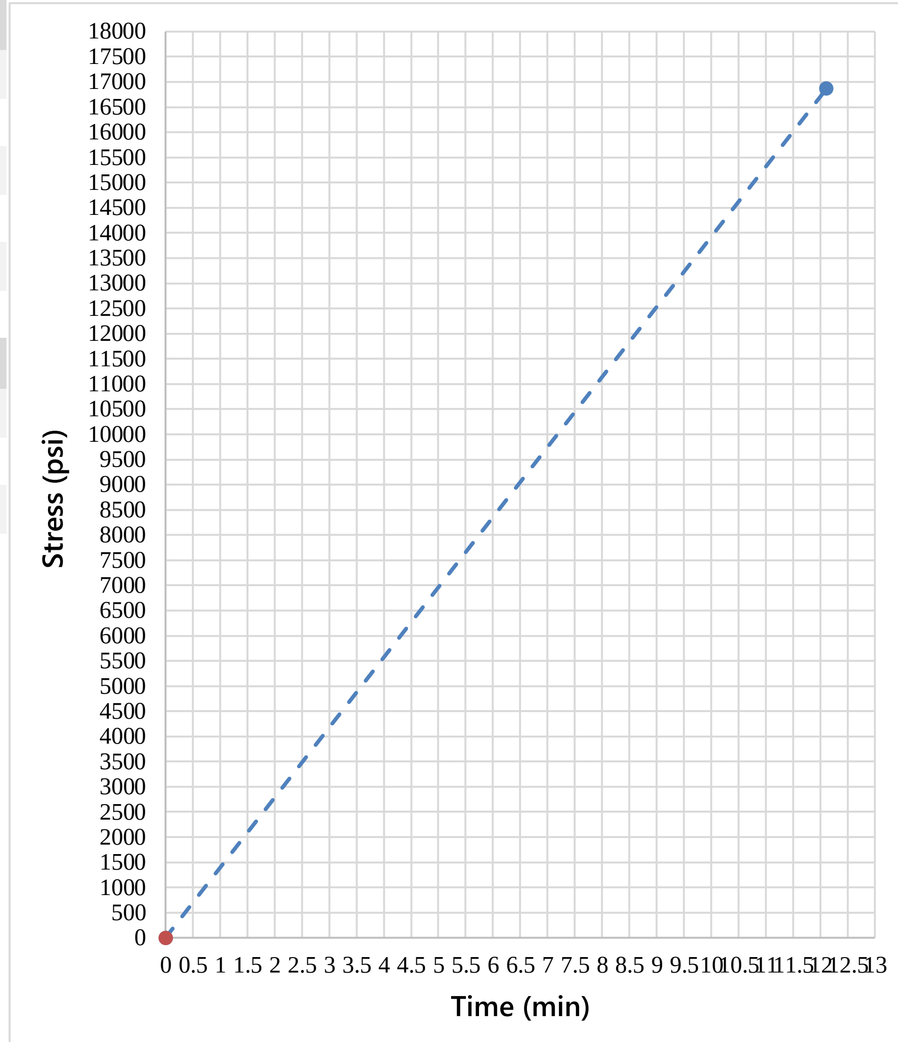
Thielsch DIVISION OF THE RISE GROUP	195 Frances Avenue Cranston, Rhode Island 02910 Phone: (401) 467-6454 Fax: (401) 467-2398 www.thielsch.com *Let's Build a Solid Foundation*	**Client Information:** GZA GeoEnvironmental Norwood, MA Project Manager: Joseph Beniot Assigned by: Joseph Beniot Collected by: Client	**Project Information:** Wind Turbine Foundations Oneida, NY Project Number: 01.0177169.10 Technician: AF Report Date: 9/25/2023

ASTM D7012 Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Sample Information		Compressive Test Information	
Boring ID:	GZ-1	**Unit Weight (pcf):**	165.6
Sample No.:	C-4	**Failure Stress (psi):**	16,870
Depth (ft):	21.1-21.5	**Failure Mode:**	Fresh
Tested Depth (ft):	21.1-21.5	**Time to Failure (min):**	12.12
Rock Type:	Light Grey Limestone		
Features:	Fresh Break		

Test Specimen Information		Elastic Moduli Test Information	
Diameter, D (in):	1.970	**Poisson's Ratio @ 50%:**	NA
Length, L (in):	4.171	**Strain %:**	NA
L:D Ratio:	2.12	**E sec PSI @ 50%:**	NA





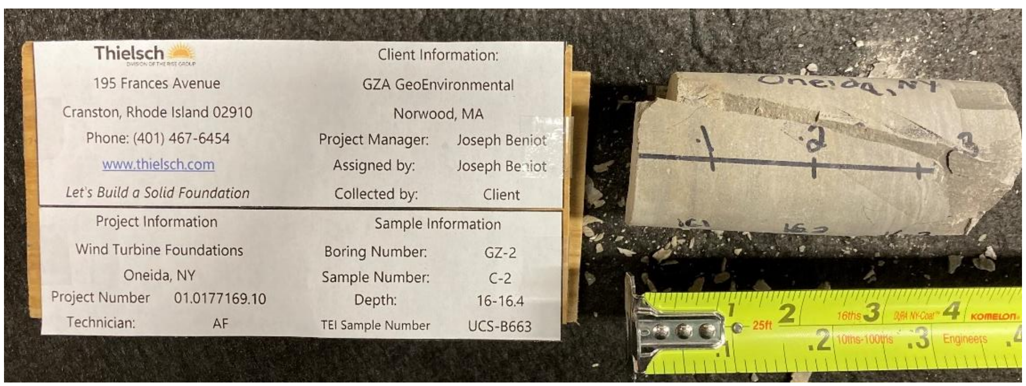
Testing Notes:

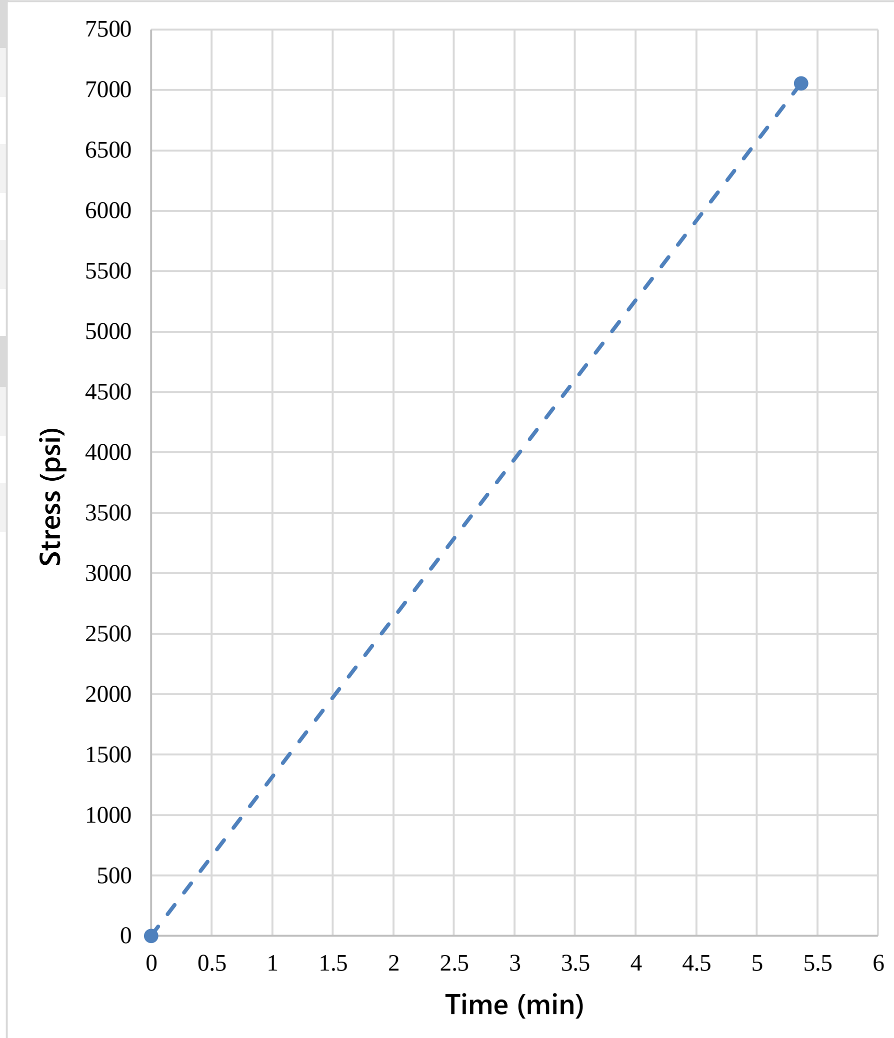
Thielsch DIVISION OF THE RISE GROUP	195 Frances Avenue Cranston, Rhode Island 02910 Phone: (401) 467-6454 Fax: (401) 467-2398 www.thielsch.com *Let's Build a Solid Foundation*	**Client Information:** GZA GeoEnvironmental Norwood, MA Project Manager: Joseph Beniot Assigned by: Joseph Beniot Collected by: Client	**Project Information:** Wind Turbine Foundations Oneida, NY Project Number: 01.0177169.10 Technician: AF Report Date: 9/25/2023

ASTM D7012 Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Sample Information		Compressive Test Information	
Boring ID:	GZ-2	**Unit Weight (pcf):**	165.7
Sample No.:	C-2	**Failure Stress (psi):**	7,057
Depth (ft):	16-16.4	**Failure Mode:**	Fresh
Tested Depth (ft):	16-16.4	**Time to Failure (min):**	5.37
Rock Type:	Light Grey Limestone		
Features:	Fresh Break		

Test Specimen Information		Elastic Moduli Test Information	
Diameter, D (in):	1.968	**Poisson's Ratio @ 50%:**	NA
Length, L (in):	4.059	**Strain %:**	NA
L:D Ratio:	2.06	**E sec PSI @ 50%:**	NA





Testing Notes:

Appendix H – Laboratory Corrosivity Test Results

CERTIFICATE OF ANALYSIS

Joseph Benoit
GZA GeoEnvironmental, Inc.
249 Vanderbilt Avenue
Norwood, MA 02062

RE: Geotech Services - Wind Turbine Foundations (01.0177169.10 Task 2)
ESS Laboratory Work Order Number: 23I0247

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 2:12 pm, Sep 18, 2023

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Geotech Services - Wind Turbine Foundations

ESS Laboratory Work Order: 23I0247

SAMPLE RECEIPT

The following samples were received on September 11, 2023 for the analyses specified on the enclosed Chain of Custody Record.

Lab Number	Sample Name	Matrix	Analysis
23I0247-01	4949 Forest Ave NY- Composite sample	Soil	2580, 9030B, 9038, 9045, 9050A, 9250

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Geotech Services - Wind Turbine Foundations   ESS Laboratory Work Order: 23I0247

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Geotech Services - Wind Turbine Foundations

ESS Laboratory Work Order: 23I0247

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 18-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Geotech Services - Wind Turbine Foundations
Client Sample ID: 4949 Forest Ave NY- Composite sample
Date Sampled: 09/07/23 16:00
Percent Solids: 84

ESS Laboratory Work Order: 23I0247
ESS Laboratory Sample ID: 23I0247-01
Sample Matrix: Soil

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Chloride	**WL** ND (36)		9250		1	LAB	09/14/23 11:15	mg/kg dry	DI31417
Corrosivity (pH)	**7.68** (N/A)		9045		1	JLK	09/11/23 19:09	S.U.	DI31140
Corrosivity (pH) Sample Temp	**Soil pH measured in water at 21.1 ºC.**								
Redox Potential	**WL 204** (N/A)		2580		1	JLK	09/11/23 19:09	mv	DI31141
Resistivity	**WL 0.006** (N/A)		9050A		1	EAM	09/12/23 15:22	Mohms/cm	DI31234
Sulfate	**WL 292** (59)		9038		1	JLK	09/11/23 19:28	mg/kg dry	DI31139
Sulfide	**WL** ND (0.6)		9030B		1	JLK	09/12/23 19:45	mg/kg dry	DI31242

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Geotech Services - Wind Turbine Foundations
ESS Laboratory Work Order: 23I0247

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Classical Chemistry										
Batch DI31139 - General Preparation										
Blank										
Sulfate	ND	5	mg/kg wet							
LCS										
Sulfate	10		mg/L	9.988		97	80-120			
Batch DI31242 - General Preparation										
Blank										
Sulfide	ND	0.05	mg/kg wet							
LCS										
Sulfide	0.5		mg/L	0.5000		102	85-115			
Batch DI31417 - General Preparation										
Blank										
Chloride	ND	3	mg/kg wet							
LCS										
Chloride	29		mg/L	30.00		98	90-110			

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Geotech Services - Wind Turbine Foundations   ESS Laboratory Work Order: 23I0247

Notes and Definitions

Z-10	Soil pH measured in water at 21.1 ºC.
WL	Results obtained from a deionized water leach of the sample.
U	Analyte included in the analysis, but not detected
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probable Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: GZA GeoEnvironmental, Inc.
Client Project ID: Geotech Services - Wind Turbine Foundations
ESS Laboratory Work Order: 23I0247

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: GZA - Norwood, MA - GZA/TB

Shipped/Delivered Via: ESS Courier

ESS Project ID: 2310247
Date Received: 9/11/2023
Project Due Date: 9/18/2023
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 3.9 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** (Yes) / No / NA
10. Were any analyses received outside of hold time? (Yes) / No
    ORP, pH

11. Any Subcontracting needed? Yes / (No)
    ESS Sample IDs:
    Analysis:
    TAT:
12. Were VOAs received? Yes / (No)
    a. Air bubbles in aqueous VOAs? Yes / No
    b. Does methanol cover soil completely? Yes / No / NA

13. Are the samples properly preserved? (Yes) / No
    a. If metals preserved upon receipt: Date: Time: By/Acid Lot#:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

Tests out of hold.

14. Was there a need to contact Project Manager? (Yes) / No
    a. Was there a need to contact the client? Yes / No
    Who was contacted? Date: Time: By:

Resolution:

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608 Pesticides)
1	471701	Yes	N/A	Yes	Driller Jar	NP	

2nd Review
Were all containers scanned into storage/lab? Initials TD
Are barcode labels on correct containers? Yes / No
Are all Flashpoint stickers attached/container ID # circled? Yes / No / NA
Are all Hex Chrome stickers attached? Yes / No / NA
Are all QC stickers attached? Yes / No / NA
Are VOA stickers attached if bubbles noted? Yes / No / NA

Completed By: Taylor Davies Date & Time: 1030 9/11/23.
Reviewed By: Date & Time: 1634 9/11/23

ESS LABORATORY
185 Frances Avenue
Cranston, RI 02921
Phone: 401-461-7181
Fax: 401-461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 2310247. | Page 1 of 1

Turn Time ☐>5 ☐5 ☐4 ☐3 ☐2 ☐1 ☐Same Day

Regulatory State: MA Criteria:

Is this project for any of the following?: ☐CT RCP ☐MA MCP ☐RGP ☐Permit ☐401 WQ

ELECTRONIC DELIVERABLES (Final Reports are PDF)

☐ Limit Checker ☐ State Forms ☐ EQuIS
☑ Excel ☐ Hard Copy ☐ Enviro Data
☐ CLP-Like Package ☐ Other (Specify) →

CLIENT INFORMATION

Client: GZA GeoEnvironmental, Inc.
Address: 249 Vanderbilt Avenue, Norwood, MA 02062
Phone: 617.352.2994
Email Distribution List: joseph.benoit@gza.com

PROJECT INFORMATION

Project Name: Geotech Services - Wind Turbine Foundations
Project Location: 4949 Forest Ave, Oneida, NY 13421
Project Number: 01.0177169.10; Task 2
Project Manager: Joe Benoit
Bill to:
PO#:
Quote#:

Client acknowledges that sampling is compliant with all EPA / State regulatory programs

REQUESTED ANALYSES

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Electrical Resistivity (9050A)	pH (9045)	Sulfate (9038)	Sulfide (9030B)	Soluble Chloride (9250)	Oxidation/Reduction Potential (2580)	Total Number of Bottles
1	9/7/2023	1600	Composite	Soil	4949 Forest Ave, NY - Composite Sample	X	X	X	X	X	X	1

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer J-Jar O-Other P-Poly S-Sterile V-Vial

Container Volume: 1-100 mL 2-2.5 gal 3-250 mL 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*

Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*

Sampled by : Lauren Shea

Chain needs to be filled out neatly and completely for on time delivery.

Laboratory Use Only
Cooler Temperature (°C): 3.9
1 er

Comments: * Please specify "Other" preservative and containers types in this space
Standard Turnaround Time.

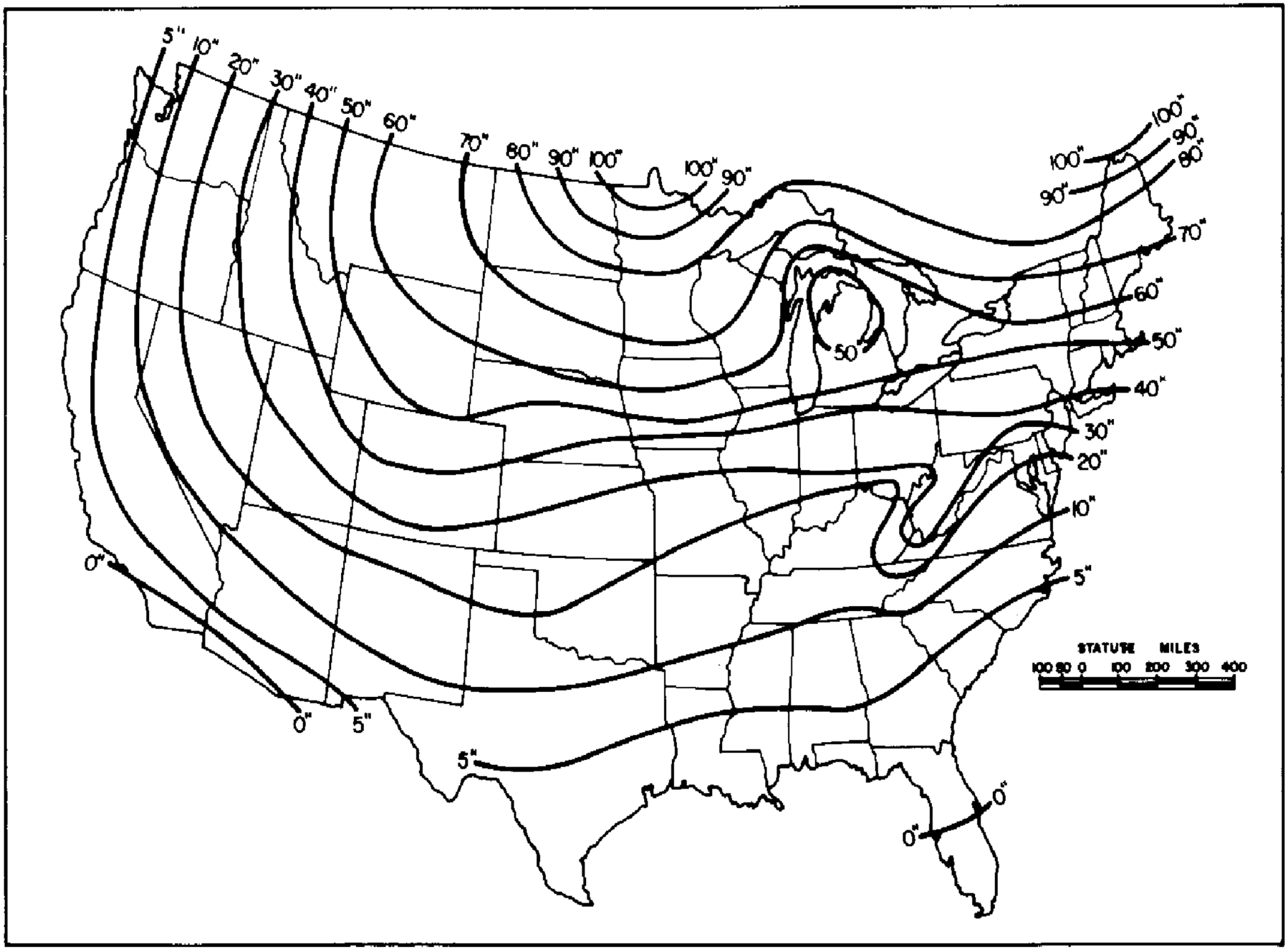
All samples submitted are subject to ESS Laboratory's payment terms and conditions.

Dissolved Filtration
☐ Lab Filter

Relinquished by (Signature)	Date	Time	Received by (Signature)	Relinquished by (Signature)	Date	Time	Received by (Signature)
[signature] ~~9/8/23~~	9/8/23	10:00	[signature] 9/11/23 11:16	[signature]	9/11/23	16:11	[signature]

Relinquished by (Signature)	Date	Time	Received by (Signature)	Relinquished by (Signature)	Date	Time	Received by (Signature)

Appendix I – U.S. Navy Frost Depth Map



Approximate Depth of Frost Penetration in the United States (NAVFAC Design Manual 7.01 U.S. Navy, 1986