April 26, 2023

Christopher Henry
Director of Planning and Development
109 N. Main Street
Oneida, New York

RE: Oneida Wind Geotechnical and Foundation Considerations

Mr. Henry,

Please see below for additional information as requested regarding preliminary geotechnical information and turbine foundations. A full geotechnical investigation and structural design of the foundation will be performed prior to construction, but this level of design is not available currently. However, preliminary investigation of the site has been performed. Additionally, information is provided on the types of foundations that may be required, the types of construction necessary, and examples of mitigation that can be taken to ensure wells and water supplies in the area are not impacted.

Existing Conditions

The location of the proposed turbine is currently a meadow surrounded by wooded areas. Nearby areas consist of agricultural land, forest, and low density rural residential land. No residential structures exist on site. Neighboring residences are closest along Brewer Road to the west, Forest Ave to the south, and Crescent Ave to the west. The topography of the site slopes down from a high point of 1245 feet above mean sea level in the center of the property, to an elevation of less than 1180 feet above sea level in the west.

Preliminary Geotechnical Review and Site Investigation

The United States Department of Agriculture Natural Resources Conservation Services (NRCS) maintains a database of soil and subsurface data. This data has been reviewed to provide an estimate of what the subsurface conditions may be on site. Please see the report attached. The report characterizes the soil near the turbine as partially Farmington-Wassaic-Rock outcrop complex (FGC) and partially Wassaic silt loam (WmB). These soils have high bedrock tables. After review of the NRCS data, a site walk was performed. Some small areas of bedrock outcropping were identified during this site walk. These areas were very small, most of the site was covered in thick vegetation. These observations support the NRCS data that bedrock is at a shallow depth on site.

Proposed Work

The proposed project features a single Wind Turbine located approximately 2,575 feet north of Forest Ave. The turbine will be interconnected to the distribution grid along Forest Ave. The turbine tower will have a total tip height of approximately 560 feet above finished grade. Ancillary equipment installed will include a utility communication tower, gravel crane pad, ground mounted electrical equipment, and a series of underground conduit and utility poles running south from the turbine location to the interconnection area on Forest Ave.

The proposed location of the turbine is on the southern edge of the existing field, at approximately 1240 feet above mean sea level. Please see Figure 1 below for a locus map of the turbine location.

Figure 1: Locus Map

Turbine

The turbine to be constructed consists of a foundation, tower, nacelle, and blades. The tower component is anchored to the foundation and supports the nacelle. The nacelle houses the gearbox and electrical generator. The only fluids with a spill potential that will be on site are the lubrication oils held within the turbine nacelle. This fluid is gear oil and is not considered a hazardous material. The volume of gear oil contained in the nacelle is approximately 400 gallons.

Expected Foundation

Any potential impact to water sources would be related to the wind turbine foundation. There are a variety of technologies and designs that may be employed to support a wind turbine. The preferred option depends on the site location and geotechnical conditions. Generally, the foundation options fall into three types that may be employed;

Shallow foundations - The most common type of foundation, a shallow foundation consists of a concrete gravity base about 50-75 feet wide and 10-15 feet deep. It is made up of reinforced concrete. The construction of these types of foundations consist of surface excavation, concrete forming, rebar work, and concrete placement. The foundation is then backfilled so that only a circular pedestal is exposed. The turbine is anchored via bolted connections to this concrete pedestal. Below is an example of a shallow foundation. Note the circular pedestal which will be the only portion exposed upon completion of the foundation.

Figure 2: Shallow Foundation

To achieve the depth required for this foundation, solid and bedrock must be excavated to a depth of approximately 15 feet. The primary method to achieve this depth is through traditional excavation using an excavator. If bedrock is encountered, other methods may be employed. Significantly weathered bedrock may be broken up and removed with the use of an excavator-mounted impact hammer. However, if solid bedrock is encountered, the use of blasting may be necessary to meet the design depths. Several mitigation techniques will be utilized to ensure this work does not affect off-site properties. These include:

- Containment: The contractor shall berm around the excavation to redirect surface water run-off from entering the excavation and bedrock.

- If voids or large fractures are identified at the bedrock surface indicative of karst conditions, the contractor will pack the void/fracture surface with no-slump concrete.
- Placement of geotextile separation blanket at the base of the foundation and placement of concrete above the fabric to keep concrete from entering fractures or voids in the bedrock

Other Types of Foundation

Other foundation types are sometimes necessary for wind turbine projects, but are not anticipated to be used for the 0 Brewer Road turbine, unless recommended by the structural engineer after final geotechnical investigations are complete.

Deep foundations - These foundations include drilled piles, drilled shafts and piers.

Anchored foundations - These foundations are used as required based on site conditions. They consist of a shallow reinforced concrete mat that has anchors installed by drilling a shaft and filling the shaft with a high strength anchor bolt and grout. These foundations provide overturning resistance via tension in the anchors.

Blasting

Blasting shall be used only as needed and closely coordinated with the city and neighbors. If required, several steps and procedures will be followed to ensure the work is completed safely and without impacts to neighbors. New Leaf Energy is amenable to including the following as conditions of approval for the issuance of a Conditional Use Permit.

Licensing - Blasting contractor shall possess a valid New York State Explosives License and Blaster Certificate of Competence.

Submittal of Written Blast Plan - Prior to any blasting, a blasting plan shall be prepared and filed with the City, as well as any other relevant parties or agencies. The plan shall also provide contractor license information, details on the proposed pre-blast survey methodology, and identify pre-blast survey locations. Blasting shall be conducted between 7:00 am and 8:00 pm, Monday through Friday.

Notifications - The City of Oneida, Oneida Fire Department, and property owners within 3,000 feet of the blast area shall be notified of blasting activities at least 10 but not more than 30 days prior to commencement of blasting. This notice must contain at minimum:

1) the name, address, and telephone number of the operator,

2) notice of how to sign up for optional pre and post-blasting well water testing,

3) identification of the specific area in which blasting will take place,

4) dates and time periods when explosives are to be detonated,

5) methods to be used to control access to the blasting areas, and

6) types and patterns of audible warning and all-clear signals to be used before and after blasting.

Well Water Testing - Any landowner within 3,000 feet of the blast site may request pre and post well water quality testing be performed at the project proponents expense. Notification that blasting will occur shall be provided to all owners of wells within 3,000 feet of the blasting area, as noted above. Upon the completion of blasting, well water from each well tested shall be tested again. If this testing reveals that blasting has negatively impacted water quality, the project proponent shall work with the landowner and the City of Oneida in good faith to rectify the situation. The figure below indicates potential well locations of homes that may request testing.

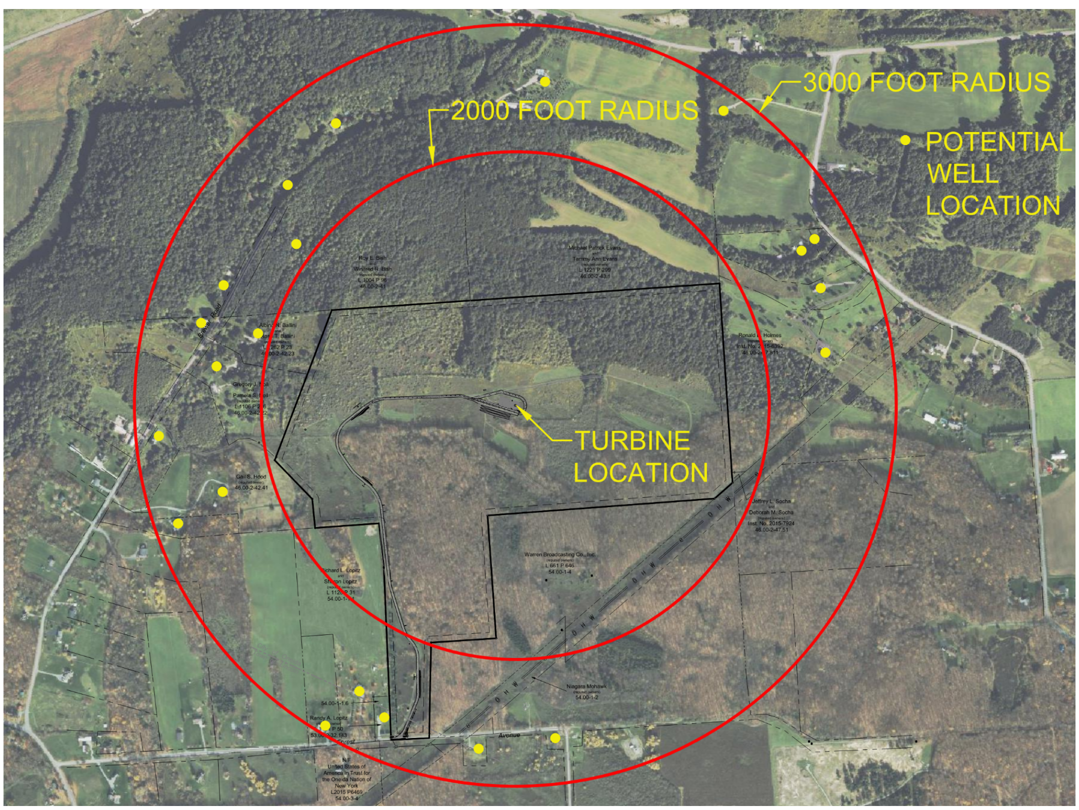


Figure 3: Potential Well Testing Locations

It should be noted that the above precautions are not exhaustive, and any work shall be performed in accordance with applicable state, local, and industry standards.

Proximity to Water Sources

There are no known water wells on the subject parcel. The turbine is set back from the property line more than 840 feet in all directions. Any water source is therefore at least 840 feet from the turbine base. An analysis of the surrounding properties identified the nearest likely existing well to be on the residential properties along Brewer Road, over two thousand feet west of the proposed location. Construction activities requiring blasting, typically for road construction, are regularly performed closer to residential wells than this site. For context on acceptable distances for a variety of land uses, please see Table 1. Table 1 is from The New York Department of Health Drinking Water Regulations Section 5-B.7 Separability:

Table 1: New York Department of Health Required Minimum Separation Distance to Protect Water Wells From Contamination

Contaminant Source	Distance (Feet)[1]
Chemical storage sites not protected from the elements (e.g., salt and sand/salt storage)[2]	300
Landfill waste disposal area, or hazardous or radiological waste disposal area[2]	300
Land surface application or subsurface injection of effluent or digested sludge from a Municipal or public wastewater treatment facility	200
Land surface application or subsurface injection of septage waste	200
Land surface spreading or subsurface injection of liquid or solid manure [3]	200
Storage Areas for Manure piles [4]	200
Barnyard, silo, barn gutters and animal pens [5, 6]	100
Cesspools (i.e. pits with no septic tank pretreatment)	200
Wastewater treatment absorption systems located in coarse gravel or in the Direct path of drainage to a well	200
Fertilizer and/or pesticide mixing and/or clean up areas	150
Seepage pit (following septic tank) [5]	150
Underground single walled chemical or petroleum storage vessels	150
Absorption field or bed [5]	100
Contained chemical storage sites protected from the elements (e.g. salt and sand/salt storage within covered structures) [7]	100
Septic system components (non-watertight) [5]	100
Intermittent sand filter without a watertight liner [5]	100
Sanitary Privy pit [5]	100
Surface wastewater recharge absorption system constructed to discharge storm water from parking lots, roadways or driveways [5]	100
Cemeteries	100
Sanitary privy with a watertight vault	50
Septic tank, aerobic unit, watertight effluent line to distribution box	50
Sanitary sewer or combined sewer	50
Surface water recharge absorption system with no automotive-related Wastes (e.g., clear-water basin, clear-water dry well)	50
Stream, lake, watercourse, drainage ditch, or wetland	25
All known sources of contamination otherwise not shown above	100

Notes for Table 1:

1. The listed water well separation distances from contaminant sources shall be increased by 50% whenever aquifer water enters the water well at less than 50 feet below grade. If a 50% increase in separation distances can not be achieved, then the greatest possible increase in separation distance shall be provided with such additional measures as needed to prevent contamination. See also Note 6 to Table 2.

2. Water wells shall not be located in a direct line of flow from these items, nor in any contaminant plume created by these items, except with such additional measures (e.g., sentinel groundwater monitoring, hydraulic containment, source water treatment) as needed to prevent contamination.
3. Based upon on-site evaluations of agricultural properties done per agricultural environmental management (AEM) or comprehensive nutrient management plan (CNMP) programs by a certified nutrient management planner or soil and water conservation district (SWCD) official, water wells may be located a minimum of 100 feet from areas subject to land spreading of manure.
4. Water wells may be located 100 feet from temporary (30 days or less) manure piles/staging areas that are controlled to preclude contamination of surface or groundwater or 100 feet from otherwise managed manure piles that are controlled pursuant to regulation in a manner that prevents contamination of surface or groundwater.
5. When these contamination sources are located in coarse gravel or are located upgrade and in the direct path of drainage to a water well, the water well shall be located at least 200 feet away from the closest part of these sources.
6. Animal pen does not include small pet shelters or kennels housing 3 or fewer adult pets.
7. Chemical storage sites as used in this entry do not include properly maintained storage areas of chemicals used for water treatment nor areas of household quantities of commonly used domestic chemicals.

Conclusion

Final foundation design cannot be completed without subsurface investigation, however, available site data has been compiled and reviewed to provide an understanding of expected foundation design and construction. This data indicates that the site likely has a high bedrock table, and that a spread footing is the expected foundation type. This will require excavation of approximately 15 feet. Blasting will be utilized as a last resort, but due to the high bedrock expected, may be necessary. The distance from neighboring properties provides a significant buffer to prevent impact to neighboring properties. If blasting is required, the city and neighbors will be notified, and mitigation measures will be taken during construction to ensure impacts to wells or water supplies are minimized.

Attachments:

1. Natural Resources Conservation Service Soil Report
2. GZA Desktop Assessment of Subsurface Conditions

United States Department of Agriculture

NRCS

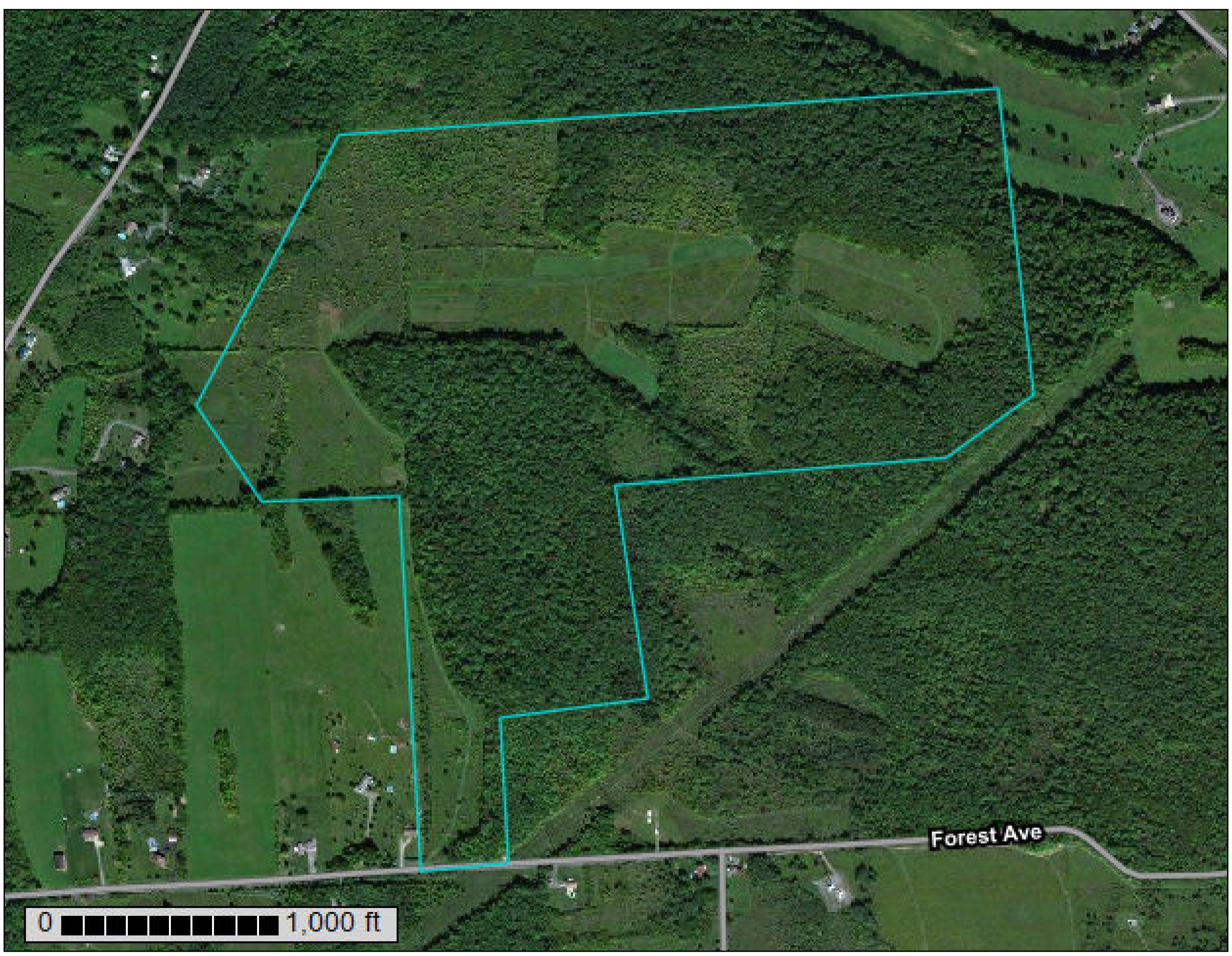
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Madison County, New York

4949 Forest Avenue



July 26, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:9,270 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 100, 200, 400, 600

Feet: 0, 450, 900, 1800, 2700

N

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

Soil Survey Area: Madison County, New York
Survey Area Data: Version 19, Jun 11, 2020

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

Date(s) aerial images were photographed: Aug 29, 2012—Sep 27, 2016

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AuB	Aurora silt loam, 3 to 8 percent slopes	18.4	11.1%
AuC	Aurora silt loam, 8 to 15 percent slopes	0.4	0.2%
CfC	Cazenovia silt loam, 8 to 15 percent slopes	0.8	0.5%
FGC	Farmington-Wassaic-Rock outcrop complex, sloping	110.4	66.6%
HOE	Honeoye-Farmington complex, 25 to 65 percent slopes, rocky	4.5	2.7%
WmB	Wassaic silt loam, 3 to 8 percent slopes	31.3	18.9%
Totals for Area of Interest		**165.8**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

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

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

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

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

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

Madison County, New York

AuB—Aurora silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9td5
Elevation: 1,000 to 1,300 feet
Mean annual precipitation: 38 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 110 to 190 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Aurora and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aurora

Setting

Landform: Benches, ridges, till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Loamy till derived mainly from calcareous shale, with some limestone and sandstone

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 28 inches: channery silty clay loam
C - 28 to 34 inches: channery silt loam
R - 34 to 41 inches: weathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: F101XY013NY - Moist Till
Hydric soil rating: No

Minor Components

Angola

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

Wassaic

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

Cazenovia

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

Lima

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

AuC—Aurora silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9td6
Elevation: 1,000 to 1,300 feet
Mean annual precipitation: 38 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 110 to 190 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Aurora and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aurora

Setting

Landform: Benches, ridges, till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Loamy till derived mainly from calcareous shale, with some limestone and sandstone

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 28 inches: channery silty clay loam
C - 28 to 34 inches: channery silt loam
R - 34 to 41 inches: weathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: F101XY013NY - Moist Till
Hydric soil rating: No

Minor Components

Cazenovia

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

Lima

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

Angola

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

Farmington

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

CfC—Cazenovia silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9tdl
Elevation: 410 to 1,660 feet
Mean annual precipitation: 38 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 110 to 190 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cazenovia and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cazenovia

Setting

Landform: Reworked lake plains, till plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till that contains limestone with an admixture of reddish lake-laid clays or reddish clay shale

Typical profile

H1 - 0 to 11 inches: silt loam
H2 - 11 to 29 inches: silty clay loam
H3 - 29 to 52 inches: gravelly silt loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 48 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water capacity: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F101XY013NY - Moist Till
Hydric soil rating: No

Minor Components

Odessa

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

Ovid

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

Honeoye

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

Schoharie

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

FGC—Farmington-Wassaic-Rock outcrop complex, sloping

Map Unit Setting

National map unit symbol: 9tf6
Elevation: 100 to 1,750 feet
Mean annual precipitation: 38 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 110 to 190 days
Farmland classification: Not prime farmland

Map Unit Composition

Farmington and similar soils: 50 percent
Wassaic and similar soils: 20 percent
Rock outcrop: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Farmington

Setting

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

Typical profile

H1 - 0 to 7 inches: gravelly silt loam
H2 - 7 to 17 inches: gravelly silt loam
H3 - 17 to 21 inches: unweathered bedrock

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Very low (about 2.1 inches)

Interpretive groups

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

Description of Rock Outcrop

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydric soil rating: Unranked

Description of Wassaic

Setting

Landform: Benches, ridges, till plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till derived mainly from limestone, with varying amounts of sandstone, shale, and crystalline rock

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 10 inches: gravelly silt loam
H3 - 10 to 29 inches: gravelly silty clay loam
H4 - 29 to 33 inches: unweathered bedrock

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: About 19 to 39 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.3 inches)

Interpretive groups

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

Minor Components

Aurora

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

Honeoye

Percent of map unit: 3 percent
Hydric soil rating: No

Conesus

Percent of map unit: 2 percent
Hydric soil rating: No

HOE—Honeoye-Farmington complex, 25 to 65 percent slopes, rocky

Map Unit Setting

National map unit symbol: 2w3pc
Elevation: 360 to 1,990 feet
Mean annual precipitation: 31 to 57 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 100 to 190 days
Farmland classification: Not prime farmland

Map Unit Composition

Honeoye, rocky, and similar soils: 45 percent
Farmington and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Honeoye, Rocky

Setting

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

Typical profile

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

Properties and qualities

Slope: 25 to 65 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Available water capacity: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Farmington

Setting

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

Typical profile

H1 - 0 to 7 inches: gravelly silt loam
H2 - 7 to 17 inches: gravelly silt loam
H3 - 17 to 21 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 65 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Very low (about 2.1 inches)

Interpretive groups

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

Minor Components

Wassaic

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

Lima

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

Rock outcrop

Percent of map unit: 1 percent
Hydric soil rating: Unranked

WmB—Wassaic silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9tjc
Elevation: 800 to 1,750 feet
Mean annual precipitation: 38 to 44 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 110 to 190 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Wassaic and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wassaic

Setting

Landform: Benches, ridges, till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Loamy till derived mainly from limestone, with varying amounts of sandstone, shale, and crystalline rock

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 10 inches: gravelly silt loam
H3 - 10 to 29 inches: gravelly silty clay loam
H4 - 29 to 33 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: About 19 to 39 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.3 inches)

Interpretive groups

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

Minor Components

Farmington

Percent of map unit: 10 percent
Hydric soil rating: No

Honeoye

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

Rock outcrop

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

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104 West 29th Street
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New York, NY 10001
T: 212.594.8140
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

J:\170,000-179,999\177169\177169-00.JMB\GZA Letter Regarding Proposed Wind Turbine at 4949 Forrest Ave Oneida NY.docx