Agricola Wind Project

Permit Application No. 23-00064

1100-2.11 Exhibit 10

Geology, Seismology, and Soils

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EXHIBIT 10 GEOLOGY, SEISMOLOGY, AND SOILS

(a) Study of the Geology, Seismology, and Soils Impacts

This Exhibit includes a study of the geologic, seismologic, and soil impacts of the Facility. It includes mapped or otherwise identified existing conditions, an impact analysis, and proposed impact avoidance and mitigation measures.

(1) Existing Slopes Map

The Facility Site is on a localized high area that slopes down to the east and west, primarily containing agricultural areas. The majority of slopes within the Facility Site range between 0 and 35%,[1] with the greatest proportion of the slopes being between 0 and 8%. The steepest slopes are associated with the collection system and range from 0% to 35%, while slopes associated with wind turbines range from 0% to 8% and slopes associated with access roads (not the slope of the access road itself, but any area within 10 feet of an access road) range from 0% to 15%. Figure 10-1 delineates existing slopes (0-3%, 3-8%, 8-15%, 15-25%, 25-35%, and greater than 35%) in the vicinity of the Facility. This figure was prepared using digital elevation model data provided by the U.S. Geological Survey (USGS) and the New York State GIS Program Office. The data was processed using ESRI ArcGIS® software.

(2) Proposed Site Plan

Civil Design Drawings indicating existing and proposed contours at 2-foot intervals are included in the site plans provided with Exhibit 5. The scale of these drawings is sufficient to show all proposed buildings, structures, paved and vegetative areas, and construction areas, as required by 16 NYCRR Section 1100-2.11(a)(2).

(3) Excavation Techniques to be Employed

Pending the receipt of all required permits, construction is anticipated to start in the fourth quarter of 2026. Facility construction will be performed in several stages. The stages involving excavation are described below. Excavation activities will be primarily associated with grading, trenching, and the installation of the wind turbine foundations. Excavation will be completed using conventional construction equipment, including, but not limited to, bulldozers, track hoes, pan excavators, cable plows, rock saws, rock wheels, and trenchers. In addition, as discussed in Exhibit 10(a)(5)-(7) construction of the Facility may require some blasting. Techniques anticipated to be employed for individual Facility components are described below.

Laydown Yard Construction

The construction laydown yards will be developed by stripping and stockpiling the topsoil and grading and compacting the subsoil. Alternatively, the Applicant is also considering the use of

[1] Slopes of 45 degrees are considered to be 100%; therefore, slopes over 45 degrees are calculated to be over 100%.

cement stabilization at the laydown yards. This would include mixing the subsoil with cement and water. Geotextile fabric and gravel will then be installed to create a level working area.

Public Road Improvements

Improvements to existing public roads, including temporary modifications to establish appropriate turning radii for oversize/overweight (OS/OW) vehicles, will generally require soil stripping and the placement of gravel. A geotextile fabric or grid will be installed beneath the road surface, if necessary, to provide additional support.

Access Road Construction

Wherever feasible, existing driveways, farm lanes, and forest roads will be upgraded for use as Facility access roads to minimize impacts to active agricultural areas, cultural resources, forests, and wetland/stream areas. Where an existing road is unavailable or unsuitable, new gravel surfaced access roads will be constructed. Road construction will involve grubbing of stumps, topsoil stripping, and grading, as necessary. Stripped topsoil will be stockpiled (and segregated from subsoil) along the road corridor for use in site restoration. Following removal of topsoil, subsoil will be graded, compacted, and surfaced with gravel or crushed stone. A geotextile fabric or grid will be installed beneath the road surface, if necessary, to provide additional support. Should the method of utilizing gravel or crushed stone be insufficient to stabilize access roads, the Applicant will work with the construction team to develop alternative options.

Foundation Construction

Once the access roads are complete for a particular group of turbine sites, turbine foundation construction will commence for that group. Based on the design of a foundation for a generic 4- to 7-megawatt wind turbine, it is assumed the foundation will be installed approximately 10 to 13.5 feet below the ground surface with 6 inches of grading at the surface to allow for drainage around the foundation and cut/fill balance. Initial activity at each tower site will typically involve clearing and leveling (as needed) based on the site conditions at each tower location. The topsoil and organic material are usually mixed during the excavation process, and thus, will not be reused for structural fill. This material will be placed separately away from the rest of the excavated material to avoid comingling and later used for surface restoration. Topsoil removed during site stripping should be graded into existing site topography and may be used in grading nonstructural fill such as fields, or service areas in which compressibility of the material does not have an impact on structures.

Following topsoil removal, excavators will be used to excavate the foundation hole. Subsoil and rock will be segregated from topsoil and stockpiled for reuse as backfill to the extent possible. Spread footer turbine foundations will be approximately 10 to 13.5 feet deep and 75 feet in diameter (see Appendix 5-A). Blasting may be required at some turbine foundation sites. If blasting is required, it will occur in accordance with the Blasting Plan (see Appendix 10-A) and the discussion in Exhibit 10(a)(5).

Electrical Collection System Installation

Underground Electrical Collection Lines

The electrical collection system will be installed using direct burial methods except at road crossings (and certain other locations) where directional boring or open trench techniques will be deployed as agreed to with the local municipalities. Industry standard equipment (e.g., cable plows) will be used. Direct burial will involve the installation of bundled cable directly into a narrow cut or "rip" in the ground. The rip would disturb an area approximately 24 inches wide. Bundled cable would be installed to a minimum depth of 48 inches in all agricultural and non-agricultural areas. Where direct burial is not possible, an open trench will typically be excavated. During open trenching, topsoil and subsoil will be segregated and stockpiled adjacent to the trench for use in site restoration. As utility trenches can provide a conduit for groundwater flow, trenches will be backfilled with material that approximately matches the permeability characteristics of the surrounding soil. If higher permeability fill is used in trenches, consideration will be given to installing seepage collars and/or trench breakers to reduce the likelihood of water migration through the trenches. Depending on soil topology occurring at specific locations of underground cable installation, cable bedding, which typically includes the placement of sand beneath cables, may be required.

At locations where a collection line crosses a stream, wetland, public roadway, or other sensitive feature identified by the Applicant, trenchless technologies (e.g., horizontal directional drilling [HDD] or jack and bore) may be used to avoid impacts. See Exhibit 21(a)(7) for additional information regarding these technologies. See also the Design Drawings (Appendix 5-A) for details regarding where such technologies will be implemented. At these crossings, boring equipment will be staged in boring pits excavated on either side of the road, stream, or wetland, and the collection line(s) will be routed underground between the bore pits. No surface disturbance is required between the bore pits, and all existing vegetation along the streams and within the wetlands (including mature trees) remain in place. The only potential impact associated with directional drilling is a potential surface release, or an "inadvertent return," of drilling fluid. Such inadvertent returns are rare and will be avoided or minimized to the maximum extent practicable when utilizing these technologies. An Inadvertent Return Plan will be submitted as a compliance filing pursuant to Section 1100-10.2(f)(5). Scaled drawings showing typical HDD and/or jack and bore equipment staging layout and design are provided in Appendix 5-A. For more information on locations where HDD and/or jack and bore will be utilized to avoid impacts to streams and wetlands, see Figures 10-2 and 14-2, and Exhibits 13 and 14.

Overhead Electrical Collection Lines

Consistent with the Town of Venice Wind Energy Facilities Law, Local Law No. 2 of 2024, the Applicant has designed the Facility to comply with the following provisions as applicable to overhead electrical collection lines:

1) Section 8 (1)(F) states, "[t]he use of guy wires is prohibited, except if otherwise unfeasible in the case of a Wind Energy Conversion Unit/Wind Turbine (Small Project), meteorological towers or transmission infrastructure."

2) Section 8 (1)(J)(5)(A) states, "All power transmission lines servicing the project, or any portion thereof shall be underground to the extent practical… If this standard is deemed to be technically infeasible, rationale and alternative solutions and designs shall be submitted with the completed application for review and approval by the Town Board."

The Applicant will bury collection lines underground to the greatest extent practicable and utilize self-supporting steel structures at the point of interconnection to ensure compliance with this requirement. The Applicant is proposing only one section of overhead collection line at the crossing of a tributary of Big Salmon Creek, located within the western portion of the Facility Site. In this location, the tributary has cut a 50-foot-deep ravine with steep slopes on either side. The extremely steep grades in this location and the perennial flow characteristics of the tributary would make an underground crossing using standard trenching technically infeasible. As an alternative to trenching, the use of HDD was explored by the Applicant; however, this installation method was determined to be technically infeasible due to the steep slopes present on either side of the ravine. Although an operator can curve the trajectory of an underground boring using HDD, there are limitations. These curvature limitations and the steepness of the banks of the ravine would result in the cable being installed at a depth of 30 feet or more below the ground surface in some locations, significantly greater than what is allowable to ensure adequate cable thermal dissipation.

The Applicant's proposed approximately 420-foot overhead crossing of this tributary to Big Salmon Creek will utilize standard utility poles with guy wires that have been placed outside of or on the edge of active agricultural fields to avoid impacts to ongoing agricultural activities. Utilizing self-supporting steel poles in this location is not feasible as the length of the crossing would require the use of potentially larger infrastructure, the installation of which require concrete footings that could result in additional disturbance. Installing a standard overhead line with guys wires is the simplest and least impactful approach to crossing this tributary to Big Salmon Creek.

Construction of this single section of overhead collection line within the Town of Venice will not require significant grading or topsoil excavation. Vegetation will be cleared within the right-of-way, as needed, but grubbing and permanent soil disturbance will be limited to areas required for access and the siting of collection line pole footings. Collection line poles will be directly embedded in pre-drilled holes and backfilled with crushed aggregate or concrete. Poles will be embedded to a depth of 12 feet 9 inches (see Exhibit 21, Table 21-1). Final pole foundation details, including foundation depth and backfill material, will be finalized during final detailed design. Collection line structures will require support guy wires, typically secured via helical screw anchors wherever soil conditions allow. Helical screw anchors do not require soil excavation and will only create limited soil disturbance at the point of placement associated with construction. If soil conditions do not allow the use of helical screw anchors (i.e., existing geotechnical conditions cause refusal), plate anchors with concrete backfill may be utilized to secure the guy wires. For areas with solid soil conditions or homogenous rock, rock anchors can be utilized in place of helical screw anchors or plate anchors.

Substation and Switchyard

Substation and point of interconnection (POI) switchyard construction will begin with clearing the site and stockpiling topsoil for later use in site restoration. The site will be graded, and a laydown area for construction equipment, materials, and parking will be prepared. As the fill is brought into the site area, concrete foundations for major equipment and structural supports will be placed, followed by the installation of various conduits, cable trenches, and grounding grid conductors. The area will then receive aggregate surfacing appropriate for the electrical activity taking place in the area.

(4) Suitability for Construction

On behalf of the Applicant, Westwood Surveying & Engineering (Westwood) conducted a preliminary geotechnical investigation to obtain geotechnical data and provide geotechnical recommendations for the proposed structures within the Facility Site. The results of the investigation are summarized in the Preliminary Geotechnical Investigation Report (see Appendix 10-B). As part of this evaluation, Westwood:

- Investigated subsurface soil and bedrock conditions through sampling and limited geotechnical laboratory testing at three bulk sample sites and seven boring sites.
- Collected and reviewed publicly available data regarding regional geology, soils, surficial and bedrock geology, and tectonic setting and seismology.
- Analyzed the available data to determine the suitability of the site for construction.
- Developed a Preliminary Geotechnical Investigation Report, that discusses:
    - Facility Area Geology
    - Geotechnical Characterization of the Facility Site (e.g., groundwater conditions, bedrock, soil and subsurface soil types)
    - Seismic Site Classification
    - Laboratory Testing
    - Chemical and Engineering Properties
    - Design and Construction Considerations and Recommendations.

Based on Westwood's findings, the Facility Site is generally suitable for the proposed development, and soils within the Facility Site are generally suitable for the proposed foundation systems. The typical stratigraphy of the Facility Site includes approximately 3 to 4 inches of topsoil, although the rootzone typically extends deeper. The topsoil encountered was generally brown and clayey with moderate organics and active roots. Topsoil depths could be greater in some portions of the site, particularly in topographic low areas. Underlying the topsoil is a lean clay to silt with varying amounts of gravel and sand. This unit is typically various shades of brown and gray, damp to wet, and stiff to hard. This unit ranged in thickness between approximately 2 and 38 ft, occasionally extending to the bedrock below. Underlying and interbedded within the clay was sand and gravel with varying amounts of clay. This unit was typically various shades of brown and gray, loose to very dense, and dry to wet. This unit ranged in thickness between approximately 0.5 and 7 ft, occasionally extending to the bedrock and may consist of weathered bedrock fragments.

Shale bedrock was visually observed at two boring locations (B-02 and B-04) across the site between 13.5 and 25 feet below grade. The shallower portion of the bedrock was typically weathered and transitioned into more competent bedrock with depth. Rock cores were typically light gray to gray with rock quality designation (RQD) values generally ranging from approximately 0% to 55%. The majority of shallow rock cores had RQD values less than 40%, indicating generally poor to moderate rock quality with very limited rock continuity.

All excavations completed during the construction of the Facility will comply with Occupational Safety and Health Administration, local, state, and federal safety regulations. See Exhibit 10(a)(5)-(7) for more details about potential blasting and mitigation measures.

Groundwater was encountered at five of the seven boring locations (B-02, B-03, B-04, HDD-01, and Sub-01) at depths ranging from approximately 7 to 28 feet below grade. Groundwater levels can fluctuate due to seasonal variation, so depth to groundwater should be further recorded during final geotechnical investigations. During the initial investigation visit, piezometers were installed to monitor ground water. Depth to groundwater was measured at the time the borings were completed and in December 2023, approximately three months after the completion of the borings. The depth to groundwater on site varied from approximately 7 feet to greater than 40 feet below ground surface (bgs) during drilling and between 2.0 feet and 4.5 feet bgs during the piezometer monitoring trip in December 2023. The depths to groundwater measured during drilling and after the piezometer monitoring trip are recorded in Table 3.4 of the Geotechnical Engineering Investigation Report (Appendix 10-B). The water level encountered during drilling was generally deeper compared to the longer-term water level measured in the piezometers, as expected in clayey soil. Depth to groundwater should be recorded during the final geotechnical investigation, and piezometers should be installed at proposed preliminary turbine locations for dynamic observation of water levels. See Exhibit 13, Section (a)(3) for an additional discussion of groundwater on site and how water will be managed during construction. The Facility is not proposed to contain any below grade facilities that would require continuous dewatering during operations.

Shallow groundwater can be successfully managed throughout the construction process based on the preliminary recommendations provided in Westwood's Preliminary Geotechnical Investigation Report (Appendix 10-B). The accumulation of groundwater in foundation excavations should be actively managed throughout construction and care should be taken to prevent ponding surface water by promoting positive drainage away from excavations, roads, and laydown areas, as well as minimizing the time of exposure to precipitation. Sumps and portable pumps can generally be used for short periods to dewater the site. Should any water collect within the foundation excavations, the bottom of the excavations should be cleared of any water and loose material prior to the placement of concrete or poles, or concrete may be poured using tremie method. All foundations bearing below groundwater should be designed to account for buoyant forces. Establishing adequate stormwater control practices will help to reduce damage to access roads and laydown areas caused by surface water and saturated subgrade conditions.

The corrosivity potential of soils at the Facility Site was measured at three boring locations. The chemical constituent test results indicate that the soil is relatively neutral with a pH ranging from 7.3 to 7.8. Soluble sulfates were measured as high as 37 mg/kg and soluble chlorides measured as high as 6 mg/kg. Chloride exposure is considered to be class C1, and sulfate exposure is considered low with concrete exposure class S0 (ACI, 2014). Test results are presented in Appendix C of the Geotechnical Engineering Investigation Report (Appendix 10-B) and summarized in the Lab Test Summary Table.

The estimated maximum frost penetration depth is 48 inches. To prevent frost heave, all foundations should be constructed at minimum 48 inches below the estimated frost penetration line. Because foundations for the wind turbines, substation, transmission line, overhead collection line, and any other ancillary features are anticipated to be constructed at a depth of greater than 48 inches, no mitigation measures are required to protect Facility foundations from frost heave.

In addition to frost heave, shrink and swell potential of the on-site soils was analyzed. The soils observed in the Facility Site are classified as lean clay by the U.S. Department of Agriculture (USDA) and are not expected to have significant expansion potential. The units are primarily mapped as having a low to moderate linear extensibility with a small, isolated region of very high linear extensibility (USDA, 2023), which is a laboratory measured soil property that describes the difference in soil volume between dry and moist state. The United States Army Corps of Engineers technical manual for foundations in expansive soils (USACE, 1983) maps the Project Site in an area of non-expansive soil to extremely limited expansion occurrence. The overall risk of expansive soil is considered low.

Subsurface hydrologic conditions indicate that although the high clay content of the subgrade soil will generally limit the amount of groundwater infiltration into foundation excavations, some dewatering of excavations may be required to remove precipitation and surface water runoff, groundwater seepage through sandy/gravelly layers, or upwelling through exposed fractured bedrock. Based on these conditions, groundwater dewatering is not anticipated in most locations. However, surface water may flow into the excavations following precipitation events and may require periodic removal to facilitate construction.

Locations where HDD is proposed are shown on the Design Drawings (Appendix 5-A). As indicated in the Geotechnical Report, generally, HDD should be feasible in site soil and fractured rock throughout the site through the proper use of current technologies, appropriate equipment, tooling and drilling fluids, and an experienced contractor. Conditions identified such as shallow bedrock, varying bedrock elevation, saturated sands and gravels, and cobbles and boulders will present challenges and limitations to HDD. It is recommended that geotechnical borings be performed at HDD-specific locations during the design phase geotechnical investigation.

The preliminary geotechnical investigation found bedrock to be at a depth of 13.5 feet or greater throughout the footprint of the proposed Facility. The relatively short bore lengths contemplated for the majority of the borings proposed for the Project will be specified, as is common practice, for a target depth of cover between 5 and 10 feet and so it is anticipated that the boring will occur within the soils zone of the geological profile. While majority of the bores on site are relatively short, there are longer bores planned for as well. The soil characteristics found in the bore samples, including fine grain sand, silt, and clay, are readily suitable soil conditions for all proposed bores. With the relatively short bore lengths planned for the majority of HDD locations within the Facility, drilling fluid pressures can remain low, reducing the probability of inadvertent returns; however, there is the possibility that inadvertent returns could happen in the short or longer bores. Inadvertent return risks can be mitigated with additional pre-drilling investigations, proper drilling fluid management, and real-time monitoring. The Applicant will prepare an Inadvertent Return Plan to address the unlikely occurrence of inadvertent returns should they occur.

(5) Blasting Plan

Shallow soils and weathered bedrock can be excavated by heavy equipment using conventional excavating and ripping techniques. More competent bedrock below the weathered zone may require very hard ripping or blasting to remove. The level of effort to construct foundations and buried utilities will depend on the depth these elements are to be installed within the weathered and more competent bedrock present.

Based on the results of the geotechnical investigation (see Appendix 10-B) and Westwood's experience with similar sites, the rock within anticipated foundation excavation depths (less than 10 to 13 feet below grade) within the Facility Site is generally expected to be rippable. However, a full geotechnical investigation of the Facility has not been completed and site-specific geotechnical data is not yet available for all wind turbine locations. As shown in Table 10-1 and Figure 10-4, publicly available bedrock depth data appears to have limited accuracy. If competent, near-surface bedrock is discovered during the final geotechnical investigation, blasting may be required. In these cases, blasting will likely generate less noise and take less time than conventional excavation techniques.

Table 10-1. Bedrock Depth at the Proposed Wind Turbine Locations

Wind Turbine(s)	Bedrock Depth	
	NRCS Soil Survey Data	Preliminary Geotechnical Data
1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15, 16, 17, 18, 19, 21, 22, 24	> 6 feet	n/a
2	> 6 feet	8 feet
6	< 1 foot	n/a
10	> 6 feet	20 feet
14	> 6 feet	8 feet

Wind Turbine(s)	Bedrock Depth	
	NRCS Soil Survey Data	Preliminary Geotechnical Data
20	> 6 feet	6 feet
23	> 6 feet	12 feet

Prior to construction, a final geotechnical investigation will be completed that will include all wind turbine locations, as well as other relevant locations within the Facility Site. This final investigation will include seismic refraction testing that will measure P-wave velocities to better assess the competency of rock that is likely to be encountered at all final wind turbine locations and at other sites across the Facility. In Westwood's experience, blasting will likely be required wherever shallow, non-rippable bedrock or bedrock containing large boulders is encountered within 6-10 feet of the ground surface and seismic refraction testing returns velocities greater than 5,000 fps.

Following the completion of the final geotechnical investigations, the Applicant will determine where blasting may be needed, the extent required, and an estimated amount of rock to be removed, based on the criteria outlined above, the potential noise impacts, construction schedule and costs, the volume of rock encountered, the hardness of the rock to be removed, required safety precautions, and other factors.

A Blasting Plan (Appendix 10-A) has been prepared that addresses: 1) the minimum contractor qualification requirements; 2) notification measures, including procedures and timeframes for notifying host communities and property owners within a one-half mile radius of blasting locations prior to blasting; 3) safe transportation, handling, and storage of blasting materials; 4) use of blasting mats; and 5) identifying and avoiding potential impacts to drinking water wells. This Blasting Plan is intended to provide preliminary guidance and procedures for all the blasting required for the Facility and anticipates that most blasting will be associated with the construction of wind turbine foundations. The footing for a wind turbine takes up approximately 450 cubic yards of volume; therefore, if blasting is required at a turbine location, the maximum amount of rock extracted through blasting per foundation site would be approximately 450 cubic yards.

Prior to blasting at each site, a pre-blast survey will be conducted. The pre-blast survey will inspect the blast area, and adjacent areas (defined as no less than a 500-foot radius from the blast area). The survey will document existing conditions and will include, but not be limited to buildings/structures, water supply wells, utilities (above and below ground). The survey will include written documentation as well as photographic documentation of existing conditions.

(6) Potential Blasting Impacts

Blasting undertaken for the construction of the Facility, in accordance with a properly designed blasting plan, will result in controlled removal of shallow bedrock and minimal impact on existing and above ground structures.

Considering the setbacks the Applicant has incorporated into the design of the Facility (see Exhibit 5(b)), long-term blasting-related impacts are generally not anticipated. In addition, blasting shall be designed and controlled to meet the limits for ground vibration set forth in United States Bureau of Mines Report of Investigation 8507 Figure B-1 (see Section 1100-15.1(k)(1)(i) of this Part) and air overpressure shall be under the limits set forth in the Conclusion Section in United States Bureau of Mines Report of Investigation 8485 (USBM RI8507 and USBM RI 8485 (see Section 1100-15.1(k)(1)(ii) of this Part) to protect structures from damage. Once blasting is complete, a post-blast survey will be conducted for the same facilities that were documented during the pre-blast survey.

Blasting Impacts to Above-Ground Structures

In designing blasts, the Applicant's blasting contractor will consider locations of residences, seasonal cabins, and other structures within 500 feet of the blast site. Each blast will be designed to limit vibration amplitudes at these locations to be less than limits set to prevent cosmetic damage to plaster walls, which the Society of Explosives Engineers has determined are typically the most vulnerable to blasting. Limits set to prevent damage to plaster walls will ensure no damage occurs to drywall walls, residential structures, or foundations.

Blasting Impacts to Below-Ground Structures

In designing blasts, the blasting contractor will consider locations of below-ground structures and utilities within 500 feet of the blast site. There are no known existing water supply wells located within 500 feet of any wind turbine location, and blasting will be prohibited within 500 feet of all known water supply wells.

With respect to water well impacts, several studies have been carried out to investigate the potential effects of blasting. One study evaluated the performance of 25 test wells drilled at four sites in Ohio, Pennsylvania, and West Virginia, where companies were using blasting to mine coal (Robertson et al., 1980). Test wells, ranging from 80 to 200 feet deep, were drilled 1,000 feet or more from active blasting, and researchers monitored the wells as the blasting progressed to as close as 50 feet from the wells. Blasting caused maximum ground vibration levels at the well sites ranging from 20 millimeters/second (0.84 inches/second) to 138 millimeters/second (5.44 inches/second). Based on monitoring of the well performance during and after the ground vibrations, the study concluded ground level vibrations of 51 millimeters/second (2.0 inches/second) or less are not substantial enough to damage wells. Consistent with this, the Society of Explosives Engineers has concluded that standards that protect plaster walls in houses will also protect below-ground structures, including groundwater wells. See www.explosives.org.

(7) Mitigation Measures for Blasting Impacts

Prior to determining that blasting is necessary, the Applicant will consider several alternative technologies available for excavating rock, including the following:

- Soundless chemical demolition agents (SCDAs): Cementitious powdery substance with quicklime (CaO) as its primary ingredient that expands upon contact with water, resulting in a large expansive pressure when the CaO hydration reaction occurs in a confined condition. By injecting the SCDA into boreholes of a rock mass, the resulting expansive pressure is sufficient to create an effective fracture network in the confined rock mass around the borehole and the rock having been fractured by the SCDA process can then be removed with excavators.
- Rock splitters/pneumatic hammers: Attached to a conventional excavator the drill-like rock splitter is inserted into a pre-drilled borehole and hydraulics of the excavator are used to push the splitter wedge between the splitter feathers to create an outward pressure in the borehole wall that splits the rock. Rock splitters are limited to an effective bench depth of 3.5 feet.
- Rock cutters: Rock-grinding attachments for excavators consisting of fixed-tooth hydraulic rotary drum cutters capable of cutting through hard rock. This equipment is widely used in road construction, underground utility work, tunneling, trenching, mining, and quarrying.

At locations where alternative technologies are not practicable, and blasting is required, blasting impacts to above- and below-ground structures will be avoided and minimized through the appropriate setbacks, the implementation of established Bureau of Mines vibration standards, and through compliance with the Blasting Plan (Appendix 10-A).

All blasting operations adjacent to residences, buildings, structures, utilities or other facilities will be planned with full consideration for all forces and conditions involved. The minimum amount of blasting material will be used to effectively fracture the competent rock to the required excavation depth. Independent monitoring of vibration and air concussion levels will be carried out by the contractor during all blasting operations. In addition, all blasts will comply with the following requirements to mitigate potential adverse impacts:

- All blasting operations, schedules, and contact information will be provided to adjoining property owners.
- Local safety officials and first responders will be notified of blasting schedules.
- Warning signs will be provided at points of access to blasting areas.
- Blasting operations will only be conducted between 7 a.m. and 7 p.m. Monday through Saturday. Blasting will not be conducted on Sunday and national holidays.
- Each blast will be preceded by a 1-minute series of warning signals. Prior to firing a blast, all persons in the danger area will be warned of the blast and ordered to a safe distance from the area, and a flag person shall be posted at all access points to danger areas. No blast will be fired until the area has been secured and determined safe.
- Following the blast all-clear signals will be given, which will be of different character from the warning signals.
- Access to the blasting area will be controlled to prevent unauthorized entry before each blast and until the perimeter’s authorized representative has determined that no unusual circumstances exist after the blast. Access to and travel in or through the area can then safely resume.

- Areas in which charged holes are awaiting firing will be guarded, barricaded and posted or flagged against unauthorized entry.
- Blasting mats and backfill will be used to control excessive amounts of rock movement and flyrock when blasting near structures.

If environmental or engineering constraints require blasting within 1,000 feet of a known existing, active water supply well on a non-participating parcel, the Applicant will engage a qualified third party to conduct testing of the water wells before commencement of blasting and after completion of blasting to ensure the wells are not impacted, provided the Applicant is granted access. If the testing at any of these locations conclude that the water supply met federal and state standards for potable water prior to construction but failed to meet standards after construction as a result of Facility activities, the Applicant will construct a new water well, in consultation with that landowner and in accordance with Section 1100-6.4(n)(1)(iv).

(8) Regional Geology, Tectonic Setting, and Seismology

The Facility is located in the southern part of Cayuga County, New York within the Allegheny Plateau (glaciated) physiographic province. The glaciated portion of the Allegheny Plateau is underlain by great thicknesses of sedimentary rocks, which lie almost horizontal, except in the middle of the finger lakes district where they sag. Severe dissection by both water and ice erosion has given the uplands a somewhat rugged relief. The elevation of the Allegheny Plateau varies from 500 to 600 feet in the north to more than 2,000 feet in the south. The Geologic Map of New York classifies the underlying bedrock as part of the Upper and Middle Devonian geologic periods (West River Shale; Genundewa Limestone, Tully Limestone) (NYSM/NYSGS, 1970). No known or suspected areas of karst geology, which are characterized by underground drainage systems with sinkholes and caves, are located within the Facility Area. Karst geology generally forms in limestone bedrock, and the dominant bedrock in the Facility Area is mostly sandstone and shale.

The Facility Site is located in a part of New York State considered to have low tectonic activity and the lowest probability of earthquake occurrence. Areas of New York State with higher probabilities of earthquake occurrences are located in the northern (St. Lawrence River Valley), western (Buffalo-Attica regions), and southern (New York City region) portions of the state.

Based on the 2014 New York State Hazard Map (USGS, 2014), the Facility Site is located in an area of low seismic hazard, with a 10% or less chance that an earthquake exceeding magnitude 2.5 on the Richter scale will occur within a 50-year window. The USGS Earthquake Hazards Program does not list any young faults or faults that have had displacement in the Holocene epoch within the vicinity of the Facility Area (USGS, 2018). Likewise, according to the Preliminary Geotechnical Investigation Report, seismicity within the Facility Site is low (see Appendix 10-B). Therefore, no seismic activity is anticipated within or adjacent to the Facility Site.

(9) Facility Impacts on Regional Geology

The Facility is not anticipated to result in any significant impacts to the regional geology.

Based on subsurface inspections and analyses, the Facility Site is considered suitable for the construction and operation of the Facility and therefore is not anticipated to result in any significant impacts to the regional geology. Only temporary, minor impacts to geology are expected as a result of construction activities. For example, cut and fill may be required where wind turbines, associated structures, and access road sites are not located on completely level terrain; however, the impact to overall topography is anticipated to be minor.

Construction of foundations will be generally limited to a shallow zone of soil and rock located 0 to 13 feet below surface within the foundation footprint. Due to disturbance of only shallow, localized zones of soil and rock stratigraphy, the impacts on regional geology is expected to be minimal. The shale and sandstone bedrock present under the site is not subject to dissolution and formation of caves or karst features, and therefore, measures to mitigate construction risks in karst areas are not required.

Overall, Facility components will be designed, sited, and constructed in a manner that avoids and minimizes temporary or permanent impacts to physiography, geology, and soils, to the extent practicable. Accordingly, when operational, Facility impacts to regional geology will be negligible.

(10) Impacts of Seismic Activity on Facility Operation

Facility operations are considered low risk to impacts from seismic activity, with no young faults or faults that have had displacement in the Holocene epoch identified within the Facility Site. See Exhibit 10(a)(8) for a discussion of the risk factors related to the anticipated impacts of seismic activity on the Facility.

(11) Soil Types Map

Soil types at the Facility Site were mapped using data from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey (USDA, 2020). See Figure 10-3 for a map delineating soil types within the Facility Site.

(12) Characteristics of Each Soil Type and Suitability for Construction

A wide variety of soil types are documented within the Facility Site according to the Soil Survey Geographic Database (SSURGO) database and NRCS Web Soil Survey (Soil Survey Staff, 2022). According to this publicly available data, 13 primary soil series comprise the majority of the Facility Site. The general characteristics of these soil units are presented in Table 10-2. It is important to note that the SSURGO is the most comprehensive information published by the National Cooperative Soil Survey but not all areas have been field-verified. Therefore, this Exhibit supplements the SSURGO soils data with site-specific soils information gathered during site investigations conducted by the Applicant. These data have been compiled and summarized in Exhibit 10(a)(4) and the Preliminary Geotechnical

Investigation Report (Appendix 10-B). These investigations included a site visit to characterize surficial features, an assessment of the Facility Site's general constructability, and a subsurface investigation.

Table 10-2. Soil Series Identified within the Facility Site and their Characteristics.

Soil Series	Main Characteristics
Ontario	• Slope: 0 to 60% • Type of land: cropland, pasture, forest • Land forms: undulating to rolling till plains and drumlins • Texture: loam, silt loam, or sandy clay loam • Drainage: well drained • Depth to bedrock: 40+ inches
Lima	• Slope: 0 to 20% • Type of land: cropland, forest • Land forms: level to moderately steep parts of till plains • Texture: sandy loam, silt loam • Drainage: moderately well drained • Depth to bedrock: 60+ inches
Lansing	• Slope: 0 to 60% • Type of land: cropland, forest • Land forms: level to rolling and steep soils on till plains • Texture: fine sandy loam, silt loam, silty clay loam • Drainage: well drained • Depth to bedrock: 60+ inches
Honeoye	• Slope: 0 to 65% • Type of land: cropland, forest • Land forms: gently undulating to rolling till plains • Texture: loam, fine sandy loam, silt loam, clay loam • Drainage: well drained • Depth to bedrock: 60+ inches
Conesus	• Slope: 0 to 25% • Type of land: cropland, pasture, forest • Land forms: level to sloping soils on till plains • Texture: loam, silt loam, silty clay loam • Drainage: moderately well drained • Depth to bedrock: 60+ inches
Lansing	• Slope: 0 to 60% • Type of land: cropland, woodlots • Land forms: nearly level to rolling and steep soils on till plains • Texture: loam, gravelly silt loam • Drainage: well drained • Depth to bedrock: 152+ inches
Alden	• Slope: 0 to 8% • Type of land: wooded, pasture • Land forms: nearly level and are in depressions on till plains • Texture: silty clay loam, silt loam, fine sandy loam • Drainage: very poorly

Soil Series	Main Characteristics
	• Saturated hydraulic conductivity; moderately high or high : 20 to 40 inches
Aurora	• Slope: 0 to 75% • Type of land: cropland • Land forms: nearly level through very steep soils • Texture: silty clay loam, sandy loam, silt loam • Drainage: moderately well drained • Organic Material: 20 to 40 inches
Muck (Adrian)	• Slope: 0 to 1% • Type of land: marsh grasses, pastures, cropland • Land forms: shallow closed depressions • Texture: sand, gravelly, loamy sand • Drainage: very poorly drained • Organic Material: 2 to 25 inches
Kendaia	• Slope: 0 to 15% • Type of land: cropland, pasture, woodlots • Land forms: nearly level to sloping • Texture: silt loam and fine sandyloam • Drainage: somewhat poorly drainage • Depth to bedrock: 152+ inches
Fonda	• Slope: 0 through 1% • Type of Land: woodlots, pastures • Land Forms: slightly depressed and sediment-filled depressions of till upland • Texture: Silt loam, silty clay loam • Drainage: very poorly drained • Depth to bedrock: 60+ inches
Sloan	• Slope: 0 to 2% • Type of Land: pasture, woodland, cropland • Land Forms: flood plain or depression along streams • Texture: silty clay loam, silt loam, gravelly sand • Drainage: very poorly drained Depth to bedrock: moderately deep
Palmyra	• Slope: 0 to 40% • Type of Land: pasture, wooded • Land forms: level to gently sloping • Texture: Calcareous • Drainage: well to excessively drained Depth to bedrock: 60+inches

Source: SSURGO Database (Soil Survey Staff, 2022).

Suitability and limitations of existing soils and depth to bedrock with respect to construction of the Facility were addressed earlier in this Exhibit and in the Preliminary Geotechnical Investigation Report (see Section (a)(4) above and also see Appendix 10-B). The generalized stratigraphy of the Facility Site, as determined from field data (from the ground surface down), consists predominantly of stiff to hard lean clay with varying amounts of sand and gravel and medium dense to dense clayey sand with varying amounts of gravel.

(13) Bedrock Analyses and Maps

Figure 10-4 of this Application shows depth to bedrock and depth to the high-water table across the Facility Site relative to Facility components. Representations of bedrock and high-water table depth are derived from both public data (i.e., USDA NRCS SSURGO) and the Applicant's site-specific data (i.e., data from individual borings completed during the geotechnical program). It is important to note that public data may represent mapped bedrock and high-water table depth differently than the site-specific bedrock depth and high-water table depth measured during geotechnical investigations. This is primarily due to the fact that the public data is extrapolated from a limited field campaign. The Preliminary Geotechnical Investigation Report (Appendix 10-B) includes maps, figures, and a more detailed discussion of subsurface conditions across the Facility Site. The Design Drawings (Appendix 5-A) and Electrical Design & Substation Plan Drawings (Appendix 5-B) depict the typical foundation depths of the various Facility components.

The typical stratigraphy, as determined from field data, consists of approximately 3 to 4 inches of topsoil overlying lean clay that transitions into likely residual bedrock or saprolite ranging from 13.5 to 25 feet below existing grade. Underlying the residual bedrock/saprolite is a more competent bedrock layer, which was inferred due to auger refusal at a depth of approximately 38 feet below ground surface (bgs). Weathered rock is defined as rock in which boring could be advanced by an auger. The shallower portion of the bedrock was typically weathered and transitioned into more competent bedrock with depth. Vertical profiles from the preliminary geotechnical investigation are included in Appendix 10-B.

Based on the results of the borings, bedrock is anticipated to be encountered at relatively shallow depths under many of the turbine locations. The bedrock encountered is anticipated to be structurally suitable for support of foundations for wind turbines and other Facility components. However, turbine locations will undergo additional subsurface investigation prior to construction. See Exhibit 10(a)(5) and (6) and the Preliminary Blasting Plan (Appendix 10-A) for a discussion of blasting anticipated to be conducted as part of Facility construction. Additionally, foundation bases will be placed below the frost penetration depth, which is estimated to be approximately 48 inches across the Facility Site.

(b) Foundation Suitability Evaluation

Based upon the geotechnical conditions within the Facility Site, spread footings and drilled concrete piers/shafts are feasible wind turbine, substation, or transmission line structure foundation types (Appendix 10-B). Foundation construction will occur in several stages, which typically include excavation, pouring of concrete mud mat, rebar and bolt cage assembly, outer form setting, casting, and finishing of the concrete, removal of the forms, backfilling and compacting, and site restoration. Excavation and foundation construction will be conducted in a manner that will minimize the size and duration of excavated areas required to install foundations. In addition, foundations will be constructed and inspected in accordance with relevant portions of the New York State Building Code and in conformance with all pre-construction site-specific studies.

(1) Preliminary Engineering Assessment

As previously mentioned, the Preliminary Geotechnical Investigation Report indicates that the Facility Site soils and underlying sedimentary bedrock are generally considered to be structurally suitable to support wind turbine foundations, support buildings, and access roads. However, additional borings will be performed prior to construction to assess localized subsurface conditions at proposed structure locations. Preliminary investigation and testing of the Facility Site found 7 to 38 feet of clay, sand, and gravel over shale bedrock. For these conditions, a spread footing foundation system is suitable (Appendix 10-B). Based on the results of the preliminary geotechnical investigation (Appendix 10-B), none of the investigated wind turbine locations exhibit zones of lower strength material at or below the assumed foundation bearing depth of 9.5 feet. All foundation construction techniques employed will conform to applicable building codes and industry standards.

Based on the characteristics of on-site soils, the risk of frost heave is present at the Facility Site. Foundations for the wind turbines and associated structures will be constructed at a suitable depth below the frost line, assumed approximately 48 inches below ground surface. Therefore, further assessment of frost action was not conducted.

The soils observed in the test borings generally consists of non-plastic silt with varying amounts of sand and gravel. On-site soils should have minimal shrink/swell potential. Therefore, specific construction procedures for potentially expansive clays are not required and further assessment was not conducted.

(14) Pile Driving Assessment

Pile driving is not anticipated to be needed for this Facility. Concrete mat foundations, with or without rock anchors, are suitable for the wind turbine models proposed in this Application.

(15) Mitigation Measures for Pile Driving Impacts

Pile driving will not be needed for this Facility; therefore, this section is not applicable.

(16) Vulnerability to Earthquake and Tsunami Events

As previously indicated in Exhibit 10(a)(8), the Facility is considered to have minimal vulnerability associated with seismic events based on a review of publicly available data. The components of this Facility will be evaluated, designed, and constructed to resist the effects of earthquake motions in accordance with the American Society of Civil Engineers (ASCE) and Section 1613 of the Building Code 2015 of New York State. The Preliminary Geotechnical Investigation Report indicates that the Facility Site is Site Class C, D. Based on soil conditions present in the Facility Site and a lack of faults or seismic activity, the Facility Site is not considered vulnerable to earthquake events. The soils encountered during the subsurface explorations are not susceptible to liquefaction. The Preliminary Geotechnical Investigation Report lists the applicable parameters for design based on the seismic site classification in accordance with ASCE 7-10. Additionally, the Facility is not located near any tidal water bodies; therefore, vulnerability associated with tsunami events will not be discussed in this Application.

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