RIVERSIDE SOLAR, LLC

Matter No. 21-00752

900-2.11 Exhibit 10

Geology, Seismology, and Soils

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Acronym List

AES	The AES Corporation, Inc.
ASCE	American Society of Civil Engineers
bgs	below ground surface
HDD	horizontal directional drilling
IBC	International Building Code
IFP	Issued for Permit
Ksat	saturated hydraulic conductivity
NRCS	Natural Resources Conservation Service
NYS DHSES	New York State Division of Homeland Security & Emergency Services
NYSED	New York State Education Department
PV	Photovoltaic
RQD	rock quality designation
SPT	Standard Penetration Test
SWPPP	Stormwater Pollution Prevention Plan
USCs	Uniform Standards and Conditions
USGS	United States Geological Survey

Glossary Terms

Facility	The proposed components to be constructed for the collection and distribution of energy for the Riverside Solar Project, which includes solar arrays, inverters, electric collection lines, and the collection substation.
Facility Site	The parcels encompassing Facility components which totals 1,168 acres in the Towns of Lyme and Brownville, Jefferson County, New York (Figure 2-1).
Towns	The Towns of Lyme and Brownville, Jefferson County, New York.

Exhibit 10: Geology, Seismology and Soils

This Exhibit addresses the requirements specified in §900-2.11 Exhibit 10: Geology, Seismology and Soils. This Exhibit contains a study of the geology, seismology, and soils impacts of the Riverside Solar Project (Facility) including the identification and mapping of existing conditions within the approximate 1,168-acre property on which the Facility is proposed (the Facility Site), and proposed impact avoidance and mitigation measures.

10(a) Geology, Seismology, and Soils Impacts of the Facility

A study of the geology, seismology, and soils impacts of the Facility consisting of the identification and mapping of existing conditions, an impact analysis, and proposed impact avoidance and mitigation measures have been included in the following sections.

(1) Existing Slopes Map

Based on the topographic survey completed for the Facility Site, it is not expected that Facility construction will occur on slopes greater than 25 percent (%). With respect to the erodibility of natural soils, the topographic relief of the Facility Site ranges from flat to mildly-sloped. The Facility is also well-vegetated. These conditions should minimize the potential for appreciable erosion.

Figure 10-1 has been provided which includes a map delineating existing slopes (0-3%, 3-8%, 8-15%, 15-25%, 25-35%, greater than 35%) within the Facility Site potentially influenced by the Facility and interconnections.

(2) Proposed Site Plan

Issued for Permit (IFP) Design Drawings for the Facility are included as Appendix 5-1 of Exhibit 5 to this Application and include existing and proposed contours at two-foot intervals for the Facility and interconnections at a scale sufficient to show all proposed buildings, structures, paved and vegetated areas, and construction areas, per part §900-2.11 of the Section 94-c regulations.

(3) Construction Methodology and Excavation Techniques

- Photovoltaic (PV) solar array support posts will be driven to a depth of between eight and 12 feet below ground surface (bgs). Should bedrock refusal be encountered shallower than the design embedment depth, it is anticipated that the location will be pre-drilled, and the support posts will be installed in place. Any spoils generated by drilling activities will be re-placed into the hole as backfill or spread within the Facility Site to maintain site grade and minimize off-site disposal.
- Equipment foundations within the solar array will generally be steel skid on 10- to 12-foot deep piles or placed on slab-on-grade foundations with an anticipated embedment depth of between 12 inches and 18 inches underlain by free-draining granular fill. Foundation sizes will be apportioned based on the allowable bearing capacities recommended within the Geotechnical Report (Appendix 10-1). Excavation of slab on grade foundations will be performed with traditional excavation equipment, such as backhoes or tracked excavators.
- Direct burial methods utilizing appropriate industry equipment including, but not limited to, a cable plow, rock saw, rock wheel and/or trencher will be used during the installation of underground electrical collection system whenever possible. Direct burial involves the installation of bundled cable (electrical and fiber optic bundles) directly into a narrow cut or "rip" in the ground. The narrow cut disturbs an area approximately 2-3 feet wide with bundled cable installed to a minimum depth of about 24-48 inches in most areas.
- Where direct burial of cabling is not possible or cost effective, an open trench will be excavated 2-3 feet wide. Using this installation technique, topsoil and subsoil are excavated, segregated, and stockpiled adjacent to the trench. Where necessary, clean sand bedding will be placed in the bottom of the trench before installing cables. Following cable installation, the trench is backfilled with suitable fill material and any additional spoils are spread out or otherwise spread on site. Following installation of the buried collection line, areas will be returned to pre-construction grades. One or more soil screening areas may be established on site to screen excavated material to the required specification for trench backfill. It is anticipated that the excavated material can be screened to provide sufficient quantities of backfill material.

- At locations where an electrical collection line crosses a sensitive area, it is anticipated that a trenchless technology such as horizontal directional drilling (HDD) will be used. This technique involves installing the conduit underground using boring equipment set up on either side of the crossing. No surface disturbance is required between the bore pits and existing vegetation may remain in place. As HDD techniques will depend on the installation contractor, it is anticipated that, an Inadvertent Return Flow Plan will be prepared and submitted as a Compliance Filing, per subpart 900-10.2(f)(5).
- Excavations in the substation area will generally consist of foundation and underground electrical installations. Concrete foundations for major equipment and structural supports will be placed, followed by the installation of various conduits, cable trenches, and grounding grid conductors. It is anticipated that spread footings will be utilized for the substation equipment. Therefore most, if not all, of the excavations within the substation can be performed by traditional excavation equipment. However, drilled or driven piers may prove to be a more economical solution for some structures within the substation, such as dead-end / takeoff structures. Drilled piers are constructed by drilling a hole in the ground, installing a steel reinforcing cage, and backfilling with concrete.
- Culverts will be installed to maintain natural drainage patterns where necessary. Where haul roads must cross wetlands with flowing water, a temporary pump-around or coffer dam may be used to install crossings “in the dry.” Appropriate sediment and erosion control measures will be installed and maintained according to the Facility-specific Stormwater Pollution Prevention Plan (SWPPP). A preliminary version of this plan has been included in Attachment 13-3.

Cut or fills to achieve the final grades are currently not anticipated for the solar array area of the Facility. It is planned that, to the extent possible, the topography will be accommodated in the design to minimize the impact of grading and site disturbance, as well as the need for removal and disturbance of vegetation. During design stages, topographic survey data collected using aerial methods was utilized to minimize areas of cut and fill, and in order to maintain existing drainage patterns.

It is anticipated that the site development activities will consist of installation of posts for solar module racking, small foundation slabs for ancillary structures, and limited, narrow excavations for installation of cables. The construction of haul roads across the site will also be accomplished with minimal cut and fill. Where the haul roads traverse an existing grade that exceeds the maximum design slope, construction of the road is proposed on a side slope, or the need to flatten the top of an existing high point, limited cut and fill may occur in these situations.

The areas planned for the solar related facilities are relatively flat and open. Therefore, there are minimal areas which will require re-grading with the exception of some of the haul roads. Based on the preliminary design, cut and fill is not anticipated to be required to achieve proposed finished grades

A geotechnical investigation was completed at the Facility Site to evaluate the expected surface profile. The findings of this investigation can be found in the Geotechnical Report included as Appendix 10-1 of this exhibit. Bedrock was encountered as shallow as three feet below grade, but generally six feet or deeper below grade. Notwithstanding, as very limited re-grading is anticipated, it is anticipated that, likewise, very little mass excavation of rock will be required for grading and trenching. Rock coring conducted during the field investigation of the site geotechnical program indicates that the rock material is slightly weathered to fresh limestone of strong strength. If removal of rock is necessary, it is anticipated that rock removal techniques such as ripping, hammering, or pre-drilling can be completed to allow construction of the proposed Facility. It is not anticipated that rock blasting will be required.

If cut-and-fill activities are required, any material which is moved is anticipated to be re-used onsite to the extent possible. It is not anticipated that any fill will be transported offsite from the Facility Site, which will minimize the potential for introduction and/or transport of invasive species. No fill material, other than gravel for road surfacing and sand for trench bedding, will be required from offsite areas. However, as previously stated, cut-and-fill are not anticipated as part of the Facility.

(4) Characteristics and Suitability of Material Excavated for Construction

A geotechnical investigation was conducted to evaluate the nature of soils, bedrock, and groundwater conditions on and in the vicinity of the Facility Site. As part of this evaluation the following items were reviewed and reported as part of a Geotechnical Report (Appendix 10-1):

- Subsurface Soils - Section 3 of the Geotechnical Report
- Bedrock Conditions – Section 3 of the Geotechnical Report

- Groundwater and Hydrogeologic Conditions – Section 3 of the Geotechnical Report
- Drainage Characteristics - Section 3 of the Geotechnical Report, and Item (12) of this Exhibit
- Karst Features – Item (9) of this Exhibit
- Chemical Properties (corrosivity) – Section 4.3 of the Geotechnical Report
- Engineering Properties – Section 7.3 and 7.4 of the Geotechnical Report
- Frost Risk – Section 7.2 of the Geotechnical Report
- Laboratory Testing – Section 4 of the Geotechnical Report
- Seismic Considerations – Section 6 of the Geotechnical Report
- Construction Suitability Analysis and Recommendations – Section 8 of the Geotechnical Report

It was observed that the subsurface conditions generally encountered across the Facility Site consisted of approximately six to ten inches of topsoil, followed by a layer of stiff to very stiff clay and silt, and underlain by limestone bedrock. As indicated in Section 5.2 of the Geotechnical Report (Appendix 10-1), the results of site-specific soil samples collected for corrosivity evaluation indicated a low risk of soil-related corrosion to concrete elements and high risk of soil-related corrosion to steel elements. In addition, frost considerations and mitigation measures by engineering design and construction-phase measures to accommodate frost and potential shallow bedrock have been outlined in the Geotechnical Report.

HDD will be employed to avoid and/or minimize impacts to wetlands within the Facility Site. Specifically, HDD will be used underneath wetlands W-NSD-7, W-NSD-12, W-NSD-13, and W-BF-5. Additionally, HDD will be used under streams S-NSD-4, S-NSD-5 and under Weaver Road in the eastern portion of the Facility. Soils within these wetlands consisted of clay, clay loam, and silty clay loam. Dominant soil unit types within these areas include Covington silty clay (Cp), Kingsbury silty clay (KgA), and Guffin clay (Gv). Descriptions of these soil unit types can be found in Section 10(a)(12) below, with more information on the associated wetlands included in Exhibits 14. Further information regarding subsurface conditions within the Facility Site are included within the Geotechnical Report (Appendix 10-1). An Inadvertent Return Plan will be submitted as a compliance filing.

Based on the findings of the geotechnical investigation, as indicated in Section 2.4 of the Geotechnical Report (Appendix 10-1), the Facility Site is considered suitable for the proposed Facility.

(5) Preliminary Plan for Blasting Operations

Bedrock was encountered across the Facility Site and was three feet below grade at its shallowest point, but was generally six feet or deeper below grade. Figure 2 within the Geotechnical Report (Appendix 10-1) has provided a “heat map” showing depth to bedrock across the Facility Site, along with Table 4 which identifies depth to bedrock at each of the investigation points which were advanced during the field investigation program. In the event that rock is encountered, it is anticipated that rock removal techniques such as ripping, hammering, or pre-drilling can be completed to allow construction of the proposed Facility. Therefore, blasting is not anticipated during construction of the Facility and a Blasting Plan has not been included as part of the Application.

(6) Assessment of Potential Impacts from Blasting

Blasting will not be required during construction of the Facility. Although the geotechnical investigation identified the potential presence of shallow bedrock, it is believed that rock removal techniques, such as ripping, hammering, or pre-drilling, can be completed to allow construction of the proposed Facility. Depth to bedrock is discussed in greater detail throughout the Geotechnical Report (Appendix 10-1).

(7) Identification and Evaluation of Reasonable Mitigation Measures Regarding Blasting Impacts

No blasting will occur during construction of the Facility and thus, no mitigation related to blasting impacts is required.

(8) Regional Geology, Tectonic Setting, and Seismology

As described in the Geologic Review (Section 3) conducted as part of the Geotechnical Report (Appendix 10-1), surficial geologic mapping provided by the New York State Education Department (NYSED) indicates that the Facility Site is predominantly mapped within the “Lacustrine Silt and Clay” unit. Minor surficial geologic units include recent alluvium. Review of publicly available surficial soil mapping provided by the Natural Resources Conservation Service (NRCS) Web Soil Survey identifies the Facility Site to be primarily comprised of the Kingsbury silty clay (25.3 percent) and Vergennes silty clay (36.2 percent) units. The site-specific geologic field investigation conducted was in general conformance with this publicly-available mapping. Figure 10-2 provides a Surficial Geology Map which identifies the surficial geology expected across the Facility Site.

Bedrock geology within the Facility Site boundary is mapped as sedimentary rock of the North American platform, Middle Ordovician in age. Based on the "Geologic Map of New York, Adirondack Bedrock Sheet" prepared by NYSED, it is understood that the specific bedrock formation within the Facility Site boundary is the Chaumont Limestone, which consists of cherty, thick bedded gray-black calcilutite. The site-specific geologic field investigation conducted was also in general conformance with this publicly available data. Figure 10-3 provides a Bedrock Geology Map which identifies the bedrock geology expected across the Facility Site.

From a tectonic and seismic setting, as noted by the Isachsen, et. al (1990), the Facility is located in a "tectonically passive" region of New York state. Bedrock in the Facility Site was deposited in shallow seas on the stable North American craton, with geologic setting in the Interior Lowlands adjacent to Lake Ontario and trending upwards toward the Tug Hill Plateau east of the Facility. Figure 10-4, which identifies seismic hazard potential and the relative distances of documented prior epicenters to the Facility, and distances from the Facility based on the 2018 United States Geological Survey (USGS) Long-term National Seismic Hazard Model depicts the Facility Site, and has been provided with this Exhibit. Mapping reveals a low hazard for seismic hazard. The USGS Model defines the potential for earthquake ground shaking for various probability levels across the conterminous United States and is applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. According to the USGS, the model represents an assessment of the best-available science in earthquake hazards and incorporates new findings on earthquake ground shaking, seismicity, and long-period amplification over deep sedimentary basins.

A full description of the regional geology, tectonic setting, and seismology of the Facility has been provided in Section 6 of the attached Geotechnical Report (Appendix 10-1). In addition, data obtained from the geotechnical investigation, including soil boring and test pit logs, was utilized to determine the Seismic Site Class for the Facility.

In accordance with the Standard Penetration Test (SPT) average N-value method, as prescribed in Chapter 20 of the American Society of Civil Engineers (ASCE) Standard 7-16 design manual, Site Class C for "very dense soil and soft rock" applies to the northern extent of the Facility. The following seismic ground motion values were also obtained from the USGS Seismic Hazard Maps for this portion of the Facility Site (Site Class C):

- 0.2 second spectral response acceleration, SS= 0.172 g[1]
- 1 second spectral response acceleration, S1= 0.059 g
- Maximum spectral acceleration for short periods, SMS= 0.275 g
- Maximum spectral acceleration for a 1-second period, SM1= 0.143 g
- 5% damped design spectral acceleration at short periods, SDS= 0.183 g
- 5% damped design spectral acceleration at 1-second period, SD1= 0.095 g

(9) Facility Construction and Operation Impacts to Regional Geology

Based on review of publicly available USGS Digital Karst Map Compilation and Database (hereafter, USGS Karst Map), as well as the "Geologic Map of New York, Adirondack Sheet" prepared by NYSED, the bedrock formation beneath the Facility Site consists of the Black River Group, which is characterized as carbonate karst. The Black River Group includes Chaumont Limestone – locally cherty, Lowville Limestone, and Pamelia Formation – dolostone (USGS, 2020). The primary rock type beneath the Facility is limestone, and the secondary rock type is dolostone. Other rock types identified beneath the Facility by the USGS Karst Map include shale, arkose, and chert. The carbonate formation beneath the Facility Site is mapped at depths as shallow as one to three meters (three to 10 feet) below grade. As mentioned in the Geotechnical Report (Appendix 10-1) in Section 3, limestone was found at various depths through the site in a number of soil borings and test pits across the Facility Site.

Furthermore, evidence of such karst geology was identified during the field investigation. The AES Corporation, Inc. (AES) retained a geotechnical professional experienced in karst terrain to perform a focused field evaluation to investigate the potential disappearing stream located

[1] The unit "g" represents the acceleration due to gravity.

within the Facility Site boundary, as well as the two suspect topographic depressions which may be markers for subsurface karst activity. The findings of the field evaluation confirmed several areas of karst topography, including openings in surface rock outcrops which led to underlying, existing caverns or chasms within those areas. The karst features which were observed appeared to be long-standing, as the rock outcropping showed signs of weathering, graffiti, and overgrown vegetation. The details of the karst site reconnaissance are documented in a Preliminary Karst Field Reconnaissance Report prepared by ANS Geo Inc. dated June 16, 2021 included as Appendix 10-2 of this Exhibit.

Following the karst reconnaissance, an engineering evaluation was completed to determine the risk of karst impacts on the Facility development. Based on the results of the site-specific geotechnical borings, it was observed that Rock cores yielded recovery of between 78 to 100%, and rock quality designation (RQD) of 47 to 100%. Compressive strength testing of the rock cores indicated a medium strong to strong limestone with compressive strengths of at least 6,240 psi. The high recovery and RQD provide supporting information that the potential for sinkhole formation is low. Typically, when karst or sinkholes are present across large areas of the Facility Site, when advancing soil borings, open void zones or areas of soft soil which have filled into these relic sinkholes/voids may be encountered. These zones are usually observed as “rod drops” during the investigation—zones within the subsurface where your sampling tool will “drop” or have little to no resistance during drilling due to the presence of an open void or soft soil. These zones can also be seen as “weight-of-hammer” or very low blow-counts (N-value less than 3) since the sampler is penetrating into soft or wet soils which have previously filled into a sinkhole. Soil borings during the geotechnical investigation did not encounter any of these types of typical karst/sinkhole features. On the contrary, the higher recovery, RQD, and strength of the rock all support low concern for active sinkhole formation.

In addition to evaluating geotechnical borings, it is understood that sinkhole formation and karst is aggravated by change in surface drainage, change in groundwater flow quantity or direction, or increase in infiltration to the subsurface. As is typical with solar developments, the majority of the topography will remain unchanged since cut and fill will be minimized. In addition, it is not expected that the array areas will be stripped of grass or vegetation or be denuded during construction. By minimizing cut and fill, and limiting the change to existing vegetative cover, the hydrology and runoff will remain mostly consistent to pre-development conditions. Therefore, the risk of increasing sinkhole development potential is minimized.

Within the Facility Site, there were eight Areas of Concern (AOC) identified during the field investigation (Appendix 10-2). AOC-01 is located approximately 1,000 m west of the nearest HDD location within wetland W-NSD-7. AOC-02 is located approximately 800 m west of the nearest HDD location within W-NSD-7. AOC-03 is located approximately 400 meters west of the nearest HDD location within wetland W-NSD-7. AOC-04 is located approximately 850 m west of the nearest HDD location within wetland W-BF-5. AOC-05 and AOC-06 are located approximately one kilometer southwest of the nearest HDD location within wetland W-BF-5 (Appendix 10-2).

Finally, while karst conditions were observed and documented and the risk publications and reports by NY agencies indicate the presence of karst topography, the potential for sinkhole formation and cover-collapse is minimal. Typically, sinkhole activity in New York has shown that the frequency of localized subsidence occurrences will be low, and the relative scale of related karst features would be small enough for standard mitigative measures. A 2014 New York State Hazard Mitigation Plan prepared by the New York State Division of Homeland Security & Emergency Services (NYS DHSES) discusses the concern for land subsidence and expansive soils across NY. As indicated in the Plan, "*In NY, there is karst topography which is nicely developed in a narrow band along the Helderberg Escarpment in Schoharie and Albany counties. These areas are triggered by highly soluble Silurian and Devonian rocks including the upper part of the Rondout Formation and upward to the Onondaga Formation. However, the best expression of karst is in the intervening Coeymans and Manlius Formations*." The Riverside site is underlain by Chaumont Limestone of the Black River Group, which does not fit any of these formations of concern.

In addition, according to the referenced Mitigation Plan report, the potential for caverns or voids is also limited, and more likely due to man-made developments such as mining, which have not occurred at the Facility Site. Per the Plan, "*According to NYSGS staff, land subsidence, better known as sink holes, have a tendency to occur more often than not due to man-made influences (i.e., mining). These occurrences are found more commonly underground made from evaporate rock. Evaporated rock is soluble in water, and can potentially cause large cavity formations to occur. Sink holes occur when underground holes are created either naturally or artificially, and collapse due to induced force. Carbonate rock (limestone and dolomite) are also prone to void formation, but are less soluble and therefore take much more time, to form all things remaining constant.*" Also, as indicated in the Plan, "*Collapses are relatively rare in NYS where regions of* *karst topography are found. The last reported occurrence was roughly fifteen years ago [1989] in the Cobleskill area*".

Although the potential for karst-related risks is anticipated to be low, AES has prepared a Karst Mitigation Plan to document the measures which will be taken to minimize, manage, and remediate karst risks through the various stages of Facility planning, design, and construction. The Mitigation Plan has identified buffer and set-back distances from documented karst as the primary minimization and avoidance measure with respect to karst features. Should karst be identified during construction, the Karst Mitigation Plan has identified standard measures which can be used to remediate the site features. The Karst Mitigation Plan has been included as Appendix 10-3 of this Exhibit.

(10) Seismic Activity Impacts on the Facility Location and Operation

The USGS Earthquake Hazards Program did not identify any young faults within the vicinity of the Facility and, therefore, the Facility Site is at a low risk of impact from seismic activity.

(11) Soils Types Map

Maps depicting soil units within the Facility Site are included in Attachment H of the Geotechnical Report (Appendix 10-1). In addition, Figure 10-5 has been prepared to highlight each of the NRCS soil types across the Facility footprint and substation.

(12) Soil Type Characteristics and Suitability for Construction and Dewatering

Information regarding onsite soils was obtained from onsite investigations by ANSGeo Inc., and from existing published sources, including the Soil Survey of Jefferson County and the NRCS Web Soil Survey. NRCS identified the Facility Site to be primarily comprised of the Kingsbury silty clay and Vergennes silty clay units. A summary of predominant soil unit properties has been provided in Table 10-1. A table of all soils identified within the Facility Site has been include in Section 15(b)(5) of Exhibit 15.

Table 10-1. NRCS Soil Properties

Soil Unit	Drainage Class	Available Water Storage	Erosion Hazard
Kingsbury silty clay	Somewhat poorly drained	Moderate (~8.3 inches)	Slight
Vergennes silty clay	Moderately well drained	Moderate (~8.1 inches)	Moderate

Individual soil map units that occur within the Facility Site, as well as their respective hydrologic soil group rating, acreage within the Facility Site, percent of the Facility Site, and NRCS soil properties are included in Attachment H of the Geotechnical Report (Appendix 10-1).

Representative soil samples collected during the geotechnical investigation were submitted to an accredited geotechnical laboratory for testing of material index properties for engineering design in accordance with their applicable ASTM International standards. A summary of laboratory testing data is provided as Section 4 of the Geotechnical Report (Appendix 10-1).

Descriptions of individual soil map units sampled during the geotechnical investigation based on the NRCS Web Soil Survey and the Soil Survey of Jefferson County are as follows:

Benson Series consists of shallow, somewhat excessively drained soils on uplands where bedrock is less than 20 inches deep. These soils formed in glacial till or in wind or water-deposited material mixed with till or congeliturbate with slopes ranging from zero to 50 percent.

Galoo Series consists of very shallow, excessively and somewhat excessively drained soils on glacial till plains underlain by bedrock. These soils formed in a thin layer of glacial till overlying limestone or calcareous sandstone bedrock with slopes ranging from zero to eight percent.

BgB is Benson-Galoo complex, very rocky, with zero to eight percent slopes. Parent material consists of Channery loamy till underlain by limestone or calcareous shale. Depth to a restrictive feature is two to 10 inches. These soils are somewhat excessively drained, have a hydric rating of zero, and are considered not prime farmland. This soil unit contains 1.80 percent organic matter. The saturated hydraulic conductivity (Ksat) is very low to moderately high and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, excessively drained classification, and hydric rating of zero likely result in a very slow infiltration rate.

Chaumont Series consists of moderately deep, somewhat poorly drained soils on lake plains. These soils formed in clayey lacustrine sediments with slopes ranging from zero to eight percent.

ClA is Chaumont silty clay, with zero to three percent slopes. Parent material consists of clayey glaciolacustrine deposits or glaciomarine deposits. Depth to a restrictive feature is 20 to 40 inches. These soils are somewhat poorly drained, have a hydric rating of 12, and are considered farmland of statewide importance. This soil unit contains 2.05 percent organic matter. The Ksat is very low to moderately high and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, somewhat poorly drained classification, and hydric rating of 12 likely result in a very slow infiltration rate.

ClB is Chaumont silty clay, with three to eight percent slopes. Parent material consists of clayey glaciolacustrine deposits or glaciomarine deposits. Depth to a restrictive feature is 20 to 40 inches. These soils are somewhat poorly drained, have a hydric rating of seven, and are considered farmland of statewide importance. This soil unit contains 2.05 percent organic matter. The Ksat is very low to moderately high and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, somewhat poorly drained classification, and hydric rating of seven likely result in a very slow infiltration rate.

Covington Series consists of very deep, poorly drained soils on lowland lake plains. These soils formed in lacustrine and estuarine deposits of clay and silt with slopes ranging from zero to three percent.

Cp is Covington silty clay, with zero to three percent slopes. Parent material consists of clayey glaciolacustrine deposits or glaciomarine deposits. Depth to a restrictive feature is more than 80 inches. These soils are poorly drained, have a hydric rating of 90, and are considered not prime farmland. This soil unit contains 1.98 percent organic matter. The Ksat is very low and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, poorly drained classification, and hydric rating of 90 likely result in a very slow infiltration rate.

Farmington Series consists of shallow, well drained and somewhat excessively drained soils. These soils formed in glacial till or in win and water-laid deposits mixed with till or congeliturbate with slopes ranging from zero to eight percent.

FaB is Farmington loam, with zero to eight percent slopes. Parent material consists of loamy till or congeliturbate derived from limestone, dolomite, shale, and sandstone, and in many places mixed with wind and water deposits. Depth to a restrictive feature is 10 to 20 inches. These soils are well drained, have a hydric rating of five, and are considered farmland of statewide importance. This soil unit contains 2.25 percent organic matter. The Ksat is very low and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, well drained classification, and hydric rating of five likely result in a very slow infiltration rate.

Fluvaquents Series consists of very deep, very poorly drained soils along small creeks and streams with frequently changing channel morphology. These soils formed in recent alluvial material derived mainly from transported glacial till and lacustrine and outwash deposits with slopes ranging from zero to eight percent.

Udifluvents Series consists of very deep, well drained and moderately well drained soils on flood plain, lake plain, and outwash deposits. These soils formed in recent water-laid deposits mainly in nearly level to gently sloping areas on floodplains, fans, and deltas of rivers, and creeks and small streams with slopes ranging from zero to eight percent.

Fu is Fluvaquents-Udifluvents complex, frequently flooded, with zero to three percent slopes. Parent material consists of alluvium with highly variable texture. Depth to a restrictive feature is more than 80 inches. These soils are poorly drained, have a hydric rating of 48, and are considered not prime farmland. This soil unit contains 1.39 percent organic matter. The Ksat is moderately low to high and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, poorly drained classification, and hydric rating of 48 likely result in a high to very slow infiltration rate.

Galoo Series consists of very shallow, excessively and somewhat excessively drained soils on glacial till plains underlain by bedrock. These soils formed in a thin layer of glacial till overlying limestone or calcareous sandstone bedrock with slopes ranging from zero to eight percent.

GbB is Galoo-Rock outcrop complex, with zero to eight percent slopes. Parent material consists of a thin layer of loamy till that overlies limestone or calcareous sandstone bedrock. Depth to a restrictive feature is two to 10 inches. These soils are excessively drained, have a hydric rating of five, and are considered not prime farmland. This soil unit contains 2.67 percent organic matter. The Ksat is very low to moderately high and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, excessively drained classification, and hydric rating of five likely result in a very slow infiltration rate.

Guffin Series consists of moderately deep, poorly drained and very poorly drained soils on lake plains. These soils formed in calcareous, lacustrine, and estuarine sediments with slopes ranging from zero to three percent.

Gv is Guffin clay, with zero to three percent slopes. Parent material consists of clayey glaciolacustrine deposits or glaciomarine deposits. Depth to a restrictive feature is 20 to 40 inches. These soils are poorly drained, have a hydric rating of 85, and are considered farmland of statewide importance. This soil unit contains 3.38 percent organic matter. The Ksat is very low to moderately high and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, poorly drained classification, and hydric rating of 85 likely result in a very slow infiltration rate.

Kingsbury Series consists of very deep, somewhat poorly drained soils on lake plains. These soils formed in lacustrine or marine deposits that are high in clay content with slopes ranging from zero to six percent.

KgA is Kingsbury silty clay, with zero to two percent slopes. Parent material consists of calcareous, clayey glaciomarine deposits or glaciolacustrine deposits. Depth to a restrictive feature is more than 80 inches. These soils are somewhat poorly drained, have a hydric rating of seven, and are considered farmland of statewide importance. This soil unit contains 1.86 percent organic matter. The Ksat is very low and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, somewhat poorly drained classification, and hydric rating of seven likely result in a very slow infiltration rate.

KgB is Kingsbury silty clay, with two to six percent slopes. Parent material consists of calcareous, clayey glaciomarine deposits or glaciolacustrine deposits. Depth to a restrictive feature is more than 80 inches. These soils are somewhat poorly drained, have a hydric rating of six, and are considered farmland of statewide importance. This soil unit contains 1.86 percent organic matter. The Ksat is very low and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, somewhat poorly drained classification, and hydric rating of six likely result in a very slow infiltration rate.

Livingston Series consists of very deep, very poorly drained soils on lake plains. These soils formed in lacustrine or estuarine deposits of clays with slopes ranging from zero to three percent.

Lc is Livingston mucky silty clay, with zero to three percent slopes. Parent material consists of clayey estuarine deposits or glaciolacustrine deposits. Depth to a restrictive feature is more than 80 inches. These soils are very poorly drained, have a hydric rating of 85, and are considered not prime farmland. This soil unit contains 1.92 percent organic matter. The Ksat is moderately low to moderately high and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, very poorly drained classification, and hydric rating of 85 likely result in a slow to very slow infiltration rate.

Vergennes Series consists of very deep, moderately well drained soils on lake plains. These soils formed in glaciolacustrine or marine deposits that consist of calcareous clays that are very low in silt and very fine sand with slopes ranging from three to 15 percent.

VeB is Vergennes silty clay loam, with three to eight percent slopes. Parent material consists of calcareous clayey estuarine deposits derived from limestone and/or calcareous clayey glaciolacustrine deposits derived from limestone. Depth to a restrictive feature is more than 80 inches. These soils are moderately well drained, have a hydric rating of zero, and are considered farmland of statewide importance. This soil unit contains 0.70 percent organic matter. The Ksat is very low to moderately low and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, moderately well drained classification, and hydric rating of zero likely result in a very slow infiltration rate.

Wilpoint Series consists of moderately deep, moderately well drained soils on lake plains cored with bedrock. These soils formed in clayey, lacustrine sediments with slopes ranging from three to 15 percent.

WnB is Wilpoint silty clay loam, with three to eight percent slopes. Parent material consists of clayey glaciolacustrine or glaciomarine deposits. Depth to a restrictive feature is 20 to 40 inches. These soils are moderately well drained, have a hydric rating of eight, and are considered farmland of statewide importance. This soil unit contains 1.74 percent organic matter. The Ksat is very low to moderately high and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, moderately well drained classification, and hydric rating of eight likely result in a very slow infiltration rate.

WnC is Wilpoint silty clay loam, with eight to 15 percent slopes. Parent material consists of clayey glaciolacustrine or glaciomarine deposits. Depth to a restrictive feature is 20 to 40 inches. These soils are moderately well drained, have a hydric rating of eight, and are considered farmland of statewide importance. This soil unit contains 1.74 percent organic matter. The Ksat is very low to moderately high and the infiltration rating is most limited, with a low permeability rating of 1.0. The low permeability rating, moderately well drained classification, and hydric rating of eight likely result in a very slow infiltration rate.

Groundwater was not observed at the time of the geotechnical investigation; therefore, dewatering is not anticipated. If excavations are affected by groundwater or stormwater, the selected contractor during construction will be prepared to manage groundwater or infiltrated stormwater using pump-and-sump or similar techniques to allow for foundation construction in-the-dry, if necessary. If determined necessary, water will be discharged to an appropriate upland area identified within the SWPPP. Dewatering methods will involve pumping the water to a predetermined well-vegetated discharge point, away from wetlands, waterbodies, and other sensitive resources. Discharge of water will include measures/devices to slow water velocities and trap any suspended sediment.

The Facility Site is relatively flat with elevations ranging from 260 feet in the southwestern portion to approximately 300 feet in the central section. The Facility Site is comprised of predominantly low infiltration areas. The Facility Site consists primarily of agricultural hay fields and row crops, with forested lands intermixed. Most of the Facility Site is, and will continue throughout the life of the Facility, to be heavily vegetated. Considering this, impacts to recharge/infiltration will be minimal.

Based on this investigation, the Facility Site is considered suitable for construction and operation of the Facility.

(13) Bedrock and Underlying Bedrock Maps, Figures, and Analyses

Bedrock geology within the Facility Site boundary is mapped as sedimentary rock of the North American platform, Middle Ordovician in age. Based on the USGS Karst Map, it is understood that the specific bedrock formation within the Facility Site boundary is the Black River Group which consists of:

- Chaumont Limestone: cherty, thick bedded gray-black calcilutite.
- Lowville Limestone: light gray, thick to thin bedded calcilutite
- Pamelia Dolostone: greenish gray argillaceous dolostone, feldspathic sandstone at base.

The site-specific geologic field investigation conducted was also in general conformance with this publicly-available mapping. Bedrock was encountered across the Facility Site at depths as shallow as three feet bgs but generally six feet or deeper below grade. Figure 10-3 has been prepared to highlight the bedrock geology across the Facility footprint and substation.

Section 3 of the Geotechnical Report (Appendix 10-1) describes the subsurface conditions of soil and bedrock underlying the Facility Site. A subsurface cross section was developed using soil borings data, test pit data, and observations collected during the geotechnical investigation.

10(b)Evaluation of Suitable Building and Equipment Foundations

The following provides an evaluation of suitable building and equipment foundations.

(1) Preliminary Engineering Assessment

Driven and/or drilled and driven embedded H-piles are proposed to be installed to support the proposed PV racks. In general, installation of shallow foundations will be limited to depths of five feet bgs and installation of driven piles will be limited to depths of 12 feet bgs, however, actual foundations sizes and embedment depths will be apportioned based on recommended capacities provided in the Geotechnical Report (Appendix 10-1) .

Conventional shallow foundation elements, such as sonotubes, spread footings or similar systems, are proposed to be installed to support equipment pads (e.g. inverter skids, medium voltage transformers) within the solar arrays, as well as the substation transformers and equipment. Inverters will likely arrive on site as a single package on steel skids which may be similarly supported by concrete footings, sonotubes, or driven steel piles. These foundation elements are also anticipated to support lightly-loaded equipment within the substation area.

A preliminary engineering assessment was performed as part of the geotechnical evaluation for the Facility Site. The results of the engineering assessment are provided as Section 7 of the Geotechnical Report (Appendix 10-1). The recommendations utilize the latest version of the International Building Code (IBC) and standard industry accepted design standards.

(2) Pile Driving Impact Assessment

Solar panels will be supported by steel H-piles driven to a depth of approximately eight to 12 feet bgs. It is likely that pre-drilling of piles may be required prior to the installation of the posts, as shallow bedrock was documented during field investigations. The parameters provided in Section 7.3 of the Geotechnical Report (Appendix 10-1) have been used to size the H-piles. The number of installed piles for solar racking is estimated to be between 25,000 and 35,000 posts, depending on the final configuration of the racking system, module layout, and panel configuration (two in-portrait or one in-portrait). It is anticipated that the piles will be installed in 90 days utilizing six pile installation crews working 10 hours per day.

It is not anticipated that a traditional, large crane-operated pile driving hammer used for heavily-loaded structures will be employed. Should pre-drilling be required, it will likely be completed by using an excavator outfitted with an auger or drill attachment, or rock drill such as Ingersoll-Rand ECM-350 or similar machine. Based on the relatively small pile cross-section and the anticipated installation methods, ground-borne vibrations will be minimal and will not create any risk with respect to surrounding properties and structures.

(3) Pile Driving Mitigation

Solar tracker pile installation is commonly performed using vibrating pile drivers with no off-site vibration effects. The expected pile driver type is the Vermeer PD10 vibratory hammer, Gayk HRE4000, or similar, which will exert a maximum driving energy between 750 and 850 pound-feet using a hammer weight of 8,000 pounds while driving the pile to depth of 8-12 feet. The pile driver for the inverter skids and substation equipment, if required, will have similar specifications. Pile driving activities will not pose risk with respect to surrounding properties or structures, and will be performed in compliance with the Section 94-c regulations. Because no impacts to surrounding properties from pile driving are anticipated, mitigation measures and a compensation plan are not applicable.

(4) Evaluation of Earthquake and Tsunami Event Vulnerability at the Facility Site

Based on observation of subsurface conditions, computed Site Class ratings, and review of USGS's 2014 National Seismic Hazard Map, there is a low risk of significant seismic activity within the Facility Site that could cause damage to the Facility.

Figure 10-4, which identifies seismic hazard potential, known prior epicenters, and distances from the Facility based on the 2018 USGS Long-term National Seismic Hazard Model depicts the Facility Site, has been provided with this Exhibit. Mapping reveals a low potential for seismic hazard. The USGS Model defines the potential for earthquake ground shaking for various probability levels across the conterminous United States and is applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. According to the USGS, the model represents an assessment of the best-available science in earthquake hazards and incorporates new findings on earthquake ground shaking, seismicity, and long-period amplification over deep sedimentary basins.

Based on its geographic location, the Facility Site is not subject to risk of a tsunami event.

Conclusions

The Facility Site is relatively flat and open. There are minimal areas which will require re-grading to achieve proposed finished grades with the exception of some of the haul roads. Therefore, existing drainage patterns can be maintained, impacts to grading, vegetation, and recharge/infiltration will be minimal. The potential for sinkhole formation or seismic activity is low. Although the geotechnical investigation identified the potential presence of shallow bedrock, rock removal techniques such as ripping, hammering, or pre-drilling can likely be completed without the requirement of blasting. Due to the presence of shallow bedrock, pile pre-drilling may be required. However, ground-borne vibrations will be minimal and will not create any risk with respect to surrounding properties and structures. Eight potential karst AOCs were inspected during field reconnaissance, of which, only six AOCs were found to have evidence of karst features. Remaining AOCs were concentrated in the western and central portions of the Facility Site. All AOCs are 400 meters or greater from areas where HDD will be used. The Facility has been designed to comply with 19 NYCRR § 900-2.11 and the Uniform Standards and Conditions (USCs) and impacts related to geology, seismology, and soils have been avoided and minimized to the maximum extent practicable.

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