



Town of Farmington  
Planning Board  
1000 County Road 8  
Farmington, NY 14425

July 11, 2019

RE: Additional Information for Question 1a of SEQR Part 2, Yellow Mills Road Solar

Dear Farmington Planning Board Members,

Delaware River Solar (DRS) is pleased to bring the benefits of Community Solar to the Town of Farmington, and appreciates the Board's review of the proposed action to develop three 2.338 Megawatt AC solar energy systems.

On May 22, the Planning Board provided Delaware River Solar (DRS) with a Supplemental Narrative of the Board's responses to the State Environmental Quality Review (SEQR) – Full Environmental Assessment Form Part 2 (FEAF), determined at the May 15, 2019 public hearing. In this narrative, DRS was asked to provide additional information for "Question 1a – Impact on Land", in light of a geotechnical study of the parcel, to determine, as clarified by the Town Engineer, "the potential impacts the project would have on the existing bedrock and water table located on the project site."

DRS has worked diligently to provide this information to the Board. To do this, DRS needed to wait for the geotechnical engineer and geologist to complete the geotechnical study on the land. Once this study was complete, the results were shared with our construction engineer, who selected steel racking posts suitable to the soil conditions determined by the geotechnical report. After posts were selected, the geotechnical engineer determined if any impacts would be created, and what mitigations should be necessary.

In response, please find the following attached to this cover letter:

1. A geo-technical summary of the development area of the parcel, conducted by Foundation Design, PC;



2. An opinion letter from RBI Solar, the construction engineer of the proposed action, who selected suitable galvanized steel posts for the development based on soil condition results of the aforementioned study;
3. An opinion letter from Foundation Design on the environmental impacts of the selected steel posts.

To more thoroughly review these findings, we ask that the engineers at MRB Group (Town Engineer) and Foundation Design discuss the findings prior to the scheduled July 17, 2019 public hearing, so that these professional engineers may help address any and all questions the Board may have at the July 17 public hearing regarding this topic.

We hope this information is helpful to the Planning Board, and fully answers the questions the Board has regarding Question 1a of SEQR Part 2.

Sincerely,

Daniel Compitello  
*Project Developer*



130 North Winton Road  
Rochester, NY 14610  
[www.delawariversolar.com](http://www.delawariversolar.com)

Attachments:

1. Yellow Mills Road Solar Farm, Geotechnical Evaluation
2. RBI – Opinion Letter on Galvanized Steel Posts
3. Foundation Design – Opinion Letter on Galvanized Steel Posts



# Foundation Design, P.C.

SOIL • BEDROCK • GROUNDWATER

July 9, 2019

Delaware River Solar  
33 Irving Place  
New York, New York 10003

Attention: Mr. Peter Dolgos

Reference: Yellow Mills Road Solar Farm  
466 Yellow Mills Road, Farmington, New York  
Geotechnical Evaluation, 4618.0 (Revised)

Dear Mr. Dolgos:

This letter report summarizes our geotechnical evaluation for the referenced project. The 7mW Yellow Mills Road Solar Farm will cover 30± acres west of Yellow Mills Road in Palmyra, New York. The racking system, likely to be supported by driven piles, will be located in the open field. We base this report on our review of U.S.G.S. topographic mapping, National Resource Conservation Service mapping, test boring exploration; field and laboratory testing; and consultation with the design team. Delaware River Solar, LLC. retained Foundation Design, P.C. to perform the services outlined in our May 17, 2019 *Geotechnical Services Proposal, P4264.0*. We intend this report for exclusive use on this project.

The Yellow Mills Road Solar Farm will be located at 466 Yellow Mills Road in Farmington, New York. Fox Road lies to the north. A *General Location Plan*, on 2016 U.S.G.S. topographic mapping, is attached to this report. The parcel is pasture farmland located on the north face of a knoll. The ground surface rises gradually from approximately elevation 555 at the north end of the site to 570 to the south. A large hill lies south of the development area.

Delaware River Solar  
July 9, 2019  
Page 2

We completed soil borings P-1 through P-24 between June 13 and June 18, 2018. Target Drilling provided a CME-75 truck-mounted drill rig for the soil sampling. They advanced the test borings using hollow stem auger casings, recovering SPT split spoon soil samples continuously to 10 feet and at five foot intervals after that to completion; several borings terminated at auger refusal on cobbles/boulders within the soil matrix. The test borings terminated 12.5 to 20.0 feet below grade. A *Boring Location Plan* and the test boring logs are enclosed.

On June 21, 2019, we performed four, 4-point Wenner soil resistivity test (ASTM G-57) and eight soil thermal conductivity tests (ANSI/IEEE 442). These tests were performed in/adjacent to borings P-6, P-7, P-19, and P-23. For the 4-point Wenner soil resistivity tests, we used an AEMC Instruments 4630 digital ground resistance meter. Pins were spaced at 10 foot intervals and inserted six inches below grade. We measured in-place soil resistances as shown in Table No. 1 below. The field test reports are attached.

<b>Table No. 1 – Field Resistivity Test Results</b>	
<b>Location</b>	<b>Resistivity (ohm-cm)</b>
P-6	10,176
P-7	9,858
P-19	38,641
P-23	18,246

For the soil thermal conductivity tests, we used a Decagon Devices KD-2 Pro thermal conductivity meter for the testing. Macedon Excavating and Paving provided a Cat 307 excavator to extend the holes to a 36-inch depth; testing at P-6 was performed at a 30-inch depth due to heavy water flow. CME Associates, Inc. performed in-place density tests (ASTM D-6938), documenting the in-place wet and dry density and the moisture content of the soil at that depth. We measured in-place soil thermal conductivity and thermal resistance values as shown in Table No. 2 below. The field test reports are attached.



Delaware River Solar  
July 9, 2019  
Page 3

**Table No. 2 – Soil Thermal Conductivity Test Results**

Location	Wet Density (pcf)	Dry Density (pcf)	Moisture Content (%)	Thermal Conductivity (W/(m*K))	Thermal Resistivity (°C*(cm/W))	Initial Temp. (°C)
P-4	107.5	94.1	13.4	2.436	41.0	15.96
P-5	124.5	111.0	13.4	1.694	59.0	16.65
P-6	125.0	105.8	19.1	2.760	36.2	17.09
P-7	122.8	108.1	14.7	1.075	93.0	15.80
P-10	115.7	92.5	23.2	1.998	50.1	14.80
P-11	150.4	139.9	15.1	3.861	25.9	12.96
P-19	152.4	140.9	8.2	0.889	122.5	16.98
P-23	114.4	99.4	15.1	1.665	60.1	15.99

Upon completion of the fieldwork, we selected representative soil samples for laboratory testing. The testing program consisted of three pH determination, three lab resistivity test, two soluble chlorides tests, two soluble sulfates tests, seven sieve analysis, one liquid/plastic limits tests, and eleven moisture content tests. The test results are discussed below. The laboratory report is enclosed.

We encountered a subsurface profile consisting of surface topsoil over glacial outwash sand/gravel, then glacial till. The surface topsoil ranges from 6 to 30 inches thick at the sampled locations. The glacial outwash is a highly variable deposit. It consists primarily of sand and gravel with trace to some silt (SM or GM). The sand/gravel formation contains thinner layers of silty sand (SP-SM), clayey silt with sand (ML) and silt clay (CL). The outwash is loose to very dense. Numerous cobbles and boulders were noted during the augering. The glacial till formation consists of firm to very dense silt with sand, gravel and clay (ML in the Unified Soil Classification System). The till surfaces along the southern edge of the site; we believe the hill to the south is comprised of the till deposit.

Bedrock was not encountered in the test borings and is estimated to lie over 30 feet below grade. Geologic mapping indicates that the bedrock is the Akron and Bertie Formations. The Akron Formation consists of dolomites; the Bertie Formation consist of black shales.

Delaware River Solar  
July 9, 2019  
Page 4

We noted three water surfaces on the parcel. In general, the depth to groundwater drops from south to north across the parcel. We believe that the ponded water around elevation 545 north of the site (along Fox Road) is more representative of the true groundwater table.

Surface water appears to be travelling on top of the topsoil where the 'intermittent stream' is present southeast of the development; the stream appears to flow into the pond northwest of the barnyard and infiltrate. The surface gradient allows for water flow over the well compacted topsoil faster than infiltrating. Note that the groundwater in the borings adjacent to the stream (borings P-5 and P-7) did not encounter water until a depth of seven feet below ground surface. Test pits excavated adjacent to the 'stream' for in-place density testing and soil thermal conductivity tests were dry to a three foot depth.

Shallow, 'perched' groundwater conditions (wet/saturated soil samples within four feet of the surface) were noted at borings P-2, P-6, P-8, P-12, P-14, P-15, and P-22. Groundwater was not encountered at soil borings P-13, P-19, and P-21 located along the north edge of the proposed development. Heavy water flow occurred into the test pit excavated adjacent to P-6 below 2.5 feet after heavy rains the day before; soil samples at a similar depth were wet (not saturated) when boring P-6 was performed a week prior. While we believe this 'perched water condition' is due to water travelling on top of the dense glacial till formation, it may intersect with the groundwater that surfaces near Fox Road. The high permeability of the upper sand/gravel formation overlying the dense soil likely results in large fluctuations in the water levels over short periods.

As part of this evaluation, we performed laboratory testing to assess the corrosive environment on-site. This testing consisted of soluble chloride concentrations, soluble sulfates concentrations, pH determinations and lab resistivity testing. Chloride and sulfate levels were very low, below the detectable limits. Table No. 3 below summarizes the test results. Although the soil resistivity values



Delaware River Solar  
July 9, 2019  
Page 5

are somewhat low, the pH values are near neutral. Based on these results, we do not anticipate a corrosive environment on this parcel.

<b>Table No. 3 - Corrosion Test Results</b>				
<b>Boring Location</b>	<b>Lab Resistivity (ohm-cm)</b>	<b>pH</b>	<b>Soluble Chlorides (mg/L)</b>	<b>Soluble Sulfates (mg/L)</b>
P-9 S-1/S-2	---	---	34	34
S-3/S-4	5,200	7.4	---	---
P-17 S-1/S-2	---	---	33	33
S-3/S-4	4,200	7.3	---	---
P-19 S-3/S-4	21,000	7.7	---	---
Criteria for Potential Corrosive Environment:				
pH	< 5.5			
Resistivity	< 2,000 ohm-cm			
Chlorides	> 500 mg/L			
Sulfates	>2,000 mg/L			

Based on the above, we make the following specific recommendations:

1. Clear and grub the solar array area. If re-grading is required, remove the surface topsoil prior to starting major site grading operations. The contractor should provide a loaded ten-wheel truck or similar heavy construction equipment for the proof-rolling. Rework or replace as directed areas that rut, weave, quake, or are otherwise deemed unsuitable prior to starting the filling operations.
2. It is our opinion that the on-site sand/gravel soil is suitable for use as structural fill during re-grading operations (if required). However, the near surface on-site soils are silty/clayey, will tend to be moisture sensitive, and are frost susceptible. If planning to reuse the on-site soil as structural fill, plan for the earthwork/utility backfilling to be performed during the drier summer months. Place and moisture condition structural fill to within two percent of optimum moisture. Compact structural fill to at least 95 percent of maximum dry density as determined by the Standard Proctor method, ASTM D-698. Place fill in loose lifts not exceeding twelve inches thick. Maintain good surface drainage.
3. We understand that the preferred foundation system would consist of the light-weight steel I-beams or C-channel. While it is our opinion that this type of system is viable for the soil conditions expected, pre-augering of each hole should be expected due to cobbles, boulders,

and very dense soil conditions that will limit the penetration depths. The racking system design should account for frost impact and potential heaving of the racks. For preliminary estimating of the pile performance, assume the soil properties outlined in Table No. 4 below. We recommend performing uplift and lateral load tests to confirm that the required design resistance is developed and that production piles be installed using equipment and methods similar as those used during the test pile installation process.

<b>Table No. 4 – Soil Properties</b>		
<b>Soil Property</b>	<b>Upper Four Feet</b>	<b>Deeper Soil Conditions</b>
Unit Weight (Moist)	120 pcf	140 pcf
Friction Angle	28°	34°
Cohesion	0 psf	0 psf
Vertical Subgrade Modulus	20 psi/in	60 psi/in

4. The corrosion testing performed leads us to believe that a corrosive environment is not present on this parcel.
5. Based on values from the nearby Canandaigua Station, we recommend designing the solar array based on mean annual temperature of 48°F, and the Air Freezing Index Return Periods (°F-Days) tabulated below:

<b>Table No. 5 – Air Freezing Index Return Periods (°F-Days)</b>		
<b>5-Year</b>	<b>10-Year</b>	<b>20-Year</b>
870	965	1,045

Based on these Air Freeze values and assuming a clear, turf surface condition, we recommend using a site specific frost depth of 30 inches below the surface. For the on-site soils, we recommend using an ad-freeze value of 25 psi for the sand/gravel soil within the frost zone.

6. Construct the transformer pad and other support equipment on mat foundations. Remove all surface topsoil from under the new equipment. We recommend placing at least 12-inches of granular material under the mat slabs. N.Y.S.D.O.T. Item 304.12 (No. 2 crusher-run stone) meets this criterion. Rework and re-compact the underlying native soil to structural fill standards outlined in Paragraph No. 2 above prior to installing the stone base course. Design the mat foundations based on an uncorrected Modulus of Subgrade Reaction,  $K_{vi}$ , of 250 psi/in at the bottom of slab/top of stone; the structural engineer should adjust this subgrade value for the size of the mat.



Frost may heave the pad, potentially separating pipe conduit at joints. To protect the pad, we suggest 1.) undercutting the pad to a 48-inch depth and backfilling with a non-frost susceptible material such as No. 2 crusher-run stone subbase (NYSDOT Item 304.12) or 2.) installing a high density insulation board under the pad. Under the insulation approach, extend the board horizontally 48-inches in each direction beyond the edge of the pad. Cover the board with a minimum of six inches of soil. If insulation board is used, we suggest using a 2-inch thick, Type IV, V, VI or VII XPS board.

7. The measured in-place soil thermal resistivity values ( $R_{ho}$ ) documented at a 36-inch depth ranged from 25.0 to 122.5°C\*(cm/W), representative of the highly variable soil conditions in the upper portion of the soil profile. As part of this design, we have not developed dry-out curves (plots of  $R_{ho}$  versus density and  $R_{ho}$  versus moisture) to assess further variability of these values.

Due to the highly variable test result, we do not recommend backfilling the electric trenches using the on-site soil. We are concerned that localized hot spots may develop that burn out the wiring. We recommend backfilling with an imported processed, uniform material that would allow for more consistent design values to be used.

8. The NYS Building Code identifies various seismic design criteria for this project. We identify the site as having a Site Classification of D (Stiff Soil Profile). Based on ASCE 7-10 guidelines and using a Risk Category IV, we recommend using the following seismic design parameters.

Table No. 6 – Seismic Design Parameters					
Spectral Response Acceleration		Soil Factors		Design Spectral Response Acceleration	
$S_s$	$S_1$	$S_{MS}$	$S_{M1}$	$SD_s$	$SD_1$
0.150g	0.059g	0.240g	0.141g	0.160g	0.094g

9. Perform the trenching and excavating work in accordance with NYS Building Code and OSHA safety standards. The contractor is responsible for determining what measures are required to meet these standards. Under no circumstances should slopes be steeper than 1 horizontal on 1 vertical. While it is our opinion that the foundation and utility excavation work can be achieved with 'normal' excavating equipment capable of achieving the desired depths, cobbles and boulders should be expected. Remove water that accumulates in open excavations using sumps and pumps.

Delaware River Solar  
July 9, 2019  
Page 8

10. Due to the on-site soil conditions, we suggest budgeting for the following minimum pavement sections for your access roadway. Be sure to completely remove all topsoil from under the new roadway; make up undercuts to remove thick topsoil areas using extra subbase material. Thicken this section as needed if used as the construction haul road for the material deliveries expected.

Table No. 7 –Pavement Section		
9.0"	No. 2 Crusher-run Stone Subbase	NYSDOT Item 304.12
	Geogrid	Tensar T-130
	Subgrade	Approved Proof Roll

11. Establish site drainage to keep water from ponding. Ponding water will result in more significant frost heave developing during the winter months and may impact rack performance in areas nearby.

Attached is a Geoprofessional Business Council paper entitled *Important Information about your Geotechnical Engineering Report*. It describes how we intend this report to be used. We will continue to work cooperatively with you, other project principals, and interested parties to achieve win/win solutions that benefit all.

This concludes our geotechnical consultation services; call if you have questions or if you require additional design information. Forward a copy of the near final plans and specifications for our review and comment. It has been a pleasure to work with you on this project and we look forward to hearing from you again in the near future.

Very truly yours,  
**FOUNDATION DESIGN, P.C.**



Jeffrey D. Netzband, P.E., P.G.  
Vice President  
Enc.







5513 Vine Street, Cincinnati, OH 45217 • Ph: 513-242-2051 • Fax: 513-242-0816

July 9<sup>th</sup>, 2019

RE: Yellow Mills PV Array \_Impact of HDG Post  
Yellow Mills Road  
Farmington, NY 14522

To Whom It May Concern:

Based on the SEQR review, the Town of Farmington board has requested 3<sup>rd</sup> party comment in regards to the potential environmental impact of hot dipped galvanized steel columns driven into the native soil.

RBI's steel racking will be supported on steel piles driven approximately 10ft below grade. Based on soils report performed by Foundation Design, P.C. dated, 7/9/19, ground water was observed at various depths likely due to the permeable upper sand/gravel formation overlaying the dense impermeable glacial till formation. It is known that ground water depths will vary seasonally. Therefore, there is potential that perched ground water may exist at different times of the year based on rainfall accumulation. Over time, moisture and concurrent soil conditions will begin to erode the zinc coating. However, it is important to note that the soil conditions on site are not consistent with highly corrosive soils.

According to the USGS, zinc results in no ill health effect nor is it toxic to plants except in high levels. High levels of zinc are present in areas of zinc mining, industrial waste, metal plating, etc. We would not expect high levels of zinc released in the soils based on the application in which it's being used. In addition, based on conversations with the American Galv Association, zinc released from corrosion is not bio-available. This basically means the zinc cannot be further broken down to be consumed by organisms/plant life.

Based on the post spacing, quantity of posts, and relatively small volume of steel below grade in comparison of volume of soil within the foot print of the array, it's in RBI's opinion that the effect on ground water depth is minimal. The effect is even more insignificant when ground water is present at deeper depths.

Sincerely,



Nick Allen, P.E.



**Foundation  
Design, P.C.**

SOIL • BEDROCK • GROUNDWATER

July 11, 2019

Delaware River Solar  
33 Irving Place, Suite 1090  
New York, New York 10003

Attention: Mr. Daniel Compitello

Reference: Yellow Mills Road Solar Array  
466 Yellow Mills Road, Farmington, New York  
Galvanizing Impacts, 4618.0

Dear Mr. Comitello:

This letter summarizes our consultation on the potential impacts that the galvanized steel piles may have on the groundwater. We understand that during the State Environmental Quality Review of the Yellow Mills Road Solar project, the Town of Farmington Planning Board asked what environmental impacts may occur to groundwater from the galvanized steel piles used in the construction of the development, and what measures would need to be taken to mitigate any impacts created.

We understand that your contractor plans to install W5x9 or CG3x8 (10g) galvanized steel piles to support the racking system. The galvanizing process consists of applying a zinc coating over the outside of the piles, thereby adding corrosion protection to the piles. Zinc is a naturally occurring element, often found in the environment.





SOIL • BEDROCK • GROUNDWATER

Delaware River Solar  
July 11, 2019  
Page 2

Briefly, we do not believe that the galvanized piles proposed to be installed pose a threat to the environment; no mitigation measures should be required. The zinc coating is intended to bond to the steel to create a protective coat, therefore is not likely to interact with the groundwater once installed. The galvanizing process has been approved as a corrosion protection measure by the Federal Highway Administration for driven piles and culvert pipes along major waterways. The hot dipped zinc coating process also used for galvanized steel pipe for water supplies in residential homes. Zinc only poses an environmental issue when it accumulates in very high concentrations, usually associated with larger scale industrial or mining operations.

We hope this summary of our findings meets your current needs. We will provide more subsurface data and copies of the final boring logs/locations in the final report.

Very truly yours,

**FOUNDATION DESIGN, P.C.**

Jeffrey D. Netzband, P.E., P.G.  
Vice President

cc. Mr. Peter Dolgos – Delaware River Solar