



CONNECTICUT DEPARTMENT OF AGRICULTURE

450 Columbus Blvd, Suite 701 | Hartford, Connecticut 06103 | 860.713.2500
Office of the Commissioner
An Equal Opportunity Employer



November 27, 2023

Melanie A. Bachman
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: Verogy Windsor Solar One – 445 & 427 River Street, Windsor, proposed 3-Megawatt AC solar project – Revised letter from Agency amending its October 3, 2023 letter

Dear Executive Director Bachman:

On October 3, 2023, DOAG issued a letter of no material affect for this project based on the information submitted as set forth in that letter. The applicant has modified their application to add stormwater drainage work which will disturb the soil on the project site. They have requested the Agency’s approval of the modification and that the letter previously issued be revised to reflect the modifications.

Accordingly, and pursuant to 16-50k(a) of the Connecticut General Statutes, we have reviewed the above cited project with respect to agricultural impacts, specifically, to determine whether “...such project will not materially affect the status of such land as prime farmland...”

This project will be located at 445 & 427 River Street in Windsor, on land owned by Steven Stosonis. The entire 47.1-acre parcel contains approximately 3.4 acres of prime farmland soils and 42.5 acres of statewide important farmland soils. The proposed solar facility will occupy approximately 13.5 acres in the northern portion of the parcel containing statewide important farmland soils. This area is currently used to grow broad leaf tobacco.

In a letter to the Department of Agriculture (DOAG), dated August 21, 2023, and a follow up letter dated November 2, 2023, the developers (Windsor Solar One, LLC) have agreed to design and manage the solar facility for the rotational grazing of sheep. Windsor Solar One has provided the Department with a site-specific grazing plan prepared in conjunction with Natalie Cohen of Hillview Farm.

Based on preliminary information provided to DOAG (enclosed), and the successful implementation of the co-uses and continuing farming activities described above, the Department of Agriculture concludes this project will not materially affect the status of project land as prime farmland.

This determination is conditioned upon:

1. The co-uses described above operating on the project site for the life of the project.
2. The solar developer adhering to the *Requirements for Solar Grazing Properties* (enclosed).

3. That there will be no grading, cutting or filling, topsoil removal, or other actions associated with the project's installation and ultimate deconstruction, except as shown on the revised site plan dated November 2, 2023.

The Department of Agriculture will continue to monitor the proposed project and if changes or additions to the proposal are necessary due to regulatory requirements, a revised project proposal must come before the Agency. Should any changes raise concerns to the Agency, we reserve the right to modify our position on this project, including opposing it, as detailed plans are provided by the developers.

If you have any questions, please feel free to contact Eileen Underwood of my staff. Eileen can be reached at eileen.underwood@ct.gov.

Sincerely,



Bryan P. Hurlburt
Commissioner

Enc.

Cc: Katie Dykes, Commissioner, Department of Energy and Environmental Protection
Peter Schmitt, USS Somers Solar LLC



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Requirements for Solar Grazing Properties

Below is a list of requirements for the co-location of sheep on solar array sites. Solar developers and grazers must adhere to the requirements below to ensure that the sheep on site are provided with the appropriate management and care to promote and sustain their health.

Site Requirements

1. Proper site preparation must be completed by solar developers to create a safe and productive environment for livestock. No debris from construction should be left in the array and panels should be designed for maximum grazing efficiency.
2. Proper soil preparation must take place including preliminary soil testing, followed by repeated testing every 2-3 years and the incorporation of soil amendments as needed.
3. If herbicides or pesticides will be used on the property, the solar developer must share application areas and plans with the solar grazer and a plan for animal safety must be established.
4. Exterior fencing around the solar site must completely enclose the overall array without any holes or gaps.
 - a. Eight-foot-tall chain link fencing with a curl back underground and tension wire running along the bottom should be installed.
 - b. Gates with opening should be tight enough to prevent predators.
5. The solar developer shall provide the necessary fencing identified by the farmer within the solar site to create grazing paddocks. Fencing is also necessary to keep livestock out of hazardous areas including roads, catch basins, transformers, drainage ditches, and containment ponds.
6. In addition to exterior fencing, best practices for flock protection other than dogs, includes llamas or donkeys. If you are planning to utilize guardian dogs, you should be aware of the significant training required to implement such a program. Texas A&M has created an introduction to using guardian dogs that can be found here: <https://sanangelo.tamu.edu/research/lgd/>
7. Signs must be installed around the exterior fencing of the solar site announcing the presence of livestock and providing contact information for the solar grazer.

Livestock Health and Wellness

8. A reliable water source will be provided by the solar developer. The water source, whether surface or groundwater, shall be tested for contaminants prior to livestock being brought to the site. The solar developer is responsible for ensuring that the water source has sufficient yield throughout the season when sheep are grazed on the property.
9. Livestock cannot have access to waterways, ponds, etc. Water shall be pumped from its source and provided to the sheep via a trough or stock tank.
10. A productive and nutritious forage needs to be established and maintained. This shall include regular mowing to keep fields from becoming overgrown. The developers shall work with a grazing expert to select a forage mix that is suitable for the climate, soil quality, and livestock. The solar developer should not expect to graze sheep on the site until the forage has had a full growing season to establish. A forage sample analysis shall be completed yearly to ensure the crop meets livestock nutritional needs.
11. Solar grazers will use proper stocking rates to ensure that a sufficient quantity and quality of forage is available for the livestock.
12. Solar grazers will be required to perform mandated health checks on their sheep which shall include:
 - a. All animals should be officially identified with either an 840 tag or Scrapie tag https://eregulations.ct.gov/eRegsPortal/Browse/RCSA/Title_22Subtitle_22-278-A/
 - b. Regular monitoring of body condition, foot health, and visible signs of injury or illness.
 - c. Mandatory, at least annually, health check performed by a veterinarian including all vaccinations deemed necessary at the veterinarian's discretion including a yearly rabies vaccine that is labeled for use in sheep - https://eregulations.ct.gov/eRegsPortal/Browse/RCSA/Title_22Subtitle_22-359/
13. If sheep come from out of state, all imported animals need to meet all importation requirements. [CTImportRequirements2021.pdf](#)
14. If a dog or any animal other than sheep will be on site, they must be vaccinated for rabies. Dogs must be licensed. Records must be kept up to date and provided upon request. https://www.cga.ct.gov/current/pub/chap_435.htm#sec_22-338
15. Department of Agriculture staff must be allowed to visit the site with notice to check on the welfare of the livestock.

Education and Training

16. Developers need to ensure there is an adequate plan for care and management of the sheep and training for anyone working at the site to ensure that both worker and animal welfare is effectively managed.
17. The solar developer will work with the grazer to create a contingency plan for unforeseen events such as flooding, drought, or other natural disasters.
18. Training must be provided to solar employees who regularly access the site regarding how to interact with the sheep on site.
19. Solar developers are expected to hire and financially compensate solar grazers/farmers for the vegetation management services they are providing.
20. Solar grazers must have 24/7 access to the site.
21. The solar developer shall allow a representative of the Commissioner of Agriculture to conduct a site visit on an as needed basis to confirm compliance with solar grazing activity on the site.

Windsor Solar One, LLC
124 LaSalle Road, 2nd Floor
West Hartford, CT 06107
Verogy.com

August 21, 2023
Revised November 2, 2023

VIA ELECTRONIC MAIL

Eileen Underwood
Agricultural Development & Resource Conservation
Connecticut Dept. of Agriculture
450 Columbus Blvd., Suite 701
Hartford, CT 06103

RE: Windsor Solar One – Department of Agriculture Consultation

Dear Ms. Underwood:

This letter is to request a revision to the Department of Agriculture’s previously issued letter for the project dated October 3, 2023. Windsor Solar One, LLC (“Windsor Solar One”) is requesting a change to condition number three of the letter, “That there will be no grading, cutting or filling, topsoil removal, or other actions associated with the project’s installation and ultimate deconstruction after 20 to 30 years.”, so that the proposed project is able to comply with the Connecticut Department of Energy and Environmental Protection’s (“CTDEEP”) Construction Stormwater General Permit and other typical work associated with the construction of the Facility. Below you will find the previously communicated items as well as the addition of item number five which details the items required to comply with CTDEEP’s Construction Stormwater General permit requirements.

Windsor Solar One, LLC (“Windsor Solar One”) is currently proposing a 3 megawatt (“MW”) solar-based electric generating facility (“Project” or; “Facility”) located at 445 River Street in Windsor, Connecticut (“Project Site”; or the “Site”). The Facility was selected by Eversource under the Shared Clean Energy Facilities (“SCEF”) program. Attached for your review you will find the proposed Facility site plan, farmland soils map for the parcel with and without current use areas identified, and a draft sheep grazing plan. The sheep grazing plan would be finalized and sent for your review as the project progresses through the permitting process.

Section 16-50k(a) of the Connecticut General Statutes requires, for any solar photovoltaic facility with a capacity of two (2) or more megawatts measured in alternating current (“AC”) that petitions for a declaratory ruling by the Connecticut Siting Council (“Council”), the Department of Agriculture represents, in writing, that the project will not materially affect the status of such land as prime farmland.

Windsor Solar One would like to submit this project as a Petition for Declaratory Ruling with the Council and respectfully requests that the Department of Agriculture review the project and our proposal. Below you will find the detailed information on the parcel and our project.

1. Farm / Property Information

a. Farm owner(s), farm name and locations

- i. Steven Stosonis
- ii. River Street Farm
- iii. 445 & 427 River Street, Windsor, CT 06095

The Farm House is currently, and will continue to be occupied. It is our understanding that the barns will continue to be available for use, undisturbed by the proposed solar development.

b. Total acreage, identification of prime, statewide and or/ locally important farmland soils and acreage

- i. 47.1 acres total
- ii. ~3.4 acres prime farmland soils
- iii. ~42.5 acres statewide important farmland soils
- iv. ~1.2 acres neither

c. Current production agriculture on the farm and the approximate location of crops, farm buildings, etc. used to support the farming operation

- i. Current production: Broad leaf tobacco field on ~23.6 acres with existing house and multiple existing farm buildings to support the farming operations.

2. Energy Project Information

a. Describe the energy project

- i. The energy project is a 3.00 MWac (3.97 MWdc) solar photovoltaic array consisting of 7,280 solar modules. Additional infrastructure needed to support the project include 24 string level inverters, driven post racking, DC string wiring, AC wire runs, transformers, switchgear, and metering equipment.

b. Describe what the energy will be used for and how it will benefit the farming operation

- i. The project is currently configured as a Shared Clean Energy Facility which is designed to cost-effectively deploy clean energy projects in Connecticut and deliver the benefit of such projects to: (1) low-income utility customers (20% of total energy production); (2) low to moderate-income utility customers (40% of total energy production); (3) small business utility customers (20% of total energy production); (4) state or municipal utility customers (not more than 20% of total energy production); (5) commercial customers (not more than 20% of total energy production); and (6) non low to moderate-income residential utility customers that would otherwise be ineligible for onsite solar (not more than 20% of total energy production).

- c. Are there future plans to increase energy capacity beyond what is proposed? If so, please describe these future plans, and any impacts the increase may have on prime farmland or the overall farming operation
 - i. No, there are no future plans to increase energy capacity beyond what is proposed at this Site.

3. Agricultural Resource Impacts

- a. Describe any production agriculture currently being conducted within the footprint of the solar project;
 - i. There is currently ~13.5 acres being cultivated within the footprint of the solar project. Of the area being cultivated within the footprint of the solar project ~13.5 acres are statewide important farmland soils.
- b. Describe overall how the project will impact production agriculture currently being conducted on the farm; and
 - i. The project will prohibit the growth of crops on ~13.5 of the ~23.6 acres as they are currently being farmed today. However, the project intends to have an agricultural use in conjunction with the solar array.
- c. Provide a description of any plans by the farm owner(s) to foster production agriculture within or as a result of the development (e.g., grazing animals in and around the solar project, providing pollinator habitat)
 - i. The project developer / operator intends to introduce a pollinator habitat and grazing of sheep within the Project area. The project developer / operator plans to contract with Natalie Cohen of Hillview Farm to manage the grazing program at the Site. Attached is a site-specific grazing plan that would be implemented as part of the Project.

4. Alternatives to Locating the Energy Project on Prime Farmland

- a. Provide a description of any alternatives considered by the farm owner(s) to developing the project on prime farmland soils (e.g., the option of selling agricultural development rights for the farm instead of developing for solar, or as a mitigation measure to reduce the size of the solar development);
 - i. The property is owned by Steven Stosonis of River Street Farm they previously farmed the property but have since leased the land to farmers for the purpose of earning income. Farmers grow other crop on the land. The goal is to co-exist on the property as agricultural production and a solar energy generating facility.
- b. Describe any alternatives examined which might enable placement of some or all of the solar panels in locations other than on prime farmland (e.g., elsewhere on the property or on farm buildings); and
 - i. The house and farm building are not suitable to host a rooftop solar energy facility.

- ii. The other areas of the parcel were not able to be used for the solar facility because of slopes and proximity to wetlands.
- c. Provide a description of any other form of mitigation considered by the farm owner(s) (e.g., farmland restoration, or a future commitment to preserve the farm)
 - i. The farm owners intend to retain ownership of the land and development rights, as opposed to selling the land for other development types. The solar lease will provide the landowners with revenue over the duration of the useful life of the solar farm.

5. Requirements to Comply with CT DEEP Construction Stormwater General Permit

- a. Provide a description of any basins, swales, sediment traps and/or basins, silt or soil excavation and associated map of the proposed work with the farmland soil classifications overlaid;
 - i. In order to comply with the CT DEEP Construction Stormwater General Permit the project requires the installation of one (1) temporary sediment traps on the east side of the Project. The traps require the excavation of approximately 1,800 cy of soil. The soil will be placed on the downstream sides of the temporary traps and stabilized to form a berm. Upon completion of construction the soil will be used to fill the traps back in and bring the grade back to existing conditions at which time it will be permanently stabilized. Additionally, there will be excavation for the electrical trenching, access road, and equipment pads. Any limited excess soil generated will be kept on site and spread and stabilized as required. See attached figure that shows the overlay of the proposed facility and sediment traps and the farmland soil classification.
- b. Provide a Fill Management Plan if required;
 - i. The Project does not require the importation of any fill to the site so a Fill Management Plan is not required.

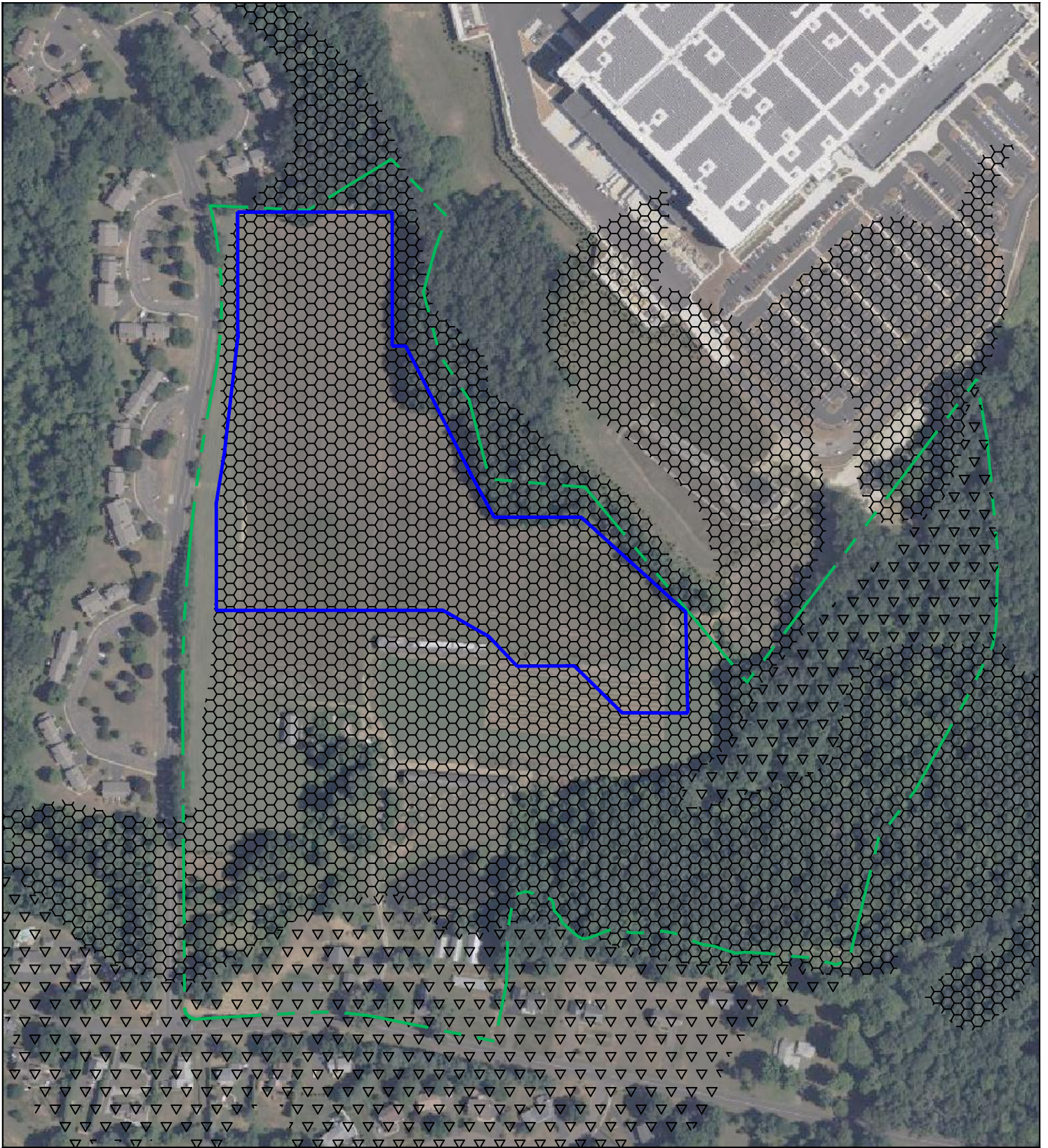
Thank you very much for your time and consideration should you have any questions or comments please feel free to contact me at bparsons@verogy.com or (860) 288-7215.

Sincerely,



Bradley J. Parsons,
Director of Design & Permitting

Cc: Bryan Fitzgerald (bfitzgerald@verogy.com)
James Cerkanowicz (jcerkanowicz@verogy.com)

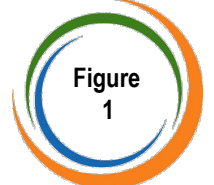
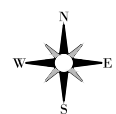


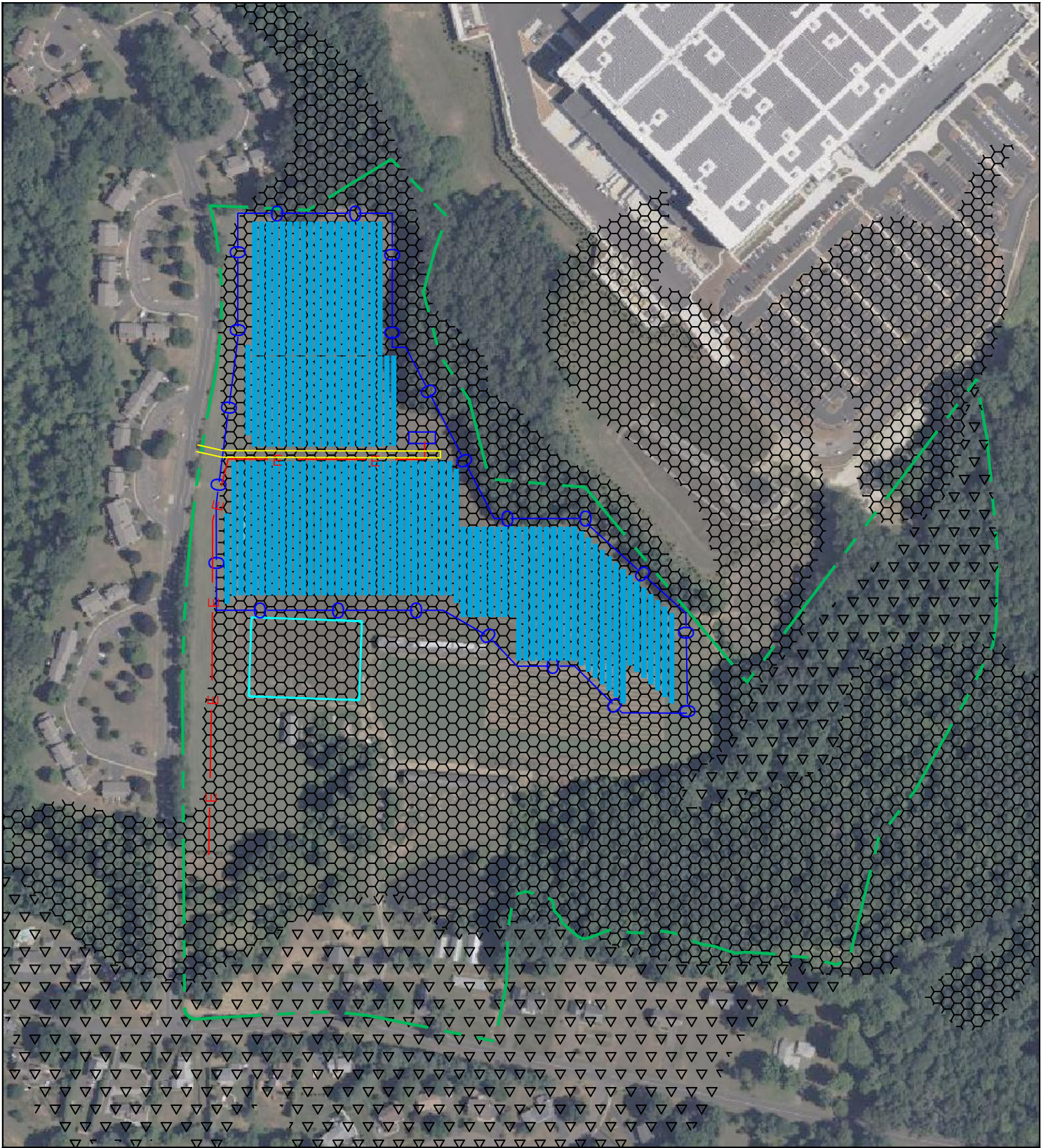
Legend

-  Property Boundary
-  Solar Facility
-  Prime Farmland Soils
-  Statewide Important Farmland Soils

FARMLAND SOILS MAP
OCTOBER 2023

WINDSOR SOLAR ONE
445 River Street
Windsor, CT



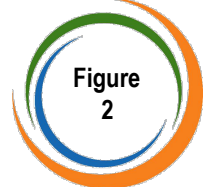
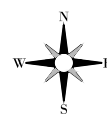


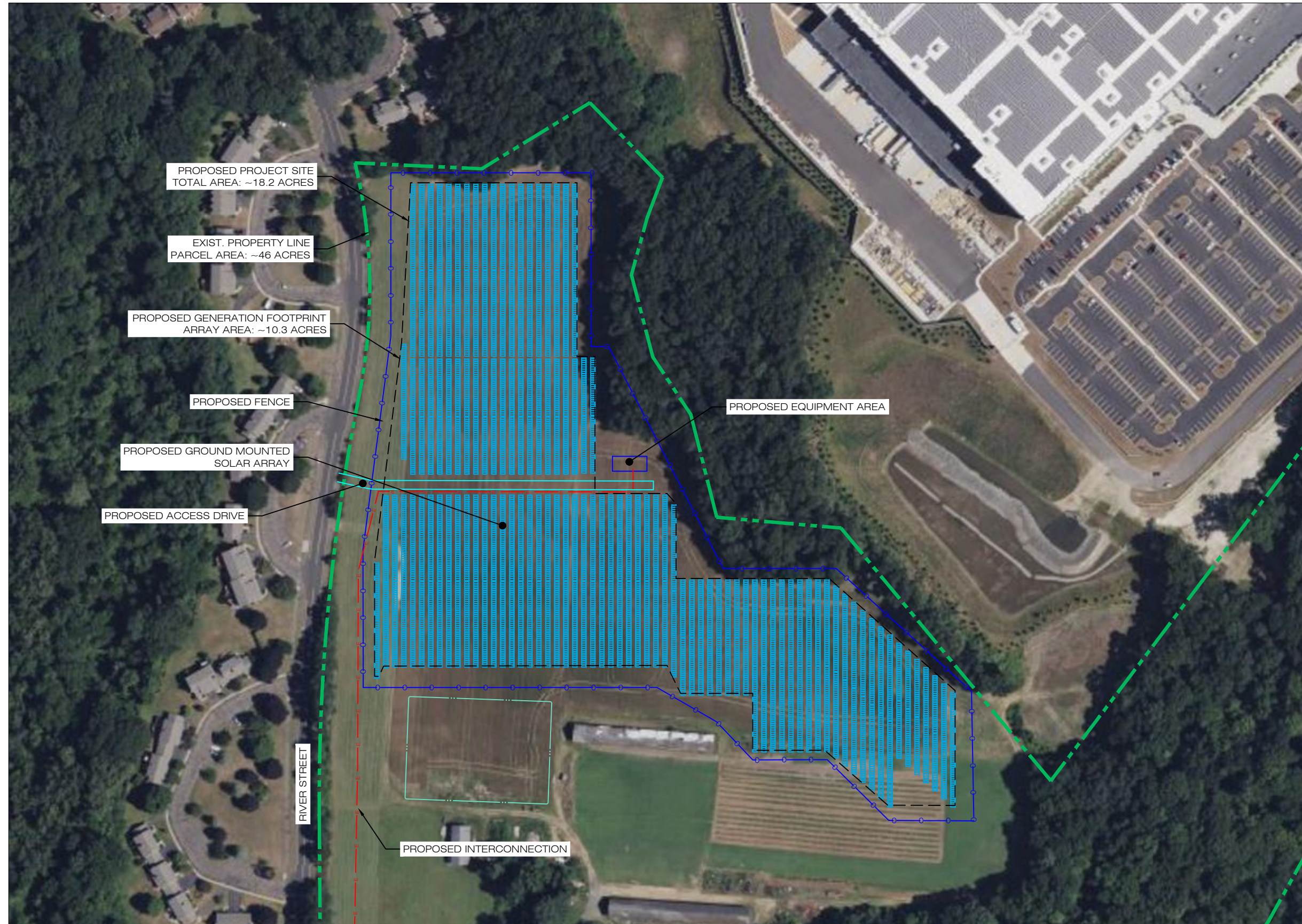
Legend

- Property Boundary
- Solar Facility
- ▽ Prime Farmland Soils
- ◻ Statewide Important Farmland Soils
- Temp. Sediment Trap

**FARMLAND SOILS MAP
WITH PROJECT OVERLAY
OCTOBER 2023**

**WINDSOR SOLAR ONE
445 River Street
Windsor, CT**





CP-1

WINDSOR SOLAR ONE

SCALE: 1" = 80'

General Notes

SYSTEM SPECIFICATIONS

DC SYSTEM SIZE	3,967.60 kW
AC SYSTEM SIZE	3,000.0 kW
MODULE QUANTITY	7,280
MODULE POWER	545 W
TILT	55°/55°
AZIMUTH	0°

NOTES

No.	Revision/Issue	Date

Firm Name and Address
VEROGY
 150 TRUMBULL STREET
 HARTFORD, CT 06103

Project Name and Address
 WINDSOR SOLAR ONE
 445 RIVER STREET
 WINDSOR, CT
 41.900711, -72.664163

Project WINDSOR SOLAR ONE	Sheet CP-1
Date 09/30/2023	
Drawn By BJP	



DRAFT

Windsor Solar One

**Sheep Grazing Plan
Ground Mount PV Array**

Date:

August 2023

Prepared By:

Windsor Solar One, LLC

in conjunction with Natalie Cohen of Hillview Farm



Introduction

Ground-mounted solar sites, by nature of their design, have ample fenced areas. The fencing at solar sites is uniquely suited to serve as grazing areas or be subdivided into grazing paddocks in a pasture rotation with sheep. The perimeter fencing also serves as predator deterrent, the solar panels provide shading and shelter for inhabitants, and the solar arrays provide palatable pasture species for ruminant nutrition. In turn, rotationally grazed sheep provide adequate and comparatively cheap vegetation management, optimal ground coverage and thus reduced erosion and run-off, as well as agricultural usage of lands that can add to the viability of farming communities.

Windsor Solar One, located at 445 River Street in Windsor, CT, is planned for approximately 13.5 acres of fenced in solar array ("Facility"). Sheep grazing will be used to control vegetation within the fenced facility to:

- Prevent panel shading from vegetation,
- Control and remove invasive and unpalatable plant species,
- Avoid the growth of brush and woody species under the solar panels,
- Maintain a diverse forage population to support optimal sheep nutrition,
- Encourage flowering forb and plant species to maximize pollinator habitat,
- Optimize sequestered soil carbon through increasing top-soil amount and root matter,
- Control erosion.

To achieve these goals a rotational grazing system will be implemented. Rotational grazing is a technique where animals are moved as one group, from one pastured area ("paddock") to the next (Hodgson, 1979). Only one paddock is grazed at any given time throughout the rotation, while the other paddocks are given a rest period to achieve pasture regrowth. Compared to continuous or extensive grazing, rotational grazing inhibits weed growth, improves the health of pasture, sustains healthy vegetation, and improves sheep health.

Site Requirements

The perimeter fencing can be chain link or "ag type" woven wire and should be installed to the ground. It can be buried slightly below grade or have a maximum gap of 1-2". Gaps caused by uneven ground should be cleaned up with a small machine. If chain link fencing is used it should be installed with a bottom tensioning wire.

The perimeter gates should be installed to meet evenly and have an even spacing to the ground. The maximum gap between the gates and the ground should be 1-2". Care should be taken to add some gravel or grade the area to avoid large gaps.

The site should be building on an existing sod or hay-ground or planting an existing tilled field. The solar facility should be seeded with Ernst Conservation Seeds, Inc. Fuzz & Buzz mix or equivalent. The Fuzz & Buzz mix is the best way to blend grazing with solar and introducing pollinator friendly species. This seed mix was developed by Ernst and the Cornell Sheep Program in conjunction with the American Solar Grazing Association. For additional seedings, clover or legume mixes are a good option for vigor and grazing friendliness. For grass species fescue species should be avoided unless they are endophyte-free varieties.

Rotation planning

Windsor Solar One was assessed for a planned grazing rotation based on the preliminary panel layout, and 13.5 acres fenced area under panels. The grazing plan requires division of the solar array into smaller grazing units, known as *paddocks*. The site layout can be subdivided into 4 different grazing paddocks with Electronet® fencing (Figure 1). The Electronet® is a portable fence that is a product familiar to farmers in the grazing community. It is a white, lightweight fence that is energized using a portable battery, battery/solar, or 110V power supply. This fencing is simple to power on/off and will only be located inside the fenced areas. Its use is to facilitate grazing inside the permanently fenced areas only. The Electronet® will be installed by the grazing manager according to the grazing plan.

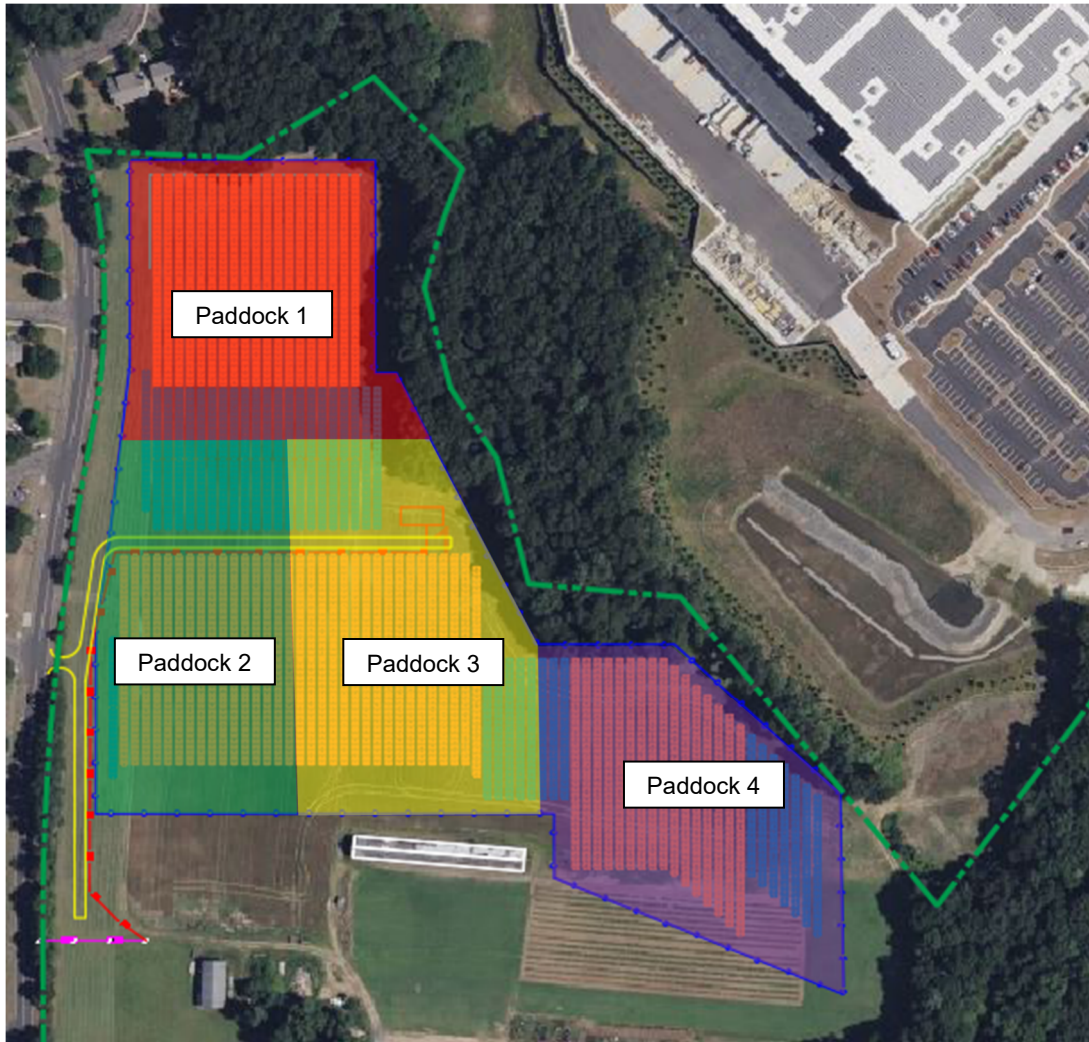


Figure 1. Windsor Solar One Layout with distinctly colored sections. Please note that this is an approximation and subject to change.

- Paddock 1 (3.4 acres)
- Paddock 2 (3.4 acres)
- Paddock 3 (3.4 acres)
- Paddock 4 (3.3 acres)

The number of grazing paddocks in each array is dependent on a unique set of factors. The number depends on size and layout of the permanently fenced array, panel orientation, and space used for access roads, inverter pads, and other non-forage producing areas.

Manure management is a subset of the flock management and sheep management planned for the solar site. The primary purpose of the placement of sheep on the solar site is to achieve vegetation management goals. The planned movement of the sheep around the solar site has the underlying benefit of moving and distributing sheep manure at the same time. Sheep manure is typically small and pelletized. For the layperson, sheep manure may resemble the manure of rabbits or deer. Similarly, the manure is typically invisible within a short period of time and begins nutrient cycling in the soils.

The correct sheep stocking rate and density (sheep per acre per unit of time) will be calculated before the grazing season based on site size, and quantity and type of vegetation present. This metric also ensures that no over-grazing occurs, and that the amount of manure deposition does not outpace the rate of manure decomposition throughout the grazing rotation.

The flock will not overwinter within the fenced area of the solar array.

Acreage

The sheep flock is sized to cover the four grazing paddocks in a full rotation, i.e. the amount of sheep needed to graze Paddock 1, 2, 3 and 4 with 3.4, 3.4, 3.3 and 3.3 acres, respectively, in a +/- 45-day rotation. The precise number of days per paddock may be adjusted over the season by the flock manager, depending on weather and forage growth conditions. The number of sheep determined by the grazing plan can be found in Table 1 below:

Windsor Solar One - Grazing Plan										
Items		Paddock 1		Paddock 2		Paddock 3		Paddock 4		Site Totals
Paddock Info.	Total Paddock Area (ac)									13.5
	Number of Paddocks									4
	Paddock Rest Period (days)									45
	Paddock Use (days)									15
	Paddock Size (ac)	3.4		3.4		3.4		3.3		
Feed Analysis	Vegetation Cover of Paddock (%),(ac)	80%	2.72	80%	2.72	80%	2.72	80%	2.64	80% 10.80
	Biomass (lbs/sy)	1.5		1.5		1.5		1.5		1.5
	Dry Matter (%), (lbs/sy)	20%	0.3	20%	0.3	20%	0.3	20%	0.3	20% 0.3
	Dry Matter per Acre (lbs)	1452		1452		1452		1452		1452
	Dry Matter per Paddock (lbs)	3949		3949		3949		3833		15682
	Refusals per Paddock (%), (lbs)	30%	1185	30%	1185	30%	1185	30%	1150	30% 4704
	Adjusted Dry Matter per Paddock (lbs)	2765		2765		2765		2683		10977
Feed Intake	Average sheep weight (lbs)									160.0
	Dry Matter Intake per Sheep (%),(lbs)									3.5% 5.6
Sheep Analysis	Total Paddock Area (ac)									13.5
	Total Adjusted Dry Matter (lbs)									10977
	Number of Sheep for Site									33
	Sheep Stocking Rate									2.4

Table 1. Grazing Plan Windsor Solar One Project

The rest time for a given grazed area is largely guided by management for the sheep flock's health. The rest time can be considered the window during which the sheep are not present in a given area and the space is given a rest. The pasture rest period (time between grazing periods) in the US Northeast should not be less than 40-days to minimize internal parasite pressure for sheep. Internal parasites are a health risk to the sheep but not to humans. Internal parasites of sheep are not zoonotic, but a threat only to the health of sheep. This health risk to sheep is minimized by following the following prescriptive grazing plan.

A common internal parasite specific to ruminates is the stomach nematode *H. contortus* or barber pole worm. It has a life cycle of 40 days; thus, a clean pasture can only be achieved with rest periods of 40+ days to avoid reinfection

through ingestion of larvae. However, in effective grazing regimens with parasite-resistant sheep flocks, exceptions can be made by the flock manager if the vegetation pressure is too high to adhere to a 40-day rest period before re-grazing.

Sampling and analysis

In newly commissioned solar sites, full vegetation coverage cannot be expected in the first 1-2 years. Additionally, access roads, inverter pads and other site infrastructure will reduce the overall vegetation cover. The estimate for NY State solar sites lies between 65 and 85% vegetation coverage for new sites. This number should be estimated and considered separately for each individual paddock. This number will be adjusted over subsequent years and grazing seasons.

As previous management regimes for solar sites might consist of hay fields, crop fields, marginal pastures or brush areas, the vegetation coverage is expected to be heterogeneous. Therefore, vegetation sampling must be performed to determine sheep stocking rate and density, which is a requirement prior to establishing a grazing rotation. Tabular dry matter and nutrient values as they are published for uniform stands of established crops, hay field or other, are not adequate for evaluating solar array site vegetation for grazing. A detailed organic matter (OM) vegetation sampling protocol is published on the American Solar Grazing Association (ASGA) website. The grazing rotation will largely depend on the amount of forage dry matter (DM) growing within the individual areas. Manager may perform vegetation sampling at intervals to analyze the nutritional value of the forage.

Forage analysis laboratories such as Dairy One provide detailed analyses that can be used to calculate the available DM per grazing paddock from submitted OM samples. Dry matter is a percent of total percent plant weight minus water content. These DM values are necessary to establish the amount of available feed for sheep, and eventually the sheep stocking rate and density. Typically, pasture DM values in the Northeastern US for well-maintained pastures are between 18-25%, depending on the season.

Typically, well managed Northeast pastures can achieve yields above 2,500 lbs DM per acre. The yield in the grazing plan draft above is substantially lower; it is expected that the solar array pastures will take time after establishment to reach their potential. It is necessary to plan a grazing rotation prior to the grazing season, which would be used to guide a flock manager's rotation plan. The flock manager would then use his/her own experience and observation to decide daily if the rotation plan is reasonable and responsible, and to make necessary adjustments in rotation days and stocking rates.

Pasture utilization should be between 70 and 85% to ensure optimal regrowth and animal nutrition. Thus, pasture refusals (uneaten vegetation remaining after grazing) should be part of the calculation and should be between 15% and 35%.

Two examples of common adjustments to rotation plans include: First, in late spring after rain events and with the warming weather, stocking rates may have to be increased to be able to clear the vegetation growth. Secondly, in the summer, sheep may have to be moved from paddock to paddock faster than they were in spring or fall due to the slowed growth of dormant cool-season vegetation.

Feed Intake

It is recommended to graze uniform animal groups that are either dry (non-lactating) ewes, open (non-pregnant) ewes, ewes in their early stages of pregnancy, yearling ewes or growing lambs of at least 60 lb. (or alternatively, 50% of their mature body weight in case of small breeds). In the case of groups of growing lambs, the lambs should be of the same sex or the males should be castrated.

Breed	Stage of production	Body weight, lbs	Feed intake, DM %BW	Feed intake, lbs DM
Katahdin hair sheep	Growing lamb, 50% mature BW	65	2.5	1.6
	Yearling	110	3.0	3.3
	Open, dry ewe	130	3.5	4.6
Polypay composite	Growing lamb, 50% mature BW	80	2.5	2.0
	Yearling	130	3.0	3.9
	Open, dry ewe	160	3.5	5.6
Texel	Growing lamb, 50% mature BW	90	2.5	2.3
	Yearling	150	3.0	4.5
	Open, dry ewe	180	3.5	6.3

Depending on the breed and uniformity of the group of sheep, an average weight for the individual animals in the flock can be determined. Table 2. Body weight and feed intake, gives an overview of BW (body weight) and feed intake across popular Northeastern sheep breeds. According to NRC nutritional requirements for small ruminants (NRC, 2007), daily DM consumption per animal can be estimated as a percentage of bodyweight.

Totals

These calculations can be used to determine the optimal number of sheep per paddock according to body weight and stage of production. By using this with the chosen grazing rotation days (or rest period), the stocking rate (the necessary sheep number for the calculated grazing time within each paddock) can be calculated, and the optimal grazing flock size calculated.

On the 13.5 acre Windsor Solar One project, the grazing plan allows for 33 mature ewes managed in four grazing paddocks, a stocking rate of 2.4 sheep per acre, and 15 grazing days per paddock with a 45-day rest period.

Animal welfare recommendations

Regardless of season, ad libitum clean and fresh water access is crucial for animal welfare (NRC, 2007). Site-specific amenities like well water or connection to municipal water lines are ideal, but transported water is typical of solar grazing operations. For sheep of the recommended production stages (non-lactating and > 60 lbs growing lambs), water requirements are very low in spring and fall. Typically, dry, non-gestating ewes will consume between 5 and 10 % of their BW water daily.

Granulated mineral feed must be available ad libitum and contain adequate concentrations. Mineral feed should be offered in troughs that can be moved with the flock according to the rotation and rotation days. Mineral feed is specially blended and commercially available for sheep producers (Cargill, 2019).

Sheep will be visually inspected on every rotation day by the flock manager. A closer inspection of each member of the flock is recommended at regular intervals (every 6 weeks on site), including parasite monitoring or treatment with a FAMACHA (FAffa MAlAn CHArt) protocol (Wyk and Bath, 2002), and 5-point checks (Bath and van Wyk, 2009). Each spring, before the flocks begin the grazing season, certain protocols are recommended to ensure they are in optimal health before their work at the solar site begins:

- Feet must be checked and trimmed,
- Ear tags replaced or added, in compliance with USDA regulations,
- Wool sheep must be shorn,
- Wool sheep should be tail-banded,
- Body-condition scores should be recorded to monitor nutritional and health status across the grazing season,
- ***Sheep should be kept in a dry lot on hay 24 hours prior to moving on site in Spring and de-wormed with a commercially available de-wormer to prevent parasite infections on site.***

Emergency Protocols

In the event of a site emergency, the following protocol is to be on hand to ensure safe site access for emergency personnel:

- Clear signage will be displayed at the main gate with emergency contact information of the sheep manager. The manager should be contacted immediately in the event emergency personnel have to enter the site in order to ascertain if there are animals present, and to provide notification to the sheep manager that the animals may need to be removed.
- If portable electric fence is installed crossing site roadways, the fence charger will be placed clearly by the side of the roadway. In the event of emergency, the charger will only need to be switched off and the fence pulled up by hand to allow passage.
- If possible, animals should remain inside the site during an emergency, until the sheep manager can safely remove them. They will likely move as a flock away from any commotion and pose little risk of being in the way. If they do escape during the site emergency, they should be monitored and pushed towards fields and away from roads if possible.

Literature

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