Petition No. 1220
Interrogatories
Set One
April 4, 2016
Windham Solar LLC (WS) Responses April 18, 2016

General Questions

1. Windham Solar LLC (WS) included an abutters map under Exhibit D of its Petition (Petition) dated March 15, 2016 for the proposed project in Griswold. Please submit a properly-labeled abutters map identifying each parcel owner, including but not limited to, the abutters listed in Exhibit D of the petition.
   A revised Map has been attached identifying parcels, and the associated owners. – Exhibit A

2. Is the eastern portion of the project located on 1219 Voluntown Road and the western portion of the project on 1240 Voluntown Road? Was notice provided to the owner of these properties at the time of filing of the Petition?
   A 100' offset was used from the GIS boundary line of the project, a typical distance that Windham Solar LLC (WS) has used in other public notice applications. Upon further review of the CSC petition guidelines, there is no specific distance that notices must be provided to abutters, and these parcels were not noticed. There are 5 parcels that were outside the 100' offset and are identified below:

Voluntown Parcel ID	Owner	Address	City	State	Zip
59-107-23	NOAH GOODRICH	1182 Voluntown Road	Griswold	CT	06351
50-107-22.1	EARLE WHIPPLE AND DARRELL PHILLIPS	1176 Voluntown Road	Griswold	CT	06351
50-107-22.2	DARRELL PHILLIPS & CYNTHIA PHILLIPS	1168 Voluntown Road	Griswold	CT	06351
59-107-21	EARLE WHIPPLE AND DARRELL PHILLIPS	1166 Voluntown Road	Griswold	CT	06351
50-107-20	TOWN OF GRISWOLD	28 Main St	Jewett City	CT	06351

   WS has prepared and submitted notices via Certified mail to the above property owners on April 18, 2016. WS will attend any additional meetings required for this notice oversite.

3. Where is the nearest off-site residence from the center of the eastern portion of the project? Provide the distance, direction, and address of such off-site residence. Where is the nearest-off-site residence from the center of the western portion of the project? Provide the distance, direction, and address of such off-site residence.
   The overall site plan has been revised to show dimensions from the homes to the closest modules to the facility and parcels are identified. – Exhibit B

Electrical / Energy Questions

4. The proposed project consists of three 2.0 megawatt (MW) and one 1.0 MW solar arrays totaling 7 MW. Is that 7 MW power output for the proposed solar project based on alternating current (AC)? If no, explain.
   Output to the grid is calculated in AC. The AC:DC ratio of the project is 1:1.17.

5. Indicate which solar arrays on the Overall Site Plan (Sheet 4 of 12) are the 2 MW arrays and which array is the 1 MW array.
   Boundaries have been added to the overall site plan, illustrating each array area. – Exhibit B

6. Pages four and five of the Petition indicate that, "Each 2.0 MW Facility will consist of approximately 6,790 solar modules and the 1.0 MW facility will consist of approximately 3,395 solar modules (based on a module rating of 345 watts)." With three 2.0 MW arrays and one 1.0 MW array, would this total 23,765 modules? If yes, reconcile that number with the 26,676 solar modules indicated on the Overall Site Plan (Sheet 4 of 12). If the number of solar modules on the Overall Site Plan is incorrect, provide a revised Overall Site Plan.
   The narrative of the project addresses what WS intends to build with 345 watt modules, 23,765 thus a total DC output of 8.198 MW. However, the site plan illustrates 26,676 modules to allow for the flexibility to change the system to a lower wattage module of 310W and still construct a facility with the DC output of 8.198 MW. Module pricing fluctuates, and WS wants the option of adjusting the module wattage.

7. Provide the total direct current (DC) power output in MW for the project based on the total number of modules and wattage of such modules.
   Based on the current footprint the total DC output is as follows:
   9.203 MW (DC) for a 345 watt module.
   or
   8.198 MW (DC) for a 310 watt module.

8. In general, in the case of fixed solar panels, does orienting your solar panels to the south provide a sort of balance (in terms of sun exposure) between the sun rising in the east and setting in the west and ultimately result in optimizing (or attempting to maximize) your total annual energy production (in kilowatt-hours) and your capacity factor?
   This statement is correct for the WS project. There are situations in some parts of the country where a more westerly orientation is preferred in order to maximize energy production during peak demand periods, but this is usually only considered in situations where the power purchaser pays a time-of-use rate that is higher during peak demand periods than what is paid during shoulder or off-peak periods.

9. On page 7 of the Petition, WS notes that, according to the 2012 Integrated Resources Plan (IRP), the capacity factor for PV solar (and thus the proposed project) is approximately 13 percent. Is that based on the DC or AC side of the proposed solar facility?
   The 13% capacity factor stated in the 2012 Integrated Resources Plan for Connecticut is based on the DC nameplate of a solar facility.

10. How many 1,000-kilowatt inverters would be installed (e.g. seven)?
    Seven 1,000 kW inverters are planned to be installed, however, WS may elect to utilize a 60 kW string inverter design. In the case of a string inverter design, approximately 117 – 60 kW inverters would be installed (one inverter would be downsized to 40kWs to achieve a 7,000 kW ac nameplate).

11. Provide the specifications sheet for the inverters.
    Attached are two specifications of the PV inverters that are currently being considered for the project. - Exhibit C

12. Provide the specification sheet for the proposed solar photovoltaic modules/panels.
    Attached are two specification of the PV modules that are currently being considered for the project. – Exhibit D

13. What are the estimated heights of the transformers and inverters?
    The transformer is approximately 7' high.
    The 1,000 kW centralized inverter is approximately 7' high. The 60 kW string inverters would be mounted at a height of approximately 5' – 6' high and be located throughout the array field. A cut sheet of a typical inverter/transformer pad has been added (2-1000-kilowatt inverters and 1 2000KvA transformer) – Exhibit E

14. Does Eversource currently have three-phase overhead electrical distribution on Voluntown Road? Is WS planning three separate utility connections to the distribution system: one in the vicinity of pole number 249, one in the vicinity of pole 2890, and one in the vicinity of pole number 2888? (See Overall Site Plan – Sheet 4 of 12.)
    Yes, there will be three separate utility connections, one at each specified location.

Construction Questions

15. Would the tree clearing be performed in stages (e.g. five acres at a time), or would the clearing all be performed together as one stage of construction? (Note: Connecticut Department of Energy and Environmental Protection "DEEP" General Permit for the Discharge of Stormwater and Dewatering Wastewasters Associated with Construction Activities states that, "Whenever possible, the site shall be phased to avoid the disturbance of over five acres at a time…")
    Tree clearing will be phased per the DEEP requirements, and the federal NPDES requirements.

16. Estimate the amounts of cut and fill in cubic yards.
    Approximately 1700 yards of cut and 1700 yards of fill associated with the grading of the roadways and the grading in the east array for the solar racking requirements.

17. Approximately how tall would the poles be for the video cameras and meteorological equipment noted on page 11 of the Petition?
    Video and meteorological poles at the central skid will be 12' to 15' high. Approximately 6-10 perimeter fence posts per project limits will be installed at 12' high and will have motion

detecting video mounted to atop the higher fence posts. These locations will be based on the final footprint, and camera sight lines. The cameras are battery powered, and run on an internal wireless project network.

18. How would the H-beams (that support the racking system) be driven into the ground?
    The intent is that a majority of the H-beams will be driven pile. However, an alternative grouted foundation is also designed if subsurface boulders or ledge is encountered. All structural pile designs will be signed by a CT licensed Professional Engineer.

19. What are the estimated constructed hours (e.g. Monday through Friday 8 AM to 5 PM)?
    Local zoning code working hours will be adhered to which are as follows:

    Griswold Zoning Code Section 12.4.5:
    All excavations shall be limited to the hours of 7:00 am to 7:00 p.m., Monday through Saturday. No work shall be permitted on legal holidays recognized by the State of Connecticut. The Commission may allow additional hours and days of operation under extraordinary circumstances or in special cases.

20. Approximately what size mesh does WS anticipate utilizing for the chain link fence? While 2-inch mesh is a common size, would WS consider utilizing a mesh size less than two inches as an anti-climbing measure? Would the fence have barbed wire?
    7' chain link would be preferred. The sites security system will identify intruders or a breach in the perimeter on the site. WS would consider a smaller mesh, if costs are similar. The majority of our sites do not have barb wire given our planned security measures, and barb wire is not intended for this project.

Environmental Questions

21. What is the closest distance from the proposed project to wetlands (i.e. the smallest wetland buffer)? (For example, see the eastern-most corner of the southwest array on the Overall Site Plan – Sheet 4 of 12).
    Dimensions have been added to the site plan which indicate the distance to nearby wetlands. – Exhibit B

22. The Connecticut Department of Energy and Environmental Protection (DEEP) has indicated that no State-listed species are expected to be negatively impacted by the proposed project. Are any federally-listed species known in the vicinity of the proposed project? If yes, describe possible impacts to such species and mitigation measures.
    A search of the Federal Endangered Species highlights the following Species Occurrence on the project:

    Animals
        Northern long-eared Bat (Myotis septentrionalis)
        Piping Plover (Charadrius melodus)
    Plants
        Sandplain gerardia (Agalinis acuta)
        Small Whorled pogonia (Isotria medeoloides)

A wildlife biologist will be contacted to perform a site visit and determine if the site possesses the appropriate habitat for the above plants and animals. The biologist will determine if mitigation measures are necessary, and to what extent.

23. Is the total tree clearing about 20.8 acres? If no, provide the total tree clearing area. Is this total inclusive of the 1.8 acres of tree removal in wetland buffer areas, or is this in addition to the 20.8 acres (or updated number as specified)?
    Total tree clearing on site is 20.8 acres, and includes the 1.8 acres within the buffer areas.

24. Provide the carbon debt payback period. Specifically, as an estimate, you may utilize the U.S. Environmental Protection Agency (EPA) number of 1.22 metric tons of carbon dioxide sequestered by one acre of average U.S. forest in one year. That number can be multiplied by the number of acres of trees to be cleared to estimate the annual loss of carbon dioxide sequestration in metric tons per year for the project. Then the total projected annual electrical production in kilowatt-hours for the solar facility can be multiplied by the EPA estimate of 6.89551×10^{-4} metric tons of carbon dioxide displaced per kilowatt-hour in order to provide the annual carbon dioxide emissions avoided by the operation of solar plant. Based on this or a different analysis, compute the number of months or years it would take to "break even" with carbon dioxide or when the carbon dioxide emissions reductions would equal the sequestration loss. (Data source: http://www.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references)
    WS is proposing to clear 20.8 acres as part of the construction of the facility. Based on the formula provided above, the loss of carbon dioxide sequestration would be 25.376 tons per year. The WS facility is expected to generate 10,912,530 kWh during its first year of operation, degrading by 0.5% per year thereafter. Based on the EPA estimates provided above, the WS facility would off-set 7,524 metric tons of carbon dioxide during its first year of operation or approximately 20.6137 tons per day. Therefore, the sequestration loss from clearing the trees would be off-set by the solar facility in 1.23 days of operation in the first year.

25. On page 11 of the Petition, WS estimates 403,900 tons of CO_2 equivalent offset or eliminated during the 45-year life of the facility. How was the 403,900 tons computed?

    The carbon off-set estimates provided in the Petition for Declaratory Ruling were based off of an estimated carbon off-set rate of 1.645 lbs per kWh of generation. This figure was based on a generation mix of 50% coal (2.07 lbs per kWh) and 50% natural gas (1.22 lbs per kWh) (source: https://www.eia.gov/tools/faqs/faq.cfm?id=74&t=11). Windham Solar is willing to accept the calculations provided by the EPA above.

26. Has the Petitioner received a response from the State Historic Preservation Office to date? If yes, provide a copy of such correspondence.
    An application was submitted to SHPO by WS in mid-February. WS is still awaiting a response from SHPO on the parcels.

27. Is the proposed project located within an acquifer protection area?
    No, an acquifer protection map has been attached. - Exhibit F

28. Is any of the proposed project located within a 100-year or 500-year flood zone? If yes, indicate which portion(s) of the project area are located within flood zones, and provide a Federal Emergency Management Agency flood zone map that includes the subject property.
    No the entire project is Zone X.

29. In Exhibit F of the Petition, by letter dated February 2, 2016, Highland Soils, LLC indicated that a more detailed wetland report would be prepared following another site visit. Does the Petitioner have an updated Wetlands Report at this time? If yes, provide a copy of such full report. Were any vernal pools located as a result of such site visit? Are any additional wetland and/or vernal pool protective measures proposed at this time? If no visit has been made, provide an estimated timeframe for the visit and updated report.
    Updated Wetland report is attached –Exhibit G. There are no vernal pools located as a result of such site visit.

30. If vernal pools are identified as result of a site visit, include the following. Describe the methodologies used to evaluate the vernal pools and include the date(s) of his studies. Specifically detail how the egg masses were counted, how many visits over what period of time were made, and indicate if any other techniques such as minnow trapping were used, if applicable.
    Updated Wetland report is attached addressing vernal pool conditions on site, which states there are no locations – Exhibit G

31. If vernal pools are identified as a result of a site visit, include the following. Analyze the five vernal pools using the Calhoun and Klemens methodology. While forested habitat is preferable, open habitat may be used and also can serve as areas that animals move through. Open habitat also over time can improve by regrowth. It cannot be merely discounted as developed habitat as one can have areas that have houses and roads. An excellent example of how to correctly analyze a habitat that has various components is that for Council Docket 455 (Tab 14 of that application) which clearly shows the correct treatment of wooded, open and grassed areas, versus developed areas. Only the developed areas are considered to be lost habitat. This document, as a sample wetlands and vernal pool analysis, has been attached for your convenience. The map at the end of the document is a useful template or reference.
    Updated Wetland report is attached addressing vernal pool conditions on site, which states there are no locations – Exhibit G

32. Would the solar panels "heat" rainwater and potentially thermally pollute wetlands?
    No. There is no evidence that this occurs given the short duration that rainwater is on the panels, furthermore, the panels would be clouded during the time of rainfall, so surface temperatures of the panels would be less than on a sunny day.

33. Has or will the Petitioner conduct soil sampling for OCP-impacted soil as recommended by the Phase 1 ESA?
    No. Based on the construction activities proposed by WS, we do not foresee a measurable risk to determine if OCP impacted soil is on site, for all on site soil will remain on site post construction.

34. Would the proposed project meet the applicable DEEP noise standards at the boundaries of the subject properties? (Sources of noise might include but not be limited to inverters, transformers, etc.)
Yes.

35. Would the remaining trees at the far western limits of the project be sufficient to screen the views of the proposed facility from residential structures off of Lewis Avenue, Lee Avenue and Latham Drive? Would the remaining trees at the far northern limits of the project be sufficient to screen the views of the proposed facility from residential structures located north of Culver Road?
Screening can be objective and these locations can be investigated during the site visit. WS will incorporate additional plantings into the final design to the extent necessary to aid in the screening of the facility to residences within a close proximity to the site.

Maintenance Questions

36. How would WS handle potential snow accumulation on the panels and its effects of blocking the sunlight?
Snow soiling has been accounted for in our solar modeling, no cleaning of panels is contemplated.

37. Has WS done any analysis to determine structural limits of snow accumulation on the solar panels and steel support structures, assuming heavy, wet snow? What accumulation of snow could the structures handle? Would WS clear snow from the panels when it approached the limit?
The project racking will be designed for the regions wind and snow loading, and will be stamped by a licensed structural engineer. No clearing of snow is contemplated.

38. Would any mowing be required under or around the proposed solar panels/modules, and if so, approximately how often would mowing occur?
Below is a typical operations and maintenance schedule, an operations and maintenance manual will be included in the projects final design.

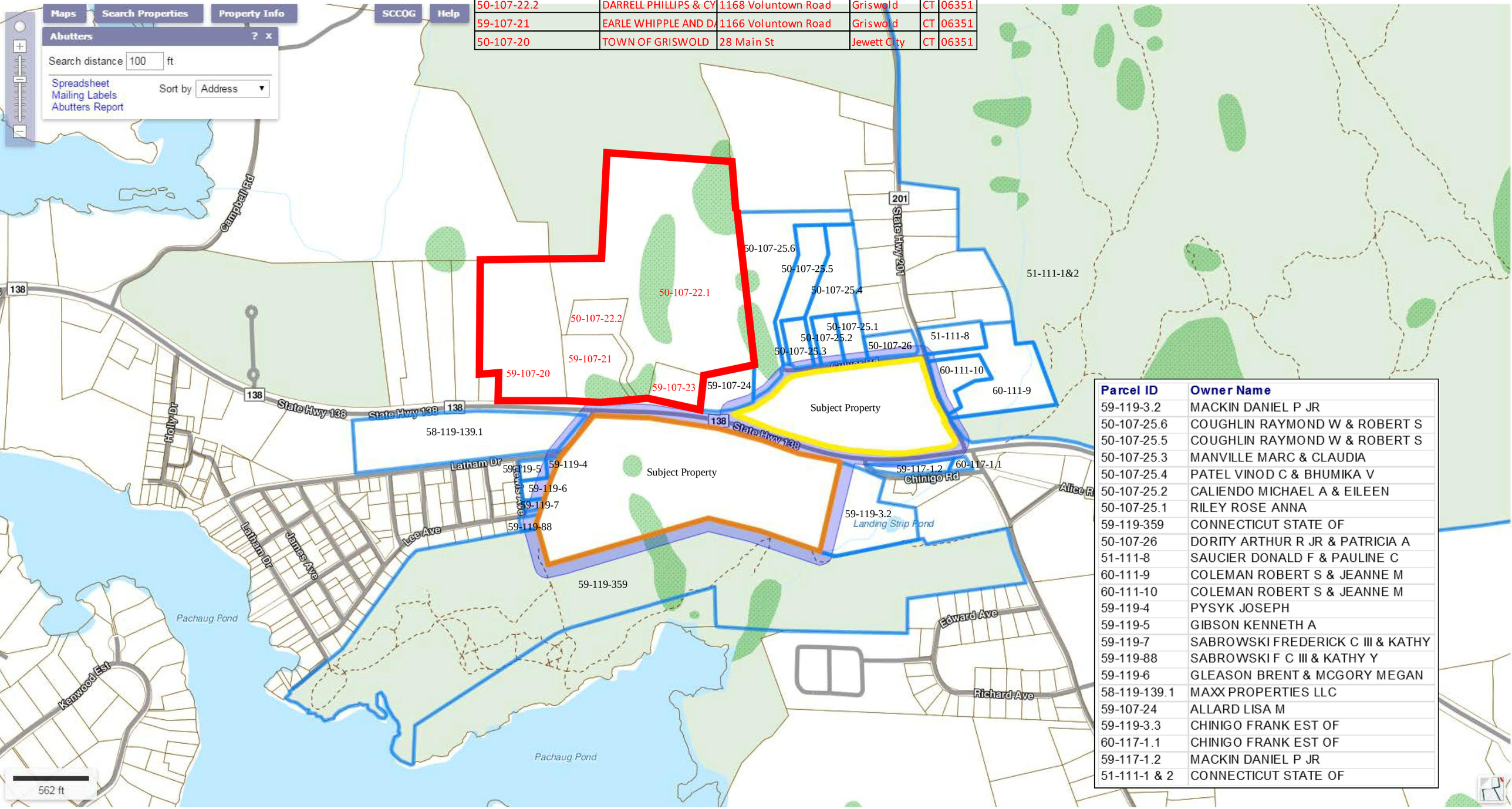
Monthly:
Inspect the site vegetation growth, and establish a mowing schedule keeping vegetation between 6" and 18". Any growth above 18" begins shading lower elevation panels.
Inspect the gravel roadways for washout locations or potential erosion issues, schedule maintenance as necessary
Inspect the array field for any locations where excessive growth is identified, schedule maintenance as necessary

Bi-Annually (April and October):
Inspect vegetation during both the growing and non-growing seasons to ensure proper groundcover density.
Identify stumps and areas within the array or at the perimeter, that have grown to create shading, schedule maintenance as necessary.
Replant bare areas or areas with sparse growth with the project specific seed mix.
Inspect perimeter landscaping screening, to ensure ongoing establishment of new plantings.

Exhibit A

PID MAP

Voluntown Parcel ID	Owner	Address	City	Sta	Zip
59-107-23	NOAH GOODRICH	1182 Voluntown Road	Griswold	CT	06351
50-107-22.1	EARLE WHIPPLE AND DA	1176 Voluntown Road	Griswold	CT	06351
50-107-22.2	DARRELL PHILLIPS & CY	1168 Voluntown Road	Griswold	CT	06351
59-107-21	EARLE WHIPPLE AND DA	1166 Voluntown Road	Griswold	CT	06351
50-107-20	TOWN OF GRISWOLD	28 Main St	Jewett City	CT	06351

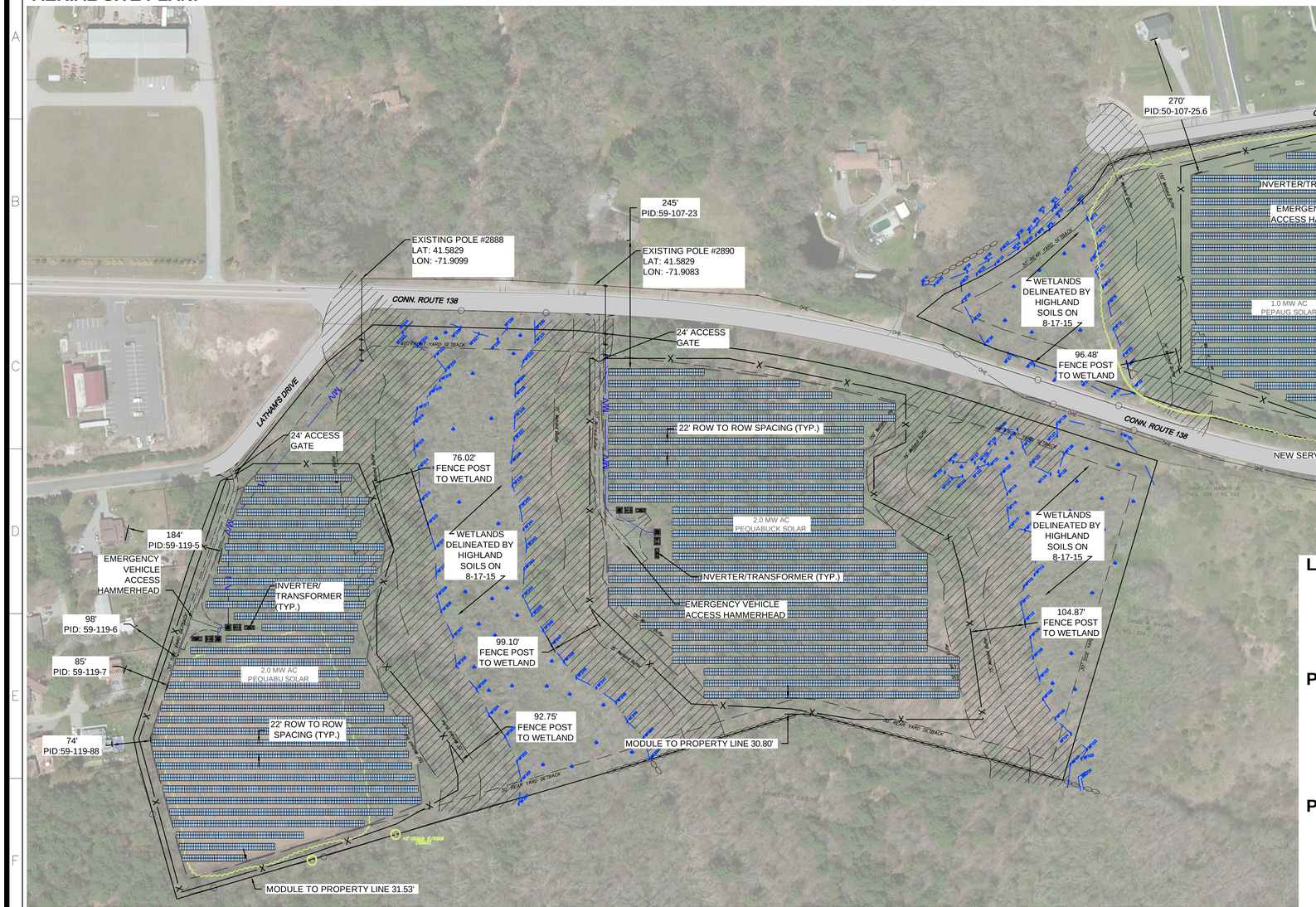


Parcel ID	Owner Name
59-119-3.2	MACKIN DANIEL P JR
50-107-25.6	COUGHLIN RAYMOND W & ROBERT S
50-107-25.5	COUGHLIN RAYMOND W & ROBERT S
50-107-25.3	MANVILLE MARC & CLAUDIA
50-107-25.4	PATEL VINOD C & BHUMIKA V
50-107-25.2	CALIENDO MICHAEL A & EILEEN
50-107-25.1	RILEY ROSE ANNA
59-119-359	CONNECTICUT STATE OF
50-107-26	DORITY ARTHUR R JR & PATRICIA A
51-111-8	SAUCIER DONALD F & PAULINE C
60-111-9	COLEMAN ROBERT S & JEANNE M
60-111-10	COLEMAN ROBERT S & JEANNE M
59-119-4	PYSYK JOSEPH
59-119-5	GIBSON KENNETH A
59-119-7	SABROWSKI FREDERICK C III & KATHY
59-119-88	SABROWSKI F C III & KATHY Y
59-119-6	GLEASON BRENT & MCGORY MEGAN
58-119-139.1	MAXX PROPERTIES LLC
59-107-24	ALLARD LISA M
59-119-3.3	CHINIGO FRANK EST OF
60-117-1.1	CHINIGO FRANK EST OF
59-117-1.2	MACKIN DANIEL P JR
51-111-1 & 2	CONNECTICUT STATE OF

Exhibit B

Site Plan

AERIAL SITE PLAN:



LEGEND:

- EXISTING PROPERTY LINE
- PROPOSED PROJECT FENCE
- PROPOSED GRAVEL ACCESS ROAD
- M/V PROPOSED AC DISTRIBUTION
- 150' WETLAND BUFFER AREA
- WETLAND DELINEATION LINE
- 18 x 2 SOLAR MODULE BOCK

PROJECT INFORMATION:

EXISTING ZONING : C-1
PROPOSED USE : SOLAR FACILITY - 26,676 SOLAR MODULES

SPECIFIC SITE NOTES:
1. NO LIGHTING PROPOSED WITH THE PROJECT
2. NO AUDIBLE NOISE GREATER THAN THE SITES EXISTING AMBIENT NOISE LEVEL SHALL BE DETECTABLE AT OR BEYOND THE PROPERTY LINE OF THE PROJECT
3. EMERGENCY VEHICULAR & SITE ACCESS TO BE PROVIDED TO ALL LOCAL RESPONDERS (POLICE, FIRE, ETC...)

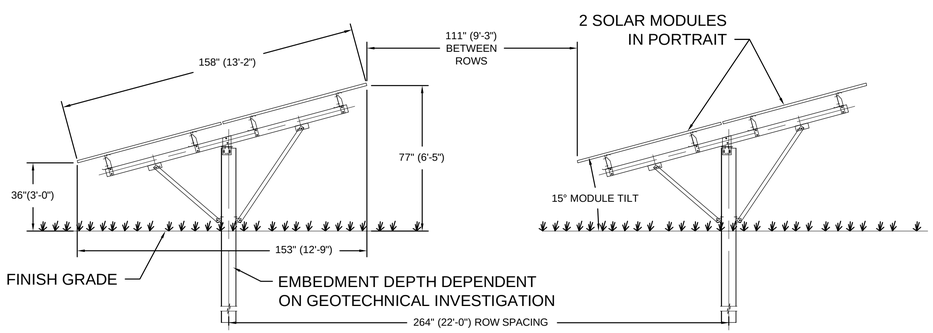
PROJECT AREAS & IMPACTS:

TOTAL SITE AREA = 50.1 ACRES
EAST SITE = 17.4 ACRES
WEST SITE = 32.7 ACRES

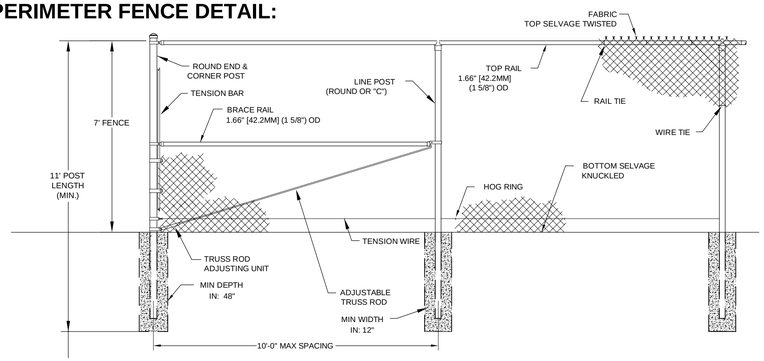
ARRAY FOOTPRINTS (FENCE LIMITS) = 29.1 AC

PROPOSED IMPERVIOUS:
GRAVEL ACCESS ROAD, STRUCTURAL POSTS & EQUIPMENT PADS = 0.78 AC

RACKING PROFILE DETAIL:



PERIMETER FENCE DETAIL:



Westwood

Phone (480) 747-6558 6909 East Greenway Parkway, Suite 250
Fax (480) 376-8025 Scottsdale, AZ 85254
westwoodps.com

Westwood Professional Services, Inc.

STATE OF CONNECTICUT
JOSEPH D. CHRISTIAN
0030668
LICENSED
PROFESSIONAL ENGINEER

Designed: ADC
Checked: SAW
Drawn: SJB
Record Drawing by/date:

Revisions:

#	DATE	DESCRIPTION
-	03/15/2016	CT SITING BOARD SUBMISSION
-	04/18/2016	CT SITING BOARD INTERROGATORIES

Prepared for:

ecos ENERGY
222 SOUTH 9TH STREET
SUITE 1600
MINNEAPOLIS, MN 55402

0' 120' 240' 360'

VOLUNTOWN RD. SOLAR

1219 & 1240 VOLUNTOWN RD.
GRISWOLD, CT 06351
NEW LONDON COUNTY

OVERALL SITE PLAN

SITING BOARD REVIEW

DATE: 03/15/2016
SHEET: 4 of 12

Exhibit C

INVERTER DATA SHEETS

Central Inverter - Option 1

NORTH AMERICA
OUTDOOR UTILITY SCALE
Solar Inverters

HEC-US

UTILITY SCALE SOLAR INVERTER

C US

EXTENDED MPPT
MPPt

AUTOMATIC REDUNDANT MODULAR MASTER SLAVE SYSTEM
ARM²S²

MULTIPLE MPPt
MPPt

REVOLUTIONAY COOLING

ADJUSTABLE POWER
DAY
NIGHT

OUTDOOR DURABILITY

INGRESS PROTECTION

HEC-US

The HEC-US central inverter is an industry leading modular system designed for outdoor use with a NEMA 3R Stainless Steel enclosure, pre-engineered DC Recombiner, AC output circuit breaker and built-in ARM^{2}S^2 revolutionary filter-less cooling system.

The HEC–US inverter is certified to UL-1741 and IEEE-1547 and designed for utility scale PV plants located in the most demanding environments. Power-Electronics inverters include proven dynamic grid support features that enhance grid quality and PV plant management.

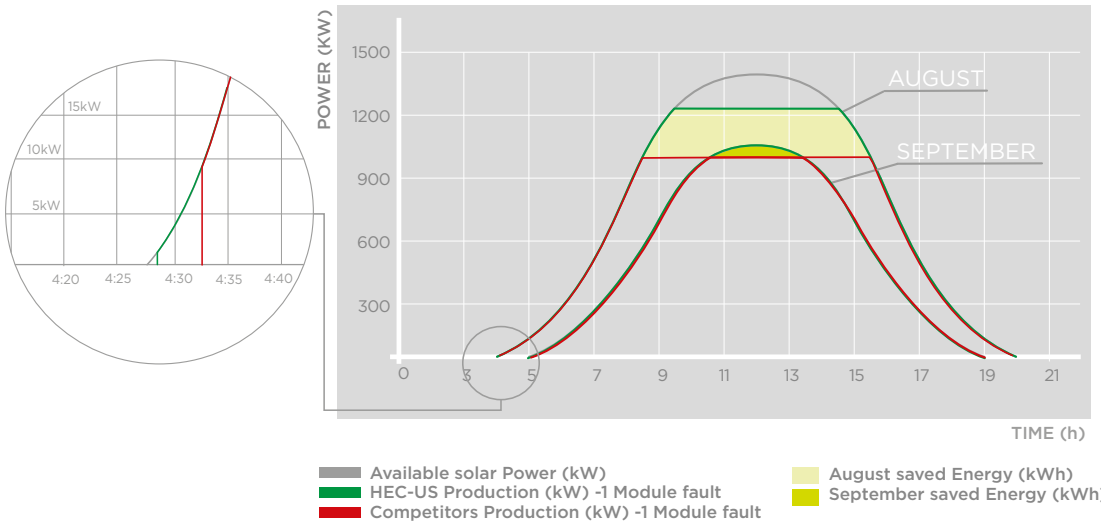
The HEC–US is available in a turnkey MW platform called the HEK Series. Delivered with factory tested Inverters, MV Pad-mounted transformer and auxiliary equipment, skid mounted solutions reduce installation and commissioning time and cost.

A MODULAR AND REDUNDANT SYSTEM MAXIMIZES UP-TIME AND PERFORMANCE

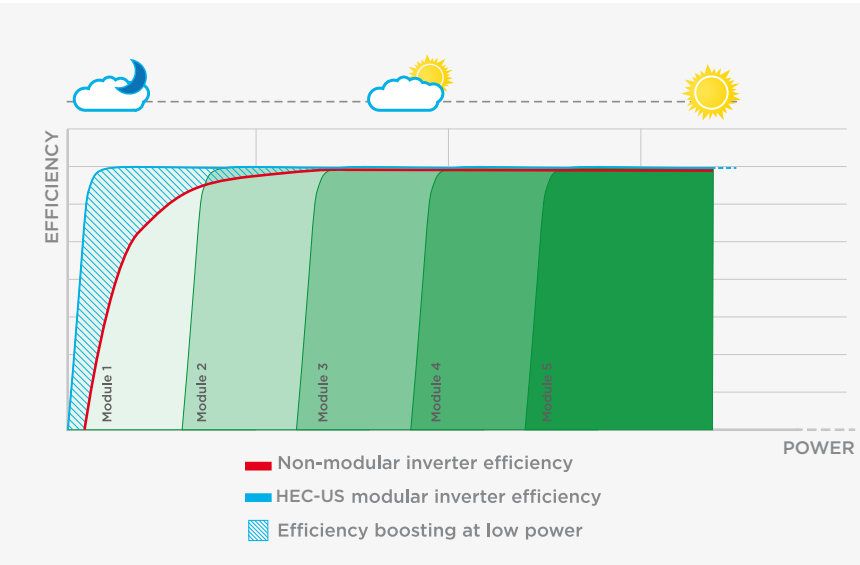
AUTOMATIC REDUNDANT MODULAR MASTER SLAVE SYSTEM

HEC-US topology combines the advantages of a central inverter with the availability of string inverters. HEC-US inverters are designed using 80 to 170 KVA independent modules. Each module is self-contained with its own control board, an independent power platform and its own cooling system, coupled together to common DC and AC buses. Each day, the HEC-US inverter wakes up with a single module power on-line. As the available PV power increases more modules are added to maintain peak inverter efficiency.

If there is a fault in one module, the faulted module is taken off-line and the output power is distributed evenly among the remaining system modules. All power modules work in parallel controlled by the master module. The master is the main governor of the system and is responsible for the MPPt tracking, synchronization sequence and overall protection. The automatic mode shifts the master module every night by comparing the register of energy production of all the modules in the system. The module with the least energy produced (kWh) will act as the master on the following day.



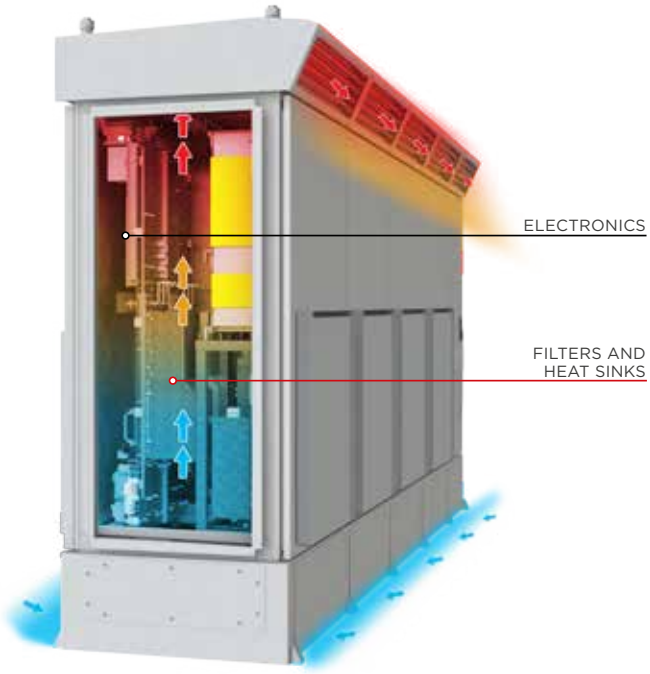
A modular inverter is more efficient than a central inverter. During low radiation conditions, a modular architecture uses the correct number of power modules to provide power while the central inverter must consume power internally to support the entire system. With lower losses, a modular inverter can begin to provide power earlier in the morning and stop later at the end of the day. As a result, throughout the entire service life of the PV plant, the HEC-US inverter generates higher yields than a central inverter with a higher reliability than string inverters.



REVOLUTIONARY COOLING SYSTEM

The design philosophy for the HEC-US inverters is to oversize sensitive components (like IGBTs & DC bus capacitors) and provide sufficient margin so the HEC-US can operate at 122F (50°C) with no power derating. Power-Electronics equipment is installed in mines, water treatment plants and concentrated solar power facilities in the most demanding locations in the world. Our expertise in harsh environments is the foundation for the perfect technical solution for our outdoor solar inverters.

The cooling systems on the HEC-US modules are divided into two main areas: the clean area (electronics) and the hot area (LC filters and heat sinks). The electronics are sealed in a NEMA 4 area and use a temperature control low flow cooling system that reduces filter maintenance. The hot area integrates independent speed controlled fans per each module that reduce stand-by consumption at low capacity, minimize audible noise and increase cooling capacity for PV installations located in hot environments or high altitudes.

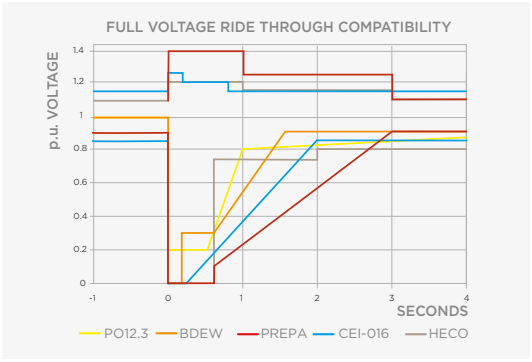


VAR AT NIGHT

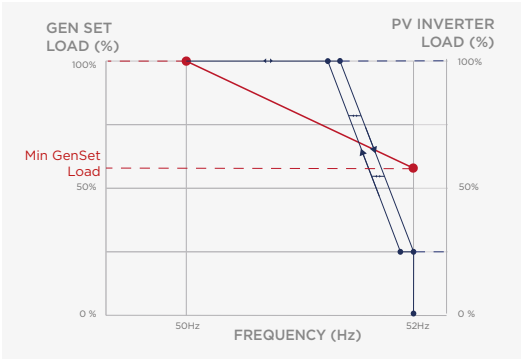
At night, the HEC-US inverter can shift to reactive power compensation mode. The inverter can respond to an external dynamic signal, a Power Plant Controller command or pre-set reactive power level (kVAr).

DYNAMIC GRID SUPPORT

HEC-US firmware includes the latest utility interactive features (LVRT, OVRT, FRS, FRT, Anti-islanding, active and reactive power curtailment...), and is compatible with all the specific requirements of the utilities.

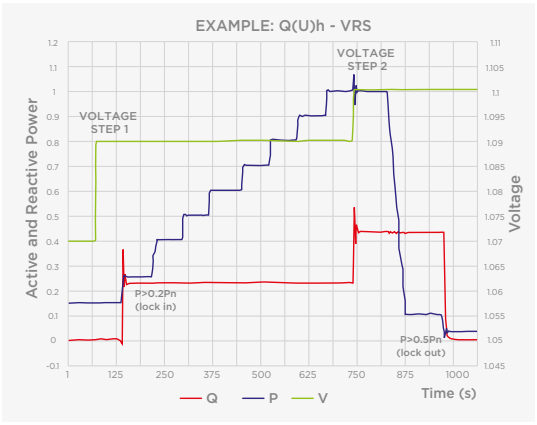


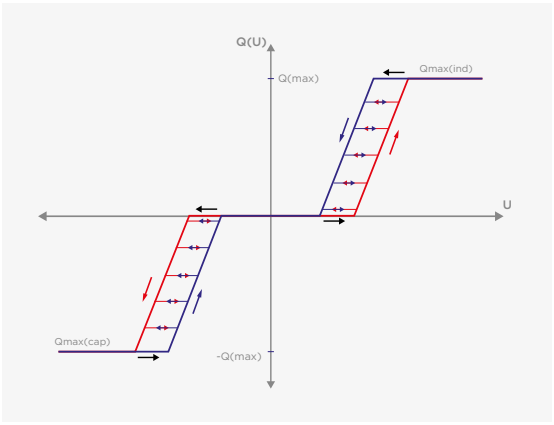
▲ **LVRT or ZVRT (Low Voltage Ride Through).** Inverters can withstand any voltage dip or profile required by the local utility. The inverter can immediately feed the fault with full reactive power, as long as the protection limits are not exceeded.

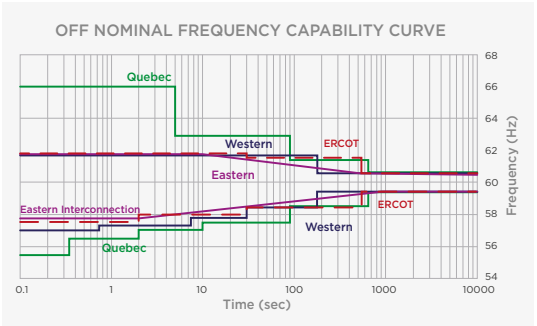


▲ **FRS: Frequency Regulation System.** Frequency droop algorithm curtails the active power along a preset characteristic curve supporting grid stabilization.

The advanced control allows the inverter to support the grid through reactive power injection or phase shift control by programming a wide range of fixed or dynamic power functions based on voltage and frequency inputs.







◀ **Frequency Ride Through:** Power Electronics inverters have flexible frequency protection settings and can be easily adjusted to comply with future requirements.

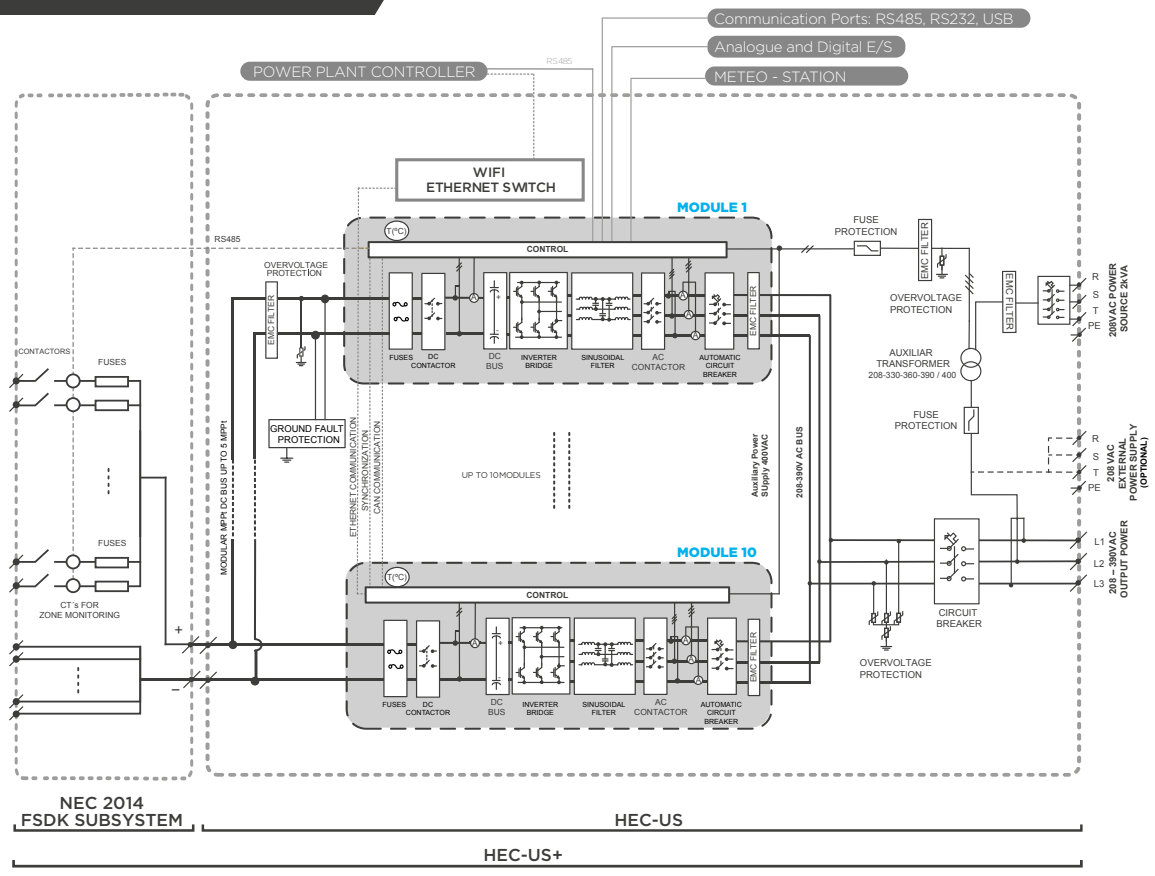
The HEC-US inverter has a unique anti-islanding protection that combines passive and active methods that eliminate nuisance tripping and reduce grid distortion. The inverter is certified to IEC 62116 and IEEE1547.

Power Electronics offers a **POWER PLANT CONTROLLER** that will allow both the PV plant operator and the utility to perform active and reactive power curtailment, voltage regulation and frequency regulation based on feedback from a power meter at the point of interconnection.

HEC-US

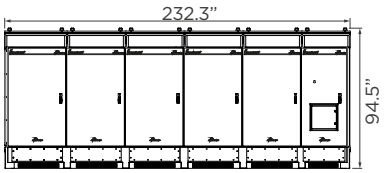
TECHNICAL CHARACTERISTICS

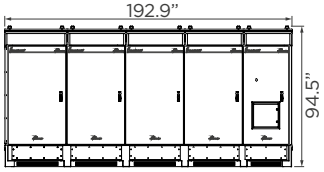
OPERATIONAL DIAGRAM

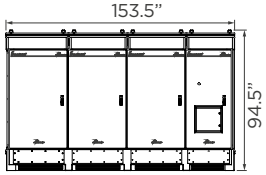


DIMENSIONS

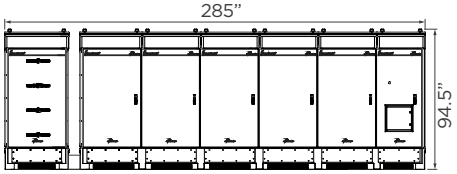
HEC-US

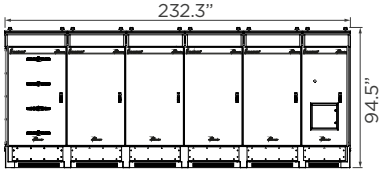


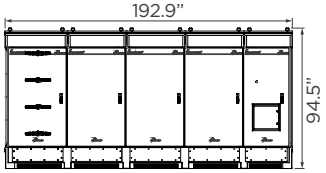




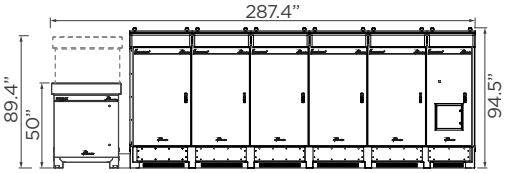
HEC-US+ NEC2011

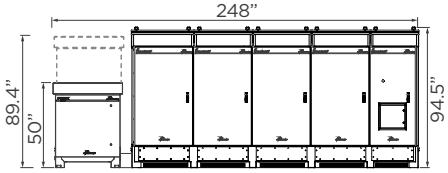


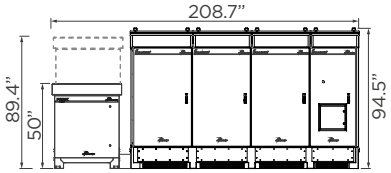




HEC-US+ NEC2014







NOTE Depth of all units is 40.12”.
Please consult hardware and installation manual for additional information on dimensions and weights.

HEC-US

TECHNICAL CHARACTERISTICS

		390VAC						
		FRAME 1	FRAME 2		FRAME 3		FRAME 4	
NUMBER OF MODULES		4	5	6	7	8	9	10
MODEL NUMBER		FS0600CU	FS0751CU	FS0900CU	FS1050CU	FS1250CU	FS1350CU	FS1500CU
OUTPUT	Maximum Power (kW/kVA) @PF=1; 50°C	680	850	1020	1190	1360	1530	1700
	Maximum Power (kW) @PF=0.9; 50°C	600	750	900	1050	1250	1350	1500
	Max. Output Current(A)	1007	1259	1510	1762	2014	2268	2520
	Operating Grid Voltage(VAC)	390Vac ±10%						
	Operating Range, Grid Frequency	60Hz (59.3Hz - 60.5Hz)						
	Power Factor [1]	0.9 leading... 0.9 lagging						
	Current Harmonic Distortion (THDi)	< 3% at nominal power						
INPUT	MPPt Window	552V - 900V						
	Maximum DC voltage	1000V						
	Rated DC current	1200A	1500A	1800A	2100A	2400A	2700A	3000A
	Maximum. short circuit DC current	1560A	1950A	2340	2730A	3120A	3510A	3900A
EFFICIENCY & AUX. SUPPLY	Max. Efficiency / CEC (η)	98.6% / 98.0%						
	Max. Standby Consumption (Pnight)	< approx. 40W/per module						
	Aux. Power Supply (208VAC)	6100VA	5300VA	4600VA	3800VA	3000VA	1800VA	1000VA
	Maximum Power Consumption (W)	1840W	2300W	2760W	3220W	3680W	4140W	4600W
ENVIRON-MENT	Degree of protection	NEMA 3R						
	Cooling system	Forced air intake through bottom and exhausted through upper exhaust hood						
	Permissible Ambient Temperature[2]	-22°F to +122°F / -30°C ...+50°C ; >50°C/ 122°F power derating						
	Relative Humidity	4% to 100%, Active heating and humidity control						
	Max. Altitude (above sea level)[2]	4000m; >1000m power derating 1% Sn (kVA) per 100m						
CONTROL INTERFACE	Interface	Alphanumeric display, ON-OFF Selector, ON/OFF pushbutton (Optional)						
	Communication	RS232 / RS485 / USB / Ethernet, (Modbus RTU Protocol, Modbus TCP/IP)						
	Analogue Inputs	1 programmable and differential inputs; (0-20mA or ± 10mV to ± 10V) and PT100						
	Digital Outputs	1 electrically-isolated programmable switched relays (250VAC, 8A or 30 VDC, 8A)						
PROTECTIONS	Ground Fault Protection	Floating PV array: Isolation Monitoring per MPP NEC2011 Grounded PV array: GFDI protection NEC2014 Grounded PV array: GFDI protection and isolation monitoring (requires 1 Digital Output)						
	NEC2011 Recombiner[3]	Max. 4x700A switches. Max. 32 inputs (70-200A fuse). Max. 28 (400A fuse) Max. 3x1250A switches. Max. 24 inputs (70-200A fuse). Max. 21 inputs (400A fuse)						
	NEC2014 Recombiner[3]	Max. 40 inputs (70-400A fuse)						
	Overvoltage Protection	DC and AC Inverter sides (Type 4) and Auxiliary Supply type 2 - Internal Standard						
CERTI-FICA-TIONS	Safety	UL 1741; CSA 22.2 No.107.1-01						
	Utility Interconnect	IEEE 1547						

NOTES [1] Power factor adjustable from pure leading to pure lagging.
[2] Below -20°C equipped with extended Active Heating + Heating Resistor. Other characteristics consult with Power Electronics.
[3] Check maximum shortcircuit DC current of the inverter to assure full recombiner compatibility.

HEC-US

TECHNICAL CHARACTERISTICS

		360VAC						
		FRAME 2			FRAME 3		FRAME 4	
NUMBER OF MODULES		5	6	6	7	8	9	10
MODEL NUMBER		FS0701CU	FS0752CU	FS0830CU	FS1003CU	FS1110CU	FS1251CU	FS1400CU
OUTPUT	Maximum Power (kW/kVA) @PF=1; 50°C	780	930	930	1100	1250	1400	1550
	Maximum Power (kW) @PF=0.9; 50°C	700	750	830	1000	1110	1250	1400
	Max. Output Current(A)	1251	1492	1492	1765	1989	2246	2486
	Operating Grid Voltage(VAC)	360Vac ±10%						
	Operating Range, Grid Frequency	60Hz (59.3Hz - 60.5Hz)						
	Power Factor[1]	0.9 leading... 0.9 lagging						
	Current Harmonic Distortion (THDi)	< 3% at nominal power						
INPUT	MPPt Window	510V - 900V						
	Maximum permissible DC voltage	1000V						
	Rated DC current	1500A	1800A	1800A	2100A	2400A	2700A	3000A
	Maximum short circuit DC current	1950A	2340	2340	2730A	3120A	3510A	3900A
EFFICIENCY & AUX. SUPPLY	Max. Efficiency / CEC (η)	98.6% / 98.0%						
	Max. Standby Consumption (Pnight)	< approx. 40W/per module						
	Aux. Power Supply (208VAC)	5300VA	4600VA	4600VA	3800VA	3000VA	1800VA	1000VA
	Maximum Power Consumption (W)	2300W	2760W	2760W	3220W	3680W	4140W	4600W

NOTES

[1] Power factor adjustable from pure leading to pure lagging.
[2] Below -20°C equipped with extended Active Heating + Heating Resistor. Other characteristics consult with Power Electronics.
[3] Check maximum shortcircuit DC current of the inverter to assure full recombiner compatibility.

String Inverter - Option 2

SG 60KU-M

SUNGROW

www.sungrowpower.com

Efficient and flexible

- High flexibility for complex configurations due to 4 MPP trackers and a wide input voltage range
- High yields due to efficiency up to 98.9% and CEC efficiency of 98.5%
- Output power up to 66kVA / 66kW at power factor of 1
- Can be installed at any angle

Grid-friendly

- Active power continuously adjustable (0~100%)
- Fulfill a variety of reactive power adjustment requirments with power factor 0.8 overexited ~ 0.8 underexited
- Integrated LVRT and HVRT function
- Includes RS-485 and Ethernet interface, compatible with all common monitoring systems

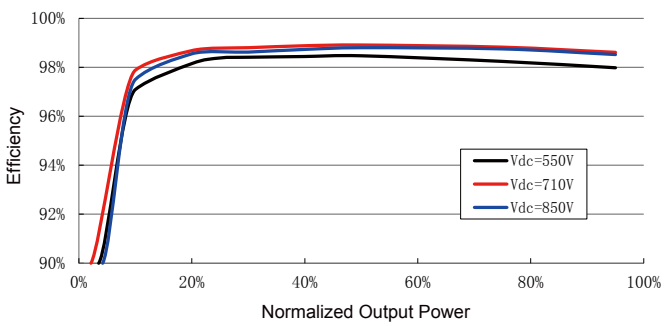
Intelligent design

- Integrated combiner box: 16 x Screw terminal pairs with DC string fuses (both positive and negative), Type II overvoltage protection(both DC and AC), DC and AC switch, more safety and lower the system cost
- Integrated string detection function and arc fault detection

Reliable

- Product certification: UL 1741, IEEE 1547, IEEE1547.1, CSA C22.2 107.1-01-2001, FCC Part 15 Sub-part B Class B Limits
- Manufacturer certification: ISO 9001, ISO 14001, OHSAS 18000

Efficiency Curve



Input Data

Max. PV input voltage	1000V
Startup voltage	300V
Stop Voltage	280V
MPP voltage range	300~950V
MPP voltage range for nominal power	550~850V / 513~850V
String Fuse	Positive and Negative
No. of MPPTs	4
Max. number of PV strings per MPPT	4
Max. PV input current	112A
Maximum DC short circuit current	200A
Max. current for input connector	12A
Max. Cable Size	10AWG, Cu or Al
Arc Flash Detection	Yes
DC Switch	Yes
Insulation Detection	Yes
DC Surge Arrestor	Type II DIN rail surge arreste

Output Data

Nominal AC output power	60000W / 56000W
Max AC output power (PF=1)	66000W
Max. AC output apparent power	66000VA
Max. AC output current	80A
Nominal AC voltage	3Ø/3W +Ground, 480Vac
AC voltage range	422~528Vac
Nominal grid frequency	60Hz
Grid frequency range	55~65Hz
THD	<3% (Nominal power)
DC current injection	<0.5%In
Power factor	>0.99@default value at nominal power, (adj. 0.8 eading ~ 0.8 lagging)
Max. Cable Size	70m², Cu or Al
AC Surge Arrestor	Type II DIN rail surge arreste (40kA)

Protection

Anti-islanding protection	Yes
Low Voltage Ride Through	Yes
DC reverse connection protection	Yes
AC short circuit protection	Yes
Leakage current protection	Yes
Overvoltage protection	Type II DIN rail surge arrester
AC switch	Yes

Mechanical Data

Dimensions (W*H*D)	665*915*276 mm	26.2*36*10.9inch
Mounting method	Wall bracket	
Weight	70kg	154lbs

System Data

Max. efficiency	98.90%	
CEC efficiency	98.50%	
Isolation method	Transformerless	
Ingress protection rating	NEMA4X	
Tare Loss	<1W	
Operating ambient temperature range	-25~60℃ (>50℃ derating)	-13…+140℉ (>122℉ derating)
Allowable relative humidity range	0~100%	
Cooling method	Smart forced air cooling	
Max. operating altitude	4000m (>3000m derated)	13,000ft (>9,800ft derated)
Display	Graphic LCD	
Communication	RS485 / Ethernet	
DC connection type	Screw terminals	
AC connection type	Screw clamp terminal	
Certification	cCSAus	
Safety and EMC Standard	UL 1741, IEEE 1547, IEEE1547.1, CSA C22.2 107.1-01-2001, FCC Part 15 Sub-part B Class B Limits	

Communication

RS485	Standard
Ethernet	Standard
I/O dry contact	Standard
Protocol	Modbus

Circuit Diagram

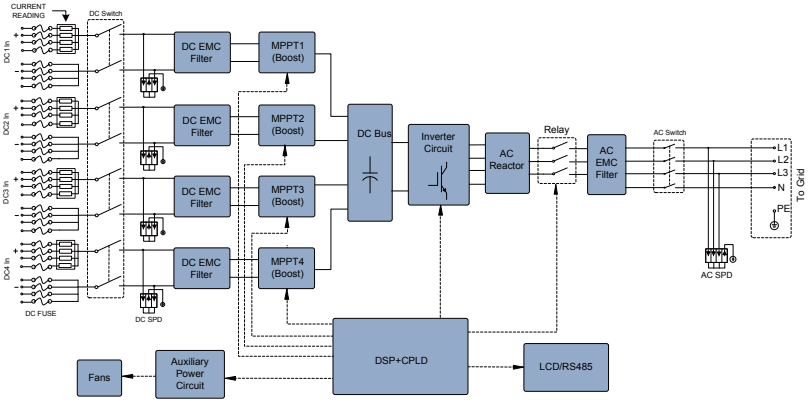


Exhibit D

MODULE DATA SHEETS

Sunmodule®
SW 340-350 XL MONO

SOLARWORLD
REAL VALUE

TUV Power controlled:
Lowest measuring tolerance in industry

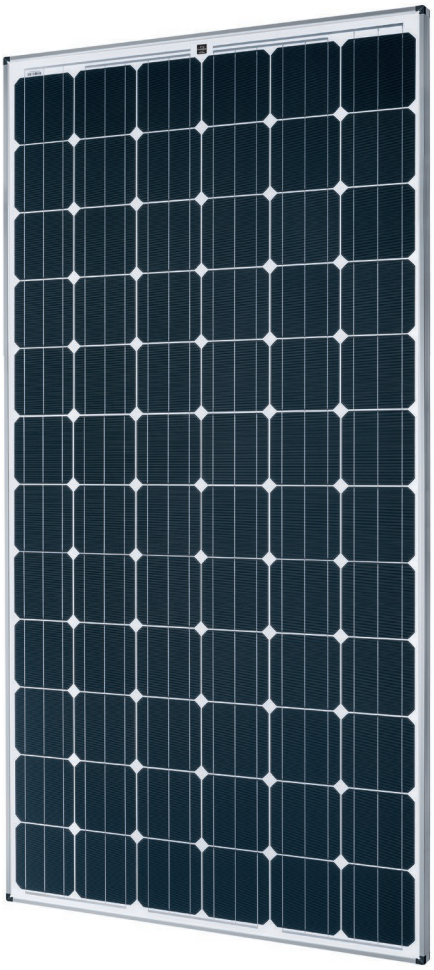
Every component is tested to meet
3 times IEC requirements

Designed to withstand heavy
accumulations of snow and ice

Sunmodule
Positive performance tolerance

25-year linear performance warranty
and 10-year product warranty

Glass with anti-reflective coating



World-class quality
Fully-automated production lines and seamless monitoring of the process and material ensure the quality that the company sets as its benchmark for its sites worldwide.

SolarWorld Plus-Sorting
Plus-Sorting guarantees highest system efficiency. SolarWorld only delivers modules that have greater than or equal to the nameplate rated power.

25-year linear performance guarantee and extension of product warranty to 10 years
SolarWorld guarantees a maximum performance digression of 0.7% p.a. in the course of 25 years, a significant added value compared to the two-phase warranties common in the industry, along with our industry-first 10-year product warranty.*

*in accordance with the applicable SolarWorld Limited Warranty at purchase.
www.solarworld.com/warranty

• Qualified, IEC 61215
• Safety tested, IEC 61730
• Blowing sand resistance, IEC 60068-2-68
• Ammonia resistance, IEC 62716
• Salt mist corrosion, IEC 61701
• Periodic inspection

• Periodic inspection
• Power controlled

UL 1703

ISO 9001
ISO 14001
Certified

Home Innovation
NGBS GREEN CERTIFIED

solarworld.com

Sunmodule®
SW 340-350 XL MONO

SOLARWORLD
REAL VALUE

PERFORMANCE UNDER STANDARD TEST CONDITIONS (STC)*

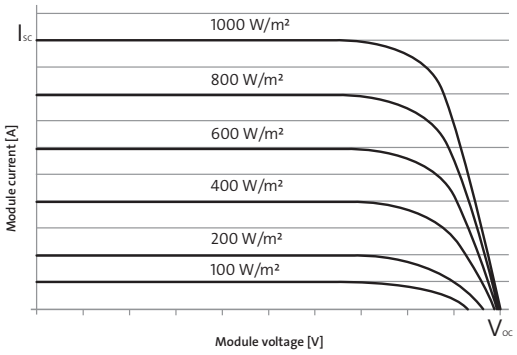
		SW 340	SW 345	SW 350
Maximum power	P_{max}	340 Wp	345 Wp	350 Wp
Open circuit voltage	V_{oc}	47.6 V	47.8 V	48.0 V
Maximum power point voltage	V_{mpp}	38.0 V	38.2 V	38.4 V
Short circuit current	I_{sc}	9.69 A	9.75 A	9.82 A
Maximum power point current	I_{mpp}	9.01 A	9.10 A	9.17 A
Module efficiency	η_m	17.04 %	17.29 %	17.54 %

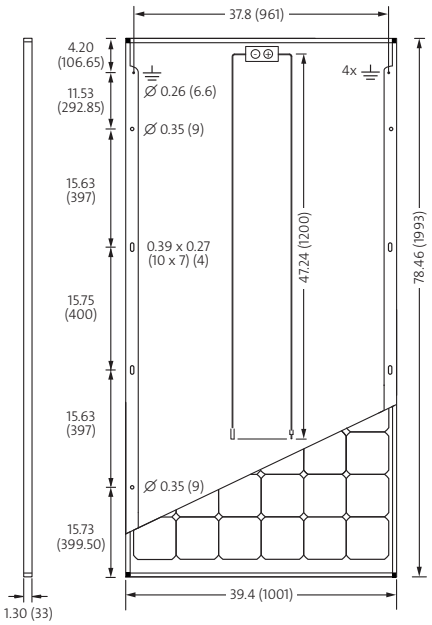
*STC: 1000W/m², 25°C, AM 1.5

PERFORMANCE AT 800 W/M², NOCT, AM 1.5

		SW 340	SW 345	SW 350
Maximum power	P_{max}	259.3 Wp	263.8 Wp	267.2 Wp
Open circuit voltage	V_{oc}	41.5 V	41.8 V	42.0 V
Maximum power point voltage	V_{mpp}	34.9 V	35.2 V	35.4 V
Short circuit current	I_{sc}	8.05 A	8.10 A	8.16 A
Maximum power point current	I_{mpp}	7.42 A	7.50 A	7.56 A

Minor reduction in efficiency under partial load conditions at 25° C: at 200 W/m², 100% of the STC efficiency (1000 W/m²) is achieved.





COMPONENT MATERIALS

Cells per module	72	*Front*	Low-iron tempered glass with ARC (EN 12150)
Cell type	Monocrystalline	*Frame*	Clear anodized aluminum
Cell dimensions	6.17 in x 6.17 in (156.75 x 156.75 mm)	*Weight*	47.6 lbs (21.6 kg)

THERMAL CHARACTERISTICS

NOCT	46 °C
TCI_{sc}	0.042 % / °C
TCV_{oc}	-0.304 % / °C
TCP_{mpp}	-0.43 % / °C
Operating temp	-40 to +85 °C

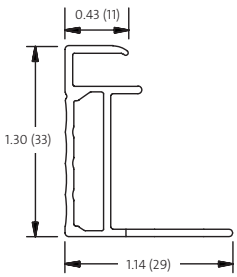
ADDITIONAL DATA

Power sorting	-0 Wp/+5 Wp
J-Box	IP65
Connector	PV wire per UL4703 with H4/UTX connectors
Module fire performance	(UL 1703) Type 1

PARAMETERS FOR OPTIMAL SYSTEM INTEGRATION

Maximum system voltage SC II / NEC		1000 V
Maximum reverse current		25 A
Number of bypass diodes		3
*Design loads**	*Two rail system*	113 psf downward, 64 psf upward
*Design loads**	*Edge mounting*	178 psf downward, 23 psf upward

* Please refer to the Sunmodule installation instructions for the details associated with these load cases.



- Compatible with both "Top-Down" and "Bottom" mounting methods
- ⏚ Grounding Locations:
  – 4 locations along the length of the module in the extended flange.

All units provided are imperial. SI units provided in parentheses.
SolarWorld AG reserves the right to make specification changes without notice.

THE TALLMAX MODULE

72 CELL
MULTICRYSTALLINE MODULE

305-320W
POWER OUTPUT RANGE

16.5%
MAXIMUM EFFICIENCY

0~+5W
POSITIVE POWER TOLERANCE

As a leading global manufacturer of next generation photovoltaic products, we believe close cooperation with our partners is critical to success. With local presence around the globe, Trina is able to provide exceptional service to each customer in each market and supplement our innovative, reliable products with the backing of Trina as a strong, bankable partner. We are committed to building strategic, mutually beneficial collaboration with installers, developers, distributors and other partners as the backbone of our shared success in driving Smart Energy Together.

Trina Solar Limited
www.trinasolar.com

Trinasolar
Smart Energy Together

Ideal for large scale installations
- High powerful footprint reduces installation time and BOS costs
- 1000V UL/1000V IEC certified

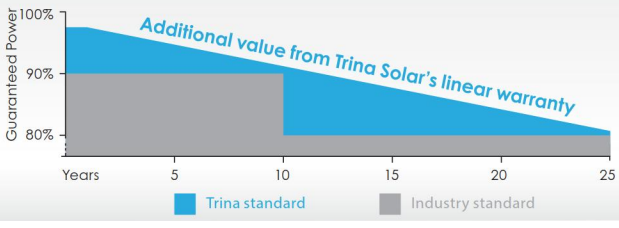
One of the industry's most trusted modules
- Field proven performance

Highly reliable due to stringent quality control
- Over 30 in-house tests (UV, TC, HF, and many more)
- In-house testing goes well beyond certification requirements
- PID resistant

Certified to withstand challenging environmental conditions
- 2400 Pa wind load
- 5400 Pa snow load
- 35 mm hail stones at 97 km/h

LINEAR PERFORMANCE WARRANTY

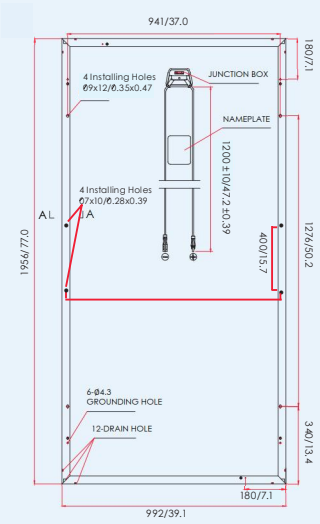
10 Year Product Warranty • 25 Year Linear Power Warranty



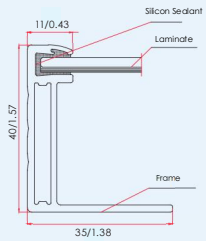
THE TALLMAX MODULE

TSM-PD14

DIMENSIONS OF PV MODULE
unit:mm/in

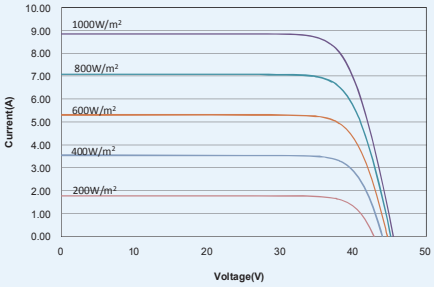


Back View



A-A

I-V CURVES OF PV MODULE(310W)



CERTIFICATION

ELECTRICAL DATA (STC)

Peak Power Watts-P_{MAX} (Wp)	305	310	315	320
Power Output Tolerance-P_{MAX} (W)	0 ~ +5			
Maximum Power Voltage-V_{MPP} (V)	36.6	37.0	37.1	37.1
Maximum Power Current-I_{MPP} (A)	8.33	8.38	8.51	8.63
Open Circuit Voltage-V_{OC} (V)	45.5	45.5	45.6	45.8
Short Circuit Current-I_{SC} (A)	8.81	8.85	9.00	9.10
Module Efficiency η_m (%)	15.7	16.0	16.2	16.5

STC: Irradiance 1000 W/m², Cell Temperature 25°C, Air Mass AM1.5.

ELECTRICAL DATA (NOCT)

Maximum Power-P_{MAX} (Wp)	227	230	234	238
Maximum Power Voltage-V_{MPP} (V)	34.0	34.3	34.3	34.4
Maximum Power Current-I_{MPP} (A)	6.68	6.72	6.83	6.91
Open Circuit Voltage-V_{OC} (V)	42.2	42.2	42.3	42.5
Short Circuit Current-I_{SC} (A)	7.11	7.15	7.27	7.35

NOCT: Irradiance at 800 W/m², Ambient Temperature 20°C, Wind Speed 1 m/s.

MECHANICAL DATA

Solar cells	Multicrystalline 156 × 156 mm (6 inches)
Cell orientation	72 cells (6 × 12)
Module dimensions	1956 × 992 × 40 mm(77.0 × 39.1 × 1.6 inches)
Weight	22.5 kg (50 lb)
Glass	3.2 mm,High Transmission, AR Coated Tempered Glass
Backsheet	White
Frame	Silver Anodized Aluminium Alloy
J-Box	IP 65 or IP 67 rated
Cables	Photovoltaic Technology cable 4.0mm² (0.006 inches²), 1200mm (47.2 inches)
Connector	UTX Amphenol
Fire Type	Type 1 or 2

TEMPERATURE RATINGS

Nominal Operating Cell Temperature (NOCT)	44°C (±2°C)
Temperature Coefficient of P_{MAX}	- 0.41%/°C
Temperature Coefficient of V_{OC}	- 0.32%/°C
Temperature Coefficient of I_{SC}	0.05%/°C

MAXIMUM RATINGS

Operational Temperature	-40~+85°C
Maximum System Voltage	1000VDC (IEC) 1000VDC(UL)
Max Series Fuse Rating	15A

WARRANTY

10 year Product Workmanship Warranty

25 year Linear Power Warranty

(Please refer to product warranty for details)

PACKAGING CONFIGURATION

Modules per box: 26 pieces

Modules per 40' container: 572 pieces

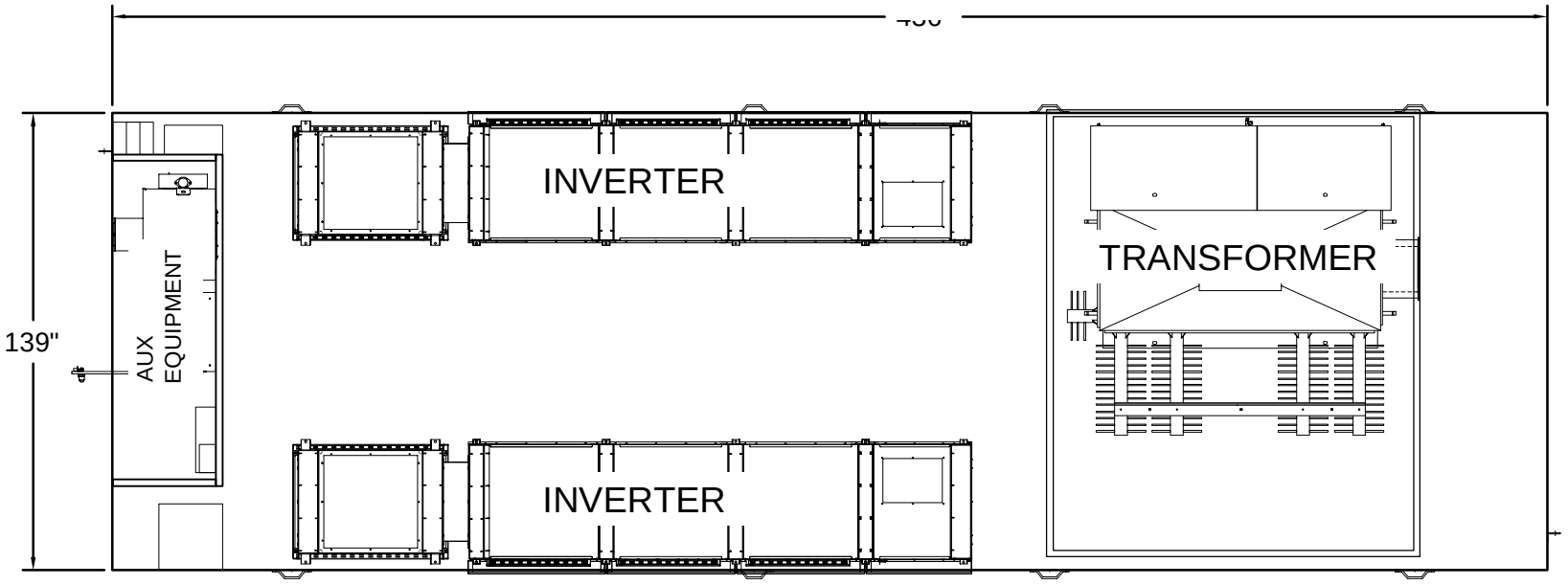
*The mechanical loading is dependent upon the mounting method. The mounting method described in the Installtion Manual section 6.1-C can pass 2400Pa wind load and 2400Pa snow load.

TSM EN 2016 A

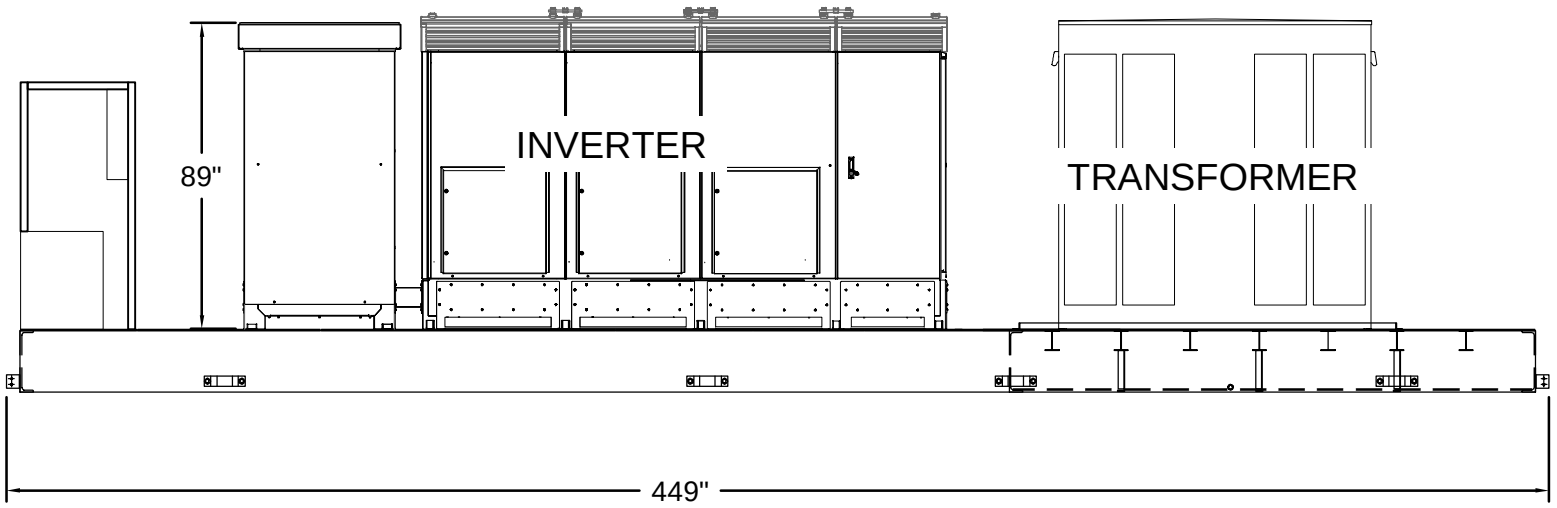
Trinasolar
Smart Energy Together

Exhibit E

INVERTER/TRANSFORMER PADS



PLAN VIEW



ELEVATION

INVERTER SKID PLAN AND PROFILE

Exhibit F

ACQUIFER PROTECTION MAP

AQUIFER PROTECTION AREAS

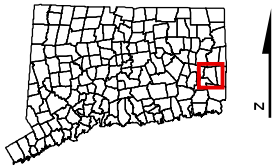
Griswold, CT

December 28, 2015

- Level A APA (Final Adopted)
- Level A APA (Final)
- Level B APA (Preliminary)
- Town Boundary

NOTE: The Aquifer Protection Areas were delineated through Connecitcut's Level A and Level B Mapping Processes. Aquifer Protection Areas are delineated for active public water supply wells in stratified drift that serve more than 1000 people, in accordance with Sections 22a-354c and 22a-354z of the Connecticut General Statutes. Level B Mapping delineates a preliminary aquifer protection area, providing an estimate of the land area from which the well draws its water. Level A Mapping delineates the final Aquifer Protection Area, which becomes the regulatory boundary for land use controls designed to protect the well from contamination. As Level A Mapping is completed for each well field and approved by DEEP, it replaces the Level B Mapping. Final Adopted Level A Areas are those where towns have land use regulations for them. Masschusetts and Rhode Island Wellhead Protection Areas may be shown for informational purposes.

QUESTIONS:
Bureau of Water Protection and Land Reuse
Planning and Standards Division
Phone: (860) 424-3020
www.ct.gov/deep/aquiferprotection



STATE OF CONNECTICUT
DEPARTMENT OF
ENERGY & ENVIRONMENTAL PROTECTION
79 Elm Street
Hartford, CT 06106-5127

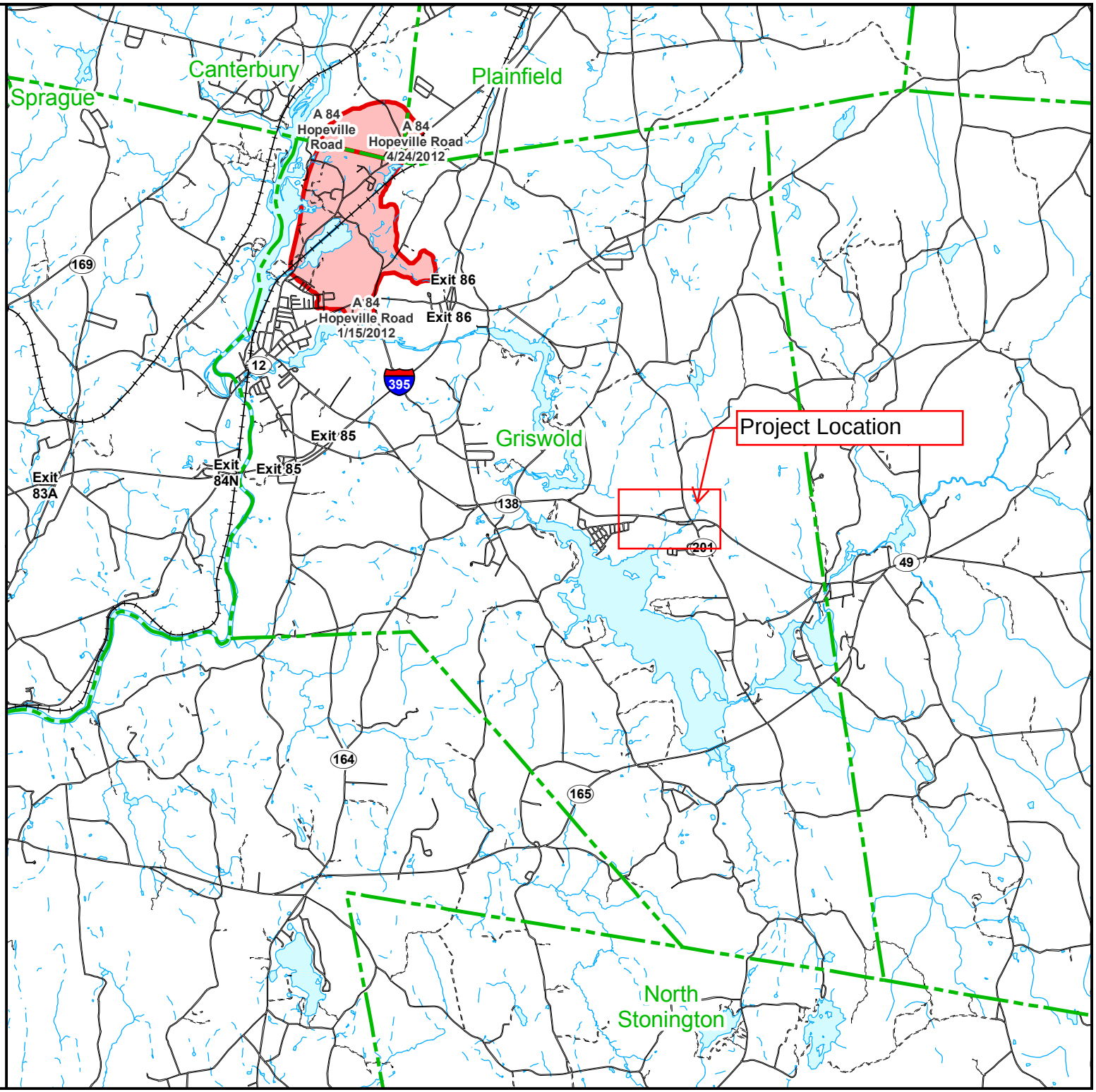


Exhibit G

WETLAND REPORT

HIGHLAND SOILS LLC

WETLAND REPORT

VOLUNTOWN ROAD SOLAR
1219 & 1240 VOLUNTOWN ROAD
GRISWOLD, CONNECTICUT

PREPARED FOR
ECOS ENERGY, LLC

BY
JOHN P. IANNI
PROFESSIONAL SOIL SCIENTIST

MARCH 25, 2016

P.O Box 337, Storrs, CT 06268 · 860-742-5868 · Highlandsoils@aol.com

INTRODUCTION

A solar photovoltaic renewable energy generating facility is proposed for a site located at 1219 and 1240 Voluntown Road, Griswold, CT. The site consists of two parcels of land on the north and south side of Voluntown Road. The East Site is located on the north side of Voluntown Road and is bounded to the north by Culver Road and to the east by Hopeville Road (Route 201).

The West Site is located on the south side of Voluntown Road and is just west of Latham Drive. The land to the east is an existing farm and the land to the south is vacant woodlands.

The inland wetland boundaries on the subject properties were field delineated on August 3 and 4, 2015. The wetlands were field delineated in accordance with the standards of the National Cooperative Soil Survey and the definition of wetlands as found in the Connecticut General Statutes, Chapter 440, Section 22A-38. I have reviewed the prepared plans have found the representation of the field delineated wetlands to be substantially correct.

Additionally, the boundaries also conform to the jurisdictional wetlands definition (Federal or Army Corps wetlands) as based on:

> Environmental Laboratory. 1987. "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Additional field data was collected on March 16 and 17, 2016.

EXISTING CONDITIONS

EAST SITE

The East Site contains 17.1 acres and generally slopes from the northeast to the southwest. The eastern half of the site is mainly wooded with a small abandoned corn field located in the southeastern corner. The wooded area contains moderate slopes and is dominated by mixed hardwood species that include White ash, Shagbark hickory and a variety of Oaks. Black cherry, White pine and Hemlock are also present to a lesser degree. In places Red cedar dominates the vegetative community. Along the edges of the wooded area Multiflora rose, Honeysuckle, Autumn olive and Japanese barberry were noted. The fallow corn field contains stubble from the last corn crop and is currently transitioning to annual weed species.

To the west of the wooded area is a large fallow corn field that appears to have been last tilled in 2014. The field appears to have been over-seeded with Rye grass, and stubble from the last corn crop is still visible. Annual weed species are beginning to overtake the field.

To the west of the open corn field is an area of wetlands. There is a row of Red maple trees, with an accumulation of Multiflora rose and Honeysuckle along the transition from the corn field to the wetlands. A sharp topographic break was noted along the wetland/upland boundary. The wetland area is mainly open in the center with Reed canary grass being the

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dominant species. A small well defined channel was noted in the wetland. The channel is approximately three feet wide and is approximately one to two feet deep. This portion of the wetland contained shallow (less than four feet deep) organic soils over a sand and gravel substratum. The far western portion of the mapped wetland is transitioning to a wooded community with Red maple and White pine being the dominant tree species. The area is drier and mineral soils of the poorly drained Walpole Series were identified. Rough alder and Tussock sedge were noted along the transition between the open meadow part of the wetland and the western woodlands.

An old road-bed follows the northern property line, and it appears to have been the extension of Culver Road, which now terminates at a cul-de-sac at the eastern edge of the wetlands. The former road-bed is elevated above the natural ground surface and a breach in the road-bed allows for surface water to flow from north to south. The road-bed does allow for surface water to pond on the north side. Highbush blueberry, Rough alder and Multiflora rose were prevalent along the former road-bed.

The wetland drains from north to south through an existing culvert into a wetland area that is part of the West Site of the proposed Solar Facility. Since this wetland connects to the larger wetland on the south side of the road its functions and values will be included in the overall discussion.

WEST SITE

The West Site is located on the south side of Voluntown Road and is just east of Latham Drive. An existing farm is to the east and the land to the south is undeveloped woodland. Along the eastern boundary of the site is the continuation of the wetland system discussed in the "East Site" section of this report. The wetland is lightly wooded with Red maple as the dominant tree species. Red elm is also present and the understory contains Multiflora rose along the edges with Highbush blueberry and Winterberry in the center. A well defined water course was noted along the eastern side of the wetland and the water course is buffered by a robust stand of Japanese barberry. The water course is well defined and contains a sand and gravel bottom. Older hummocks of Tussock sedge were visible in the wetland and Sphagnum moss was prevalent on the forest floor. The wetland contains poorly drained soils of the Walpole Series, which overlay deposits of sand and gravel. The eastern edge of the wetland is off-site and transitions to open pasture as the western side of the wetland transitions to a mixed hardwood/softwood growth. In the western fringe of the wetland White pine is dominant in the understory and moderate slopes were noted adjacent to the wetland boundaries.

The second wetland area is just east of Latham Drive in the western portion of the site and runs from north to south. This wooded wetland system is dominated by Red maple with White pine, Highbush blueberry and Winterberry in the understory. The surface flow in the wetland is diffuse and mainly occurs nearer the western edge of the wetland where ground water exfiltration was most pronounced. Older hummocks of Tussock sedge were noted in the wetland system and Sphagnum moss dominates the ground cover. As stated earlier, the surface flow in the wetland is diffuse and no defined water course channels were noted until the southern

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boundary of the wetland. Moderate to steep slopes were noted in the uplands adjacent to this wetland.

The upland area between the two wetlands contains a mix of hardwood and softwood species. Oaks dominate the hardwoods and White pine is the dominant softwood species. The understory is sparse and contains saplings of the fore mentioned species.

The upland area in the far eastern portion of the site also contains Oaks and White pine, however, the White pine is dominant in the canopy. Well drained to excessively well drained soils were noted in the uplands. A fallow corn field was noted in the southwestern corner of the site.

VERNAL POOL HABITAT

A field survey was conducted on March 16, 2016. The temperatures ranged from 45 degrees F. to 60 degrees F. Sunny skies gave way to mostly clouded skies by late afternoon. All wetland and upland areas were surveyed for breeding amphibians.

As a result of the field survey it was concluded that no Vernal Pool habitats were noted on the site. No suitable areas of ponded surface water were noted and no evidence of obligate amphibian species was found.

It should be noted that Wood Frogs were calling from two distinct ponded areas on the north side of Voluntown Road. One area is across from Latham Drive and the second area was just east of Latham Drive. Both areas are on private property and no attempt was made to access the potential Vernal Pools.

WETLAND FUNCTIONS

The functions and values of the wetlands will be described in a qualitative manner modeled after the method used by the US Army Corps of Engineers. The information is from *The Highway Methodology Workbook Supplement*. This publication uses a descriptive approach to assessing functional values, versus the CT D.E.P. approach, which uses a quantitative or numerical approach to ranking wetland functions and values.

Ground Water Recharge/Discharge - This function considers the potential for a wetland to serve as a ground water recharge and/or discharge area. It refers to the fundamental interaction between wetlands and aquifers, regardless of the size or importance of either.

The on-site wetlands are underlain by stratified drift (sand and gravel) and ground water recharge is likely. Ground water seepage or exfiltration was noted along the edges of the wetlands and other signs of recharge are present. Parts of the wetlands are associated with water courses and both ground and surface water quality are high. Groundwater

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recharge and discharge functions are present and this is a primary function of the wetlands.

Floodflow Alteration - This function considers the effectiveness of the wetland in reducing flood damage by water retention for prolonged periods following precipitation events and the gradual release of flood waters. It adds to the stability of the wetland ecological system or its buffering characteristics and provides social or economic value relative to erosion and/or flood prone areas.

The wetlands along the eastern part of the site are associated with a defined water course and no outlet restrictions were noted. Although some indication of over-the-bank flows were present, the overall potential for this function is limited by the lack of outlet controls. Fine-grained soils and organic soils are present in the wetlands which are positive indicators, and some storage of flood waters is present. However, the wetlands are relatively small in relation to the watershed and overall flood storage is limited. The wetland in the western portion of the West Site has more potential for flood storage with its flat and diffuse surface flows. However, this wetland lacks a constricted outlet and is bordered by well drained soils with little potential for overland flow. Other than ground water seepage this wetland has low imputes of surface flow. The function is present but is not a primary function.

Fish and Shellfish Habitat - This function considers the effectiveness of seasonal or permanent watercourses associated with wetland in question for fish and shellfish habitat.

The wetlands are not associated with a water course capable of supporting fish or shellfish habitat. The surface flows in the wetlands are either diffuse or are associated with seasonal or intermittent flows.

Sediment/Toxicant/Pathogen Retention - This function reduces or prevents degradation of water quality. It relates to the effectiveness of the wetland as a trap for sediments, toxicants or pathogens in runoff water from surrounding uplands, or upstream eroding wetland areas.

The wetland system on the East Site abuts an existing tilled field and potential sources of sediment are present. The wetland also has the potential for sediment trapping due to the presence of organic soils and the fact that the associated water course is in the center of the wetland. The southern component of this wetland system also abuts agricultural land where the potential for sediment is present. The systems are broad and flat and sediment trapping is present. The western wetland system has slow moving diffuse surface flow and fine-grained mineral soils, however, the surrounding land use is wooded and sediment sources are generally lacking. Both wetland systems receive runoff from Voluntown Road which is a sediment source. This is a primary function of the wetlands.

Nutrient Removal/Retention/Transformation - This function considers the effectiveness of the wetland as a trap for nutrients in runoff water from surrounding uplands or contiguous wetlands, and the ability of the wetlands to process these nutrients into other forms or trophic levels. One

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aspect of this function is to prevent ill effects of nutrients entering aquifers or surface waters such as ponds, lakes, streams, rivers or estuaries.

As with the previous function, the wetland on the East Site has greater potential for this function due to possible excess nutrients coming from the adjacent corn field. The presence of organic soils and diverse vegetation classes increase the potential for this function. The other wetland system lacks the potential inputs of nutrients and has less diversity of vegetative types. Although this function is represented on-site it is not a primary function of the wetlands.

Production Export - This function relates to the effectiveness of the wetland to produce food or usable products for human, or other living organisms.

Some indicators for this function are present, however most indicators are not. The presence of organic soils indicates more attenuation than export. Additionally the wetlands do not contain a high degree of flowering plants or species diversity. There does not appear to be flushing of organic matter from the wetlands and there is a lack of aquatic diversity and/or abundance in the wetlands. This is not a primary function.

Sediment/Shoreline Stabilization - This function evaluates the effectiveness of a wetland to stabilize stream banks and shorelines against erosion.

The eastern wetland system is associated with a seasonal water course and no indication of recent erosion was present. The wetlands are not associated with a pond or other water body and no water based recreation occurs in the wetlands. The watercourse is well buffered by existing wetland soils and other than the cross culvert and surface flow from Voluntown Road there are no sources of erosive velocities. The western wetland is not associated with a watercourse, pond or water body and this function is not present on site.

Wildlife Habitat - This function considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and wetland edges. Both resident and/or migrating species are considered.

The positive qualifiers for this function include good water quality, the surrounding land use is mainly undeveloped and/or agriculture, and the wetlands are contiguous with other off-site wetlands. What is generally lacking for this function are areas of permanent open water, diversity in vegetative cover classes and wildlife food sources. The lack of a high degree of flowering plants and low potential for amphibians limit the potential for the wetlands to perform this function. Although wildlife utilization does occur in the wetlands it is not a primary function for this methodology.

Recreation – (Consumptive and Non-Consumptive) This value considers the suitability of the wetland and associated watercourses to provide recreational opportunities such as hiking, canoeing, boating, fishing, hunting and other active or passive recreational activities.

The wetlands are not associated with areas suitable for water based recreation or fishing. Hunting is limited due to the proximity of roads and dwellings. Access is currently

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limited and will be further limited once developed. Overall this is not a value that is present in the wetlands.

Educational/Scientific Value - This function considers the suitability of the wetland as an "outdoor classroom" or for scientific research.

The wetlands generally lack diversity in wetland types, with wooded wetlands being the dominant vegetative community. Additionally the wetlands lack open water in the form of ponds, lakes or perennial streams. The wetlands are also in close proximity to a busy road and the wetlands lack wildlife habitat. This is not a primary value of the wetlands.

Uniqueness/Heritage - This value considers the effectiveness of the wetland for special values such as archeological sites, rare and endangered species habitat or uniqueness for its location.

The wetlands are fairly typical for the area. The wetlands exhibit one cover class (wooded) and lack the interspersion of open water and vegetation. Of the 31 listed qualifiers for this value only four are present. There are no known archeological sites and the site lacks low-growing wetland types such as marsh, bog or scrub shrub type systems. This is not a primary value

Visual Qualities/Aesthetics - This value relates to the visual qualities of the wetlands.

The wetlands lack multiple cover classes as well as marsh habitat, which are necessary for this value. The wooded wetlands are not distinguished from the wooded uplands and the primary viewing location is noisy and contains debris from the adjacent road. This is not a primary value.

Endangered Species Habitat – This value considers the suitability of the wetland to support threatened or endangered species.

A letter has been issued for the project from the Connecticut Department of Energy and the Environment. The letter indicated no adverse impacts from the project.

WETLAND IMPACTS

The project has been designed to avoid all direct wetland impacts.

On the East Site all activity, including the perimeter fencing, is outside of the 75 foot upland review area (URA). Some activity is proposed within the 150 foot upland review area, however, the activity will occur in areas that were previously cleared and used for agriculture.

Currently, the existing agricultural field extends close to the field mapped wetland boundary and there is a small buffer of vegetation between the tilled field and the wetlands. Under the current proposal the 75 foot URA will be allowed to revert to native and naturalized vegetation, thus providing a greater buffer to the wetlands than currently exists. Additionally, a good portion of the 150 foot URA will also be allowed to revert to native and naturalized vegetation, further reducing the potential for wetland impacts. This is a net benefit to the

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wetlands as the potential for sediment and nutrients to enter the wetland system will be greatly reduced or eliminated.

On the West Site there are two wetland systems, once again no direct wetland impacts are proposed.

The eastern-most wetland system, which straddles the eastern property line, will have no activity within the wetlands or 75 foot URA. The proposed perimeter fencing will encroach slightly on the 150 foot URA in the south and a few of the solar arrays are just into the 150 foot URA. Moderate slopes exist along the west side of this wetland system and the perimeter fencing generally follows the top of the slope. More importantly the solar arrays will not be on the slope leading to the wetland but instead take advantage of the relatively flatter upland areas. Additionally, the limits of clearing are within the proposed perimeter fence and a majority of the 150 foot URA will remain wooded. The entire 75 foot URA will remain vegetated thus providing an adequate buffer to the wetlands.

The second wetland system lies in the center of the proposed solar arrays and will have activity on both the east and west side. Once again no activity is proposed in the wetlands or within the 75 foot URA. The proposed access drive, perimeter fencing and some solar arrays are proposed within the 150 foot URA. As seen on the east side, there are moderate slopes adjacent to the wetlands. Once again the project has been designed to avoid the slopes adjacent to the wetlands and all activity is proposed for the flatter upland areas above the slopes. The exception is to the south where the slopes adjacent to the wetlands are shallow and the solar arrays are within the 150 foot URA.

On the west side of the western wetland system the moderate slopes extend approximately 75 feet from the wetlands. The perimeter fencing and limits of clearing parallel this area. Beyond the 75 feet URA the land plateaus and is generally flat out to Latham Drive and the western property line. The project has been designed to avoid the slopes adjacent to the wetlands; some of the solar arrays are within the 150 foot URA but are within flat areas of the property.

In summary, the project has been designed to avoid all direct wetland impacts and maintain activity outside of the 75 foot URA. Some activity is proposed between the 75 foot and 150 foot URA, however, the activity is proposed on flatter areas that avoid the slopes adjacent to the wetlands. In conclusion, the project should have minimal impacts to the functions and values of the wetlands.

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