Bristol, RI

Proposed Photovoltaic Array - Bristol Sanitary Landfill

January 2023

ENGINEERING REPORT

Prepared for:

Town of Bristol
10 Court Street
Bristol, Rhode Island 02809

and

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(Bristol Landfill Solar NG, LLC)
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LIST OF ATTACHMENTS

1.0 INTRODUCTION

On behalf of the Town of Bristol and NuGen Capital Management, LLC (NuGen), BETA Group, Inc., (BETA) has prepared this Engineering Report to support the installation of a photovoltaic (PV) array on the Bristol Sanitary Landfill. Siting a PV array on the capped landfill is an ideal re-use opportunity given that the site is already free of trees and the elevated terrain promotes maximum exposure to the sun. Generating power via a renewable resource decreases reliance on fossil fuels and greenhouse gas emissions.

The Town and NuGen have entered into a 25-year lease agreement (dated August 30, 2019) whereby NuGen is granted permission to construct a PV system on the landfill. NuGen will transfer construction responsibilities for this project to Bristol Landfill Solar NG, LLC. Bristol Landfill Solar NG, LLC will in-turn retain NuGen O&M to perform all required maintenance activities (electrical systems and landfill related). Nugen has the option to renew the lease for a maximum of four (4) five-year terms. At the end of the lease, NuGen or Bristol Landfill solar NG, LLC is responsible for the removal of all equipment associated with the PV system and returning the site to its pre-construction state.

The landfill, which is located at the eastern end of Minturn Farm Road, is situated on a 91.54-acre parcel identified as lot 25 on Assessor's Plat 171. The parcel is owned by the Town of Bristol. The area within and around the landfill is zoned as Open Space with a municipal land use. Besides the closed landfill, the site presently supports the Town's transfer station, an animal shelter, the wastewater biosolids composting operation and the Town's yard waste management facilities.

The project, as designed, will produce 6.88 megawatts DC (4.98 megawatts AC) of power. The PV array will consist of 10,640 panels rated at 325 watts (Heliene 72P) and 10,052 panels rated at 340 watts (Hansol TD-AN3). The panels will be supported by a steel racking system. To protect and minimize disturbances to the landfill cap, a ballasted ground mount system utilizing poured in place concrete tubs will be employed. In total, 3,904 tubs will be used to anchor the array. The tubs have a bottom surface area of 11.8 square feet but will range in weight from 2,230 pounds to 3,356 pounds, depending on the amount of concrete needed. As demonstrated on the design drawings included as Attachment A, the array will cover the majority of the approximate 20.75 acres on top of the landfill.

Aside from the installation of solar panels, other prominent features of the system include the construction of a 10-foot wide gravel access road through the center of the array, the installation of 6 new utility poles and associated overhead wiring and the installation of two concrete pads to mount electrical equipment. All facility components (and the associated work) will be located outside of wetland areas and their associated buffer zones. FEMA classifies the area as Zone X, which is determined to be outside of the 500-year floodplain.

Permitting, construction and maintenance of a solar array on a landfill requires special considerations. Accordingly, this report discusses the following elements that are required by Paragraph 2.1.9(J) of the Solid Waste Regulations:

- Anchoring System Details
- Cap Loading Analysis
- Potential for Increased Settlement
- Slope and Stability Analysis
- Vegetative Cover
- Gas and Leachate Management Systems
- Stormwater Management and RIDEM Water Resources Approvals

- Minimum Spacing for Maintenance and Emergency Events
- Access Roads and Access Restrictions
- Electrical Plans and Specifications
- Health and Safety Plan
- Operations and Maintenance Plan

2.0 ANCHORING SYSTEM DETAILS

A ballasted racking system consisting of 1,952 pairs of concrete-filled, round, polyethylene tubs (3,904 tubs) placed on the ground surface will be used to anchor the array. Depending on their position in the array, the weight of the tubs will range from 2,230 pounds to 3,356 pounds. Design of the anchoring considers uplift at wind speeds of 126 mph. A tub distribution plan is provided in the drawings provided as Attachment A.

The tubs will be Pour-in-Place™ XL, as manufactured by Gamechanger Solar. The units have a bottom diameter of approximately 46.5 inches, a top diameter of 52 inches and a height of 21 inches. Concrete will be filled to the appropriate height to meet the required weight. A data sheet for the tubs is also included in the drawings provided as Attachment A.

3.0 CAP LOADING ANALYSIS

The overall weight of a conventional PV system and its force on the landfill cover, is a key design criterion for landfill PV projects. Components contributing to the weight of the system include the anchoring system, mounting or racking system, selected PV modules, electrical equipment and snow and wind loads. An EPA publication titled *Best Practices for Siting Solar Photovoltaics on Municipal Solid Waste Landfills* that was issued in May 2022 states that "typically, landfill covers can handle dead weight point loads of up to 7 pounds per square inch (psi), although an upper limit of 5 psi is used by some landfill solar developers."

The cap over the Bristol Landfill consists of four layers of material, a 12-inch vegetative layer, 12-inch sand drainage layer, a geosynthetic clay liner (GCL) and a 6-inch compacted sand bedding layer (refer to Figure 1). The geotechnical firm of Paul B. Aldinger & Associates (PBA) was retained to perform a feasibility study to ensure that the proposed project will not have an adverse impact on the integrity of the existing cap and the GCL. The GCL is the Bentomat ST as manufactured by CETCO. This product is a reinforced GCL consisting of a layer of sodium bentonite clay between a woven and a nonwoven geotextile that are needlepunched together. This needlepunching produces a stronger and more rigid GCL, making it less susceptible to damage during installation and increases its the design life.

In consideration of the increase in load on the cap and more specifically the GCL, a representative from CETCO was contacted to see if there were any guidelines on loads or other concerns. CETCO indicated that the added loading would not impair the GCL in any way. Their opinion was that the soil layers above the GCL prevent a decrease in liner thickness from point loads and therefore there is little impact on performance. They also stated that studies have shown that a moderate increase in load on the GCL actually makes it more impervious, making it more effective as a water barrier. CETCO's one suggestion was to use equipment with low contact pressure during construction, such as a rubber tracked vehicles.

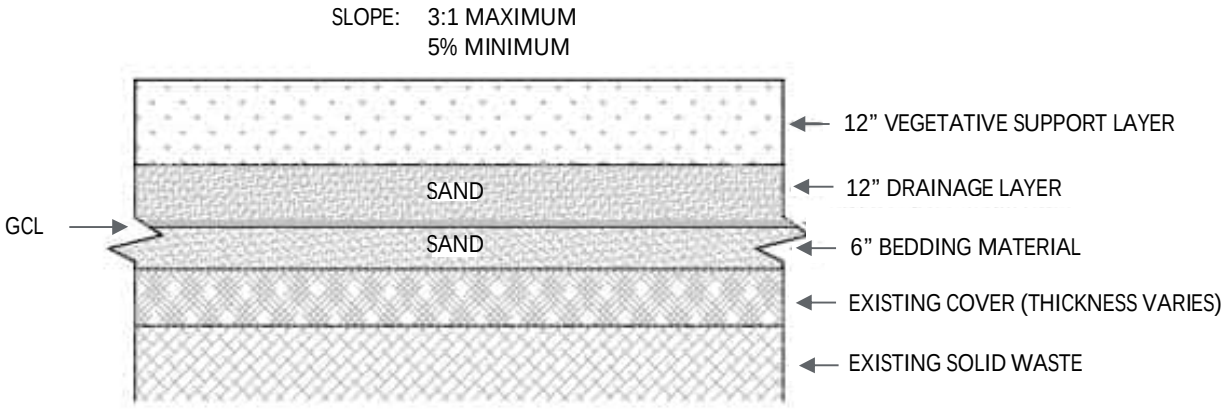

Figure 1: Landfill Cap Detail

PBA also reviewed an EPA publication, EPA530-F-97-002 entitled "Geosynthetic Clay Liners Used in Municipal Solid Waste Landfills", revised December 2001. This publication confirms CETCO's assessment that adding load will decrease the hydraulic conductivity (permeability). The publication states that "Test values for hydraulic conductivity depend upon the degree of effective overburden stress around the GCL during testing. The higher the effective overburden stress, the lower the hydraulic conductivity." A letter report issued by PBA is provided as Attachment B.

Proposed racking for the PV array was designed by Gamechanger Solar (refer to Attachment C). The racking system was designed using the following loading conditions:

- Ground Snow Load 30 lb/ft^2
- Wind Speed (wind loads) 126 mph
- Tilt Angle 20 degrees

Given that the spacing between support beams varies throughout the array, Gamechanger carries out several design iterations for the steel racking system. As designed, the racking system carries a dead load of approximately 3 pounds per square foot (0.02 psi).

To determine the overall loading impacts on the landfill cap, the following worst-case conditions were evaluated:

- A 10-module wide section (20 Hansol modules)
- A 7-module wide section (14 Hansol Modules) with inverters supported from the rack
- The pad supporting the transformer.

Components of the load that were given consideration included:

- Applied (roof) snow loads;
- Weight of the racking system;
- Weight of modules and supported electrical equipment;
- Weight of the concrete tubs; and
- Weight of concrete pads.

Four tubs will support each section of the PV array. Therefore 25-percent of the load from each section will be distributed to each tub. Accounting for adjacent sections, the applied load to each tub is doubled to 50-percent of the load from one section. As demonstrated in the calculations provided in Attachment D, the loading on the cap for the three conditions described above are:

- A 10-module wide section 4.48 psi
- A 7-module wide section with inverters 4.41 psi
- The pad supporting the transformer 1.58 psi

Since the maximum applied loads will be less than 5 psi, the integrity of the cap will not be compromised. Research also indicates that increase in load from the PV array on the capped landfill may increase the effectiveness of the GCL as a water barrier. When operating on the landfill surface, low contact pressure equipment will be used. Work will also not be allowed to take place under wet conditions to minimize disturbances to the vegetative layer.

4.0 Potential for Increased Settlement

In November 2020, a topographic survey (0.25-foot contour interval) was conducted at the Bristol Landfill. The purpose of the survey was to gauge the degree to which the landfill had settled and to identify areas where localized depressions exist due to differential settlement. To form this comparison, elevations from the 2020 survey were compared to those obtained following the last phase of closure in 2005. As reported to RIDEM, the landfill has settled by approximately 2 feet in a fairly uniform manner. Several shallow depressions caused by differential settlement were noted but the depths were less than 6-inches. These depressions, which had a combined volume of approximately 70 cubic yards, have been filled in by town personnel.

Regarding landfill settlement, it has been reported (Tchobanoglous, George, etal.; Solid Wastes; McGraw Hill, 1977) that 90-percent of the ultimate settlement occurs within the first five years. Since the last phase of closure at the Bristol Landfill took place in 2005, significant future settlement is therefore not expected to occur.

5.0 Slope and Stability Analysis

The proposed PV array will be located on the top of the landfill where slopes range from 2-percent to 5-percent. None of the modules or the associated electrical equipment will be placed on the steeper side slopes of the landfill. Therefore, the stability of the side slopes will not be compromised.

6.0 Vegetative Cover

All construction vehicles that will operate on top of the landfill will have rubber tracks to distribute loads and minimize disturbances to the vegetative layer. One of the more intensive operations will be filling the ballast tubs with concrete. Concrete will be transported to the base of the landfill in a concrete mixing truck. Mixed concrete will then be poured into a hopper attached to a skid steer. The skid steer will then access the top of the landfill via the proposed crushed stone access road, which runs the entire width of

the array from east to west. To minimize disturbances to the vegetative layer, the skid steer will exit the access road at 90-degree angles to the tub locations.

Although there is perception that shading caused by the panels can adversely impact vegetative growth, it is NuGen's position that this is not a concern. NuGen has twenty PV installations covering over 200 acres of land with modules situated at a similar lie angle of 20-percent, where there have been no impacts on vegetative growth. As part of the Operations and Maintenance Plan, Nugen O&M and BETA (as the environmental consultant for the Town of Bristol) will monitor the vegetative layer for signs of erosion as part of the on-going post closure monitoring program. Where erosion is occurring, corrective measures will be implemented by NuGen O&M.

7.0 GAS AND LEACHATE MANAGEMENT SYSTEM

Under typical conditions, the rate of decomposition and gas production in a landfill reaches a peak within the first two years and then slowly tapers for periods of 25 years or more. Since the last phase of closure at the Bristol Landfill occurred in 2004, it is expected that minimal landfill gas is being generated at this time. In March 2020, BETA personnel field analyzed the discharge from 45 gas vents located throughout the landfill property for the presence of methane, hydrogen sulfide, oxygen and carbon dioxide using a Landtec GEM-2000 Plus Landfill Gas Detector. Prior to use, the instrument was calibrated by U.S. Environmental Rental Corporation. To conduct the analyses, the discharge opening at each vent was sealed with a plastic bag and gases were allowed to accumulate for 5 minutes before the sampling tube penetrated the bag. Trace concentrations of methane were noted in 5 of the 45 vents that sampled. No detectable concentrations of hydrogen sulfide were registered. A photoionization detector was also used to measure the concentrations of total volatile organic compounds at each vent. Trace concentrations were detected in only 4 of the 40 vents sampled. This sampling program confirms that little to no landfill gas is currently being generated. A table summarizing field sampling results is provided in Attachment E.

To facilitate the installation of the solar array, RIDEM approved a request to reduce the height of the gas vents within the array by 6 to 12 inches. This work will be performed, as needed, during construction.

Construction of the array will have no impact on existing subsurface drainage or leachate collection systems.

8.0 STORMWATER MANAGEMENT

A Stormwater Application has been submitted to RIDEM Freshwater Wetlands (FWW) Division and approval is pending. Components of the PV array and all associated work are outside of wetland areas and their associated buffer zones. Therefore, there will be no adverse impacts to the resource areas within the project area.

The PV array will be installed on the top of the landfill using a ballasted system. The top of the landfill presently contributes runoff to existing diversion berms with underdrains and existing drainage swales (See Existing Condition Plan in Permitting Plan Set under separate cover). The berms and swales have been cleared and the necessary maintenance has been performed to ensure proper functionality. Based on discussions with RIDEM, if the cumulative area of the concrete ballast tubs (or the increase in imperious area) is less than 10% of the overall array area, the array will have an insignificant impact on the

stormwater characteristics of the site. The total area of ballast tubs incorporated into the project is 1.06 acres or 5.1% of the total area of the PV array. Therefore, there is no requirement to meet the eleven Minimum Stormwater Management Standards. However, all eleven Minimum Standards have been addressed to the maximum extent practicable in the Stormwater Management Report, which is included in Attachment F.

9.0 Minimum Spacing for Maintenance and Emergency Events

The proposed PV array consists of a northern section and southern section. A minimum 10-foot wide crushed stone access road, running the full width of the array from east to west, will be constructed between the northern and southern sections. Additionally, the spacing between rows of modules is also set at 10 feet. This spacing will provide adequate access for repair work, mowing and emergency equipment.

10.0 Access Roads and Access Restrictions

The only access to the overall site is via the scale at the gated entrance to the property. The gate is typically open weekdays from 7:30 AM-3:00 PM and Saturdays from 8:00 AM-12:00 PM, when the compost facility and transfer stations are in operation. At all other times, the gate is locked.

Once on the property, there is unrestricted vehicular access to the general location of the PV array. To reach the top of the landfill an access road (crushed stone) will be constructed up its western side. The access road will then extend the entire width of the array from east to west a distance of approximately 1,400 feet.

To construct the access road, the 12-inch vegetative layer will be removed and replaced with 4-inches of gravel and 8-inches of crushed stone. The gravel will be underlain with a woven geotextile (Mirafi RS 280i, or equal) to separate road materials from the drainage layer and stabilize the installation. Refer to the drawings in Attachment A for construction details.

The existing landfill is fenced on three sides. There is no fence on the western side adjacent to the composting facility. A new section of fencing will be installed to prevent access to the PV array and its associated equipment. A gate will be installed with a double lock system. Bristol Landfill Solar NG, LLC and the Town will each have access via their designated lock. Fence posts will be installed to a depth of 20 inches below the existing ground surface to avoid disturbances to the GCL. The posts will be encased in concrete to improve stability. Details are provided in Attachment A.

11.0 Electrical Plans and Specifications

Since the proposed work will take place on a landfill, landfill gas (methane) may be present in the project area. Provisions will be made to prevent gas from accumulating in electrical systems. To minimize risks associated with landfill gas, the majority of the proposed work will occur aboveground. To the extent practicable, AC and DC electrical wiring will be run aboveground in cable trays supported by concrete blocks. Where electrical wiring needs to cross access roads, conduits will be encased in concrete to protect them from vehicular traffic and buried a minimum of 12-inches but no more than 18-inches below

ground surface. This will keep them above the GCL. Sealing fittings such as model EYS manufactured by Crouse-Hinds, shall be installed on all underground electrical conduits to prevent the entrance of landfill gas. Sealing fittings shall also be installed at each conduit entrance to electrical enclosures. In the event that a sealing fitting cannot be used in a certain location, an expanding foam sealant shall be used to seal the conduits from landfill gas and water. The sealant shall minimize gas and vapor passage per NEC Article 501.15(B)(2). The foam sealant shall be type FST™ as manufactured by American Polywater Corporation, or equal.

Power generated by the proposed PV system will be connected via overhead wires to the existing power grid owned by RI Energy. The connection will be made at Utility Pole P-5, which is located at the southern side of the entrance road in the western section of the site. To accomplish this, nine new utility poles (Poles P5-1 through P5-9) will be installed to carry the wires. Since the wires will cross an active yard waste composting operation, a minimum ground to wire clearance of 30 feet will be provided to allow for the movement of large excavation equipment.

Locations for Utility Poles P5-1 through P5-3 are expected to be outside the landfill footprint and as such should not encounter the GCL or buried refuse. These poles will be installed by RI Energy. Utility Poles P5-4 through P5-9 are within the footprint of the landfill so penetration of the GCL and structural support of the poles must be considered. These poles will be installed by a contractor selected by Bristol Landfill Solar NG, LLC. To penetrate the GCL, a 3' x3' section of the cap (vegetative layer and drainage layer) will be excavated down to the GCL. The GCL will be cut in an "X" configuration to allow the auger to penetrate without further disturbance to the surrounding liner. Once the pole is installed, the excavation will be backfilled with a 1-foot layer of bentonite to repair the liner and one foot of plantable soil. A detail is provided in drawings included as Attachment A. Please note that the structural and support elements associated with utility pole installation will be provided by the electrical contractor. If the design significantly alters the method to reestablish the liner, a detail will be submitted to the Office of Land Revitalization and Sustainable Materials Management for approval.

12.0 HEALTH AND SAFETY PLAN (HASP)

The primary safety concern related to the installation of a PV system on a closed landfill is gas generated from the anaerobic decomposition of buried refuse. As indicated in Section 7, the rate at which gas is being generated at the Bristol Landfill is low since the last phase of closure occurred more than 18 years ago. This likely minimizes health and safety risks; however, adequate precautions still need to be taken when working on the landfill. The contractor selected to install the PV array will be required to have a site-specific HASP in place prior to the initiation of any work. The contractor has sole responsibility for the health and safety of his/her employees. A sample HASP outlining some of the primary concerns and protective measures associated with work on the landfill is provided as Attachment G.

Some of these concerns and provisions include:

- gas monitoring when any excavation below the landfill cap occurs, particularly during the installation of utility poles;
- installation of gas arrestors for buried conduits and penetrations into electrical cabinets; and,
- personal protective measures to prevent tick bites.

Although there are chemicals of concern (volatile organic compounds (vocs), heavy metals, etc.) present in groundwater beneath the landfill, construction of the proposed project is primarily aboveground and interactions with groundwater will not occur. If groundwater is encountered during the installation of utility poles the area should be monitored for the presence of VOCs with a photoionization detector. If concentrations of organic vapors are elevated, respiratory protection for site workers may be required.

13.0 Operations and Maintenance Plan

The Town of Bristol is presently responsible for operations and maintenance of all systems related to the closed landfill. Operation and maintenance practices for the landfill are outlined in the Operating and Closure Plan dated April 1999. The Town and NuGen have entered into a 25-year lease agreement (dated August 30, 2019) that will shift some of these responsibilities to NuGen or their project-specific operating entity (Bristol Landfill Solar NG, LLC) once the Commercial Operation date is reached. A copy of the lease agreement is included as Attachment H.

Once installed, access to the PV system will be restricted to Bristol Landfill Solar NG, LLC maintenance personnel, Town emergency personnel and the Town's environmental monitoring consultant. As such, NuGen will assume the following responsibilities:

- Maintenance of access roads, gates and fences associated with the PV system;
- Mowing within the confines of the PV system plus a 15-foot buffer;
- Settlement upkeep within the confines of the PV system; and,
- Maintenance of all electrical components and PV systems.

An operations manual prepared by NuGen that delineates responsibilities between NuGen or its operating entity and the Town of Bristol, and provides various inspection frequencies is provided in the NuGen Operation and Maintenance Manual provided as Attachment I. This manual also summarizes maintenance requirements for the vegetated areas, the access roads and existing drainage features.

Attachment A: Permitting Plans

BRISTOL
LANDFILL SOLAR
MINTURN FARM RD,
BRISTOL, RHODE ISLAND 02809

DRAWING LIST

ISSUE FOR CONSTRUCTION	
E-001	TITLE PAGE
C-001	GENERAL NOTES AND LEGEND
C-100	EXISTING CONDITIONS SITE PREP PLAN
E-100	OVERALL ARRAY LAYOUT PLAN
E-101	EQUIPMENT AREA PLAN
C-101	CIVIL DETAILS
E-010	ELECTRICAL NOTES
E-011	ELECTRICAL NOTES
E-002	EQUIPMENT DATASHEET
E-200	CONSTRUCTION DETAILS
E-201	CONSTRUCTION DETAILS
E-202	GROUNDING DETAILS
E-203	GROUNDING DETAILS
E-400	ONE LINE DIAGRAM
E-401	FEEDER SCHEDULES
E-500	EQUIPMENT LABELS
E-501	EQUIPMENT LABELS
S100	SITE PLAN
S200	TUB PLAN
S250	TUB SPACING PLAN
S251	TUB SPACING PLAN (Hansol)
S403	TYPICAL ASSEMBLY EAST ELEVATION

PROJECT SUMMARY

PROJECT SIZE	
DC SYSTEM SIZE	6,875.68 KW
AC SYSTEM SIZE	4,980.00 KW
DC/AC RATIO	1.455
EQUIPMENT INFORMATION	
MODULE INFO	HANSOL 340TD-AN3 (340W) - 10,056 TOTAL (10,052 ACTIVE)
	HELIENE SOLAR 72P (325W) - 10,640 MODULES
TILT	20 DEGREES
AZIMUTH	171 DEGREES
INVERTER INFO	YASAKAWA SOLECTRIA XGI 1500 166/166 - 30 (QTY)
RACKING INFO	GAMECHANGE SOLAR FIXED TILT BALLASTED

OWNER: TOWN OF BRISTOL, RHODE ISLAND
APPLICANT: NUGEN CAPITAL MANAGEMENT, LLC
267 WARREN STREET
WARREN, RI 02885

2 VICINITY MAP
SCALE: 1" = 500'-0"

-1000'-0" -500'-0" 0'-0" 500'-0" 1000'-0"

NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	CHK
1	90% DESIGN	01/03/2023	DB
0	90% DESIGN	12/15/2022	DB
8	PRELIMINARY LAYOUT	07/05/2022	DB
7	PRELIMINARY LAYOUT	06/13/2022	DB
6	PRELIMINARY LAYOUT	06/10/2022	DB
5	PRELIMINARY LAYOUT	04/25/2022	DB
4	PRELIMINARY LAYOUT	04/22/2022	DB
3	PRELIMINARY LAYOUT	04/12/2022	DB
2	PRELIMINARY LAYOUT	04/05/2022	DB

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BETA

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DEVELOPER
NUGEN CAPITAL

NUGEN CAPITAL MANAGEMENT LLC.
267 WATER STREET
WARREN, RI 02885
http://www.nugencapital.com/

PROJECT NAME AND ADDRESS
BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE
TITLE PAGE

ENGINEER:	DRAWN BY:
DB	AJ
PROJECT NO. 01-19-001	SHEET NO. E-001
CREATION DATE 12/31/2019	SHEET 1 OF 22

LEGEND

GENERAL SYMBOLS

EXISTING	PROPOSED	
		CURB (TYPE AS NOTED)
		BERM
		EDGE OF PAVEMENT / LIMIT OF PAVEMENT
CB		CATCH BASIN (OR GUTTER INLET, DROP INLET, CATCH BASIN CURB INLET)
EHH	A	ELECTRIC HANDHOLE (NUMBER AS NOTED)
E	E	ELECTRIC MANHOLE
T	T	TELEPHONE MANHOLE (TYPE NOTED)
W	W	WATER MANHOLE (TYPE NOTED)
S	S	SEWER MANHOLE (TYPE NOTED)
D	D	DRAINAGE MANHOLE (TYPE NOTED)
GG	GG	GAS GATE / GAS SHUT OFF
WG	WG	WATER GATE / WATER SHUT OFF
HYD	HYD.	HYDRANT
FA	FAB	FIRE ALARM BOX
LP	LP	STREET LIGHT POLE
UP		UTILITY POLE
		SIGN
GUY	GUY	GUY POLE
12" RCP (AB)		ABANDONED UTILITY LINE (TYPE AS NOTED)
D 12" RCP D	D 10'-12" RCP D	DRAIN PIPE (SIZE AND SLOPE AS NOTED)
S 12" CS	10'-8" PVC S	SEWER MAIN (SIZE AS NOTED)
		SEWER SERVICE LINE
E E		ELECTRIC DUCT
G 4" HP	G	GAS MAIN (SIZE AS NOTED)
GS GS		GAS SERVICE LINE
W 8" CI	W	WATER MAIN (SIZE AS NOTED)
WS WS		WATER SERVICE LINE
T T	T T	TELEPHONE DUCT (SIZE AS NOTED)
MB		MAIL BOX
		WOOD GUARD RAIL STEEL BEAM GUARD, WOOD OR STEEL POSTS (TYPE AS NOTED)
		STEEL GUARD RAIL, STEEL POSTS (TYPE NOTED)
		STONE WALL
		RETAINING WALL (TYPE NOTED)
BND	BND	HIGHWAY/PROPERTY BOUND (TYPE AS NOTED)
E.S.H.L.		STATE HIGHWAY LAYOUT LINE (S.H.L.)
Boundary Name		CITY, TOWN, COUNTY OR STATE BOUNDARY LINE
		PROPERTY LINE
T.E.B.	T.E.B.	TEMPORARY EASEMENT LINE
P.E.B.	P.E.B.	PERMANENT EASEMENT LINE
	2+00	CONSTRUCTION BASELINE
N00°00'00"E 000.00'		SURVEY LINE
		RAILROAD OR STREET RAILWAY TRACKS WITH SIDELINES
		WHEELCHAIR RAMP
		TREE (SIZE AND TYPE AS NOTED)
		HEDGE
x x x x	x x x x	FENCE (SIZE AND TYPE AS NOTED)
WF-1		EDGE OF WETLAND W/ FLAGGED NUMBER
		EDGE OF RIVER/STREAM LINE
		50 FT. WETLAND BUFFER LIMIT
		100 FT. WETLAND BUFFER LIMIT
		100 FT. RIVER FRONT LIMIT
		200 FT. RIVER FRONT LIMIT
		WOODED AREA / LIMIT OF CLEARING
x 00.0	x 00.00	SPOT GRADE
		SAW CUT LINE
		COMPOST FILTER SOCK
		PROPERTY LINE

EXISTING	PROPOSED	
		Building
100	100	CONTOUR MAJOR
		CONTOUR MINOR
		DRIVEWAY DIRT
		DRIVEWAY PAVED
TP	TP	TEST PIT "QUALITY LEVEL A" DATA POINT
BH-15'		BORING
P-10'		PROBE
MW		MONITORING WELL
GV		GAS VENT
		CAP / PLUG PIPE

ABBREVIATIONS

GENERAL

ABAN.	ABANDON
ADJ.	ADJUST
AADT	ANNUAL AVERAGE DAILY TRAFFIC
APPROX.	APPROXIMATE
℄	BASELINE
BM	BENCH MARK
BIT.	BITUMINOUS
BB	BITUMINOUS BERM
BC	BITUMINOUS CURB
BOS	BOTTOM OF SLOPE
BOW	BOTTOM OF WALL
BD OR BND	BOUND
BLDG.	BUILDING
CEM.	CEMENT
℄	CENTER LINE
CLF	CHAIN LINK FENCE
CONC.	CONCRETE
CC	CONCRETE CURB
CONT.	CONTINUOUS
CONST.	CONSTRUCTION
CO.	COUNTY
CS	COMBINED SEWER PIPE
D	DELTA ANGLE (CENTRAL ANGLE OF HORIZ. CURVE)
DWY.	DRIVEWAY
EB	EAST BOUND
EP, EOP	EDGE OF PAVEMENT
EL.	ELEVATION
ETW	EDGE OF TRAVEL WAY
EXIST.	EXISTING
FLDSTN	FIELDSTONE
FDN.	FOUNDATION
GAR.	GARAGE
GRAN.	GRANITE
GC	GRANITE CURB
GE	GRANITE EDGING
GRAV.	GRAVEL
GD	GROUND
HOR.	HORIZONTAL
HMA	HOT MIX ASPHALT
HO	HOUSE
IP	IRON PIPE
JCT	JUNCTION
LT.	LEFT
LP	LOW POINT
MB	MAIL BOX
MAX.	MAXIMUM
MIN.	MINIMUM
NB	NORTH BOUND
NTS	NOT TO SCALE
OC	ON CENTER
PVMT.	PAVEMENT
PGL	PROFILE GRADE LINE
PROJ.	PROJECT
℄ OR PROP. LINE	PROPERTY LINE
PROP.	PROPOSED
R	RADIUS OF CURVATURE
RR	RAILROAD
R&D	REMOVE & DISPOSE
REM.	REMOVE
REMOD.	REMODEL
RET.	RETAINING
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
RT.	RIGHT
ROW	RIGHT-OF-WAY
RD.	ROAD
SHT.	SHEET
SHLD.	SHOULDER
SDWK.	SIDEWALK
SB	SOUTH BOUND OR STONE BOUND
SHLL	STATE HIGHWAY LAYOUT LINE
STA.	STATION
ST.	STREET
TAN	TANGENT
T	TANGENT DISTANCE OF CURVE/TRUCK PERCENTAGE
TEB	TEMPORARY EASEMENT BOUNDARY
TEMP.	TEMPORARY
TOS	TOP OF SLOPE
TOW	TOP OF WALL
TP	TURNING POINT
TYP.	TYPICAL
VAR.	VARIABLE
VERT.	VERTICAL
VC	VERTICAL CURVE
VGC	VERTICAL GRANITE CURB
WB	WEST BOUND
WCR	WHEELCHAIR RAMP

UTILITIES

CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CIP	CAST IRON PIPE
CIT	CHANGE IN TYPE
CL.	CLASS (PIPE, CONCRETE, EXCAVATION, ETC.)
COND.	CONDUIT
CAP	CORRUGATED ALUMINUM PIPE
CMP	CORRUGATED METAL PIPE
CPP	CORRUGATED PLASTIC PIPE
CSP	CORRUGATED STEEL PIPE
CULV.	CULVERT
CI	CURB INLET
DI	DROP INLET
DIP	DUCTILE IRON PIPE
DMH	DRAIN MANHOLE
EL. (OR ELEV.)	ELEVATION
FM	FORCE MAIN
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
GIP	GALVANIZED IRON PIPE
GG	GAS GATE
GI	GUTTER INLET
HDW	HEADWALL
HYD.	HYDRANT
INV.	INVERT ELEVATION
LP	LIGHT POLE
MH	MANHOLE
PVC	POLY-VINYL-CHLORIDE PIPE
PWW	PAVED WATER WAY
R&D	REMOVE & DISPOSE
RCP	REINFORCED CONCRETE PIPE (CLASS III UNLESS NOTED)
SMH	SEWER MANHOLE
SD	SUBDRAIN
TSV&B	TAPPING SLEEVE, VALVE AND BOX
TS	TRAFFIC SIGNAL
TSC	TRAFFIC SIGNAL CONDUIT
UP	UTILITY POLE
VCP	VITRIFIED CLAY PIPE
WG	WATER GATE
WM	WATER METER/WATER MAIN
WIP	WROUGHT IRON PIPE

GENERAL NOTES:

1. VERTICAL DATUM - NAVD 88.
2. THE EXISTING SURVEY IS A COMPILATION OF AN AERIAL SURVEY PERFORMED IN 2002 BY T3 GLOBAL STRATEGIES AND UPDATED IN 2020 BY DIPRETE ENGINEERING, INC.
3. THE STANDARD SPECIFICATIONS FOR ROAD & BRIDGE CONSTRUCTION (AMENDED AUGUST 2013) AND ALL APPROVED REVISIONS IN THE COMPILATIONS OF APPROVED SPECIFICATIONS, THE LATEST EDITION OF THE RHODE ISLAND STANDARD DETAILS WITH REVISIONS, THE LATEST MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, THE RIDOT TRAFFIC DESIGN MANUAL (OCTOBER 2004), THE AMERICAN STANDARD FOR NURSERY STOCK (ANSI Z-60.1-1986) AND ALL AMENDMENTS WILL GOVERN.
4. THE LOCATION OF SUBSURFACE UTILITIES SHOWN IS APPROXIMATE AND NOT GUARANTEED TO BE COMPLETE OR ACCURATE. THE CONTRACTOR SHALL VERIFY THE LOCATIONS AND ELEVATIONS OF EXISTING UTILITY LINES AND STRUCTURES PRIOR TO COMMENCEMENT OF WORK. THE CONTRACTOR MUST NOTIFY DIG SAFE PRIOR TO ANY EXCAVATION OR DEMOLITION WORK IN PUBLIC OR PRIVATE WAYS OR UTILITY COMPANY RIGHT OF WAYS OR EASEMENTS.
5. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR, AND THE INFORMATION FURNISHED TO THE ENGINEER FOR THE RESOLUTION OF THE CONFLICT.
6. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.
7. TREES WITHIN THE LIMITS OF GRADING SHALL NOT BE REMOVED UNLESS APPROVED BY THE ENGINEER.

SOIL EROSION AND SEDIMENTATION CONTROL:

1. ALL EROSION AND SEDIMENTATION (E&S) CONTROL MEASURES WILL BE INSTALLED AND INSPECTED PRIOR TO THE START OF CONSTRUCTION. THE E&S CONTROLS SHALL BE CLEANED AND MAINTAINED THROUGHOUT THE DURATION OF CONSTRUCTION OPERATIONS AND UNTIL ALL DISTURBED AREAS ARE STABILIZED AFTER CONSTRUCTION IS COMPLETE. E&S CONTROLS SHALL BE INSPECTED AND CLEANED AFTER ALL STORM EVENTS AND UPON THE REQUEST OF THE OWNER OR ENGINEER. CONTRACTOR WILL MAINTAIN AN ADEQUATE SUPPLY OF SILT SOCK ON SITE TO BE INSTALLED IN AREAS WHERE EXISTING E&S CONTROLS HAVE FAILED OR AS DETERMINED NECESSARY BY THE ENGINEER. NO WORK OR STORAGE OF CONSTRUCTION EQUIPMENT WILL BE PERMITTED OUTSIDE THE LIMIT OF DISTURBANCE ADJACENT TO THE WETLAND. TEMPORARY SOIL EROSION AND SEDIMENTATION CONTROLS (SILT SOCKS, ETC.) SHALL BE MAINTAINED UNTIL ALL EXPOSED SOILS ARE SATISFACTORILY STABILIZED.
2. ALL CATCH BASINS SHALL BE PROTECTED WITH FILTER FABRIC INSERTS IN UNPAVED LOCATIONS AND PAVED OR OTHERWISE IMPERVIOUS AREAS FOR THE DURATION OF THE PROJECT.
3. CONSTRUCTION ENTRANCES CONSISTING OF STONE STABILIZED PAD SHALL BE PROVIDED AND MAINTAINED BY THE CONTRACTOR TO PREVENT TRACKING OF OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS.
4. ALL REFERENCED SOIL EROSION AND SEDIMENTATION CONTROLS INCLUDING MATERIALS USED, APPLICATION RATES AND THE INSTALLATION PROCEDURES SHALL BE PERFORMED PER THE "RHODE ISLAND SOIL EROSION AND SEDIMENTATION CONTROL HANDBOOK", LATEST EDITION, WITH ALL SOIL CONSERVATION SERVICE, AND/OR THE RHODE ISLAND DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.
5. UPON COMPLETION AND ACCEPTANCE OF SITE PREPARATION AND INITIAL INSTALLATION OF EROSION, RUNOFF, AND SEDIMENT CONTROLS AND TEMPORARY POLLUTION PREVENTION MEASURES, THE OPERATOR SHALL INITIATE APPROPRIATE STABILIZATION PRACTICES DURING ALL PHASES OF CONSTRUCTION ON ALL DISTURBED AREAS AS SOON AS POSSIBLE, BUT NOT MORE THAN FOURTEEN (14) DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT AREA HAS TEMPORARILY OR PERMANENTLY CEASED.
6. ANY DISTURBED AREAS THAT WILL NOT HAVE ACTIVE CONSTRUCTION ACTIVITY OCCURRING WITHIN 14 DAYS MUST BE STABILIZED USING THE CONTROL MEASURES, SUCH AS EROSION CONTROL MATTING, AND IN ACCORDANCE WITH APPLICABLE MEASURES SPECIFIED IN THE *RHODE ISLAND SOIL EROSION AND SEDIMENT CONTROL HANDBOOK* (AS AMENDED).
7. SOIL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSPECTED AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND WITHIN TWENTY FOUR HOURS AFTER AN EVENT WHICH GENERATES 0.25 INCHES OF RAIN IN A TWENTY FOUR HOUR PERIOD. CLEANOUT OF ACCUMULATED SEDIMENT BEHIND THE SILT SOCK SHALL BE PERFORMED WHEN ½ THE ORIGINAL HEIGHT OF THE SILT SOCK BECOMES FILLED WITH SEDIMENT. ANY SEDIMENT DEPOSITS REMAINING IN PLACE AFTER THE SILT FENCE HAS BEEN REMOVED SHOULD BE DRESSED TO CONFORM TO THE EXISTING GRADE, PREPARED AND SEEDED.
6. VEGETATIVE PRACTICES ON DISTURBED SOILS, INCLUDING STOCKPILES, SHALL BEGIN AS SOON AS POSSIBLE BUT NO LATER THAN 14 DAYS AFTER THE LAST ACTIVITY IN THAT AREA UNLESS ACTIVITY IS TO RESUME WITHIN 21 DAYS.
7. AREAS HAVING SLOPES GREATER THAN OR EQUAL TO 3H:1V SHALL BE STABILIZED WITH EROSION CONTROL MATS OR BLANKETS IN COMBINATION WITH SEEDING, AS INDICATED ON THE DRAWINGS AND SPECIFIED.
8. EXCESS SOIL, STUMPS, TREES, ROCKS, BOULDERS, AND OTHER REFUSE SHALL BE DISCARDED OFF-SITE IN AN APPROPRIATE UPLAND LOCATION, OUTSIDE OF ALL REGULATED WETLAND AREAS.

REV	DESCRIPTION	DATE	CHK

NOT FOR CONSTRUCTION

BETA GROUP, INC.
701 GEORGE WASHINGTON HGWY.
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www.BETA-Inc.com

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DEVELOPER
NUGEN CAPITAL MANAGEMENT LLC.
267 WATER STREET
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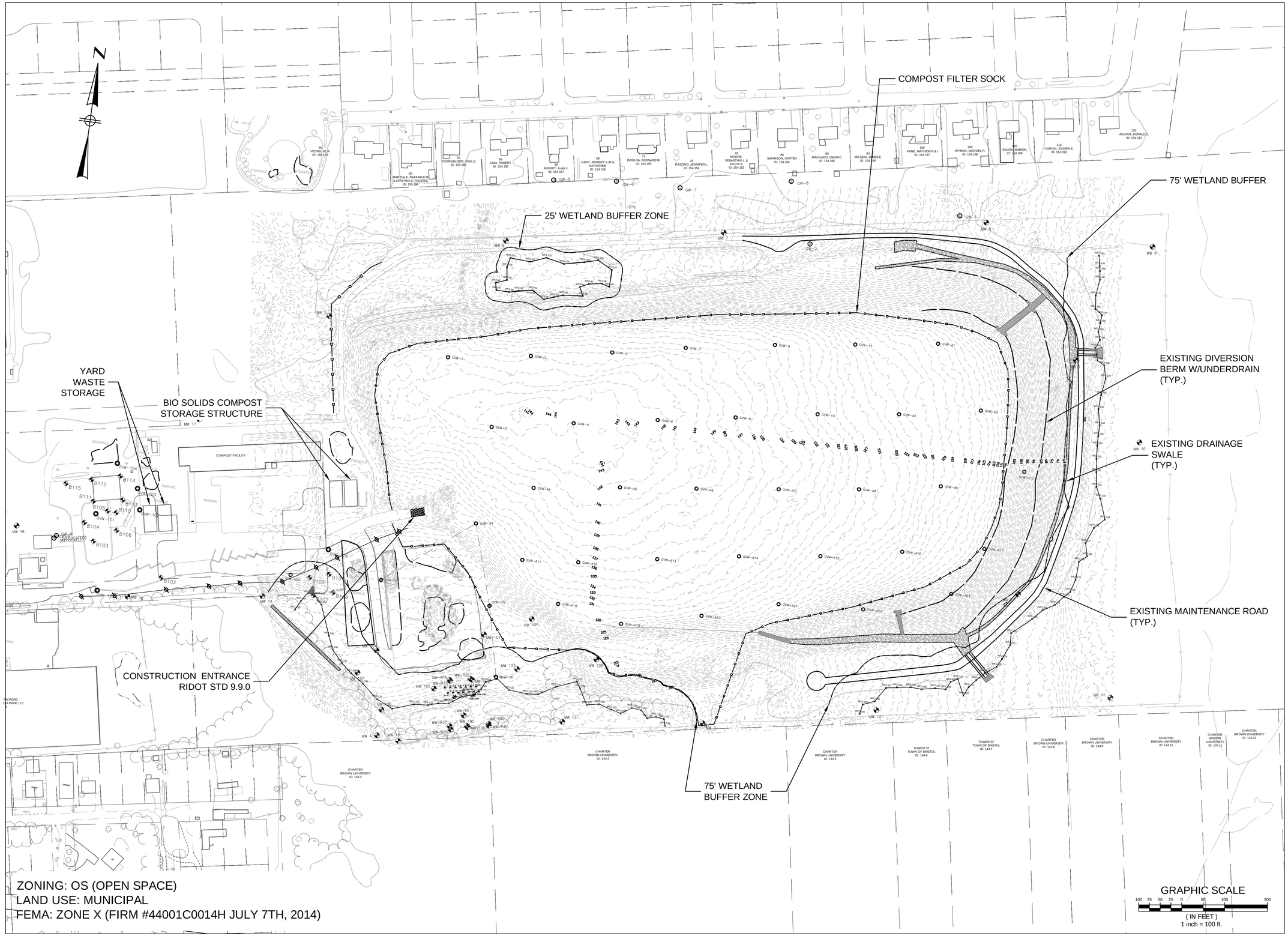
PROJECT NAME AND ADDRESS

BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE

GENERAL NOTES & LEGEND

ENGINEER:	DRAWN BY:
SJR	JC
PROJECT NO.	SHEET NO.
6851	C-001
CREATION DATE	SHEET 2 OF 22
10/16/2020	
SCALE	
NOT TO SCALE	



REV	DESCRIPTION	DATE	CHK

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PROJECT NAME AND ADDRESS

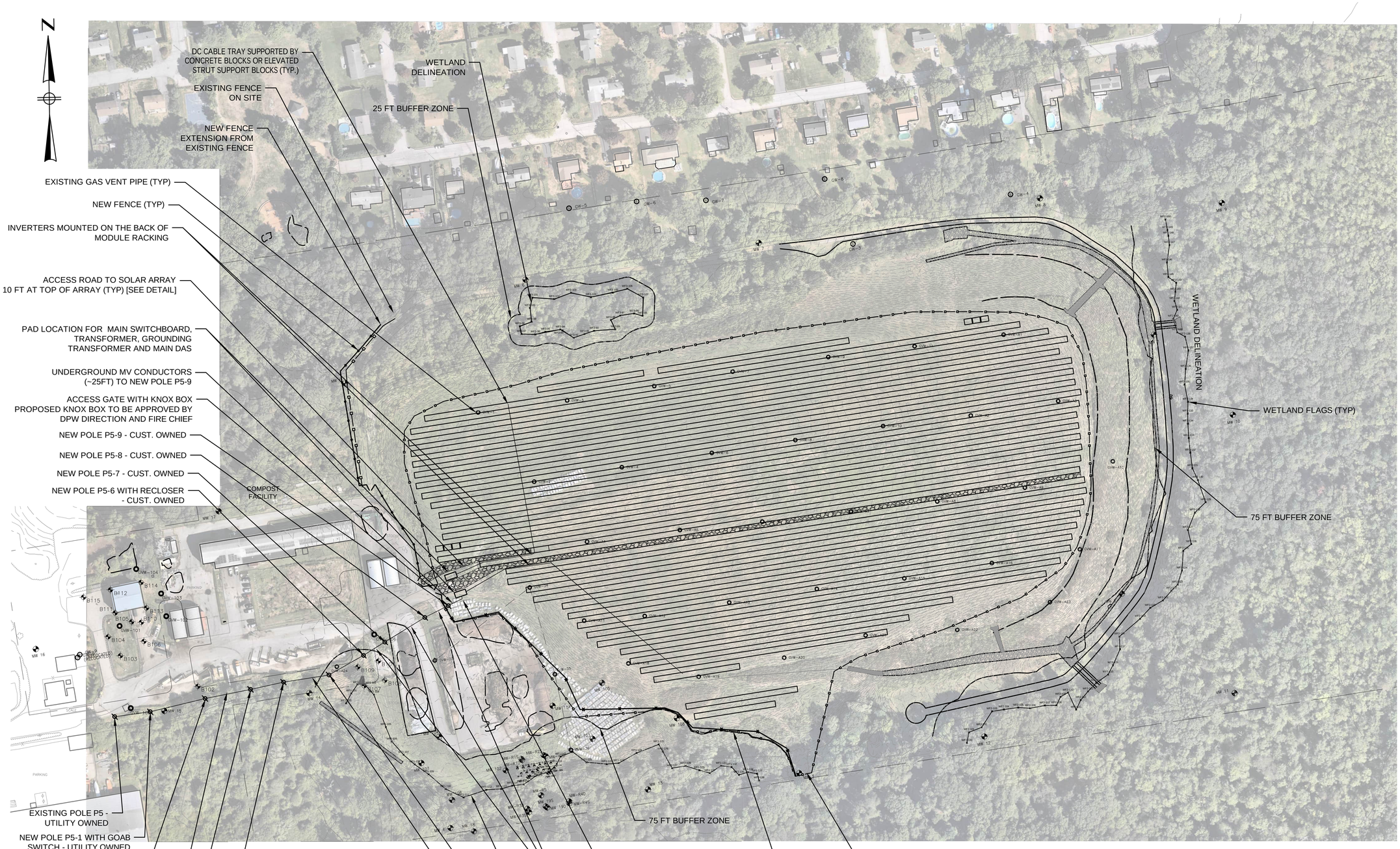
BRISTOL LANDFILL SOLAR

MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE

EXISTING CONDITIONS SITE PREP PLAN

ENGINEER:	DRAWN BY:
SJR	JC
PROJECT NO.: 6851	SHEET NO.: C-100
CREATION DATE: 10/16/2020	SHEET 3 OF 22
SCALE: 1" = 100'	



NOTES:

1. THERE ARE NO PROPOSED GRADE CHANGES.
2. DISTURBED AREAS WILL BE RESTORED ARRORDING TO LANDFILL CAP REQUIREMENTS.
3. FINAL UTILITY POLE LOACTIONS TO BE COODINATED WITH OPERATORS OF THE COMPOSTING OPERATION AND NATIONAL GRID.

GRAPHIC SCALE

100 75 50 25 0 50 100 200

(IN FEET)

1 inch = 100 ft.

REV	DESCRIPTION	DATE	CHK

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PROJECT NAME AND ADDRESS

BRISTOL LANDFILL SOLAR

MINTURN FARM RD
BRISTOL, RI 02809

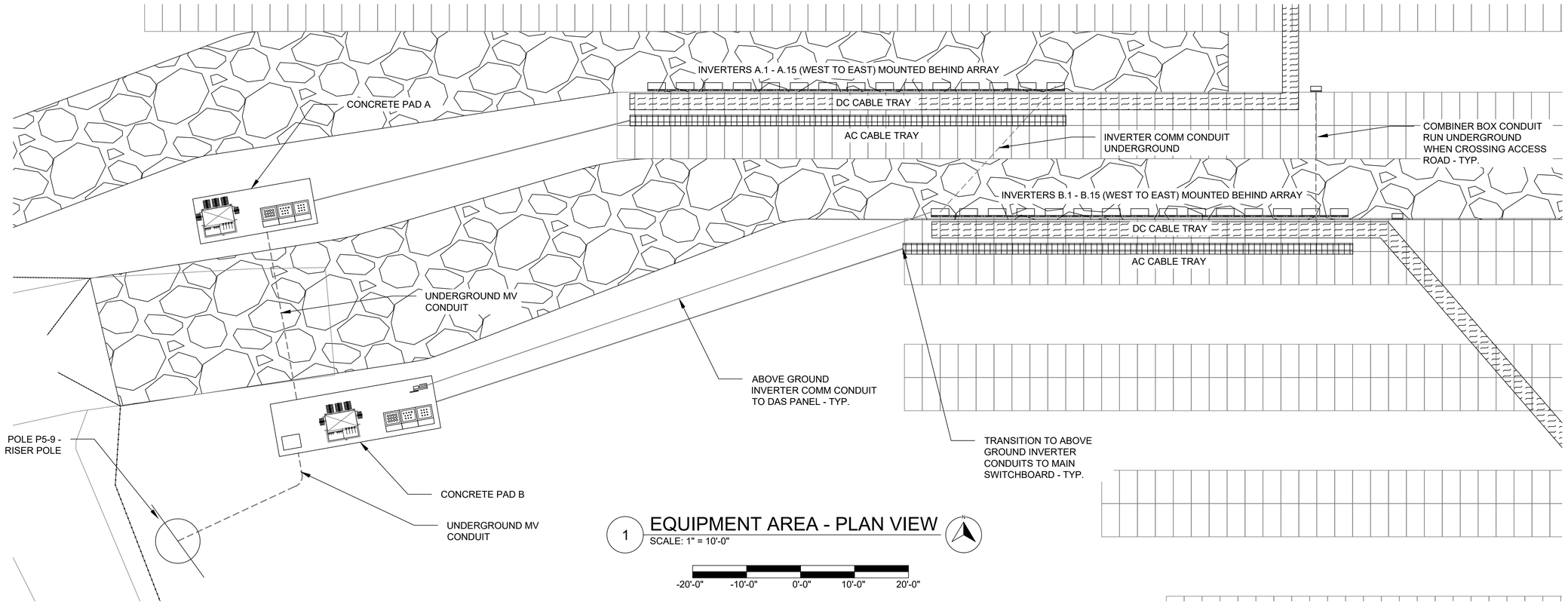
SHEET TITLE

OVERALL ARRAY LAYOUT PLAN

ENGINEER:	DRAWN BY:
SJR	JC
PROJECT NO.	SHEET NO.
6851	**E-100**
CREATION DATE	SHEET 4 OF 22
10/16/2020	
SCALE	
1" = 100'	

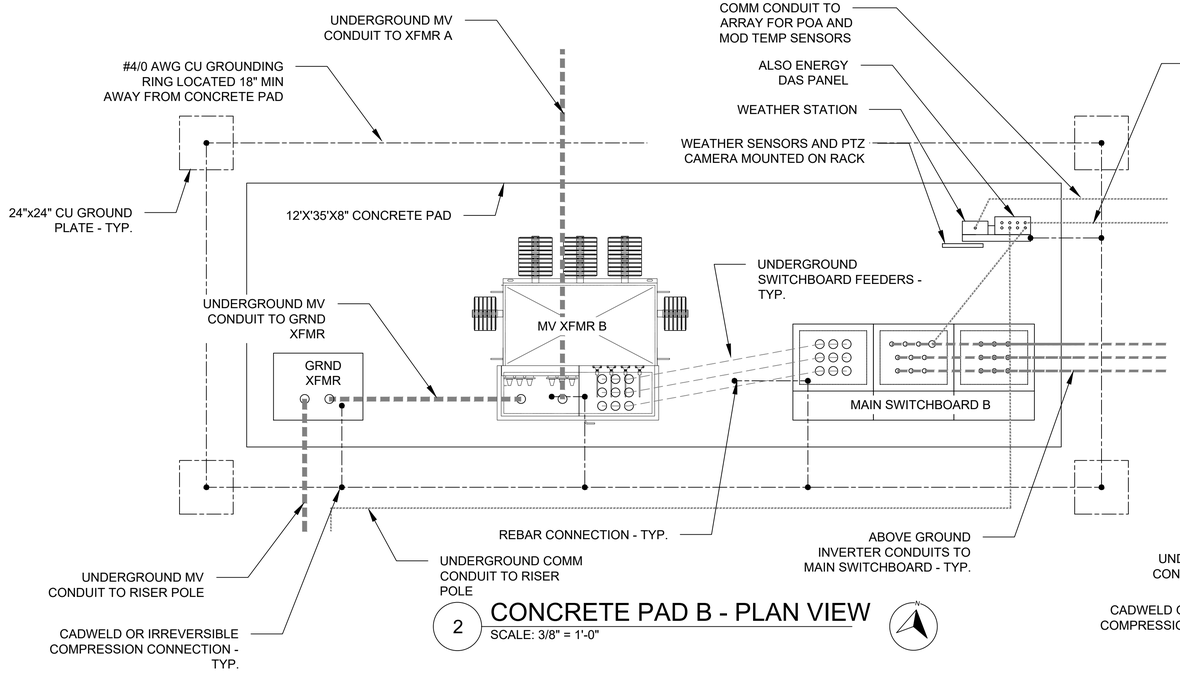
NOTE:

1. CONDUIT ROUTING FOR DIAGRAMMATICAL PURPOSES ONLY. CONTRACTOR TO VERIFY CONDUIT STUB UP PLACEMENT IN THE FIELD.
2. SEE CIVIL DRAWINGS FOR CONCRETE PAD MIX AND INSTALLATION
3. SEE CIVIL DRAWINGS FOR STRUT RACK INSTALLATION, INCLUDING STRUT CHANNEL AND EQUIPMENT ANCHOR SPECIFICATIONS

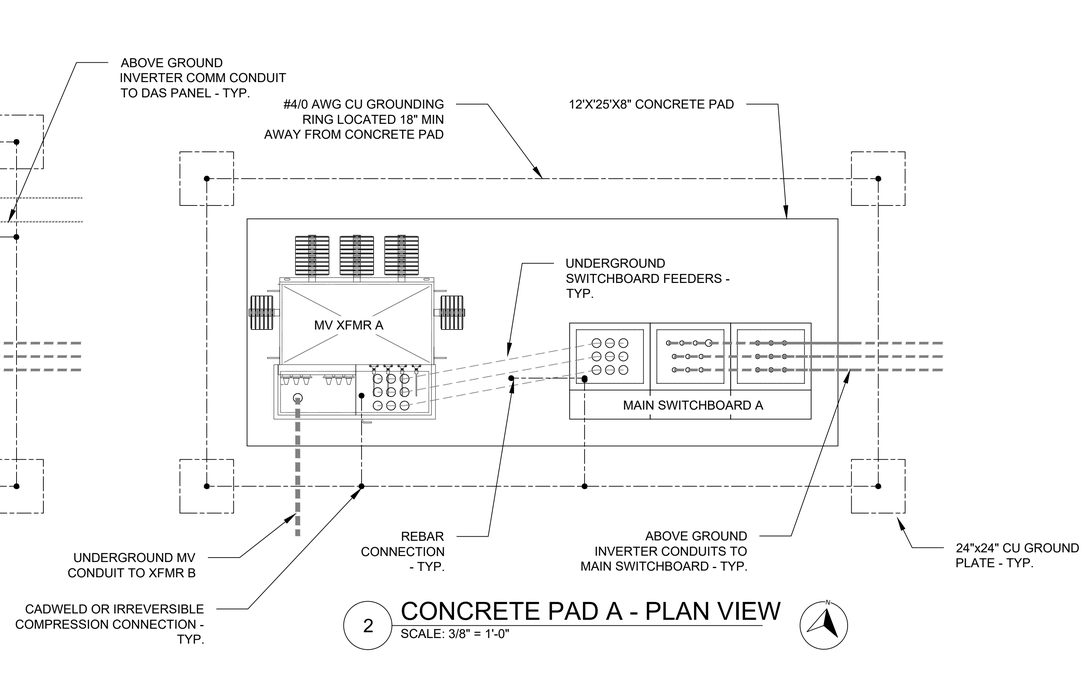


1 EQUIPMENT AREA - PLAN VIEW
SCALE: 1" = 10'-0"

-20'-0" -10'-0" 0'-0" 10'-0" 20'-0"



2 CONCRETE PAD B - PLAN VIEW
SCALE: 3/8" = 1'-0"



2 CONCRETE PAD A - PLAN VIEW
SCALE: 3/8" = 1'-0"

NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	CHK
2	90% DESIGN	01/18/2023	DB
1	90% DESIGN	01/03/2023	DB
0	90% DESIGN	12/15/2022	DB
8	PRELIMINARY LAYOUT	07/05/2022	DB
7	PRELIMINARY LAYOUT	06/13/2022	DB
6	PRELIMINARY LAYOUT	06/10/2022	DB
5	PRELIMINARY LAYOUT	04/25/2022	DB
4	PRELIMINARY LAYOUT	04/22/2022	DB
3	PRELIMINARY LAYOUT	04/12/2022	DB
2	PRELIMINARY LAYOUT	04/05/2022	DB

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DEVELOPER

NUGEN CAPITAL

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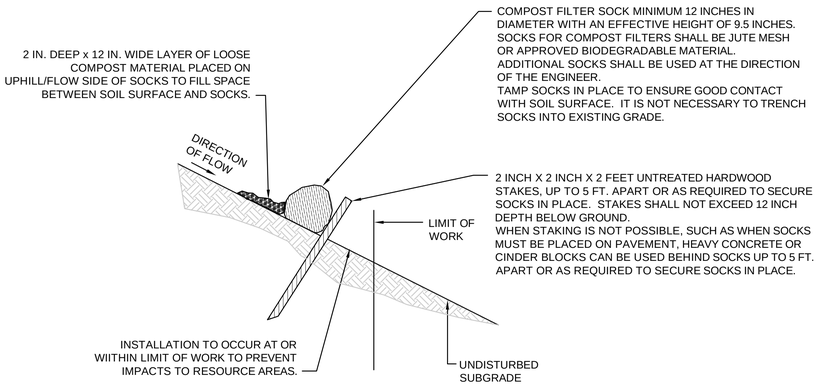
PROJECT NAME AND ADDRESS

BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE

EQUIPMENT AREA PLAN

ENGINEER:	DRAWN BY:
DB	AJ
PROJECT NO. 01-19-001	SHEET NO. E-101
CREATION DATE 12/31/2019	SHEET 5 OF 22

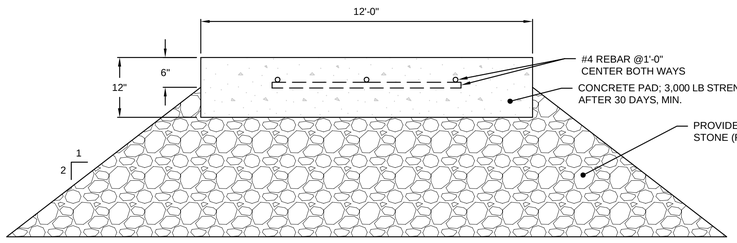


NOTES:

1. PROVIDE A MINIMUM SOCK DIAMETER OF 12 INCHES FOR SLOPES UP TO 50 FEET IN LENGTH WITH A SLOPE RATIO OF 3H:1V OR STEEPER. LONGER SLOPES OF 3H:1V MAY REQUIRE LARGER SOCK DIAMETER OR ADDITIONAL COURSING OF FILTER SOCKS TO CREATE A FILTER BERM. REFER TO MANUFACTURER'S RECOMMENDATIONS FOR SITUATIONS WITH LONGER OR STEEPER SLOPES.
2. INSTALL SOCKS ALONG CONTOURS AND PERPENDICULAR TO SHEET OR CONCENTRATED FLOW.
3. CONFIGURE SOCKS AROUND EXISTING SITE FEATURES TO MINIMIZE SITE DISTURBANCE AND MAXIMIZE CAPTURE AREA OF STORMWATER RUN-OFF.

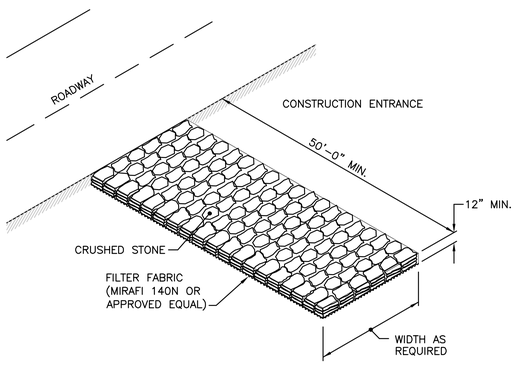
COMPOST FILTER SOCK

NOT TO SCALE



GENERATOR PAD DETAIL

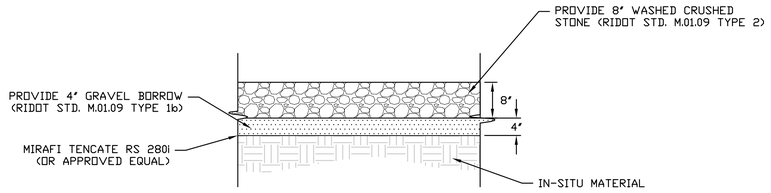
NOT TO SCALE



NOTE:
SHALL BE IN ACCORDANCE WITH SECTION 211 OF THE R.I. STANDARD SPECIFICATIONS.

CONSTRUCTION ACCESS

NOT TO SCALE



GENERAL NOTES:

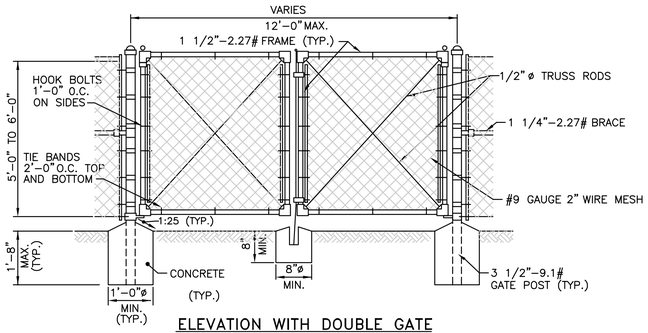
1. USE OF THIS DETAIL IS LIMITED TO CONSTRUCTION AND OCCASIONAL MAINTENANCE OF THE ACCESS DRIVE TO THE TOP OF THE LANDFILL.
2. CROSS SLOPE SHALL BE 2% AND RUNNING SLOPE SHALL NOT EXCEED 10%.
3. IN AREAS OF NO EARTHWORK, THE DRIVE INSTALLED ON UN-COMPACTED IN-SITU MATERIAL. WHERE REQUIRED, A GRAVEL BORROW WEDGE, COMPACTED TO 80% MDD, MAY BE INSTALLED. WEDGE SHALL BE SLOPED AT 2% MINIMUM TO SHED WATER.
4. THE ACCESS DRIVE SHALL BE INSTALLED IN FLUSH WITH EXISTING GRADE.
5. DO NOT OIL, WATER BIND, SEALCOAT, OR CHOKE START
6. DO NOT OVERLAY WITH CONCRETE, ASPHALT PAVEMENT, OR ANY MATERIAL THAT WILL CREATE AN IMPERVIOUS SURFACE
7. APPROPRIATE EROSION AND SEDIMENT CONTROL TECHNIQUES SHALL BE USED DURING CONSTRUCTION TO ENSURE THAT SEDIMENT FINES ARE NOT DEPOSITED WITHIN THE VOIDS OF THE RIDOT STD. M.01.09 TYPE 2 OF THE ACCESS DRIVE.

CRUSHED STONE ACCESS DRIVEWAY DETAIL

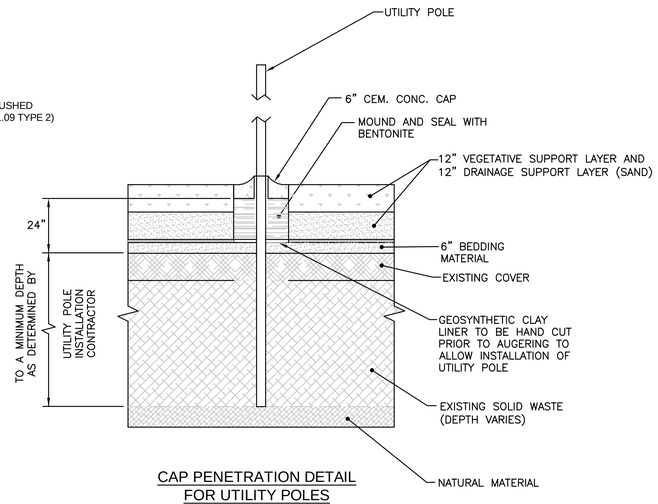
NOT TO SCALE

NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 903 OF THE R.I. STANDARD SPECIFICATIONS.
2. 6 GAUGE STREET CLIPS TO BE USED TO FASTEN SPRING TENSION WIRE TO LINE POST.
3. SPRING TENSION WIRE – NO. 7 GAUGE CORRUGATED HEAVILY GALVANIZED (2.0 OZ. PER SQ. FT.) ALUMINUM COATED (0.4 OZ. PER SQ. FT.)
4. ALL PIPES REFER TO SCHEDULE 40 NOMINAL PIPE SIZES.
5. A 1 1/4"–2.27# TOP RAIL MAY BE SUBSTITUTED FOR THE TOP TENSION WIRE WHEN THE FENCE IS NOT LOCATED IN THE CLEAR ZONE.
6. WHEN A TOP RAIL IS USED, LOCATE THE BRACE RAIL AT 1/2 H.
7. WHEN A TOP RAIL IS USED, DELETE THE BOTTOM SPRING TENSION WIRE.
8. FENCE POST MOST NOT PENETRATE THE GCL LINER IS APPROXIMATELY 24–INCHES BELOW GROUND SURFACE.



ELEVATION WITH DOUBLE GATE

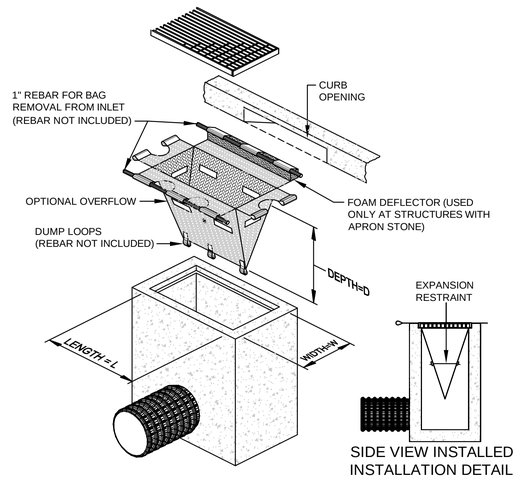


CAP PENETRATION DETAIL FOR UTILITY POLES

NOT TO SCALE

UTILITY POLE GENERAL NOTES

1. UTILITY POLE DETAIL IS PROVIDED TO SHOW THE METHOD OF PENETRATING THE GCL AND RESEALING THE LINER AFTER INSTALLATION ONLY. THE UTILITY CONTRACTOR INSTALLING THE POLES WILL BE RESPONSIBLE FOR DESIGN AND INSTALLATION OF THE POLES.
2. PRIOR TO AUGERING FOR THE UTILITY POLE INSTALLATION, THE AREA SHALL BE HAND OR VACUUM EXCAVATED TO EXPOSE THE GEOSYNTHETIC CLAY LINER.THE LINER SHALL THEN BE CUT TO ACCOMMODATE THE DIAMETER OF THE AUGER.
3. THE UTILITY POLE SHALL BE SEALED BY PLACING 24–INCHES OF BENTONITE AS SHOWN ON THE DETAIL AND APPROVED BY THE ENGINEER.
4. BENTONITE SHALL BE PELLETS OF COMPRESSED OR ROLLED BENTONITE APPROXIMATELY ½–INCH IN DIAMETER SUCH AS "PI–PELLETS" DISTRIBUTED BY PIEZOMETER RESEARCH & DEVELOPMENT CORP., 33 MAGEE AVENUE, STAMFORD CONNECTICUT, 06902.
4. UTILITY POLES SHALL BE GROUTED IN CONCRETE AT THE SURFACE TO PREVENT RAINWATER AND/OR SURFACE WATER FROM ENTERING THE DRILL HOLE.



SIDE VIEW INSTALLED INSTALLATION DETAIL

INLET SEDIMENT CONTROL DEVICE (WITH OPTIONAL CURB DEFLECTOR)

NOT TO SCALE

REV	DESCRIPTION	DATE	CHK

NOT FOR CONSTRUCTION

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DEVELOPER
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WARREN, RI 02885
http://www.nugencapital.com/

PROJECT NAME AND ADDRESS
BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE
CIVIL DETAILS

ENGINEER:	DRAWN BY:
SJR	JC
PROJECT NO.	SHEET NO.
6851	C-101
CREATION DATE	
10/16/2020	
SCALE	SHEET 6 OF 22
NOT TO SCALE	

NOTES:

GENERAL GROUNDING NOTES

1. THE BONDING CONNECTION BETWEEN MODULES IN A SOURCE CIRCUIT SHALL BE SO ARRANGED THAT REMOVAL OF A MODULE FROM THE PV SOURCE CIRCUIT DOES NOT INTERRUPT A GROUND TO ANOTHER PV SOURCE CIRCUIT.

2. MODULES SHALL BE GROUNDED PER MANUFACTURER'S INSTALLATION GUIDELINES. BARE COPPER USED FOR GROUNDING SHALL NOT TOUCH THE MODULE FRAMES.

3. THE DC CIRCUIT GROUNDING CONNECTION SHALL BE MADE AT A SINGLE POINT IN THE INVERTER, PER MANUFACTURER'S INSTALLATION GUIDELINES. [REFERENCE NEC 690.42]

4. EXPOSED NON–CURRENT-CARRYING METAL PARTS OF MODULE FRAMES, EQUIPMENT, AND CONDUCTOR ENCLOSURES SHALL BE GROUNDED IN ACCORDANCE WITH NEC 250.134 OR 250.136(A) REGARDLESS OF VOLTAGE. AN EQUIPMENT GROUNDING CONDUCTOR BETWEEN A PV ARRAY AND OTHER EQUIPMENT SHALL BE REQUIRED IN ACCORDANCE WITH 250.110. [NEC 690.42]

5. RACKING COMPONENTS AND STRUCTURAL SUPPORTS MUST BE ELECTRICALLY BONDED TOGETHER BY AN ACCEPTABLE MEANS.

6. IF APPLICABLE, PAINT/FINISH AT POINT OF CONTACT ON EXPOSED NON-CURRENT CARRYING METAL PARTS SHALL BE PROPERLY REMOVED.

7. EQUIPMENT GROUNDING CONDUCTORS FOR THE PV ARRAY AND STRUCTURE (WHERE INSTALLED) SHALL BE CONTAINED WITHIN THE SAME RACEWAY OR CABLE, OR OTHERWISE RUN WITH THE PV ARRAY CIRCUIT CONDUCTORS WHEN THOSE CIRCUIT CONDUCTORS LEAVE THE VICINITY OF THE PV ARRAY. [NEC 690.43]

8. EQUIPMENT GROUNDING CONDUCTORS AND SYSTEM GROUNDING CONDUCTORS WILL HAVE AS SHORT A DISTANCE TO GROUND AS POSSIBLE AND A MINIMUM NUMBER OF TURNS.

9. GROUNDING SYSTEM COMPONENTS SHALL BE LISTED FOR THEIR PURPOSE, INCLUDING BUT NOT LIMITED TO GROUND RODS, GROUNDING LUGS, GROUNDING CLAMPS, ETC.

PV ARRAY COMMISSIONING

1. BEFORE CLOSING DISCONNECTS OR ATTEMPTING TO ENERGIZE THE INVERTERS, THE FOLLOWING COMMISSIONING PROCEDURE SHALL BE COMPLETED.

1.1. CHECK THE OPEN CIRCUIT VOLTAGE AND POLARITY OF EACH SOURCE CIRCUIT. DOCUMENT THE VALUES.
1.2. CHECK THAT ALL THE FUSES, DISCONNECTS, AND OTHER BALANCE OF SYSTEM COMPONENTS ARE RATED FOR 1500 VDC AND THE APPROPRIATE CURRENT CAPACITY.
1.3. COMPLETE A VISUAL INSPECTION OF ALL THE MODULES AND CONDUCTORS TO CHECK FOR BROKEN GLASS, FRAYED WIRES, DAMAGED OR PINCHED WIRE INSULATION, EXPOSED CONDUCTORS AND OTHER PROBLEMS THAT MAY CAUSE FAULT CONDITIONS. IT WILL BE IN THE SOLE DISCRETION OF THE OWNER IF A CONDUCTOR NEEDS TO BE REPLACED.

INVERTER COMMISSIONING

1. BEFORE TURNING THE INVERTER ON OR CLOSING ANY OF THE INVERTER DISCONNECTS, THE FOLLOWING COMMISSIONING PROCEDURE SHOULD BE COMPLETED. REFER TO THE MANUFACTURER'S INSTALLATION MANUAL FOR DETAILED START UP PROCEDURES.

1.1. CHECK THAT THE INVERTER IS PROPERLY GROUNDED AS DESCRIBED IN THE INSTALLATION MANUAL PROVIDED BY THE MANUFACTURER.
1.2. CHECK THE INVERTER DC INPUT VOLTAGE FOR THE PROPER POLARITY INSIDE THE INVERTER CABINET.
1.3. VERIFY THAT THE DC INPUT VOLTAGE IS WITHIN THE PROPER RANGE FOR THE INVERTER PER THE INSTALLATION MANUAL PROVIDED BY THE MANUFACTURER.
1.4. VERIFY THAT THE AC INPUT VOLTAGE IS IN THE PROPER PHASE SEQUENCE.
1.5. CHECK THAT THE AC GRID VOLTAGE AT THE INVERTER AC TERMINALS IS WITHIN THE PROPER RANGE AS DEFINED BY THE INVERTER RATING LABEL AND THE INSTALLATION MANUAL PROVIDED BY THE MANUFACTURER.

ELECTRICAL WIRING AND WIRING METHODS

1. PV STRING WIRING SHALL BE TYPE PV, #10AWG COPPER CONDUCTOR, UV RESISTANT, 90 DEGREE C, WET RATED.

2. ALL DC CONDUCTORS AND EQUIPMENT IN PV SOURCE AND OUTPUT CIRCUITS SHALL BE RATED 1500V DC MINIMUM.

3. DC SOURCE CIRCUIT CONNECTORS SHALL MATCH THE BRAND AND MODEL OF OEM SUPPLIED CONDUCTORS. NO INTERMATING OF CONNECTORS IS PERMITTED.

4. ALL EXPOSED CABLES, SUCH AS MODULE LEADS SHALL BE SECURED WITH MECHANICAL OR OTHER SUNLIGHT RESISTANT MEANS. THE USE OF PLASTIC UV RATED ZIP TIES ARE NOT ALLOWED FOR SECURING CABLES. PLASTIC ZIP TIES ARE ONLY ALLOWED TO BE USED FOR ORGANIZATION ONLY.

5. DURING CONSTRUCTION, ANY OPEN (UN-MATED) DC SOURCE CIRCUIT CONNECTORS (MC4 TYPE) SHALL AT ALL TIMES BE (I) KEPT OFF THE GROUND AND (II) PROTECTED FROM WATER INTRUSION AND OTHER CONTAMINATION. IF WATER OR OTHER CONTAMINATION GETS INTO THE CONNECTORS, THE CONTRACTOR MUST REPLACE THE CONNECTOR WITH A NEW PART.

6. ALL PVC CONDUIT AND FITTINGS SHALL BE RATED AS UV RESISTANT.

7. THE LAYOUT OF CONDUIT SHOWN IN THE PLANS IS INDICATIVE ONLY. INSTALLER SHALL ROUTE AND LOCATE THE CONDUITS TO SUIT THE SITE CONDITIONS BUT SHALL NOT EXCEED THE CABLE LENGTHS SHOWN IN THE CABLE SCHEDULE WITHOUT PRIOR APPROVAL BY THE ENGINEER OF RECORD.

8. WIRE SIZING IS BASED ON THE WIRE LENGTHS SHOWN ON THE DRAWINGS. IF THE LENGTHS INCREASE, THE ENGINEER OF RECORD SHALL BE NOTIFIED TO CONFIRM SIZING OF CONDUCTORS AND CONDUITS STILL APPLY.

9. UNDERGROUND CONDUITS AND CONDUCTORS SHALL COMPLY WITH THE MINIMUM COVER REQUIREMENTS OF NEC 300.5 AND 300.50.

10. PROVIDE PULL, JUNCTION OR CHRISTY BOXES WHERE REQUIRED TO FACILITATE THE INSTALLATION OF THE WIRING IN ADDITION TO THOSE SHOWN ON THE DRAWINGS. A PULLBOX IS REQUIRED AFTER 360 DEGREES OF CONDUIT BEND.

11. WHERE WATER CAN REASONABLY BE EXPECTED TO FOLLOW A CONDUIT RUN, A PULLBOX SHALL BE USED TO ALLOW WATER TO EXIT THE CONDUIT SYSTEM.

12. PHOTOVOLTAIC SOURCE CIRCUITS AND PHOTOVOLTAIC OUTPUT CIRCUITS SHALL NOT BE CONTAINED IN THE SAME RACEWAY, CABLE TRAY, CABLE, OUTLET BOX, JUNCTION BOX, OR SIMILAR FITTING AS FEEDERS OR BRANCH CIRCUITS OF OTHER SYSTEMS, UNLESS THE CONDUCTORS OF THE DIFFERENT SYSTEMS ARE SEPARATED BY A PARTITION OR ARE CONNECTED TOGETHER. [NEC 690.4 (B)]

13. SUPPORT CONDUIT USING STEEL PIPE STRAPS, LAY-IN ADJUSTABLE HANGERS, CLEVIS HANGERS OR SPLIT-HANGERS. HANGER SPACING SHALL BE INSTALLED AS PER THE NEC REQUIREMENTS FOR THE CONDUIT TYPE.

14. WHEN FIELD CUTTING OF CONDUIT IS REQUIRED, ENSURE THAT THE ENDS ARE CUT SQUARE AND DEBURRED.

15. CONDUIT SIZES NOT SPECIFIED SHALL MEET THE NEC FILL REQUIREMENTS AND SHALL NOT BE SMALLER THAN 3/4" IN DIAMETER.

16. CONNECTORS SHALL BE TORQUED PER DEVICE LISTING OR MANUFACTURER'S RECOMMENDATION. IN THE ABSENCE OF MANUFACTURER TORQUE VALUES, REFERENCE NEC ANNEX I.

17. BECAUSE OF DIFFERENT CHARACTERISTICS OF DISSIMILAR METALS, DEVICES SUCH AS PRESSURE TERMINAL OR PRESSURE SPLICING CONNECTORS AND SOLDERING LUGS SHALL BE IDENTIFIED FOR THE MATERIAL OF THE CONDUCTOR AND SHALL BE PROPERLY INSTALLED AND USED. CONDUCTORS OF DISSIMILAR METALS SHALL NOT BE INTERMIXED IN A TERMINAL OR SPLICING CONNECTOR WHERE PHYSICAL CONTACT OCCURS BETWEEN DISSIMILAR CONDUCTORS (SUCH AS COPPER AND ALUMINUM, COPPER AND COPPER-CLAD ALUMINUM, OR ALUMINUM AND COPPER-CLAD ALUMINUM), UNLESS THE DEVICE IS IDENTIFIED FOR THE PURPOSE AND CONDITIONS OF USE. MATERIALS SUCH AS SOLDER, FLUXES, INHIBITORS, AND COMPOUNDS, WHERE EMPLOYED, SHALL BE SUITABLE FOR THE USE AND SHALL BE OF A TYPE THAT WILL NOT ADVERSELY AFFECT THE CONDUCTORS, INSTALLATION, OR EQUIPMENT. [NEC 110.14]

18. HEAT SHRINK WRAP SHALL BE USED AT THE AC TERMINATIONS OF INVERTER WIRING BOX FOR INVERTER AC CIRCUITS

19. TERMINALS, SPLIT BOLTS, SPLICES, CONNECTORS SHALL BE INSTALLED IN ACCORDANCE TO NEC 110.14 OR PER MANUFACTURER'S GUIDELINES. ALL TERMINALS SHALL BE RATED 75°C MINIMUM.

20. CONTRACTOR SHALL PROVIDE AND INSTALL PRINTED WIRE MARKERS AT ALL CONDUCTOR TERMINATIONS, INCLUDING BOTH ENDS OF THE CIRCUIT. WIRE MARKERS SHALL BEAR THE WIRE NUMBER, CIRCUIT OR STRING NUMBER AS INDICATED ON THE DRAWINGS.

21. THE INSTALLER SHALL USE PERMANENTLY COLOR CODED INSULATION PER THE COLOR WIRE COLOR TABLE BELOW. PHASE TAPE IS NOT ALLOWED.

WIRE COLOR TABLE

VOLTAGE	PHASE	COLOR
MEDIUM VOLTAGE	A	BLACK
	B	RED
	C	BLUE
600V OR 480V, 3Ø	A	BROWN
	B	ORANGE
	C	YELLOW
240V OR 208V, 3Ø	A	BLACK
	B	RED
	C	BLUE
240/120V 1Ø	L1	BLACK
	L2	RED
AC NEUTRAL	N	WHITE
GROUND	G	GREEN OR BARE
DC POS	+	RED
DC NEG	-	BLACK

GENERAL NOTES

1. INSTALLER SHALL CONTACT UNDERGROUND SERVICES ALERT FOR LOCATION OF UNDERGROUND UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION.

2. THE INSTALLER SHALL BECOME FAMILIAR WITH ALL UTILITY AS-BUILT PLANS AND THE LOCATIONS OF ALL EXISTING UTILITIES AND STRUCTURES. THE INSTALLER SHALL BE RESPONSIBLE FOR ANY DAMAGE TO EXISTING UTILITIES, STRUCTURES, PAVEMENT OR IMPROVEMENTS.

3. INSTALLER SHALL VERIFY EXISTING CONDITIONS AND NOTIFY THE OWNER AND ENGINEER OF RECORD OF DISCREPANCIES REQUIRING FURTHER CLARIFICATION BEFORE PROCEEDING WITH THE WORKS.

4. INSTALLER SHALL ASSUME FULL RESPONSIBILITY AND LIABILITY FOR COMPLIANCE WITH REGULATIONS PER FEDERAL OSHA AND LOCAL REGULATIONS PERTAINING TO WORK PRACTICES, PROTECTION OF WORKERS AND VISITORS TO THE SITE.

5. INSTALLER SHALL VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS AT SITE BEFORE COMMENCING WORK.

6. INSTALLER INITIATED CHANGES SHALL BE SUBMITTED IN WRITING TO THE ENGINEER OF RECORD FOR APPROVAL PRIOR TO MAKING ANY CHANGES. APPROVED CHANGES SHALL REQUIRE A DRAWING REVISION TO MAINTAIN CONTROL OVER THE DESIGN. DEVIATION FROM THE THE APPROVED PLANS PRIOR TO ENGINEER APPROVAL SHALL PLACE LIABILITY ONTO THE INSTALLER.

7. EQUIPMENT SUBSTITUTIONS ARE TO BE APPROVED BY THE OWNER AND ENGINEER OF RECORD.

8. ALL MATERIALS SHALL BE IN NEW AND UNUSED CONDITION.

9. MANUFACTURER'S MATERIAL, EQUIPMENT, ETC. SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS AND INSTRUCTIONS.

10. ALL WORK SHALL BE INSTALLED IN CONFORMANCE WITH ALL APPLICABLE LOCAL CODES AND ORDINANCES BY EXPERIENCED WORKFORCE AND DULY LICENSED CONTRACTORS WHO SHALL OBTAIN ALL NECESSARY PERMITS AND REGISTRATIONS WITH APPLICABLE STATE AND LOCAL COUNTY OFFICIALS, AND PAY ALL ASSOCIATED AND APPLICABLE FEES FOR SUCH.

11. INSTALL ALL ASPECTS OF THIS PROJECT IN ACCORDANCE WITH THE SPECIFICATIONS AND AS NOTED ON DRAWINGS ISSUED FOR CONSTRUCTION.

12. FOLLOW ALL SITE-SPECIFIC POLICIES AND THE OWNER'S POLICIES AND PROCEDURES REGARDING SAFETY AND ENVIRONMENTAL REQUIREMENTS IN ADDITION TO ANY PERMIT REQUIREMENTS.

13. ANY METAL SHAVINGS RESULTING FROM SITE WORK SHALL BE CLEANED FROM THE ENCLOSURE INTERIORS BEFORE POWER OR GROUND CONDUCTORS ARE INSTALLED.

14. ANY STRUT HOLES PUNCHED IN WORK BOXES SHOULD BE DE-BURRED AND REPAINTED WITH COLD GALVANIZING PAINT.

GENERAL ELECTRICAL NOTES

1. ALL ELECTRICAL MATERIALS AND EQUIPMENT SHALL BE NEW AND SHALL BE CERTIFIED BY A NATIONALLY RECOGNIZED TESTING LAB TO A UL SPECIFICATION PERTAINING TO THE PRODUCT. IN ADDITION, THE MATERIALS, EQUIPMENT, AND INSTALLATION SHALL COMPLY WITH THE REQUIREMENTS OF THE FOLLOWING:

1.1. AMERICAN SOCIETY OF TESTING MATERIALS (ASTM)
1.2. INSULATED POWER CABLE ENGINEERS ASSOCIATION (IPCEA)
1.3. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
1.4. AMERICAN STANDARD ASSOCIATION (ASA)
1.5. NATIONAL FIRE PROTECTION AGENCY (NFPA)
1.6. AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)
1.7. NATIONAL ELECTRICAL CODE (NEC) - 2017
1.8. NATIONAL ELECTRICAL SAFETY CODE (NESC) - 2017
1.9. INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)
1.10. ALL LOCAL CODES HAVING JURISDICTION
1.11. SUPPORT SYSTEM BONDING PATH PER UL 2703
1.12. CABLE MANAGEMENT PER UL 62275
1.13. INVERTERS PER UL 1741

2. INSTALLER IS ADVISED THAT ALL DRAWINGS AND COMPONENT MANUALS ARE TO BE READ AND UNDERSTOOD PRIOR TO INSTALLATION OR ENERGIZATION OF ANY EQUIPMENT. THE INSTALLER IS ALSO ADVISED TO HAVE ALL COMPONENT SWITCHES IN THE OPEN POSITION AND FUSES REMOVED PRIOR TO INSTALLATION OF FUSE-BEARING COMPONENTS.

3. THE PHOTOVOLTAIC SYSTEM SHALL BE INSTALLED PER THE APPLICABLE VERSION OF THE NATIONAL ELECTRICAL CODE OR LOCAL CODE THAT MAY SUPERSEDE.

4. THE INSTALLER IS RESPONSIBLE FOR THE PROCUREMENT OF EQUIPMENT AND MATERIALS THAT WILL LAST THE DESIGN LIFE OF THE SYSTEM.

5. DURING DAYLIGHT HOURS DC VOLTAGE FROM THE ARRAY IS ALWAYS PRESENT AT THE MODULE PIGTAIL TERMINAL AND THE DC TERMINALS ON THE INVERTER. ALL PERSONS WORKING ON OR INVOLVED WITH THE INSTALLATION OF THIS PV SYSTEM MUST BE MADE OF AWARE OF THIS FACT.

6. SAFETY REGULATIONS, SUCH AS LOCK OUT AND TAG PROCEDURES, SHALL BE OBSERVED BY THE INSTALLER DURING CONSTRUCTION.

7. ALL PORTIONS OF THE PV SYSTEM SHALL BE MARKED AS REQUIRED PER NATIONAL ELECTRICAL CODE ARTICLE 690.

8. CONDUIT AND CABLE ROUTING SHOWN IS DIAGRAMMATIC. CONTRACTOR SHALL LAY OUT RUNS TO SUIT FIELD CONDITIONS AND THE COORDINATION REQUIREMENTS OF OTHER TRADES.

9. CONTRACTOR SHALL PREPARE AND SUBMIT SHOP DRAWINGS OF DEVIATIONS FROM DESIGNED WIRING OR ROUTING DETAILS.

10. SEAL CONDUIT ENDS WITH FOAM OR CAULK AT ENCLOSURE ENTRY POINTS TO MINIMIZE CONDENSATION AND PESTS WITHIN ENCLOSURES.

11. NEMA 3 BOXES SHALL BE EQUIPPED WITH A WEEP HOLE OR LISTED DRAIN PLUGS INSTALLED TO ALLOW WATER TO DRAIN.

12. ALL CONDUIT BENDS SHALL CONFORM TO NEC MINIMUM BEND RADII STANDARDS.

13. ALL ABOVE GRADE CONDUIT RUNS SHALL BE SECURELY FASTENED AT INTERVALS IN ACCORDANCE WITH THE NEC.

14. MINIMUM CLEARANCE BETWEEN ALL NEW EQUIPMENT TO BE INSTALLED AND ANY NEW SHALL BE IN ACCORDANCE WITH NEC 110.26.

15. ALL OUTDOOR EQUIPMENT SHALL BE APPROPRIATELY RATED PER NEC 110.20, INCLUDING OUTDOOR MOUNTED JUNCTION BOXES, COMBINER BOXES AND SWITCHES.

TESTING NOTES

1. AC CONDUCTOR MEGGER TEST REQUIREMENT (600VAC CIRCUITS):

1.1. CONDUCTOR BEING TESTED IS NOT TERMINATED
1.2. TEST VOLTAGE SET TO 1000V OR HIGHER
1.3. TEST REPORT TO INCLUDE DETAILS ON TECHNICIAN PERFORMING TEST, DATE/TIME, AMBIENT TEMP AT TIME OF TEST, AND TEST VOLTAGE
1.4. RECORD THE FOLLOWING VALUES FOR EACH CONDUCTOR (60 SECOND TEST FOR EACH CONDUCTOR):
1.4.1 MEGGER VALUE AT 30 SECONDS
1.4.2 MEGGER VALUE AT 60 SECONDS
1.5. MINIMUM ACCEPTABLE TEST RESULTS:
1.5.1 READING AT 60 SECONDS MUST EXCEED 100 MEGAOHMS
1.5.2 READING FOR EACH CONDUCTOR MUST CONTINUALLY CLIMB OR MAX OUT METER VALUE THROUGHOUT 60 SECOND TEST
1.6. IF ANY OF THE MINIMUM TEST THRESHOLD ARE NOT MET IT IS THE DISCRETION OF THE OWNER TO EITHER (A) ACCEPT THE CONDUCTOR AS IS OR (B) REQUIRE THE CONTRACTOR TO INSTALL A NEW CONDUCTOR IN ITS PLACE AND PERFORM THE SAME TEST.

2. DC CONDUCTOR MEGGER TEST REQUIREMENT (1500VDC CIRCUITS):

2.1. CONDUCTOR BEING TESTED IS NOT TERMINATED (NO CONDUCTORS LANDED IN INVERTER WIRING BOX)
2.2. CONFIRM POLARITY TO GROUND FOR EACH CONDUCTOR
2.3. TEST VOLTAGE SET TO 2000V OR HIGHER
2.4. TEST REPORT TO INCLUDE DETAILS ON TECHNICIAN PERFORMING TEST, DATE/TIME, AMBIENT TEMP AT TIME OF TEST, AND TEST VOLTAGE
2.5. RECORD THE FOLLOWING VALUES FOR EACH CONDUCTOR (60 SECOND TEST FOR EACH CONDUCTOR):
2.5.1. MEGGER VALUE AT 30 SECONDS
2.5.2. MEGGER VALUE AT 60 SECONDS
2.6. MINIMUM ACCEPTABLE TEST RESULTS:
2.6.1 READING AT 60 SECONDS MUST EXCEED 100 MEGAOHMS
2.6.2 READING FOR EACH CONDUCTOR MUST CONTINUALLY CLIMB OR MAX OUT METER VALUE THROUGHOUT 60 SECOND TEST
2.7. IF ANY OF THE MINIMUM TEST THRESHOLD ARE NOT MET IT IS THE DISCRETION OF THE OWNER TO EITHER (A) ACCEPT THE CONDUCTOR AS IS OR (B) REQUIRE THE CONTRACTOR TO INSTALL A NEW CONDUCTOR IN ITS PLACE AND PERFORM THE SAME TEST.

3. DC SOURCE CIRCUIT VOC TEST REQUIREMENT (1500VDC CIRCUITS):

3.1. CONDUCTORS BEING TESTED SHALL BE TERMINATED ON BOTH ENDS OF CIRCUIT (CONNECTORS IN ARRAY, WIRING BOX AT INVERTER)
3.2. INVERTER DC FUSES SHALL BE OPENED AND INVERTER DC SWITCH IS IN OPEN POSITION
3.3. TEST REPORT TO INCLUDE DETAILS ON TECHNICIAN PERFORMING TEST, DATE/TIME AND AMBIENT TEMP AT TIME OF TEST
3.4. CONFIRM POLARITY IS CORRECT ON ALL STRINGS PRIOR TO VOC TESTING
3.5. TEST AND RECORD VALUE OF VOLTAGE BETWEEN POSITIVE AND NEGATIVE OF EACH STRING
3.6. IF ANY VOC READINGS ARE SIGNIFICANTLY DEVIATED FROM EITHER (A) OTHER STRINGS WITHIN THE INVERTER OR (B) THE EXPECTED VALUE BASED ON MODULE VOC MULTIPLIED BY THE NO. OF MODULES IN THE STRING, THEN CONTRACTOR MUST FURTHER INVESTIGATE THE CAUSE OF THE DEVIATION AND TAKE CORRECTIVE ACTION AS NECESSARY

4. MV CONDUCTOR VLF WITHSTAND TEST REQUIREMENT (MV CIRCUITS):

4.1. CONDUCTORS BEING TESTED SHALL BE ISOLATED AT BOTH ENDS OF CIRCUIT (CONNECTORS IN TRANSFORMER, SURGE ARRESTORS, ETC.)
4.2. ALL CIRCUIT CONDUCTORS NOT UNDER TEST, INCLUDING CABLE SHIELDS AND NEARBY EQUIPMENT, SHALLED BE GROUNDED
4.3. TEST REPORT TO INCLUDE DETAILS ON TECHNICIAN PERFORMING TEST, DATE/TIME, AMBIENT TEMP AT TIME OF TEST, TEST VOLTAGE AND FREQUENCY
4.4. TEST AND RECORD VALUE OF MEASUREMENTS FROM TEST
4.5. IF ANY OF THE MINIMUM TEST THRESHOLD ARE NOT MET IT IS THE DISCRETION OF THE OWNER TO EITHER (A) ACCEPT THE CONDUCTOR AS IS OR (B) REQUIRE THE CONTRACTOR TO INSTALL A NEW CONDUCTOR IN ITS PLACE AND PERFORM THE SAME TEST.

NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	CHK
1	90% DESIGN	01/03/2023	DB
0	90% DESIGN	12/15/2022	DB
8	PRELIMINARY LAYOUT	07/05/2022	DB
7	PRELIMINARY LAYOUT	06/13/2022	DB
6	PRELIMINARY LAYOUT	06/10/2022	DB
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4	PRELIMINARY LAYOUT	04/22/2022	DB
3	PRELIMINARY LAYOUT	04/12/2022	DB
2	PRELIMINARY LAYOUT	04/05/2022	DB

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PROJECT NAME AND ADDRESS

BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE

ELECTRICAL NOTES

ENGINEER:	DRAWN BY:
DB	AJ
PROJECT NO.: 01-19-001	SHEET NO.: E-010
CREATION DATE: 12/31/2019	SHEET 7 OF 22

ELECTRICAL SYMBOLS:

PV MODULE

INVERTER

DC-DC CONVERTER

MPPT — MPPT BLOCK

CIRCUIT BREAKER

DRAW OUT CIRCUIT BREAKER

DISCONNECT SWITCH

GANG OPERATE AIR BREAK SWITCH

FUSED CUTOUT

M — METER

CURRENT TRANSFORMER

CPT TRANSFORMER

FUSE

GFI DUPLEX RECEPTACLE

Φ — PHASE

R — RECLOSER

WYE

WYE-GROUNDED

DELTA

GROUND CONNECTION

TRANSFORMER

CONTINUATION SYMBOL

MCOV — SURGE ARRESTER

OVERHEAD POLE

ZIG-ZAG TRANSFORMER

NEUTRAL GROUNDING REACTOR

AUXILIARY CONTACTS

LOW ENERGY ANALOG VOLTAGE INPUT

ELECTRICAL ABBREVIATIONS:

A/AMP - AMPERE
AAC - ALL ALUMINUM CONDUCTOR
ACSR - ALUMINUM CONDUCTOR STEEL REINFORCED
AMB TEMP - AMBIENT TEMPERATURE
AC - ALTERNATING CURRENT
AG - ABOVE GROUND
AL - ALUMINUM
APPROX - APPROXIMATELY
AWG - AMERICAN WIRE GAUGE
BLDG - BUILDING
C.F. - CORRECTION FACTOR
CAT - CATEOGRY
CONC - CONCRETE
CONT - CONTINUOUS
CT - CURRENT TRANSFORMER
CU - COPPER
DC - DIRECT CURRENT
DISC - DISCONNECT
DWG - DRAWING
EA - EACH
EGC - EQUIPMENT GROUNDING CONDUCTOR
EXP. - EXPANSION
ELEV - ELEVATION
ELEC - ELECTRICAL
EMT - ELECTRICAL METAL TUBING
FLEX - FLEXIBLE
FMC - FLEXIBLE METAL CONDUIT
FT - FEET
G - GROUND
GC - GENERAL CONTRACTOR
GCR - GROUND COVERAGE RATIO
GEC - GROUNDING ELECTRODE CONDUCTOR
GEN - GENERAL
HT - HEIGHT
IBC - INTERNATIONAL BUILDING CODE
IFC - INTERNATIONAL FIRE CODE
IMC - INTERMEDIATE METAL CONDUIT
IMPP - MXIMUM POWER POINT CURRENT
INV - INVERTER
ISC - SHORT CIRCUIT CURRENT
JB - JUNCTION BOX
KCMIL - 1000 CIRCULAR MILS
KV - KILO-VOLT
KVA - KILO VOLT-AMPERE
KW - KILOWATT
KWH - KILOWATT-HOUR
KWP - KILOWATT PEAK
LFMC - LIQUIDTIGHT FLEXIBLE METAL CONDUIT
LSIG - LONG SHORT INSTANTEOUS GROUND
LTP - LONG TIME PICKUP
LV - LOW VOLTAGE
MAX - MAXIMUM
MDP - MAIN DISTRIBUTION PANEL
MCOV - MAXIMUM CONTINUOUS OPERATING VOLTAGE
MFG - MANUFACTURER
MIN - MINIMUM
MISC - MISCELLANEOUS
MLO - MAIN LUGS ONLY
MODS - MODULES
MPPT - MAXIMUM POWER POINT TRACKING
MW - MEGAWATT
MWH - MEGAWATT-HOURS
MWP - MEGAWATT0PEAK
MV - MEDIUM VOLTAGE
N - NEUTRAL
N/A - NOT AVAILABLE
NEC - NATIONAL ELECTRICAL CODE
NEG - NEGATIVE
NEMA - NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NTS - NOT TO SCALE
OC - ON CENTER
OCPD - OVERCURRENT PROTECTION DEVICE
PNB - PV PANELBOARD
POCC - POINT OF COMMON COUPLING
POI - POINT OF INTERCONNECTION
PSF - POUNDS PER SQUARE FOOT
PT - POTENTIAL TRANSFORMER
PV - PHOTOVOLTAIC
PVC - POLYVINYL CHLORIDE
REF - REFERENCE
RMC - RIGID METAL CONDUIT
SCH - SCHEDULE
SECT - SECTION
SHT - SHEET
SQFT - SQUARE FEET
SS - STAINLESS STEEL
STC - STANDARD TEST CONDITIONS
STR - STRING
STL - STEEL
SWBD - SWITCHBOARD
SWGR - SWITCHGEAR
SYM - SYMMETRICAL
TEMP - TEMPERATURE
THWN - THERMOPLASTIC HEAT & WATER RESISTANT NYLON
TYP - TYPICAL
UG - UNDERGROUND
V - VOLTAGE
VD - VOLTAGE DROP
VMPP - MAXIMUM POWER POINT VOLTAGE
VOC - OPEN CIRCUIT VOLTAGE
W/ - WITH
W/O - WITHOUT
W - WIRE
WT - WEIGHT
XFMR - TRANSFORMER
XHHW - XLPE HIGH HEAT-RESISTANT WATER-RESISTANT
XLPE - CROSSLINKED POLYETHYLENE

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PROJECT NAME AND ADDRESS

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SHEET TITLE

ELECTRICAL NOTES

ENGINEER:	DRAWN BY:
DB	AJ
PROJECT NO.: 01-19-001	SHEET NO.: E-011
CREATION DATE: 12/31/2019	SHEET 8 OF 22

Hansol

Mono 72 cells (320~360Watt)

Those who dream of a better future can help lead to a more meaningful and enriched world.
As a leading solar module manufacturer in Korea, we never stop to achieve competitiveness through differentiation, implement the maximum value, and commit to sustainable development with customers.

Key Features

- **Linear Performance Warranty** — 10 Years product warranty, 25 Years linear performance warranty
- **Certified Durability** — 5400 Pa snow load, 2400 Pa wind load
- **1500V** — Designed for UL 1500 and TUV 1500, Saving BOS costs
- **PID Free** — Anti-PID Cell, Anti-PID encapsulation technology

Optional Features

- **Floating PV Installation** — Module backside blocks moisture permeability
- **Power Optimization** — Increase the energy output of each individual panel in a system to enhance O&M, shade and age tolerance
- **Black Frame** — Sleek and aesthetic appearance

Product Certificates

IEC 61215 / IEC 61730 : TUV / CE
IEC 61701 Salt Mist Corrosion Level 6
UL 1703 Fire Rating Type 1

Hansol
www.solar.hansoltechnics.com
Everlasting sustainable energy solution provider

Mono - Crystalline Solar Module (TD-AN3)

72 cells (320~360Watt)

Electrical Data / STC (TD-AN3) : Irradiance of 1000W/㎡, spectrum AM 1.5 and cell temperature of 25°C

Nominal Max Power	Pmax (Wp)	320	325	330	335	340	345	350	355	360
Voltage at Pmax	Vmp (v)	36.4	36.8	37.2	37.6	38.0	38.4	38.8	39.2	39.6
Current at Pmax	Imp (A)	8.80	8.84	8.88	8.92	8.95	8.99	9.03	9.06	9.10
Open Circuit Voltage	Voc (v)	45.0	45.4	45.8	46.2	46.6	47.0	47.4	47.8	48.2
Short Circuit Current	Isc (A)	9.38	9.42	9.46	9.50	9.54	9.58	9.62	9.65	9.69
Module Efficiency	%	16.05%	16.30%	16.55%	16.80%	17.05%	17.30%	17.55%	17.80%	18.05%
Operating Temperature	-40°C ~ +85°C									
Max. System Voltage	1500 Vdc TUV, 1500 Vdc UL									
Max. Service Fuse Rating	20A									
Max. Reverse Current	20A									
Power tolerance	0 ~ +4.99W									

Electrical Data / NOCT (TD-AN3) : Irradiance of 800W/㎡, spectrum AM 1.5 and ambient temperature of 20°C, wind speed 1m/s

Nominal Max Power	Pmax (Wp)	233.4	237	240.7	244.3	247.8	251.4	255.1	258.6	262.4
Voltage at Pmax	Vmp (v)	33.2	33.5	33.9	34.2	34.5	34.9	35.2	35.6	35.9
Current at Pmax	Imp (A)	7.04	7.07	7.11	7.14	7.17	7.21	7.24	7.27	7.31
Open Circuit Voltage	Voc (v)	41.2	41.6	41.9	42.3	42.6	43.0	43.3	43.7	44.0
Short Circuit Current	Isc (A)	7.57	7.60	7.63	7.66	7.70	7.73	7.76	7.78	7.82

Mechanical Data

Cell Type	Mono-crystalline, 6 inch
Cell Arrangement	72 (6 x 12)
Dimensions	1994 x 1000 x 40mm
Weight	22.5kg (49.6 lbs)
Frame	Anodized aluminum
Front glass	3.2mm Tempered glass
J-Box	IP68, 3 diodes
Output cable	(+)1200mm, (-)1200mm, 12 AWG
Connectors	MC4 compatible
Module Fire Performance	Type 1
Stand. Packaging	26 pcs (vertical)
Pallets per Container	22
Module Pieces per Container	572

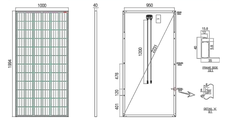
Warranties

Product	10 years
Performance	10 years performance warranty (>90%) 25 years linear power warranty (>80%)

Temperature Characteristics

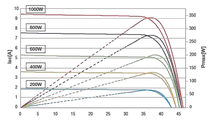
Specifications	Data
Temperature coefficient (Pmax)	-0.44
Temperature coefficient (Voc)	-0.31
Temperature coefficient (Isc)	0.04
Normal Operating Cell Temperature	46.0 ± 2°C

MODULE DIAGRAM (unit : mm (inch))



1994 X 1000 X 40mm

I-V Curve according to Irradiance



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E-mail : solar@hansol.com

The information included in this Module Datasheet is subject to change without notice and is provided for information purposes only.

MONO **POLY**

HELIENE

72P

72-CELL POLYCRYSTALLINE MODULE

340 Wp
MAX POWER OUTPUT

17.5%
MAX EFFICIENCY

10 YEAR
PRODUCT WARRANTY

25 YEAR
LINEAR PERFORMANCE GUARANTEE

HELIENE INC. IS A PREMIER SOLAR MODULE MANUFACTURER, SERVICING THE GROWING SOLAR ENERGY MARKETS OF NORTH AMERICA.

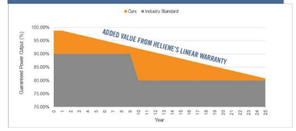
COMBINING PROVEN EUROPEAN TECHNOLOGY WITH NORTH AMERICAN INGENUITY ALLOWS HELIENE TO MAKE A REAL COMMITMENT IN PROVIDING SMARTER ENERGY CHOICES FOR THE FUTURE.

HELIENE
www.heliene.com

- H-BLACK INTEGRATION AVAILABLE (ALL-BLACK MODULE)
- AVAILABLE IN 1000V OR 1500V SYSTEM VOLTAGE RATING
- MANUFACTURED ACCORDING TO INTERNATIONAL QUALITY SYSTEM STANDARDS: ISO9001
- GUARANTEED POSITIVE POWER SORTING: [-0 : +4.99 WP]

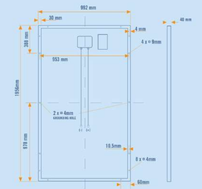
LINEAR PERFORMANCE GUARANTEE

10 YEAR WORKMANSHIP WARRANTY • 25 YEAR LINEAR PERFORMANCE GUARANTEE

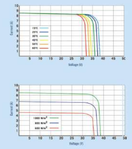


72P

DIMENSIONS FOR HELIENE 72P SERIES MODULES



I-V CURVE FOR HELIENE 72P SERIES



CERTIFICATIONS

ELECTRICAL DATA (STC)

Peak Rated Power	P_{max} (W)	340	335	330	325	320	310
Maximum Power Voltage	V_{mp} (V)	38.45	38.05	37.54	37.42	37.40	37.20
Maximum Power Current	I_{mp} (A)	8.92	8.90	8.83	8.745	8.64	8.40
Open Circuit Voltage	V_{oc} (V)	46.37	46.28	46.20	46.11	45.99	45.66
Short Circuit Current	Isc (A)	9.45	9.20	9.12	9.05	8.97	8.81
Module Efficiency *	Eff (%)	17.5	17.3	17.0	16.7	16.5	16.0
Maximum Series Fuse Rating	MF (A)	15	15	15	15	15	15
Power Output Tolerance	[- 0 , + 4.99] Wp						

STC - Standard Test Conditions: Irradiation 1000 W/m2 - Air mass AM 1.5 - Cell temperature 25 °C
* Calculated using maximum power based on full positive output tolerance (-0 , +4.99) Wp

MECHANICAL DATA

Dimensions (L x W x D)	1936 x 992 x 40 mm (77 x 39 x 1.6 inch)
Weight	21.9 kg (48.28 lbs)
Output Cables	1.2 m (47.2 inch) symmetrical cables with MC4 type connectors
Junction Box	IP-67 rated with bypass diodes
Frame	Double webbed 15 micron anodized aluminum alloy
Front Glass	Low-iron content, high-transmission PV solar glass
Solar Cells	72 Polycrystalline cells (156 x 156 mm)

CERTIFICATIONS

UL Certification	ULC/ORD-C1703-1, UL1703
IEC Certification	Optional

All Heliene modules are certified under the California Energy Commission (CEC) Listing Report

TEMPERATURE RATINGS

Nominal Operating Cell Temperature (NOCT)	+45°C (±2°C)
Temperature Coefficient of P_{max}	-0.43%/°C
Temperature Coefficient of V_{oc}	-0.32%/°C
Temperature Coefficient of I_{sc}	0.05%/°C

MAXIMUM RATINGS

Operational Temperature	-40°C ~ +85°C
Max System Voltage	1000V (*1500V) *Optional

WARRANTY

10 Year Manufacturer's Workmanship Warranty
25 Year Linear Power Guarantee
(Refer to product warranty page for details)

PACKAGING CONFIGURATION

Modules per box:	26 pieces
Modules per 53' trailer:	780 pieces

HELIENE

CAUTION: READ SAFETY AND INSTALLATION INSTRUCTIONS BEFORE USING THE PRODUCT.
Specifications included in this datasheet are subject to change without notice.

IEC-HELIE72P_PD_1761-Rev.04

SOLECTRIA® XGI 1500-166 SERIES

PREMIUM 3-PHASE TRANSFORMERLESS UTILITY-SCALE INVERTERS

FEATURES

- Made in the USA with global components
- Buy American Act (BAA) compliant
- Four models:
  - 125kW/125kVA,
  - 125kW/150kVA,
  - 150kW/166kVA,
  - 166kW/166kVA
- Additional models available certified to UL1699b, Photovoltaic DC Arc-Fault Circuit Protection
- 99.0% peak efficiency
- Flexible solution for distributed and centralized system architecture
- Advanced grid-support functionality Rule 21/UL1741SA
- Robust, dependable, & built to last
- Lowest O&M and installation costs
- Access all inverters on site via WiFi from one location
- Remote diagnostics and firmware upgrades
- SunSpec Modbus Certified
- Tested compatible with the TESLA PowerPack Microgrid System app for system visibility

OPTIONS

- String combiners for distributed and centralized systems
- Web-based monitoring
- Extended warranty

Yaskawa Solectria Solar's XGI 1500 utility-scale string inverters are designed for high reliability and built of the highest quality components that were selected, tested and proven to last beyond their warranty.

XGI 1500 inverters provide advanced grid-support functionality and meet the latest IEEE 1547 and UL 1741 standards for safety. They are the most powerful 1500 VDC string inverters in the PV market and have been engineered for both distributed and centralized system architecture.

Designed and engineered in Lawrence, MA, XGI inverters are assembled and tested at Yaskawa America's facilities in Buffalo Grove, IL. They are Made in the USA with global components and are compliant with the Buy American Act.

MADE IN THE USA — Puts U.S. and Global Components to Work

YASKAWA SOLECTRIA SOLAR

Yaskawa Solectria Solar 1-978-683-9700 | Email: inverters@solectria.com | solectria.com

Document No. FL.XGI1500.01 | 07/21/2022 |

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SOLECTRIA® XGI 1500-166 SERIES TECHNICAL DATA

SPECIFICATIONS

SOLECTRIA XGI 1500 Model		XGI 1500-125/125-UL XGI 1500-125/125-UL-A	XGI 1500-125/150-UL XGI 1500-125/150-UL-A	XGI 1500-150/166-UL XGI 1500-150/166-UL-A	XGI 1500-166/166-UL XGI 1500-166/166-UL-A
DC Input	Absolute Max Input Voltage	1500 VDC	1500 VDC	1500 VDC	1500 VDC
	Max Power Input Voltage Range (MPPT)	860-1250 VDC	860-1250 VDC	860-1250 VDC	860-1250 VDC
	Operating Voltage Range (MPPT)	860-1450 VDC	860-1450 VDC	860-1450 VDC	860-1450 VDC
	Number of MPP Trackers	1 MPPT	1 MPPT	1 MPPT	1 MPPT
	Max Operating Input Current	148.5 A	148.5 A	178.0 A	197.7 A
	Max Operating PV Power	128 kW	128 kW	153 kW	170 kW
	Max DC/AC Ratio | Max Rated PV Power	2.6 | 332 kW	2.6 | 332 kW	2.2 | 332 kW	2.0 | 332 kW
	Max Rated PV Short-Circuit Current (Isc x 1.25)	500 A	500 A	500 A	500 A
AC Output	Nominal Output Voltage	600 VAC, 3-Ph	600 VAC, 3-Ph	600 VAC, 3-Ph	600 VAC, 3-Ph
	AC Voltage Range	-12% to +10%	-12% to +10%	-12% to +10%	-12% to +10%
	Continuous Real Output Power	125 kW	125 kW	150 kW	166 kW
	Continuous Apparent Output Power	125 kVA	150 kVA	166 kVA	166 kVA
	Max Output Current	120 A	144 A	160 A	160 A
	Nominal Output Frequency	60 Hz	60 Hz	60 Hz	60 Hz
	Power Factor (Unity default)	+/- 0.80 Adjustable	+/- 0.80 Adjustable	+/- 0.80 Adjustable	+/- 0.80 Adjustable
	Total Harmonic Distortion (THD) @ Rated Load	<3%	<3%	<3%	<3%
	Grid Connection Type	3-Ph + N/GND	3-Ph + N/GND	3-Ph + N/GND	3-Ph + N/GND
	Fault Current Contribution (1 cycle RMS)	144 A	173 A	192 A	192 A
Efficiency	Peak Efficiency	98.9%	98.9%	99.0%	99.0%
	CEC Average Efficiency	98.5%	98.5%	98.5%	98.5%
Temperature	Tare Loss	<1 W	<1 W	<1 W	<1 W
	Ambient Temp Range	-40°F to 140°F (-40C to 60C)		-40°F to 140°F (-40C to 60C)	
	De-Rating Temperature	122°F (50C)		113°F (45C)	
	Storage Temperature Range	-40°F to 167°F (-40C to 75C)		-40°F to 167°F (-40C to 75C)	
	Relative Humidity (non-condensing)	0 - 95%		0 - 95%	
	Operating Altitude	Full Power up to 9,840 ft (3.0 km); De-Rate to 70% of Full Power at 13,123 ft (4.0 km)			
Communications	Advanced Graphical User Interface	WiFi			
	Communication Interface	Ethernet			
	Third-Party Monitoring Protocol	SunSpec Modbus TCP/IP			
	Web-Based Monitoring	Optional			
	Firmware Updates	Remote and Local			
Testing & Certifications	Safety Listings & Certifications	UL 1741, IEEE 1547, UL 1998 (All models) UL 1699b Photovoltaic Arc-Fault Circuit Protection Certified (-A models)			
	Advanced Grid Support Functionality	Rule 21, UL 1741SA			
	Testing Agency	ETL			
	FCC Compliance	FCC Part 15 (Subpart B, Class A)			
Warranty	Standard and Options	5 Years Standard; Option for 10 Years			
Enclosure	Acoustic Noise Rating	73 dBA @ 1 m ; 67dBA @ 3 m			
	DC Disconnect	Integrated 2-Pole 250 A DC Disconnect			
	Mounting Angle	Vertical only			
	Dimensions	Height: 29.5 in. (750 mm) | Width: 39.4 in. (1000 mm) | Depth: 15.1 in. (380 mm)			
	Weight	270 lbs (122 kg)			
	Enclosure Rating and Finish	Type 4X, Polyester Powder-Coated Aluminum			

IT'S PERSONAL

YASKAWA SOLECTRIA SOLAR

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1500 VDC Solutions

SolarBOS Disconnect Combiners and Recombiners for 1500 VDC photovoltaic systems provide direct cost savings, they allow for more modules per source circuits and fewer BOS components. Combiners feature load break disconnect switches up to 400A. Recombiners are available with load break or non-load break disconnects.

Disconnect Combiners

Product features

- ETL listed to UL-1741
- 10k SCCR
- Up to 36 input circuits
- 90C input/output terminals
- Cover doors with poured-in-place seamless gaskets
- NEMA-3R, 4 & 4X enclosures

Available options

- Transient surge suppression
- Provisions for compression output lugs / Dual output lugs
- Floating and bi-polar configurations
- Pre-terminated input conductors
- Touch safe cover over live parts
- Breather and drain vents
- Padlockable enclosures

Disconnect Combiner, 1600VDC, 400A disconnect, 14 input circuits, transient surge protection, pre-terminated bulkhead connectors, NEMA-4 powder coated steel enclosure

Disconnect Recombiners

Product features

- ETL listed to UL-1741
- Up to 16 input circuits
- 75/90C input/output terminals
- Includes touch safe protective cover
- Cover doors with poured-in-place seamless gaskets
- NEMA-3R, 4 & 4X enclosures

Available options

- Zone level monitoring
- Transient surge suppression
- Provisions for compression output lugs / Dual output lugs
- Floating and bi-polar configurations
- Integrated non-load break or load break disconnect switch(es)
- Blown fuse indicators
- Custom layouts

Disconnect Recombiner, 1600VDC, 350A disconnects, 8 inputs circuits, NEMA-3R powder coated steel enclosure

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GAMECHANGE SOLAR
REPOWERING THE PLANET

OVER 21 GW SOLD
Global Innovation Leader for Trackers, Fixed Tilt & BOS

TECHNICAL DATASHEET

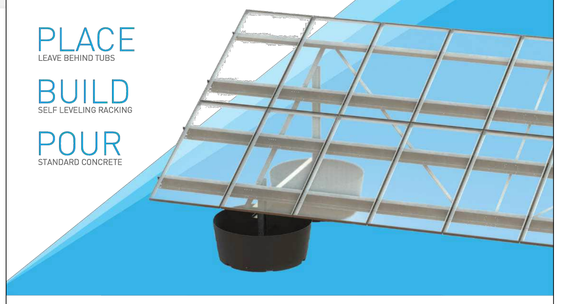
POUR-IN-PLACE™ BALLASTED GROUND SYSTEM

LANDFILL LEADER AND BEST SOLUTION FOR ROCKY SITES

PLACE
LEAVE BEHIND TUBS

BUILD
SELF LEVELING RACKING

POUR
STANDARD CONCRETE



NO NEED TO FIGHT ROCKY GROUND WITH POSTS OR SCREWS

- 68% FASTER THAN PRECAST
- MINIMAL IMPACT ON DRAINAGE

BENEFITS OF POUR-IN-PLACE™ VS. SCREW OR POST SYSTEMS:

POUR-IN-PLACE™ BALLASTED GROUND SYSTEM

- ✓ Complete your site on time and on budget.
- ✓ Peace of mind with risk-free install.
- ✓ Up to 26% lower install racking cost than screw or post systems.

SCREW OR POST SYSTEMS

- ⊘ Slow drilling needed for every hole.
- ⊘ Slow and uncertain install timeline and budget.
- ⊘ Up to 25% higher install racking cost than Pour-In-Place™.

NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	CHK
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5	PRELIMINARY LAYOUT	04/25/2022	DB
4	PRELIMINARY LAYOUT	04/22/2022	DB
3	PRELIMINARY LAYOUT	04/12/2022	DB
2	PRELIMINARY LAYOUT	04/05/2022	DB

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DEVELOPER

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http://www.nugencapital.com/

PROJECT NAME AND ADDRESS

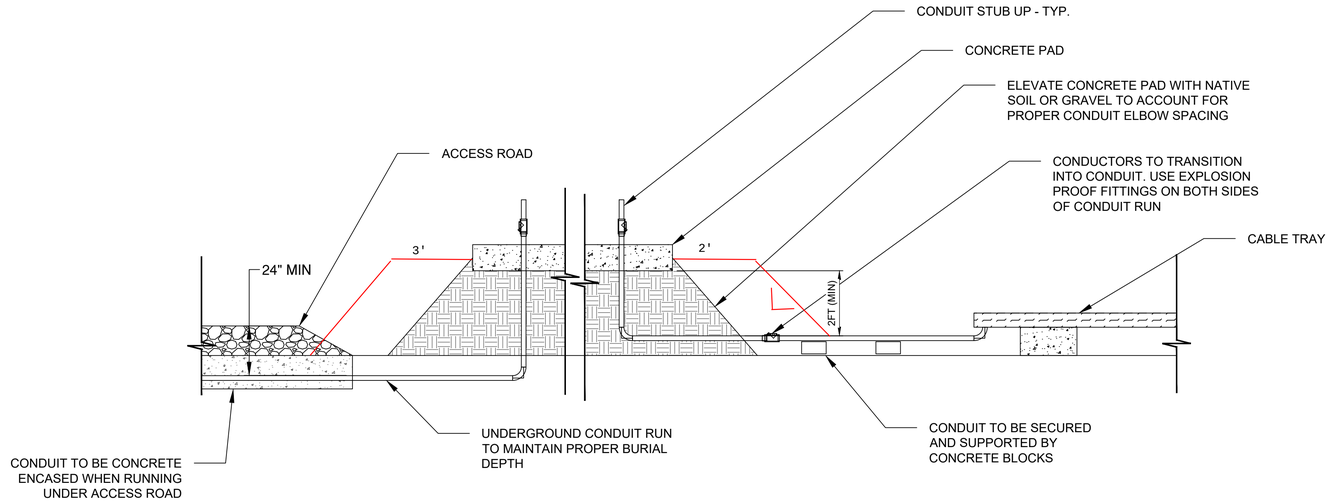
BRISTOL LANDFILL SOLAR

MINTURN FARM RD
BRISTOL, RI 02809

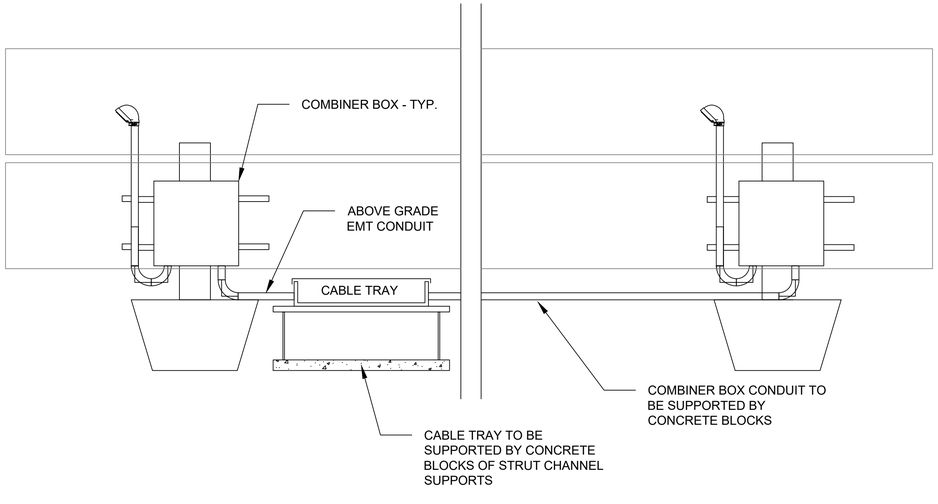
SHEET TITLE

EQUIPMENT DATASHEET

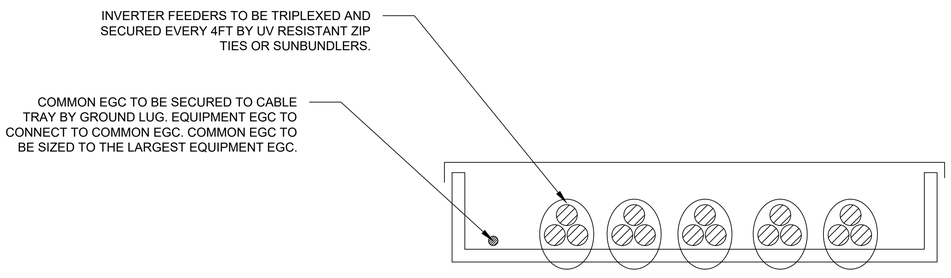
ENGINEER:	DRAWN BY:
DB	AJ
PROJECT NO.: 01-19-001	SHEET NO.: E-002
CREATION DATE: 12/31/2019	SHEET 9 OF 22



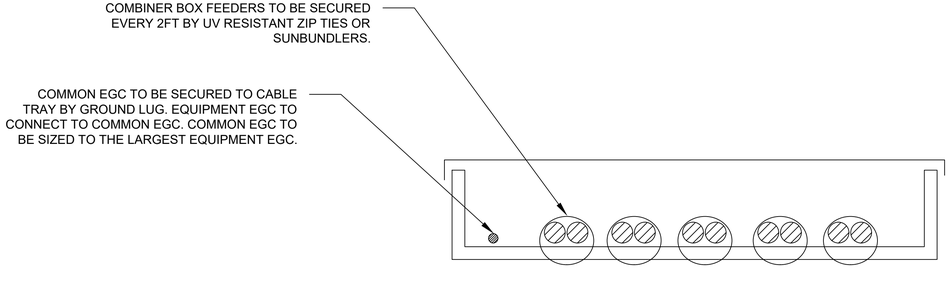
1 CONDUIT DETAIL - EQUIPMENT PAD



2 CONDUIT DETAIL - COMBINER BOX



3 AC CABLE TRAY DETAIL



4 DC CABLE TRAY DETAIL

NOT FOR CONSTRUCTION

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3	PRELIMINARY LAYOUT	04/12/2022	DB
2	PRELIMINARY LAYOUT	04/05/2022	DB

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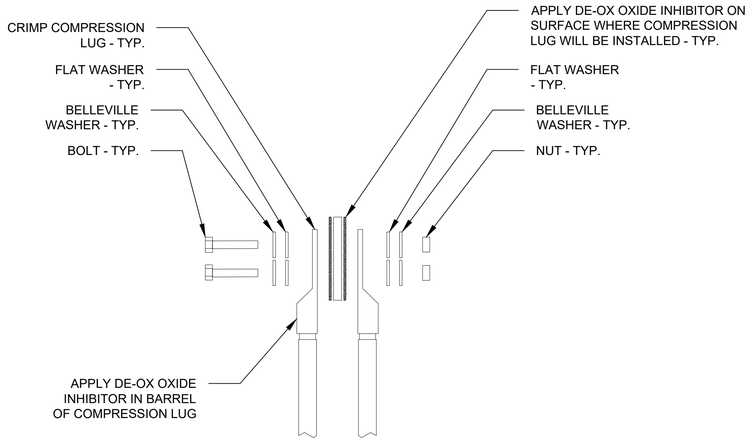
PROJECT NAME AND ADDRESS

BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE

CONSTRUCTION DETAILS

ENGINEER:	DRAWN BY:
DB	AJ
PROJECT NO. 01-19-001	SHEET NO. E-200
CREATION DATE 12/31/2019	SHEET 10 OF 22



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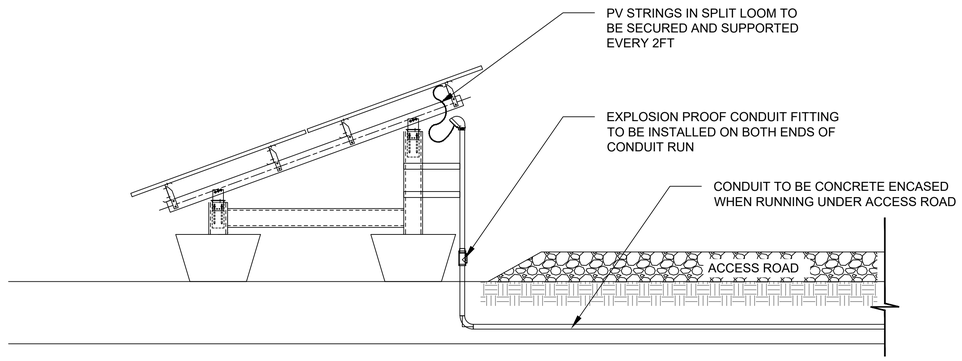
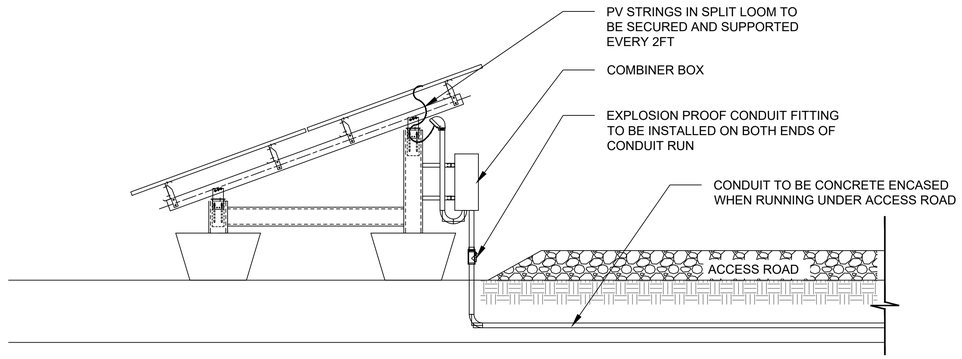
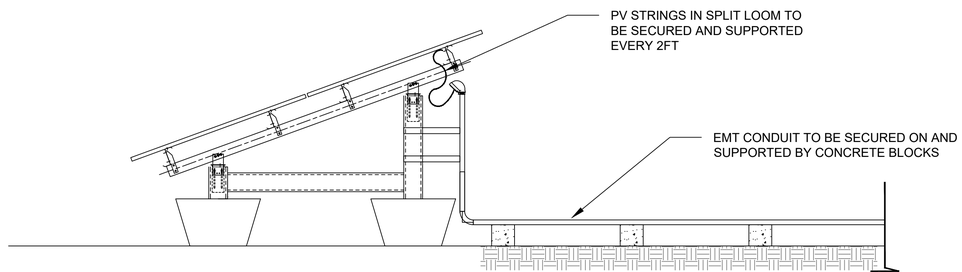


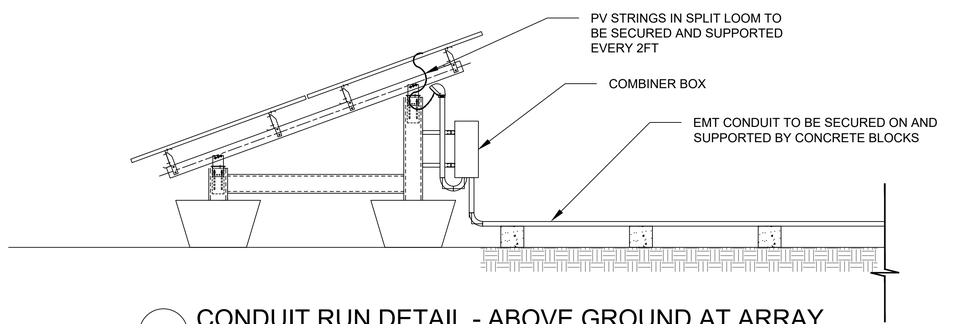
2 CONDUIT RUN DETAIL - UNDERGROUND AT ARRAY



3 CONDUIT RUN DETAIL - UNDERGROUND AT ARRAY



4 CONDUIT RUN DETAIL - ABOVE GROUND AT ARRAY



5 CONDUIT RUN DETAIL - ABOVE GROUND AT ARRAY

NOT FOR CONSTRUCTION

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6	PRELIMINARY LAYOUT	06/10/2022	DB
5	PRELIMINARY LAYOUT	04/25/2022	DB
4	PRELIMINARY LAYOUT	04/22/2022	DB
3	PRELIMINARY LAYOUT	04/12/2022	DB
2	PRELIMINARY LAYOUT	04/05/2022	DB

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CONSTRUCTION DETAILS

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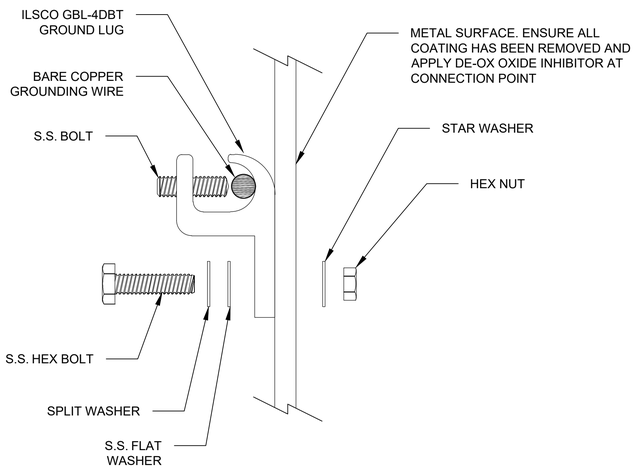
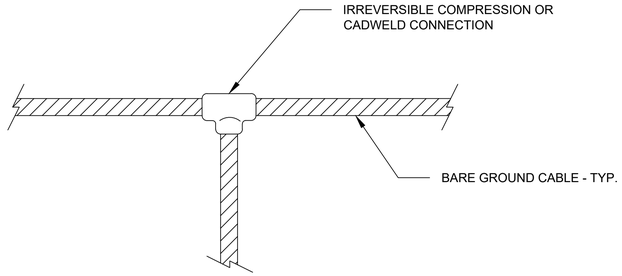
DB	AJ
PROJECT NO. 01-19-001	SHEET NO. E-201
CREATION DATE 12/31/2019	SHEET 11 OF 22

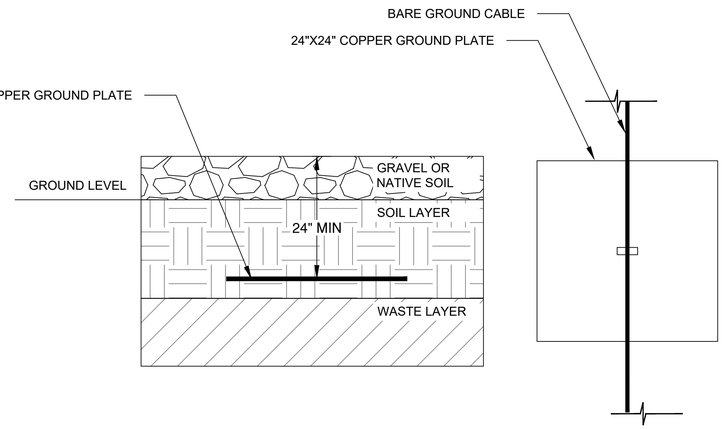


1 GROUND LUG DETAIL

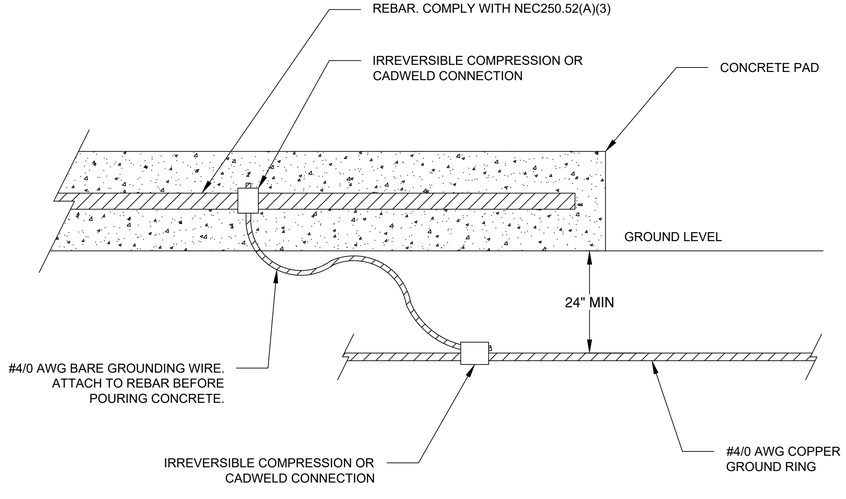


2 GROUNDING CONNECTION DETAIL

NOTE:
1. ADD NATIVE SOIL OR GRAVEL AT GRADE TO ENSURE PROPER BURIAL DEPTH OF GROUND PLATE



3 GROUND PLATE DETAIL



4 GROUND RING DETAIL

NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	CHK
2	90% DESIGN	01/18/2023	DB
1	90% DESIGN	01/03/2023	DB
0	90% DESIGN	12/15/2022	DB
8	PRELIMINARY LAYOUT	07/05/2022	DB
7	PRELIMINARY LAYOUT	06/13/2022	DB
6	PRELIMINARY LAYOUT	06/10/2022	DB
5	PRELIMINARY LAYOUT	04/25/2022	DB
4	PRELIMINARY LAYOUT	04/22/2022	DB
3	PRELIMINARY LAYOUT	04/12/2022	DB
2	PRELIMINARY LAYOUT	04/05/2022	DB

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DEVELOPER
NUGEN CAPITAL
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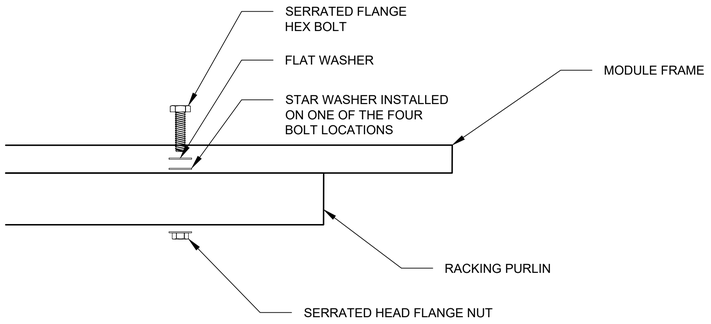
PROJECT NAME AND ADDRESS

BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE

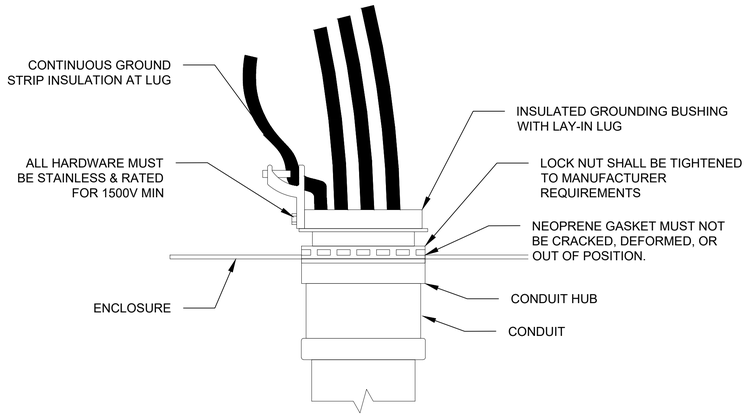
GROUNDING DETAILS

ENGINEER:	DRAWN BY:
DB	AJ
PROJECT NO.: 01-19-001	SHEET NO.: E-202
CREATION DATE: 12/31/2019	SHEET 12 OF 22



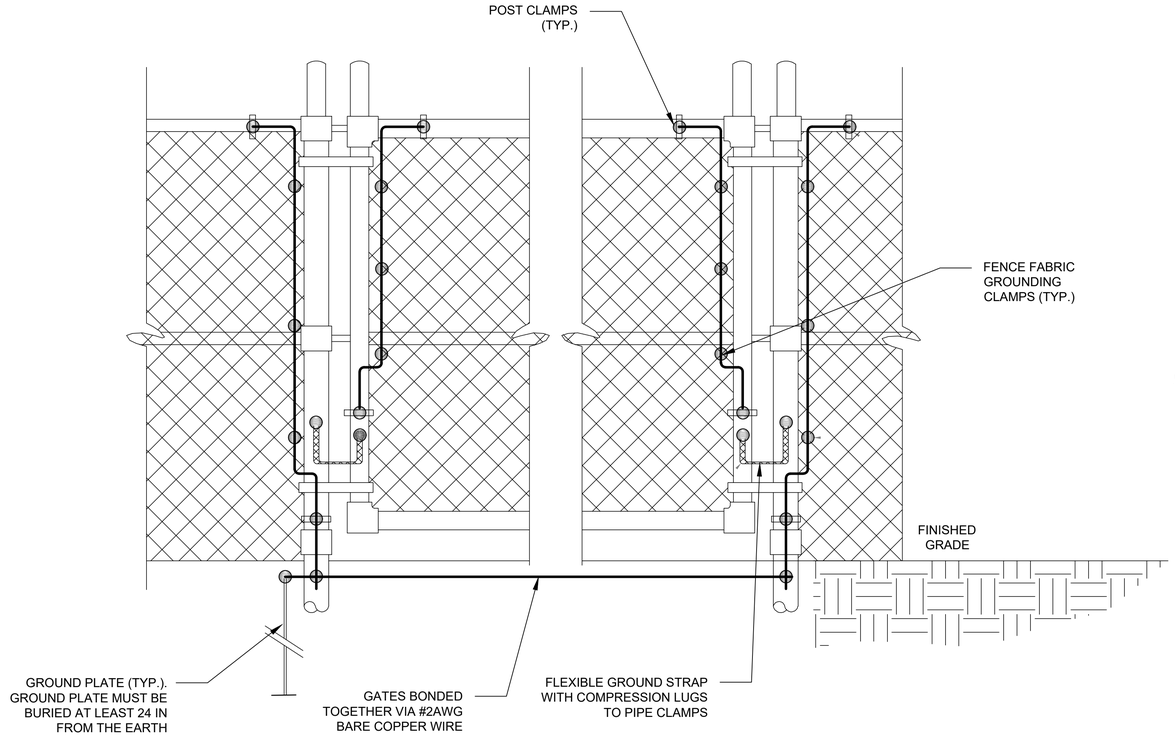
NOTES:
1. FOLLOW RACKING MANUFACTURER INSTALLATIONS ON PROPER MODULE BONDING METHOD

1 MODULE GROUNDING DETAIL



NOTES:
1. ALL METALLIC CONDUIT RUNS MUST HAVE A MINIMUM OF 1 INSULATED GROUNDING BUSHING INSTALLED. THE OPPOSITE END OF THE RUN MAY HAVE AN INSULATED BUSHING INSTALLED.
2. AN INSULATED GROUNDING BUSHING SHALL BE USED ON BOTH CONDUIT ENDS FOR CONDUIT RUNS WITH AN EXPANSION JOINT.
3. NO SHARP METAL EDGES ARE PERMITTED ON ANY CONDUIT.
4. IF A CONDUIT MUST ENTER THE SIDE OR TOP OF AN ENCLOSURE A MEYERS HUB SHALL BE USED.
5. BARE COPPER WIRE IS PROHIBITED IN EMT CONDUIT.
6. ALL CONDUITS SHALL HAVE A WIRE INSULATING BUSHING INSTALLED TO PROTECT THE WIRE.
7. CONDUITS ENTERING ANY ENCLOSURE NEEDS TO BE LIQUID-TIGHT.
8. WHEN PENETRATING AN ENCLOSURE, DEBUR ENTRY AND RE-COAT WITH GALVY

2 CONDUIT GROUNDING DETAIL



GENERAL NOTES:
1. EXPOSED FENCE GROUNDING CONDUCTORS AND CLAMPS SHALL BE INSTALLED INSIDE FENCE PERIMETER
2. FENCES SHALL BE GROUNDED AT EACH SIDE OF A GATE OR OPENING. GROUND ALL GATE POSTS.
3. RODS AND GEC SHALL BE BURIED AT LEAST 2FT OUTSIDE THE PERIMETER OF THE FENCE.
4. SEE CIVIL DRAWINGS FOR STRUCTURAL DESIGN OF FENCE, INCLUDING POST EMBEDMENT DEPTH, FENCE MATERIAL, POST FOUNDATION, ETC, FENCE HEIGHT, ETC.

3 FENCE GROUNDING DETAIL

NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	CHK
1	90% DESIGN	01/03/2023	DB
0	90% DESIGN	12/15/2022	DB
8	PRELIMINARY LAYOUT	07/05/2022	DB
7	PRELIMINARY LAYOUT	06/13/2022	DB
6	PRELIMINARY LAYOUT	06/10/2022	DB
5	PRELIMINARY LAYOUT	04/25/2022	DB
4	PRELIMINARY LAYOUT	04/22/2022	DB
3	PRELIMINARY LAYOUT	04/12/2022	DB
2	PRELIMINARY LAYOUT	04/05/2022	DB

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PROJECT NAME AND ADDRESS
BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE
GROUNDING DETAILS

ENGINEER:	DRAWN BY:
DB	AJ
PROJECT NO. 01-19-001	SHEET NO. E-203
CREATION DATE 12/31/2019	SHEET 13 OF 22

SUBARRAY A			
INVERTER	AC SYSTEM SIZE	STRING BREAKDOWN	DC SYSTEM SIZE
INVERTER (INV.A1)	166 KW	26 STRINGS OF 28 HELIENE 325W MODS	236.60 KW
INVERTER (INV.A2)	166 KW	25 STRINGS OF 28 HELIENE 325W MODS	227.50 KW
INVERTER (INV.A3)	166 KW	26 STRINGS OF 28 HELIENE 325W MODS	236.60 KW
INVERTER (INV.A4)	166 KW	26 STRINGS OF 28 HELIENE 325W MODS	236.60 KW
INVERTER (INV.A5)	166 KW	25 STRINGS OF 28 HELIENE 325W MODS	227.50 KW
INVERTER (INV.A6)	166 KW	25 STRINGS OF 28 HELIENE 325W MODS	227.50 KW
INVERTER (INV.A7)	166 KW	25 STRINGS OF 28 HELIENE 325W MODS	227.5 KW
INVERTER (INV.A8)	166 KW	25 STRINGS OF 28 HELIENE 325W MODS	227.5 KW
INVERTER (INV.A9)	166 KW	25 STRINGS OF 28 HELIENE 325W MODS	227.5 KW
INVERTER (INV.A10)	166 KW	25 STRINGS OF 28 HELIENE 325W MODS	227.5 KW
INVERTER (INV.A11)	166 KW	25 STRINGS OF 28 HELIENE 325W MODS	227.5 KW
INVERTER (INV.A12)	166 KW	25 STRINGS OF 28 HELIENE 325W MODS	236.60 KW
INVERTER (INV.A13)	166 KW	26 STRINGS OF 28 HELIENE 325W MODS	227.50 KW
INVERTER (INV.A14)	166 KW	26 STRINGS OF 28 HELIENE 325W MODS	227.50 KW
INVERTER (INV.A15)	166 KW	25 STRINGS OF 28 HELIENE 325W MODS	236.60 KW

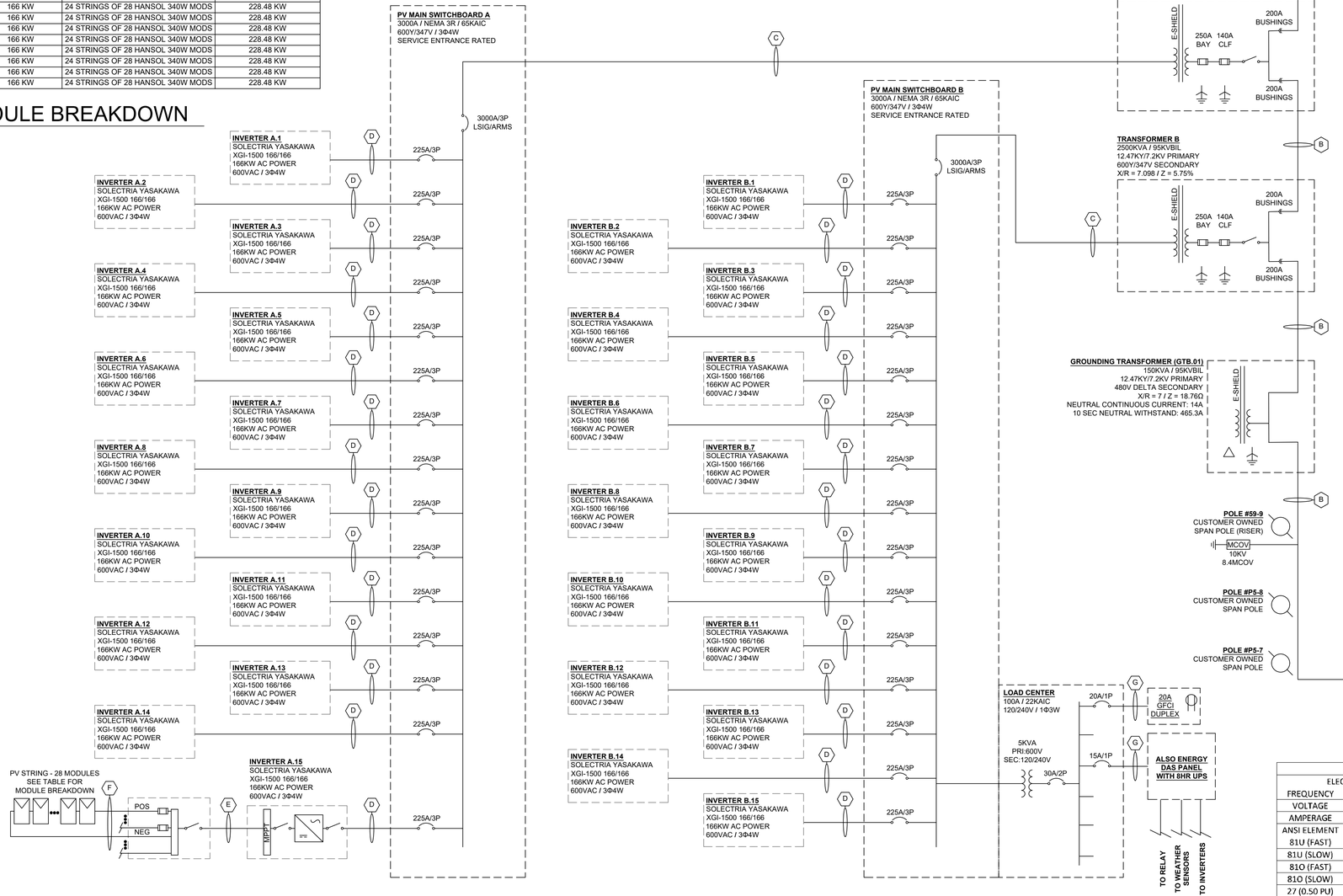
SUBARRAY B			
INVERTER	AC SYSTEM SIZE	STRING BREAKDOWN	DC SYSTEM SIZE
INVERTER (INV.B1)	166 KW	23 STRINGS OF 28 HANSOL 340W MODS	218.96 KW
INVERTER (INV.B2)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B3)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B4)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B5)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B6)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B7)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B8)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B9)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B10)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B11)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B12)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B13)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B14)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW
INVERTER (INV.B15)	166 KW	24 STRINGS OF 28 HANSOL 340W MODS	228.48 KW

CABLE SCHEDULE							
CALLOUT ID	WIRE QTY	PARALLEL RUNS	PHASE SIZE	NEUTRAL SIZE	GROUND SIZE & TYPE	INSULATION/TYPE	CONDUIT TYPE
A	3Φ, N	1	#2/0 AWG ASCR	#2/0 AWG ASCR		15KV BARE	-
B	3Φ, N, G	1	#350 KCMIL AL-MV105	FULL CONC.	CABLE SHIELD	15KV 133% EPR	5" PVC SCH40
C	3Φ, N	9	600 KCMIL AL	600 KCMIL AL	-	600V XHHW2	4" PVC SCH40
D	3Φ, G	1	#250 KCMIL AL	-	#4 AWG CU EGC	600V XHHW2	2" PVC SCH40[11]
E	2Φ PER STRING, G	1		SEE E302		2KV PVWIRE	VARIES[10, 11]
F	2Φ PER STRING, G	1	#10 AWG CU	-	#6 AWG CU EGC	2KV PVWIRE	VARIES[9]
G	1Φ, N, G	1	#12 AWG CU	#12 AWG CU	#12 CU EGC	600V THWN2	3/4" EMT

GENERAL NOTES:

1. ALL UTILITY OWNED EQUIPMENT IS SHOWN FOR REFERENCE PURPOSES ONLY. THE UTILITY EQUIPMENT MAY BE CHANGED BY THE UTILITY AT ANY TIME. COORDINATE WITH THE UTILITY FOR FINAL EQUIPMENT SPECS/LINEUP.
2. THE RELAY POWER FAILURE ALARM AND UPS FAILURE ALARM TO CAUSE RELAY TO PICKUP AND TRIP 52R ELEMENT WITHIN 2 SECONDS.
3. EQUIPMENT LISTED AS 'TYPICAL' SHALL REPRESENT THE EQUIPMENT SPECIFICATIONS USED FOR THE OTHER EQUIPMENT THROUGHOUT THE PROJECT UNLESS NOTED OTHERWISE.
4. THE PV MAIN DISCONNECT SWITCH SHALL BE ACCESSIBLE BY THE UTILITY 24/7. IF THE PV MAIN DISCONNECT SWITCH IS ENCLOSED IN A FENCED AREA, THE UTILITY WILL HAVE MEANS OF ACCESS WITHIN THE FENCED AREA AT ALL TIMES.
5. THE PV MAIN DISCONNECT SWITCH SHALL BE LOCKABLE IN THE OPEN POSITION.
6. THE CU FEEDERS USED SHALL HAVE A THWN-2 RATED JACKET UNLESS NOTED OTHERWISE. THE AL FEEDERS USED SHALL HAVE A XHHW-2 RATED JACKET UNLESS NOTED OTHERWISE.
7. REFER TO THE EQUIPMENT MANUFACTURER'S INSTALLATION MANUAL FOR PROPER INSTALLATION AND SETTINGS.
8. ALL 600V RATED CIRCUIT BREAKERS MUST HAVE ADEQUATE KAIC RATING FOR POTENTIAL INTERRUPTION AT 105% OF NOMINAL VOLTAGE.
9. MAXIMUM NO. OF TOTAL CONDUCTORS ALLOWED IN DC CONDUIT:
   - 1.5" EMT SCH40 CONDUIT: 10 TOTAL DC CONDUCTORS + GND (36.9% CONDUIT FILL)
   - 2" EMT SCH40 CONDUIT: 20 TOTAL DC CONDUCTORS + GND (38.4% CONDUIT FILL)
   - ASSUMES OUTER DIAMETER OF 0.27". DIFFERENT DIAMETER MAY RESULT IN RESIZING.
10. DC COMBINER BOX FEEDERS CONDUIT TO BE FOUND IN E301
11. CONDUITS TO TRANSITION TO CABLE TRAY

3 MODULE BREAKDOWN



1 ONE LINE DIAGRAM

INVERTER SETTINGS			
ELECTRICAL CHARACTERISTICS			
FREQUENCY	60HZ		
VOLTAGE	346.4V		
AMPERAGE	230.56A		
ANSI ELEMENT	PICKUP	CLEAR (SEC)	VALUE
81U (FAST)	0.09	0.16	56.5 Hz
81U (SLOW)	299.93	300.00	58.5 Hz
81O (FAST)	0.09	0.16	62 Hz
81O (SLOW)	299.93	300.00	61.2 Hz
27 (0.50 PU)	1.03	1.10	173.2 V
27 (0.88 PU)	1.93	2.00	304.8 V
59 (1.10 PU)	1.93	2.00	381.1 V
59 (1.20 PU)	0.09	0.16	415.7 V

SEL-651R RELAY SETTINGS			
ELECTRICAL CHARACTERISTICS			
ANSI ELEMENT	PU (PRI)	CURVE	TD
51	300.00	U1	2
51N	55.00	U1	1.3

2 EQUIPMENT SETTINGS

NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	CHK
1	90% DESIGN	01/03/2023	DB
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DEVELOPER

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PROJECT NAME AND ADDRESS

BRISTOL LANDFILL SOLAR

MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE

ONE LINE DIAGRAM

ENGINEER:	DRAWN BY:
DB	AJ
PROJECT NO. 01-19-001	SHEET NO. E-400
CREATION DATE 12/31/2019	SHEET 14 OF 22

FEEDER SCHEDULE

EQUIPMENT	ESTIMATED DISTANCE	NUMBER OF SETS	PHASE SIZE	NEUTRAL SIZE	GROUND SIZE	75° CONDUCTOR AMPACITY	TEMPERATURE CORRECTION FACTOR	CONDUIT FILL CORRECTION FACTOR NEC 310.15(B)(3)	90° AMPACITY W/ CORRECTION FACTOR	CONDUCTOR RESISTANCE (OHMS/KFT)	CONDUCTOR VOLTAGE DROP	VOLTAGE DROP FROM PCC	SYSTEM VOLTAGE	CONTINUOUS LOAD AMPERAGE	125% FACTOR NEC 690.8(B)	MINIMUM OCPD SIZE NEC 240.4	CONDUIT TYPE	CONDUIT SIZE	CONDUIT FILL
INVERTER A.1 TO PV MAIN SWITCHBOARD A	80	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.32%	0.42%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.2 TO PV MAIN SWITCHBOARD A	90	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.36%	0.46%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.3 TO PV MAIN SWITCHBOARD A	100	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.40%	0.50%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.4 TO PV MAIN SWITCHBOARD A	110	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.44%	0.54%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.5 TO PV MAIN SWITCHBOARD A	120	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.48%	0.58%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.6 TO PV MAIN SWITCHBOARD A	130	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.52%	0.61%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.7 TO PV MAIN SWITCHBOARD A	140	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.06%	0.15%	600	16.00	20.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.8 TO PV MAIN SWITCHBOARD A	150	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.60%	0.69%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.9 TO PV MAIN SWITCHBOARD A	160	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.64%	0.73%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.10 TO PV MAIN SWITCHBOARD A	170	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.68%	0.77%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.11 TO PV MAIN SWITCHBOARD A	180	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.71%	0.81%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.12 TO PV MAIN SWITCHBOARD A	190	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.75%	0.85%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.13 TO PV MAIN SWITCHBOARD A	200	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.79%	0.89%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.14 TO PV MAIN SWITCHBOARD A	210	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.83%	0.93%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER A.15 TO PV MAIN SWITCHBOARD A	220	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.87%	0.97%	600	160.00	200.00	200	PVC SCH 40 / EMT	2"	31.71%
PV MAIN SWITCHBOARD A TO TRANSFORMER A	20	9	600 KCMIL AL	600 KCMIL AL	-	3060	-	1.00	3465	0.038	0.05%	0.10%	600	2256.00	2820.00	3000	PVC SCH 40	4"	23.69%
TRANSFORMER A TO TRANSFORMER B	50	1	#350MCM AL MV-105 133%EPR	1/3 CONCENTRIC NEUTRAL	-	-	1.04	1.00	384.8	0.063	0.01%	0.04%	12470	115.75	-	-	PVC SCH 40	5"	17.63%
INVERTER B.1 TO PV MAIN SWITCHBOARD B	100	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.40%	0.51%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.2 TO PV MAIN SWITCHBOARD B	110	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.44%	0.55%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.3 TO PV MAIN SWITCHBOARD B	120	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.48%	0.59%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.4 TO PV MAIN SWITCHBOARD B	130	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.52%	0.63%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.5 TO PV MAIN SWITCHBOARD B	140	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.56%	0.67%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.6 TO PV MAIN SWITCHBOARD B	150	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.59%	0.71%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.7 TO PV MAIN SWITCHBOARD B	160	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.63%	0.75%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.8 TO PV MAIN SWITCHBOARD B	170	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.67%	0.79%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.9 TO PV MAIN SWITCHBOARD B	180	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.71%	0.83%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.10 TO PV MAIN SWITCHBOARD B	190	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.75%	0.87%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.11 TO PV MAIN SWITCHBOARD B	200	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.79%	0.91%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.12 TO PV MAIN SWITCHBOARD B	210	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.83%	0.95%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.13 TO PV MAIN SWITCHBOARD B	220	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.87%	0.99%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.14 TO PV MAIN SWITCHBOARD B	230	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.91%	1.03%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
INVERTER B.15 TO PV MAIN SWITCHBOARD B	240	1	#250 KCMIL AL	-	#6 AWG CU	205	-	1.00	230.0	0.086	0.95%	1.07%	600	159.74	199.67	200	PVC SCH 40 / EMT	2"	31.71%
PV MAIN SWITCHBOARD B TO TRANSFORMER B	20	9	600 KCMIL AL	600 KCMIL AL	-	3060	-	1.00	3465	0.038	0.06%	0.18%	600	2352.09	2940.11	-	PVC SCH 40	4"	23.69%
TRANSFORMER B TO GROUNDING TRRANSFORMER	20	1	#350MCM AL MV-105 133%EPR	1/3 CONCENTRIC NEUTRAL	-	-	1.04	1.00	343.2	0.063	0.08%	0.12%	600	218.70	273.38	-	PVC SCH 40	5"	23.69%
TRANSFORMER D1 TO RISER POLE	50	1	#350MCM AL MV-105 133%EPR	1/3 CONCENTRIC NEUTRAL	-	-	1.04	1.00	343.2	0.063	0.01%	0.04%	12470	231.50	-	-	HDPE	5"	17.63%
RISER POLE TO POI	500	1	WAXWING ACSR	WAXWING ACSR	-	-	0.92	1.00	253.9	0.176	0.03%	0.03%	12470	231.50	-	-	-	-	-

GENERAL NOTES:

1. TOTAL INVERTER VOLTAGE DROP = 0.73%
2. DISTANCES ARE ESTIMATES AND USED FOR VOLTAGE DROP CALCULATIONS. CONTRACTOR IS RESPONSIBLE FOR MEASURING CONDUCTOR LENGTHS IN THE FIELD.
3. CONDUIT FILL ARE ESTIMATES BASED ON TYPICAL CONDUIT AND CONDUCTOR DIAMETER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING CONDUIT FILL IN THE FIELD.
4. THE CU FEEDERS USED SHALL BE 90°C RATED AND HAVE A THWN-2 RATED JACKET UNLESS NOTED OTHERWISE. THE AL FEEDERS USED SHALL BE 90°C RATED AND HAVE A XHHW-2 RATED JACKET UNLESS NOTED OTHERWISE.
5. THE MV FEEDERS USED IN CONDUIT SHALL HAVE A 133% EPR RATED JACKET UNLESS NOTED OTHERWISE.
6. THE CONDUCTORS THAT ARE RUN UNDERGROUND WITH LESS THAN 10FT OF WIRE ABOVE GROUND, EITHER LEAVING OR ENTERING THE TRENCH, IS NOT SUBJECT TO ANY TEMPERATURE CORRECTION FACTORS PER NEC310.15(B)(3)(a)(3).
7. TEMPERATURE CORRECTION FACTORS FOR MV INSULATED CONDUCTORS USED PER TABLE NEC310.60(C)(4). TEMPERATURE CORRECTION FACTOR FOR MV OVERHEAD WIRE BASED ON AMBIENT SITE TEMP OF 33C, WIRE TEMP OF 75C, AND AMBIENT TEST TEMP OF 25C IN DATASHEET.

1 FEEDER SCHEDULE

NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	CHK
1	90% DESIGN	01/03/2023	DB
0	90% DESIGN	12/15/2022	DB
8	PRELIMINARY LAYOUT	07/05/2022	DB
7	PRELIMINARY LAYOUT	06/13/2022	DB
6	PRELIMINARY LAYOUT	06/10/2022	DB
5	PRELIMINARY LAYOUT	04/25/2022	DB
4	PRELIMINARY LAYOUT	04/22/2022	DB
3	PRELIMINARY LAYOUT	04/12/2022	DB
2	PRELIMINARY LAYOUT	04/05/2022	DB

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DEVELOPER

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http://www.nugencapital.com/

PROJECT NAME AND ADDRESS

BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE

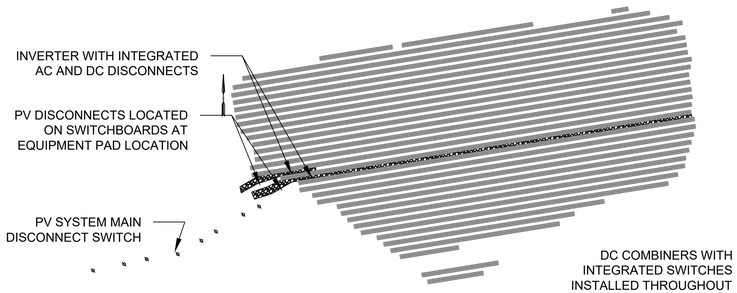
FEEDER SCHEDULE

ENGINEER:	DRAWN BY:
DB	AJ
PROJECT NO. 01-19-001	SHEET NO. E-401
CREATION DATE 12/31/2019	SHEET 15 OF 22

11"

CAUTION

POWER TO THIS SITE IS SUPPLIED BY
MUTLIPLE SOURCES:
DISCONNECT LOCATIONS ARE SHOWN BELOW



8 1/2"

PLACARD SHALL BE PLACED AT GOAB SWITCH POLE LOCATION AND AT MAIN SWITCHBOARDS

5 1/2"
LABEL SHALL BE PLACED AT TRANSFORMERS

TRANSFORMER

1 3/4"

5 1/2"
LABEL SHALL BE PLACED AT TRANSFORMERS

OPERATING RATINGS:

KVA RATING: 2500 KVA
PRIMARY VOLTAGE: 12.47KY/7.2KV
SECONDARY VOLTAGE: 600Y/347V

2 1/2"

5 1/2"
LABEL SHALL BE PLACED AT GOAB SWITCH POLE

MAIN PHOTOVOLTAIC SYSTEM AC DISCONNECT

1 3/4"

5"
LABEL SHALL BE PLACED AT GOAB SWITCH POLE

OPERATING RATINGS
OPERATING CURRENT: 289.4A
OPERATING VOLTAGE: 12.47KV

1 1/2"

5 1/2"
LABEL SHALL BE PLACED AT MAIN SWITCHBOARDS

PV MAIN SWITCHBOARD

1 3/4"

5 1/2"
LABEL SHALL BE PLACED AT DISCONNECTING MEANS OF MAIN SWITCHBOARDS

PHOTOVOLTAIC SYSTEM AC DISCONNECT

1 3/4"

5"
LABEL SHALL BE PLACED AT MAIN BREAKERS OF SWITCHBOARDS A & B

OPERATING RATINGS
OPERATING CURRENT: 2,400A
OPERATING VOLTAGE: 600V

1 1/2"

5"

WARNING: PHOTOVOLTAIC POWER SOURCE

1"

LABEL SHALL BE PLACED ON ALL DC EXPOSED CONDUITS AND RACEWAYS

4"

WARNING
ARC FLASH AND SHOCK HAZARD
Appropriate PPE and Tools Required when working on this Equipment

2"

LABEL SHALL BE PLACED ON ALL ELECTRICAL EQUIPMENT, SUCH AS SWITCHBOARDS, INDUSTRIAL CONTROL PANELS, METER SOCKET ENCLOSURES, THAT ARE LIKELY TO REQUIRE EXAMINATION, ADJUSTMENT, SERVICING OR MAINTENANCE WHILE ENERGIZED.

14"

DANGER
HIGH VOLTAGE
AUTHORIZED PERSONNEL ONLY

10"

14"X10" SIGNAGE NOT TO SCALE.
SIGNAGE SHALL BE PLACED ON FENCELINE AT 50FT INTERVALS FROM FENCE CORNER

5"

LOAD CENTER PANEL

1"

LABEL SHALL BE PLACED ON LOAD CENTER PANEL

5"

UTILITY REVENUE GRADE METER

1"

LABEL SHALL BE PLACED ON UTILITY METER PNAEL

5"

ALSO ENERGY DAS PANEL

1"

LABEL SHALL BE PLACED ON ALSO ENERGY DAS PANEL

5"

CUSTOMER RECLOSER

1"

LABEL SHALL BE PLACED ON THE CUSTOMER OWNED RECLOSER PANEL

5 1/2"

CUSTOMER OWNED GROUNDING TRANSFORMER

1 3/4"

LABEL SHALL BE PLACED ON ALL GROUNDING TRANSFORMERS

5"

CUSTOMER OWNED PV PRODUCTION METER

1"

LABEL SHALL BE PLACED ON THE PRIMARY METER PANEL

5"
LABEL SHALL BE PLACED AT GOAB SWITCH

PV SYSTEM GOAB SWITCH

1"

5 1/2"
LABEL SHALL BE PLACED AT GOAB SWITCH

PHOTOVOLTAIC SYSTEM AC DISCONNECT

1 3/4"

5"
LABEL SHALL BE PLACED AT GOAB SWITCH

OPERATING RATINGS
OPERATING CURRENT: 289.4A
OPERATING VOLTAGE: 12.47KV

1 1/2"

1 EQUIPMENT LABELS
SCALE: 1:1

GENERAL LABEL NOTES:

1. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL PLACARDS AS REQUIRED BY THE NEC, LOCAL UTILITY AND LOCAL AUTHORITY HAVING JURISDICTION REQUIREMENTS.
2. PLACARDS AND LABELS SHALL USE ARIAL OR SIMILAR FONT, LETTERING IN CAPITAL LETTERS, AND SHALL BE MADE OF WEATHER RESISTANT AND DURABLE MATERIAL. PLACARDS AND LABELS SHALL BE NEC 2017 COMPLIANT.
3. ALL PLACARDS AND LABELS SHALL BE AFFIXED TO EQUIPMENT UNLESS NOTED OTHERWISE.
4. ALL CONDUCTORS SHALL BE LABELED WITH HEAT SHRINK LABELS AT THE FOLLOWING LOCATIONS:
   - DC CONDUCTORS AT THE MODULE CONNECTORS AND AT INVERTER INPUT TERMINALS
   - INVERTER CONDUCTORS AT INVERTER OUTPUT TERMINALS AND TERMINALS OF DISCONNECTING MEANS
   - AC FEEDERS (BOTH SIDES) AT LUGS OR TERMINALS OF DISCONNECTING MEANS

NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	CHK
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PROJECT NAME AND ADDRESS
BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE
EQUIPMENT LABELS

ENGINEER:	DRAWN BY:
DB	AJ
PROJECT NO.: 01-19-001	SHEET NO.: E-500
CREATION DATE: 12/31/2019	SHEET 16 OF 22

5 1/4"

LABEL SHALL BE PLACED ON INVERTERS
A.1, A.3, A.4, A.13, A.14 (26 STRINGS - HELIENE)

INPUT RATINGS
MAX CIRCUIT CURRENT: 294.13A
MAX DC VOLTAGE: 1,464.60V

OUTPUT RATINGS
OPERATING CURRENT: 160.00A
OPERATING VOLTAGE: 600V

3"

5 1/4"

LABEL SHALL BE PLACED ON INVERTERS
A.2, A.5-A.12, A.15 (25 STRINGS - HELIENE)

INPUT RATINGS
MAX CIRCUIT CURRENT: 282.81A
MAX DC VOLTAGE: 1,464.60V

OUTPUT RATINGS
OPERATING CURRENT: 160.00A
OPERATING VOLTAGE: 600V

3"

5 1/4"

LABEL SHALL BE PLACED ON INVERTERS
B.2-B.15 (24 STRINGS - HANSOL)

INPUT RATINGS
MAX CIRCUIT CURRENT: 286.20A
MAX DC VOLTAGE: 1,474.68V

OUTPUT RATINGS
OPERATING CURRENT: 160.00A
OPERATING VOLTAGE: 600V

3"

5 1/4"

LABEL SHALL BE PLACED ON INVERTERS
B.1 (23 STRINGS - HANSOL)

INPUT RATINGS
MAX CIRCUIT CURRENT: 274.28A
MAX DC VOLTAGE: 1,474.68V

OUTPUT RATINGS
OPERATING CURRENT: 160.00A
OPERATING VOLTAGE: 600V

3"

5"

INVERTER XX

1"

LABEL SHALL BE PLACED ON ALL INVERTERS. THE REFERENCE 'XX' SHALL MATCH THE NUMERICAL NAME OF THE INVERTER THE LABEL IS PLACED ON.

5"

LABEL SHALL BE PLACED ON COMBINER BOXES
A.1, A.3, A.4, A.13, A.14 (26 STRINGS - HELIENE)

OPERATING RATINGS
MAX CIRCUIT CURRENT: 294.13A
MAX DC VOLTAGE: 1,464.60V

1 1/2"

5"

LABEL SHALL BE PLACED ON COMBINER BOXES
A.2, A.5-A.12, A.15 (25 STRINGS - HELIENE)

OPERATING RATINGS
MAX CIRCUIT CURRENT: 282.81A
MAX DC VOLTAGE: 1,464.60V

1 1/2"

5"

LABEL SHALL BE PLACED ON COMBINER BOXES
B.1 (23 STRINGS - HANSOL)

OPERATING RATINGS
MAX CIRCUIT CURRENT: 274.28A
MAX DC VOLTAGE: 1,474.68V

1 1/2"

5"

LABEL SHALL BE PLACED ON COMBINER BOXES
B.2-B.15 (24 STRINGS - HANSOL)

OPERATING RATINGS
MAX CIRCUIT CURRENT: 286.20A
MAX DC VOLTAGE: 1,474.68V

1 1/2"

5"

COMBINER BOX XX

1 1/2"

LABEL SHALL BE PLACED ON ALL COMBINER BOXES. THE REFERENCE 'XX' SHALL MATCH THE NUMERICAL NAME OF THE COMBINER BOXES THE LABEL IS PLACED ON.

GENERAL LABEL NOTES:

1. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL PLACARDS AS REQUIRED BY THE NEC, LOCAL UTILITY AND LOCAL AUTHORITY HAVING JURISDICTION REQUIREMENTS.
2. PLACARDS AND LABELS SHALL USE ARIAL OR SIMILAR FONT, LETTERING IN CAPITAL LETTERS, AND SHALL BE MADE OF WEATHER RESISTANT AND DURABLE MATERIAL. PLACARDS AND LABELS SHALL BE NEC 2017 COMPLIANT.
3. ALL PLACARDS AND LABELS SHALL BE AFFIXED TO EQUIPMENT UNLESS NOTED OTHERWISE.
4. ALL CONDUCTORS SHALL BE LABELED WITH HEAT SHRINK LABELS AT THE FOLLOWING LOCATIONS:
   - DC CONDUCTORS AT THE MODULE CONNECTORS AND AT INVERTER INPUT TERMINALS
   - INVERTER CONDUCTORS AT INVERTER OUTPUT TERMINALS AND TERMINALS OF DISCONNECTING MEANS
   - AC FEEDERS (BOTH SIDES) AT LUGS OR TERMINALS OF DISCONNECTING MEANS

5 1/2"

WARNING

ELECTRIC SHOCK HAZARD

DO NOT TOUCH TERMINALS
TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

3 3/4"

LABEL SHALL BE PLACED ON ALL INVERTERS BY THE INVERTER WIRING BOX & ALL DC COMBINER BOXES

NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	CHK
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DEVELOPER

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PROJECT NAME AND ADDRESS

BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

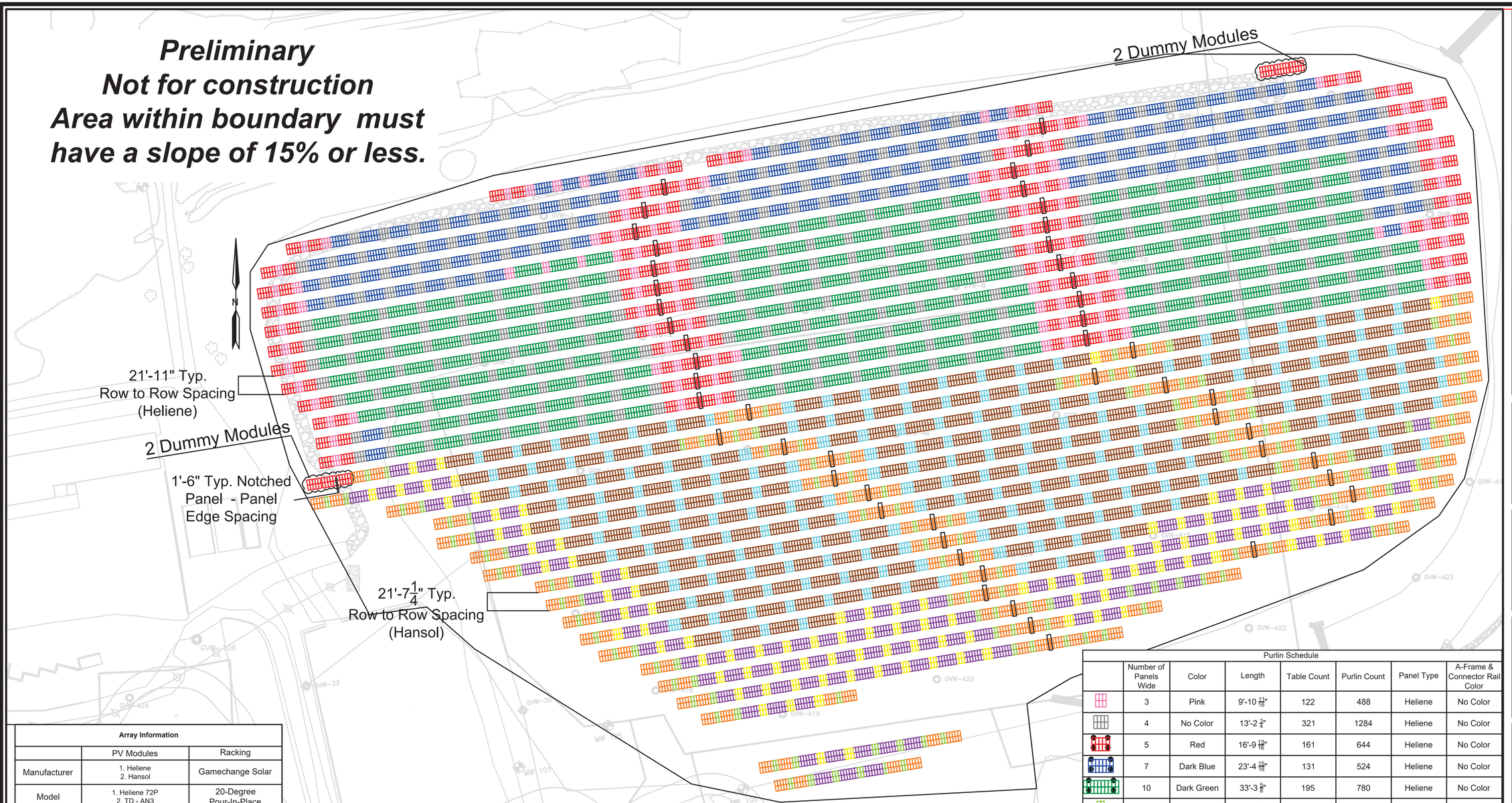
SHEET TITLE

EQUIPMENT LABELS

ENGINEER:	DRAWN BY:
DB	AJ
PROJECT NO.: 01-19-001	SHEET NO.: E-501
CREATION DATE: 12/31/2019	SHEET 17 OF 22

1 EQUIPMENT LABELS
SCALE: 1:1

Preliminary
Not for construction
Area within boundary must have a slope of 15% or less.



Array Information		
	PV Modules	Racking
Manufacturer	1. Heliene 2. Hansol	Gamechange Solar
Model	1. Heliene 72P 2. TD - AN3	20-Degree Pour-In-Place
Dimensions	1. 77.01" x 39.06" x 1.58" 2. 78.50" x 39.37" x 1.58"	
Weight	1. 48.29 lbs 2. 49.62 lbs	
Quantity	1. 10640 + 4 Dummy Modules 2. 10052	1952 Tub Pairs
Ground Clearance	42 in	
10640 modules at 325W 10052 modules at 340W 6.877 MW		

Purlin Schedule							
	Number of Panels Wide	Color	Length	Table Count	Purlin Count	Panel Type	A-Frame & Connector Rail Color
	3	Pink	9'-10 11/16"	122	488	Heliene	No Color
	4	No Color	13'-2 1/4"	321	1284	Heliene	No Color
	5	Red	16'-9 13/16"	161	644	Heliene	No Color
	7	Dark Blue	23'-4 15/16"	131	524	Heliene	No Color
	10	Dark Green	33'-3 5/8"	195	780	Heliene	No Color
	2	Light Green	6'-7 3/4"	149	596	Hansol	Red
	3	Yellow	9'-11 5/8"	103	412	Hansol	Red
	4	Light Blue	13'-3 1/2"	192	768	Hansol	Red
	5	Orange	16'-11 3/8"	180	720	Hansol	Red
	7	Purple	23'-7 1/16"	113	452	Hansol	Red
	10	Brown	33'-6 11/16"	196	784	Hansol	Red

NOTE : Tables Marked ▯ will require 18" thermal breaks.

GENERAL NOTES

- The layout shown herein is based on site layout geometry provided to GameChange Solar by the customer.
- Any changes to the site that may affect the solar PV arrays depicted herein shall be notified to GameChange Solar.
- The layouts and details shown herein are a custom design for this project and are specific to the PV module(s) shown in the Array Information table.
- GameChange Solar cannot be responsible for errors during installation caused by changes that impact the layout as shown
- Install foundations at specified distances along slope line, Not by plane view. See Detail Sheets for additional info
- Minimum safety factor of 1.5 used in structural design per UL2703

Design Information

Building Occupancy Category	I	Area of Array	21.84 acres	Distributed Dead Load	14.5 psf
Wind Exposure Category	C	No. of rows	34	Seismic Site Class	D
Design Wind Speed	126 mph ASCE7-10	Distance to Saltwater	approx. 1 mile	S_S/S_1	0.174 g/ 0.06 g
Design Snow Load	30 psf	Years Since Landfill Capped	over 20 years	Project Design Life	25 Years

AERIAL VIEW

REV	DESCRIPTION	DATE	CHK
A	Issued For Client Approval	2022-09-28	HD
B	Updated Layout	2022-11-17	MG

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Tel:212-388-5160
www.gamechangesolar.com

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PROJECT NAME AND ADDRESS

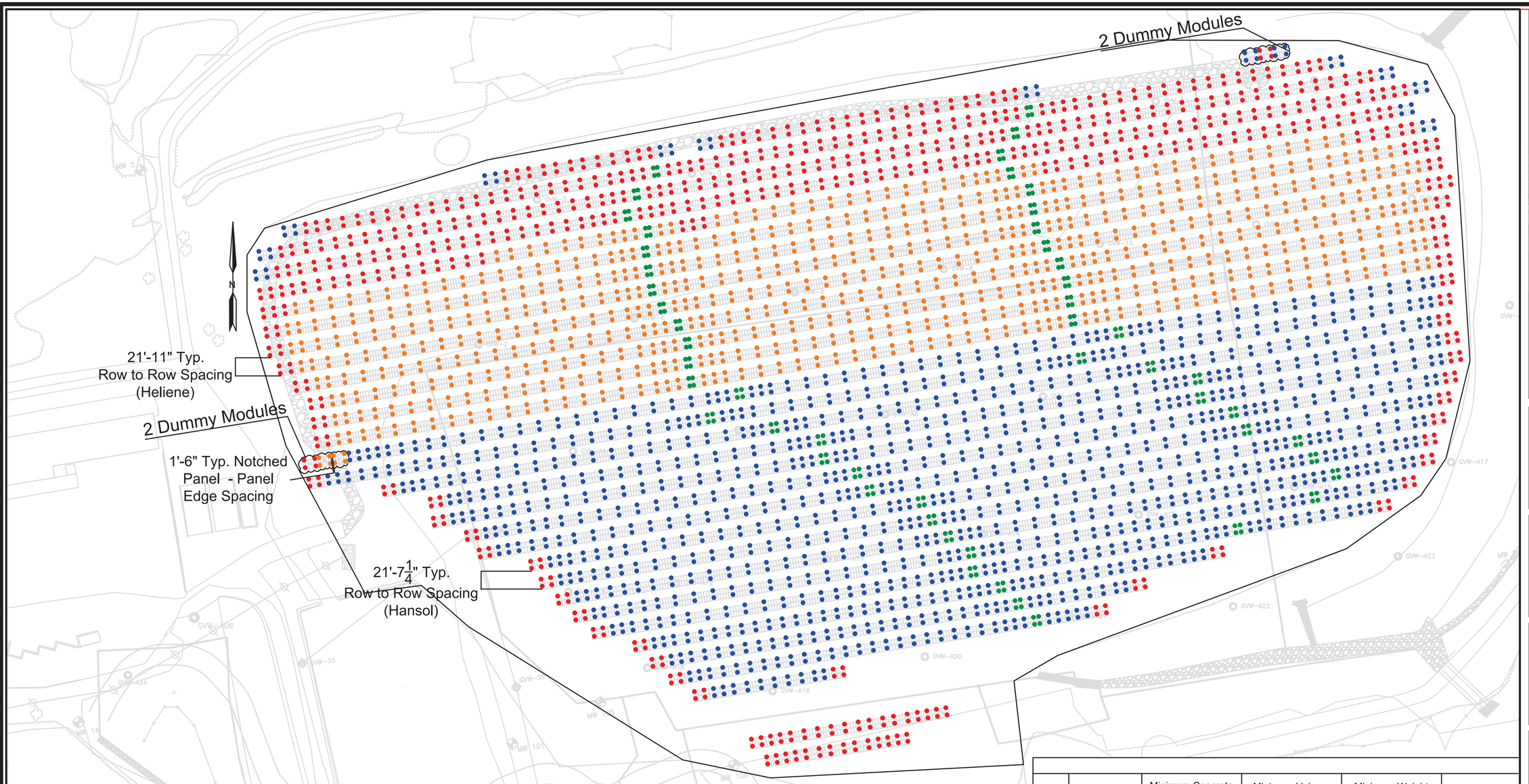
BRISTOL LANDFILL SOLAR

MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE

SITE PLAN

ENGINEER:	DRAWN BY:
SVP	MG
PROJECT NO.	SHEET NO.
1369	**S100**
CREATION DATE	
01/13/2023	
SCALE	
As Shown	SHEET 18 OF 22



Preliminary
Not for construction
Area within boundary must have a slope of 15% or less.

Color	Tub Height	Minimum Concrete Fill Height	Minimum Volume Per Tub	Minimum Weight Per Tub	Count
● ●	21"	21"	0.86 yd^3	3356 lbs	444 Tub Pairs (888 Tubs)
● ●	21"	20.5"	0.83 yd^3	3267 lbs	858 Tub Pairs (1716 Tubs)
● ●	21"	19"	0.77 yd^3	3001 lbs	548 Tub Pairs (1096 Tubs)
● ●	18"	14.5"	0.57 yd^3	2230 lbs	102 Tub Pairs (204 Tubs)

GENERAL NOTES

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AERIAL VIEW

REV	DESCRIPTION	DATE	CHK
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B	Updated Layout	2022-11-17	MG

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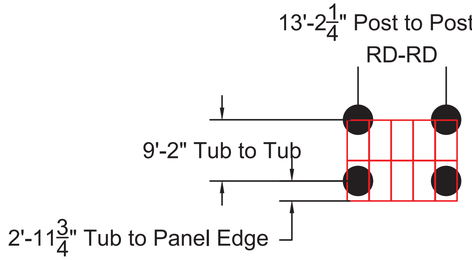
PROJECT NAME AND ADDRESS

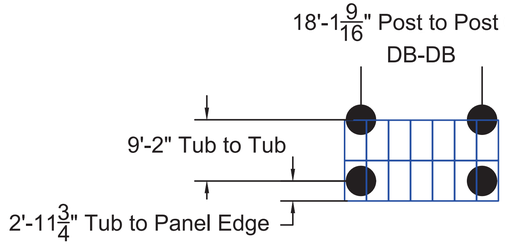
BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

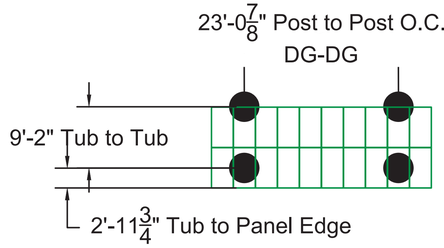
SHEET TITLE

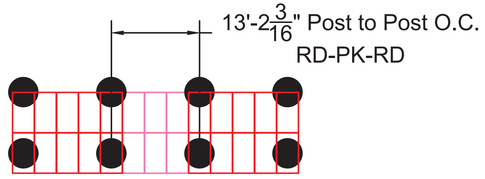
TUB PLAN

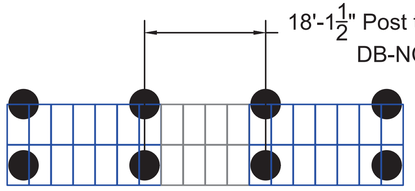
ENGINEER: SVP	DRAWN BY: MG
PROJECT NO. 1369	SHEET NO. S200
CREATION DATE 01/13/2023	
SCALE As Shown	SHEET 19 OF 22

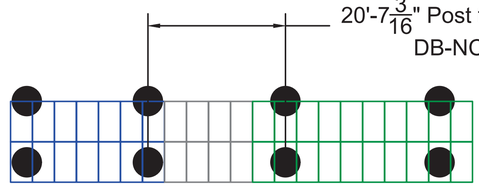


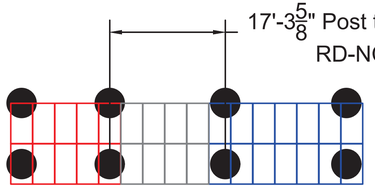


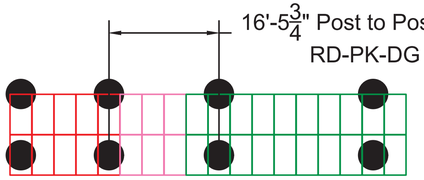


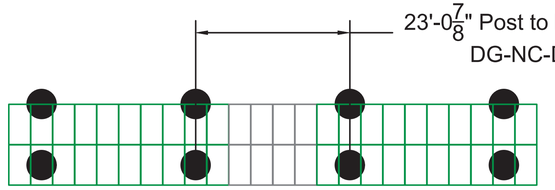


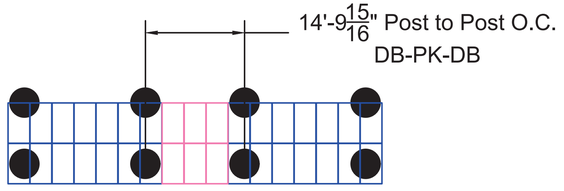


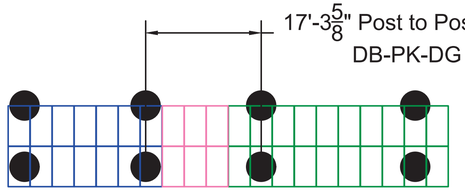


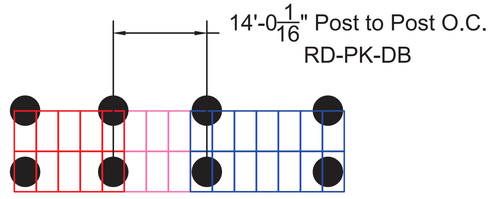


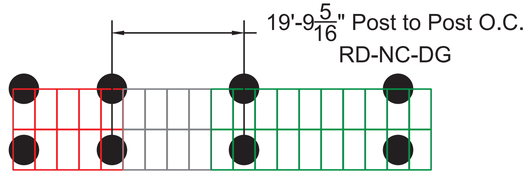












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Design Information

Building Occupancy Category	I	Area of Array	21.84 acres	Distributed Dead Load	14.5 psf
Wind Exposure Category	C	No. of rows	34	Seismic Site Class	D
Design Wind Speed	126 mph ASCE7-10	Distance to Saltwater	approx. 1 mile	S_S/S_1	0.174 g/ 0.06 g
Design Snow Load	30 psf	Years Since Landfill Capped	over 20 years	Project Design Life	25 Years

AERIAL VIEW

REV	DESCRIPTION	DATE	CHK
A	Issued For Client Approval	2022-09-28	HD
B	Updated Layout	2022-11-17	MG

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http://www.renuaenergy.com/

DEVELOPER
NUGEN CAPITAL
NUGEN CAPITAL MANAGEMENT LLC.
267 WATER STREET
WARREN, RI 02885
http://www.nugencapital.com/

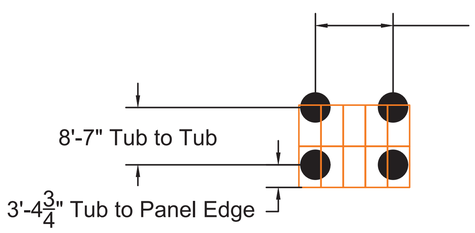
PROJECT NAME AND ADDRESS

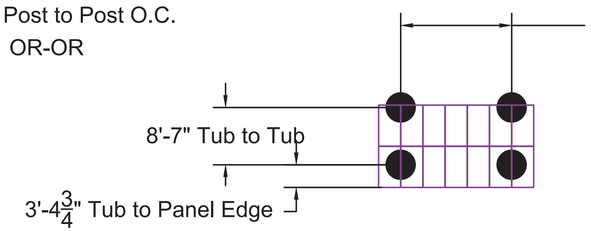
BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

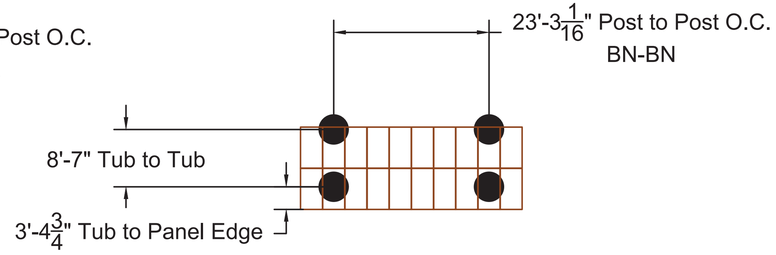
SHEET TITLE

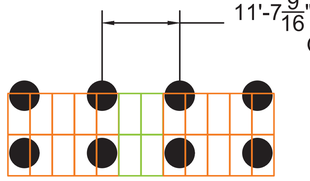
TUB SPACING PLAN (Heliene)

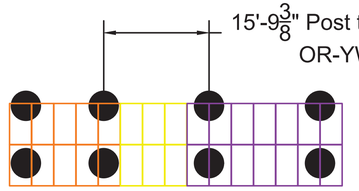
ENGINEER:	DRAWN BY:
SVP	MG
PROJECT NO.	SHEET NO.
1369	S250
CREATION DATE	
01/13/2023	
SCALE	SHEET 20 OF 22
As Shown	

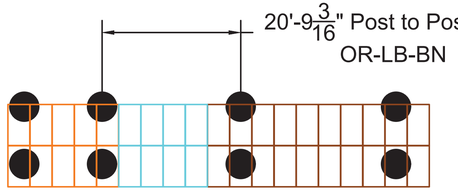


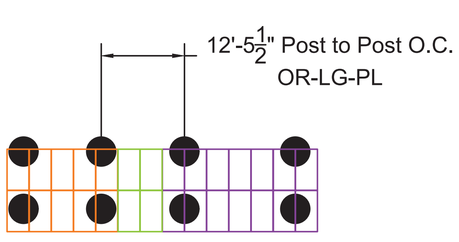


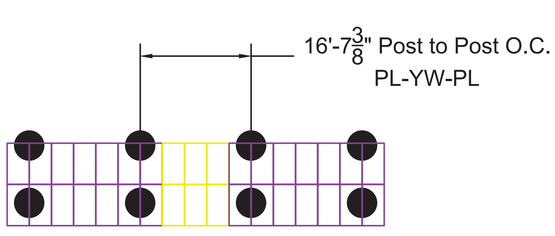


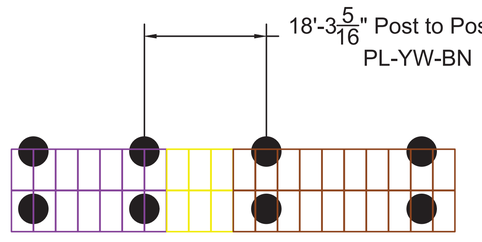


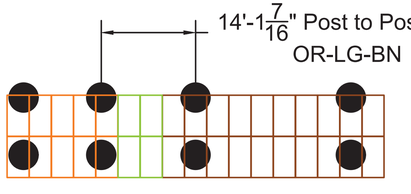


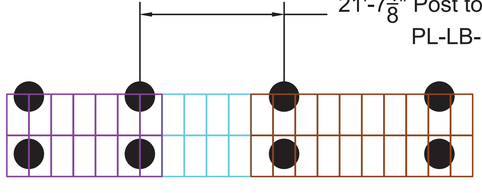


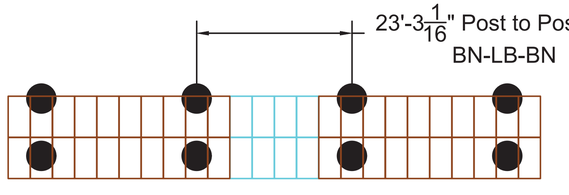












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AERIAL VIEW

REV	DESCRIPTION	DATE	CHK
A	Issued For Client Approval	2022-09-28	HD
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PROJECT NAME AND ADDRESS

BRISTOL LANDFILL SOLAR

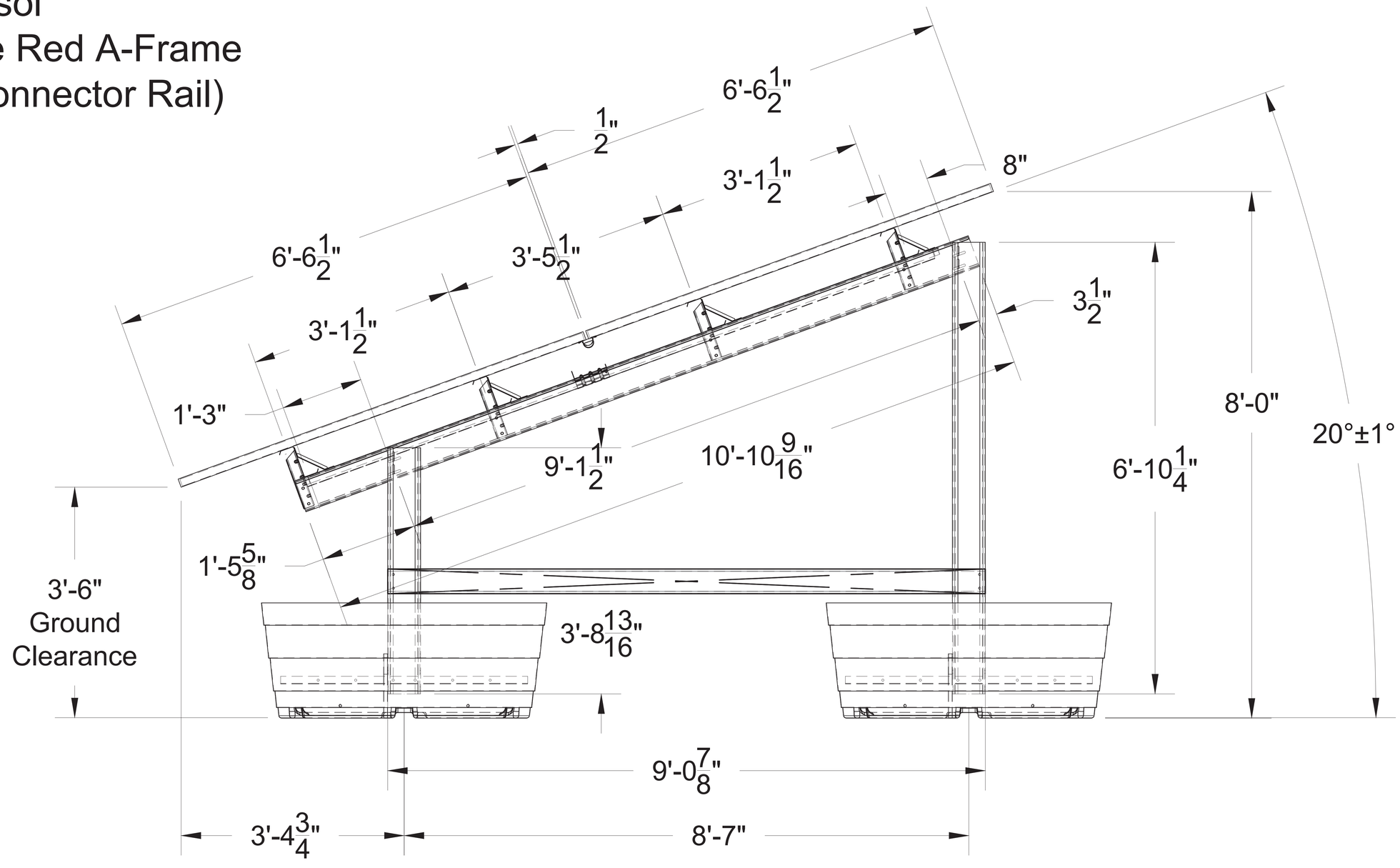
MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE

TUB SPACING PLAN (Hansol)

ENGINEER:	DRAWN BY:
SVP	MG
PROJECT NO.	SHEET NO.
1369	S251
CREATION DATE	
01/13/2023	
SCALE	
As Shown	SHEET 21 OF 22

Hansol
(Use Red A-Frame & Connector Rail)



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PROJECT NAME AND ADDRESS

BRISTOL LANDFILL SOLAR
MINTURN FARM RD
BRISTOL, RI 02809

SHEET TITLE

TYPICAL ASSEMBLY
East Elevation

ENGINEER:	DRAWN BY:
SVP	MG
PROJECT NO.	SHEET NO.
1369	S403
CREATION DATE	
01/13/2023	
SCALE	SHEET 22 OF 22
As Shown	

Attachment B: GCL Report

PAUL B. ALDINGER & ASSOCIATES, INC.
Consulting in Geotechnical Engineering & Groundwater Hydrology
860A Waterman Avenue, Suite 9 East Providence, RI 02914 (401) 435-5570

June 22, 2020

Mr. Steven J. Richtarik, PE
BETA Group, Inc.
701 George Washington Hwy
Lincoln, RI 02865

Re: Solar Array on Bristol Landfill

Dear Mr. Richtarik:

We understand that the Town proposes to place a solar array on the Bristol landfill. As part of that plan, they were required to submit an application to the RI Department of Environmental Management (RIDEM). Since the landfill cap includes a bentonite GCL, RIDEM has questioned whether the added load of the solar array would potentially jeopardize the integrity of the GCL and make it more permeable and unable to serve the function as an impermeable barrier. At your request we have investigated this issue and developed this letter with our findings.

BACKGROUND

The landfill cap on the Bristol landfill consists of four layers of material placed on the previously existing cover material. This consisted of 6" of compacted sand (a gas venting material) under the geosynthetic clay liner (GCL), under another 12" thick sand layer (a drainage layer), under a 12" thick vegetative support layer. The GCL is the Bentomat ST manufactured by CETCO. This product is a reinforced GCL consisting of a layer of sodium bentonite clay between a woven and a nonwoven geotextile, which are needlepunched together. This needlepunching produces a stronger and more rigid GCL, making it less susceptible to damage during installation and the life of the product.

PROPOSED DEVELOPMENT

We understand that the proposal is to place solar panels on the relatively flat areas of the landfill. These panels will be supported by ballast blocks which are anticipated to be 10' long by 4' wide and 1.5' tall. They would weigh from 8,000 to 9,000 pounds each. This would make the contact pressure on the landfill surface of approximately 200 to 225 PSF. These ballast blocks would be supported by the one foot thick vegetative support layer and one foot of sand drainage layer. Assuming a 0.5H to 1V load distribution beneath it, this would increase the stress on the GCL from approximately 250 PSF to approximately 400 PSF. This is a relatively light load and a small increase in load.

We researched the impacts of this potential increase in the load on the GCL. We spoke to a

representative of the manufacturer of the GCL, Mr. Tom Hauck of CETCO. His opinion was that increasing the load on the GCL will actually make it more impervious, making it more effective as a water barrier. He really had no concern that adding load would impair the GCL in any way. His one concern was that when placing these panels on the landfill, they should be careful not to damage the GCL. He recommended that they be required to use equipment with low contact pressure, such as a tracked vehicle or dozer.

We also reviewed an EPA publication, EPA530-F-97-002 entitled "Geosynthetic Clay Liners Used in Municipal Solid Waste Landfills", revised December 2001. This publication confirms Mr. Hauck's assessment that adding load will decrease the hydraulic conductivity (permeability). On page 3, it states the following:

> "*Test values for hydraulic conductivity depend upon the degree of effective overburden stress around the GCL during testing. The higher the effective overburden stress, the lower the hydraulic conductivity."*

CONCLUSION

It is our opinion that adding the solar panels to the relatively level part of the landfill and placing them on the vegetative layer as described herein should not detrimentally impact the effectiveness of the capping material. Our research indicates that properly installed, there is evidence that placement of the solar panels will actually increase the effectiveness of the GCL as a water barrier. We do caution, however, that care should be taken when operating on the landfill surface by using low contact pressure equipment and requiring a restrictive controlled operation. Accordingly, we recommend that contract specifications should specifically require low contact equipment to place these solar panels, that equipment speed be controlled and that rutting of the cover material be strictly prohibited. Close observance of the contractor should be provided to ensure that these measures are strictly enforced.

We trust that this is adequate for your needs at this time. If there are any questions or if you need additional information, please do not hesitate to contact this office.

Very truly yours,

PAUL B. ALDINGER & ASSOCIATES, INC.

Paul B. Aldinger, Ph.D., P.E.
Chief Engineer

Attachment B: GCL Report

Calculation Package for

Bristol Landfill

6 Minturn Farm Rd, Bristol, RI, USA 02809

Date:
10/27/2022

Prepared for:
NuGen Capital

Prepared by:
GameChange Solar LP
230 East Ave, Norwalk, CT 06855

Calculation Package for GCS Pour-In-Place System

Project: Nugen-Bristol Landfill
Address: 6 Minturn Farm Rd, Bristol, RI 02809, USA
Update: 10/27/2022 **By:** MG

INDEX	
Page No	**Objective**
3	General Wind Zone : Mid Row Mid
18	General Wind Zone : North Row Mid, South Row Mid
33	General Wind Zone : North Row End, Mid Aisle, Mid Row End,South Row End
48	Airborne Corrosion Analysis

NOTE : This calculation package shows the analysis of the fixed tilt tables supporting the hansol modules. The same design methodology shown herein was used to design the tables for Heliene modules. The Hansol modules will experience the highest load. Therefore the analysis herein is conservative for the other module.

GAMECHANGE SOLAR
REPOWERING THE PLANET

Calculation Package for GCS Pour-in-Place System

Wind Zone : Mid Row Mid

Project: Nugen-Bristol Landfill
Address: 6 Minturn Farm Rd, Bristol, RI 02809, USA
Update: 4/1/2022 **By:** HD

General Information

Setup	Portrait	
Tilt	20	degree
Clearance	42	in
Panel Length	78.50	in
Panel Width	39.37	in
Panel Weight	49.61	lbs
Space between Panels N-S	0.5	in
Space between Panels E-W	0.5	in
Mounting Type	Bottom	
Number of Panels Up	2	#
Number of Purlins	4	#
No. of Panels Supported	14	#
No. of Panel Widths per Span	7.00	#
No. of Panel Widths per Overhang	1.50	#
Purlin Span Length	23.26	ft
Loading Code	ASCE7-10	
Occupancy Category	I	
Exposure Category	C	
Seismic Site Class	D	
Assumed Load Bearing Capacity of Soil	1	ksf
Dead Load:	3.0	psf
Ground Snow Load (Pg)	30	psf
Basic Wind Speed	126	mph

Seismic Design Values

Ss	0.174	g
S1	0.06	g
Fa	1.6	
Fv	2.4	
SDS	0.186	g
SD1	0.096	g

1. Loading Calculations

1.1 Snow Load

Snow load is calculated per ASCE7

Pg (psf)	30.00	
Ce	0.90	Per Table 7-2.
Ct	1.20	Per Table 7-3.
Is	0.80	Per Table 7-4.
Cs	0.91	Per Figure 7-2c.

According to equation (7-1) and (7-2)

Ps=Cs*Pf = Cs*(0.7Ce*Ct*Is*Pg) Ps = 16.49

1.2 Wind Load

Wind pressure is calculated per ASCE7

V (mph)	126.00	
Kd	0.85	Per Table 26.6-1
Kz	1.00	Per Wind Tunnel Test Report
Kzt	1.00	Per Section 26.8
Iw	1.00	Wind Importance Factor equals unity for ASCE7-10

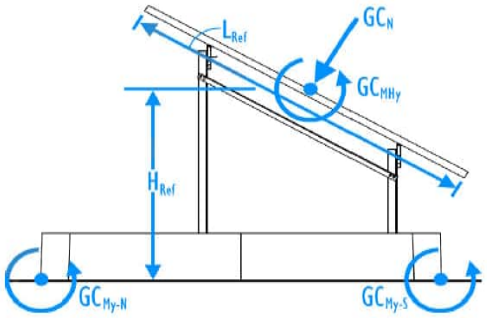
According to Equation (27.3-1)

qh = 0.00256*Kd*Kz*Kzt*(V^2)*I qh = 34.55

According to equation (27.4-3)

$P=q_h GC_N$

The results of wind load factors including normal and overturning moments provided by CPP are located in the calculation sheets. The results are given for two opposite directions of wind which causes upward and downward wind forces calculated based on worst case design wind loads.
GC_N is the normal force factor, GC-My is the moment at the base of the post. The factor of safety is calculated based on the worst case scenario, when the dead load and full wind loads are present. These factors are used to generate all wind load components for the following calculations.

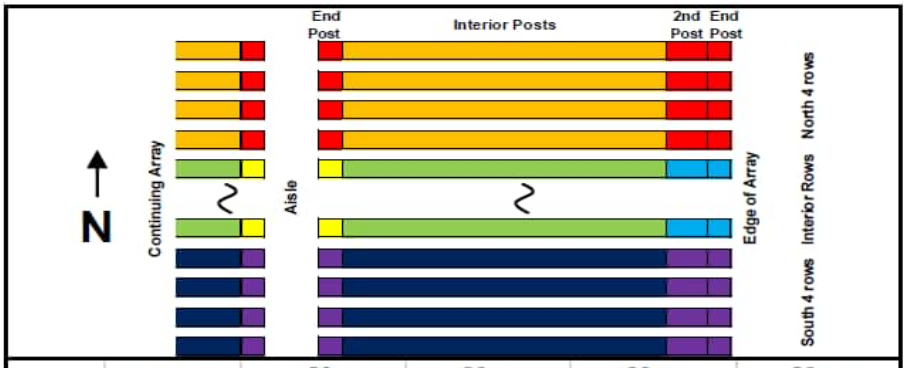


Schematic of wind load coefficients – PourInPlace System

$$GC_N = \frac{F_N}{q_z A_{ref}}$$

$$GC_{MHy} = \frac{M_{Hy}}{q_z A_{ref} L_{ref}}$$

$$GC_{My} = \frac{M_y}{q_z A_{ref} H_{ref}}$$



Zone	Tilt/height*	GC_N		GC_{MHv}		$GC_{Mv\text{-}N}$		$GC_{Mv\text{-}S}$	
		Min	Max	Min	Max	Min	Max	Min	Max
	15° / 0.12	-0.72	0.62	-0.16	0.03	-1.83	1.43	-1.76	0.89
	15° / 0.46	-0.84	0.60	-0.18	0.04	-0.66	0.54	-1.00	0.47
	30° / 0.12	-1.14	1.14	-0.17	0.04	-1.65	1.14	-1.94	1.36
	30° / 0.46	-1.20	1.24	-0.22	0.05	-0.64	0.29	-1.40	1.05
	15° / 0.12	-0.66	0.28	-0.10	0.02	-0.84	1.48	-1.40	0.44
	15° / 0.46	-0.71	0.26	-0.16	0.02	-0.29	0.50	-0.84	0.19
	30° / 0.12	-0.85	0.47	-0.09	0.04	-0.60	0.95	-1.31	0.65
	30° / 0.46	-0.86	0.45	-0.14	0.06	-0.23	0.27	-0.94	0.39
	15° / 0.12	-0.34	0.50	-0.09	0.02	-1.48	0.72	-0.81	0.70
	15° / 0.46	-0.58	0.59	-0.11	0.03	-0.66	0.40	-0.66	0.42
	30° / 0.12	-0.56	0.88	-0.09	0.03	-1.31	0.58	-0.93	1.02
	30° / 0.46	-0.63	1.11	-0.12	0.03	-0.59	0.19	-0.69	0.92
	15° / 0.12	-0.43	0.24	-0.10	0.01	-0.72	0.80	-1.09	0.33
	15° / 0.46	-0.46	0.25	-0.12	0.01	-0.27	0.29	-0.57	0.19
	30° / 0.12	-0.53	0.38	-0.07	0.03	-0.51	0.56	-0.86	0.52
	30° / 0.46	-0.57	0.43	-0.10	0.02	-0.23	0.16	-0.64	0.36
	15° / 0.12	-0.54	0.44	-0.11	0.02	-1.28	1.12	-1.24	0.67
	15° / 0.46	-0.77	0.51	-0.15	0.03	-0.54	0.53	-0.88	0.38
	30° / 0.12	-1.03	0.95	-0.16	0.02	-1.39	0.99	-1.78	1.12
	30° / 0.46	-1.19	1.12	-0.20	0.02	-0.57	0.32	-1.35	0.96
	15° / 0.12	-0.49	0.52	-0.11	0.02	-1.70	0.90	-1.22	0.57
	15° / 0.46	-0.48	0.87	-0.14	0.02	-1.02	0.28	-0.62	0.56
	30° / 0.12	-0.65	0.67	-0.08	0.03	-1.03	0.69	-1.05	0.74
	30° / 0.46	-0.75	0.88	-0.13	0.02	-0.47	0.20	-0.85	0.73
	15° / 0.12	-0.67	0.47	-0.12	0.03	-1.48	1.36	-1.55	0.72
	15° / 0.46	-0.88	0.76	-0.17	0.03	-0.89	0.60	-1.02	0.48
	30° / 0.12	-1.31	0.92	-0.20	0.02	-1.35	1.20	-2.28	1.08
	30° / 0.46	-1.42	1.10	-0.25	0.03	-0.57	0.32	-1.66	0.93

* Height is expressed as the ratio of the gap from the ground to the low edge of the PV divided by the cl
Interpolation between configurations is allowed

1.3 Load Combinations:

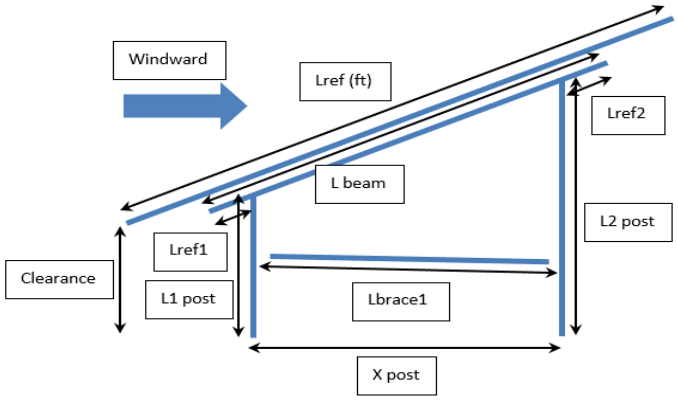
Basic load combinations are per ASCE7-10 and ASD design method.

Combo 1	D				
Combo 3	D	+	S		
Combo 5	D	+	0.60W		
Combo 6a	D	+	0.75S	+	0.45W
Combo 7	0.6D	+/-	0.60W		
Combo 8	D	+	0.7E		

1.4 Safety Factors

	Ωc	Ωb	Ωv		$SF_{FDN.}$
Safety Factor	1.5	1.5	1.5		1.5

2.0 Analysis and Design: Geometry



Tilt (degrees)	20
Clearance (in)	42.00
Lref (in)	157.51
Lref1 (in)	15.00
Lref2 (in)	-8.00
Bottom Overhang (in)	20.51
Top Overhang (in)	20.51
X post (in)	104.29
L1 post (in)	42.04
L2 post (in)	79.49
Brace to Beam (in)	39.04
L brace1 (in)	110.29
Brace1 Angle w/ Horiz	0.00
L beam (in)	125.99
Href (in)	68.94

NOTES:
Post Lengths are unbraced lengths from top of concrete to connection with NS Beam

2.1 Post Design (AISI S100-07)

South Post	GC361WP 14 Ga	Grade	80
North Post	GC361WP 14 Ga	Grade	80

Material Type: Pre-Galvanized Steel

Effective section properties at applied loads:

South Post	Ae (in^2)	1.012	Ixe(in^4)	5.918	Iye (in^4)	1.438	C Channel 6x3.125x1
			Sxe(t) (in^3)	1.97	Sye(l) (in^3)	1.34	
			Sxe(b) (in^3)	1.97	Sye(r) (in^3)	0.70	
North Post	Ae (in^2)	1.012	Ixe(in^4)	5.918	Iye (in^4)	1.438	
			Sxe(t) (in^3)	1.97	Sye(l) (in^3)	1.34	
			Sxe(b) (in^3)	1.97	Sye(r) (in^3)	0.70	

Reactions at Base of South Post

		Combo 3	Combo 5	Combo 6a	Combo 7
North Row End	Moment (kip-in)				
	Axial load (kip)				
North Row Mid	Moment (kip-in)				
	Axial load (kip)				
Mid Aisle	Moment (kip-in)				
	Axial load (kip)				
Mid Row Mid	Moment (kip-in)	0.00	18.29	13.72	-37.89
	Axial load (kip)	3.66	1.77	3.79	-2.13
Mid Row End	Moment (kip-in)				
	Axial load (kip)				
South Row Mid	Moment (kip-in)				
	Axial load (kip)				
South Row End	Moment (kip-in)				
	Axial load (kip)				

Reactions at Base of North Post

		Combo 3	Combo 5	Combo 6a	Combo 7
North Row End	Moment (kip-in)				
	Axial load (kip)				
North Row Mid	Moment (kip-in)				
	Axial load (kip)				
Mid Aisle	Moment (kip-in)				
	Axial load (kip)				
Mid Row Mid	Moment (kip-in)	0.00	26.47	19.85	-54.83
	Axial load (kip)	2.80	1.35	2.90	-1.63
Mid Row End	Moment (kip-in)				
	Axial load (kip)				
South Row Mid	Moment (kip-in)				
	Axial load (kip)				
South Row End	Moment (kip-in)				
	Axial load (kip)				

According to North American Specification for the Design of Cold-Formed Steel Structural Members (2007 Edition), Equation C5.2.1-1-C5.2.1.3

$$\frac{\Omega_c P}{P_n}+\frac{\Omega_b M_x}{M_{nx}}+\frac{\Omega_b M_y}{M_{ny}}\leq 1.0$$

		South Post		
		Pn/Ωc	**Mxn/Ωb**	**Myn/Ωb**
Strength	Compress.	31.19	110.73	39.38
	Tension	56.81		

Section Check at Post Base

		Combo 3	**Combo 5**	**Combo 6a**	**Combo 7**	
North Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
North Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Aisle	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Row Mid	ΩcP/Pn	0.118	0.057	0.121	0.068	
	ΩbMx/Mnx	0.000	0.165	0.124	0.342	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.118**	**0.222**	**0.245**	**0.411**	<1 OK
Mid Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
South Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
South Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					

		North Post		
		Pn/Ωc	**Mxn/Ωb**	**Myn/Ωb**
Strength	Compress.	8.72	110.73	39.38
	Tension	56.81		

Section Check at Post Base

		Combo 3	**Combo 5**	**Combo 6a**	**Combo 7**	
North Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
North Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Aisle	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Row Mid	ΩcP/Pn	0.321	0.155	0.332	0.187	
	ΩbMx/Mnx	0.000	0.239	0.179	0.495	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.321**	**0.394**	**0.512**	**0.682**	<1 OK
Mid Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
South Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
South Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					

2.2 Brace Design

Brace (Channel 4.6x2.6, 14 Gauge)

Material Type:Pre-galvanized Steel, Fy= 50 ksi

Effective section properties at applied loads

Ae (in^2)	0.699	Ixe (in^4)	2.421	Iye (in^4)	0.492
		Sxe(t) (in^4)	1.0526	Sye(l) (in^4)	0.6999
		Sxe(b) (in^4)	1.0526	Sye(r) (in^4)	0.2594

Brace is technically a zero force member. Conservatively check for axial load = 20% of frame lateral load

					kip	kip-in	kip-in
Axial force (kip)	**Combo 3**	**Combo 5**	**Combo 6a**	**Combo 7**	**P**	**Mx**	**My**
North Row End							
North Row Mid							
Mid Aisle							
Mid Row Mid	0.00	0.07	0.05	-0.14	0.14	0	0.11
Mid Row End							
South Row Mid							
South Row End							

	Pn/Ωc	**Mxn/Ωb**	**Myn/Ωb**
Strength	4.55	33.49	8.25

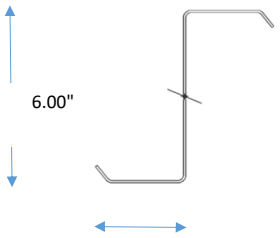
According to North American Specification for the Design of Cold-Formed Steel Structural Members (2007 Edition), Equation C5.2.1-1-C5.2.1.3.As ΩbP/Pn>0.15, equation C5.2.1-2 should be adopted.

$$\frac{\Omega_c P}{P_{no}}+\frac{\Omega_b M_x}{M_{nx}}+\frac{\Omega_b M_y}{M_{ny}} \le 1.0$$

	ΩcP/Pn	ΩbMx/Mnx	ΩbMy/Mny	Sum	
North Row End					
North Row Mid					
Mid Aisle					
Mid Row Mid	0.030	0.000	0.013	0.044	<1 OK
Mid Row End					
South Row Mid					
South Row End					

2.3 Beam Design (AISI S100-07)

Grade	Gauge
80	Gauge 12



Material Type: Pre-galvanized Steel

Section Properties

Ae (in^2)	1.28	Ixe (in^4)	7.16	Iye (in^4)	2.01
		Sxe(t) (in^3)	2.39	Sye(l) (in^3)	0.69
		Sxe(b) (in^3)	2.39	Sye(r) (in^3)	0.69

		Combo 3	Combo 5	Combo 6a	Combo 7
North Row End	Moment (kip-in)				
	Axial load (kip)				
North Row Mid	Moment (kip-in)				
	Axial load (kip)				
Mid Aisle	Moment (kip-in)				
	Axial load (kip)				
Mid Row Mid	Moment (kip-in)	71.81	37.71	76.54	-48.23
	Axial load (kip)	0.50	0.08	0.40	0.08
Mid Row End	Moment (kip-in)				
	Axial load (kip)				
South Row Mid	Moment (kip-in)				
	Axial load (kip)				
South Row End	Moment (kip-in)				
	Axial load (kip)				

According to North American Specification for the Design of Cold-Formed Steel Structural Members (2007 Edition),

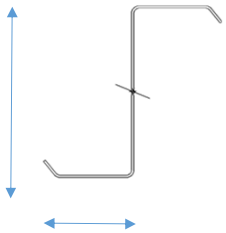
$$\frac{\Omega_c P}{P_n}+\frac{\Omega_b M_x}{M_{nx}}+\frac{\Omega_b M_y}{M_{ny}}\leq 1.0$$

	Pn/Ωc	Mxn/Ωb	Myn/Ωb
Strength	54.87	102.31	29.51

		Combo 3	Combo 5	Combo 6a	Combo 7	
North Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
North Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Aisle	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Row Mid	ΩcP/Pn	0.009	0.001	0.007	0.001	
	ΩbMx/Mnx	0.702	0.369	0.748	0.471	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.711**	**0.370**	**0.755**	**0.473**	<1 OK
Mid Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
South Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
South Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					

2.4 Purlin Design

	Grade	Gauge
Heavy Grade	80	GC63-2.92x.053
Light Grade	80	GC63-2.92x.053



Effective Properties

Heavy Grade	Ae (in^2)	0.64	Ixe (in^4)	3.64	Iye (in^4)	1.05
			Sxe(t) (in^3)	1.213	Sye(l) (in^3)	0.360
			Sxe(b) (in^3)	1.213	Sye(r) (in^3)	0.360
Light Grade	Ae (in^2)	0.64	Ixe (in^4)	3.64	Iye (in^4)	1.05
			Sxe(t) (in^3)	1.213	Sye(l) (in^3)	0.360
			Sxe(b) (in^3)	1.213	Sye(r) (in^3)	0.360

		Combo 3	Combo 5	Combo 6a	Combo 7
North Row End	moment major (kip-in)				
	moment minor (kip-in)				
North Row Mid	moment major (kip-in)				
	moment minor (kip-in)				
Mid Aisle	moment major (kip-in)				
	moment minor (kip-in)				
Mid Row Mid	moment major (kip-in)	33.02	17.34	35.20	-22.18
	moment minor (kip-in)	3.64	0.57	2.87	0.57
Mid Row End	moment major (kip-in)				
	moment minor (kip-in)				
South Row Mid	moment major (kip-in)				
	moment minor (kip-in)				
South Row End	moment major (kip-in)				
	moment minor (kip-in)				

Buckling Check (Per Equation C3.1.2.1-15):

	Continuous Spans		End Spans	
	Fc(x) (ksi)	**Fc(y) (ksi)**	**Fc(x) (ksi)**	**Fc(y) (ksi)**
Heavy Grade Strength	64.45	80.92	40.37	72.11
Light Grade Strength	64.45	80.92	40.37	72.11

	Mx+/Ωb	**My+/Ωb**	**Mx-/Ωb**	**My-/Ωb**
	kip-in	kip-in	kip-in	kip-in
Heavy Grade Strength	49.65	18.47	31.10	16.46
Light Grade Strength	49.65	18.47	31.10	16.46

According to North American Specification for the Design of Cold-Formed Steel Structural Members (2007 Edition), Equation C5.2.1-1-C5.2.1.3

$$\frac{\Omega_c P}{P_n}+\frac{\Omega_b M_x}{M_{nx}}+\frac{\Omega_b M_y}{M_{ny}}\leq 1.0$$

		Combo 3	Combo 5	Combo 6a	Combo 7	
North Row End	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					
North Row Mid	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					
Mid Aisle	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					
Mid Row Mid	ΩbMx/Mnx	0.665	0.349	0.709	0.447	
	ΩbMy/Mny	0.197	0.031	0.155	0.031	
Light Grade	Sum	**0.862**	**0.380**	**0.864**	**0.477**	<1 OK
Mid Row End	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					
South Row Mid	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					
South Row End	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					

Deflection Check

Allowable deflection per panel manufacturer = L/ 100 (0.01mm/mm)

	North Row Ends	North Row Mid	Mid Aisles	Mid Row Mid	Mid Row Ends	South Row Mid	South Row Ends
Max at midspan (in)				0.770			
Δ / L				0.003			
Check				OK			

Purlin Angle Check: OK

Note:

The Purlin analysis above accounts for the longest acceptable purlin length for this project. Some purlins supplied for this project may be shorter than this length due to site geometry or to match the number of panels in a rack with a client requested string size. As the shorter purlins will have less load applied to them and a shorter unbraced length, they have sufficient structural capacty to resist the applied loads.

3. Seismic Forces

Seismic Design Values

Ss	0.174	g	
S1	0.06	g	
Fa	1.6		
Fv	2.4		
SDS	0.19	g	
SD1	0.10	g	
R	3.25		Per Table 12.2-1
Ie	1		Per Table 1.5-2
W	915	lbs	
Cs	0.06	g	Per Eq. 15.4-2
V	52.26	lbs	Per Eq. 12.8-1
My	2.91	k*in	

Utilization Check

Myn/Ωb	74.82	k*in
ΩbMy/Mny	0.04	<1 OK

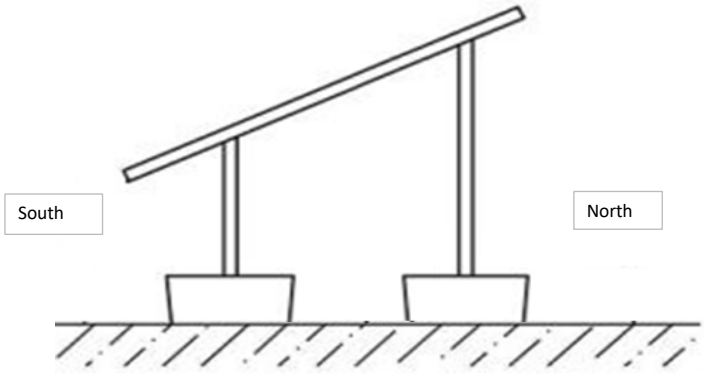
4. Foundation

Ballast Properties

	North Row Ends	North Row Mid	Mid Aisles	Mid Row Mid	Mid Row Ends	South Row Mid	South Row Ends
South Tub Concrete Height (in)				20.5			
North Tub Concrete Height (in)				20.5			
Weight of Tub Pair (lb)				6534			

All Tubs

South Tub Diameter (in)	52
North Tub Diameter (in)	52
Front of panel to front of tub (in)	7.4
Soil bearing capacity (psf)	1000
weight of concrete (pcf)	145



Overturning Moment Check

	North Row Ends	North Row Mid	Mid Aisles	Mid Row Mid	Mid Row Ends	South Row Mid	South Row Ends
Overturning Moment about North Toe (uplift) (k*ft)				18.75			
Overturning Moment about South Toe (uplift) (k*ft)				30.25			
Resistive Moment North (k*ft)				47.29			
Resistive Moment South (k*ft)				45.65			
Min Factor of Safety				1.51			
Safety Factor Check				OK			

Max Uplift / Sliding Check

	North Row Ends	North Row Mid	Mid Aisles	Mid Row Mid	Mid Row Ends	South Row Mid	South Row Ends
Wind Uplift (k)				-2.84			
Ballast Weight (lb)				6534			
Horizontal Resistance (k)				2.74			
Horizontal Load (k)				1.03			
Safety Factor				2.65			
Safety Factor Check				OK			

Note:
Sliding Resistance includes 0.6 Friction Coefficient per Intertek Testing

Max Bearing Pressure Check

		Combo 3	Combo 5	Combo 6a	Max Pressure (psf)	Max Pressure (psi)	Max Load (kips)	
North Row End	Max Bearing Pressure							
North Row Mid	Max Bearing Pressure							
Mid Aisle	Max Bearing Pressure							
Mid Row Mid	Max Bearing Pressure	0.41	0.45	0.50	495	3.44	7.30	OK
Mid Row End	Max Bearing Pressure							
South Row Mid	Max Bearing Pressure							
South Row End	Max Bearing Pressure							

GAMECHANGE SOLAR
REPOWERING THE PLANET

Calculation Package for GCS Pour-in-Place System

Wind Zone : North Row Mid, South Row Mid

Project: Nugen-Bristol Landfill
Address: 6 Minturn Farm Rd, Bristol, RI 02809, USA
Update: 4/1/2022 **By:** HD

General Information

Setup	Portrait	
Tilt	20	degree
Clearance	42	in
Panel Length	78.50	in
Panel Width	39.37	in
Panel Weight	49.61	lbs
Space between Panels N-S	0.5	in
Space between Panels E-W	0.5	in
Mounting Type	Bottom	
Number of Panels Up	2	#
Number of Purlins	4	#
No. of Panels Supported	10	#
No. of Panel Widths per Span	5.00	#
No. of Panel Widths per Overhang	1.00	#
Purlin Span Length	16.61	ft
Loading Code	ASCE7-10	
Occupancy Category	I	
Exposure Category	C	
Seismic Site Class	D	
Assumed Load Bearing Capacity of Soil	1	ksf
Dead Load:	3.0	psf
Ground Snow Load (Pg)	30	psf
Basic Wind Speed	126	mph

Seismic Design Values

Ss	0.174	g
S1	0.06	g
Fa	1.6	
Fv	2.4	
SDS	0.186	g
SD1	0.096	g

1. Loading Calculations

1.1 Snow Load

Snow load is calculated per ASCE7

Pg (psf)	30.00	
Ce	0.90	Per Table 7-2.
Ct	1.20	Per Table 7-3.
Is	0.80	Per Table 7-4.
Cs	0.91	Per Figure 7-2c.

According to equation (7-1) and (7-2)

Ps=Cs*Pf = Cs*(0.7Ce*Ct*Is*Pg) Ps = 16.49

1.2 Wind Load

Wind pressure is calculated per ASCE7

V (mph)	126.00	
Kd	0.85	Per Table 26.6-1
Kz	1.00	Per Wind Tunnel Test Report
Kzt	1.00	Per Section 26.8
Iw	1.00	Wind Importance Factor equals unity for ASCE7-10

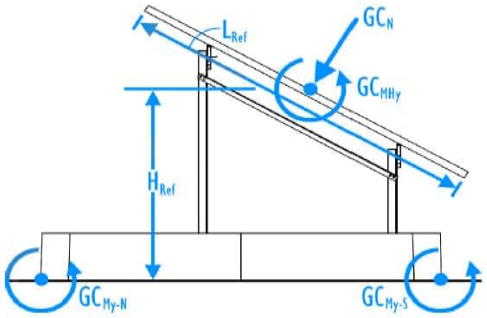
According to Equation (27.3-1)

qh = 0.00256*Kd*Kz*Kzt*(V^2)*I qh = 34.55

According to equation (27.4-3)

$P=q_h GC_N$

The results of wind load factors including normal and overturning moments provided by CPP are located in the calculation sheets. The results are given for two opposite directions of wind which causes upward and downward wind forces calculated based on worst case design wind loads.
GC_N is the normal force factor, GC-My is the moment at the base of the post. The factor of safety is calculated based on the worst case scenario, when the dead load and full wind loads are present. These factors are used to generate all wind load components for the following calculations.

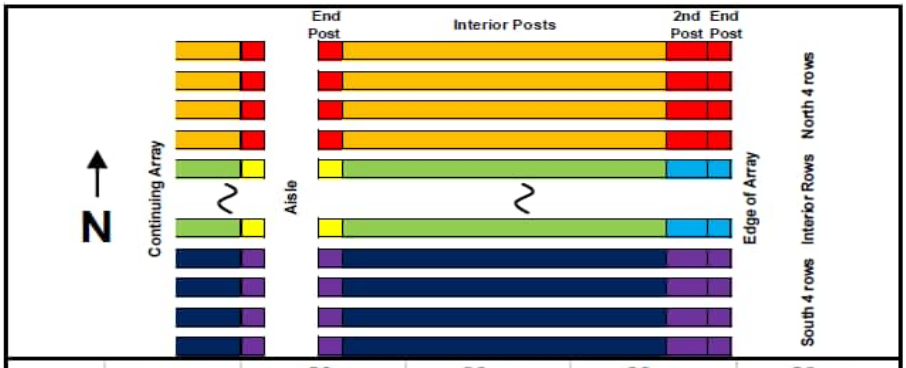


Schematic of wind load coefficients – PourInPlace System

$$GC_N = \frac{F_N}{q_z A_{ref}}$$

$$GC_{MHy} = \frac{M_{Hy}}{q_z A_{ref} L_{ref}}$$

$$GC_{My} = \frac{M_y}{q_z A_{ref} H_{ref}}$$



Zone	Tilt/height*	GC_N		GC_{MHv}		$GC_{Mv\text{-}N}$		$GC_{Mv\text{-}S}$	
		Min	Max	Min	Max	Min	Max	Min	Max
	15° / 0.12	-0.72	0.62	-0.16	0.03	-1.83	1.43	-1.76	0.89
	15° / 0.46	-0.84	0.60	-0.18	0.04	-0.66	0.54	-1.00	0.47
	30° / 0.12	-1.14	1.14	-0.17	0.04	-1.65	1.14	-1.94	1.36
	30° / 0.46	-1.20	1.24	-0.22	0.05	-0.64	0.29	-1.40	1.05
	15° / 0.12	-0.66	0.28	-0.10	0.02	-0.84	1.48	-1.40	0.44
	15° / 0.46	-0.71	0.26	-0.16	0.02	-0.29	0.50	-0.84	0.19
	30° / 0.12	-0.85	0.47	-0.09	0.04	-0.60	0.95	-1.31	0.65
	30° / 0.46	-0.86	0.45	-0.14	0.06	-0.23	0.27	-0.94	0.39
	15° / 0.12	-0.34	0.50	-0.09	0.02	-1.48	0.72	-0.81	0.70
	15° / 0.46	-0.58	0.59	-0.11	0.03	-0.66	0.40	-0.66	0.42
	30° / 0.12	-0.56	0.88	-0.09	0.03	-1.31	0.58	-0.93	1.02
	30° / 0.46	-0.63	1.11	-0.12	0.03	-0.59	0.19	-0.69	0.92
	15° / 0.12	-0.43	0.24	-0.10	0.01	-0.72	0.80	-1.09	0.33
	15° / 0.46	-0.46	0.25	-0.12	0.01	-0.27	0.29	-0.57	0.19
	30° / 0.12	-0.53	0.38	-0.07	0.03	-0.51	0.56	-0.86	0.52
	30° / 0.46	-0.57	0.43	-0.10	0.02	-0.23	0.16	-0.64	0.36
	15° / 0.12	-0.54	0.44	-0.11	0.02	-1.28	1.12	-1.24	0.67
	15° / 0.46	-0.77	0.51	-0.15	0.03	-0.54	0.53	-0.88	0.38
	30° / 0.12	-1.03	0.95	-0.16	0.02	-1.39	0.99	-1.78	1.12
	30° / 0.46	-1.19	1.12	-0.20	0.02	-0.57	0.32	-1.35	0.96
	15° / 0.12	-0.49	0.52	-0.11	0.02	-1.70	0.90	-1.22	0.57
	15° / 0.46	-0.48	0.87	-0.14	0.02	-1.02	0.28	-0.62	0.56
	30° / 0.12	-0.65	0.67	-0.08	0.03	-1.03	0.69	-1.05	0.74
	30° / 0.46	-0.75	0.88	-0.13	0.02	-0.47	0.20	-0.85	0.73
	15° / 0.12	-0.67	0.47	-0.12	0.03	-1.48	1.36	-1.55	0.72
	15° / 0.46	-0.88	0.76	-0.17	0.03	-0.89	0.60	-1.02	0.48
	30° / 0.12	-1.31	0.92	-0.20	0.02	-1.35	1.20	-2.28	1.08
	30° / 0.46	-1.42	1.10	-0.25	0.03	-0.57	0.32	-1.66	0.93

* Height is expressed as the ratio of the gap from the ground to the low edge of the PV divided by the cl
Interpolation between configurations is allowed

1.3 Load Combinations:

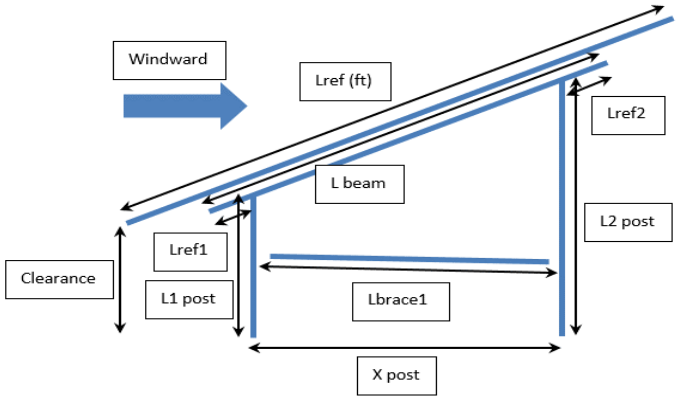
Basic load combinations are per ASCE7-10 and ASD design method.

Combo 1	D				
Combo 3	D	+	S		
Combo 5	D	+	0.60W		
Combo 6a	D	+	0.75S	+	0.45W
Combo 7	0.6D	+/-	0.60W		
Combo 8	D	+	0.7E		

1.4 Safety Factors

	Ωc	Ωb	Ωv		$SF_{FDN.}$
Safety Factor	1.5	1.5	1.5		1.5

2.0 Analysis and Design: Geometry



Tilt (degrees)	20
Clearance (in)	42.00
Lref (in)	157.51
Lref1 (in)	15.00
Lref2 (in)	-8.00
Bottom Overhang (in)	20.51
Top Overhang (in)	20.51
X post (in)	104.29
L1 post (in)	42.04
L2 post (in)	79.49
Brace to Beam (in)	39.04
L brace1 (in)	110.29
Brace1 Angle w/ Horiz	0.00
L beam (in)	125.99
Href (in)	68.94

NOTES:
Post Lengths are unbraced lengths from top of concrete to connection with NS Beam

2.1 Post Design (AISI S100-07)

South Post	GC361WP 14 Ga	Grade	80
North Post	GC361WP 14 Ga	Grade	80

Material Type: Pre-Galvanized Steel

Effective section properties at applied loads:

South Post	Ae (in^2)	1.012	Ixe(in^4)	5.918	Iye (in^4)	1.438	C Channel 6x3.125x1
			Sxe(t) (in^3)	1.97	Sye(l) (in^3)	1.34	
			Sxe(b) (in^3)	1.97	Sye(r) (in^3)	0.70	
North Post	Ae (in^2)	1.012	Ixe(in^4)	5.918	Iye (in^4)	1.438	
			Sxe(t) (in^3)	1.97	Sye(l) (in^3)	1.34	
			Sxe(b) (in^3)	1.97	Sye(r) (in^3)	0.70	

Reactions at Base of South Post

		Combo 3	Combo 5	Combo 6a	Combo 7
North Row End	Moment (kip-in)				
	Axial load (kip)				
North Row Mid	Moment (kip-in)	0.00	15.72	11.79	-39.19
	Axial load (kip)	2.62	1.44	2.84	-2.32
Mid Aisle	Moment (kip-in)				
	Axial load (kip)				
Mid Row Mid	Moment (kip-in)				
	Axial load (kip)				
Mid Row End	Moment (kip-in)				
	Axial load (kip)				
South Row Mid	Moment (kip-in)	0.00	29.73	22.30	-31.40
	Axial load (kip)	2.62	2.35	3.52	-1.81
South Row End	Moment (kip-in)				
	Axial load (kip)				

Reactions at Base of North Post

		Combo 3	Combo 5	Combo 6a	Combo 7
North Row End	Moment (kip-in)				
	Axial load (kip)				
North Row Mid	Moment (kip-in)	0.00	22.75	17.06	-56.70
	Axial load (kip)	2.00	1.10	2.17	-1.77
Mid Aisle	Moment (kip-in)				
	Axial load (kip)				
Mid Row Mid	Moment (kip-in)				
	Axial load (kip)				
Mid Row End	Moment (kip-in)				
	Axial load (kip)				
South Row Mid	Moment (kip-in)	0.00	43.02	32.27	-45.44
	Axial load (kip)	2.00	1.80	2.70	-1.38
South Row End	Moment (kip-in)				
	Axial load (kip)				

According to North American Specification for the Design of Cold-Formed Steel Structural Members (2007 Edition), Equation C5.2.1-1-C5.2.1.3

$$\frac{\Omega_c P}{P_n}+\frac{\Omega_b M_x}{M_{nx}}+\frac{\Omega_b M_y}{M_{ny}}\leq 1.0$$

		South Post		
		Pn/Ωc	**Mxn/Ωb**	**Myn/Ωb**
Strength	Compress.	31.19	110.73	39.38
	Tension	56.81		

Section Check at Post Base

		Combo 3	**Combo 5**	**Combo 6a**	**Combo 7**	
North Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
North Row Mid	ΩcP/Pn	0.084	0.046	0.091	0.074	
	ΩbMx/Mnx	0.000	0.142	0.106	0.354	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.084**	**0.188**	**0.197**	**0.428**	<1 OK
Mid Aisle	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
South Row Mid	ΩcP/Pn	0.084	0.075	0.113	0.058	
	ΩbMx/Mnx	0.000	0.269	0.201	0.284	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.084**	**0.344**	**0.314**	**0.342**	<1 OK
South Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					

		North Post		
		Pn/Ωc	**Mxn/Ωb**	**Myn/Ωb**
Strength	Compress.	8.72	110.73	39.38
	Tension	56.81		

Section Check at Post Base

		Combo 3	**Combo 5**	**Combo 6a**	**Combo 7**	
North Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
North Row Mid	ΩcP/Pn	0.230	0.126	0.249	0.203	
	ΩbMx/Mnx	0.000	0.205	0.154	0.512	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.230**	**0.331**	**0.403**	**0.715**	<1 OK
Mid Aisle	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
South Row Mid	ΩcP/Pn	0.230	0.206	0.309	0.159	
	ΩbMx/Mnx	0.000	0.389	0.291	0.410	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.230**	**0.595**	**0.600**	**0.569**	<1 OK
South Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					

2.2 Brace Design

Brace (Channel 4.6x2.6, 14 Gauge)

Material Type:Pre-galvanized Steel, Fy= 50 ksi

Effective section properties at applied loads

Ae (in^2)	0.699	Ixe (in^4)	2.421	Iye (in^4)	0.492
		Sxe(t) (in^4)	1.0526	Sye(l) (in^4)	0.6999
		Sxe(b) (in^4)	1.0526	Sye(r) (in^4)	0.2594

Brace is technically a zero force member. Conservatively check for axial load = 20% of frame lateral load

					kip	kip-in	kip-in
Axial force (kip)	**Combo 3**	**Combo 5**	**Combo 6a**	**Combo 7**	**P**	**Mx**	**My**
North Row End							
North Row Mid	0.00	0.06	0.04	-0.14	0.14	0	0.11
Mid Aisle							
Mid Row Mid							
Mid Row End							
South Row Mid	0.00	0.11	0.08	-0.11	0.11	0	0.09
South Row End							

	Pn/Ωc	**Mxn/Ωb**	**Myn/Ωb**
Strength	4.55	33.49	8.25

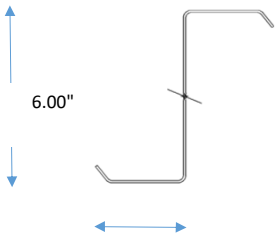
According to North American Specification for the Design of Cold-Formed Steel Structural Members (2007 Edition), Equation C5.2.1-1-C5.2.1.3.As ΩbP/Pn>0.15, equation C5.2.1-2 should be adopted.

$$\frac{\Omega_c P}{P_{no}}+\frac{\Omega_b M_x}{M_{nx}}+\frac{\Omega_b M_y}{M_{ny}} \le 1.0$$

	ΩcP/Pn	ΩbMx/Mnx	ΩbMy/Mny	Sum	
North Row End					
North Row Mid	0.031	0.000	0.014	0.045	<1 OK
Mid Aisle					
Mid Row Mid					
Mid Row End					
South Row Mid	0.025	0.000	0.011	0.036	<1 OK
South Row End					

2.3 Beam Design (AISI S100-07)

Grade	Gauge
80	Gauge 12



Material Type: Pre-galvanized Steel

Section Properties

Ae (in^2)	1.28	Ixe (in^4)	7.16	Iye (in^4)	2.01
		Sxe(t) (in^3)	2.39	Sye(l) (in^3)	0.69
		Sxe(b) (in^3)	2.39	Sye(r) (in^3)	0.69

		Combo 3	Combo 5	Combo 6a	Combo 7
North Row End	Moment (kip-in)				
	Axial load (kip)				
North Row Mid	Moment (kip-in)	51.11	30.68	57.36	-51.84
	Axial load (kip)	0.36	0.06	0.28	0.03
Mid Aisle	Moment (kip-in)				
	Axial load (kip)				
Mid Row Mid	Moment (kip-in)				
	Axial load (kip)				
Mid Row End	Moment (kip-in)				
	Axial load (kip)				
South Row Mid	Moment (kip-in)	51.11	50.92	72.54	-40.59
	Axial load (kip)	0.36	0.06	0.28	0.03
South Row End	Moment (kip-in)				
	Axial load (kip)				

According to North American Specification for the Design of Cold-Formed Steel Structural Members (2007 Edition),

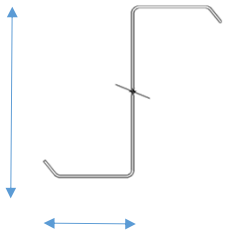
$$\frac{\Omega_c P}{P_n}+\frac{\Omega_b M_x}{M_{nx}}+\frac{\Omega_b M_y}{M_{ny}}\leq 1.0$$

	Pn/Ωc	Mxn/Ωb	Myn/Ωb
Strength	54.87	102.31	29.51

		Combo 3	Combo 5	Combo 6a	Combo 7	
North Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
North Row Mid	ΩcP/Pn	0.007	0.001	0.005	0.001	
	ΩbMx/Mnx	0.500	0.300	0.561	0.507	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.506**	**0.301**	**0.566**	**0.507**	<1 OK
Mid Aisle	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
South Row Mid	ΩcP/Pn	0.007	0.001	0.005	0.001	
	ΩbMx/Mnx	0.500	0.498	0.709	0.397	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.506**	**0.499**	**0.714**	**0.397**	<1 OK
South Row End	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					

2.4 Purlin Design

	Grade	Gauge
Heavy Grade	80	GC63-2.92x.053
Light Grade	80	GC63-2.92x.053



Effective Properties						
Heavy Grade	Ae (in^2)	0.64	Ixe (in^4)	3.64	Iye (in^4)	1.05
			Sxe(t) (in^3)	1.213	Sye(l) (in^3)	0.360
			Sxe(b) (in^3)	1.213	Sye(r) (in^3)	0.360
Light Grade	Ae (in^2)	0.64	Ixe (in^4)	3.64	Iye (in^4)	1.05
			Sxe(t) (in^3)	1.213	Sye(l) (in^3)	0.360
			Sxe(b) (in^3)	1.213	Sye(r) (in^3)	0.360

		Combo 3	Combo 5	Combo 6a	Combo 7
North Row End	moment major (kip-in)				
	moment minor (kip-in)				
North Row Mid	moment major (kip-in)	20.61	12.37	23.13	-20.90
	moment minor (kip-in)	1.83	0.28	1.44	0.17
Mid Aisle	moment major (kip-in)				
	moment minor (kip-in)				
Mid Row Mid	moment major (kip-in)				
	moment minor (kip-in)				
Mid Row End	moment major (kip-in)				
	moment minor (kip-in)				
South Row Mid	moment major (kip-in)	20.61	20.53	29.25	-16.37
	moment minor (kip-in)	1.83	0.28	1.44	0.17
South Row End	moment major (kip-in)				
	moment minor (kip-in)				

Buckling Check (Per Equation C3.1.2.1-15):

	Continuous Spans		End Spans	
	Fc(x) (ksi)	**Fc(y) (ksi)**	**Fc(x) (ksi)**	**Fc(y) (ksi)**
Heavy Grade Strength	77.20	81.08	64.82	80.98
Light Grade Strength	77.20	81.08	64.82	80.98

	Mx+/Ωb	**My+/Ωb**	**Mx-/Ωb**	**My-/Ωb**
	kip-in	kip-in	kip-in	kip-in
Heavy Grade Strength	59.47	18.51	49.94	18.49
Light Grade Strength	59.47	18.51	49.94	18.49

According to North American Specification for the Design of Cold-Formed Steel Structural Members (2007 Edition), Equation C5.2.1-1-C5.2.1.3

$$\frac{\Omega_c P}{P_n}+\frac{\Omega_b M_x}{M_{nx}}+\frac{\Omega_b M_y}{M_{ny}}\leq 1.0$$

		Combo 3	Combo 5	Combo 6a	Combo 7	
North Row End	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					
North Row Mid	ΩbMx/Mnx	0.346	0.208	0.389	0.351	
	ΩbMy/Mny	0.099	0.015	0.078	0.009	
Light Grade	Sum	**0.445**	**0.223**	**0.467**	**0.361**	<1 OK
Mid Aisle	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					
Mid Row Mid	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					
Mid Row End	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					
South Row Mid	ΩbMx/Mnx	0.346	0.345	0.492	0.275	
	ΩbMy/Mny	0.099	0.015	0.078	0.009	
Light Grade	Sum	**0.445**	**0.361**	**0.570**	**0.284**	<1 OK
South Row End	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					

Deflection Check

Allowable deflection per panel manufacturer = L/ 100 (0.01mm/mm)

	North Row Ends	North Row Mid	Mid Aisles	Mid Row Mid	Mid Row Ends	South Row Mid	South Row Ends
Max at midspan (in)		0.208				0.263	
Δ / L		0.001				0.001	
Check		OK				OK	

Purlin Angle Check: OK

Note:

The Purlin analysis above accounts for the longest acceptable purlin length for this project. Some purlins supplied for this project may be shorter than this length due to site geometry or to match the number of panels in a rack with a client requested string size. As the shorter purlins will have less load applied to them and a shorter unbraced length, they have sufficient structural capacty to resist the applied loads.

3. Seismic Forces

Seismic Design Values

Ss	0.174	g	
S1	0.06	g	
Fa	1.6		
Fv	2.4		
SDS	0.19	g	
SD1	0.10	g	
R	3.25		Per Table 12.2-1
Ie	1		Per Table 1.5-2
W	654	lbs	
Cs	0.06	g	Per Eq. 15.4-2
V	37.33	lbs	Per Eq. 12.8-1
My	2.08	k*in	

Utilization Check

Myn/Ωb	74.82	k*in
ΩbMy/Mny	0.03	<1 OK

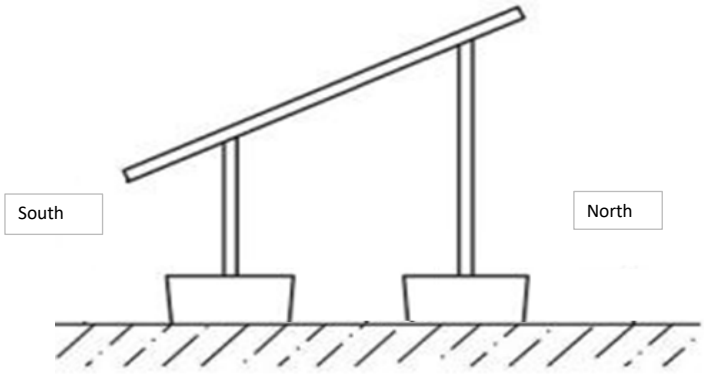
4. Foundation

Ballast Properties

	North Row Ends	North Row Mid	Mid Aisles	Mid Row Mid	Mid Row Ends	South Row Mid	South Row Ends
South Tub Concrete Height (in)		21.0				20.5	
North Tub Concrete Height (in)		21.0				20.5	
Weight of Tub Pair (lb)		6713				6534	

All Tubs

South Tub Diameter (in)	52
North Tub Diameter (in)	52
Front of panel to front of tub (in)	7.4
Soil bearing capacity (psf)	1000
weight of concrete (pcf)	145



Overturning Moment Check

	North Row Ends	North Row Mid	Mid Aisles	Mid Row Mid	Mid Row Ends	South Row Mid	South Row Ends
Overturning Moment about North Toe (uplift) (k*ft)		23.98				15.09	
Overturning Moment about South Toe (uplift) (k*ft)		30.01				24.98	
Resistive Moment North (k*ft)		47.10				45.94	
Resistive Moment South (k*ft)		45.93				44.76	
Min Factor of Safety		1.53				1.79	
Safety Factor Check		OK				OK	

Max Uplift / Sliding Check

	North Row Ends	North Row Mid	Mid Aisles	Mid Row Mid	Mid Row Ends	South Row Mid	South Row Ends
Wind Uplift (k)		-3.14				-2.36	
Ballast Weight (lb)		6713				6534	
Horizontal Resistance (k)		2.52				2.88	
Horizontal Load (k)		1.14				1.08	
Safety Factor		2.20				2.66	
Safety Factor Check		OK				OK	

Note:
Sliding Resistance includes 0.6 Friction Coefficient per Intertek Testing

Max Bearing Pressure Check

		Combo 3	Combo 5	Combo 6a	Max Pressure (psf)	Max Pressure (psi)	Max Load (kips)	
North Row End	Max Bearing Pressure							
North Row Mid	Max Bearing Pressure	0.37	0.49	0.50	496	3.45	7.32	OK
Mid Aisle	Max Bearing Pressure							
Mid Row Mid	Max Bearing Pressure							
Mid Row End	Max Bearing Pressure							
South Row Mid	Max Bearing Pressure	0.38	0.42	0.45	446	3.10	6.58	OK
South Row End	Max Bearing Pressure							

GAMECHANGE SOLAR
REPOWERING THE PLANET

Calculation Package for GCS Pour-in-Place System

Wind Zone : North Row End, Mid Aisle, Mid Row End, South Row End

Project: Nugen-Bristol Landfill
Address: 6 Minturn Farm Rd, Bristol, RI 02809, USA
Update: 4/1/2022 **By:** HD

General Information

Setup	Portrait	
Tilt	20	degree
Clearance	42	in
Panel Length	78.50	in
Panel Width	39.37	in
Panel Weight	49.61	lbs
Space between Panels N-S	0.5	in
Space between Panels E-W	0.5	in
Mounting Type	Bottom	
Number of Panels Up	2	#
Number of Purlins	4	#
No. of Panels Supported	7	#
No. of Panel Widths per Span	3.50	#
No. of Panel Widths per Overhang	0.75	#
Purlin Span Length	11.63	ft
Loading Code	ASCE7-10	
Occupancy Category	I	
Exposure Category	C	
Seismic Site Class	D	
Assumed Load Bearing Capacity of Soil	1	ksf
Dead Load:	3.0	psf
Ground Snow Load (Pg)	30	psf
Basic Wind Speed	126	mph

Seismic Design Values

Ss	0.174	g
S1	0.06	g
Fa	1.6	
Fv	2.4	
SDS	0.186	g
SD1	0.096	g

1. Loading Calculations

1.1 Snow Load

Snow load is calculated per ASCE7

Pg (psf)	30.00	
Ce	0.90	Per Table 7-2.
Ct	1.20	Per Table 7-3.
Is	0.80	Per Table 7-4.
Cs	0.91	Per Figure 7-2c.

According to equation (7-1) and (7-2)

Ps=Cs*Pf = Cs*(0.7Ce*Ct*Is*Pg) Ps = 16.49

1.2 Wind Load

Wind pressure is calculated per ASCE7

V (mph)	126.00	
Kd	0.85	Per Table 26.6-1
Kz	1.00	Per Wind Tunnel Test Report
Kzt	1.00	Per Section 26.8
Iw	1.00	Wind Importance Factor equals unity for ASCE7-10

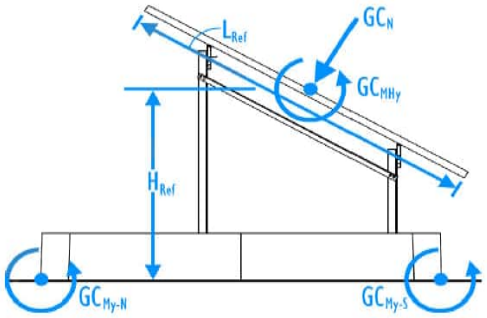
According to Equation (27.3-1)

qh = 0.00256*Kd*Kz*Kzt*(V^2)*I qh = 34.55

According to equation (27.4-3)

$P=q_h GC_N$

The results of wind load factors including normal and overturning moments provided by CPP are located in the calculation sheets. The results are given for two opposite directions of wind which causes upward and downward wind forces calculated based on worst case design wind loads.
GC_N is the normal force factor, GC-My is the moment at the base of the post. The factor of safety is calculated based on the worst case scenario, when the dead load and full wind loads are present. These factors are used to generate all wind load components for the following calculations.

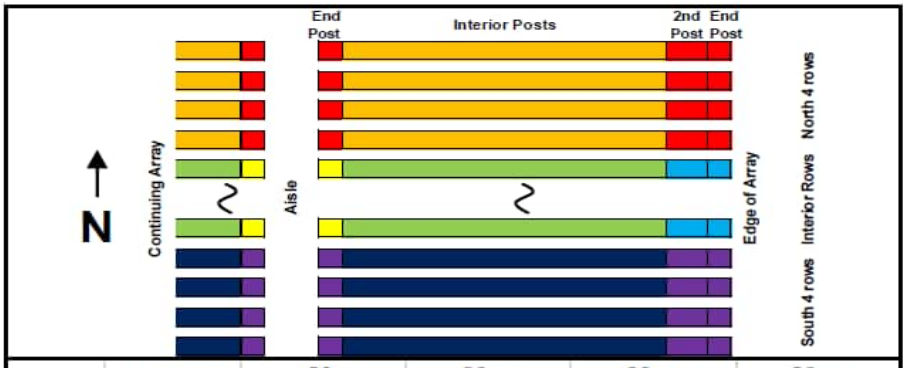


Schematic of wind load coefficients – PourInPlace System

$$GC_N = \frac{F_N}{q_z A_{ref}}$$

$$GC_{MHy} = \frac{M_{Hy}}{q_z A_{ref} L_{ref}}$$

$$GC_{My} = \frac{M_y}{q_z A_{ref} H_{ref}}$$



Zone	Tilt/height*	GC_N		GC_{MHv}		$GC_{Mv\text{-}N}$		$GC_{Mv\text{-}S}$	
		Min	Max	Min	Max	Min	Max	Min	Max
	15° / 0.12	-0.72	0.62	-0.16	0.03	-1.83	1.43	-1.76	0.89
	15° / 0.46	-0.84	0.60	-0.18	0.04	-0.66	0.54	-1.00	0.47
	30° / 0.12	-1.14	1.14	-0.17	0.04	-1.65	1.14	-1.94	1.36
	30° / 0.46	-1.20	1.24	-0.22	0.05	-0.64	0.29	-1.40	1.05
	15° / 0.12	-0.66	0.28	-0.10	0.02	-0.84	1.48	-1.40	0.44
	15° / 0.46	-0.71	0.26	-0.16	0.02	-0.29	0.50	-0.84	0.19
	30° / 0.12	-0.85	0.47	-0.09	0.04	-0.60	0.95	-1.31	0.65
	30° / 0.46	-0.86	0.45	-0.14	0.06	-0.23	0.27	-0.94	0.39
	15° / 0.12	-0.34	0.50	-0.09	0.02	-1.48	0.72	-0.81	0.70
	15° / 0.46	-0.58	0.59	-0.11	0.03	-0.66	0.40	-0.66	0.42
	30° / 0.12	-0.56	0.88	-0.09	0.03	-1.31	0.58	-0.93	1.02
	30° / 0.46	-0.63	1.11	-0.12	0.03	-0.59	0.19	-0.69	0.92
	15° / 0.12	-0.43	0.24	-0.10	0.01	-0.72	0.80	-1.09	0.33
	15° / 0.46	-0.46	0.25	-0.12	0.01	-0.27	0.29	-0.57	0.19
	30° / 0.12	-0.53	0.38	-0.07	0.03	-0.51	0.56	-0.86	0.52
	30° / 0.46	-0.57	0.43	-0.10	0.02	-0.23	0.16	-0.64	0.36
	15° / 0.12	-0.54	0.44	-0.11	0.02	-1.28	1.12	-1.24	0.67
	15° / 0.46	-0.77	0.51	-0.15	0.03	-0.54	0.53	-0.88	0.38
	30° / 0.12	-1.03	0.95	-0.16	0.02	-1.39	0.99	-1.78	1.12
	30° / 0.46	-1.19	1.12	-0.20	0.02	-0.57	0.32	-1.35	0.96
	15° / 0.12	-0.49	0.52	-0.11	0.02	-1.70	0.90	-1.22	0.57
	15° / 0.46	-0.48	0.87	-0.14	0.02	-1.02	0.28	-0.62	0.56
	30° / 0.12	-0.65	0.67	-0.08	0.03	-1.03	0.69	-1.05	0.74
	30° / 0.46	-0.75	0.88	-0.13	0.02	-0.47	0.20	-0.85	0.73
	15° / 0.12	-0.67	0.47	-0.12	0.03	-1.48	1.36	-1.55	0.72
	15° / 0.46	-0.88	0.76	-0.17	0.03	-0.89	0.60	-1.02	0.48
	30° / 0.12	-1.31	0.92	-0.20	0.02	-1.35	1.20	-2.28	1.08
	30° / 0.46	-1.42	1.10	-0.25	0.03	-0.57	0.32	-1.66	0.93

* Height is expressed as the ratio of the gap from the ground to the low edge of the PV divided by the cl
Interpolation between configurations is allowed

1.3 Load Combinations:

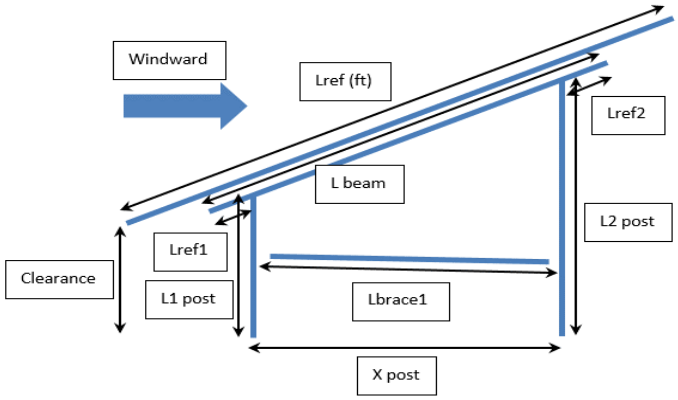
Basic load combinations are per ASCE7-10 and ASD design method.

Combo 1	D				
Combo 3	D	+	S		
Combo 5	D	+	0.60W		
Combo 6a	D	+	0.75S	+	0.45W
Combo 7	0.6D	+/-	0.60W		
Combo 8	D	+	0.7E		

1.4 Safety Factors

	Ωc	Ωb	Ωv		$SF_{FDN.}$
Safety Factor	1.5	1.5	1.5		1.5

2.0 Analysis and Design: Geometry



Tilt (degrees)	20
Clearance (in)	42.00
Lref (in)	157.51
Lref1 (in)	15.00
Lref2 (in)	-8.00
Bottom Overhang (in)	20.51
Top Overhang (in)	20.51
X post (in)	104.29
L1 post (in)	42.04
L2 post (in)	79.49
Brace to Beam (in)	39.04
L brace1 (in)	110.29
Brace1 Angle w/ Horiz	0.00
L beam (in)	125.99
Href (in)	68.94

NOTES:
Post Lengths are unbraced lengths from top of concrete to connection with NS Beam

2.1 Post Design (AISI S100-07)

South Post	GC361WP 14 Ga	Grade	80
North Post	GC361WP 14 Ga	Grade	80

Material Type: Pre-Galvanized Steel

Effective section properties at applied loads:

South Post	Ae (in^2)	1.012	Ixe(in^4)	5.918	Iye (in^4)	1.438	C Channel 6x3.125x1
			Sxe(t) (in^3)	1.97	Sye(l) (in^3)	1.34	
			Sxe(b) (in^3)	1.97	Sye(r) (in^3)	0.70	
North Post	Ae (in^2)	1.012	Ixe(in^4)	5.918	Iye (in^4)	1.438	
			Sxe(t) (in^3)	1.97	Sye(l) (in^3)	1.34	
			Sxe(b) (in^3)	1.97	Sye(r) (in^3)	0.70	

Reactions at Base of South Post

		Combo 3	Combo 5	Combo 6a	Combo 7
North Row End	Moment (kip-in)	0.00	24.52	18.39	-35.10
	Axial load (kip)	1.83	1.89	2.65	-2.12
North Row Mid	Moment (kip-in)				
	Axial load (kip)				
Mid Aisle	Moment (kip-in)	0.00	20.63	15.47	-19.36
	Axial load (kip)	1.83	1.63	2.46	-1.09
Mid Row Mid	Moment (kip-in)				
	Axial load (kip)				
Mid Row End	Moment (kip-in)	0.00	19.57	14.68	-30.20
	Axial load (kip)	1.83	1.56	2.41	-1.80
South Row Mid	Moment (kip-in)				
	Axial load (kip)				
South Row End	Moment (kip-in)	0.00	21.95	16.47	-36.22
	Axial load (kip)	1.83	1.72	2.52	-2.20

Reactions at Base of North Post

		Combo 3	Combo 5	Combo 6a	Combo 7
North Row End	Moment (kip-in)	0.00	35.48	26.61	-50.79
	Axial load (kip)	1.40	1.44	2.03	-1.62
North Row Mid	Moment (kip-in)				
	Axial load (kip)				
Mid Aisle	Moment (kip-in)	0.00	29.85	22.39	-28.01
	Axial load (kip)	1.40	1.25	1.88	-0.84
Mid Row Mid	Moment (kip-in)				
	Axial load (kip)				
Mid Row End	Moment (kip-in)	0.00	28.32	21.24	-43.69
	Axial load (kip)	1.40	1.20	1.84	-1.38
South Row Mid	Moment (kip-in)				
	Axial load (kip)				
South Row End	Moment (kip-in)	0.00	31.77	23.83	-52.42
	Axial load (kip)	1.40	1.32	1.93	-1.68

According to North American Specification for the Design of Cold-Formed Steel Structural Members (2007 Edition), Equation C5.2.1-1-C5.2.1.3

$$\frac{\Omega_c P}{P_n}+\frac{\Omega_b M_x}{M_{nx}}+\frac{\Omega_b M_y}{M_{ny}}\leq 1.0$$

		South Post		
		Pn/Ωc	**Mxn/Ωb**	**Myn/Ωb**
Strength	Compress.	31.19	110.73	39.38
	Tension	56.81		

Section Check at Post Base

		Combo 3	**Combo 5**	**Combo 6a**	**Combo 7**	
North Row End	ΩcP/Pn	0.059	0.061	0.085	0.068	
	ΩbMx/Mnx	0.000	0.221	0.166	0.317	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.059**	**0.282**	**0.251**	**0.385**	<1 OK
North Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Aisle	ΩcP/Pn	0.059	0.052	0.079	0.035	
	ΩbMx/Mnx	0.000	0.186	0.140	0.175	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.059**	**0.239**	**0.218**	**0.210**	<1 OK
Mid Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Row End	ΩcP/Pn	0.059	0.050	0.077	0.058	
	ΩbMx/Mnx	0.000	0.177	0.133	0.273	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.059**	**0.227**	**0.210**	**0.330**	<1 OK
South Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
South Row End	ΩcP/Pn	0.059	0.055	0.081	0.070	
	ΩbMx/Mnx	0.000	0.198	0.149	0.327	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.059**	**0.253**	**0.230**	**0.398**	<1 OK

		North Post		
		Pn/Ωc	**Mxn/Ωb**	**Myn/Ωb**
Strength	Compress.	8.72	110.73	39.38
	Tension	56.81		

Section Check at Post Base

		Combo 3	Combo 5	Combo 6a	Combo 7	
North Row End	ΩcP/Pn	0.161	0.166	0.232	0.186	
	ΩbMx/Mnx	0.000	0.320	0.240	0.459	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.161**	**0.486**	**0.473**	**0.645**	<1 OK
North Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Aisle	ΩcP/Pn	0.161	0.143	0.216	0.096	
	ΩbMx/Mnx	0.000	0.270	0.202	0.253	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.161**	**0.413**	**0.418**	**0.349**	<1 OK
Mid Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Row End	ΩcP/Pn	0.161	0.137	0.211	0.158	
	ΩbMx/Mnx	0.000	0.256	0.192	0.395	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.161**	**0.393**	**0.403**	**0.553**	<1 OK
South Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
South Row End	ΩcP/Pn	0.161	0.151	0.221	0.193	
	ΩbMx/Mnx	0.000	0.287	0.215	0.473	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.161**	**0.438**	**0.436**	**0.666**	<1 OK

2.2 Brace Design

Brace (Channel 4.6x2.6, 14 Gauge)

Material Type:Pre-galvanized Steel, Fy= 50 ksi

Effective section properties at applied loads

Ae (in^2)	0.699	Ixe (in^4)	2.421	Iye (in^4)	0.492
		Sxe(t) (in^4)	1.0526	Sye(l) (in^4)	0.6999
		Sxe(b) (in^4)	1.0526	Sye(r) (in^4)	0.2594

Brace is technically a zero force member. Conservatively check for axial load = 20% of frame lateral load

					kip	kip-in	kip-in
Axial force (kip)	**Combo 3**	**Combo 5**	**Combo 6a**	**Combo 7**	**P**	**Mx**	**My**
North Row End	0.00	0.09	0.07	-0.13	0.13	0	0.10
North Row Mid							
Mid Aisle	0.00	0.08	0.06	-0.07	0.08	0	0.06
Mid Row Mid							
Mid Row End	0.00	0.07	0.05	-0.11	0.11	0	0.09
South Row Mid							
South Row End	0.00	0.08	0.06	-0.13	0.13	0	0.11

	Pn/Ωc	**Mxn/Ωb**	**Myn/Ωb**
Strength	4.55	33.49	8.25

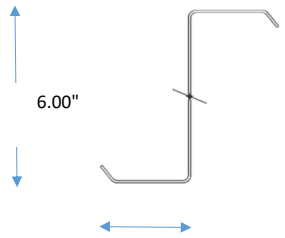
According to North American Specification for the Design of Cold-Formed Steel Structural Members (2007 Edition), Equation C5.2.1-1-C5.2.1.3.As ΩbP/Pn>0.15, equation C5.2.1-2 should be adopted.

$$\frac{\Omega_c P}{P_{no}}+\frac{\Omega_b M_x}{M_{nx}}+\frac{\Omega_b M_y}{M_{ny}} \le 1.0$$

	ΩcP/Pn	ΩbMx/Mnx	ΩbMy/Mny	Sum	
North Row End	0.028	0.000	0.012	0.041	<1 OK
North Row Mid					
Mid Aisle	0.017	0.000	0.007	0.024	<1 OK
Mid Row Mid					
Mid Row End	0.024	0.000	0.011	0.035	<1 OK
South Row Mid					
South Row End	0.029	0.000	0.013	0.042	<1 OK

2.3 Beam Design (AISI S100-07)

Grade	Gauge
80	Gauge 12



Material Type: Pre-galvanized Steel

Section Properties

Ae (in^2)	1.28	Ixe (in^4)	7.16	Iye (in^4)	2.01
		Sxe(t) (in^3)	2.39	Sye(l) (in^3)	0.69
		Sxe(b) (in^3)	2.39	Sye(r) (in^3)	0.69

		Combo 3	Combo 5	Combo 6a	Combo 7
North Row End	Moment (kip-in)	35.58	40.78	54.50	-47.11
	Axial load (kip)	0.37	0.04	0.20	0.02
North Row Mid	Moment (kip-in)				
	Axial load (kip)				
Mid Aisle	Moment (kip-in)	35.58	35.19	50.30	-24.49
	Axial load (kip)	0.25	0.04	0.20	0.02
Mid Row Mid	Moment (kip-in)				
	Axial load (kip)				
Mid Row End	Moment (kip-in)	35.58	33.67	49.17	-40.06
	Axial load (kip)	0.25	0.04	0.20	0.04
South Row Mid	Moment (kip-in)				
	Axial load (kip)				
South Row End	Moment (kip-in)	35.58	37.09	51.73	-48.73
	Axial load (kip)	0.25	0.04	0.20	0.02

According to North American Specification for the Design of Cold-Formed Steel Structural Members (2007 Edition),

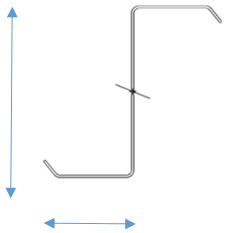
$$\frac{\Omega_c P}{P_n}+\frac{\Omega_b M_x}{M_{nx}}+\frac{\Omega_b M_y}{M_{ny}}\leq 1.0$$

	Pn/Ωc	Mxn/Ωb	Myn/Ωb
Strength	54.87	102.31	29.51

		Combo 3	Combo 5	Combo 6a	Combo 7	
North Row End	ΩcP/Pn	0.007	0.001	0.004	0.000	
	ΩbMx/Mnx	0.348	0.399	0.533	0.460	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.355**	**0.399**	**0.536**	**0.461**	<1 OK
North Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Aisle	ΩcP/Pn	0.005	0.001	0.004	0.000	
	ΩbMx/Mnx	0.348	0.344	0.492	0.239	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.352**	**0.345**	**0.495**	**0.240**	<1 OK
Mid Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
Mid Row End	ΩcP/Pn	0.005	0.001	0.004	0.001	
	ΩbMx/Mnx	0.348	0.329	0.481	0.392	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.352**	**0.330**	**0.484**	**0.392**	<1 OK
South Row Mid	ΩcP/Pn					
	ΩbMx/Mnx					
	ΩbMy/Mny					
	Sum					
South Row End	ΩcP/Pn	0.005	0.001	0.004	0.000	
	ΩbMx/Mnx	0.348	0.363	0.506	0.476	
	ΩbMy/Mny	0.000	0.000	0.000	0.000	
	Sum	**0.352**	**0.363**	**0.509**	**0.477**	<1 OK

2.4 Purlin Design

	Grade	Gauge
Heavy Grade	80	GC63-2.92x.053
Light Grade	80	GC63-2.92x.053



Effective Properties

Heavy Grade	Ae (in^2)	0.64	Ixe (in^4)	3.64	Iye (in^4)	1.05
			Sxe(t) (in^3)	1.213	Sye(l) (in^3)	0.360
			Sxe(b) (in^3)	1.213	Sye(r) (in^3)	0.360
Light Grade	Ae (in^2)	0.64	Ixe (in^4)	3.64	Iye (in^4)	1.05
			Sxe(t) (in^3)	1.213	Sye(l) (in^3)	0.360
			Sxe(b) (in^3)	1.213	Sye(r) (in^3)	0.360

		Combo 3	**Combo 5**	**Combo 6a**	**Combo 7**
North Row End	moment major (kip-in)	11.75	13.47	18.00	-15.56
	moment minor (kip-in)	1.03	0.16	0.81	0.10
North Row Mid	moment major (kip-in)				
	moment minor (kip-in)				
Mid Aisle	moment major (kip-in)	11.75	11.62	16.61	-8.09
	moment minor (kip-in)	1.03	0.16	0.81	0.10
Mid Row Mid	moment major (kip-in)				
	moment minor (kip-in)				
Mid Row End	moment major (kip-in)	11.75	11.12	16.24	-13.23
	moment minor (kip-in)	1.03	0.16	0.81	0.16
South Row Mid	moment major (kip-in)				
	moment minor (kip-in)				
South Row End	moment major (kip-in)	11.75	12.25	17.08	-16.09
	moment minor (kip-in)	1.03	0.16	0.81	0.10

Buckling Check (Per Equation C3.1.2.1-15):

	Continuous Spans		End Spans	
	Fc(x) (ksi)	**Fc(y) (ksi)**	**Fc(x) (ksi)**	**Fc(y) (ksi)**
Heavy Grade Strength	81.08	81.08	77.98	81.08
Light Grade Strength	81.08	81.08	77.98	81.08

	Mx+/Ωb	**My+/Ωb**	**Mx-/Ωb**	**My-/Ωb**
	kip-in	kip-in	kip-in	kip-in
Heavy Grade Strength	62.46	18.51	60.07	18.51
Light Grade Strength	62.46	18.51	60.07	18.51

According to North American Specification for the Design of Cold-Formed Steel Structural Members (2007 Edition), Equation C5.2.1-1-C5.2.1.3

$$\frac{\Omega_c P}{P_n}+\frac{\Omega_b M_x}{M_{nx}}+\frac{\Omega_b M_y}{M_{ny}}\leq 1.0$$

		Combo 3	Combo 5	Combo 6a	Combo 7	
North Row End	ΩbMx/Mnx	0.196	0.224	0.300	0.259	
	ΩbMy/Mny	0.056	0.009	0.044	0.005	
Light Grade	Sum	**0.251**	**0.233**	**0.344**	**0.264**	<1 OK
North Row Mid	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					
Mid Aisle	ΩbMx/Mnx	0.196	0.193	0.277	0.135	
	ΩbMy/Mny	0.056	0.009	0.044	0.005	
Light Grade	Sum	**0.251**	**0.202**	**0.320**	**0.140**	<1 OK
Mid Row Mid	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					
Mid Row End	ΩbMx/Mnx	0.196	0.185	0.270	0.220	
	ΩbMy/Mny	0.056	0.009	0.044	0.009	
Light Grade	Sum	**0.251**	**0.194**	**0.314**	**0.229**	<1 OK
South Row Mid	ΩbMx/Mnx					
	ΩbMy/Mny					
Light Grade	Sum					
South Row End	ΩbMx/Mnx	0.196	0.204	0.284	0.268	
	ΩbMy/Mny	0.056	0.009	0.044	0.005	
Light Grade	Sum	**0.251**	**0.213**	**0.328**	**0.273**	<1 OK

Deflection Check

Allowable deflection per panel manufacturer = L/ 100 (0.01mm/mm)

	North Row Ends	North Row Mid	Mid Aisles	Mid Row Mid	Mid Row Ends	South Row Mid	South Row Ends
Max at midspan (in)	0.067		0.062		0.060		0.063
Δ / L	0.000		0.000		0.000		0.000
Check	OK		OK		OK		OK

Purlin Angle Check: OK

Note:

The Purlin analysis above accounts for the longest acceptable purlin length for this project. Some purlins supplied for this project may be shorter than this length due to site geometry or to match the number of panels in a rack with a client requested string size. As the shorter purlins will have less load applied to them and a shorter unbraced length, they have sufficient structural capacty to resist the applied loads.

3. Seismic Forces

Seismic Design Values

Ss	0.174	g	
S1	0.06	g	
Fa	1.6		
Fv	2.4		
SDS	0.19	g	
SD1	0.10	g	
R	3.25		Per Table 12.2-1
Ie	1		Per Table 1.5-2
W	458	lbs	
Cs	0.06	g	Per Eq. 15.4-2
V	26.13	lbs	Per Eq. 12.8-1
My	1.45	k*in	

Utilization Check

Myn/Ωb	74.82	k*in
ΩbMy/Mny	0.02	<1 OK

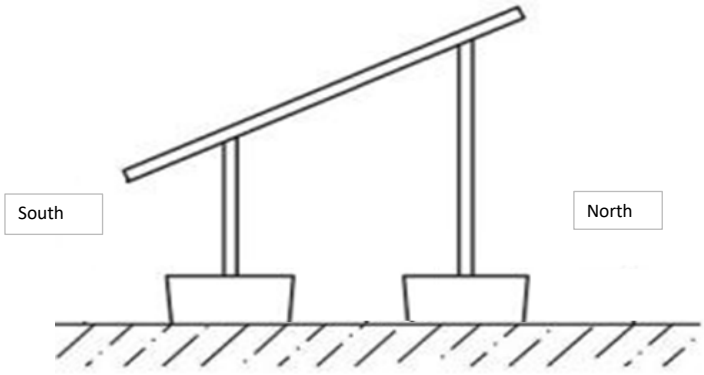
4. Foundation

Ballast Properties

	North Row Ends	North Row Mid	Mid Aisles	Mid Row Mid	Mid Row Ends	South Row Mid	South Row Ends
South Tub Concrete Height (in)	19.5		14.0		20.5		20.0
North Tub Concrete Height (in)	19.5		14.0		20.5		20.0
Weight of Tub Pair (lb)	6178		4293		6534		6355

All Tubs

South Tub Diameter (in)	52
North Tub Diameter (in)	52
Front of panel to front of tub (in)	7.4
Soil bearing capacity (psf)	1000
weight of concrete (pcf)	145



Overturning Moment Check

	North Row Ends	North Row Mid	Mid Aisles	Mid Row Mid	Mid Row Ends	South Row Mid	South Row Ends
Overturning Moment about North Toe (uplift) (k*ft)	17.36		9.55		14.73		17.48
Overturning Moment about South Toe (uplift) (k*ft)	27.69		14.04		22.80		28.20
Resistive Moment North (k*ft)	42.61		30.33		44.92		43.76
Resistive Moment South (k*ft)	41.78		29.51		44.10		42.94
Min Factor of Safety	1.51		2.10		1.93		1.52
Safety Factor Check	OK		OK		OK		OK

Max Uplift / Sliding Check

	North Row Ends	North Row Mid	Mid Aisles	Mid Row Mid	Mid Row Ends	South Row Mid	South Row Ends
Wind Uplift (k)	-2.68		-1.46		-2.36		-2.85
Ballast Weight (lb)	6178		4293		6534		6355
Horizontal Resistance (k)	2.36		1.96		2.77		2.36
Horizontal Load (k)	0.98		0.74		0.86		1.04
Safety Factor	2.41		2.64		3.23		2.28
Safety Factor Check	OK		OK		OK		OK

Note:
Sliding Resistance includes 0.6 Friction Coefficient per Intertek Testing

Max Bearing Pressure Check

		Combo 3	Combo 5	Combo 6a	Max Pressure (psf)	Max Pressure (psi)	Max Load (kips)	
North Row End	Max Bearing Pressure	0.35	0.43	0.44	441	3.06	6.51	OK
North Row Mid	Max Bearing Pressure							
Mid Aisle	Max Bearing Pressure	0.38	0.38	0.42	418	2.90	6.17	OK
Mid Row Mid	Max Bearing Pressure							
Mid Row End	Max Bearing Pressure	0.35	0.41	0.42	423	2.94	6.24	OK
South Row Mid	Max Bearing Pressure							
South Row End	Max Bearing Pressure	0.35	0.43	0.44	440	3.06	6.50	OK

GAMECHANGE SOLAR
REPOWERING THE PLANET

Airborne Corrosion Analysis

Project: Nugen-Bristol Landfill
Address: 6 Minturn Farm Rd, Bristol, RI 02809, USA
Update: 4/1/2022 **By:** HD

This Analysis is performed in accordance with ISO standards 9223-12 and 9224-12
The first-year corrosion loss for zinc is calculated per ISO 9223-12 Section 8.2, Equation 2 as follows:

$$r_{corr} = 0{,}012\,9 \cdot P_d^{0{,}44} \cdot \exp(0{,}046 \cdot RH + f_{Zn}) + 0{,}017\,5 \cdot S_d^{0{,}57} \cdot \exp(0{,}008 \cdot RH + 0{,}085 \cdot T)$$

$$f_{Zn} = 0{,}038 \cdot (T - 10) \text{ when } T \leq 10\ °C; \text{ otherwise, } -0{,}071 \cdot (T - 10)$$

$$N = 114,\ R^2 = 0{,}78$$

Coating	PREGALV		
Item	**Value**	**Units**	**Notes**
SO_2 deposition (P_d)	4	mg/(m^2*d)	Standard for Rural Areas
Relative Humidity (RH)	80.78	%	Per NASA Meteorological Data
Cl^- deposition (S_d)	272.582	kg/(hectare*yr)	Per National Atmosphereic Deposition Program Maps
	74.68	mg/(m^2*d)	
Average Temperature (T)	10.96	degrees C	Per NASA Meteorological Data
f_{zn}	-0.068		
1st Year Corrosion Rate (r_{corr})	1.902	micrometers / yr	
	0.075	mils / yr	
Corrosion Category	C3		

For projects with short term exposure (design life of 20 years or less), the total corrosion loss for zinc is calculated per ISO 9224-12, Section 4, Equation 1

$$D = r_{corr}\, t^b$$

For projects with long term exposure (design life in excess of 20 years), the total corrosion loss for zinc is calculated per ISO 9224-12, Section 7, Equation 3

$$D(t > 20) = r_{corr}\,[20^b + b\,(20^{b-1})\,(t - 20)]$$

Where the Metal-environment-specific time exponent (b) is equal to the B2 value for zinc in order to conservatively account for uncertainty in the corrosion rate

Design Life (t)	25	yr.s
Metal-environment-specific time exponent (b)	0.873	
Total Zinc Corrosion Loss (D)	1.25	mils

Coating Type	G180		
Coating thickness	1.52	mils	OK

Attachment D: Cap Loading Analysis

Bristol Sanitary Landfill
Proposed Ground Mounted PV Array
Cap Loading Analysis

1. DATA

Hansol 325 W Panel

Length	1994	mm
Width	1000	mm
Weight	49.6	pounds
Lie Angle	20	degrees

Heliene 340 W panel

Length	1956	mm
Width	992	mm
Weight	48.28	pounds
Lie Angle	20	degrees

Ballast Tubs

Bottom Diameter	46.49	inches
Weight (blue/orange)	3267	pounds

Racking System

Load	3	pounds/ft^2

Ground Snow Load			30	pounds/ft^2
Applied Snow Load (roof) =	Cs*(0.7*Ce*Ct*Is*Pg)		ASCE 7-10	
Ce	Exposure Factor		0.9	
Ct	Thermal Factor		1.2	
Is	Importance Factor		0.8	
Pg	Ground Snow Load		30	pounds/ft^2
Cs	Slope factor		0.91	
	Applied Snow Load		16.51	pounds/ft^2

Inverters

Weight	270	pounds

Transformers

Weight	14246	pounds
Pad Length	300	inches
Pad Width	144	inches

2. Loading Analysis

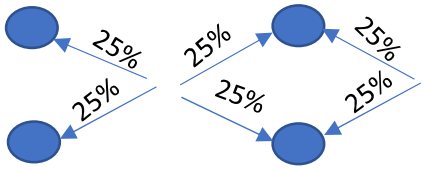
A. Transformer Pad

Transformer Weight	14246	pounds

Pad Weight	45000	pounds
Ground Snow Load	9000	pounds
Total Weight	68246	pounds
Loading	1.58	psi

B. 7 Panel (Hansol) Wide Rack with Inverters

Rack Area	300.49	ft^2
Panel Weight	694.4	pounds
Rack Weight	901.47	pounds
Inverter Weight	1890	pounds
Snow Weight (20 degree lie angle)	4961.09	pounds



Load Distrubution

Total Weight Distributed	8446.96	pounds
Weight Applied Per Ballast Tub (not including the tub)	4223.48	pounds
Loading (including concrete tub)	4.41	psi

C. 10 panel Wide Section (Hansol)

Rack Area	429.26	ft^2
Panel Weight	992	pounds
Rack Weight	1287.78	pounds
Snow Weight	7087.08	pounds
Total Weight Distributed	9366.86	pounds
Weight Applied Per Ballast Tub (not including the tub)	4683.43	pounds
Loading (including concrete tub)	4.68	psi

Attachment E: Gas Vent Data 031620

Gas Vent Monitoring
Bristol Landfill
3/16/2020

Sampling Location	Area	Date	Time	O2 (%)	CO2 (%)	CH4 (%)	H2S (ppm)	VOC (ppmv)	Notes
GVW-1	Landfill Cap	3/16/2020	7:45	22.8	0.2	0.0	0	0.0	PVC drum connection damaged
GVW-2	Landfill Cap	3/16/2020	7:55	22.4	0.1	0.0	0	0.0	PVC drum connection damaged
GVW-3	Landfill Cap	3/16/2020	8:05	23.0	0	0.0	0	0.0	PVC drum connection damaged
GVW-4	Landfill Cap	3/16/2020	8:15	22.9	0.1	0.0	0	0.0	PVC drum connection damaged
GVW-5	Landfill Cap	3/16/2020	8:25	22.9	0.2	0.0	0	0.0	PVC drum connection damaged
GVW-6	Landfill Cap	3/16/2020	8:35	23.2	0.2	0.0	0	0.0	PVC drum connection damaged
GVW-7	Landfill Cap	3/16/2020	8:45	22.4	0.1	0.0	0	0.6	PVC drum connection damaged
GVW-8	Landfill Cap	3/16/2020	8:55	22.4	0.1	0.1	0	0.0	PVC drum connection damaged
GVW-9	Landfill Cap	3/16/2020	9:00	22.8	0.2	0.0	0	0.0	PVC drum connection damaged
GVW-10	Landfill Cap	3/16/2020	9:10	22.7	0.2	0.0	0	0.0	PVC drum connection damaged
GVW-11	Landfill Cap	3/16/2020	9:20	23.2	0.2	0.0	0	0.0	PVC drum connection damaged
GVW-A1	Landfill Cap	3/16/2020	9:30	23.1	0.2	0.0	0	0.0	PVC drum connection damaged
GVW-A2	Landfill Cap	3/16/2020	9:40	22.4	0.1	0.0	0	0.0	Satisfactory condition
GVW-A3	Landfill Cap	3/16/2020	9:50	22.7	0.2	0.0	0	0.0	PVC drum connection damaged
GVW-A4	Landfill Cap	3/16/2020	10:00	22.8	0.2	0.0	0	0.0	Satisfactory condition
GVW-A5	Landfill Cap	3/16/2020	10:10	23.3	0.2	0.0	0	0.0	PVC drum connection damaged
GVW-A6	Landfill Cap	3/16/2020	10:20	22.7	0.2	0.0	0	0.2	Satisfactory condition
GVW-A7	Landfill Cap	3/16/2020	10:30	22.4	0.1	0.1	0	0.0	Satisfactory condition
GVW-A8	Landfill Cap	3/16/2020	10:40	-	-	-	-	-	DESTROYED
GVW-A9	Landfill Cap	3/16/2020	10:50	-	-	-	-	-	DESTROYED
GVW-A10	Landfill Cap	3/16/2020	11:00	22.8	0.2	0.0	0	0.0	Satisfactory condition
GVW-A11	Landfill Cap	3/16/2020	11:10	22.3	0.2	0.0	0	0.0	Satisfactory condition
GVW-A12	Landfill Cap	3/16/2020	11:20	22.5	0.2	0.1	0	0.0	PVC damaged
GVW-A13	Landfill Cap	3/16/2020	11:30	22.2	0.1	0.0	0	0.0	Carbon vessel damaged
GVW-A14	Landfill Cap	3/16/2020	11:40	22.9	0.3	0.1	0	0.0	PVC drum connection damaged
GVW-A15	Landfill Cap	3/16/2020	11:50	22.9	0.1	0.0	0	0.0	PVC drum connection damaged
GVW-A16	Landfill Cap	3/16/2020	12:00	22.9	0.1	0.0	0	0.0	PVC drum connection damaged
GVW-A17	Landfill Cap	3/16/2020	12:10	22.3	0.2	0.0	0	0.0	PVC drum connection damaged
GVW-A18	Landfill Cap	3/16/2020	12:20	21.9	0.2	0.0	0	0.0	Satisfactory condition
GVW-A19	Landfill Cap	3/16/2020	12:30	22.4	0.1	0.0	0	0.0	PVC drum connection damaged
GVW-A20	Landfill Cap	3/16/2020	12:40	22.7	0.1	0.0	0	0.2	PVC drum connection damaged
GVW-A21	Landfill Cap	3/16/2020	12:50	22.7	0.3	0.1	0	0.2	PVC drum connection damaged
GVW-A22	Landfill Cap	3/16/2020	13:00	22.3	0.2	0.0	0	0.0	PVC drum connection damaged
GVW-A23	Landfill Cap	3/16/2020	13:10	22.2	0.2	0.0	0	0.0	PVC Damaged
GVW-A24	Landfill Cap	3/16/2020	13:20	22.9	0.1	0.0	0	0.0	Satisfactory condition

Gas Vent Monitoring
Bristol Landfill
3/16/2020

Sampling Location	Area	Date	Time	O2 (%)	CO2 (%)	CH4 (%)	H2S (ppm)	VOC (ppmv)	Notes
GVW-33	Yard Waste Drop-Off	3/16/2020	13:35	-	-	-	-	-	DESTROYED
GVW-34	Yard Waste Drop-Off	3/16/2020	13:40	23.3	0.1	0.0	0	0.0	Satisfactory condition
GVW-35	Yard Waste Drop-Off	3/16/2020	13:45	-	-	-	-	-	DESTROYED
GVW-36	Yard Waste Drop-Off	3/16/2020	13:50	-	-	-	-	-	DESTROYED
GVW-101	Facilities	3/16/2020	14:00	21.8	0.2	0.0	0	0.0	Satisfactory condition
GVW-102	Facilities	3/16/2020	14:05	21.9	0.2	0.0	0	0.0	Satisfactory condition
GVW-103	Facilities	3/16/2020	14:10	22.1	0.2	0.0	0	0.0	Satisfactory condition
GVW-104	Facilities	3/16/2020	14:15	21.8	0.3	0.0	0	0.0	Satisfactory condition
GVW-105	Facilities	3/16/2020	14:20	21.7	0.3	0.0	0	0.0	Satisfactory condition
GVW-106	Facilities	3/16/2020	14:25	22.9	0.2	0.0	0	0.0	PVC Damaged

Attachment F: Stormwater Report

Bristol Landfill Solar Facility

Bristol, Rhode Island

January 2023

Stormwater Management Report

701 George Washington Hwy
Lincoln, Rhode Island 02865
401.333.2382
www.BETA-Inc.com

TABLE OF CONTENTS

APPENDICIES

INTRODUCTION

On behalf of Bristol Landfill Solar NG, LLC, BETA Group, Inc., (BETA) has prepared the following stormwater application for the proposed Bristol Landfill Solar Facility Project. This report has been prepared in accordance with the guidance provided in the 2015 Rhode Island Stormwater Design and Installation Standards Manual (hereafter referred to as the "RISDISM").

This project proposes the installation of a 6.88 MW AC Solar Facility on the capped Bristol Landfill. The solar array will be constructed using a ballasted system to minimize any disturbance to the landfill cap. There will be no proposed impervious area or land disturbance/excavation on top of the landfill.

GENERAL INFORMATION

The following general information is provided in accordance with Appendix Section A.1.1 of the RISDISM:

Applicant

NuGen Capital, LLC
267 Water Street, 2nd Floor
Warren, RI 02885
Project Contact: Laura Frazier
(401) 889-2373 Phone
assetmanagement@nugencapital.com Email

Town of Bristol
10 Court Street
Bristol, RI 02809
Project Contact: Diane Williamson
(401) 253-7000 Phone

Site Plan / Stormwater Management Designer

BETA Group, Inc.
701 George Washington Highway
Lincoln, RI 02865
Project Manager: Nicole Iannuzzi, P.E.
(401) 333-2382 Phone
(401) 333-9225 Fax

Address of Site

The Bristol Landfill (Bristol Plat 171, Lot 25) is located at 6 Minturn Farm Road.

Vicinity Map

Please refer to Figure 1 – Vicinity Map:

BETA

BRISTOL LANDFILL SOLAR

FIGURE 1

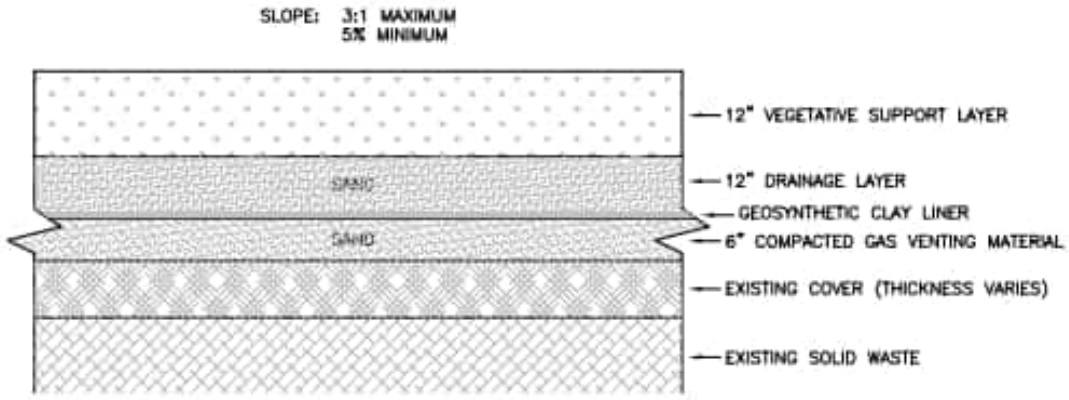
VICINITY MAP

K:\2796 Bristol Landfill\Solar\Permitting\RIDEM\Figures\Vicinity Map.dwg Plot Date: 1/20/2023 3:59 PM

EXISITNG CONDITIONS

The project site is the Bristol Landfill, located at 6 Minturn Farm Road Bristol, Rhode Island (the "Site"). The Bristol Assessor's Office identifies the previously developed Site as Lot 171-25 with an area of 91.54 acres. The area within and around the Site is zoned as Open Space and the land use is municipal consisting of the landfill itself, the Town's transfer station, animal shelter, the wastewater biosolids composting operation and the Town's yard waste management facilities. FEMA classifies the area as Zone X, which is determined to be outside of the 500-year flood. Facility components and associated work will take place outside of the wetland areas and their associated buffer zones.

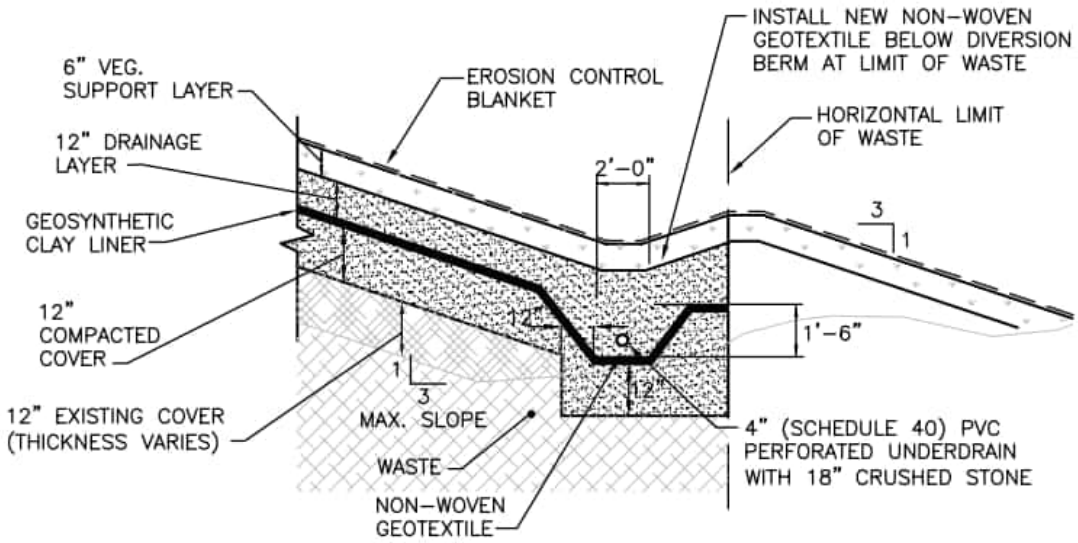
The Bristol Landfill is closed and capped. The landfill cap consists of four layers of material. The cap consists of a 12" vegetative layer, 12" sand drainage layer, the geosynthetic clay liner and 6" of compacted sand (gas venting detail).



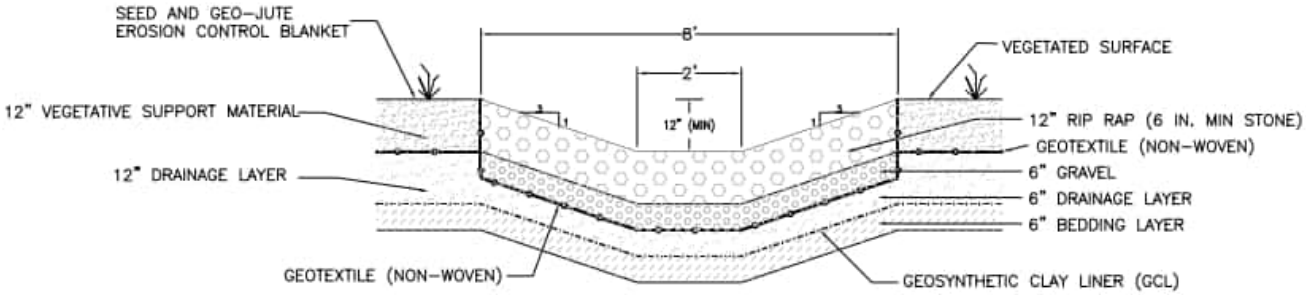
Landfill Cap Detail

Watershed

As depicted on the existing watershed map, the landfill is divided into two subwatersheds. The majority of the landfill and a portion of the residential area along Berry Lane drains to the wetland to the east (EX-WS-A). The southwestern portion of the landfill, a portion of the compost facility and the yard waste area drain to the wetland in the southwestern portion of the parcel (EX-WS-B). The northeastern portion of EX-WS-A contributes flow to a small wetland area which eventually discharges to the larger wetland area to the east. The eastern portion of EX-WS-A conveys flow to existing diversion berms with underdrains and existing drainage swales. The compost area and access road within EX-WS-B contribute flow to a closed drainage system which outfalls to the wetland in the southwestern corner of the subwatershed. The remaining area within EX-WS-B (including the landfill) conveys overland flow to the southwestern wetland.



Diversion Berm/Underdrain Detail



Drainage Swale Detail

Wetlands

BETA Group, Inc delineated the wetlands in the project area in October 2019. The entire Town of Bristol falls within the RIDEM River Protection Region 2. The following is a summary of the findings.

Wetland 1 (WFI Series – Flags WF1-100 to WF1-115; WF1-116 to WF1-138) A Buffer Zone of 75 feet has been assigned to this wetland area.

- WF1 Series wetland is separated into two (2) different wetland types.
- One of these wetland types, approximately from flags WF1-100 to WF1-115, can be described as a scrub-scrub wetland. Areas approx. 30 feet downgradient of the

boundary were flooded at the time of inspection. This area is mapped as a "Scrub-Shrub Wetland – Shrub Swamp" on the RIDEM Environmental Resources Map, which generally supports our findings. This area is unmapped by the National Wetlands Inventory (NWI).

- The wetland, approximately from flags WF1-116 to WF-138, can be described as a forested palustrine wetland system. Dominant vegetation included red maple (*Acer rubrum*), round- leaf greenbrier (*Smilax rotundifolia*), and cinnamon fern (*Osmundastrum cinnamomeum*). This area is mapped as a deciduous forested wetland, which generally supports our findings. This area is mapped as PFO1B by the National Wetlands Inventory (NWI), a seasonally saturated deciduous forested palustrine wetland system.

Wetland 2 (WF2 Series – Flags WF2-100 to WF2-150) A Buffer Zone of 75 feet has been assigned to this wetland area.

- The WF2 Series wetland is a large seasonally flooded, forested wetland system. Dominant vegetation included American elm (Ulmnus americana), Eastern skunk cabbage (Symplocarpus foetidus), Northern spicebush (Lindera benzoin), and red maple (Acer rubrum).
- Portions of this wetland are mapped as a deciduous forested wetland on the RIDEM Environmental Resources Map, which generally supports our findings.
- Portions of this wetland are mapped as PFO1E by the NWI, a seasonally saturated deciduous forested palustrine wetland system. This generally supports our findings.

Wetland 3 (WF3 Series – Flags WF3-85 to WF3-107) A Buffer Zone of 25 feet has been assigned to this wetland area.

- The WF3 Series wetland is a small forested wetland system. Dominant vegetation included red maple, round-leaf greenbrier, and glossy buckthorn (*Frangula alnus*). The area between flags WF3-95 to WF3-99 was dominated with phragmites and appeared to flood/be saturated frequently.
- This wetland area is primarily mapped as a deciduous forested wetland on the RIDEM Environmental Resources Map with a small portion (along the edge of the landfill) mapped as an emergent wetland, marsh/wet meadow. This generally supports our findings.
- This wetland is unmapped by the NWI.

PROPOSED CONDITIONS

This project proposes the installation of an approximately 6.88 MW AC Solar Facility on the capped landfill. The solar array will be constructed using a ballasted system to minimize any disturbance to the landfill cap. There will be minimal land disturbance/excavation on top of the landfill to install electrical cable. The access road

will be constructed of washed, crushed stone with a non-compacted subbase. The road will be approximately 20 feet wide at the entrance and transition to 10 feet wide as it reaches the top of the landfill. Proposed impervious areas will be limited to the small pads beneath transformers and inverters.

Watershed

The proposed watershed delineation will not change from the existing conditions. As noted previously, the array will utilize a ballasted system.

- The ballast blocks will be tubs with a diameter of 3.88 feet (11.8 square feet).
- Total number of ballast tubs will be 3,904.
- 3,904 tubs x 11.8 square feet per tub = 46,067 square feet = 1.06 acres.
- Area on top of landfill with panels = 903,659 square feet = 20.75 acres
- 1.06 acres/20.75 acres = 5.1% of overall solar array is comprised of ballast tubs.

Based on discussions with RIDEM, if the percent of ballast tub area is less than 10% of the overall array area, the array will have an insignificant impact on the stormwater characteristics of the site. Therefore, there will be no required water quality volume based on the proposed conditions. The minimum water quality volume of 0.2 watershed inches (0.2 inches over the disturbed areas) will also be waived as no fertilizer, herbicides or pesticides will be used on the landfill.

The proposed watershed analysis was performed by taking 5.1% of the capped landfill area with a CN of 80 (from existing conditions) and designating that as "Ballast" area with a CN of 98. The proposed conditions peak flows for the 1, 10 and 100 year design storms are the same as the existing conditions peak flows. See results in Appendix B.

Watershed	1 Year Storm Peak Flow (cfs)		10 Year Storm Peak Flow (cfs)		100 Year Storm Peak Flow (cfs)	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
EX-WS-A	28.28	28.28	73.82	73.82	160.82	160.82
EX-WS-B	15.08	15.08	33.83	33.83	67.30	67.30

Wetlands

Facility components and associated work will take place outside of the wetland areas and their associated buffer zones. There will be no adverse impacts to the resource areas within the project area.

MINIMUM STANDARDS

The following narrative provides more detailed information for each of the individual

Minimum Standards from Chapter 3 and summarizes the Stormwater Management Checklist. As stated previously, the proposed project is below the 10 percent threshold (ballast block to overall array area) and does not propose any other impervious area. Therefore, there is no requirement to meet the eleven (11) Minimum Standards. However, all eleven (11) Minimum Standards have been addressed to the maximum extent practicable.

Standard 1 – LID Design

This standard has been met; applicable LID strategies to avoid, minimize, or mitigate stormwater impacts have been incorporated in the project design to some degree.

Specifically:

Avoiding Impacts

- A major goal of this project is to avoid the delineated wetlands and associated buffer zones. The limit of disturbance has been minimized to the greatest extent possible to achieve this goal.

Reducing Impacts

- The access road has been minimized to the maximum extent practicable while still providing access to the site, the access road will be clean, washed crushed stone as to not increase the impervious area of the site.

Therefore, it is our opinion, the project does consider and incorporate LID measures to the maximum extent practicable

Standard 2 – Groundwater Recharge

Groundwater recharge is not required as part of this project. The landfill is capped. Therefore, recharge is not possible.

Standard 3 – Water Quality
Standard 4 – Conveyance and Natural Channel Protection
Standard 5 – Overbank Flood Protection

Standards 3, 4 and 5 are not required as part of this project as the proposed project results in 5.1 % change in surface cover which is below the 10 percent threshold (ballast tub to overall array area) and does not propose any other impervious area. Therefore, it is assumed that the project will have an insignificant impact on the hydrologic and hydraulic characteristics of the site.

Standard 6 – Redevelopment & Infill Projects

This standard is not applicable, as the project does not qualify as a redevelopment or an infill project.

Standard 7 – Pollution Prevention

This standard has been met; the proposed project will not introduce any pollutants to the landfill or surrounding wetlands.

Standard 8 – LUHPPL's

This standard has been met, no portion of the project area is classified as a LUHPPL, nor are there any LUHPPL's in the vicinity of the project area.

Standard 9 – Illicit Discharges

This standard has been met; the Town of Bristol asserts that there are no, nor shall there be, any known existing or planned illicit discharges to or through any of the proposed stormwater facilities within the project area.

Standard 10 – Construction Erosion and Sedimentation Control

This standard has been met; erosion and sedimentation control (ESC) measures have been incorporated into the project design plans. During construction, straw wattles will be put in place at the limit of work as depicted on the Construction Plan. Disturbed areas will be treated with loam and seed as indicated on the Construction Plan.

Standard 11 – Stormwater Management System Operation and Maintenance

This standard has been met; a detailed *Stormwater Management System Long-Term Operation and Maintenance Plan*, prepared in accordance with guidance provided in Appendix E of the RISDISM, is included under separate cover. As part of the Operations and Maintenance Plan, regular inspections will be performed to ensure that the drip edge from the panels does not cause any erosion.

CONCLUSIONS

The Town of Bristol and NuGen Capital are proposing to install a solar array on top of the Bristol Landfill.

The work being proposed is outside of the wetlands and associated buffer zones. The project will have an insignificant impact on the hydrologic and hydraulic characteristics of the site.

All work being proposed satisfies the intent of the Wetland regulations and NuGen is requesting RIDEM approval for the project.

APPENDIX A

WETLAND REPORT

Bristol Landfill Wetlands Delineation
Bristol Landfill - Off Minturn Farm Rd, Bristol, RI

Wetland 1 (WFI Series – Flags WF1-100 to WF1-115; WF1-116 to WF1-138)

- WF1 Series wetland is separated into two (2) different wetland types.
- One of these wetland types, approximately from flags WF1-100 to WF1-115, can be described as a scrub-scrub wetland. Areas approx. 30 feet downgradient of the boundary were flooded at the time of inspection. This area is mapped as a "Scrub-Shrub Wetland – Shrub Swamp" on the RIDEM Environmental Resources Map, which generally supports our findings. This area is unmapped by the National Wetlands Inventory (NWI).
- The wetland, approximately from flags WF1-116 to WF-138, can be described as a forested palustrine wetland system. Dominant vegetation included red maple (*Acer rubrum*), round-leaf greenbrier (*Smilax rotundifolia*), and cinnamon fern (*Osmundastrum cinnamomeum*). This area is mapped as a deciduous forested wetland, which generally supports our findings. This area is mapped as PFO1B by the National Wetlands Inventory (NWI), a seasonally saturated deciduous forested palustrine wetland system.

Wetland 2 (WF2 Series – Flags WF2-100 to WF2-150)

- The WF2 Series wetland is a large seasonally flooded, forested wetland system. Dominant vegetation included American elm (*Ulmnus americana*), Eastern skunk cabbage (*Symplocarpus foetidus),* Northern spicebush (*Lindera benzoin*), and red maple (*Acer rubrum*).
- Portions of this wetland are mapped as a deciduous forested wetland on the RIDEM Environmental Resources Map, which generally supports our findings.
- Portions of this wetland are mapped as PFO1E by the NWI, a seasonally saturated deciduous forested palustrine wetland system. This generally supports our findings.

Wetland 3 (WF3 Series – Flags WF3-85 to WF3-107)

- The WF3 Series wetland is a small forested wetland system. Dominant vegetation included red maple, round-leaf greenbrier, and glossy buckthorn (*Frangula alnus*). The area between flags WF3-95 to WF3-99 was dominated with phragmites and appeared to flood/be saturated frequently.
- This wetland area is primarily mapped as a deciduous forested wetland on the RIDEM Environmental Resources Map with a small portion (along the edge of the landfill) mapped as an emergent wetland, marsh/wet meadow. This generally supports our findings.
- This wetland is unmapped by the NWI.

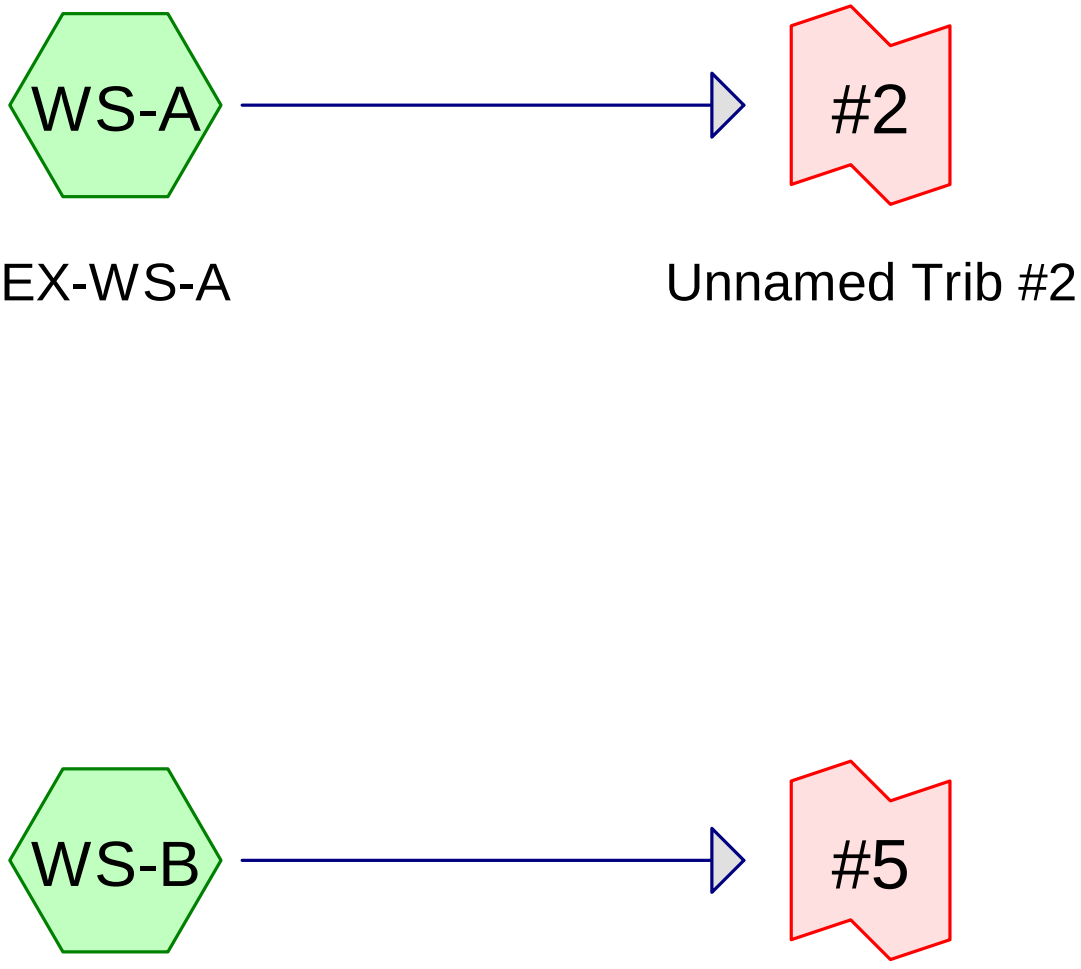

WF3-85 to WF3-107
WF2-100 to WF2-150
WF1-100 to WF1-138
• WF3-85 connects to WF3-107
• WF2-114 connects to culvert outlet
• WF2-138 connects to culvert

Source: http://ridemgis.maps.arcgis.com/apps/

Source: https://www.fws.gov/wetlands/data/mapper.html

APPENDIX B

HYDROLOGIC ANALYSIS



Subcat Reach Pond Link

Routing Diagram for 2796 - Prop Conditions
Prepared by {enter your company name here}, Printed 1/15/2023
HydroCAD® 10.00-22 s/n 01895 © 2018 HydroCAD Software Solutions LLC

Summary for Subcatchment WS-A: EX-WS-A

Runoff = 28.28 cfs @ 12.47 hrs, Volume= 161,574 cf, Depth= 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.80"

	Area (sf)	CN	Description
*	1,378,386	80	Capped Landfill
	350,723	80	1/2 acre lots, 25% imp, HSG C
*	30,189	98	Ballast
	1,759,298	80	Weighted Average
	1,641,428		93.30% Pervious Area
	117,870		6.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0210	0.12		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
10.1	567	0.0353	0.94		**Shallow Concentrated Flow, Shallow Woodlands** Woodland Kv= 5.0 fps
4.2	885	0.0486	3.55		**Shallow Concentrated Flow, Shallow Unpaved/Gravel** Unpaved Kv= 16.1 fps
3.0	217	0.0600	1.22		**Shallow Concentrated Flow, Shallow Woodland** Woodland Kv= 5.0 fps
31.1	1,769	Total			

Summary for Subcatchment WS-B: EX-WS-B

Runoff = 15.08 cfs @ 12.23 hrs, Volume= 64,694 cf, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.80"

	Area (sf)	CN	Description
*	274,619	80	Capped Landfill
	133,492	98	Paved parking, HSG C
	102,910	86	<50% Grass cover, Poor, HSG C
*	9,131	98	Ballast
	520,152	86	Weighted Average
	377,529		72.58% Pervious Area
	142,623		27.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0400	0.16		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
6.3	645	0.0600	1.71		**Shallow Concentrated Flow, Shallow Grass** Short Grass Pasture Kv= 7.0 fps
16.9	745	Total			

Summary for Link #2: Unnamed Trib #2

Inflow Area = 1,759,298 sf, 6.70% Impervious, Inflow Depth = 1.10" for 1-Year event
Inflow = 28.28 cfs @ 12.47 hrs, Volume= 161,574 cf
Primary = 28.28 cfs @ 12.47 hrs, Volume= 161,574 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs

Summary for Link #5: Unnamed Trib #5

Inflow Area = 520,152 sf, 27.42% Impervious, Inflow Depth = 1.49" for 1-Year event
Inflow = 15.08 cfs @ 12.23 hrs, Volume= 64,694 cf
Primary = 15.08 cfs @ 12.23 hrs, Volume= 64,694 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS-A: EX-WS-A

Runoff = 73.82 cfs @ 12.43 hrs, Volume= 411,353 cf, Depth= 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (sf)	CN	Description
*	1,378,386	80	Capped Landfill
	350,723	80	1/2 acre lots, 25% imp, HSG C
*	30,189	98	Ballast
	1,759,298	80	Weighted Average
	1,641,428		93.30% Pervious Area
	117,870		6.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0210	0.12		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
10.1	567	0.0353	0.94		**Shallow Concentrated Flow, Shallow Woodlands** Woodland Kv= 5.0 fps
4.2	885	0.0486	3.55		**Shallow Concentrated Flow, Shallow Unpaved/Gravel** Unpaved Kv= 16.1 fps
3.0	217	0.0600	1.22		**Shallow Concentrated Flow, Shallow Woodland** Woodland Kv= 5.0 fps
31.1	1,769	Total			

Summary for Subcatchment WS-B: EX-WS-B

Runoff = 33.83 cfs @ 12.23 hrs, Volume= 146,240 cf, Depth= 3.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (sf)	CN	Description
*	274,619	80	Capped Landfill
	133,492	98	Paved parking, HSG C
	102,910	86	<50% Grass cover, Poor, HSG C
*	9,131	98	Ballast
	520,152	86	Weighted Average
	377,529		72.58% Pervious Area
	142,623		27.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0400	0.16		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
6.3	645	0.0600	1.71		**Shallow Concentrated Flow, Shallow Grass** Short Grass Pasture Kv= 7.0 fps
16.9	745	Total			

Summary for Link #2: Unnamed Trib #2

Inflow Area = 1,759,298 sf, 6.70% Impervious, Inflow Depth = 2.81" for 10-Year event
Inflow = 73.82 cfs @ 12.43 hrs, Volume= 411,353 cf
Primary = 73.82 cfs @ 12.43 hrs, Volume= 411,353 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs

Summary for Link #5: Unnamed Trib #5

Inflow Area = 520,152 sf, 27.42% Impervious, Inflow Depth = 3.37" for 10-Year event
Inflow = 33.83 cfs @ 12.23 hrs, Volume= 146,240 cf
Primary = 33.83 cfs @ 12.23 hrs, Volume= 146,240 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS-A: EX-WS-A

Runoff = 160.82 cfs @ 12.41 hrs, Volume= 907,449 cf, Depth= 6.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.60"

	Area (sf)	CN	Description
*	1,378,386	80	Capped Landfill
	350,723	80	1/2 acre lots, 25% imp, HSG C
*	30,189	98	Ballast
	1,759,298	80	Weighted Average
	1,641,428		93.30% Pervious Area
	117,870		6.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0210	0.12		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
10.1	567	0.0353	0.94		**Shallow Concentrated Flow, Shallow Woodlands** Woodland Kv= 5.0 fps
4.2	885	0.0486	3.55		**Shallow Concentrated Flow, Shallow Unpaved/Gravel** Unpaved Kv= 16.1 fps
3.0	217	0.0600	1.22		**Shallow Concentrated Flow, Shallow Woodland** Woodland Kv= 5.0 fps
31.1	1,769	Total			

Summary for Subcatchment WS-B: EX-WS-B

Runoff = 67.30 cfs @ 12.22 hrs, Volume= 299,700 cf, Depth= 6.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.60"

	Area (sf)	CN	Description
*	274,619	80	Capped Landfill
	133,492	98	Paved parking, HSG C
	102,910	86	<50% Grass cover, Poor, HSG C
*	9,131	98	Ballast
	520,152	86	Weighted Average
	377,529		72.58% Pervious Area
	142,623		27.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0400	0.16		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
6.3	645	0.0600	1.71		**Shallow Concentrated Flow, Shallow Grass** Short Grass Pasture Kv= 7.0 fps
16.9	745	Total			

Summary for Link #2: Unnamed Trib #2

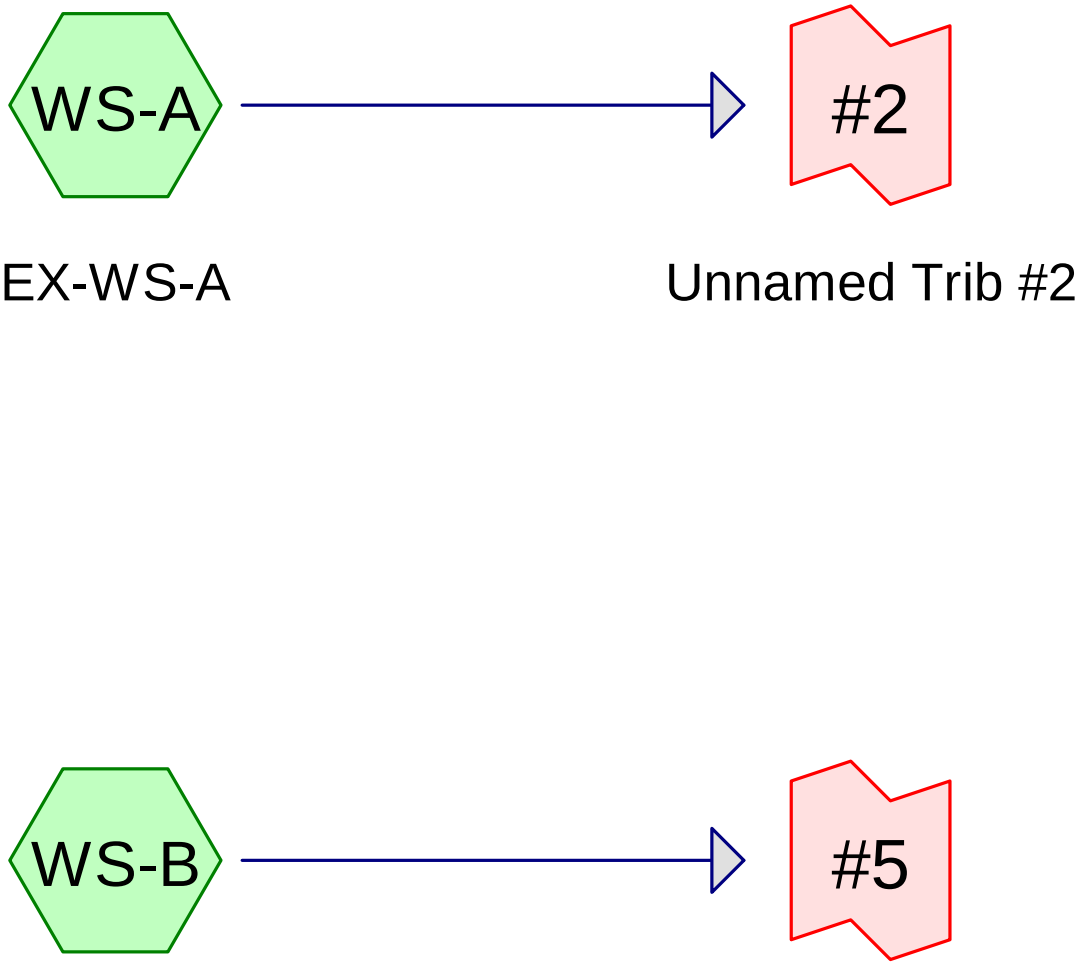
Inflow Area = 1,759,298 sf, 6.70% Impervious, Inflow Depth = 6.19" for 100-Year event
Inflow = 160.82 cfs @ 12.41 hrs, Volume= 907,449 cf
Primary = 160.82 cfs @ 12.41 hrs, Volume= 907,449 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs

Summary for Link #5: Unnamed Trib #5

Inflow Area = 520,152 sf, 27.42% Impervious, Inflow Depth = 6.91" for 100-Year event
Inflow = 67.30 cfs @ 12.22 hrs, Volume= 299,700 cf
Primary = 67.30 cfs @ 12.22 hrs, Volume= 299,700 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs



Subcat Reach Pond Link

Routing Diagram for 2796 - Ex Conditions
Prepared by {enter your company name here}, Printed 1/15/2023
HydroCAD® 10.00-22 s/n 01895 © 2018 HydroCAD Software Solutions LLC

Summary for Subcatchment WS-A: EX-WS-A

Runoff = 28.28 cfs @ 12.47 hrs, Volume= 161,574 cf, Depth= 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.80"

	Area (sf)	CN	Description
*	1,408,575	80	Capped Landfill
	350,723	80	1/2 acre lots, 25% imp, HSG C
	1,759,298	80	Weighted Average
	1,671,617		95.02% Pervious Area
	87,681		4.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0210	0.12		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
10.1	567	0.0353	0.94		**Shallow Concentrated Flow, Shallow Woodlands** Woodland Kv= 5.0 fps
4.2	885	0.0486	3.55		**Shallow Concentrated Flow, Shallow Unpaved/Gravel** Unpaved Kv= 16.1 fps
3.0	217	0.0600	1.22		**Shallow Concentrated Flow, Shallow Woodland** Woodland Kv= 5.0 fps
31.1	1,769	Total			

Summary for Subcatchment WS-B: EX-WS-B

Runoff = 15.08 cfs @ 12.23 hrs, Volume= 64,694 cf, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.80"

	Area (sf)	CN	Description
*	283,750	80	Capped Landfill
	133,492	98	Paved parking, HSG C
	102,910	86	<50% Grass cover, Poor, HSG C
	520,152	86	Weighted Average
	386,660		74.34% Pervious Area
	133,492		25.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0400	0.16		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
6.3	645	0.0600	1.71		**Shallow Concentrated Flow, Shallow Grass** Short Grass Pasture Kv= 7.0 fps
16.9	745	Total			

Summary for Link #2: Unnamed Trib #2

Inflow Area = 1,759,298 sf, 4.98% Impervious, Inflow Depth = 1.10" for 1-Year event
Inflow = 28.28 cfs @ 12.47 hrs, Volume= 161,574 cf
Primary = 28.28 cfs @ 12.47 hrs, Volume= 161,574 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs

Summary for Link #5: Unnamed Trib #5

Inflow Area = 520,152 sf, 25.66% Impervious, Inflow Depth = 1.49" for 1-Year event
Inflow = 15.08 cfs @ 12.23 hrs, Volume= 64,694 cf
Primary = 15.08 cfs @ 12.23 hrs, Volume= 64,694 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS-A: EX-WS-A

Runoff = 73.82 cfs @ 12.43 hrs, Volume= 411,353 cf, Depth= 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (sf)	CN	Description
*	1,408,575	80	Capped Landfill
	350,723	80	1/2 acre lots, 25% imp, HSG C
	1,759,298	80	Weighted Average
	1,671,617		95.02% Pervious Area
	87,681		4.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0210	0.12		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
10.1	567	0.0353	0.94		**Shallow Concentrated Flow, Shallow Woodlands** Woodland Kv= 5.0 fps
4.2	885	0.0486	3.55		**Shallow Concentrated Flow, Shallow Unpaved/Gravel** Unpaved Kv= 16.1 fps
3.0	217	0.0600	1.22		**Shallow Concentrated Flow, Shallow Woodland** Woodland Kv= 5.0 fps
31.1	1,769	Total			

Summary for Subcatchment WS-B: EX-WS-B

Runoff = 33.83 cfs @ 12.23 hrs, Volume= 146,240 cf, Depth= 3.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.90"

	Area (sf)	CN	Description
*	283,750	80	Capped Landfill
	133,492	98	Paved parking, HSG C
	102,910	86	<50% Grass cover, Poor, HSG C
	520,152	86	Weighted Average
	386,660		74.34% Pervious Area
	133,492		25.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0400	0.16		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
6.3	645	0.0600	1.71		**Shallow Concentrated Flow, Shallow Grass** Short Grass Pasture Kv= 7.0 fps
16.9	745	Total			

Summary for Link #2: Unnamed Trib #2

Inflow Area = 1,759,298 sf, 4.98% Impervious, Inflow Depth = 2.81" for 10-Year event
Inflow = 73.82 cfs @ 12.43 hrs, Volume= 411,353 cf
Primary = 73.82 cfs @ 12.43 hrs, Volume= 411,353 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs

Summary for Link #5: Unnamed Trib #5

Inflow Area = 520,152 sf, 25.66% Impervious, Inflow Depth = 3.37" for 10-Year event
Inflow = 33.83 cfs @ 12.23 hrs, Volume= 146,240 cf
Primary = 33.83 cfs @ 12.23 hrs, Volume= 146,240 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS-A: EX-WS-A

Runoff = 160.82 cfs @ 12.41 hrs, Volume= 907,449 cf, Depth= 6.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.60"

	Area (sf)	CN	Description
*	1,408,575	80	Capped Landfill
	350,723	80	1/2 acre lots, 25% imp, HSG C
	1,759,298	80	Weighted Average
	1,671,617		95.02% Pervious Area
	87,681		4.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0210	0.12		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
10.1	567	0.0353	0.94		**Shallow Concentrated Flow, Shallow Woodlands** Woodland Kv= 5.0 fps
4.2	885	0.0486	3.55		**Shallow Concentrated Flow, Shallow Unpaved/Gravel** Unpaved Kv= 16.1 fps
3.0	217	0.0600	1.22		**Shallow Concentrated Flow, Shallow Woodland** Woodland Kv= 5.0 fps
31.1	1,769	Total			

Summary for Subcatchment WS-B: EX-WS-B

Runoff = 67.30 cfs @ 12.22 hrs, Volume= 299,700 cf, Depth= 6.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.60"

	Area (sf)	CN	Description
*	283,750	80	Capped Landfill
	133,492	98	Paved parking, HSG C
	102,910	86	<50% Grass cover, Poor, HSG C
	520,152	86	Weighted Average
	386,660		74.34% Pervious Area
	133,492		25.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0400	0.16		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
6.3	645	0.0600	1.71		**Shallow Concentrated Flow, Shallow Grass** Short Grass Pasture Kv= 7.0 fps
16.9	745	Total			

Summary for Link #2: Unnamed Trib #2

Inflow Area = 1,759,298 sf, 4.98% Impervious, Inflow Depth = 6.19" for 100-Year event
Inflow = 160.82 cfs @ 12.41 hrs, Volume= 907,449 cf
Primary = 160.82 cfs @ 12.41 hrs, Volume= 907,449 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs

Summary for Link #5: Unnamed Trib #5

Inflow Area = 520,152 sf, 25.66% Impervious, Inflow Depth = 6.91" for 100-Year event
Inflow = 67.30 cfs @ 12.22 hrs, Volume= 299,700 cf
Primary = 67.30 cfs @ 12.22 hrs, Volume= 299,700 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-42.00 hrs, dt= 0.01 hrs

APPENDIX C

APPENDIX A CHECKLIST

APPENDIX A: STORMWATER MANAGEMENT PLAN CHECKLIST AND LID PLANNING REPORT – STORMWATER DESIGN SUMMARY

PROJECT NAME **Bristol Landfill Solar Facility**	**(RIDEM USE ONLY)**
TOWN **Bristol, Rhode Island**	**STW/WQC File #:**
BRIEF PROJECT DESCRIPTION: This project proposes the installation of a 6.88 MW AC Solar Facility on the capped Bristol Landfill. The solar array will be constructed using a ballasted system to minimize any disturbance to the landfill cap. There will be no proposed impervious area or land disturbance/excavation on top of the landfill.	**Date Received:**

Stormwater Management Plan (SMP) Elements – Minimum Standards

When submitting a SMP,[1] submit four separately bound documents: Appendix A Checklist; Stormwater Site Planning, Analysis and Design Report with Plan Set/Drawings; Soil Erosion and Sediment Control (SESC) Plan, and Post Construction Operations and Maintenance (O&M) Plan. Please refer to Suggestions to Promote Brevity**.**

Note**: All stormwater construction projects must create a Stormwater Management Plan (SMP). However, not every element listed below is required per the RIDEM Stormwater Rules and the RIPDES Construction General Permit (CGP). This checklist will help identify the required elements to be submitted with an Application for Stormwater Construction Permit & Water Quality Certification.**

PART 1. PROJECT AND SITE INFORMATION

PROJECT TYPE (Check all that apply)

☐ Residential	☐ Commercial	☐ Federal	☐ Retrofit	☐ Restoration
☐ Road	☒ Utility	☐ Fill	☐ Dredge	☐ Mine
☐ Other (specify):				

SITE INFORMATION

☒ Vicinity Map

INITIAL DISCHARGE LOCATION(S): The WQv discharges to: (You may choose more than one answer if several discharge points are associated with the project.)

☐ **Groundwater**	☒ **Surface Water**	☐ **MS4**
☐ GAA	☐ Isolated Wetland	☐ RIDOT
☒ GA	☒ Named Waterbody	☐ RIDOT Alteration Permit is Approved
☐ GB	☐ Unnamed Waterbody Connected to Named Waterbody	☐ Town
		☐ Other (specify):

ULTIMATE RECEIVING WATERBODY LOCATION(S): Include pertinent information that applies to both WQ_v and flow from larger storm events including overflows. Choose all that apply, and repeat table for each waterbody.

☐ Groundwater or Disconnected Wetland	☐ SRWP		
☒ Waterbody Name: Tributary to Mount Hope Bay	☐ Coldwater	☐ Warmwater	☐ Unassessed
☐ Waterbody ID: RI0007032R-03 & RI0007032R-03	☐ 4th order stream of pond 50 acres or more		
☐ TMDL for:	☐ Watershed of flood prone river (e.g., Pocasset River)		
☐ Contributes to a priority outfall listed in the TMDL	☐ Contributes stormwater to a public beach		
☐ 303(d) list – Impairment(s) for:	☐ Contributes to shellfishing grounds		

[1] Applications for a Construction General Permit that do not require any other permits from RIDEM and will disturb less than 5 acres over the entire course of the project do not need to submit a SMP. The Appendix A checklist must still be submitted.

PROJECT HISTORY		
☐ RIDEM Pre- Application Meeting	Meeting Date:	☐ Minutes Attached
☐ Municipal Master Plan Approval	Approval Date:	☐ Minutes Attached
☐ Subdivision Suitability Required	Approval #:	
☐ Previous Enforcement Action has been taken on the property	Enforcement #:	

FLOODPLAIN & FLOODWAY See Guidance Pertaining to Floodplain and Floodways	
☐ Riverine 100-year floodplain: **FEMA FLOODPLAIN FIRMETTE** has been reviewed and the 100-year floodplain is on site	
☐ Delineated from FEMA Maps	
NOTE: Per Rule 250-RICR-150-10-8-1.1(B)(5)(d)(3), provide volumetric floodplain compensation calculations for cut and fill/displacement calculated by qualified professional	
☐ Calculated by Professional Engineer	
☐ Calculations are provided for cut vs. fill/displacement volumes proposed within the 100-year floodplain	Amount of Fill (CY):
	Amount of Cut (CY):
☐ Restrictions or modifications are proposed to the flow path or velocities in a floodway	
☐ Floodplain storage capacity is impacted	
☒ Project area is not within 100-year floodplain as defined by RIDEM	

CRMC JURISDICTION
☐ CRMC Assent required
☐ Property subject to a Special Area Management Plan (SAMP). If so, specify which SAMP:
☐ Sea level rise mitigation has been designed into this project

LUHPPL IDENTIFICATION - MINIMUM STANDARD 8:			
1. OFFICE OF Land Revitalization and Sustainable Materials Management (OLRSMM)			
	☐ Known or suspected releases of HAZARDOUS MATERIAL are present at the site (Hazardous Material is defined in Rule 1.4(A)(33) of 250-140-30-1 of the RIDEM Rules and Regulations for Investigation and Remediation of Hazardous Materials (the Remediation Regulations))		**RIDEM CONTACT:**
	☐ Known or suspected releases of PETROLEUM PRODUCT are present at the site (Petroleum Product as defined in Rule 1.5(A)(84) of 250-140-25-1 of the RIDEM Rules and Regulations for Underground Storage Facilities Used for Regulated Substances and Hazardous Materials)		
	☒ This site is identified on the RIDEM Environmental Resources Map as one of the following regulated facilities		**SITE ID#**:
		☐ CERCLIS/Superfund (NPL)	
		☐ State Hazardous Waste Site (SHWS)	
		☐ Environmental Land Usage Restriction (ELUR)	
		☐ Leaking Underground Storage Tank (LUST)	
		☒ Closed Landfill	SR-02-0164
Note: If any boxes in 1 above are checked, the applicant must contact the RIDEM OLRSMM Project Manager associated with the Site to determine if subsurface infiltration of stormwater is allowable for the project. Indicate if the infiltration corresponds to "Red," "Yellow" or "Green" as described in Section 3.2.8 of the RISDISM Guidance (Subsurface Contamination Guidance). Also, note and reference approval in PART 3, Minimum Standard 2: Groundwater Recharge/Infiltration**.**			
2. PER MINIMUM STANDARD 8 of RICR 8.14.C.1-6 "LUHPPLS," THE SITE IS/HAS:			
	☐ Industrial Site with RIPDES MSGP, except where No Exposure Certification exists. http://www.dem.ri.gov/programs/water/permits/ripdes/stormwater/status.php		
	☐ Auto Fueling Facility (e.g., gas station)		
	☐ Exterior Vehicles Service, Maintenance, or Equipment Cleaning Area		

	☐ Road Salt Storage and Loading Areas (exposed to rainwater)	
	☐ Outdoor Storage and Loading/Unloading of Hazardous Substances	
3.	**STORMWATER INDUSTRIAL PERMITTING**	
	☐ The site is associated with existing or proposed activities that are considered Land Uses with Higher Potential Pollutant Loads (LUHPPLS) (see RICR 8.14.C)	Activities: Sector:
	☐ Construction is proposed on a site that is subject to THE MULTI-SECTOR GENERAL PERMIT (MSGP) UNDER RULE 31(B)15 OF THE RIPDES REGULATIONS.	MSGP permit #
	☐ Additional stormwater treatment is required by the MSGP Explain:	

REDEVELOPMENT STANDARD – MINIMUM STANDARD 6		
☒ Pre Construction Impervious Area		
	☐ Total Pre-Construction Impervious Area (**TIA**) = 4.61 acres	
	☒ Total Site Area (**TSA**) = 91.54 acres	
	☒ Jurisdictional Wetlands (**JW**) = 36.73 acres	
	☐ Conservation Land (**CL**)=	
☒ Calculate the Site Size (defined as contiguous properties under same ownership)		
	☒ Site Size (**SS**) = (**TSA**) – (**JW**) – (**CL**) = 54.81 acres	
	☒ (**TIA**) / (**SS**) = 0.084	☐ (**TIA**) / (**SS**) >**0.4**? No
☐ YES, Redevelopment		

PART 2. LOW IMPACT DEVELOPMENT ASSESSMENT – MINIMUM STANDARD 1

(NOT REQUIRED FOR REDEVELOPMENT OR RETROFITS)

This section may be deleted if not required.

Note: A written description must be provided specifying why each method is not being used or is not applicable at the Site. Appropriate answers may include:

- Town requires … (state the specific local requirement)
- Meets Town's dimensional requirement of …
- Not practical for site because …
- Applying for waiver/variance to achieve this (pending/approved/denied)
- Applying for wavier/variance to seek relief from this (pending/approved/denied)

A) PRESERVATION OF UNDISTURBED AREAS, BUFFERS, AND FLOODPLAINS	**IF NOT IMPLEMENTED, EXPLAIN HERE**
☒ Sensitive resource areas and site constraints are identified (required) ☒ Local development regulations have been reviewed (required) ☒ All vegetated buffers and coastal and freshwater wetlands will be protected during and after construction ☒ Conservation Development or another site design technique has been incorporated to protect open space and pre-development hydrology. **Note:** If Conservation Development has been used, check box and skip to Subpart C ☒ As much natural vegetation and pre-development hydrology as possible has been maintained	

B) LOCATE DEVELOPMENT IN LESS SENSITIVE AREAS AND WORK WITH THE NATURAL LANDSCAPE CONDITIONS, HYDROLOGY, AND SOILS ☒ Development sites and building envelopes have been appropriately distanced from wetlands and waterbodies ☒ Development and stormwater systems have been located in areas with greatest infiltration capacity (e.g., soil groups A and B) ☒ Plans show measures to prevent soil compaction in areas designated as Qualified Pervious Areas (QPA's) ☒ Development sites and building envelopes have been positioned outside of floodplains ☒ Site design positions buildings, roadways and parking areas in a manner that avoids impacts to surface water features ☒ Development sites and building envelopes have been located to minimize impacts to steep slopes (≥15%) ☐ Other (describe):	
C) MINIMIZE CLEARING AND GRADING ☒ Site clearing has been restricted to <u>minimum area needed</u> for building footprints, development activities, construction access, and safety. ☒ Site has been designed to position buildings, roadways, and parking areas in a manner that minimizes grading (cut and fill quantities) ☒ Protection for stands of trees and individual trees and their root zones to be preserved has been specified, and such protection extends at least to the tree canopy drip line(s) ☒ Plan notes specify that public trees removed or damaged during construction shall be replaced with equivalent	
D) REDUCE IMPERVIOUS COVER ☐ Reduced roadway widths (≤22 feet for ADT ≤ 400; ≤ 26 feet for ADT 400 - 2,000) ☐ Reduced driveway areas (length minimized via reduced ROW width (≤ 45 ft.) and/or reduced (or absolute minimum) front yard setback; width minimized to ≤ 9 ft. wide one lane; ≤ 18 ft. wide two lanes; shared driveways; pervious surface) ☐ Reduced building footprint: Explain approach: ☐ Reduced sidewalk area (≤ 4 ft. wide; one side of the street; unpaved path; pervious surface) ☐ Reduced cul-de-sacs (radius < 45 ft; vegetated island; alternative turn-around) ☐ Reduced parking lot area: Explain approach ☐ Use of pervious surfaces for driveways, sidewalks, parking areas/overflow parking areas, etc. ☐ Minimized impervious surfaces (project meets or is less than maximum specified by Zoning Ordinance) ☐ Other (describe):	Not Applicable; there is not impervious cover being proposed in the project.
E) DISCONNECT IMPERVIOUS AREA ☐ Impervious surfaces have been disconnected, and runoff has been diverted to QPAs to the maximum extent possible ☐ Residential street edges allow side-of-the-road drainage into vegetated open swales ☐ Parking lot landscaping breaks up impervious expanse AND accepts runoff ☐ Other (describe):	Not Applicable; there is not impervious cover being proposed in the project.
F) MITIGATE RUNOFF AT THE POINT OF GENERATION ☐ Small-scale BMPs have been designated to treat runoff as close as possible to the source	

G) PROVIDE LOW-MAINTENANCE NATIVE VEGETATION ☒ Low-maintenance landscaping has been proposed using native species and cultivars ☒ Plantings of native trees and shrubs in areas previously cleared of native vegetation are shown on site plan ☒ Lawn areas have been limited/minimized, and yards have been kept undisturbed to the maximum extent practicable on residential lots	
H) RESTORE STREAMS/WETLANDS ☒ Historic drainage patterns have been restored by removing closed drainage systems, daylighting buried streams, and/or restoring degraded stream channels and/or wetlands ☐ Removal of invasive species ☐ Other	No work within the regulated wetlands is being proposed as part of the project.

PART 3. SUMMARY OF REMAINING STANDARDS

GROUNDWATER RECHARGE – MINIMUM STANDARD 2		
YES	**NO**	
☐	☒	The project has been designed to meet the groundwater recharge standard.
☒	☐	If "No," the justification for groundwater recharge criterion waiver has been explained in the Narrative (e.g., threat of groundwater contamination or physical limitation), if applicable (see RICR 8.8.D);
☒	☐	Your waiver request has been explained in the Narrative, if applicable.
☐	☒	Is this site identified as a Regulated Facility in Part 1, Minimum Standard 8: LUHPPL Identification?
☐	☐	If "Yes," has approval for infiltration by the OLRSMM Site Project Manager, per Part 1, Minimum Standard 8, been requested?

TABLE 2-1: Summary of Recharge (see RISDISM Section 3.3.2)
(Add or Subtract Rows as Necessary)

Design Point	**Impervious Area Treated (sq ft)**	**Total Re_v Required (cu ft)**	**LID Stormwater Credits (see RISDISM Section 4.6.1)**	**Recharge Required by Remaining BMPs (cu ft)**	**Recharge Provided by BMPs (cu ft)**
			Portion of Re_v directed to a QPA (cu ft)		
DP-1:					
DP-2:					
DP-3:					
DP-4:					
TOTALS:					

Notes:
1. Only BMPs listed in RISDISM Table 3-5 "List of BMPs Acceptable for Recharge" may be used to meet the recharge requirement.
2. Recharge requirement must be satisfied for each waterbody ID.

☐ Indicate where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.):

WATER QUALITY – MINIMUM STANDARD 3		
YES	**NO**	
☐	☒	Does this project meet or exceed the required water quality volume WQv (see RICR 8.9.E-I)?
☐	☒	Is the proposed final impervious cover greater than 20% of the disturbed area (see RICR 8.9.E-I)?
☐	☐	If "Yes," either the Modified Curve Number Method or the Split Pervious/Impervious method in Hydro-CAD was used to calculate WQv; or,
☐	☐	If "Yes," either TR-55 or TR-20 was used to calculate WQv; and,
☐	☒	If "No," the project meets the minimum WQv of 0.2 watershed inches over the entire disturbed area.
☐	☒	Not Applicable
☐	☒	Does this project meet or exceed the ability to treat required water quality flow WQf (see RICR 8.9.I.1-3)?
☐	☒	Does this project propose an increase of impervious cover to a receiving water body with impairments? If "Yes," please indicate below the method that was used to address the water quality requirements of no further degradation to a low-quality water.
☐	☒	RICR 8.36. A Pollutant Loading Analysis is needed and has been completed.
☒	☐	The Water Quality Guidance Document (Water Quality Goals and Pollutant Loading Analysis Guidance for Discharges to Impaired Waters) has been followed as applicable.
☐	☒	BMPs are proposed that are on the approved technology list . If "Yes," please provide all required worksheets from the manufacturer.
☐	☒	Additional pollutant-specific requirements and/or pollutant removal efficiencies are applicable to the site as the result of a TMDL, SAMP, or other watershed-specific requirements. If "Yes," please describe:

TABLE 3-1: Summary of Water Quality (see RICR 8.9)					
Design Point and WB ID	**Impervious area treated (sq ft)**	**Total WQ_v Required (cu ft)**	**LID Stormwater Credits** (see RICR 8.18) **WQv directed to a QPA (cu ft)**	**Water Quality Treatment Remaining (cu ft)**	**Water Quality Provided by BMPs (cu ft)**
DP-1:					
DP-2:					
DP-3:					
DP-4:					
TOTALS:					

Notes:
1. Only BMPs listed in RICR 8.20 and 8.25 or the Approved Technologies List of BMPs is Acceptable for Water Quality treatment.
2. For each Design Point, the Water Quality Volume Standard must be met for each Waterbody ID.

☐ YES ☐ NO	This project has met the setback requirements for each BMP. If "No," please explain:

☐ Indicate where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.):

CONVEYANCE AND NATURAL CHANNEL PROTECTION (RICR 8.10) – MINIMUM STANDARD 4		
YES	**NO**	
☐	☒	Is this standard waived? If "Yes," please indicate one or more of the reasons below:
		☐ The project directs discharge to a large river (i.e., 4th-order stream or larger. See RISDISM Appendix I for State-wide list and map of stream orders), bodies of water >50.0 acres in surface area (i.e., lakes, ponds, reservoirs), or tidal waters. ☐ The project is a small facility with impervious cover of less than or equal to 1 acre. ☐ The project has a post-development peak discharge rate from the facility that is less than 2 cfs for the 1-year, 24-hour Type III design storm event (prior to any attenuation). (Note: LID design strategies can greatly reduce the peak discharge rate).
☒	☐	Conveyance and natural channel protection for the site have been met. If "No,' explain why:

TABLE 4-1: Summary of Channel Protection Volumes (see RICR 8.10)					
Design Point	**Receiving Water Body Name**	**Coldwater Fishery? (Y/N)**	**Total CPv Required (cu ft)**	**Total CPv Provided (cu ft)**	**Average Release Rate Modeled in the 1-yr storm (cfs)**
DP-1:					
DP-2:					
DP-3:					
DP-4:					
TOTALS:					
Note: The Channel Protection Volume Standard must be met in each waterbody ID.					
☐ YES ☐ NO	The CPv is released at roughly a uniform rate over a 24-hour duration (see examples of sizing calculations in Appendix D of the RISDISM).				
☐ YES ☐ NO	Do additional design restrictions apply resulting from any discharge to cold-water fisheries; If "Yes," please indicate restrictions and solutions below.				
☐ Indicate below where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.).					

OVERBANK FLOOD PROTECTION (RICR 8.11) AND OTHER POTENTIAL HIGH FLOWS – MINIMUM STANDARD 5			
YES	**NO**		
☐	☒	Is this standard waived? If yes, please indicate one or more of the reasons below:	
		☐	The project directs discharge to a large river (i.e., 4th-order stream or larger. See Appendix I for state-wide list and map of stream orders), bodies of water >50.0 acres in surface area (i.e., lakes, ponds, reservoirs), or tidal waters.
		☐	A Downstream Analysis (see RICR 8.11.D and E) indicates that peak discharge control would not be beneficial or would exacerbate peak flows in a downstream tributary of a particular site (e.g., through coincident peaks).
☐	☒	Does the project flow to an MS4 system or subject to other stormwater requirements? If "Yes," indicate as follows:	
		☐	RIDOT
		☐	Other (specify):
Note: The project could be approved by RIDEM but not meet RIDOT or Town standards. RIDOT's regulations indicate that post-volumes must be **less** than pre-volumes for the 10-yr storm at the design point entering the RIDOT system. If you have not already received approval for the discharge to an MS4, please explain below your strategy to comply with RIDEM and the MS4.			
		Indicate below which model was used for your analysis. ☐ TR-55 ☐ TR-20 ☒ HydroCAD ☐ Bentley/Haestad ☐ Intellisolve ☐ Other (Specify):	
YES	**NO**		
☒	☐	Does the drainage design demonstrate that flows from the 100-year storm event through a BMP will safely manage and convey the 100-year storm? If "No," please explain briefly below and reference where in the application further documentation can be found (i.e., name of report/document, page numbers, appendices, etc.):	
☐	☒	Do off-site areas contribute to the sub-watersheds and design points? If "Yes,"	
☐	☐	Are the areas modeled as "present condition" for both pre- and post-development analysis?	
☐	☐	Are the off-site areas shown on the subwatershed maps?	
☐	☒	Does the drainage design confirm safe passage of the 100-year flow through the site for off-site runoff?	
☐	☒	Is a Downstream Analysis required (see RICR 8.11.E.1)?	
☒	☐	Calculate the following:	
		☒	Area of disturbance within the sub-watershed (areas) = 1.06 acres
		☒	Impervious cover (%) = 5.1%
☐	☒	Is a dam breach analysis required (earthen embankments over six (6) feet in height, or a capacity of 15 acre-feet or more, and contributes to a significant or high hazard dam)?	
☐	☐	Does this project meet the overbank flood protection standard?	

Table 5-1 Hydraulic Analysis Summary								
Subwatershed (Design Point)	**1.2" Peak Flow** (cfs) **		**1-yr Peak Flow** (cfs)		**10-yr Peak Flow** (cfs)		**100-yr Peak Flow** (cfs)	
	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
WS-A	2.61	2.61	28.28	28.28	73.82	73.82	160.82	160.82
WS-B:	2.72	2.72	15.08	15.08	33.83	33.83	67.30	67.30
TOTALS:								

** Utilize modified curve number method or split pervious /impervious method in HydroCAD.

Note: The hydraulic analysis must demonstrate no impact to each individual subwatershed DP unless each DP discharges to the same wetland or water resource.

Indicate as follows where the pertinent calculations and/or information for the items above are provided	**Name of report/document, page numbers, appendices, etc.**
Existing conditions analysis for each subwatershed, including curve numbers, times of concentration, runoff rates, volumes, and water surface elevations showing methodologies used and supporting calculations.	Appendix B of the Stormwater Management Report
Proposed conditions analysis for each subwatershed, including curve numbers, times of concentration, runoff rates, volumes, water surface elevations, and routing showing the methodologies used and supporting calculations.	Appendix B of the Stormwater Management Report
Final sizing calculations for structural stormwater BMPs, including contributing drainage area, storage, and outlet configuration.	
Stage-storage, inflow and outflow hydrographs for storage facilities (e.g., detention, retention, or infiltration facilities).	

Table 5-2 Summary of Best Management Practices												
BMP ID	**DP #**	**BMP Type** (e.g., bioretention, tree filter)	**BMP Functions**					**Bypass Type**	**Horizontal Setback Criteria are met per RICR 8.21.B.10, 8.22.D.11, and 8.35.B.4**		
			Pre-Treatment (Y/N/ NA)	Re_v	WQ_v	CP_v (Y/N/ NA)	Overbank Flood Reduction (Y/N/NA)	External (E) Internal (I) or NA	Yes/ No	Technical Justification (Design Report page number)	Distance Provided
		TOTALS:									

Table 5.3 Summary of Soils to Evaluate Each BMP									
DP #	**BMP ID**	**BMP Type** (e.g., bioretention, tree filter)	**Soils Analysis for Each BMP**						
			Test Pit ID# and Ground Elevation		SHWT Elevation (ft)	Bottom of Practice Elevation* (ft)	Separation Distance Provided (ft)	Hydrologic Soil Group (A, B, C, D)	Exfiltration Rate Applied (in/hr)
			Primary	Secondary					
		TOTALS:							

* For underground infiltration systems (UICs) bottom equals bottom of stone, for surface infiltration basins bottom equals bottom of basin, for filters bottom equals interface of storage and top of filter layer

LAND USES WITH HIGHER POTENTIAL POLLUTANTS LOADS (LUHPPLs) – MINIMUM STANDARD 8			
YES	**NO**	**N/A**	
☐	☐	☒	Describe any LUHPPLs identified in Part 1, Minimum Standard 8, Section 2. If not applicable, continue to Minimum Standard 9.
☐	☐	☒	Are these activities already covered under an MSGP? If "No," please explain if you have applied for an MSGP or intend to do so?
☐	☐	☒	List the specific BMPs that are proposed for this project that receive stormwater from LUHPPL drainage areas. These BMP types must be listed in RISDISM Table 3-3, "Acceptable BMPs for Use at LUHPPLs." Please list BMPs:
☐	☐	☒	Additional BMPs, or additional pretreatment BMP's if any, that meet RIPDES MSGP requirements; Please list BMPs:
			Indicate below where the pertinent calculations and/or information for the above items are provided (i.e., name of report/document, page numbers, appendices, etc.).

ILLICIT DISCHARGES – MINIMUM STANDARD 9			
Illicit discharges are defined as unpermitted discharges to Waters of the State that do not consist entirely of stormwater or uncontaminated groundwater, except for certain discharges identified in the RIPDES Phase II Stormwater General Permit.			
YES	**NO**	**N/A**	
☒	☐	☐	Have you checked for illicit discharges?
☐	☒	☐	Have any been found and/or corrected? If "Yes," please identify.
☒	☐	☐	Does your report explain preventative measures that keep non-stormwater discharges out of the Waters of the State (during and after construction)?

SOIL EROSION AND SEDIMENT CONTROL (SESC) – MINIMUM STANDARD 10				
YES	**NO**	**N/A**		
☒	☐	☐	Have you included a Soil Erosion and Sediment Control Plan Set and/or Complete Construction Plan Set?	
☐	☐	☐	Have you provided a **separately-bound** document based upon the SESC Template? If yes, proceed to Minimum Standard 11 (the following items can be assumed to be addressed).	
			If "No," include a document with your submittal that addresses the following elements of an SESC Plan:	
			☐	Soil Erosion and Sediment Control Plan Project Narrative, including a description of how the fifteen (15) Performance Criteria have been met:
			☐	Provide Natural Buffers and Maintain Existing Vegetation
			☐	Minimize Area of Disturbance
			☐	Minimize the Disturbance of Steep Slopes
			☐	Preserve Topsoil
			☐	Stabilize Soils
			☐	Protect Storm Drain Inlets
			☐	Protect Storm Drain Outlets
			☐	Establish Temporary Controls for the Protection of Post-Construction Stormwater Control Measures
			☐	Establish Perimeter Controls and Sediment Barriers
			☐	Divert or Manage Run-On from Up-Gradient Areas
			☐	Properly Design Constructed Stormwater Conveyance Channels
			☐	Retain Sediment On-Site
			☐	Control Temporary Increases in Stormwater Velocity, Volume, and Peak Flows
			☐	Apply Construction Activity Pollution Prevention Control Measures
			☐	Install, Inspect, and Maintain Control Measures and Take Corrective Actions
			☐	Qualified SESC Plan Preparer's Information and Certification
			☐	Operator's Information and Certification; if not known at the time of application, the Operator must certify the SESC Plan upon selection and prior to initiating site activities
			☐	Description of Control Measures, such as Temporary Sediment Trapping and Conveyance Practices, including design calculations and supporting documentation, as required

STORMWATER MANAGEMENT SYSTEM OPERATION, MAINTENANCE, AND POLLUTION PREVENTION PLAN – MINIMUM STANDARDS 7 AND 9		
Operation and Maintenance Section		
YES	**NO**	
☒	☐	Have you minimized all sources of pollutant contact with stormwater runoff, to the maximum extent practicable?
☐	☒	Have you provided a **separately-bound** Operation and Maintenance Plan for the site and for all of the BMPs, and does it address each element of RICR 8.17 and RISDISM Appendix C and E?
☒	☐	Lawn, Garden, and Landscape Management meet the requirements of RISDISM Section G.7? If "No," why not?
☒	☐	Is the property owner or homeowner's association responsible for the stormwater maintenance of all BMP's? If "No," you must provide a legally binding and enforceable maintenance agreement (see RISDISM Appendix E, page 26) that identifies the entity that will be responsible for maintenance of the stormwater. Indicate where this agreement can be found in your report (i.e., name of report/document, page numbers, appendices, etc.).
☐	☒	Do you anticipate that you will need legal agreements related to the stormwater structures? (e.g. off-site easements, deed restrictions, covenants, or ELUR per the Remediation Regulations). If "Yes," have you obtained them? Or please explain your plan to obtain them:

☐	☒	Is stormwater being directed from public areas to private property? If "Yes," note the following: Note: This is not allowed unless a funding mechanism is in place to provide the finances for the long-term maintenance of the BMP and drainage, or a funding mechanism is demonstrated that can guarantee the long-term maintenance of a stormwater BMP by an individual homeowner.
Pollution Prevention Section		
☐	☒	Designated snow stockpile locations?
☐	☒	Trash racks to prevent floatables, trash, and debris from discharging to Waters of the State?
☒	☐	Asphalt-only based sealants?
☐	☐	Pet waste stations? (Note: If a receiving water has a bacterial impairment, and the project involves housing units, then this could be an important part of your pollution prevention plan).
☒	☐	Regular sweeping? Please describe: Weekly or as required by site conditions. Dust suppression techniques shall be employed at all time during soil disturbance.
☐	☒	De-icing specifications, in accordance with RISDISM Appendix G. (NOTE: If the groundwater is GAA, or this area contributes to a drinking water supply, then this could be an important part of your pollution prevention plan).
☐	☒	A prohibition of phosphate-based fertilizers? (Note: If the site discharges to a phosphorus impaired waterbody, then this could be an important part of your pollution prevention plan).

PART 4. SUBWATERSHED MAPPING AND SITE-PLAN DETAILS

Existing and Proposed Subwatershed Mapping (REQUIRED)			
YES	**NO**		
☒	☐		Existing and proposed drainage area delineations
☒	☐		Locations of all streams and drainage swales
☒	☐		Drainage flow paths, mapped according to the DEM *Guidance for Preparation of Drainage Area Maps* (included in RISDISM Appendix K)
☒	☐		Complete drainage area boundaries; include off-site areas in both mapping and analyses, as applicable
☐	☒		Logs of borings and/or test pit investigations along with supporting soils/geotechnical report
☐	☒		Mapped seasonal high-water-table test pit locations
☐	☒		Mapped locations of the site-specific borings and/or test pits and soils information from the test pits at the locations of the BMPs
☒	☐		Mapped locations of the BMPs, with the BMPs consistently identified on the Site Construction Plans
☐	☒		Mapped bedrock outcrops adjacent to any infiltration BMP
☐	☒		Soils were logged by a:
		☐	DEM-licensed Class IV soil evaluator Name:
		☐	RI-registered P.E. Name:

Subwatershed and Impervious Area Summary				
Subwatershed (area to each design point)	**First Receiving Water ID or MS4**	**Area Disturbed (units)**	**Existing Impervious (units)**	**Proposed Impervious (units)**
DP-1:				
DP-2:				
DP-3:				
DP-4:				
TOTALS:				

Site Construction Plans (Indicate that the following applicable specifications are provided)		
YES	**NO**	
☐	☒	Existing and proposed plans (scale not greater than 1" = 40') with North arrow
☒	☐	Existing and proposed site topography (with 1 or 2-foot contours); 10-foot contours accepted for off-site areas
☒	☐	Boundaries of existing predominant vegetation and proposed limits of clearing
☒	☐	Site Location clarification
☒	☐	Location and field-verified boundaries of resource protection areas such as: ▸ freshwater and coastal wetlands, including lakes and ponds ▸ coastal shoreline features Perennial and intermittent streams, in addition to Areas Subject to Storm Flowage (ASSFs)
☒	☐	All required setbacks (e.g., buffers, water-supply wells, septic systems)
☒	☐	Representative cross-section and profile drawings, and notes and details of structural stormwater management practices and conveyances (i.e., storm drains, open channels, swales, etc.), which include: ▸ Location and size of the stormwater treatment practices (type of practice, depth, area). Stormwater treatment practices (BMPs) must have labels that correspond to RISDISM Table 5-2; ▸ Design water surface elevations (applicable storms); ▸ Structural details of outlet structures, embankments, spillways, stilling basins, grade-control structures, conveyance channels, etc.; ▸ Existing and proposed structural elevations (e.g., inverts of pipes, manholes, etc.); ▸ Location of floodplain and, if applicable, floodway limits and relationship of site to upstream and downstream properties or drainage that could be affected by work in the floodplain; ▸ Planting plans for structural stormwater BMPs, including species, size, planting methods, and maintenance requirements of proposed planting
☐	☒	Logs of borings and/or test pit investigations along with supporting soils/geotechnical report and corresponding water tables
☐	☒	Mapping of any OLRSMM-approved remedial actions/systems (including ELURs)
☒	☐	Location of existing and proposed roads, buildings, and other structures including limits of disturbance; ▸ Existing and proposed utilities (e.g., water, sewer, gas, electric) and easements; ▸ Location of existing and proposed conveyance systems, such as grass channels, swales, and storm drains, and location(s) of final discharge point(s) (wetland, waterbody, etc.); ▸ Cross sections of roadways, with edge details such as curbs and sidewalks; ▸ Location and dimensions of channel modifications, such as bridge or culvert crossings
☐	☒	Locations, cross sections, and profiles of all stream or wetland crossings and their method of stabilization

Attachment G: HASP

HEALTH AND SAFETY PLAN (Sample- Not for Contractor's Use)

This Health and Safety Plan is specific to construction and post-construction observation and reporting activities at:

Project Name: Bristol Landfill Solar Facility

Address: Minturn Farm Road, Bristol, Rhode Island

Main Contaminents of Concern: Landfill gas, Volatile Organic Compounds (VOCs).

Other Health and Safety Concerns: Electrical hazards, oxygen deficiency, insect hazards (in season), sun exposure.

Site Description: The site is a former landfill that has been capped. A photovoltaic (PV) solar power system will be installed on the landfill cap.

Scope of Work: Costruction and monitoring of the PV suystem.

Dig Safe Notified? N/A

Name _____

Date _____

Dig Safe File #: _____

Primary Level of Protection: Level D or Modified Level D (as appropriate), insect protection seasonally and sun protection as required.

Contingency Level of Protection: Level C.

EMERGENCY PHONE NUMBERS

LOCATION OF NEAREST PHONE: cell phone, Compost Facility

BRISTOL EMERGENCY FIRE AND RESCUE:	401-263-6611 or 911
BRISTOL DEPARTMENT OF PUBLIC WORKS:	401-253-4100
BRISTOL TOWN HALL:	401-253-7000
BRISTOL TRANSFER STATION / COMPOST FACILITY:	401-254-2920
RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT	
Office of Land Revitalization and Sustainable Materials Management:	401-222-2797
After Hours Emergency	401-222-3070

NEAREST HOSPITAL

Name: Newport Hospital
Address: 20 Powel Avenue, Newport, RI
Phone Number: 401-846-6400

Directions:
1. Head west on Minturn Farm Rd toward Metacom Ave
2. Turn left onto Metacom Ave for 1.8 miles
3. Slight left onto Ferry Road for 0.3 miles
4. Continue onto RI-114 S/Mountt Hope Bridge for 1.1 miles
5. Turn right onto RI-114 for 1.2 miles
6. Turn right onto RI-114 S/W. Main Road for 6.8 miles
7. Continue onto Broadway for 0.6 miles
8. Turn left onto Powel Avenue

ROLES AND RESPONSIBILITIES

- Project Manager: Steven Richtarik, responsible for project coordination, site observations and documentation.
- Project Engineer: Chris Oien, responsible for implementation of H&S Plan, groundwater sampling, and project reporting.

SITE HAZARD EVALUATION

Chemical Hazards:
The Site received municipal and industrial wastes from the 1950's until the last phase of the landfill was closed in 2004. The refuse disposed of onsite consisted of waste from the residential, commercial and industrial sectors. Unidentified industrial wastes were disposed in the southwestern section of the landfill. Elevated concentrations of VOCs in groundwater have been reported in this area. The PV system does not encroach upon this area of the landfill.

The landfill has been capped with the following layers and material from bottom to top: a 6-inch layer of bedding mateial, a geosynthetic clay liner, a 12-inch sand drainage layer and a 12-inch vegetative support layer.

A passive landfill gas (methane, hydrogen sulfide, carbon dixide) venting system discharges landfill gas to the atmosphere through a series of vent pipes.

VOCs may also be present in the gas. The most likely VOCs at this site are 2-butanone, benzene, tetrachloroethylene, trichloroethylene, 1,1-dichloroethane, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, 4-methyl-2-pentanone, 1,1,1-trichloroethane and vinyl chloride.

Major Routes of Exposure: Construction of the PV system is will cause minimal disturbances to the landfill cap. Inhalation of the chemicals of concern is the primary exposure pathway. When sampling or

pereforming maintenance of the PV array, to the extent practicable, personnel shall stay upwind of the vent pipes.

Symptoms of Exposure/Potential Health Effects: Irritation of skin or eyes. Hydrogen sulfide in particular can cause a loss of smell, mucous membrane irritation, headache, nausea, diarrhea, vertigo, dizziness, weakness, and vision disturbance. Symptoms may be very mild, or severe, depending on degree of chemical toxicity and magnitude of exposure. Severe over-exposure can cause loss of consciousness (fainting), and may result in potentially serious health effects. Overexposure can result in respiratory distress, CNS effects, and eye damage.

Physical Hazards:
General site work hazards included slips, trips and falls on uneven ground, related scrapes and cuts and hand, foot and back injuries.

Insect Hazards:
Insect hazards in New England generally are a concern from early April to mid - November. Insect hazards are greatly reduced by freezing conditions.

Mosquitos
The existence of mosquitos in adjacent wetland areas pose a hazard for West Nile Virus (WNV) and other mosquito borne diseases.

Symptoms of Exposure/Potential Health Effects: CDC reports that in four out of five cases, persons infected with WNV show no symptoms. In almost 20% of the cases, infections result in very mild flu-like symptoms, called West Nile fever. These mild cases of West Nile fever normally last only a few days and are not believed to cause any long-term effects. According to the CDC, severe cases occur in one out of 150 people infected with WNV and result in "West Nile encephalitis," an inflammation of the brain, "West Nile meningitis," inflammation of the membrane around the brain, or "West Nile meningoencephalitis," an inflammation of the brain and the membrane around it. The signs and symptoms of severe disease may last several weeks and may have permanent neurological effects.

The typical time from infection to the onset of signs and symptoms is 3 to 14 days. Signs and symptoms of the milder West Nile Fever illness can last a few days to several weeks and include headache, fever, tiredness, body aches, nausea and vomiting, and sometimes, swollen lymph nodes and a skin rash on the body.

The CDC reports that with more severe infection (West Nile encephalitis or meningitis), the signs and symptoms lasts several weeks, sometimes resulting in permanent neurological problems, and include headache, high fever, stiffness in the neck, nausea and vomiting, stupor or disorientation (in very severe cases, coma), tremors and convulsions, muscle weakness (in very severe cases, paralysis), loss of vision.

Ticks
The abundance of ticks in the grassed areas poses a hazard for lyme and other tick borne diseases, including babesiosis, ehrlichiosis, tularemia, and Rocky Mountain spotted fever.

Symptoms of Exposure/Potential Health Effects: Many of the signs and symptoms associated with Lyme disease are similar to those of the flu. Lyme disease often presents with a characteristic “bulls-eye” rash

termed erythema migrans. This rash is seen in 60-80% of people who develop the infection; some people may have the disease without the presence of a rash.

If recognized early, Lyme and other tick borne diseases can be treated with antibiotic medication. However, if the disease goes unrecognized and untreated, chronic conditions may ensue, including varying degrees of permanent damage to the joints or the nervous system.

Noise Hazards:
None Identified.

Heat Stress Hazards:
Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. A suggested work rest regiment and procedures for calculating ambient adjusted temperatures are described below. [a] [d]

Adjusted Temperature [b]	Work/Rest Regime Normal Work Ensemble [c]	Work/Rest Regime Impermeable Ensemble
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5° - 90°F (30.8° - 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5° - 87.5°F (29.1° - 30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5° - 82.5°F (25.3° -28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5° - 77.5°F (22.5° - 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

NOTES:
a. For work levels of 250 kilocalories/hour (Light-Moderate Work Type)
b. Calculate the adjusted air temperature (ta adj) by using this equation: ta adj°F = ta°F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 % sunshine = no cloud cover and a sharp, distinct shadow, 0% sunshine = no shadow.)
c. A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.
d. The information presented above was generated using the information provided in the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) Handbook.

Fire/Explosion Hazards:
Solar facility maintenance and inspection personnel can be exposed to potential fire/explosion hazards from methane gas if concentrations in the ambient air become elevated. Workers on the landfill cap must use a LEL/02 meter to continuously monitor LEL and O2 levels within ambient air as work is being performed. See Section A for further details on PPE, Section E for action levels and presribed actions.

Electrical Hazards:
Workers at solar facilities can be exposed to potential electrical hazards present in the work environment, which makes them more vulnerable to the danger of electrocution and arc flash hazards. Such hazards can cause severe injuries and death.

Symptoms of Exposure/Potential Health Effects: Severe burns, confusion, difficulty breathing, heart rhythm problems (arrhythmias), cardiac arrest, muscle pain and contractions, seizures and loss of consciousness.

Oxygen Deficiency Hazards:
Workers on landfills with passive venting systems may be exposed to potential oxygen deficiency due to the potential presence of methane and hydrogen sulfide gas.

Symptoms of Exposure/Potential Health Effects: Changes in the color of skin, ranging from blue to cherry red, confusion, cough, fast heart rate, rapid breathing, shortness of breath, sweating and wheezing.

Personnel working on the cap must use a LEL/02 meter to continuously monitor oxygen levels. See Section A for further details on PPE, Section B for further details on required air monitoring equipment, and Section E for action levels and presribed actions.

Confined Space Entry:
None identified.

Radioactive Materials:
None identified.

Other Physical Hazards:
None identified.

Other Environmental Hazards:
Sunlight contains ultraviolet (UV) radiation, which causes premature aging of the skin, wrinkles, cataracts, and skin cancer. The amount of damage from UV exposure depends on the strength of the light, the length of exposure, and whether the skin is protected. *There are no safe UV rays or safe suntans.* Worker should be especially careful in the sun if you burn easily, spend a lot of time outdoors, or have any of the following physical features:

- Numerous, irregular, or large moles.
- Freckles.
- Fair skin.
- Blond, red, or light brown hair.

PERSONNEL HEALTH & SAFETY REQUIREMENTS

TRAINING REQUIREMENTS: Site personnel must have a had at least 40 hours of relevant health and safety training and/or experience which included coverage of hazard recognition, use of site monitoring instruments, use of personal protective equipment, etc. Site personnel must be up to date on their annual health and safety refresher course, and must have a cell phone available. If personnel have any insect allergies, an epinephrine injector should be carried during insect season. Sunscreen should be applied as conditions warrant.

PERSONAL PROTECTIVE EQUIPMENT:

Protective clothing: Site personnel must wear hard hats and safety vests during Site observation activities. Level D (normal work clothes) is acceptable.

Footwear: Site personnel must wear insulated safety shoes with steel toes.

Protective Gloves: While performing sampling activities, non-powdered nitrile gloves shall be worn.

Hearing Protection: Not required since personnel will not be exposed to loud noises.

Insect Protection In Season:

- Wear light-colored clothing so that ticks can be more easily seen and removed before attachment occurs;
- Wear a hat, long-sleeved shirts and tuck pant legs into socks or boots to prevent ticks from reaching the skin and wear high boots or closed shoes that cover the entire foot;
- After returning indoors, use soap and water to wash skin that has been treated with insect repellent;
- Shower, and wash and dry clothes at a high temperature after outdoor exposure;
- Check the body carefully for ticks; once found, promptly remove them with tweezers. (Grasp the tick firmly and as close to the skin as possible. With a steady motion, pull the tick's body away from the skin. Cleanse the area with an antiseptic. DO NOT use petroleum jelly, a hot match, nail polish, or other products to remove the tick);
- Take extra precautions whenever mosquitoes are present and biting (for example, mosquito swarms are often present at dusk or at dawn);
- In warm weather, wear light-weight, loose clothing. This type of clothing protects workers against the sun's harmful rays, and also provides a barrier to insects;
- Avoid use of perfumes and colognes when working outdoors during peak times when mosquitoes may be active; mosquitoes may be more attracted to individuals wearing perfumes and colognes;
- Use insect repellent containing an EPA-registered active ingredient. All of the EPA-registered active ingredients have demonstrated repellency however some provide more long-lasting protection than others. Research suggests that repellents containing DEET (N,N-diethyl-m-toluamide) or picaridin (KBR 3023) typically provide longer-lasting protection than the other products, and oil of lemon eucalyptus (p-menthane-3,8-diol) provides longer lasting protection than other plant-based repellents. Permethrin is another long-lasting repellent that is intended for application to clothing and gear, but not directly to skin;
- Choose a repellent that provides protection for the amount of time that you will be outdoors. In general, the more active ingredient (higher concentration) a repellent contains, the longer it will protect against mosquito bites. For example, the more DEET a

repellent contains, the longer time it can protect you from mosquito bites, with protection times ranging from 1 hour (4.75% DEET) to 5 hours (23.8% DEET). However, products with greater than 50% DEET were not shown to offer additional protection and protection times can vary due to temperature, perspiration, and water exposure;

- To avoid reaction to DEET or other ingredients of insect repellents, read and follow the directions on all insect repellent before use. Spray insect repellent on the outside of your clothing, as it is possible for mosquitoes to bite through thin clothing;
- Do NOT spray insect repellent on skin that is under clothing;
- Do NOT apply insect repellent to skin that is already irritated, or to cuts/lacerations;
- Do NOT spray aerosol or pump products in enclosed areas. Do NOT spray a pump or aerosol product directly on your face. First spray on hands and carefully rub on face (do not allow insect repellent to contact your eyes and mouth).

Solar Radiation (UV Rays) Protection:

- Cover up. Wear tightly-woven clothing that blocks out light.
- Use sunscreen. A sun protection factor (SPF) of at least 15 blocks 93 percent of UV rays. You want to block both UVA and UVB rays to guard against skin cancer. Be sure to follow application directions on the bottle.
- Wear a hat under your hard hat. A wide brim hat (not a baseball cap) is ideal because it protects the neck, ears, eyes, forehead, nose, and scalp.
- Wear UV-absorbent shades. Sunglasses don't have to be expensive, but they should block 99 to 100 percent of UVA and UVB radiation.
- Limit exposure. UV rays are most intense between 10 a.m. and 4 p.m.

MONITORING EQUIPMENT:

Combustible Gas Meter (LEL): LEL and O2 monitoring of ambient air during Site observation activities will be completed by a trained person using a portable gas analyzer capable of continuously and simultaneously measuring percent of Lower Explosive Limit – (%LEL) and percent oxygen (%O2) . The analyzer will be equipped with a digital display and audible and visual warning lights. Readings will be collected continuously while personnel are on the capped portion of the landfill. Monitoring will occur in the breathing zone.

SITE CONTROL:

Do not allow visitors, onlookers, or other unauthorized personnel within work area. If work site is located in an unsecured area with possible pedestrian access, mark off work area with traffic cones, caution tape, warning placards, etc., as appropriate.

WORK PROCEDURES:

- Begin working in Level D (Standard Work Clothes, Boots, Hardhats, Sunscreen, Insect Protection in season).
- No smoking is permitted anywhere on site;
- Monitor air continuously in the breathing zone with the O2/LEL(%) meter;
- If bees/wasps nests are encountered they should be avoided, their location marked and the information forwarded to the solar facility owner and/or operator for removal by trained personnel.
- To maintain protection from electrical shock, stay at least 10' (ten feet) away from all equipment which is marked High Voltage. Do not come in direct contact with any part of the solar array, including panels, conduits, cabinets, wires or poles.

IMPORTANT NOTE:

IF SITE PERSONNEL SHOW SIGNS AND SYMPTOMS OF CHEMICAL EXPOSURE, DISCONTINUE WORK AND FOLLOW APPROPRIATE EMERGENCY PROCEDURES IMMEDIATELY!

IF SITE OBSERVATIONS, ODORS, OR ANY OTHER INFORMATION INDICATES THAT CONTAMINANTS OTHER THAN THE CHEMICALS SPECIFIED IN THIS PLAN ARE PRESENT, STOP WORK, AND CONTACT THE PROJECT MANAGER OR HEALTH & SAFETY REPRESENTATIVE FOR FURTHER INSTRUCTIONS. IF FURTHER INSTRUCTIONS ARE NOT AVAILABLE, DISCONTINUE WORK AT THAT LOCATION.

E. ACTION LEVELS

Project Action Levels		
Target	Action Level	Rationale
Percent of Lower Explosive Limit (%LEL)	Equal to or greater than 10% of LEL	OSHA Section I 9I5.12(b)(3) Flammable atmospheres. Atmospheres with a concentration of flammable vapors at or above 10 percent of the lower explosive limit(LEL) are considered hazardous when located in confined spaces.
Percent Oxygen (%0_2)	Less than 19.5%, stop task, evacuate area	OSHA Section 1915.12(a)(3)—Minimum amount of oxygen required to support life.

If the action levels are triggered, the personnel monitoring the air will immediately instruct all workers in the area to immediately stop work and evacuate the work area. Work within the area will be allowed to recommence upon retesting the air and documenting that no action levels are triggered. If the corrective actions as described above cannot achieve a safe work environment, work will cease until the environment is made safe.

If at any time monitoring detects the presence of any combustible gases at or in excess of 10% of the lower explosive limit at any location within a building or within any utility conduits on site or off-site the owner/operator shall notify the local fire department (911) and the Rhode Island Department of Environmental Management at 222-2797.

DECONTAMINATION & CLEAN UP:

- Decontamination of personnel and equipment is not anticipated.
- Wash hands & face thoroughly with soap and water before lunch or coffee breaks, and as soon as practicable after finishing work for the day. If returning to work reapply all insect protection if applicable.
- Shower, and wash and dry clothes at a high temperature after use of insect repellents.

EMERGENCY PROCEDURES

PERSONAL INJURY--Administer appropriate first aid. If injury is serious, transport the victim to the nearest hospital. If possible, notify hospital in advance of incoming patient and nature of injury. If there is a question about whether it is safe to move the victim, DO NOT move the victim--instead, make him/her as comfortable as possible, and summon emergency assistance.

CHEMICAL EXPOSURE--If site personnel show signs of inhalation exposure, retreat to fresh air for recovery. If symptoms are serious, such as nausea or fainting, bring the victim to the nearest hospital for observation, and discontinue work at that location and consult with Project Manager

In case of skin or eye irritation due to chemical contact, wash affected skin with soap and water, or flush eyes with generous amounts of water. If irritation is serious, seek medical attention.

FIRE/EXPLOSION--If fire can be easily contained and extinguished, do so with fire extinguisher. If explosion risk is present, DO NOT attempt to extinguish--EVACUATE all personnel to a safe area and call the fire department.

INSECT BITES/STINGS--

- Wash the area with soap and water;
- Remove the stinger using gauze wiped over the area or by scraping a fingernail over the area. (Bees leave stingers. Wasps and hornets do not and can sting repeatedly);
- Apply a cool compress to reduce swelling;
- Apply cream or gel with lidocaine to help control pain and calamine lotion to help with itching. Use an over-the-counter pain reliever like acetaminophen and an antihistamine like Benadryl (Diphenhydramine) to help reduce your reaction to the sting;
- Benadryl calms anaphylaxis and should be included in first aid kits. If systoms of anaphylaxis are present, administration of benadryl and immediate transport to the nearest hospital is required.

ELECTROCUTION--

- Don't touch the injured person if he or she is still in contact with the electrical current. Turn off the source of electricity, if possible;
- Call 911 or your local emergency number if the source of the burn is a high-voltage wire or lightning. Don't get near high-voltage wires until the power is turned off. Overhead power lines usually aren't insulated;
- Stay at least 20 feet (about 6 meters) away — farther if wires are jumping and sparking;
- Don't move a person with an electrical injury unless he or she is in immediate danger;
- Begin CPR if the person shows no signs of circulation, such as breathing, coughing or movement;
- Try to prevent the injured person from becoming chilled;
- Apply a bandage. Cover any burned areas with a sterile gauze bandage, if available, or a clean cloth. Don't use a blanket or towel, because loose fibers can stick to the burns.

SUNBURN--

- Take frequent cool baths or showers to help relieve the pain. As soon as you get out of the bathtub or shower, gently pat yourself dry, but leave a little water on your skin. Then, apply a moisturizer to help trap the water in your skin. This can help ease the dryness. Use a moisturizer that contains aloe vera or soy to help soothe sunburned skin. If a particular area feels especially uncomfortable, you may want to apply a hydrocortisone cream that you can buy without a prescription. Do not treat sunburn with "-caine" products (such as benzocaine), as these may irritate the skin or cause an allergic reaction.
- Consider taking aspirin or ibuprofen to help reduce any swelling, redness and discomfort.
- Drink extra water. A sunburn draws fluid to the skin's surface and away from the rest of the body. Drinking extra water when you are sunburned helps prevent dehydration.
- If your skin blisters, allow the blisters to heal. Blistering skin means you have a second-degree sunburn. You should not pop the blisters, as blisters form to help your skin heal and protect you from infection.
- Take extra care to protect sunburned skin while it heals. Wear clothing that covers your skin when outdoors.
- Although it may seem like a temporary condition, sunburn—a result of skin receiving too much exposure from the sun's ultraviolet (UV) rays—can cause long-lasting damage to the skin. This

damage increases a person's risk for getting skin cancer, making it critical to protect the skin from the sun.

- It's important to examine your body monthly because skin cancers detected early can almost always be cured. The most important warning sign is a spot on the skin that is changing in size, shape, or color during a period of 1 month to 1 or 2 years. Skin cancers often take the following forms: Pale, wax-like, pearly nodules, red, scaly, sharply outlined patches, sores that don't heal, and small, mole-like growths - melanoma, the most serious type of skin cancer. If you find such unusual skin changes, see a health care professional immediately.

IMPORTANT NOTE

IF SITE OBSERVATIONS, SAMPLING RESULTS, OR ANY OTHER INFORMATION INDICATES THE PRESENCE OF CHEMICAL CONTAMINANTS OTHER THAN THOSE SPECIFIED IN THIS PLAN, OR ANY HAZARD NOT SPECIFIED IN THIS PLAN IS PRESENT, THIS HEALTH AND SAFETY PLAN BECOMES VOID, AND A NEW PLAN MUST BE PREPARED AND APPROVED.

HEALTH & SAFETY PLAN PREPARED BY DATE

HEALTH & SAFETY PLAN APPROVED BY DATE

Attachment H: Lease Agreement

AMENDED
SOLAR FACILITIES LEASE

THIS Amendment to the SOLAR FACILITIES LEASE is made and entered into as of the 30th day of August, 2019 (the "**Effective Date**") by and between the Town of Bristol a Municipal Corporation (the "**Landlord**"), and NuGen Capital Management, LLC, a Delaware limited liability company, its successors and/or assigns (the "**Tenant**"). This Amended Lease supersedes and replaces the Solar Facilities Lease dated December _____, 2018 entered into between the Parties.

RECITALS:

WHEREAS, Landlord has the right and authority to lease to Tenant portions of the Property (as defined in **Schedule 1** attached hereto and made a part hereto);

WHEREAS, Tenant desires to lease from Landlord, and Landlord desires to lease to Tenant, certain portions of the Property, together with the right to make the exclusive and/or non-exclusive, use of other portions of the Property, all as more particularly set forth in the Lease (as defined in **Schedule 1** attached hereto and made a part hereof);

NOW, THEREFORE, for Ten and No/100 Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Landlord and Tenant agree as follows.

1. Recitals. The recitals set forth above are true and correct and are incorporated herein.

2. Definition. Capitalized terms not otherwise defined herein shall have the meaning ascribed to such terms in **Schedule 1** attached hereto and made a part hereof.

3. Lease of Leased Premises; Rights in Appurtenances.

   3.1. Leased Premises. Commencing on the Effective Date, Landlord hereby leases to Tenant, and Tenant hereby leases from Landlord, the Leased Premises in accordance with the terms and conditions of this Lease.

   3.2. Acceptance of Leased Premises. Tenant accepts the Leased Premises in its condition as of the Effective Date subject to and benefitted by (a) the terms of this Lease, including, but not limited to, all of Landlord's covenants, obligations, representations and warranties set forth in this Lease, and (b) all Applicable Laws and such of the Permitted Encumbrances applicable to Tenant's use of the Leased Premises in accordance with this Lease. Landlord and Tenant agree that the exact location of the Leased Premises and the final Permitted Encumbrances shall be updated after Tenant's receipt of its proposed owner's leasehold title insurance proforma, survey and executed PCUP, and upon mutual agreement of Landlord and Tenant

3.3. Appurtenant Easements and Licenses. Landlord hereby grants to Tenant, and Tenant hereby accepts from Landlord, the right to make use of the Appurtenant Easements and Licenses and to gain access to and make use of the Appurtenant Easement and License Areas.

3.3.1. Tenant shall exercise reasonable care in entering upon and making use of the Appurtenant Easement and License Areas so as to not unreasonably interfere with the use and enjoyment of the Appurtenant Easement and License Areas by its owners and such other parties as may have the right to make use of such Appurtenant Easement and License Areas. Tenant shall promptly repair any damage to the Appurtenant Easement and License Areas caused by such entry or as a result of such activities by Tenant. Any period or periods of non-use of the Appurtenant Easements and Licenses and/or the Appurtenant Easement and License Areas during the Lease Term shall not constitute an abandonment of, or cause the extinguishment of, the Tenant's right to make use of the Appurtenant Easements and Licenses and/or the Appurtenant Easement and License Areas.

3.3.2. In addition to, and not by way of limitation of, any other remedy available to Tenant, in the event Tenant is unable to use the Appurtenant Easements and Licenses and/or unable to make use of and/or access the Appurtenant Easement and License Areas, Tenant shall have the right, and Landlord hereby permits Tenant, to enter upon the Property, the Common Areas, the Appurtenant Easement and License Areas, the Appurtenant Ground Rights Area and the Appurtenant Cable Lines and Facilities Areas, to perform any of the obligations required to be performed by the Landlord in order to permit Tenant to resume its use of the Appurtenant Easements and Licenses and/or gain access to the Appurtenant Easement and License Areas. Landlord shall reimburse Tenant for all costs so incurred by Tenant within ten (10) days after Tenant makes a written demand upon Landlord for such reimbursement, which written demand shall be accompanied by such documentation (e.g., invoices) as may be reasonably necessary to account for the costs for which Tenant is seeking reimbursement.

3.3.3. The rights granted to Tenant to make use of the Appurtenant Easements and Licenses and to gain access to and make use of the Appurtenant Easement and License Areas granted herein shall be binding upon the Landlord, and its successors and assigns and the final location will be agreed to by Landlord and Tenant and included in the form of Memorandum of Lease prior to recording. The term of the right to make use of the Appurtenant Easements and Licenses and to gain access to and make use of the Appurtenant Easement and License Areas shall run concurrently with the Lease Term and any applicable Post Term Removal Period. The Appurtenant Easements and Licenses and the right to make use of the Appurtenant Easement and License Areas shall expire or terminate simultaneously with the expiration of the Post Term Removal Period. Notwithstanding anything in this Lease or elsewhere to the contrary, the

right granted to Tenant to use the Appurtenant Easements and Licenses and to use and gain access to the Appurtenant Easement and License Areas shall be irrevocable until the expiration of the Post Term Removal Period.

3.3.4. Landlord shall keep the Appurtenant Easement and License Areas free from obstruction and shall not construct or place, or allow to be constructed or placed, in or on the Appurtenant Easement and License Areas any Improvements in a manner which in any way will or which potentially may interfere with or otherwise impede Tenant's access to and/or the exercise of any and all rights granted to Tenant in such Appurtenant Easements and Licenses and/or the Appurtenant Easement and License Areas pursuant to the terms of this Lease.

3.4. Appurtenant Cable Lines and Facilities Rights. Landlord hereby grants to Tenant, and Tenant hereby accepts from Landlord, the Appurtenant Cable Lines and Facilities Rights.

3.4.1. Tenant shall exercise reasonable care and reasonable consideration in entering upon the Appurtenant Cable Lines and Facilities Areas so as to not unreasonably interfere with the use and enjoyment of the Appurtenant Cable Lines and Facilities Areas by its owners and occupants. Tenant shall promptly repair any damage to the Appurtenant Cable Lines and Facilities Areas caused by such entry or as a result of such activities by Tenant. Any period or periods of non-use of the Appurtenant Cable Lines and Facilities Areas during the Lease Term shall not constitute an abandonment of, or cause the extinguishment of, the Appurtenant Cable Lines and Facilities Rights.

3.4.2. In addition to, and not by way of limitation of, any other remedy available to Tenant, in the event Tenant is unable to use or access the Appurtenant Cable Lines and Facilities Areas, Tenant shall have the right, and Landlord hereby permits Tenant to enter upon the Property, the Common Areas, the Appurtenant Ground Rights Area and the Appurtenant Cable Lines and Facilities Areas, to perform any of the obligations required to be performed by the Landlord in order to permit Tenant to resume its use of the Appurtenant Cable Lines and Facilities Areas. Landlord shall reimburse Tenant for all costs so incurred by Tenant within ten (10) days after Tenant makes a written demand upon Landlord for such reimbursement, which written demand shall be accompanied by such documentation (e.g., invoices) as may be reasonably necessary to account for the costs for which Tenant is seeking reimbursement.

3.4.3. The Appurtenant Cable Lines and Facilities Rights granted herein shall be binding upon the Landlord, and its successors and assigns and the final Appurtenant Cable Lines and Facilities Area location will be agreed to by Landlord and Tenant and included in the form of Memorandum of Lease prior to recording. The term of the Appurtenant Cable Lines and Facilities

Rights shall run concurrently with the Lease Term and any applicable Post Term Removal Period. The Appurtenant Cable Lines and Facilities Rights shall expire or terminate simultaneously with the expiration of the Post Term Removal Period. Notwithstanding anything in this Lease or elsewhere to the contrary, the Appurtenant Cable Lines and Facilities Rights shall be irrevocable until the expiration of the Post Term Removal Period.

3.4.4. Landlord shall keep the Appurtenant Cable Lines and Facilities Areas free from obstruction and shall not construct or place, or allow to be constructed or placed, in or on the Appurtenant Cable Lines and Facilities Areas any Improvements in a manner which in any way will or which potentially may (a) interfere with or damage the Cable Lines and Facilities and/or and any and all other Solar Facilities lying within the Appurtenant Cable Lines and Facilities Areas and/or (b) interfere with or otherwise impede Tenant's access to and/or the exercise of any and all rights granted to Tenant in such Appurtenant Ground Rights Area pursuant to the terms of this Lease.

3.4.5. Landlord shall have the right to use, and to grant to third parties the right to use, the Appurtenant Cable Lines and Facilities Areas; provided, however, that such Landlord (or third-party) use shall not in any way interfere with the construction, installation, operation, maintenance, repair, testing, monitoring, relocation, and/or replacement of the Solar Facilities and/or Tenant's full and unfettered exercise of the rights granted to Tenant pursuant to this Lease.

3.5. Appurtenant Ground Rights. Landlord hereby grants to Tenant, and Tenant hereby accepts from Landlord, the Appurtenant Ground Rights.

3.5.1. Tenant shall exercise reasonable care and reasonable consideration in entering upon the Appurtenant Ground Rights Area so as to not unreasonably interfere with the use and enjoyment of the Property by its owners and occupants, and Tenant shall promptly repair any damage to the Appurtenant Ground Rights Area caused by such entry or as a result of such activities by Tenant. Any period or periods of non-use of the Appurtenant Ground Rights Area during the Lease Term shall not constitute an abandonment of, or cause the extinguishment of, the Appurtenant Ground Rights.

3.5.2. In addition to, and not by way of limitation of, any other remedy available to Tenant, in the event Tenant is unable to use or access the Appurtenant Ground Rights Area, Tenant shall have the right, and Landlord hereby permits Tenant to enter upon the Property, the Common Areas, the Appurtenant Ground Rights Area and the Appurtenant Cable Lines and Facilities Areas, to perform any of the obligations required to be performed by the Landlord in order to permit Tenant to resume its use of the Appurtenant Ground Rights Area. Landlord shall reimburse Tenant for all costs so incurred by Tenant within ten (10) days after Tenant makes a

written demand upon Landlord for such reimbursement, which written demand shall be accompanied by such documentation (e.g., invoices) as may be reasonably necessary to account for the costs for which Tenant is seeking reimbursement.

3.5.3. The Appurtenant Ground Rights granted herein shall be binding upon the Landlord, and its successors and assigns and the final location will be agreed to by Landlord and Tenant and included in the form of Memorandum of Lease prior to recording. The term of the Appurtenant Ground Rights shall run concurrently with the Lease Term and any applicable Post Term Removal Period. The Appurtenant Ground Rights shall expire or terminate simultaneously with the expiration of the Post Term Removal Period. Notwithstanding anything in this Lease or elsewhere to the contrary, the Appurtenant Ground are irrevocable until the expiration of the Post Term Removal Period.

3.5.4. Landlord shall keep the Appurtenant Ground Rights Area free from obstruction and (a) shall not construct or place, or allow to be constructed or placed, in, on, under or above the Appurtenant Ground Rights Area any Improvements, and (b) shall not interfere with or otherwise impede, or allow others to interfere with or otherwise impeded, Tenant's access to and/or the exercise of any and all rights granted to Tenant in such Appurtenant Ground Rights Area pursuant to the terms of this Lease.

4. Use of Leased Premises and Appurtenant Rights. The Leased Premises and Appurtenant Rights may be used for the construction, installation, operation, testing, monitoring, repairing, alteration, replacement, removal and maintenance of the Solar Facilities, as more particularly set forth herein, and for any and all other purposes specifically set forth or implied in this Lease. Tenant, at its sole expense, shall comply with all Tenant's Legal Requirements. All of the Appurtenant Rights are critical rights running in favor of Tenant as the tenant of the Leased Premises, without which the Tenant's rights in the Leased Premises will be materially and adversely impacted. Notwithstanding anything else in this Lease to the contrary, in no event shall any of the Appurtenant Rights terminate or otherwise expire prior to the expiration of the post Term Removal Period.

4.1. Tenant and its Agents shall have access to the Property, the Leased Premises, the Common Areas, the Appurtenant Easement and License Areas, the Appurtenant Cable Lines and Facilities Areas, and the Appurtenant Ground Rights Area twenty four (24) hours per day, three hundred and sixty five (365) days (or three hundred and sixty six (366) days, as the case may be) per year.

5. Lease Term; Lease Term Renewal.

5.1. Lease Term. The term of this Lease (the **"Initial Lease Term"**) shall commence on the Effective Date and shall expire at 12:01 a.m. on the twenty-fifth (25^{th}) anniversary date of the Commercial Operation Date, unless and until terminated earlier pursuant to the provisions of this Lease. After the Initial Lease Term, the

Tenant shall have the option to renew this Lease for successive five (5) year terms (each, a "**Renewal Term**"), up to a maximum of four (4) such Renewal Terms, by providing written notice of renewal to the Landlord at least three (3) months prior to the expiration of the Initial Lease Term or then applicable Renewal Term unless rejected by Landlord within thirty (30) days of receiving said renewal notification. The Initial Lease Term and all subsequent Renewal Terms, if any, are referred to collectively as the "**Lease Term**."

5.2. Tenant's Right to Terminate Lease Prior to the Commercial Operation Date. Notwithstanding anything in this Lease to the contrary, from the Effective Date through and including the day prior to the Commercial Operation Date, for any or no reason whatsoever, without penalty, Tenant shall be entitled to terminate this Lease by providing Landlord with written notice of such termination together with a lease termination fee made payable to Landlord in the amount of One Hundred and No/100 Dollars ($100.00) as full and fair consideration to Landlord for such termination. In such an event, the Lease Term shall terminate on the date specified in such notice to Landlord, Tenant shall vacate the Leased Premises in accordance with the requirements of this Lease on or before the end of the Post Term Removal Period and Landlord and Tenant shall be relieved of and from any and all further obligations arising under this Lease, other than for such matters as specifically are stated to survive the termination of this Lease.

5.3 Landlord's Right to Terminate.

Notwithstanding anything in this Lease to the contrary, if the Rent Commencement Date is later than January 1, 2025, the Landlord may terminate this Lease in its sole and absolute discretion unless the Tenant has mechanically completed installation as evidenced by the submission of a report by an engineer of record for the Solar Facilities.

6. Taxes and Tenant Payments.

6.1. Rent Commencement Date. Tenant shall provide Landlord with written notice of the Rent Commencement Date within five (5) business days after the Rent Commencement Date.

6.2. Base Rent Amount. Commencing on the Rent Commencement Date, and continuing until the expiration or earlier termination of the Lease Term, the base rent (the "**Base Rent**") due pursuant to this Lease shall be an amount equal to One Hundred Ten Thousand and 00/100 ($110,000.00) per annum, subject to tax adjustments as further set forth in this Section and **Exhibit J**.

6.3. Payment of Base Rent. Tenant shall pay Base Rent in equal monthly installments, with the first of such payments due within ten (10) days after the Rent Commencement Date. Tenant promises to pay to Landlord in advance, without demand, deduction or set-off, monthly installments of Base Rent on or before the first (1st) day of each calendar month succeeding the Rent Commencement Date;

provided, however, that if the first day of the first full calendar month during the Lease Term occurs less than ten (10) days after the Rent Commencement Date, then such first full monthly payment of Base Rent shall be due and payable ten (10) days after the Rent Commencement Date. Payments of Base Rent for any fractional calendar month shall be prorated.

6.3.1. All payments required to be made by Tenant to Landlord hereunder (or to such other party as Landlord may from time to time specify in writing) shall be made at such place, within the continental United States, as Landlord may from time to time designate to Tenant in writing. Except as otherwise specifically provided in this Lease, (a) the obligation of Tenant to pay Base Rent and other sums to Landlord and the obligations of Landlord under this Lease are independent obligations. Either Landlord or Tenant may request that all payments of Base Rent be made by electronic or wire transfer to an account of Landlord established with a United States national bank with a branch located in the United States. Landlord and Tenant agree to cooperate with each other and exchange necessary information to accomplish the payment of Base Rent by wire or electronic transfer.

6.4. If Tenant is delinquent in any monthly installment of Base Rent for more than ten (10) days, Tenant shall pay to Landlord on demand a late charge equal to five percent (5%) of such delinquent sum. The provision for such late charge shall be in addition to all of Landlord's other rights and remedies hereunder or at law and shall not be construed as a penalty.

6.5. Taxes. Each Party shall be responsible for all income, gross receipts, ad valorem, personal property or real property or other similar taxes and any and all franchise fees or similar fees assessed against it due to its ownership of its property (i.e., in the case of the Landlord, the Property; in the case of the Tenant, only the Solar Facilities Taxes for the System) ("**Taxes**"). Neither Party shall be obligated for any Taxes payable by or assessed against the other Party based on or related to such Party's overall income or revenues. Notwithstanding the above, the parties shall enter into a PILOT agreement for the real property and personal property taxes that shall equal Fifteen Thousand Dollars ($15,000.00) per Annum and with no escalator for a period of thirty (30) years.

6.5.1. To the extent Tenant, in its reasonable good faith judgment, believes the relevant taxing authority has erred in its assessment and/or calculation of the Solar Facilities Taxes, then following the written notice thereof to Landlord, Tenant may withhold payment of such Solar Facilities Taxes and contest such Solar Facilities Taxes by filing a Solar Facilities Tax Contest. Tenant shall pay the amount of the Solar Facilities Taxes determined to be due pursuant to such Solar Facilities Tax Contest within the timeframes established for such payment pursuant to any order or judgment rendered in such a Solar Facilities Tax Contest. The cost of such Solar Facilities Tax Contest shall be borne by Tenant.

6.5.2. In the event of a change in the methodology by which property taxes are assessed against the Solar Facilities, Landlord and Tenant agree to negotiate in good faith so as to share equitably the consequences of such change.

6.6. Minimize Taxes. The Parties shall administer and implement this Lease with the intent to minimize the Solar Facilities Taxes. Landlord shall timely provide to Tenant all exemption certificates and other information necessary to evidence any applicable exemption or otherwise reasonably requested by Tenant, and until Landlord does so Tenant shall not be required to recognize any exemption.

7. Leased Premises Permitted Uses; Restrictions Against the Property.

7.1. Permitted Uses. Tenant shall only use the Leased Premises for the Permitted Use. Tenant shall not use or permit the Leased Premises to be used for any purpose or purposes other than the Permitted Use without the prior consent of Landlord, which consent shall not be unreasonably withheld, delayed or conditioned. Except (a) during the construction, installation, repair, maintenance, alteration, relocation and/or replacement of the Solar Facilities, and (b) for items reasonably required by Tenant in connection with normal and customary operation, inspection, monitoring, testing, maintenance and repair of the Solar Facilities (including but not limited to, small quantities of replacement parts and related sundry items), which items shall be stored in a safe and discreet manner, Tenant shall not store any materials in, on or about the Leased Premises.

7.2. Exclusive Right to Generate Electricity on the Property. Tenant shall have the sole and exclusive right to convert and store all of the solar resources of the Property to electrical energy during the Lease Term. Neither Landlord nor any third party shall hereafter be entitled to generate (other than for temporary emergency generator service) or store electricity anywhere on the Property during the term of this Lease. Any memorandum of lease recorded in the public records of the county within which the property is located shall restate the foregoing restriction of record.

7.3. Tenant's Exclusive Right Regarding Electricity Generation Facilities on the Property. Throughout the Lease Term, Landlord shall not: (a) lease, license or grant any easement or other right, or permit the assignment, sublease, license or other use of, any portion of the Property for the operation of any equipment or any solar electricity related installations designed to produce electricity from the sun, or any other source of light, or to store any such electricity, or (b) permit any vegetation or any other Improvements to be installed or grown on the Property that may block or otherwise interfere with sunlight or any other source of light reaching the Solar Facilities without the prior written consent of Tenant, which consent may be withheld by Tenant in Tenant's sole and absolute discretion. Any memorandum of lease recorded in the public records of the county within which the property is located shall restate the foregoing restriction of record.

7.4. Inspections by Third Parties. Tenant shall have the right to permit any of Tenant's prospective purchasers, assignees, lenders, power purchasers, lessees, sublessees,

investors and their respective Agents to access the Property, the Leased Premises, the Common Areas, the Appurtenant Easement and License Areas, the Appurtenant Cable Lines and Facilities Areas and the Appurtenant Ground Rights Area to perform any required inspections or other due diligence related to such party's interest or prospective interest in the Solar, or other facilities similar to the Solar Facilities to be installed at other locations, including, but not limited to, inspections to determine whether the Solar Facilities are in commercial operation.

8. Installation of Solar Facilities; Post Installation Access.

8.1. Tenant's Initial Installation of the Solar Facilities. From and after the Effective Date, and throughout the performance of Tenant's Work, a substantial portion of which shall occur prior to the Commercial Operation Date, Tenant and its Agents shall have the right to access and use the Property, the Common Areas (including, but not limited to, the parking areas on the Property for the use by contractors, subcontractors, materials suppliers and any and all other parties on the Property for the purpose of assisting with the performance of the Tenant's Work), the Leased Premises, the Appurtenant Easement and License Areas, the Appurtenant Cable Lines and Facilities Areas and the Appurtenant Ground Rights Area to the extent reasonably necessary and/or desirable to prepare for and perform the Tenant's Work substantially in accordance with the Solar Facilities Installation Plan without charge for the use thereof or for the use of water, wastewater, and electricity reasonably necessary to perform the Tenant's Work, all of which Landlord shall make available to Tenant at Landlord's expense during the performance of such Tenant's Work. In addition, at no additional charge, during such time as the Tenant's Work is being performed, Landlord shall provide Tenant with a staging and construction area that Tenant may (but shall not be required) to cordon off, which staging area is more particularly described in the Solar Facilities Installation Plan. Such staging area may be used to store equipment and supplies, to operate a construction trailer, and to perform such construction activities as may reasonably be necessary and/or desirable to install the Solar Facilities substantially in accordance with the Solar Facilities Installation Plan. During the construction and installation of the Solar Facilities, Tenant shall have the right to permit its construction lender and its representatives to access the Property, the Leased Premises, the Common Areas, the Appurtenant Easement and License Areas, the Appurtenant Cable Lines and Facilities Areas and the Appurtenant Ground Rights Area to perform any inspections contemplated under Tenant's loan agreements with such lender. The lender's rights of access shall in no way exceed the access rights of Tenant as provided in this Lease. With respect to the Solar Facilities, Tenant's Work shall conform in all material respects with the requirements set forth in **Exhibit I** attached hereto and made a part hereof.

8.2. Restrictions on Tenant's Use. Except as expressly provided in the Solar Facilities Installation Plan or elsewhere in this Lease to the contrary, or upon Tenant's receipt of Landlord's prior consent, Tenant shall not store any materials or equipment in the Common Areas or other areas of the Property. Tenant shall promptly remove

from the Leased Premises, at Tenant's expense, any garbage, waste, and construction debris that might at any time be generated by Tenant or its Agents.

8.3. Cost of Solar Facilities. Other than as may be specifically set forth in this Lease, Tenant shall directly pay for all costs in connection with the construction, installation, operation, maintenance, testing, and monitoring of the Solar Facilities.

8.4. Reserved.

8.5. Solar Facilities Approvals; Solar Facilities Construction Monitoring. Landlord shall cooperate, at Tenant's sole cost, with Tenant obtaining any and all Approvals related to the Solar Facilities. Landlord shall sign any and all applications for such Approvals to the extent necessary or desirable as determined in Tenant's reasonable discretion and shall further provide such affidavits and other documents as may be reasonably requested by a title company. Upon request, Landlord shall also sign an authorization permitting Tenant to apply for such Approvals on Landlord's behalf if such a written authorization will expedite Tenant obtaining any or all of such Approvals. All Approvals shall belong to Tenant. The terms of this Section 8.5 shall survive the termination or expiration of this Lease.

8.5.1. In connection with any application by Tenant for any Approval related to the Solar Facilities, Landlord agrees to actively support and not oppose, in any way, whether directly or indirectly, any such Solar Facilities Approval, at any and all governmental, quasi-governmental, administrative, judicial or legislative levels, which support shall include attending such hearings and other meetings related to obtaining such Approvals to voice support for such Approvals, to the extent reasonably requested by or on behalf of Tenant.

8.5.2. Landlord, at Landlord's sole cost, may monitor the construction and installation of any Solar Facilities from time to time placed upon the Property and/or the Leased Premises; provided, however, that in no event may Landlord direct such activities or in any way get involved in the management or direction of the parties performing such activities. Landlord's sole right shall be to observe the progress of such construction and/or installation and to notify Tenant if Landlord observes any action that may violate the terms of this Lease.

8.6. Solar Facilities Lien Waivers. Upon written request by Landlord, Tenant shall use commercially reasonable efforts to provide Landlord with lien waivers from all contractors and subcontractors that performed work on the Leased Premises.

8.7. Post Installation Access. After completion of Tenant's Work, Tenant and its Agents shall have the right to access the Leased Premises, the Property, Common Areas, Appurtenant Easement and License Areas, Appurtenant Cable Lines and Facilities Areas, and the Appurtenant Ground Rights Area, and shall have the right to use the parking areas located within the Common Areas to park, but not store, Tenant's vehicles in the common parking areas serving the Property free of charge

provided that there is no material interference with the access of other tenants to the Property parking lots and truck courts. Such access shall be limited to such access as Tenant determines to be reasonably necessary and/or desirable to operate, maintain, monitor, test, service, repair, replace, relocate, make alterations to, and remove the Solar Facilities during the Lease Term and the Post Term Removal Period and to otherwise exercise any and all rights granted to Lessee as set forth in this Lease. Other than as may be specifically required elsewhere in this Lease, no prior notice to Landlord shall be required. In addition to the foregoing, Tenant and its Agents shall be entitled to access the interior of the Building to the extent reasonably necessary for Tenant to exercise Tenant's rights under this Lease, including, but not limited to, gaining access to the Leased Premises and the Cable Lines and Facilities Areas.

9. Tenant's Covenants and Obligations.

9.1. Prohibition Against Tenant Interference. Tenant shall refrain from, and shall use commercially reasonable efforts to prevent any Tenant Parties from causing a Tenant Interference during the installation and throughout the Lease Term. Notwithstanding anything in this Lease to the contrary, it is specifically understood and agreed that the normal and customary construction, installation, operation, monitoring, testing, alteration, repairing, maintaining, relocation and replacement of the Solar Facilities shall in no event constitute a Tenant Interference.

9.2. In the event Tenant or Tenant's Parties cause a Tenant Interference, Tenant agrees to use commercially reasonable efforts to eliminate such Tenant Interference within forty eight (48) hours after Tenant receives written notification thereof from Landlord; provided, however, that if the elimination of such Tenant Interference is expected to take longer than forty eight (48) hours to perform, Tenant shall commence curing such Tenant Interference within such forty eight (48) hour period and shall diligently prosecute such work in connection therewith to completion.

9.3. Notwithstanding the foregoing, in the event a Tenant Interference constitutes an Emergency, other than as set forth in this Section 9.3 below or as otherwise specifically set forth in this Lease, Landlord shall be entitled to take such action as Landlord determines to be reasonably necessary and shall provide Tenant with written notification of the Tenant Interference and the actions taken by Landlord as soon as is reasonably possible thereafter. In such an event, Tenant shall reimburse Landlord for all reasonable costs so incurred by Landlord within ten (10) days after Landlord makes a written demand upon Tenant for such reimbursement, which written demand shall be accompanied by such documentation (e.g., invoices) as may be reasonably necessary to account for the costs for which Landlord is seeking reimbursement. Notwithstanding the foregoing, if such an Emergency is related in any way to the Solar Facilities, Landlord shall be prohibited from taking any action whatsoever unless such Emergency requires immediate action related to the preservation of the Property and/or a threat to the safety of persons located on the Property.

9.4. Tenant Maintenance Obligations. Tenant shall, at Tenant's sole cost and expense, promptly and adequately repair all damage to the Leased Premises caused by Tenant, ordinary wear and tear excepted.

9.5. Tenant's Option to Not Repair the Solar Facilities. If on or after the Commercial Operation Date, (1) the Solar Facilities are materially damaged or destroyed or require repairs or replacements that Tenant determines make the operation of the Solar Facilities not economically viable, or (2) the Tenant is required by any authorization, organization, utility, consortium, consortium of utilities, administration, agency or regulation to expend monies in order to remain connected or to reconnect the Solar Facilities to off-site transmission lines and facilities and/or to the power grid that Tenant determines, in its absolute and sole discretion, renders operation of the Solar Facilities not economically viable, then Tenant may, but shall not be obligated to, repair or replace the Solar Facilities. If Tenant elects (1) not to repair or replace the Solar Facilities or (2) not to expend the monies required to remain connected or to reconnect the Solar Facilities to the off-site transmissions lines and facilities and/or to the power grid, as the case may be, pursuant to this Section 9.5, then it shall give written notice thereof to Landlord and this Lease shall terminate on the date set forth in such notice without liability to either party and Tenant shall surrender the Leased Premises in accordance with this Lease after the expiration of the Post Term Removal Period.

9.6. Landlord's Future Mortgages. If, after the date hereof, Landlord creates any additional mortgages with respect to the Property, or any part thereof, then Landlord and Tenant shall cooperate with each other and Landlord's new mortgagee to complete, execute and deliver the SNDA attached hereto as **Exhibit E** by and between Landlord, Landlord's new mortgagee and Tenant reasonably acceptable to Tenant. Landlord shall provide Tenant with a fully executed and notarized copy of any such SNDA within ten (10) days after such SNDA has been fully executed and notarized.

10. Landlord Covenants and Obligations.

10.1. Prohibition Against Landlord Interference. Landlord shall use good faith, best efforts to ensure that any and all activities of Landlord, Landlord's other tenants, other third parties, and the activities of their respective Agents, occurring on or around the Property, the Common Areas, the Appurtenant Easement and License Areas, shall not cause any Landlord Interference with the rights granted to Tenant pursuant to this Lease, including, but not limited to, Tenant's use of the Leased Premises, the Appurtenant Easement and License Areas, the Appurtenant Cable Lines and Facilities Area, the Appurtenant Ground Rights Area, the Property, the Common Areas and/or the operation of the Solar Facilities, or in any way impedes or prevents the access of sunlight to the Photovoltaic Facilities or other light absorbing and/or electrical storage facilities or equipment located from time to time on or within the Leased Premises. In no event shall Landlord install or otherwise permit the installation of any other equipment or facilities of any kind on the Property that will in any way shade or impede the full access of sunlight to the

Photovoltaic Facilities or other sunlight collection devices from time to time located on the Leased Premises, and (b) Landlord shall obtain Tenant's prior written consent to the installation or replacement of any such equipment of facilities, which consent shall not be unreasonably withheld, delayed or conditioned.

10.1.1. In the event of any such Landlord Interference, Landlord agrees to use its best efforts to eliminate such Landlord Interference within forty eight (48) hours after Landlord's receipt of written notification thereof from Tenant; provided, however, that if such Landlord Interference cannot be reasonably eliminated within forty eight (48) hours, then Landlord shall have an amount of time reasonably necessary to eliminate such Landlord Interference provided Landlord shall commence curing such Landlord Interference within such forty eight (48) hour period and shall diligently prosecute such work in connection therewith to completion. Notwithstanding the foregoing, in the event of an Emergency, Tenant shall be entitled to take such action as Tenant determines to be reasonably necessary and provide Landlord with written notification of the Landlord Interference and the actions taken by Tenant as soon as is reasonably possible thereafter. In such an event, Landlord shall reimburse Tenant for all reasonable costs and lost revenue so incurred by Tenant within ten (10) days after Tenant makes a written demand upon Landlord for such reimbursement, which written demand shall be accompanied by such documentation (e.g., invoices) as may be reasonably necessary to account for the costs for which Tenant is seeking reimbursement.

10.2. Prohibitions Against Sunlight Interference. Notwithstanding anything in this Lease to the contrary, Landlord shall be responsible for preventing and, if necessary, promptly removing, any Sunlight Interference. In the event of any such Sunlight Interference, Landlord agrees to use its best efforts to eliminate such Sunlight Interference within forty eight (48) hours after Landlord receives written notification thereof from Tenant; provided, however, that if such Sunlight Interference cannot be reasonably eliminated within forty eight (48) hours, such failure shall constitute an Emergency, in which event Tenant shall be entitled to take such action as Tenant determines to be reasonably necessary and provide Landlord with written notification of the Sunlight Interference and the actions taken by Tenant as soon as is reasonably possible thereafter. In such an event, Landlord shall reimburse Tenant for all reasonable costs and lost revenue so incurred by Tenant within ten (10) days after Tenant makes a written demand upon Landlord for such reimbursement, which written demand shall be accompanied by such documentation (e.g., invoices) as may be reasonably necessary to account for the costs for which Tenant is seeking reimbursement.

10.3. Reserved.

10.4. Payment of Landlord's Taxes and Expenses. Except as otherwise expressly provided in this Lease to the contrary, in no event shall Tenant be responsible for the payment of any of the Landlord's Expenses and/or the Landlord's Taxes and

Insurance Expenses. Landlord shall timely pay all of such Landlord's Expenses and such Landlord's Taxes and Insurance Expenses. Upon Tenant demand, Landlord shall provide Tenant with evidence of Landlord's payment of such Landlord's Taxes and Insurance Expenses within thirty (30) days after Landlord pays any of such Landlord's Taxes and Insurance Expenses, but in no event later than ten (10) days after the date any such Landlord's Taxes and Insurance Expenses would have become delinquent if unpaid, which evidence of payment shall be accompanied by a copy of the tax bill or insurance bill, as the case may be, for such Landlord's Taxes and Insurance Expenses then paid.

10.5. Property Repairs. Landlord shall, at Landlord's sole cost and expense, keep the Property in good condition and repair.

10.6. Reserved.

10.6.1. Intentionally Omitted.

10.6.2. Reserved.

10.7. Intentionally Omitted.

10.8. Execution and Delivery of a Subordination, Non-Disturbance and Attornment Agreement. Simultaneously with the execution and delivery of this Lease, Landlord and the Existing Lender shall deliver to Tenant an original Subordination, Non-Disturbance and Attornment Agreement executed by and notarized on behalf of Landlord and the Existing Lender in recordable form regarding the Existing Lender's mortgage and related security instruments encumbering the Property, as described in the Permitted Encumbrances, which Subordination, Non-Disturbance and Attornment Agreement shall be substantially in the form of the SNDA.

10.9. Notification of Disputes. Landlord shall promptly (a) inform Tenant of any disagreements, disputes, threatened litigation or pending litigation between Landlord and any other party that may materially impact Tenant's use of the Leased Premises, the Property, the Appurtenant Rights and/or the Solar Facilities, (b) promptly give Tenant copies of any and all notices, material correspondence or other material written or digital communication received by Landlord in connection with any such disagreement, dispute, threatened litigation or pending litigation, and (c) vigorously defend against any such disagreement, dispute, threatened litigation or pending litigation, if the same will have, or could reasonably be anticipated to possibly have, a material adverse effect on Tenant's ability to exercise the rights granted to Tenant pursuant to this Lease.

10.10. Reserved.

10.11. No New Restrictions. Without the prior written consent of Tenant, Landlord shall not seek, or enter into a voluntary agreement which would impose, any obligations, impositions, restrictions or regulatory changes that would render the Solar Facilities, or Tenant's use of the Leased Premises non-conforming, or otherwise

materially adversely affect the Solar Facilities, and/or the ability of Tenant to optimally operate the Solar Facilities and/or on the Leased Premises now or at any time in the future. Under the foregoing circumstances, Tenant shall be entitled to either grant or withhold its consent in the exercise of its sole and absolute discretion. Notwithstanding the foregoing to the contrary, a sale in lieu of condemnation shall not be covered by the above restriction.

10.12. Maintain Easements and Licenses in Full Force and Effect. Landlord agrees to maintain all Easements and Licenses in full force and effect. If for any reason whatsoever any of the Easements and Licenses are not in full force and effect and such failure of such Easements and Licenses to be in full force and effect adversely impacts Tenant's ability to fully make use of the rights granted to Tenant pursuant to this Lease, then Landlord shall immediately use its best efforts to remedy such failure and shall diligently and continuously pursue remedying such failure until such failure has been corrected and Tenant is able to make full use of the rights granted to Tenant to make use of the Easements and Licenses pursuant to the terms of this Lease.

11. Solar Facilities Alterations.

11.1. Solar Facilities Alterations During the Lease Term. Other than as set forth in this Section 11 below, Tenant may undertake Solar Facilities Alterations without Landlord's prior written consent. Landlord understands and agrees that the technology for the generation and storage of solar power is constantly evolving and that Tenant may, from time to time, determine that it is in Tenant's best interest to make certain Solar Facilities Alterations so as to make use of such solar technology that Tenant deems to be best suited for Tenant's purposes and business interests. Landlord further agrees that the interpretation of this Section 11 shall be liberally construed in Tenant's favor.

11.2. Solar Facilities Alterations Approvals; Solar Facilities Alterations Construction Monitoring. Landlord shall cooperate, at Tenant's sole cost, with Tenant obtaining any and all Approvals related to the Solar Facilities Alterations. Landlord shall sign any and all applications for such Approvals to the extent necessary or desirable as determined in Tenant's reasonable discretion and shall further provide such affidavits and other documents as may be reasonably requested by a title company. Upon request, Landlord shall also sign an authorization permitting Tenant to apply for such Approvals on Landlord's behalf if such a written authorization will expedite Tenant obtaining any or all of such Approvals.

11.2.1. In connection with any application by Tenant for any Approval related to the Solar Facilities Alterations, Landlord agrees to actively support and not oppose, in any way, whether directly or indirectly, any such Solar Facilities Alterations Approval, at any and all governmental, quasi-governmental, administrative, judicial or legislative levels, which support shall include attending such hearings and other meetings related to obtaining such Solar Facilities Alterations Approvals to voice support for such Solar Facilities

Alteration Approvals, to the extent reasonably requested by or on behalf of Tenant.

11.2.2. Landlord, at Landlord's sole cost, may monitor the construction and installation of any Solar Facilities Alterations from time to time placed upon the Property, and/or the Leased Premises; provided, however, that in no event may Landlord direct such activities or in any way get involved in the management or direction of the parties involved in such activities. Landlord's sole right shall be to observe the progress of such construction and/or installation and to notify Tenant if Landlord observes any action that may violate the terms of this Lease.

11.3. Solar Facilities Alterations Lien Waivers. Tenant use its best efforts to provide Landlord with lien waivers from all contractors, subcontractors and materialmen performing work on the Leased Premises.

12. Ownership and Removal of Solar Facilities.

12.1. Ownership Interests in Solar Facilities. The Solar Facilities shall at all times be and remain the Tenant's personal property and shall not constitute a fixture. Tenant shall have the right to remove the Solar Facilities, or any part thereof, at any reasonable time upon at least thirty (30) days' prior written notice to Landlord. During the Post Term Removal Period, Tenant, at Tenant's expense, shall remove the Solar Facilities.

12.1.1. At the expiration of the Post Term Removal Period and unless by mutual agreement otherwise, Tenant shall return the Leased Premises to Landlord in its condition substantially similar to that existing prior to Tenant's installation of the Solar Facilities, ordinary wear and tear excepted, including, but not limited to, the effect, if any, on such Property caused by or related to actions permitted in accordance with the terms of this Lease and (b) any modifications, alterations, or additions made to the Leased Premises by or on behalf of Landlord, as set forth in this Lease.

13. Indemnification and Insurance.

13.1. Indemnification and Waiver. Except to the extent due to the negligence or willful misconduct of any of the Tenant Parties, Landlord shall indemnify, defend, and hold the Tenant Parties harmless from and against any and all Claims incurred by any of the Tenant Parties arising out of (1) the gross negligence or willful misconduct of any of the Landlord Parties, or (2) the use, maintenance, and repair of the Solar Facilities. Other than as specifically set forth in this Lease, neither (a) Landlord or the Landlord Parties, nor (b) Tenant or the Tenant Parties, shall be liable under any circumstances for injury or damage to, or interference with, the other party's business, including but not limited to, loss of profits, or other revenues, loss of business opportunity, loss of goodwill or loss of use, in each case,

however occurring. The provisions of this Section 13 shall survive the expiration or earlier termination of this Lease.

13.2. Tenant's Insurance. Tenant, at its expense, shall maintain during the Lease Term those insurance coverage as required by law and as commonly procured for Solar Facilities of similar size in a similar location

13.3. Landlord's Insurance. Landlord shall, at Landlord's sole cost and expense, carry commercial general liability insurance with respect to the Property during the Lease Term, including the installation phase (which liability insurance shall cover claims of bodily injury, personal injury and property damage (including loss of use thereof) arising out of Landlord's operations, and contractual liabilities) with limits not less than $3,000,000.00 Combined Single Limit. Landlord shall carry property insurance written on an "all risks" basis covering the full replacement cost of the Property which shall be increased to reflect the addition of the solar panel improvement. Such coverage shall be issued by a highly rated insurance company with an A.M. Best rating no less than A-. Landlord will name Tenant as Loss Payee with respect to the solar panel installation property section and Additional Insured on the General Liability section. Upon demand by Tenant, Landlord will deliver evidence to Tenant at least thirty (30) days prior to each insurance renewal.

13.4. Subrogation. Landlord intends that its property loss risks shall be borne by "all-risk" property insurance required to be carried by Landlord under this Lease, and Landlord hereby agrees to look solely to, and seek recovery only from, its respective insurance carriers in the event of a property loss. Tenant intends that its property loss risks shall be borne by property insurance required to be carried by Tenant under this Lease, and Tenant hereby agrees to look solely to, and seek recovery only from, its respective insurance carriers in the event of a property loss. The parties agree that their respective property insurance policies are now, or shall, include a waiver of subrogation by the insurers and all rights based upon an assignment from its insured against Landlord or Tenant, as the case may be, and their respective officers, directors, and employees, in connection with any loss or damage thereby insured against. Moreover, neither party hereto, nor their respective officers, directors, and/or employees, shall be liable to the other for loss or damage caused by any risk coverable by its respective property insurance, and each party waives any claims against the other party and their respective officers, directors, and employees for such loss or damage. The failure of Landlord to retain all risk insurance covering its respective property shall not void this waiver. The failure of Tenant to retain insurance covering its respective property shall not void this waiver. Other than as specifically set forth in this Lease, Tenant and its officers, directors, and employees shall not be liable for, and Landlord hereby waives all claims against such parties for, business interruption losses sustained by Landlord or any of Landlord's other tenants on the Property resulting from any accident or occurrence in or upon the Leased Premises or the Property from any cause whatsoever, other than with respect to damage caused in whole or in part, directly or indirectly, by the gross negligence or willful act of Tenant and/or any of its Agents.

14. Casualty. In the event that material damage to the Leased Premises affecting at least seventy-five percent (75%) of the Array Area shall occur as a result of a casualty, Landlord shall promptly and diligently, subject to reasonable delays for insurance adjustment or other matters beyond Landlord's reasonable control, and subject to all other terms of this Section 14, restore the Leased Premises. Such restoration shall be to substantially the same condition of the Leased Premises prior to the casualty, except for modifications required by zoning and building codes and other laws or by the holder of a mortgage on the Property, or any other modifications to the Common Areas deemed desirable by Landlord. Landlord shall not be liable for any inconvenience or annoyance to Tenant or its visitors, or injury to Tenant's business resulting in any way from such damage or the repair thereof. Regardless of the cause of the damage, the Parties acknowledge that damage contemplated by this Section shall constitute a Base Rent Abatement Event.

15. Abatement of Base Rent.

15.1. If a Base Rent Abatement Event occurs, and such Base Rent Abatement Event continues for a period of three (3) days or more, then, commencing on the first (1st) day of the Base Rent Abatement Event, and continuing until the expiration of the Base Rent Abatement Event, Base Rent shall be abated or reduced, as the case may be, in the proportion that the rentable area of the portion of the Leased Premises that Tenant is prevented from using bears to the total rentable area of the Leased Premises; provided, however, that in the event that Tenant is prevented from using a portion of the Leased Premises and the remaining portion of the Leased Premises is not sufficient to allow Tenant to effectively conduct its business thereon, and if Tenant does not conduct its business from such remaining portion of the Leased Premises, then commencing on the first (1st) day of the Base Rent Commencement Event, and continuing until the expiration of the Base Rent Abatement Event, the Base Rent for the entire Leased Premises shall be abated. If, however, Tenant reoccupies any portion of the Leased Premises during such period, the Base Rent allocable to such reoccupied portion, based on the proportion that the rentable area of such reoccupied portion of the Leased Premises bears to the total rentable area of the Leased Premises, shall be payable by Tenant from the date Tenant reoccupies such portion of the Leased Premises. The abatement of Base Rent as set forth in this Section 15 shall be in addition to, and not in lieu of, any and all other remedies available to Tenant at law and in equity to the extent that the cause of the Base Rent Abatement Event constitutes a default by Landlord hereunder.

15.2. Notwithstanding anything to contrary, should the Tenant, at any time during the Lease Term, be (i) interfered with from continuing connection of the Solar Facilities to off-site transmission lines and facilities and/or to the power grid, including maintenance of the Landfill Cap or (ii) interfered with from satisfying its obligations under the PPA, or (iii) adversely effects the performance or generation of the Solar Facilities, then, in any such case, the Base Rent shall be abated in its entirety for the duration of the time period the Tenant is precluded from connecting the Solar Facilities to such off-site transmission lines and facilities and/or to the power grid or complying with its obligations under the PPA. Payment of Base Rent shall commence at that point in time in which the Solar Facilities are online and

reconnected to the off-site transmission lines and facilities and/or to the power grid and the Solar Facilities are generating power for sale pursuant to the PPA.

16. Events of Default.

16.1. Tenant Default. Each of the following occurrences shall constitute an "Event of Default" by Tenant under this Lease:

16.1.1. Monetary Default. Tenant's failure to remit any undisputed payment hereunder following Tenant's receipt of written notice that the same was not paid when due with regard to the first (1st) such failure in any twelve (12)-month period, or (b) five (5) business days following Tenant's receipt of written notice that the same was not paid when due with regard to any subsequent failure in the same twelve (12)-month period.

16.1.2. Non-Monetary Default. Breach by Tenant of any non-monetary provision of this Lease where such breach shall continue for a period of thirty (30) days after written notice thereof from Landlord; provided, however, that if the nature of the Tenant's nonperformance is such that more than thirty (30) days are reasonably required for its cure, then Tenant shall not be deemed to be in default if Tenant commences such cure within said thirty (30) day period and thereafter diligently pursues such cure to completion.

16.1.3. Insurance. Any insurance required to be maintained by Tenant pursuant to this Lease shall be cancelled or terminated or shall expire or shall be reduced or materially changed, except, in each case, as permitted in this Lease and such failure shall continue for a period of thirty (30) days after Landlord provides Tenant with written notice of failure.

16.1.4. Intentionally Omitted.

16.1.5. Other. In the event Tenant (a) makes a general assignment for the benefit of creditors, (b) commences any Proceeding for Relief, (c) becomes the subject of any Proceeding for Relief which is not dismissed within ninety (90) days after its filing or entry, or (d) is dissolved or otherwise fails to maintain its legal existence.

16.2. Landlord Default. Each of the following occurrences shall constitute an "Event of Default" by Landlord under this Lease:

16.2.1. Monetary Default. Landlord's failure to remit any undisputed payment hereunder following Landlord's receipt of written notice that the same was not paid when due with regard to the first (1st) such failure in any twelve (12)-month period, or (b) five (5) business days following Landlord's receipt of written notice that the same was not paid when due with regard to any subsequent failure in the same twelve (12)-month period.

16.2.2. Non-Monetary Default. Breach by Landlord of any non-monetary provision of this Lease where such breach shall continue for a period of thirty (30) days after written notice thereof from Tenant; provided, however, that if the nature of the Landlord's nonperformance is such that more than thirty (30) days are reasonably required for its cure, then Landlord shall not be deemed to be in default if Landlord commences such cure within said thirty (30) day period and thereafter diligently pursues such cure to completion, provided that such cure must be completed within ninety (90) days after the date of the original notice.

16.2.3. Insurance Cancellation of Termination. Any insurance required to be maintained by Landlord pursuant to this Lease shall be cancelled or terminated or shall expire or shall be reduced or materially changed, except, in each case, as permitted in this Lease and such failure shall continue for a period of thirty (30) days after Tenant provides Landlord with written notice of such failure.

16.2.4. Intentionally Omitted.

16.2.5. Other. In the event Landlord (a) makes a general assignment for the benefit of creditors, (b) commences any Proceeding for Relief, (c) becomes the subject of any Proceeding for Relief which is not dismissed within ninety (90) days after its filing or entry, or (d) is dissolved or otherwise fails to maintain its legal existence.

17. Remedies.

17.1. Landlord Remedies.

17.1.1. Upon the occurrence of an Event of Default by Tenant, Landlord shall have, in addition to any other remedies available to Landlord at law or in equity (all of which remedies shall be distinct, separate and cumulative) the option to pursue any one or more of the following remedies, each and all of which shall be cumulative and nonexclusive, without any notice or demand whatsoever:

17.1.1.1. Landlord may, at its option, terminate this Lease, in which event Tenant shall surrender the Leased Premises to Landlord after the expiration of the Post Term Removal Period in accordance with the terms of this Lease, and if Tenant fails to do so, Landlord may, without prejudice to any other remedy, at law or in equity, enter upon and take possession of the Leased Premises and expel or remove Tenant and any other person who may be occupying the Leased Premises or any part thereof, without being liable for prosecution or any claim or damages therefor; and Landlord may recover from Tenant such amounts as available pursuant to applicable law.

17.1.1.2. If Landlord does not elect to terminate this Lease on account of any default by Tenant, Landlord may, from time to time, without terminating this Lease, enforce all of its rights and remedies under this Lease.

17.1.1.3. With regard to a non-monetary default by Tenant, if Tenant has not cured such non-monetary default within the time period established for such cure in Subsection 16.1.2 above, then Landlord may proceed to take action to the extent necessary to cure such default, and Landlord shall be entitled to prompt reimbursement by Tenant of Landlord's reasonable costs and expenses in taking such action.

17.2. Tenant Remedies.

17.2.1. Upon the occurrence of an Event of Default by Landlord, Tenant may:

17.2.1.1. undertake any and all remedies for any such a default otherwise set forth in this Lease;

17.2.1.2. proceed to take such action as Tenant deems to be necessary and/or desirable to cure such default on Landlord's behalf, in which event Landlord shall reimburse Tenant for all reasonable costs so incurred by Tenant within thirty (30) days after Tenant makes a written demand upon Landlord for such reimbursement, which written demand shall be accompanied by such documentation (e.g., invoices) as may be reasonably necessary to account for the costs for which Tenant is seeking reimbursement and

17.2.1.3. pursue any and all remedies available to Tenant at law and/or in equity without any notice or demand whatsoever.

All of Tenant's remedies shall be distinct, separate, cumulative and non-exclusive.

17.3. Waiver of Default. No waiver by Landlord or Tenant of any violation or breach of any of the terms, provisions and covenants herein contained shall be deemed or construed to constitute a waiver of any other or later violation or breach of the same or any other of the terms, provisions, and covenants herein contained. Forbearance by Landlord or Tenant in enforcement of one or more of the remedies herein provided upon an Event of Default shall not be deemed or construed to constitute a waiver of such an Event of Default.

18. Assignment, Subletting and Tenant Encumbrances.

18.1. Transfers. Without Landlord's consent or approval, Tenant, from time to time, shall be entitled to enter into any Transfer Transaction.

18.2. Landlord Cooperation. Landlord shall cooperate with Tenant, Tenant Lenders and Tenant Investors with respect to such Transfer Transactions. In connection with such cooperation, Landlord shall promptly provide Tenant with any and all affidavits, acknowledgements, estoppel certificates, NDAs, SNDAs, recognition agreements, amendments to this Lease, and any and all other documents reasonably required by Tenant in connection with such Transfer Transactions, all in a form and content reasonably acceptable to Tenant and to any Leasehold Mortgagee, Tenant Investor, Tenant Lender and any and all other applicable transferee, assignee, or purchaser; provided, however, that, other than as set forth herein or elsewhere to the contrary, (a) Landlord shall not provide any guarantees including, but not limited to, guarantees that would be considered "credit enhancers", (b) Landlord shall not have any financial obligation whatsoever for Tenant's leasehold mortgage or other indebtedness, (c) Landlord shall not be required to mortgage its fee simple interest in the Property, (d) Landlord shall not in any way be required to pledge or encumber the Property or subordinate its interest therein to any Tenant Investor, Tenant Lender, Leasehold Mortgagee, Leasehold Mortgage or to any other equity or financing structure, (e) any such amendment to this Lease shall be solely for the purposes of modifying this Lease to reflect the then current market standards for lease provisions as may be reasonably necessary to finance Tenant's interests in this Lease and/or the Solar Facilities and any and all other improvements related thereto owned by Tenant and (f) no such amendment shall impose any new material obligations or burdens on Landlord.

18.3. Notice by Tenant Investors and Tenant Lenders to Landlord. If Tenant shall enter into any Transfer Transaction, any Tenant Investor and/or Tenant Lender, as the case may be, may provide Landlord with written notice of such Tenant Investor's and/or Tenant Lender's status as a Tenant Investor and/or Tenant Lender, as the case may be, which notice shall (a) be provided in accordance with the notice requirements set forth in Section 24 below, and (b) provide such Tenant Investor's or Tenant Lender's address for notice purposes.

18.4. Notice by Landlord to Tenant Investors and Tenant Lenders. Landlord agrees to provide all Tenant Investors and Tenant Lenders that provide notice to Landlord in accordance with Subsection 18.3 above, with any and all notices to Tenant informing Tenant of (a) any Event of Default under this Lease, (b) any matter that, with the passage of time may result in an Event of Default under this Lease, (c) the termination of this Lease, or (d) any and all other material information regarding this Lease and the rights and obligations of the parties hereunder. All of such notices by Landlord to such Tenant Investors and Tenant Lenders shall comply with the notice requirements of Section 24 below. Notwithstanding anything in this Lease to the contrary, none of the notices by Landlord to Tenant described in Section 24 below shall be deemed to have been duly given unless and until a copy thereof has been so provided to every Tenant Investor and Tenant Lender that has provided Landlord with notice in accordance with Subsection 18.3 above. From and after the date such notice has been given to a Tenant Investor or Tenant Lender, as the case may be, such Tenant Investor or Tenant Lender shall have the same period, after the giving of such notice upon it, for remedying any Event of Default or causing

the same to be remedied (but shall have no obligation to remedy or cause the remedy of any Event of Default), as is given Tenant after the giving of such notice to Tenant, plus in each instance, the additional periods of time specified in Subsection 18.5 below to remedy, commence remedying or cause to be remedied the Event(s) of Defaults specified in any such notice. Landlord shall accept such performance by or at the instigation of such Tenant Investor or Tenant Lender as if the same had been done by Tenant. Each Tenant Investor and Tenant Lender may take any such action at such Tenant Investor's or Tenant Lender's option, and Landlord does hereby authorize entry upon the Property, the Common Areas, the Appurtenant Cable Lines and Facilities Areas, the Appurtenant Ground Rights Area, and the Leased Premises by such Tenant Investors and Tenant Lenders for such purpose.

18.5. Termination Notice. Anything contained in this Lease to the contrary notwithstanding, if any Event of Default shall occur which entitles Landlord to terminate this Lease, Landlord shall have no right to terminate this Lease unless, following the expiration of the period of time given Tenant to cure such Event of Default, Landlord shall provide Tenant and all Tenant Investors and Tenant Lenders that have provided Landlord with notice in accordance with Section 18.3 above a Termination Notice at least twenty (20) days in advance of the proposed effective date of such termination if such Event of Default is capable of being cured by payment of money, and at least sixty (60) days in advance of the proposed effective date of such termination if such Event of Default is not capable of being cured by the payment of money.

18.5.1. If, during such twenty (20) day or sixty (60) day period, as the case may be, any Tenant Investor and Tenant Lender shall notify Landlord of such Tenant Investor's or Tenant Lender's desire to nullify such Termination Notice, and either

18.5.1.1. pay or cause to be paid any undisputed payments then due and in arrears, as specified in the Termination Notice to such Tenant Investor or Tenant Lender, as the case may be, during such twenty (20) day period, or

18.5.1.2. cure all such non-monetary Events of Default set forth in the Termination Notice, or if such non-monetary Events of Default cannot be cured within said sixty (60) day period, commence to cure and diligently pursue curing said non-monetary Events of Default until such Events of Default have been cured,

then the Termination Notice shall be nullified and this Lease shall remain in full force and effect.

18.5.2. Notwithstanding anything in this Lease to the contrary, if any Tenant Investor or Tenant Lender provides Landlord with written notice in accordance with Subsection 18.3 above, then no agreement between Landlord and Tenant to cancel, surrender or modify this Lease shall be

effective as to any such Tenant Investor or Tenant Lender unless consented to in writing by such Tenant Investor and/or Tenant Lender, which consent may be granted or withheld in such Tenant Investor's and/or Tenant Lender's sole and absolute discretion.

18.5.3. For the purposes of this Lease, the creation of any security interest in this Lease or the leasehold estate hereby created in favor of any Tenant Lender, shall not be deemed to be an assignment or transfer of this Lease or the leasehold estate hereby created so as to require the holder of such security interest to assume the performance of any of the terms, covenants or conditions on the part of the Tenant to be performed hereunder or to cure any Event of Default by Tenant hereunder, but the purchaser at any sale of this Lease and/or of the leasehold estate hereby created in any proceedings for the foreclosure of any Leasehold Mortgage (or any other legal process to exercise any security interest in favor of a Tenant Lender), or the assignee or transferee of this Lease and of the leasehold estate hereby created under any instrument of assignment or transfer in lieu of the foreclosure by or on behalf of any Tenant Lender shall be deemed to have agreed to perform only the terms, covenants and conditions on the part of Tenant to be performed after the date of such foreclosure (or other legal proceeding), purchase and assignment but, as to the Tenant Lender, only for so long as such Tenant Investor is the owner of the leasehold estate hereby created.

18.5.4. Any Tenant Investor, Tenant Lender or other acquirer of the leasehold estate of Tenant pursuant to foreclosure, assignment in lieu of foreclosure or other proceedings may, upon acquiring Tenant's leasehold estate, without consent of Landlord, sell and assign the leasehold estate on such terms and to such persons and organizations as are acceptable to such Tenant Investor or Tenant Lender or acquirer and thereafter be relieved of all obligations under this Lease; provided that such assignee has delivered to Landlord its written agreement to be prospectively bound by all of the provisions of this Lease.

18.6. Notwithstanding the foregoing, to the extent that Tenant, in its sole discretion, deems it necessary to finance the Solar Facilities and/or any other personal property, equipment or trade fixtures owned by Tenant and from time to time located, or to be located in, under or on the Leased Premises, and/or the Property, Tenant shall be entitled to grant the lender a security interest therein and/or in this Lease and Landlord shall execute any document reasonably requested by the lender to acknowledge that Landlord has waived any and all common law and statutory landlord's liens to which the Landlord may be entitled on such property in accordance with Section 25.10 below.

19. Estoppel Certificates. Within ten (10) days following a request in writing by Landlord or Tenant to the other, the responding party shall execute, acknowledge and deliver to the requesting party an estoppel certificate, which estoppel certificate shall indicate the Lease Effective Date, the Lease Term, that this Lease is in full force and effect, that this Lease has not been modified or otherwise amended, that there are no defaults of either party to

this Lease, that there has been no waiver of any breach, nor any failure to enforce a potential breach under the terms of this Lease any exceptions to such statements, and such other information as may be reasonably required regarding this Lease which is normal and customary to be included in such estoppel certificates; provided, however, that no such additional information shall impose any new material obligations on the party executing and delivering such estoppel certificate. Any such estoppel certificate may be relied upon by any existing or prospective lender secured by or to be secured by the Property, any Tenant Investor, any Tenant Lender, any prospective purchaser of all or any portion of the Property, the assignee or prospective assignee of Tenant's interest in this Lease, and/or the sublessee or prospective sublessee of Tenant's interest in this Lease. Failure of the Responding Party to timely execute, acknowledge and deliver such an estoppel certificate shall constitute an acknowledgment by the Responding Party that the statements included in the estoppel certificate are true and correct, without exception.

20. Hazardous Materials. Except for Hazardous Materials (a) contained in products used by Tenant in de minimis quantities for ordinary cleaning, maintenance and repair purposes, (b) normally and customarily found on job sites during the construction, installation and/or replacement of all or any portion of the Solar Facilities, and/or (c) contained in the Solar Facilities, Tenant shall not permit or cause any Tenant and/or its Agents to bring any Hazardous Materials upon the Leased Premises without Landlord's prior written consent, which consent shall not be unreasonably withheld, delayed or conditioned. Tenant, at its sole cost and expense, shall operate its business on the Leased Premises in compliance with all Environmental Requirements and if necessary, shall remediate to levels required by such Environmental Requirements in a manner permitted by such Environmental Requirements any Hazardous Materials released on the Leased Premises by the Tenant Parties from and after the Effective Date. As defined in Environmental Requirements, Tenant is and shall be deemed to be the "operator" of Tenant's "facility" with regard to the Solar Facilities only and the "owner" of all Hazardous Materials from and after the Effective Date brought on the Leased Premises by Tenant and/or its Agents, and the wastes, by-products, or residues generated, resulting, or produced therefrom.

20.1. Landlord represents to Tenant that, to the best of Landlord's actual knowledge, there has been no release of any Hazardous Materials in reportable quantities on or under the Property other than as described in the October 1998 Operations and Closure Plan for the Bristol Sanitary Landfill, such Hazardous Materials and the landfill cap, collectively, the "**Landfill Cap**". The phrase "actual knowledge of Landlord" shall mean and refer only to the actual knowledge of the officers and managers of Landlord having direct, operational responsibility for the Property, with the express limitations and qualifications that the knowledge of any contractor or consultant shall not be imputed to Landlord, and none of such officers or managers has made any special investigation or inquiry, and none of such officers or managers has any duty or obligation of diligent investigation or inquiry other than public records documents and information, or any other duty or obligation, to acquire or to attempt to acquire information beyond or in addition to the actual knowledge of such persons.

20.2. Tenant shall indemnify, defend, and hold the Landlord Parties harmless from and against any and all losses, claims, demands, actions, suits, damages, expenses (including, without limitation, remediation, removal, repair, corrective action, or cleanup expenses), and costs (including, without limitation, actual attorneys' fees, consultant fees or expert fees) which are brought or recoverable against, or suffered or incurred by the Landlord Parties to the extent of any release of Hazardous Materials on the Leased Premises for which Tenant is obligated to remediate as provided in this Section 20 above. The obligations of Tenant under this Section 20.2 shall survive the expiration or any earlier termination of this Lease.

20.3. Notwithstanding anything in this Lease to the contrary, the Tenant Parties shall have no liability of any kind in any way related to Hazardous Materials located on the Property or Leased Premises; (i) as of the Effective Date and (ii) from and after the Effective unless caused by Tenant. Landlord shall indemnify, defend, and hold the Tenant Parties harmless from and against any and all losses, claims, demands, actions, suits, damages, expenses (including, without limitation, remediation, removal, repair, corrective action, or cleanup expenses), and costs (including, without limitation, actual attorneys' fees, consultant fees or expert fees) which are brought or recoverable against, or suffered or incurred by any of the Tenant Parties to the extent of any release of Hazardous Materials for which Tenant has not indemnified the Landlord Parties as set forth in Section 20.2 above. The obligations of Landlord under this Section 20.3 shall survive the expiration or any earlier termination of this Lease.

20.4. As of the Effective Date, Landlord and Landlord Parties are required to perform certain ongoing maintenance obligations as set forth in the Landlord Cap closure documentation. Landlord hereby covenants and agrees that any Landfill Cap maintenance shall be performed as its sole cost and expense, with prior notice to Tenant, with minimal interference to the Solar Facilities and subject to Base Rent Abatement should a Base Rent Abatement Event occur as set forth in Section 15. Landlord shall indemnify, defend and hold the Tenant Parties harmless from and against any and all losses, claims, demands, actions, suits, damages, costs and expenses relating to the Landfill Cap, including both maintenance obligations in accordance with Environmental Requirements and Hazardous Materials related thereto and shall reimburse Tenant for any damage to the Solar Facilities and any lost Environmental Attributes or Environmental Incentives.

21. Condemnation.

21.1. Condemnation. If the whole or any material part of the Leased Premises or the Property (including the parking areas) shall be taken by power of eminent domain or condemned by any competent authority for any public or quasi-public use or purpose, or if any adjacent property or street shall be so taken or condemned, or reconfigured or vacated by such authority in such manner as to require the use, reconstruction or remodeling of any part of the Leased Premises, Building or Property, or if Landlord shall grant a deed or other instrument in lieu of such taking by eminent domain or condemnation, or by private purchase in lieu thereof (a

"**Taking**" or "**Taken**"), and the Taking (a) would in Tenant's judgment prevent or materially interfere with Tenant's Permitted Use of the Leased Premises, or (b) would in Landlord's judgment materially interfere with or impair its ownership or operation of the Property, then upon written notice by Landlord or Tenant (as applicable) to the other party this Lease shall terminate. Other than as set forth in this Section 21.1 below, Landlord shall be entitled to receive the entire award or payment in connection therewith other than to the extent such award is attributable to (x) the damages incurred by Tenant related to the termination of this Lease, and (y) any portion of Landlord's award or any separate award for loss of or damage to Tenant's removable personal property, including, but not limited to, the Solar Facilities, for Tenant's business damages and for relocation expenses, all of which shall be awarded and paid to Tenant.

22. Representations and Warranties of Landlord. Landlord represents and warrants to Tenant and any and all Tenant Investors and Tenant Lenders as follows:

22.1. Landlord Authority. Has the right and authority to lease to the Tenant portions of the Property, and all appurtenant rights thereto, subject only to the Permitted Encumbrances.

22.2. Permitted Encumbrances. Except as set forth in the updated Permitted Encumbrances there are no liens, encumbrances, leases, mortgages, deeds of trust, security interests, licenses, contracts, rights of first refusal, options, easements, reserved mineral rights or any other exceptions to title encumbering or affecting all or any portion of the Property all appurtenant rights thereto, the Leased Premises and/or the Appurtenant Rights.

22.3. Easements and Licenses. With regard to the Easements and Licenses, (a) all of the Easements and Licenses are in full force and effect and are superior in priority to any and all mortgages and other liens that, if foreclosed, could terminate the right of Landlord and Tenant to make proper and full use of such Easements and Licenses, (c) no consent or other approval is required for Tenant to make use of such Easements and Utilities, (d) the Easements and Licenses provide Landlord, Tenant and their respective Agents full and unhindered vehicular and pedestrian access between public rights of way and the Property, and (e) the Easements and Licenses provide all necessary, utilities services including, but not limited to, electricity, water, sewer, telephone and cable, between public rights of way and the Property.

22.4. Power and Authority. Landlord has full power, authority, capacity and legal right to enter into, execute and deliver this Lease. Each person signing this Lease on behalf of Landlord is authorized to do so.

22.5. Valid and Binding Agreement. This Lease constitutes a valid and binding agreement enforceable against Landlord, the Property, the Leased Premises and the Appurtenant Rights in accordance with its terms.

22.6. Duly Organized and Validly Existing. Landlord (a) is a duly organized and validly existing Municipal Corporation in good standing under the laws of the State of Rhode Island (b) has full power and authority to own the Property, to lease the Leased Premises and to grant the Appurtenant Rights to Tenant.

22.7. Landlord's Approvals. Landlord has all necessary approvals, governmental and otherwise, to own and operate the Property and to enter into this Lease and is in full compliance with such Approvals.

22.8. Violation of Other Agreements and/or Applicable Laws. The execution and delivery of this Lease by Landlord will not place Landlord in default of any agreements to which Landlord is a party or bound and will not violate any Applicable Laws.

22.9. Hazardous Materials. There are Hazardous Materials located on or under the Property requiring a Landfill Cap. Landlord or Landlord Parties are responsible, at their sole cost and expense, for all ongoing obligations relating to the Landfill Cap and compliance with all Environmental Requirements. There are no Hazardous Materials located on or under the Property in an amount which would require reporting, monitoring and/or remediation under any applicable Environmental Requirement or any other Applicable Law, except the Landfill Cap and there are no underground storage tanks located under the Property.

22.10. No Legal Actions. Landlord is neither a party to, nor does there exist, any pending or threatened, legal, administrative, arbitral or other proceedings, claims, actions or governmental or regulatory investigations of any kind or nature whatsoever against Landlord which could reasonably be expected to have an adverse effect on the ability of Landlord to perform its obligations under this Lease or Tenant to fully exercise its rights pursuant to this Lease in accordance with its terms.

22.11. Not a Foreign Person. Landlord is not a "foreign person" within the meaning of Section 1445(f)(3) of the Internal Revenue Code of 1986, as amended, and the related Treasury Department regulations, including temporary regulations.

22.12. No Other Agreements. Landlord has not leased or granted any other rights to the Leased Premises, the Appurtenant Ground Rights Area, or any other rights or agreements that will prohibit or hinder Tenant from fully exercising its rights under this Lease.

22.13. Compliance Representation. As of the date hereof, the Leased Premises is in good condition, free of defects, and in compliance with all Applicable Laws.

23. Tenant's Representations and Warranties. Tenant represents and warrants to Landlord that:

23.2. Power and Authority. Tenant has full power, authority, capacity and legal right to enter into, execute and deliver this Lease. Each person signing this Lease on behalf of Tenant is authorized to do so.

23.3. Valid and Binding Agreement. This Lease constitutes a valid and binding agreement enforceable against Tenant in accordance with its terms.

23.4. Duly Organized and Validly Existing. Tenant (a) is a duly organized and validly existing limited liability company in good standing under the laws of the State of Delaware, and (b) has full power and authority to enter into this Lease.

23.5. Violation of Other Agreements and/or Applicable Laws. The execution and delivery of this Lease by Tenant will not place Tenant in default of any agreements to which Tenant is a party or bound and will not violate any Applicable Laws.

23.6. No Legal Actions. Tenant is neither a party to, nor does there exist, any pending or threatened, legal, administrative, arbitral or other proceedings, claims, actions or governmental or regulatory investigations of any kind or nature whatsoever against Tenant which could reasonably be expected to have an adverse effect on the ability of Tenant to perform its obligations under this Lease or Landlord to fully exercise its rights pursuant to this Lease in accordance with its terms.

24. Notice. All Notices shall be in writing, shall be (a) sent by United States certified or registered mail, postage prepaid, return receipt requested, (b) delivered by a nationally recognized overnight courier, or (c) delivered personally. All such Notices shall reference this Lease and shall specify the location of the Property. Any Notice shall be sent, transmitted, or delivered, as the case may be, to Tenant at the appropriate address set forth below, or to such other place as Tenant may from time to time designate in a Notice to Landlord, or to Landlord at the addresses set forth below, or to such other places as Landlord may from time to time designate in a Notice to Tenant. Any Notice will be deemed given (x) three (3) days after the date it is posted if sent by mail in accordance with the foregoing requirements, (y) the date the overnight courier delivery is made, or (z) the date personal delivery is made. As of the date of this Lease, any Notices to Landlord or to Tenant shall be sent, transmitted, or delivered, as the case may be, to the following addresses:

Landlord:	Town of Bristol Attention: Town Administrator_____ Bristol Town Hall 10 Court Street Bristol, Rhode Island 02809
with one copy to:	Attention: Town Solicitor___ Ursillo, Teitz & Ritch, Ltd. 2 Williams Street Providence, Rhode Island 02903
and another copy to:	

Attention:_____

Tenant: Nugen Capital Management, LLC
267 Water Street, 2nd Floor
Warren, Rhode Island 02885
Attention: David H. Milner

with one copy to: Sherin and Lodgen LLP
101 Federal Street
Boston, Massachusetts 02110
Attention: Bethany A. Bartlett, Esq.

25. Miscellaneous.

25.1. Intentionally Omitted.

25.2. Landlord Exculpation. Notwithstanding anything in this Lease to the contrary, any remedy of Tenant for the collection of a judgment (or other judicial process) requiring the payment of money by Landlord arising from any Event of Default by Landlord hereunder or any claim, cause of action or obligation, contractual, statutory or otherwise by Tenant against Landlord concerning, arising out of or relating in any manner to this Lease and all of the covenants and conditions or any obligations, contractual, statutory, or otherwise set forth herein, shall be limited solely and exclusively to an amount which is equal to the interest of Landlord in and to the Property. No other property or assets of Landlord, or any member, officer, director, shareholder, partner, trustee, agent, servant or employee of Landlord shall be subject to levy, execution or other enforcement procedure for the satisfaction of Tenant's remedies under or with respect to this Lease, Landlord's obligations to Tenant, whether contractual, statutory or otherwise, the relationship of Landlord and Tenant hereunder. The limitations of liability contained in this Section 25.2 shall inure to the benefit of Landlord and Landlord's present and future officers, directors, trustees, partners, shareholders, members, and their respective heirs, successors and assigns.

25.3. Tenant Exculpation. Notwithstanding anything in this Lease to the contrary, any remedy of Landlord for the collection of a judgment (or other judicial process) requiring the payment of money by Tenant arising from any Event of Default by Tenant hereunder or any claim, cause of action or obligation, contractual, statutory or otherwise by Landlord against Tenant concerning, arising out of or relating in any manner to this Lease and all of the covenants and conditions or any obligations, contractual, statutory, or otherwise set forth herein, shall be limited solely and exclusively to an amount which is equal to the interest of Tenant in and to the Solar Facilities then located on the Leased Premises. No other property or assets of Tenant, or any member, officer, director, shareholder, partner, trustee, agent, servant or employee of Tenant shall be subject to levy, execution or other

enforcement procedure for the satisfaction of Landlord's remedies under or with respect to this Lease, Tenant's obligations to Landlord, whether contractual, statutory or otherwise, the relationship of Tenant and Landlord hereunder. The limitations of liability contained in this Section 25.3 shall inure to the benefit of Tenant and Tenant's present and future officers, directors, trustees, partners, shareholders, members, and their respective heirs, successors and assigns.

25.4. Brokers. Tenant and Landlord hereby warrant to each other that they have had no dealings with any broker or agent in connection with the negotiation of this Lease and that they know of no other broker or agent who is entitled to a commission, consultant's fee, facilitation fee, or its equivalent in connection with this Lease. Each party agrees to indemnify and defend the other party against and hold the other party harmless from any and all Claims with respect to any commission or equivalent compensation alleged to be owing on account of the indemnifying party's dealings with any broker or agent. The terms of this Subsection 25.4 shall survive the expiration or any earlier termination of this Lease.

25.5. Governing Law. This Lease shall be governed by and construed under the laws of the state in which the Property is located.

25.6. Attorneys' Fees. In any action to enforce the terms of this Lease, the non-prevailing party shall pay the prevailing party a reasonable sum for attorneys' fees in such suit, including on appeal. For the purposes of this Lease, the term "prevailing party" shall include, without limitation, a party who substantially obtains or defeats the relief sought, as the case may be, in any action brought by either party in a court of competent jurisdiction.

25.7. Partial Invalidity. If any term, provision or condition contained in this Lease shall, to any extent, be invalid or unenforceable, the remainder of this Lease, or the application of such term, provision or condition to persons or circumstances other than those with respect to which it is invalid or unenforceable, shall not be affected thereby, and each and every other term, provision and condition of this Lease shall be valid and enforceable to the fullest extent possible permitted by law.

25.8. Rights Granted to Tenant. All rights granted to Tenant pursuant to this Lease shall run in favor of Tenant and Tenant's successors and assigns.

25.9. Counterparts. This Lease may be executed in counterparts, each of which shall be deemed an original, but such counterparts, when taken together, shall constitute one agreement.

25.10. Quiet Enjoyment. Landlord, on behalf of itself and its successors and assigns, covenants that Tenant, shall, during the Lease Term, peaceably and quietly have, hold and enjoy the Leased Premises subject to the terms, covenants, conditions, provisions and agreements hereof without interference by any persons lawfully claiming by or through Landlord or any of Landlord's other tenants on the Property.

25.11. Waiver of Landlord's Lien. Landlord waives any and all statutory and common law landlord's lien rights it may have concerning the Solar Facilities, and any and all other improvements made by or on behalf of Tenant or Tenant's Agents to the Leased Premises and/or the Property pursuant to the terms of this Lease, and Tenant has the right to remove the same in accordance with the terms of this Lease.

25.12. Memorandum of Lease. Tenant shall have the right, at Tenant's sole cost and expense, to record the Memorandum of Lease. Landlord agrees that upon Tenant's request, Landlord shall execute, notarize and deliver such Memorandum of Lease in recordable form to Tenant within five (5) business days after Landlord's receipt of the Memorandum of Lease from Tenant. If Landlord fails to do so, Landlord appoints Tenant as its attorney-in-fact for the limited purpose of executing such Memorandum of Lease on Landlord's behalf.

25.12.1. If this Lease is amended or otherwise modified from time to time, either party hereto may request the other party hereto to execute, notarize and deliver in recordable form an amendment to or an amended and restated Memorandum of Lease describing the amendments and/or other modifications to this Lease, which amendment to or amended and restated Memorandum of Lease shall be delivered to the requesting party within five (5) days after the party so requested to execute, notarize and deliver such amended and/or amended and restated Memorandum of Lease has received the same for execution.

25.12.2. Upon the expiration of the Post Term Removal Period, Tenant shall execute, notarize and deliver to Landlord a termination of Memorandum of Lease in recordable form, terminating the Memorandum of Lease and any amendments and/or amended and restated Memoranda of Lease. If Tenant fails to do so, after the expiration of such Post Term Removal Period, Tenant appoints Landlord as its attorney-in-fact for the limited purpose of executing such termination of Memorandum of Lease on Tenant's behalf.

25.13. Entry by Landlord. To the extent, and only to the extent, specifically permitted by this Lease, Landlord shall have the right at all reasonable times and upon reasonable notice to Tenant (except in the case of an Emergency) to enter the Leased Premises to (a) inspect the Leased Premises (but not the Solar Facilities), (b) to alter, improve or repair the Property other than to the extent restricted or prohibited from doing so by the terms of this Lease, and (c) to take such other actions which Landlord is specifically permitted to undertake by the terms of this Lease.

25.14. Covenant Against Liens. Tenant has no authority or power to cause or permit any lien or encumbrance of any kind whatsoever, whether created by act of Tenant, operation of law or otherwise, to attach to or be placed upon the Property or the Leased Premises, and any and all liens and encumbrances created by Tenant shall attach solely to Tenant's interest in this Lease, the Solar Facilities and/or in any other property owned by Tenant and from time to time located in, under or upon

the Property, the Leased Premises, the Appurtenant Cable and Facilities Area and/or the Ground Lease Rights Area.

25.15. Entire Agreement. It is understood and acknowledged that there are no oral agreements between the parties hereto affecting this Lease, the Property and/or the Solar Facilities. This Lease constitutes the parties' entire agreement with respect to the leasing of the Leased Premises and supersedes and cancels any and all previous negotiations, arrangements, brochures, agreements and understandings, if any, between the parties hereto or displayed by Landlord to Tenant and/or by Tenant to Landlord with respect to the subject matter thereof, and none thereof shall be used to interpret or construe this Lease. None of the terms, covenants, conditions or provisions of this Lease can be modified, deleted or added to except in writing signed by the parties hereto.

25.16. No Ownership Interest in the Property and No Partnership or Joint Venture. Nothing contained herein shall be construed as granting to Tenant any property or ownership rights in the Property, other than those rights expressly set forth in this Lease, or to create a partnership or joint venture between Landlord and Tenant.

25.17. Force Majeure. Notwithstanding anything in this Lease to the contrary, any obligation on the part of either Landlord or Tenant that cannot be performed due to the occurrence of a Force Majeure shall be excused for a period of time equal to any prevention, delay or stoppage caused by such Force Majeure and, therefore, if this Lease specifies a time period for performance of an obligation of either party, that time period shall be extended by the period of any delay in such party's performance caused by a Force Majeure.

25.18. Ownership of Electricity and Environmental Attributes. Landlord acknowledges and agrees that Tenant, or its affiliate or transferee, is the exclusive owner of electricity generated by the Solar Facilities and of the Environmental Attributes and Environmental Incentives in any way related to and/or arising from the Solar Facilities, including, but not limited to, the installation and operation thereof. Landlord agrees to execute any and all documents reasonably requested by Landlord to confirm and verify the terms of this Section 25.18. This Section 25.18 shall survive the expiration and/or any earlier termination of this Lease.

25.19. Marketing Cooperation by Landlord. Tenant may use Landlord's name, trade name, trademark, and the name identifying the Property, if one exists, in any of Tenant's promotional or advertising material without the prior written permission of Landlord. Landlord shall fully cooperate with Tenant regarding the presence of the Solar Facilities and the operation of such Solar Facilities on the Leased Premises including, but not limited to, publicity releases, press events, case studies, web identification and other opportunities to highlight and promote the success of the installation and operation of the Solar Facilities.

25.20. Communications/Publicity. No later than the Commercial Operation Date, Landlord and Tenant shall mutually agree on, and shall thereafter comply with, a

communications plan governing all publicity related to the project (specifically excluding any and all marketing material described in Section 25.19 above), which at a minimum shall provide that: (a) each of Landlord and Tenant may publish or post factually accurate information regarding the Project, (b) other than as otherwise provided elsewhere in this Lease to the contrary, any tours or guest access provided by Tenant to the Property shall be subject to prior Landlord's approval, which approval shall not be unreasonably withheld, delayed or conditioned, and (c) Landlord and Tenant may each take photographs or videos of the Solar Facilities and its construction and operation and may use such photographs and videos in its sole and absolute discretion to promote this and similar solar projects. Notwithstanding anything contained herein to the contrary, all disclosures of economic and financial terms of this Lease shall be subject to the confidentiality provisions of Section 26 below.

26. Confidentiality. Landlord and Tenant shall maintain in the strictest confidence, for the benefit of the other party, all information pertaining to the financial terms of or payments under this Lease, and Landlord shall maintain in the strictest confidence information regarding the Solar Facilities' specifications and the Solar Facilities Installation Plan, unless such information (a) is in the public domain by reason of prior publication through no act or omission of the disclosing party, (b) was already known to the party to whom such information was disclosed at the time of such disclosure and the party to whom such information was disclosed is otherwise free to use or disclose such information without the breach of any obligation to any person or entity, (c) as required by a regulatory authority in connection with any regulatory proceedings governing Tenant or any of its affiliates or (d) as are required by Landlord pursuant to state law under the Access to Public Records Act. Notwithstanding the foregoing, the parties hereto may disclose such information (v) to such party's existing or proposed lenders, (w) to its attorneys, accountants and other personal financial advisors solely for use in connection with their representation of such party in any way related to this Lease, (x) to any prospective purchaser of the Property who has a made a written offer to purchase or otherwise acquire the Property that Landlord desires to accept, (y) to any Tenant Investor, Tenant Lender, prospective purchaser of all or any portion of the Solar Facilities, or any prospective assignee or sublessee of Tenant's interest in this lease and the Leased Premises, and (z) pursuant to lawful process, subpoena or court order requiring such disclosure; provided, however, that in making such disclosure the disclosing party shall advise the party receiving such information of the confidentiality of the information and shall obtain the written agreement of said party not to disclose such information, which agreement shall run to the benefit of and be enforceable by the nondisclosing party hereto. The provisions of this Section 26 shall survive the expiration or any earlier termination of this Lease.

27. Schedules and Exhibits. The Schedules and Exhibits to this Lease, all of which are attached hereto and made a part hereof, are as follows:

Schedule 1 Definitions

Exhibit A Description of the Appurtenant Cable Lines and Facilities Areas

Exhibit B Description of the Appurtenant Ground Rights Area

Exhibit C Description of the Leased Premises

Exhibit D Form of Memorandum of Lease

Exhibit E Form Subordination, Non-Disturbance and Attornment Agreement

Exhibit F Permitted Encumbrances

Exhibit G Description of the Property

Exhibit H Description of the Solar Facilities

Exhibit I Solar Facilities Installation Plan

Exhibit J Solar Rent and Development Fee Adjustment Schedule

[Signature Page Follows]

IN WITNESS WHEREOF, the parties hereto have executed this Lease as of the Effective Date.

LANDLORD	TENANT
TOWN OF BRISTOL, a Rhode Island Municipal Corporation	NUGEN CAPITAL MANAGEMENT, LLC, a Delaware limited liability company
By: _____	By: _____
Its: ~~STEVEN CONTENTE~~ Town Administrator	Its: David H. Milner, its Authorized Member

SCHEDULE 1

Definitions. Capitalized terms not otherwise defined in the Lease or the Schedules and Exhibits attached thereto, shall have the following meanings:

"Agents" means a party's officers, directors, employees, agents, representatives, contractors, subcontractors, invitees and licensees.

"Applicable Laws" means all federal, state, and local statutes, ordinances, codes, rules, regulations, orders, judgments, decrees, standards and any and all other laws, including, but not limited to, the Environmental Requirements, of any and all governmental and quasi-governmental authorities and agencies having jurisdiction over Landlord, Tenant and/or the rights and obligations arising pursuant to the terms of the Lease.

"Approvals" means any and all permits, licenses, authorizations, variances, non-conforming use approvals, orders, the PCUP and any and all other approvals that Tenant determines to be necessary and/or desirable in order to construct, install, finance, operate, maintain, test, monitor, repair, replace, relocate and/or remove the Solar Facilities, to generate electricity therefrom and to sell such electricity to third parties.

"Appurtenant Cable Lines and Facilities Areas" means any and all portions of the Property and the interior and exterior of the Building that are used or that can be used for the installation of the Cable Lines and Facilities, including, but not limited to, (a) all riser systems and chase ways now or hereafter located in or around the Building, and (b) those portions of the Property and the Building to be more particularly described on **Exhibit A** attached hereto and made a part hereof, all of which may be used by Tenant in the exercise of its Appurtenant Cable Lines and Facilities Rights.

"Appurtenant Cable Lines and Facilities Rights" means non-revocable, non-exclusive rights appurtenant to Tenant's right to make use of the Appurtenant Cable Lines and Facilities Areas, in addition to the Leased Premises for the purposes of constructing, installing, operating, maintaining, monitoring, testing, repairing, replacing, and removing the Cable Lines and Facilities.

"Appurtenant Easements and Licenses" means all easements and licenses and all other rights including, but not limited to, vehicular and pedestrian ingress and egress between public rights of way and the Property and electricity, water, sewer, telephone and cable utility services between public rights of way and the Property, benefitting Landlord, the Property and/or any Improvements located thereon.

"Appurtenant Easement and License Areas" means the real property (surface and subsurface) and air rights encumbered by the Appurtenant Easements and Licenses.

"Appurtenant Ground Rights" means a non-revocable, exclusive right to use the Appurtenant Ground Rights Area for the purposes of constructing, installing, operating, maintaining, testing, repairing, removing, relocating and replacing (a) Tenant's Cable Lines and Facilities, (b) Tenant's

data acquisition system and telecommunications system; and (c) the Equipment; all of which shall be used in connection with the operation of the Solar Facilities.

"Appurtenant Ground Rights Area" means that portion of the Property to be more particularly described on **Exhibit B** attached hereto and made a part hereof for the Tenant's exercise of its Appurtenant Ground Rights, as more particularly set forth herein.

"Appurtenant Rights" means the Appurtenant Cable Lines and Facilities Rights, the Appurtenant Ground Rights, Tenant's right to make use of the Common Areas as set forth in the Lease, and any and all other rights in and to all or any other portions of the Building and/or the Property granted in the Lease to Tenant.

"Array Area" means the Leased Premises.

"**Base Rent Abatement Event**" means at any point during the Lease Term, any event or act of Landlord, its agents, employees, successors and/or assigns that (i) interferes with the continuing connection of the Solar Facilities to off-site transmission lines and facilities and/or to the power grid, or (ii) interferes with Tenant from satisfying its obligations under the PPA or replacement power purchase agreement, or (iii) adversely effects the generation or performance of the Solar Facilities.

"Building" means that certain building located on the Property and having a street address of Minturn Farm Road, Bristol, Rhode Island.

"Cable Lines and Facilities" means any and all cables, lines, conduits, network connections, data acquisition, telecommunications and transmission lines, interconnect lines, and all related facilities and equipment, as may be necessary and/or desirable from time to time during the Lease Term for the proper, most efficient and optimal use and operation of the Solar Facilities, as determined by Tenant in the exercise of Tenant's business judgment, including, but not limited to, any and all transmission and interconnect lines and facilities necessary and/or desirable to tie the Solar Facilities to off-site, transmission lines and to the grid.

"Claims" means any and all losses, damages, claims, actions, causes of action, liabilities, costs and expenses, including, but not limited to, any and all reasonable attorneys' fees and costs incurred at all pre-trail, trial and appellate levels.

"Commercial Operation Date" shall be the date upon which Tenant delivers the Completion Notice to the Landlord stating that (i) the Solar Facilities are substantially complete and interconnected with the electric system of the Property, (ii) the Tenant has accepted the Solar Facilities from its equipment suppliers and installers and (iii) the results of the System Test establish that, subject to available Solar Resources, the Solar Facilities generate electric energy as expected, and the System has been approved for interconnected operation by the Utility, then Tenant shall send a written Completion Notice to that effect to Landlord, accompanied by a copy of the results of the System Test. The Commercial Operation Date shall be the date on which the Tenant sends the Completion Notice to Landlord.

"Common Areas" means all areas of the Property and the Building intended for the common use or benefit of the tenants of the Building and their respective Agents, including, without limitation,

all lobbies, hallways, common restroom facilities, elevators, stairwells, parking areas, pedestrian walkways, driveways and access roads, entrances and exits, curb cuts, landscaped areas, sanitary sewer lines and facilities, water lines and related facilities, drainage lines and related facilities.

"Completion Notice" shall mean the written notice provided by Tenant to Landlord demonstrating that the Commercial Operation Date of the Solar Facilities.

"Delivery Point" shall be the location or locations within the electric system of the Property on Buyer's side of the Property's utility meter where Energy is to be delivered and received.

"Effective Date" shall have the meaning ascribed to such term on the first page of this Lease.

"**Emergency**" means an event threatening immediate and material danger to people located in the Building or immediate, material damage to the Building, the Building and Property Structure, the Building's systems or the Solar Facilities, or creates a realistic possibility of an immediate and material interference with, or immediate and material interruption of, a material aspect of Tenant's business operations.

"Energy" means electric energy produced by the System and delivered to the Delivery Point**.**

"Environmental Attributes" means any and all environmental benefits, air quality credits, emissions reductions, offsets, and allowances, howsoever entitled, directly or indirectly attributable to the generation from the Solar Facilities and its displacement of conventional energy. Environmental Attributes include but are not limited to: (a) any benefit accruing from the renewable nature of the generation's motive source, (b) any avoided emissions of pollutants to the air, soil or water (such as sulfur oxides (SOx), nitrogen oxides (NOx), and carbon monoxide (CO)), (c) any avoided emissions of carbon dioxide (CO2), methane (CH4) and other greenhouse gases (GHGs) that may contribute to the actual or potential threat of altering the Earth's climate by trapping heat in the atmosphere, (d) any property rights that may exist with respect to the foregoing attributes howsoever entitled, (e) displacements of energy generation by fossil fuel sources, and (f) any reporting rights to these avoided emissions such as Green Tag Reporting Rights.

"Environmental Incentives" include, but are not limited to, (a) federal, state or local production tax credits associated with the construction or operation of the energy projects, (b) any other financial incentives in the form of credits, reductions, or allowances associated with the Solar Facilities that are applicable to a local, state or federal income taxation obligation, (c) grants or subsidies in support of renewable energy, (d) emission reduction credits encumbered or used by the Solar Facilities for compliance with local, state, or federal operating and/or air quality permits, and (e) all rebates, benefits, reductions, tax deductions, offsets, and allowances and entitlements of any kind, howsoever entitled, resulting from the Environmental Attributes or the installation and operation of the Solar Facilities.

"Environmental Requirements" means all applicable present and future statutes, regulations, ordinances, rules, codes, judgments, orders or other similar enactments of any governmental authority or agency regulating or relating to health, safety, or environmental conditions on, under, or about the Leased Premises or the environment, including without limitation, the following: the Comprehensive Environmental Response, Compensation and Liability Act, the Resource

Conservation and Recovery Act, all state and local counterparts thereto, and any regulations or policies promulgated or issued thereunder.

"Event of Default" shall have the meaning ascribed to such term as set forth in Section 16 of the Lease.

"Existing Landlord's Mortgagee" means the owner and holder of the mortgage to Landlord and related security instruments included herein as Permitted Encumbrances.

"**Force Majeure**" means any prevention, delay or stoppage of an obligation of either Landlord or Tenant due to strikes, lockouts, labor disputes, acts of God, acts of war, terrorist acts, inability to obtain services, labor, or materials or reasonable substitutes therefor, governmental actions, civil commotions, fire or other casualty, and other causes beyond the reasonable control of the party so obligated to perform.

"Hazardous Materials" means and includes any substance, material, waste, pollutant, or contaminant listed or defined as hazardous or toxic under any of the Environmental Requirements, asbestos and petroleum, including crude oil or any fraction thereof, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas).

"Improvements" means any and all landscaping, trees, bushes, utilities lines and/or facilities, drainage lines and/or facilities, water lines and/or facilities, sewer lines and/or facilities, conduits, buildings, including, but not limited to, the Building, and any and all other structures of any kind above and/or below the surface of the Property.

"Interconnection Facilities" means the lines, equipment and facilities necessary and/or desirable from time to time during the Lease Term for connecting the Solar Facilities to off-site transmission lines and facilities and to the power grid.

"Landfill Cap" has the meaning set forth in Section 20.

"Landlord" shall have the meaning ascribed to such term on the first page of this Lease.

"Landlord Interference" means any full or partial interference, hindrance or obstruction of Tenant's use or occupancy of the Leased Premises for the Permitted Use, and/or the Appurtenant Cable Lines and Facilities Areas, the Appurtenant Ground Rights Area, the Property, the Building and/or the Common Areas for their intended purposes as set forth in the Lease by any of the Landlord Parties, the Landlord's other tenants, or any of their respective Agents.

"Landlord's Legal Requirements" means all permits, licenses, and Applicable Laws now or hereafter applicable to Landlord's ownership, use, occupancy and/or operation of the Property.

"Landlord Parties" means Landlord, Town of Bristol, its Administrator, and Town Council, members and Agents.

"Landlord's Expenses" means any and all costs, expenses and charges incurred by Landlord in connection with Landlord's ownership, use, operation and management of the Property including, but not limited to, Landlord's Taxes and Insurance Expenses, common area maintenance charges,

utilities charges and all other expenses related to the maintenance, repair and, if necessary, the replacement of the Property, or any parts thereof, in a manner consistent with the community standards for properties similar in size and caliber as the Property.

"Landlord's Taxes and Insurance Expenses" means any and all ad valorem taxes, personal property taxes and any other taxes that may be attributable to Landlord's ownership of the Building, the Property and/or any of Landlord's personal property located therein or thereon, specifically excluding therefrom any and all Solar Facilities Taxes, together with any and all insurance required to be maintained by Landlord pursuant to the Lease.

"Lease" means this Solar Facilities Lease, as amended, extended and assigned from time to time in accordance with its terms.

"Lease Term" shall have the meaning ascribed to such term in Section 5 of the Lease.

"Leased Premises" means the approximate Landfill Cap areas marked Phase II, Phase III and Phase IV Areas of the Property, as more approximately shown on **Exhibit C** attached hereto and made a part hereof, and to be updated and finalized by agreement of Landlord and Tenant upon completion of Tenant's proposed owner's leasehold title insurance proforma, survey and receipt of the PCUP, together with (a) the exclusive right to all air rights above such Property, and (b) the exclusive right to any and all light that may illuminate the Property from time to time emanating from above the Property without any Sunlight Interference and/or Landlord Interference.

"**Leasehold Mortgage**" means a mortgage, a deed of trust, a deed to secure debt, or other security instrument by which Tenant's leasehold estate under the Lease is mortgaged, conveyed, assigned, or otherwise transferred, to secure a debt or other obligation.

"**Leasehold Mortgagee**" means a holder from time to time of a Leasehold Mortgage.

"MWac" means megawatt (alternating current) in terms of the capacity of the Solar Facilities.

"Memorandum of Lease" means a memorandum of lease substantially in the form of the memorandum of lease attached hereto as **Exhibit D** and made a part hereof.

"Notices" means all notices, demands, statements, designations, approvals or other communications given or required to be given by either party to the other hereunder or by law.

"PCUP" means a Post Closure Use Permit and such other permits from the Rhode Island Department of Environmental Management and such other federal, state or local agencies allowing the Permitted Use on the Leased Premises.

"Permitted Encumbrances" means those exceptions to title to the Property to be set forth on **Exhibit F** attached hereto and made a part hereof.

"Permitted Use" means the construction, installation, inspection, operation, maintenance, monitoring, testing, repair, upgrading, replacement and removal of the Solar Facilities and any and all incidental and related uses connected therewith.

"Photovoltaic Facilities" shall mean any and all photoelectric cells or other materials designed for the generation of electrical power from solar radiation, including without limitation, the associated support structure, braces, wiring, and related equipment.

"Post Term Removal Period" means a period of two hundred seventy days (270) days commencing simultaneously with the expiration or other termination of the Lease.

"PPA" means that certain Power Purchase Agreement to be entered into by and between Tenant and a third party who agrees to purchase, and Tenant agrees to sell, the electricity generated by the Solar Facilities, as such Power Purchase Agreement may be modified, extended and/or replaced from time to time.

"Proceeding for Relief" means any case, proceeding or other action seeking to have an order for relief entered on a party's behalf as a debtor or to adjudicate it as bankrupt or insolvent, or seeking reorganization, arrangement, adjustment, liquidation, dissolution or composition of it or its debts or seeking appointment of a receiver, trustee, custodian or other similar official for it or for all or of any substantial part of its property.

"Property" means the real property to be described on **Exhibit G** attached hereto and made a part hereof, together with all rights appurtenant thereto.

"Rent Commencement Date" means that date which is one (1) year from the date on which the Solar Facilities are fully constructed pursuant to the engineering, procurement and construction contract entered into by Tenant for the engineering, procurement and construction of the Solar Facilities.

"SNDA" means a Subordination, Non-Disturbance and Attornment Agreement attached hereto as **Exhibit E** and made a part hereof.

"Solar Facilities" means the items described on **Exhibit H** attached hereto and made a part hereof together with any and all other lines, equipment, and related facilities (including, but not limited to, the Cable Lines and Facilities) necessary and/or desirable from time to time to properly and optimally construct, install, operate, maintain, monitor, test, repair and replace (a) the solar facilities necessary for Tenant to satisfy and comply with the requirements of the PPA and (b) any and all electricity storage devices that may increase the total electricity output of the solar generation system located on the Leased Premises from time to time.

"Solar Facilities Alterations" means any and all alterations, modifications, enhancements, and/or additions to, and/or replacement of, the Solar Facilities.

"Solar Facilities Installation Plan" means that certain plan to be attached hereto as **Exhibit I** and made a part hereof setting forth in general terms the procedures that Tenant intends to follow regarding the installation of the Solar Facilities on, under and/or upon the Leased Premises and the Property.

"Solar Facilities Taxes" means the personal property taxes attributable solely to the Solar Facilities.

"Solar Facilities Tax Contest" means a challenge to proposed Solar Facilities Taxes filed in accordance with the requirements of any and all statutes, ordinances, rules, regulations and any and all other laws establishing the procedures for such a challenge.

"Solar Resources" means physical and meteorological site characteristics as they relate to the average annual insolation, site elevation, site terrain, and shading factors such as trees or buildings.

"Sunlight Interference" means any natural or manmade object (excluding, however, weather conditions) now or hereafter located on or above the Property that in any way interferes with or impedes the natural path of sunlight to the Photovoltaic Facilities other than if caused by Tenant or any of Tenant's Agents.

"System Test" means such tests performed by the Tenant or its contractor or subcontractor to establish the Commercial Operation Date of the Solar Facilities.

"Tenant" shall have the meaning ascribed to such term on the first page of this Lease.

"Tenant Interference" means any interference, hindrance or obstruction, on the part of the Tenant Parties, or any of their respective Agents, that materially disturbs or that constitutes a material nuisance to the other tenants, lessees or licensees of the Building other than as otherwise may be expressly or implicitly permitted pursuant to the terms of the Lease.

"Tenant Investor" means any savings bank, savings and loan association, commercial bank, trust company, credit union, insurance company, college, university, real estate investment trust, pension fund or any other entity or individual providing any equity investment from time to time in Tenant.

"Tenant Lender" means any savings bank, savings and loan association, commercial bank, trust company, credit union, insurance company, college, university, real estate investment trust, pension fund or any other entity or individual providing financing or refinancing from time to time to Tenant and/or to any Tenant Investor.

"Tenant Parties" means Tenant, its principals, partners, shareholders, members, and Agents.

"Tenant's Legal Requirements" means all permits, licenses and any and all Applicable Laws now or hereafter applicable to Tenant's specific use and/or occupancy of the Leased Premises, the Appurtenant Cable Lines and Facilities Areas, the Appurtenant Ground Lines Rights Areas, the Property, the Common Areas and/or the Building.

"Tenant's Work" means all construction activities necessary and/or desirable to be performed on in or under the Property, the Building, the Appurtenant Cable Lines and Facilities Areas, the Appurtenant Ground Lines Rights Areas, and/or the Leased Premises in connection with the initial construction and installation of the Solar Facilities, all substantially in accordance with the Solar Facilities Installation Plan.

"Termination Notice" means a notice to be provided by Landlord to any and all then existing Tenant Investors and Tenant Lenders, following the expiration of the period of time given Tenant

to cure any Tenant Event of Default, notifying such Tenant Investors and Tenant Lenders of Landlord's intention to terminate the Lease.

"Transfer Transaction" means the following actions by or on behalf of Tenant, all of which may be occur without the consent of Landlord: (a) an assignment, encumbrance, mortgage, security interest, conveyance, or any other manner of transferring or encumbering Tenant's interest in the Lease, in any estate or interest herein, in any of the improvements from time to time located or to be located on the Leased Premises, the Building and/or the Property, including, but not limited to, the Solar Facilities; (b) subletting the Leased Premises, the Appurtenant Rights, the Solar Facilities, and/or any and all other of Tenant's improvements from time to time located on or within the Leased Premises, the Building and/or the Property, or any part thereof, or the granting of any license, concession or right to occupy any portion thereof; (c) an assignment, encumbrance, mortgage, security interest, conveyance, or any other method of transferring or encumbering of all or any portion of the ownership interests in Tenant, whether or not resulting in a change in the control of Tenant; (d) permitting any other person or entity to become Tenant by merger, consolidation or otherwise; and/or (e) financing the development, permitting, engineering, construction, re-development, and/or operation of the Solar Facilities and/or any and all other improvements from time to time located or to be located on, under or over the Leased Premises, the Building, and/or the Property, and securing such financing by the encumbrance or sale of all or any portion of Tenant's interest in the Lease, said improvements and/or all or any portion of the ownership interests in Tenant.

EXHIBIT A

Description of the Appurtenant Cable Lines and Facilities Areas

[To be Updated]

EXHIBIT B

Description of the Appurtenant Ground Rights Area

[To be Updated]

EXHIBIT C

Description of the Leased Premises

[To be Updated]

EXHIBIT D

Form of Memorandum of Lease

Prepared by and return to:
_____
_____
_____
_____
Parcel ID No.:_____

MEMORANDUM OF LEASE

THIS MEMORANDUM OF LEASE (the **"Memorandum"**) is made and entered into as of the _____ day of _____, _____, by and between _____, a _____, having its principal office at _____ (the **"Landlord"**), and _____, a _____, having its principal office at _____ (the **"Tenant"**).

WITNESSETH:

WHEREAS, Landlord and Tenant have entered into that certain Solar Facilities Lease dated as of _____, 20____ (the **"Lease"**), for the lease of certain portions Property (as defined in the Lease) described on Exhibit "A" attached hereto and made a part hereof (the **"Premises"**); and

WHEREAS, Landlord and Tenant have agreed that Tenant shall have the exclusive right to electricity generation facilities and to generate electricity on the Property; and

WHEREAS, the Landlord and Tenant have agreed to enter into this Memorandum of Lease to memorialize in the Public Records of _____ County, _____ (the **"Public Records"**), certain agreements of the parties arising out of the Lease and/or the Option Agreement.

NOW, THEREFORE, for Ten and No/100 Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereto agree as follows:

1. The recitals set forth above are true and correct and are incorporated herein.

2. **Term of Lease**. The Effective Date (as defined in the Lease) is _____, 20____. The Lease terms shall expire on _____, 20___.

3. **Exclusive Right to Generate Electricity on the Property**. Tenant shall have the sole and exclusive right to convert and store all of the solar resources of the Property (as defined in the Lease) to electrical energy during the term of the Lease. Neither Landlord nor any third party shall hereafter be entitled to generate (other than for temporary emergency generator service) or store electricity anywhere on the Property during the term of this Lease.

4. **Tenant's Exclusive Right Regarding Electricity Generation Facilities on the Property**. Throughout the term of the Lease, Landlord shall not: (a) lease, license or grant any easement or other right, or permit the assignment, sublease, license or other use of, any portion of the Property for the operation of any equipment or any solar electricity related installations designed to produce electricity from the sun, or any other source of light, or to store any such electricity, or (b) permit any vegetation or any other Improvements (as defined in the Lease) to be installed or grown on the Property that may block or otherwise interfere with sunlight or any other source of light reaching the Solar Facilities without the prior written consent of Tenant, which consent may be withheld by Tenant in Tenant's sole and absolute discretion.

5. At such time as the Lease expires or otherwise terminates, Landlord and Tenant agree to execute, deliver and record in the Public Records a release or termination of this Memorandum and Notice.

The parties hereto have set their hands and seals as of the day and year first above written.

LANDLORD

Signed, sealed and delivered
in the presence of:

_____, a
_____

_____
Print Name: _____

By: _____
Print Name: _____
Print Title: _____

_____
Print Name: _____

(Corporate Seal)

TENANT

_____, a
_____

_____
Print Name: _____

By: _____
Print Name: _____
Print Title: _____

_____
Print Name: _____

(Corporate Seal)

STATE OF _____)
ss.
COUNTY OF _____)

The foregoing instrument was acknowledged before me on this _____ day of _____, 20____, by _____, in his/her capacity as the _____of _____, a _____, on behalf of said _____, who is personally known to me or who has produced _____ as identification.

_____
Notary Public, State of _____

(Notary Seal)

STATE OF _____)
ss.
COUNTY OF _____)

The foregoing instrument was acknowledged before me on this _____ day of _____, 20____, by _____, in his/her capacity as the _____of _____, a _____, on behalf of said _____, who is personally known to me or who has produced _____ as identification.

_____
Notary Public, State of _____

(Notary Seal)

EXHIBIT "A"

PREMISES

EXHIBIT E

Form of Subordination, Non-Disturbance and Attornment Agreement

SUBORDINATION, NON-DISTURBANCE AND ATTORNMENT AGREEMENT

THIS AGREEMENT dated the [_____] day of [_____], 20__ between [_____], a [_____] duly organized and existing under the laws of [_____] having its principal place of business at [_____] ("Lender"), and _____ ("Tenant").

WITNESSETH:

WHEREAS, Tenant has entered into a lease dated the _____ (hereinafter referred to as said lease) leasing certain premises in _____, said premises more particularly described in said lease, and

WHEREAS, Lender is the holder of a certain Note in the sum of $[_____] secured by a [_____] (the "Mortgage") upon premises of which the leased premises are a portion, the lien of said [_____] being prior to the Tenant's leasehold estate, and

WHEREAS, Tenant desires to be assured of the continued use and occupancy of the premises under the terms of said Lease, and

WHEREAS, Lender agrees to such continued use and occupancy by Tenant provided that by these presents Tenant agrees to recognize and attorn to Lender of purchaser in the event of foreclosure or otherwise.

NOW, THEREFORE, in consideration of the premises and the sum of $1.00 by each party in hand paid to the other, receipt of which is hereby acknowledged, it is hereby mutually covenanted and agreed as follows:

1. In the event it should become necessary to foreclose the said Mortgage or Lender should otherwise come into possession of the premises, Lender will not join Tenant under said lease in summary or foreclosure proceedings and will not disturb the use and occupancy of Tenant under said lease so long as Tenant is not in default under any of the terms, covenants, or conditions of said Lease beyond any applicable cure period; and has not prepaid the rent except monthly in advance as provided by the terms of said lease (although absent another default, Tenant's rights hereunder shall not be disturbed due to any such prepayment, but Tenant shall not be entitled to credit therefor). The Lease is and shall be subject and subordinate to the provisions and lien of the Mortgage and to all renewals, modifications, consolidations, replacements and extensions thereof, to the full extent of the principal amount and other sums secured thereby and interest thereon.

2. Tenant agrees that in the event any proceedings are brought for the foreclosure of any such Mortgage it will attorn to the purchaser of such foreclosure sale and recognize such purchaser as the landlord under said lease accruing from and after the date of such foreclosure. Said purchaser by virtue of such foreclosure to be deemed to have assumed and agreed to be bound, as substitute Landlord, by the terms and conditions of said lease until the resale or other disposition of its interest by such purchaser, except that such

assumption shall not be deemed of itself an acknowledgment of such purchaser of the validity of any then existing claims of Tenant against the prior Landlord. All rights and obligations herein and hereunder to continue as though such foreclosure proceedings had not been brought, except as aforesaid. Tenant agrees to execute and deliver to any such purchaser such further assurance and other documents, including a new lease upon the same terms and conditions as the said lease, confirming the foregoing as such purchaser may reasonably request. Tenant waives the provisions of any statute or rule of law now or hereafter in effect which may give or purport to give it any right or election to terminate or otherwise adversely affect the said lease and the obligations of Tenant thereunder by reason of any such foreclosure proceeding.

3. Landlord authorizes and directs Tenant to honor any written demand or notice from Lender instructing Tenant to pay rent or other sums to Lender rather than Landlord (a "Payment Demand"), regardless of any other or contrary notice or instruction which Tenant may receive from Landlord before or after Tenant's receipt of such Payment Demand. Tenant may rely upon any notice, instruction, Payment Demand, certificate, consent or other document from, and signed by, Lender and shall have no duty to Landlord to investigate the same or the circumstances under which the same was given. Any payment made by Tenant to Lender or in response to a Payment Demand shall be deemed proper payment by Tenant of such sum pursuant to the Lease.

4. The provisions of this Agreement are binding upon and shall inure to the benefit of the heirs, successors, and assigns of the parties hereto.

IN WITNESS WHEREOF the parties hereto have executed these presents the day and year first above written.

_____, Company
By:_____

_____, Tenant
By: _____

The terms of the above Agreement are hereby consented and agreed to.
_____, Owner and Landlord
By: _____

EXHIBIT F

Permitted Encumbrances

[To be Updated]

EXHIBIT G

Description of the Property

That portion of the Landfill Cap located at Minturn Farm Road, Bristol Rhode Island

[To be Updated]

EXHIBIT H

Description of the Solar Facilities

SOLAR FACILITIES

(a) The Photovoltaic Facilities, (b) Interconnection Facilities, (c) electrical transmission and distribution facilities, including without limitation, overhead and underground transmission, distribution or collector lines, circuit breakers, meters, conduit, footings, poles, crossarms, guy lines, anchors, cabling and wires, (d) overhead and underground control, communications and radio relay systems, (e) switching facilities, transformers and inverters, (vi) control boxes and computer monitoring hardware, (f) safety protection facilities, (g) signs and fences, and (h) any and all other improvements, fixtures, facilities, machinery and equipment associated or connected with the generation, conversion, storage, switching, metering, step-up, step-down, transmission, distribution, conducting, wheeling, sale or other use or conveyance of electricity.

EXHIBIT I

Solar Facilities Installation Plan

[To be Updated]

EXHIBIT J

Solar Rent and Development Fee Adjustment Schedule

The following adjustment shall be applied to the definition of "Base Rent" (as set forth in **Section 6.2** of the Solar Facilities Lease), to account for the following change in the economic assumptions of the Tenant's proposed Solar Facilities (the "Project"). For the annual tax item below, the adjustment shall be made as a setoff against the Base Rent in any such year that a change in the tax rate occurs.

1. The Project shall have an annual tax rate of $15,000 with the Town of Bristol. Should the tax rate be higher or lower than $15,000 in any given year, the Base Rent shall be reduced by the increase or increased by the reduction, as the case may be, in the tax.

Attachment I: O&M Manual

Bristol, RI

Bristol Landfill Solar Facility

January 2023

OPERATIONS AND MAINTENANCE MANUAL

Prepared for:

Town of Bristol
10 Court Street
Bristol, Rhode Island 02809

And

NuGen Capital Management, LLC
267 Water Street
Warren, Rhode Island 02885

Prepared by:

BETA
701 George Washington Hwy
Lincoln, Rhode Island 02865
401.333.2382
www.BETA-Inc.com

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INTRODUCTION

On behalf of the Town of Bristol, Rhode Island and Bristol Landfill Solar, NG, LLC (NuGen), BETA Group, Inc., (BETA) has prepared this Operation and Maintenance (O&M) Manual for site activities following the installation of the PV system at the Bristol Landfill. This manual covers maintenance of the existing stormwater management system, maintenance of the landfill cap and cover system, and the operation of the PV system itself. This plan has been prepared in accordance with the guidance provided in the 2015 Rhode Island Stormwater Design and Installation Standards Manual and pertinent Solid Waste Regulations.

The Town of Bristol is presently responsible for operations and maintenance of all systems related to the closed landfill. The Town and NuGen have entered into a 25-year lease agreement (dated August 30, 2019) that will shift some of these responsibilities to NuGen once the Commercial Operation date is reached. Once installed, access to the PV system will be restricted to NuGen maintenance personnel, Town emergency personnel and the Town's environmental monitoring consultant. As such, NuGen will assume the following responsibilities:

- Maintenance of access roads, gates and fences associated with the PV system;
- Mowing within the confines of the PV system plus a 15-foot buffer;
- Settlement upkeep within the confines of the PV system; and,
- Maintenance of all electrical components and systems

An operations manual prepared by NuGen that delineates responsibilities between NuGen and the Town of Bristol and provides various inspection frequencies is appended to this document.

I – GENERAL INFORMATION

The following general information is provided in accordance with Appendix Section A.1.1 of the RIDEM manual:

I-A - Owner

Town of Bristol
10 Court Street
Bristol, RI 02809
Project Contact: Diane Williamson
(401) 253-7000 Phone

Bristol Landfill Solar, NG, LLC
267 Water Street
Warren, RI 02885
Project Contact: Aaron Rust
(401) 889-2373 (Phone)
assetmanagement@nugencapital.com (Email)

I-B – Site/Stormwater Management Designer and Environmental Monitoring

BETA Group, Inc.
701 George Washington Highway
Lincoln, RI 02865
Project Managers: Nicole Iannuzzi, P.E.
Steven Richtarik, PE
(401) 333-2382 (Office Phone)
(401) 333-9225 (Fax)

I-C - Address of Site

The project site is located at 6 Minturn Farm Road, Bristol, RI 02809.

I-D - Vicinity Map

Please refer to Figure I-1 – Vicinity Map.

II – STORMWATER MANAGEMENT SYSTEM SUMMARY

There are no proposed changes to the landfill's stormwater management system resulting from the proposed Bristol Landfill solar project. The existing stormwater management system servicing the site

consists of diversion berms with underdrains and drainage swales. These components are inspected semi-annually, and necessary maintenance is performed by the Town of Bristol.

III - OPERATION AND MAINTENANCE PLAN

All components of the stormwater management system within the confines of the solar project area, shall be the responsibility of NuGen to operate and maintain. The following summarizes the actions specific to this project.

III-A GENERAL:

III-A.1 Inspections

Inspections shall assess the following conditions for all components of the stormwater management system:

Structural Elements – The condition of all elements of the particular component being inspected shall be assessed, and if deemed to be deficient or compromised by routine wear and deterioration, shall be scheduled for repair or replacement as soon as possible.

Accumulated Materials – The volume and nature of accumulated materials shall be noted during all inspections. The accumulation of excessive levels of materials (sediments, trash and other debris) and/or the presence of atypical materials or contaminants within the structure shall be cause for further inspection of the stormwater system and/or the land area tributary thereto, to locate and identify the source of the excessive or atypical material and to correct the cause of same.

An inspection form shall be completed for each structure inspected; completed sheets shall be kept in a binder to be managed by the maintenance provider.

III-A.2 Cleaning

Cleaning shall include completely removing all accumulated material (e.g., sediments, trash, debris, and organic material) by means appropriate to the particular component of the stormwater system and legally disposing of the material at an off-site location.

In the case of atypical materials or contaminants in the stormwater system, said materials may require additional sampling, testing and analysis to determine the nature of the contamination and the appropriate methods of handling and disposal for same.

III-A.3 Access & Safety

Access to the stormwater management system for inspections and cleaning shall be made at the designated locations for same and shall be made in a manner that avoids or minimizes interference with the operation of the stormwater management system.

Inspections and cleaning of all elements of the stormwater management system shall be performed by properly trained personnel using appropriate tools and equipment and shall at all times be performed in a manner which prioritizes safety for the personnel performing the inspections and/or cleaning.

In instances where impacts to the site or the stormwater management system cannot be avoided during inspections and/or cleaning, all reasonable measures and precautions shall be taken to protect the personnel performing the inspections and/or cleaning as well as the travelling public using the roadway corridor. Such measures may include, but not be limited to:

Stormwater Management System Impacts:

- Temporary stormwater flow diversion;
- Bypass pumping

III-B EASEMENTS:
For the purposes of this project, the stormwater management system is located on Town-owned property.

III-C FUNDING SOURCE:
As stated above, the work described herein, within the confines of the PV system, shall be performed by NuGen and/or its designated agents. Funding of these maintenance activities shall be provided by NuGen in accordance with the terms of the lease.

NuGen shall be responsible for ensuring that adequate funds are allocated and reserved for use in the proper implementation of this plan each year and shall adjust its annual budget accordingly to reflect any changes in the costs/expenses associated with same.

III-D SPECIFIC COMPONENTS:

III-D.1 Components

III-D.1.1 – Vegetative Cover

Inspections: The vegetative cover within the PV area shall be inspected quarterly. The inspection will include identifying evidence of erosion along the drip edge line of the panels and settlement adjacent to the ballast tubs.

Scheduled Maintenance:

- The grass shall be mowed two (2) to three (3) times per year (as needed).

Corrective Maintenance:

- If concentrated flows result in erosion along any portion of the vegetative cover, the impacted areas shall be immediately loamed, reseeded and stabilized (straw mulch, bio-degradable erosion control blanket, etc.) until such time as the new grass has sufficiently established itself.
- If erosion continues to occur, scour protection below the drip edge line will be installed (such as a level spreader made of crushed stone).
- There shall be no fertilizer applications on site.

III-D.1.2 – Access Road

Inspections: The access road within the PV area shall be inspected quarterly.

Scheduled Maintenance: The washed crushed stone shall be scarified bi-annually or more frequently if necessary.

Corrective Maintenance: If at any time the access road is not a uniform 8” in depth or the width is not consistent with design, the stone will be replenished, as necessary.

BETA

BRISTOL LANDFILL SOLAR

FIGURE 1

VICINITY MAP

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APPENDIX A

BRISTOL LANDFILL SOLAR, NG, LLC O&M MANUAL

Bristol Landfill Solar, LLC
Operations Manual

The following procedure shall be performed after initial commissioning of the Site, and again at regular intervals thereafter to ensure continued peak performance and reliability expectations are met.

Site Information	
Site Name:	Bristol Landfill Solar
Site Address:	6 Minturn Farm Road
Site City:	Bristol
Site State:	Rhode Island
Zip:	02809

Preventative Maintenance Schedule		
General Visual Inspection	Frequency	Responsible Party
Overall site conditions, Roads, PV arrays, electrical equipment, Racking, Gates, fence, vegetation, erosion, corrosion, modules, MV transformers, switchgear, and protective relays.	Quarterly	NuGen O&M
Additional Upkeep of Grounds		
Mowing | Solar Area Everything under the foot print of the solar site to include a 15' buffer around the perimeter of the array.	2 to 3 times a year, depending on rate of growth of grass.	NuGen O&M
Mowing | Outside Solar Area Everything outside of a 15' buffer around the perimeter of the array.	2 to 3 times a year, depending on rate of growth of grass.	Town of Bristol
Settlement Upkeep | Ballast Block Area Settlement Upkeep will be maintained, as needed, for all settlement underneath the ballast blocks under the footprint of the array on the landfill.	As Needed	NuGen O&M
Settlement Upkeep | Outside Ballast Block Area Everything outside of the ballast block area.	As Needed	Town of Bristol
Road Upkeep | Solar Area The road will be maintained within the footprint of the solar array.	As Needed	NuGen O&M
Fence Upkeep and maintenance of fencing and fence line	As Needed	Town of Bristol

Groundwater Requirements & Drainage System Upkeep Maintenance and upkeep of groundwater requirements & drainage system elements.	As Needed	Town of Bristol
Landfill Gas Monitoring Maintence and upkeep of landfill gas monitoring.	As Needed	Town of Bristol
Electrical Inspection (each to be performed between March 1 and April 30 in each calendar year on sunny days) and conducted in accordance with the Electrical Inspection Requirements below	**Frequency**	**Responsible Party**
Test Switches and disconnects.	Once per year	NuGen O&M
Infrared scans combiner and re-combiner boxes; tighten loose connections;	Once per year	NuGen O&M
Check sensors and meters, including pyranometers, anemometers, and tilt sensors when present. Ensure battery back-up is working	Once per year	NuGen O&M
Wash pyranometer	Once per year	NuGen O&M
Additional Electrical Inspection Requirements		
Thermal Inspection • Open each combiner box and photograph the connections using the IR Camera. Write down a list of all connections that are more than +5 deg. C higher in temperature, to be tightened when the power is removed in the next section. • Open each DC disconnect switch and photograph the connections using the IR Camera. Write down a list of all connections that are more than +5 deg. C higher in temperature, to be tightened when the power is removed in the next section. • Open each AC disconnect switch and photograph the connections using the IR Camera. Write down a list of all connections that are more than +5 deg. C higher in temperature, to be tightened when the power is removed in the next section.	Once per year	NuGen O&M
Sensor and Meter Inspection Check sensors and meters, including pyranometers, anemometers and tilt sensors when present. • Record meter readings as available. • Turn meters OFF and ON to make sure they are communicating properly, and ensure the battery backups are working if present. Check calibration labels. Write down serial numbers of exchanged meters.	Once per year	NuGen O&M
Equipment Verification • Turn off the PV inverter. • For all AC Disconnect Switches – Turn them OFF then ON to verify they function properly.	Once per year	NuGen O&M

• Turn off all AC Disconnect switches. • For all DC Disconnect Switches – Turn them OFF then ON to verify they function properly. • Turn off all DC Disconnect switches.		
Connection Verification o Verify the Inverter and all AC, and DC disconnect switches are in the OFF position. o Referring to the images taken at each combiner box and disconnect switch, verify and correct Torque at all connections that were +5 deg. C or higher than the normal temperature to the manufacturer's specifications. (Confirm Torque settings to manufacturer's documentation.)	Once per year	NuGen O&M
PV Array Maintenance for Modules	**Frequency**	**Responsible Party**
Wash all panels with water with no chemicals or solar panel cleaning solution.	As needed	NuGen O&M
Remove snow and control vegetation.	As needed	NuGen O&M
Perform infrared scan of a randomly selected sample	Once per year	NuGen O&M

Electrical System Preventative Maintenance	Frequency	Responsible Party
Clean and/or replace filters (as necessary to comply with applicable manufacturer's warranties), check pressure gauges (address as necessary), check MOVs, thermal imaging (address connections and hot spots), inspect DC/AC capacitors, inspect all inductors and transformers, inspect all power cables included lug connections, inspect DC fans (replace as necessary), inspect weather stripping (replace as necessary), inspect AC contactor (replace parts as necessary), and heat exchanger (if applicable on inverter manufacturer's schedule).	As necessary to comply with the applicable manufacturer's warranties.	NuGen O&M
Clean all cabinet air vents.	Once per year	NuGen O&M
Clean and remove dust from heat sinks per manufacturer's warranty requirements.	Once per year	NuGen O&M
Check torque marks and re-tightening appropriate wiring connections to design specification torque force per manufacturer's guidelines	Once per year	NuGen O&M
Alarm Monitoring and Dispatch		
Dispatch resources in response to alarms and alerts/service requests received by Asset Management Team.	Upon occurrence	NuGen O&M