222 South 9th Street
Minneapolis, MN 55402
Phone: 612-326-1500
E-mail: steve.broyer@ecosrenewable.com
May 30th, 2019

Transmittal

To: Melanie A. Bachman
Staff Attorney/Acting Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: Petition NO. 1220 – Full Sitework Development & Management Plan

---

Melanie-

I'm writing to request that the Connecticut Siting Council reviews the Complete Sitework Development and Management Plan of the solar facility associated with Petition No. 1220 located at 1240 and 1219 Voluntown Road, Griswold, Connecticut.

On June 23rd, 2016 the Connecticut Siting Council (Council) approved the proposed construction, maintenance and operation of (3) 2.0MW AC and (1) 1.0MW AC solar photovoltaic electrical generation facilities. A condition of the approval is for the petitioner to prepare a Development and Management plan for the facility and submit it to the Council for approval prior to the commencement of construction.

On August 30th, 2018, the Council approved a Partial Development and Management Plan for the site clearing of 1240 Voluntown Road. Construction was limited to commencement until the issuance of a Stormwater General Permit by DEEP for the project. On October 31st, 2018, DEEP approved the general permit for the entire project which includes both the 1219 and 1240 Voluntown Road sites *(Exhibit A – GSN003354 Approval Letter)*. The projects approved SWCPC can be found in the following link: https://ecosenergy.box.com/s/ui66jb61u6l8jemfo3ws4pwxnfczs9ed.

Given the approval from CT-DEEP of the General Permit and the approvals granted by the Council on August 30th, 2018, Windham Solar will be commencing full construction activities for the first phase of

the facility at 1240 Voluntown Road in June of this year. Windham solar is now applying for the full sitework and development and management plan to include the parcels associated with 1219 Voluntown Road.

The petitioner has also addressed the following requirements associated with the June 24th, 2016 Connecticut Siting Council approval letter:

a) Final Site Plan, the final site plan illustrated in the Civil Sitework Documents, locates the projects perimeter fencing infrastructure, access roadway design, and stormwater features. The solar facility illustrated in the Overall Site Plan illustrates the same project footprint associated with the June 23rd 2016, Council decision. *(Exhibit B – Civil Sitework Documents).*
b) A federally listed species review was performed on May 22nd, 2019. *(Exhibit C –ESA Review).*
c) Construction hours and days of the week are outlined in the approved SWPCP; Monday through Saturday 7:00AM to 6:00PM.
d) The approved SWCPC and final site design is based on the requirements set forth by the 2002 CT Guidelines for Erosion and Sedimentation Control and addresses all elements of stabilization during the construction process of the sitework and solar facility.
e) The final site design incorporates a stormwater management plan consistent with the 2004 CT Stormwater quality Manual. The stormwater/hydrology report within the SWPCP considers the maximum effective impervious area associated with the project footprint.
f) Landscaping screening has been identified in detail on page 5 and 6 of the Civil Sitework Documents. The plan represents screening associated with the projects initial approval documents reviewed by the Council.
g) SHPO has required that a cultural resource assessment and reconnaissance survey be performed on the site. In January of 2019 ACS (Archeological Consulting Services) prepared a Phase 1A site investigations and submitted it to SHPO for review. The fill report can be found in the following link:
https://ecosenergy.box.com/s/j6am0syf00iek5djuz3c2tv8jc5w7i3w
Attached with this submission is a letter from SHPO relating to the review of the Phase 1A investigation concurrence of avoidance of the identified areas. *(Exhibit D – SHPO Letter 3-4-19)*

The documents provided with this request, illustrate that Windham Solar, LLC has taken the appropriate measures to adhere to all requirements set forth in the conditions. Outside of local building permits, all aspects of the requirements set forth in the siting council approval have been completed. Windham solar requests the Council reviews the attached documents at their July 18th meeting, to approve the Development and Management Plan for the entire project footprint to include both project sites.

Electrical and Structural racking design for the initial 2.0 MW AC to be constructed at 1240 Voluntown Road, is also underway and will be completed by mid-June 2019 for local building permit submittals, progress plans of these documents are attached:

a) Electrical Design Documents are currently at a 90% level, and illustrate the project layout,

stringing, and equipment, Final documents will be issued for electrical construction mid-June and the revisions will be minor. *(Exhibit E – Voluntown Solar 90% electrical – 5-31-19)*

b) Structural Racking documents are currently at a 90% level and illustrate the project racking layout and structural embedment depth based on field testing. These documents are currently being reviewed by the design team prior to issuing IFC documents. *(Exhibit F – Voluntown Solar 90% Racking – 5-21-19)*

Sincerely,

Steven J Broyer

EXHIBIT A

Connecticut Department of

ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

Bureau of Materials Management and Compliance Assurance

Notice of Permit Authorization

October, 31 2018

Steve Broyer
WINDHAM SOLAR LLC
222 S 9TH ST
MINNEAPOLIS, MN 55402-3382

Subject: General Permit Registration for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities
Application NO.: 201809790

Steve Broyer:

The Department of Energy and Environmental Protection, Water Permitting and Enforcement Division of the Bureau of Materials Management and Compliance Assurance, has completed the review of the Voluntown Solar (located at 1240 Voluntown Rd, Griswold) registration for the **General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, effective 10/1/13 (general permit)** . The project is compliant with the requirements of the general permit and the discharge(s) associated with this project is (are) authorized to commence as of the date of this letter. Permit No. GSN003354 has been assigned to authorize the stormwater discharge(s) from this project.

Questions can be emailed to deep.stormwater@ct.gov.

Steve Broyer

From: Yurasevecz, Sharon <Sharon.Yurasevecz@ct.gov>
Sent: Thursday, November 1, 2018 7:38 AM
To: Steve Broyer
Subject: RE: Voluntown & Bilton SWCPC

Steve-

The approval letter is populated from our data base. It appears that entering multiple addressed was not an option for you at the time you completed the filing. I will send a help ticket to IT asking about limitations of the program as well as my options on editing the approval letter . Although the letter used only one address, I can ensure you that the documentation provided in your application, including the SWPCP, is approved.

Sharon

From: Steve Broyer [mailto:steve.broyer@ecosrenewable.com]
Sent: Wednesday, October 31, 2018 3:38 PM
To: Yurasevecz, Sharon <Sharon.Yurasevecz@ct.gov>
Subject: RE: Voluntown & Bilton SWCPC

Sharon-
The approval leter associated with 44036 (attached) states that the project was approved for 1240 Voluntown road, the project is actually 2 sites 1240 and 1219, the system doesn't allow for 2 addresses for the site, however I want to ensure that both sites, are approved under the general permit, for that was how the SWCPC and the construction documents were prepared. Is there a way you can edit the letter to state that?

From: Yurasevecz, Sharon <Sharon.Yurasevecz@ct.gov>
Sent: Wednesday, October 31, 2018 12:47 PM
To: Steve Broyer <steve.broyer@ecosrenewable.com>
Subject: RE: Voluntown & Bilton SWCPC

Hi Steve,

All set. I just approved both. See Attached.

As always, feel free to call me if any questions.

Sharon

From: Steve Broyer [mailto:steve.broyer@ecosrenewable.com]
Sent: Wednesday, October 31, 2018 7:43 AM
To: Yurasevecz, Sharon <Sharon.Yurasevecz@ct.gov>
Subject: Re: Voluntown & Bilton SWCPC

Please try my cell this morning to discuss the swpcp.

Get Outlook for iOS

From: Steve Broyer <steve.broyer@ecosrenewable.com>
Sent: Monday, October 29, 2018 11:45 AM
To: Yurasevecz, Sharon
Subject: Voluntown & Bilton SWCPC

Sharon-
We've played some phone tag last week on the review portion of these SWPCPs. Please let me know the status, and if there is anything you need to discuss, and what else I can do to help move these towards approval.

Thanks
Steve

Steve Broyer
Direct: (612) 326-1500
Mobile: (612) 770-4645
steve.broyer@ecosrenewable.com

Ecos Energy | www.ecosrenewable.com
222 S 9th St, Suite 1600
Minneapolis, MN 55402

EXHIBIT B

VOLUNTOWN ROAD SOLAR
BID/PERMITTING DOCUMENTS

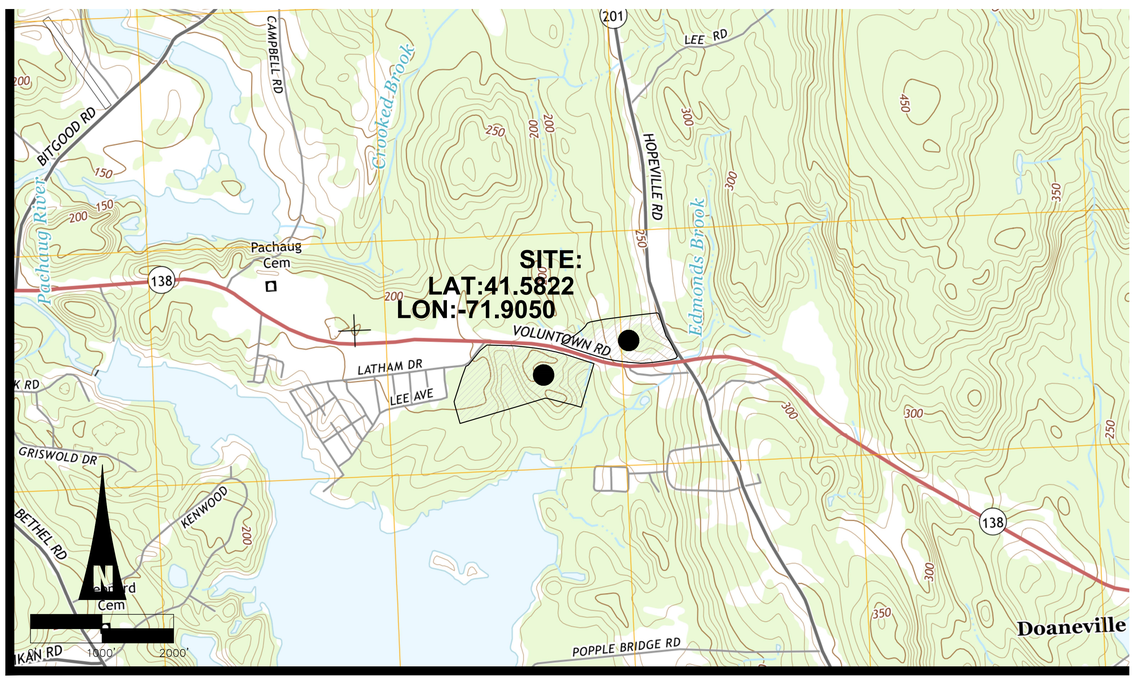
FOR

Site/Electrical Layout, Grading/Drainage/Erosion Control/Landscaping

IN

GRISWOLD, CONNECTICUT

LOCATION MAP



SHEET INDEX

●		1/8/2018	1	COVER SHEET
●		10/15/2015	2	ALTA SURVEY (BY HELLSTROM LS, LLC)
●		10/15/2015	3	ALTA SURVEY (BY HELLSTROM LS, LLC)
●		1/8/2018	4	OVERALL SITE PLAN
●		1/8/2018	5	EAST SITE & GRADING PLAN - 1"=50'
●		1/8/2018	6	CENTRAL & WEST SITE & GRADING PLAN - 1"=50'
●		1/8/2018	7	EAST DRAINAGE AREA 1&2
●		1/8/2018	8	EAST DRAINAGE AREA 3
●		1/8/2018	9	CENTRAL DRAINAGE AREA 1
●		1/8/2018	10	CENTRAL DRAINAGE AREA 2
●		1/8/2018	11	CENTRAL DRAINAGE AREA 3
●		1/8/2018	12	CENTRAL DRAINAGE AREA 4
●		1/8/2018	13	WEST DRAINAGE AREA 1
●		1/8/2018	14	WEST DRAINAGE AREA 2
●		1/8/2018	15	WEST DRAINAGE AREA 3&4
●		1/8/2018	16	LANDSCAPE PLAN
●		1/8/2018	17	CIVIL NOTES
●		1/8/2018	18	CIVIL DETAILS

DRAWING INDEX LEGEND

FILLED CIRCLE INDICATES DRAWING INCLUDED WITHIN THIS ISSUE
MOST RECENT REVISION NUMBER
MOST RECENT ISSUE OR REVISION DATE

○	-	X/XX/201X	X	SHEET TITLE

CONTACT INFO:

RECORD LANDOWNER:
PLH, LLC
77 WATER STREET
8TH FLOOR
NEW YORK, NY 10005

OWNER/DEVELOPER:
ECOS ENERGY
222 SOUTH 9TH STREET
SUITE 1600
MINNEAPOLIS, MN 55402

CIVIL ENGINEER:
CLA ENGINEERS, INC.
317 MAIN STREET
NORWICH, CT 06360

SURVEYOR:
ROB HELLSTROM LAND
SURVEYING, LLC
P.O. BOX 497
HEBRON, CT 06248

WETLAND DELINEATION:
HIGHLAND SOILS
P.O. BOX 337
STORRS, CT 06268

No.	DATE	REVISION

CLA Engineers, Inc.
CIVIL • STRUCTURAL • SURVEYING
317 Main Street Norwich, CT 06360
(860) 886-1966 Fax (860) 886-9165

STATE OF CONNECTICUT ROBERT J. DONOVAN 29 REGISTERED PROFESSIONAL ENGINEER

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

COVER SHEET

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 1

CLA

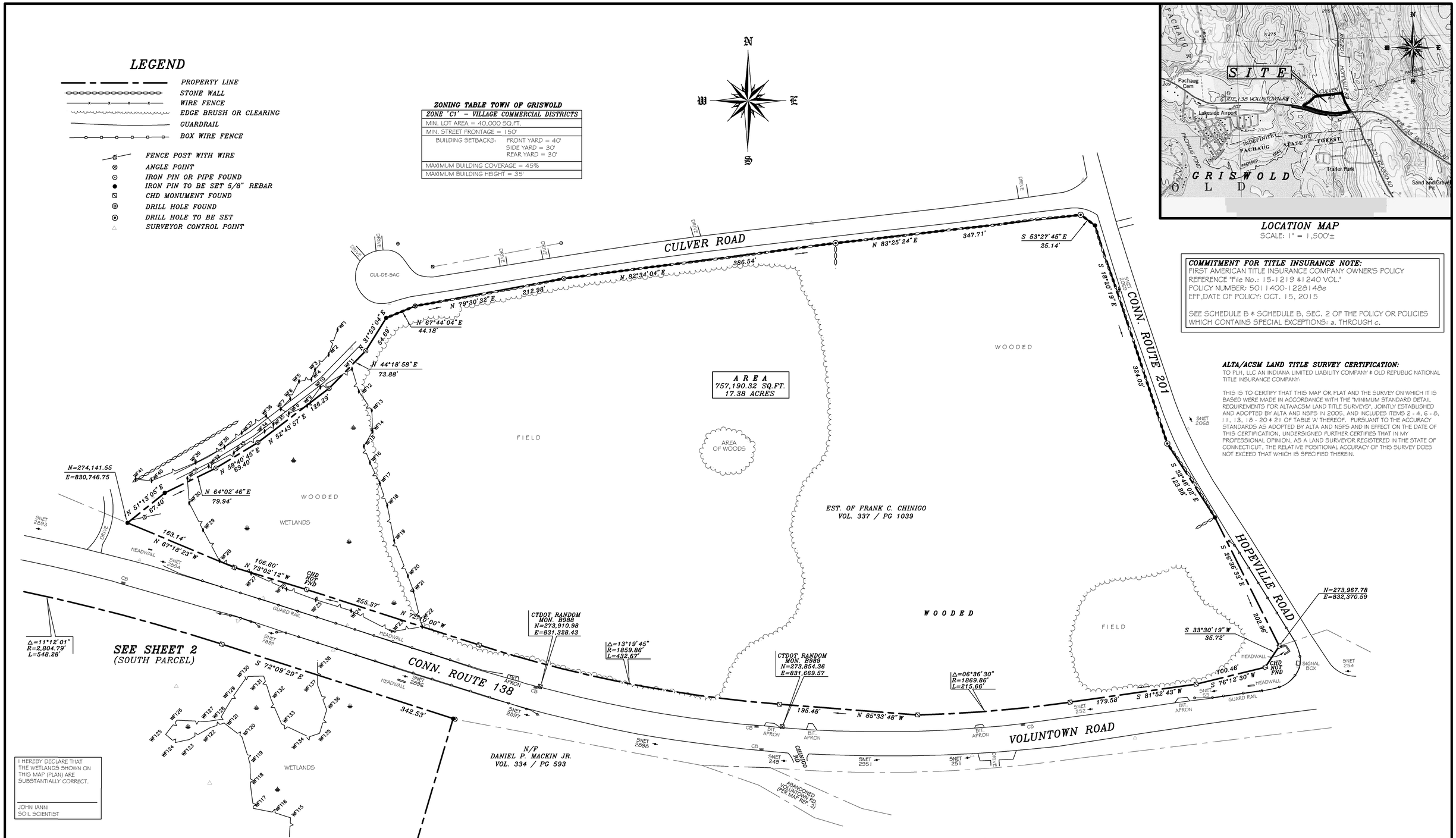
M:\6000\6100\6153 Voluntown Rd. Solar\Drawings\6153_01-COVER SHEET.dwg, 7/25/2018 10:50:01 AM, DWG To PDF.pc3

LEGEND

- PROPERTY LINE
- STONE WALL
- WIRE FENCE
- EDGE BRUSH OR CLEARING
- GUARDRAIL
- BOX WIRE FENCE
- FENCE POST WITH WIRE
- ANGLE POINT
- IRON PIN OR PIPE FOUND
- IRON PIN TO BE SET 5/8" REBAR
- CHD MONUMENT FOUND
- DRILL HOLE FOUND
- DRILL HOLE TO BE SET
- SURVEYOR CONTROL POINT

ZONING TABLE TOWN OF GRISWOLD

ZONE 'C1' – VILLAGE COMMERCIAL DISTRICTS	
MIN. LOT AREA = 40,000 SQ.FT.	
MIN. STREET FRONTAGE = 150'	
BUILDING SETBACKS:	FRONT YARD = 40' SIDE YARD = 30' REAR YARD = 30'
MAXIMUM BUILDING COVERAGE = 45%	
MAXIMUM BUILDING HEIGHT = 35'	



LOCATION MAP
SCALE: 1" = 1,500'±

COMMITMENT FOR TITLE INSURANCE NOTE:
FIRST AMERICAN TITLE INSURANCE COMPANY OWNER'S POLICY
REFERENCE "File No.: 15-1219 & 1240 VOL."
POLICY NUMBER: 5011400-1228148e
EFF.DATE OF POLICY: OCT. 15, 2015

SEE SCHEDULE B & SCHEDULE B, SEC. 2 OF THE POLICY OR POLICIES WHICH CONTAINS SPECIAL EXCEPTIONS: a. THROUGH c.

ALTA/ACSM LAND TITLE SURVEY CERTIFICATION:
TO PLH, LLC AN INDIANA LIMITED LIABILITY COMPANY & OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY:

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE "MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/ACSM LAND TITLE SURVEYS", JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS IN 2005, AND INCLUDES ITEMS 2 - 4, 6 - 8, 11, 13, 18 - 20 & 21 OF TABLE 'A' THEREOF. PURSUANT TO THE ACCURACY STANDARDS AS ADOPTED BY ALTA AND NSPS AND IN EFFECT ON THE DATE OF THIS CERTIFICATION, UNDERSIGNED FURTHER CERTIFIES THAT IN MY PROFESSIONAL OPINION, AS A LAND SURVEYOR REGISTERED IN THE STATE OF CONNECTICUT, THE RELATIVE POSITIONAL ACCURACY OF THIS SURVEY DOES NOT EXCEED THAT WHICH IS SPECIFIED THEREIN.

I HEREBY DECLARE THAT THE WETLANDS SHOWN ON THIS MAP (PLAN) ARE SUBSTANTIALLY CORRECT.

JOHN IANNI
SOIL SCIENTIST

MAP STANDARD NOTES:
1. THIS SURVEY (OR MAP) HAS BEEN PREPARED PURSUANT TO THE REGULATIONS OF CONNECTICUT STATE AGENCIES SECTIONS 20-300b-1 THRU 20-300b-20 AND THE "STANDARDS FOR SURVEYS AND MAPS IN THE STATE OF CONNECTICUT" AS ADOPTED BY THE CONNECTICUT ASSOCIATION OF LAND SURVEYORS, INC. ON SEPTEMBER 26, 1996. THE TYPE OF SURVEY IS A BOUNDARY SURVEY. BOUNDARY DETERMINATION IS BASED ON A RESURVEY OF PROPERTY AND CONFORMS TO THE 'A-2' CLASS OF ACCURACY.
2. HORIZONTAL DATUM IS BASED ON GRID NORTH, CONNECTICUT GRID SYSTEM, NAD27 (MAP REFERENCE #3).
3. TOPOGRAPHIC FEATURES WERE PREPARED IN ACCORDANCE WITH CLASS T-D PER ECOS ENGINEERS, 1 FOOT INTERVAL CONTOURS.
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6. PARCELS ARE NOT LOCATED IN A FLOOD ZONE AS DETERMINED PER THE NATIONAL FLOOD INSURANCE PROGRAM, FIRM, NEW LONDON COUNTY, MAP PANEL 233 & 234 OF 554, PANEL 0233G 4023462, MAP NO. 09011C0234G & 09011C0233G, EFF. DATES JULY 18, 2011.

GRISWOLD TOWN PARCEL REFERENCE:
TOWN OF GRISWOLD VOL. 337 / PG. 1039

MAP REFERENCES:
1. "SITE PLAN PREPARED FOR PSK REALTY, LLC, LEWIS AVENUE & LEE AVENUE, GRISWOLD, CONNECTICUT", SCALE 1" = 20', SHEET 1 OF 1, PROJ.#03-052, DATED SEPT 5, 2003 BY ADVANCED SURVEYS, LLC.
2. "PLAN MADE FOR FREDERICK SABROWSKI III, LEE AVENUE, GRISWOLD, CONN.", SCALE 1" = 20', DATED APRIL 1979 BY CHANDLER, PALMER & KING, NORWICH, CONN.
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GRAPHIC SCALE
-60' 0' 60' 120'
(IN FEET)
1 inch = 60 ft.

NO.	DATE	DESCRIPTION
1	10-14-15	POLICY # & EFF. DATE ADDED TO COMMITMENT NOTE

REVISIONS

TO MY KNOWLEDGE AND BELIEF, THIS MAP IS SUBSTANTIALLY CORRECT AS NOTED HEREON.

THIS DRAWING IS NOT VALID UNLESS IT BEARS AN ORIGINAL INK SIGNATURE AND EMBOSSED SEAL

ROBERT W. HELLSTROM, L.S. #13626

ROB HELLSTROM
LAND SURVEYING LLC
Mailing Address:
P.O. BOX 497
COLUMBIA, CT. 06237-0497
(860) 228-9853
(860) 228-1360 (FAX)
32 MAIN STREET HEBRON, CT., 06248
hellstromsurveying@yahoo.com
www.hellstromlandsurveying.com

DATE: SEPTEMBER 22, 2015

BOUNDARY SURVEY

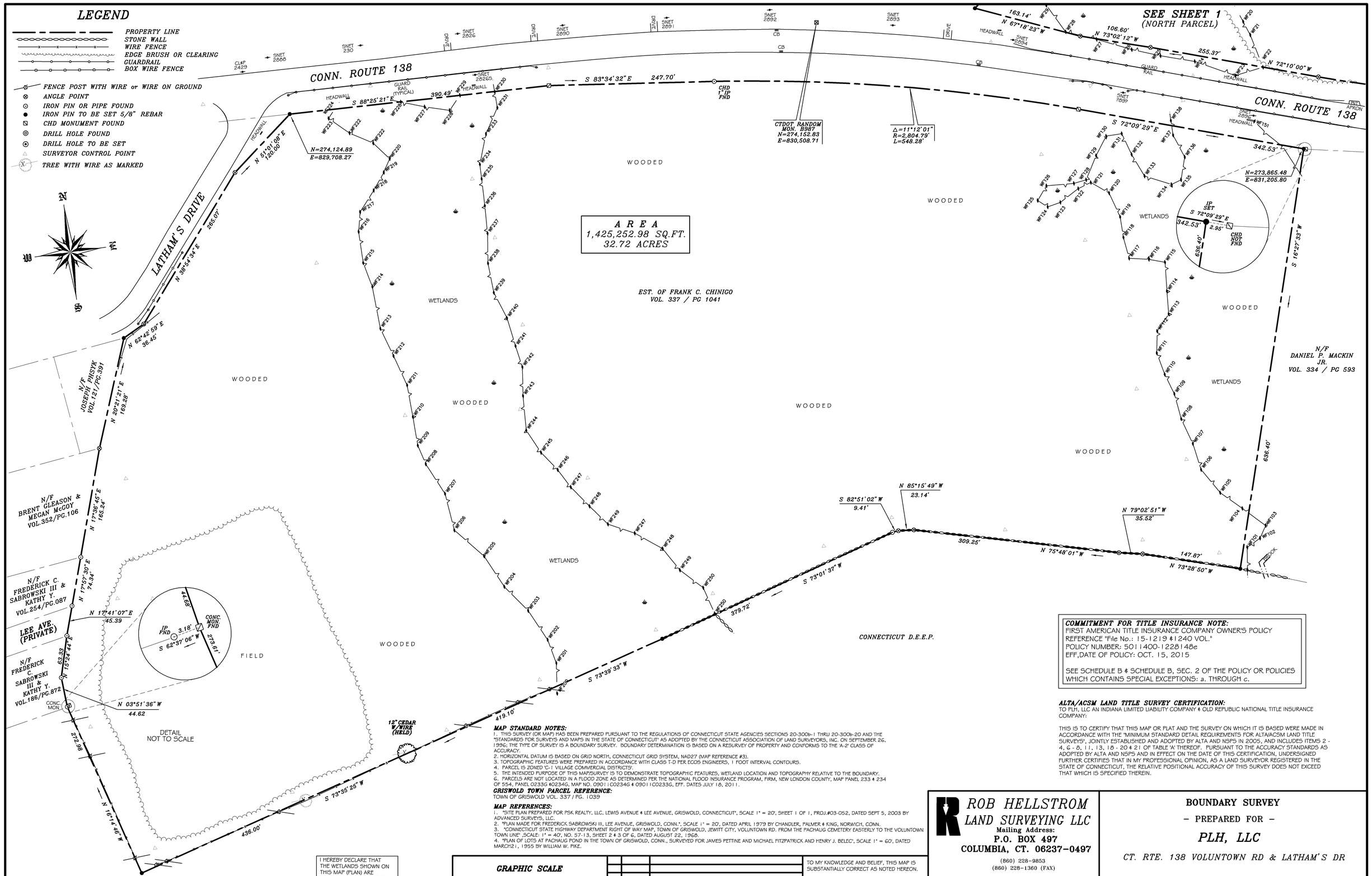
– PREPARED FOR –

PLH, LLC

CT. RTE. 138 VOLUNTOWN RD &
CT. RTE. 201 HOPEVILLE RD.

GRISWOLD CONNECTICUT

SHEET NO.:	1 OF 2	JOB NO.:	2015-067
BY: ROBIN H.	SCALE: 1" = 60'	FILE NO.:	EC15067 NORTH



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JOHN IANNI
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ROBERT W. HELLSTROM, L.S. #13626

ROB HELLSTROM
LAND SURVEYING LLC
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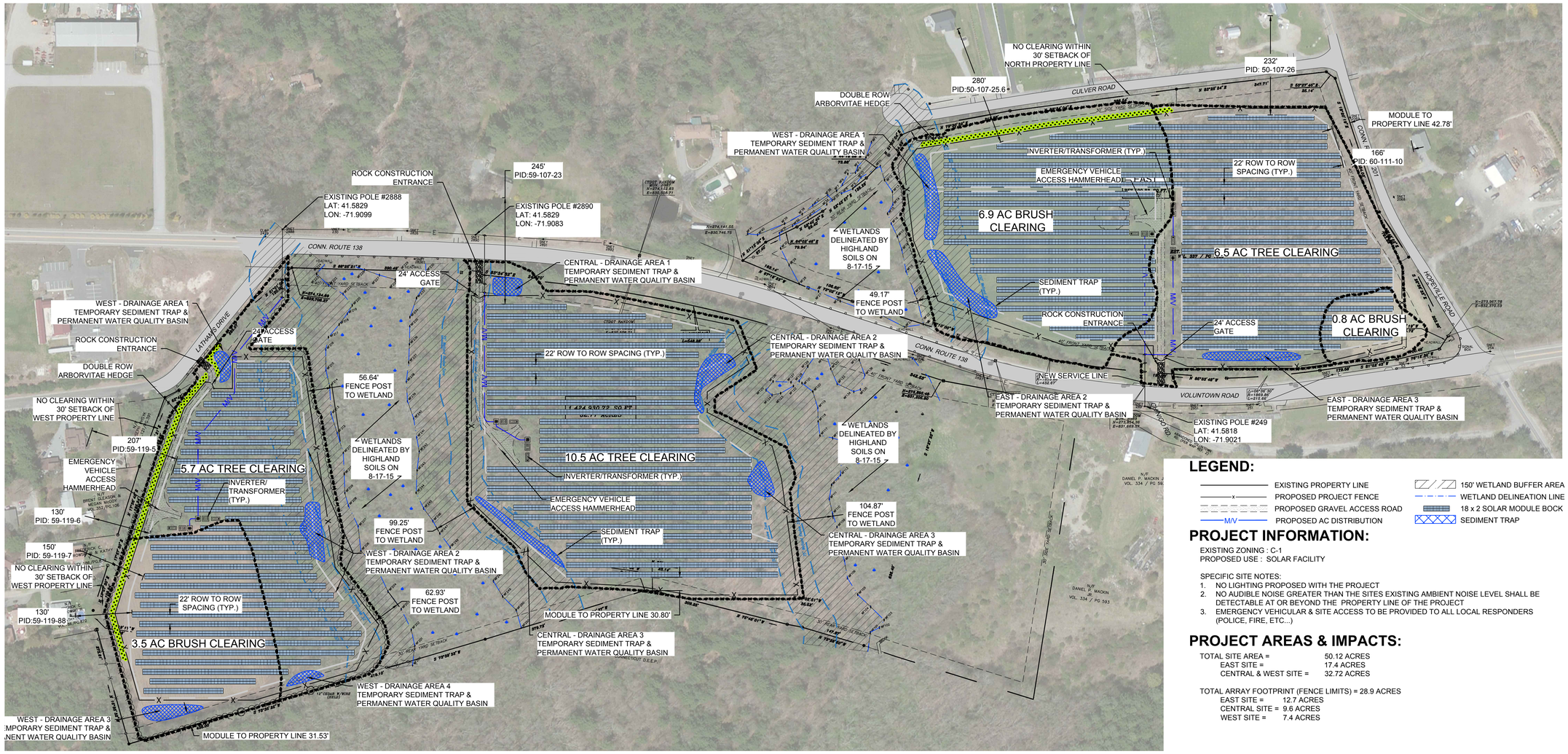
COLUMBIA, CT. 06237-0497
(860) 228-9853
(860) 228-1360 (FAX)
32 MAIN STREET HEBRON, CT., 06248
hellstromsurveying@yahoo.com
www.hellstromlandsurveying.com

BOUNDARY SURVEY
– PREPARED FOR –
PLH, LLC
CT. RTE. 138 VOLUNTOWN RD & LATHAM'S DR

GRISWOLD CONNECTICUT

DATE: SEPTEMBER 22, 2015	BY: ROBIN H.	SCALE: 1" = 60'	FILE NO.: EC15067 SOUTH
SHEET NO.: 2 OF 2			JOB NO.: 2015-067

AERIAL SITE PLAN:



LEGEND:

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

PROJECT INFORMATION:

EXISTING ZONING : C-1
PROPOSED USE : SOLAR FACILITY

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

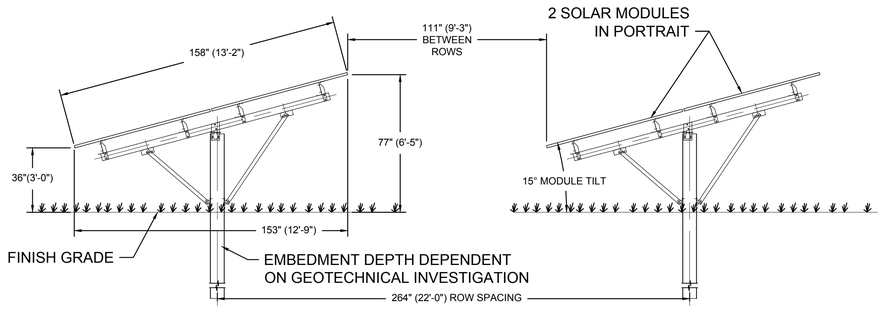
PROJECT AREAS & IMPACTS:

TOTAL SITE AREA =	50.12 ACRES
EAST SITE =	17.4 ACRES
CENTRAL & WEST SITE =	32.72 ACRES

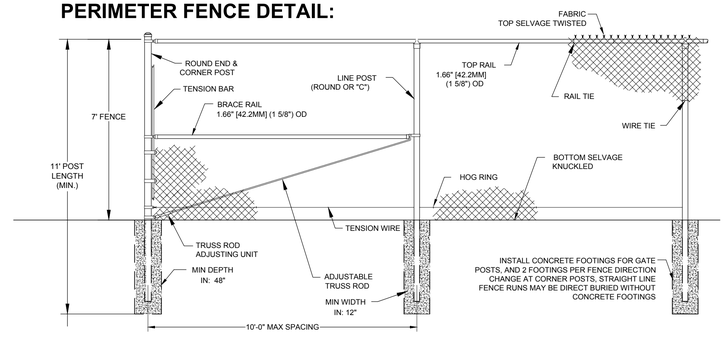
TOTAL ARRAY FOOTPRINT (FENCE LIMITS) = 28.9 ACRES

EAST SITE =	12.7 ACRES
CENTRAL SITE =	9.6 ACRES
WEST SITE =	7.4 ACRES

RACKING PROFILE DETAIL:



PERIMETER FENCE DETAIL:



No.	DATE	REVISION

CLA Engineers, Inc.
CIVIL • STRUCTURAL • SURVEYING
317 Main Street Norwich, CT 06360
(860) 886-1966 Fax (860) 886-9165

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

OVERALL SITE PLAN

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 4

CLA

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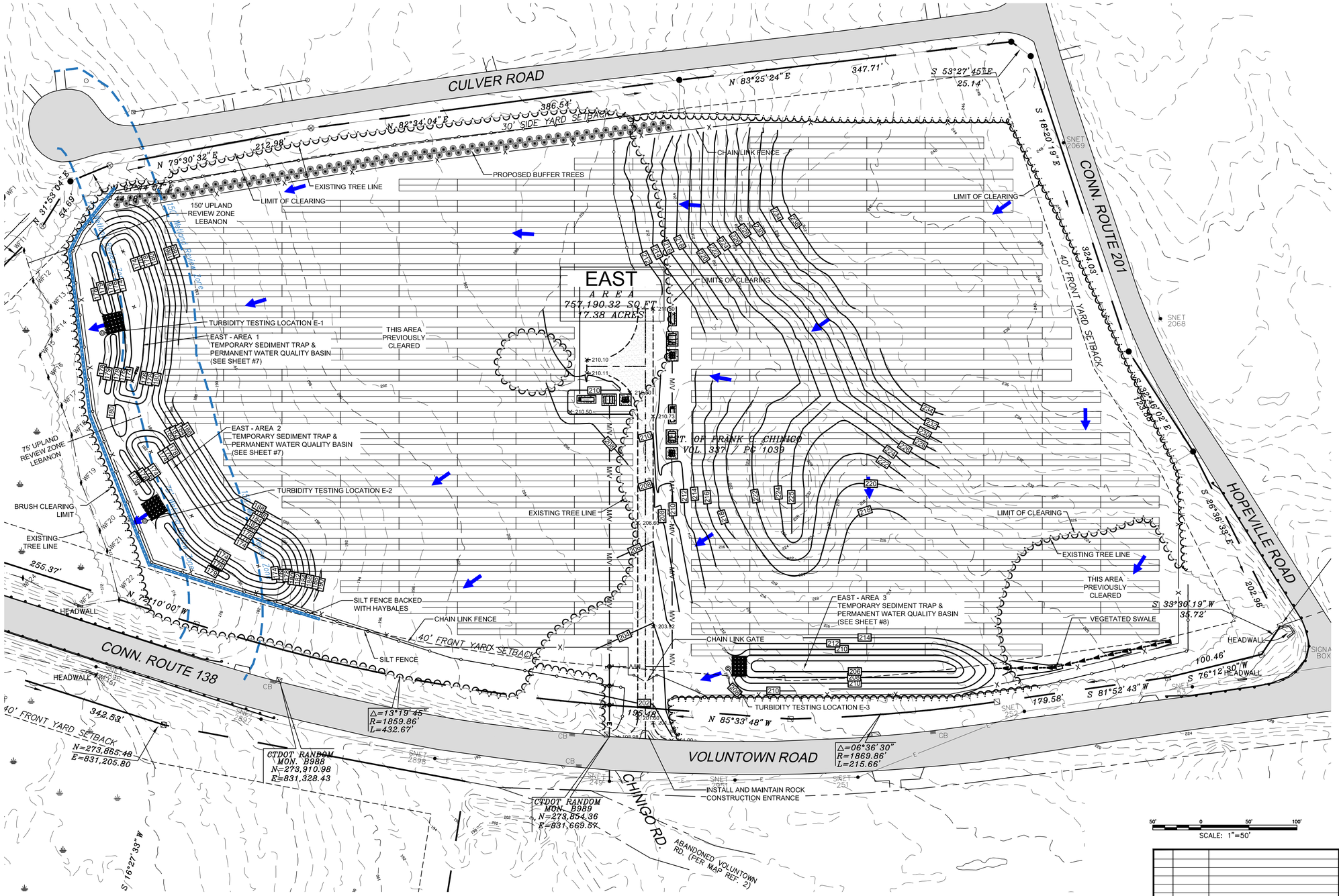

No.	DATE	REVISION

CLA Engineers, Inc.
CIVIL • STRUCTURAL • SURVEYING
317 Main Street Norwich, CT 06360
(860) 886-1966 Fax (860) 886-9165

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

EAST SITE & GRADING PLAN

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 5

CLA

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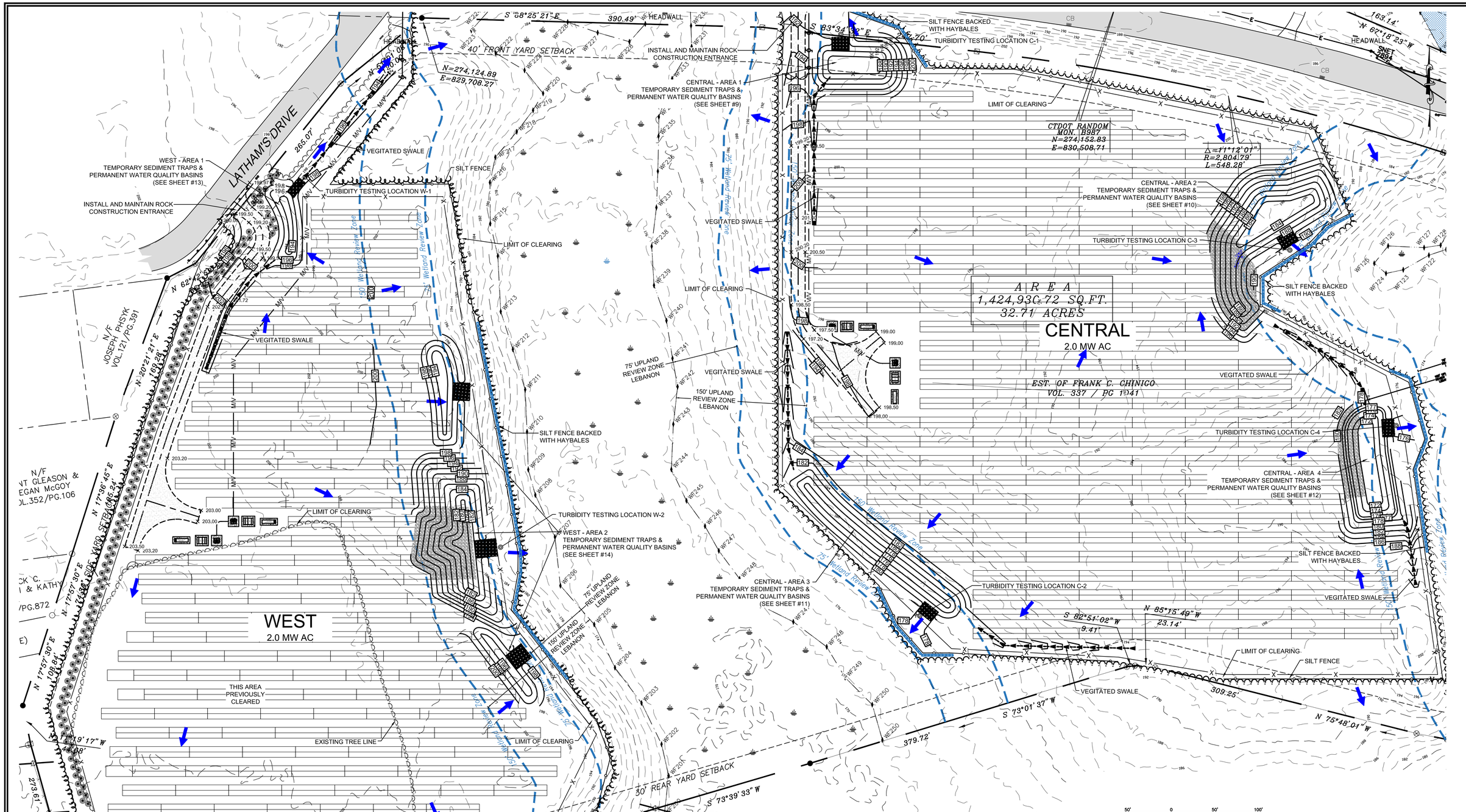

No.	DATE	REVISION

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317 Main Street Norwich, CT 06360
(860) 886-1966 Fax (860) 886-9165

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

CENTRAL & WEST SITE & GRADING PLAN

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 6

CLA

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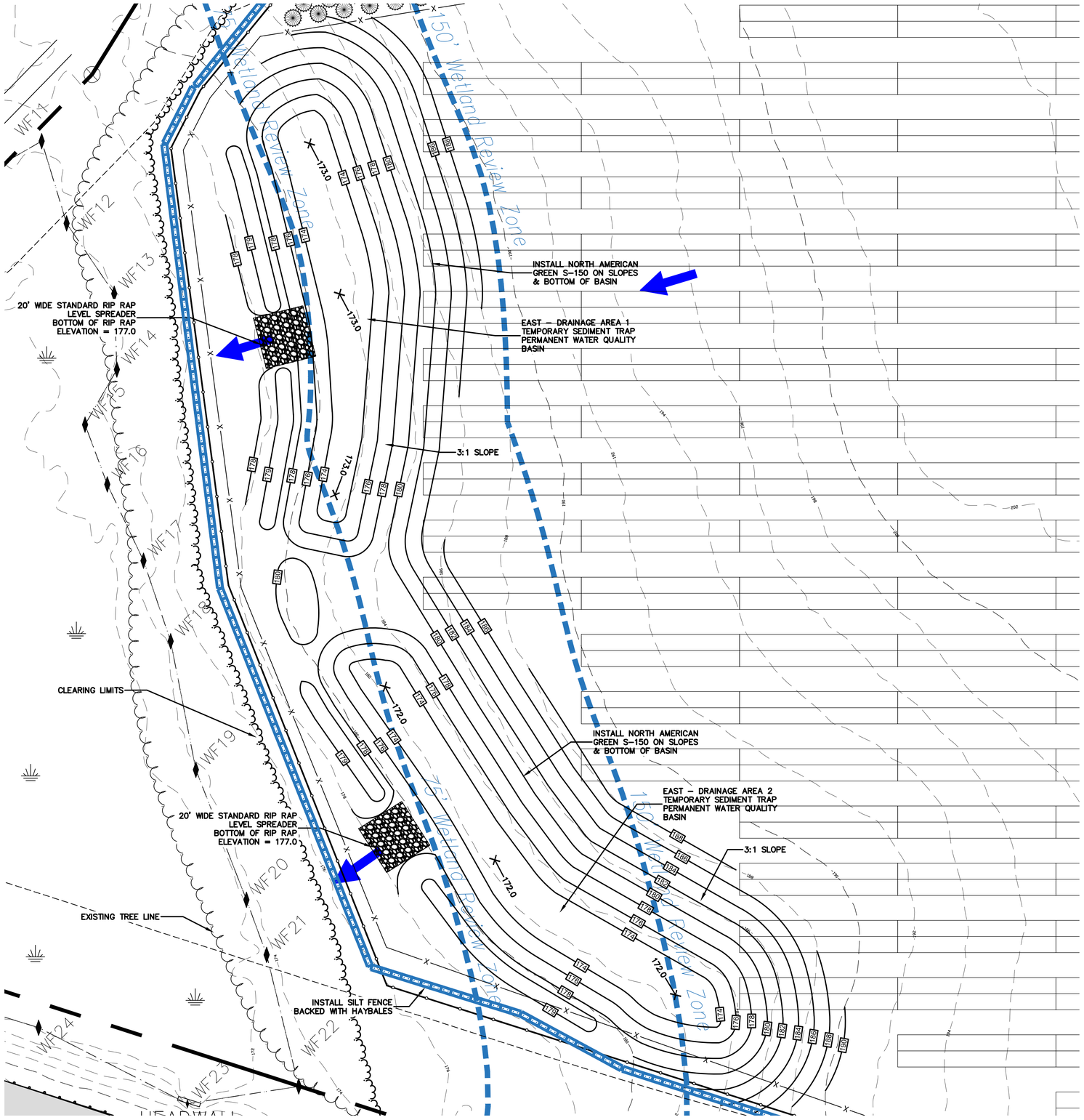
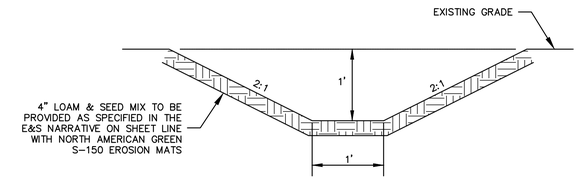
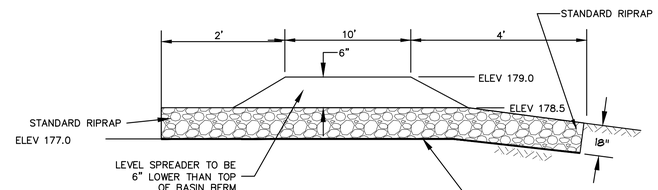




TEMPORARY VEGETATED SWALE

NOT TO SCALE



LEVEL SPREADER

NOT TO SCALE

SEED MIX FOR STORMWATER TREATMENT BASIN

THE NEW ENGLAND EROSION CONTROL/RESTORATION MIX FOR DETENTION BASINS AND MOIST SITES CONTAINS A SELECTION OF NATIVE GRASSES AND WILDFLOWERS DESIGNED TO COLONIZE RECENTLY DISTURBED SITES WHERE QUICK GROWTH OF VEGETATION IS DESIRED TO STABILIZE THE SOIL SURFACE. IT IS AN EXCELLENT SEED MIX FOR ECOLOGICALLY APPROPRIATE RESTORATIONS ON MOIST SITES THAT REQUIRE QUICK STABILIZATION AS WELL AS LONG-TERM ESTABLISHMENT OF NATIVE VEGETATION. THIS MIX IS PARTICULARLY APPROPRIATE FOR DETENTION BASIS THAT DO NOT NORMALLY HOLD STANDING WATER. SOME PLANTS IN THIS MIX CAN TOLERATE INFREQUENT INUNDATION, BUT NOT CONSTANT FLOODING.

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APPLICATION RATE: 35 LBS/ACRE (1250 SQ. FT./LB.)

SPECIES *: SWITCHGRASS (PANICUM VIRGATUM), VIRGINIA WILD RYE (ELYMUS VIRGINICUS), CREEPING RED FESCUE (FESTUCA RUBRA), FOX SEDGE (CAREX VULPINOIDEA), CREEPING BENTGRASS (AGROSTIS STOLONIFERA), SOFT RUSH (JUNCUS EFFUSUS), NEW ENGLAND ASTER (ASTER NOVAE-ANGLIAE), GRASS-LEAVED GOLDENROD (EUTHAMIA GRAMINIFOLIA), GREEN BULRUSH (SCIRPUS ATROVIRENS), BONESET (EUPATORIUM PERFOLIATUM), BLUE VERVAIN (VERBENA HASTATA) UPLAND BENTGRASS (AGROSTIS PERENNANS), BIG BLUESTEM, NIAGRA (ANDROPOGON GERARDII), SENSITIVE FERN (ONOCLEA SENSIBILIS), LITTLE BLUESTEM (SCHIZACHYRIUM SCOPARIUM), WOOLGRASS (SCIRPUS CYPERINUS).

20' 0 20' 40'

SCALE: 1"=20'

No.	DATE	REVISION

CLA Engineers, Inc.
CIVIL • STRUCTURAL • SURVEYING
317 Main Street Norwich, CT 06360
(860) 886-1966 Fax (860) 886-9165

STATE OF CONNECTICUT
MICHAEL A. BUSHNELL
No. 18104
LICENSED PROFESSIONAL ENGINEER

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

EAST - DRAINAGE AREA 1&2
TEMPORARY SEDIMENT TRAP
PERMANENT WATER QUALITY BASIN

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 7

CLA

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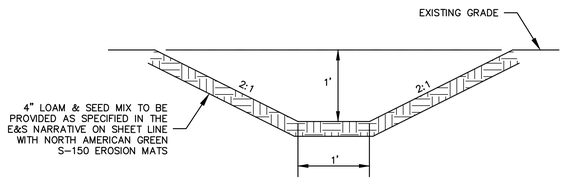

TEMPORARY VEGETATED SWALE

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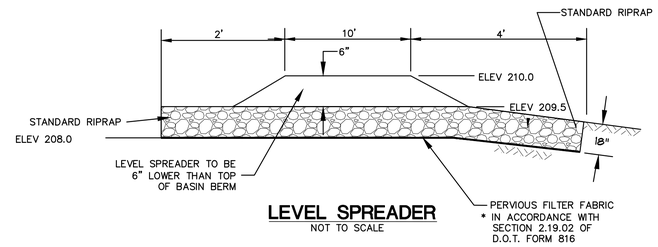

LEVEL SPREADER

NOT TO SCALE

SEED MIX FOR STORMWATER TREATMENT BASIN

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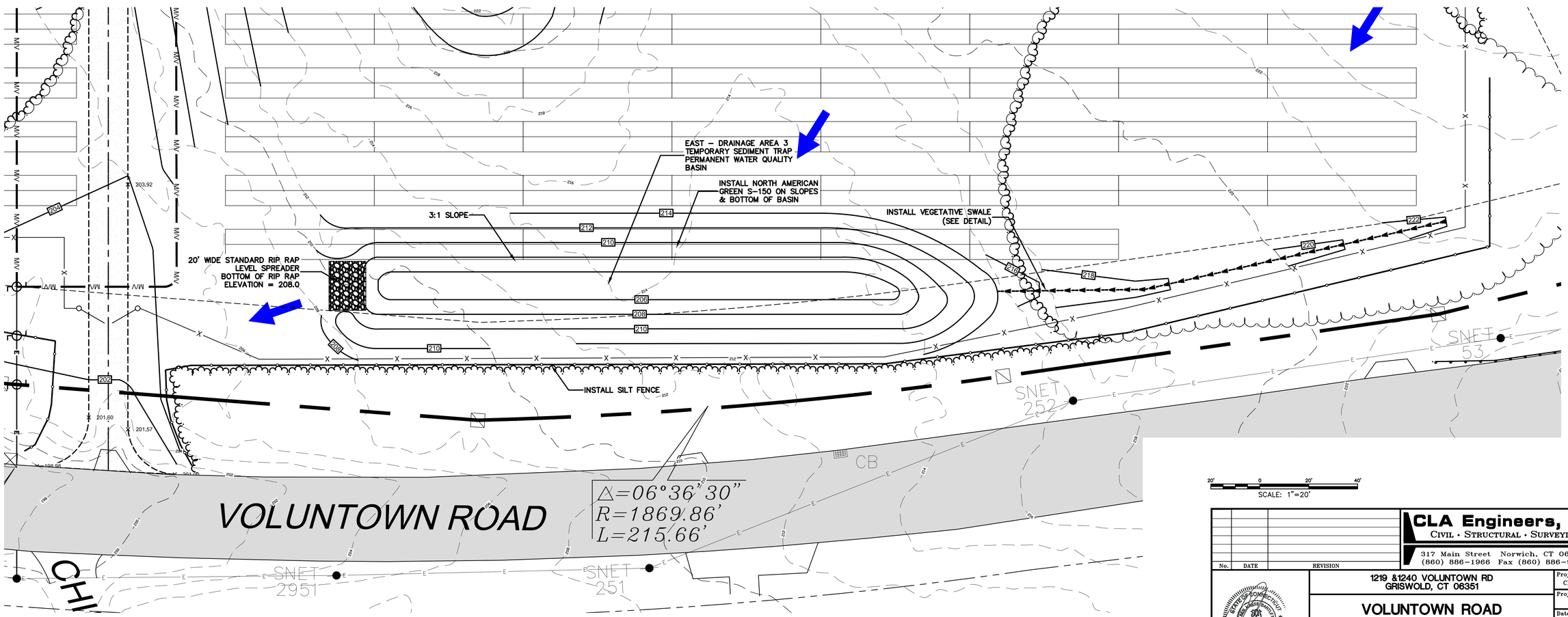

No.	DATE	REVISION

CLA Engineers, Inc.
CIVIL • STRUCTURAL • SURVEYING
317 Main Street Norwich, CT 06360
(860) 886-1966 Fax (860) 886-9165

STATE OF CONNECTICUT LICENSED PROFESSIONAL ENGINEER

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

EAST - DRAINAGE AREA 3
TEMPORARY SEDIMENT TRAP
PERMANENT WATER QUALITY BASIN

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 8

CLA

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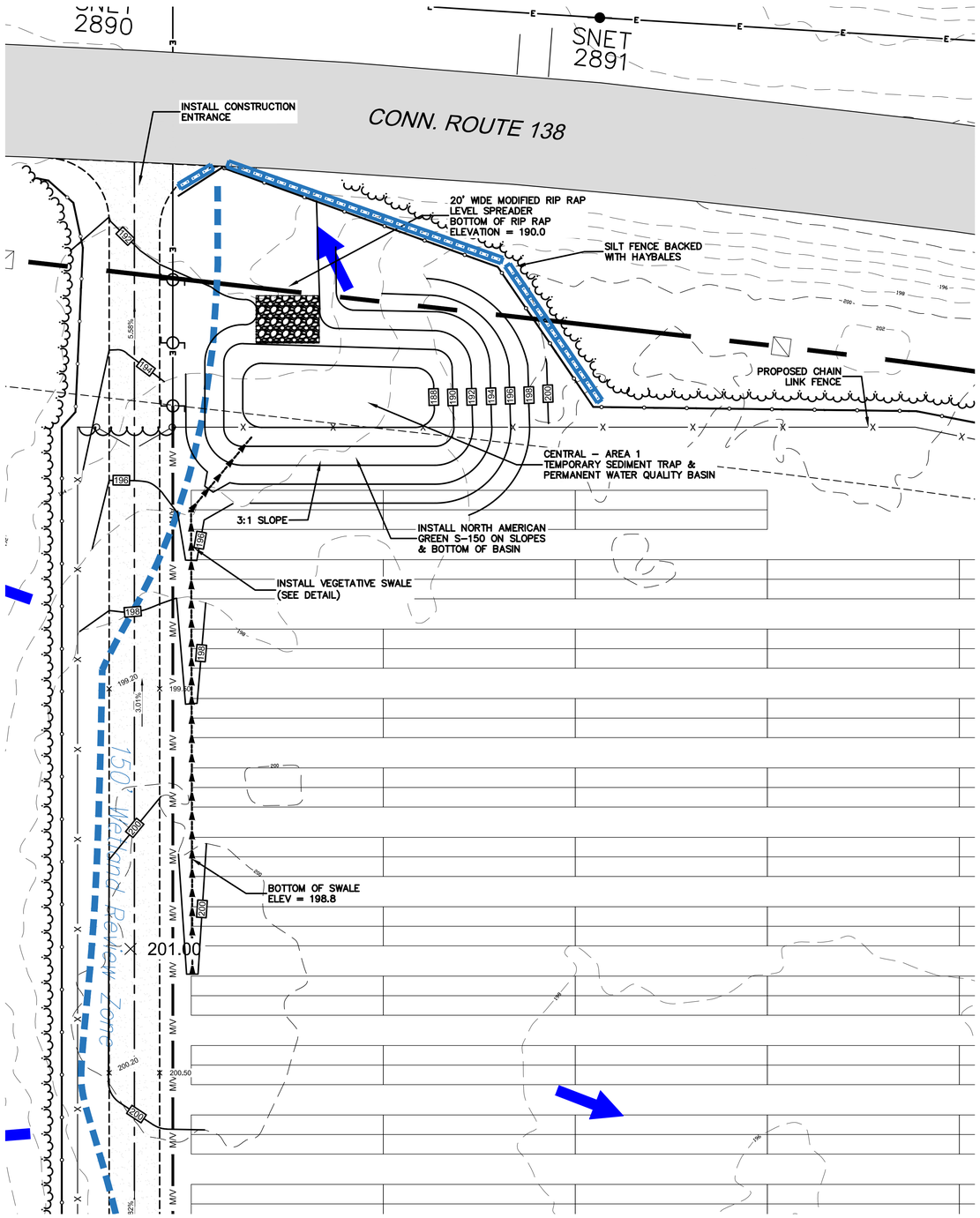
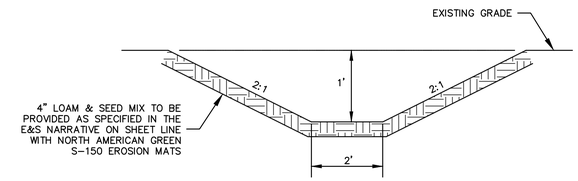
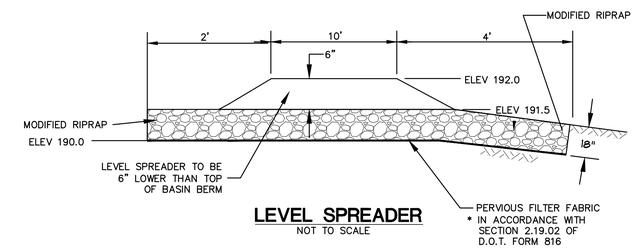




TEMPORARY VEGETATED SWALE

NOT TO SCALE



LEVEL SPREADER

NOT TO SCALE

SEED MIX FOR STORMWATER TREATMENT BASIN

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50' 0 50' 100'

SCALE: 1"=50'

No.	DATE	REVISION

CLA Engineers, Inc.
CIVIL • STRUCTURAL • SURVEYING
317 Main Street Norwich, CT 06360
(860) 886-1966 Fax (860) 886-9165

STATE OF CONNECTICUT ★ ERIC BRUCE BERTRAM ★ 29-0034 ★ LICENSED PROFESSIONAL ENGINEER

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

CENTRAL - DRAINAGE AREA 1
TEMPORARY SEDIMENT TRAP
PERMANENT WATER QUALITY BASIN

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 9

CLA

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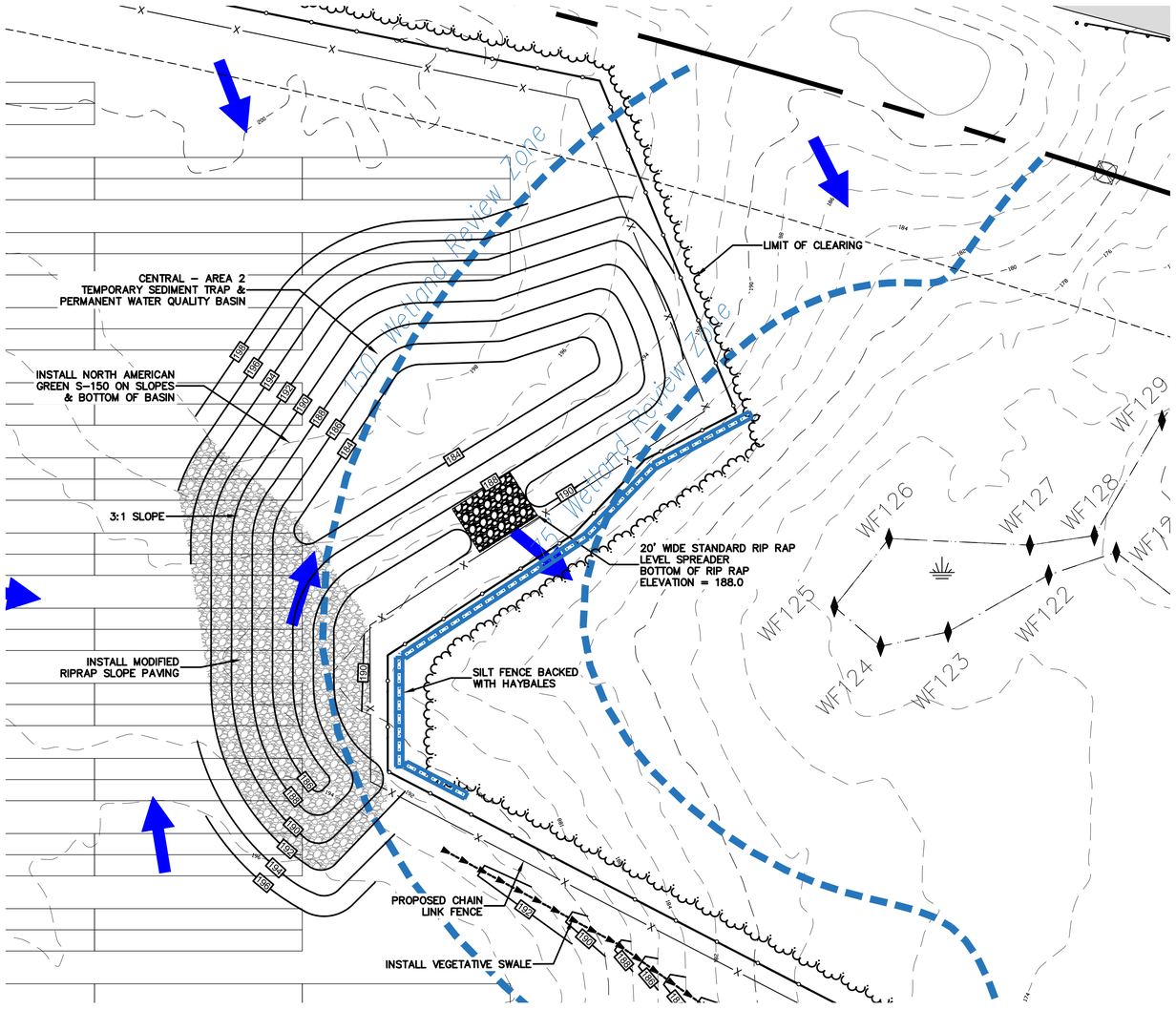
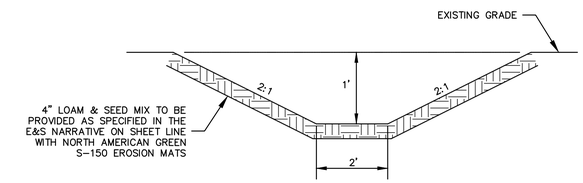
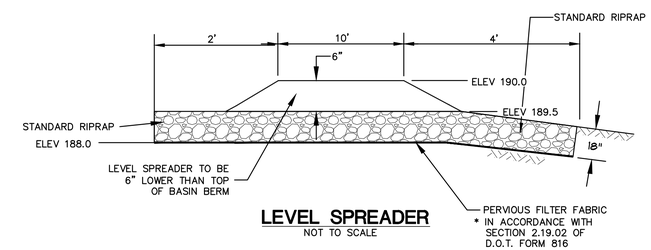




TEMPORARY VEGETATED SWALE

NOT TO SCALE



LEVEL SPREADER

NOT TO SCALE

SEED MIX FOR STORMWATER TREATMENT BASIN

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50' 0 50' 100'

SCALE: 1"=50'

No.	DATE	REVISION

CLA Engineers, Inc.
CIVIL • STRUCTURAL • SURVEYING
317 Main Street Norwich, CT 06360
(860) 886-1966 Fax (860) 886-9165

STATE OF CONNECTICUT
ASSOCIATE
REGISTERED
PROFESSIONAL ENGINEER

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

CENTRAL - DRAINAGE AREA 2
TEMPORARY SEDIMENT TRAP
PERMANENT WATER QUALITY BASIN

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 10

CLA

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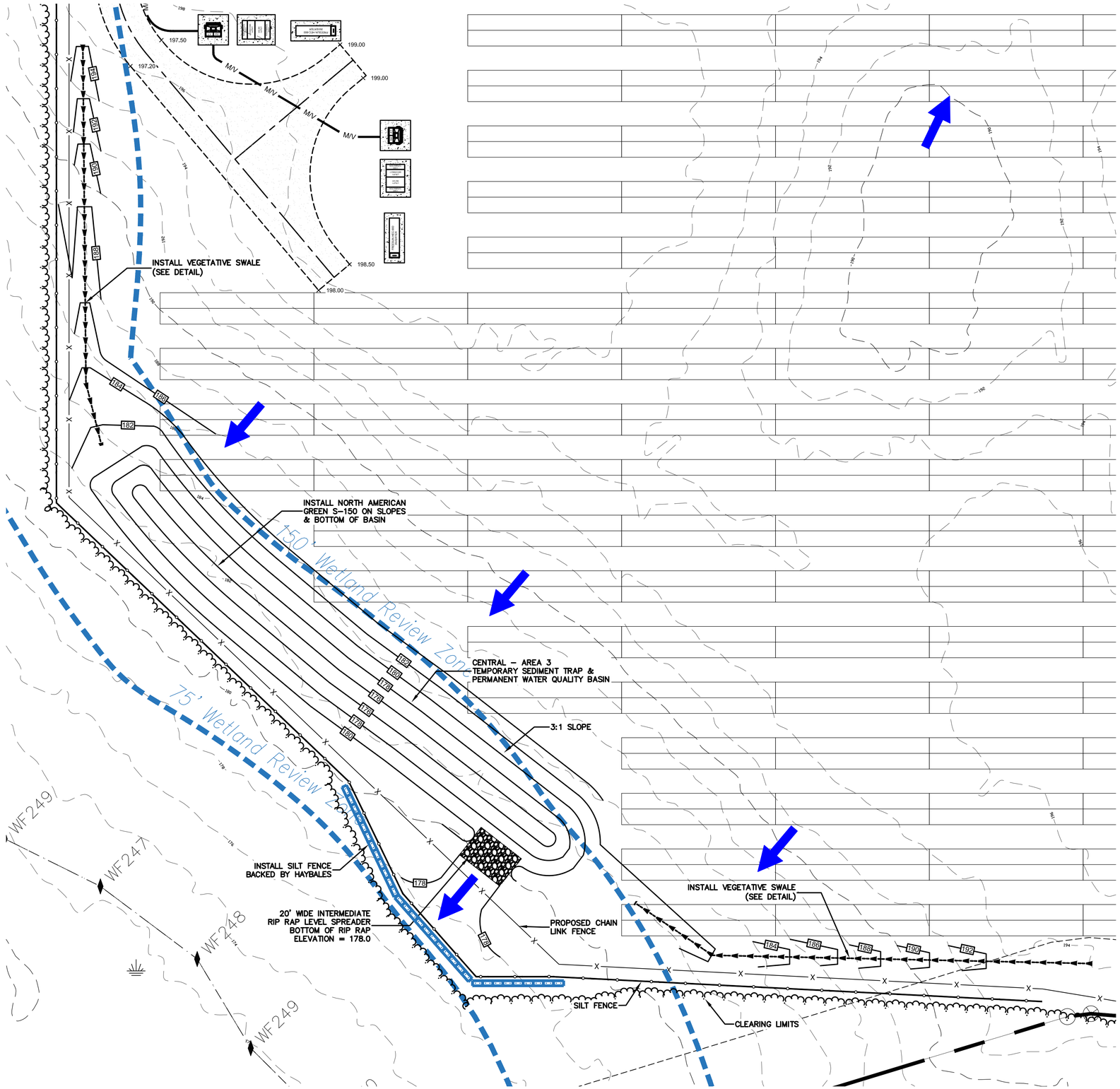
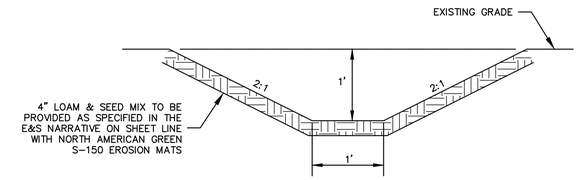
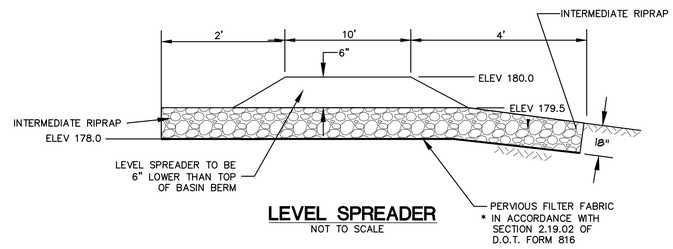




TEMPORARY VEGETATED SWALE

NOT TO SCALE



LEVEL SPREADER

NOT TO SCALE

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50' 0 50' 100'

SCALE: 1"=50'

No.	DATE	REVISION

CLA Engineers, Inc.
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317 Main Street Norwich, CT 06360
(860) 886-1966 Fax (860) 886-9165

STATE OF CONNECTICUT ELIZABETH BETTIOL 27194 REGISTERED PROFESSIONAL ENGINEER

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

CENTRAL - DRAINAGE AREA 3
TEMPORARY SEDIMENT TRAP
PERMANENT WATER QUALITY BASIN

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 11

CLA

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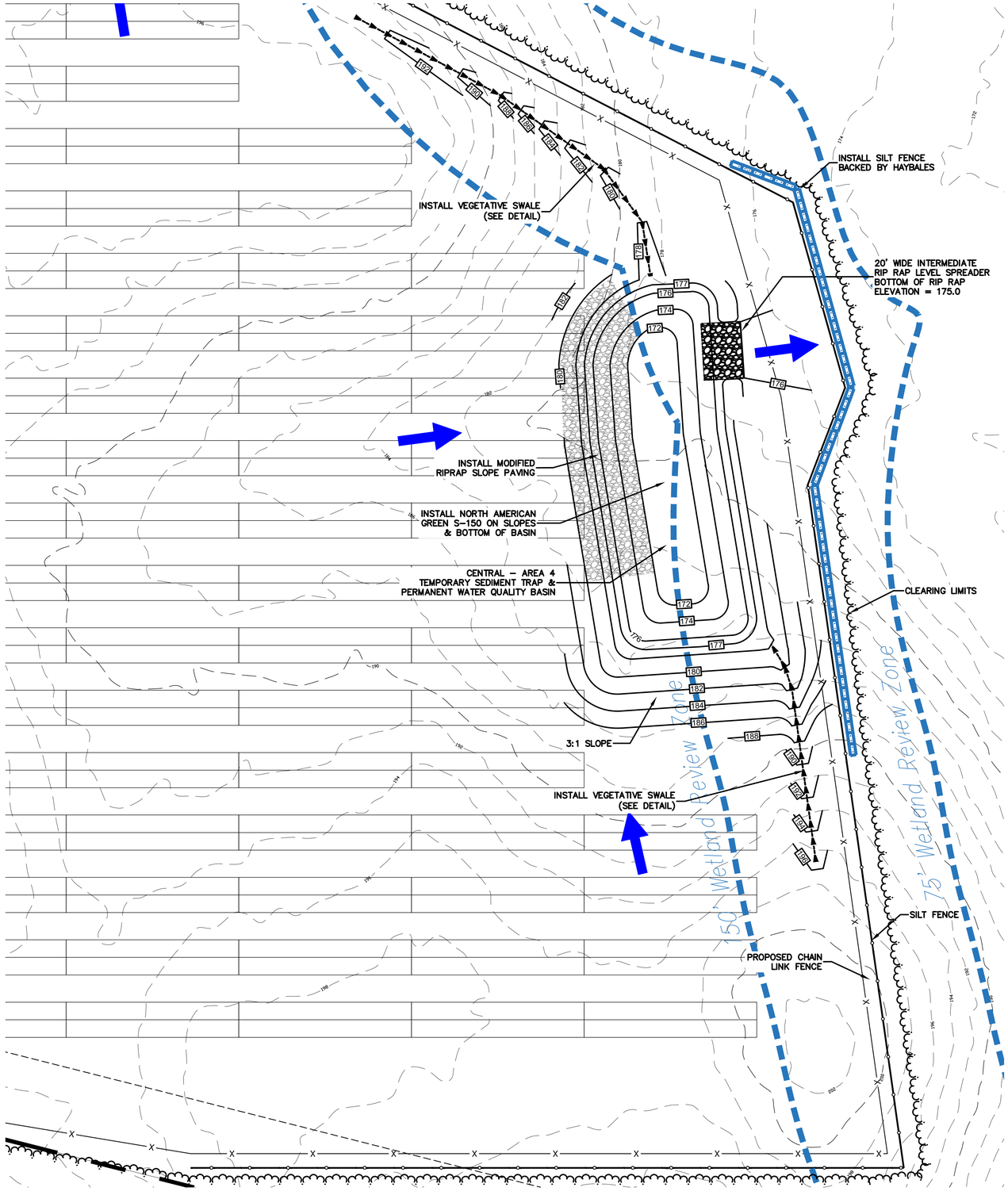
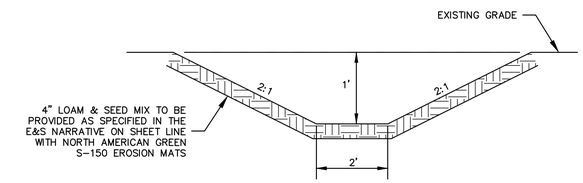
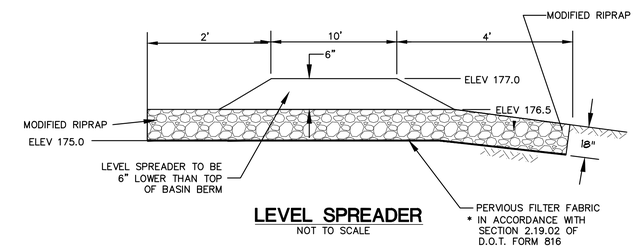




TEMPORARY VEGETATED SWALE

NOT TO SCALE



LEVEL SPREADER

NOT TO SCALE

SEED MIX FOR STORMWATER TREATMENT BASIN

THE NEW ENGLAND EROSION CONTROL/RESTORATION MIX FOR DETENTION BASINS AND MOIST SITES
CONTAINS A SELECTION OF NATIVE GRASSES AND WILDFLOWERS DESIGNED TO COLONIZE RECENTLY DISTURBED SITES WHERE QUICK GROWTH OF VEGETATION IS DESIRED TO STABILIZE THE SOIL SURFACE. IT IS AN EXCELLENT SEED MIX FOR ECOLOGICALLY APPROPRIATE RESTORATIONS ON MOIST SITES THAT REQUIRE QUICK STABILIZATION AS WELL AS LONG–TERM ESTABLISHMENT OF NATIVE VEGETATION. THIS MIX IS PARTICULARLY APPROPRIATE FOR DETENTION BASIS THAT DO NOT NORMALLY HOLD STANDING WATER. SOME PLANTS IN THIS MIX CAN TOLERATE INFREQUENT INUNDATION, BUT NOT CONSTANT FLOODING.

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APPLICATION RATE: 35 LBS/ACRE (1250 SQ. FT./LB.)

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50' 0 50' 100'
SCALE: 1"=50'

No.	DATE	REVISION

CLA Engineers, Inc.
CIVIL • STRUCTURAL • SURVEYING
317 Main Street Norwich, CT 06360
(860) 886–1966 Fax (860) 886–9165

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

CENTRAL - DRAINAGE AREA 4
TEMPORARY SEDIMENT TRAP
PERMANENT WATER QUALITY BASIN

Project No. CLA–6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 12

CLA

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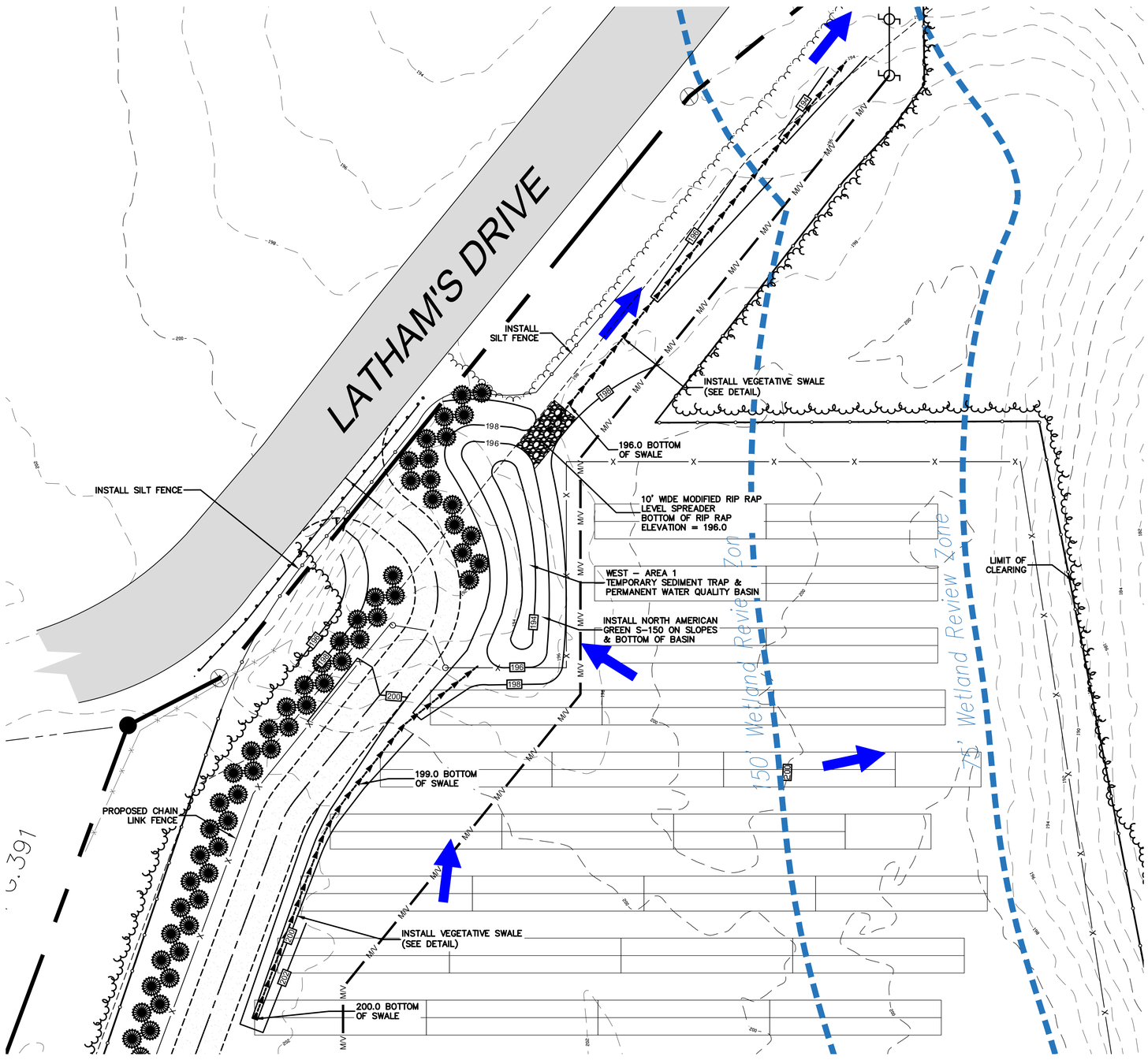

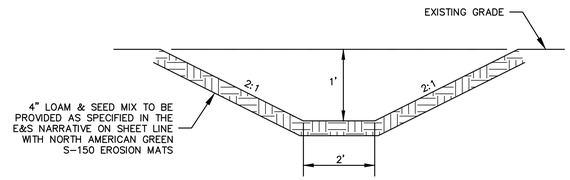

TEMPORARY VEGETATED SWALE

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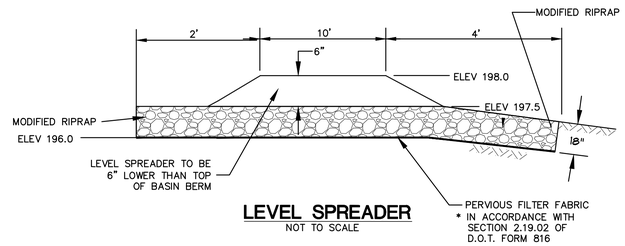

LEVEL SPREADER

NOT TO SCALE

SEED MIX FOR STORMWATER TREATMENT BASIN

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40' 0 20' 40'

SCALE: 1"=20'

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1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

WEST - DRAINAGE AREA 1
TEMPORARY SEDIMENT TRAP
PERMANENT WATER QUALITY BASIN

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 13

CLA

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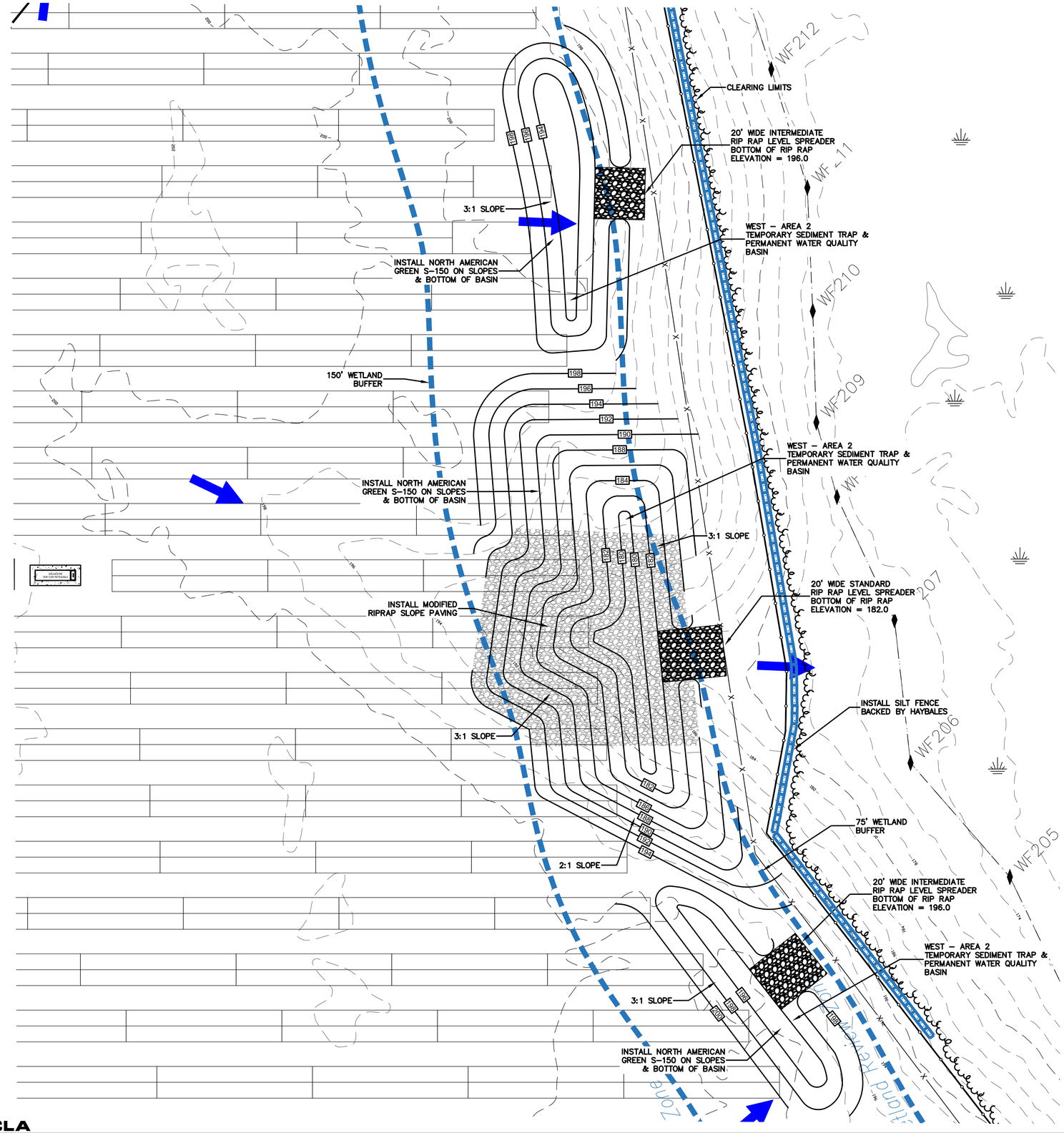

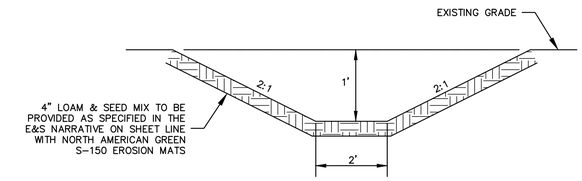

TEMPORARY VEGETATED SWALE

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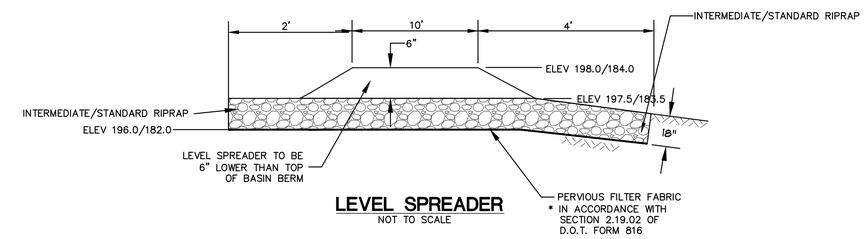

LEVEL SPREADER

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40' 0 20' 40'
SCALE: 1"=20'

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GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

WEST - DRAINAGE AREA 2
TEMPORARY SEDIMENT TRAP
PERMANENT WATER QUALITY BASIN

STATE OF CONNECTICUT
ERIC A. BERGERON
LICENSED PROFESSIONAL ENGINEER
No. 19184
PROFESSIONAL ENGINEER

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 14

CLA

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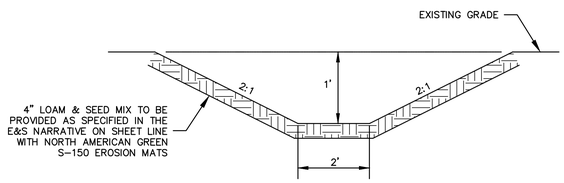

TEMPORARY VEGETATED SWALE

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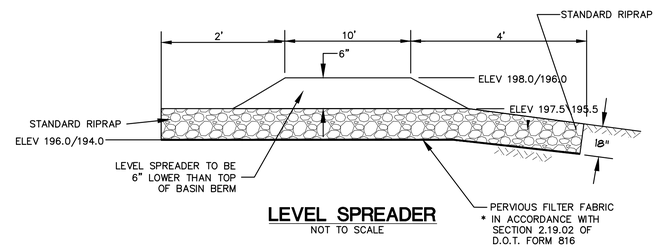

LEVEL SPREADER

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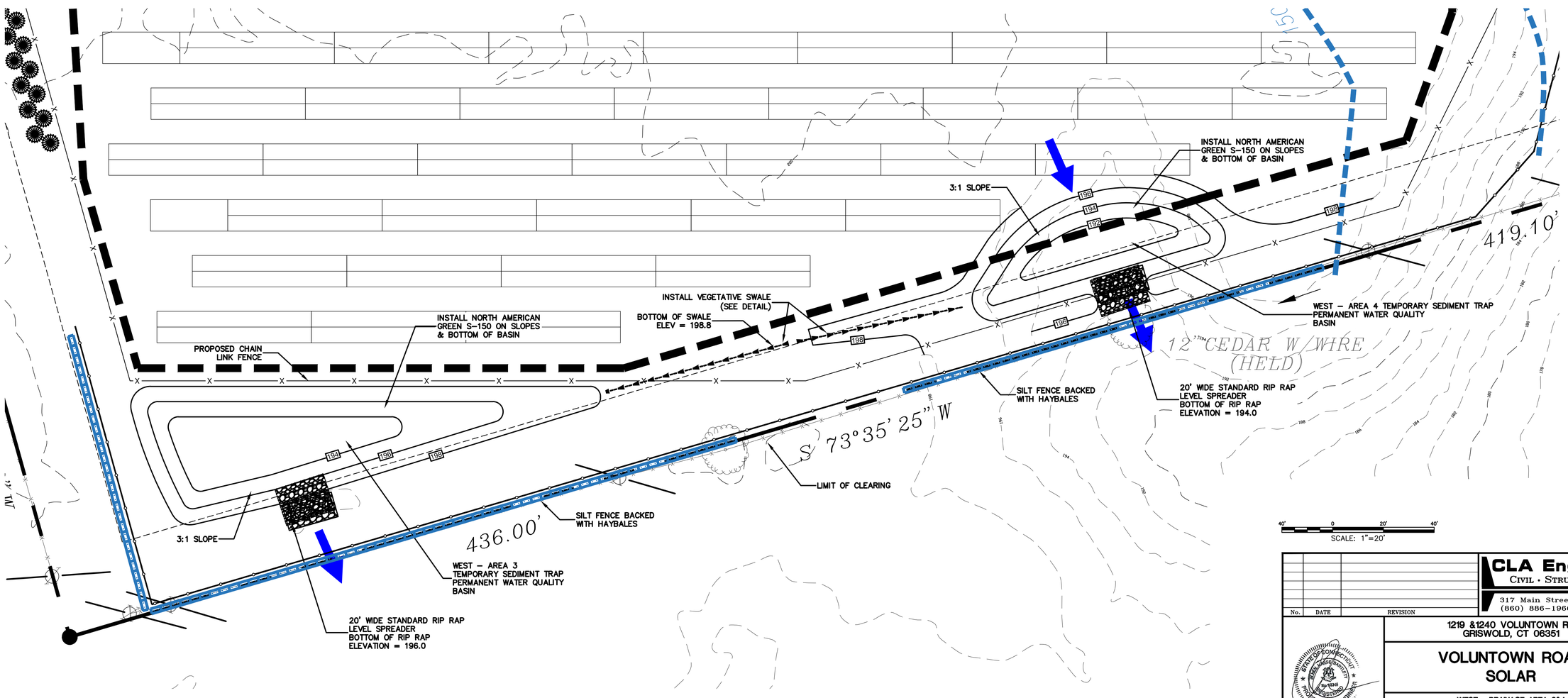

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317 Main Street Norwich, CT 06360
(860) 886-1966 Fax (860) 886-9165

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

WEST - DRAINAGE AREA 3&4
TEMPORARY SEDIMENT TRAP
PERMANENT WATER QUALITY BASIN

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 15

CLA

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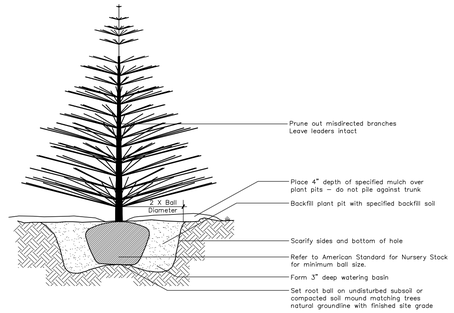
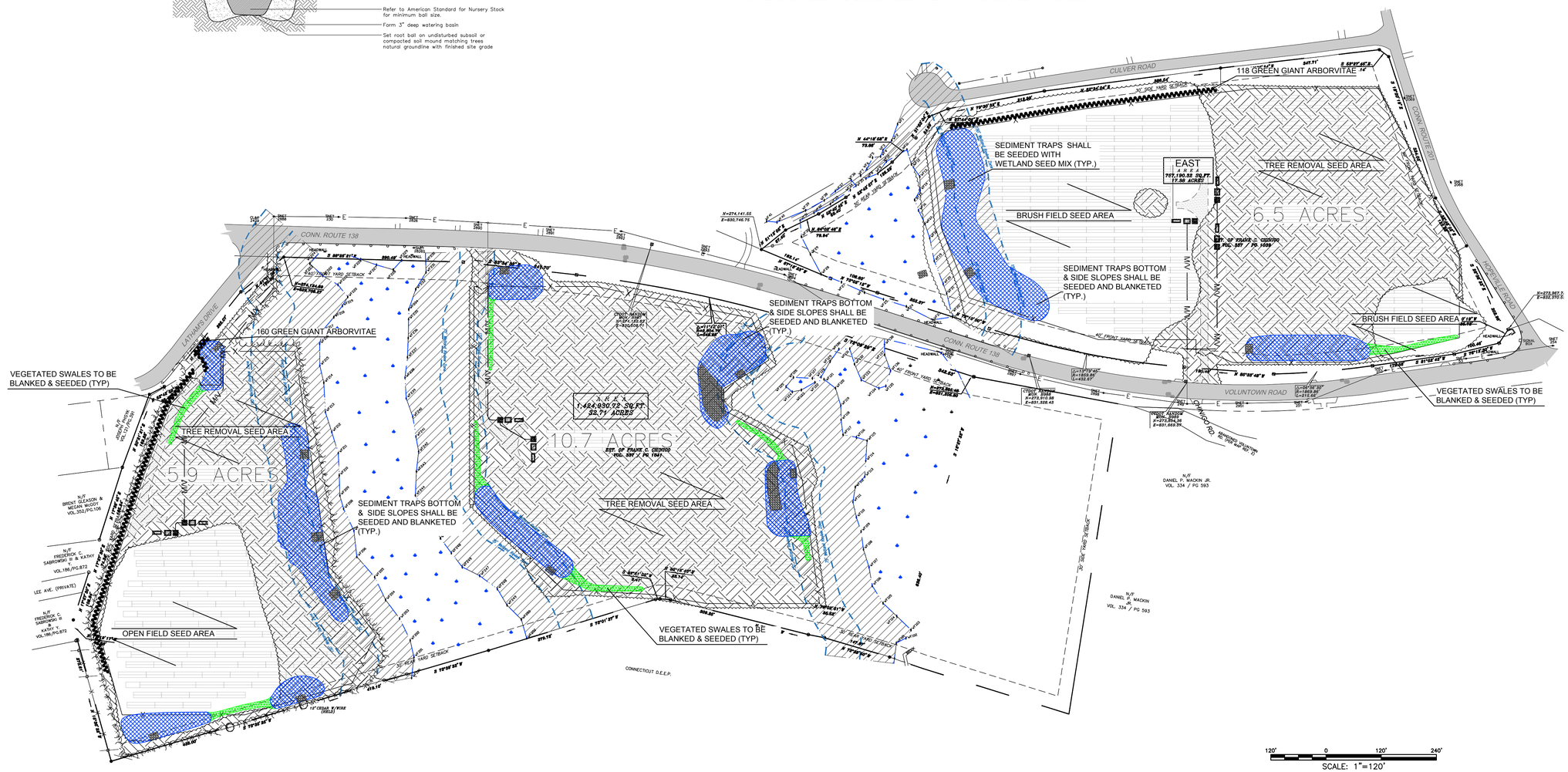
ARBORVITAE TREE DETAIL



SEEDING NOTES:

1. THE CONTRACTOR SHALL SEED ALL DISTURBED AREAS ASSOCIATED WITH TREE REMOVAL AND SITE CLEARING. CONTRACTOR SHALL A INSTALL A 50% / 50% CLOVER / FESCUE MIX OR ENGINEER APPROVED ALTERNATE SEED MIXTURE. TOTAL TREE REMOVAL AREA IS APPROXIMATELY 22 ACRES.
2. SEDIMENT TRAPS BOTTOM AND SIDE SLOPES SHALL BE SEEDED WITH THE NEW ENGLAND EROSION CONTROL/RESTORATION MIX FOR DETENTION BASIN AND MOIST SITES. CONTRACTOR TO PROVIDED SEED MIXTURE TO ENGINEER PRIOR TO SEEDING BASINS. TOTAL BASIN WETLAND SEED AREA IS APPROXIMATELY 1 ACRE.
3. ALL SEDIMENT TRAP BOTTOM AND SIDE SLOPES SHALL BE SEEDED AND BLANKETED.
4. OPEN FIELD AND BRUSH FIELD SEED AREAS SHALL BE SEEDED IN GRUBBED AREAS, A FULL 100% SEED OF THE AREA WILL LIKELY NOT BE REQUIRED. TOTAL OPEN FIELD AND BRUSH FIELD AREA IS APPROXIMATELY 10 ACRES.



SCALE: 1"=120'

No.	DATE	REVISION

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(860) 886-1966 Fax (860) 886-9165

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD SOLAR

LANDSCAPE PLAN

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 16

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ROAD DESIGN PARAMETERS

1. ROAD MAINTENANCE CAN BE EXPECTED OVER THE LIFE OF THE PERMANENT FACILITY.

SPECIAL PROVISIONS FOR GRADING AND EROSION CONTROL

THE CONTRACTOR SHALL PROVIDE EROSION CONTROL MEASURES AS PLANNED AND SPECIFIED FOLLOWING BEST MANAGEMENT PRACTICES AS OUTLINED BY THE STATE OF CONNECTICUT AND BEING IN CONFORMANCE WITH THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) GENERAL STORMWATER PERMIT. SEE THE STORMWATER POLLUTION CONTROL PLAN (SWPCP) FOR EROSION CONTROL AND RESTORATION SPECIFICATIONS. UNLESS OTHERWISE NOTED OR MODIFIED HEREIN, ALL SECTIONS OF THE GENERAL CONDITIONS SHALL APPLY.

EXECUTION

1. CLEARING AND GRUBBING
   A. THE CONTRACTOR SHALL BE REQUIRED TO REMOVE ALL TREES, STUMPS, BRUSH, AND DEBRIS WITHIN THE GRADING LIMITS SHOWN ON THE PLANS. THE CONTRACTOR IS TO REMOVE ONLY THOSE TREES WHICH ARE DESIGNATED BY THE OWNER'S REPRESENTATIVE FOR REMOVAL, AND SHALL EXERCISE EXTREME CARE AROUND EXISTING TREES TO BE SAVED.
2. TOPSOIL STRIPPING
   A. TOPSOIL SHALL BE STRIPPED FROM ALL ROADWAY AREAS THROUGH THE ROOT ZONE. TOPSOIL SHALL NOT BE STRIPPED OUTSIDE OF THE DESIGNATED DISTURBANCE AREAS.
   B. ANY TOPSOIL, THAT HAS BEEN STRIPPED, SHALL BE RE-SPREAD OR STOCKPILED WITHIN GRADING AREAS AND/OR USED AS FILL OUTSIDE OF THE DISTURBANCE AREAS, AS DIRECTED BY THE ENGINEER.
3. EMBANKMENT CONSTRUCTION.
   A. EMBANKMENT CONSTRUCTION SHALL CONSIST OF THE PLACING OF SUITABLE FILL MATERIAL, AFTER TOPSOIL STRIPPING, ABOVE THE EXISTING GRADE. GENERALLY, EMBANKMENTS SHALL HAVE COMPACTED SUPPORT SLOPES OF TWO AND A HALF FEET HORIZONTAL TO ONE FOOT VERTICAL. THE MATERIAL FOR EMBANKMENT CONSTRUCTION SHALL BE OBTAINED FROM THE ACCESS ROAD EXCAVATION (SEE GEOTECHNICAL REPORT FOR RESTRICTIONS), OR ANY SUITABLE, APPROVED SOIL OBTAINED OFFSITE BY CONTRACTOR, AS DIRECTED OR APPROVED BY THE ENGINEER. THIS MATERIAL SHALL BE PLACED IN LIFTS NOT TO EXCEED 9".
   B. SIDE SLOPES GREATER THAN 2.5:1 WILL NOT BE PERMITTED, UNLESS OTHERWISE NOTED ON THE PLAN.

TESTING REQUIREMENTS:
1. TESTING SHALL BE PERFORMED BY A DESIGNATED INDEPENDENT TESTING AGENCY.
2. SUBMIT TESTING AND INSPECTION RECORDS SPECIFIED TO THE CIVIL ENGINEER OF RECORD FOR REVIEW.
   A. THE ENGINEER WILL REVIEW THE TESTING AND INSPECTION RECORDS TO CHECK CONFORMANCE WITH THE DRAWINGS AND SPECIFICATIONS. THE ENGINEER'S REVIEW DOES NOT RELIEVE THE CONSTRUCTION CONTRACTOR FROM THE RESPONSIBILITY FOR CORRECTING DEFECTIVE WORK.
3. PROOF ROLLING:
   A. PROOF-ROLLING SHALL BE PERFORMED IN THE PRESENCE OF THE GEOTECHNICAL ENGINEER OR QUALIFIED GEOTECHNICAL REPRESENTATIVE USING A FULLY LOADED TANDEM AXLE DUMP TRUCK WITH A MINIMUM GROSS WEIGHT OF 25 TONS OR A FULLY LOADED WATER TRUCK WITH AN EQUIVALENT AXLE LOADING. PROOF-ROLLING ACCEPTANCE STANDARDS INCLUDE NO RUTTING GREATER THAN 1.5 INCHES, AND NO "PUMPING" OF THE SOIL BEHIND THE LOADED TRUCK.
4. SIEVE ANALYSIS:
   A. SIEVE ANALYSIS SHALL BE CONDUCTED IN ACCORDANCE WITH AASHTO T27
5. PROCTOR:
   A. PROCTORS SHALL BE DETERMINED IN ACCORDANCE WITH ASTM D-1557
6. ATTERBERG LIMITS:
   A. ATTERBERG LIMITS SHALL BE DETERMINED IN ACCORDANCE WITH AASHTO T89 AND T90
7. MOISTURE DENSITY (NUCLEAR DENSITY):
   A. MOISTURE DENSITY TESTING SHALL BE DONE IN ACCORDANCE WITH AASHTO T310

SUBGRADE COMPACTION, TEST ROLLING AND AGGREGATE BASE COMPACTION:
1. FILL MATERIAL:
   A. SOILS USED AS FILL MATERIAL SHALL BE TESTED FOR GRAIN SIZE ANALYSIS, MOISTURE CONTENT, ATTERBERG LIMITS ON FINES CONTENT, AND PROCTOR TESTS (MODIFIED DRY MAXIMUM DENSITY).
      a. FOR PLACED & COMPACTED FILLS, PROVIDE ONE COMPACTION TEST PER LIFT FOR EVERY 1000 FT OF ROAD LENGTH. INCLUDE THE LOCATION, DRY DENSITY, MOISTURE CONTENT, AND COMPACTION PERCENT BASED ON MODIFIED PROCTOR MAXIMUM DRY DENSITY.
   B. IN ROADWAY CUT AREAS, OR WHERE EMBANKMENT CONSTRUCTION REQUIRES LESS THAN 12 INCHES OF FILL PLACEMENT, COMPACT TO A MINIMUM OF 95 PERCENT OF THE MATERIAL'S MODIFIED PROCTOR MAXIMUM DRY DENSITY.
2. COMPACTED SUBGRADE:
   A. THE ENTIRE SUBGRADE SHALL BE PROOF-ROLLED PRIOR TO THE PLACEMENT OF THE AGGREGATE BASE TO IDENTIFY AREAS OF UNSTABLE SUBGRADE.
   B. IF PROOF ROLLING DETERMINES THAT THE SUBGRADE STABILIZATION CANNOT BE ACHIEVED, THE FOLLOWING ALTERNATIVES WILL BE IMPLEMENTED:
      a. REMOVE UNSUITABLE MATERIAL AND REPLACE WITH SUITABLE EMBANKMENT.
      b. SCARIFY, DRY, AND RECOMPACT SUBGRADE AND PERFORM ADDITIONAL PROOF ROLL.
      c. INCREASE ROAD BASE THICKNESS.
   C. PROVIDE 1 MOISTURE DENSITY COMPACTION TESTS FOR EVERY 1000 L.F. OF ROAD LENGTH. COMPACTED SUBGRADE MUST BE COMPACTED TO A MINIMUM OF 95% MODIFIED PROCTOR MAXIMUM DRY DENSITY AT ±3% OF OPTIMUM MOISTURE CONTENT FOR GRANULAR SOILS AND AT -1 TO +3% OF OPTIMUM MOISTURE CONTENT FOR COHESIVE SOILS.
3. AGGREGATE BASE:
   A. AGGREGATE BASE SHALL BE PROOF-ROLLED OVER THE ENTIRE LENGTH. PROVIDE 1 SIEVE ANALYSIS PER 2500 CY OF ROAD BASE PLACED.
      a. IF PROOF ROLLING DETERMINES THAT THE ROAD IS UNSTABLE, ADDITIONAL AGGREGATE SHALL BE ADDED UNTIL THE UNSTABLE SECTION IS ABLE TO PASS A PROOF ROLL.

TABLE 1: TESTING SCHEDULE SUMMARY

LOCATION	TEST	FREQUENCY
STRUCTURAL FILL	GRAIN SIZE ANALYSIS, MOISTURE CONTENT, ATTERBERG LIMITS ON FINES CONTENT, AND PROCTOR	1 PER MAJOR SOIL TYPE
	MOISTURE DENSITY	1 PER 2,000 CY OR MIN. 1 PER LIFT
COMPACTED SUBGRADE	PROOF-ROLL	ENTIRE LENGTH
	MOISTURE DENSITY TEST (NUCLEAR DENSITY)	1 PER 1,000 FT OR MIN. 5 FOR THE SITE
AGGREGATE BASE	PROOF-ROLL	ENTIRE LENGTH
	SIEVE ANALYSIS	1 PER 2,500 CY

GENERAL NOTES:
1. THE PLANIMETRIC FEATURES, GROUND SURFACE CONTOURS ON A LIDAR SURFACE PROVIDED NOAA.
2. NO GRADING OR SOIL DISTURBANCE IS PERMITTED OUTSIDE OF THE GRADING LIMITS IDENTIFIED ON THE PLANS.
3. GRADE ALL PROPOSED ROADS TO THE SLOPES PROPOSED ON THE PLANS.
4. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING DRAINAGE THROUGHOUT THE CONSTRUCTION OF THIS PROJECT. CONSTRUCTION ACTIVITIES SHALL NOT BLOCK THE NATURAL OR MANMADE DRAINAGE SWALES CAUSING RAINWATER TO POND. ADDITIONAL CULVERTS IN EXCESS OF THOSE ON THE PLANS MAY BE REQUIRED AS APPROVED BY THE ENGINEER.
5. THE CONTRACTOR SHALL NOTIFY CONNECTICUT CALL BEFORE YOU DIG (811) AT LEAST 48 HOURS BEFORE EXCAVATION ACTIVITIES COMMENCE.
6. WETLAND INFORMATION SHOWN ON THE PLAN WAS PROVIDED BY ROB HELLSTROM LAND SURVEYING AND FLAGGED BY HIGHLANDS SOILS.
7. ELECTRICAL COLLECTION SYSTEM SHOWN ON THE PLAN SHALL BE CONSIDERED PRELIMINARY. CONTRACTOR SHALL REFER TO FINAL ELECTRICAL DESIGN PLANS FOR ACTUAL DESIGN LOCATIONS.

SLOPE STABILIZATION:

ALL AREAS DESIGNATED ON THE PLAN FOR SLOPE STABILIZATION SHALL BE GRADED AND COMPACTED, SMOOTH AND CLEAN TO THE FINISH CONTOURS SHOWN ON THE PLAN, WITH A MINIMUM OF 4 INCHES OF TOPSOIL PLACED ON THE AREA. STABILIZATION SHALL BE ACHIEVED IN ONE OF TWO MANNERS:

EITHER: 1) HAND-PLACED RIPRAP
OR:
2) SEED WITH EROSION CONTROL AND REVEGITATION MAT (ECRM)

1. PLACEMENT OF RIP-RAP

RIPRAP HAND PLACED. HAND-PLACED RIPRAP SHALL CONSIST OF ROUGH UNHEWN QUARRY STONES, APPROXIMATELY RECTANGULAR, PLACED DIRECTLY ON THE SPECIFIED SLOPES OR SURFACES. IT SHALL BE SO LAID THAT THE WEIGHT OF THE LARGE STONES IS CARRIED BY THE SOIL RATHER THAN BY ADJACENT STONES. STONES SHALL WEIGH BETWEEN 50 AND 150 LB. EACH AND AT LEAST 60 % OF THEM SHALL WEIGH MORE THAN 100 LB. EACH WHEN USED ON EMBANKMENT CONSTRUCTION. RIP RAP FOR BMPS SHALL BE 6"-8" DIA. PREPARATION FOR HAND-PLACED RIP RAP. BEFORE ANY RIP RAP IS PLACED, THE SURFACE TO BE COVERED SHALL BE FULLY COMPACTED AND GRADED TO THE REQUIRED SLOPE. PLACE MIRAFITM8 OR APPROVED EQUAL GEOTEXTILE ON SLOPE. RIP RAP ON SLOPES SHALL COMMENCE COMMENCE IN A TRENCH BELOW THE TOW OF THE SLOPE AND SHALL PROGRESS UPWARD, EACH STONE BEING LAID BY HAND PERPENDICULAR TO THE SLOPE WITH THE LONG DIMENSION VERTICAL, FIRMLY BEDDED AGAINST THE SLOPE AND AGAINST THE ADJOINING STONE, WITH ENDS IN CONTACT, AND WITH WELL-BROKEN JOINTS. SIMILAR METHODS SHALL BE USED WHEN LAYING RIPRAP ON STREAM BEDS, IN DITCHES, AND ON LEVEL SURFACES.

THE FINISHED SURFACE OF THE RIPRAP SHALL PRESENT AN EVEN, TIGHT SURFACE, NOT LESS THAN 12 INCHES THICK, MEASURED PERPENDICULAR TO THE SLOPE.

THE STONES WEIGHING MORE THAN 100 LB. SHALL BE WELL DISPERSED THROUGHOUT THE AREA WITH THE 50-100 LB. STONES LAID BETWEEN THEM IN SUCH A MANNER THAT ALL STONES WILL BE IN CLOSE CONTACT. THE REMAINING VOIDS SHALL BE FILLED WITH SPALLS OF SUITABLE SIZE AND WELL TAMPED TO PRODUCE A FIRM AND COMPACT REVETMENT.

2. STABILIZATION WITH EROSION CONTROL AND REVEGITATION MAT (ECRM)
   1) AREA MUST BE GRADED SMOOTH AND CLEAN TO FINISH GRADES, AND COMPACTED.

   2) SEED AND MULCH AREA. USE SEED MIX APPROVED BY THE ENGINEER.

   3) INSTALL ECRM PER MANUFACTURER'S INSTRUCTIONS, HOWEVER THESE MUST INCLUDE THE FOLLOWING MINIMUM REQUIREMENTS:

      A) GRADE GROUND TO FINISH CONTOURS. REMOVE ALL ROCKS, DIRT CLODS, STUMPS, ROOTS, TRASH, AND OTHER OBSTRUCTIONS LYING IN DIRECT CONTACT WITH THE SOIL SURFACE.

      B) DIG MAT ANCHOR TRENCHES (MINIMUM 12"DEEP, 6" WIDE) AT TERMINAL ENDS AND PERIMETER SIDES WHERE MAT IS TO BE INSTALLED.

      C) INSTALL MAT BY ROLLING UPHILL PARALLEL TO WATER FLOW, STARTING AT TRENCH. OVERLAP ROLLS BY MINIMUM OF 3". FASTEN TO GROUND WITH 18" PINS AND 1 1/2" WASHERS, OR EQUIVALENT. PIN MAT AT ENDS, AND EVERY 3' TO 5' ALONG OVERLAPS. DO NO STRETCH MAT. SPLICING ROLLS SHOULD BE DONE IN A CHECK SLOT. BACKFILL TO COVER ENDS AND FASTENERS, ROLLING MAT ACROSS BACKFILL AND PIN AGAIN.

   FOR MAT USE NORTH AMERICAN GREEN S-150.

SEEDING:

1. COMPOSITION OF SEED MIX CHANGES YEARLY. SEED SPECIFICATIONS MUST BE SUBMITTED TO ENGINEER 2 WEEKS PRIOR TO INSTALLATION. ALL SPECIES MUST BE NATIVE TO NEW LONDON COUNTY.

2. RESTORED AREAS TO BE SEEDED WITH ABOVE MIX OR EQUAL (SUBJECT TO ENGINEERS APPROVAL). SEED TO BE LIGHTLY RAKED TO ALLOW FOR PROPER SEED/SOIL CONTACT.

3. CONTRACTOR SHALL OVERSEED AND/OR RE-MULCH AS NECESSARY TO ESTABLISH A GOOD COVER OF VEGETATION, WHETHER DUE TO POOR INITIAL COVER, INCLEMENT WEATHER BEFORE/DURING/AFTER SEEDING, OR THE ONSET OF WINTER.

4. RILLING, GULLIES, OR OTHER EROSION DUE TO POOR COVER SHALL BE RAKED AND/OR REFILLED AND REMULCH/RESEEDED.

5. CONTRACTOR SHALL WARRANTEE SEEDING, MULCHING AND EROSION CONTROL FABRIC FOR ONE YEAR FROM THE SUBSTANTIAL COMPLETION OF THE RELEVANT AREA OF WORK.

INVASIVE SPECIES:

1. ALL EQUIPMENT SHALL BE INSPECTED UPON ARRIVAL. EQUIPMENT ARRIVING WITH OBSERVABLE SOIL OR PLANT FRAGMENTS WILL BE REMOVED AND CLEANED.
2. HAY BALES ARE NOT BE USED ON SITE; ONLY WEED-FREE STRAW BALES ARE APPROVED.
3. OFF-SITE TOPSOIL MUST BE FREE OF INVASIVE SPECIES. THE ENGINEER SHALL BE NOTIFIED OF THE TOPSOIL SOURCE 6 WEEKS BEFORE DELIVERY.

SEDIMENTATION AND EROSION CONTROL PLAN

CONTACT:
STEVE BROYER
ECOS ENERGY
222 SOUTH 9TH STREET
SUITE 1600
MINNEAPOLIS MN 55402

THE PURPOSE OF THIS PROJECT IS TO INSTALL APPROXIMATELY **26,000** SOLAR MODULES AND ASSCOCIATED ELECTICAL EQUIPMENT FOR POWER GENERATION.

THE TOTAL AREA OF THE PROJECT SITE IS APPROXIMATELY 50.1 ACRES (THE EAST PARCEL IS 17.38 ACRES, THE WEST AND CENTRAL AREAS COMPRISE 32.72 ACRES) AND THE TOTAL AREAS OF THE SITE THAT IS EXPECTED TO BE DISTURBED BY CONSTRUCTION ACTIVITIES IS 29.7 ACRES (7.4 ACRES ON THE WEST, 9.6 ON THE CENTRAL AND 12.7 ON THE EAST).

THE EROSION & SEDIMENTATION CONTROL PLAN AND DETAILS HAVE BEEN DEVELOPED AS A STRATEGY TO CONTROL SOIL EROSION AND SEDIMENTATION DURING AND AFTER CONSTRUCTION. THIS PLAN IS BASED ON THE "2002 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL" BY THE CONNECTICUT COUNCIL ON SOIL AND WATER CONSERVATION IN COOPERATION WITH THE CONNECTICUT DEEP.

IN THE AREAS OF SOLAR PANEL INSTALLATION, THERE ARE SEVERAL ACTIVITIES (SITE GRADING, FOOTING INSTALLATION, PANEL INSTALLATION, AND ELECTRICAL TRENCH WORK) THAT WILL DISTURB SOIL. SOIL MUST BE PROMPTLY STABILIZED AFTER EACH ACTIVITY.

THIS PROJECT WILL NOT BE PHASED. THERE ARE THREE SEPARATE AREAS OF DEVELOPMENT, WEST, CENTRAL AND EAST, AND EACH WILL FOLLOW THE CONSTRUCTION SEQUENCE PROVIDED ON THIS PLAN.

THE PROPOSED LOCATIONS OF SILTATION AND EROSION CONTROL MEASURES ARE SHOWN ON THE PLANS. THE CONTRACTOR SHALL PROVIDE SILT FENCE, HAY BALES, EROSION MAT, STONE CHECK DAMS, A CONSTRUCTION ENTRANCE, AND/OR OTHER EROSION CONTROL MEASURES AS NEEDED OR DIRECTED BY THE ENGINEER OR TOWN STAFF TO ADEQUATELY PREVENT SEDIMENT TRANSPORT.

EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO SITE DISTURBANCE.

THE CONTRACTOR SHALL INSPECT, REPAIR AND/OR REPLACE EROSION CONTROL MEASURES EVERY 7 DAYS AND IMMEDIATELY FOLLOWING ANY SIGNIFICANT RAINFALL OR SNOW MELT. SEDIMENT DEPOSITS MUST BE REMOVED BEFORE DEPOSITS REACH APPROXIMATELY ONE HALF THE HEIGHT OF THE BARRIER. SEDIMENT CONTROL DEVICES SHALL REMAIN IN PLACE AND BE MAINTAINED BY THE CONTRACTOR UNTIL AREAS UPSLOPE ARE PERMANENTLY STABILIZED.

STAKED HAY BALE SILT BARRIERS OR SILT FENCE SHALL BE INSTALLED AROUND ANY TEMPORARYSTOCKPILE AREAS. TEMPORARY VEGETATIVE COVER MAY BE REQUIRED (SEE NOTE).

CONTINUOUS DUST CONTROL USING WATER OR APPROVED EQUAL SHALL BE PROVIDED FOR ALL EARTH STOCKPILES, EARTH PILED ALONG EXCAVATIONS, SURFACES OF BACKFILLED TRENCHES AND GRAVELED ROADWAY SURFACES. THE USE OF CALCIUM CHLORIDE FOR DUST CONTROL SHALL NOT BE ALLOWED.

IF DEWATERING IS NECESSARY DURING ANY TIME OF CONSTRUCTION A CLEAR WATER DISCHARGE SHALL BE PROVIDED AS SHOWN IN THE HAY-BALE BARRIER DEWATERING DETAIL OR ALTERNATE METHOD PROPOSED BY THE CONTRACTOR AND APPROVED BY THE ENGINEER.

ALL DISTURBED AREAS SHALL BE RESTORED PER THE SLOPE STABILIZATION AND PERMANENT VEGETATION DETAILS. ALL DISTURBED AREAS THAT ARE SLOPED LESS THAN THREE HORIZONTAL TO ONE VERTICAL (3:1) SLOPE SHALL BE LOAMED, SEEDED, FERTILIZED AND MULCHED PER THE PERMANENT VEGETATIVE COVER SPECIFICATIONS. EROSION CONTROL MATTING SHALL BE PROVIDED ON ALL DISTURBED AREAS THAT ARE SLOPED MORE THAN THREE HORIZONTAL TO ONE VERTICAL (3:1).

IF FINAL SEEDING OF DISTURBED AREAS IS NOT TO BE COMPLETED BEFORE OCTOBER 15, THE CONTRACTOR SHALL PROVIDE TEMPORARY MULCHING (DORMANT SEEDING MAY BE ATTEMPTED AS WELL) TO PROTECT THE SITE AND DELAY PERMANENT SEEDING.

WHEN FEASIBLE, TEMPORARY SEEDING OF DISTURBED AREAS THAT HAVE NOT BEEN FINISHED GRADED SHALL BE COMPLETED PRIOR TO OCTOBER 15.

ON EACH FRIDAY AND ALSO ON THE DAY BEFORE ANY RAIN FORECAST OF 0.5 INCHES OR MORE, THE CONTRACTOR SHALL HAY MULCH ALL EXPOSED SOIL.

ANY EROSION WHICH OCCURS WITHIN THE DISTURBED AREAS SHALL BE IMMEDIATELY REPAIRED AND STABILIZED. DURING THE CONSTRUCTION PHASE, INTERCEPTED SEDIMENT SHALL BE RETURNED TO THE SITE. POST SEEDING, INTERCEPTED SEDIMENT, IF ANY, SHALL BE DISPOSED OF IN A MANNER APPROVED BY THE TOWN AND ENGINEER.

EROSION AND SEDIMENTATION CONTROL MEASURES SHALL REMAIN IN PLACE UNTIL VEGETATION IS RE-ESTABLISHED OR SLOPES ARE STABILIZED AND REMOVAL IS APPROVED BY THE TOWN.

UNFORESEEN PROBLEMS WHICH ARE ENCOUNTERED IN THE FIELD SHALL BE SOLVED ACCORDING TO THE "2002 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL" BY THE CONNECTICUT COUNCIL ON SOIL AND WATER CONSERVATION IN COOPERATION WITH THE CONNECTICUT DEEP.

THE CONTRACTOR SHALL PROVIDE THE NAME AND EMERGENCY CONTACT INFORMATION FOR THE PROJECT PERSONNEL RESPONSIBLE FOR EROSION AND SEDIMENTATION CONTROLS PRIOR TO THE START OF CONSTRUCTION.

THE OWNER WILL EMPLOY A CERTIFIED SOIL SCIENTIST TO PERFORM WEEKLY EROSION & SEDIMENTATION CONTROL INSPECTION.
A. ROUTINE REPAIRS OR MODIFICATIONS SHALL BE COMPLETED BY THE CONTRACTOR WITHIN 48 HOURS AFTER DIRECTION BY THE INSPECTOR.
B. EMERGENCY REPAIRS SHALL BE COMPLETED IMMEDIATELY UPON DIRECTION BY THE INSPECTOR.

THE WETLANDS ENFORCEMENT OFFICER SHALL BE NOTIFIED AT LEAST 2 BUSINESS DAYS PRIOR TO CONSTRUCTION TO INSPECT EROSION CONTROLS.

THE WETLAND ENFORCEMENT OFFICER SHALL BE NOTIFIED AT THE COMPLETION OF WORK FOR FINAL INSPECTION AND SIGN OFF OF PERMIT COMPLIANCE.

LOCAL STATE AND FEDERAL PERMITS REQUIRED: THIS PROJECT REQUIRES AN INLAND WETLANDS PERMIT AND A FROM THE STATE OF CONNECTICUT SITING COUNCIL.

THE FOLLOWING DOCUMENTS ARE CONSIDERED TO BE PART OF THIS EROSION AND SEDIMENTATION CONTROL PLAN: THE COMPLETE SITE PLANS, THE DRAINAGE NARRATIVE PREPARED BY CLA ENGINEERS, AND THE CTDEEP 2002 MANUAL.

EROSION AND SEDIMENTATION CONTROL SEQUENCE TO BE FOLLOWED FOR THE WEST, CENTRAL AND EAST PARCELS

1. BEFORE ANY WORK TAKES PLACE CONTACT CALL BEFORE YOU DIG 1-800-922- 4455 TO MARK UTILITIES.
2. NOTIFY THE TOWN OF GRISWOLD ZONING AND INLAND WETLANDS AGENTS OF START OF CONSTRUCTION A MINIMUM OF 48 HOURS IN ADVANCE.
3. HAVE LICENSED SURVEYOR STAKE OUT THE CLEARING LIMITS
4. CUT TREES BUT DO NOT GRUB.
5. INSTALL CONSTRUCTION ENTRANCE AND PERIMETER EROSION AND SEDIMENTATION CONTROLS AND HAVE INSPECTED BY SITE INSPECTOR.
6. INSTALL ADDITIONAL E&S AS SHOWN ON PLANS INCLUDING TEMPORARY VEGETATED SWALES AND TEMPORARY SEDIMENT TRAPS AND HAVE THEM INSPECTED BY THE SITE INSPECTOR.
7. ANY DEWATERING WILL BE MONITORED BY A QUALIFIED ENVIRONMENTAL PROFESSIONAL TO MAINTAIN SUITABLE QUALITY OF DISCHARGE FROM THE DEWATERING AND TO ENSURE REMOVAL OF ACCUMULATED SEDIMENTS AT APPROPRIATE INTERVALS. SEDIMENTS WILL BE DISPOSED OF AT AN APPROPRIATE ON-SITE LOCATION. DEWATERING WILL DISCHARGE INTO TEMPORARY SEDIMENT TRAPS.
8. ROUGH GRADE SITE.
9. INSTALL CHAIN LINK FENCE AROUND PERIMETER.
10. INSTALL SOLAR PANELS, HYDROSEED OR SEED AND MULCH AROUND PANELS AND HYDROSEED OR MULCH AND SEED ANY EXPOSED SOIL AT THE END OF EACH WEEK AND BEFORE EVERY RAINFALL PREDICTED FOR 0.5 INCHES OR MORE.
11. TRENCH FOR AND INSTALL ELECTRIC LINES AND AT THE END OF EACH WEEK HYDROSEED OR MULCH AND SEED ANY EXPOSED SOIL AT THE END OF EACH WEEK AND BEFORE EVERY RAINFALL PREDICTED FOR 0.5 INCHES OR MORE.
12. INSTALL REMAINING ELECTRIC INFRASTRUCTURE AND AT THE END OF EACH WEEK HYDROSEED OR MULCH AND SEED ANY EXPOSED SOIL AT THE END OF EACH WEEK AND BEFORE EVERY RAINFALL PREDICTED FOR 0.5 INCHES OR MORE.
13. OVERSEED DISTURBED SOILS WHEN ALL SOLAR PANEL INSTALLTION IS COMPLETE.
14. CLEAN SEDIMENTS BASINS AND GRADE AND RE-SEED FOR USE AS STORMWATER BASINS WHEN SITE INSPECTOR DEEMS SOILS ARE STABILIZED.
15. INSTALL PLANTINGS
16. MAINTAIN E&S AND PROVIDE REPORTS TO TOWNS AND CTDEEP.

No.	DATE	REVISION

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STATE OF CONNECTICUT
EDWARD BARRETT BROYER
PROFESSIONAL ENGINEER

1219 &1240 VOLUNTOWN RD
GRISWOLD, CT 06351

VOLUNTOWN ROAD
SOLAR

CIVIL & EROSION CONTROL NOTES

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 17

CLA

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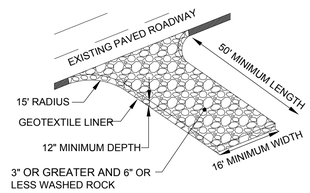
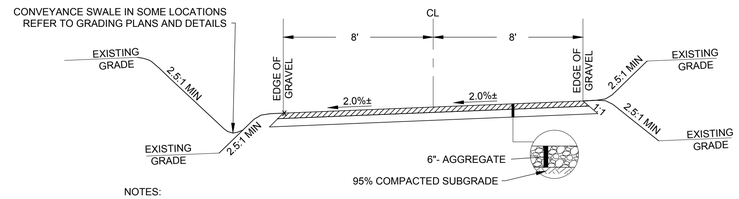


NOTE:

ROCK CONSTRUCTION ENTRANCE SHOULD BE A MINIMUM THICKNESS OF 1.0' AND CONTAIN MAXIMUM SIDE SLOPES OF 4:1. ROCK ENTRANCE SHOULD BE INSPECTED AND MAINTAINED REGULARLY. ROCK ENTRANCE LENGTH MAY NEED TO BE EXTENDED IN CLAY SOILS.

ROCK CONSTRUCTION ENTRANCE

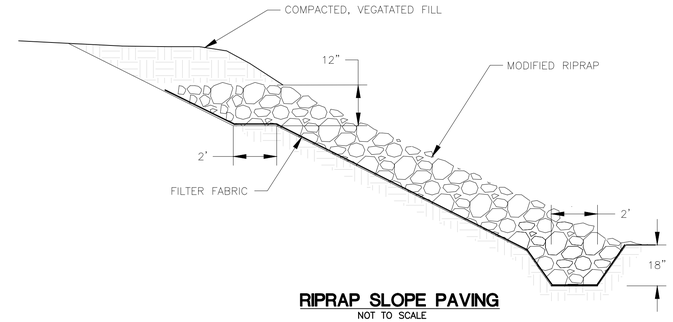
NOT TO SCALE



NOTES:
1. CONTRACTOR TO SUBCUT ROADWAY TO EXISTING GRADE ELEVATION TO MAINTAIN EXISTING SITE DRAINAGE PATTERNS WHEREVER POSSIBLE.
2. IN FILL LOCATIONS CONTRACTOR TO GRADE TOE OF SLOPE TO EXISTING GRADE, AND MAINTAIN NATURAL DRAINAGE PATTERNS.
3. IN CUT LOCATIONS CONTRACTOR TO CREATE SWALE ON DOWNSTREAM SIDE, REFER TO GRADING PLANS FOR DETAILS.
4. CONTRACTOR TO COMPACT AGGREGATE TO 95% MAXIMUM DRY DENSITY.
5. REFER TO GEOTECHNICAL RECOMMENDATIONS FOR ADDITIONAL ROADWAY SECTION DESIGN INFORMATION.

ACCESS ROAD DETAIL

NOT TO SCALE



RIPRAP SLOPE PAVING

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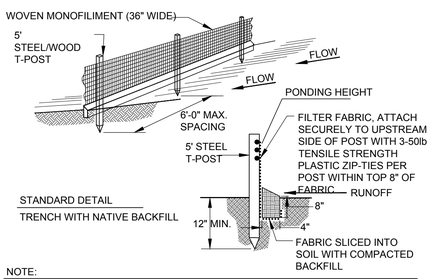


STANDARD DETAIL

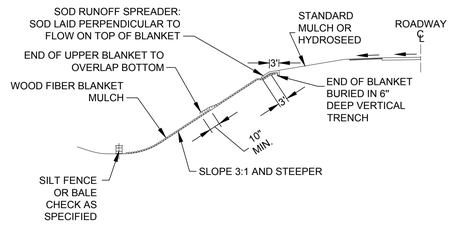
TRENCH WITH NATIVE BACKFILL

NOTE:

1. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN ACCUMULATED TO 1/3 THE HEIGHT OF THE FABRIC OR MORE.
2. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.
3. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
4. ALL ENDS OF THE SILT FENCE SHALL BE WRAPPED UPSLOPE SO THE ELEVATION OF THE BOTTOM OF FABRIC IS HIGHER THAN "PONDING HEIGHT".

SILT FENCE

NOT TO SCALE



EROSION CONTROL BLANKET INSTALLATION ON AN INSLOPE
(WHEN REQUIRED)

CATEGORY	SLOPE	VELOCITY
1	FLAT	-
2	3:1	< 5.0 fps
3	3:1	< 6.5 fps
4	2:1	< 7.0 fps

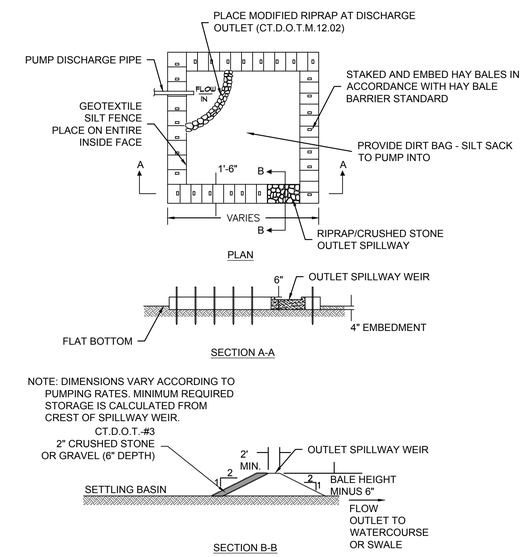
CATEGORY	ACCEPTABLE TYPES
1	STRAW RD 1S, WOOD FIBER RD 1S
2	STRAW 1S, WOOD FIBER 1S
3	STRAW 2S, WOOD FIBER 2S
4	STRAW/COCONUT 2S, WOOD FIBER HV 2S

THE LETTERING DESIGNATION SHALL BE DEFINED AS FOLLOWS:

1S - NETTING ON ONE SIDE
RD - RAPIDLY DEGRADABLE
2S - NETTING ON TWO SIDES
HV - HIGH VELOCITY

EROSION CONTROL BLANKET

NOT TO SCALE



DEWATERING SETTLING BASIN DETAIL

NOT TO SCALE

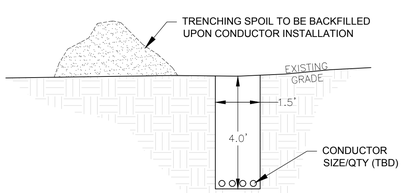
DEWATERING PLAN

IF DEWATERING IS NECESSARY DURING CONSTRUCTION A CLEAR WATER DISCHARGE SHALL BE PROVIDED AS FOLLOWS:

A. THE PUMP INLET WILL BE WRAPPED IN FILTER FABRIC AND PLACED IN CRUSHED STONE WITHIN THE TRENCH.

B. THE PUMP OUTLET WILL DISCHARGE TO THE DEWATERING ENCLOSURE PER THE DETAIL FOR DEWATERING SETTLING BASIN TO BE LOCATED OUTSIDE OF THE 100' UPLAND REVIEW ZONE.

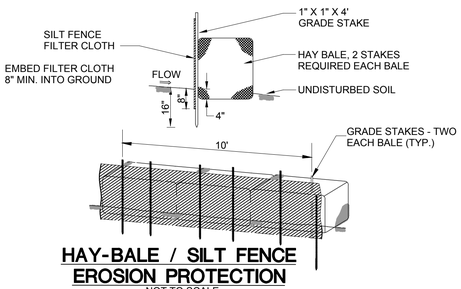
C. THE DISCHARGE FROM THE DEWATERING ENCLOSURE WILL BE MONITORED AND ADDITIONAL MEASURES EMPLOYED IF NECESSARY.



NOTES:
1. CONDUCTOR CLEARANCES DEPENDENT ON GEOTECHNICAL PARAMETERS AND ELECTRICAL DESIGN
2. CONDUCTOR SIZING AND QUANTITIES PER TRENCH DEPENDENT ON FINAL ELECTRICAL DESIGN TRENCH DIMENSIONS FOR EARTHWORK QUANTITIES ARE CONSERVATIVE.

TRENCHING DETAIL

NOT TO SCALE



HAY-BALE / SILT FENCE EROSION PROTECTION

NOT TO SCALE

CONSTRUCTION NOTES:

1. SILT FENCE FILTER CLOTH TO BE SECURELY FASTENED TO GRADE STAKE WITH STAPLES, 6" ON CENTER.
2. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN ONE ANOTHER THEY SHALL OVERLAP BY 6" AND BE FOLDED.
3. BALES SHALL BE PLACED IN A ROW WITH ENDS TIGHTLY ABUTTING THE ADJACENT BALES.

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VOLUNTOWN ROAD SOLAR

CIVIL & EROSION CONTROL DETAILS

Project No. CLA-6153
Proj. Engineer E.B.
Date: 06/30/18
Sheet No. 18

CLA

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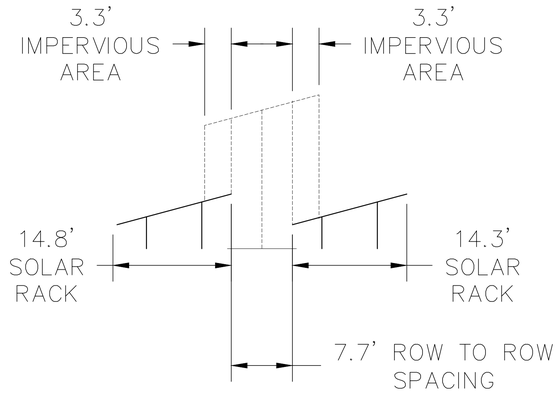
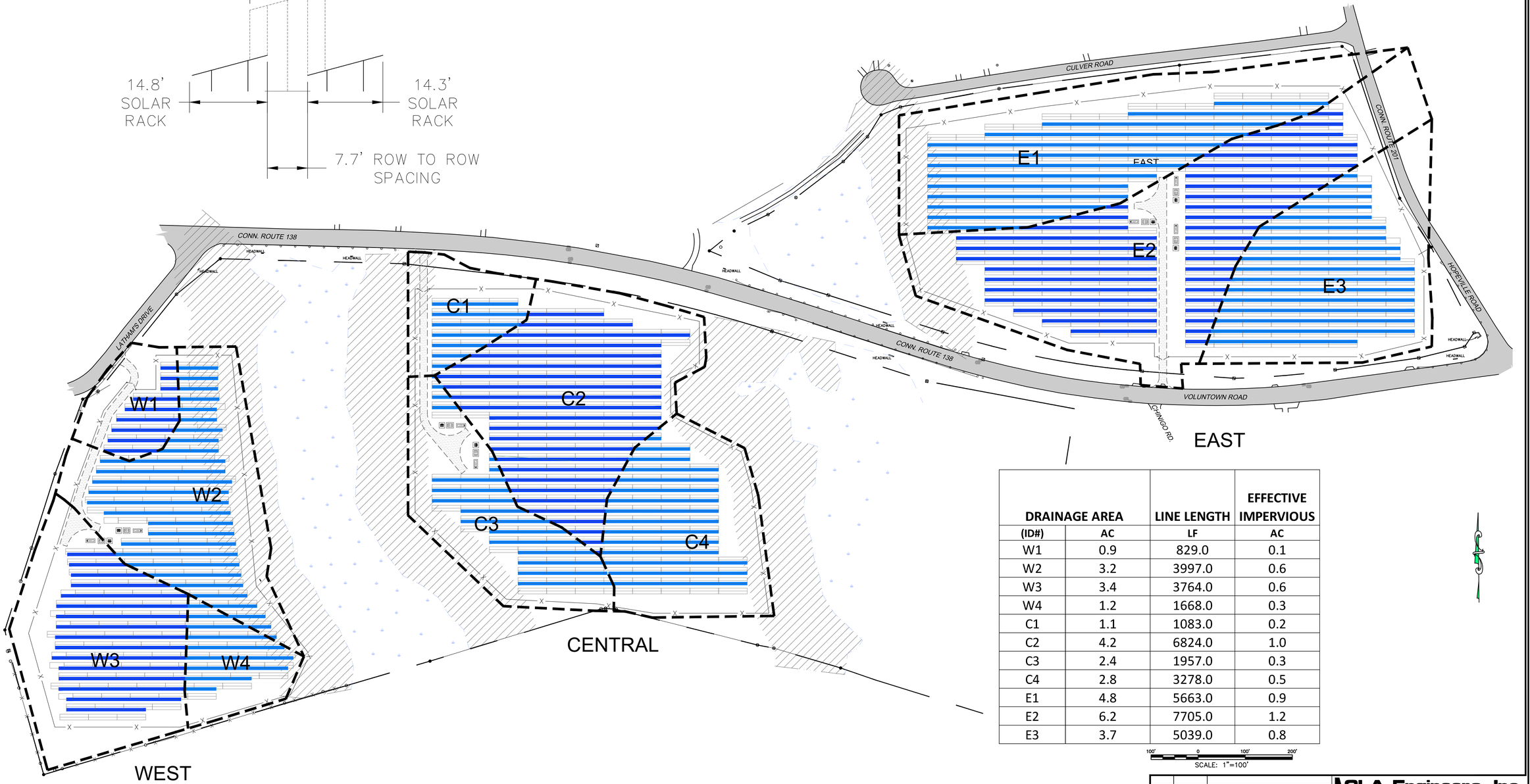




DRAINAGE AREA		LINE LENGTH	EFFECTIVE IMPERVIOUS
(ID#)	AC	LF	AC
W1	0.9	829.0	0.1
W2	3.2	3997.0	0.6
W3	3.4	3764.0	0.6
W4	1.2	1668.0	0.3
C1	1.1	1083.0	0.2
C2	4.2	6824.0	1.0
C3	2.4	1957.0	0.3
C4	2.8	3278.0	0.5
E1	4.8	5663.0	0.9
E2	6.2	7705.0	1.2
E3	3.7	5039.0	0.8

100' 0 100' 200'
SCALE: 1"=100'

No.	Date	Revision
	6/26/18	PERMITTING DESIGN

CLA Engineers, Inc.
CIVIL • STRUCTURAL • SURVEYING
317 Main Street Norwich, Connecticut
(860) 886-1966 Fax (860) 886-9165

STATE OF CONNECTICUT ★ EMIL M. BUSTELO ★ No. 19184 REGISTERED PROFESSIONAL ENGINEER

1219 & 1240 VOLUNTOWN ROAD
GRISWOLD, CT 06351

VOLUNTOWN SOLAR

SOLAR MODULE EFFECTIVE IMPERVIOUS EXHIBIT

Project No. CLA-
Proj. Engineer E.M.B.
Date: 6/26/18
Sheet No. 1

CLA

M:\6000\6100\6153 Voluntown Rd. Solar\Drawings\incoming\V-DRAINAGE AND EFF IMP - Standard\00 DRAINAGE AND EFF IMP.dwg, 7/25/2018 10:48:00 AM, DWG To PDF.pc3

EXHIBIT C

Endangered Species Review and Analysis

Voluntown Solar
1219 and 1240 Voluntown Road
Griswold, CT
New London County

ECOS Energy, LLC (ECOS) has attained approval to develop a renewable energy facility designed to gather solar energy to be located at 1219 and 1240 Voluntown Road, Griswold, CT in New London County. The proposed facility will install photovoltaic panels to collect solar energy for energy distribution. A review of the project and assessment of the potential impacts to species that are afforded protection under the Endangered Species Act of 1973 (ESA; 16 U.S.C. § 1531 et seq.) which is administered by the US Fish and Wildlife Service (FWS) has been requested by and preformed for the Connecticut Siting Council.

The FWS maintains various databases with entries for every species listed under the ESA. This information is accessible to the general public and provides detailed species information such as species specific life cycles, habitat requirements, current and historical recorded occurrences. This information is provided by the FWS as a service to the public for informational purposes and to professionals for project planning. The Environmental Conservation Online System provided by the FWS offers the Information for Planning and Conservation (IPaC) web based service which is a project planning tool designed to streamline the FWS environmental review process. On May 22, 2019, the IPaC system was accessed to evaluate potential occurrences of ESA listed species within the proposed project area; the results were analyzed with respect to potential impacts to ESA listed species with the potential to occur within the project area.

<u>IPaC Results – ESA Listed Species</u>:

- Northern long-eared bat (*Myotis septentrionalis*)
  - ESA Status: Threatened

The Northern long-eared bat (NLEB) was the only species identified by the IPaC consultation conducted for this project. This species has an expansive range which encompasses all of New England. Scientist have observed a measurable decline in this species' population throughout its range and have attributed the loss in population primarily due to the white-nose syndrome. The FWS has determined that the most effective conservation measure to protect this species throughout its range will be through restrictions of tree clearing activities. As of February 16, 2016 the 4(d) Rule for the Northern Long-Eared Bat went into effect which states the following management measures:

- Tree clearing at any time of the year within a 0.25 mile radius of known NLEB is prohibited; and
- Tree clearing within 150-foot radius of known occupied maternity roost trees during the pup season (June 1 through July 31) is prohibited.

FWS published data with respect to the locations of known NLEB hibernacula in Connecticut (attached) which illustrates that there is no known NLEB hibernacula and there are no know maternity roost trees recorded in New London or surrounding counties.

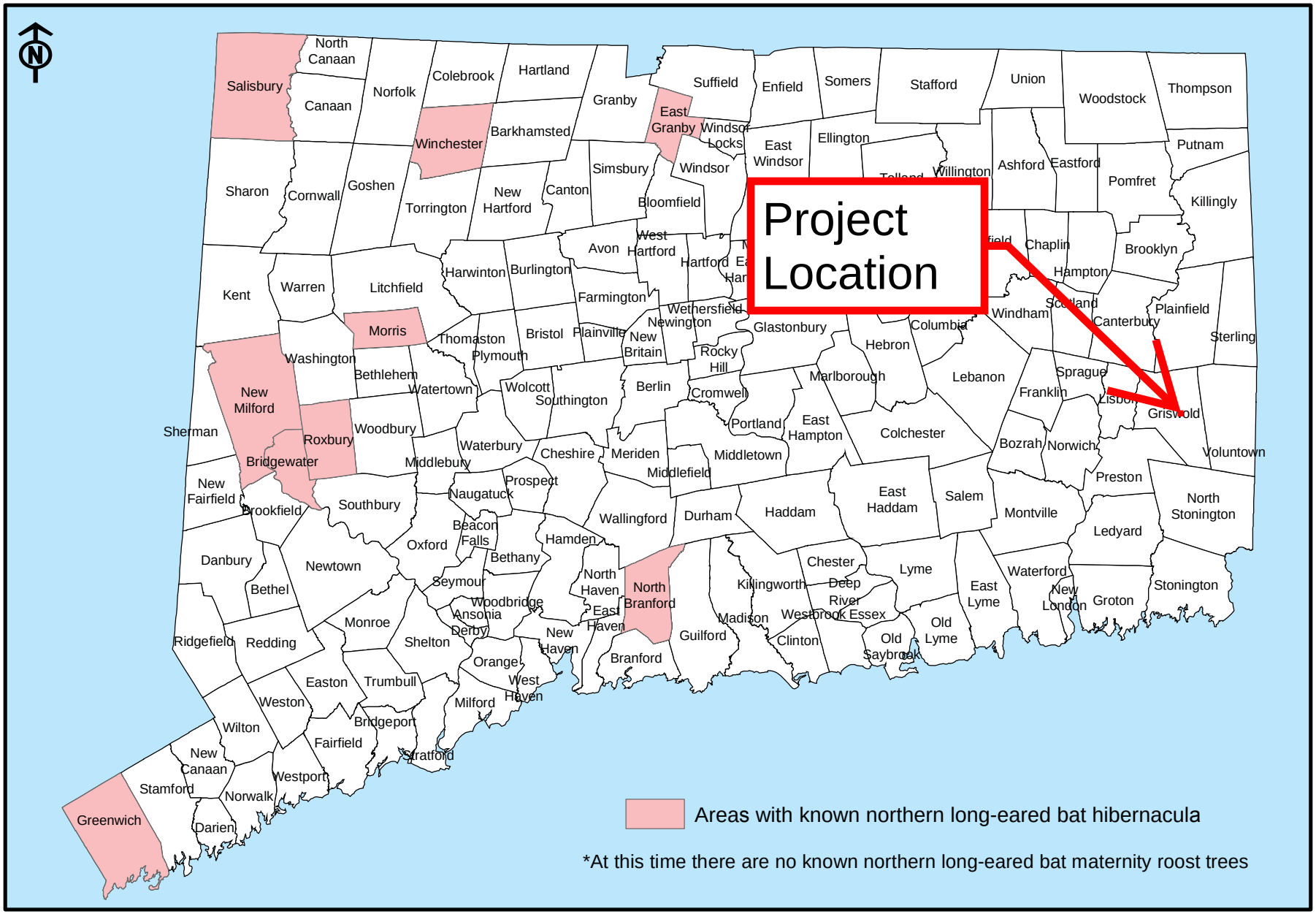
<u>Other ESA Species Reported to Occur in New London County:</u>

- Piping plover (*Charadrius melodus*) – is a migratory shorebird species closely associated with the seaboard habitat. The project due to its distance from the coast and the lack of suitable breeding habitat will not result in a negative impact to this species.

- Sandplain geradia (*Agalinis acuta*) – is a plant species that is known to favor the coastal plains. The project due to its distance from the coast will not result in a negative impact to this species. ESA protection is not granted to plants for activities on private land that are not federally funded.

- Small Whorled pogonia (*Isotria medeoloides*) – is an extremely rare forest orchid. This plant species favors acidic soils under the canopy of deciduous or mixed deciduous – coniferous forests. Due to the lack of preferred habitat and based upon previous consultation with state agency the proposed project will not have adverse impacts on this species. ESA protection is not granted to plants for activities on private land that are not federally funded.

Northern long-eared bat areas of concern in Connecticut to assist with Federal Endangered Species Act Compliance



February 1, 2016

For information on federal requirements visit http://www.fws.gov/midwest/endangered/mammals/nleb/

EXHIBIT D

Connecticut® still revolutionary

Department of Economic and Community Development

State Historic Preservation Office

March 4, 2019

Mr. Christopher Little
Ecos Energy
222 South Ninth Street, Suite 1600
Minneapolis, MN 55402

Subject: Cultural Resources Survey
Voluntown Road Solar Field, CSC #1220
Griswold, Connecticut

Dear Mr. Little:

The State Historic Preservation Office (SHPO) has received two copies of the professional archeological survey report prepared by Archaeological Consulting Services (ACS) for the referenced project, dated January 2019: one will be kept for use in the office and the other will be transferred to the Thomas J. Dodd Research Center for permanent archiving and public accessibility. The fieldwork was completed at the request of this office in a letter dated September 21, 2018. The reconnaissance survey included the excavation of 142 systematically and judgmentally positioned shovel tests in areas that would be subject to ground disturbing impacts and that were considered archeologically sensitive. The submitted report is well-written, comprehensive, and meets the standards set forth in the *Environmental Review Primer for Connecticut's Archaeological Resources*.

As a result of the archaeological survey, six fragments of culturally modified quartzite were recovered from four of the shovel tests. Although diagnostic materials were not recovered, this small concentration represents an interesting assemblage of Native American artifacts that warrant additional consideration. SHPO has received a completed State of Connecticut archaeological prehistoric resources inventory form and has tentatively assigned this resources site number 58-16. SHPO concurs with proposed avoidance of the site area located within the southeast corner of testing Block B. If avoidance of this resource is not possible, SHPO requests that additional archaeological investigations be completed to evaluate the full nature and extent of the site and to assess its potential for listing to the National Register of Historic Places. ACS also noted the presence of several stone walls. Although project plans appear to avoid these features, this office recommends refraining from impacts to these features to the greatest extent possible during construction, use, and maintenance of this facility.

SHPO appreciates the cooperation of all interested parties in the professional management of Connecticut's archeological resources. This letter updates and supersedes all previous correspondence regarding the proposed project. For additional information, please contact me at (860) 500-2329 or catherine.labadia@ct.gov.

Sincerely,

Catherine Labadia
Deputy State Historic Preservation Officer

cc: Walwer, ACS (via email)

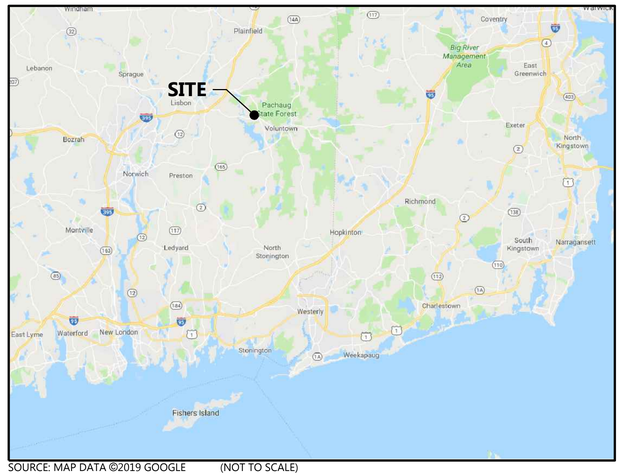
EXHIBIT E

Voluntown Solar

New London County, Connecticut

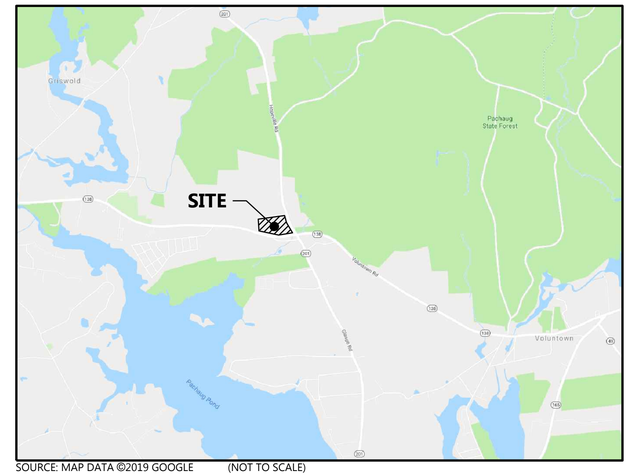
Electrical Design Plans

REGIONAL MAP



SOURCE: MAP DATA ©2019 GOOGLE (NOT TO SCALE)

VICINITY MAP



SOURCE: MAP DATA ©2019 GOOGLE (NOT TO SCALE)

PROJECT CONTACT INFORMATION			
TITLE	COMPANY	NAME	CONTACT NUMBER
SENIOR PROJECT MANAGER	WESTWOOD	DOUG MUTCHER	952-697-5709
ELECTRICAL PROJECT MANAGER	WESTWOOD	DAN HONOMICHL	952-697-5704
ELECTRICAL ENGINEER	WESTWOOD	BRANDON BLATTNER	952-697-5741
CONTRACTOR	ECOS ENERGY	XX	XX

PROJECT ADDRESS:
1240 Voluntown Road
Griswold, CT. 06351

Westwood
Phone (952) 937-5150 12701 Whitewater Drive, Suite #300
Fax (952) 937-5822 Minnetonka, MN 55343
Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.

PREPARED FOR:

ecos ENERGY

REVISIONS:

#	DATE	COMMENT
A	05/06/2019	50% SUBMITTAL
B	05/30/2019	90% SUBMITTAL

Voluntown Solar
New London County, CT

Cover

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.100

Sheet List Table

Sheet Number	Sheet Title
E.100	Cover
E.101	Sheet Index
E.102	Electrical Notes
E.103	Electrical Symbology & Equipment Labeling
E.104	General Symbology & Abreviations
E.105	Labels & Markings
E.106	Project Design Summary
E.110	Project Site Plan
E.200	MVAC Oneline Diagram
E.210	LVAC Oneline Diagram
E.220	DC Oneline Diagram
E.230	Communication Oneline Diagram
E.300	MVAC Site Plan
E.350	MVAC Details
E.400	DC and LVAC Site Plan Block 1
E.401	DC and LVAC Site Plan Block 2
E.450	Electrical Details
E.451	Electrical Details
E.452	Electrical Details
E.500	Communication Site Plan Block 1
E.501	Communication Site Plan Block 2
E.650	Trench Details
E.700	Grounding Diagram
E.701	Grounding Details
E.702	Grounding DetailS
E.800	MVAC Schedule
E.810	LVAC Schedule
E.820	DC Schedules
E.821	DC Schedules
E.822	DC Schedules
E.900	Specification Sheet - Module
E.901	Specification Sheet - Inverter

Westwood

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Toll Free (888) 937-5150

12701 Whitewater Drive, Suite #300
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Westwood Professional Services, Inc.

PREPARED FOR:

ecos ENERGY

REVISIONS:

#	DATE	COMMENT
A	05/06/2019	50% SUBMITTAL
B	05/30/2019	90% SUBMITTAL

Voluntown Solar

New London County, CT

Sheet Index

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.101

SECTION 16010 - GENERAL PROVISIONS - ELECTRICAL

A. The work included under Division 16 shall consist of furnishing labor and materials necessary for the complete installation of lighting, power, and photovoltaic systems shown on the drawings. All work shall be complete and left in operating condition at completion of Contract.

B. Include minor items that are obviously and reasonably necessary to complete the installation and usually included in similar work. Such items include bolts, nuts, anchors, brackets, sleeves, and minor offsets in conduit, junction boxes, etc

C. Some equipment and materials provided under other divisions may require composite work crews because of trade jurisdiction. It is the Contractor's or Subcontractor's responsibility to review all Contract Documents to determine where these composite crews are required.

D. All temporary and permanent permits and licenses required in connection with this Division's work shall be the responsibility of the Contractor awarded that work.

E. Installation shall meet or exceed current applicable codes, ordinances and regulations in effect at the site. If a Contractor or Subcontractor observes that the Contract Documents are at variance with governing codes and regulations, they shall promptly notify the Engineer in writing, who will respond to such variances in writing. If the Contractor performs work knowing it is not compliant with applicable codes, and does not notify the Engineer, the Contractor shall assume full responsibility and bear all costs attributable to correcting the non-complying work.

F. The reference to Codes and Standards shall not permit a lower grade of construction where Contract Documents call for workmanship and/or materials in excess of those references.

G. Where the terms "provide" or "shall be" are used in this Division or on the drawings, they shall be taken to mean "The Contractor shall furnish and install".

H. If equipment or materials other than those specified in the design of this project are proposed to be used on this project, the Contractor and supplier shall check it for dimensional differences, electrical requirements and any other potential variances. This comparison shall be made for manufacturers specified as well as those proposed prior to requesting approval. The Contractor shall be responsible for any extra costs incurred as a result of Substitutions, including those of other contractors, such as might be due to (but not limited to) different electrical, mechanical and architectural requirements.

I. Shop Drawings:

1. Carefully examine all shop drawings noting capacity, arrangement and physical dimensions and mark the drawings as being reviewed and approved prior to submitting to the Engineer. Where catalog data is submitted which includes items which do not apply to this project, those items shall be clearly marked out or relevant items clearly noted. Any deviations from the documents shall be so noted by the Contractor or equipment supplier. The intent and requirements of the drawings and specifications shall be adhered to at all times and are not waived or superseded in any way by the shop drawing submittal or review.
2. Submit a minimum (1) electronic copy of shop drawings for review and approval. Contractor shall retain a final approved copy for incorporation in the Operation and Maintenance Manuals.
3. If returned shop drawings are marked "NO EXCEPTIONS TAKEN", no additional submittal is required. If the shop drawing is marked "MAKE CORRECTIONS NOTED", the changes noted on the shop drawings are to be incorporated, with no further resubmittal required. If marked "REVISE AND RESUBMIT", changes noted on the shop drawings are to be made and the drawings resubmitted for review. If marked "REJECTED", the equipment submitted is unacceptable and different equipment or materials need to be submitted.

J. No asbestos or PCB containing materials of any type shall be used on this Project.

K. Consult the Contract Drawings and Specifications of all other Divisions and other trades for correlating information and layout work so that it will not interfere with other trades. Verify all dimensions and conditions. If conflicts occur such that resolution is not possible by the affected trades on the job, the Engineer shall be notified and a resolution will be worked out.

L. Electrical equipment enclosures (switchboards, panelboards, transformers, relay cabinets, systems racks/cabinets, combiner boxes, etc.) shall be vacuumed and wiped clean prior to energizing and again at substantial completion.

M. Install material and equipment in accordance with Manufacturers' recommendations, instructions, and current N.E.C.A. standards.

N. Install equipment and materials to provide required access for servicing and maintenance. Coordinate final equipment location with required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

O. Record Drawings: As work progresses, in a neat and legible manner, record all changes or deviations from the contract drawings. Submit Record Drawings to Engineer for review at completion of Work. The Record Drawings will become part of the Operation and Maintenance Manual package submitted to the Owner after the completion of the project.

SECTION 16050 - BASIC MATERIALS AND METHODS

A. All materials shall be new, as specified or approved, and in original packaging. Catalog numbers specified shall be verified with vendors prior to ordering material.

B. All materials shall be listed by a NRTL (i.e. UL, ETL, etc.) and have an associated label unless special fabrication of material is required. Special fabricated material shall be fabricated using listed components and procedures.

C. Where the word "provide" is used, it shall require the electrical subcontractor to furnish and install material complete to a workable system.

D. All work shall be tested in accordance with industry accepted standards. Before testing, a thorough visual inspection shall be made to detect connection problems, damaged components, poor workmanship, inappropriate overcurrent protection, debris, etc. Testing apparatus shall be certified or demonstrated to be accurate within reasonable limits. Competent personnel familiar with the test equipment shall perform all tests. If testing procedures employed are not satisfactory to the Engineer, outside testing will be done at the electrical subcontractor's expense.

E. Electrical subcontractor to identify all electrical equipment with engraved 1/4" white letters on black plates. Inscriptions shall indicate the name, voltage, phase, wires, feeder size, feeder source and location of source, and the device number.

F. All low voltage cables shall be bundled and labeled as to their function within terminal cabinets, wireways and cable trays.

G. Branch circuitry shall match circuit numbers as shown on the drawings and as scheduled. Any required deviation shall be indicated on the as-built drawings.

H. All opening into equipment shall be sealed to prevent entry of insects and rodents.

SECTION 16110 - RACEWAYS

A. Construction shall be as per Underwriter's Laboratories Standard UL 870 for wireways, auxiliary gutters and associated fittings.

B. Wireways shall be painted steel with hinged removable cover, which can be used as either a hinged cover or set screw cover. Shall be fabricated such that the entire length of wireway and fittings permit lay-in wiring application. Cross sectional area shall be 6" x 6" minimum unless otherwise noted. Raintight wireway shall be NEMA 3R construction with gaskets and a corrosion resistant finish.

C. Where required, provide cable strain relief, grounding connectors, expansion fittings.

D. Schedule 40 PVC shall be used for all raceways where not restricted by this section or specifically noted otherwise. Schedule 80 PVC shall be used where above ground or transitions where emerging from ground and exposed to physical damage.

E. PVC conduit used above grade shall be UV resistant type.

F. Flexible liquid tight conduit shall be used on all motor, moving, and vibrating equipment connections. Use minimum 1/2" size with grounding type fittings and provide grounding conductor.

G. Conduit shall not be mounted on mechanical or other equipment which vibrates except at connection points.

H. Installations of underground wiring shall be in trench, duct or conduit or by plowing in place as specified on plans.

I. Underground raceways or direct burial cables shall be installed to meet the following requirements:

1. Spacing between exterior surfaces of underground conduits/cables shall be not less than the following:
   a. 2 inches between communications (copper) conduits/cables
   b. 2 inches between AC conduits/cables operating at not over 1000 volts
   c. 6 inches between a communications conduit/cable and any power conduit/cable (AC or DC not over 100V) in the same trench
   d. 12 inches between a communications conduit/cable and any power conduit/cable (AC or DC over 1000V) in the same trench, unless noted otherwise
   e. 6 inches between AC conduits/cables operating at over 1000 volts
   f. 6 inches between AC power conduits/cables and DC power conduits/cables.
   g. 6 inches between armored fiber optic cable or in metallic conduit and power conduits/cables (AC or DC)
2. Where crossing perpendicular, spacing between exterior surface of underground conduits/cables shall be not less than the following:
   a. 6 inches between AC and DC power conduits/cables operating at any voltage.
   b. 12 inches between conduits/cables containing AC and DC power conduits operating at any voltage and communications (copper) conduits/cables.

J. All underground raceways or wiring when specified in excavated trenches shall have backfill compacted. Refer to compaction requirements in trench compaction details. Backfill immediately around conduits/conductors to be a minimum of 3" native soil free from debris and organic material. Backfill surrounding direct buried cables shall be free of rocks 3/8" or larger, debris and organic material. Thermal conductivity of imported backfill shall be tested in accordance with ASTM D5334-08 to confirm the thermal resistively is equal to or less than that of the native soil or, if applicable, the specific requirements on these plans.

K. Underground conduit shall be installed to allow drainage into manholes/handholes a minimum of 4 inches per 100 feet of horizontal run. Where conduits or ducts enter a manhole, handhole, or above grade cabinet, each shall be permanently identified by means of plastic fiber, laminated plastic or non-corrosive metal tags to indicate origination point.

L. When non-metallic conduit requires field bending, utilize a hot-bending appliance. Use of torches to bend conduit is unacceptable.

M. Where conduits terminate in handholes/vaults or in pad mounted equipment, terminate conduits a minimum of 4 inches above bedding or slab. Conduits shall use bell ends. Where routed through slabs, provide sleeves to allow settling/heaving of slab.

N. Where HDPE innerduct is used, Schedule 40 PVC or Schedule 80 PVC (where subject to damage) conduit shall be used for transitions to above grade.

SECTION 16120 - WIRING AND CABLE

A. Building Wire:

1. Description: Single conductor insulated wire.
2. Conductor: 98% Commercially pure copper conductors or AA-8000 series aluminum alloy compact stranded conductors
3. Insulation Voltage Rating: 600 volts and 2000 volts
4. Insulation: ANSI/NFPA 70, 90° C Type THHN-2, THWN-2, XHHW-2, RHW-2, USE-2, and PV
5. Exposed PV module wiring and combiner box feeders shall be 2000 volt tray rated PV type.
6. 600V AC wiring installed below grade shall be type XHHW-2, RHW-2, or USE-2.

B. Approved direct burial cable assembly shall be used only where approved.

C. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

D. Neatly trim and lace wiring inside boxes, equipment, and panelboards.

E. Clean conductor surfaces before installing lugs and connectors.

F. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.

G. Parallel 3-phase feeder runs in conduit shall have all three phase conductors (including neutral and ground where required) installed in each conduit. Grouping a single phase (or two phases) in a single conduit is not permitted.

H. Identification

1. Control wiring shall be marked at both ends as to its function.
2. Spare conductors shall be identified as such.

I. Direct burial wiring to meet spacing requirements under section 16110/I.

J. Aluminum cable is allowed for all MV cables and any LVAC and DC cables #6 AWG and larger unless otherwise specified.

SECTION 16125 - MEDIUM VOLTAGE CABLES

A. Cables for the 34.5 KV system shall be UD 35 KV MV-90 Listed single conductor, insulated, shielded and jacketed medium voltage type power cable with 100% insulation level, 90º C continuous operation rating, 130º C emergency rating, 250º C short circuit rating.

B. Cables for the 34.5 KV system shall be UD 35 KV MV-105 Listed single conductor, insulated, shielded and jacketed medium voltage type power cable with 100% insulation level, 105º C continuous operation rating, 130º C emergency rating, 250º C short circuit rating.

C. Cable shall have ASTM B-609 aluminum conductors with Class B stranding in accordance with ASTM B-231, moisture blocked strands, an extruded semi-conducting shield layer (40 mil min.) over the conductor for stress control, direct-burial XLPE insulation (345 mils min.), a concentric copper neutral, and moisture/chemical/oil/flame resistant PVC jacket.

D. Cables shall be Manufactured by Okonite, Prysmian, Southwire, General Cable, WTEC, or approved equal.

E. All MV cables must use cable termination kit manufactured by 3M, TE Connectivity, Eaton/Cooper, or Richards.

F. Complete installation shall be per National Electrical Code Articles 310 and 328. Do not exceed manufacturer's published maximum pulling tension or sidewall pressure. Provide sufficient slack in cable, ground and drain wires to permit elbow connectors to be moved to their respective parking stands.

G. All cables shall be labeled at each end at an accessible location for viewing. Label shall indicate circuit, phase, and destination/origination. Labels shall be black phenolic with white lettering and secured with a minimum of (2) UV-resistant zip ties.

H. Splices and terminations shall be made by an experienced journeyman whose qualifications are subject to approval by the Engineer. No splices shall be allowed unless specifically noted. No underground splices are permitted. Fiberglass splice boxes are not permitted unless approved by owner. All splices to be approved by owner.

I. Arrange phases at termination points, A-B-C from left to right or top to bottom as viewed from the front.

J. Test all cables according to IEEE Standard 400. Each power cable over 1000V shall be given a continuity test, and each medium voltage cable shall be given a continuity and a VLF test after installation and after terminations having been made. All single conductor cables shall be tested between conductors and ground with metallic shield and the other two conductors grounded to the same ground. Each conductor shall be successively tested in the same manner. Direct current voltages shall be applied with negative polarity to the cable conductor. See testing procedures as required.

K. No cable shall be permanently energized until a copy of its test record is approved by the Engineer.

L. In addition to any testing specified herein, perform testing consistent with the requirements of the applicable codes, NETA Acceptance Testing criteria, and the manufacturers' current quality assurance program.

M. Direct burial wiring to meet spacing requirements under section 16110/I.

SECTION 16130 - BOXES

A. Pull and junction boxes shall be code gauge, gasketed, painted, galvanized steel, PVC, or fiberglass. Covers shall be secured with screws.

B. Outlet boxes shall be cast malleable iron with threaded hubs or PVC and be of high conductive metal to maintain maximum electric continuity.

C. All outlets shall be equipped with outlet boxes approved for the use.

D. Covers or plates for boxes shall conform substantially to the outlet of the boxes with no projecting edges or corners.

E. Conduit fittings ("LB", "C", "T") or types approved for the location may be employed as required to facilitate pulling in conductors.

F. Provide pull and above ground junction boxes to facilitate pulling or splicing of conductors.

G. Mount boxes to allow for maximum flexibility.

H. Install grounding bushings with bonding conductor on all metallic feeder conduits entering box. Ground bushings and bonding conductors are not required on branch circuit conduits.

SECTION 16340 - MEDIUM VOLTAGE SECTIONALIZING CABINETS/MEDIUM VOLTAGE JUNCTION BOXES

A. Sectionalizing cabinets shall be designed for burial with the junction modules mounted above the ground line. Pedestals shall be in complete conformance with ANSI C57.12.28, Pad-mounted Equipment Enclosure Integrity Standard.

B. Sectionalizing cabinets shall be Manufactured by Nordic, Cooper, Hubbell, G&W, Power Design Inc., Highline, Federal Pacific, Hoffman, S&C or approved equal.

C. Enlosure shall be 3/16" nominal thickness fire resistant, laminate, fiberglass, with munsell green gel coat finish or shall be 12 gauge galvanized steel, with munsell green polyester powder coat finish. Enclosure access doors shall utilize stainless steel hinges and shall have provisions for padlocking. Doors shall have provisions for securing in the open position.

D. Provide junction panels with bushings to accommodate the size and quantity of dead break elbows indicated on drawings.

E. Provide ground bar in unit for bonding of ground conductors and concentric neutrals.

F. Provide fiberglass ground sleeve extending 36" below cabinet installed on a 6" pea rock base to allow drainage.

SECTION 16440 - DISCONNECT SWITCHES

A. All disconnect switches shall be NEMA heavy duty Type H.D., horsepower rated, and U.L. listed. Disconnects shall be Eaton, GE, Square D, Siemens or approved equal.

B. Provide auxiliary disconnect contacts for control circuits when supplied from an independent source.

C. Switch Interior - All switches shall have switch blades which are fully visible in the off position when the door is open. Switches shall be of dead-front construction with permanently attached arc suppressors hinged or otherwise attached to permit easy access to line-side lugs without removal of the arc suppressor. Lugs shall be UL listed for copper and/or aluminum cables and front removable. All current carrying parts shall be plated by electrolytic processes.

D. Switch Mechanism - Switches shall have a quick-make and quick-break operating handle and mechanism which shall be an integral part of the box, not the cover. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door in the ON position or closing of the switch mechanism with the door open. Switches shall provisions for locking the switch in both the ON and the OFF positions by padlock.

E. Enclosures shall be NEMA 3R enclosures unless otherwise specified. Raintight covers shall be securable in the open position. Enclosures shall be code gauge (UL 98) galvanized steel (NEMA 3R). They shall be treated with a rust-inhibiting phosphate and finished in gray baked enamel.

F. Install disconnect switches in an accessible location as convenient as possible to equipment served.

G. Switches shall be rated for the voltage and system type they are used for.

SECTION 16450 - GROUNDING

A. Provide complete grounding systems as described herein and as shown on the drawings.

B. All grounding components shall be listed for the purpose they are installed for. Components shall be Manufactured by AMPACT, Burndy, CADWELD, ITT Blackburn, Ilsco, or Lyncole.

C. Ground rods shall be 3/4 inch diameter by 10 feet long copper clad steel. Connecting cables shall be copper as indicated on drawings. All ground conductors exposed to the elements or in direct contact with the earth shall be tin coated or bare copper.

D. All metallic conduits, supports, cabinets, non-current carrying parts of equipment, and metallic structures shall be solidly grounded to form a continuous permanent and effective grounded system.

E. All wireways, metal enclosures, cable trays and similar parts of the electrical installation described herein shall be grounded.

F. UFER grounds shall be via exothermically weld connection to a minimum of (2) continuous 20'-0" sections of rebar encased in the concrete footings/piers with a minimum of 2" of concrete cover. Rebar shall be a minimum of a #4 and shall NOT be epoxy coated. If multiple pieces of rebar are required to provide the 20'-0" lengths, they shall be welded together to provide a continuous ground path.

G. The special attention of the Contractor is called to metallic building components and mechanical piping which must be grounded in an approved manner according to the NEC.

H. Provide a continuous grounding conductor for each feeder serving several panelboards. Connect this ground conductor to each related cabinet ground bar.

I. For LVAC circuits less than 1000 VAC not supplied by cables a with integral ground wire, provide a separate green insulated equipment grounding conductor for each single or three phase feeder and each branch circuit with a three phase protective device. Install the required grounding conductor in the common conduit with the related phase/hot and neutral conductors. Where parallel feeders are installed in more than one raceway, provide a green insulated equipment grounding conductor in each raceway.

J. Single Phase Branch Circuits for Lighting, Receptacles, Motors and Other Similar Equipment: Provide single phase branch circuits serving lighting, receptacles, motors, and other similar equipment consisting of phase, neutral, and green insulated equipment ground conductor installed in a common conduit.

K. Single Phase Branch Circuits for Special Equipment: Provide single phase branch circuits serving special equipment, and all branch circuits installed in nonmetallic or flexible conduits with a separate grounding conductor.

L. All transformers shall be bonded to the grounding electrode system as well as building steel (where applicable).

M. Bond all cable tray and equipment racks to ground with a minimum 4/0 AWG ground conductor.

N. Connections to the PV modules shall be installed such that removal of a module from the string does not interrupt the grounded conductor to another string. Sets of modules connected in series rated at 50 volts or more with or without blocking diodes, and having a single overcurrent device shall be considered a string.

O. When required by the testing plan, the resistance to earth shall be measured using a 3-point fall of potential test with the inverter station ground grid isolated. Results shall be compared to grounding model/study to verify field measured earth resistance is within the same order of magnitude as the grounding model/study.

SECTION 16475 - FUSES

A. DC fuses for PV string circuits shall be 1500Vdc rated HP15M as Manufactured by Mersen.

B. DC fuses for PV feeders shall be Class J or gPV type as Manufactured by Bussman, Mersen, or Littelfuse.

C. Fuses in switchboard, 601A and larger shall be Class L type and be Bussman Class L, Limitron KTU (or Hi Cap KRP-C), CEFCO Class L, CLL, Ferraz Shawmut Class L, Amp Trap A4BY, or Littelfuse Class L, KLP-C.

D. Fuses for feeder circuits 600A and less shall be Class RK1 and be Bussman Low Peak LPN-RK (250V) or LPS-RK (600V); CEFCO Lo-Ip LON-RK (250V) or LOS-RK (600V); Ferraz Shawmut Amp-Trap II A2D-R (250V) or A6D-R (600 V); or Littelfuse Little Peak LLN-RK (250V) or LLS-RK (600V).

E. Fuses for motor circuits shall be Class RK5 type and be Bussman Fusetron FRN-R (250V) or FRS-R (600 V); CEFCO CEFCON CRN-R (250V) or CRS-R (600V); Ferraz Shawmut Trionic TR-R (250 V) or TRS-R (600 V); or Littelfuse Slo-Blo FLN-RL (250V) or FLS-R (600V).

F. For in-line fuses and weatherproof assembly, provide Bussman Tron Type HEB fuse holder and Type KTK fuse with 1A0513 boot or equal.

G. For protection of control circuit transformers, provide Bussman Type FNQ time delay fuses or equal.

H. Install fuses to allow viewing of "Blown-Fuse" indicators through viewing windows in gear, where provided.

I. Provide label inside each switch and motor starter cover stating type of fuse required for replacement.

SECTION 16630 - COMBINER BOXES

A. Provide 1500V combiner box(s) Listed to UL 1741, complete with circuitry as necessary to protect the equipment including disconnect switch with finger-safe fuse holders having all necessary fusing. Combiner boxes shall be Eaton/Cooper, Shoals, SolarBos, Amtec, Teal, Bentek, WTEC, or approved equal.

B. A finger-safe, non-fused load break disconnect is required and it shall be interlocked to prevent the opening of the cover when the switch is in the ON position. Interlock shall be defeatable for testing purposes. Handle must be lockable in OFF position.

C. All fuse holders shall be finger-safe.

D. The combiner box shall be arranged to have a minimum number of input circuits and fuse sizes as indicated on the combiner box schedules for a negatively grounded system. Input fuse holders shall be rated to hold 32A fuses.

E. Enclosures shall be a minimum of NEMA 3/IP54 with seamless door gaskets and an integral disconnect rated as indicated on the combiner box schedules.

F. All wire terminations/lugs shall be Listed for 90°C field terminations.

G. Combiner boxes including disconnect and fuses shall be Listed for continuous operation at 100% of its collector bus/disconnect rating.

H. Provide units with integral DC surge protection devices rated for 40kA discharge current (8/20 µs) and maximum continuous operating voltage of 1500Vdc

I. Equipment shall have a nameplate installed and mounted to the front cover and indicate, at a minimum: number of input circuits, ampere rating of input circuits, voltage rating, short-circuit current rating, and integrated disconnect ampere rating.

J. Combiner box Manufacturer shall review combiner box schedules and verify combiner boxes enclosures are large enough and configured to allow termination of the size and quantity of string and feeder conductors/conduits indicated on the schedules.

K. Provide typed PV string directory inside cover to denote strings and their associated fuse/terminal number.

L. All combiner box components shall be pre-wired before arriving to site.

M. Provide a directory of combiner boxes at each inverter to facilitate location and shut down of DC sources.

Westwood

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Westwood Professional Services, Inc.

PREPARED FOR:

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REVISIONS:

#	DATE	COMMENT
A	05/06/2019	50% SUBMITTAL
B	05/30/2019	90% SUBMITTAL
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Voluntown Solar

New London County, CT

Electrical Notes

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.102

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ELECTRICAL SYMBOLOGY

- MOTOR
- FUSE
- SWITCH/DISCONNECT
- MV 3 POLE FUSED SWITCH/DISCONNECT
- BREAKER
- GANG-OPERATED AIRBREAK SWITCH
- TRANSFORMER
- SURGE ARRESTOR
- NON-LOAD BREAK ELBOW
- LOAD BREAK ELBOW
- DRAW OUT MEDIUM VOLTAGE CIRCUIT BREAKER
- FAULT INDICATOR, TEST POINT RESET, SEL OR EQUIVALENT
- 3-PHASE: GROUNDED WYE
- 3-PHASE: UNGROUNDED WYE
- 3-PHASE: DELTA
- HANDHOLE
- POWER METER
- PV MODULE SERIES STRING
- INVERTER
- CURRENT TRANSFORMER
- POTENTIAL TRANSFORMER
- NUMBER OF CIRCUITS IN TRENCH

PLAN LINE SYMBOLOGY

- CHAIN LINK SECURITY FENCE
- INVERTER BLOCK BOUNDARY
- COMBINER BLOCK BOUNDARY
- AC MV WIRING
- DC WIRING LEVEL 1
- DC WIRING LEVEL 2
- FIBER OPTIC LINE
- COMM CABLE
- CAB MESSENGER WIRE
- MOTOR CIRCUIT WIRE
- OVERHEAD CABLES
- DC TRENCH

EQUIPMENT LABELING KEY

		IDENTIFIER 1		IDENTIFIER 2		IDENTIFIER 3		
ITEM	BLOCK #	EQUIPMENT	NUMBER	EQUIPMENT	NUMBER	EQUIPMENT	NUMBER	EXAMPLE
PV TRANSFORMER	1	XFMR	-	-	-	-	-	1.XFMR
SWITCHGEAR	1	SWG	-	-	-	-	-	1.SWG
PANELBOARD	1	PNL	1	-	-	-	-	1.PNL1
AUXILIARY TRANSFORMER	1	XFMR	-	AUX	1	-	-	1.XFMR.AUX1
AUXILIARY PANELBOARD	1	PNL	-	AUX	1	-	-	1.PNL.AUX1
STRING INVERTER	1	PNL	1	INV	1	-	-	1.PNL1.INV1
MODULE STRING	1	PNL	1	INV	1	STR	1	1.PNL1.INV1.STR1

NOTES

1. THESE SYMBOLS APPLY TO THIS ELECTRICAL SET OF CONTRACT DRAWINGS.
2. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE-EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.
3. CONTRACTOR SHALL VERIFY THAT WIRING CODE COMPLIES WITH AHJ WIRING CODE AND DUKE ENERGY REQUIREMENTS.

Westwood

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A	05/06/2019	50% SUBMITTAL
B	05/30/2019	90% SUBMITTAL

Voluntown Solar

New London County, CT

Electrical Symbology & Equipment Labeling

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.103

GENERAL SYMBOLOGY

NORTH ARROW

X — KEYNOTE

B OR MV01 — CONDUCTOR ID

DETAIL TITLE

1 Drawing Title
1:1

DETAIL NUMBER

SCALE

DETAIL CALLOUT

X
E.XXX

DETAIL NUMBER

DRAWING NUMBER

SECTION CALLOUT

X
E.XXX

DETAIL NUMBER

DRAWING NUMBER

ELEVATION CALLOUT

DETAIL NUMBER

DRAWING NUMBER

CAB TO TRENCH TRANSITION CALLOUT

X
E.XXX

DETAIL NUMBER

DRAWING NUMBER

ABBREVIATIONS

A,AMP	AMPERAGE
A/E	ARCHITECT/ENGINEER
ABAN	ABANDON
ABC	AGGREGATE BASE COURSE
AC	ALTERNATING CURRENT
ACC	ASPHALTIC CONCRETE PAVEMENT
ADDL	ADDITIONAL
ADJ	ADJUSTABLE/ADJACENT
AFCI	ARC FAULT CIRCUIT INTERRUPTER
AFF	ABOVE FINISH FLOOR
AFG	ABOVE FINISH GRADE
AGGR	AGGREGATE
AIC	AMPS INTERRUPTING CAPACITY
AL	ALUMINUM
ALIG	ALIGNMENT
ALT	ALTERNATE
ANSI	AMERICAN NATIONAL STANDARDS INSTITU
APRX	APPROXIMATE
APVD	APPROVED
ARCH	ARCHITECTURAL
ASSY	ASSEMBLY
AUTO	AUTOMATIC
AUX	AUXILIARY
AWG	AMERICAN WIRE GUAGE
BITUM	BITUMINOUS
BKR	BREAKER
BL	BASE LINE
BLDG	BUILDING
BMP	BEST MANAGEMENT PRACTICE
BOC	BACK OF CURB
BRD	BOARD
C	CONDUIT
C&G	CURB AND GUTTER
CAB	CABINET
CB	CIRCUIT BREAKER
CCB	CONCRETE BLOCK
CCTV	CLOSED CIRCUIT TELEVISION
CE	CONCRETE EDGE
CF	CUBIC FOOT/FEET
CIP	CAST-IN-PLACE
CL	CENTERLINE
CLR	CLEAR, CLEARANCE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY RE UNIT
CO	CLEANOUT
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONTR	CONTRACTOR
CTR	CENTER
CTRL	CONTROL
CU	COPPER
DC	DIRECT CURRENT
DEMO	DEMOLITION
DIA	DIAMETER
DISC	DISCONNECT
DTL	DETAIL
DWG	DRAWING
EA	EACH
EL	ELEVATION
ELEC	ELECTRIC/ELECTRICAL
EMT	ELECTRICAL METAL TUBING
ENGR	ENGINEER
EOP	EDGE OF PAVEMENT
EQ	EQUAL
EQUIP	EQUIPMENT
EST	ESTIMATE
EXC	EXCAVATION
EXIST	EXISTING
F	FUSE
FBO	FURNISHED BY OTHERS
FG	FINISHED GRADE
FLR	FLOOR
FLUOR	FLUORESCENT
FOC	FACE OF CONCRETE/CURB
FT	FEET/FOOT
FUT	FUTURE
GEN	GENERAL
GFI	GROUND FAULT INTERRUPTER
GR	GRADE
GVL	GRAVEL
HORIZ	HORIZONTAL
HP	HORSE POWER
HT	HEIGHT
HZ	HERTZ
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IMC	INTERMEDIATE METALLIC CONDUIT
IN	INCH
INV	INVERT
JB	JUNCTION BOX (J-BOX)
KO	KNOCKOUT
KV	KILOVOLT
KVA	KILOVOLT AMPERE
KVAR	KILOVOLT AMPERE REACTIVE
KW	KILOWATT
KWH	KILOWATT HOUR
LATL	LATERAL
LBS	POUNDS
LP	LOWPOINT
LT	LIGHT
LTG	LIGHTING
LV	LOW VOLTAGE
MA	MILLIAMPERE
MATL	MATERIAL
MAX	MAXIMUM
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MFR	MANUFACTURER
MIN	MINIMUM
MLO	MAIN LUG ONLY
MON	MONUMENT
MTD	MOUNTED
NA	NOT APPLICABLE
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OC	ON CENTER
PB	PUSHBUTTON
PCC	PORTLAND CONCRETE PAVEMENT
PF	POWER FACTOR
PH,Φ	PHASE
PL	PROPERTY LINE
PNL	PANEL
PROP	PROPERTY/PROPOSED
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
PWR	POWER
QTY	QUANTITY
R	RADIUS
R&R	REMOVE AND REPLACE
R&S	REMOVE AND SALVAGE
RCPT	RECEPTACLE
REF	REFERENCE
REQD	REQUIRED
RET	RETAINING
REV	REVISION
RGH	ROUGH
RM	ROOM
SAN	SANITARY
SCHED	SCHEDULE
SD	STORM DRAIN
SHT	SHEET
SL	SLOPE
SOG	SLAB ON GRADE
SPD	SURGE PROTECTOR DEVICE
SPEC	SPECIFICATION
SQ	SQUARE
SQ FT	SQUARE FEET
STA	STATION
STD	STANDARD
SW	SWITCH
SWBD	SWITCHBOARD
SY	SQUARE YARD
SYS	SYSTEM
T&B	TOP AND BOTTOM
TEL	TELEPHONE
TOB	TOP OF BERM
TOC	TOP OF CURB
TOPO	TOPOGRAPHY
TOS	TOP OF SLAB/TOE OF SLOPE
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
TYP	TYPICAL
UG	UNDERGROUND
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUPTIBLE POWER SUPPLY
UTIL	UTILITY
V	VOLT
VA	VOLT AMPERE
W	WATT
W/	WITH
W/O	WITHOUT
WP	WEATHERPROOF
XFMR	TRANSFORMER
XSECT	RE CROSS SECTION

EQUIPMENT CODES

AAT	AMBIENT AIR TEMPERATURE SENSOR
ANE	ANEMOMETER
ATS	AUTOMATIC TRANSFER SWITCH
BAT	BATTERY
BUS	BUS CONDUCTOR
CBK	CIRCUIT BREAKER
CBL	CABLE
CHGR	BATTERY CHARGER
CLM	CELLULAR MODEM
CMB	COMBINER BOX
CMT	CHECK METER
CNT	CONDUIT
CPC	CAPACITOR BANK
CT	CURRENT TRANSFORMER
DAM	DATA ACQUISITION MODULE
DAS	DATA ACQUISITION SYSTEM
DCI	COMBINER INPUT AT INVERTER
DCA	DISCONNECT - AC
DCD	DISCONNECT - DC
DCF	DISCONNECT - FUSED
DCH	DISCONNECT - HIGH VOLTAGE
DCM	DISCONNECT - MEDIUM VOLTAGE
GND	GROUND CONDUCTOR
GSW	GANG-OPERATED SWITCH
HPY	HORIZONTAL PYRANOMETER
INS	INSULATOR
I	INVERTER
JBM	JUNCTION BOX - MEDIUM VOLTAGE
JMP	JUMPER CONDUCTOR
LAR	LIGHTNING ARRESTOR
MBR	MAIN BREAKER
MET	METERING STATION
MPNL	METER PANEL
MTR	METER
NDS	NIGHTTIME DISCONNECT SWITCH
OHC	OVERHEAD CONDUCTOR
PAP	PLANE OF ARRAY PYRANOMETER
PEN	ROOF PENETRATION
PIL	SUPPORT PILE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PLS	POLE - STEEL
PLW	POLE - WOOD
PNL	POWER PANEL
RCB	RECOMBINER BOX
RCT	REACTOR
REL	RELAY
RMT	REVENUE METER
RTU	RTU
SA	SURGE ARRESTOR
SC	SEPARABLE CONNECTOR
STL	STRUCTURAL STEEL
SWF	SWITCH - FUSED
SWG	MEDIUM VOLTAGE SWITCHGEAR
TB	TAP BOX
TC	TRACKER CONTROLLER
TFH	TRANSFORMER - MAIN STEP-UP
TFM	TRANSFORMER - INVERTER STEP-UP
TFS	TRANSFORMER - STATION SERVICE
THS	THERMAL SENSOR
TM	TRACKER MOTOR
TT	TORQUE TUBE
UCT	UNDERGROUND CABLE TERMINATION
VT	VOLTAGE TRANSFORMER
WS	WEATHER STATION
WSS	WIND STOW SWITCHES
WVA	WFATHFR VANF

MATERIALS IN PLAN/SECTION

RIPRAP (PLAN AND/OR SECTION)

CONCRETE (PLAN AND/OR SECTION)

GRANULAR FILL (SECTION)

UNDISTURBED EARTH (SECTION)

COMPACTED EARTH (SECTION)

SAND (SECTION)

NOTES

1. THIS IS A STANDARD SYMBOLOGY AND ABBREVIATION SHEET. ALL SYMBOLS AND ABBREVIATIONS ARE NOT NECESSARILY USED ON THIS PROJECT.
2. THESE SYMBOLS AND ABBREVIATIONS APPLY TO THIS ENTIRE SET OF ELECTRICAL DRAWINGS.
3. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE-EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.

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Voluntown Solar

New London County, CT

General Symbology & Abreviations

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.104

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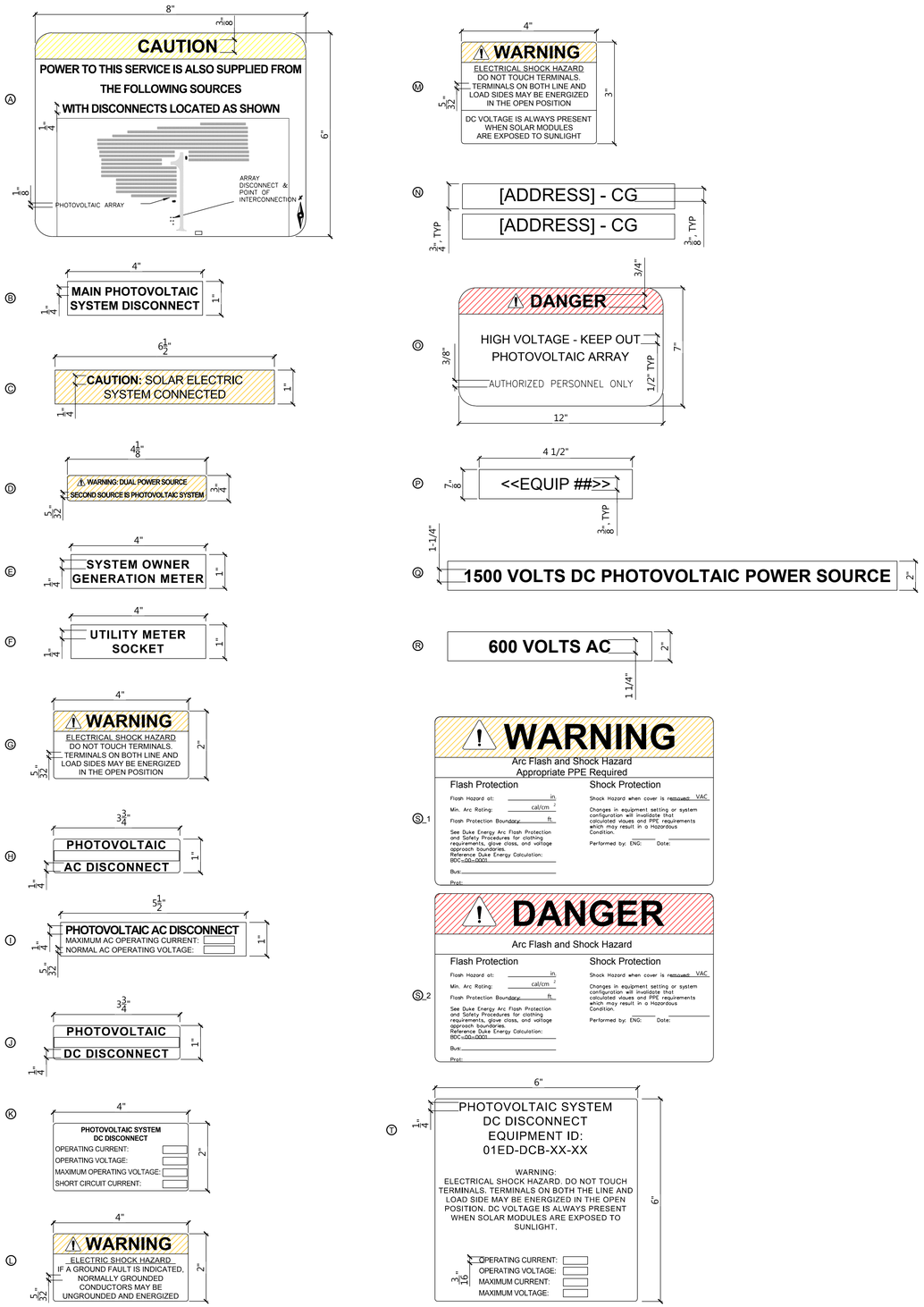

LABELS AND MARKINGS LEGEND:

Ⓐ CAUTION LABEL FOR THE LOCATION OF THE SERVICE DISCONNECTING MEANS AND THE PHOTOVOLTAIC DISCONNECTING MEANS. THIS PLAQUE SHALL BE APPLIED TO THE MAIN SERVICE DISCONNECTING MEANS AT THE SUBSTATION POCC. CUSTOM LABEL WITH WHITE BACKGROUND AND BLACK LETTERS. SHOW LOCATION OF ALL PHOTOVOLTAIC SYSTEM DISCONNECTING MEANS ON SITE PLAN.

Ⓑ LABEL FOR UTILITY MAIN AC DISCONNECT. APPLIED TO SERVICE DISCONNECTING MEANS AND PHOTOVOLTAIC DISCONNECTING MEANS AT SUBSTATION. LABEL WITH RED BACKGROUND AND WHITE LETTERS.

Ⓒ CAUTION LABEL FOR PHOTOVOLTAIC SYSTEM CONNECTED. APPLIED TO ALL PHOTOVOLTAIC DISCONNECTING MEANS AND PRODUCTION METERS. APPLY TO SUBSTATION MAIN SERVICE DISCONNECT, FEEDER BREAKERS, UTILITY PRODUCTION METER AND CUSTOMER METER. LABEL WITH YELLOW BACKGROUND AND BLACK LETTERS.

Ⓓ WARNING LABEL FOR DUAL POWER SOURCE PRESENT. APPLY TO UTILITY PRODUCTION METER, CUSTOMER METER AND PULL BOXES.

Ⓔ SYSTEM OWNER'S GENERATION METER LABEL. LABEL WITH RED BACKGROUND AND WHITE LETTERS.

Ⓕ LABEL FOR REQUIRED UTILITY (PRODUCTION) METER SOCKET. LABEL WITH RED BACKGROUND AND WHITE LETTERS.

Ⓖ WARNING LABEL FOR DISCONNECTING MEANS WHERE BOTH SIDES MAY BE ENERGIZED IN THE OPEN POSITION. APPLY TO MAIN SERVICE DISCONNECT, ALL AC PHOTOVOLTAIC DISCONNECTS, AND PULL BOXES.

Ⓗ LABEL FOR AC DISCONNECTS IDENTIFICATION. LOCATED AT INVERTER STATIONS. LABEL WITH RED BACKGROUND AND WHITE LETTERS. LABEL WITH WHITE STRIPE ALONG CENTER.

Ⓘ LABEL FOR AC DISCONNECT INFORMATION. LOCATED AT INVERTER STATIONS. LABEL WITH RED BACKGROUND AND WHITE LETTERS. INFORMATION IN BLACK LETTERS WITHIN WHITE BOXES.

Ⓙ LABEL FOR DC DISCONNECT IDENTIFICATION. APPLY TO ALL COMBINER BOXES AND RE-COMBINERS. LABEL WITH RED BACKGROUND AND WHITE LETTERS. LABEL WITH WHITE STRIPE ALONG CENTER.

Ⓚ LABEL FOR DC DISCONNECT INFORMATION. APPLY TO ALL COMBINER BOXES AND RE-COMBINERS. LABEL WITH RED BACKGROUND AND WHITE LETTERS. INFORMATION IN BLACK LETTERS WITHIN WHITE BOXES.

Ⓛ LABEL FOR INVERTER OR APPLIED BY THE INSTALLER NEAR THE GROUND-FAULT INDICATOR AT A VISIBLE LOCATION.

Ⓜ WARNING LABEL FOR DC DISCONNECTS. APPLY TO ALL COMBINER BOXES AND RE-COMBINERS.

Ⓝ LABEL FOR BUILDING ADDRESS; ONE PER SYSTEM METER AND ONE TO BE PLACED OUTSIDE OF POCC LOCATION

Ⓞ DANGER LABEL FOR CHAIN LINK SECURITY FENCE; SPACED EVERY 200 FEET AROUND PERIMETER OF ARRAY. SIGNS SHALL BE AT LEAST 14 GAUGE GALVANIZED STEEL OR ALUMINUM OR MINIMUM 3/32" THICK UV STABILIZED POLYCARBONATE OR PLEXIGLASS WITH 20 YEAR MINIMUM LIFE UV RESISTANT PAINT/LAMINATE FINISH. FASTEN TO FENCE WITH A MINIMUM OF (4) GALVANIZED STEEL OR 1/4" NOMINAL HEAVY DUTY UV STABILIZED ZIP TIES

Ⓟ GENERIC EQUIPMENT NUMBERING LABEL; ONE PER SWITCHBOARD, ONE PER PANELBOARD, ONE PER INVERTER AND ONE PER TRANSFORMER

Ⓠ CONDUIT RUN FROM COMBINER TO INVERTER. (AS NEEDED)

Ⓡ CONDUIT RUN FROM PANELBOARD TO STEP-UP TRANSFORMER. COORDINATE WITH TRANSFORMER STATION MANUFACTURER. (AS NEEDED)

Ⓢ ARC FLASH WARNING LABEL SHALL BE PLACED ON ALL EQUIPMENT AS REQUIRED BY NEC 110.16 INCLUDING, BUT NOT LIMITED TO, COMBINER BOXES, DISCONNECTS, INVERTERS, PANEL BOARDS AND SWITCHBOARDS. TOTAL QUANTITY TO BE DETERMINED BY CONTRACTOR. LABEL SHOWN IS AN EXAMPLE - VALUES WILL VARY BETWEEN EQUIPMENT. CHOOSE APPROPRIATE LABEL FOR APPROPRIATE HAZARD CONDITION. WARNING LABEL DESIGNATES INCIDENT ENERGY < 40 CAL/CM^2 AND DANGER LABEL DESIGNATES INCIDENT ENERGY >= 40 CAL/CM^2.

Ⓣ LABEL FOR DC DISCONNECT INFORMATION WHICH COMBINES LABELS G, J, AND K ON THIS SHEET. APPLY TO ALL COMBINER BOXES.

GENERAL NOTES

1. SOLAR MODULES SHALL BE SUPPLIED FROM THE MANUFACTURER WITH MARKINGS PRE-APPLIED TO MEET THE REQUIREMENTS OF THE NEC.
2. INVERTERS SHALL BE SUPPLIED FROM THE MANUFACTURER WITH THE APPROPRIATE LABELS AND MARKINGS TO MEET THE REQUIREMENTS OF THE NEC.
3. FINAL LABEL QUANTITIES, TEXT, AND LOCATIONS TO BE DETERMINED BY CONTRACTOR.
4. THE LABELING, MARKING, IDENTIFICATION, AND GROUPING REQUIREMENTS OF THE 2017 EDITION OF THE NATIONAL ELECTRIC CODE SHALL BE APPLICABLE TO THIS PHOTOVOLTAIC PROJECT.
5. IN ADDITION TO NEC-REQUIRED LABELING, ALL MAJOR ELECTRICAL EQUIPMENT SHALL BE IDENTIFIED PER SPECIFICATIONS IN THIS PLAN SET. LABELS SHALL BE SUITABLE FOR THE ENVIRONMENT IN WHICH THEY ARE INSTALLED.
6. INTERCONNECTION EQUIPMENT AND MATERIALS, INCLUDING SHARED EQUIPMENT WITH THE UTILITY, SHALL BE LABELED PER UTILITY SPECIFICATIONS.
7. ALL WARNING, CAUTION AND/OR DANGER LABELS TO COMPLY WITH ANSI Z535.4-2011 STANDARD FOR PROPER TEXT SIZE, DESIGN, ETC.
8. BELOW IS A LIST OF MAJOR SECTIONS OF ARTICLE 690 OF THE NEC WHICH OUTLINE PV LABELING AND MARKING. THIS LIST, NOR THE EXAMPLES SHOWN ON THIS SHEET, SHOULD NOT BE CONSIDERED EXHAUSTIVE. CONTRACTOR IS REQUIRED TO UNDERSTAND THE NEC LABELING REQUIREMENTS AND APPLY THESE REQUIREMENTS TO PROJECT AS REQUIRED. SECTIONS IN ITALICS ARE DIRECT QUOTES FROM NEC.

   NEC 690.13(B)
   DISCONNECTING MEANS IDENTIFICATION.

   NEC 690.15
   EQUIPMENT ENERGIZED BY MORE THAN ONE SOURCE.

   NEC 690.17(E)
   WHEN BOTH TERMINALS OF A DISCONNECTING MEANS MAY BE ENERGIZED.

   NEC 690.31(G)(3)
   MARKING AND LABELING REQUIRED.

   NEC 690.31(G)(4)
   MARKING AND LABELING METHODS AND LOCATIONS.

   NEC 690.35(F)
   PHOTOVOLTAIC POWER SOURCE LABELED AT J-BOXES, COMBINER BOXES, DEVICES.

   NEC 690.53
   LABEL FOR DC PV POWER SOURCE AT PV DISCONNECTING MEANS.

   NEC 690.54
   LABEL FOR INTERACTIVE SYSTEM POINTS OF INTERCONNECTION WOTH OTHER SOURCES.

   NEC 690.56(B)
   FACILITIES WITH UTILITY SERVICE AND PV SYSTEMS.

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Voluntown Solar

New London County, CT

Labels & Markings

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.105

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Voluntown Design Summary

Project AC Capacity:		1998 kW-AC
Project DC Capacity:		2400kW-DC

INVERTER				MODULE RACK		MODULE			ARRAY							
Block #	MAKE	MODEL	KW/KVA	MAKE	MODEL	MAKE	MODEL	WATTAGE (W)	QUANTITY OF MODULES PER STRING	QUANTITY OF STRINGS PER INVERTER	QUANTITY OF STRINGS	QUANTITY OF MODULES	QUANTITY OF INVERTERS	CAPACITY (kW-AC)	NAMEPLATE (kW-DC)	DC:AC RATIO
1	ABB	PVS-166-TL-US	166.5	X	25° FIX TILT	LG	LG400N2W	400	25	20	120	3000	6	999	1200.0	1.201
2	ABB	PVS-166-TL-US	166.5	X	25° FIX TILT	LG	LG400N2W	400	25	20	120	3000	6	999	1200.0	1.201

SITE TOTALS	240	6000	12	1998.00	2400.00	1.201

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Voluntown Solar

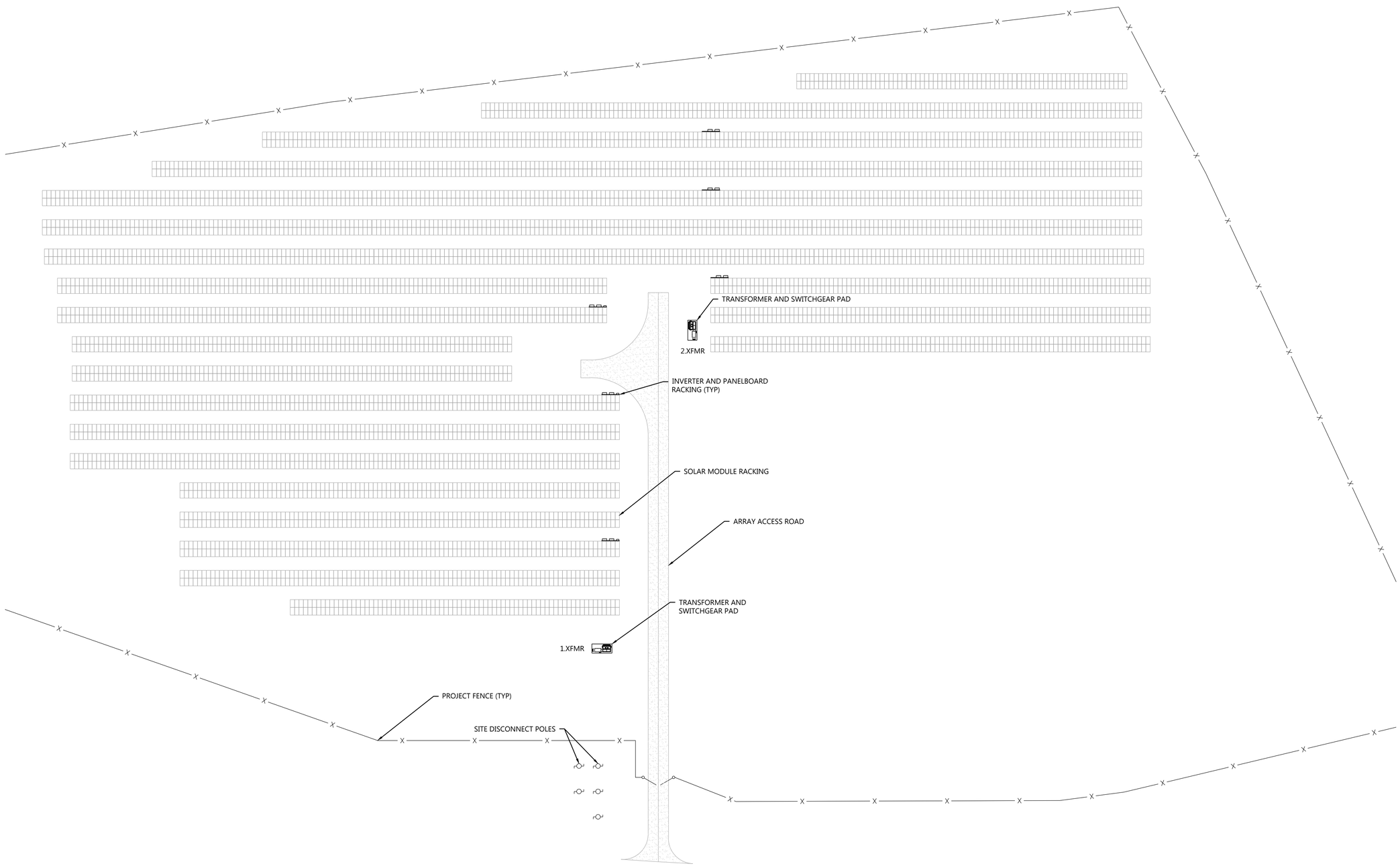
New London County, CT

Project Design Summary

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.106



1 Project Site Plan
1" = 40'

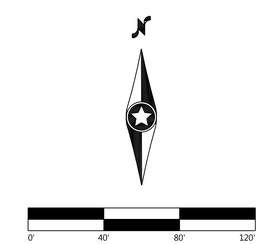
Westwood
Phone (952) 937-5150 12701 Whitewater Drive, Suite #300
Fax (952) 937-5822 Minnetonka, MN 55343
Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.

PREPARED FOR:

ecos ENERGY

REVISIONS:

#	DATE	COMMENT
A	05/06/2019	50% SUBMITTAL
B	05/30/2019	90% SUBMITTAL



Voluntown Solar

New London County, CT

Project Site Plan

NOT FOR CONSTRUCTION

DATE: 05/30/2019

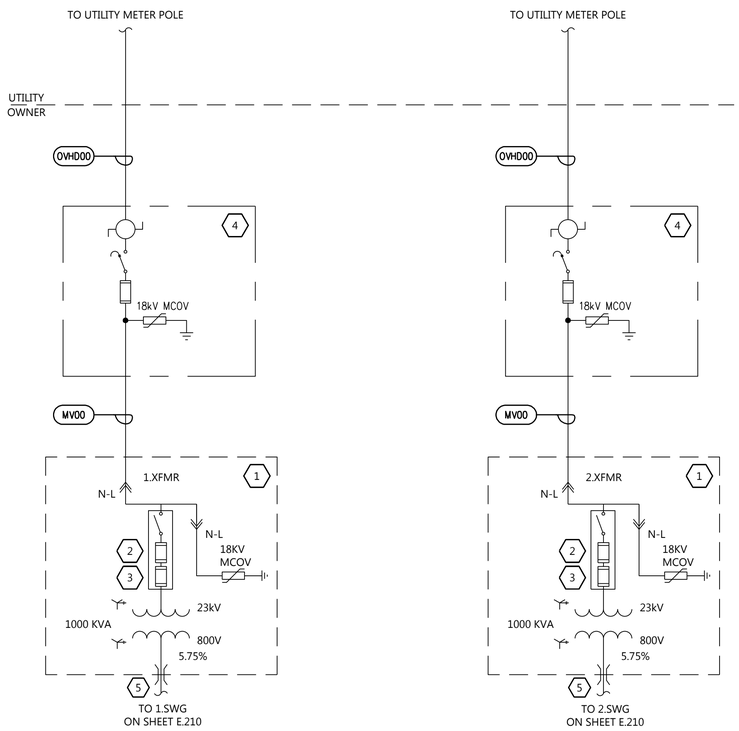
SHEET: E.110

NOTES:

1. PROVIDE EXTERNAL SURGE ARRESTERS AT TRANSFORMERS, ELBOW CONNECTED ON THE HIGH VOLTAGE SIDE OF TRANSFORMER WHERE SHOWN.
2. INSTALL ALL EQUIPMENT AND WIRING IN ACCORDANCE WITH THE NEC, NESC, AND ALL APPLICABLE REQUIREMENTS OF THE LOCAL UTILITY COMPANY AND LOCAL AUTHORITY HAVING JURISDICTION.
3. REFER TO SHEET E.103 MVAC EQUIPMENT LABELING REQUIREMENTS.
4. REFER TO SHEETS E.210 FOR LVAC SINGLE LINE DIAGRAM.
5. REFER TO SHEET E.220 FOR DC SINGLE LINE DIAGRAM
6. REFER TO SHEET E.800 FOR MVAC SCHEDULE.

KEY NOTES:

1. 1000 KVA, 23,000V GROUNDED WYE/800V GROUNDED WYE, Z=5.75%, 3 PHASE, 4W, 95KV BIL, TWO-WINDING PAD MOUNTED STEP-UP TRANSFORMER.
2. CURRENT LIMITING FUSE, RATING TBD.
3. EXPULSION FUSE, RATING TBD.
4. POLE MOUNTED S&C OMNI-RUPTER GANG OPERATED LOAD BREAK DISCONNECT MANNUALLY OPERATED (147442R4-A1P1-S1) 25KV, 150KV BIL, 800A CONTINUOUS, 65KA, 24/7 UTILITY ACCESS, VISIBLE BREAK, AND UTILITY LOCKABLE.
5. MAIN SWTICHGEAR AND TRANSFORMER TO BE CLOSE COUPLED WITH PROVIDED FLEX BUSS.



WIRING SCHEDULE	
WIRING ID	NOTES
MV00	REFER TO MVAC SCHEDULES ON SHEET E.800 FOR CONDUCTOR SIZE AND SPECS.
OVHD00	REFER TO MVAC SCHEDULES ON SHEET E.800 FOR CONDUCTOR SIZE AND SPECS.

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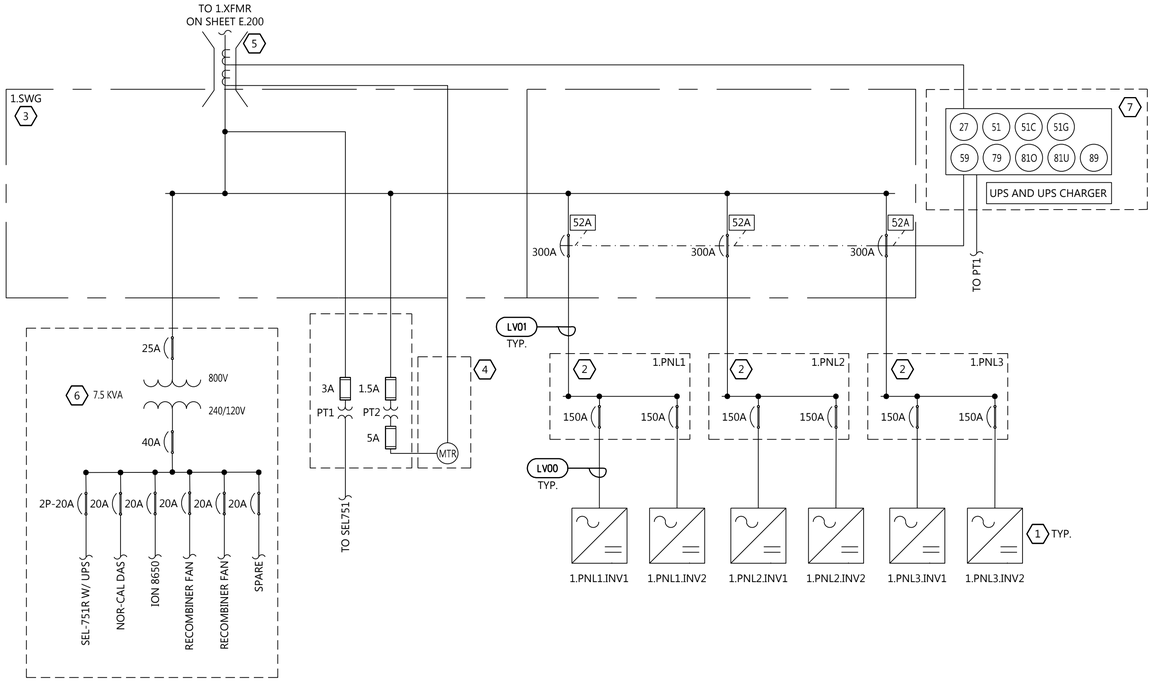
MVAC Oneline Diagram

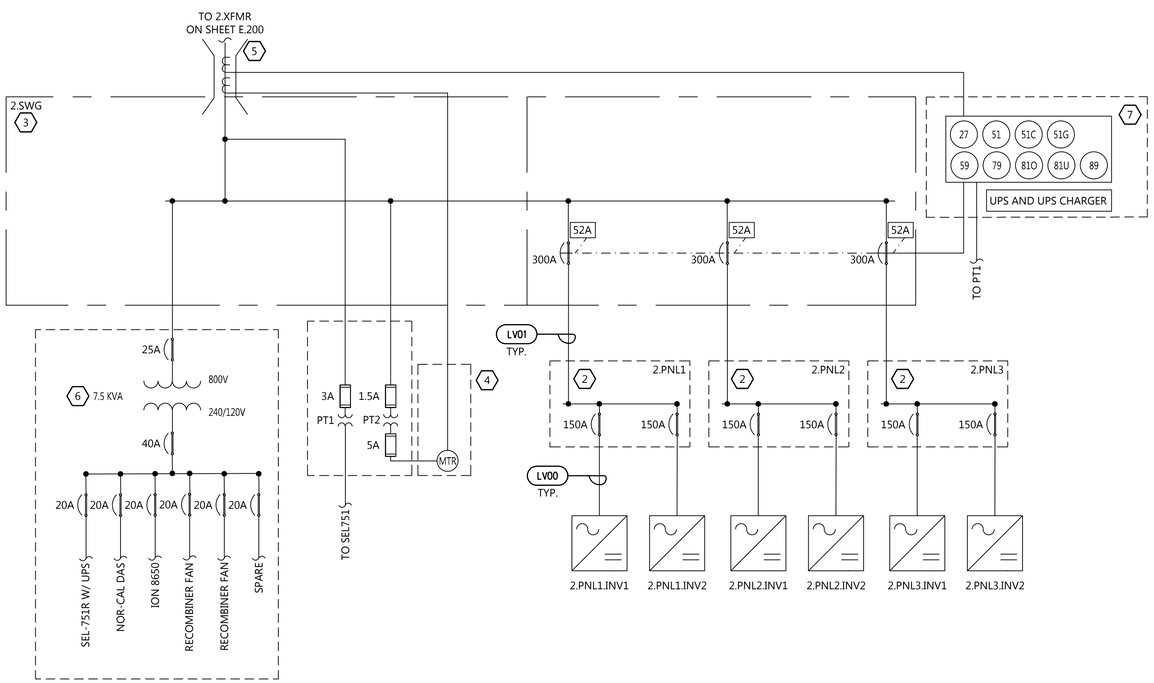
NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.200



1 Switchgear Single Line Diagram - 1.SWG



2 Switchgear Single Line Diagram - 2.SWG

NOTES:

1. INSTALL ALL EQUIPMENT AND WIRING IN ACCORDANCE WITH THE NEC, NESC, AND ALL APPLICABLE REQUIREMENTS OF THE LOCAL UTILITY COMPANY AND LOCAL AUTHORITY HAVING JURISDICTION.
2. REFER TO SHEET E.103 FOR EQUIPMENT LABELING REQUIREMENTS.
3. REFER TO SHEETS E.200 FOR MVAC SINGLE LINE DIAGRAM.
4. REFER TO SHEET E.220 FOR DC SINGLE LINE DIAGRAM
5. REFER TO SHEET E.810 FOR LVAC SCHEDULE.

KEY NOTES:

1. STRING INVERTER: ABB PVS-166-TL-US, 3 PHASE, 4W, 800V OUTPUT. CSA TO UL 1741SA & IEEE1547 CERTIFIED.
2. PANELBOARD: BACKFEED RATED, 800V, 400A. BREAKERS ARE TO BE ABB 800V RATED.
3. MAIN SWITCHGEAR: BACKFEED RATED, 800V, 1500A, 3 PHASE, 4W. SHUNT-TRIP BREAKERS TO ABB 800V RATED W/POSITION CONTACTS.
4. REC METER CABINET: GE MODEL 125-102 PROVIDED BY ABB.
5. MAIN SWITCHGEAR AND TRANSFORMER TO BE CLOSE COUPLED WITH PROVIDED FLEX BUSS.
6. 7.5KVA TRANSFORMER, 800V:240/120V, SINGLE PHASE, 10KAIC. EATON DRY TYPE (OR EQUIVALENT) 6 CKT BREAKER PANEL.
7. SEL-751R W/UPS

WIRING SCHEDULE

WIRING ID	NOTES
LV00	REFER TO LVAC SCHEDULES ON SHEET E.810 FOR CONDUCTOR SIZE AND SPECS.
LV01	REFER TO LVAC SCHEDULES ON SHEET E.810 FOR CONDUCTOR SIZE AND SPECS.

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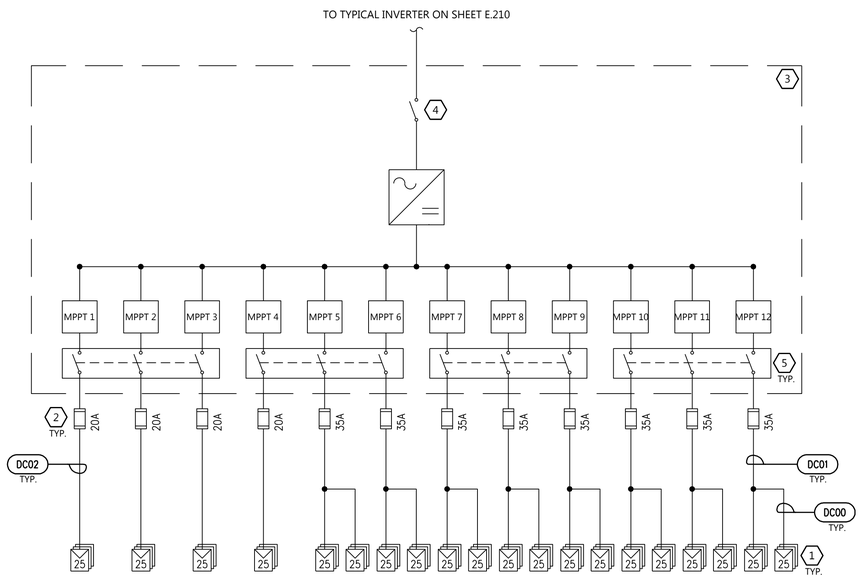
LVAC Oneline Diagram

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.210



1 String Inverter Single Line Diagram

NOTES:

1. INSTALL ALL EQUIPMENT AND WIRING IN ACCORDANCE WITH THE NEC, NESC, AND ALL APPLICABLE REQUIREMENTS OF THE LOCAL UTILITY COMPANY AND LOCAL AUTHORITY HAVING JURISDICTION.
2. REFER TO SHEET E.103 FOR EQUIPMENT LABELING REQUIREMENTS.
3. REFER TO SHEETS E.210 FOR LVAC SINGLE LINE DIAGRAM.
4. REFER TO SHEET E.230 FOR INVERTER COMMUNICATION DIAGRAM.
5. REFER TO SHEET E.820-E.822 FOR DC SCHEDULES.

KEY NOTES:

1. SOLAR MODULE: LG LG400N2W-V5, 1500V, 400W, 25 CONNECT IN SERIES FOR ONE STRING.
2. FUSE ON POSITIVE CONDUCTOR ONLY.
3. STRING INVERTER: ABB PVS-166-TL-US, 3 PHASE, 4W, 800V OUTPUT. CSA TO UL 1741SA & IEEE1547 CERTIFIED.
4. AC DISCONNECT
5. DC DISCONNECT

WIRING SCHEDULE

WIRING ID	NOTES
DC00	BACK OF MODULE CONDUCTORS. REFER TO MODULE SPEC SHEET FOR SIZE AND CONNECTOR TYPE.
DC01	REFER TO DC SCHEDULES ON SHEET E.820 - E.822 FOR CONDUCTOR SIZE AND SPECS.
DC02	REFER TO DC SCHEDULES ON SHEET E.820 - E.822 FOR CONDUCTOR SIZE AND SPECS.

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DC Oneline Diagram

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.220

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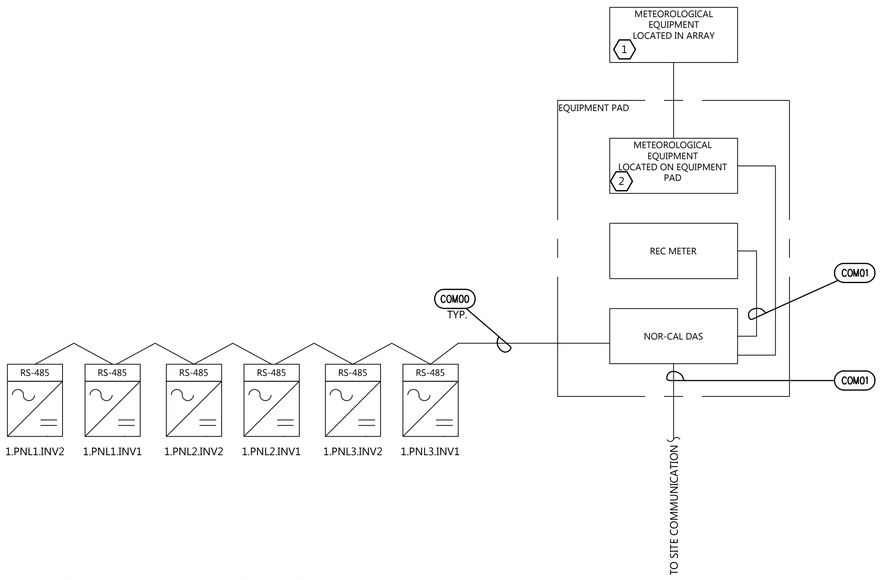
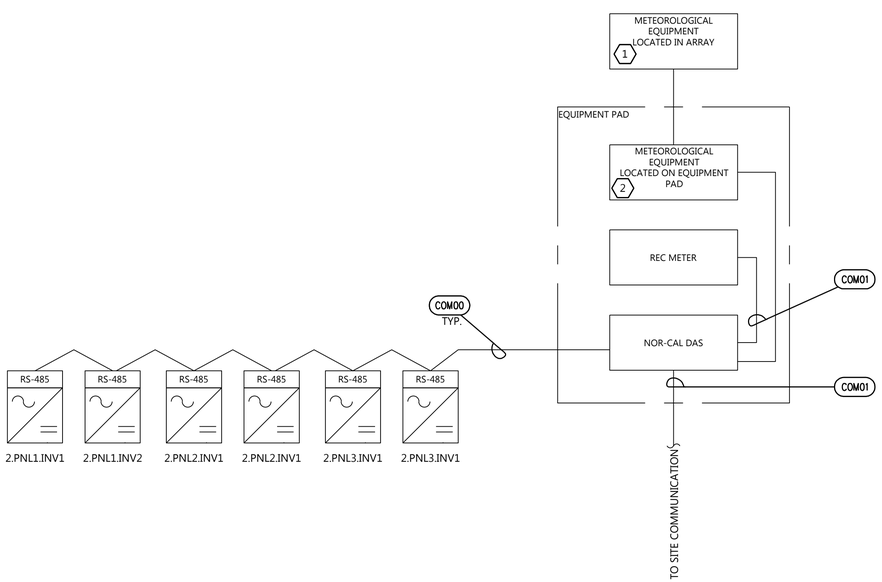


1 Block 1 Communication Single Line Diagram



2 Block 2 Communication Single Line Diagram

NOTES:

1. REFER TO SHEET E.103 FOR EQUIPMENT LABELING REQUIREMENTS.
2. REFER TO SHEET E.210 FOR LVAC SINGLE LINE DIAGRAM
3. REFER TO SHEET E.500-E.501 FOR COMMUNICATION SITE PLAN.

KEY NOTES:

1. TWO POA PYRANOMETERS, TWO BACK OF MODULE TEMP. SENSORS.
2. ONE ANEMOMETER, ONE AMBIENT TEMP SENSOR.

WIRING SCHEDULE

WIRING ID	NOTES
COM00	SHIELDED RS-485
COM01	ETHERNET

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Communication Oneline Diagram

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DATE: 05/30/2019

SHEET: E.230

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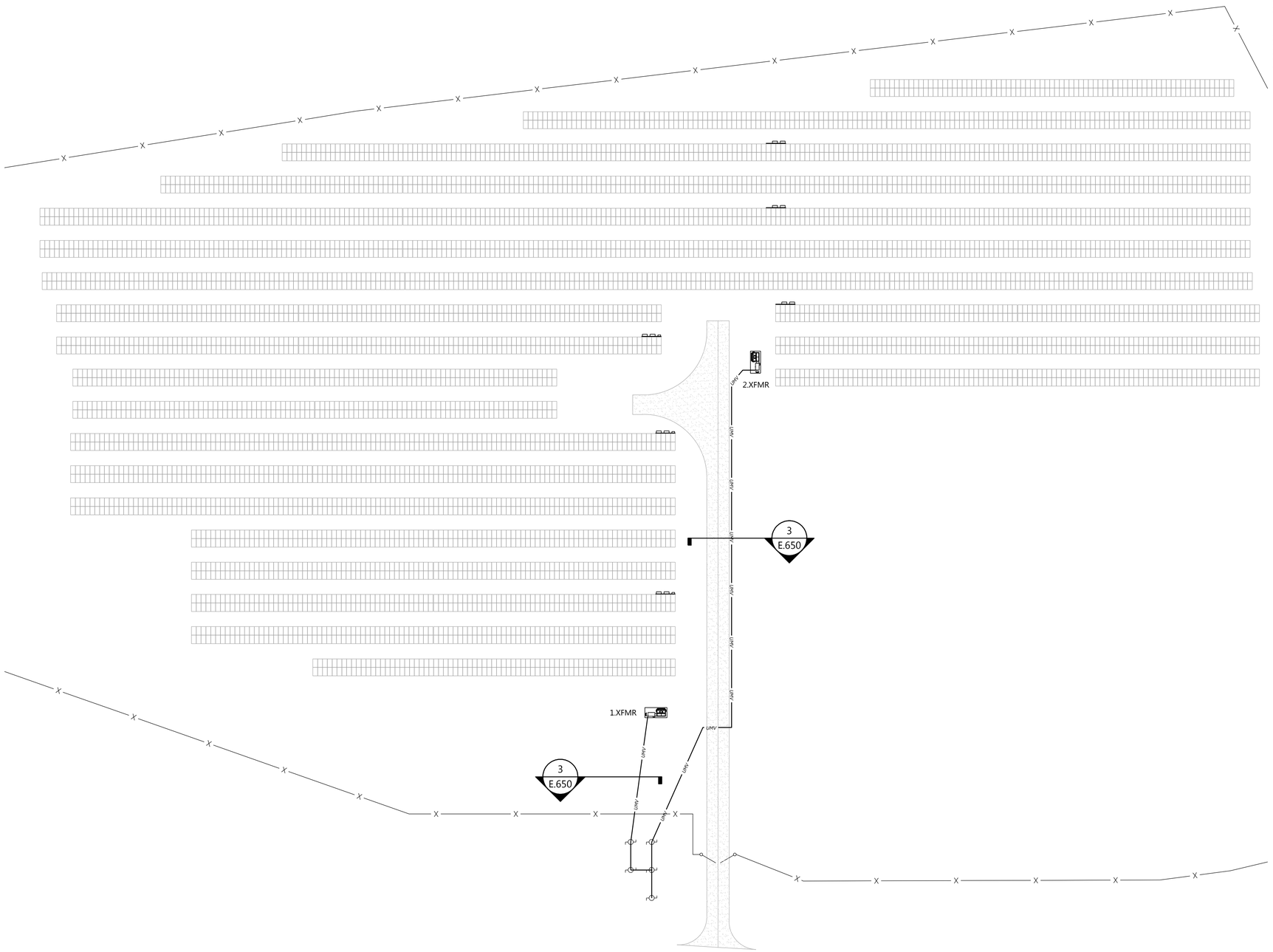

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2. REFER TO SHEET E.103 FOR EQUIPMENT LABELING REQUIREMENTS.
3. REFER TO SHEETS E.200 FOR MVAC SINGLE LINE DIAGRAM.
3. REFER TO SHEET E.800 FOR MVAC SCHEDULES.
4. REFER TO SHEET E.650 FOR TRENCH DETAILS.

1 MVAC Routing Site Plan
1" = 40'

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0' 40' 80' 120'

Voluntown Solar

New London County, CT

MVAC Site Plan

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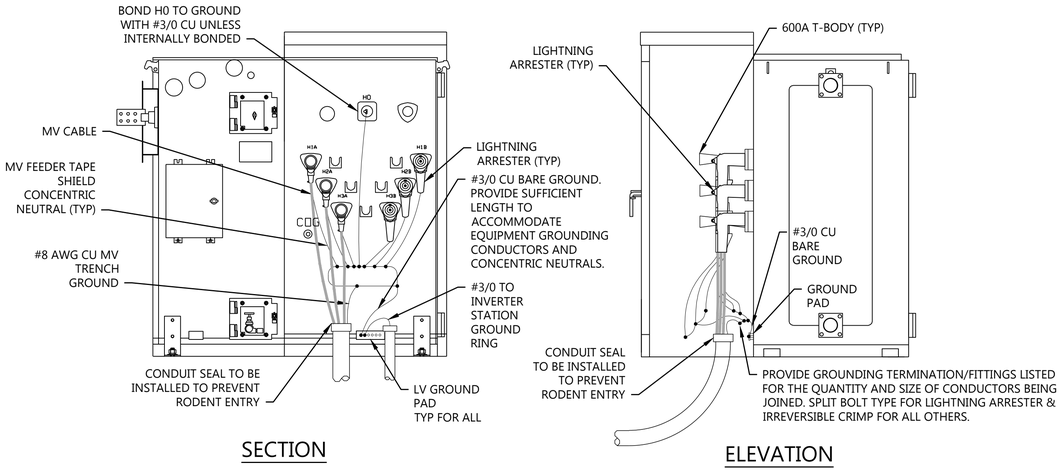
SHEET: E.300



1 Transfomer Primary Connection & Grounding

NTS

NOTES:

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4. REFER TO SHEET E.300 FOR MVAC SITE PLAN.
5. REFER TO SHEET E.800 FOR MVAC SCHEDULES.

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New London County, CT

MVAC Details

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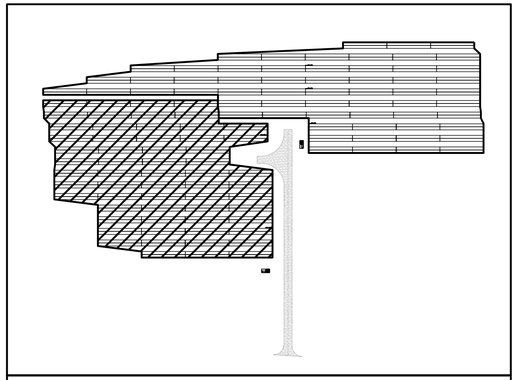
DATE: 05/30/2019

SHEET: E.350



Key Plan

NOTES:

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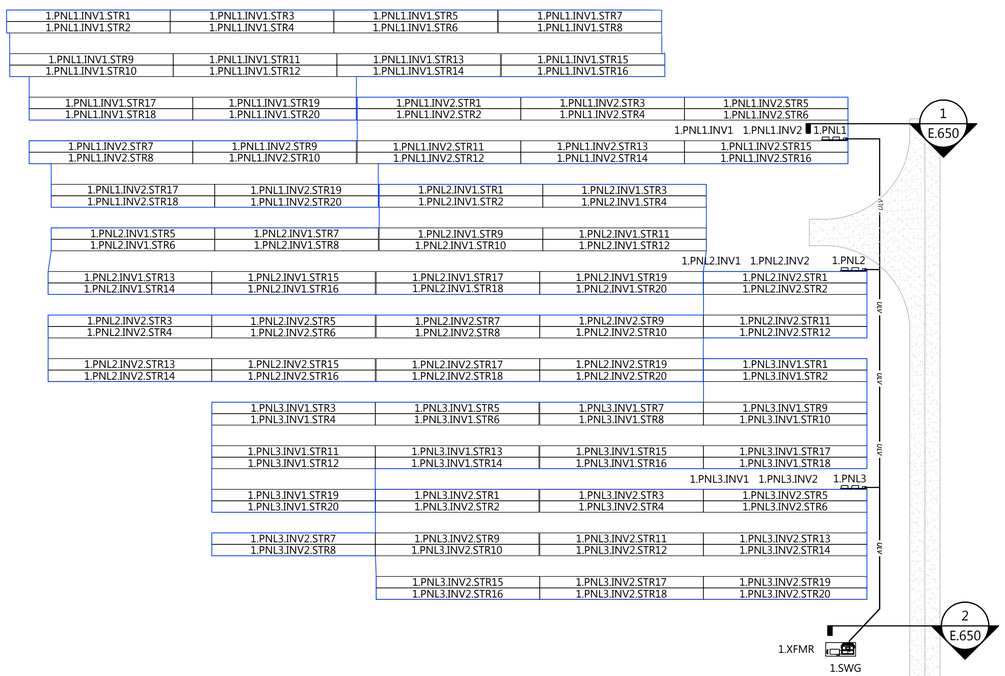
3. REFER TO SHEETS E.220 FOR DC SINGLE LINE DIAGRAM.
4. REFER TO SHEET E.810 FOR LVAC SCHEDULES.
5. REFER TO SHEET E.820-E.822 FOR DC SCHEDULES.
6. REFER TO SHEET E.650 FOR TRENCH DETAILS.



1 DC and LVAC Site Plan Block 1

1" = 40'

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0' #### #### ####

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New London County, CT

DC and LVAC Site Plan Block 1

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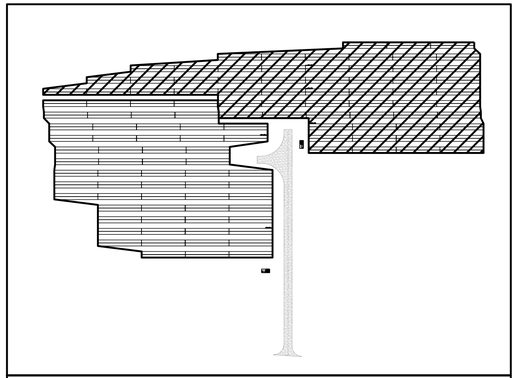
DATE: 05/30/2019

SHEET: E.400



Key Plan

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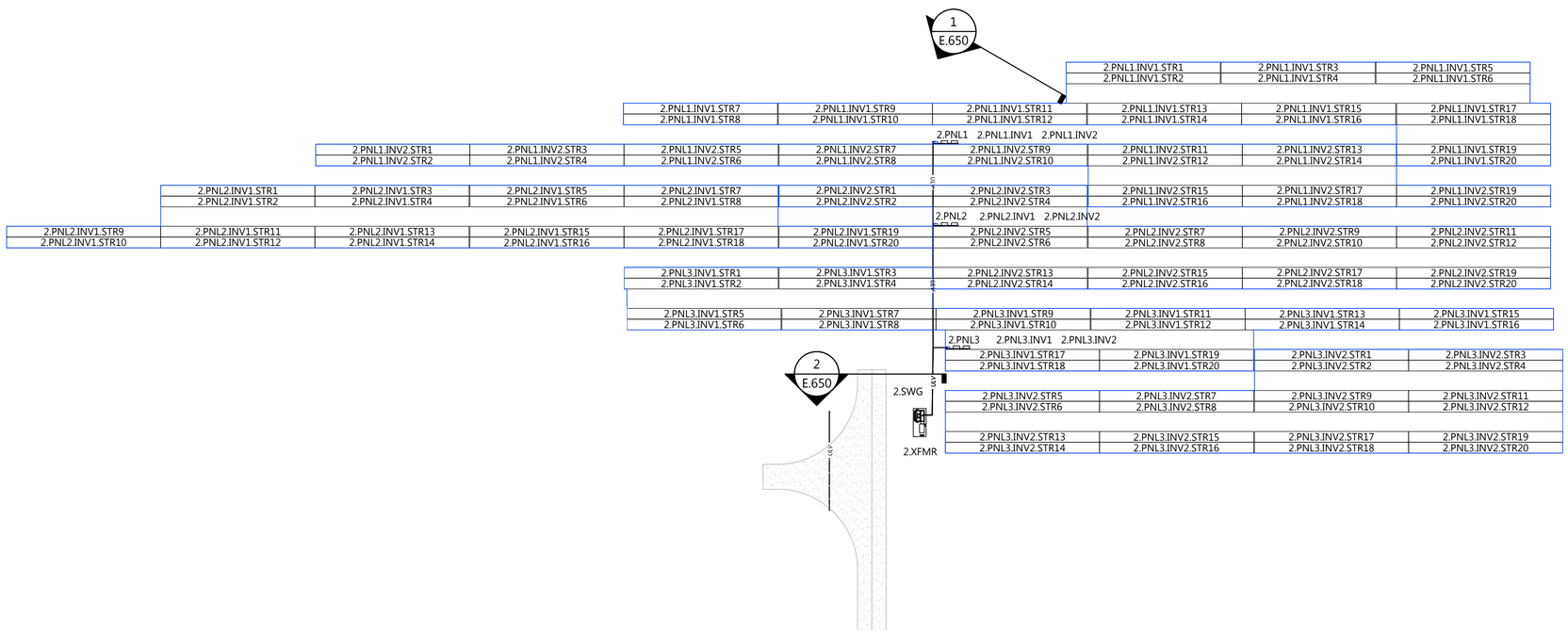
5. REFER TO SHEET E.820-E.822 FOR DC SCHEDULES.
6. REFER TO SHEET E.650 FOR TRENCH DETAILS.



1 DC and LVAC Site Plan Block 2

1" = 40'

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0' #### #### ####

Voluntown Solar

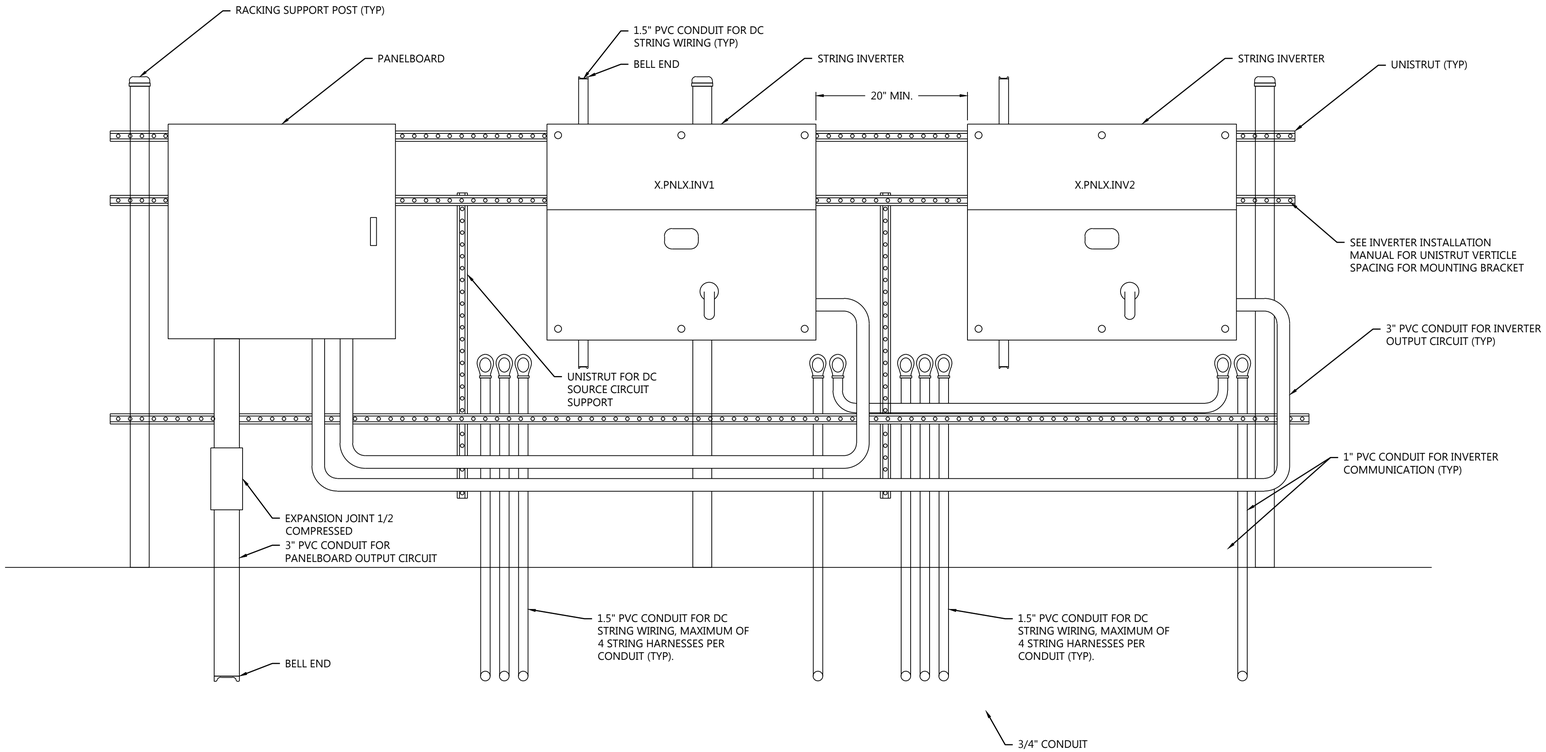
New London County, CT

DC and LVAC Site Plan Block 2

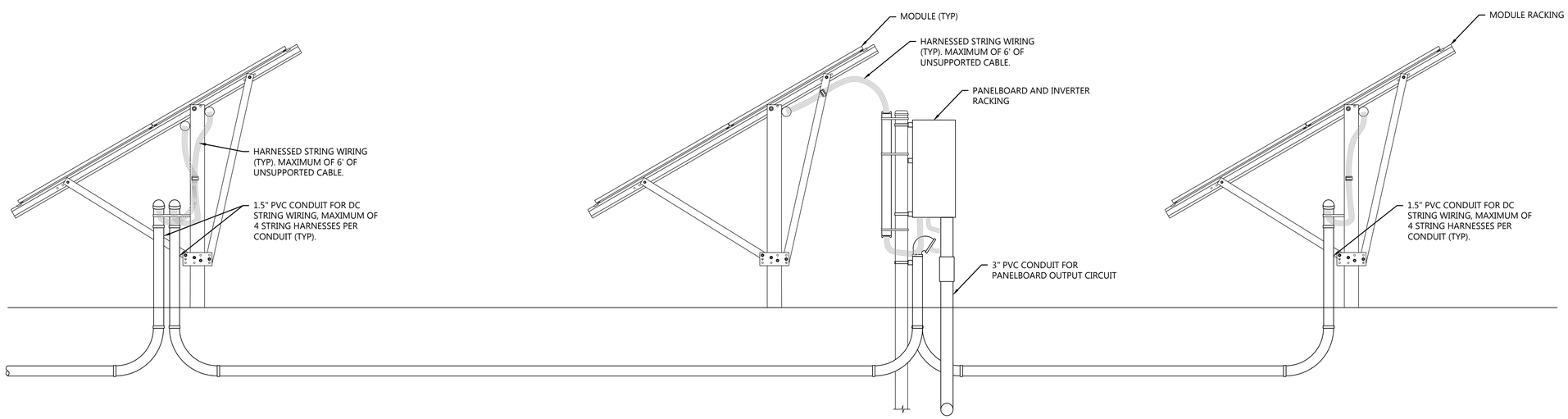
NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.401



1 Typical Inverter and Panelboard Elevation
NTS



2 Typical Inverter, Panelboard, and Module Racking Detail
NTS

NOTES:

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2. REFER TO SHEETS E.210 FOR LVAC SINGLE LINE DIAGRAM.
3. REFER TO SHEETS E.220 FOR DC SINGLE LINE DIAGRAM.
4. REFER TO SHEET E.810 FOR LVAC SCHEDULES.
5. REFER TO SHEET E.820-E.822 FOR DC SCHEDULES.
6. REFER TO SHEET E.650 FOR TRENCH DETAILS.
7. ELECTRICAL EQUIPMENT BOTTOMS TO BE MOUNTED 1' ABOVE 100 YEAR FLOOD DEPTH.
8. ALL BELOW GRADE CONDUITS SHALL BE SHC 40 PVC. ALL ABOVE GRADE CONDUITS SHALL BE SHC 80 PVC.
9. PROVIDE PVC EXPANSION JOINTS FOR CONDUITS TERMINATING IN ENCLOSURES.
10. PROVIDE OPTIONAL INVERTER AC OUTPUT PLATE FOR CONDUIT FORMAT. SEE INVERTER MANUAL FOR PART #.

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Voluntown Solar
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Electrical Details

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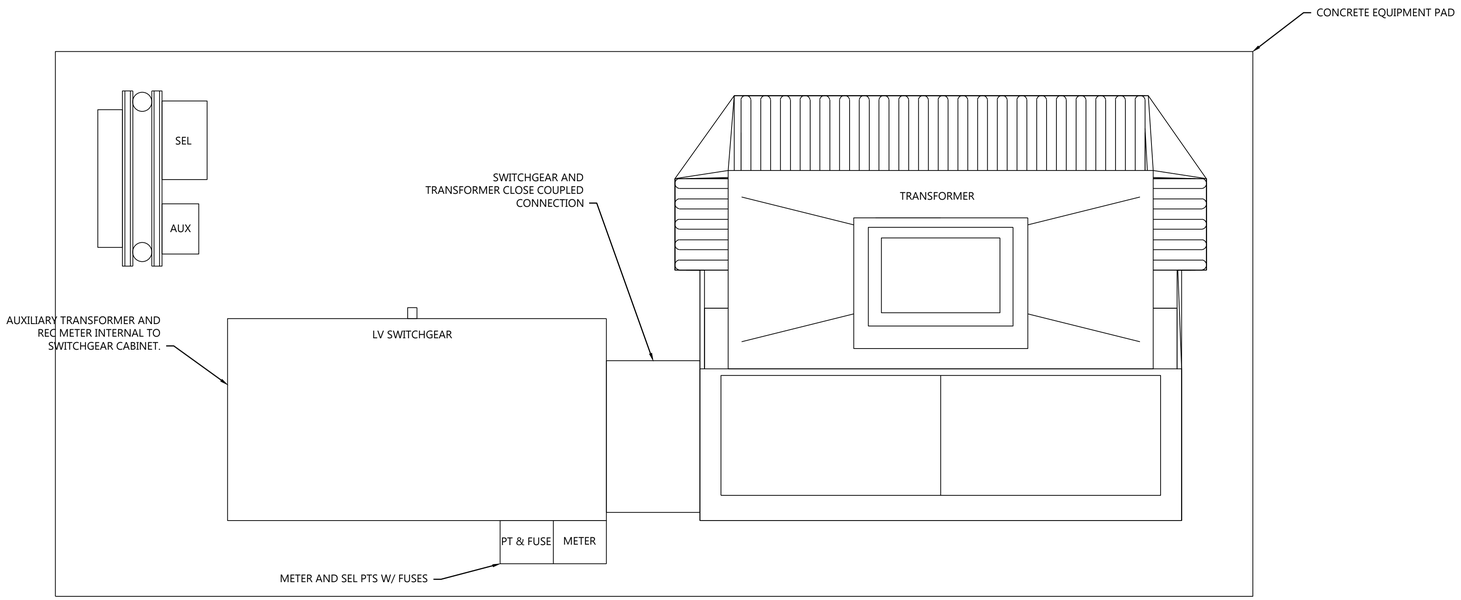
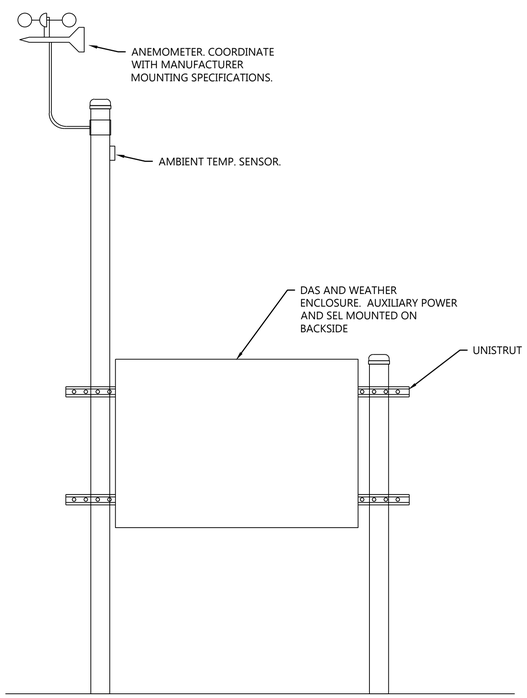
SHEET: E.450



1 Equipment Pad Layout
NTS



2 Equipment Racking Elevation
NTS

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3. REFER TO SHEETS E.220 FOR DC SINGLE LINE DIAGRAM.
4. REFER TO SHEET E.810 FOR LVAC SCHEDULES.
5. REFER TO SHEET E.820-E.822 FOR DC SCHEDULES.
6. REFER TO SHEET E.650 FOR TRENCH DETAILS.
7. ELECTRICAL EQUIPMENT BOTTOMS TO BE MOUNTED 1' ABOVE 100 YEAR FLOOD DEPTH.
8. ALL BELOW GRADE CONDUITS SHALL BE SHC 40 PVC. ALL ABOVE GRADE CONDUITS SHALL BE SHC 80 PVC.
9. PROVIDE PVC EXPANSION JOINTS FOR CONDUITS TERMINATING IN ENCLOSURES.
10. WIRE SEL PT & CT TO SEL751 BOX.

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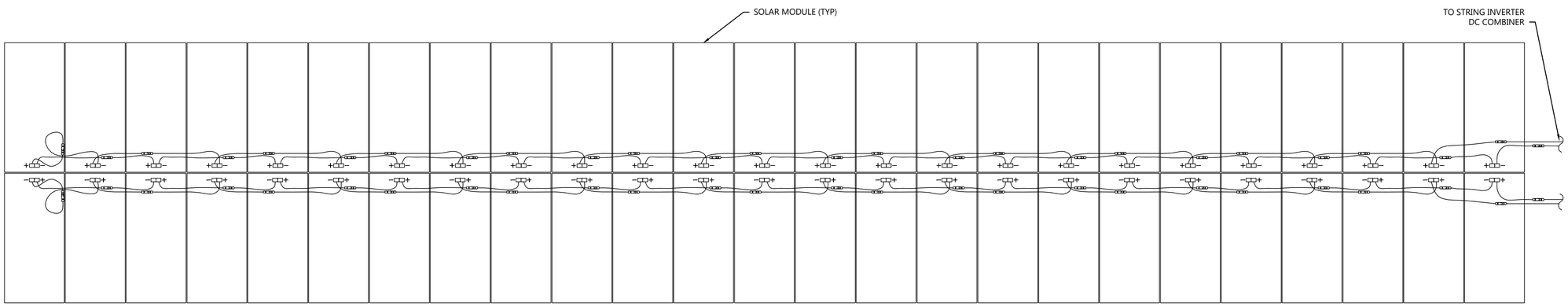
DATE: 05/30/2019

SHEET: E.451

NOTES:

1. REFER TO SHEETS E.220 FOR DC SINGLE LINE DIAGRAM.
2. REFER TO SHEETS E.400-E.401 FOR DC SITE PLANS.
3. REFER TO SHEET E.820-E.822 FOR DC SCHEDULES.



1 Typical String Wiring Detail
NTS

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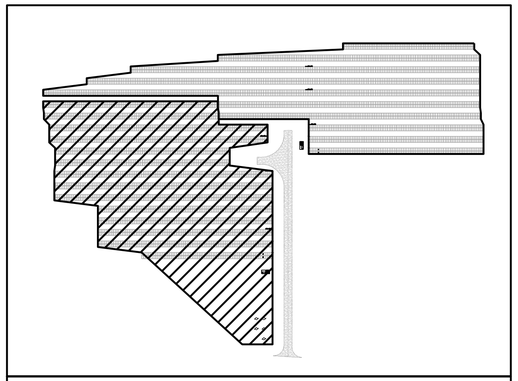
DATE: 05/30/2019

SHEET: E.452



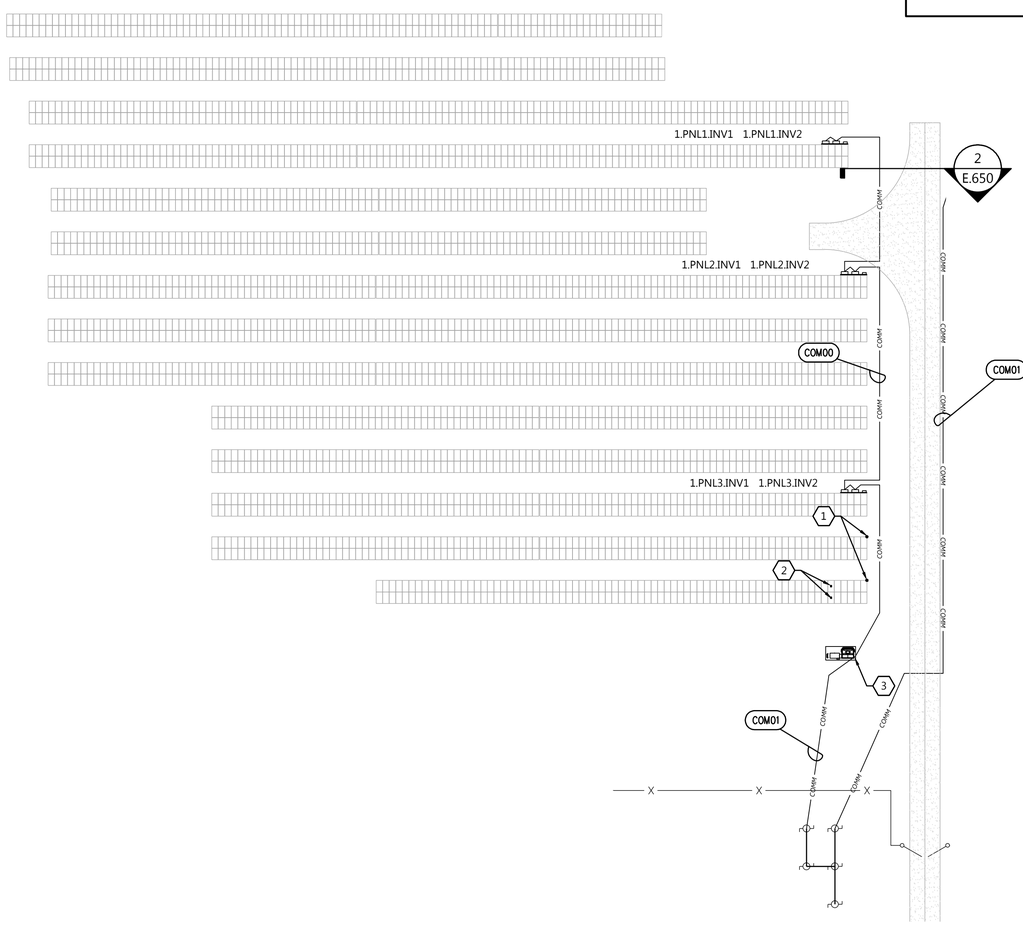
Key Plan

NOTES:

1. REFER TO SHEET E.103 FOR EQUIPMENT LABELING REQUIREMENTS.
2. REFER TO SHEET E.230 FOR COMMUNICATION ONELINES.
3. REFER TO SHEET E.550 FOR COMMUNICATION EQUIPMENT MOUNTING DETAILS.
4. REFER TO SHEET E.650 FOR TRENCH DETAILS.

KEY NOTES:

1. TWO POA PYRANOMETERS
2. TWO BACK OF MODULE TEMP. SENSORS
3. ANEMOMETER AND AMBIENT TEMP SENSOR LOCATED AT EQUIPMENT PAD.



WIRING SCHEDULE

WIRING ID	NOTES
COM00	RS-485, 1" PVC CONDUIT
COM01	ETHERNET, 1" PVC CONDUIT

1 Communication Site Plan Block 1
1" = 40'

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A	05/06/2019	50% SUBMITTAL
B	05/30/2019	90% SUBMITTAL
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Voluntown Solar

New London County, CT

Communication Site Plan Block 1

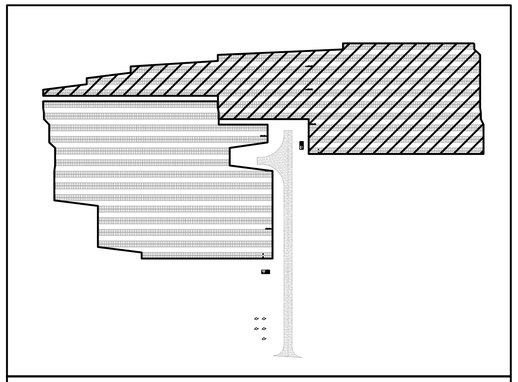
NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.500

WIRING SCHEDULE

WIRING ID	NOTES
COM00	RS-485, 1" PVC CONDUIT
COM01	ETHERNET, 1" PVC CONDUIT



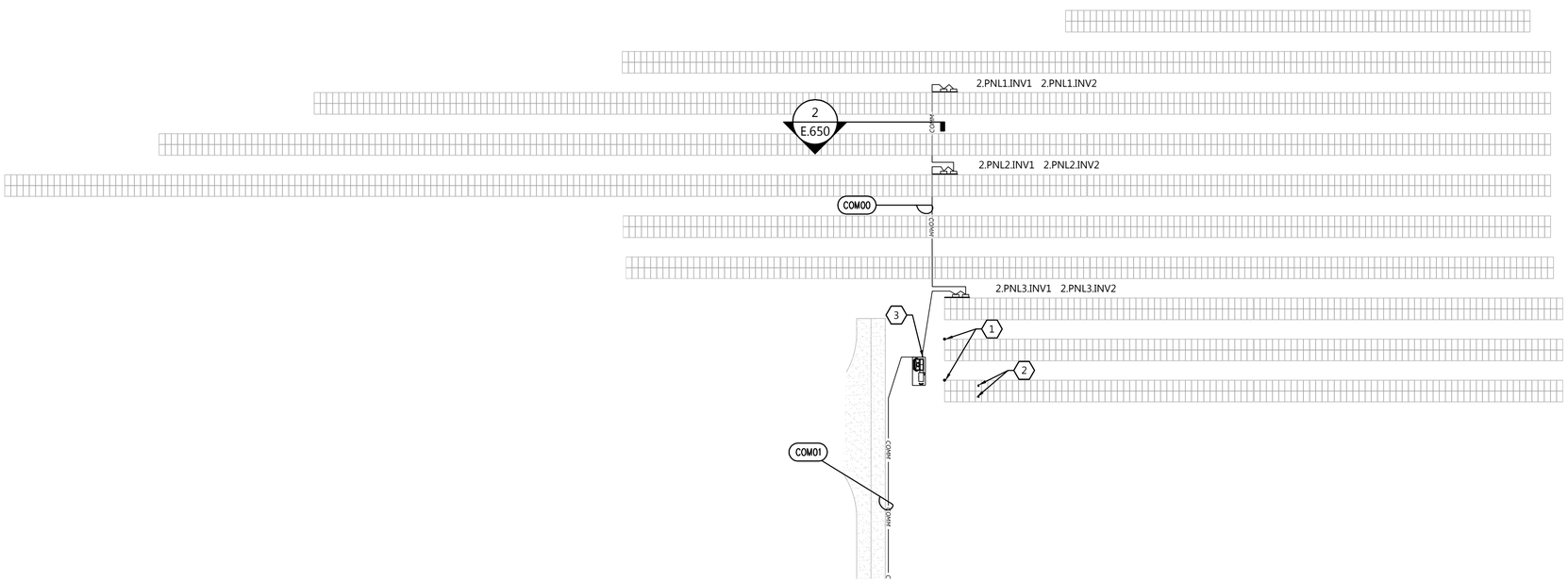
Key Plan

NOTES:

1. REFER TO SHEET E.103 FOR EQUIPMENT LABELING REQUIREMENTS.
2. REFER TO SHEET E.230 FOR COMMUNICATION ONELINES.
3. REFER TO SHEET E.550 FOR COMMUNICATION EQUIPMENT MOUNTING DETAILS.
4. REFER TO SHEET E.650 FOR TRENCH DETAILS.

KEY NOTES:

1. TWO POA PYRANOMETERS
2. TWO BACK OF MODULE TEMP. SENSORS
3. ANEMOMETER AND AMBIENT TEMP SENSOR LOCATED AT EQUIPMENT PAD.



1 Communication Site Plan Block 2
1" = 40'

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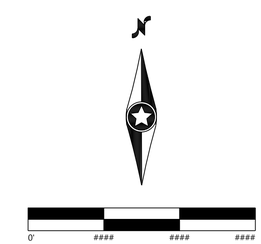


Voluntown Solar

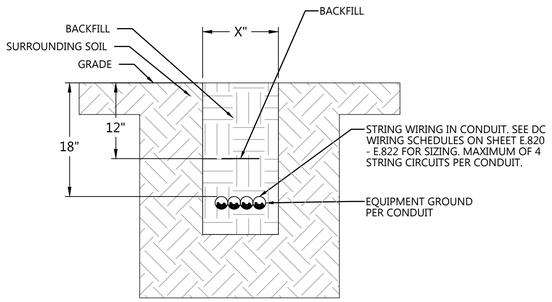
New London County, CT

Communication Site Plan Block 2

NOT FOR CONSTRUCTION

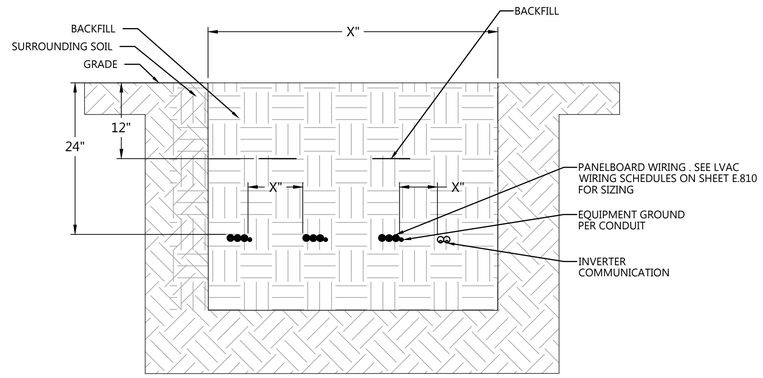
DATE: 05/30/2019

SHEET: E.501



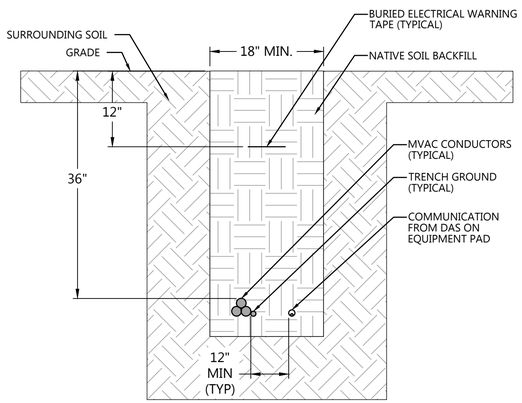
1 Typical String Wiring Trench Detail

NTS



2 Inverter Panelboard Trench Detail

NTS



3 Typical MVAC Trench

NTS

NOTES:

1. COORDINATE WITH MVAC SCHEDULES ON SHEET E.800, LVAC SCHEDULES ON SHEET E.810, AND DC SCHEDULES AND E.820 - E.822.
2. REFER TO SHEET E.300 FOR MVAC SITE PLAN.
3. REFER TO SHEET E.400 AND E.401 FOR LVAC AND DC SITE PLANS.
4. INVERTER COMMUNICATIONS UNSPLICED RETURN LOOP TO BE IN SEPARATE CONDUIT.

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Trench Details

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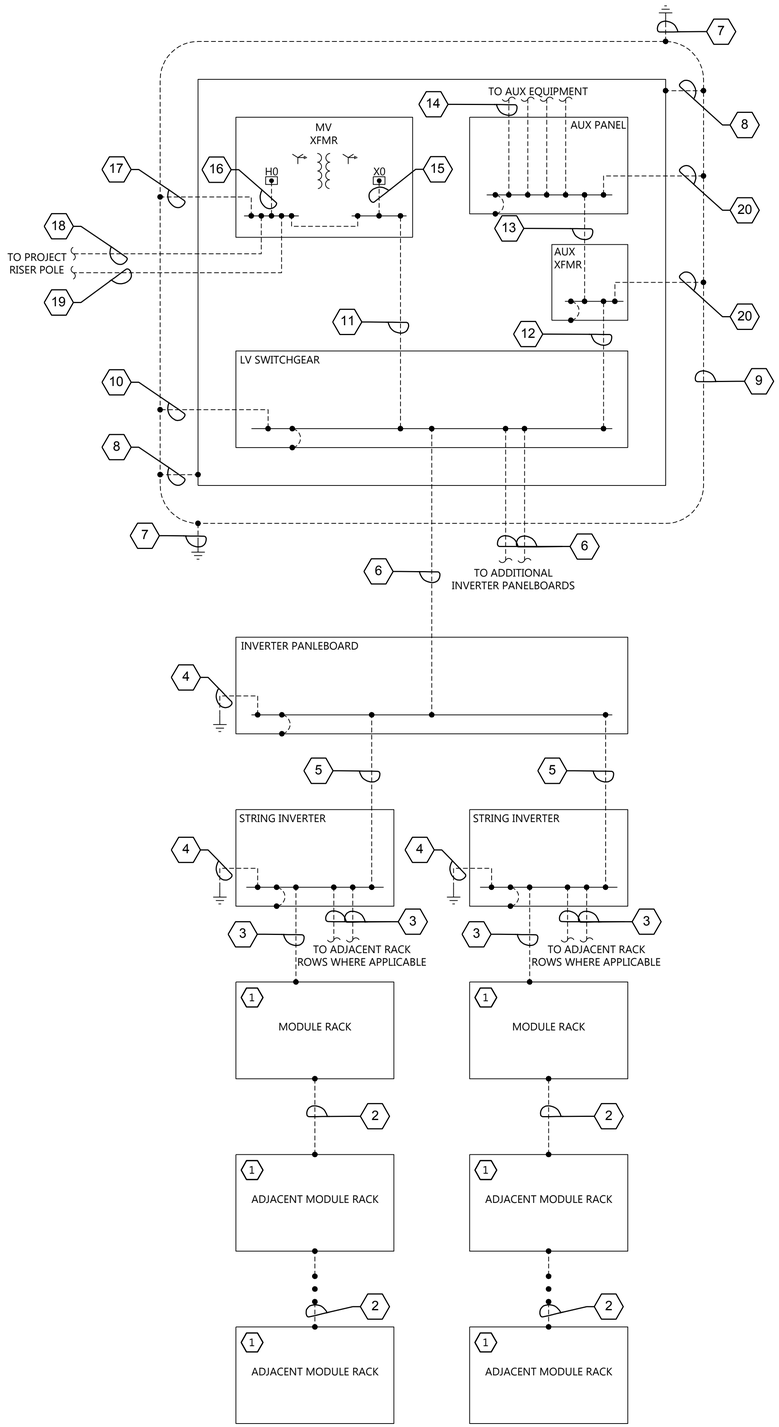
DATE: 05/30/2019

SHEET: E.650



NOTES:

1. COORDINATE WITH MVAC SCHEDULES ON SHEET E.800, LVAC SCHEDULES ON SHEET E.810, AND DC SCHEDULES AND E.820 - E.822.
2. REFER TO SHEET E.300 FOR MVAC SITE PLAN.
3. REFER TO SHEET E.400 AND E.401 FOR LVAC AND DC SITE PLANS.
4. COORDINATE WITH ELECTRICAL EQUIPMENT MANUFACTURER SPECIFICATIONS FOR MORE DETAILS ON DEVICE GROUNDING.

KEY NOTES:

1. MODULES ARE APPROVED FOR BONDING AND GROUNDING WITH LISTED CLAMPS.
2. #6 AWG COPPER BONDING JUMPER CONNECTING ADJACENT RACKING. SEE DETAIL 3 OF SHEET E.701 FOR MORE DETAIL.
3. #6 AWG COPPER EQUIPMENT GROUND CONDUCTOR FROM MODULE RACKS TO INVERTER GROUND BUS. GROUND CONDUCTOR INSTALLED IN CONDUIT WITH MODULE DC STRING WIRING.
4. #6 AWG COPPER GROUND ELECTRODE CONDUCTOR BONDED TO EQUIPMENT RACKING SUPPORT POST. RACKING SUPPORT POST TO HAVE MINIMUM 8' EMBEDMENT.
5. #6 AWG COPPER EQUIPMENT GROUND CONDUCTOR ROUTED WITH INVERTER AC OUTPUT CIRCUIT.
6. #4 AWG COPPER EQUIPMENT GROUND CONDUCTOR ROUTED WITH PANELBOARD AC OUTPUT CIRCUIT.
7. 3/4" x 10' COPPER CLAD STEEL GROUND ROD BONDED TO GROUND RING. PLACE A MINIMUM OF 2 GROUND RODS ON DIAGONAL CORNERS OF THE GROUND RING. PLACE ONE GROUND WELL PER EQUIPMENT PAD.
8. 3/0 AWG COPPER BONDING JUMPER FROM GROUND RING TO MINIMUM OF 20' OF UNCOATED REBAR WITHIN THE AC EQUIPMENT PAD.
9. 3/0 KCMIL COPPER GROUND RING SURROUNDING THE AC EQUIPMENT PAD BURIED AT A MINIMUM DEPTH OF 30" AND 24" AWAY FROM CONCRETE EDGE.
10. 3/0 AWG COPPER GROUNDING ELECTRODE CONDUCTOR FROM LVAC SWITCHGEAR TO GROUND RING.
11. 2/0 AWG COPPER EQUIPMENT GROUND CONDUCTOR ROUTED WITH SWITCHGEAR OUTPUT CIRCUIT.
12. #12 AWG COPPER EQUIPMENT GROUND CONDUCTOR ROUTED WITH AUXILIARY TRANSFORMER HIGH SIDE CIRCUIT.
13. #10 AWG COPPER EQUIPMENT GROUND CONDUCTOR ROUTED WITH AUXILIARY TRANSFORMER LOW SIDE CIRCUIT.
14. #12 AWG COPPER EQUIPMENT GROUND CONDUCTOR ROUTED WITH AUXILIARY CIRCUITS.
15. 2/0 AWG COPPER GROUNDING JUMPER FROM XO TERMIANL ON MVAC TRANSFORMER TO LOW VOLTAGE GROUND BUS. CONTRACTOR TO CONFIRM INTERNALLY GROUNDED.
16. #8 AWG COPPER GOUNDING JUMPER FROM HO TERMINAL ON MVAC TRANSFORMER TO HIGH VOLTAGE GROUND BUS. CONTRACTOR TO CONFIRM INTERNALLY GROUNDED
17. 3/0 AWG COPPER GROUNDING ELECTRODE CONDUCTOR FROM MV TRANSFORMER GROUND BUS TO GROUND RING.
18. MVAC CONCENTRIC NEUTRAL.
19. #8 COPPER EQUIPMENT GROUND CONDUCTOR ROUTED FROM MV TRANSFORMER TO POI POLE.
20. #8 AWG COPPER GROUNDING ELECTRODE CONDUCTOR FROM GROUND RING TO EQUIPMENT GROUND BUS.

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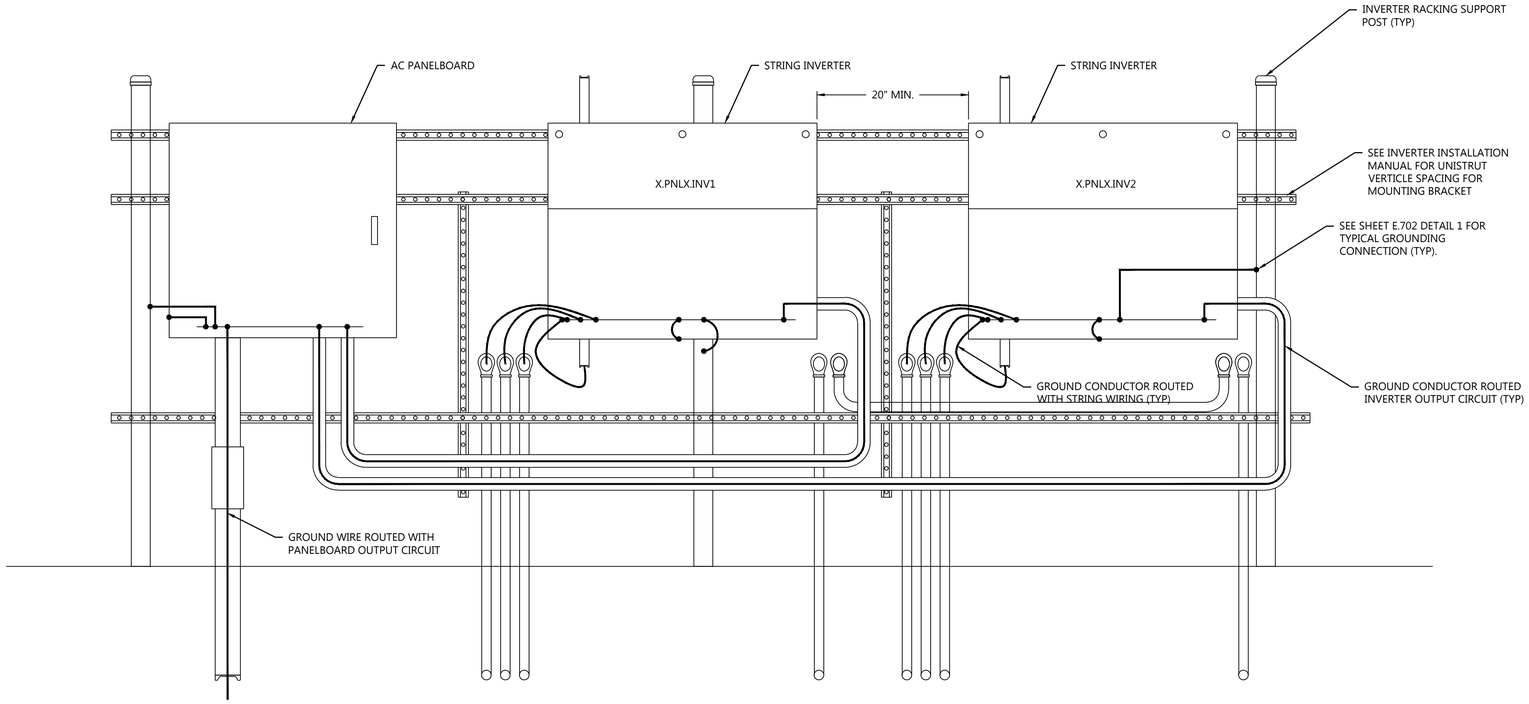
New London County, CT

Grounding Diagram

NOT FOR CONSTRUCTION

DATE: 05/30/2019

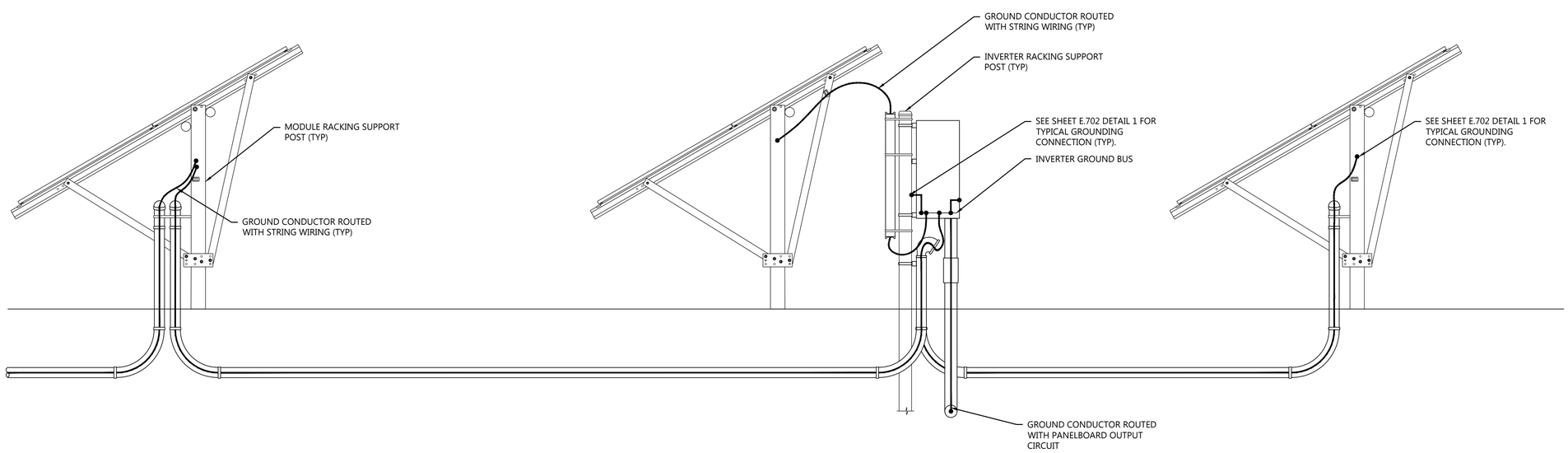
SHEET: E.700



1 Typical Inverter and Panelboard Elevation
NTS

NOTES:

1. COORDINATE WITH MVAC SCHEDULES ON SHEET E.800, LVAC SCHEDULES ON SHEET E.810, AND DC SCHEDULES AND E.820 - E.822.
2. REFER TO SHEET E.300 FOR MVAC SITE PLAN.
3. REFER TO SHEET E.400 AND E.401 FOR LVAC AND DC SITE PLANS.
4. COORDINATE WITH ELECTRICAL EQUIPMENT MANUFACTURER SPECIFICATIONS FOR MORE DETAILS ON DEVICE GROUNDING.



2 Typical Inverter, Panelboard, and Module Racking Detail
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Voluntown Solar
New London County, CT

Grounding Details

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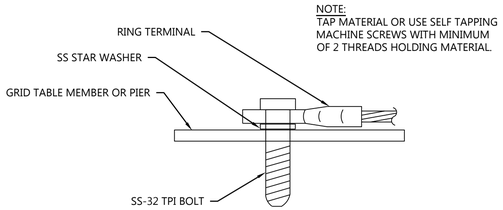
DATE: 05/30/2019

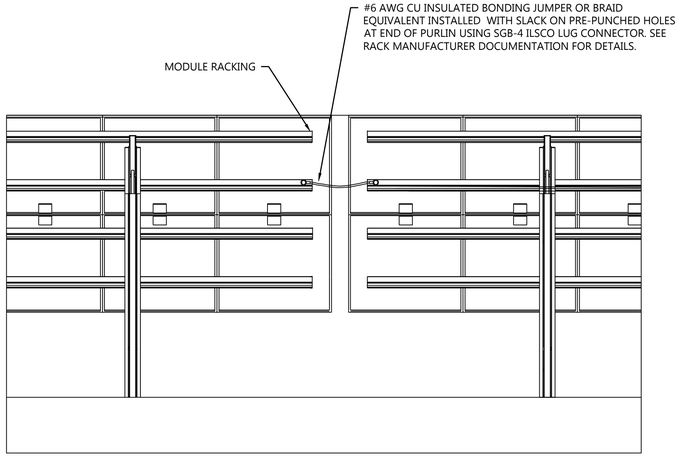
SHEET: E.701

NOTES:

1. COORDINATE WITH MVAC SCHEDULES ON SHEET E.800, LVAC SCHEDULES ON SHEET E.810, AND DC SCHEDULES AND E.820 - E.822.
2. REFER TO SHEET E.300 FOR MVAC SITE PLAN.
3. REFER TO SHEET E.400 AND E.401 FOR LVAC AND DC SITE PLANS.
4. COORDINATE WITH ELECTRICAL EQUIPMENT MANUFACTURER SPECIFICATIONS FOR MORE DETAILS ON DEVICE GROUNDING.



1 Grounding Ring Terminal Detail
NTS



2 Adjacent Rack Grounding Detail
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Grounding Details

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DATE: 05/30/2019

SHEET: E.702

MVAC WIRING SCHEDULE															
CONDUCTOR LOCATION CODE	ORIGINATING EQUIPMENT	TERMINATING EQUIPMENT	RATED Vac (kV)	END OF CABLE Vac (kV)	Iac (A)	LENGTH (FT)	CONDUCTOR SIZE	CONDUCTOR MATERIAL	# OF PARALLEL CONDUCTORS	VOLTAGE DROP %	GROUND CONDUCTOR SIZE	GROUND CONDUCTOR MATERIAL	DRAWING REFERENCE	CONDUCTOR SPECIFICS	NOTES
OVHD00	METER.POLE.1	DISC.POLE.1	23	23.000	25.10	30		AL	1	0.0014	1#8 AWG	Copper	E.200	ACSR Turkey Overhead Conductor	
MV00	DISC.POLE.1	1.XFMR	23	22.999	25.10	140	3#1/0 AWG	AL	1	0.0050	1#8 AWG	Copper	E.200	23KV, 1/C, Trefoil, 100% Insulation, Type MV-90, Full CN	
OVHD00	METER.POLE.2	DISC.POLE.2	23	23.000	25.10	30		AL	1	0.0014	1#8 AWG	Copper	E.200	ACSR Turkey Overhead Conductor	
MV00	DISC.POLE.2	2.XFMR	23	22.996	25.10	430	3#1/0 AWG	AL	1	0.0154	1#8 AWG	Copper	E.200	23KV, 1/C, Trefoil, 100% Insulation, Type MV-90, Full CN	

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New London County, CT

MVAC Schedule

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.800

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LVAC WIRING SCHEDULE

CONDUCTOR LOCATION CODE	ORIGINATING EQUIPMENT	TERMINATING EQUIPMENT	Rated Vac (kV)	End of Cable Vac (kV)	Iac (A)	LENGTH (FT)	CONDUCTOR SIZE	CONDUCTOR MATERIAL	# OF PARALLEL CONDUCTORS	VOLTAGE DROP %	GROUND CONDUCTOR SIZE	GROUND CONDUCTOR MATERIAL	DRAWING REFERENCE	CONDUCTOR SPECIFICS
LV02	1.XFMR	1.SWG	800	799.897	720.97	5	3#400 KCMIL	AL	4	0.0129	1#400 KCMIL	CU	E.200	600V, 1/C, XHHW-2 75°C
LV01	1.SWG	1.PNL1	800	792.208	240.32	324	3#500 KCMIL	AL	1	0.9612	1#4 AWG	CU	E.200	600V, 1/C, XHHW-2 75°C
LV01	1.SWG	1.PNL2	800	794.083	240.32	245	3#500 KCMIL	AL	1	0.7268	1#4 AWG	CU	E.200	600V, 1/C, XHHW-2 75°C
LV01	1.SWG	1.PNL3	800	796.812	240.32	130	3#500 KCMIL	AL	1	0.3857	1#4 AWG	CU	E.200	600V, 1/C, XHHW-2 75°C
LV00	1.PNL1	1.PNL1.INV1	800	791.798	120.16	15	3#3/0 AWG	AL	1	0.0519	1#6 AWG	CU	E.200	600V, 1/C, XHHW-2 75°C
LV00	1.PNL1	1.PNL1.INV2	800	791.661	120.16	20	3#3/0 AWG	AL	1	0.0692	1#6 AWG	CU	E.200	600V, 3/C, XHHW-2 75°C
LV00	1.PNL2	1.PNL2.INV1	800	793.673	120.16	15	3#3/0 AWG	AL	1	0.0516	1#6 AWG	CU	E.200	600V, 3/C, XHHW-2 75°C
LV00	1.PNL2	1.PNL2.INV2	800	793.536	120.16	20	3#3/0 AWG	AL	1	0.0688	1#6 AWG	CU	E.200	600V, 3/C, XHHW-2 75°C
LV00	1.PNL3	1.PNL3.INV1	800	796.403	120.16	15	3#3/0 AWG	AL	1	0.0513	1#6 AWG	CU	E.200	600V, 3/C, XHHW-2 75°C
LV00	1.PNL3	1.PNL3.INV2	800	796.267	120.16	20	3#3/0 AWG	AL	1	0.0684	1#6 AWG	CU	E.200	600V, 3/C, XHHW-2 75°C

LVAC WIRING SCHEDULE

CONDUCTOR LOCATION CODE	ORIGINATING EQUIPMENT	TERMINATING EQUIPMENT	Rated Vac (kV)	End of Cable Vac (kV)	Iac (A)	LENGTH (FT)	CONDUCTOR SIZE	CONDUCTOR MATERIAL	# OF PARALLEL CONDUCTORS	VOLTAGE DROP %	GROUND CONDUCTOR SIZE	GROUND CONDUCTOR MATERIAL	DRAWING REFERENCE	CONDUCTOR SPECIFICS
LV02	2.XFMR	2.SWG	800	799.897	720.97	5	3#400 KCMIL	AL	4	0.0129	1#400 KCMIL	CU	E.200	600V, 1/C, XHHW-2 75°C
LV01	2.SWG	2.PNL1	800	795.151	240.32	200	3#500 KCMIL	AL	1	0.5933	1#4 AWG	CU	E.200	600V, 1/C, XHHW-2 75°C
LV01	2.SWG	2.PNL2	800	796.575	240.32	140	3#500 KCMIL	AL	1	0.4153	1#4 AWG	CU	E.200	600V, 1/C, XHHW-2 75°C
LV01	2.SWG	2.PNL3	800	797.998	240.32	80	3#500 KCMIL	AL	1	0.2373	1#4 AWG	CU	E.200	600V, 1/C, XHHW-2 75°C
LV00	2.PNL1	2.PNL1.INV1	800	794.741	120.16	15	3#3/0 AWG	AL	1	0.0515	1#6 AWG	CU	E.200	600V, 1/C, XHHW-2 75°C
LV00	2.PNL1	2.PNL1.INV2	800	794.605	120.16	20	3#3/0 AWG	AL	1	0.0687	1#6 AWG	CU	E.200	600V, 3/C, XHHW-2 75°C
LV00	2.PNL2	2.PNL2.INV1	800	796.166	120.16	15	3#3/0 AWG	AL	1	0.0513	1#6 AWG	CU	E.200	600V, 3/C, XHHW-2 75°C
LV00	2.PNL2	2.PNL2.INV2	800	796.030	120.16	20	3#3/0 AWG	AL	1	0.0684	1#6 AWG	CU	E.200	600V, 3/C, XHHW-2 75°C
LV00	2.PNL3	2.PNL3.INV1	800	797.590	120.16	15	3#3/0 AWG	AL	1	0.0511	1#6 AWG	CU	E.200	600V, 3/C, XHHW-2 75°C
LV00	2.PNL3	2.PNL3.INV2	800	797.454	120.16	20	3#3/0 AWG	AL	1	0.0682	1#6 AWG	CU	E.200	600V, 3/C, XHHW-2 75°C

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Voluntown Solar

New London County, CT

LVAC Schedule

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.810

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DC Level 1: String Wire Collection to String Inverter: 1.PNL1.INV1

COMBINER BOX INPUT	FROM	TO	MODULE	MODULES PER STRING	STRINGS PER CIRCUIT	Pmp (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	MAX. CIRCUIT CURRENT (A)	FUSE SIZE AT COMBINER (A)	CABLE TYPE	CONDUCTOR MATERIAL	CONDUCTOR SIZE	# OF PARALLEL CONDUCTORS	GROUND CONDUCTOR MATERIAL	GROUND CONDUCTOR SIZE	TOTAL ONE WAY DISTANCE (FT)	LINE VOLTAGE DROP (%)	TOTAL DC VOLTAGE DROP (%)
1	1.PNL1.INV1.STR1	1.PNL1.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	437	1.0857	1.0857
2	1.PNL1.INV1.STR2	1.PNL1.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	437	1.0857	1.0857
3	1.PNL1.INV1.STR3	1.PNL1.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	348	0.8650	0.8650
4	1.PNL1.INV1.STR4	1.PNL1.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	348	0.8650	0.8650
5	1.PNL1.INV1.STR5/6	1.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	260	0.8117	0.8117
6	1.PNL1.INV1.STR7/8	1.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	170	0.5316	0.5316
7	1.PNL1.INV1.STR9/10	1.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	413	1.2892	1.2892
8	1.PNL1.INV1.STR11/12	1.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	325	1.0154	1.0154
9	1.PNL1.INV1.STR13/14	1.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	238	0.7417	0.7417
10	1.PNL1.INV1.STR15/16	1.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	148	0.4616	0.4616
11	1.PNL1.INV1.STR17/18	1.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	379	1.1841	1.1841
12	1.PNL1.INV1.STR19/20	1.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	292	0.9104	0.9104
																			Average Voltage Drop %:	0.8896	0.8896

DC Level 1: String Wire Collection to String Inverter: 1.PNL1.INV2

COMBINER BOX INPUT	FROM	TO	MODULE	MODULES PER STRING	STRINGS PER CIRCUIT	Pmp (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	MAX. CIRCUIT CURRENT (A)	FUSE SIZE AT COMBINER (A)	CABLE TYPE	CONDUCTOR MATERIAL	CONDUCTOR SIZE	# OF PARALLEL CONDUCTORS	GROUND CONDUCTOR MATERIAL	GROUND CONDUCTOR SIZE	TOTAL ONE WAY DISTANCE (FT)	LINE VOLTAGE DROP (%)	TOTAL DC VOLTAGE DROP (%)
1	1.PNL1.INV2.STR1	1.PNL1.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	200	0.4972	0.4972
2	1.PNL1.INV2.STR2	1.PNL1.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	200	0.4972	0.4972
3	1.PNL1.INV2.STR3	1.PNL1.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	113	0.2816	0.2816
4	1.PNL1.INV2.STR4	1.PNL1.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	113	0.2816	0.2816
5	1.PNL1.INV2.STR5/6	1.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	44	0.1369	0.1369
6	1.PNL1.INV2.STR7/8	1.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	384	1.1969	1.1969
7	1.PNL1.INV2.STR9/10	1.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	296	0.9231	0.9231
8	1.PNL1.INV2.STR11/12	1.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	206	0.6430	0.6430
9	1.PNL1.INV2.STR13/14	1.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	119	0.3724	0.3724
10	1.PNL1.INV2.STR15/16	1.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	28	0.0859	0.0859
11	1.PNL1.INV2.STR17/18	1.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	353	1.1014	1.1014
12	1.PNL1.INV2.STR19/20	1.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	264	0.8244	0.8244
																			Average Voltage Drop %:	0.6063	0.6063

DC Level 1: String Wire Collection to String Inverter: 1.PNL2.INV1

COMBINER BOX INPUT	FROM	TO	MODULE	MODULES PER STRING	STRINGS PER CIRCUIT	Pmp (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	MAX. CIRCUIT CURRENT (A)	FUSE SIZE AT COMBINER (A)	CABLE TYPE	CONDUCTOR MATERIAL	CONDUCTOR SIZE	# OF PARALLEL CONDUCTORS	GROUND CONDUCTOR MATERIAL	GROUND CONDUCTOR SIZE	TOTAL ONE WAY DISTANCE (FT)	LINE VOLTAGE DROP (%)	TOTAL DC VOLTAGE DROP (%)
1	1.PNL2.INV1.STR1	1.PNL2.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	196	0.4870	0.4870
2	1.PNL2.INV1.STR2	1.PNL2.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	196	0.4870	0.4870
3	1.PNL2.INV1.STR3	1.PNL2.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	108	0.2689	0.2689
4	1.PNL2.INV1.STR4	1.PNL2.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	108	0.2689	0.2689
5	1.PNL2.INV1.STR5/6	1.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	364	1.1364	1.1364
6	1.PNL2.INV1.STR7/8	1.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	276	0.8626	0.8626
7	1.PNL2.INV1.STR9/10	1.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	187	0.5825	0.5825
8	1.PNL2.INV1.STR11/12	1.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	100	0.3119	0.3119
9	1.PNL2.INV1.STR13/14	1.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	378	1.1809	1.1809
10	1.PNL2.INV1.STR15/16	1.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	291	0.9072	0.9072
11	1.PNL2.INV1.STR17/18	1.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	201	0.6271	0.6271
12	1.PNL2.INV1.STR19/20	1.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	112	0.3501	0.3501
																			Average Voltage Drop %:	0.6715	0.6715

DC Level 1: String Wire Collection to String Inverter: 1.PNL2.INV2

COMBINER BOX INPUT	FROM	TO	MODULE	MODULES PER STRING	STRINGS PER CIRCUIT	Pmp (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	MAX. CIRCUIT CURRENT (A)	FUSE SIZE AT COMBINER (A)	CABLE TYPE	CONDUCTOR MATERIAL	CONDUCTOR SIZE	# OF PARALLEL CONDUCTORS	GROUND CONDUCTOR MATERIAL	GROUND CONDUCTOR SIZE	TOTAL ONE WAY DISTANCE (FT)	LINE VOLTAGE DROP (%)	TOTAL DC VOLTAGE DROP (%)
1	1.PNL2.INV2.STR1	1.PNL2.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	30	0.0736	0.0736
2	1.PNL2.INV2.STR2	1.PNL2.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	30	0.0736	0.0736
3	1.PNL2.INV2.STR3	1.PNL2.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	402	0.9995	0.9995
4	1.PNL2.INV2.STR4	1.PNL2.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	402	0.9995	0.9995
5	1.PNL2.INV2.STR5/6	1.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	313	0.9772	0.9772
6	1.PNL2.INV2.STR7/8	1.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	224	0.7003	0.7003
7	1.PNL2.INV2.STR9/10	1.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	136	0.4234	0.4234
8	1.PNL2.INV2.STR11/12	1.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	46	0.1432	0.1432
9	1.PNL2.INV2.STR13/14	1.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	425	1.3274	1.3274
10	1.PNL2.INV2.STR15/16	1.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	338	1.0536	1.0536
11	1.PNL2.INV2.STR17/18	1.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	250	0.7799	0.7799
12	1.PNL2.INV2.STR19/20	1.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	161	0.5029	0.5029
																			Average Voltage Drop %:	0.6981	0.6981

NOTES:

1. DISTANCES SHOWN ARE APPROXIMATE FOR VOLTAGE DROP CALCULATION PURPOSES. CONTRACTOR SHALL FIELD-VERIFY LENGTH OF CONDUCTORS REQUIRED TO MAKE CONNECTIONS.
2. REFER TO DC SITE PLANS FOR CONDUIT AND WIRING ROUTING.
3. CABLES ARE SIZED PER NEC 690.8(B).
4. FUSES ARE SIZED USING Isc*1.25*1.25 PER NEC 690.9(B) & 220.5(B).
5. AMBIENT GROUND TEMPERATURE IS ASSUMED 27°C AT BURIAL DEPTH.
6. CONDUCTOR TEMPERATURE IS ASSUMED 85°C BASED ON SOFTWARE SIMULATION.
7. AMBIENT AIR TEMPERATURE IS ASSUMED X°C.

CALCULATIONS:

1. FORMULA USED FOR VOLTAGE DROP CALCULATION:

$$VD = \frac{2 * K * Imp * D}{N * 1000}$$

WHERE:

VD = VOLTAGE DROP

K = TEMPERATURE CORRECTED WIRE RESISTANCE

Imp = MAXIMUM POWER POINT CURRENT

D = ONE WAY LENGTH OF CIRCUIT SEGMENT (FT)

N = NUMBER OF PARALLEL CONDUCTORS

2. FORMULA USED FOR WIRE RESISTANCE CALCULATION:

$$K = R1 * [1 + \alpha * (T2 - 75°C)$$

WHERE

K = TEMPERATURE CORRECTED WIRE RESISTANCE

R1 = WIRE RESISTANCE (NEC TABLE 8, OHM/KFT)

T2 = CABLE TEMPERATURE (°C)

WHERE

α = 0.00323 FOR COPPER

α = 0.00330 FOR ALUMINUM

3. MAXIMUM STRING VOLTAGE CALCULATION (PER NEC 690.7):

$$Vmax = Vmod * N * [1 +(25°C-TL)*(\beta/100)]$$

WHERE

Vmax = MAXIMUM STRING VOLTAGE (V)

Vmod = MODULE OPEN CIRCUIT VOLTAGE AT STC (V)

N = NUMBER OF MODULES PER STRING

TL = MINIMUM EXPECTED SITE TEMPERATURE (°C)

β = TEMPERATURE COEFFICIENT OF Voc (%/°C)

4. WEIGHTED VOLTAGE DROP CALCULATION:

$$Vt = \sum_{i=0}^{n}(Xi * VDi) / \sum_{i=0}^{n}(Xi)$$

WHERE

Vt = TOTAL WEIGHTED VOLTAGE DROP (V)

X = NUMBER OF STRINGS PER CIRCUIT

VD = VOLTAGE DROP (V)

n = TOTAL NUMBER OF CIRCUITS IN SUMMATION

i = EACH CIRCUIT CONNECTED TO COMMON POINT

Westwood

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Westwood Professional Services, Inc.

PREPARED FOR:

ecos ENERGY

REVISIONS:

#	DATE	COMMENT
A	05/06/2019	50% SUBMITTAL
B	05/30/2019	90% SUBMITTAL
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Voluntown Solar

New London County, CT

DC Schedules

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.820

N:\0023866.00-ecos\Electrical\0023866.E.820 DC Schedule.dwg 5/30/2019 3:40 PM Brandon Blattner

DC Level 1: String Wire Collection to String Inverter: 1.PNL3.INV1

COMBINER BOX INPUT	FROM	TO	MODULE	MODULES PER STRING	STRINGS PER CIRCUIT	Pmp (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	MAX. CIRCUIT CURRENT (A)	FUSE SIZE AT COMBINER (A)	CABLE TYPE	CONDUCTOR MATERIAL	CONDUCTOR SIZE	# OF PARALLEL CONDUCTORS	GROUND CONDUCTOR MATERIAL	GROUND CONDUCTOR SIZE	TOTAL ONE WAY DISTANCE (FT)	LINE VOLTAGE DROP (%)	TOTAL DC VOLTAGE DROP (%)
1	1.PNL3.INV1.STR1	1.PNL3.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	83	0.2055	0.2055
2	1.PNL3.INV1.STR2	1.PNL3.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	83	0.2055	0.2055
3	1.PNL3.INV1.STR3	1.PNL3.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	322	0.8016	0.8016
4	1.PNL3.INV1.STR4	1.PNL3.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	322	0.8016	0.8016
5	1.PNL3.INV1.STR5/6	1.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	234	0.7289	0.7289
6	1.PNL3.INV1.STR7/8	1.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	145	0.4520	0.4520
7	1.PNL3.INV1.STR9/10	1.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	59	0.1846	0.1846
8	1.PNL3.INV1.STR11/12	1.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	299	0.9327	0.9327
9	1.PNL3.INV1.STR13/14	1.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	210	0.6557	0.6557
10	1.PNL3.INV1.STR15/16	1.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	122	0.3820	0.3820
11	1.PNL3.INV1.STR17/18	1.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	36	0.1114	0.1114
12	1.PNL3.INV1.STR19/20	1.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	293	0.9136	0.9136
																			Average Voltage Drop %:	0.5368	0.5368

DC Level 1: String Wire Collection to String Inverter: 1.PNL3.INV2

COMBINER BOX INPUT	FROM	TO	MODULE	MODULES PER STRING	STRINGS PER CIRCUIT	Pmp (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	MAX. CIRCUIT CURRENT (A)	FUSE SIZE AT COMBINER (A)	CABLE TYPE	CONDUCTOR MATERIAL	CONDUCTOR SIZE	# OF PARALLEL CONDUCTORS	GROUND CONDUCTOR MATERIAL	GROUND CONDUCTOR SIZE	TOTAL ONE WAY DISTANCE (FT)	LINE VOLTAGE DROP (%)	TOTAL DC VOLTAGE DROP (%)
1	1.PNL3.INV2.STR1	1.PNL3.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	208	0.5175	0.5175
2	1.PNL3.INV2.STR2	1.PNL3.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	208	0.5175	0.5175
3	1.PNL3.INV2.STR3	1.PNL3.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	119	0.2968	0.2968
4	1.PNL3.INV2.STR4	1.PNL3.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	119	0.2968	0.2968
5	1.PNL3.INV2.STR5/6	1.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	29	0.0891	0.0891
6	1.PNL3.INV2.STR7/8	1.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	320	0.9995	0.9995
7	1.PNL3.INV2.STR9/10	1.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	232	0.7226	0.7226
8	1.PNL3.INV2.STR11/12	1.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	144	0.4488	0.4488
9	1.PNL3.INV2.STR13/14	1.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	51	0.1592	0.1592
10	1.PNL3.INV2.STR15/16	1.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	255	0.7958	0.7958
11	1.PNL3.INV2.STR17/18	1.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	167	0.5220	0.5220
12	1.PNL3.INV2.STR19/20	1.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	74	0.2324	0.2324
																			Average Voltage Drop %:	0.4784	0.4784

DC Level 1: String Wire Collection to String Inverter: 2.PNL1.INV1

COMBINER BOX INPUT	FROM	TO	MODULE	MODULES PER STRING	STRINGS PER CIRCUIT	Pmp (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	MAX. CIRCUIT CURRENT (A)	FUSE SIZE AT COMBINER (A)	CABLE TYPE	CONDUCTOR MATERIAL	CONDUCTOR SIZE	# OF PARALLEL CONDUCTORS	GROUND CONDUCTOR MATERIAL	GROUND CONDUCTOR SIZE	TOTAL ONE WAY DISTANCE (FT)	LINE VOLTAGE DROP (%)	TOTAL DC VOLTAGE DROP (%)
1	2.PNL1.INV1.STR1	2.PNL1.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	99	0.2461	0.2461
2	2.PNL1.INV1.STR2	2.PNL1.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	99	0.2461	0.2461
3	2.PNL1.INV1.STR3	2.PNL1.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	188	0.4668	0.4668
4	2.PNL1.INV1.STR4	2.PNL1.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	188	0.4668	0.4668
5	2.PNL1.INV1.STR5/6	2.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	275	0.8594	0.8594
6	2.PNL1.INV1.STR7/8	2.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	125	0.3915	0.3915
7	2.PNL1.INV1.STR9/10	2.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	38	0.1178	0.1178
8	2.PNL1.INV1.STR11/12	2.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	38	0.1178	0.1178
9	2.PNL1.INV1.STR13/14	2.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	124	0.3883	0.3883
10	2.PNL1.INV1.STR15/16	2.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	213	0.6653	0.6653
11	2.PNL1.INV1.STR17/18	2.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	302	0.9422	0.9422
12	2.PNL1.INV1.STR19/20	2.PNL1.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	291	0.9072	0.9072
																			Average Voltage Drop %:	0.5102	0.5102

DC Level 1: String Wire Collection to String Inverter: 2.PNL1.INV2

COMBINER BOX INPUT	FROM	TO	MODULE	MODULES PER STRING	STRINGS PER CIRCUIT	Pmp (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	MAX. CIRCUIT CURRENT (A)	FUSE SIZE AT COMBINER (A)	CABLE TYPE	CONDUCTOR MATERIAL	CONDUCTOR SIZE	# OF PARALLEL CONDUCTORS	GROUND CONDUCTOR MATERIAL	GROUND CONDUCTOR SIZE	TOTAL ONE WAY DISTANCE (FT)	LINE VOLTAGE DROP (%)	TOTAL DC VOLTAGE DROP (%)
1	2.PNL1.INV2.STR1	2.PNL1.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	295	0.7331	0.7331
2	2.PNL1.INV2.STR2	2.PNL1.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	295	0.7331	0.7331
3	2.PNL1.INV2.STR3	2.PNL1.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	207	0.5149	0.5149
4	2.PNL1.INV2.STR4	2.PNL1.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	207	0.5149	0.5149
5	2.PNL1.INV2.STR5/6	2.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	118	0.3692	0.3692
6	2.PNL1.INV2.STR7/8	2.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	31	0.0955	0.0955
7	2.PNL1.INV2.STR9/10	2.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	32	0.0987	0.0987
8	2.PNL1.INV2.STR11/12	2.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	117	0.3661	0.3661
9	2.PNL1.INV2.STR13/14	2.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	207	0.6462	0.6462
10	2.PNL1.INV2.STR15/16	2.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	143	0.4456	0.4456
11	2.PNL1.INV2.STR17/18	2.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	231	0.7194	0.7194
12	2.PNL1.INV2.STR19/20	2.PNL1.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	319	0.9963	0.9963
																			Average Voltage Drop %:	0.4985	0.4985

NOTES:

1. DISTANCES SHOWN ARE APPROXIMATE FOR VOLTAGE DROP CALCULATION PURPOSES. CONTRACTOR SHALL FIELD-VERIFY LENGTH OF CONDUCTORS REQUIRED TO MAKE CONNECTIONS.
2. REFER TO DC SITE PLANS FOR CONDUIT AND WIRING ROUTING.
3. CABLES ARE SIZED PER NEC 690.8(B).
4. FUSES ARE SIZED USING Isc*1.25*1.25 PER NEC 690.9(B) & 220.5(B).
5. AMBIENT GROUND TEMPERATURE IS ASSUMED 27°C AT BURIAL DEPTH.
6. CONDUCTOR TEMPERATURE IS ASSUMED 85°C BASED ON SOFTWARE SIMULATION.
7. AMBIENT AIR TEMPERATURE IS ASSUMED X°C.

CALCULATIONS:

1. FORMULA USED FOR VOLTAGE DROP CALCULATION:

$$VD = \frac{2 * K * Imp * D}{N * 1000}$$

WHERE:

VD = VOLTAGE DROP

K = TEMPERATURE CORRECTED WIRE RESISTANCE

Imp = MAXIMUM POWER POINT CURRENT

D = ONE WAY LENGTH OF CIRCUIT SEGMENT (FT)

N = NUMBER OF PARALLEL CONDUCTORS

2. FORMULA USED FOR WIRE RESISTANCE CALCULATION:

$$K = R1 * [1 + \alpha * (T2 - 75°C)$$

WHERE

K = TEMPERATURE CORRECTED WIRE RESISTANCE

R1 = WIRE RESISTANCE (NEC TABLE 8, OHM/KFT)

T2 = CABLE TEMPERATURE (°C)

WHERE

α = 0.00323 FOR COPPER

α = 0.00330 FOR ALUMINUM

3. MAXIMUM STRING VOLTAGE CALCULATION (PER NEC 690.7):

$$Vmax = Vmod * N * [1 +(25°C-TL)*(\beta/100)]$$

WHERE

Vmax = MAXIMUM STRING VOLTAGE (V)

Vmod = MODULE OPEN CIRCUIT VOLTAGE AT STC (V)

N = NUMBER OF MODULES PER STRING

TL = MINIMUM EXPECTED SITE TEMPERATURE (°C)

β = TEMPERATURE COEFFICIENT OF Voc (%/°C)

4. WEIGHTED VOLTAGE DROP CALCULATION:

$$Vt = \sum^{n}_{i=0}(Xi * VDi) \Big/ \sum^{n}_{i=0}(Xi)$$

WHERE

Vt = TOTAL WEIGHTED VOLTAGE DROP (V)

X = NUMBER OF STRINGS PER CIRCUIT

VD = VOLTAGE DROP (V)

n = TOTAL NUMBER OF CIRCUITS IN SUMMATION

i = EACH CIRCUIT CONNECTED TO COMMON POINT

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PREPARED FOR:

ecos ENERGY

REVISIONS:

#	DATE	COMMENT
A	05/06/2019	50% SUBMITTAL
B	05/30/2019	90% SUBMITTAL
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Voluntown Solar

New London County, CT

DC Schedules

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.821

N:\2023366.00\Dwg\Electrical\023366.E.820.DC Schedule.dwg, 5/30/2019 3:40 PM Brandon.Blattner

DC Level 1: String Wire Collection to String Inverter: 2.PNL2.INV1

COMBINER BOX INPUT	FROM	TO	MODULE	MODULES PER STRING	STRINGS PER CIRCUIT	Pmp (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	MAX. CIRCUIT CURRENT (A)	FUSE SIZE AT COMBINER (A)	CABLE TYPE	CONDUCTOR MATERIAL	CONDUCTOR SIZE	# OF PARALLEL CONDUCTORS	GROUND CONDUCTOR MATERIAL	GROUND CONDUCTOR SIZE	TOTAL ONE WAY DISTANCE (FT)	LINE VOLTAGE DROP (%)	TOTAL DC VOLTAGE DROP (%)
1	2.PNL2.INV1.STR1	2.PNL2.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	390	0.9690	0.9690
2	2.PNL2.INV1.STR2	2.PNL2.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	390	0.9690	0.9690
3	2.PNL2.INV1.STR3	2.PNL2.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	302	0.7509	0.7509
4	2.PNL2.INV1.STR4	2.PNL2.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	302	0.7509	0.7509
5	2.PNL2.INV1.STR5/6	2.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	212	0.6621	0.6621
6	2.PNL2.INV1.STR7/8	2.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	124	0.3883	0.3883
7	2.PNL2.INV1.STR9/10	2.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	468	1.4611	1.4611
8	2.PNL2.INV1.STR11/12	2.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	380	1.1873	1.1873
9	2.PNL2.INV1.STR13/14	2.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	293	0.9136	0.9136
10	2.PNL2.INV1.STR15/16	2.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	204	0.6366	0.6366
11	2.PNL2.INV1.STR17/18	2.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	116	0.3629	0.3629
12	2.PNL2.INV1.STR19/20	2.PNL2.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	30	0.0923	0.0923
																			Average Voltage Drop %:	0.7424	0.7424

DC Level 1: String Wire Collection to String Inverter: 2.PNL2.INV2

COMBINER BOX INPUT	FROM	TO	MODULE	MODULES PER STRING	STRINGS PER CIRCUIT	Pmp (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	MAX. CIRCUIT CURRENT (A)	FUSE SIZE AT COMBINER (A)	CABLE TYPE	CONDUCTOR MATERIAL	CONDUCTOR SIZE	# OF PARALLEL CONDUCTORS	GROUND CONDUCTOR MATERIAL	GROUND CONDUCTOR SIZE	TOTAL ONE WAY DISTANCE (FT)	LINE VOLTAGE DROP (%)	TOTAL DC VOLTAGE DROP (%)
1	2.PNL2.INV2.STR1	2.PNL2.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	39	0.0964	0.0964
2	2.PNL2.INV2.STR2	2.PNL2.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	39	0.0964	0.0964
3	2.PNL2.INV2.STR3	2.PNL2.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	40	0.0989	0.0989
4	2.PNL2.INV2.STR4	2.PNL2.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	40	0.0989	0.0989
5	2.PNL2.INV2.STR5/6	2.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	28	0.0859	0.0859
6	2.PNL2.INV2.STR7/8	2.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	119	0.3724	0.3724
7	2.PNL2.INV2.STR9/10	2.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	208	0.6494	0.6494
8	2.PNL2.INV2.STR11/12	2.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	295	0.9199	0.9199
9	2.PNL2.INV2.STR13/14	2.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	51	0.1592	0.1592
10	2.PNL2.INV2.STR15/16	2.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	137	0.4265	0.4265
11	2.PNL2.INV2.STR17/18	2.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	224	0.7003	0.7003
12	2.PNL2.INV2.STR19/20	2.PNL2.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	313	0.9772	0.9772
																			Average Voltage Drop %:	0.4486	0.4486

DC Level 1: String Wire Collection to String Inverter: 2.PNL3.INV1

COMBINER BOX INPUT	FROM	TO	MODULE	MODULES PER STRING	STRINGS PER CIRCUIT	Pmp (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	MAX. CIRCUIT CURRENT (A)	FUSE SIZE AT COMBINER (A)	CABLE TYPE	CONDUCTOR MATERIAL	CONDUCTOR SIZE	# OF PARALLEL CONDUCTORS	GROUND CONDUCTOR MATERIAL	GROUND CONDUCTOR SIZE	TOTAL ONE WAY DISTANCE (FT)	LINE VOLTAGE DROP (%)	TOTAL DC VOLTAGE DROP (%)
1	2.PNL3.INV1.STR1	2.PNL3.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	150	0.3729	0.3729
2	2.PNL3.INV1.STR2	2.PNL3.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	150	0.3729	0.3729
3	2.PNL3.INV1.STR3	2.PNL3.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	65	0.1623	0.1623
4	2.PNL3.INV1.STR4	2.PNL3.INV1	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	65	0.1623	0.1623
5	2.PNL3.INV1.STR5/6	2.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	130	0.4043	0.4043
6	2.PNL3.INV1.STR7/8	2.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	40	0.1241	0.1241
7	2.PNL3.INV1.STR9/10	2.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	43	0.1337	0.1337
8	2.PNL3.INV1.STR11/12	2.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	130	0.4043	0.4043
9	2.PNL3.INV1.STR13/14	2.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	217	0.6780	0.6780
10	2.PNL3.INV1.STR15/16	2.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	306	0.9549	0.9549
11	2.PNL3.INV1.STR17/18	2.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	23	0.0732	0.0732
12	2.PNL3.INV1.STR19/20	2.PNL3.INV1	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	112	0.3501	0.3501
																			Average Voltage Drop %:	0.3658	0.3658

DC Level 1: String Wire Collection to String Inverter: 2.PNL3.INV2

COMBINER BOX INPUT	FROM	TO	MODULE	MODULES PER STRING	STRINGS PER CIRCUIT	Pmp (W)	Voc (V)	Vmp (V)	Isc (A)	Imp (A)	MAX. CIRCUIT CURRENT (A)	FUSE SIZE AT COMBINER (A)	CABLE TYPE	CONDUCTOR MATERIAL	CONDUCTOR SIZE	# OF PARALLEL CONDUCTORS	GROUND CONDUCTOR MATERIAL	GROUND CONDUCTOR SIZE	TOTAL ONE WAY DISTANCE (FT)	LINE VOLTAGE DROP (%)	TOTAL DC VOLTAGE DROP (%)
1	2.PNL3.INV2.STR1	2.PNL3.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	209	0.5200	0.5200
2	2.PNL3.INV2.STR2	2.PNL3.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	209	0.5200	0.5200
3	2.PNL3.INV2.STR3	2.PNL3.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	298	0.7407	0.7407
4	2.PNL3.INV2.STR4	2.PNL3.INV2	LG LG400N2W-V5 400W	25	1	10000	1232.5	1015	10.47	9.86	13	20	1000V/2000V PV WIRE	CU	10 AWG	1	CU	6 AWG	298	0.7407	0.7407
5	2.PNL3.INV2.STR5/6	2.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	46	0.1432	0.1432
6	2.PNL3.INV2.STR7/8	2.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	136	0.4234	0.4234
7	2.PNL3.INV2.STR9/10	2.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	225	0.7035	0.7035
8	2.PNL3.INV2.STR11/12	2.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	313	0.9772	0.9772
9	2.PNL3.INV2.STR13/14	2.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	70	0.2196	0.2196
10	2.PNL3.INV2.STR15/16	2.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	159	0.4966	0.4966
11	2.PNL3.INV2.STR17/18	2.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	248	0.7735	0.7735
12	2.PNL3.INV2.STR19/20	2.PNL3.INV2	LG LG400N2W-V5 400W	25	2	20000	1232.5	1015	20.94	19.72	26	35	1000V/2000V PV WIRE	CU	8 AWG	1	CU	6 AWG	337	1.0504	1.0504
																			Average Voltage Drop %:	0.6048	0.6048

NOTES:

1. DISTANCES SHOWN ARE APPROXIMATE FOR VOLTAGE DROP CALCULATION PURPOSES. CONTRACTOR SHALL FIELD-VERIFY LENGTH OF CONDUCTORS REQUIRED TO MAKE CONNECTIONS.
2. REFER TO DC SITE PLANS FOR CONDUIT AND WIRING ROUTING.
3. CABLES ARE SIZED PER NEC 690.8(B).
4. FUSES ARE SIZED USING Isc*1.25*1.25 PER NEC 690.9(B) & 220.5(B).
5. AMBIENT GROUND TEMPERATURE IS ASSUMED 27°C AT BURIAL DEPTH.
6. CONDUCTOR TEMPERATURE IS ASSUMED 85°C BASED ON SOFTWARE SIMULATION.
7. AMBIENT AIR TEMPERATURE IS ASSUMED X°C.

CALCULATIONS:

1. FORMULA USED FOR VOLTAGE DROP CALCULATION:

$$VD = \frac{2 * K * Imp * D}{N * 1000}$$

WHERE:

VD = VOLTAGE DROP

K = TEMPERATURE CORRECTED WIRE RESISTANCE

Imp = MAXIMUM POWER POINT CURRENT

D = ONE WAY LENGTH OF CIRCUIT SEGMENT (FT)

N = NUMBER OF PARALLEL CONDUCTORS

2. FORMULA USED FOR WIRE RESISTANCE CALCULATION:

$$K = R1 * [1 + \alpha * (T2 - 75°C)$$

WHERE

K = TEMPERATURE CORRECTED WIRE RESISTANCE

R1 = WIRE RESISTANCE (NEC TABLE 8, OHM/KFT)

T2 = CABLE TEMPERATURE (°C)

WHERE

α = 0.00323 FOR COPPER

α = 0.00330 FOR ALUMINUM

3. MAXIMUM STRING VOLTAGE CALCULATION (PER NEC 690.7):

$$Vmax = Vmod * N * [1 +(25°C-TL)*(\beta/100)]$$

WHERE

Vmax = MAXIMUM STRING VOLTAGE (V)

Vmod = MODULE OPEN CIRCUIT VOLTAGE AT STC (V)

N = NUMBER OF MODULES PER STRING

TL = MINIMUM EXPECTED SITE TEMPERATURE (°C)

β = TEMPERATURE COEFFICIENT OF Voc (%/°C)

4. WEIGHTED VOLTAGE DROP CALCULATION:

$$Vt = \sum_{i=0}^{n}(Xi * VDi) \Big/ \sum_{i=0}^{n}(Xi)$$

WHERE

Vt = TOTAL WEIGHTED VOLTAGE DROP (V)

X = NUMBER OF STRINGS PER CIRCUIT

VD = VOLTAGE DROP (V)

n = TOTAL NUMBER OF CIRCUITS IN SUMMATION

i = EACH CIRCUIT CONNECTED TO COMMON POINT

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A	05/06/2019	50% SUBMITTAL
B	05/30/2019	90% SUBMITTAL
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Voluntown Solar

New London County, CT

DC Schedules

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DATE: 05/30/2019

SHEET: E.822

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LG NeON® 2

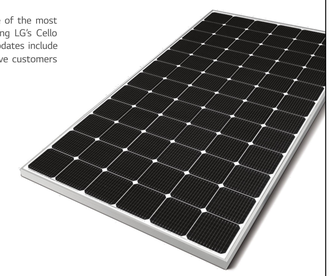
LG400N2W-V5

72

400W

The LG NeON® 2 is LG's best selling solar module, and is one of the most powerful and versatile modules on the market today. Featuring LG's Cello Technology, the LG NeON® 2 increases power output. New updates include an extended performance warranty from 86% to 89.6% to give customers higher performance and reliability.

In progress



Features

Enhanced Performance Warranty

LG NeON® 2 has an enhanced performance warranty. After 25 years, LG NeON® 2 is guaranteed to perform at minimum 89.6% of initial performance.

Enhanced Product Warranty

LG has extended the warranty of the NeON® 2 to 25 years, which is among the top of industry standards.

Better Performance on a Sunny Day

LG NeON® 2 now performs better on sunny days, thanks to its improved temperature coefficient.

BOS (Balance Of System) Saving

LG NeON® 2 can reduce the total number of strings due to its high module efficiency resulting in a more cost effective and efficient solar power system.

About LG Electronics

LG Electronics is a global leader in electronic products in the clean energy markets by offering solar PV panels and energy storage systems. The company first embarked on a solar energy source research program in 1985, supported by LG Group's vast experience in the semi-conductor, LCD, chemistry and materials industries. In 2010, LG Solar successfully released its first Mono$X^{\text{®}}$ series to the market, which is now available in 32 countries. The NeON® (previous. Mono$X^{\text{®}}$ NeON), NeON®2, NeON®2 Bifacial won the "Intersolar AWARD" in 2013, 2015 and 2016, which demonstrates LG's leadership and innovation in the solar industry.

LG NeON® 2

Made in USA From Imported Parts

LG400N2W-V5

General Data

Cell Properties (Material / Type)	Monocrystalline / N-type
Cell Maker	LG
Cell Configuration	72 Cells (6 x 12)
Number of Busbars	12EA
Module Dimensions (L x W x H)	2,024mm x 1,024mm x 40 mm
Weight	20.3 kg
Glass(Material)	Tempered Glass with AR Coating
Backsheet(Color)	White
Frame(Material)	Anodized Aluminium
Junction Box(Protection Degree)	IP 68
Cables(Length)	1,200 mm x 2EA
Connector(Type / Maker)	MC 4 / MC

Certifications and Warranty

Certifications	IEC 61215-1/-1-1/2:2016, IEC 61730-1/2:2016, UL 1703
	ISO 9001, ISO 14001, ISO 50001
	OHSAS 18001, PV CYCLE
Salt Mist Corrosion Test	IEC 61701 : 2012 Severity 6
Ammonia Corrosion Test	IEC 62716 : 2013
Module Fire Performance	Type 1 (UL 1703)
Fire Rating	Class C (UL 790, ULC/ORD C 1703)
Solar Module Product Warranty	25 Years
Solar Module Output Warranty	Linear Warranty*

* 1) First year : 98% 2) After 1st year : 0.35% annual degradation 3) 89.6% for 25 years

Temperature Characteristics

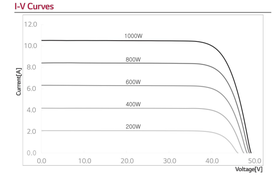
NMOT	[℃]	42 ± 3
Pmax	[%/℃]	-0.36
Voc	[%/℃]	-0.26
Isc	[%/℃]	0.02

* NMOT (Nominal Module Operating Temperature): Irradiance 800 W/m², Ambient temperature 20 ℃, Wind speed 1 m/s, Spectrum AM 1.5

Electrical Properties (NMOT)

Model		LG400N2W-V5
Maximum Power (Pmax)	[W]	300
MPP Voltage (Vmpp)	[V]	38.0
MPP Current (Impp)	[A]	7.88
Open Circuit Voltage (Voc)	[V]	46.5
Short Circuit Current (Isc)	[A]	8.40

I-V Curves



Electrical Properties (STC*)

Model		LG400N2W-V5
Maximum Power (Pmax)	[W]	400
MPP Voltage (Vmpp)	[V]	40.6
MPP Current (Impp)	[A]	9.86
Open Circuit Voltage (Voc, ±5%)	[V]	49.3
Short Circuit Current (Isc, ±5%)	[A]	10.47
Module Efficiency	[%]	19.3
Power Tolerance	[%]	0 ~ +3

* STC (Standard Test Condition): Irradiance 1000 W/m², Cell temperature 25 ℃, AM 1.5

Operating Conditions

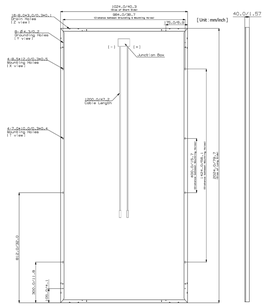
Operating Temperature	[℃]	-40 ~ +90
Maximum System Voltage	[V]	1,500(UL), 1000(IEC)
Maximum Series Fuse Rating	[A]	20
Mechanical Test Load (Front)	[Pa / psf]	5,400 / 113
Mechanical Test Load (Rear)	[Pa / psf]	3,000 / 63

* Test Load = Design load X Safety Factor (1.5)

Packaging Configuration

Number of Modules per Pallet	[EA]	25
Number of Modules per 40ft HQ Container	[EA]	550
Packaging Box Dimensions (L x W x H)	[mm]	2,080 x 1,120 x 1,226
Packaging Box Gross Weight	[kg]	551

Dimensions (mm / inch)



LG Life's Good

LG Electronics Inc.
Solar Business Division
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Lincolnshire, IL 60069
www.lg-solar.com

Product specifications are subject to change without notice.
LG400N2W-V5_US_Ver01

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Voluntown Solar

New London County, CT

Specification Sheet - Module

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DATE: 05/30/2019

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SOLAR INVERTERS

ABB string inverters
PVS-166/175-TL-US

PVS-166/175-TL-US three-phase string inverter

The PVS-166/175-TL-US is ABB's innovative three-phase string inverter, delivering a solution to enhance and optimize solar power generation for ground mounted utility scale applications.

Highest power in class
This new high-power string inverter, within the 1500 Vdc segment, delivers up to 185 kVA at 800 Vac. This not only maximizes the ROI for ground mounted utility-scale applications but also reduces Balance of System costs (i.e. AC side cabling) for small to large scale, free field ground mounted PV installations.

Design flexibility
The inverter comes equipped with 24 inputs and 12 MPPT, the highest available in the market, enabling maximum PV plant design flexibility and increasing yields also in case of complex installations.

Installer friendly design
Quick and easy installation, thanks to plug and play connectors, as the existing PV module's mounting systems can be used to install the inverters, thus saving time and cost on site preparation.
The fuse and combiner free design eliminates the need for external components, such as separate DC combiner boxes, thanks to the integrated DC disconnect and AC wiring compartment.
The Advanced Cooling Concept preserves the lifetime of the system and minimizes O&M costs thanks to internal heavy-duty cooling fans. These can be easily removed during scheduled maintenance cycles whilst the power module can be easily replaced without removing the wiring box.

Advanced communication for O&M
Standard wireless access from any mobile device makes the configuration of inverter and plant easier and faster. An improved user experience thanks to a built-in User Interface (UI) enables access to advanced inverter configuration settings.
The Installer for Solar Inverters mobile app and configuration wizard enable a quick multi-inverter installation and commissioning reducing the time spent on site.

Fast system integration
Industry standard Modbus (RTU/TCP)/SUNSPEC protocol enables fast system integration.
Two Ethernet ports enable fast and future-proof communication for PV plants.

Protect your assets
Monitoring your assets is made easy, as every inverter is capable to connect to ABB cloud platform and thanks to the state-of-the-art cybersecurity and Arc Fault Detection option, your assets and profitability are secure in the long term.

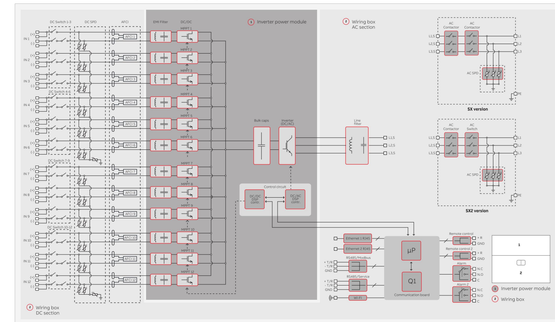
Highlights
- Up to 185 kW power rating, highest in class
- All-in-one combiner and fuse free design
- Separate power module and wiring compartment for fast swap and replacement
- 12 MPPT and wide input voltage range for maximum energy yield
- WLAN interface for commissioning and configuration
- Remote monitoring and firmware upgrade via ABB cloud platform (logger free)
- Free of charge standard access to Aurora Vision® cloud

ABB string inverters
PVS-166/175-TL-US
166.5 to 185 kW

Technical data and types

Type code	PVS-166-TL US	PVS-175-TL US
Input side		
Absolute maximum DC input voltage ($V_{max,abs}$)	1500 V	
Start-up DC input voltage (V_{start})	750 V (650...1000 V)	
Operating DC input voltage range (V_{dcmin}...V_{dcmax})	0.7 x V_{start}...1500 V (min 600 V)	
Rated DC input voltage (V_{dcr})	1150 V	
Rated DC input power (P_{dcr})	169 000 W @ 40°C	188 000 W @ 30°C (177 kW @ 40°C)
Number of independent MPPT	12	
MPPT input DC voltage range ($V_{MPPTmin}$...$V_{MPPTmax}$) at P_{acr}	850..1350 V	
Maximum DC input current for each MPPT ($I_{dcMPTmax}$)	22 A	
Maximum input short circuit current for each MPPT (I_{scMPT})	30 A	
Number of DC input pairs for each MPPT	2 DC Inputs per MPPT	
DC connection type	PV quick fit connector [1]	
Input protection		
DC Series Arc Fault Circuit Interrupter	Type I acc. to UL 1699B [2] with single-MPPT sensing capability	
Reverse polarity protection	Yes, from limited current source	
Input over voltage protection for each MPPT - replaceable surge arrester	Type 2 with monitoring	
Photovoltaic array isolation control (Insulation Resistance, R-iso)	Yes (pre start-up R-iso measurement)	
Residual Current Monitoring Unit (leakage current protection)	Yes (dynamic GFDI)	
DC Load Breaking Disconnect Switch (rating for each MPPT)	30A/1500 V	
Fuse rating	N/A, No fuses required	
String current monitoring	MPPT-level current sense	
Output side		
AC Grid connection type	Three phase 3W+PE	
Rated AC power (P_{acr} @cosϕ=1)	166 500 W @ 40°C	175 000 W @ 40°C
Maximum AC output power (P_{acmax} @cosϕ=1)	166 500 W @ 30°C	185 000 W @ ≤ 30°C
Maximum apparent power (S_{max})	166 500 VA	185 000 VA
Rated AC grid voltage (V_{acr})	800 V	
AC voltage range	552...960 [3]	
Maximum AC output current (I_{acmax})	134 A	
Rated output frequency (f)	50 Hz / 60 Hz	
Output frequency range (f_{min}...f_{max})	45...55 Hz / 55...65 Hz [3]	
Nominal power factor and adjustable range	> 0.995, 0...1 inductive/capacitive with maximum S_{max}	
Total current harmonic distortion	< 3%	
Max DC current injection (% of In)	< 0.5%*In	
AC wire range	4x1x2/0 AWG to 4x1x400 kcmil, Cu/Al [4]	
AC plate	Opening for Trade size 3 conduit	
AC connection type	Copper Busbar for ring terminal lug connections with M10 stud type terminal block (bolts included)	
Output protection		
Anti-islanding protection	Meets UL1741 / IEEE1547 requirements	
Output overvoltage protection - replaceable surge protection device	Type 2 with monitoring	
Operating performance		
Maximum efficiency (η_{max})	98.6 %	
Weighted CEC efficiency (η_{CEC})	98.4 %	
Communication		
Embedded communication interfaces	Dual port Ethernet, WLAN [5], RS-485	
User Interface	4 LEDs, Web User Interface, Mobile APP	
Communication protocol	Modbus RTU/TCP (SunSpec compliant)	
Commissioning tool	Web User Interface, Mobile APP	
Monitoring	Plant Portfolio Manager, Plant Viewer	

ABB PVS-166/175-TL-US string inverter block diagram



Technical data and types

Type code	PVS-166-TL US	PVS-175-TL US
FW update	Remote Inverter FW upgrade via Ethernet/WLAN Interface locally/remotely	
Parameter upgrade	Remote Inverter parameter upgrade via Ethernet/WLAN according to SunSpec Modbus protocol	
Environmental		
Operating ambient temperature range	-13...+140°F (-25...+60°C) with derating above 104°F (40°C)	
Relative humidity	0...100% condensing	
Sound pressure level, typical	<65 dB(A)@ 1m	
Maximum operating altitude without derating	2000 m / 6560 ft	
Physical		
Environmental protection rating	Cert. to UL 50E Type 4X – meets or exceeds NEMA 4X	
Cooling	Forced air cooling with variable speed cooling fan	
Dimension (H x W x D)	34.2x42.7x16.5 in (867 x 1086 x 419 mm) / -SX model 34.2x42.7x18 in (867 x 1086 x 458 mm) / -SX2 model	
Weight	~76.5kg / 168 lbs for power module ~76.8kg / 169 lbs for wiring box Overall max 153 kg / 338 lbs	
Mounting system	Bracket (included, vertical mounting only)	
Safety		
Isolation level	Transformer-less (floating array)	
Marking (Pending)	TUV_{dk}	
Safety and EMC standard (Pending)	UL1741, IEEE1547, IEEE1547.1, CSA-C22.2 No. 107.1-01, UL1998, UL 1699B, FCC 47 CFR Part 15B Class A Limits	
Grid standard (Pending)	UL 1741 SA, IEEE1547, IEEE 1547a, Rule 21, Rule 14 (HI)	
Available products variants		
Inverter power module	PVS-166-TL-POWER MODULE	PVS-175-TL-POWER MODULE
24 quick fit connector pairs (2 each mppt) + DC switches + SPD Type 2 Pluggable Cartridges (DC & AC)	WB-SX-PVS-166-TL-US	WB-SX-PVS-175-TL-US
24 quick fit connector pairs (2 each mppt) + DC switches + AC disconnection switch + SPD Type 2 Pluggable Cartridges (DC & AC)	WB-SX2-PVS-166-TL-US	WB-SX2-PVS-175-TL-US
Optional available		
DC link recharge circuit	Night time operation with restart capability	
Anti-PID [6]	Based on night time polarization of the array	

1) Multicontact MC4-Evo2. Cable couplers may accept up to 10mm² (AWG8)
2) Performance in line with the relevant requirements of the Draft IEC 63027 standard
3) The AC voltage and frequency range may vary depending on specific country grid standard
4) Aluminum cable requires bi-metallic compression lug or bi-metallic adapter
5) as per IEEE 802.11 b/g/n standard, 2.4 GHz
6) Cannot operate simultaneously when installed in conjunction with the DC link recharge circuit

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New London County, CT

Specification Sheet - Inverter

NOT FOR CONSTRUCTION

DATE: 05/30/2019

SHEET: E.901

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EXHIBIT F

PHOTOVOLTAIC MODULE GROUND MOUNT SYSTEM

RBI SOLAR RACK MODEL: GM-2

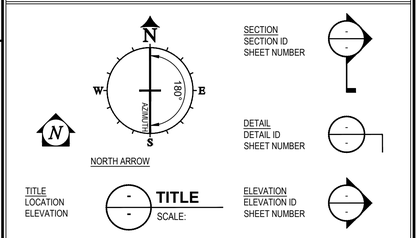
FOR

ECOS ENERGY

AT

VOLUNTOWN
1240 VOLUNTOWN ROAD
GRISWOLD, CT 06351

SYMBOLS LEGEND



GOVERNING CODE

2016 CONNECTICUT STATE BUILDING CODE (IBC 2015)

RISK CATEGORY: I

DESIGN LOADS:

1. DEAD LOADS:
   - STRUCTURE: 2.0 PSF
   - GLAZING: 3.0 PSF
     Σ 5.0 PSF
2. ROOF LIVE LOAD = 0 PSF
3. SNOW LOAD:
   - P_g = 30.0 PSF (GROUND SNOW)
   - P_f^0 = 30.0 PSF (FLAT ROOF SNOW)
   - P_s = 24.6 PSF (SLOPED ROOF SNOW)
   - C_e = 0.90
   - C_t = 1.20
   - C_s = 0.82
   - I_s = 0.80
4. WIND LOAD: (MAIN WIND FORCE RESISTING SYSTEM)
   - V = 110 MPH (PER LOCAL WINDY STUDY BY WINDSIM)
     DATED: 04/18/2019
     REPORT #: 190417_RBI_GRISWOLD_100
   - EXPOSURE: C
5. SEISMIC:
   - S_s = 0.179
   - S_1 = 0.064
   - S_{ds} = 0.191
   - S_{d1} = 0.103
   - I_{eq} = 1.00
   - SITE CLASS: D
   - SEISMIC DESIGN CATEGORY: B
   - SEISMIC FORCE RESISTING SYSTEM = CANTILEVERED COLUMN SYSTEM
   - DESIGN BASE SHEAR: V = 0.096*W
     C_S = 0.096
     R = 2.00
   - EQUIVALENT LATERAL FORCE ANALYSIS

VICINITY MAP

SHEET INDEX

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CUSTOMER SPECIFICATIONS

NOTE:
THIS SUBMITTAL/CONSTRUCTION SET WAS PRODUCED FROM DOCUMENTS RECEIVED FROM CUSTOMER ON 04/12/19.

PV MODULE MANUFACTURER	LG
PV MODULE MODEL #	LG400N2W-V5
PV MODULE WATTAGE	400
# OF PV MODULES/STRING	25
# OF ACTIVE PV MODULES	6000
# OF INACTIVE PV MODULES	0
TOTAL # OF PV MODULES	6000
TOTAL PV SYSTEM WATTS	2.4 MW
TOPOGRAPHIC RELATIONSHIP	FOLLOW GRADE
ARRAY TILT	25° ±2°
MINIMUM MODULE CLEARANCE	3'-0"
ARRAY AZIMUTH	180° (NOT ADJUSTED FOR MAGNETIC DECLINATION)

RBI SOLAR
Total Solar Service: Design * Fabrication
Installation * Parts * Repair Service
5513 VINE STREET
CINCINNATI, OH 45217
513.242.2051
FAX: 513.242.0816

PROFESSIONAL SEAL

ENGINEER'S SEAL APPLIES TO DESIGN OF STRUCTURAL COMPONENTS ONLY

NOT FOR CONSTRUCTION

RBI SOLAR IS NOT RESPONSIBLE FOR CONSTRUCTION THAT IS BUILT FROM SET LABELED "NOT FOR CONSTRUCTION"

GROUND MOUNT FOR ECOS ENERGY

RELEASE RECORD

MARK	DATE	DESCRIPTION
2	05/21/19	90% REVIEW
1	04/16/19	50% REVIEW

PROJECT INFORMATION

TITLE & ADDRESS:
VOLUNTOWN
1240 VOLUNTOWN ROAD
GRISWOLD, CT 06351

RBI SOLAR PROJECT No.: 1930106

DRAWN BY: JMF
REVIEWED BY: CCS/JFB

SHEET TITLE: COVER SHEET

SHEET No.: **SG001**

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USER: JFEHRENBACH PLOTTED: 5/21/2019 - 9:55 AM C:\Users\jfehrenbach.RBIappdata\local\temp\AcPublish_6980\1930106.dwg LAYOUT: SG001

MODULE SPECIFICATION SHEETS

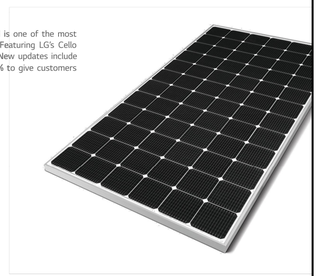
LG NeON® 2

LG400N2W-V5

72

400W

The LG NeON® 2 is LG's best selling solar module, and is one of the most powerful and versatile modules on the market today. Featuring LG's Cello Technology, the LG NeON® 2 increases power output. New updates include an extended performance warranty from 86% to 89.6% to give customers higher performance and reliability.



Features

Enhanced Performance Warranty
LG NeON® 2 has an enhanced performance warranty. After 25 years, LG NeON® 2 is guaranteed to perform at minimum 89.6% of initial performance.

Enhanced Product Warranty
LG has extended the warranty of the NeON® 2 to 25 years, which is among the top of industry standards.

Better Performance on a Sunny Day
LG NeON® 2 now performs better on sunny days, thanks to its improved temperature coefficient.

BOS (Balance Of System) Saving
LG NeON® 2 can reduce the total number of strings due to its high module efficiency resulting in a more cost effective and efficient solar power system.

About LG Electronics
LG Electronics is a global leader in electronic products in the clean energy markets by offering solar PV panels and energy storage systems. The company first embarked on a solar energy source research program in 1985, supported by LG Group's vast experience in the semi-conductor, LCD, chemistry and materials industries. In 2010, LG Solar successfully released its first Monx® series to the market, which is now available in 32 countries. The NeON® (previous. Monx® NeON), NeON®2, NeON®2 Bifacial won the "Intersolar AWARD" in 2013, 2015 and 2016, which demonstrates LG's leadership and innovation in the solar industry.

LG NeON® 2

LG400N2W-V5

General Data

Cell Properties (Material / Type)	Monocrystalline / N-type
Cell Maker	LG
Cell Configuration	72 Cells (6 x 12)
Number of Busbars	12EA
Module Dimensions (L x W x H)	2,024mm x 1,024mm x 40 mm
Weight	20.3 kg
Glass(Material)	Tempered Glass with AR Coating
Backsheet(Color)	White
Frame(Material)	Anodized Aluminium
Junction Box(Protection Degree)	IP 68
Cables(Length)	1,200 mm x 2EA
Connector(Type / Maker)	MC 4 / MC

Certifications and Warranty

Certifications	IEC 61215-1/-1-1/-2:2016, IEC 61730-1/2:2016, UL 1703
	ISO 9001, ISO 14001, ISO 50001
	OHSAS 18001, PV CYCLE
Salt Mist Corrosion Test	IEC 61701 : 2012 Severity 6
Ammonia Corrosion Test	IEC 62716 : 2013
Module Fire Performance	Type 1 (UL 1703)
Fire Rating	Class C (UL 790, ULC/ORD C 1703)
Solar Module Product Warranty	25 Years
Solar Module Output Warranty	Linear Warranty*

* 1) First year : 98% 2) After 1st year : 0.35% annual degradation 3) 89.6% for 25 years

Temperature Characteristics

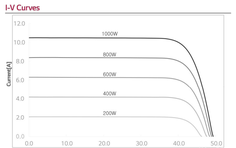
NMOT	[°C]	42 ± 3
Pmax	[%/°C]	-0.36
Voc	[%/°C]	-0.26
Isc	[%/°C]	0.02

* NMOT (Nominal Module Operating Temperature) Irradiance 800 W/m², Ambient temperature 20 °C, Wind speed 1 m/s, Spectrum AM 1.5

Electrical Properties (NMOT)

Model		LG400N2W-V5
Maximum Power (Pmax)	[W]	300
MPP Voltage (Vmpp)	[V]	38.0
MPP Current (Impp)	[A]	7.88
Open Circuit Voltage (Voc)	[V]	46.5
Short Circuit Current (Isc)	[A]	8.40

I-V Curves



Electrical Properties (STC*)

Model		LG400N2W-V5
Maximum Power (Pmax)	[W]	400
MPP Voltage (Vmpp)	[V]	40.6
MPP Current (Impp)	[A]	9.86
Open Circuit Voltage (Voc, ±5%)	[V]	49.3
Short Circuit Current (Isc, ±5%)	[A]	10.47
Module Efficiency	[%]	19.3
Power Tolerance	[%]	0 ~ +3

* STC (Standard Test Condition): Irradiance 1000 W/m², Cell temperature 25 °C, AM 1.5

Operating Conditions

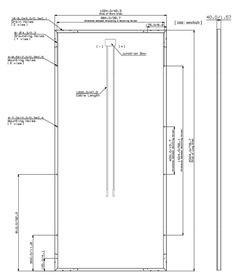
Operating Temperature	[°C]	-40 ~ +90
Maximum System Voltage	[V]	1,500(UL), 1000(IEC)
Maximum Series Fuse Rating	[A]	20
Mechanical Test Load (Front)	[Pa / psf]	5,400 / 113
Mechanical Test Load (Rear)	[Pa / psf]	3,000 / 63

* Test Load = Design load X Safety Factor (1.5)

Packaging Configuration

Number of Modules per Pallet	[EA]	25
Number of Modules per 40ft HQ Container	[EA]	550
Packaging Box Dimensions (L x W x H)	[mm]	2,080 x 1,120 x 1,226
Packaging Box Gross Weight	[kg]	551

Dimensions (mm / inch)



LG Life's Good

LG Electronics Inc.
Solar Business Division
2000 Millbrook Drive
Lincolnshire, IL 60069
www.lg-solar.com

Product specifications are subject to change without notice.
LG400N2W-V5_US_Ver01

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GENERAL NOTES

GENERAL/CONSTRUCTION/SAFETY:

1. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE APPLICABLE CONSTRUCTION CODE AND THE PROJECT SPECIFICATIONS.
2. LOCATION OF UNDERGROUND UTILITIES SHALL BE VERIFIED PRIOR TO COMMENCEMENT OF CONSTRUCTION.
3. DIMENSIONS SHOWN ON PLAN SHALL BE VERIFIED IN FIELD.
4. LAYOUT IS SUBJECT TO CHANGE PER REQUEST AND/OR EXISTING CONDITIONS IN THE FIELD.
5. ENGINEER SHALL NOT BE RESPONSIBLE FOR THE MEANS, METHODS, TECHNIQUES, SEQUENCES OR PROCEDURES OF CONSTRUCTION SELECTED BY CONTRACTOR.
6. CONTRACTOR SHALL FIELD MEASURE AND VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. ANY UNEXPECTED CONDITIONS OR DISCREPANCIES WITH THE DESIGN DOCUMENTS SHALL BE REPORTED TO THE ENGINEER PRIOR TO INSTALLATION OR ERECTION OF MATERIALS.
7. THE CONTRACTOR WILL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS OF THE JOB SITE INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THIS REQUIREMENT WILL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. WHEN ON SITE, THE ENGINEER IS RESPONSIBLE FOR HIS OWN SAFETY BUT HAS NO RESPONSIBILITY FOR THE SAFETY OF OTHER PERSONNEL OR SAFETY CONDITIONS AT THE SITE.
8. NO PERSONNEL SHALL STEP OR STAND ON PHOTOVOLTAIC (PV) MODULES (SOLAR PANELS) AT ANY TIME. RACK STRUCTURE AND PV MODULES ARE NOT DESIGNED FOR LIVE LOADS AND MAY VOID WARRANTY.
9. THIS RBI SOLAR CONSTRUCTION SET IS DESIGNED FROM PV MODULE DATA SHEET(S) PROVIDED BY THE CUSTOMER. CUSTOMER IS RESPONSIBLE FOR VERIFYING THAT THE PV MODULE(S) DELIVERED TO SITE MATCH DATA SHEET(S) PROVIDED TO RBI SOLAR. RBI SOLAR IS NOT RESPONSIBLE FOR PV MODULE DIMENSIONAL DISCREPANCIES DUE TO FURNISHED PV MODULES NOT MATCHING CUSTOMER FURNISHED PV MODULE DATA SHEETS.

SPECIAL FIELD INSPECTIONS:

SPECIAL INSPECTION NOT REQUIRED BY RBI SOLAR. AS REQUIRED BY OWNER/CUSTOMER AND/OR AUTHORITY HAVING JURISDICTION, MINIMUM INSPECTION SHALL INCLUDE THE FOLLOWING NOTES AND TABLE:

1. ALL SPECIAL INSPECTORS SHALL BE RETAINED BY OWNER/CUSTOMER. THE EXTENT OF THE INSPECTION SHALL COMPLY WITH THE CONTRACT DOCUMENTS, THE BUILDING CODE REQUIREMENTS, AND LOCAL JURISDICTION. IT IS THE OWNER/CUSTOMER'S RESPONSIBILITY TO GIVE PROPER NOTIFICATION TO THE SPECIAL INSPECTOR AND PROCEED WITH THE WORK ONLY AFTER THE SPECIAL INSPECTOR'S APPROVAL.
2. FAILURE TO NOTIFY THE SPECIAL INSPECTOR MAY RESULT IN OWNER/CUSTOMER HAVING TO REMOVE WORK FOR THE PURPOSE OF INSPECTION AT THE OWNER'S/CUSTOMER'S EXPENSE.
3. PREMATURE NOTIFICATION FOR INSPECTION WILL RESULT IN AN ADDITIONAL INSPECTION WITH ALL EXPENSES AND FEES PAID BY THE OWNER/CUSTOMER.
4. SPECIAL INSPECTORS SHALL KEEP RECORDS OF ALL INSPECTIONS. RECORDS SHALL BE FURNISHED TO THE OWNER, ENGINEER OF RECORD, AND LOCAL JURISDICTION AS REQUIRED. ANY AND ALL DISCREPANCIES SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE CONTRACTOR. CORRECTIONS SHALL BE MADE AND A FINAL REPORT OF INSPECTIONS SHALL BE PROVIDED NOTING COMPLETION OF INSPECTIONS AND CORRECTIONS OF DISCREPANCIES. FAILURE TO CORRECT DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER OF RECORD AND THE LOCAL JURISDICTION AND MAY RESULT IN REMOVAL OF COMPLETED WORK AND ADDITIONAL WORK TO CORRECT DISCREPANCIES AT THE CONTRACTOR'S EXPENSE.

IBC TABLE 1705		
STRUCTURAL STEEL/ALUMINUM FABRICATION	CONTINUOUS	PERIODIC
MATERIAL IDENTIFICATION		X
HIGH STRENGTH BOLTS - MATERIAL IDENTIFICATION OF BOLTS, NUTS AND WASHERS		X
WELD FILLER MATERIALS - IDENTIFICATION AND CONFIRMATION OF COMPLIANCE WITH DESIGN DOCUMENTS		X
STRUCTURAL STEEL/ALUMINUM ERECTION		
MATERIAL IDENTIFICATION		X
INSTALLATION OF HIGH STRENGTH BOLTS		X
WELDED CONNECTIONS		X
MEMBER SIZES AND PLACEMENT		X
GENERAL CONFORMANCE WITH DESIGN DOCUMENTS		X
CONCRETE CONSTRUCTION		
MATERIAL IDENTIFICATION		X
MIX DESIGN VERIFICATION		X
SIZE AND PLACEMENT OF REINFORCING STEEL		X
PLACEMENT OF CONCRETE USING PROPER TECHNIQUES		X
CONCRETE SAMPLES FOR SLUMP, AIR CONTENT, TEMPERATURE, STRENGTH TESTS, ETC. IN ACCORDANCE WITH ACI 318		X
PROPER MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES		X
FOUNDATIONS		
SIZE AND LOCATION OF FOUNDATION EXCAVATIONS		X
PLACEMENT OF REINFORCING STEEL AS REQUIRED		X

WORK BY OTHERS:

1. SITE WORK AND DEVELOPMENT.
2. ALL ELECTRICAL WORK INCLUDING WIRING, CONDUIT, PANELS AND LIGHTS TO BE FURNISHED AND INSTALLED BY ELECTRICAL CONTRACTOR.
3. GROUNDING REQUIREMENTS.
4. ALL SHADING ANALYSIS AND/OR PRODUCTION ANALYSIS SHALL BE PERFORMED AND VERIFIED BY OTHERS. RBI SOLAR IS NOT RESPONSIBLE FOR PV SYSTEM DESIGN AS IT PERTAINS TO ELECTRICAL OR PV SYSTEM PRODUCTION.

SURVEYING REQUIREMENTS:

1. ALL SURVEYING WORK MUST BE COMPLETED BY OTHERS PRIOR TO RBI SOLAR MOBILIZING ON-SITE UNLESS NOTED OTHERWISE.
2. ALL SURVEYING FOR THE RACKING MUST BE BASED OFF OF RBI SOLAR'S LATEST DOCUMENT SET.
3. THE FIRST AND LAST RACKING POST IN EVERY ROW MUST HAVE THE CENTER POINTS SURVEYED AND MARKED. THERE MUST BE A FIVE FOOT OFFSET TO THE WEST OF THE WESTERNMOST POST LOCATION AND A FIVE FOOT OFFSET TO THE EAST OF THE EASTERNMOST POST LOCATION IN EVERY ROW.
4. FOR ROWS LONGER THAN 100 FEET, THE CENTERLINE LOCATION MUST BE MARKED WITHIN THE ROW AT EVERY 100 FEET MAXIMUM. THESE ADDITIONAL MARKS SHOULD NOT BE AT A POST LOCATION. DO NOT MARK EACH INDIVIDUAL POST LOCATION WITHIN A ROW AS IT WILL NOT BE ACCURATE DUE TO TOPOGRAPHY.
5. EVERY INDIVIDUAL EQUIPMENT POST LOCATION MUST HAVE THE CENTER POINT SURVEYED AND MARKED.

ETL CLASSIFIED:

THIS PROJECT CONTAINS RACKING LABELED AS ETL CLASSIFIED UNDER UL SUBJECT 2703 OR UL STANDARD 2703. LABELS ARE APPLIED AT THE FACTORY ON COMPONENTS THAT MAY BE ASSEMBLED AT THE FACTORY OR IN THE FIELD. SEE DETAIL SHEET IN THIS DRAWING SET FOR MORE INFORMATION.

RBI SOLAR
MODEL
EXAMPLE
NA
Classified under UL Standard #### for Bonding and Grounding Only

STRUCTURAL STEEL:

1. ALL STRUCTURAL STEEL SHALL BE DESIGNED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE LATEST VERSION OF AISC "MANUAL OF STEEL CONSTRUCTION." LIGHT GAGE COLD-FORMED SECTIONS SHALL CONFORM TO LATEST VERSION OF AISI SPECIFICATIONS FOR COLD-FORMED STEEL STRUCTURAL MEMBERS.
2. MATERIALS:
   - A. ROLLED SHAPES: ASTM A992 OR A572 GRADE 55, F_Y = 55 KSI MINIMUM
   - B. PLATES: ASTM A36
   - C. TUBULAR SHAPES: ASTM A500 GRADE C, F_Y = 50 KSI MINIMUM
   - D. FIELD BOLTS (TYP. U.N.O): SAE J429 GRADE 5
   - E. SCREWS: #12 TEKS - GALVANIZED
   - F. COLD-FORMED/LIGHT GAGE ASTM A653 GRADE 55
   - G. ANCHOR RODS ASTM A307 (TYPICAL U.N.O.)
3. TEK SCREWS ARE TO BE INSTALLED USING A 2500 RPM MAX. NON-IMPACTING VARIABLE SPEED DRILL WITH CLUTCH OUT.
4. REFER TO THE LATEST RBI SOLAR MODEL GM-I OR GM-2 INSTALLATION GUIDE FOR STRUCTURAL CONNECTION TORQUE VALUES.
5. ALL WELDING OF STEEL SHALL BE DONE IN ACCORDANCE WITH THE LATEST VERSION OF THE AMERICAN WELD SOCIETY'S SPECIFICATIONS - AWS D1.1. ELECTRODES SHALL BE E70 SERIES UNLESS NOTED OTHERWISE.
6. GALVANIZING SPECIFICATIONS
   - A. STRUCTURAL SHAPES: HOT-DIPPED GALVANIZING SHALL BE PER ASTM A123.
   - B. PRE-GALVANIZED MATERIALS SHALL COMPLY WITH ASTM A653 - G90 MINIMUM.
   - C. ALL STRUCTURAL HARDWARE (NOT MODULE MOUNTING HARDWARE): HOT-DIPPED GALVANIZING SHALL BE PER ASTM F2329 UNLESS NOTED OTHERWISE.

MISCELLANEOUS FASTENERS:

1. ALL BOLTS SHALL BE THE TYPE AND SIZE INDICATED ON DRAWINGS.
2. ALL HARDWARE USED FOR MOUNTING PV MODULES SHALL BE STAINLESS STEEL UNLESS NOTED OTHERWISE.
3. ALL PV MODULE MOUNTING HARDWARE SHALL BE INSTALLED AND TORQUED PER THE LATEST RBI SOLAR MODEL GM-2 INSTALLATION GUIDE.

FOUNDATIONS/CONCRETE:

1. THE FOUNDATION DESIGN IS BASED ON ASSUMED MINIMUM CODE ALLOWABLE VALUES AND FIELD TESTS PERFORMED BY RBI SOLAR ON: 5/1/19
2. CONCRETE SPECIFICATIONS:
   STRENGTH: 2500 PSI MINIMUM @ 28 DAYS FOR FOOTINGS OR 4000 PSI MINIMUM @ 28 DAYS FOR BALLASTS
   AIR CONTENT: 4-6% AGGREGATE SIZE: 3/4" MAXIMUM MINIMUM COVER: 3" UNLESS NOTED OTHERWISE
3. GROUT SPECIFICATIONS: 8000 PSI MINIMUM, NON-SHRINK
4. REINFORCING STEEL: ASTM A615 GRADE 60 BILLET STEEL
5. CUSTOMER IS RESPONSIBLE FOR VERIFYING FINAL SOIL CONDITIONS DURING CONSTRUCTION HAVE NOT BEEN PURPOSELY ALTERED IN ANY WAY TO ENSURE THE SOIL IS CONSISTENT WITH FINDINGS INCLUDED IN GEOTECHNICAL REPORT, IF APPLICABLE, AND OR FIELD TESTS PERFORMED BY RBI SOLAR. VARIATIONS IN SOIL CONDITIONS SHALL BE REPORTED TO GEOTECHNICAL ENGINEER AND/OR ENGINEER OF RECORD RESPONSIBLE FOR FOUNDATION DESIGN PRIOR TO INSTALLATION OF ANY FOUNDATION MATERIALS.
6. CUSTOMER IS RESPONSIBLE FOR VERIFYING CORROSION COMPATIBILITY WITH FOUNDATIONS AND/OR DRIVEN POSTS.
7. INSTALLER/CONTRACTOR SHALL COORDINATE PLACEMENT OF FOUNDATIONS AND/OR ANCHOR BOLTS PER DESIGN DRAWINGS AND/OR MANUFACTURER'S SPECIFICATIONS.
8. RBI SOLAR, INC. DESIGNS DRIVEN-PILE AND ALTERNATIVE FOUNDATIONS BASED ON SOIL PROPERTIES OUTLINED IN CERTIFIED GEOTECHNICAL REPORTS AND/OR DATA FROM FIELD TESTING. ALL DESIGNS ASSUME UNDISTURBED SOIL CONDITIONS, AND DO NOT TAKE INTO ACCOUNT TRENCHING NEAR FOUNDATIONS. FOR CASES WHERE TRENCHING FOR ELECTRICAL WORK IS AT OR NEAR A FOUNDATION, RBI SOLAR RECOMMENDS A MINIMUM OF 3'-0" CLEAR FROM THE EDGE OF THE TRENCH TO THE EDGE OF THE FOUNDATION FOR "NORMAL GOOD SOIL CONDITIONS." IN CASES OF "POOR SOIL" CONDITIONS, RBI SOLAR RECOMMENDS A MINIMUM CLEAR DISTANCE EQUAL TO OR GREATER THAN THE DEPTH OF THE FOUNDATION. IF IN DOUBT OF SOIL CONDITIONS, RBI SOLAR RECOMMENDS CONSULTING A QUALIFIED GEOTECHNICAL ENGINEER TO ASSESS SOIL CONDITIONS AT THE SITE.

   NOTE: TRENCHING/EXCAVATION WITHIN 3'-0" OF ANY RACK SUPPORT POST REQUIRES REPLACING THE ORIGINAL SOIL AND COMPACTION TO 95% STANDARD PROCTOR DENSITY. FOR FURTHER CLARIFICATION ON COMPACTION REQUIREMENTS, RBI SOLAR RECOMMENDS CONSULTING A QUALIFIED GEOTECHNICAL ENGINEER.

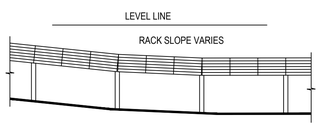
REFUSAL ON DRIVEN POST PROCEDURE:

WHEN DRIVEN POSTS DO NOT ACCOMPLISH MINIMUM DESIGN EMBEDMENT DEPTHS DURING POST DRIVING DUE TO REFUSAL, FOLLOW THIS PROCEDURE:

1. ATTEMPT TO DRIVE POST TO DEPTH SHOWN ON DESIGN DOCUMENTS - REFERENCE DETAIL A6/SG301.
2. IF REFUSAL IS ENCOUNTERED, EFFORTS TO DRIVE THE POST FURTHER SHOULD BE STOPPED.
3. DEPTH AND LOCATION OF ANY POST THAT DOES NOT MEET MINIMUM DESIGN EMBEDMENT SHALL BE RECORDED FOR ENGINEERING REVIEW AND RECORD DRAWINGS.
4. POSTS SHALL BE FIELD TESTED FOR UPLIFT CAPACITY PROVIDED A MINIMUM EMBEDMENT OF 5.0 FT. IS ACHIEVED. EMBEDMENT LESS THAN 5.0 FT. SHALL REQUIRE AN ALTERNATE FOUNDATION.
5. VERTICAL PULL TEST ON POSTS THAT DO NOT REACH MINIMUM DESIGN EMBEDMENT SHALL RESIST A MINIMUM UPLIFT FORCE OF 4000 LBS. IF POSTS DO NOT MEET THIS MINIMUM, AN ALTERNATE FOUNDATION IS REQUIRED.
6. LATERAL TEST ON POSTS THAT DO NOT REACH MINIMUM DESIGN EMBEDMENT SHALL RESIST A MINIMUM LATERAL FORCE OF 3500 LBS. & THE POST SHALL REBOUND WITHIN 1/4" OF ORIGINAL LOCATION. IF POSTS DO NOT MEET THIS MINIMUM REQUIREMENT AN ALTERNATE FOUNDATION IS REQUIRED.
7. POSTS THAT PASS THE FIELD TESTS SHALL BE CUT DOWN TO APPROPRIATE HEIGHT AND HOLES FOR POST-TOP MOUNTING BRACKETS DRILLED IN THE TOP OF POST.
8. ALL CUT SURFACES SHALL BE PAINTED WITH BRUSH-ON GALVANIZING PAINT. RBI SOLAR DOES NOT RECOMMEND SPRAY GALVANIZING FOR REPAIR AND PAINTING OF CUT SURFACES.

FOR THE ALTERNATE PRE-DRILL & DRIVE FOUNDATION SOLUTION. REFER TO THE LATEST RBI SOLAR 'PRE-DRILL & DRIVE PROCEDURE' DOCUMENT FOR INSTALLATION INSTRUCTIONS. FOR INSTANCES WHERE IT IS DESIRED TO REDUCE THE POST EMBEDMENT BUT REFUSAL IS NOT ENCOUNTERED, PLEASE CONTACT THE RBI SOLAR ENGINEERING DEPARTMENT FOR RECOMMENDATIONS.

RACK SYSTEM TOPOGRAPHIC RELATIONSHIP



KEY POINTS
1. RACK STRUCTURE IS PARALLEL TO SITE GRADE
2. COLUMN LENGTHS ARE EQUAL THROUGHOUT
3. TOPS OF PIERS FOLLOW SITE GRADE
4. EXPOSED PIER HEIGHTS MAY VARY

FOLLOW GRADE

RBI SOLAR
Total Solar Service: Design * Fabrication
Installation * Parts * Repair Service
5513 VINE STREET
CINCINNATI, OH 45217
513.242.2051
FAX: 513.242.0816

PROFESSIONAL SEAL

ENGINEER'S SEAL APPLIES TO DESIGN OF STRUCTURAL COMPONENTS ONLY

NOT FOR CONSTRUCTION

RBI SOLAR IS NOT RESPONSIBLE FOR CONSTRUCTION THAT IS BUILT FROM SET LABELED "NOT FOR CONSTRUCTION"

GROUND MOUNT FOR ECOS ENERGY

RELEASE RECORD

MARK	DATE	DESCRIPTION
2	05/21/19	90% REVIEW
1	04/16/19	50% REVIEW

PROJECT INFORMATION

TITLE & ADDRESS:
VOLUNTOWN

1240 VOLUNTOWN ROAD
GRISWOLD, CT 06351

RBI SOLAR PROJECT No.: 1930106

DRAWN BY: JMF
REVIEWED BY: CCS/JFB

SHEET TITLE: GENERAL NOTES/ MODULE SPECIFICATION SHEETS

SHEET No.: **SG002**

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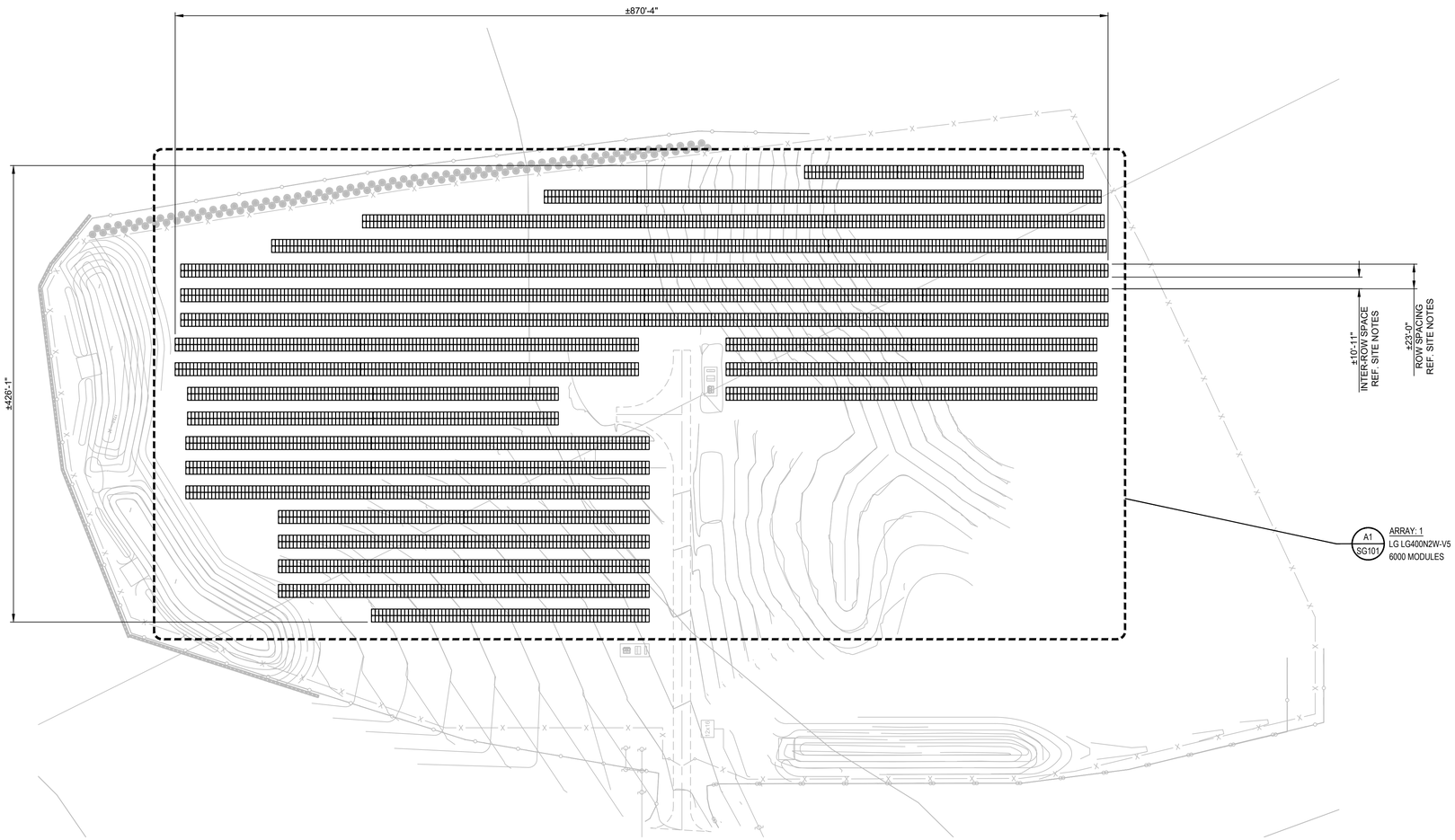

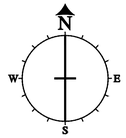

SITE NOTES

1. TOPOGRAPHY PROVIDED BY ECOS ENERGY ON 04/12/2019. DIMENSIONS SHOWN FOR REFERENCE ONLY. PRESUMPTIVE OR INADEQUATE TOPOGRAPHY USED FOR THIS DESIGN MAY REQUIRE ADDITIONAL MATERIALS. ACTUAL ON-SITE CONDITIONS SHALL BE FIELD VERIFIED AND RBI SOLAR SHALL BE NOTIFIED IF ON-SITE CONDITIONS ARE DIFFERENT THAN SHOWN OR PRESUMED.

BAY INFORMATION

TYPE	QTY.
BAY TYPE 4EP2	55
BAY TYPE 4WP2	55
BAY TYPE 5P2	490
TOTAL # OF BAYS	600

BILL OF MATERIALS

ITEM	QTY.
RACKING POST TYPE A	655
TOTAL # OF RACKING POSTS	655
EQUIPMENT POST TYPE -	12
TOTAL # OF EQUIPMENT POSTS	12
PURLINS:	
PURLIN MARK Z4E	220
PURLIN MARK Z4W	220
PURLIN MARK Z5	1960
TOTAL # OF PURLINS	2400
TOTAL # OF TOP CHORD ASSEMBLIES	655
TOTAL # OF STANDARD POST TOP ASSEMBLIES	545
TOTAL # OF EXTENDED POST TOP ASSEMBLIES	110
48 5/16" x 2" SQ. 15 GA. GALVANIZED KNEE BRACES	655
78" x 2" SQ. 15 GA. GALVANIZED KNEE BRACES	655
KNEE BRACE CLIPS	2620
3/4" X 5" MAGNI BOLT WITH NUT	1310
3/8" X 1 1/4" GALV. BOLT WITH NUT	6550
1/2" x 3" GALV. BOLT WITH NUT	1310
3/8" X 3/4" GALV. BOLT WITH NUT	10480
3/8" X 5" GALV. BOLT WITH NUT	655
3/8" GALV. WASHER	2620
#12 X 1 1/4" HEX HEAD TEK SCREW	1530
MODULE S.S. HARDWARE STACK (BOLT, 2 WASHER, FLANGE NUT)	24000

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513.242.2051
FAX: 513.242.0816

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GROUND MOUNT FOR ECOS ENERGY

RELEASE RECORD

MARK	DATE	DESCRIPTION
2	05/21/19	90% REVIEW
1	04/16/19	50% REVIEW

PROJECT INFORMATION

TITLE & ADDRESS:
VOLUNTOWN

1240 VOLUNTOWN ROAD
GRISWOLD, CT 06351

RBI SOLAR PROJECT No.: 1930106

DRAWN BY: JMF
REVIEWED BY: CCS/JFB

SHEET TITLE: SITE PLAN

SHEET No.: **SG003**

A1 SCALE: 1" = 60'-0"

OVERALL SITE PLAN

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LEGEND

"X"	SYMBOL REPRESENTS X" WIDE ROW BREAK PER DETAIL G9/SG301

POST SCHEDULE

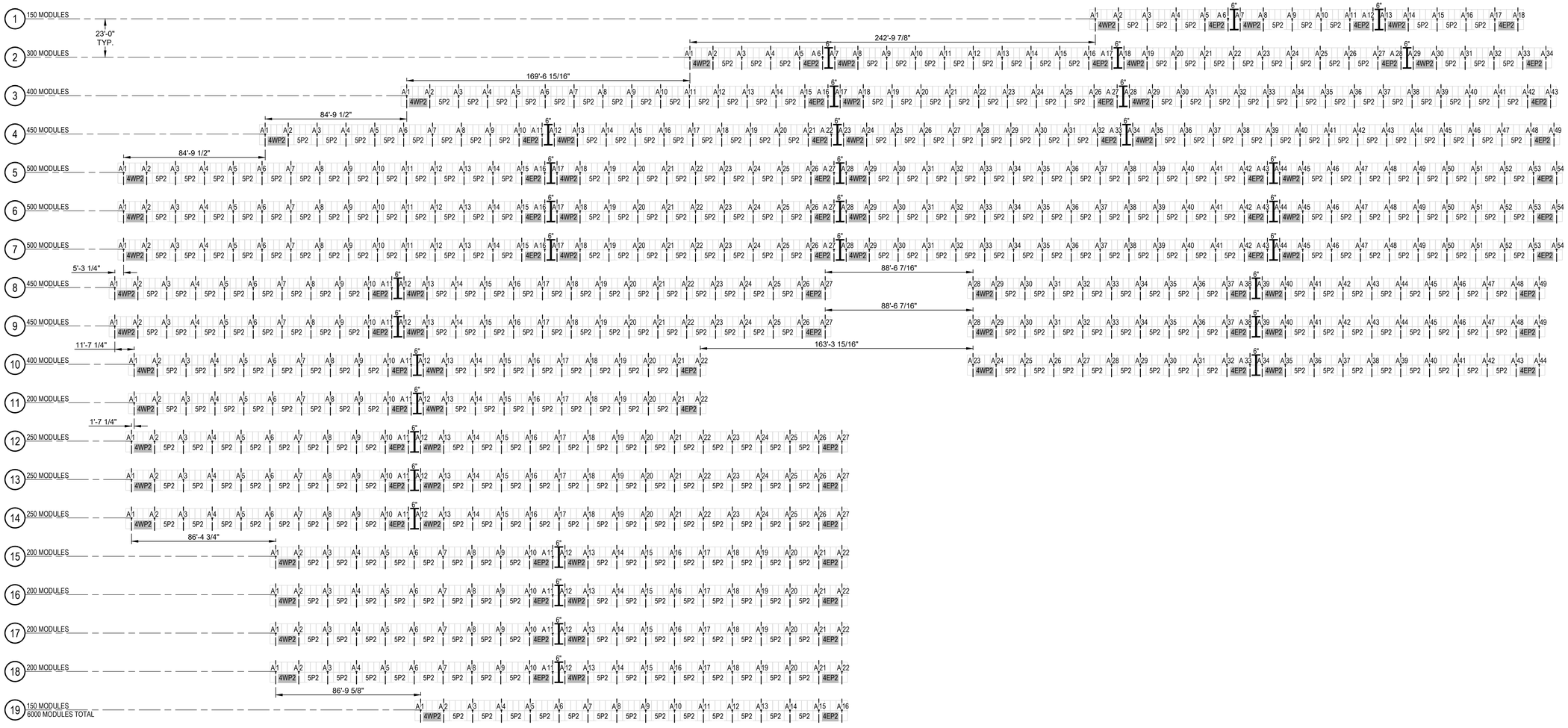
SYMBOL	MARK	DESCRIPTION	LENGTH	PIECES	DETAIL
"X" # "X" # OR PER PLAN	A	W6x9	13'-2"	655	A6/SG301
	-	W6x9 EQUIPMENT POST (FIELD LOCATE)	13'-2"	12	A1/SG201

POST SETTING NOTES:
1. ALL POST DIMENSIONS SHOWN ARE CENTERLINE TO CENTERLINE OF POST WEB.
2. REFERENCE DETAIL A6/SG301 & SHEET SG201 FOR ADDITIONAL INFORMATION ON REQUIRED POST EMBED DEPTHS.
3. POST LENGTH INCLUDES ADDITIONAL MATERIAL TO ALLOW FOR TOPOGRAPHICAL VARIANCE.

BAY SCHEDULE

BAYS				PURLINS			DETAIL
TYPE	QTY.	POST-POST	DESCRIPTION	MARK	#/BAY	PCS.	
4EP2	55	SEE BAY PLAN	LG LG400N2W-V5 PORTRAIT MODULES 4 WIDE x 2 HIGH WITH 1 CANTILEVER EAST SIDE AND 25.0° TILT	Z4E	4	220	A3/SG301
4WP2	55	SEE BAY PLAN	LG LG400N2W-V5 PORTRAIT MODULES 4 WIDE x 2 HIGH WITH 1 CANTILEVER WEST SIDE AND 25.0° TILT	Z4W	4	220	C3/SG301
5P2	490	SEE BAY PLAN	LG LG400N2W-V5 PORTRAIT MODULES 5 WIDE x 2 HIGH AND 25.0° TILT	Z5	4	1960	E3/SG301

NOTES THIS BAY:
1. PURLINS ARE 2 1/2" x 7" x 2 1/2" ZEE 16 GA. GALVANIZED UNLESS NOTED OTHERWISE.
2. TOP CHORDS ARE 142 3/4" x 4" x 4 3/4" CEE 14 GA. GALVANIZED UNLESS NOTED OTHERWISE.
3. LOWER KNEE BRACES ARE 48 5/16" x 2" SQ. 15 GA. GALVANIZED UNLESS NOTED OTHERWISE.
4. UPPER KNEE BRACES ARE 78" x 2" SQ. 15 GA. GALVANIZED UNLESS NOTED OTHERWISE.
5. INSTALL EXTENDED POST TOP ASSEMBLY AT EACH ROW END UNDER CANTILEVER BAY TYPES.



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GROUND MOUNT FOR ECOS ENERGY

RELEASE RECORD

MARK	DATE	DESCRIPTION
2	05/21/19	90% REVIEW

PROJECT INFORMATION

TITLE & ADDRESS:
VOLUNTOWN

1240 VOLUNTOWN ROAD
GRISWOLD, CT 06351

RBI SOLAR PROJECT No.: 1930106

DRAWN BY: JMF
REVIEWED BY: CCS/JFB

SHEET TITLE:
ARRAY: 1
COMPONENT LAYOUT

SHEET No.: **SG101**

A1 SCALE: 1/32" = 1'-0"

ARRAY: 1
COMPONENT LAYOUT

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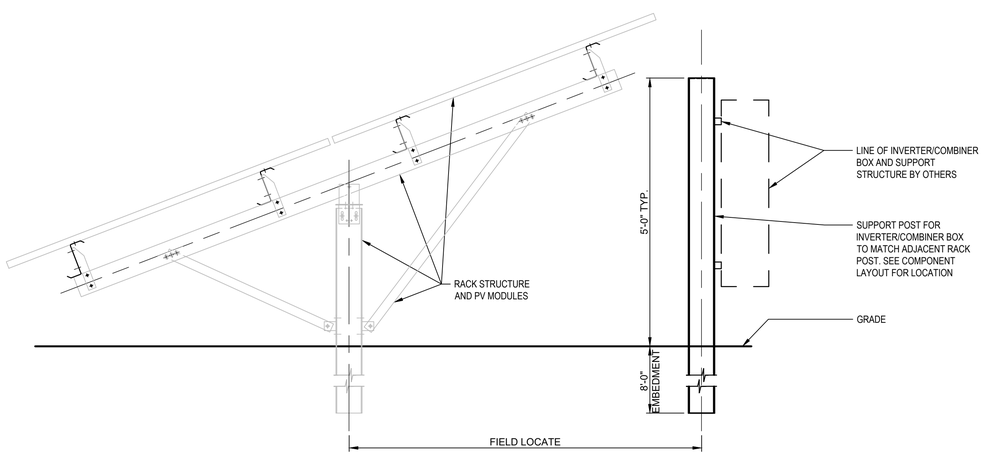
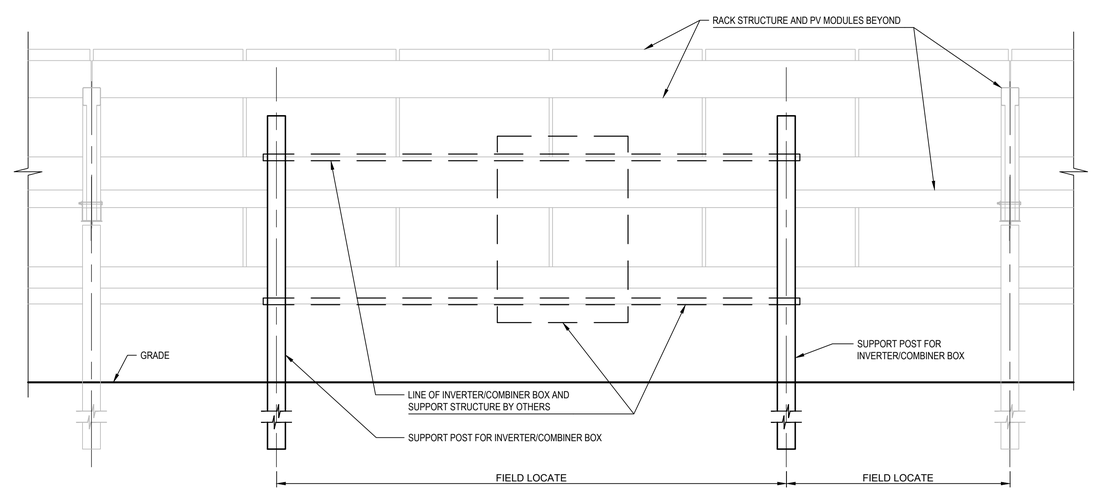


SIDE VIEW

NOTE:
RACK STRUCTURE AND PV MODULES SHOWN ARE FOR ILLUSTRATIVE PURPOSES ONLY. ACTUAL COMPONENTS MAY VARY.



REAR VIEW

A1
SCALE: 3/4" = 1'-0"

STAND-ALONE ADDITIONAL POSTS

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GROUND MOUNT FOR ECOS ENERGY

RELEASE RECORD

MARK	DATE	DESCRIPTION
2	05/21/19	90% REVIEW

PROJECT INFORMATION

TITLE & ADDRESS:
VOLUNTOWN

1240 VOLUNTOWN ROAD
GRISWOLD, CT 06351

RBI SOLAR PROJECT No.: 1930106

DRAWN BY:

REVIEWED BY: CCS/JFB

SHEET TITLE:
ADDITIONAL POST SECTIONS & ELEVATIONS

SHEET No.:
SG201

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NOT USED

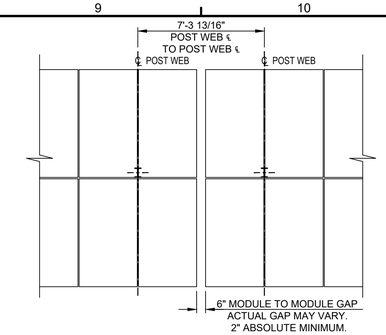
G1 SCALE: 1/4" = 1'-0" **-**
BAY PLAN VIEW

NOT USED

G3 SCALE: 1/4" = 1'-0" **-**
BAY PLAN VIEW

NOT USED

G6 SCALE: 1/4" = 1'-0" **-**
BAY PLAN VIEW

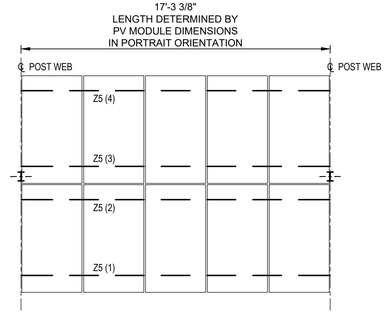


NOTE: COMPONENTS SHOWN MAY VARY FROM ACTUAL CONFIGURATION.
SEE INDIVIDUAL BAY PLANS THIS SHEET FOR MORE DETAILED PLANS.
INSTALL EXTENDED POST TOP ASSEMBLY AT EITHER SIDE OF ROW BREAK PER DETAIL A1/SG501.

G9 SCALE: NONE **TYPICAL ROW BREAK DETAIL**

NOT USED

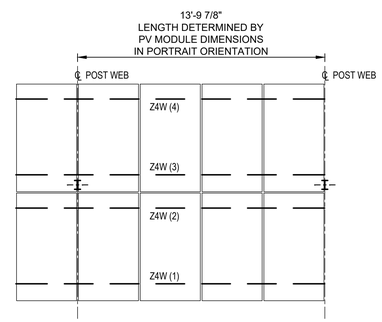
E1 SCALE: 1/4" = 1'-0" **-**
BAY PLAN VIEW



E3 SCALE: 1/4" = 1'-0" **5P2**
BAY PLAN VIEW

NOT USED

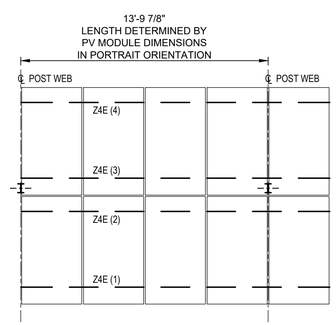
C1 SCALE: 1/4" = 1'-0" **-**
BAY PLAN VIEW



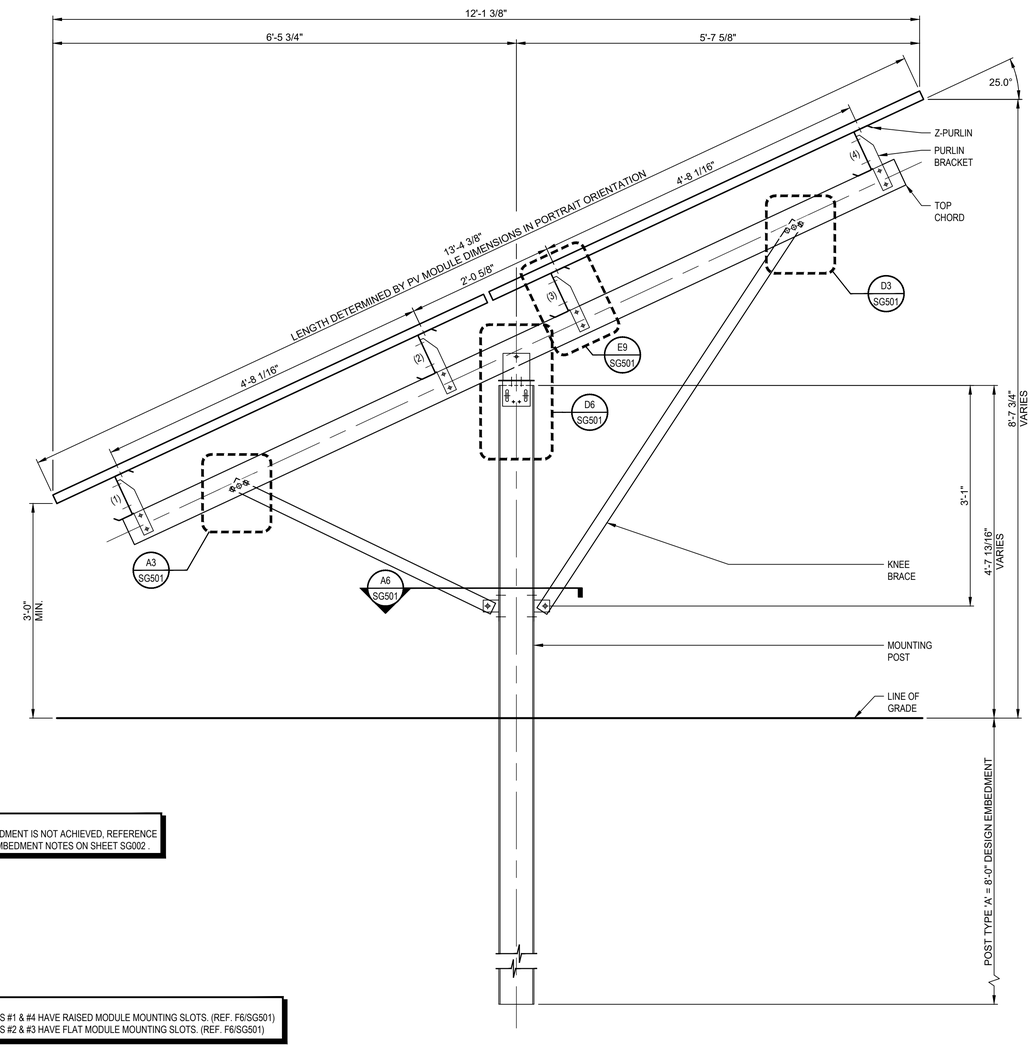
C3 SCALE: 1/4" = 1'-0" **4WP2**
BAY PLAN VIEW

NOT USED

A1 SCALE: 1/4" = 1'-0" **-**
BAY PLAN VIEW



A3 SCALE: 1/4" = 1'-0" **4EP2**
BAY PLAN VIEW



NOTE:
IF DESIGN EMBEDMENT IS NOT ACHIEVED, REFERENCE DRIVEN POST EMBEDMENT NOTES ON SHEET SG002.

NOTE:
1. Z-PURLINS #1 & #4 HAVE RAISED MODULE MOUNTING SLOTS. (REF. F6/SG501)
2. Z-PURLINS #2 & #3 HAVE FLAT MODULE MOUNTING SLOTS. (REF. F6/SG501)

A6 SCALE: 1" = 1'-0" **DESIGN RACK SECTION**

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GROUND MOUNT FOR ECOS ENERGY

RELEASE RECORD

MARK	DATE	DESCRIPTION
2	05/21/19	90% REVIEW
1	04/16/19	50% REVIEW

PROJECT INFORMATION

TITLE & ADDRESS:
VOLUNTOWN
1240 VOLUNTOWN ROAD
GRISWOLD, CT 06351

RBI SOLAR PROJECT No.: 1930106

DRAWN BY: JMF
REVIEWED BY: CCS/JFB

SHEET TITLE:
RACK SECTION
& BAY PLAN VIEWS

SHEET No.: **SG301**

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NOT USED

E1 SCALE: 1" = 1'-0"
COLLAR FOOTING PLAN

NOT USED

C1 SCALE: 1" = 1'-0"
COLLAR FOOTING SECTION

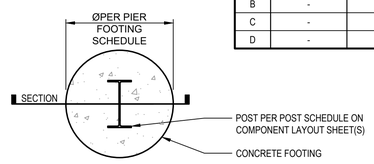
NOT USED

A1 SCALE: 1" = 1'-0"
COLLAR FOOTING SECTION

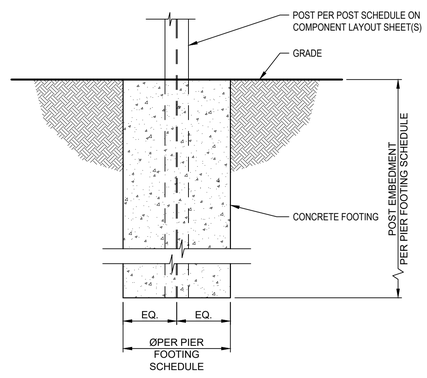
NOT USED

E5 SCALE: 1" = 1'-0"
PRE-DRILL & DRIVE DETAIL

PIER FOOTING SCHEDULE		
TYPE	DIAMETER	DEPTH
A	1'-6"	7'-0"
B	-	-
C	-	-
D	-	-



PLAN



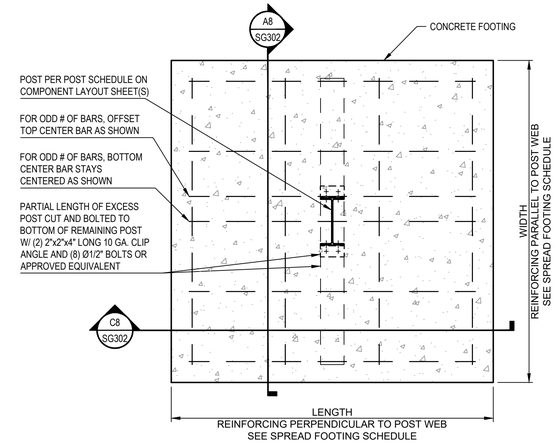
SECTION

NOTE: CONCRETE PIER DEPTH SHALL MEET OR EXCEED DESIGN EMBEDMENT. BOTTOM OF STEEL POST MAY BE RAISED A MAXIMUM OF 1'-0" ABOVE DESIGN EMBEDMENT AS REQUIRED.

A5 SCALE: 1" = 1'-0"
PIER FOOTING DETAIL

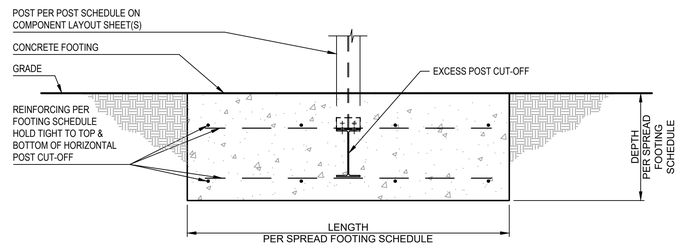
SPREAD FOOTING SCHEDULE					
TYPE	LENGTH	WIDTH	DEPTH	REINFORCING PARALLEL TO POST WEB AND POST CUT-OFF	REINFORCING PERPENDICULAR TO POST WEB AND POST CUT-OFF
A	6'-0"	6'-0"	1'-6"	(4) #4 BARS T&B OR (4) #5 BARS T&B	(6) #4 BARS T&B OR (5) #5 BARS T&B
B	-	-	-	-	-
C	-	-	-	-	-
D	-	-	-	-	-

NOTE: ALL REINFORCING TO HAVE 3" MINIMUM COVER

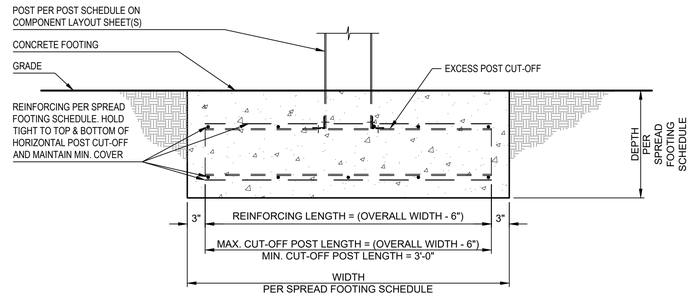


NOTE:
REINFORCING SHOWN MAY NOT REPRESENT THE ACTUAL REINFORCING REQUIRED.
SEE SPREAD FOOTING SCHEDULE FOR REQUIRED REINFORCING.
PROVIDE MINIMUM 3" COVER FOR ALL REINFORCEMENT.

E8 SCALE: 1" = 1'-0"
SPREAD FOOTING PLAN



C8 SCALE: 1" = 1'-0"
SPREAD FOOTING SECTION



A8 SCALE: 1" = 1'-0"
SPREAD FOOTING SECTION

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RELEASE RECORD

MARK	DATE	DESCRIPTION
2	05/21/19	90% REVIEW
1	04/16/19	50% REVIEW

PROJECT INFORMATION

TITLE & ADDRESS:
VOLUNTOWN

1240 VOLUNTOWN ROAD
GRISWOLD, CT 06351

RBI SOLAR PROJECT No.: 1930106

DRAWN BY: JMF
REVIEWED BY: CCS/JFB

SHEET TITLE: ALTERNATE FOUNDATIONS DETAILS & SCHEDULES

SHEET No.: **SG302**

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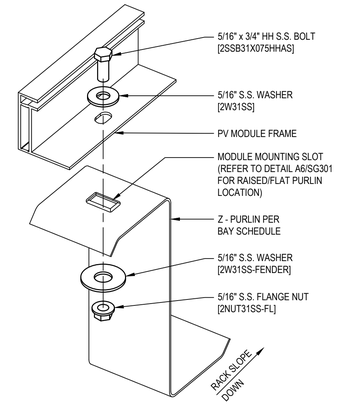
NOT USED

G1 X-BRACE TO POST CONNECTION DETAIL
SCALE: 3" = 1'-0"

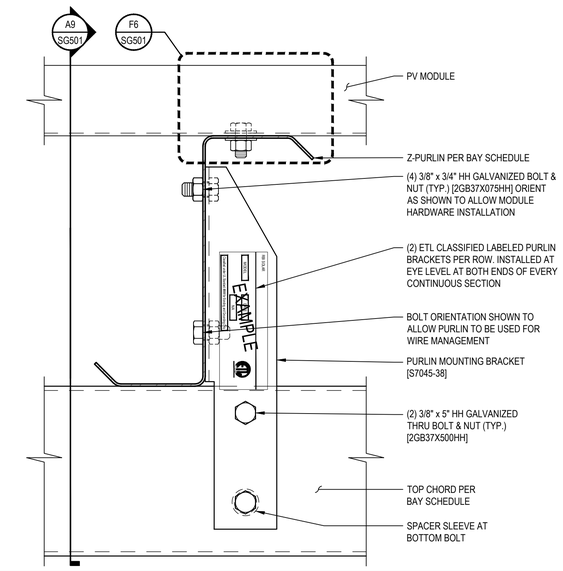
NOT USED

G3 X-BRACING ELEVATION
SCALE: 1/2" = 1'-0"



NOTE: TORQUE CONNECTION TO 8 ft-lb$_f$

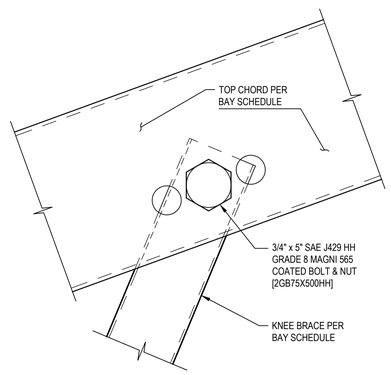
F6 PV MODULE TO PURLIN CONNECTION DETAIL
SCALE: NONE



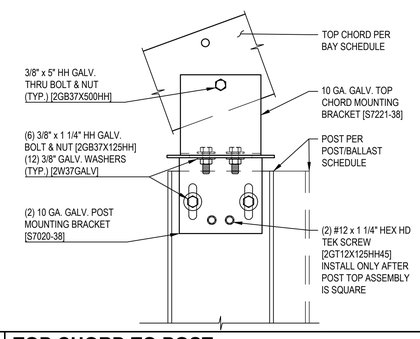
E9 TRANSVERSE PURLIN CONNECTION DETAIL
SCALE: 6" = 1'-0"

NOT USED

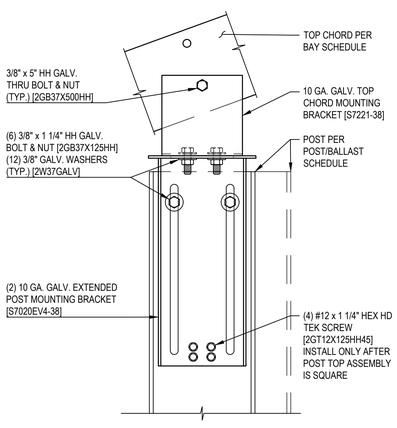
D1 WEEB PV MODULE BONDING WASHER DETAIL
SCALE: NONE



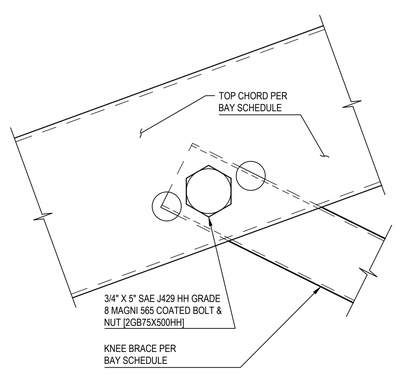
D3 UPPER KNEE BRACE TO TOP CHORD CONNECTION DETAIL
SCALE: 6" = 1'-0"



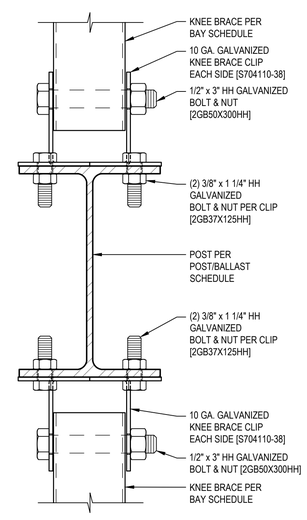
D6 TOP CHORD TO POST CONNECTION DETAIL
SCALE: 3" = 1'-0"



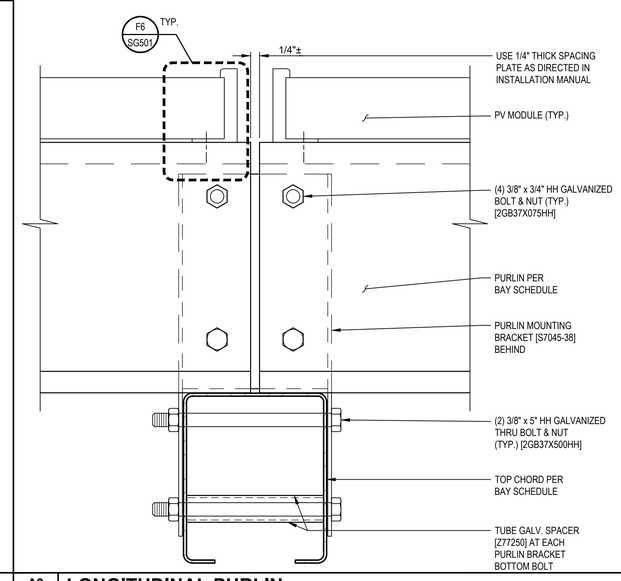
A1 TOP CHORD TO POST CONNECTION DETAIL (EXTENDED)
SCALE: 3" = 1'-0"



A3 LOWER KNEE BRACE TO TOP CHORD CONNECTION DETAIL
SCALE: 6" = 1'-0"



A6 KNEE BRACE TO POST CONNECTION DETAIL
SCALE: 6" = 1'-0"



A9 LONGITUDINAL PURLIN CONNECTION DETAIL
SCALE: 6" = 1'-0"

RBI SOLAR
Total Solar Service: Design * Fabrication Installation * Parts * Repair Service
5513 VINE STREET
CINCINNATI, OH 45217
513.242.2051
FAX: 513.242.0816

PROFESSIONAL SEAL

ENGINEER'S SEAL APPLIES TO DESIGN OF STRUCTURAL COMPONENTS ONLY

NOT FOR CONSTRUCTION

RBI SOLAR IS NOT RESPONSIBLE FOR CONSTRUCTION THAT IS BUILT FROM SET LABELED "NOT FOR CONSTRUCTION"

GROUND MOUNT FOR ECOS ENERGY

RELEASE RECORD

MARK	DATE	DESCRIPTION
2	05/21/19	90% REVIEW
1	04/16/19	50% REVIEW

PROJECT INFORMATION

TITLE & ADDRESS:
VOLUNTOWN

1240 VOLUNTOWN ROAD
GRISWOLD, CT 06351

RBI SOLAR PROJECT No.: 1930106

DRAWN BY: JMF
REVIEWED BY: CCS/JFB

SHEET TITLE: DETAILS

SHEET No.: **SG501**

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USER: JFEHRENBACH PLOTTED: 5/21/2019 - 9:56 AM C:\Users\jfehrenbach.RBIappdata\local\temp\AcPublish_6980\1930106.dwg