

Planning Decision Petition

Zoning Board of Appeals

- Special Permit(s)
- Variance
- Administrative Appeal
- Comprehensive Permit

Planning Board

- Site Plan Approval
- ANR endorsement
- Preliminary Subdivision Approval
- Definitive Subdivision Approval
- Special Permit(s)
- Low Impact Development Endorsement

Fee Rec'd

An additional fee will be due for advertising

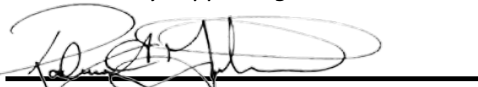
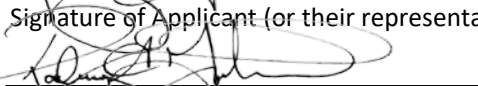
Project Number

Submission Materials to be included with this Petition Form are outlined in the Town of Winchendon Zoning Bylaws and the Planning Board Regulations. This application shall not be deemed complete unless all required items are included or appropriate waivers have been requested.

Property Address	<u>801 Spring Street</u>	Date	<u>July 27, 2020</u>
Property Owner's Name	<u>PLH, LLC</u>	Book	_____
Owner's Address	<u>222 South 9th Street #1600</u> <u>Minneapolis, MN 55402</u>	Map	_____
Petitioner's name	<u>Ecos Energy, LLC</u>	Lot Size	<u>71.29 acres</u>
Petitioner's Phone No.	<u>860.932.3086</u>	Frontage	<u>966'+/-</u>
Petitioner's address	<u>222 South 9th Street #1600</u> <u>Minneapolis, MN 55402</u>	Zone	<u>Industrial</u>

Project Summary & Decision Sought: Site plan approval for the installation of a 9MW ground mounted solar voltaic tracker system.

I hereby certify that the information provided in this application, and the accompanying drawing(s) of the property as well as any supporting data are accurate, true and correct to the best of my knowledge and belief.

 _____ Signature of Applicant (or their representative)	<u>7/28/2020</u> _____ Date
 _____ Signature of Property Owner	<u>7/28/2020</u> _____ Date

Tax Certification (Treasurer has up to 10 days to complete this certification):

Pursuant to the provisions of Massachusetts General Law, Chapter 40, Section 57, the Town Bylaw, Licenses and Permits of Delinquent Taxpayer, Section 21.1: "Any Board... shall deny application... for any person, corporation or business enterprise who has neglected to pay any local taxes, fees, assessments, betterments or any municipal charge."

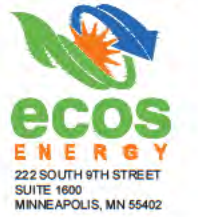
I hereby certify that the applicant or the owner of record owes no debt to the Town of Winchendon for a period of time greater than twelve (12) months.

Winchendon Treasurer

Date

WINCHENDON SOLAR SITE PLAN REVIEW

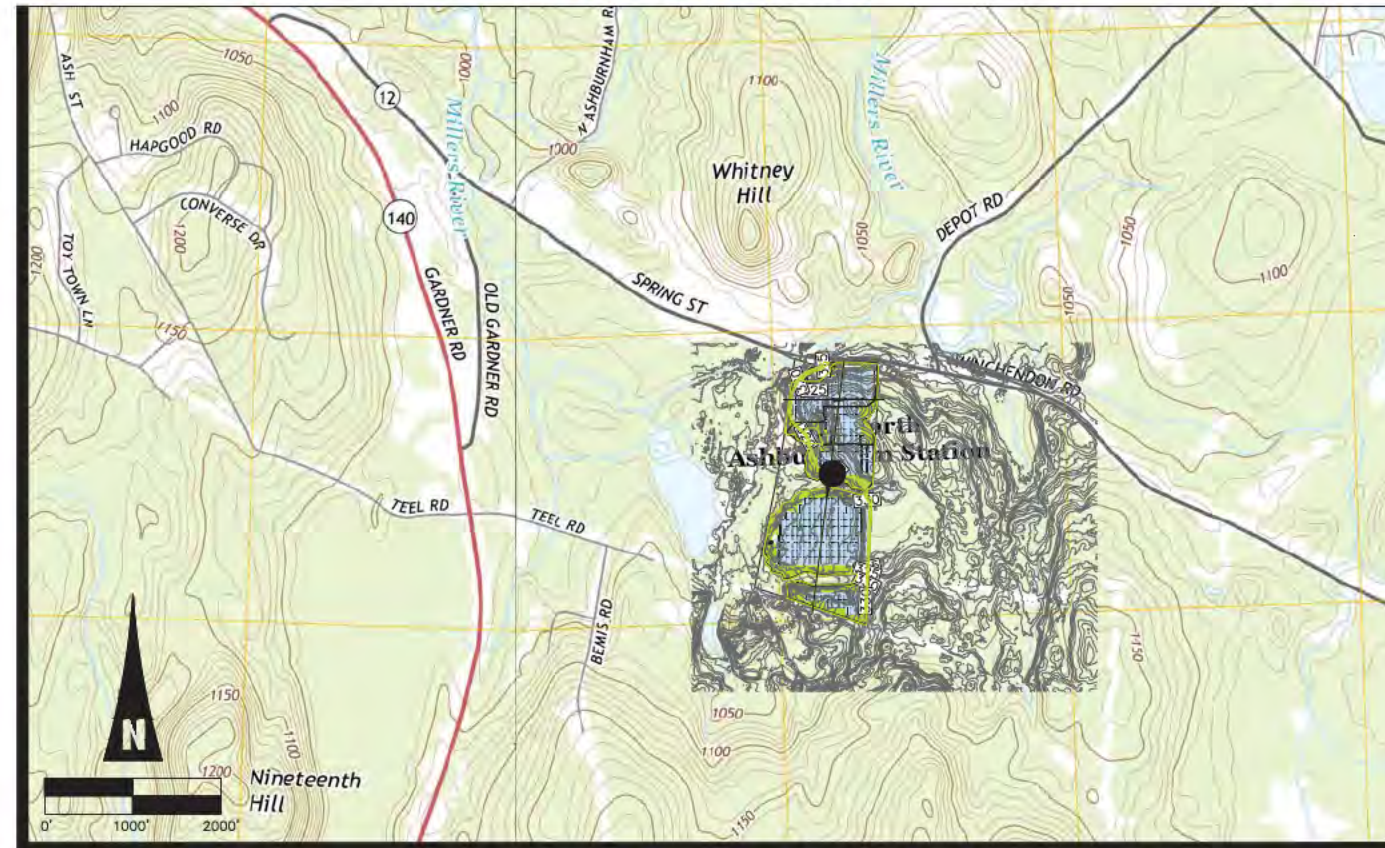
FOR
Site/Electrical Layout, Grading/Drainage/Erosion Control/Landscaping
IN
WINCHENDON, MASSACHUSETTS



REVISION LOG:
4/8/2020 - CC SUBMISSION



LOCATION MAP



SHEET INDEX

●	-	4/8/2020	1	COVER SHEET
●	-	2/04/2019	2	ALTA SURVEY (BY GOPFREY HOFFMANHODGE, LLC)
●	-	4/8/2020	3	OVERALL SITE PLAN
●	-	4/8/2020	4	OVERALL CLEARING PLAN
●	-	4/8/2020	5	GRADING AND EROSION CONTROL PLAN NORTH
●	-	4/8/2020	6	GRADING AND EROSION CONTROL PLAN NORTH2
●	-	4/8/2020	7	GRADING AND EROSION CONTROL PLAN CENTRAL
●	-	4/8/2020	8	GRADING AND EROSION CONTROL SOUTH
●	-	4/8/2020	9	OVERALL LANDSCAPING PLAN
●	-	4/8/2020	10	SITE CROSS SECTIONS
●	-	4/8/2020	11	CIVIL NOTES
●	-	4/8/2020	12	CIVIL DETAILS

DRAWING INDEX LEGEND

○	-	X/XX/202X	X	SHEET TITLE
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FILLED CIRCLE INDICATES DRAWING INCLUDED WITHIN THIS ISSUE
MOST RECENT REVISION NUMBER
MOST RECENT ISSUE OR REVISION DATE

CONTACT INFO:

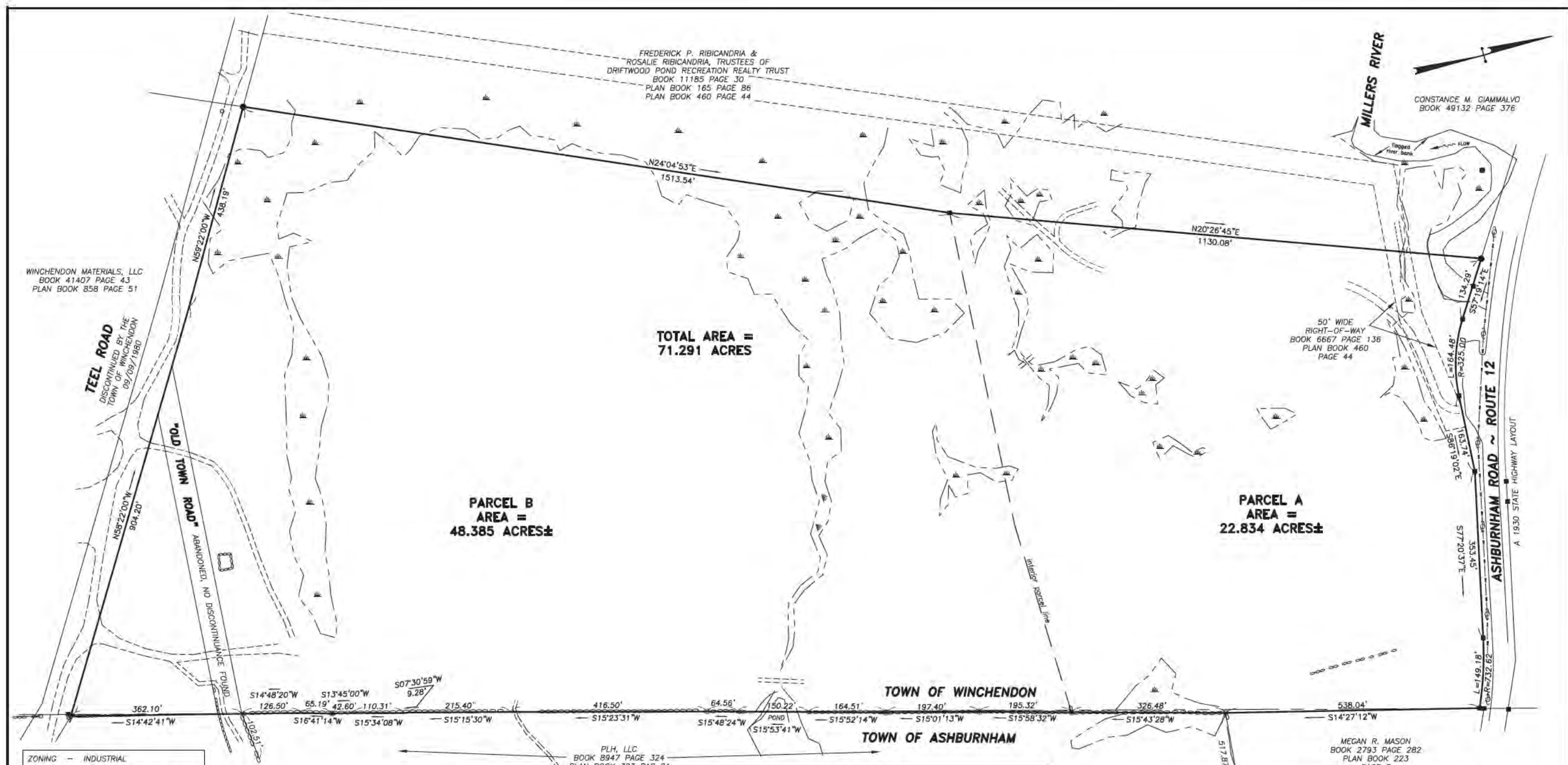
RECORD LANDOWNER:
PLH, LLC
77 WATER STREET
8TH FLOOR
NEW YORK, NY 10005

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

SURVEYOR:
HERITAGE SURVEYS, INC.
COLEGE HIGHWAY & PARK STREET
P.O. BOX 1
SOUTHAMPTON, MA 01073
TEL: 413-527-3600

WETLANDS:
NEW ENGLAND ENVIRONMENTAL DESIGN, INC.
2451 MAIN STREET
HOLDEN, MA 01520
TEL: 508-829-7222

WINCHENDON SOLAR
PARCEL # 9-0-97 & 9-0-98
SPRING STREET
WINCHENDON, MASSACHUSETTS 01430
WORCESTER COUNTY
COVER SHEET



WINCHENDON MATERIALS, LLC
BOOK 41407 PAGE 43
PLAN BOOK 858 PAGE 51

FREDERICK P. RIBICANDRIA &
ROSALIE RIBICANDRIA, TRUSTEES OF
DRIFTWOOD POND RECREATION REALTY TRUST
BOOK 11185 PAGE 30
PLAN BOOK 165 PAGE 86
PLAN BOOK 460 PAGE 44

CONSTANCE M. GIAMMALVO
BOOK 49132 PAGE 376

TOTAL AREA =
71.291 ACRES

PARCEL B
AREA =
48.385 ACRES±

PARCEL A
AREA =
22.834 ACRES±

ZONING -- INDUSTRIAL

MINIMUM LOT AREA	43,560 SQ.FT.
MINIMUM FRONTAGE	150'
FRONT SETBACK	40'
SIDE SETBACK	25'
REAR SETBACK	50'
MAX BUILDING HEIGHT	50'

TO: ECOS ENERGY,

THIS IS TO CERTIFY THAT THIS MAP AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2016 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 2-4, 6a, 6b, 7a, 8, 11, 13, 16, 18, 19 & 20 OF TABLE "A" THEREOF. THE FIELDWORK WAS COMPLETED ON 12/04/2017.

THIS PLAN SHOWS THE PROPERTY LINES THAT ARE THE LINES OF EXISTING OWNERSHIP, AND THE LINES OF STREETS AND WAYS SHOWN ARE THOSE OF PUBLIC OR PRIVATE STREETS OR WAYS ALREADY ESTABLISHED, AND NO NEW LINES FOR DIVISION OF EXISTING OWNERSHIP OR FOR NEW WAYS ARE SHOWN. FURTHERMORE, THIS SURVEY AND PLAN WERE PREPARED IN ACCORDANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS, AND THE PROCEDURAL AND TECHNICAL STANDARDS FOR THE PRACTICE OF LAND SURVEYING IN THE COMMONWEALTH OF MASSACHUSETTS.

06/12/2019 *Bruce A. Coomb*
DATE REGISTERED LAND SURVEYOR

NOTES:

- FOR REFERENCE TO PARCEL A, SEE BOOK 16541 PAGE 95 & PLAN BOOK 394 PAGE 76.
- FOR REFERENCE TO PARCEL B, SEE BOOK 13007 PAGE 268 (TRACT II - PARCEL 1).
- THE PRESENT OWNER OF PARCELS A & B IS KESTREL ENTERPRISES LIMITED PARTNERSHIP.
- A SMALL PORTION IN THE NORTHWEST CORNER OF PARCEL A, ALONG THE BANK OF THE MILLERS RIVER, LIES WITHIN FLOOD ZONE A4, AS SHOWN ON FEDERAL FLOOD INSURANCE RATE MAP COMMUNITY PANEL NUMBER 25034B 0019 B, EFFECTIVE DATE JUNE 15, 1982.
- WETLAND DELINEATION BY OTHERS.

LEGAL DESCRIPTION

PARCEL A
A certain parcel of land situated on the southerly side of Ashburnham Road, Route 12, in the easterly part of Winchendon, Worcester County, Massachusetts, bounded and described as follows:
Beginning at the northeasterly corner thereof of a Massachusetts highway bound at a point of tangency in the southerly line of Ashburnham Road, Route 12, and at the Winchendon-Ashburnham town line;
THENCE S. 14° 49' W., by the Winchendon-Ashburnham town line, partly by a wall, 284 feet to a corner of walls of land now or formerly of George C. Beals;
THENCE S. 89° W., by said Beals land and a wall, 413 feet to an angle in the wall;
THENCE N. 88° W., still by said Beals land, partly by a wall, 891 feet to a stone monument at land now or formerly of Alfred W. LeVerge;
THENCE about N. 21° E., by said LeVerge land, about 1165 feet to a point in the southerly line of Ashburnham Road;
THENCE S. 57° 18' 37" E., about 135 feet to a Massachusetts highway bound at a point of curvature;
THENCE easterly by a curve to the left having a radius of 325 feet, a distance of 164.48 feet to a point of tangency;
THENCE S. 86° 18' 25" E., 163.74 feet to a Massachusetts highway bound;
THENCE S. 77° 20' 00" E., 353.45 feet to a Massachusetts highway bound at a point of curvature;
THENCE easterly by a curve to the right having a radius of 732.62 feet, a distance of 149.18 feet to the place of beginning, the preceding five (5) courses being by the southerly line of Ashburnham Road.

PARCEL B
A certain tract or parcel of land situated in the southeast part of the town of Winchendon and bound as follows, viz:
BEGINNING at the southeast corner of said land, at a point by the old road and the town line between said towns of Winchendon and Ashburnham;
THENCE north on said town line to land of Samuel Baldwin;
THENCE west on land of said Samuel Baldwin to land of Martin Cook;
THENCE south on land of said Martin Cook to said old road;
THENCE on line of said old road to the place of beginning.
CONTAINING fifty acres to be more or less.

LEGEND

○	IRON PIPE FOUND	○	OVERHEAD UTILITIES	— — — — —	— — — — —
●	IRON BAR FOUND	— x — x — x —	BARBED WIRE FENCE	— — — — —	— — — — —
— — — — —	BOUND FOUND	— — — — —	WETLAND BOUNDARY	— — — — —	— — — — —
●	IRON PIPE TO BE ET	— — — — —	WETLAND SYMBOL	— — — — —	— — — — —
□	UTILITY POLE	— — — — —	WOODS ROAD	— — — — —	— — — — —
		— — — — —	STONE WALL	— — — — —	— — — — —

REGISTRY OF DEEDS
WORCESTER COUNTY

ALTA/NSPS LAND TITLE SURVEY PLAN OF LAND IN
WINCHENDON, MASSACHUSETTS
SURVEYED FOR
ECOS ENERGY

SCALE: 1" = 100'
DATE: JUNE 12, 2019

HERITAGE SURVEYS, INC.
REGISTERED PROFESSIONAL LAND SURVEYORS
COLLEGE HIGHWAY & CLARK STREET
POST OFFICE BOX 1
SOUTHAMPTON, MASSACHUSETTS
(413) 527-3600



LEGEND:

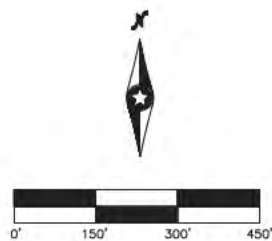
-  EXISTING PROPERTY LINE
-  PROPOSED FENCE
-  PROPOSED GRAVEL ACCESS ROAD
-  PROPOSED CLEARING PHASE LIMITS
-  PROPOSED TREE CLEARING
-  100' BW BUFFER
-  WETLAND DELINEATION LINE
-  WETLAND DELINEATION FLAGGING
-  *WETLAND DELINEATED BY NEW ENGLAND ENVIRONMENTAL DESIGN, LLC ON 10/2/16

CLEARING AREAS:

PHASE #	PHASE SITE AREA (AC)	CLEARING AREA (AC)
1	10.6	6.8
2	15	7.6
3	10.4	2.3
4	21.7	2.3
5	13.4	3.7

EROSION AND SEDIMENTATION CONTROL SEQUENCE

1. BEFORE ANY WORK TAKES PLACE CONTACT CALL BEFORE YOU DIG 1-800-922- 4455 TO MARK UTILITIES.
2. NOTIFY THE TOWN OF START OF CONSTRUCTION A MINIMUM OF 48 HOURS IN ADVANCE.
3. HAVE LICENSED SURVEYOR STAKE OUT THE CLEARING LIMITS.
4. CUT TREES PER CLEARING PLAN PHASING BUT DO NOT GRUB.
5. INSTALL CONSTRUCTION ENTRANCE AND PERIMETER EROSION AND SEDIMENTATION CONTROLS AND HAVE INSPECTED BY SITE INSPECTOR.
6. INSTALL E&S AS SHOWN ON PLANS 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.
8. GRUB AND GRADE SITE IN CLEARING AREAS AND CONSTRUCT STORMWATER BASINS AND ASSOCIATED OUTLETS.
9. GRADE ACCESS ROADWAY REALIGNMENT
10. INSTALL CHAIN LINK FENCE AROUND SITE PERIMETER AND BEGIN SOLAR RACKING FOUNDATION INSTALLATION.
11. TRENCH FOR AND INSTALL ELECTRIC LINES HYDROSEED OR MULCH AND SEED ANY EXPOSED SOIL AT THE END OF EACH WEEK AND/OR BEFORE EVERY RAINFALL PREDICTED FOR 0.5 INCHES OR MORE.
12. MAINTAIN RUTTING BETWEEN RACKING ROWS DURING INSTALLATION TRAFFIC, OVERSEED DISTURBED SOILS WHEN ALL SOLAR PANEL AND STRING WIRE INSTALLATION IS COMPLETE.
13. CLEAN SEDIMENTS BASINS AND GRADE AND RE-SEED UPON THE COMPLETION OF THE PROJECT.
14. MAINTAIN E&S AND PROVIDE REPORTS TO ALL AHJS.

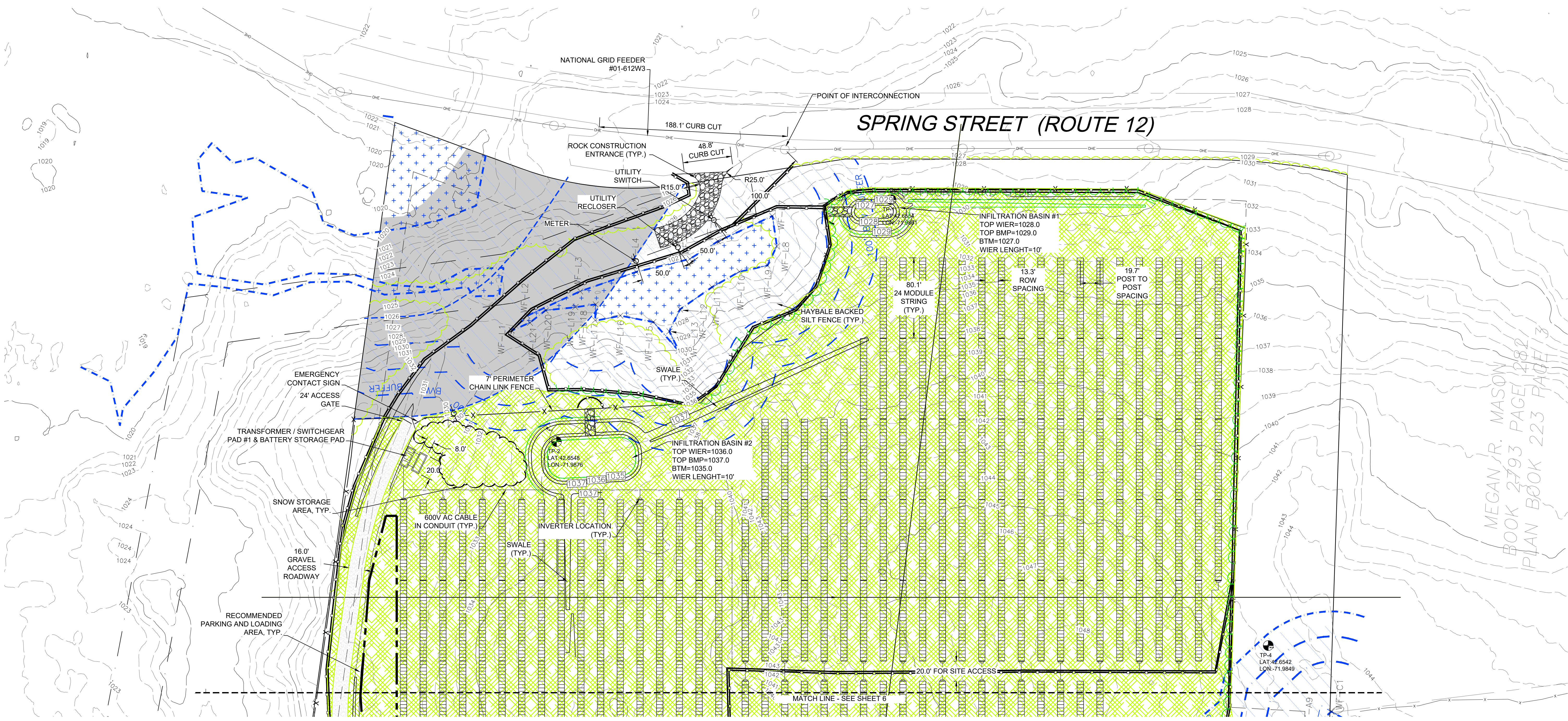


REVISION LOG

4/6/2020 - CC SUBMISSION

WINCHENDON SOLAR
 PARCEL # 9-0-97 & 9-0-96
 SPRING STREET
 WINCHENDON, MASSACHUSETTS 01430
 WORCESTER COUNTY

CLEARING PLAN

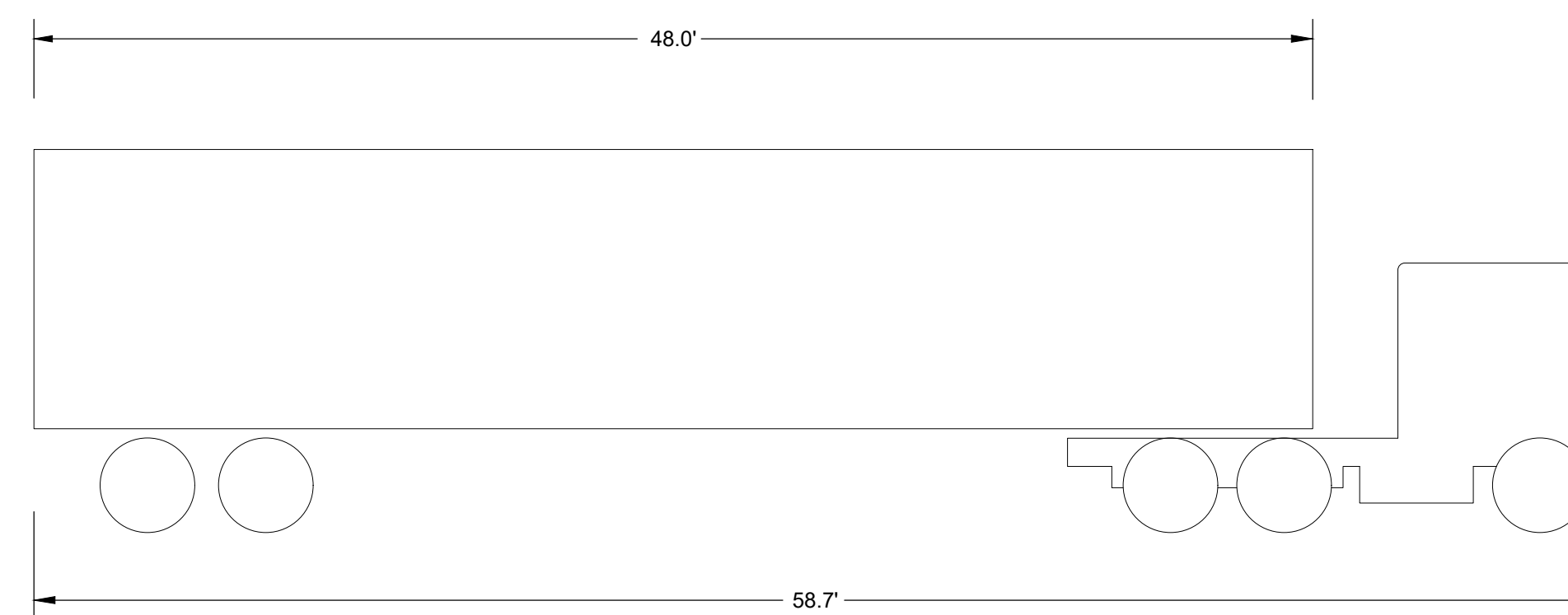


MEGAN R. MASON
BOOK 2793 PAGE 482
PLAN BOOK 223 PAGE 13








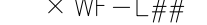











GENERAL NOTES:

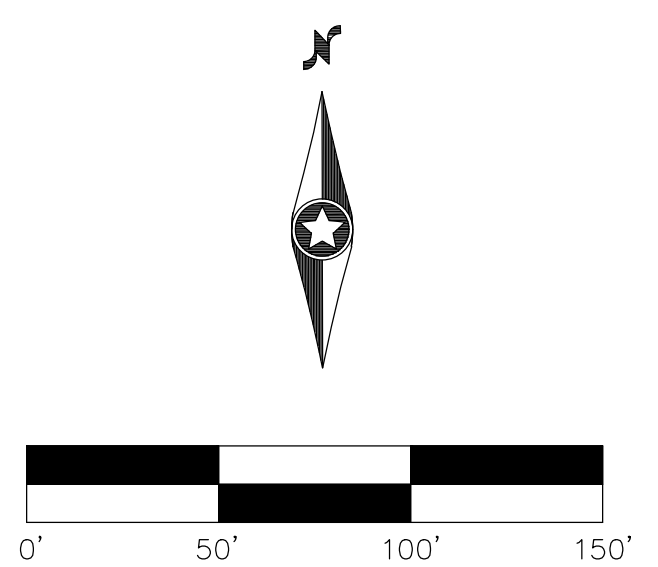
1. Loading and parking areas to be located within the proposed array footprint or an area approved by the owner. Under no circumstances shall the loading and parking areas be located within the wetland buffers.
2. There is to be no mass earth removal from the site.
3. Fill shall be clean and free of hazardous materials.
4. All stormwater facilities shall be cleaned and maintained per the approved Construction Period Pollution Prevention Plan, after construction and per the approved Long-term Pollution Prevention Plan.
5. Any earth material, (e.g. topsoil, crushed stone) shall be hauled during the hours of 9 a.m and 4 p.m weekdays.
6. There are no proposed sidewalks or proposed paved driveways located within the project site.

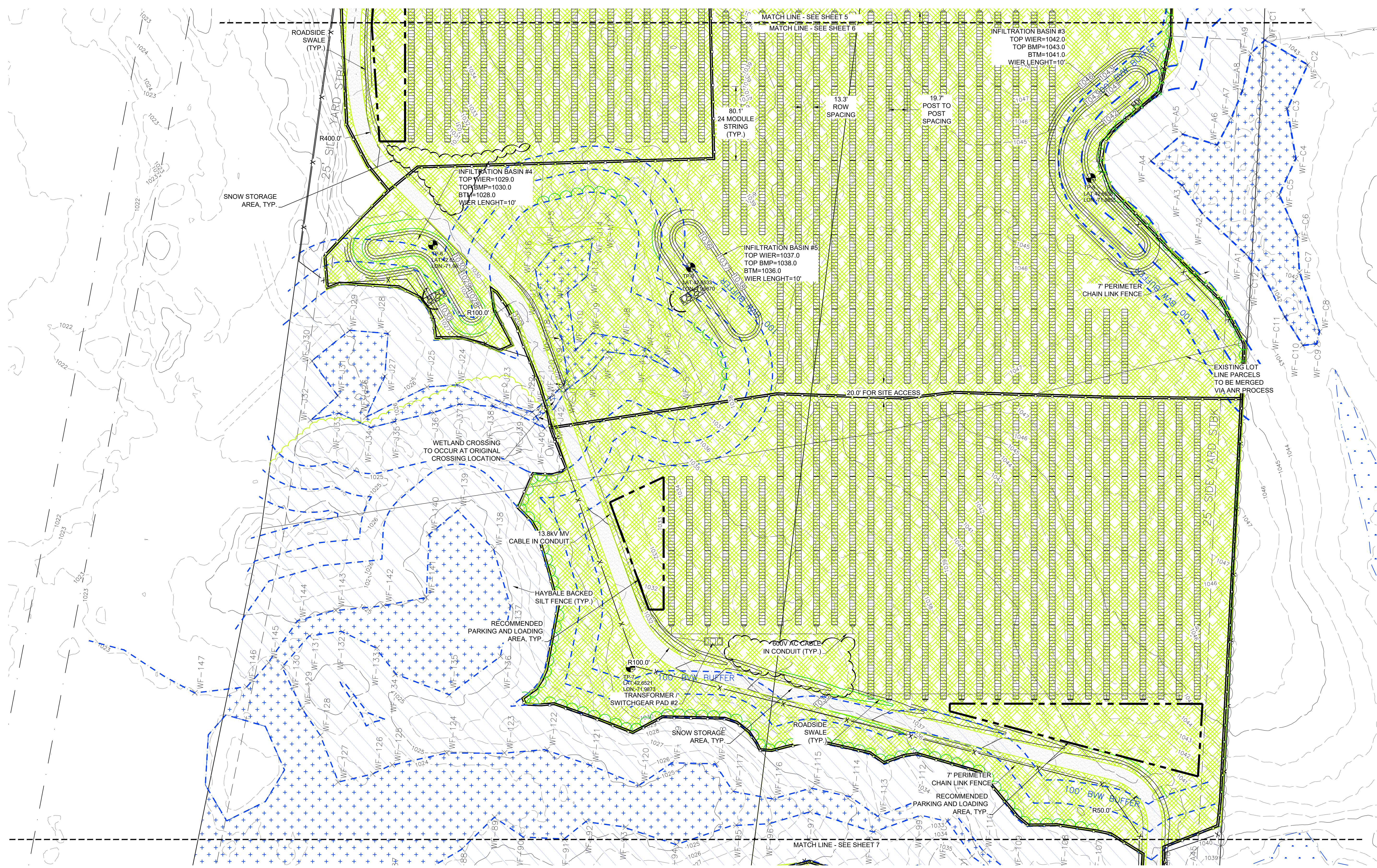
TRAILER TRUCK DETAIL:




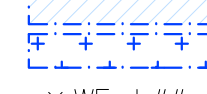



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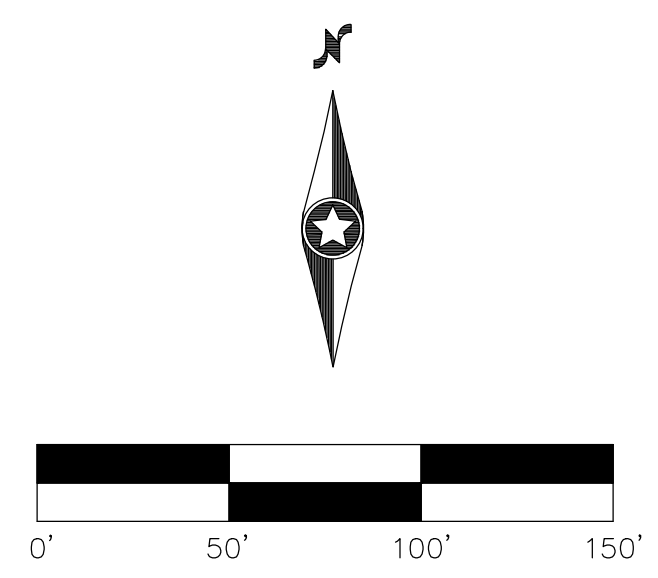
- | | | | |
|---|---|---|--|
|  | EXISTING PROPERTY LINE |  | RIVERFRONT AREA |
|  | PROPOSED FENCE |  | 100' BVW BUFFER |
|  | PROPOSED GRAVEL ACCESS ROAD |  | WETLAND DELINEATION LINE |
|  | PROPOSED SINGLE AXIS TRACKER (24 MODULE STRING) |  | WETLAND DELINEATION FLAGGING |
|  | PROPOSED 13.8 kVA AC DISTRIBUTION |  | *WETLAND DELINEATED BY NEW ENGLAND ENVIRONMENTAL DESIGN, LLC ON 10/22/18 |
|  | PROPOSED 600V AC ARRAY DISTRIBUTION |  | |
|  | PROPOSED OVERHEAD ELECTRIC |  | |
|  | EXISTING CONTOUR |  | |
|  | PROPOSED CONTOUR |  | |
| | |  | BASIN OUTLET |


















- LEGEND:**
- EXISTING PROPERTY LINE
 - x- PROPOSED FENCE
 - PROPOSED GRAVEL ACCESS ROAD
 - PROPOSED SINGLE AXIS TRACKER (24 MODULE STRING)
 - UMV PROPOSED 13.8 kVA AC DISTRIBUTION
 - ULV PROPOSED 600V AC ARRAY DISTRIBUTION
 - o- PROPOSED OVERHEAD ELECTRIC
 - 65.8 EXISTING CONTOUR
 - 65.8 PROPOSED CONTOUR

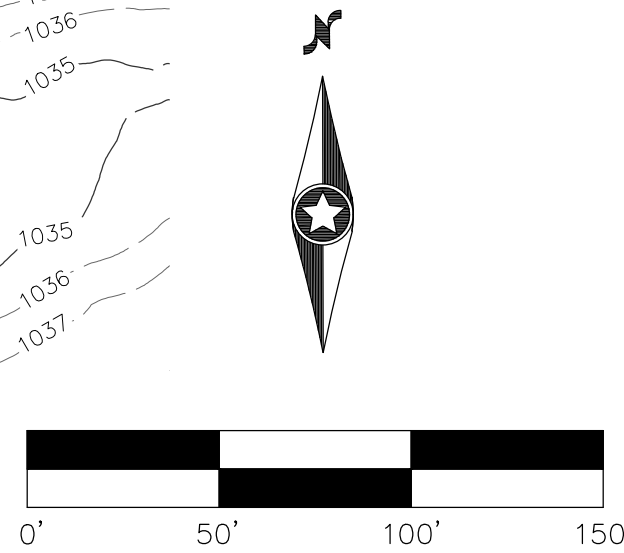
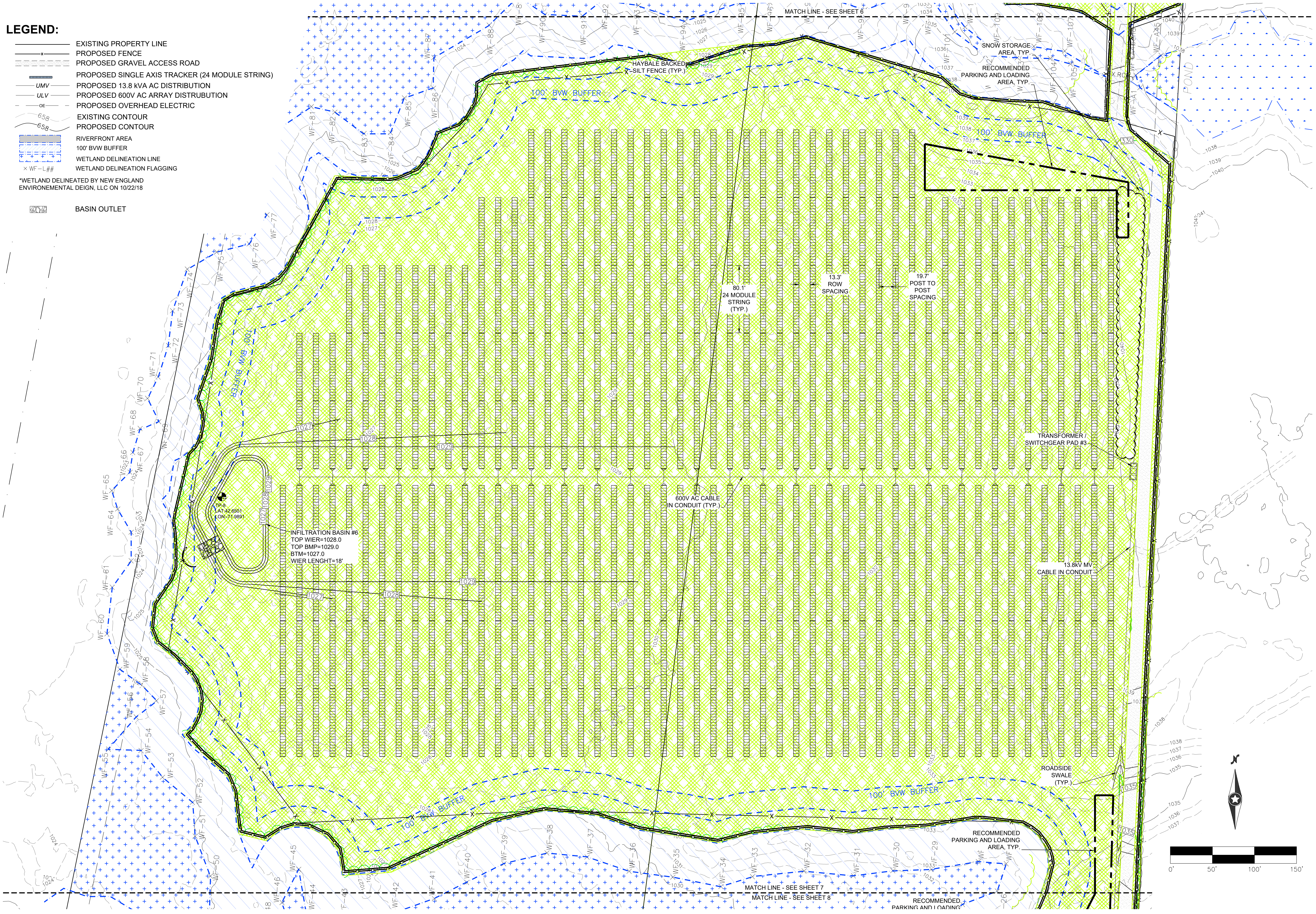
-  RIVERFRONT AREA
-  100' BWV BUFFER
-  WETLAND DELINEATION LINE
-  WETLAND DELINEATION FLAGGING
- x WF-L##
- *WETLAND DELINEATED BY NEW ENGLAND ENVIRONMENTAL DESIGN, LLC ON 10/22/18
-  BASIN OUTLET



LEGEND:

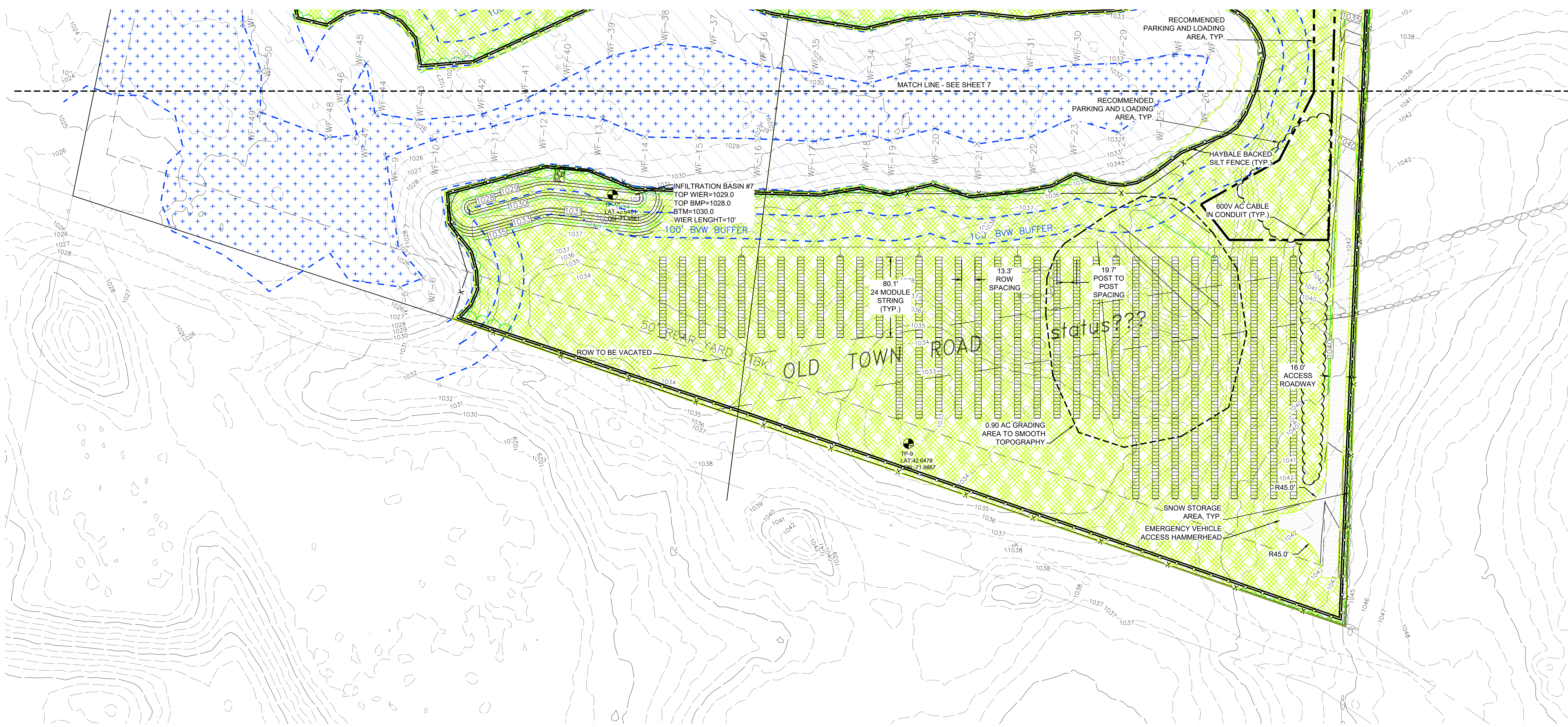
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 BASIN OUTLET



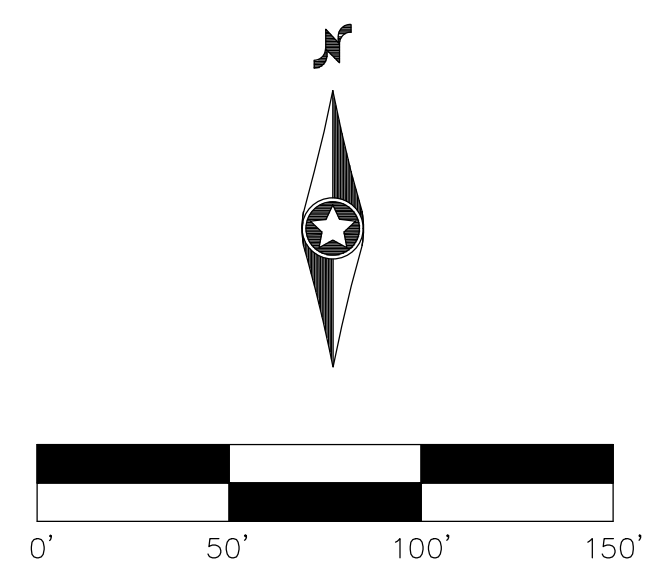
REVISION LOG:

4/8/2020	- CC SUBMISSION
9/15/2020	- REVISED PER CC REVIEW
10/13/2020	- REVISED PER PB REVIEW














- LEGEND:**
- EXISTING PROPERTY LINE
 - PROPOSED FENCE
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 - *WF-L##
 - BASIN OUTLET
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LEGEND:

-  EXISTING PROPERTY LINE
-  PROPOSED FENCE
-  PROPOSED GRAVEL ACCESS ROAD
-  PROPOSED SINGLE AXIS TRACKER (24 MODULE STRING)
-  UMV PROPOSED 13.8 KVA AC DISTRIBUTION
-  ULV PROPOSED 600V AC ARRAY DISTRIBUTION
-  PROPOSED OVERHEAD ELECTRIC
-  100' BVW BUFFER
-  WETLAND DELINEATION LINE
-  PROPOSED INFILTRATION BASIN
-  BASIN OUTLET

SEED LEGEND:

-  INFILTRATION BASIN SEED MIX (AREA 1.0 AC)
-  SOLAR ARRAY SEEDING / HAY MULCH EROSION CONTROL (AREA 55.5 AC)

SEED MIX FOR INFILTRATION 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 BASINS THAT DO NOT NORMALLY HOLD STANDING WATER. SOME PLANTS IN THIS MIX CAN TOLERATE INFREQUENT INUNDATION, BUT NOT CONSTANT FLOODING.

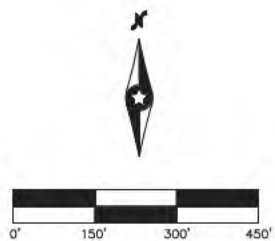
SEEDING: THE MIX MAY BE APPLIED BY HYDROSEEDING, BY MECHANICAL SPREADER, BY HYDRO-SEEDING OR ON SMALL SITES IT CAN BE SPREAD BY HAND. WHEN APPLYING ON BARE SOIL, RAKE THE SOIL TO CREATE GROOVES, APPLY SEED, THEN LIGHTLY RAKE OVER. IN NEW ENGLAND, THE BEST RESULTS ARE OBTAINED WITH A SPRING OR EARLY FALL SEEDING. SUMMER AND LATE FALL SEEDING WILL BENEFIT WITH A LIGHT MULCHING OF WEED-FREE STRAW TO CONSERVE MOISTURE. LATE FALL AND WINTER DORMANT SEEDING REQUIRE A SLIGHT INCREASE IN THE SEEDING RATE. FERTILIZATION IS NOT REQUIRED UNLESS THE SOILS ARE PARTICULARLY INFERTILE.

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 BULLFINCH (Scirpus atrovirens), BONSIBET (Elyptorum perfoliatum), BLUE VERNON (Veronica hastata), UPLAND BENTGRASS (Agrostis perennans), BIG BLUESTEM (Schedachyrium scarparium), WOOLGRASS (Scirpus cyperinus).

SEEDING NOTES:

1. THE CONTRACTOR SHALL SEED ALL DISTURBED AREAS ASSOCIATED WITH TREE AND ROCK REMOVAL AND SITE CLEARING. CONTRACTOR SHALL A INSTALL A 50% / 50% CLOVER / FESCUE MIX OR ENGINEER APPROVED ALTERNATE SEED MIXTURE.
2. ALL SEDIMENT TRAP SIDE SLOPES ARE 3:1 AND SHALL BE SEEDED AND BLANKETED



REVISION LOG

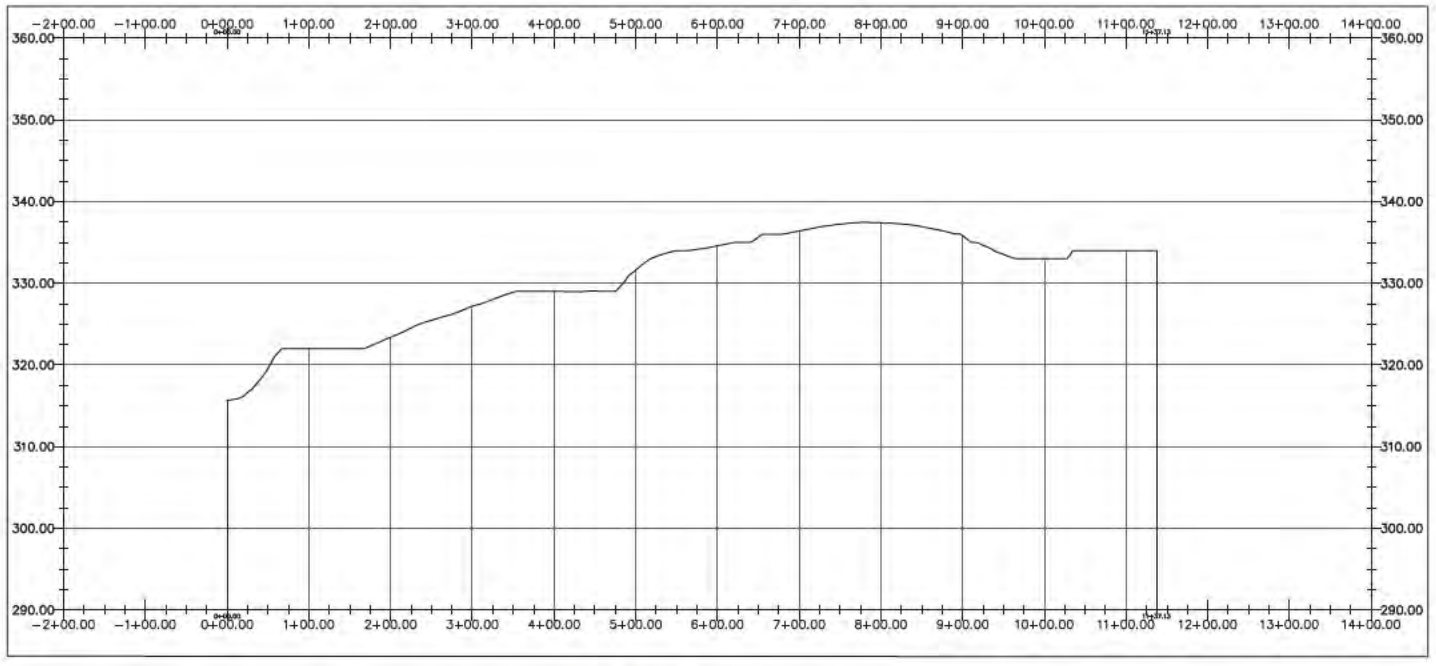
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WINCHENDON SOLAR
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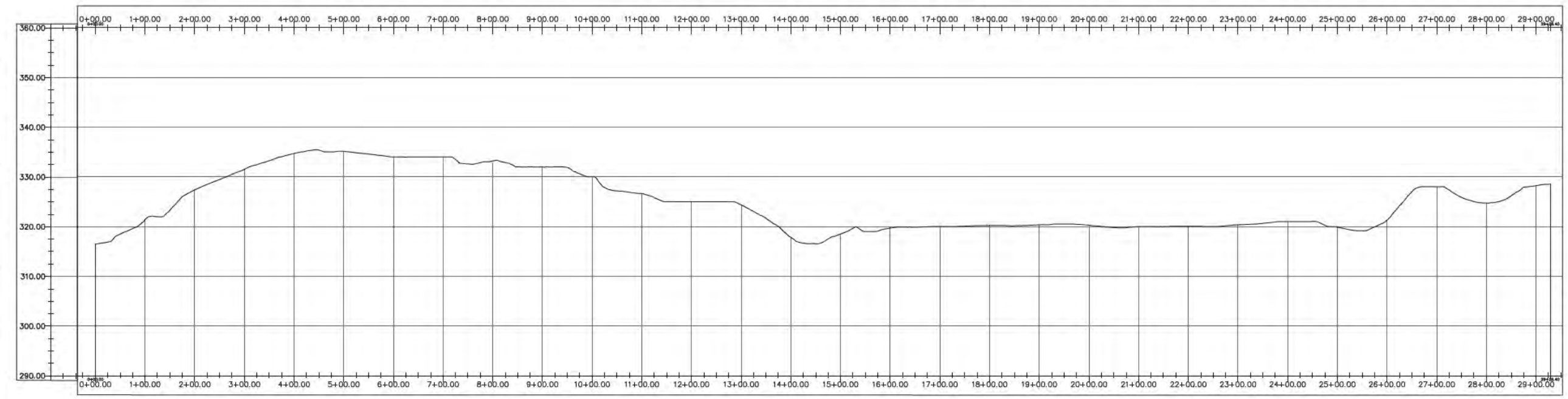
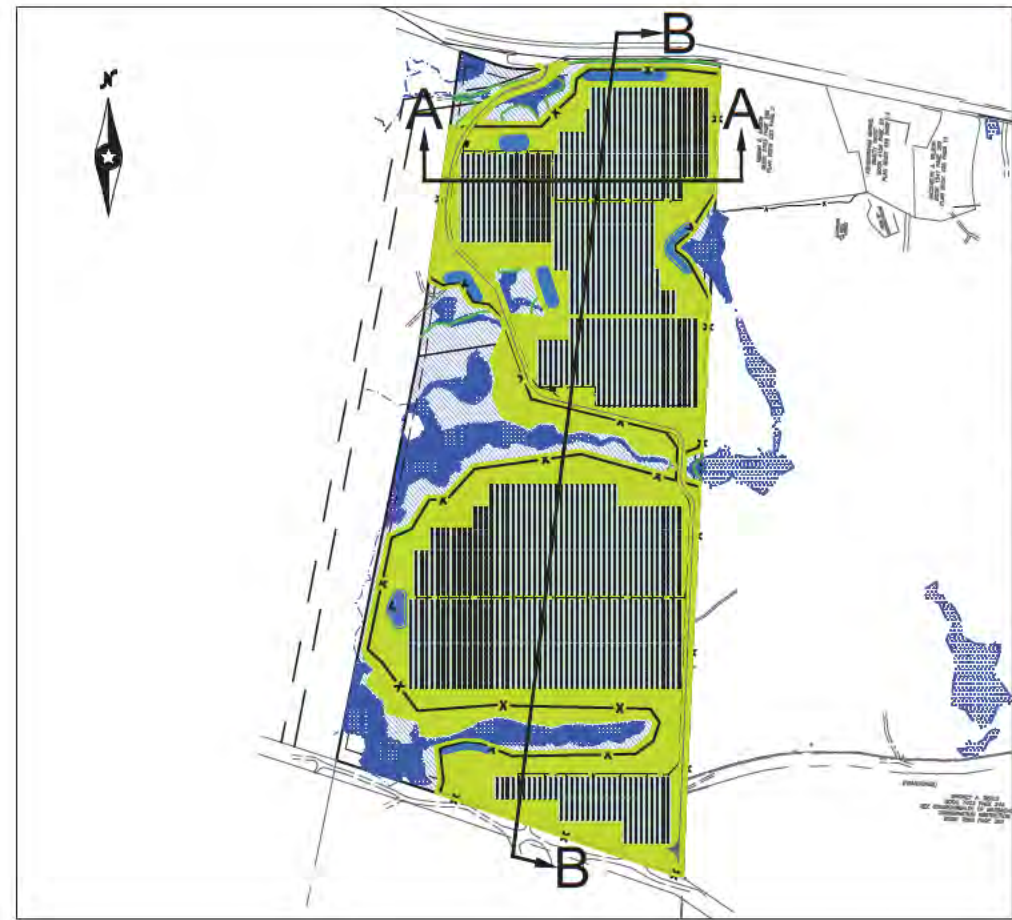
OVERALL LANDSCAPE PLAN

REVISION LOG

4/6/2020 - CC SUBMISSION



SECTION A-A



SECTION B-B

ROAD DESIGN PARAMETERS

- 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 PREVENTION PLAN (SWPPP) FOR EROSION CONTROL AND RESTORATION SPECIFICATIONS. UNLESS OTHERWISE NOTED OR MODIFIED HEREIN, ALL SECTIONS OF THE GENERAL CONDITIONS SHALL APPLY.

EXECUTION

- CLEARING AND GRUBBING
 - 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.
- TOPSOIL STRIPPING
 - TOPSOIL SHALL BE STRIPPED FROM ALL ROADWAY AREAS THROUGH THE ROOT ZONE. TOPSOIL SHALL NOT BE STRIPPED OUTSIDE OF THE DESIGNATED DISTURBANCE AREAS.
 - 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.
- EMBANKMENT CONSTRUCTION
 - 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".
 - SIDE SLOPES GREATER THAN 2.5:1 WILL NOT BE PERMITTED, UNLESS OTHERWISE NOTED ON THE PLAN.

TESTING REQUIREMENTS

- TESTING SHALL BE PERFORMED BY A DESIGNATED INDEPENDENT TESTING AGENCY.
- SUBMIT TESTING AND INSPECTION RECORDS SPECIFIED TO THE CIVIL ENGINEER OF RECORD FOR REVIEW
 - 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.
- PROOF ROLLING
 - 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.
- SIEVE ANALYSIS
 - SIEVE ANALYSIS SHALL BE CONDUCTED IN ACCORDANCE WITH AASHTO T27
- PROCTOR
 - PROCTORS SHALL BE DETERMINED IN ACCORDANCE WITH ASTM D-1557
- ATTERBERG LIMITS
 - ATTERBERG LIMITS SHALL BE DETERMINED IN ACCORDANCE WITH AASHTO T89 AND T90
- MOISTURE DENSITY (NUCLEAR DENSITY)
 - MOISTURE DENSITY TESTING SHALL BE DONE IN ACCORDANCE WITH AASHTO T310

SUBGRADE COMPACTION, TEST ROLLING AND AGGREGATE BASE COMPACTION

- FILL MATERIAL
 - 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)
 - 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.
 - 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.
- COMPACTED SUBGRADE
 - THE ENTIRE SUBGRADE SHALL BE PROOF-ROLLED PRIOR TO THE PLACEMENT OF THE AGGREGATE BASE TO IDENTIFY AREAS OF UNSTABLE SUBGRADE.
 - IF PROOF ROLLING DETERMINES THAT THE SUBGRADE STABILIZATION CANNOT BE ACHIEVED, THE FOLLOWING ALTERNATIVES WILL BE IMPLEMENTED:
 - REMOVE UNSUITABLE MATERIAL AND REPLACE WITH SUITABLE EMBANKMENT.
 - SCARIFY, DRY, AND RECOMPACT SUBGRADE AND PERFORM ADDITIONAL PROOF ROLL.
 - INCREASE ROAD BASE THICKNESS.
 - 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 23% OF OPTIMUM MOISTURE CONTENT FOR GRANULAR SOILS AND AT -1 TO +3% OF OPTIMUM MOISTURE CONTENT FOR COHESIVE SOILS.
- AGGREGATE BASE
 - AGGREGATE BASE SHALL BE PROOF-ROLLED OVER THE ENTIRE LENGTH. PROVIDE 1 SIEVE ANALYSIS PER 2500 CY OF ROAD BASE PLACED.
 - 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:

- THE PLANIMETRIC FEATURES, GROUND SURFACE CONTOURS ON A LIDAR SURFACE PROVIDED NOAA.
- NO GRADING OR SOIL DISTURBANCE IS PERMITTED OUTSIDE OF THE GRADING LIMITS IDENTIFIED ON THE PLANS.
- GRADE ALL PROPOSED ROADS TO THE SLOPES PROPOSED ON THE PLANS.
- THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING DRAINAGE THROUGHOUT THE CONSTRUCTION OF THIS PROJECT. CONSTRUCTION ACTIVITIES SHALL NOT BLOCK THE NATURAL OR MANMADE CREEKS OR DRAINAGE SWALES CAUSING RAINWATER TO POND. ADDITIONAL CULVERTS IN EXCESS OF THOSE ON THE PLANS MAY BE REQUIRED AS APPROVED BY THE ENGINEER.
- THE CONTRACTOR SHALL NOTIFY DIGSAFE AT LEAST 48 HOURS BEFORE EXCAVATION ACTIVITIES COMMENCE.
- WETLAND INFORMATION SHOWN ON THE PLAN WAS PROVIDED BY ROB HELLSSTROM LAND SURVEYING AND FLAGGED BY HIGHLANDS SOILS. THE GENERAL CONTRACTOR SHALL VERIFY THAT ALL WETLAND PERMITS HAVE BEEN SUBMITTED AND APPROVED PRIOR TO CONSTRUCTION COMMENCING.
- ELECTRICAL COLLECTION SYSTEM SHOWN ON THE PLAN SHALL BE CONSIDERED PRELIMINARY. CONTRACTOR SHALL REFER TO FINAL ELECTRICAL DESIGN PLANS FOR ACTUAL DESIGN LOCATIONS.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP):

- REFER TO THE SWPPP BOOKLET FOR SEDIMENT AND EROSION CONTROL PROCEDURES, LOCATIONS OF BMPs, DETAILS, AND INSPECTION INFORMATION.
- ALL AREAS DISTURBED DURING CONSTRUCTION ACTIVITIES AND NOT COVERED BY ROAD SURFACING MATERIALS, SHALL BE SEEDDED IN ACCORDANCE WITH THE SWPPP PLAN.
- TEMPORARY EROSION CONTROL SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. THE TEMPORARY EROSION CONTROL PLAN SHALL BE IN ACCORDANCE WITH STATE OF CONNECTICUT, THE EPA, AND THE SWPPP ON FILE.

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 REVEGETATION 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 8"-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 MIRAFITMS 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 REVEGETATION MAT (ECRM)

- AREA MUST BE GRADED SMOOTH AND CLEAN TO FINISH GRADES, AND COMPACTED.
 - SEED AND MULCH AREA. USE SEED MIX APPROVED BY THE ENGINEER.
 - INSTALL ECRM PER MANUFACTURER'S INSTRUCTIONS, HOWEVER THESE MUST INCLUDE THE FOLLOWING MINIMUM REQUIREMENTS:
 - GRADE GROUND TO FINISH CONTOURS. REMOVE ALL ROCKS, DIRT CLODS, STUMPS, ROOTS, TRASH, AND OTHER OBSTRUCTIONS LYING IN DIRECT CONTACT WITH THE SOIL SURFACE.
 - DIG MAT ANCHOR TRENCHES (MINIMUM 12" DEEP, 6" WIDE) AT TERMINAL ENDS AND PERIMETER SIDES WHERE MAT IS TO BE INSTALLED.
 - 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 NOT 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 MIRAFI MIRAMAT TM8 OR EQUIVALENT.

INVASIVE SPECIES:

- ALL EQUIPMENT SHALL BE INSPECTED UPON ARRIVAL. EQUIPMENT ARRIVING WITH OBSERVABLE SOIL OR PLANT FRAGMENTS WILL BE REMOVED AND CLEANED.
- HAY BALES ARE NOT BE USED ON SITE. ONLY WEED-FREE STRAW BALES ARE APPROVED.
- 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:
RODNEY GALTON
ECOS ENERGY
222 SOUTH 9TH STREET
SUITE 1600
MINNEAPOLIS MN 55402

THE PURPOSE OF THIS PROJECT IS TO INSTALL APPROXIMATELY 20,700 SOLAR MODULES AND ASSOCIATED ELECTRICAL EQUIPMENT FOR POWER GENERATION AND STORAGE.

THE TOTAL AREA OF THE PROJECT SITE IS APPROXIMATELY 71.2 ACRES AND THE TOTAL AREA OF THE SITE THAT IS EXPECTED TO BE DISTURBED BY CONSTRUCTION ACTIVITIES IS 58.7 ACRES.

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.

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 SNOWMELT. 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 TEMPORARY STOCKPILE 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, SEEDDED, 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 ENGINEER.

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.

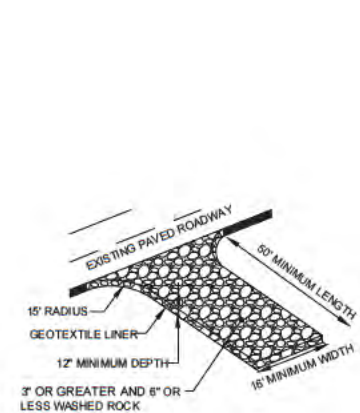
THE WETLANDS ENFORCEMENT OFFICER SHALL BE NOTIFIED AT LEAST 2 BUSINESS DAYS PRIOR TO CONSTRUCTION TO INSPECT EROSION CONTROLS.

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



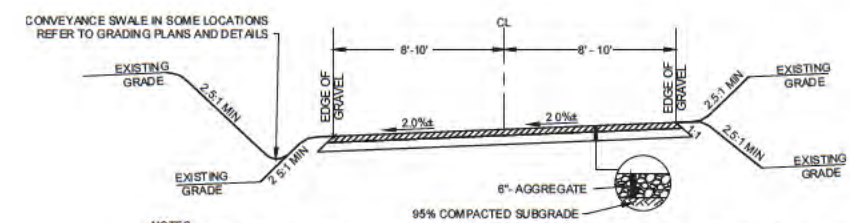
REVISION LOG
4/6/2020 - CC SUBMISSION

WINCHENDON SOLAR
PARCEL # 9-0-97 & 9-0-96
SPRING STREET
WINCHENDON, MASSACHUSETTS 01430
WORCESTER COUNTY
CIVIL NOTES



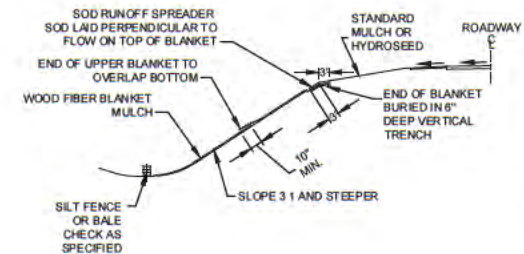
NOTE
ROCK CONSTRUCTION ENTRANCE SHOULD BE A MINIMUM THICKNESS OF 1.0' AND CONTAIN MAXIMUM SIDE SLOPES OF 4:1. ROCK ENTRANCE SHOULD BE INSPECTED AND MAINTAINED REGULARLY. ROCK ENTRANCE LENGTH MAY NEED TO BE EXTENDED IN CLAY SOILS.

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.

ACCESS ROAD DETAIL
NOT TO SCALE

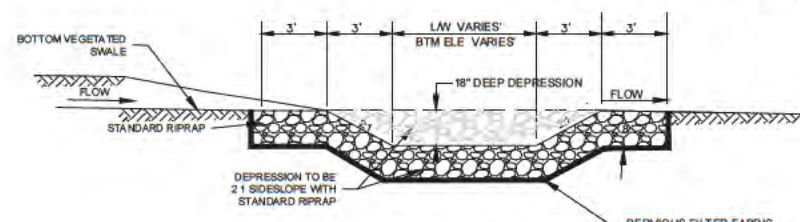


EROSION CONTROL BLANKET INSTALLATION ON AN INSLOPE (WHEN REQUIRED)

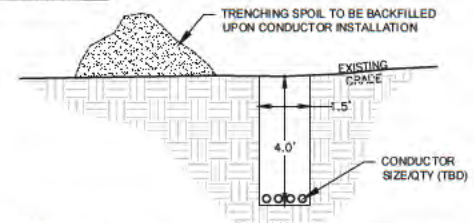
CATEGORY	FLAT	VELOCITY
1	3:1	< 5.0 fps
2	3:1	< 6.5 fps
3	3:1	< 7.0 fps
4	2:1	< 7.0 fps

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

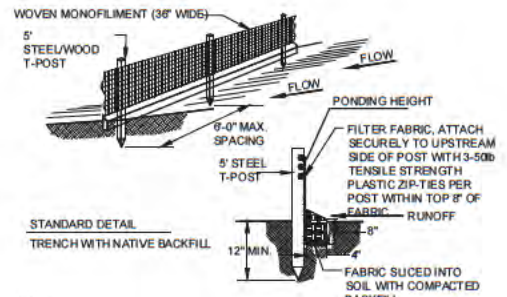


RIP-RAP SPLASH PAD
NOT TO SCALE



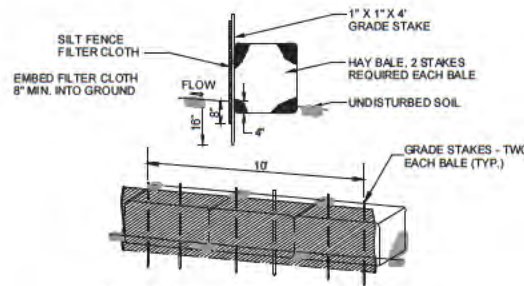
NOTES
1. CONDUCTOR CLEARANCES DEPENDENT ON GEOTECHNICAL PARAMETERS AND ELECTRICAL DESIGN
2. CONDUCTOR SIZING AND QUANTITIES PER TRENCH DEPENDENT ON FINAL ELECTRICAL DESIGN TRENCH DIMENSIONS FOR EARTHWORK QUANTITIES ARE CONSERVATIVE.

TRENCHING DETAIL
NOT TO SCALE



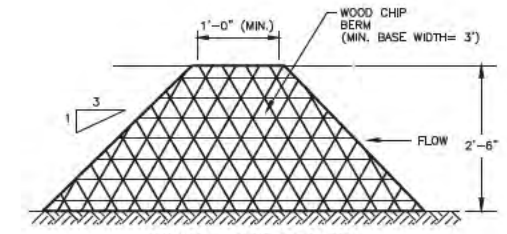
NOTE
1. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN ACCUMULATED TO 1/3 THE HEIGHT OF THE FABRIC OR MORE.
2. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.
3. SILT FENCE SHALL BE PLACED ON SLOPE 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

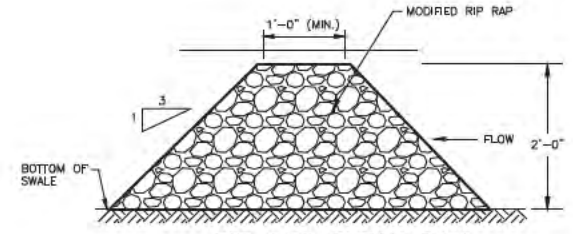


HAY-BALE / SILT FENCE EROSION PROTECTION
NOT TO SCALE

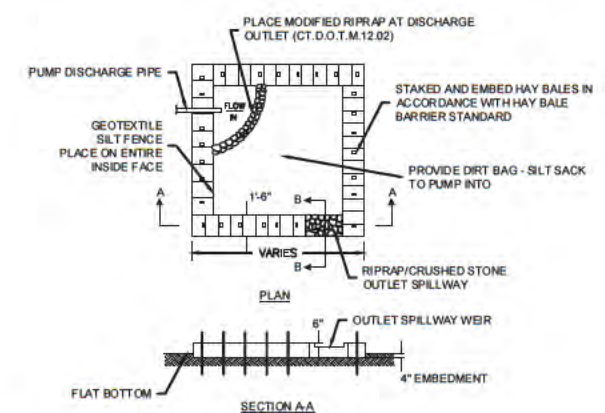
CONSTRUCTION NOTES
1. SILT FENCE FILTER CLOTH TO BE SECURELY FASTENED TO GRADE STAKE WITH STAPLES, 6" ON CENTER.
2. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN ONE ANOTHER THEY SHALL OVERLAP BY 6" AND BE FOLDED.
3. BALES SHALL BE PLACED IN A ROW WITH ENDS TIGHTLY ABUTTING THE ADJACENT BALES.



WOOD CHIP BERM
NOT TO SCALE



RIP-RAP CHECK DAM
NOT TO SCALE



NOTE DIMENSIONS VARY ACCORDING TO PUMPING RATES. MINIMUM REQUIRED STORAGE IS CALCULATED FROM CREST OF SPILLWAY WEIR.
CT.D.O.T.#3
2" CRUSHED STONE OR GRAVEL (6" DEPTH)
2' MIN
OUTLET SPILLWAY WBR
BALE HEIGHT MINUS 6"
FLOW OUTLET TO WATERCOURSE OR SWALE

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.



222 South 9th Street
Minneapolis, MN 55402
Phone: 860.932.3086
E-mail: rodney.galton@ecosrenewable.com
October 13, 2020

To: Alison Manugian,
Planning Agent
Town of Winchendon
109 Front Street
Winchendon, MA 01475

Re: Winchendon Solar – Site Plan Application

Dear Alison,

Below are the responses to the Tighe & Bond, (T&B), peer review letter dated August 27, 2020. A summary of the T&B's comments have been included as well as Ecos Energy's, (Ecos), responses have been included in ***Bold and Italics***.

1. The following requirements under Section 3.3.3 (Form and Contents of Site Plan) of the Site Plan Regulations were not included on the site plans:
 - a. A scale of 1"=40' was not provided on the site plans and a scale of 1"=1,000' was not provided on the index plan. The Board should determine if this scale is acceptable. ***A waiver request is attached for the 1" = 40' scale requirement for the site plans, however, the Location Map is provided at a scale of 1" = 1,000'.***
 - b. The site plans provided display parcel 9-0-96 and 9-0-97. According to the Massachusetts Interactive Property Map, the limits of the proposed Project is also located within parcel 9-0-38. The applicant should confirm the properties on which work is occurring, and include all relevant properties. ***The ALTA Survey indicates that the property is made up of two parcels 9-0-96 & 9-0-97.***
 - c. The site plans do not display loading areas or parking areas. Although parking areas are likely to only be temporary, the Board should determine whether temporary parking should be noted on the site plans. Loading areas should be displayed on the site plans to provide context to the extent of the staging of materials. ***The loading areas and parking areas will vary greatly depending on the which construction activity is being performed in each phase. A general note has been added to the site plan: "Loading and parking areas to be located within the proposed array footprint or an area approved by the owner. Under no circumstances shall the loading and parking areas be located within the wetland buffers."***
 - d. The applicant should provide the location of any signs that are proposed for the Project, if applicable. ***There will be no signage other than emergency signage on the main gate of the facility. This location has been indicated on the site plan.***
2. The following requirements under Section 3.3.4 (Supplemental Plan Information Required) of the Site Plan Regulations were not included on the Site Plans:

- a. The applicant should provide whether earth removal is proposed as a part of this Project. If proposed, calculations should be provided and prepared by a Registered Engineer. If no earth removal is provided, the statement “no earth is to be removed” should be provided. ***A note has been added to the site plan.***
 - b. The location of any off-site loading and unloading should be provided in the site plans, per Section 3.3.4(M) of the Site Plan Regulations. ***No off-site loading or unloading is anticipated.***
 - c. All permits that have been obtained to date should be provided to the Board prior to Site Plan Review. ***A copy of the NOI approval will be provided when available.***
 - d. In accordance with Section 3.3.4(S), the following information should be provided in the notes section of the site plans. The Project shall:
 - i. Forbid the use of fill containing hazardous materials; ***Note added to the site plan.***
 - ii. Require the cleaning of catch basins, sumps and stormwater basins following construction and annually thereafter; ***Note added to the site plan.***
 - iii. Restrict the hauling of earth materials to or from the site to the hours between 9 a.m. and 4 p.m. on weekdays; ***Note added to the site plan.***
 - iv. Describe the materials to be used in the construction of impermeable surfaces such as sidewalks and driveways. ***Note added to the site plan.***
 - e. The site plans should provide the driveway entrance dimensions at the curb line for compliance with the access requirements of the Zoning Bylaw. Additionally, the size of the largest truck expected to be used shall be provided. We note the access road width of 16’ was provided on the site Tighe & Bond did not receive or review an Impact Statement that is required under plans. However, the entrance dimensions should be provided as well. ***Dimensions of the driveway at the curb cut have been added as well as the dimensions of the expected largest vehicle expected on-site during construction activities.***
3. Tighe & Bond did not receive or review an Impact Statement that is required under plans. However, the entrance dimensions should be provided as well. Section 3.3.5 (Impact Statement) of the Site Plan Regulations. An Impact Statement should be provided to the Board prior to the application approval. ***An Impact Statement was provided for review.***
 4. Under Section 4.4.3 (Snow Removal) of the Site Plan Regulations, adequate provisions for snow removal should be made and shown on the plan to eliminate or minimize polluted runoff. Snow removal or storage of snow removal should be provided on the site plans. ***Snow storage areas have been shown on the site plan.***
 5. The following requirements under Section 6.3.1 (Filing Application) of the Low Impact Development were not included in the applicant’s submittals:
 - a. Low Impact Development Endorsement was not marked on the Planning Board Decision Petition form. ***Noted.***
 - b. An abutters form was not provided to Tighe & Bond as a part of the applicant’s submittals. Abutters within 300 feet are required to be notified prior to the Project’s hearing to allow for public participation. ***Town staff provided the abutter notification services.***
 - c. A Project description was not provided to Tighe & Bond for the Low Impact Development application. A Project narrative and description should be provided prior to the application approval. ***A Project Summary was provided as part of the Impact Statement.***
 - d. An Inspection and Maintenance agreement was not provided to Tighe & Bond for the Low Impact Development application, as required under Section 6.3.1.6.

- e. A Low Impact Development Management Plan was not provided to Tighe & Bond for the Low Impact Development application, as required under Section 6.3.1. ***An Operation and Maintenance Plan is attached.***
 - f. The stormwater management system's compliance with the Massachusetts Stormwater Standards was reviewed separately through the Notice of Intent process with the Winchendon Conservation Commission (Commission). As of the date of this letter, there are a number of outstanding comments with the Commission relative to stormwater management and the site plans. The most recent Conservation Commission response to comments letter is herein attached. The NOI for the proposed project has been approved. The compliance with the Stormwater Standard was conducted as part of that review.
6. The following requirements under Section 6.11.6 of the Winchendon Zoning Bylaws (Solar Energy Collection Systems) were not included in the final deliverable:
- a. A statement bearing the seal of a licensed professional engineer stating the measured normal pre- and post-construction noise levels at points along the property lines was not provided. The Applicant should provide the required information to satisfy the Town of Winchendon Zoning Bylaws. ***A waiver request is attached.***
 - b. A one- or three-line electrical diagram detailing the installation, components, and interconnection methods. ***A one-line diagram was submitted for review.***
 - c. The name, address, and contact information for the proposed system installer was not provided. The Applicant should provide the required information to satisfy the Town of Winchendon Zoning Bylaws. ***Ecos Energy requests that this be made a condition of approval as the installer has not been selected.***
 - d. Proof of liability insurance. ***Proof of insurance is attached.***
 - e. Description of financial security. ***Ecos is working with Seminole Financial Services, LLC for construction financing. Ecos and Seminole have a solid relationship as they have financed seven projects for Ecos over the last two-years.***
 - f. Mounting System Specification sheets were not provided. ***Specification sheets are attached.***

Please review the information provided and contact me should any clarification be needed.

Best regards,



Rodney Galton, PE CPESC
Senior Project Manager



222 South 9th Street #1600
Minneapolis, MN 55402
Phone: 860.932.3086
E-mail: rodney.galton@ecosrenewable.com
October 13, 2020

To: Guy Corbosiero, Chair
Planning Board
Town of Winchendon
109 Front Street
Winchendon, MA 01475

Re: Winchendon Solar – Site Plan Application Waiver Request

Dear Mr. Corbosiero and the member of the Planning Board,

Ecos Energy LLC is formally requesting a waiver for the following requirements of the *Rules and Regulations For the Review and Approval of Site Plans and Site Development* and the *Zoning Bylaws*.

Rules and Regulations For the Review and Approval of Site Plans and Site Development:

3.3.3.A - Site Plan at a scale of 1"=40' ***The site plans are at a scale of 1"=50' and is appropriate for the amount of information shown on the plans.***

Zoning Bylaws:

6.11.6.C - A statement bearing the seal of a licensed professional engineer stating the measured normal pre-construction noise levels at points (generally 100 feet apart) along the property lines and the expected operational noise levels at the same locations. Particular attention shall be paid to property lines abutting developed sites. A properly calibrated sound level meter meeting ANSI class 2 standards shall be used for all measurements. ***The noise level specifications from the manufacturer have been included with the submission.***

Thank you in advance for your consideration of these requests as part of the review of this application.

Best regards,



Rodney Galton, PE CPESC
Senior Project Manager



Winchendon Solar
Site Operations and Maintenance Plan

Prepared By:
Ecos Energy
April 2020

I. INTRODUCTION - O&M NARRATIVE

The solar facility will consist of approximately 21,000 PV solar modules installed on aluminum and steel racking on a single axis tracker which rotates modules in the east west direction following the azimuth of the sun. The tracker will have 1 module width per tracker row installed in the landscape position. Tracker rows will be spaced approximately 19.6' apart in the east-west direction. The racking system will be mounted on vertical support piers mechanically driven into the ground surface projecting approximately 5.0' above existing grade following the existing topography of the site. The solar facility will be surrounded by a seven-foot high fence and 16' wide access roadway will be constructed for full site and emergency vehicle access. The solar array field drains to 7 infiltration basins around the perimeter of the site for stormwater rate control. All the basins on site will be approximately 2'-5' deep and will be seeded with a New England Conservation / Wildlife Mix. The basin outlets via rip-rap overland weirs at rates to match existing hydraulic conditions. Per Standard No. 10 of the MassDEP Stormwater Management Standards, there shall be no illicit discharges to the stormwater management system. Should a spill occur, immediate action steps must be implemented to contain the spill, cordon off the area, clean it up immediately and dispose of it properly to prevent an illicit discharge to the stormwater management system.

The facility will be routinely mowed, for any growth beyond 18" in height, will result in loss of electrical production due to groundcover shading the existing panels. A minimum mow height of 6" shall be implemented in the routine mowing to promote grass/wildflower growth. At no time shall herbicides be used for vegetation control.

The facilities panels will be routinely washed with water (or deionized water to minimize spotting), washing of the panels will occur, when production of the facility is reduced due to soiled panels. The detention basins and swales will be monitored throughout the life of the project for point erosion, trash and overall turf establishment. The facility will require no other routine operations and maintenance practices.

II. RESPONSIBILITY FOR MAINTENANCE

Ecos energy will operate and maintain the facility, throughout the life of the project. Ecos' contact for operations and maintenance:

Rush Ferrell – Asset Manager
(828) 216-9176

Ecos will solicit and retain a local property maintenance company for routine mowing and maintenance of the facility. The funding for maintenance will be paid by Ecos Energy out of the company's operations account.

III. SITE MAINTENANCE SCHEDULE

Monthly:

1. Inspect the site vegetation growth, and establish a mowing schedule keeping vegetation between 6" and 18".
2. Inspect detention basins, swales and the project area for wind-blown trash and debris.
3. Inspect the gravel roadway for washout locations or potential erosion issues.

Bi-Annually (April and October):

1. Inspect vegetation during both the growing and non-growing seasons to ensure proper detention basin seed establishment.
2. Inspect detention basin for excess sediment, sediment can be excavated by hand
3. Inspect steep roadway slopes and embankments to identify potential erosion problems. Replant bare areas or areas with sparse growth with the project specific seed mix.
4. Inspect detention basins after a 1" rainfall to ensure that the 72-hour drawdown is occurring. If standing water is observed for longer than 72-hours, the basin shall be dewatered and observed by a Professional Engineer to provide an opinion on remediation.
5. Inspect perimeter landscaping screening, to ensure ongoing establishment of new plantings.

Major Storm Inspections (first 3 months):

1. Inspect detention basins after each 1" rainfall after construction of the project to ensure that the 72-hour drawdown is occurring. If standing water is observed for longer than 72-hours, the basin shall be dewatered and observed by a Professional Engineer to provide an opinion on remediation.

IV. PROJECT SEED MIXTURES

DETENTION BASIN SEED SPECIES:

NEW ENGLAND CONSERVATION / WILDLIFE MIX (PERMANENT, NON-WETLAND MIX)

APPLICATION RATE: 25 POUNDS / ACRE

APPLICATION METHOD: BROADCAST WITH LIGHT RAKING OF THE SEED

SPECIES: BIG BLUESTEM, LITTLE BLUESTEM, SWITCHGRASS, DEERTONGUE, FOWL

BLUEGRASS, CANADA WILD RYE, PENNSYLVANIA SMARTWEED, PARTRIDGE PEA, ANNUAL SUMFLOWER, SHOWY TICK-TREFOIL, COMMON MILKWEED, NEWYORK ASTER, NODDING BURMARIGOLD.

SITE SEED SPECIES:

NATIVE KENTUCKY BLUEGRASS / WHITE CLOVER MIX

APPLICATION RATE: 25 POUNDS / ACRE

APPLICATION METHOD: BROADCAST WITH LIGHT RAKING OF THE SEED



CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

10/15/2020

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Renewable Guard Insurance 300 Broadway Street Suite 21 San Francisco CA 94133	CONTACT NAME: Keaton Carlson PHONE (A/C, No, Ext): FAX (A/C, No): E-MAIL ADDRESS: keaton.carlson@renewableguard.com																				
	<table border="1"> <tr> <th colspan="2">INSURER(S) AFFORDING COVERAGE</th> <th>NAIC #</th> </tr> <tr> <td>INSURER A:</td> <td>AXIS Specialty Europe SE</td> <td></td> </tr> <tr> <td>INSURER B:</td> <td>Hartford Insurance Group</td> <td></td> </tr> <tr> <td>INSURER C:</td> <td></td> <td></td> </tr> <tr> <td>INSURER D:</td> <td></td> <td></td> </tr> <tr> <td>INSURER E:</td> <td></td> <td></td> </tr> <tr> <td>INSURER F:</td> <td></td> <td></td> </tr> </table>	INSURER(S) AFFORDING COVERAGE		NAIC #	INSURER A:	AXIS Specialty Europe SE		INSURER B:	Hartford Insurance Group		INSURER C:			INSURER D:			INSURER E:			INSURER F:	
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INSURER D:																					
INSURER E:																					
INSURER F:																					
INSURED Allco Renewable Energy Limited c/o Ecos Energy 222 South 9th Street #1600 Minneapolis MN 55402																					

COVERAGES

CERTIFICATE NUMBER: 2020/21

REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	<input checked="" type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS-MADE <input checked="" type="checkbox"/> OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: <input type="checkbox"/> POLICY <input checked="" type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC OTHER:	Y		3817000220ES	01/18/2020	01/18/2021	EACH OCCURRENCE	\$ 1,000,000
							DAMAGE TO RENTED PREMISES (Ea occurrence)	\$ 1,000,000
							MED EXP (Any one person)	\$ 10,000
							PERSONAL & ADV INJURY	\$ 1,000,000
							GENERAL AGGREGATE	\$ 2,000,000
							PRODUCTS - COMP/OP AGG	\$ 1,000,000
								\$
A	AUTOMOBILE LIABILITY <input type="checkbox"/> ANY AUTO <input type="checkbox"/> OWNED AUTOS ONLY <input checked="" type="checkbox"/> HIRED AUTOS ONLY <input type="checkbox"/> SCHEDULED AUTOS <input checked="" type="checkbox"/> NON-OWNED AUTOS ONLY	Y		3817000220ES	01/18/2020	01/18/2021	COMBINED SINGLE LIMIT (Ea accident)	\$ 1,000,000
							BODILY INJURY (Per person)	\$
							BODILY INJURY (Per accident)	\$
							PROPERTY DAMAGE (Per accident)	\$
								\$
A	<input checked="" type="checkbox"/> UMBRELLA LIAB <input checked="" type="checkbox"/> EXCESS LIAB <input type="checkbox"/> OCCUR <input type="checkbox"/> CLAIMS-MADE DED <input checked="" type="checkbox"/> RETENTION \$ 0	Y		3817000320ES	01/18/2020	01/18/2021	EACH OCCURRENCE	\$ 15,000,000
							AGGREGATE	\$ 15,000,000
							Pollution Liability	\$ 5,000,000
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	Y/N	N/A	57WECAB7TM3	07/18/2019	07/18/2020	<input checked="" type="checkbox"/> PER STATUTE <input type="checkbox"/> OTHER	
							E.L. EACH ACCIDENT	\$ 1,000,000
							E.L. DISEASE - EA EMPLOYEE	\$ 1,000,000
							E.L. DISEASE - POLICY LIMIT	\$ 1,000,000
A	Pollution Liability			3817000220ES	01/18/2020	01/18/2021	Time Element	1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

The City of New London, its officers, employees, agents, Boards and Commissions are included as Additional Insured when required by written contract.

CERTIFICATE HOLDER**CANCELLATION**

Town of Winchendon

MA

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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NX Horizon

Smart Solar Tracking System

Serving as the backbone on over 35 gigawatts of solar power plants around the world, the NX Horizon™ smart solar tracker system combines best-in-class hardware and software to help EPCs and asset owners maximize performance and minimize operational costs.

Flexible and Resilient by Design

With its self-aligning module rails and vibration-proof fasteners, NX Horizon can be easily and rapidly installed. The self-powered, decentralized architecture allows each row to be commissioned in advance of site power, and is designed to withstand high winds and other adverse weather conditions. On a recent 838 megawatt project in Villanueva, Mexico, these design features allowed for the project to go online nine months ahead of schedule.

TrueCapture and Bifacial Enabled

Incorporating the most promising innovations in utility scale solar, NX Horizon with TrueCapture™ smart control system can add additional energy production by up to six percent. Further unlocking the advantages of independent-row architecture and the data collected from thousands of sensors across its built-in wireless network, the software continuously optimizes the tracking algorithm of each row in response to site terrain and changing weather conditions. NX Horizon can also be paired with bifacial PV module technology, which can provide even more energy harvest and performance. With bifacial technology, NX Horizon outperforms conventional tracking systems with over 1% more annual energy.

Quality and Reliability from Day One

Quality and reliability are designed and tested into every NX Horizon component and system across our supply chain and manufacturing operations. NextTracker is the leader in dynamic wind analysis and safety stowing, delivering major benefits in uptime and long-term durability. NX Horizon is certified to UL 2703 and UL 3703 standards, underscoring NextTracker's commitment to safety, reliability and quality.

Features and Benefits

5 years in a row

Global Market Share Leader (2015-18)

35 GW

Delivered on 5 Continents

Best-in Class

Software Ecosystem and
Global Services

Up to 6%

Using TrueCapture Smart
Control System



GENERAL AND MECHANICAL

Tracking type	Horizontal single-axis, independent row.
String voltage	1,500 V _{DC} or 1,000 V _{DC}
Typical row size	78-90 modules, depending on module string length.
Drive type	Non-backdriving, high accuracy slew gear.
Motor type	24 V brushless DC motor
Array height	Rotation axis elevation 1.3 to 1.8 m / 4'3" to 5'10"
Ground coverage ratio (GCR)	Configurable. Typical range 28-50%.
Modules supported	Mounting options available for virtually all utility-scale crystalline modules, First Solar Series 6 and First Solar Series 4.
Bifacial features	High-rise mounting rails, bearing + driveline gaps and round torque tube.
Tracking range of motion	Options for ±60° or ±50°
Operating temperature range	SELF POWERED: -30°C to 55°C (-22°F to 131°F) AC POWERED: -40°C to 55°C (-40°F to 131°F)
Module configuration	1 in portrait. 3 x 1,500 V or 4 x 1,000 V strings per standard tracker. Partial length trackers available.
Module attachment	Self-grounding, electric tool-actuated fasteners.
Materials	Galvanized steel
Allowable wind speed	Configurable up to 225 kph (140 mph) 3-second gust
Wind protection	Intelligent wind stowing with symmetric dampers for maximum array stability in all wind conditions
Foundations	Standard W6 section foundation posts

ELECTRONICS AND CONTROLS

Solar tracking method	Astronomical algorithm with backtracking. TrueCapture™ upgrades available for terrain adaptive backtracking and diffuse tracking mode
Control electronics	NX tracker controller with inbuilt inclinometer and backup battery
Communications	Zigbee wireless communications to all tracker rows and weather stations via network control units (NCUs)
Nighttime stow	Yes
Power supply	SELF POWERED: NX provided 30 or 60W Smart Panel AC POWERED: Customer-provided 120-240 V _{AC} circuit

INSTALLATION, OPERATIONS AND SERVICE

PE stamped structural calculations and drawings	Included
Onsite training and system commissioning	Included
Installation requirements	Simple assembly using swaged fasteners and bolted connections. No field cutting, drilling or welding.
Monitoring	NX Data Hub™ centralized data aggregation and monitoring
Module cleaning compatibility	Compatible with NX qualified cleaning systems
Warranty	10-year structural, 5-year drive and control components.
Codes and standards	UL 3703 / UL 2703 / IEC 62817



Winchendon Solar
Project Summary
9.0 MW (AC) Solar Photovoltaic Facility

Impact Statement

Applicant:	Winchendon Solar, LLC Ecos Energy, LLC
Location:	Worcester County, Spencer, MA
Date Prepared:	May 12, 2020



TABLE OF CONTENTS

I.	PROJECT APPLICANT:	2
II.	APPLICATION:.....	Error! Bookmark not defined.
III.	PROJECT DESCRIPTION:.....	2
IV.	SUBJECT PROPERTY:.....	2
V.	SOLAR FACILITY:	3
VI.	CONSTRUCTION:	5
VII.	OPERATIONS	6



I. PROJECT APPLICANT:

Winchendon Solar, LLC (“WS”) is a wholly owned subsidiary of Allco Finance Limited (Allco), a renewable energy financing company. Ecos Energy, LLC (Ecos), a Minnesota-based renewable energy development and services company, which specializes in developing and operating distributed generation solar energy projects throughout the U.S. is the developer of the project. Throughout this summary, Ecos and WS may be used interchangeably, but for clarification purposes, WS is the applicant and owner of the proposed solar project and Ecos is the developer.

II. PROJECT DESCRIPTION:

WS is proposing to construct and operate a 9.0 megawatt (MW) alternating current (AC) solar photovoltaic (PV) generating facility (“Solar Facility”) on a portion of Parcel 9-0-97 and 9-0-98. The solar project array footprint (fence limits) is 58 acres of the 72 acre parcel. Interconnection between the electrical grid and the solar facility will be an overhead connection approximate 2 miles west of the site along Route 12.

IV. SUBJECT PROPERTY:

The property consists of perimeter woodlands and the majority of the site historically being used for a gravel operation. Wetlands on site were field delineated by New England Environmental Inc. The layout for the proposed Solar Facility has been sited to fit within the existing topography, distance the facilities from adjacent properties, avoid impacts to the surrounding wetlands and the 100’ buffers of the delineated wetlands. The design has no permanent impacts to existing Bordering Vegetated Wetlands.

The project has been designed per the Massachusetts Department of Environmental Protection’s (“DEP”) Stormwater Management Standards. Discharges from the site have been directed to permanent stormwater BMPs and overall site discharges have been



reduced below pre-development conditions. Detailed information about the sites existing and proposed hydraulic properties can be reviewed in the attached hydrology report.

Maintenance and fire access to the project shall utilize the existing curb cut from Spring Street. The existing access road will be utilized where practicable and will be realigned as necessary to accommodate the array field. The solar facility access driveway will enter the site at the northwest corner of project site and gradually climb the hill. The solar facility will have a 18' wide aggregate driveway. The grade of the roadway is no greater than 5%.

Adjacent parcels to the solar facility in the south, east and west directions are undeveloped deciduous woodlands. The property to the north is an auto recycling facility. The closest residence to the project is 300' east of the facility in the Town of Ashburnham. The facility is naturally screened by the surrounding woodlands.

V. SOLAR FACILITY:

The solar facility will produce 9.0 MW of AC power. The modules will be installed on a tracker system that will follow the sun. The rows will be spaced approximately 19.7' apart spaced in the east-west direction across the site. The pier height keeps all modules approximately 24" above grade. Minimal earthwork is necessary within the array fields as the site grades vary from 2% - 4% in most areas.

The facility will be enclosed by a 7.0' high chain link fence with a 0.5' wildlife gap. for an overall fence height of 7.5' feet. The site's main access point will have a swinging or rolling tube gate.



In addition to the racking equipment and modules, several electrical components will be installed throughout array field. Most of these components will be installed on driven posts and include the following items:

- Electrical Sting inverters (DC to AC)
- Electrical combiner boxes and disconnect switches
- Security cameras and equipment
- Remote monitoring equipment

The facility will have a centralized equipment pad for the projects main transformer(s), switchgear, electrical monitoring and communication. The exact location of the pads is dependent on the projects final electrical design. There will be no on site inhabited structures, therefore no sewer services, septic systems or water wells will be required for the facility.

The majority of wiring within the array will be installed above ground, linking the solar modules together in series and will be mechanically fastened to the back of the racking rows. Wire will transition from the racking to direct buried cable or PVC conduit to the project's inverters throughout locations in the array. Wire from the inverters will run to the projects central panelboards and equipment pad(s) with the project's main trenches parallel to the roadway alignment, this aids in minimizing earth disturbances for the project. The underground wires and conduits will be buried approximately 4' deep and the trench width will vary depending on the number of wires or conduits installed. Medium voltage distribution form the projects main transformer will be installed underground and travel north. Interconnection will be installed above ground within Spring Street public way.



VI. CONSTRUCTION:

Construction will be completed in a multiple phases and is expected to take approximately 9 months from building permit issuance. Construction is expected to require a peak workforce of approximately 30 management, supervisory, and craft workers. Work will be completed based on one shift per day during local working hour requirements. The average number of workers on site is anticipated to be approximately 20, this workforce is expected to draw upon the existing labor pool in Worcester County. Parking, temporary office trailers, and equipment lay down areas will be located within the facility perimeters. Deliveries to the site during construction will average 3 to 5 trips a day, with total material deliver for the facility ranging between 250 trucks. Minimal traffic will be generated by the mobilization and de-mobilization of workers or equipment. Typical equipment mobilization for the construction of the facility will include earthwork vehicles including scrapers, graders, water wagons, and compactors. Equipment used in constructing the solar facility, will require post drivers, skid loaders, forklifts and trenching equipment.

Initial construction activities will consist of establishing site erosion control measures. Once the perimeter controls are in for the specific phase then tree cutting and stumping can commence. Installation of the basins will be installed once the trees have been removed. Installation of the foundation piers, racking, and trenching for electrical facility will begin after the basins have been installed. Conduits and trenches excavated during construction are typically backfilled within 24-48 hours. Modules and facility wiring will follow, including the construction of the equipment pads.

Equipment will be placed in service once testing and commissioning of all major components meets the interconnection requirements of National Grids electrical distribution system. The testing and commissioning phase of the project has approximately a 2 week duration, with minimal workers on site.



VII. OPERATIONS

The Solar Facility will operate 24 hours per day, 7 days per week. Operation of the facility will be managed, monitored, and controlled by the facility staff and through remote monitoring and a local response team. When fully developed, maintenance of the Solar Facility is not expected to require any full-time employees. A control system will also allow unmanned operation of the Solar Facility.

PV facilities have very few moving parts and have limited maintenance requirements. Periodic scheduled and unscheduled maintenance during the life of the project will include, but not be limited to, module washing, inverter maintenance and replacement and repair of equipment, checking electrical performance parameters for remote monitoring, responding to any problems detected by remote monitoring, conducting weed abatement and dust control activities and maintaining driveways.

Water will be used for cleaning PV panels and controlling dust during construction, but no water will be used by the facilities to produce electricity. Water for both module cleaning and dust will be brought in from off site. Approximately 5,000 gallons are expected to be used annually to clean the solar modules.

Site security will be provided by monitoring cameras, electronic security systems, and typical gate locking methods. There will be no need for increased routine patrol by county law enforcement, though occasional responses by law enforcement are anticipated in the event security systems are triggered. The Solar Facility will not have any perimeter lighting, although there may be some down lighting around the transformers and central pad from the installed equipment.



No permanent fire protection system is proposed for the facility because PV panels are constructed of glass and their support structures are constructed of steel, neither of which is subject to combustion. All oil-filled transformers will be located outdoors with proper setback from adjacent structures. Areas where PV panels, other electrical equipment, and site infrastructure are placed will be maintained free of vegetation. The site access driveway will serve for emergency egress and fire department access.

There will be negligible impacts on the existing area roadway system during operation. Typical operation is estimated to add less than 2 vehicles per week to surrounding streets. Most trips will consist of a few employees performing equipment maintenance and replacement, module washing and groundcover control.



Winchendon Solar Glint & Glare Study

Prepared By Ecos Energy

September 2, 2020

Contents

Executive Summary.....	3
Glint and Glare with Solar module.....	3
Reflectivity of Solar Modules	4
Motion of the Earth and Sun.....	5
Orientation and Motion of Solar Tracking Arrays	7
Geography of Location & Analysis	9
Case 1: Normal Operation.....	10
Case 2: High Wind Stow Mode.....	11
Case 3: Tracking Not Active.....	12
Conclusions and Recommendations	14
Glossary.....	15
References	15

Attachments:

Sandia National Laboratory – Solar Glare Hazard Analysis Tool (SGHAT) - Brochure.....	17
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Executive Summary

The purpose of this study is to analyze the potential adverse impacts from glint and glare on vehicle traffic and surrounding residences from the proposed photovoltaic system, located on the south side of Spring Street, (Route 12) and north of Teel Road. The issue of glint and glare has been studied by the FAA³, Air Force and Sandia National Labs^{1,5} extensively. Sandia National Labs has produced the Solar Glare Hazard Analysis Tool, which has been used to run simulations for different observation points around the proposed tracking photovoltaic solar array. The analysis found that during normal operations glare is not an issue for the surrounding area. The closest residential structure is located northeast of the proposed array and therefore, will not be directly affected by the solar panels. The condition that can create a glint/glare issue is when the tracker is at a fixed angle during construction, maintenance or if the control system malfunctions. In this case, if the right combination of panel tilt angle, time of day and time of year coincide, an observer will experience glint and glare. However, traffic is expected to be moving at a speed such that even if all the elements combine to cause glint and glare, the driver will pass the location quick enough to only have minor visual effects.

Glint and Glare with Solar module

Glint is the direct reflection of the sun's light while glare is the reflection of surrounding bright diffuse light around the sun. The intensity of glare is many times less than that of glint; however, glare is often used to refer to both glint and glare. For simplification purposes we will use the term glare for both affects in this report unless otherwise noted. The concern with glare is the following: at which point is a person's vision impaired by glare as a result of flash blindness which is the temporary after image one experiences after looking at a bright light.



Figure 1 - Glint and Glare from Setting Sun on Fixed Tilt Array – 12/09 – 5:37pm

The amount of light energy required to cause flash blindness, according to a study performed by Sandia National Labs¹, is 7-11 W/m² (or 650-1,100 lumens/m²) at the observer’s eyes. The light energy from the sun is referred to as irradiance and varies with time of day, season, cloud cover and atmospheric haze. The average irradiance at sea level for a location perpendicular to the sun’s rays is approximately⁷ 1000W/m².

Reflectivity of Solar Modules

Solar modules are designed to absorb as much light from the sun as possible although the solar cells have some reflectivity to protect the cells from the elements. The top surface of standard crystal photovoltaic (PV) modules is glass, which is the source of most of the reflected light. The combination of the anti-reflective coatings on the module glass and on the surface of the cells reduces the reflectivity below that of water and, depending on the angle of reflection, can be as low as 2%^{2,6,8} of incident light being reflected to an observer at low angles. As an example, mirrors of a concentrating solar power plant can reflect greater than 90% of the incident light, See Figure 2.

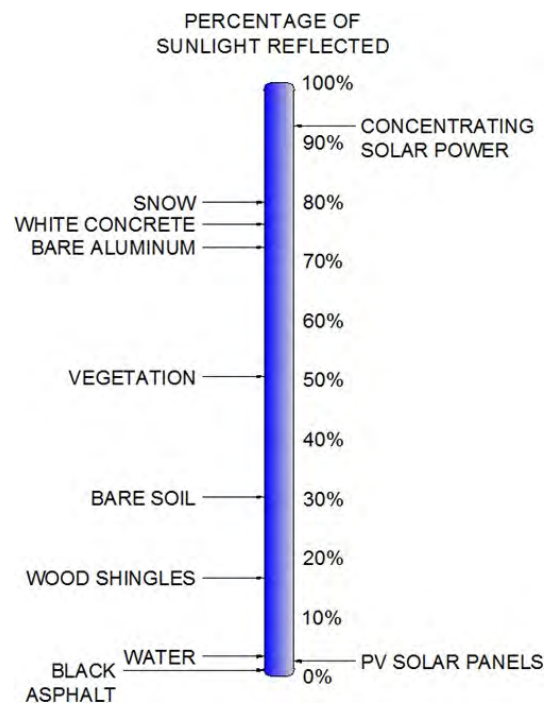


Figure 2 - Reflectivity of Common Materials versus Solar Systems^{3, 4}

Assuming an irradiance of 1000W/m² and a reflectivity of 2%, the amount of light reflected would be 20W/m² which is enough to create flash blindness. The actual amount of the reflected light will depend on the angle between the module and sun as well as factors such as module soiling.

Motion of the Earth and Sun

The Earth tilts at an angle of 23.4° with respect to the plane of its orbit about the sun. Although there are minute changes over time the value is consistent within our lifetimes. The value changes about 0.01° in 82 years. With the tilt staying the same as the Earth orbits about the sun the angle to the sun from a fixed point varies giving us the seasons. December 21st, the winter solstice, is the shortest day of the year with North Pole leaning the farthest from the sun, See Figure 3. The suns location with respect to the horizon is called the azimuth. Table 1 shows the Azimuth in degrees in relation to the cardinal directions.

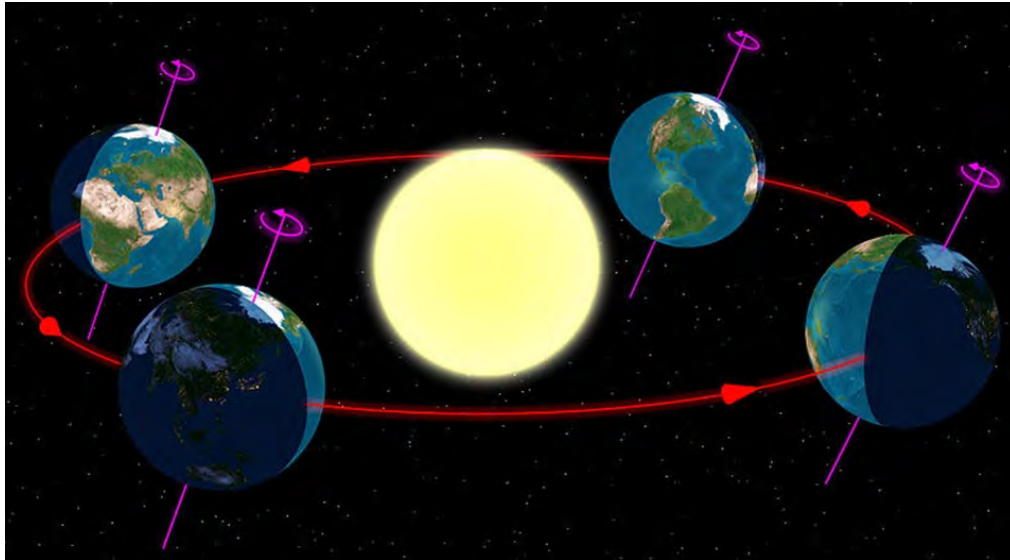


Figure 3 – Orientation of Earth and Sun, Starting on the right and moving CCW is Winter Solstice, Vernal Equinox, Summer Solstice & Autumnal Equinox. Image from Wikipedia (http://en.wikipedia.org/wiki/File:North_season.jpg)

Azimuth from North with Clockwise Rotation			
North	0° or 360°	South	180°
North-Northeast	22.5°	South-Southwest	202.5°
Northeast	45°	Southwest	225°
East-Northeast	67.5°	West-Southwest	247.5°
East	90°	West	270°
East-Southeast	112.5°	West-Northwest	292.5°
Southeast	135°	Northwest	315°
South-Southeast	157.5°	North-Northwest	337.5°

Table 1 - Azimuth in Degrees and Cardinal Directions

For the proposed site in Winchendon, Massachusetts and with the tilt of the Earth the sun will rise south of the easterly direction. With An observer facing due east at sun rise, they would see the sun rise 28.7° to the south of the easterly direction with an azimuth of 118.7° (green line on Figure 4). The sun will also set 28.5° south of the Westerly direction with an Azimuth of 241.5° (red line on Figure 4). As the year progresses, sunrise and sunset will occur more to the north each day.

GLINT & GLARE STUDY – WINCHENDON SOLAR

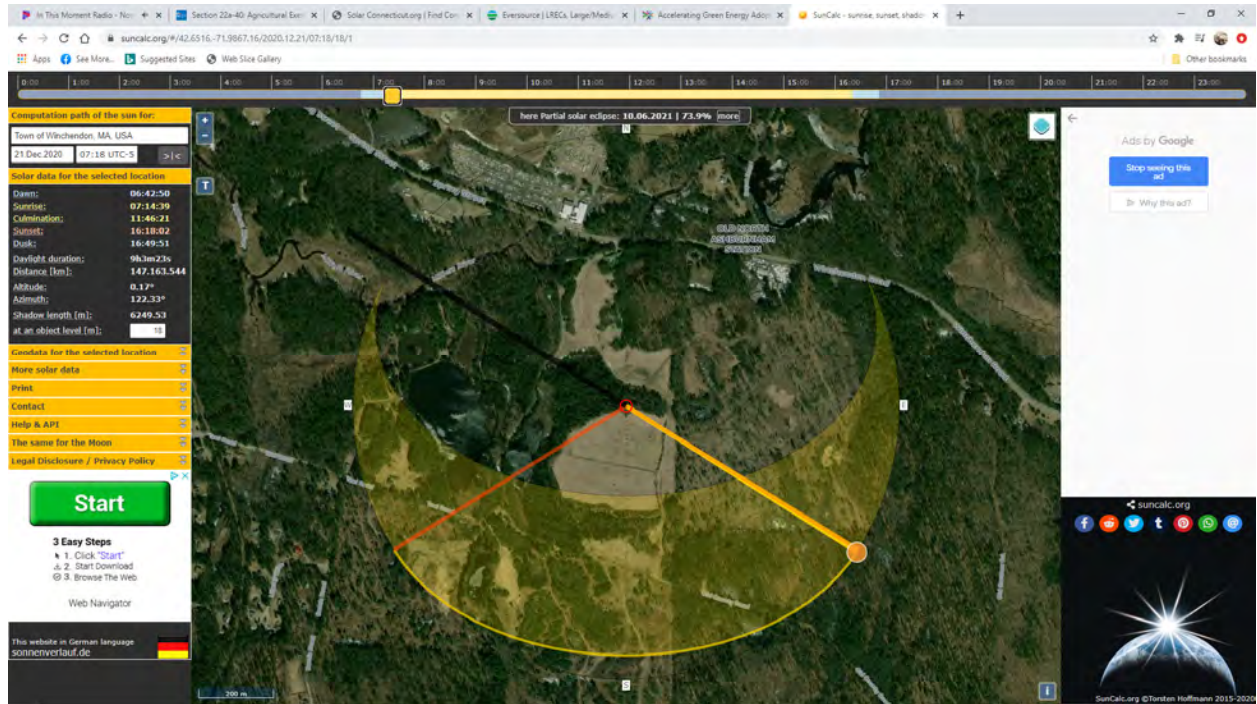


Figure 4 - Sunrise & Sunset Angles on Winter Solstice, Dec 21

Mid-year on June 20th, the Summer Solstice, the north poles tilt towards the sun is at its maximum. The sunrise and sunset occur at azimuths of 60° and 300° respectively, see Figure 5. By 9:34 AM the Sun's azimuth is 90° with an elevation of 43° and at 01:04PM, solar noon, the azimuth is 180° with an elevation of 78° such that at this latitude the sun is never quite directly overhead.

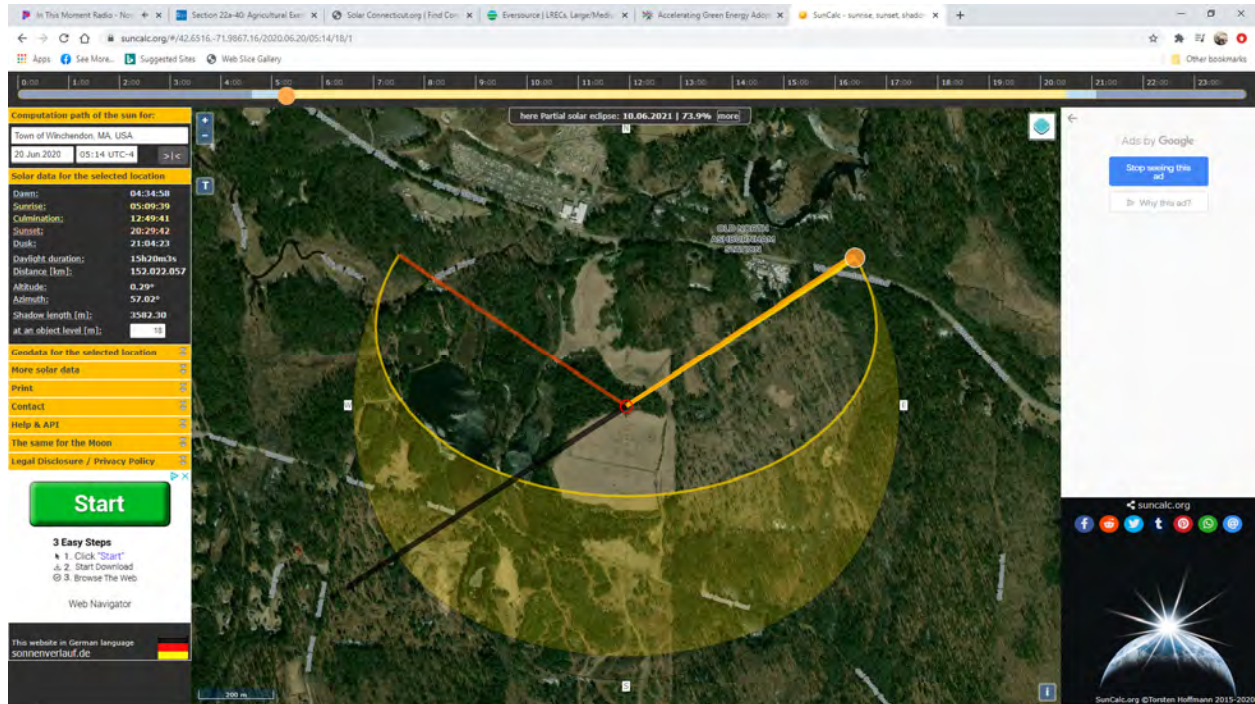


Figure 5 - Sunrise & Sunset Angles on Summer Solstice, Jun 20

Orientation and Motion of Solar Tracking Arrays

Solar tracker arrays have two primary design types. The first type is a two or dual axis tracker that both tilts to track the sun's elevation and rotates to track the sun's azimuth. The second type is a single-axis tracker that tilts to track the sun's elevation but has a fixed azimuth. Although there are many variations within each type, for this report we are examining a tracker with a zero-degree tilt in the north-south direction. With this type, the rows of modules run north-south with the tracker's axis and the modules are tilted east to west. One might think that the trackers would start in the morning facing east; however, the first row of modules would end up shading the next row to the west as the sun rises. To avoid this problem the tracker system begins at close to flat with just a few degrees of tilt to the east. As the sun rises the tracker array rows tilt more and more to the east without shading the next row. See Figure 6 for the progression of the tilt angle. The example is a simplification in 2 dimensions and neglects the azimuth for the calculation of the reflected angle. Between Sunrise and 9:34AM the Azimuth is less than 90° such that the reflected light would be coming out of the page. At noon the azimuth is 180° with an elevation of 78° such that the reflection is 78° into the paper. The date chosen for the figure is

the Summer Solstice or Jun 20th. The example does not show the change in azimuth such that at sunrise the reflected angle would be coming out of the page and by solar noon the reflected angle would be going into the page. Most tracker models have a maximum tilt of 45 degrees to the east and west.

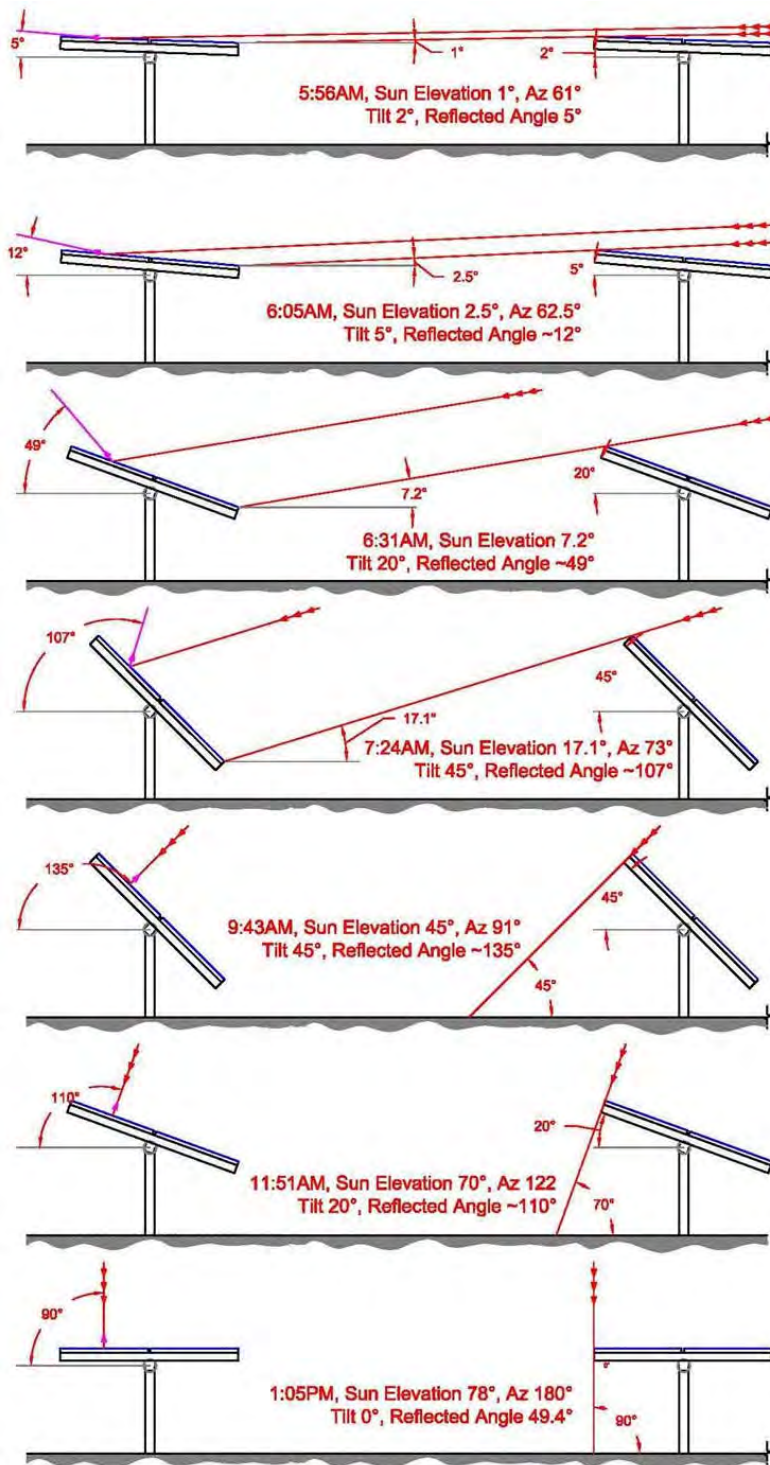


Figure 6 - Tracker angle Verse Sun Elevation

Geography of Location & Analysis

The proposed array is located on the south side of Spring Street, (Route 12), in Winchendon, MA. The array is situated between Spring street to the north and Teel Road to the south, see Figure 7.



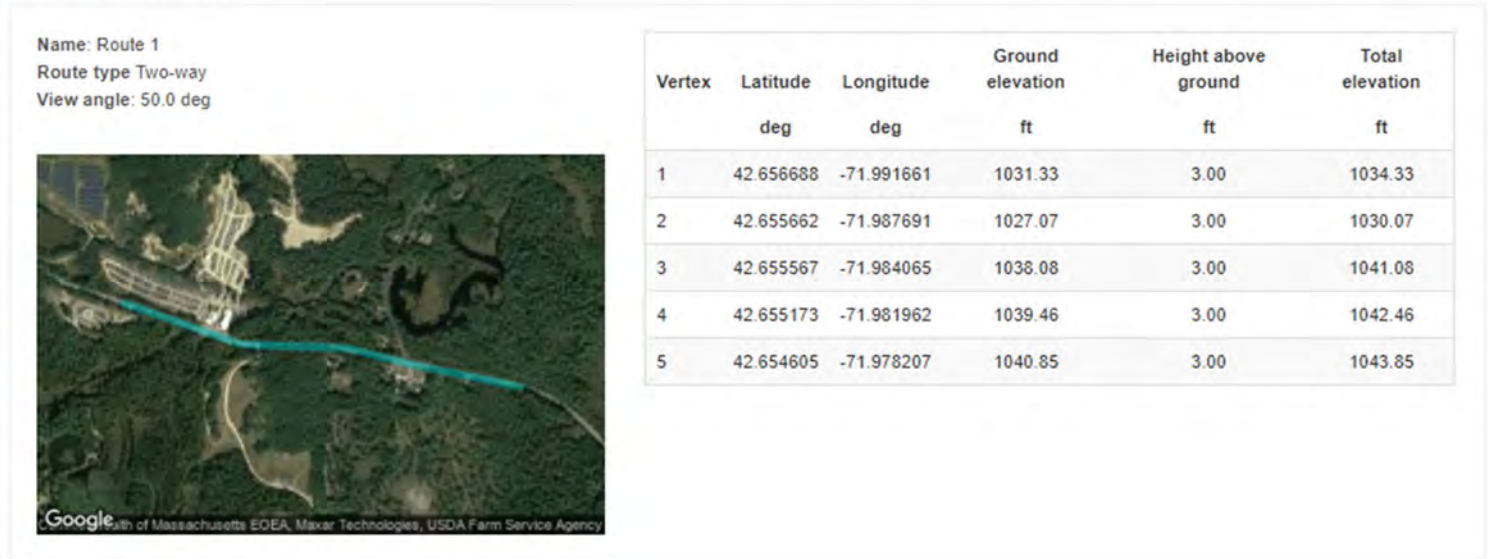
Figure 7 - Map of site from Sandia National Labs Solar Glare Hazard Analysis Tool (SGHAT)

To analyze potential glare to observers around the array, the Solar Glare Hazard Analysis Tool from Sandia National Laboratory was used. With the software the array can be inserted into a map and observation points can be selected. One observation point (OP) and two roadway routes were selected as potential locations for glare. OP 1 is a residential structure approximately 150 feet from the closet part of the array. From observation, areas directly North and South of the array will not have an issue with glare because of the North South orientation of the tracker rows.

GLINT & GLARE STUDY – WINCHENDON SOLAR

The software uses the geometric information derived from Google Earth and detailed calculations of the motion of the sun to plot the time of day and time of year that glare could be a problem.

Route Receptor(s)



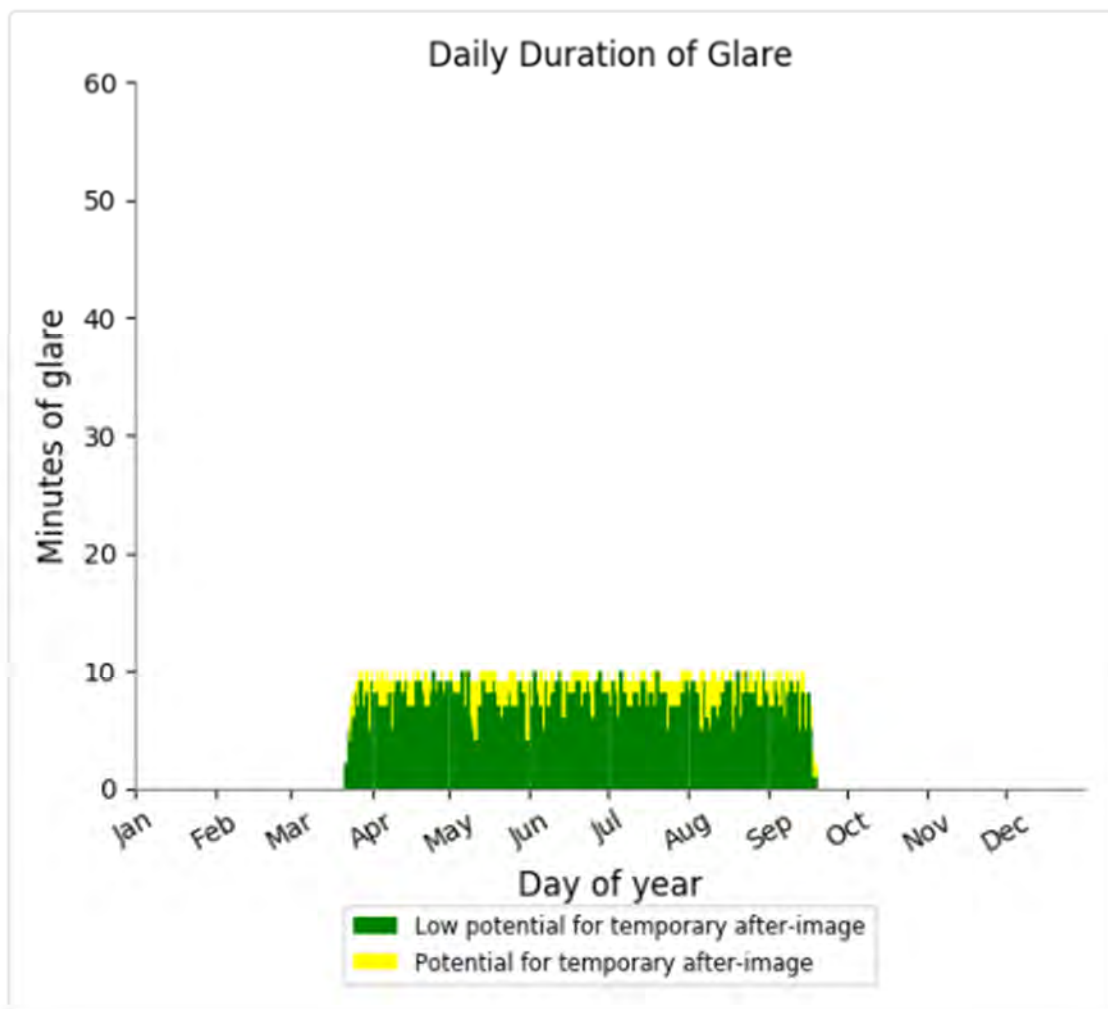
Discrete Observation Receptors

Number	Latitude deg	Longitude deg	Ground elevation ft	Height above ground ft	Total Elevation ft
OP 1	42.655337	-71.984563	1052.89	0.00	1052.89

Figure 8 - Location and Elevations of Observation Points and Routes used in the SGHAT simulation.

Case 1: Normal Operation

Under normal operation the trackers will move as described in the section on “Orientation and Motion of Solar Tracking Arrays”. The trackers will have a start position at a low angle such as 2° to the East, depending on the manufacture. When the sun rises in the East, the Horizon is at about 1° to the horizontal and the resulting reflection will rise to the West at approximately 5° which will not create glare for observers to the west of the array. As the sun continues to rise, the elevation of the sun and inclination of the panels will simultaneously increase, further directing the reflections up and out of the way of observers (Figure 7). The same will happen in reverse as the sun sets. The software does not have the ability to combine the motion of the tracker within the simulation. To work around this limitation, discrete panel tilt angles of 2° East, 45° East, 0°, 45° West and 2° West was used and the simulation was ran multiple times. Any results that occurred at a time of day that would not be consistent with the selected angle were thrown out. The results were that no potential glare existed for the 5 observation points under normal operation.



Conclusions and Recommendations

The Solar Glare Hazard Analysis Tool has been used to run simulations for areas around the proposed tracking photovoltaic array along Spring Street. The analysis found during normal operations there is a low occurrence of glare and is not an issue for the surrounding area. The condition that can create a glint glare issue is when the tracker is at a fixed angle during construction, maintenance or if the control system malfunctions. In this case if the right combination of panel tilt angle, time of day and time of year coincide an observer will experience temporary flash blindness. Traffic is expected to be moving at a speed such that even if all the elements combine to cause glint and glare, the driver will pass the location quick enough to only have minor visual effects.

To minimize potential issues the programming of the controllers should have a minimum start tilt angle of 2°. For the case of the tracker being at a fixed angle, efforts should be made during construction to angle the modules away from the sun while installing modules and move to a flat position when the tracker row is not being worked on. Maintenance should also take this into consideration and a more extensive analysis of different fixed angles can produce graphs of what angles to avoid based on time of day and season. The system's Data Acquisition System should send out alarms if a tracking system malfunction is detected so a prompt response can be made and the system repaired or the nonfunctioning rows be fixed in a 1° west tilt angle.

Glossary

Glint

Glint is a momentary flash of reflected light of a direct light source. For a person viewing a solar system, it is the direct reflection of sun.

Glare

Glare is a sustained reflection of the light source and the illumination of the area around the light source do to diffusion through atmospheric material. Glare covers a larger area of the reflective surface.

Module soiling

Module soiling is the accumulation of dust and dirt over time on the module surface. Light reflected from a soiled module will be more diffuse reducing the intensity of glint and glare.

References

1. HAZARD ANALYSES OF GLINT AND GLARE FROM CONCENTRATING SOLAR POWERPLANTS
Clifford K. Ho¹, Cheryl M. Ghanbari², and Richard B. Diver³
¹Ph.D., Sandia National Laboratories, Solar Technologies Department, P.O. Box 5800, Albuquerque, NM 87185-1127, USA Phone: 1-505-844-2384, E-mail: ckho@sandia.gov
²Test Engineer, Sandia National Laboratories, Solar Technologies Department
³Ph.D., , Sandia National Laboratories, Solar Technologies Department
2. Evergreen Solar Literature: "More Electricity" [http://www.evergreensolar.com/upload/MAY-202009-20NEW-20LITERATURE/English-20\(US\)/US_More_Electricity_010609_Lo.pdf](http://www.evergreensolar.com/upload/MAY-202009-20NEW-20LITERATURE/English-20(US)/US_More_Electricity_010609_Lo.pdf)
3. Technical Guidance for Evaluating Selected Solar Technologies on Airports, Federal Aviation Administration: Office of Airports, Office of Airport Planning and Programming, Airport Planning and Environmental Division (APP-400), 800 Independence Avenue, SW Washington, DC 20591 November 2010
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5. Measuring Solar Spectral and Angle-of-Incidence Effects on Photovoltaic Modules and Solar Irradiance Sensors
David L. King, Jay A. Kratochvil, and William E. Boyson, Sandia National Laboratories
Presented at the 26th IEEE Photovoltaic Specialists Conference, September 29-October 3, 1997, Anaheim, California
6. SUNPOWER CORPORATION, DATE: September 29, 2009
Tech Note Title & Number: SunPower Solar Module Glare And Reflectance, *T09014
7. Wikipedia:Insolation <http://en.wikipedia.org/wiki/Insolation>
8. Massachusetts Department of Environmental Protection: Clean Energy Results
<https://www.mass.gov/doc/ground-mounted-solar-pv-guide/download>



US Patent Pending on SD # 12353

TECHNOLOGY SUMMARY

With growing numbers of solar energy systems being proposed and installed throughout the United States, the potential impact of glint and glare from photovoltaic modules, concentrating solar collectors, receivers, and other components is receiving increased attention as a potential hazard or distraction for pilots, air-traffic control personnel, motorists, and residents. Hazards from reflection of solar radiation from solar power plants include the potential for permanent eye injury (e.g., retinal burn from concentrated sunlight) and temporary disability or distractions (e.g., after-image). Visual impairment can be mitigated by thoughtful application of analytical tools. Traditionally, glare hazards are analyzed in terms of the geometry of the proposed solar installation relative to key observation points. However, such geometric methods fail to provide an indication of the intensity of the reflected light or the potential ocular impacts.



Figure 1. Glare from solar panels viewed from an air traffic control tower.

Sandia has developed a web-based tool and methodology to evaluate potential glint/glare hazards associated with solar energy installations. The validated tool provides a quantified assessment of when and where glare will occur, as well as information about potential ocular impacts. The tool can also be used for design optimization to evaluate alternative configurations, orientations, and locations of solar installations that not only mitigate the impacts of glint/glare, but also optimize energy production. The calculations and methods are based on analyses, test data, and models developed over several years at Sandia to evaluate ocular hazards. The results are presented in a simple easy-to-interpret plot that specifies when glare will occur throughout the year, with color indicating the potential ocular hazard.

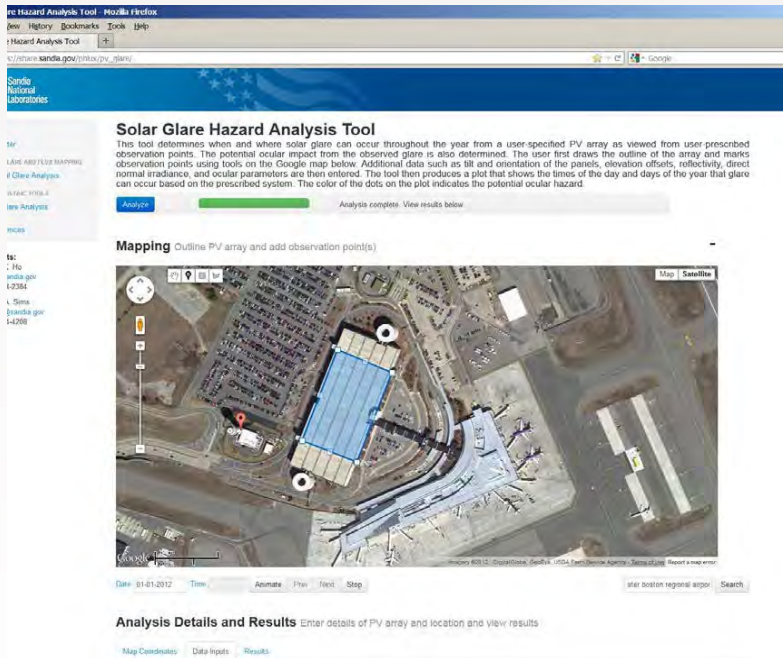


Figure 2. Screen image of glare analysis tool. PV array (blue outline) and observation points (red marker) are entered using drawing and selection tools integrated with Google Maps.



POTENTIAL APPLICATIONS

- Glint and glare ocular hazard analyses for proposed/existing solar installations near airports, roads, workplaces, and communities
 - Studies to ensure safe siting and expedited permitting
 - Design optimization to maximize energy production while mitigating glare from solar installations
-

TECHNOLOGICAL BENEFITS

- Quantifies when and where glare will occur throughout the year
 - Quantifies glare intensity and potential ocular impact
 - Determines annual energy production so that PV configurations can be optimized for maximum energy production with minimal glare
-

TECHNOLOGY READINESS LEVEL

Sandia estimates this technology to have a technology readiness level of approximately 7. Prototypes have been tested and shown to work in operational environments.

CONTACT INFORMATION

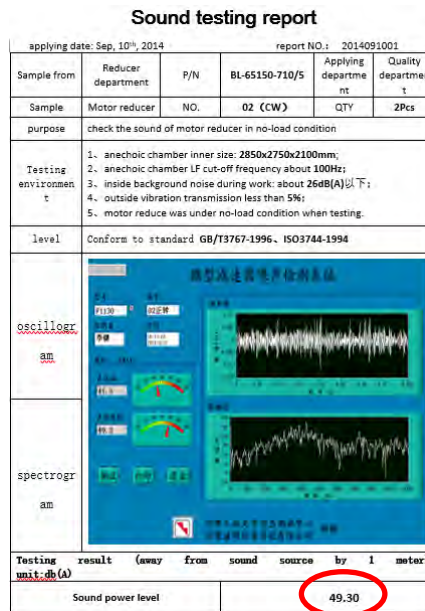
For more information or to discuss licensing opportunities please contact ip@sandia.gov.

Or to learn more, please visit our website at

<https://ip.sandia.gov>.

NEXTracker Motor Sound Test Summary

Each NEXTracker row uses a small 24V DC motor powered by a NEXTracker controller. To track the row, the motor runs for five to ten seconds every few minutes. The noise level of the motors is tested by the manufacturer. Test reports from the manufacturer show that the sound power level is ~50dB. The sound level produced is very low and essentially inaudible to surrounding site noises such as wind or generators.



Manufacturer sound test report

Inverse distance law for acoustics shows sound decrease with distance:

Distance	Sound Level	Equivalent sound
3 m (9.8 ft)	~ 40 dB	Library
30 (98 ft)	~20 dB	Rustling leaves
300 m (980 ft)	~0 dB	Inaudible

NOTES

- SYSTEM SPECIFICATIONS:**
- SYSTEM SIZE IS 3.9MW AC, & 7.848MW DC (PV).
 - SYSTEM CONSISTS OF:
 - (2) 2.2MW FACTORY LIMITED INVERTERS TO 1.95MW
 - (1) 600A SWITCHBOARD
 - (1) 40kVA MINI SUB TRANSFORMER
 - (1) 310.0kVA 3-PH. GROUNDING TRANSFORMER
 - (1) 4200kVA STEP-UP TRANSFORMER
 - (6) 1017kW SAMSUNG BATTERY BLOCK
- EQUIPMENT SPECIFICATIONS:**
- MODULE: CELLS (430W MODULE)
 - MODULES ARE WIRED IN SERIES STRINGS OF 26 MODULES
 - Is: 10.83A, Voc: 49.33V, Imp: 10.31A, Vmp: 41.70V
 - TOTAL MODULES IN FACILITY: 18,252
 - MODULES CERTIFIED TO UL 1703.
 - COMBINERS ARE LOCATED THROUGHOUT THE ARRAY.
 - COMBINERS ARE 1500V RATED.
 - COMBINERS CONTAIN AN INTEGRAL DISCONNECT SWITCH ON THE OUTPUT. INPUT STRINGS ARE FUSED AT 20A POSITIVE
 - INVERTER: MODEL FS2125K (FACTORY LIMITED TO 1.95MW)
 - 1500V DC INPUT, 600V AC OUTPUT
 - UL 1741 & IEEE1547 CERTIFIED.
 - SYSTEM NOTES:
 - ALL UG CABLE, 2/0 URD, 220MIL JACKETED, OVERHEAD CABLE 2/0 ACSR. PRELIMINARY CONDUCTOR SPECIFICATIONS BASED ON MINIMUM NEC REQUIREMENTS. ACTUAL CONDUCTOR SIZES AND TYPES TO BE DETERMINED WITH FINAL DESIGN.
 - THE SEL 651R RELAY SHALL BE POWERED BY A 24DC POWER SUPPLY OR SIMILAR. THE POWER SUPPLY WILL PROVIDE BACKUP POWER SHOULD NORMALLY AC SERVICE BE INTERRUPTED. SEE KEY NOTE #2.
 - THE SEL651R WILL BE CONFIGURED TO TRIP THE RECLOSER ON RELAY FAILURE OR LOSS OF DC SUPPLY VOLTAGE WITHIN A MAXIMUM OF 2 SECONDS.
 - CUSTOMER WILL PROVIDE A VERIZON COMMUNICATIONS LINE FOR THE MPLS NETWORK CIRCUIT TO RTU (GE IBOX OR EQUIVALENT) USING A MAGNUM DC9450 IF REQUIRED.
 - SYSTEM DESIGN TEMPERATURES FOR MODULE RATINGS, PER NEC 690. TEMPS BASED ON ASHRAE 2% DESIGN PARAMETERS FOR JAFFREY, MD: -23°C MINIMUM, 30°C MAXIMUM
 - RELAYS SHALL HAVE ABB FT-1, OR EQUIVALENT, TEST SWITCHES.
 - GROUNDING TRANSFORMER SIZING TO BE COORDINATED WITH UTILITY SHORT-CIRCUIT CONTRIBUTION AT POI.
 - COMMUNICATION BETWEEN BESS, CONVERTER AND INVERTER BY PE & IHI
 - OPERATING LOGIC: PV CHARGING OF BESS ONLY. DISCHARGE OF BESS TO MATCH UTILITY LOAD SHAVING.

KEY NOTES

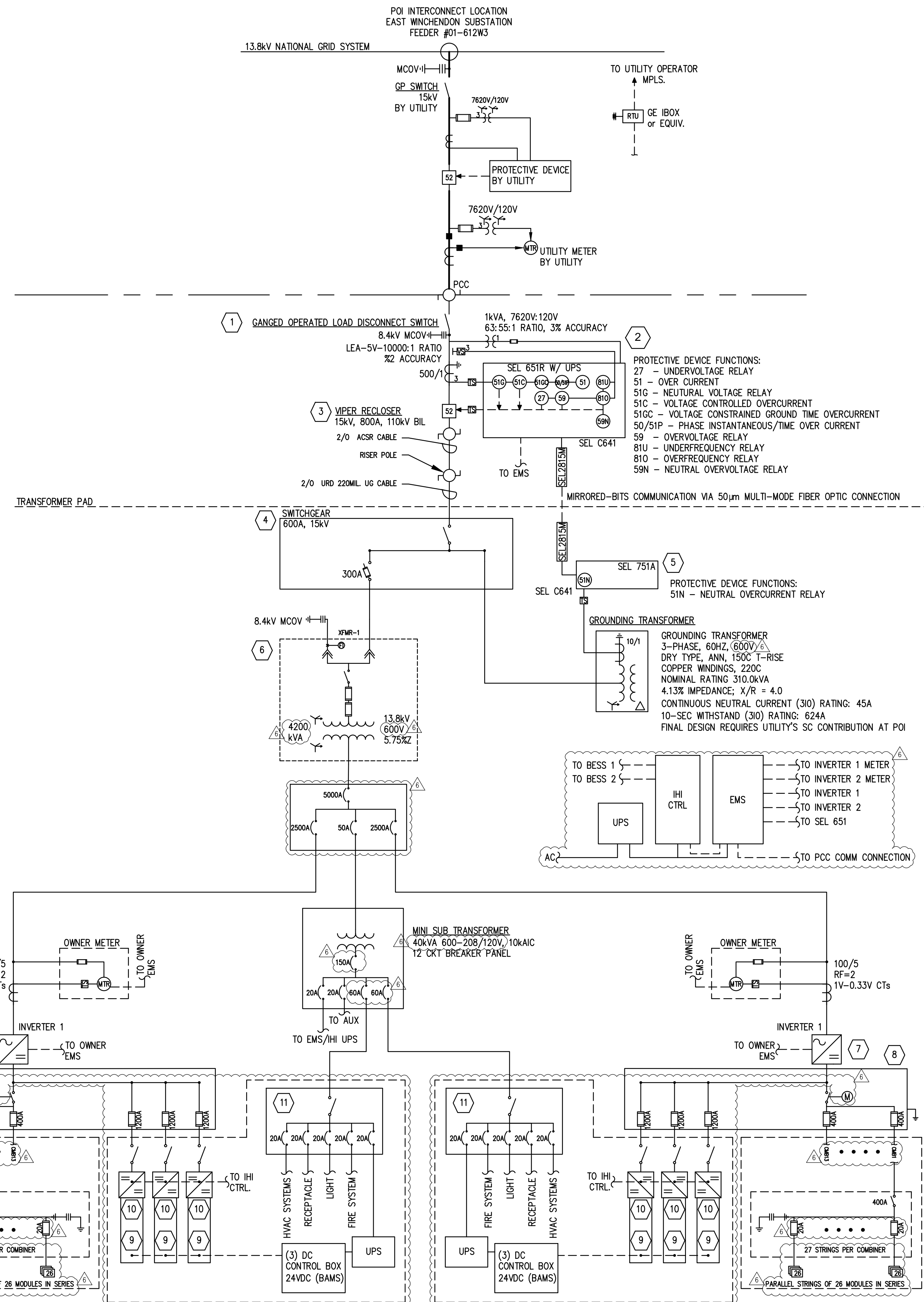
- CHANCE-HUBBELL UNITIZED D7 110KV BIL, 14.4KV, 900A, 40KA VISIBLE BLADE, UTILITY LOCKABLE AND ACCESSIBLE 24/7.
- RELAY FAILURE ALARM
RELAY FAILURE OR LOSS OF DC SUPPLY VOLTAGE WILL TRIP RECLOSER WITHIN A MAX OF 2 SECONDS.
- G&W VIPER-ST, VP378R-1-ST W/SEL651R, BATTERY BACKUP.
- DISCONNECT SWITCHGEAR
SWITCH GEAR POWER SYSTEMS 15KV, 95 BIL (600A) 3PH W/POSITION CONTACTS (PC), TRIP RECLOSER ON OPEN.
- SEL OVERCURRENT RELAY, SEL751A01D0X0X850000, FOR GROUND TRANSFORMER NEUTRAL PROTECTION (VIA MIRRORRED BITS TO SEL651R RECLOSER RELAY)
- COOPER 4200KVA TRANSFORMER
13.8KV GY: 600V GY, KNAN 95KV BIL, 2-2.5% ± TAPS, Z=5.7%, X/R=6.0.
- POWER ELECTRONICS INVERTER.
MODEL FS2125K (FACTORY LIMITED TO 1.95MW)
- POWER ELECTRONICS DC RE-COMBINER PV-BESS DUAL ISOLATING BUSS (27 PARALLEL STRINGS OF 26 MODULES IN SERIES)
- SAMSUNG SSDI-E3 ENERGY STORAGE UNIT (6) 1017KW (6.1MW) 6.4 MW
- POWER ELECTRONICS FREEMAC DC/DC CONVERTER. (6) PE-FD0500X2.
- SAMSUNG SSDI 100A AUX. PANEL & CONTROL

The switchgear shall be rated* as follows:

Nominal Voltage	15 kV	
Maximum Design Voltage, kV	15.5	
BIL, kV	95	
1-Minute Withstand Voltage (60 Hz), kV	35	
Momentary Current, 10 Cycles (sym.), kA	12.5	
3-second Withstand Current (sym.), kA	12.5	
Fault Interrupter	Continuous Current (max), A	600
	Interrupting Current (sym./asym.)	12.5/20.0
	Making Current (sym.), kA	12.5
	Cable Charging Interrupting Current, A	10.0
Load-Break Switch	Continuous Current (max), A	600
	Load Switching, A	600
	3-Shot Make and Latch (asym.), kA	20.0

LEGEND

- CURRENT TRANSFORMER
- POTENTIAL TRANSFORMER
- FUSE
- POWER METER
- DISCONNECT SWITCH
- TRANSFORMER
- BREAKER
- SURGE ARRESTER
- INVERTER
- POLE
- POWER
- COMMUNICATION/CONTROL
- RECLOSER BREAKER
- LOAD BREAK
- NON-LOAD BREAK
- TEST SWITCH
- VOLTAGE SENSOR
- MOTOR



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 Toll Free (888) 937-5150 westwoodps.com
 Westwood Professional Services, Inc.

Revisions:

#	DATE	DESCRIPTION
1	01/31/18	ADD GROUNDING XFMR SPEC
2	08/09/18	REDUCE SYSTEM TO 3.9MWAC
3	09/20/18	UTILITY REQUESTED REVISION
4	09/24/18	PER UTILITY REQUEST
5	09/27/18	PER UTILITY REQUEST
6	01/31/20	ADD DC COUPLED BESS SYSTEM

Prepared for:

Alco Finance Limited

222 S 9th Street, Suite 1600
 Minneapolis, MN 55402

Marlowe Solar

0 Spring Street
 Winchendon, MA

**3.9MW Interconnection
 Online Diagram
 Concept**

NOT FOR CONSTRUCTION

Date: 01/31/20
 Drawing No. E200

N:\0010348\DC_PROJECTS - BE MINDFUL WHICH CAD VERSION YOU ARE WORKING IN\Ashburnham_Winchendon.dwg

UNINTERRUPTIBLE POWER SUPPLY (UPS)

THE UPS UNIT IS USED IN CONJUNCTION WITH SEL651R. IT IS CONNECTED TO AND IS CONTROLLED BY THE SEL651R. AN EXTERNAL BATTERY NEEDS TO BE CONNECTED TO THE UPS, SUCH THAT THE UPS CAN DRAW POWER FROM THE BATTERY AND MAKE IT AVAILABLE TO THE SEL651R, AS WELL AS ANY OTHER AUXILIARY DEVICES, IN THE EVENT THE MAIN POWER SOURCE IS LOST. THE UPS CHARGES THE BATTERY AND ALSO TESTS THE BATTERY TO ENSURE ITS HEALTH AND AVAILABILITY.

THE UPS IS EQUIPPED WITH THE ABILITY TO MONITOR THE AVAILABILITY OF INPUT VOLTAGE IF POWERED BY AC. IN THE CASE THE MAIN AC SUPPLY IS LOST, ALARM IS PROVIDED LOCALLY TO THE LOCAL HMI AS WELL AS REMOTELY. THE UPS HAS AN ISOLATED AUXILIARY POWER SUPPLY FOR AUXILIARY EQUIPMENT SUCH AS RADIOS, MODEMS, ETC. THE AUXILIARY POWER SUPPLY HAS TWO OUTPUT VOLTAGE SETTINGS, 12VDC AND 24VDC.

THE UPS HAS AN INTEGRATED BATTERY CHARGER THAT IS A CURRENT REGULATED CHARGER. THE BATTERY VOLTAGE DETERMINES WHEN THE CHARGER IS SWITCHED OFF. THE SWITCH OFF VOLTAGE IS INFLUENCED BY THE TEMPERATURE TO SOME DEGREE. THE BATTERY CHARGER MAY CHARGE AS HIGH AS 50W, BUT THIS IS LIMITED BY THE FIRMWARE AND PRESENTLY SET TO A VALUE LESS THAN 000W. THE OUTPUT WATTAGE VARIES THROUGH DIFFERENT PORTIONS OF THE CHARGE CURVE. IF THE BATTERY TO BE CHARGED IS COMPLETELY DISCHARGED OR CLOSE TO BEING COMPLETELY DEAD THEN ONLY A SMALL AMOUNT OF CHARGE CURRENT IS APPLIED TO THE BATTERY. AS THE BATTERY STARTS CHARGING, INDICATED BY A VOLTAGE INCREASE, THE CURRENT IS INCREASED. THIS METHOD IS USED TO PREVENT BATTERY CHARGE FAILURE DUE TO TRYING TO CHARGE A DEFECTIVE BATTERY OR SHORTED BATTERY CIRCUIT. THE UPS HAS A CIRCUIT THAT SWITCHES IN 1.5 OHMS, 40 W OF RESISTANCE ACROSS THE BATTERY. THIS LOAD IS APPLIED TO THE BATTERY FOR 0.1 SECONDS. THE BATTERY'S VOLTAGE IS TAKEN BEFORE AND DURING THIS TIME. A COMPARISON OF THE TWO MEASUREMENTS CAN BE MADE AND THE HEALTH OF THE BATTERY DETERMINED. THE UPS HAS EMBEDDED BOOST CIRCUIT FOR DRIVING MOTORS OR MAGNETIC ACTUATORS.

RECLOSER CONDITION MONITORING

FOR CONTINUOUS KNOWLEDGE OF THE OPERATIONAL AVAILABILITY OF RECLOSER, THE SEL651R FEATURES A COMPREHENSIVE SET OF MONITORING FUNCTIONS. EVERYTIME THE RECLOSER OPERATES, THERE WILL BE ELECTRICAL AND MECHANICAL WEAR. THUS, THE LIFE OF THE RECLOSER REDUCES DUE TO WEAR, THE WEARING IN THE RECLOSER DEPENDS ON THE TRIPPING CURRENT, AND THE REMAINING LIFE OF THE RECLOSER IS ESTIMATED FROM THE RECLOSER TRIP CURVE PROVIDED BY THE MANUFACTURE. THE REMAINING LIFE IS CALCULATED SEPARATELY FOR EACH PHASE AND IT IS AVAILABLE AS A MONITORED DATA VALUE.

THE RECLOSER MONITORING CAN INCLUDE CHECKING THE WEAR AND TEAR OF THE RECLOSER. THE PROTECTION AND CONTROL RELAY ALSO MONITORS THE TIME AND THE NUMBER OF TRIP OPERATIONS TO PROVIDE BASIC INFORMATION FOR SCHEDULING/MAINTENANCE.

TRIP-CIRCUIT MONITORING

THE SEL651R TRIP-CIRCUIT MONITOR CONTINUOUSLY SUPERVISES THE AVAILABILITY AND OPERABILITY OF THE TRIP CIRCUIT. IT PROVIDES OPEN-CIRCUIT MONITORING BOTH WHEN THE RECLOSER IS IN ITS CLOSED AND IN ITS OPEN POSITION. IT ALSO DETECTS LOSS OF RECLOSER CONTROL VOLTAGE.

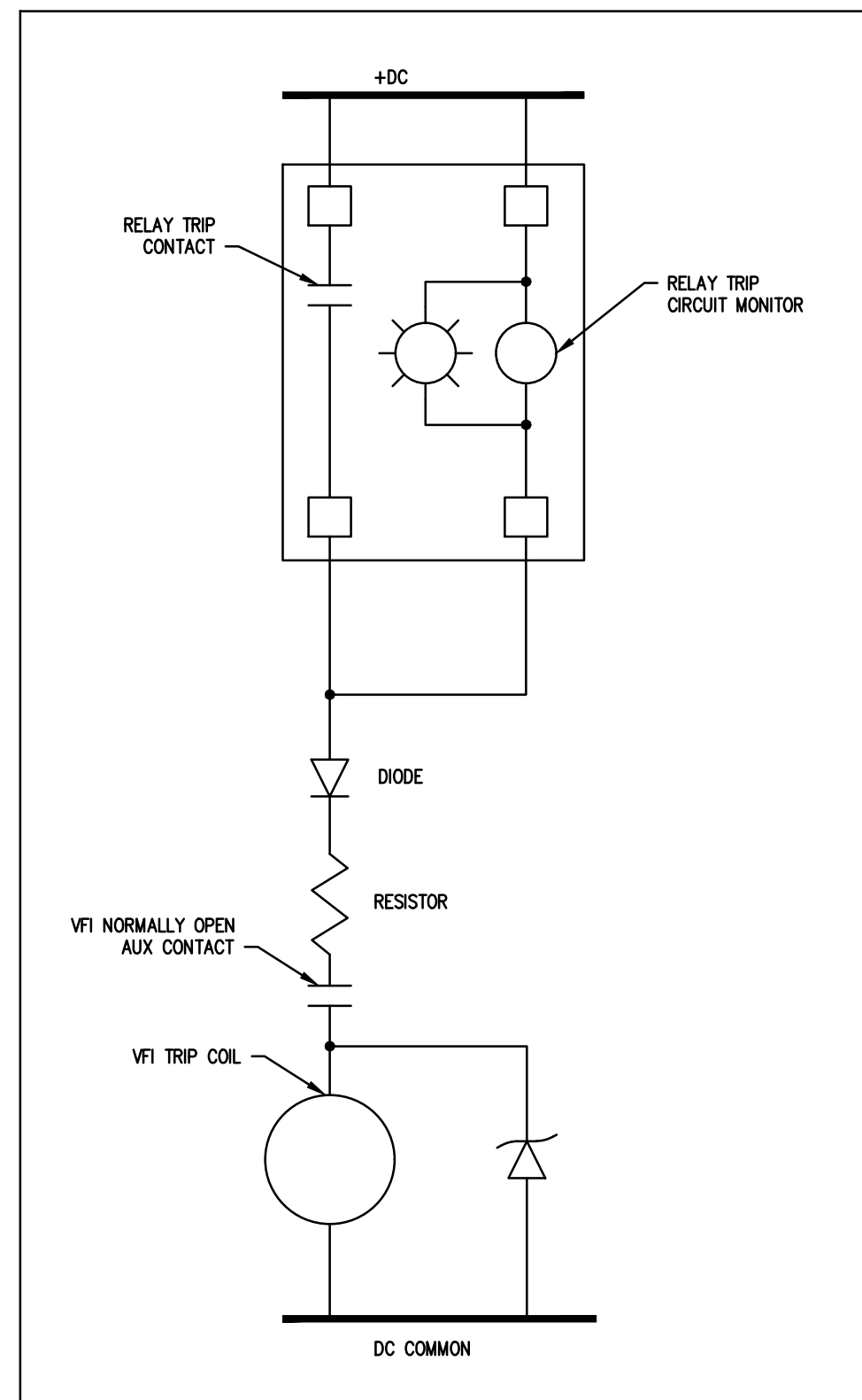
LOCAL AND REMOTE INDICATION ARE PROGRAMMABLE TO ENSURE IMMEDIATE NOTIFICATION SO THE NECESSARY STEPS CAN BE ESTABLISHED TO CORRECT BEFORE THE NEXT FAULT EVENT OCCURS.

SELF-DIAGNOSTICS

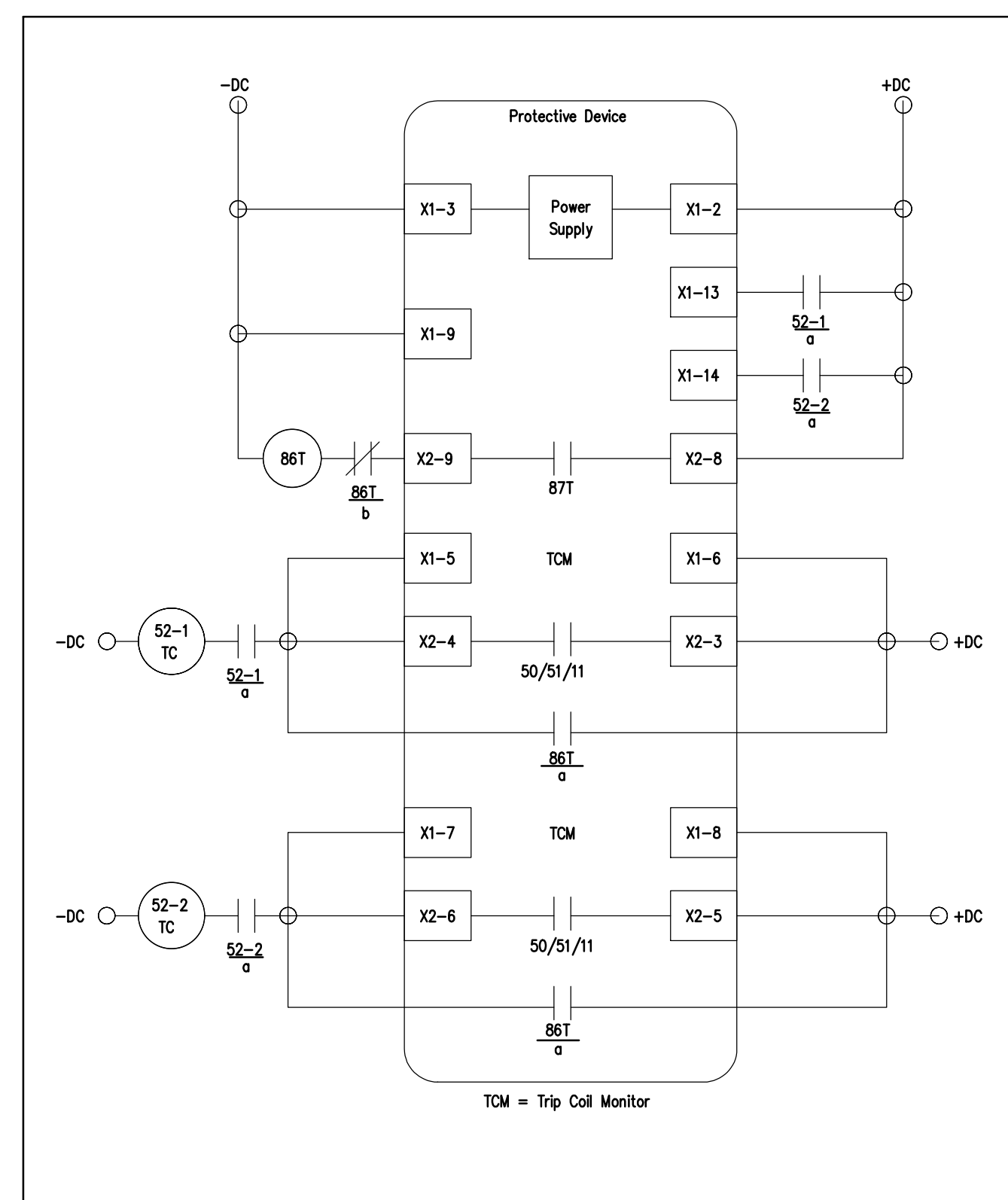
THE PROTECTION AND CONTROL RELAY'S BUILT-IN SELF-DIAGNOSTICS SYSTEM CONTINUOUSLY MONITORS THE STATE OF THE PROTECTION AND CONTROL RELAY HARDWARE AND THE OPERATION OF THE RELAY SOFTWARE. ANY FAULT OR MALFUNCTION DETECTED WILL BE USED FOR ALERTING THE OPERATOR. A PERMANENT PROTECTION AND CONTROL RELAY FAULT WILL BLOCK THE PROTECTION FUNCTIONS OF THE RELAY TO PREVENT INCORRECT RELAY OPERATION.

FUSE FAILURE PROTECTION

THE PROTECTION AND CONTROL RELAY INCLUDES FUSE FAILURE SUPERVISION FUNCTIONALITY. THE FUSE FAILURE SUPERVISION DETECTS FAILURES BETWEEN THE VOLTAGE MEASUREMENT CIRCUIT AND THE RELAY. THE FAILURES ARE DETECTED BY THE NEGATIVE SEQUENCE BASED ALGORITHM OR BY THE DELTA VOLTAGE AND DELTA CURRENT ALGORITHM. UPON THE DETECTION OF A FAILURE THE FUSE FAILURE SUPERVISION FUNCTION ACTIVATES AN ALARM AND BLOCKS VOLTAGE-DEPENDENT PROTECTION FUNCTIONS FROM UNINTENDED OPERATION.



1 DC Relay Trip Circuit NTS



2 Draft Control Wiring Diagram NTS

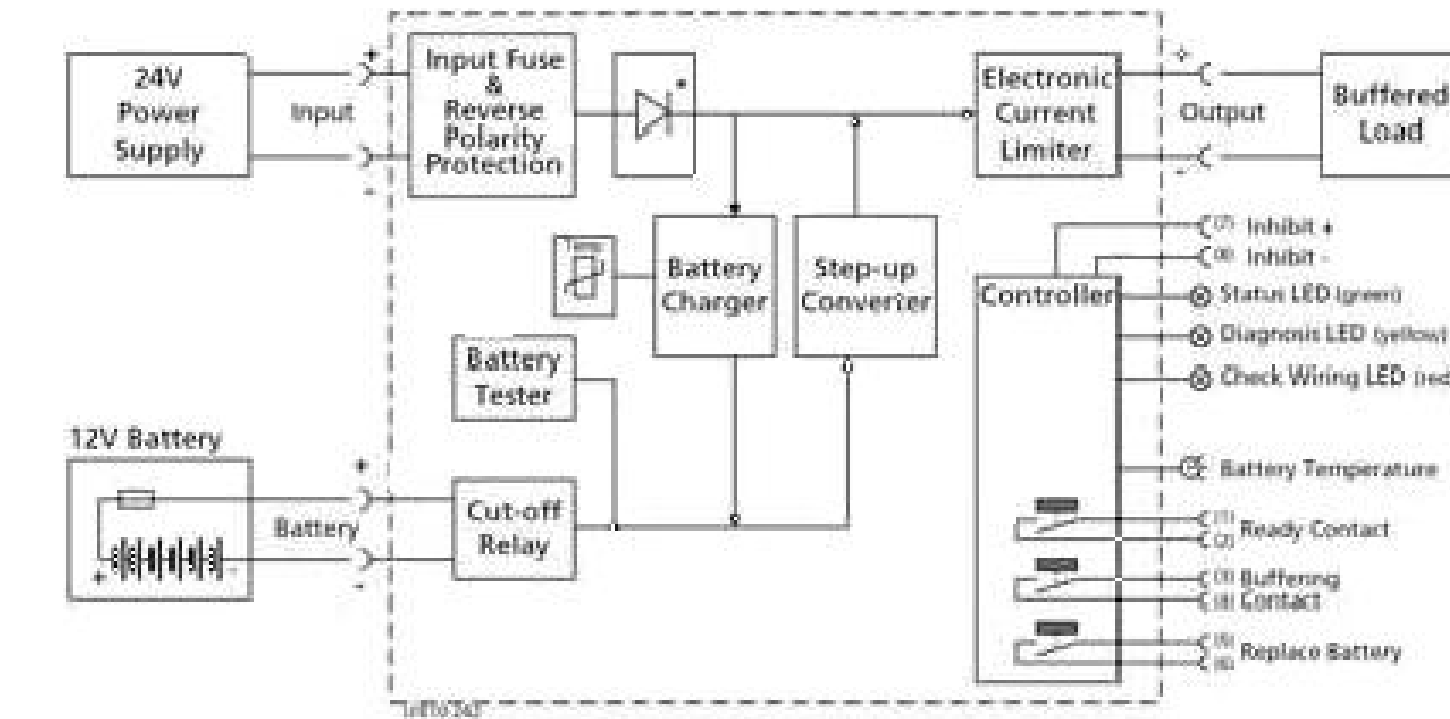
VOLTAGE & FREQUENCY PROTECTION	VFI Relay			Inverter		
	Pickup	Delay (sec)	Total Clearing Time* (sec)	Pickup	Delay (sec)	Total Clearing Time* (sec)
Under Frequency (81U2)	57.0 Hz	0.127	0.160	56.5 Hz	0.160	0.160
Under Frequency (81U1)	58.5 HZ	299.967	300.0	58.5 Hz	300.0	300.0
Over Frequency (81O1)	60.5 Hz	0.127	0.160	61.0 Hz	300.0	300.0
Under Voltage (27P2) (50% of Vnom _{L-N})	60.0 V	0.127	0.160	199.19V	0.160	0.160
Under Voltage (27P1) (88% of Vnom _{L-N})	105.6 V	2.0	2.0	350.57V	2.0	2.0
Under Voltage (59P1) (110% of Vnom _{L-N})	132.0 V	1.0	1.0	438.21V	1.0	1.0
Under Voltage (59P2) (120% of Vnom _{L-N})	144.0 V	0.127	0.160	478.05V	0.160	0.160
LROV Overvoltage (140% of Vnom _{L-N})	-	-	-	557.72V	-	1 ms

* Total Clearing time based on maximum VFI operating time of 2 cycles. Inverter power electronics have negligible operating time.

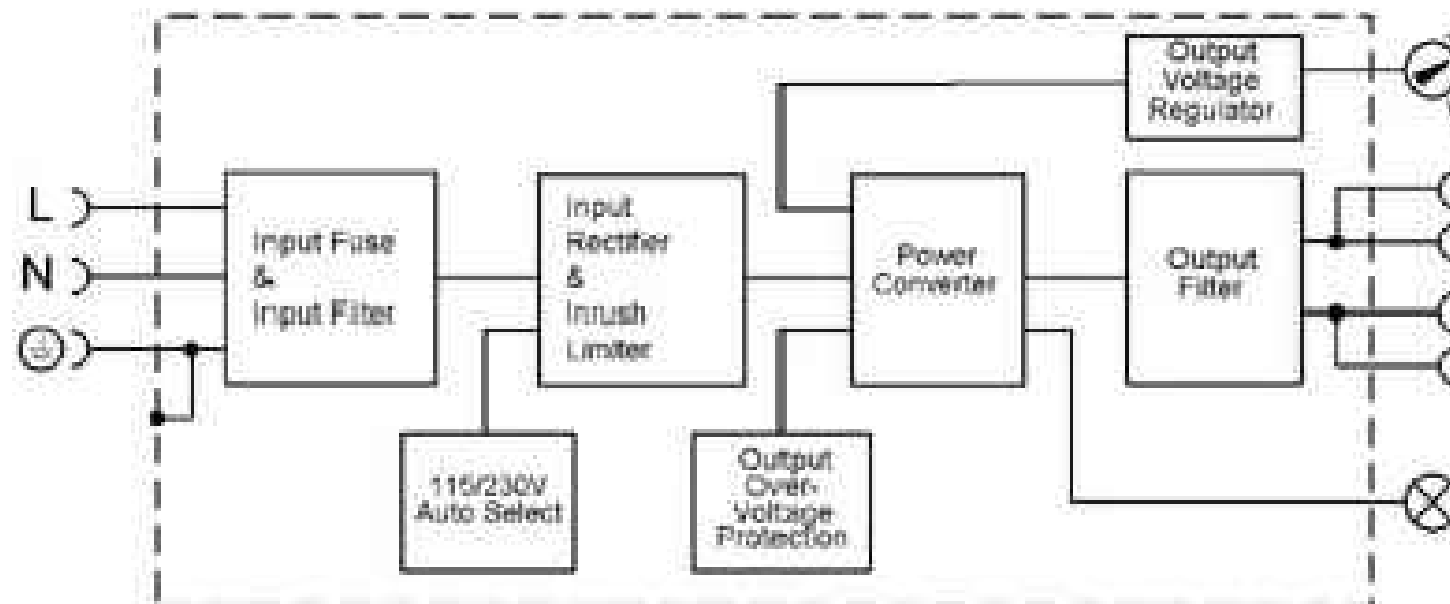
OVERCURRENT PROTECTION		
Voltage Ctrl Phase Inst Overcurrent Pickup (50P)	207.1 A, pri	(~125% normal load current)
Voltage Ctrl Phase Time Overcurrent Pickup (51P)	66.27 A, pri	(~40% normal load current)
Phase Overcurrent Time Dial (51PTD)	2	(~0.1 sec clearing time for high side 3PH fault)
Phase Overcurrent Curve Type (51PCT)	U4	(U.S. Extremely inverse)
Phase Overcurrent Voltage Control (51C)	105.6 V	(88% of Vnom _{L-N} ; Level 1 Undervoltage)
Residual Ground Time Overcurrent Pickup (51G)	82.8 A, pri	(50% of normal load current)
Residual Ground Time Dial (51GTD)	1	
Residual Ground Overcurrent Curve Type (51GCT)	U1	(U.S. Extremely inverse)
Residual Ground Overcurrent Delay (51GD)	0.07	(seconds)
Neutral Time Overcurrent Pickup (51N)	6	(Based on 4% unbalance in phase currents)
Neutral Time Dial (51NTD)	15	(~6 sec. clearing time for high side fault)
Neutral Overcurrent Curve Type (51NCT)	U4	(U.S. Moderately inverse)

TRIP AND BLOCK CLOSE LOGIC	
TRIP = TR OR 51PT OR 51GT OR 51NT OR 81U1 OR 81U2 OR 27P1 OR 27P2 OR 59P1 OR 59P2	
CLOSE = CL OR PB_1 AND !TMR1 :: Close Command OR Front Panel Push Button AND NOT(Timer 1)	
TMR1 PICKUP = !(27P1 AND 81U1) :: NOT(Level 1 Undervoltage AND Level 1 Underfrequency)	
TMR1 DELAY = 300 seconds :: 5 minutes above Level 1 Undervoltage AND Underfrequency thresholds	

4 AC Power Supply NTS



3 DC-UPS Control Unit NTS



Revisions #	DATE	DESCRIPTION
1	01/31/18	ADD GROUNDING XFMR SPEC
2	08/09/18	REDUCE SYSTEM TO 3.9MWAC
3	09/20/18	UTILITY REQUESTED REVISION
4	09/24/18	PER UTILITY REQUEST
5	09/27/18	PER UTILITY REQUEST
6	01/31/20	ADD DC COUPLED BESS SYSTEM

Prepared for:

Alco Finance Limited

222 S 9th Street, Suite 1600
 Minneapolis, MN 55402

Marlowe Solar

0 Spring Street
 Winchendon, MA

3.9MW Interconnection
 Online Diagram
 Concept

NOT FOR CONSTRUCTION

Date: 01/31/20

Drawing No. E.201



DIVISION OF
FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

July 27, 2020

Christopher Little
PLH LLC
222 S 9th Street, Suite 1600
Minneapolis, MN 55402

RE: Applicant: Christopher Little, PLH LLC
 Project Location: 0 Spring Street, Winchendon
 Project Description: Solar Facility
 NHESP File No.: **10-28278**

Dear Applicant:

The Natural Heritage & Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife (the "Division") received a MESA Project Review Checklist, site plan (dated 4/8/20) and supporting documentation for review pursuant to the Massachusetts Endangered Species Act (MESA) (MGL c.131A) and its implementing regulations (321 CMR 10.00).

The Division has determined that the proposed project is within the mapped *Priority* and *Estimated Habitat* of the Blanding's Turtle (*Emydoidea blandingii*) state-listed as Threatened. This species and its habitats are protected pursuant to the MESA (321 CMR 10.02).

Based on a review of the information provided and the information currently contained in our database, the Division has determined that this project, as currently proposed, **must be conditioned in order to avoid a prohibited Take of state-listed species (321 CMR 10.18(2)(a)).** **To avoid a prohibited Take of Blanding's Turtle** the following conditions must be met:

1. The Applicant shall submit a Blanding's Turtle Protection Plan. Said Protection Plan must be approved in writing by the Division prior to the start of Work. The Division is available for consultation on the development of the plan.
2. All erosion and sedimentation controls shall be removed and properly disposed of after the project is completed and as soon as surrounding areas are stabilized.

Provided the above-noted conditions are fully implemented and there are no changes to the project plans, this project will not result in a Take of state-listed species.

The Division notes that any future projects or activities proposed on the Property which are (a) located outside of the approval of the limit of Work shown on the site plan, (b) not exempt from review pursuant to 321 CMR 10.14, and (c) located within mapped Priority Habitat as indicated in the Massachusetts Natural Heritage Atlas, will require review by the Division pursuant to MESA. Furthermore, 321 CMR 10.16 provides that projects shall not be segmented or phased to evade

MASSWILDLIFE

or defer the review requirements under MESA. If the Division determines, based on the considerations provided for in 321 CMR 10.16, that a future project or activity proposed on the Property is part of a larger common project or scheme, it may evaluate the cumulative impacts of the existing and proposed segments of the common project when reviewing the future proposed project or activity pursuant to MESA.

This determination is a final decision of the Division of Fisheries and Wildlife pursuant to 321 CMR 10.18. This project may be subject to further review if no physical work is commenced within five years from the date of issuance of this determination, or if there is a change to the project. Please note that this determination addresses only the matter of state-listed species and their habitats. If you have any questions regarding this letter please contact David Paulson, Senior Endangered Species Biologist at 508-389-6366.

Sincerely,

A handwritten signature in black ink, reading "Everose Schlüter". The signature is written in a cursive, flowing style.

Everose Schlüter, Ph.D.
Assistant Director

cc: Whitney Beals, Kestrell Enterprises LP
Rodney Galton, Ecos Energy

SWCA

Phase I Environmental Site Assessment

Spring Street/Teel Road
Winchendon, Massachusetts

SWCA Project # 045286

October 25, 2017

SUBMITTED TO

Christopher Little
Kestrel Enterprises c/o Ecos Energy LLC
222 South 9th Street, Suite 1600
Minneapolis, MN 55402

SUBMITTED BY

SWCA Environmental Consultants
15 Research Drive
Amherst, MA 01002
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ENVIRONMENTAL CONSULTANTS

Sound Science. Creative Solutions.®

Amherst Office
15 Research Drive
Amherst, Massachusetts 01002
Tel 413.256.0202 Fax 413.256.1092

October 25, 2017

Christopher Little
Kestrel Enterprises Limited Partnership
c/o Ecos Energy LLC
222 South 9th Street, Suite 1600
Minneapolis, MN 55402

**Re: Phase I Environmental Site Assessment Report
Spring Street/Teel Road
Winchendon, Massachusetts**

SWCA Project No. 045286

Dear Mr. Little:

SWCA Environmental Consultants (SWCA) is pleased to submit this Phase I Environmental Site Assessment (ESA) for the above-referenced Site. This report was prepared to evaluate the Site for evidence of a release of oil or hazardous materials as defined by Massachusetts General Law, Chapter 21E, and was conducted in general accordance with ASTM Standard Practice E1527-13, which includes All Appropriate Inquiry. This report may be relied upon for a period of 180 days after certain supporting inquiries of the ESA were made; thereafter, elements of the report may need to be updated, pursuant to ASTM E1527-13.

We declare that, to the best of our professional knowledge and belief, we meet the definition of Environmental Professional as defined in § 312.10 of 40 CFR Part 312. We have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. We have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

SWCA appreciates the opportunity to provide these services. Please do not hesitate to contact us if you have any questions.

Sincerely,

A handwritten signature in blue ink that reads 'Joel Harris'.

Joel Harris
Project Manager

A handwritten signature in blue ink that reads 'John P. Jemsek'.

John P. Jemsek, Ph.D., LSP
Remediation Team Lead/Sr. Hydrogeologist

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	Objective	1
1.2	Scope of Services	1
1.3	Deviations	2
1.4	Limitations & Exceptions	2
1.5	User Reliance	2
1.6	Abbreviations	2
2.0	SITE OVERVIEW	3
2.1	Site Background	3
2.2	Environmental Setting	4
3.0	USER PROVIDED INFORMATION	4
3.1	Environmental Liens or Activity and Use Limitations (AUL)	4
3.2	Specialized Knowledge or Experience of the User	4
3.3	Valuation Reduction for Environmental Issues	4
3.4	Owner, Property Manager, and Occupant Information	5
3.5	Reason for Performing the Phase I	5
4.0	SITE HISTORY	5
4.1	Interviews	5
4.1.1	Interview with Owner	5
4.1.2	Interview with Site Manager	5
4.1.3	Interview with Occupants	5
4.1.4	Interview with Local Government Officials	5
4.1.5	Interview with Others	6
4.2	Site Ownership	6
4.3	Previous Environmental Reports	6
4.4	Review of Historical Sources	6
4.4.1	historical aerial photographs	6
4.4.2	historical topographic maps	7
5.0	SITE RECONNAISSANCE	7
5.1	Methodology and Limiting Conditions	7
5.2	General Site Observations	7
5.3	Petroleum and Hazardous Materials, Use, Storage and Generation	8
5.4	Floor Drains, Sumps, Pits and Lagoons	8
5.5	Potential PCB-Related Equipment	8
5.6	Solid Waste Disposal	8
5.7	Stained Surfaces and Distressed Vegetation	8
5.8	Underground Structures	8

6.0	REGULATORY REVIEW	8
6.1	Federal and State/Tribal Databases	8
6.2	Municipal Regulatory Review	9
7.0	NEIGHBORING PROPERTIES	10
7.1	Description of Adjoining Properties	10
7.2	Vapor Encroachment Screening	10
8.0	ADDITIONAL SERVICES	10
9.0	DATA GAPS, FINDINGS AND CONCLUSIONS	10
9.1	Data Gaps.....	10
9.2	Findings & Conclusions	11
10.0	References	11

LIST OF FIGURES

Figure 1	Locus Map
Figure 2	Orthophotograph

PHOTOGRAPHS

LIST OF APPENDICES

APPENDIX A	Consulting Agreement
APPENDIX B	Municipal Office Records
APPENDIX C	Environmental Data Resources (EDR) Report
APPENDIX D	User Questionnaire
APPENDIX E	Qualifications of Environmental Professionals and Staff

1.0 INTRODUCTION

SWCA Environmental Consultants (SWCA) was retained by Kestrel Enterprises Limited Partnership to conduct a Phase I Environmental Site Assessment (Phase I ESA) of the undeveloped property located on Spring Street and Teel Road in Winchendon, Massachusetts (the "Site", **Figure 1**). The subject area of the Phase I ESA consists of Parcels 9-0-97 and 9-0-98 with a total area of approximately 72.9 acres.

1.1 OBJECTIVE

The objective of this Phase I ESA was to identify recognized environmental conditions (RECs) present at the Site. As defined by the American Society for Testing and Materials (ASTM) *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, E1527-13*, (ASTM E1527-13), RECs are defined as follows:

. . . the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: (1) due to any release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment. De minimis conditions are not recognized environmental conditions.

ASTM E1527-13 further defines two subcategories of RECs: historical recognized environmental condition (HREC) and controlled recognized environmental condition (CREC). A HREC is a result of a past release of hazardous substances or petroleum products that has been adequately addressed from a regulatory perspective, and the Site subsequently meets unrestricted use criteria as defined by the regulations. A CREC, similar to a HREC, indicates that hazardous substances or petroleum products remain at the Site that are managed via implementation of institutional and/or engineering controls, e.g., an Activity and Use Limitation in Massachusetts.

In portions of this report, SWCA has referred to regulations and/or databases maintained by the Commonwealth of Massachusetts Department of Environmental Protection (MassDEP). In particular, Massachusetts Oil and Hazardous Material (OHM) Release Prevention and Response Act [MGL c. 21E], and the Massachusetts Contingency Plan (MCP) [310 CMR 40.0000] and other pertinent policies and guidelines concerning the release of hazardous substances or petroleum to the environment are considered, where applicable.

1.2 SCOPE OF SERVICES

This investigation was conducted in general conformance with the ASTM E1527-13, which was adopted for the purpose of providing a standard investigative approach that would be sufficient to provide "all appropriate inquiry (AAI) into the previous ownership and uses of the property consistent with good commercial and customary practice." The investigation included a review of local and regulatory files pertaining to the Site and surrounding area, interviews, a Site reconnaissance, and preparation of this report.

This scope of services is based on non-intrusive investigation methods only, and does not include subsurface investigation, sampling, or laboratory analysis of soil, groundwater or air, unless otherwise noted. Assessment of asbestos-containing building materials, biological agents, polychlorinated biphenyls (PCBs), lead-based paint, lead in drinking water, formaldehyde, mercury, radon or mold were not conducted as part of this Phase I ESA. No waste sampling was conducted. Furthermore, SWCA did not investigate the potential for the Site to contain endangered species, ecological resources or historic/ cultural resources. Additionally, environmental compliance or wetlands issues were not considered during this investigation, nor were health & safety or matters related to industrial hygiene at any facility at the Site.

1.3 DEVIATIONS

There are no known deviations from ASTM E1527-13 within this report.

1.4 LIMITATIONS & EXCEPTIONS

SWCA was authorized to complete the work by the Client, subject to the Remediation Services Agreement provided within **Appendix A**. The site inspection and reconnaissance included the inspection of the property for evidence of RECs as defined by ASTM Standard E1527-13. The findings of this investigation are based, in part, on information provided by third parties. SWCA provides no warranties regarding the accuracy of information provided by third parties.

1.5 USER RELIANCE

This report was prepared for the Client who is a prospective purchaser of the Site and the User of this report as defined by ASTM. The project lenders can rely on this report as if it were addressed to them and is not to be relied upon by any other party without the written authorization of SWCA. Use and/or reliance on this report are subject to all limitations specified in ASTM E1527-13 and as specifically noted in the report itself.

1.6 ABBREVIATIONS

Abbreviations used in this report are as follows:

AST	aboveground storage tank
ASTM	American Society of Testing and Materials
AUL	Activity and Use Limitation
CERCLIS List	Comprehensive Environmental Response Compensation Liability Information System List
CREC	Controlled Recognized Environmental Condition
ERNS	Emergency Response Notification System
HREC	Historical Recognized Environmental Condition
MassDEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan [310 CMR 40.0000]
NGVD	National Geodetic Vertical Datum
NPL	National Priorities List
OHM	oil and hazardous materials
ppm	parts per million
PSS	Permanent Solution Statement
RAO	Response Action Outcome
RCRA	Resource Conservation Recovery Act
REC	Recognized Environmental Condition
RTN	Release Tracking Number
SWCA	SWCA Environmental Consultants
TSD	treatment, storage, and disposal
URAM	Utility Response Abatement Measure
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
UST	underground storage tank
WMECO	Western Massachusetts Electric Company

2.0 SITE OVERVIEW

2.1 SITE BACKGROUND

The following description of Site characteristics is based on information provided by municipal agencies, review of the pertinent USGS topographic map, a portion of which is reproduced as **Figure 1** and observations during the Site reconnaissance conducted on **September 12, 2017** by Joel Harris of SWCA. Photographs taken at the Site are included in the **Photographs** attachment of this report, and a copy of the Assessor’s information is included in **Appendix B**. An aerial photograph showing the extent of the Site subject to this ESA is presented within **Figure 2**.

GENERAL SITE INFORMATION	
Site Name:	Proposed Solar Array Location
Site Location/Address:	Spring Street and Teel Road Winchendon, Massachusetts
County:	Worcester County
Tax Map Designation/Property ID:	Parcel 9-0-97 (northern parcel) & Parcel 9-0-98 (southern parcel)
Site Owner:	Kestrel Enterprises Limited Partnership 10 Chestnut Hill Road Southborough, MA 01772
Site Occupants:	Undeveloped
Last Sale Date of Property:	Parcel 9-0-97 acquired on 8/30/1994 Parcel 9-0-98 acquired on 9/19/1990
Land Area:	72.9 acres
Site Improvements:	Undeveloped
Year Built:	NA
Basement:	NA
Floor Drains:	NA
Building Heating Source:	NA
On-Site Fuel Sources:	NA
USTs or ASTs:	NA
Water Supply:	NA
Wastewater Disposal:	NA
Zoning of Facility:	Residential B
Zoning of Surrounding Properties:	Residential B
Site Topographic Relief:	Site topography includes a pond in the western portion of the Site; an unnamed stream along the northeast border of the Site; and a ravine that runs through the central portion of the Site.
USGS Quadrangle:	Ashburnham & Winchendon, Massachusetts (2012)
UTM Coordinates (18N):	255129.8 E 4726205.5 N Zone 19

Note that both subject parcels border the town line with Ashburnham, Massachusetts. Teel Road and Spring Street continue into Ashburnham as Old County Road and Winchendon Road, respectively.

2.2 ENVIRONMENTAL SETTING

Key factors with regard to the topography, surface water drainage and hydrogeology are discussed below.

ENVIRONMENTAL SETTING INFORMATION	
Topography:	Refer to Figure 1
Site Elevation:	Site elevation ranges from approximately 1,110 feet above mean sea level on the hill located on the northeast portion of the Site down to approximately 1,015 feet at the northwest corner of the Site along Spring Street.
Site Slope:	The northeast portion of the Site consists of a hill and the Site slopes down to the north, west and southwest from this area. A plateau at elevation 1050 occupies the southeastern portion of the Site.
Regional Surface Water Drainage Direction:	Surface water for the northern half of the Site would flow from the hill located on the northwest portion of the Site downslope towards the northwest and west towards wetlands to the west and the Millers River which flows across the northwest corner of the Site. Surface water on the southern half of the Site would flow to the west and southwest to wetlands located on the Site.
Closest Surface Water Feature:	Wetlands are located on the southwest portion of the Site which flow west to Lost Lake, located approximately 500 feet west of the Site. The outlet of Lost Lake flows into the Millers River which flows across the northwest corner of the Site.
Estimated Groundwater Flow Direction:	Regional groundwater flow in the Site vicinity is estimated to mimic surface water and flow down from the higher northern and central portions of the Site to the northwest, west and southwest.

3.0 USER PROVIDED INFORMATION

3.1 ENVIRONMENTAL LIENS OR ACTIVITY AND USE LIMITATIONS (AUL)

Information obtained from the local municipal offices (**Appendix B**), State file databases and from the EDR report (see **Appendix C**) suggests that no environmental liens or AULs are in place for the Site.

Environmental lien and activity and use limitation records recorded against the site were not provided by the Client. At the direction of the Client, performance of a review of these records was not included as part of the scope of services and unless notified otherwise, it is assumed that the Client is evaluating this information outside the scope of this report.

3.2 SPECIALIZED KNOWLEDGE OR EXPERIENCE OF THE USER

Mr. Christopher Little, Vice President of Ecos Energy, LLC and representative for the User, completed a User Questionnaire for the Site, which has been included as **Appendix D**. The user did not communicate any specialized knowledge with regard to environmental issues or liabilities about the Site.

3.3 VALUATION REDUCTION FOR ENVIRONMENTAL ISSUES

There is no known reduction in value of the Site due to environmental contamination issues.

3.4 OWNER, PROPERTY MANAGER, AND OCCUPANT INFORMATION

The owner's representative for the Site, Mr. Whitney Beals, of Kestrel Enterprises Limited Partnership was interviewed regarding the Site. The Site is undeveloped and no occupant exists for the Site.

3.5 REASON FOR PERFORMING THE PHASE I

The Phase I Environmental Site Assessment Report is being prepared to assess the current and historic environmental status of the property. This information is typically used to evaluate potential environmental, and therefore financial, risk associated with a property.

4.0 SITE HISTORY

Historical information pertaining to the Site was acquired through a review of the following sources:

- Interviews with select individuals that have knowledge of the Site.
- Review of any existing environmental reports.
- Review of Sanborn Fire Insurance Rate Maps, aerial photographs, city directories, historical topographic maps and/or miscellaneous site plans, if readily available.

4.1 INTERVIEWS

4.1.1 INTERVIEW WITH OWNER

SWCA interviewed the owner's representative for the Site, Mr. Whitney Beals, of Kestrel Enterprises Limited Partnership, regarding Site use history. He indicated that the northern portion of the Site (Parcel 9-0-97) was acquired in a FDIC auction in August 1994 as a depleted gravel pit and it has been undeveloped since that time. Mr. Beals indicated that the southern portion of the Site (Parcel 9-0-98) was acquired in September 1990 and is currently in a Chapter 61 trust for forest use and occasional logging. He stated that there is a current earth removal permit for the Site which included groundwater observation wells. Mr. Beals was unaware of the use/storage/release of oil and/or hazardous materials at the Site. He was also not aware of any previous environmental reports for the Site.

4.1.2 INTERVIEW WITH SITE MANAGER

The Site owner's representative, Mr. Whitney Beals, of Kestrel Enterprises Limited Partnership, is also the Site Manager. SWCA's interview with Mr. Beals is provided above in Section 4.1.1.

4.1.3 INTERVIEW WITH OCCUPANTS

The Site is undeveloped and no current occupants exist at the Site.

4.1.4 INTERVIEW WITH LOCAL GOVERNMENT OFFICIALS

SWCA contacted the Town of Winchendon Fire Department regarding records of current/former storage tanks for the Site. According to the fire department officials, there are no records of current/former storage tanks for the Site or vicinity.

SWCA contacted the Town of Winchendon Board of Health to review any available files for the Site. According to the municipal officials, there are no records of environmental violations or compliance issues currently for the Site.

4.1.5 INTERVIEW WITH OTHERS

No others were interviewed regarding the Site.

4.2 SITE OWNERSHIP

Records obtained from the Town of Winchendon Assessor's Office were reviewed for past property ownership for the Site Parcels, which have had common ownership. A summary of the property ownership is as follows:

Parcel #	Date of Purchase	Grantor	Grantee	Volume/Page Number
9-0-97	8/30/1994	G.R.O.W.T.H., INC.	Kestrel Enterprises Limited Partnership	Book 16541/Page 95
	2/27/1987	Anne Babineau Tr and Timberland Realty Trust	G.R.O.W.T.H., INC.	Book 10249/Page 97
9-0-98	9/19/1990	Philip Beals, Bank of New England, and George C Beals	Kestrel Enterprises Limited Partnership	Book 13007/Page 268

Note that this ownership review does not constitute a full title search. The previous ownership of Parcel 9-0-98 cannot be construed from the referenced deed, but the parcel is suspected of being in the Beals family for scores of years. Property cards from the municipal review are provided in **Appendix B**.

4.3 PREVIOUS ENVIRONMENTAL REPORTS

Previous environmental reports were not reviewed for the Site.

4.4 REVIEW OF HISTORICAL SOURCES

4.4.1 HISTORICAL AERIAL PHOTOGRAPHS

SWCA reviewed available historical aerial photographs for the Site for the years 1938, 1952, 1963, 1969, 1975, 1981, 1985, 1995, 1997, 2006, 2008, 2010 and 2012.

- 1938 and 1952 aerials: the Site appears as undeveloped woodlands. A residential farmhouse along Winchendon Road (Ashburnham) and agricultural fields abut the Site to the east.
- 1963 aerial: a clearing is visible on the central portion of the Site with approximately 200 automobiles parked on it and appears to be an automobile salvage yard. The clearing is visible in the 1969 aerial with approximately 100 automobiles visible parked on it.
- 1975 through 1997 aerials: the northern portion of the Site appears an active gravel pit and the southern portion appears as undeveloped woodlands. The property to the north of the Site across Spring Street has been cleared and is occupied by an automobile salvage yard.
- 2006 through 2012 aerial: the gravel pit operations appear to have ceased and the majority of the Site appears leveled and cleared with undeveloped woods in the northeast, center and southwest. The

automobile salvage yard to the north of the Site across Spring Street has expanded to the north during this time period.

4.4.2 HISTORICAL TOPOGRAPHIC MAPS

SWCA reviewed available historical topographic maps for the Site for the years 1946 and 1950. According to the topographic maps, the Site is shown as undeveloped land for the years reviewed with several buildings visible along Spring Street (State Route 12) to the northeast of the Site.

5.0 SITE RECONNAISSANCE

5.1 METHODOLOGY AND LIMITING CONDITIONS

SWCA personnel conducted a visual inspection of the Site on **September 12, 2017**. Photo documentation of the Site collected at the time of the visual reconnaissance is attached within the **Photographs** section. General Site information provided in **Section 2.1** of this report was also confirmed during the Site visit. A summary of the Site reconnaissance findings is provided below, followed by descriptions in corresponding subsections.

Potential Concerns Noted During the Site Reconnaissance	Yes - Present/ No - Absent
Hazardous Substances and Petroleum Products (Sec. 5.3)	No
Underground Storage Tanks (Sec. 5.3)	No
Aboveground Storage Tanks (Sec. 5.3)	No
Drums (Sec. 5.3)	No
Chemical Containers (> 5 Gal) (Sec. 5.3)	No
Sumps and Interior Floor Drains (Sec. 5.4)	No
Pits, Ponds and Lagoons (Sec. 5.4)	No
Potential PCBs in Electrical or Hydraulic Equipment (Sec. 5.5)	No
Solid Waste Disposal (Sec. 5.6)	Yes
Stained Soil or Pavement, Stressed Vegetation (Sec. 5.7)	No
Interior Stains or Corrosion (Sec 5.7)	No
Catch Basin or Stormwater Conveyance (Sec. 5.8)	No
Dry, Irrigation, Injection or Others Wells (Sec. 5.8)	No
Septic Systems or Cesspools (Sec. 5.8)	No

5.2 GENERAL SITE OBSERVATIONS

SWCA observed the Site conditions on the day of the Site visit. The Site consisted of undeveloped woodlands, gravel and sand pits, gravel access roads and wetlands. No evidence of structures were observed by SWCA on the Site, except for some stone walls.

5.3 PETROLEUM AND HAZARDOUS MATERIALS, USE, STORAGE AND GENERATION

SWCA observed a target shooting area on a soil berm located on the west edge of the large open cleared area in the center of the Site, as noted in **Figure 2**. SWCA observed wooden and plastic targets that had numerous holes in them and bullet casings in the area. According to the Site owner's representative, the shooting is being done informally by trespassers without permission. The presence of a shooting range on the Site is considered a Recognized Environmental Condition (REC) due to potential surface soil impacts from the lead shot.

5.4 FLOOR DRAINS, SUMPS, PITS AND LAGOONS

SWCA did not observe evidence of floor drains, sumps, pits or lagoons at the Site.

5.5 POTENTIAL PCB-RELATED EQUIPMENT

SWCA did not observe evidence of PCB-related equipment on or near the Site.

5.6 SOLID WASTE DISPOSAL

SWCA also observed a pile of concrete and several tires located in the large cleared area on the northern portion of the Site.

5.7 STAINED SURFACES AND DISTRESSED VEGETATION

No evidence of leaks or stains of OHM were noted during observations of the Site.

5.8 UNDERGROUND STRUCTURES

SWCA did not observe evidence of underground structures at the Site. According to the Site owner's representative, there are groundwater monitoring wells on the southern portion of the Site formerly used to monitor the former gravel pit. SWCA did not observe the monitoring wells on the day of the Site visit.

6.0 REGULATORY REVIEW

6.1 FEDERAL AND STATE/TRIBAL DATABASES

Reviews of standard state and federal environmental record sources pertaining to the Site and surrounding areas were conducted electronically through an Environmental Data Resources, Inc. (EDR) database search dated **September 22, 2017**. A copy of the EDR report is included in **Appendix C**. The minimum search distances suggested in the ASTM guidance document were used in order to assess the likelihood of off-site migration of OHM onto the Site. A summary of the databases reviewed by EDR, and the radius for which the search was conducted, is summarized in the table below. SWCA provides no warranties on, and conducted no independent investigations to verify information provided by third parties.

Summary of Federal and State/Tribal Databases Searched		
Database	Radius	Sites Found
NPL	1.0 mile	0
CERCLIS	0.5 mile	0
NFRAP	0.5 mile	0
RCRA CORRACT	1.0 mile	0
RCRA TSD	0.5 mile	0
RCRA GEN	0.25 mile	0
Federal IC/EC	0.5 mile	0
ERNS	0.125 mile	0
State CERCLIS	1.0 mile	1
Solid Waste Landfills	0.5 mile	0
Registered LUST/LAST	0.5 mile	0
Registered UST/AST	0.25 mile	0
State IC/EC	0.5 mile	0
State Brownfield	0.5 mile	0
Federal Brownfield	0.5 mile	0

The Site was not identified in the EDR Report. The EDR report did not identify any NPL, CERCLIS, NFRAP, RCRA CORRACT, RCRA TSD, RCRA GEN, FED IC/EC or ERNS, Solid Waste Landfills, Registered LUST/LAST, Registered UST/AST, State IC/EC, State Brownfield, or Federal Brownfield sites within the respective AAI search distances (0.125-1.0-mile radius, (see above table) of the Site. The report identified one (1) State CERCLIS site within the search radius (1.0-mile) of the Site.

The EDR listing described above in the Site vicinity does not appear to represent a REC based upon apparent topographic gradient, regulatory status and/or relative distance from the Site.

6.2 MUNICIPAL REGULATORY REVIEW

Information from the Town of Winchendon Assessor’s Office indicates that Site is owned by Kestrel Enterprises Limited Partnership who acquired Parcel 9-0-97 in August 1994 and Parcel 9-0-98 in September 1990. The Site is zoned Industrial. Assessor’s information is included in **Appendix B**.

As described above in Section 4.1.4, SWCA contacted the Town of Winchendon Fire Department and Board of Health regarding available records for the Site. According to the fire department officials, there are no records of current/ former storage tanks for the Site.

According to the Town of Winchendon Board of Health Department officials, there are no records of environmental violations or compliance issues for the Site.

7.0 NEIGHBORING PROPERTIES

7.1 DESCRIPTION OF ADJOINING PROPERTIES

Based on a review of State and local records, along with cursory visual observations of the property from the Site boundaries, properties adjoining the Site include the following:

Direction from Site	Description
North:	Spring Street (State Route 12) to the north followed by the Millers River and vacant woodlands. Auto/Truck recycling business to the northwest across Spring Street and residential house to the northeast.
South:	Partially cleared land with gravel roads and undeveloped woods to the south.
East:	Undeveloped woodlands, wetlands and Lost Lake to the east.
West:	Undeveloped woodlands to the west.

7.2 VAPOR ENCROACHMENT SCREENING

A preliminary vapor encroachment screening was conducted for the Site utilizing ASTM *Standard Guide for Vapor Encroachment Screening on Property Involved in Real Estate Transactions, E2600-10* (ASTM E2600-10). The evaluation of the potential for the presence of “vapors that have migrated into a building . . . from a release outside the building” was made in consideration of ASTM E1527-13 requirements. Specific chemicals of concern from properties of concern within distances of the Site specified by ASTM E2600-10 were reviewed as follows:

- Off-site properties with non-petroleum hydrocarbons/volatile hazardous substances within 0.3 mile of the Site.
- Off-site properties with petroleum hydrocarbons/semi-volatile hazardous substances within 0.1 miles of the Site.

Records of potential environmental issues listed at the Site or within the above search radii were reviewed utilizing the available Site information provided within this ESA and specifically the database report in **Appendix C**.

There were no relevant environmental issues found for the properties within the search radii presented above.

8.0 ADDITIONAL SERVICES

No additional services that have been conducted in completing this Phase I Environmental Site Assessment other than that required within ASTM E1527-13.

9.0 DATA GAPS, FINDINGS AND CONCLUSIONS

9.1 DATA GAPS

ASTM E1527-13 requires the identification and evaluation of data gaps or data failures, which are defined as a lack of or inability to obtain information required by the ASTM standard practice, despite good faith efforts by the environmental professional to gather such information.

SWCA identified one (1) data gap during this assessment. According to SWCA's review of historical aerial photographs, an automobile salvage yard, including a gravel parking area with up to 200 automobiles, was formerly located on the center of the Site from the early 1960s through at least 1969. The parked cars were subsequently removed and the gravel parking area developed as a gravel quarry and the soil disturbed and/or removed. SWCA was unable to determine if the historic use of the center of the Site as an automobile salvage yard impacted soil conditions in this area because the soil was subsequently disturbed by the gravel quarry. SWCA did not observe evidence of use/storage/release of OHM in the vicinity of the former automobile parking area on the day of the Site visit.

9.2 FINDINGS & CONCLUSIONS

SWCA has conducted a Phase I Environmental Site Assessment of two undeveloped parcels (Parcel 4-1A & 4-3) located on Spring Street and Teel Road in Winchendon, Massachusetts, in conformance with the scope and limitations of ASTM Practice E1527-13. Any exceptions to, or deletions from, this practice are described in **Sections 1.3 & 1.4** of this report.

This assessment has revealed evidence of one (1) Recognized Environmental Condition (REC) in connection with the Site. SWCA observed a target shooting area on a soil berm located on the west edge of the large, open cleared area located in the center of the Site. SWCA observed wooden and plastic targets that had numerous holes in them and bullet casings in the area. According to the Site owner's representative, the shooting is being done informally by trespassers without permission. The presence of a shooting range on the Site is considered a Recognized Environmental Condition (REC) due to potential surface soil impacts from the lead shot.

Note that there is a low level of environmental concern regarding the presence of the former autos parked where a gravel pit is developed. It is unlikely that any evidence of potential releases of automotive fluids from the parked cars exists in soil due to subsequent development of the gravel pit. Additionally, the former parked vehicles area do not appear to be associated with any vehicle repair operations.

SWCA has followed the guidelines described in ASTM E1527-13 to identify any RECs at the Site in a manner consistent with standard practice in the industry. However, as indicated in the ASTM standard, "No environmental site assessment can wholly eliminate uncertainty regarding the potential for RECs in connection with a property. Performance of this practice is intended to reduce, but not eliminate, uncertainty regarding the potential for RECs in connection with a property, and the practice recognizes reasonable limits of time and cost."

10.0 REFERENCES

ASTM Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, E1527-13, 2013.

ASTM Standard Guide for Vapor Encroachment Screening on Property Involved in Real Estate Transactions, E2600-10, 2010.

Environmental Data Resources, Inc. (EDR) Report, dated September 22, 2017.

Interview with Site owner, Mr. Whitney Beals of Kestrel Enterprises Limited Partnership.

Massachusetts Department of Environmental Protection (MassDEP) List of Disposal Sites and Locations to Be Investigated, Landfill or Solid Waste Disposal Sites List, Leaking and Registered UST Lists, Institutional/Engineering Control Registry, Voluntary Cleanup Sites List, Brownfields Site List.

Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Environmental Affairs.

Town of Winchendon Assessor's Office, Maps and Field cards.

Town of Winchendon Fire Department, Storage Tank Records.

United States Environmental Protection Agency (USEPA) Comprehensive Environmental Response Compensation and Liability Information System Listing (CERCLIS List), National Priorities List (1.0 mile radius), Resource Conservation and Recovery Act (RCRA) Treatment, Storage and Disposal (TSD) Facilities List, RCRA CORRACTS facilities list (1.0 mile), RCRA Generators List (site and adjoining properties), and Emergency Response Notification System (ERNS) List (site only).

U.S. Geological Survey (USGS). Ashburnham & Winchendon, Massachusetts (2012) 7.5-minute quadrangle map.

SWCA

FIGURES:

Figure 1 Site Location Map

Figure 2 Site Plan

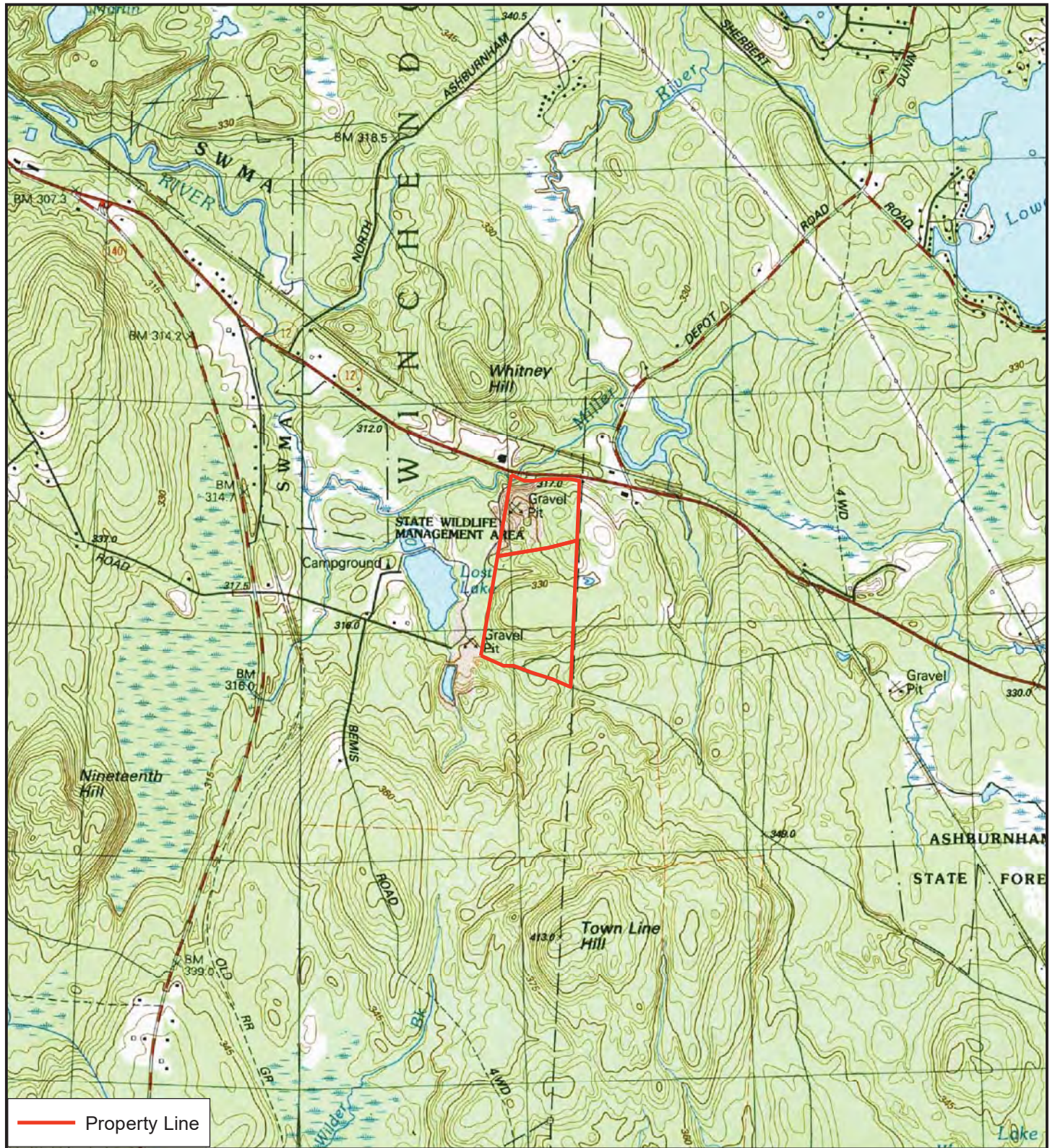


Figure1. USGS Topographic Map

**Spring Street/Teel Road
Winchendon, Massachusetts**

26 Sep 2017
SWCA Project No.: 045286

Data Source: Office of Geographic Information (MassGIS)

USGS Ashburnham, MA Quad [71] (1988)



Latitude 42° 39' 8" N
Longitude -71° 59' 14" W

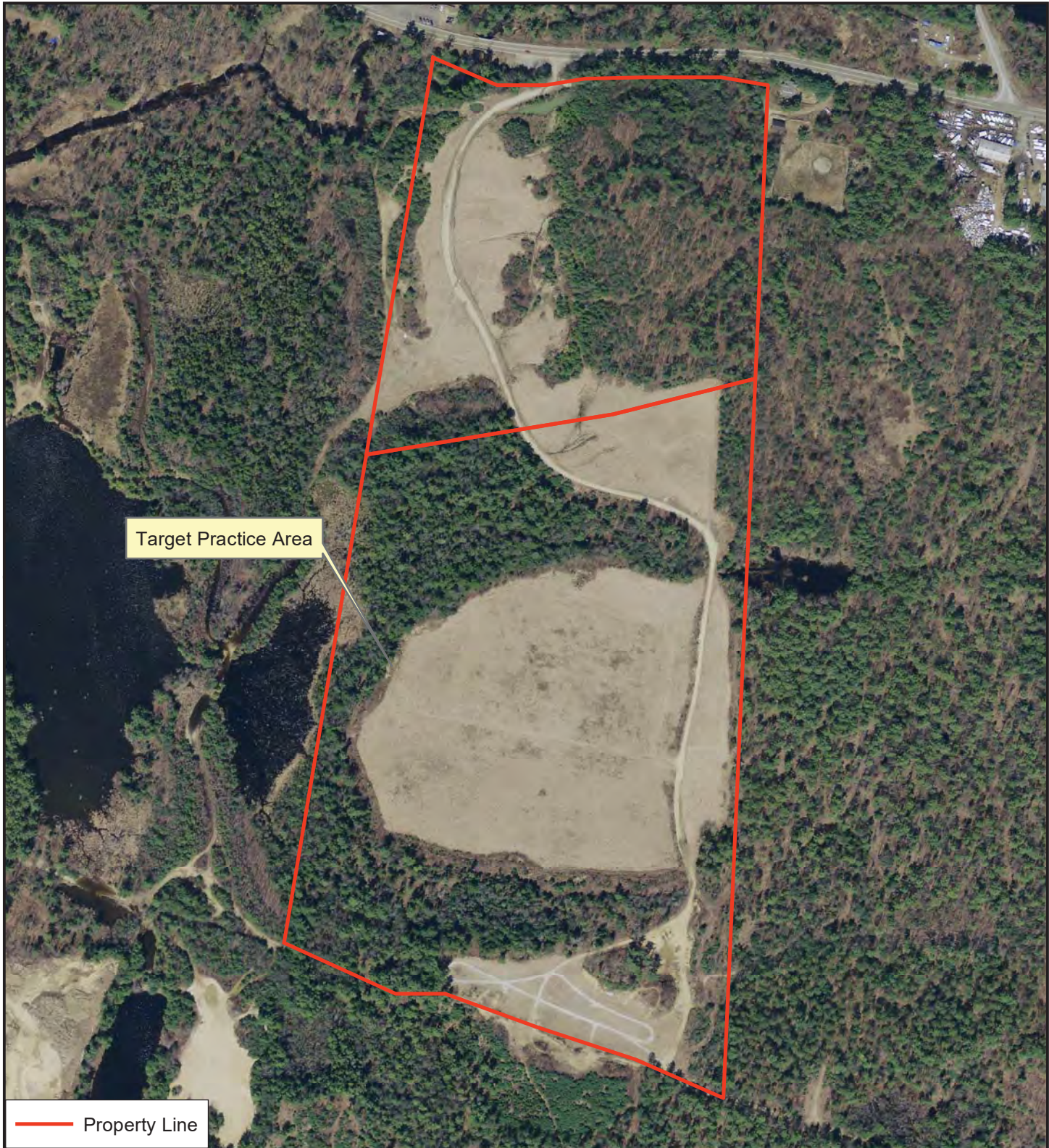


Figure 2. Site Plan

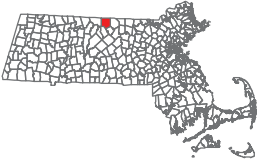
**Spring Street/Teel Road
Winchendon, Massachusetts**

26 Sep 2017
SWCA Project No.: 045286

Data Source: Office of Geographic Information (MassGIS)

Date of Photo: 2013

0 210 420 Feet



Latitude 42° 39' 8" N
Longitude -71° 59' 14" W



SWCA

PHOTOGRAPHS



Paved parking area at entrance to Site along Winchendon Road.



View of grass covered field and gravel access road on northern portion of Site.



View of pile of concrete and tires on northern portion of Site.



View of grass covered area near the middle of the Site.



View of target shooting area along the western edge of the middle portion of the Site.



View of grass covered area and gravel trails on southern portion of the Site.

WINCHENDON SOLAR
SPRING STREET
WINCHENDON, MA 01475

STORMWATER REPORT

PROJECT APPLICANT

Ecos Energy
222 South 9th Street
Suite 1600
Minneapolis, MN 55402

Table of Contents

Project Overview	2
Pre-Development Site Conditions.....	2
Post-Development Site Conditions	2
Post-Development Wetland Resource Impacts.....	3
MassDEP Stormwater Management Standards	3
Appendices.....	8

Project Overview

The Site consists of a vacant gravel operation. The land is currently a combination of gravel access roads, grass and wooded area. The property is located in the industrial zone and shown as lot 9-0-97 and lot 9-0-98 off of Spring Street (Route 12) in Winchendon, Massachusetts. The parcel is 71.2 ± acres. Proposed is the installation of ground mounted solar photovoltaic panels. This hydrology report has been prepared per the requirements set forth by the Massachusetts Department of Environmental Protection's Stormwater Management Standards and focuses on the 71.2 acres of land to be developed into the solar facility.

Pre-Development Site Conditions

The existing site use of the area to be developed consists of perimeter woodlands and the majority of the site is disturbed grassland. Wetlands on site were field delineated by New England Environmental Design, LLC. All documents and exhibits within this report are based on the surveyed field delineation data. The existing soils on site are primarily loamy sands with 2% to 6% slopes, runoff calculations have utilized the attached soils map to determine the Hydrologic Soil Groups (*Appendix A*).

HydroCAD stormwater modeling software was used for all runoff calculations, and the site was broken into watersheds determine by discharge locations.

Existing drainage for the site was modeled into 8 watersheds;

- 1 is 10.68 acres and drains to offsite to the North and North West.
- 2 is 3.35 acres and drains to a wetland located to the Northeast property line.
- 3 is 11.65 acres and drains to a wetland located along the West property line of the site.
- 4 is 10.41 acres and drains to a wetland that runs nearly the width of the property.
- 5 is 0.39 acres and drains to the Southeast.
- 6 is 21.31 acres and drains to the Southwest of the property.
- 7 is 9.95 acres and drains to a wetland in the Southwest corner of the property.
- 8 is 3.46 acres and drains to the South property line.

The hydrology was modeled as a Type III 24-hr storms, for 2-year (2.88"), 10-year (4.38") and 100-year (6.77") storm events. The storm events were taken from the latest NOAA Atlas 14 data sets (*Appendix B*).

Post-Development Site Conditions

The proposed solar facility will have a footprint of approximately 50 acres inside the project's perimeter fencing. All solar panels will be installed on racking approximately 24" above grade connected to tracker post that will follow the curvature of the existing topography. Given the solar panels are above grade the array field may still be considered pervious for hydraulic modeling. The array field will be planted with a native low maintenance groundcover seed mix.

The solar facility will have a perimeter access drive that will follow the existing drive were reasonable to do so. The gravel access roadway will accommodate fire protection and facility

maintenance. The roadway will have a 2% cross slope. Although aggregate road surfaces are not considered impervious in comparison to concrete and bituminous surfaces, runoff from those surfaces is increased. An appropriate curve number was selected for the road surface on site. These values will be used for modeling the proposed watersheds for the project.

Post-Development Wetland Resource Impacts

The projects footprint was designed to avoid impacts to as many wetland resource areas. There are two existing culverts associated with the existing access road. These crossing will be utilized as part of the project.

MassDEP Stormwater Management Standards

The Massachusetts Department of Environmental Protection’s Stormwater Management Standards address water quality (pollutants) and water quantity (flooding, low base flow and recharge) by establishing ten standards that require the implementation of a wide variety of stormwater management strategies. Each standard for the project was reviewed and addressed on an item by item basis below:

Standard 1- Discharge does not cause scour or erosion:

No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The proposed conditions will have no new connected impervious surfaces to treat, in fact, in many areas of the site the overall groundcover will be improved upon.

Standard 2 - Peak Rate Attenuation:

Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

Drainage calculations were prepared for Pre-construction conditions as well as Post construction conditions for each of the drainage areas. Infiltration basins were utilized for peak attenuation as well as recharging stormwater. Post construction peak discharges are less than Pre-construction, see the tables below:

Drainage Area 1			
Storm Event	Pre-construction	Post-Construction	Comparison
2-year	0.00 cfs	0.00 cfs	0.00 cfs
10-year	0.13 cfs	0.10 cfs	-0.03 cfs
100-year	2.30 cfs	2.30 cfs	0.00 cfs

Drainage Area 2			
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Storm Event	Pre-construction	Post-Construction	Comparison
2-year	1.13 cfs	1.04 cfs	-0.09 cfs
10-year	3.24 cfs	2.79 cfs	-0.45 cfs
100-year	7.40 cfs	6.13 cfs	-1.27 cfs
Drainage Area 3			
Storm Event	Pre-construction	Post-Construction	Comparison
2-year	0.02 cfs	0.02 cfs	0.00 cfs
10-year	0.52 cfs	0.48 cfs	-0.04 cfs
100-year	5.75 cfs	3.69 cfs	-2.06 cfs

Drainage Area 4			
Storm Event	Pre-construction	Post-Construction	Comparison
2-year	1.22 cfs	1.13 cfs	-0.09 cfs
10-year	5.60 cfs	5.15 cfs	-0.45cfs
100-year	15.73 cfs	14.48 cfs	-1.25 cfs

Drainage Area 5			
Storm Event	Pre-construction	Post-Construction	Comparison
2-year	0.06 cfs	0.06 cfs	0.00 cfs
10-year	0.30 cfs	0.30 cfs	0.00 cfs
100-year	0.86 cfs	0.86 cfs	0.00 cfs

Drainage Area 6			
Storm Event	Pre-construction	Post-Construction	Comparison
2-year	0.20 cfs	0.20 cfs	0.00 cfs
10-year	3.77 cfs	3.21 cfs	-0.56 cfs
100-year	19.24 cfs	19.22 cfs	-0.02 cfs

Drainage Area 7			
Storm Event	Pre-construction	Post-Construction	Comparison
2-year	1.02 cfs	0.98 cfs	-0.04 cfs
10-year	5.11 cfs	4.91 cfs	-0.10 cfs
100-year	14.81 cfs	14.24 cfs	-0.57 cfs

Drainage Area 8			
Storm Event	Pre-construction	Post-Construction	Comparison
2-year	5.92 cfs	0.00 cfs	-5.92 cfs
10-year	11.77 cfs	0.00 cfs	-11.77 cfs
100-year	21.55 cfs	0.18 cfs	-21.37 cfs

All existing and proposed drainage calculations are attached (*Appendix C*).

Standard 3 - Recharge:

Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-construction site shall approximate the annual recharge from pre-construction conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Per the Stormwater Handbook, infiltration (recharge) areas and subsequent volumes are to be sized based on the impervious area draining to the basin per the following equation:

$$Rv = F \times \text{impervious area}$$

There are no effective impervious surfaces that will be added to the project as solar panels are not considered impervious. Therefore, this requirement does not apply to this project, however, each infiltration basin is designed to recharge at least the 2-year storm event.

Based on the Simple Dynamic Drawdown Calculations from the MassDEP Stormwater handbook, the recharge structure for each watershed will infiltrate the required volume within 72 hours, and is presented in the table below:

Pond	Rawls Rate	Bottom Area	Drawdown Time
1aP	2.41	3708.00	0.52
1bP	2.41	3151.00	0.46
2aP	0.17	4360.00	6.85
3aP	2.41	2845.00	0.49
3bP	2.41	3696.00	0.47
6aP	0.52	5978.00	2.08
7aP	0.52	1347.00	2.69

Standard 4 - Required Water Quality Volume:

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).

The infiltration basins for the project have been designed to hold and infiltrate the 2-year storm event which exceeds the Water Quality Volume.

Standard 5: land uses with higher potential pollutant loads:

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If, through source control and/or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt and stormwater

runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L.c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

The land use proposed does not constitute a higher pollutant load. The project will have a pollution prevention plan, NOI & NPEDS permit prepared and approved for the project prior to earthwork disturbances.

Standard 6: Stormwater discharges within the Zone II or Interim Wellhead Protection Area

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A “storm water discharge” as defined in 314 CMR 3.04(2)(a)1. or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of the public water.

The land is not located within Zone II or Interim Wellhead Protection Areas. Project BMP’s are sufficient as illustrated by the previous calculations.

Standard 7: Redevelopment projects

A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

The project is not a redevelopment project.

Standard 8: Construction Erosion Control:

A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

The project will have a Stormwater pollution prevention plan, NOI & NPEDS permit prepared and approved for the project prior to earthwork disturbances. Please refer to the SWPPP Narrative.

Standard 9: Operation and Maintenance:

A Long -Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.

The Long-Term Operation and Maintenance Plan shall will include the following information:

1. Stormwater management system(s) owners;
2. The party or parties responsible for operation and maintenance, including how future property owners will be notified of the presence of the stormwater management system and the requirement for proper operation and maintenance;
3. The routine and non-routine maintenance tasks to be undertaken after construction is complete and a schedule for implementing those tasks;
4. A plan that is drawn to scale and shows the location of all stormwater BMPs in each treatment train along with the discharge point;
5. A description and delineation of public safety features; and
6. An estimated operations and maintenance budget.

This document will be created and prepared prior to earthwork disturbances and as project permitting evolves.

Standard 10: All illicit discharges to the stormwater management system are prohibited.

Worcester District Registry of Deeds - 20/20 Perfect Vision i2 Document Detail Report

Current datetime: 7/29/2020 10:28:02 AM

Doc#	Document Type	Town	Book/Page	File Date	Consideration
47009	EASEMENT DEED		62361/236	05/08/2020	1.00
Property-Street Address and/or Description					
SPRING ST, ASHBURNHAM RD, ROUTE 12 PL BK 945-29					
Grantors					
PLH VINEYARD SKY LLC, PLH LLC					
Grantees					
MASSACHUSETTS ELECTRIC CO					
References-Book/Pg Description Recorded Year					
61645/381 DEED 2019					
Registered Land Certificate(s)-Cert# Book/Pg					

Worcester South District Registry of Deeds Electronically Recorded Document

This is the first page of the document – Do not remove

Recording Information

Document Number	: 47009
Document Type	: ED
Recorded Date	: May 08, 2020
Recorded Time	: 01:23:14 PM
Recorded Book and Page	: 62361 / 236
Number of Pages(including cover sheet)	: 6
Receipt Number	: 1224694
Recording Fee (including excise)	: \$105.00

 MASSACHUSETTS EXCISE TAX
 Worcester District ROD #20 001
 Date: 05/08/2020 01:23 PM
 Ctrl# Doc# 00047009
 Fee: \$.00 Cons: \$1.00

Worcester South District Registry of Deeds
 Kathryn A. Toomey, Register
 90 Front St
 Worcester, MA 01608
 (508) 798-7717

GRANT OF EASEMENT

PLH VINEYARD SKY LLC f/k/a PLH LLC, a Delaware limited liability company having a usual place of business at 1740 Broadway, 15th Floor, New York, NY 10019 (hereinafter referred to as the Grantor), for consideration of One (\$1.00) Dollar, grants to **MASSACHUSETTS ELECTRIC COMPANY**, 40 Sylvan Road, Waltham, Massachusetts 02451, a Massachusetts corporation (hereinafter referred to as the Grantee) with quitclaim covenants, the perpetual right and easement to construct, reconstruct, repair, maintain, operate and patrol, for the transmission of high and low voltage electric current and for the transmission of intelligence and telephone use, lines to consist of, but not limited to three (3) poles, with wires and cables installed thereon, and all necessary foundations, anchors, guys, braces, fittings, equipment and appurtenances (hereinafter referred to as the "OVERHEAD SYSTEM") over, across, under and upon the Grantor's land in Winchendon, Worcester County, Massachusetts, to serve Grantor's property and others.

Said "OVERHEAD SYSTEM" is to be installed on Grantor's property, which is located on the southerly side of Spring Street a/k/a Ashburnham Road and State Route 12, to originate from Pole P.131, which is located on the southerly side of Spring Street a/k/a Ashburnham Road and State Route 12, then proceed in a southerly direction over, across and upon land of the Grantor to new Poles P.131-1, P.131-2, and P.131-3, to become established by and upon the final installation thereof by the Grantee.

Also with the further perpetual right and easement from time to time without further payment therefore to pass and repass over, across and upon said land of the Grantor as is reasonable and necessary in order to renew, replace, repair, remove, add to, maintain, operate and patrol and otherwise change said "OVERHEAD SYSTEM" and each and every part thereof and to make such other excavation or excavations as may be reasonably necessary in the opinion and judgment of the Grantee, their successors and assigns, and to clear and keep cleared the portions and areas of the premises wherein the "OVERHEAD SYSTEM" is specifically located of such trees, shrubs, bushes, above ground and below ground structures, objects and surfaces, as may, in the opinion and judgment of the Grantee, interfere with the efficient and safe operation and maintenance of the "OVERHEAD SYSTEM".

WR #25542900

Address of Grantee:
Mass El. - 40 Sylvan Road, Waltham, Massachusetts 02451

After recording return to:
Carol Childress
National Grid USA
Service Company, Inc.
939 Southridge Street
Worcester, MA 01610

05 WNCMA GEN

Property Address: Spring Street a/k/a Ashburnham Road and State Route 12, Winchendon, MA (Worcester South)

It is agreed that the "OVERHEAD SYSTEM" shall remain the property of the Grantee, their successors and assigns, and that the Grantee, their successors and assigns, shall pay all taxes assessed thereon. Grantor agrees that the rights and easement herein granted are for the purpose of providing service to Grantor's property and the further right to service others from said "OVERHEAD SYSTEM". The Grantor, for itself, its successors and assigns, covenant and agrees with the Grantee, for themselves, their successors and assigns, that this Grant of Easement and the location of the "OVERHEAD SYSTEM" may not be changed or modified without the written consent of the Grantee, their successors and assigns, which consent may be withheld by the Grantee in their sole discretion. The rights and easement herein granted are over, across and upon a certain parcel of land shown as "PARCEL A" on a Plan of Land recorded with the Worcester South District Registry of Deeds in Plan Book 945, Plan 29.

And further, said "OVERHEAD SYSTEM" (locations of the electrical equipment and other facilities on the hereinbefore referred to premises of the Grantor) is approximately shown on a sketch entitled: "EXHIBIT 'A' NOT TO SCALE; DESIGNER: BEN WENKE CHA; nationalgrid; WR 25542900; DRAWN BY: BW; DATE: 3/24/20", a reduced copy of said sketch is attached hereto as "Exhibit A", copies of which are in the possession of the Grantor and Grantee herein, but the final definitive locations of said "OVERHEAD SYSTEM" shall become established by and upon the installation and erection thereof by the Grantee.

By signing this easement, Christopher Little certifies that he is signing in the name of PLH VINEYARD SKY LLC f/k/a PLH LLC, and he is the authorized signatory and is empowered to grant the within easement on the terms and conditions stated herein.

For Grantor's title, see deed dated September 25, 2019, recorded with the Worcester South District Registry of Deeds in Book 61645, Page 381.

EXECUTED as a sealed instrument as of this 29th day of APRIL, 2020.

PLH VINEYARD SKY LLC
f/k/a PLH LLC



By: Christopher Little
Its: Authorized Signatory

STATE
~~Commonwealth of Massachusetts~~ MINNESOTA

County of Hennepin } ss.

On this the 29 day of April, 2020, before me,

Sue A. Huntington the undersigned Notary Public,
Name of Notary Public

personally appeared Christopher Little, proved to me through satisfactory evidence of identity, which was

Mn Drivers License
Description of Evidence of Identity

to be the person whose name is signed on the preceding Grant of Easement and acknowledged to me that he signed it voluntarily for its stated purpose, as the authorized signatory for PLH VINEYARD SKY LLC f/k/a PLH LLC.



Sue A. Huntington
Signature of Notary Public

Sue A. Huntington
Printed Name of Notary

My Commission Expires 01-31-2024

Place Notary Seal and/or Any Stamp Above

EXHIBIT 'A' NOT TO SCALE.
 THE EXACT LOCATION OF SAID FACILITIES
 TO BE ESTABLISHED BY AND UPON THE
 INSTALLATION AND ERECTION OF THE
 FACILITIES THEREOF.

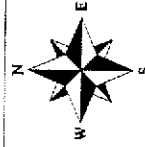
LEGEND

INS. SO POLE
 NEW INSTALL POLE

INS. JO POLE
 NEW INSTALL POLE

PROPERTY LINE

OHW OHW OHW OHW
 OVERHEAD CONDUCTORS



DESIGNER: BEN WENKE

CHA

nationalgrid

WR 25542900

DATE
 03/27/20

DRAWN BY:
 BW

