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November 19, 2018

Forest Vegetation Descriptions
Proposed Main Solar Project
310 Main Street, Hopkinton, RI

Purpose:

This report is provided to document the forest resources and cover types of the wooded portions of the subject property that is subject to a proposed development of a solar array. The developed area is proposed for 67.54 acres of a 137.86-acre parcel of land, which includes 57.91 acres of existing forestland to be cleared, and 9.63 acres of existing open meadow.

General Site Description:

The subject property is located on an old farm lying easterly of Main Street, over to Maxson Hill Road, south of Exit 1 in the town of Hopkinton, RI. The property is situated on the upland ridge of Diamond Hill and its western slopes, with some intervening drainage valleys in the central and western areas of the property that creates rolling terrain and feeds a pond and a couple of streams that runoff the property to the southwest.

According to the USDA Soil Survey, the existing soil conditions underlying the areas to be cleared for the solar arrays include well-drained Charlton and Paxton very stony fine sandy loams, 3 to 8 percent slopes, moderately well-drained Woodbridge very stony fine sandy loams, 3 to 8 percent slopes, and Sutton very stony fine sandy loam, 3 to 8 percent slopes. These soils are typically found on side slopes of glacial upland hills and ridges. Stones and boulders cover from 2 to 10 percent of the surface. There is a small area in the southwest portion of the subject site that is underlain with poorly-drained Ridgebury extremely stony fine sandy loams, 0 – 3 percent slopes, with included areas of well-drained conditions that are suitable for development for the solar arrays.

These soils have a woodland productivity rating of 3o to 4o, which is moderately to highly productive for tree growth, with some site limitations for equipment operation due to the stoniness. They have a Site Index value that ranges from 62 to 65 for Red oak in the upland areas and 72 in the mid- to lower-slope sites, and 62 to 66 for White pine in the upland sites to 68 in the lower-slope sites. This Site Index value is an indication of how well trees will grow in that soil type, and those values range from fair to good in the upland areas to very good in the lower slope sites, in relation to other Rhode Island soils. Please refer to the Woodland Productivity Tables included with the Soil Report attached to this letter.

The forest cover on the subject sites is predominately upland oaks (Scarlet oak, Black oak, and White oak), with some presence of Northern red oak, along with Black birch, American beech, Shagbark hickory, Sassafras, and Black gum, with a minor presence of Eastern hemlock and White pine. There are some more recently abandoned field sites that are stocked with Red maple, Eastern redcedar, Black cherry, and White pine.

More recently, defoliations by Gypsy moth caterpillars has resulted in moderate oak mortality in the upland areas of the property. The 2016 Aerial imagery illustrates the amount of defoliation that occurred (light-colored patches that should be green with foliage), with much of it in the upland areas of the eastern half of the property.

The forest cover has been delineated into cover types, with descriptions that follow:

EASTERN UPLAND RIDGE

COVER TYPE: Upland Oaks

AVERAGE AGE: 80 - 100 years

SOIL TYPE: Woodbridge and Paxton very stony fine sandy loams

Located along the upland ridge and its immediate west-facing slopes along the eastern and southeastern areas of the property, this cover type features an overstory of medium to large diameter mixed upland oaks, with Scarlet oak, Black oak, Northern red oak, and smaller amounts of White oak, in the 12 to 20 inch dbh size classes. There are some scattered larger diameter stems up to @ 26 inches dbh.

The intermediate stocking consists of Black birch and American beech, along with some Red maple and Sassafras stems in the 4 to 12 inch dbh size classes.

There is one small copse of American beech in the southeast corner of the property. Several of the intermediate beech stems were infected with Beech bark disease, and some have died.

Stocking levels are relatively high in the northern portion of the stand and tend to decrease in the southern areas of the stand, where a more scattered overstory with some larger crowns of oak are present.

The understory is thick with Mountain laurel shrubs along the upland ridge, which is visible in the Soil Report's aerial photograph and may be indicative of past fire history, perhaps in the 1940's or 1950's when several destructive fires did burn in southern Rhode Island. If that is the case, then many of the larger oaks will likely have internal decay from fire scars.

Other understory vegetation includes some American beech sprouts, Highbush blueberry, Huckleberry, and Lowbush blueberry shrubs.

The current health condition of these oaks is moderate to good, with some crown dieback present in the dominant and co-dominant stems, and some mortality scattered throughout the stand due to recent drought and defoliations.

Other forest health issues include the presence of Beech Bark Disease on the intermediate stems of American beech, and Nectria cankers on the Black birch, with most of these diseased stems noted in the southern portion of the stand.

There is a knoll in the southwestern portion of the stand, where the east side of the knoll drops off into the adjacent wetland valley. At the eastern edge of this knoll there is a presence of several large oaks, including White oak, that have grown up amongst the boulders that are present in that area.

The eastern edge of the open field in the south-central area of the property includes several large diameter open-grown "pasture oaks" with diameters to 60" at dbh. These oaks have large, spreading crowns and would date back to a time when all of the wooded areas were open and utilized for pasture, pre-dating the 1939 Aerial Photographs available.

The open field itself is surrounded by field edges of non-native invasive shrubs, with Autumn olive and Multi-flora rose shrubs, and some presence of bittersweet vines.

SOUTHWEST CORNER

COVER TYPE: Oak-Hardwoods

AVERAGE AGE: 60 - 80 years

SOIL TYPE: Ridgebury extremely stony fine sandy loams (included areas of well-drained, rocky sites designated for solar arrays)

Located in the southwest area of the property and situated on a couple of small rocky knolls with adjacent intermittent valleys and wetland sites, and an area abutting the open agricultural field in the southwest corner, the overstory of this stand is dominated by a mix of oaks (Scarlet, Black, and White oaks), and Red maple in the 18 to 28-inch dbh size classes. There is an intermediate stocking of a mix of hardwoods that include Red maple, Shagbark hickory, American beech, and Sassafras in the 6 to 16-inch dbh size classes. The stocking is not heavy, with many poorly-formed culls. This is likely due to the terrain, with rock outcroppings and side slopes that resulted in an inconsistent development of the overstory trees.

The understory includes thickets of Green briers, Black and Yellow birch saplings, along with some presence of Sassafras, White oak, Red maple, and American beech saplings and root

sprouts. Lowbush blueberry and Huckleberry are present at the ground level, and scattered clumps of Mountain laurel and Highbush blueberry shrubs are also found.

The overstory transitions in the western edge of the stand to a mix of pioneer species and large-crowned pasture oaks in the more recently abandoned field is located, visible as such in the 1939 Aerial Photograph. The soils here a bit moister, so Red maple is prevalent, with open-grown conditions resulting in multiple-stemmed trees. There is some Sassafras and Black oak scattered about in the 10 to 18-inch dbh size classes, with some remnant Eastern redcedars present. The understory here is thick with Green briers due to the amount of sunlight entering the stand.

NORTHWEST CORNER

COVER TYPE: post-agricultural scrub-shrub-sapling

AVERAGE AGE: 20 years

SOIL TYPE: Canton/Charlton very stony fine sandy loams

Located in the northwest corner of the property, this area of old field is in an early-successional scrub-shrub-sapling stage of development, with Eastern redcedar, Autumn-olive shrubs, and a variety of grasses and forbs typical of abandoned fields. Many of the shrubs that are present are considered invasive plants that are non-native.

Some tree species have become established in the edges of the field, with birches, aspen, and Red maple commonly present in these areas. These are small diameter saplings.

There is a small knoll adjacent to the abandoned residence that may be partially included with the clearing for the solar arrays. This wooded knoll is stocked primarily with Shagbark hickory, a few Black cherry stems, and a few Black oaks. These stems are found in the 10 – 18-inch dbh size classes, with the Black cherry in smaller diameters of 4 to 8 inches dbh. There are a few larger diameter hickory trees found in the edges of the field, which provided the seed source for the wooded knoll.

The house site itself includes the presence of several large diameter, mature specimens of tree species not normally found in the woods of Rhode Island. These are all planted trees, including some Norway spruce to 32” dbh along the driveway, a single, large diameter Dawn redwood in the backyard of the house site, and a clump of White cedar and Eastern redcedar to the south of the house. A large Hemlock tree and a single Black locust are also found adjacent to the house. The main access road runs through this site, and retention of these Legacy trees if possible is recommended.

NORTH CENTRAL AREA

COVER TYPE: Oak-Hardwoods

AVERAGE AGE: 70 - 90 years

SOIL TYPE: Sutton and Woodbridge very stony fine sandy loams

Located in the north-central areas of the property, the topography of the area includes a couple of low ridge sites with intervening intermittent stream valleys. These former agricultural fields have developed an overstory that includes mixed oaks, Red maple, and Black birch, with small amounts of Black gum and Hickory. The Black and Scarlet oaks are present in the larger, overstory size classes, from 12 to 30 inches dbh. Stocking is moderate, with some canopy gaps that have filled in with Black birch and Red maple stems.

The intermediate size classes include the Red maple and Black birch in the 8 to 12-inch dbh size classes, and small diameter Hickory and American beech in the 4 to 8-inch dbh size classes.

The understory varies throughout, but generally includes patches of Mountain laurel, American beech, Black birch and Red maple saplings. Highbush blueberry shrubs, Green briers, and patches of Lowbush blueberry/Huckleberry are also found. The Green briers are present in dense thickets in the eastern slope portion of this stand.

There is a large diameter Norway maple adjacent to the open field in the western portion of this area, and some scattered Norway maple stems in the 4 to 8 inches dbh were noted.

Although some defoliation occurred in this stand recently, there are only a few scattered dead oaks. This is likely due to the diversity of species and the beneficial soil moisture conditions of the site.

Summary of Observations:

The overall condition of this forested tract is one of mature oak overstory conditions in the historically wooded areas of the property, with some diversity in tree species in addition to the oaks, and some diversity in stand density (stocking) conditions. Most of the acreage is in oak and other hardwoods, with some old-field sites that are stocked with Eastern redcedar and shrubs that are considered invasive.

The health conditions of the woodlands include impacts to the oak overstory due to recent defoliations by Gypsy moth and/or Forest tent caterpillars, and by several years of moderate drought conditions. A moderate percentage of the upland oak resource has died in recent years, with much of the mortality in the eastern areas of the property.

Other forest health issues include typical presence of Beech bark disease and Nectria cankers in birch species.

The dense Mountain laurel understory in the eastern ridge site provides some quality habitat cover, although the presence of the town road and adjacent residential sites minimizes the habitat values. Retention of this Mountain laurel understory within the buffer zone along the Maxon Hill Road frontage, and retention of the legacy trees at the house site, are recommended in order to protect aesthetic and wildlife habitat values that these resources represent.

Prepared By: Marc J. Tremblay, CF

MA Forester Lic #239, CT Certified Forester #F-517, RI Lic. Arborist #104

Certification: I hereby attest that the above Forest Assessment Report prepared for the referenced property has been prepared according to the appropriate standards and information available, and the information provided is as accurate as current forestry practices allow.

Marc J. Tremblay, CF

Attachments:

- Forest Cover Types on Soil/Site Map
- 2016 Aerial Imagery
- 1939 Aerial Imagery
- USDA Web Soil Survey with Forestland Productivity Tables (8 pp)

MAIN STREET SOLAR

GYPSY MOTH DEFOLIATION EXTENT

JULY, 2016

Aerial Photographs (1939)

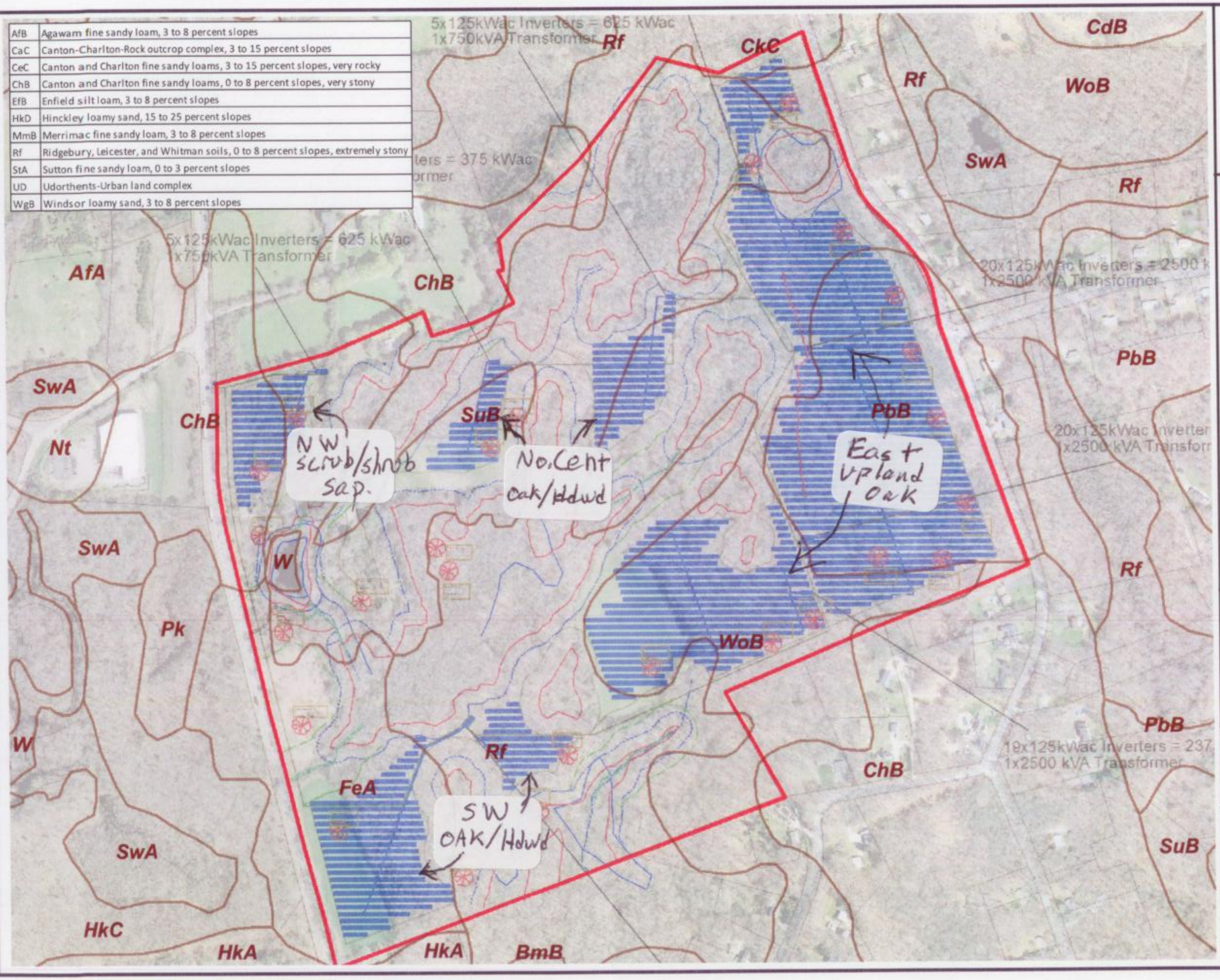
June 19, 2018

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

AfB	Agawam fine sandy loam, 3 to 8 percent slopes
CaC	Canton-Charlton-Rock outcrop complex, 3 to 15 percent slopes
CeC	Canton and Charlton fine sandy loams, 3 to 15 percent slopes, very rocky
ChB	Canton and Charlton fine sandy loams, 0 to 8 percent slopes, very stony
EfB	Enfield silt loam, 3 to 8 percent slopes
HkD	Hinckley loamy sand, 15 to 25 percent slopes
MmB	Merrimac fine sandy loam, 3 to 8 percent slopes
Rf	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony
StA	Sutton fine sandy loam, 0 to 3 percent slopes
UD	Udorthents-Urban land complex
WgB	Windsor loamy sand, 3 to 8 percent slopes



Soil Classification

Subject Property Boundary

Forest Cover Types

by: M. Tremblay, CF
11/19/18

2011 Orthoimagery Provided by RIGIS

Hopkinton, RI Property Lot Lines Provided by Hopkinton, RI IT & GIS

Soil Types Located at the Site

310 Main Street
Hopkinton, Rhode Island

Date: 06/14/2018
Job #: M779
Created By: ALM

Figure

SAGE Environmental, Inc.
172 Armistice Boulevard
Pawtucket, Rhode Island

United States Department of Agriculture

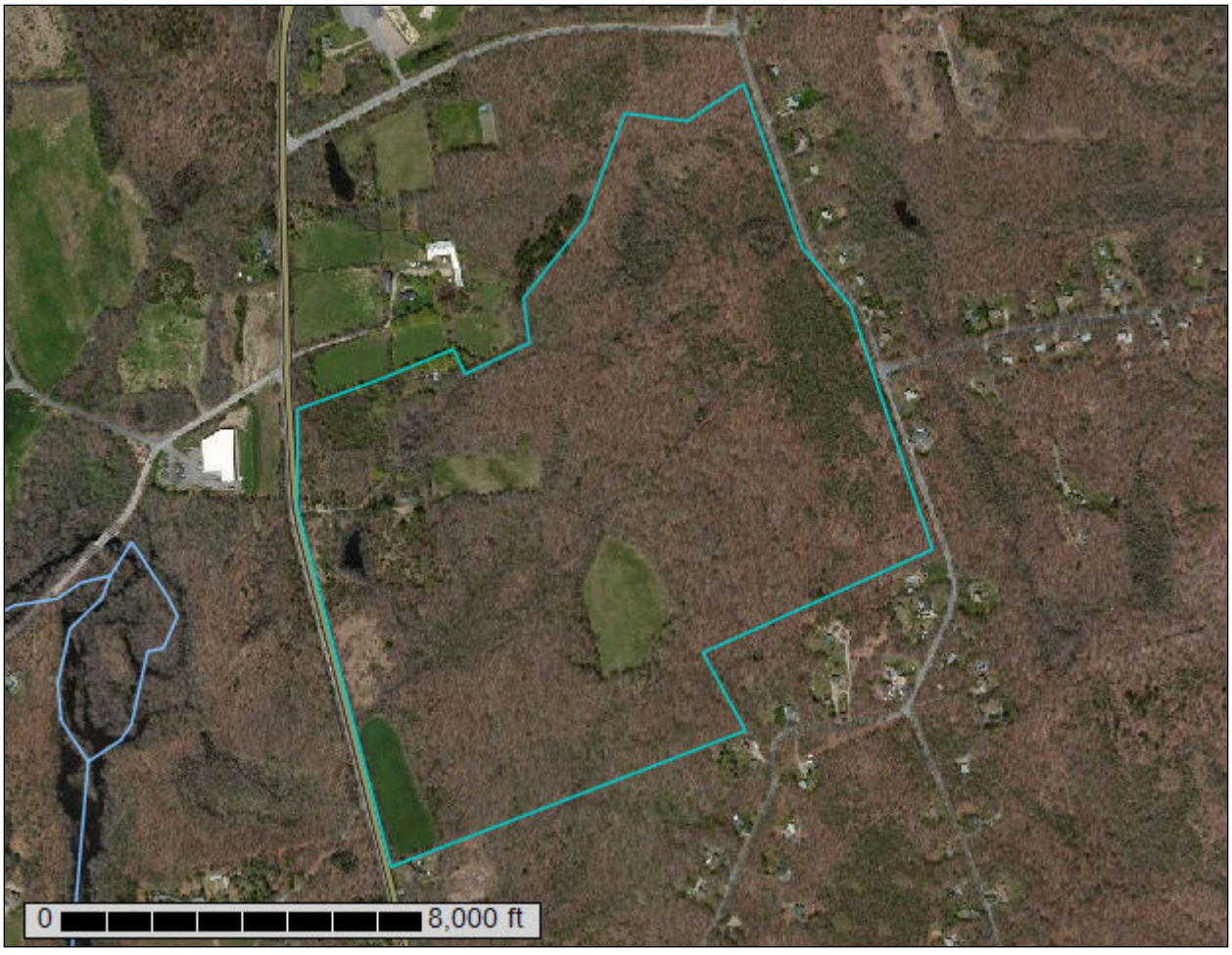
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

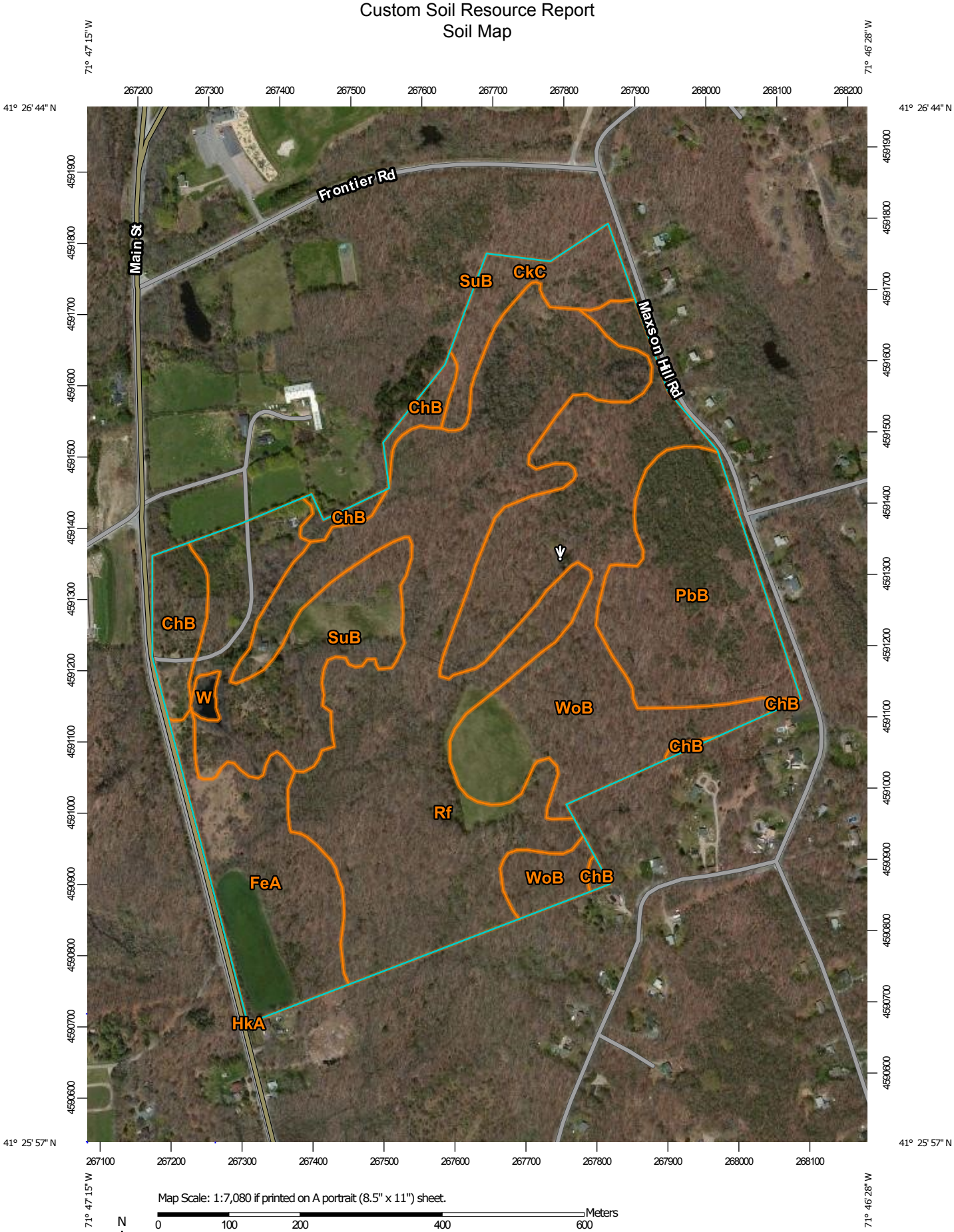
Custom Soil Resource Report for State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties

Hopkinton Solar Proposal



June 18, 2018

Custom Soil Resource Report
Soil Map



Map Scale: 1:7,080 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 100 200 400 600

Feet
0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties
Survey Area Data: Version 16, Sep 14, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Vegetative Productivity

This folder contains a collection of tabular reports that present vegetative productivity data. The reports (tables) include all selected map units and components for each map unit. Vegetative productivity includes estimates of potential vegetative production for a variety of land uses, including cropland, forestland, hayland, pastureland, horticulture and rangeland. In the underlying database, some states maintain crop yield data by individual map unit component. Other states maintain the data at the map unit level. Attributes are included for both, although only one or the other is likely to contain data for any given geographic area. For other land uses, productivity data is shown only at the map unit component level. Examples include potential crop yields under irrigated and nonirrigated conditions, forest productivity, forest site index, and total rangeland production under of normal, favorable and unfavorable conditions.

Forestland Productivity

This table can help forestland owners or managers plan the use of soils for wood crops. It shows the potential productivity of the soils for wood crops.

Potential productivity of merchantable or *common trees* on a soil is expressed as a site index and as a volume number. The *site index* is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that forestland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability. More detailed information regarding site index is available in the "National Forestry Manual," which is available in local offices of the Natural Resources Conservation Service or on the Internet.

The *volume of wood fiber*, a number, is the yield likely to be produced by the most important tree species. This number, expressed as cubic feet per acre per year and calculated at the age of culmination of the mean annual increment (CMAI), indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

Trees to manage are those that are preferred for planting, seeding, or natural regeneration and those that remain in the stand after thinning or partial harvest.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service, National Forestry Manual.

Report—Forestland Productivity

Forestland Productivity–State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties				
Map unit symbol and soil name	**Potential productivity**			**Trees to manage**
	Common trees	**Site Index**	**Volume of wood fiber**	
			Cu ft/ac/yr	
ChB—Canton and Charlton fine sandy loams, 0 to 8 percent slopes, very stony				
Canton, very stony	Eastern hemlock	—	—	Beech, Bitternut hickory, Black oak, Eastern hemlock, Eastern white pine, Gray birch, Mockernut hickory, Northern red oak, Pignut hickory, Red maple, Shagbark hickory, Sugar maple, White ash, White oak, Yellow birch
	Eastern white pine	58	100.00	
	Northern red oak	52	29.00	
	Red maple	55	29.00	
	Shagbark hickory	—	0.00	
	Sugar maple	55	29.00	
	White oak	—	—	
Charlton, very stony	Eastern hemlock	—	—	Eastern white pine, European larch, Northern red oak, Norway spruce, Red pine, Scarlet oak, Sugar maple, Tuliptree, White ash, White oak
	Eastern white pine	65	114.00	
	Northern red oak	65	43.00	
	Red maple	55	29.00	
	Red pine	70	129.00	
	Red spruce	50	114.00	
	Shagbark hickory	—	0.00	
	Sugar maple	55	29.00	
	White oak	—	—	

Forestland Productivity–State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties				
Map unit symbol and soil name	**Potential productivity**			**Trees to manage**
	Common trees	**Site Index**	**Volume of wood fiber**	
			Cu ft/ac/yr	
CkC—Canton and Charlton fine sandy loams, 3 to 15 percent slopes, extremely stony				
Canton, extremely stony	Eastern hemlock	—	—	Beech, Bitternut hickory, Black oak, Eastern hemlock, Eastern white pine, Gray birch, Mockernut hickory, Northern red oak, Pignut hickory, Red maple, Shagbark hickory, Sugar maple, White ash, White oak, Yellow birch
	Eastern white pine	58	100.00	
	Northern red oak	52	29.00	
	Red maple	55	29.00	
	Shagbark hickory	—	0.00	
	Sugar maple	55	29.00	
	White oak	—	—	
Charlton, extremely stony	Eastern hemlock	—	—	Eastern white pine, European larch, Northern red oak, Norway spruce, Red pine, Scarlet oak, Sugar maple, Tuliptree, White ash, White oak
	Eastern white pine	65	114.00	
	Northern red oak	65	43.00	
	Red maple	55	29.00	
	Red pine	70	129.00	
	Red spruce	50	114.00	
	Shagbark hickory	—	0.00	
	Sugar maple	55	29.00	
	White oak	—	—	
FeA—Freetown muck, 0 to 1 percent slopes				
Freetown	American elm	55	0.00	—
	Atlantic white cedar	60	0.00	
	Balsam fir	45	86.00	
	Eastern hemlock	55	0.00	
	Green ash	35	29.00	
	Red maple	50	29.00	
	Red spruce	50	114.00	
HkA—Hinckley loamy sand, 0 to 3 percent slopes				
Hinckley	Eastern white pine	61	100.00	Black oak, Eastern white pine, Pitch pine
	Northern red oak	49	29.00	
	Paper birch	60	54.00	
	Pitch pine	60	—	
	Red pine	54	92.00	
	Red spruce	39	86.00	
	Sugar maple	59	30.00	
	White spruce	52	114.00	

Forestland Productivity–State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties				
Map unit symbol and soil name	**Potential productivity**			**Trees to manage**
	Common trees	**Site Index**	**Volume of wood fiber**	
			Cu ft/ac/yr	
PbB—Paxton fine sandy loam, 0 to 8 percent slopes, very stony				
Paxton, very stony	Black oak	67	—	Eastern white pine, European larch, Northern red oak, Norway spruce, Red pine, Scarlet oak, Sugar maple, Tuliptree, White ash, White oak
	Eastern white pine	66	114.00	
	European larch	80	—	
	Northern red oak	65	43.00	
	Red pine	67	114.00	
	Scarlet oak	67	—	
	Sugar maple	75	43.00	
	White ash	89	—	
	White oak	60	—	
Rf—Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony				
Ridgebury, extremely stony	Eastern white pine	63	114.00	American elm, Blackgum, Green ash, Pin oak, Red maple, Swamp white oak, Yellow birch
	Northern red oak	66	43.00	
	Red maple	62	—	
	Sugar maple	56	29.00	
	White ash	60	—	
Leicester, extremely stony	Eastern white pine	69	129.00	Green ash, Red maple, Tuliptree
	Northern red oak	56	43.00	
	Red maple	70	43.00	
	Yellow birch	—	—	
Whitman, extremely stony	Blackgum	52	—	—
	Eastern white pine	56	100.00	
	Northern red oak	70	—	
	Red maple	60	29.00	
	Red spruce	44	86.00	
	White oak	57	—	
SuB—Sutton very stony fine sandy loam, 0 to 8 percent slopes				
Sutton	Black cherry	72	43.00	Eastern white pine, European larch, Norway spruce, White spruce
	Eastern white pine	62	114.00	
	Northern red oak	62	43.00	
	Red spruce	50	114.00	
	Sugar maple	54	29.00	

Forestland Productivity–State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties				
Map unit symbol and soil name	**Potential productivity**			**Trees to manage**
	Common trees	**Site Index**	**Volume of wood fiber**	
			Cu ft/ac/yr	
W—Water				
Water	—	—	—	—
WoB—Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony				
Woodbridge, very stony	Black oak	77	—	Ash, Northern red oak, Sugar maple, Tuliptree, White oak
	Eastern white pine	67	114.00	
	Northern red oak	72	57.00	
	Red pine	65	114.00	
	Red spruce	50	114.00	
	Sugar maple	65	43.00	
	Yellow poplar	84	—	