Section 4
Environmental Impacts

Environmental Impacts

4.1 State Standards

According to the Small Wind Certification, a Small Scale Wind Energy Development:

> *Will be constructed using the best practical mitigation techniques for mitigating impacts to endangered and threatened species, essential wildlife habitat, and other protected resources from all aspects of construction and operation, in accordance with rules adopted pursuant to 35-A M.R.S. § 3459;*

4.2 Local Standards

The Town of Roxbury has specific land use standards that apply to the permitting district where the Project is proposed. These standards, outlined in the Town's Natural Land Use Ordinance, were reviewed by the Project and the Town's Planning Board on February 22, 2018 when a Building Permit Application was submitted to the Town for the Project. RoxWind anticipates that the local permit for the wind energy facility will be contingent on receiving a Small Wind Certification from the State.

4.3 Overview

RoxWind has spent considerable time engaging with professional environmental consultants to design the Project using best practical mitigation techniques during construction and operation to conform to State Standards.

For mitigating impacts to endangered and threatened species and essential wildlife habitat:
The Applicant consulted with the Maine Department of Inland Fisheries and Wildlife ("MDIFW") to identify endangered, threatened and special concern species. The Applicant met with MDIFW on May 16, 2016 to introduce the Project to MDIFW and request an initial review. Following MDIFW's initial review, the Applicant commissioned studies to review the species identified by MDIFW (see Environmental Reports below). Following submission of these reports to MDIFW, the Applicant continued to work with MDIFW and has agreed to a stringent curtailment plan as requested by MDIFW.[1] The level of curtailment is a "best practical mitigation technique" to avoid the taking of protected species of bats.

For mitigating impacts to other protected resources:

[1] The Applicant met with MDIFW in person on the following dates: 5/16/16, 1/27/17, 3/30/17. The Applicant has also had numerous calls with MDIFW since 2016 to discuss the Project, understand MDIFW's approach to mitigation, and work with MDIFW to create a Project specific curtailment plan for the operational phase of the Project. The significant curtailment was selected as the "best" fit of the options available for this Project due to its small size, location, and need to balance pre-and post-development cost impacts.

4. Environmental Impacts

The Project site has been designed to minimize impacts to protected resources. In particular, the Applicant has enlisted 3rd-parties to review the conditions on the site. The Project is designed to avoid vernal pools and significant wildlife habitat. The Project has also been redesigned multiple times to decrease its environmental impact – this includes moving Turbine #3 to decrease wetland impacts on the ridgeline.

RoxWind has also complied with local standards by meeting the requirements outlined in the Town's Natural Land Use Ordinance.

4.4 Environmental Reports

In 2016, the Project requested a review by the MDIFW to assess essential habitats and endangered, threatened and special concern species. MDIFW responded to the request with a letter dated May 31, 2016 (Exhibit 4-A).

The Project engaged Kleinschmidt and Stantec Consulting Services, Inc. ("Stantec") to review the existing site conditions, survey the habitat, and compile reports for review. (Stantec is a large engineering and consulting firm that has significant experience evaluating and supporting wind energy projects in the State of Maine.) Kleinschmidt surveyed the Project site for vernal pools, streams, and wetlands. Some small areas of the Project site identified late in project design have not been delineated, but will be in spring 2018. Kleinschmidt's findings are listed in the Natural Resources Report (Exhibit 4-B). The Vernal Pools Report, part of the Natural Resources Report, was submitted to MDIFW, per MDIFW's request, for review. Stantec generated the Rare Threatened and Endangered Species Report (Exhibit 4-C) as well as the Northern Long-Eared Bat (Myotis septentrionalis) Acoustic Survey and Bicknell's Thrush (Catharus bicknelli) Survey (Exhibit 4-D). Stantec's wildlife reports were submitted to MDIFW for review. In addition, Stantec completed a soil survey for the site (Exhibit 4-E).

During construction and operation, the Project will follow the Erosion Control/Construction Plan submitted with this Application and maintain the stormwater management systems as outlined in the stormwater narrative (see Exhibit 1-B).

4.4 Additional Environmental Filings

In addition to the Project's submissions to MDIFW, the Project will file a Natural Resources Application Form and Narrative and a Permit by Rule Notification, as appropriate, with the Department for anticipated wetland and stream crossings. The Project also intends to file an application with US Army Corps of Engineers, as appropriate. RoxWind anticipates filing these applications within two (2) months[2] of filing its Small Wind Certification after collecting additional on-site natural resource data to supplement the currently surveyed area.

[2] The two (2) month timeframe assumes that conditions at the site will permit this work to proceed in April or May 2018. This timeline could be delayed if winter conditions linger and therefor the climate on site is not conducive to collecting accurate data.

At this time, it is anticipated that the Project will have four intermittent stream crossings, and one perennial stream crossing, all associated with the access road to the summit. Total wetland impacts are anticipated to be below 15,000 square feet. No vernal pool or other significant wildlife habitat impacts are anticipated.

4.5 Incidental Take Permit Summary

In addition to the third-party reports, the Project has had extensive conversations with MDIFW to design operating procedures that will be protective of bat species that may be active on the site. The culmination of these conversations is an Incidental Take Permit ("ITP") application which is submitted in draft form with this application as Appendix 4-F.

4-A

MDIFW Letter RE: Information Request - Horseshoe Valley Wind, Roxbury, May 31, 2016

PAUL R. LEPAGE
GOVERNOR

STATE OF MAINE
DEPARTMENT OF
INLAND FISHERIES & WILDLIFE
284 STATE STREET
41 STATE HOUSE STATION
AUGUSTA ME 04333-0041

CHANDLER E. WOODCOCK
COMMISSIONER

May 31, 2016

Bob Patton
Horseshoe Valley Wind

RE: Information Request - Horseshoe Valley Wind, Roxbury

Dear Bob:

Per your request, we have reviewed current Maine Department of Inland Fisheries and Wildlife (MDIFW) information for known locations of Endangered, Threatened, and Special Concern species; designated Essential and Significant Wildlife Habitats; and fisheries habitat concerns within the vicinity of the *Horseshoe Valley Wind Project* in Roxbury.

Our Department has not mapped any Essential Habitats that would be directly affected by your project.

Endangered, Threatened, and Special Concern Species

Bats

Of the eight species of bats that occur in Maine, the three *Myotis* species are protected under Maine's Endangered Species Act (MESA) and are afforded special protection under 12 M.R.S §12801 - §12810. The three *Myotis* species include little brown bat (*M. lucifugus,* State Endangered); northern long-eared bat (*M. septentrionalis,* State Endangered); and eastern small-footed bat (*M. leibii,* State Threatened). Four of the remaining bat species are listed as Special Concern: red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), and tri-colored bat (*Perimyotis subflavus*). It is MDIFW's position that the only adequate protection for bats at this time is seasonal curtailment of turbines under appropriate conditions.

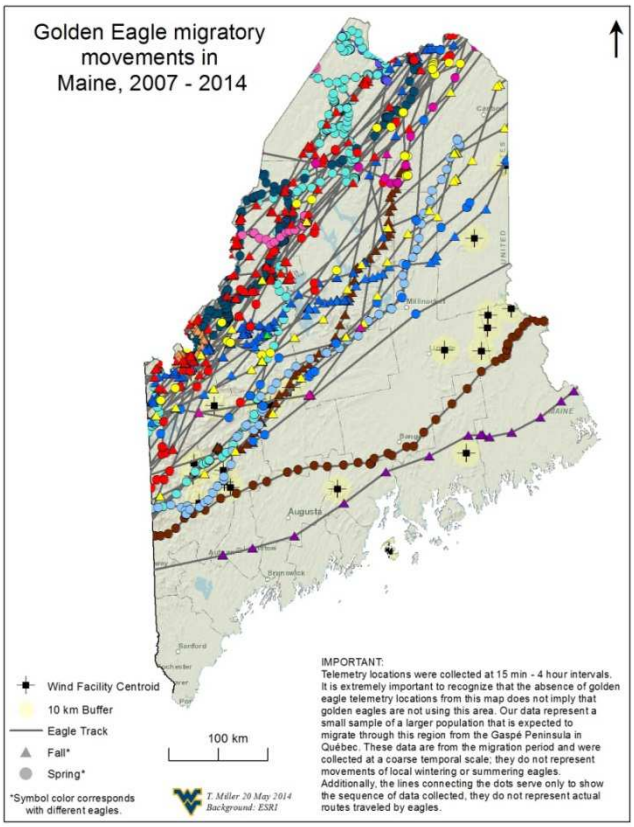
MDIFW's curtailment recommendations are based on project and resource specific considerations, research on effective procedures for avoiding and minimizing bat fatalities, recent recommendations for other similar facilities, and other relevant factors. MDIFW's recommendations take into account Agency objectives and goals for the protection of our seven vulnerable at-risk species in consideration of their particular needs and characteristics, including but not limited to migration routes and patterns, proximity to known habitats of concern (e.g. hibernacula, maternity roosts), seasonal activities, associated behaviors, population trends, etc. In recent reviews of wind power projects in Maine, MDIFW has recommended that turbines operate only at cut-in wind speeds of at least 6.0 meters per second each night, while our most recent recommendation was for turbines to operate at cut-in wind speeds of at least 6.5 meters per second. This period is from at least ½ hour before sunset to at least ½ hour after sunrise during the period April 1 – November 15 to account for the full season of bat activity

in Maine. Cut-in speeds are determined based on mean wind speeds measured at hub heights of a turbine over a 10-minute interval. MDIFW also recommends that turbines be feathered during these low wind periods to minimize risks of bat mortality. These cut-in speeds are independent of ambient air temperature.

Finally, we also recommend that you contact the U.S. Fish and Wildlife Service Maine Field Office (Wende Mahaney, 207-866-3344) for further guidance, as the northern long-eared bat is also listed as a Threatened Species under the Federal Endangered Species Act.

Golden Eagle

At present, there is no definitive evidence of golden eagle nesting activity in the Project area or elsewhere in Maine. That said, most documented golden eagle sightings have occurred in northwestern Maine although some have been documented in the Project vicinity via radio telemetry (see figure below). Golden eagle activity likely peaks during fall and spring migrations and while a few golden eagles overwinter in Maine, none are known to overwinter within the Project area. Reports of sightings during the spring/summer breeding season occur, but are rarely validated. The difficulties include the immense home range (approximately 2,000 square miles) of breeding eagles, the highly mobile nature of subadult eagles, widespread misidentification of juvenile bald eagles, and the certainty that golden eagles are a very rare bird in Maine.



1. Golden eagles (residents and visitors) have been designated as an Endangered species in Maine since 1986, pursuant to the Maine Endangered Species Act (MESA). The currently transient

nature of golden eagles in the Project area (and Maine generally) precludes a meaningful judgment of potential impacts of this Project.

2. This MDIFW review provides no assurances to the applicant from liabilities related to the Bald Eagle – Golden Eagle Protection Act and associated "Eagle Conservation Plan – Wind Energy Guidance." The U.S. Fish and Wildlife Service, Division of Migratory Bird Management has sole authority for oversight and implementation of this law; see: http://www.fws.gov/northeast/EcologicalServices/eagleact.html and http://www.fws.gov/migratorybirds/PDFs/Eagle%20Conservation%20Plan%20Guidance-Module%201.pdf

Northern bog lemming

Our Agency's traditional view of northern bog lemmings, a State Threatened Species under MESA, is that they typically occur in moist, wet meadows or boggy areas, often in conjunction with artic or alpine tundra and spruce-fir forests at elevations >2,700 feet. However, recent research in New Brunswick indicates that northern bog lemming may not only be restricted to wetlands with sphagnum mats as northern bog lemmings have been found in New Brunswick associated with riparian areas with no sphagnum present. Based on this information the species may be found in Maine at any riparian area with abundant streamside herbaceous vegetation at elevations around 1,000 feet. Therefore, based on our data from northern Maine and nearby New Brunswick there is likelihood that northern bog lemming are present within the Project area.

In addition, the US Fish and Wildlife Service announced that a formal "twelve-month" review of the status of northern bog lemming is currently underway for consideration of listing under the Federal Endangered Species Act.

MDIFW continues to recommend that surveys for northern bog lemmings are necessary to determine what impacts the Project may have on this listed species, if any. Therefore, we recommend that you work closely with MDIFW staff to design a project that minimizes the risk for potential Take and Harassment of MESA-protected species.

Roaring Brook Mayfly

Roaring Brook mayfly, a State Threatened Species, may occur in the project area. Any instream work in perennial or intermittent streams, or clearing in the vicinity of these streams, has the potential to impact this species. This species can occur in high elevation, headwater streams draining off forested (hardwood or mixed) slopes at or above 1,000 feet (including unmapped streams) within or adjacent to the currently documented range (northern Appalachian Mountain Range, stretching from Mt. Katahdin to western border with New Hampshire and Quebec).

MDIFW continues to recommend that surveys for Roaring Brook mayflies are necessary to determine what impacts the project may have on this listed species. Please contact MDIFW biologist Beth Swartz (207- 941-4476) with our Reptile, Amphibian, and Invertebrate Group for survey protocols and guidance should any instream work or work within 250 feet of streams be anticipated in the project area.

Bicknell's thrush

It is possible that Bicknell's Thrush, a Species of Special Concern, occur in the vicinity of the project area. Bicknell's thrush can be found in sub-alpine forests usually dominated by balsam fir and red spruce at elevations >2,700 feet, that typically have a history of disturbance resulting in a stunted dense understory. Because breeding individuals are known to abandon their nests as a result of even the most miniscule disturbance, please consult Regional Wildlife Biologist Bob Cordes (207-778-3324) for site-specific planning prior to implementing any clearing activities.

In addition, the US Fish and Wildlife Service announced that a formal "twelve-month" review of the status of Bicknell's thrush is currently underway for consideration of listing under the Federal Endangered Species Act.

Northern Spring Salamander

Northern spring salamanders, a Species of Special Concern, may occur in the project area. Any instream work in unmapped perennial or intermittent streams has the potential to impact this species (i.e., high elevation headwater streams) but they are also found in larger third order streams and rivers with suitable substrate (large cobble and/or gravel bars) within the documented range of primarily the western Maine mountains north and east into mountains of central Penobscot County.

MDIFW continues to recommend that surveys for northern spring salamanders are necessary to determine what impacts the project may have on this species. Please contact MDIFW biologist Beth Swartz (207- 941-4476) with our Reptile, Amphibian, and Invertebrate Group for survey protocols and guidance should any instream work or work within 250 feet of streams be anticipated in the project area.

Significant Wildlife Habitat

Significant Vernal Pools

At this time, MDIFW Significant Wildlife Habitat (SWH) maps indicate no known presence of SWHs within the project area, which include Waterfowl and Wading Bird Habitats, Deer Wintering Areas, Seabird Nesting Islands, Shorebird Areas, and Significant Vernal Pools. However, a comprehensive statewide inventory for Significant Vernal Pools has not been completed. That said we understand that a survey for vernal pools was completed during wetland delineations and that no vernal pools were documented. Please forward the vernal pool report to our Agency as soon as it becomes.

Fisheries Habitat

Without project-specific details, it is difficult to know what impacts your project may have on the mapped streams within the search area. That being said, MDIFW makes the following general recommendations as they pertain to streams.

We recommend that a 100-foot undisturbed vegetated buffer be maintained along any streams. Buffers should be measured from the edge of stream or associated fringe and floodplain wetlands. Maintaining buffers along coldwater fisheries is critical to the protection of water temperatures, water quality, and

inputs of coarse woody debris necessary to support conditions required by brook trout. Stream crossings should be avoided, but if a stream crossing is necessary, or an existing crossing needs to be modified, it should be designed to provide adequate fish passage. Small streams, including intermittent streams, can provide crucial rearing habitat, cold water for thermal refugia, and abundant food for juvenile salmonids on a seasonal basis and undersized crossings may inhibit these functions. Generally, MDIFW recommends that all new, modified, and replacement stream crossings be sized to span 1.2 times the bankfull width of the stream. In addition, we generally recommend that stream crossings be open bottomed (i.e. natural bottom), although embedded structures which are backfilled with representative streambed material have been shown to be effective in not only providing habitat connectivity for fish but also for other aquatic organisms. We encourage you to contact our Region D Fisheries staff (207-778-3322) for crossing design recommendations that best maintain fish passage. Construction Best Management Practices should be closely followed to avoid erosion, sedimentation, alteration of stream flow, and other impacts to stream habitat. In addition, we recommend that any necessary instream work or work within 100 feet of streams occur between July 15 and October 1.

This consultation review has been conducted specifically for known MDIFW jurisdictional features and should not be interpreted as a comprehensive review for the presence of other regulated features that may occur in this area. Prior to the start of any future site disturbance we recommend additional consultation with the municipality, and other state resource agencies including the Maine Natural Areas Program and Maine Department of Environmental Protection in order to avoid unintended protected resource disturbance.

Please feel free to contact my office if you have any questions regarding this information, or if I can be of any further assistance.

Best regards,

John Perry
Environmental Review Coordinator

4-B

Roxbury Wind Development Natural Resource Inventory

ROXBURY WIND DEVELOPMENT NATURAL RESOURCE INVENTORY

Prepared for:

Palmer Capital
Cohasset, Massachusetts

Prepared by:

Kleinschmidt

Pittsfield, Maine
www.KleinschmidtGroup.com

December 2017
Revision February 13, 2018

ROXBURY WIND DEVELOPMENT
NATURAL RESOURCE INVENTORY

Prepared for:

Palmer Capital
Cohasset, Massachusetts

Prepared by:

Kleinschmidt

Pittsfield, Maine
www.KleinschmidtGroup.com

December 2017
Revision February 13, 2018

ROXBURY WIND DEVELOPMENT NATURAL RESOURCE INVENTORY

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APPENDICES

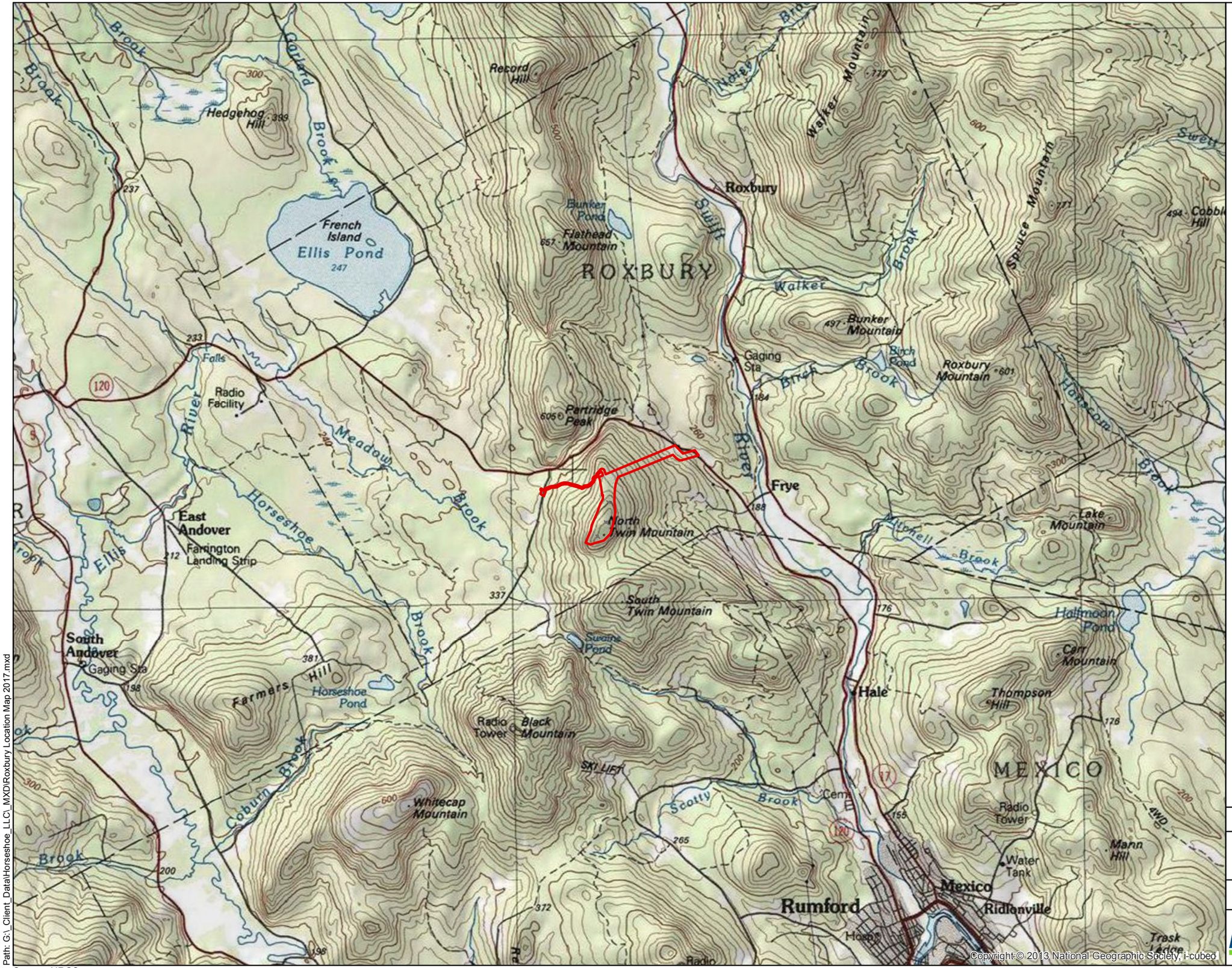
1.0 INTRODUCTION

Palmer Capital retained Kleinschmidt Associates (Kleinschmidt) to complete a vernal pool survey and wetland delineation for a proposed wind power project in the town of Roxbury, Maine in Oxford County. The proposed project includes improvements to an existing gravel access road and potentially four windmills on the ridge-top of North Twin Mountain.

2.0 METHODS

The survey area included the ridge area, including the mountain top, as well as a 300 feet wide swath along the existing CMP transmission line to the substation approximately one mile east of the ridge as well as one or two discrete areas where the existing access road may need to be straightened to allow for truck access for turbine delivery and installation. Figure 2-1 shows the approximate survey area – approximately 121 acres. Field surveys were conducted over several site visits in 2014 and in 2017. Specifically, vernal pools were surveyed on May 13, 2014 for vernal pool indicator species to identify peak Spotted Salamander breeding. Wetlands were delineated over a several-day period during late September and October of 2017.

Potential vernal pools were identified based on the Natural Resource Protection Act, Ch. 335 Significant Wildlife Habitat rules. All identified features were delineated with a Trimble® Ranger data logger and Pro-XH Global Positioning System (GPS) receiver. GPS positions were differentially corrected using Trimble Pathfinder software. Wetlands were mapped using the USACE methodology (USACE, 1987) in accordance with the Regional Supplement (USACE, 2012) which relies on a three-factor approach requiring wetland vegetation, hydrology, and soils. Wetland functions and values were assessed for each wetland based on the USACE Highway Methodology (USACE, 2001). Streams were identified based on stream criteria outlined in MSRA Title 38 §480-B. All identified features were delineated with a Trimble® Ranger data logger and Pro-XH Global Positioning System (GPS) receiver. GPS positions were differentially corrected using Trimble Pathfinder software. Wetland flags were not hung at the request of the land-owner, but GPS positions were collected at each turning point.



Source: NRCS

Path: G:_Client_Data\Horseshoe_LLC_MXD\Roxbury Location Map 2017.mxd

Legend

Natural Resource Survey Area

1 0.5 0 1

Miles

Kleinschmidt Project No. 04380-001.01
December, 2017

PALMER CAPITAL

ROXBURY WIND DEVELOPMENT
LOCATION MAP

FIGURE 2-1

Kleinschmidt
141 Main St., PO Box 650
Pittsfield, ME 04967
Telephone: (207) 487-3328
Fax: (207) 487-3124
www.KleinschmidtUSA.com

3.0 RESULTS

3.1 VERNAL POOLS

Surveys were completed for state regulated vernal pools (i.e. Significant Vernal Pools). Visits were made just after the normal peak of the wood frog breeding season (April 25-May 10), but within peak spotted salamander breeding season (May 5-May 25). While not within the peak wood frog season, egg masses were countable, but advanced in stage. No state regulated Significant Vernal Pools were identified on site, however a single amphibian breeding area (ABA) was identified in the survey area. A copy of the vernal pool survey report, which includes additional information and mapping has been included as Appendix A. The vernal pool report was submitted to the Maine Department of Environmental Protection (Maine DEP) and Maine Inland Fisheries and Wildlife (IFW). Maine DEP issued a letter on March 7, 2017, with an attachment from IFW, concluding that the vernal pool identified is "NOT SIGNIFICANT", a copy of the letter is included in Appendix D.

3.2 WETLANDS

Wetlands within the survey area include emergent and forested wetlands: scientific names of observed vegetation are included in Section 3.2.1. Emergent wetlands occur primarily in areas harvested for timber or within the cleared power right-of-way and are dominated by wool grass, soft rush, cattails, and sensitive fern (Photo 1). The largest forested wetland (GG) occurs on the ridge top, this wetland is a black spruce dominated system with sphagnum moss and organic peat over depleted subsoils (Photo 2). The remaining forested wetlands are predominantly a result of spring seeps associated with intermittent drainages. These areas are often small pockets of wetland associate with groundwater discharges.

Table 3-1 includes a summary of wetland mapped within the survey area and Table 3-2 includes the location of paired USACE sample plots; completed data forms are included as Appendix B.

TABLE 3-1 WETLANDS MAPPED WITHIN THE ROXBURY SURVEY AREA

Wetland ID	Wetland Type	Wetland Point Sequence	WOSS[1]	Square Feet	Acres
A	PFO	1-7	Yes, Portion Within 25 Feet of the stream	507	0.01
AA	PEM	1-12	No	1,216	0.03

Wetland ID	Wetland Type	Wetland Point Sequence	WOSS[1]	Square Feet	Acres
B	PFO	1-5	Yes, Portion Within 25 Feet of the stream	1,030	0.02
BB	PEM	1-16	No	2,950	0.07
C	PFO	1-10	Yes, Portion Within 25 Feet of the stream	1,148	0.03
CC	PEM	1-26	No	3,939	0.09
D	PFO	1-9	No	1,549	0.04
DD	PEM	1-23	Yes, Portion Within 25 Feet of the stream	7,764	0.18
E	PFO	1-10	No	1,732	0.04
EE	PEM	1-9	No	1,243	0.03
F	PFO	1-6	No	1,087	0.02
FF	PEM	1-22	No	14,668	0.34
FFF	PEM	1-4	No	879	0.02
G	PEM	1-26	No	5,697	0.13
GG	PFO/PEM	1-63	Yes, Portion Within 25 Feet of the stream	80,868	1.86
H	PEM	1-5	No	1,248	0.03
I	PEM	1-10	No	3,925	0.09
II	PEM/PFO	1-26	Yes, Portion Within 25 Feet of the stream	18,836	0.43
J	PEM	1-5	No	867	0.02
JJ	PEM/PFO	1-36	No	24,096	0.55
KK	PEM/PFO	1-38	Yes, Portion Within 25 Feet of the stream	27,484	0.63
LL	PFO	1-4	Yes, Portion Within 25 Feet of the stream	129	0.003
MM	PFO	1-7	Yes, Portion Within 25 Feet of the stream	799	0.02
MMM	PEM	1-10	Yes, Portion Within 25 Feet of the stream	5,332	0.12
NN	PEM	1-7	No	3,612	0.08
NNN	PFO	1-16	Yes, Portion Within 25 Feet of the stream	2,083	0.05
OO	PEM	1-7	No	720	0.02
PP	PFO	1-5	Yes, Portion Within 25 Feet of the stream	813	0.02
QQ	PFO	1-7	Yes, Portion Within 25 Feet of the stream	1,201	0.03
Total				**217,422**	**4.99**

Wetland of Special Significance

TABLE 3-2 USACE PAIRED WETLAND SAMPLE PLOT DESCRIPTIONS AND LOCATIONS

Plot ID	Habitat	Easting	Northing
Wetland C Upland Plot	Forested Wetland	2,833,334.92638	652,331.595389
Wetland C Wetland Plot		2,833,333.72375	652,346.426785
Wetland GG Upland Plot	Forested and Emergent Wetland	2,835,300.66289	650,218.124598
Wetland GG Wetland Plot		2,835,322.87282	650,271.284801
Wetland MM Upland Plot	Forested Wetland	2,837,707.52918	653,770.313200
Wetland MM Wetland Plot		2,837,700.40196	653,798.123114

State Plane, Maine-West, NAD 83 US Feet

PHOTO 1 EMERGENT WETLAND NN LOOKING NORTH ACROSS WETLAND

PHOTO 2 VIEW FORESTED WETLAND GG

N

Legend

- USACE Sample Plot
- Delineated Wetland Boundary
- Intermittent Stream
- Perennial Stream
- Wetland Area
- Natural Resource Survey Area

250 125 0 250

Scale In Feet

Kleinschmidt Project No. 04380-001.01
December, 2017

PALMER CAPITAL

ROXBURY WIND DEVELOPMENT
WETLAND MAPPING

FIGURE 3-1

Kleinschmidt
141 Main St., PO Box 650
Pittsfield, ME 04967
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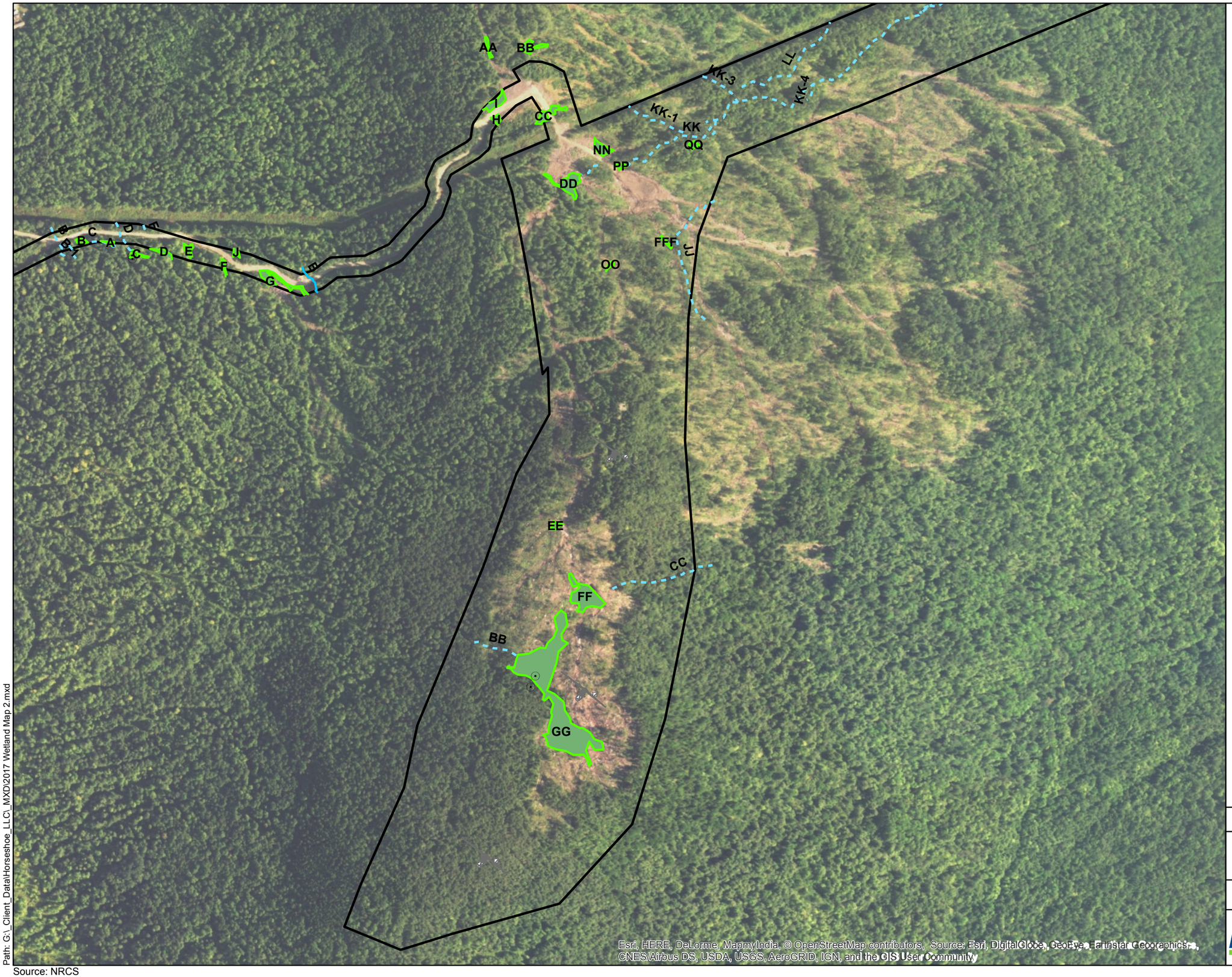
Fax: (207) 487-3124
www.KleinschmidtUSA.com

Path: G:_Client_Data\Horseshoe_LLC_MXD\2017 Wetland Map 1.mxd

Source: NRCS



Legend

- USACE Sample Plot
- Delineated Wetland Boundary
- Intermittent Stream
- Perennial Stream
- Wetland Area
- Natural Resource Survey Area

N

450 225 0 450

Scale In Feet

Kleinschmidt Project No. 04380-001.01
December, 2017

PALMER CAPITAL

ROXBURY WIND DEVELOPMENT
WETLAND MAPPING

FIGURE 3-2

Kleinschmidt
141 Main St., PO Box 650
Pittsfield, ME 04967
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Fax: (207) 487-3124
www.KleinschmidtUSA.com

Path: G:_Client_Data\Horseshoe_LLC_MXD\2017 Wetland Map 2.mxd

Source: NRCS

Legend

- USACE Sample Plot
- Delineated Wetland Boundary
- Intermittent Stream
- Perennial Stream
- Wetland Area
- Natural Resource Survey Area

350 175 0 350

Scale In Feet

Kleinschmidt Project No. 04380-001.01
December, 2017

PALMER CAPITAL

ROXBURY WIND DEVELOPMENT
WETLAND MAPPING

FIGURE 3-3

Kleinschmidt
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Fax: (207) 487-3124
www.KleinschmidtUSA.com

Path: G:_Client_Data\Horseshoe_LLC_MXD\2017 Wetland Map 3.mxd

Source: NRCS

3.2.1 VEGETATION

Forested wetlands within survey area are dominated predominantly by black spruce, balsam fir, and red maple. The largest forested wetland is a black spruce bog, which is dominated by black spruce in the over story and ground cover dominated by sphagnum moss. The remaining forested wetlands are small pockets associated with groundwater discharge. These forests areas are dominated by primarily red maple and occasionally yellow birch. Within forested wetlands on the site, shrub layer vegetation varies, but is usually a combination of saplings (i.e., black spruce, balsam fir, yellow birch, and red maple) and in some cases speckled alder, meadowsweet, and winterberry. The herbaceous understory of these hardwood forested wetlands is dominated by sensitive fern and cinnamon fern. In some locations, particularly along the two perennial streams, pockets of hemlock and balsam fir dominate the riparian area, with hemlock occurring on hummocks within these riparian wetlands. Due to the dense over story, the shrub layer and herbaceous layer is limited.

Emergent wetlands, which occur primarily in areas cleared by timber harvesting or the maintained power right-of-way, are dominated by soft rush, sensitive fern, wool grass and occasional cattails. Wetlands within the right-of-way are subjected to regular mowing and vegetation management which limits the diversity of species present. Shrub layer vegetation is mostly absent, but occasionally occurs as meadowsweet or speckled alder.

Scrub-shrub wetlands are not common on the site, and generally occur as a transitional fringe between forested and emergent systems. Scrub-shrub vegetation, when it occurs, is dominated by speckled alder and red maple saplings. Herbaceous vegetation is dominated primarily by sensitive fern. Table 3-3 contains a list of representative upland and wetland vegetation observed within the survey area.

TABLE 3-3 COMMON VEGETATION IDENTIFIED WITHIN THE STUDY AREA

Common Name	Scientific Name
Striped maple	*Acer pensylvanicum*
Red maple	*Acer rubrum*
Speckled alder	*Alnus incana*
Yellow birch	*Betula alleghaniensis*
Canada blue-joint	*Calamogrostis canadensis*
Fringed sedge	*Carex crinita*
Bladder sedge	*Carex intumescens*

Common Name	Scientific Name
Broom segde	*Carex scoparia*
Spinulose wood-fern	*Dryopteris carthusiana*
Purple-lead willow herb	*Epilobium coloratum*
Common Boneset	*Eupatorium perfoliatum*
American beech	*Fagus grandifolia*
Green ash	*Fraxinus pennsylvanica*
Rough bed-straw	*Galium asprellum*
Purple geum	*Geum rivale*
Fowl mannagrass	*Glyceria striata*
Jewelweed	*Impatiens capensis*
Soft rush	*Juncus effusus*
Water horehound	*Lycopus americanus*
Indian cucumber	*Medeola virginiana*
Indian pipe	*Monotropa uniflora*
Sensitive fern	*Onoclea sensibilis*
Cinnamon fern	*Osmunda cinnamomea*
Wood sorrel	*Oxalis montana*
Black spruce	*Picea mariana*
Blackberry	*Rubus allegheniensis*
Swamp dewberry	*Rubus hispidus*
Dark green bulrush	*Scirpus atrovirens*
Wool grass	*Scirpus cyperinus*
Late goldenrod	*Solidago altissima*
Rough goldenrod	*Solidago rugosa*
Sphagnum	*Sphagnum sp*
Meadowsweet	*Spiraea latifolia*
Steeple bush	*Spiraea tomentosa*
Twisted stalk	*Streptopus amplexifolius*
Calico aster	*Symphyotrichum lateriflorum*
Purple stemmed aster	*Symphyotrichum puniceum*
Small white aster	*Symphyotrichum racemosum*
Star flower	*Trientalis borealis*
Broad leaved cattail	*Typha latifolia*
Hobble bush	*Viburnum lantinoides*

3.2.2 SOILS

Soils for the site are dominated by Lyman-Tunbridge-Monadnock (LWE/LUD) with slopes ranging from 0-60 percent (Figure 3-3 and Table 3-4) (NRCS 2017). These soils are mostly derived from loamy supraglacial till derived from granite and gneiss and/or loamy supraglacial till derived from phyllite and/or loamy supraglacial till derived from mica schist. The remaining soils on the site are all dominated by till derived primarily from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist. Localized areas of Colton-Adams complex (CHC) are located at the valley bottom, and are derived from glaciofluvial deposits. Representative soil profiles in these locations generally consisted of 0-6 inches of brown (10 YR 4/2) sandy loam, 6-12 inches of grey (10YR 5/2) sandy loam with prominent (7.5 YR 5/6) redoximorphic features along pore linings and olive gray (10YR 6/2) redoximorphic features within the matrix (Photo 3).

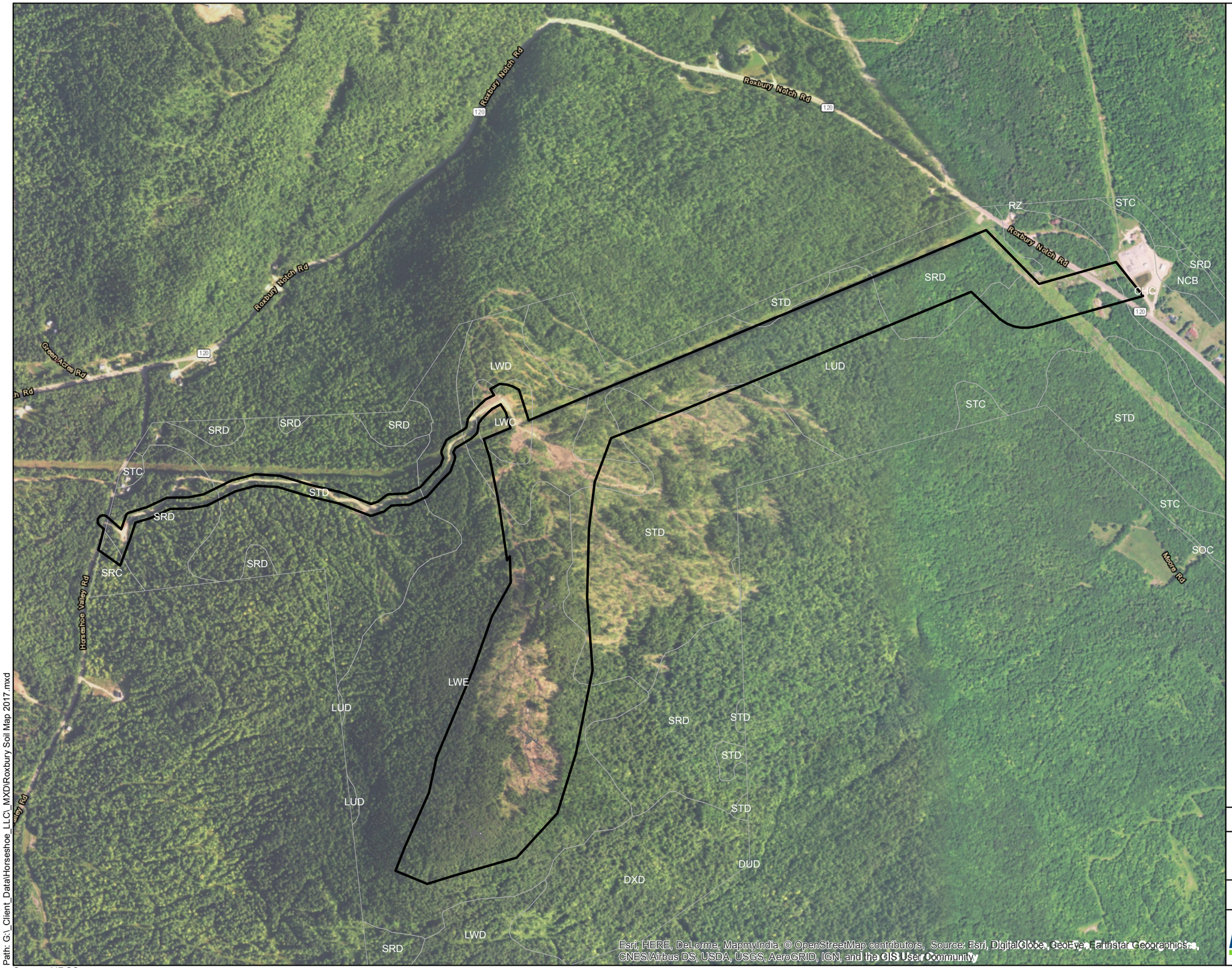
Most wetlands on the ridgetop were located in areas where shallow bedrock conditions resulted in perched water and soils here were histosols or mineral soils with histic epipedons (thick, dark, organic horizon at the surface) with organic material ranging from 0-12 inches. For wetlands identified in areas of Lyman-Tunbridge-Becket or Lyman-Tunbridge-Becket the most common hydric indicator was a reduced matrix and the presence of redoximorphic features indicating an elevated water table within the surface horizons. A full general soil report for the survey area is included as Appendix C.

TABLE 3-4 SUMMARY OF SOILS PRESENT WITHIN THE ROXBURY SURVEY AREA

Soil Symbol	Soil Name	Drainage Class	Parent Material	Square Feet	Acres	Percent of Survey Area
SRC	Skerry-Becket association, 0 to 15 percent slopes, very stony	Moderately well drained	loamy lodgment till	26729	0.6	0.4
CHC	Colton-Adams complex, 0 to 15 percent slopes	Excessively drained	sandy-skeletal glaciofluvial deposits	35988	0.8	0.5

Soil Symbol	Soil Name	Drainage Class	Parent Material	Square Feet	Acres	Percent of Survey Area
LWC	Lyman-Tunbridge-Monadnock complex, 0 to 15 percent slopes, very stony	Well drained	supraglacial glacial till	202994	4.7	3.1
LWD	Lyman-Tunbridge-Monadnock complex, 15 to 35 percent slopes, very stony	Well drained	supraglacial glacial till	511067	11.7	7.7
STD	Skerry-Colonel association, 15 to 35 percent slopes, very stony	Moderately well drained	loamy lodgment till	586058	13.5	8.8
SRD	Skerry-Becket association, 15 to 35 percent slopes, very stony	Moderately well drained	loamy lodgment till	683916	15.7	10.3
LUD	Lyman-Tunbridge-Becket complex, 15 to 35 percent slopes, very stony	Well drained	supraglacial glacial till	1551217	35.6	23.3
LWE	Lyman-Tunbridge-Monadnock complex, 35 to 60 percent slopes, very stony	Well drained	supraglacial glacial till	3055054	70.1	45.9
Totals for Survey Area				**6653023**	**152.7**	**100.0**

PHOTO 3 REPRESENTATIVE WETLAND SOIL (DEPLETED MATRIX) FOUND IN WETLAND C



Legend

- Natural Resource Survey Area
- Soil Survey

800 400 0 800

Scale In Feet

Kleinschmidt Project No. 04380-001.01
December, 2017

PALMER CAPITAL

ROXBURY WIND DEVELOPMENT
SOIL MAPPING

FIGURE 3-4

Kleinschmidt
141 Main St., PO Box 650
Pittsfield, ME 04967
Telephone: (207) 487-3328
Fax: (207) 487-3124
www.KleinschmidtUSA.com

Path: G:_Client_Data\Horseshoe_LLC_MXD\Roxbury Soil Map 2017.mxd

Source: NRCS

3.2.3 HYDROLOGY

Wetland hydrology indicators vary across the mapped wetlands, however the most commonly occurring primary indicators of hydrology included surface water, high water table, saturation, water marks, sediment deposits, and water stained leaves. Generally wetlands associated with streams showed signs of water marks and sediment staining related to seasonal high water. Secondary indicators of wetland hydrology included drainage patterns, geomorphic position, and FAC-neutral tests. Most hillside drainages processed drainage patterns.

3.2.4 WETLAND FUNCTIONS AND SERVICES

Principle functions of the majority of the wetlands identified in the survey area are: wildlife habitat, streambank stabilization, and production export. The highest quality wetland habitat is found within wetland GG, the black spruce bog found on the ridge top. Wetland GG provides good wildlife habitat, although recent timber harvesting has removed upland forest around portions of this wetland. Water quality improvements are a common principle function of many of the wetlands identified within the survey area, many wetlands occur as small pockets associated with groundwater and spring activity. Most of the wetlands provided some, but limited, water quality functions as the systems are all located in headwaters and there is no development or agriculture within the drainage area for these wetlands and stream systems. Wetland services provided by mapped wetlands in the survey area are limited, as the wetlands occur on private property which limits access by the general public for recreation or observation.

TABLE 3-5 WETLAND AND AQUATIC RESOURCES FUNCTIONS AND SERVICES

Wetland/Stream	Groundwater Recharge/Discharge	Floodflow Alteration	Fish and Shellfish Habitat	Sediment/Toxicant Retention	Nutrient Removal	Production Export	Sediment/Shoreline Stabilization	Wildlife Habitat	Recreation	Educational/Scientific Value	Uniqueness/Heritage	Visual Quality/Aesthetics	Endangered Species Habitat
A	x							x					
AA								x					
B	x							**x**					
BB								P					
C	x							P					
CC								**P**					
D	x							x					
DD		x		x	x			**P**					
E	x							x					
EE								x					
F	x							x					
FF		x		x	x			**P**					
FFF								x					
G	x							x					
GG	**x**	x		x	x	**P**		**P**	x				
H								x					
I								x					
II	**x**	x		x	x		x	x					
J								x					
JJ	**x**	x		x	x			x					
KK	**x**	x		x	x			x					
LL	x			x				x					
MM	**x**							x					
MMM	**x**			x				x					
NN	x							x					
NNN	**x**	x		x	x			**P**					
OO								x					
PP	**x**						x	x					
QQ	**x**							x					
Perennial Streams	**P**		**P**			x	x	**P**	x			**P**	
Intermittent Streams	**P**					x	x	**P**				x	

3.3 STREAMS

Several streams were identified within the survey area; the majority of these streams are intermittent drainages (Table 3-6). Two small, unnamed perennial streams (Photo 4 and Photo 5) are mapped on the site. The larger stream (Stream EE) is a direct tributary to the Swift River. Both of these streams are dominated by cobble, boulder and bedrock. Intermittent streams, of which there are several, generally convey flows from spring seeps and run-off (Photo 6). Substrates within the intermittent streams vary, but are commonly dominated by sand, gravel, and occasional cobbles.

PHOTO 4 REPRESENTATIVE VIEW OF PERENNIAL STREAM EE

PHOTO 5 REPRESENTATIVE VIEW OF PERENNIAL STREAM KK

PHOTO 6 VIEW OF REPRESENTATIVE INTERMITTENT STREAM (STREAM D)

TABLE 3-6 SUMMARY OF STREAMS MAPPED WITHIN THE ROXBURY SURVEY AREA

Stream ID	Type	Point Sequence	Length (Feet)
B	Intermittent	1-13	237
B-1	Intermittent	1-6	92
C	Intermittent	1-7	165
D	Intermittent	1-14	187
F	Intermittent	1-3	45
E	Perennial	1-11	163
JJ	Intermittent	1-19	748
KK-2	Intermittent	1-2	103
KK-3	Intermittent	1-4	232
LL	Intermittent	1-12	626
KK	Intermittent	1-67	2,855
HH	Intermittent	1-47	1,837
GG	Intermittent	1-6	158
FF	Intermittent	1-22	427
AAA	Intermittent	1-12	363
AAA	Intermittent	1-7	135
EE	Perennial	1-5	258
EE-1	Perennial	6-10	246
BB	Intermittent	1-7	228
CC	Intermittent	1-15	543
AA	Intermittent	1-6	108
KK-1	Intermittent	1-9	331
KK-5	Intermittent	1-2	53
KK-4	Intermittent	1-3	90
S-01	Intermittent	-	122
S-02	Intermittent	-	368

PHOTO 7 REPRESENTATIVE VIEW OF UNNAMED BROOK

PHOTO 8 REPRESENTATIVE VIEW, LOOKING UPSTREAM, OF UNNAMED STREAM (STREAM A)

4.0 RARE SPECIES INQUIRIES

Based on the December 13, 2017 response from the Maine Natural Areas Program (MNAP), no rare or exemplary botanical features are identified within the survey area (Appendix D). Several species have the potential to occur within the survey area based on historic observations in the vicinity of the survey area. No rare species were observed during fieldwork completed in September and October of 2017.

Based on a response from MDIFW, the project area has been surveyed for rare, endangered and species of concern in consultation with MDIFW. The MDIFW has received, reviewed, and provided comment on the aforementioned report. Consultation with the MDIFW regarding the northern long-eared bat is occurring independently of this report.

5.0 DISCUSSION

A total of 26 streams, 29 wetlands, and one amphibian breeding area were identified during the natural resource inventory completed at the Roxbury Wind Development property. Two very small perennial streams, both unnamed, occur within the survey area. The remaining streams are small intermittent drainages that result from hillside seeps and run-off from the surrounding landscape. The wetlands within the survey area are primarily forested and emergent. Most wetlands are in good condition (e.g., native plant communities, lack of pollution) and provide typical wetland functions (i.e., wildlife habitat). However, some wetlands have been impacted by timber harvesting or vegetation management within the right-of-way. Invasive species are very limited; no invasive species were identified during the field work. No state regulated vernal pools occur on the site as confirmed by Maine DEP in their finding of "NOT SIGNIFICANT", see Appendix D.

6.0 REFERENCES

U.S. Army Corps. of Engineers (USACE). 1987. Corps. of Engineers Wetland Delineation Manual. U.S. Army Corps. of Engineers. 143 pp.

USACE. 2001. The Highway Methodology Workbook. U.S. Army Corps. of Engineers New England District. 29 pp. NAEEP-360-1-30a.

USACE. 2012. Interim Regional Supplement to the Corps. of Engineers Wetland Delineation Manual: Northcentral and Northeast Region. U.S. Army Corps. of Engineers. 179 pp.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. (NRCS) Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed [November 30, 2017].

APPENDIX A

VERNAL POOL REPORT

ROXBURY WIND DEVELOPMENT VERNAL POOL SURVEY REPORT

Prepared for:

Palmer Capital
Cohasset, Massachusetts

Prepared by:

Kleinschmidt

Pittsfield, Maine
www.KleinschmidtGroup.com

November 2016

ROXBURY WIND DEVELOPMENT VERNAL POOL SURVEY REPORT

Prepared for:

Palmer Capital
Cohasset, Massachusetts

Prepared by:

Kleinschmidt

Pittsfield, Maine
www.KleinschmidtGroup.com

November 2016

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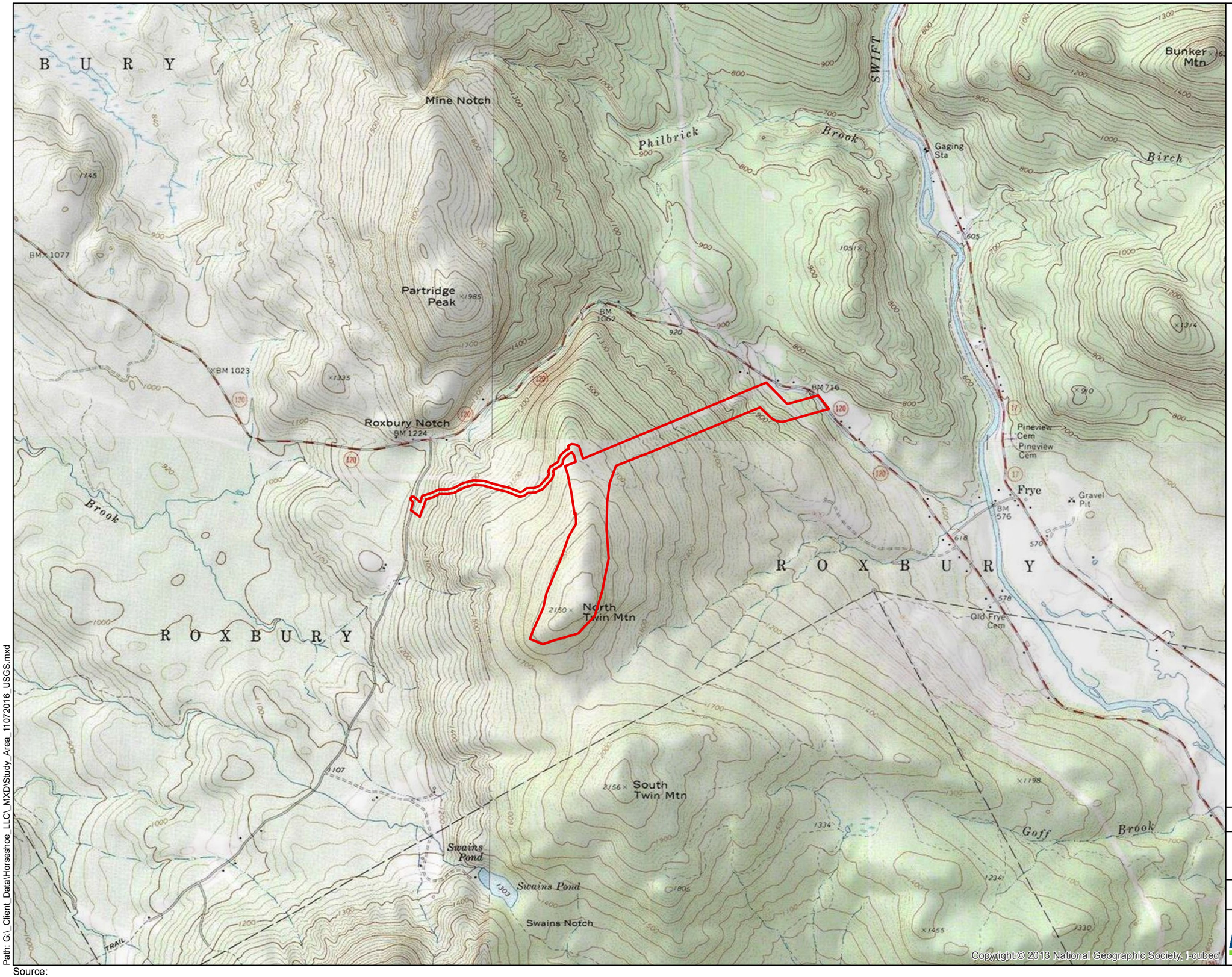
APPENDICES

1.0 INTRODUCTION

In 2014 Kleinschmidt Associates (Kleinschmidt) completed a vernal pool survey for the Roxbury Wind Development project in Roxbury, Maine. The study area included the ridge area, including the mountain top, as well as a 300 ft wide swath along the existing CMP transmission line to the substation approximately one mile east of the ridge as well as one or two discrete areas where the existing access road may need to be straightened to allow for truck access for turbine delivery and installation. Figure 1-1 shows the extent of the survey area.



N

Legend

Roxbury Survey Area

2,000 1,000 0 2,000

Scale In Feet

Kleinschmidt Project No. 4380001.00
November, 2016

PALMER CAPITAL

ROXBURY
SURVEY AREA 05-17-2014

MAP 1 OF 1

Kleinschmidt
141 Main St., PO Box 650
Pittsfield, ME 04967
Telephone: (207) 487-3328
Fax: (207) 487-3124
www.KleinschmidtUSA.com

Path: G:_Client_Data\Horseshoe_LLC_MXD\Study_Area_11072016_USGS.mxd

Source:

2.0 METHODS

A field survey for vernal pools was completed on May 17, 2014. Potential vernal pools were identified based on the Natural Resource Protection Act, Ch. 335 Significant Wildlife Habitat rules. All identified features were delineated with a Trimble® Ranger data logger and Pro-XH Global Positioning System (GPS) receiver. GPS positions were differentially corrected using Trimble Pathfinder software.

3.0 RESULTS

3.1 VERNAL POOLS

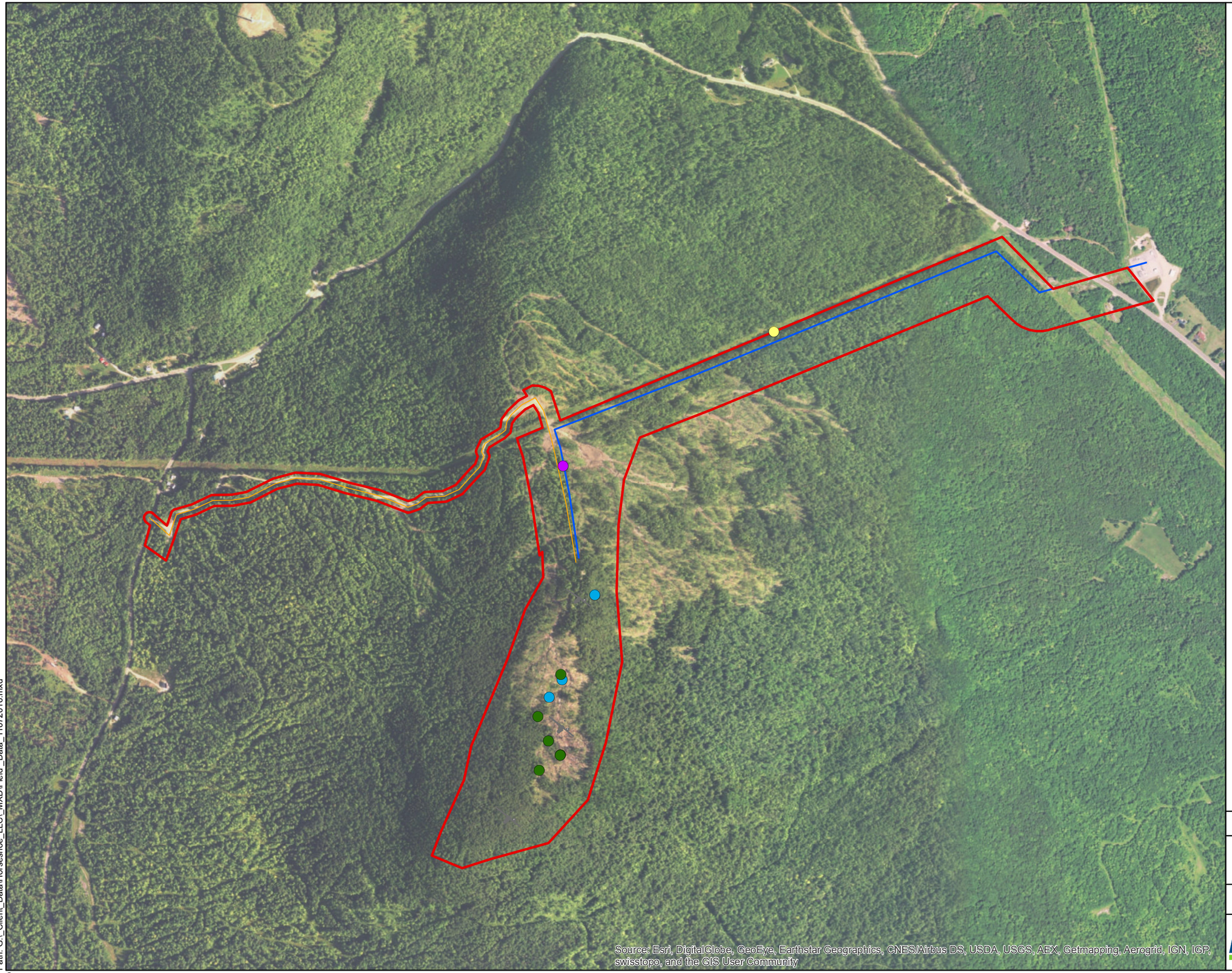
Surveys were completed for state regulated vernal pools (i.e. Significant Vernal Pools). Visits were made just after the normal peak of the wood frog breeding season (April 25-May 10), but within peak spotted salamander breeding season (May 5-May 25). While not within the peak wood frog season, egg masses were countable, but advanced in stage. No state regulated Significant Vernal Pools were identified on site, however a single amphibian breeding areas (ABA) was identified in the survey area. The breeding area identified on the site occurred in the middle of the existing CMP power line in a man-made pool that appeared to be the result of historic soil disturbance related to construction of the transmission line. The breeding area (identified as Breeding Area A on the attached data sheet) contained five wood frog egg masses. The pool is not a Significant Vernal Pool as it is man-made. The pool also contained aquatic stage eastern newts (*Notophthalmus viridescens*) and green frogs (*Lithobates clamitans*). A completed Maine Department of Inland Fisheries (MDIFW) data form is included as Appendix A and Table 3-1 includes additional details of each mapped breeding area. Photos of each breeding area are shown in Photos 3-1 and 3-2. Figure 3-1 shows the location of the mapped ABA within the survey area.

TABLE 3-1 SUMMARY OF AMPHIBIAN BREEDING AREAS IN THE SURVEY AREA

BREEDING AREA ID	WOOD FROG EGG COUNTS	SPOTTED SALAMANDER EGG COUNTS	STATE SIGNIFICANT
	5/17/2014	5/17/2014	
ABA A	5	0	No

PHOTO 3-1 WOOD FROG EGG MASSES, BREEDING AREA A

PHOTO 3-2 VIEW OF BREEDING AREA A



N

Legend

Comment

- Intermittent Stream
- Black Spruce Bog (No Indicator Spp)
- ABA
- Disturbed Wetland
- Vernal Pool Survey Area
- Access Road
- Gen-Lead

800 400 0 800

Scale In Feet

Kleinschmidt Project No. 4380001.00
November, 2016

PALMER CAPITAL

ROXBURY
SURVEY AREA 05-17-2014

MAP 1 OF 1

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Fax: (207) 487-3124
www.KleinschmidtUSA.com

Path: G:_Client_Data\Horseshoe_LLC_MXD\Field _Data_11072016.mxd

Source:

4.0 DISCUSSION

Several wetland areas were identified within the survey area, including a black spruce bog located at the ridge top of the survey area. No vernal pool indicator species were identified within the bog located at the ridge top of the ridge; there was several inches of standing water in depressions within the bog, but no use by amphibians or aquatic macro-invertebrates was observed. No other wetlands within the survey area contained indicator species egg masses or sufficient seasonal ponding to provide habitat. Several intermittent drainages and seeps are located along the hillsides within the survey area, but none support areas of ponding or provide habitat for indicator species breeding. The only feature containing indicator species egg masses was a very small excavation pit which is likely from removal of a transmission pole or some other aspect of power line construction. Five wood frog egg masses were observed in the man-made breeding area at the time of the visit.

APPENDIX A

VERNAL POOL DATA FORMS

Maine State Vernal Pool Assessment Form

INSTRUCTIONS: Complete all 3 pages of form as thoroughly as possible. Most fields are required for pool registration.

Observer's Pool ID: Breeding area A **MDIFW Pool ID:** _____

1. PRIMARY OBSERVER INFORMATION

a. Observer name: Alan Haberstock

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

2. PROJECT CONTACT INFORMATION

a. Contact name: ○ same as observer ◉ other Palmer Capital

b. Contact and credentials previously provided? ○ No (submit Addendum 1) ◉ Yes

c. Project Name: Roxbury Wind Development

NOTE: Clear photographs or digital images of a) the pool and b) the indicators (one example of each species egg mass) are required for nonprofessional observers and encouraged for all observers.

3. LANDOWNER CONTACT INFORMATION

a. Are you the landowner? ○ Yes ◉ No If no, was landowner permission obtained for survey? ◉ Yes ○ No

b. Landowner's contact information (required)

Name: Palmer Capital Phone: _____

Street Address: 13 Elm Street #200 City: Cohasset State: MA Zip: 02025

c. ☐ Large Projects: check if separate project landowner data file submitted

4. VERNAL POOL LOCATION INFORMATION

a. Location Township: Roxbury

Brief site directions to the pool (using mapped landmarks):

See Location Map (Included in survey report)

b. Mapping Requirements: At least 2 of the 3 must be submitted (check those submitted):

☐ USGS topographic map with pool clearly marked.

☒ Large scale aerial photograph with pool clearly marked.

☐ GPS data (complete section below).

GPS location of vernal pool

Longitude/Easting: 2837484.623 Latitude/Northing: 653792.561

Check Datum: ○ NAD27 ◉ NAD83 / WGS84 Coordinate system: Maine State Plane

Check one:

○ GIS shapefile
- send to Jason.Czapiga@maine.gov; observer has reviewed shape accuracy (best)

○ The pool perimeter is delineated by multiple GPS points. (excellent)
- Include map or spreadsheet with coordinates.

◉ The above GPS point is at the center of the pool. (good)

○ The center of the pool is approximately _____ m ○ /ft ○ in the compass direction of _____ degrees from the above GPS point. (acceptable)

Maine State Vernal Pool Assessment Form

5. VERNAL POOL HABITAT INFORMATION

a. Habitat survey date (only if different from indicator survey dates on page 3): _____

b. Wetland habitat characterization

■ Choose the best descriptor for the landscape setting:

- (•) Isolated depression
- ( ) Floodplain depression
- ( ) Pool associated with larger wetland complex
- ( ) Other: _____

■ Check all wetland types that best apply to this pool:

- [ ] Forested swamp
- [ ] Shrub swamp
- [ ] Peatland (fen or bog)
- [ ] Emergent marsh
- [x] Wet meadow
- [ ] Lake or Pond Cove
- [ ] Abandoned beaver flowage
- [ ] Active beaver flowage
- [ ] Slow stream
- [ ] Floodplain
- [ ] Isolated pool
- [ ] Other: _____

c. Vernal pool status under the Natural Resources Protection Act (NRPA)

i. Pool Origin: ( ) Natural ( ) Natural-Modified (•) Unnatural ( ) Unknown

If modified, unnatural or unknown, describe any modern or historic human impacts to the pool (required):

Appears to be old excavation pit associated with transmission ROW

ii. Pool Hydrology

■ Select the pool's estimated hydroperiod AND provide rationale for opinion.

- ( ) Permanent
- (•) Semi-permanent (drying partially in all years and completely in drought years)
- ( ) Ephemeral (drying out completely in most years)
- ( ) Unknown

Explain:

■ Maximum depth at survey: ( ) 0-12" (0-1 ft.) (•) 12-36" (1-3 ft.) ( ) 36-60" (3-5 ft.) ( ) >60" (>5 ft.)

■ Approximate size of pool (at spring highwater): Width: 5 ( ) m (•) ft Length: 8 ( ) m (•) ft

■ Predominate substrate in order of increasing hydroperiod:

- ( ) Mineral soil (bare, leaf-litter bottom, or upland mosses present)
- (•) Mineral soil (sphagnum moss present)
- ( ) Organic matter (peat/muck) shallow or restricted to deepest portion
- ( ) Organic matter (peat/muck) deep and widespread

■ Pool vegetation indicators in order of increasing hydroperiod (check all that apply):

- [ ] Terrestrial nonvascular spp. (e.g. haircap moss, lycopodium spp.)
- [ ] Dry site ferns (e.g. spinulose wood fern, lady fern, bracken fern)
- [ ] Moist site ferns (e.g. sensitive fern, cinnamon fern, interrupted fern, New York fern)
- [ ] Moist site vasculars (e.g. skunk cabbage, jewelweed, blue flag iris, swamp candle)
- [ ] Sphagnum moss (anchored or suspended)
- [ ] Wet site ferns (e.g. royal fern, marsh fern)
- [ ] Wet site shrubs (e.g. highbush blueberry, maleberry, winterberry, mountain holly)
- [x] Wet site graminoids (e.g. blue-joint grass, tussock sedge, cattail, bulrushes)
- [ ] Aquatic vascular spp. (e.g. pickerelweed, arrowhead)
- [ ] Floating or submerged aquatics (e.g. water lily, water shield, pond weed, bladderwort)
- [ ] No vegetation in pool

■ Faunal indicators (check all that apply):

- [ ] Fish
- [ ] Bullfrog or Green Frog tadpoles
- [ ] Other: _____

iii. Inlet/Outlet Flow Permanency

Type of inlet or outlet (a seasonal or permanent channel providing water flowing into or out of the pool):

- (•) No inlet or outlet
- ( ) Intermittent inlet or outlet
- ( ) Permanent inlet or outlet (channel with well-defined banks and permanent flow)
- ( ) Other or Unknown (explain): _____

Maine State Vernal Pool Assessment Form

6. VERNAL POOL INDICATOR INFORMATION

a. Indicator survey dates: 5/17/2014

b. Indicator abundance criteria

■ Was the entire pool surveyed for egg masses? ◉ Yes ○ No; what % of pool surveyed? _____

■ For each indicator species, indicate the exact number of egg masses, confidence level for species determination, and egg mass maturity. Separate cells are provided for separate survey dates.

INDICATOR SPECIES	Egg Masses (or adult Fairy Shrimp)			Tadpoles/Larvae		
	#	Confidence Level[1]	Egg Mass Maturity[2]	Observed	Confidence Level[1]	
Wood Frog	5	3	A/H			
Spotted Salamander						
Blue-spotted Salamander						
Fairy Shrimp[3]						

1-Confidence level: 1 = <60%, 2 = 60-95%, 3 = >95%

2-Egg mass maturity: F= Fresh (<24 hrs), M= Mature (round embryos), A= Advanced (loose matrix, curved embryos), H= Hatched or Hatching

3-Fairy Shrimp: X = present

c. Rarity criteria

■ Note any rare species associated with vernal pools. Observations should be accompanied by photographs (labeled with observer name, pool location, and date).

SPECIES	Method of Verification*			CL**	SPECIES	Method of Verification*			CL**
	P	H	S			P	H	S	
Blanding's Turtle	☐	☐	☐		Wood Turtle	☐	☐	☐	
Spotted Turtle	☐	☐	☐		Ribbon Snake	☐	☐	☐	
Ringed Boghaunter	☐	☐	☐		Other:	☐	☐	☐	

*Method of verification: P = Photographed, H = Handled, S = Seen

**CL - Confidence level in species determination: 1= <60%, 2= 60-95%, 3= >95%

d. Optional observer recommendation:

☐ SVP ☐ Potential SVP ☒ Non Significant VP ☐ Indicator Breeding Area

e. General vernal pool comments and/or observations of other wildlife:

Pool is man-made, resulting from excavation related to transmission poles.

Send completed form and supporting documentation to: Maine Dept. of Inland Fisheries and Wildlife
Attn: Vernal Pools
650 State Street, Bangor, ME 04401

NOTE: Digital submission (to Jason.Czapiga@maine.gov) of vernal pool field forms and photographs is only acceptable for projects with 3 or fewer assessed pools; larger projects must be mailed as hard copies.

For MDIFW use only Reviewed by MDIFW Date: _____ Initials: _____

This pool is: ☐ **Significant** ☐ **Potentially Significant** but lacking critical data ☐ **Not Significant** due to: ○ does not meet biological criteria. ○ does not meet MDEP vernal pool criteria.

Comments:

APPENDIX B

USACE WETLAND DATA FORMS AND PHOTOS

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Roxbury Wind Development City/County: Oxford Co. Sampling Date: 9/15/17

Applicant/Owner: Palmer Capital State: ME Sampling Point: C Wet

Investigator(s): Steve Knapp, PWS Section, Township, Range:

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): Concave Slope %: 0-5

Subregion (LRR or MLRA): LRR R Lat: SEE REPORT Long: SEE REPORT Datum: NAD83

Soil Map Unit Name: (STD) Skerry-Colonel association, 15 to 35 percent slopes, very stony NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area**
Hydric Soil Present?	Yes X	No ____	**within a Wetland?** **Yes** X **No** ____
Wetland Hydrology Present?	Yes X	No ____	If yes, optional Wetland Site ID:

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Sparsely Vegetated Concave Surface (B8)
- X Water-Stained Leaves (B9)
- ____ Aquatic Fauna (B13)
- ____ Marl Deposits (B15)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Oxidized Rhizospheres on Living Roots (C3)
- ____ Presence of Reduced Iron (C4)
- ____ Recent Iron Reduction in Tilled Soils (C6)
- X Thin Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ____ Moss Trim Lines (B16)
- ____ Dry-Season Water Table (C2)
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Stunted or Stressed Plants (D1)
- ____ Geomorphic Position (D2)
- ____ Shallow Aquitard (D3)
- ____ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 2
Water Table Present?	Yes X	No ____	Depth (inches): 12
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 1

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: C Wet

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Fraxinus pennsylvanica*	25	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	25	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Viburnum lantanoides*	10	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
	10	=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Impatiens capensis*	40	Yes	FACW
2. *Epilobium coloratum*	10	Yes	OBL
3. *Galium asprellum*			OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	50	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	65	x 2 =	130
FAC species	0	x 3 =	0
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	85 (A)		180 (B)

Prevalence Index = B/A = 2.12

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point C Wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 3/1	100					Muck	
1-12	10YR 5/2	75	7.5YR 5/6	25	C	M	Sandy	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ? Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: None

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Roxbury Wind Development City/County: Oxford Co. Sampling Date: 9/15/17

Applicant/Owner: Palmer Capital State: ME Sampling Point: CUpland

Investigator(s): Steve Knapp, PWS Section, Township, Range:

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): Convex Slope %: 5-10

Subregion (LRR or MLRA): LRR R Lat: SEE REPORT Long: SEE REPORT Datum: NAD83

Soil Map Unit Name: (STD) Skerry-Colonel association, 15 to 35 percent slopes, very stony NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area**
Hydric Soil Present?	Yes ____	No X	**within a Wetland?** **Yes** ____ **No** X
Wetland Hydrology Present?	Yes ____	No X	If yes, optional Wetland Site ID:

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: C Upland

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer spicatum*	40	Yes	FACU
2. *Fagus grandifolia*	40	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	80	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Acer spicatum*	40	Yes	FACU
2. *Fagus grandifolia*	40	Yes	FACU
3. *Viburnum lantanoides*	20	Yes	FACU
4.			
5.			
6.			
7.			
	100	=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Acer rubrum*	5	Yes	FAC
2. *Fagus grandifolia*	5	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	10	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 14.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	5	x 3 =	15
FACU species	185	x 4 =	740
UPL species	0	x 5 =	0
Column Totals:	190 (A)		755 (B)

Prevalence Index = B/A = 3.97

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point C Upland

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/1	100					Loamy/Clayey	
3-10	10YR 5/6	100					Loamy/Clayey	
10-16	10YR 6/6	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: NONE

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Roxbury Wind Development City/County: Oxford Sampling Date: 10/17/17

Applicant/Owner: Palmer Capital State: ME Sampling Point: GG Wet

Investigator(s): Steve Knapp, PWS Section, Township, Range:

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope %: 0-2

Subregion (LRR or MLRA): LRR R Lat: SEE REPORT Long: SEE REPORT Datum: NAD83

Soil Map Unit Name: (LWE) Lyman-Tunbridge-Monadnock complex, 35 to 60 percent slopes NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area**
Hydric Soil Present?	Yes X	No ____	**within a Wetland?** **Yes** X **No** ____
Wetland Hydrology Present?	Yes X	No ____	If yes, optional Wetland Site ID:

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ____	Depth (inches): 0
Water Table Present?	Yes X	No ____	Depth (inches): 12
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 4

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: GG Wet

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Picea mariana*	25	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	25	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Picea mariana*	10	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
	10	=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Carex crinita*	5	Yes	OBL
2. *Symphyotrichum puniceum*	10	Yes	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	15	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	35	x 2 =	70
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	50 (A)		85 (B)

Prevalence Index = B/A = 1.70

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point GG Wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 3/1	100					Mucky Peat	
10-16	10YR 5/2	75	7.5YR 5/6	25	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- X Histic Epipedon (A2)
- X Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Roxbury Wind Development City/County: Oxford Co Sampling Date: 10/17/17

Applicant/Owner: Palmer Capital State: ME Sampling Point: GG Upland

Investigator(s): Steve Knapp, PWS Section, Township, Range:

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope %: 0-5

Subregion (LRR or MLRA): LRR R Lat: SEE REPORT Long: SEE REPORT Datum: NAD83

Soil Map Unit Name: (LWE) Lyman-Tunbridge-Monadnock complex, 35 to 60 percent slopes NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area**
Hydric Soil Present?	Yes ____	No X	**within a Wetland?** **Yes** ____ **No** X
Wetland Hydrology Present?	Yes ____	No X	If yes, optional Wetland Site ID:

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ? Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): 0
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): 0

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: GG Upland

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	25	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	25	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Fagus grandifolia*	5	Yes	FACU
2. *Picea rubens*	5	Yes	FACU
3. *Viburnum lantanoides*	10	Yes	FACU
4.			
5.			
6.			
7.			
	20	=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Oxalis montana*	5	Yes	FACU
2. *Trientalis borealis*	5	Yes	FAC
3. *Dryopteris carthusiana*	5	Yes	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	15	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 42.9% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	30	x 3 =	90
FACU species	25	x 4 =	100
UPL species	0	x 5 =	0
Column Totals:	60 (A)		200 (B)

Prevalence Index = B/A = 3.33

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point GG Upland

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	5YR 2.5/2	100					Loamy/Clayey	
3-6	2.5YR 3/6	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 6

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Roxbury Wind Development City/County: Oxford Co Sampling Date: 10/18/17

Applicant/Owner: Palmer Capital State: ME Sampling Point: MM Wet

Investigator(s): Steve Knapp, PWS Section, Township, Range:

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): Concave Slope %: 0-2

Subregion (LRR or MLRA): LRR R Lat: SEE REPORT Long: SEE REPORT Datum: NAD83

Soil Map Unit Name: (LUD) Lyman-Tunbridge-Becket complex, 15 to 35 percent slopes NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area**
Hydric Soil Present?	Yes X	No ____	**within a Wetland?** **Yes** X **No** ____
Wetland Hydrology Present?	Yes X	No ____	If yes, optional Wetland Site ID:

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 2
Water Table Present?	Yes X	No ____	Depth (inches): 12
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 2

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: MM Wet

Tree Stratum (Plot size: NO TREES)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: NO SHRUBS)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
Herb Stratum (Plot size: 5)			
1. *Rubus hispidus*	30	Yes	FACW
2. *Dryopteris carthusiana*	10	No	FACW
3. *Galium asprellum*	15	Yes	OBL
4. *Onoclea sensibilis*	10	No	FACW
5. *Lycopus americanus*	10	No	OBL
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	75 =Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	=Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	25	x 1 =	25
FACW species	50	x 2 =	100
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	75 (A)		125 (B)

Prevalence Index = B/A = 1.67

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Area is small emergent srping seep, with surrounding upland forest providing canopy cover. No trees growing within the wetland area.

SOIL

Sampling Point MM Wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/1	100					Muck	
6-16	10YR 5/2	75	7.5YR 5/6	25	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ? Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ____

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Roxbury Wind Development City/County: Oxford Sampling Date: 10/18/17

Applicant/Owner: Palmer Capital State: ME Sampling Point: MM Upland

Investigator(s): Steve Knapp, PWS Section, Township, Range:

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): Convex Slope %: 5-10

Subregion (LRR or MLRA): LRR R Lat: SEE REPORT Long: SEE REPORT Datum: NAD83

Soil Map Unit Name: (LUD) Lyman-Tunbridge-Becket complex, 15 to 35 percent slopes NWI classification: NONE

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area**
Hydric Soil Present?	Yes ____	No X	**within a Wetland?** **Yes** ____ **No** X
Wetland Hydrology Present?	Yes ____	No X	If yes, optional Wetland Site ID:

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ? Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants.

Sampling Point: MM Upland

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	20	Yes	FAC
2. *Betula papyrifera*	20	Yes	FACU
3. *Fagus grandifolia*	15	Yes	FACU
4.			
5.			
6.			
7.			
	55	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. *Fagus grandifolia*	10	Yes	FACU
2. *Acer rubrum*	10	Yes	FAC
3. *Viburnum lantanoides*	5	Yes	FACU
4.			
5.			
6.			
7.			
	25	=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Trientalis borealis*	2	No	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	2	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	32	x 3 =	96
FACU species	50	x 4 =	200
UPL species	0	x 5 =	0
Column Totals:	82 (A)		296 (B)

Prevalence Index = B/A = 3.61

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point MM Upland

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	7.5YR 3/3	100					Loamy/Clayey	
3-6	10YR 4/4	100					Loamy/Clayey	
6-16	10YR 5/4	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ High Chroma Sands (S11) (**LRR K, L)**
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) (**LRR K, L**)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** X

Remarks:

This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils, Version 7.0, 2015 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

APPENDIX C

NRCS SOIL INFORMATION REPORT

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 Oxford County Area, Maine

Roxbury Wind Development

November 30, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

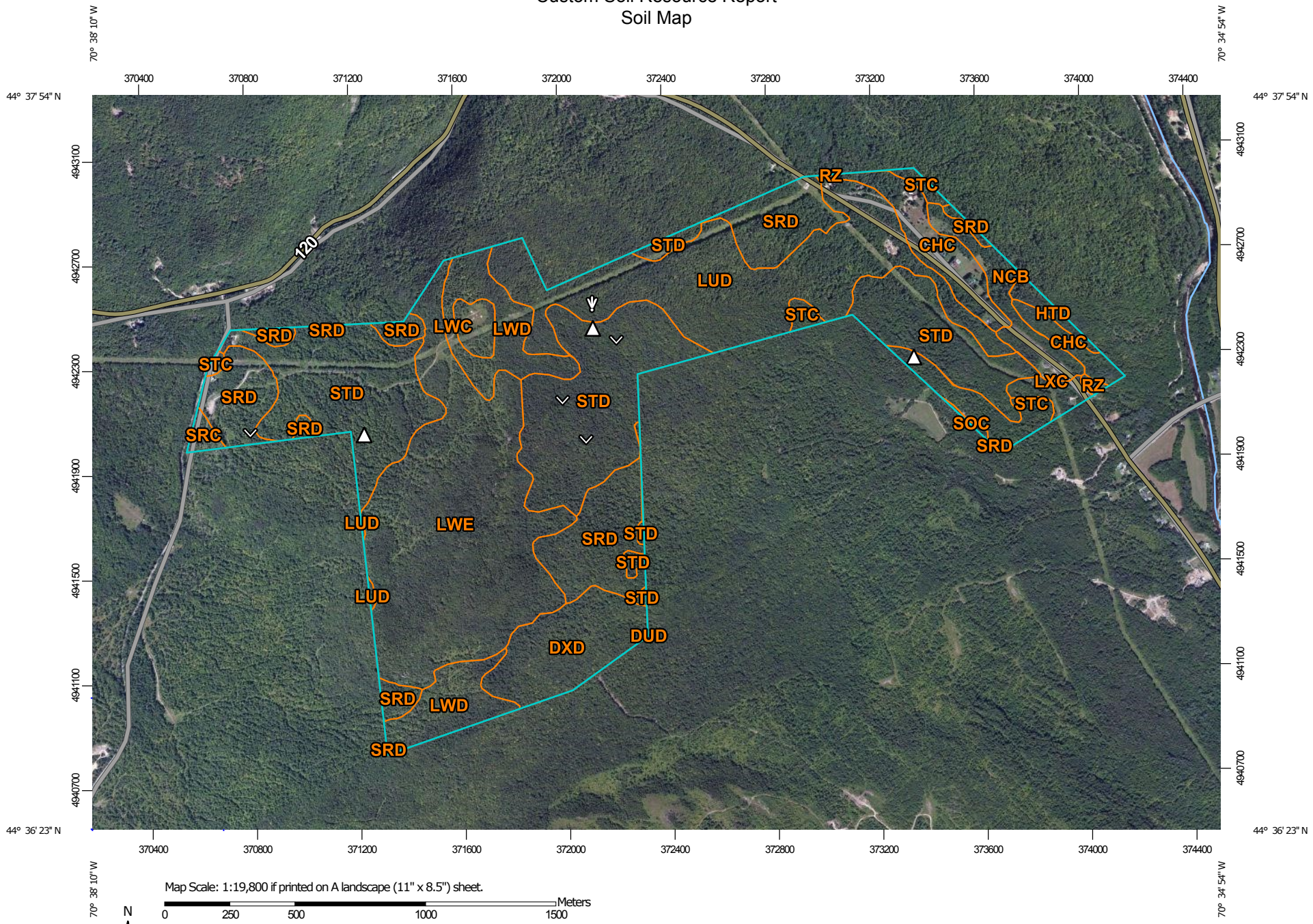
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



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 1:20,000.

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: Oxford County Area, Maine
Survey Area Data: Version 19, Sep 11, 2017

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

Date(s) aerial images were photographed: Jun 20, 2010—Aug 29, 2010

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CHC	Colton-Adams complex, 0 to 15 percent slopes	32.1	4.2%
DUD	Peru-Colonel association, 15 to 35 percent slopes, very stony	0.0	0.0%
DXD	Peru-Marlow association, 15 to 35 percent slopes, very stony	40.9	5.4%
HTD	Monadnock-Hermon association, 15 to 35 percent slopes, very stony	4.9	0.6%
LUD	Lyman-Tunbridge-Becket complex, 15 to 35 percent slopes , very stony	120.2	15.9%
LWC	Lyman-Tunbridge-Monadnock complex, 0 to 15 percent slopes, very stony	7.3	1.0%
LWD	Lyman-Tunbridge-Monadnock complex, 15 to 35 percent slopes, very stony	50.1	6.6%
LWE	Lyman-Tunbridge-Monadnock complex, 35 to 60 percent slopes, very stony	165.8	21.9%
LXC	Lyman-Tunbridge-Skerry complex, 3 to 15 percent slopes, very stony	6.8	0.9%
NCB	Naumburg-Croghan association, gently sloping	19.7	2.6%
RZ	Rumney-Podunk association, frequently flooded	1.1	0.1%
SOC	Skerry-Becket association, 3 to 15 percent slopes	0.7	0.1%
SRC	Skerry-Becket association, 0 to 15 percent slopes, very stony	3.2	0.4%
SRD	Skerry-Becket association, 15 to 35 percent slopes, very stony	91.2	12.1%
STC	Skerry-Colonel association, 0 to 15 percent slopes, very stony	22.4	3.0%
STD	Skerry-Colonel association, 15 to 35 percent slopes, very stony	189.4	25.1%
Totals for Area of Interest		**755.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas

shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Oxford County Area, Maine

CHC—Colton-Adams complex, 0 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2x1cf
Elevation: 10 to 2,000 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Colton and similar soils: 50 percent
Adams and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Colton

Setting

Landform: Eskers, kames
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy-skeletal glaciofluvial deposits

Typical profile

Oe - 0 to 4 inches: moderately decomposed plant material
E - 4 to 6 inches: gravelly sandy loam
Bs - 6 to 14 inches: gravelly loamy sand
BC - 14 to 24 inches: very gravelly coarse sand
C - 24 to 65 inches: extremely gravelly coarse sand

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Adams

Setting

Landform: Eskers, kames

Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

Oe - 0 to 4 inches: moderately decomposed plant material
E - 4 to 6 inches: loamy sand
Bs - 6 to 21 inches: sand
BC - 21 to 27 inches: sand
C - 27 to 65 inches: sand

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

DUD—Peru-Colonel association, 15 to 35 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w9nx
Elevation: 490 to 1,940 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Peru, very stony, and similar soils: 58 percent
Colonel, very stony, and similar soils: 27 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peru, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope

Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and/or loamy lodgment till derived from mica schist and/or loamy lodgment till derived from phyllite

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 5 inches: fine sandy loam
E - 5 to 6 inches: fine sandy loam
Bs1 - 6 to 7 inches: fine sandy loam
Bs2 - 7 to 13 inches: fine sandy loam
Bs3 - 13 to 18 inches: fine sandy loam
BC - 18 to 21 inches: fine sandy loam
Cd1 - 21 to 37 inches: fine sandy loam
Cd2 - 37 to 65 inches: fine sandy loam

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: About 17 to 34 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Hydric soil rating: No

Description of Colonel, Very Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy lodgment till derived from mica schist and/or loamy lodgment till derived from granite and/or loamy lodgment till derived from phyllite

Typical profile

Oa - 0 to 1 inches: highly decomposed plant material
E - 1 to 2 inches: fine sandy loam
Bhs - 2 to 3 inches: fine sandy loam
Bs1 - 3 to 9 inches: fine sandy loam
Bs2 - 9 to 12 inches: fine sandy loam
BC - 12 to 18 inches: gravelly fine sandy loam
Cd - 18 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 11 to 25 inches to densic material
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

DXD—Peru-Marlow association, 15 to 35 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w9nz
Elevation: 560 to 2,390 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Peru, very stony, and similar soils: 53 percent
Marlow, very stony, and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peru, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and/or loamy lodgment till derived from mica schist and/or loamy lodgment till derived from phyllite

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 5 inches: fine sandy loam
E - 5 to 6 inches: fine sandy loam
Bs1 - 6 to 7 inches: fine sandy loam

Bs2 - 7 to 13 inches: fine sandy loam
Bs3 - 13 to 18 inches: fine sandy loam
BC - 18 to 21 inches: fine sandy loam
Cd1 - 21 to 37 inches: fine sandy loam
Cd2 - 37 to 65 inches: fine sandy loam

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: About 17 to 34 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Hydric soil rating: No

Description of Marlow, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and/or loamy lodgment till derived from mica schist and/or loamy lodgment till derived from phyllite

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
E - 5 to 8 inches: fine sandy loam
Bs1 - 8 to 15 inches: fine sandy loam
Bs2 - 15 to 19 inches: fine sandy loam
BC - 19 to 33 inches: gravelly fine sandy loam
Cd - 33 to 65 inches: fine sandy loam

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 20 to 41 inches to densic material
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

HTD—Monadnock-Hermon association, 15 to 35 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2x9pq
Elevation: 260 to 1,770 feet
Mean annual precipitation: 31 to 65 inches
Mean annual air temperature: 36 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Monadnock, very stony, and similar soils: 45 percent
Hermon, very stony, and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Monadnock, Very Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial meltout till derived from granite and gneiss and/or mica schist and/or phyllite over sandy and gravelly supraglacial meltout till derived from granite and gneiss and/or mica schist and/or phyllite

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
E - 3 to 8 inches: fine sandy loam
Bs1 - 8 to 10 inches: fine sandy loam
Bs2 - 10 to 12 inches: fine sandy loam
Bs3 - 12 to 22 inches: gravelly fine sandy loam
BC - 22 to 25 inches: gravelly fine sandy loam
2C1 - 25 to 45 inches: gravelly loamy sand
2C2 - 45 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.03 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Hermon, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly supraglacial meltout till derived from granite and gneiss

Typical profile

Oa - 0 to 2 inches: highly decomposed plant material
E - 2 to 3 inches: sandy loam
Bhs - 3 to 9 inches: sandy loam
Bs1 - 9 to 16 inches: very gravelly sandy loam
Bs2 - 16 to 32 inches: extremely gravelly loamy sand
C - 32 to 65 inches: very gravelly coarse sand

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.03 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

LUD—Lyman-Tunbridge-Becket complex, 15 to 35 percent slopes , very stony

Map Unit Setting

National map unit symbol: 2tsv8
Elevation: 390 to 1,440 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 36 to 55 degrees F
Frost-free period: 60 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Tunbridge, very stony, and similar soils: 35 percent
Lyman, very stony, and similar soils: 35 percent
Becket, very stony, and similar soils: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tunbridge, Very Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Mountaintop, mountainflank, mountainbase, side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial till derived from granite and gneiss and/or loamy supraglacial till derived from phyllite and/or loamy supraglacial till derived from mica schist

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
Oa - 3 to 5 inches: highly decomposed plant material
E - 5 to 8 inches: fine sandy loam
Bhs - 8 to 11 inches: fine sandy loam
Bs - 11 to 26 inches: fine sandy loam
BC - 26 to 28 inches: fine sandy loam
R - 28 to 38 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 2.5 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.03 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Lyman, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Mountaintop, mountainflank, mountainbase, crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial till derived from granite and gneiss and/or loamy supraglacial till derived from phyllite and/or loamy supraglacial till derived from mica schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loam
E - 3 to 5 inches: fine sandy loam
Bhs - 5 to 7 inches: loam
Bs1 - 7 to 11 inches: loam
Bs2 - 11 to 18 inches: channery loam
R - 18 to 28 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 2.5 percent
Depth to restrictive feature: 11 to 24 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.03 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Becket, Very Stony

Setting

Landform: Drumlinoid ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from granite and gneiss

Typical profile

Oa - 0 to 1 inches: highly decomposed plant material
H1 - 1 to 2 inches: fine sandy loam
H2 - 2 to 25 inches: fine sandy loam
H3 - 25 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 2.0 percent
Depth to restrictive feature: 20 to 31 inches to densic material
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 18 to 26 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

LWC—Lyman-Tunbridge-Monadnock complex, 0 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2wlpd
Elevation: 300 to 1,540 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 60 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Lyman, very stony, and similar soils: 35 percent
Tunbridge, very stony, and similar soils: 25 percent
Monadnock, very stony, and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lyman, Very Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Mountainbase, mountaintop, mountainflank, side slope, crest

Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial till derived from granite and gneiss and/or phyllite and/or mica schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loam
E - 3 to 5 inches: fine sandy loam
Bhs - 5 to 7 inches: loam
Bs1 - 7 to 11 inches: loam
Bs2 - 11 to 18 inches: channery loam
R - 18 to 28 inches: bedrock

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 11 to 24 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Tunbridge, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Mountainbase, mountaintop, mountainflank, side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial till derived from granite and gneiss and/or phyllite and/or mica schist

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
Oa - 3 to 5 inches: highly decomposed plant material
E - 5 to 8 inches: fine sandy loam
Bhs - 8 to 11 inches: fine sandy loam
Bs - 11 to 26 inches: fine sandy loam
BC - 26 to 28 inches: fine sandy loam
R - 28 to 38 inches: bedrock

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock

Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Monadnock, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Mountainbase, mountaintop, mountainflank, side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial meltout till derived from phyllite and/or granite and gneiss and/or mica schist over sandy and gravelly supraglacial meltout till derived from phyllite and/or granite and gneiss and/or mica schist

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
E - 3 to 8 inches: fine sandy loam
Bs1 - 8 to 10 inches: fine sandy loam
Bs2 - 10 to 12 inches: fine sandy loam
Bs3 - 12 to 22 inches: gravelly fine sandy loam
BC - 22 to 25 inches: gravelly fine sandy loam
2C1 - 25 to 45 inches: gravelly loamy sand
2C2 - 45 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Hydric soil rating: No

LWD—Lyman-Tunbridge-Monadnock complex, 15 to 35 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2wlpf
Elevation: 330 to 1,870 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 60 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Lyman, very stony, and similar soils: 35 percent
Tunbridge, very stony, and similar soils: 25 percent
Monadnock, very stony, and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lyman, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Mountaintop, mountainflank, crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial till derived from granite and gneiss and/or phyllite and/or mica schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loam
E - 3 to 5 inches: fine sandy loam
Bhs - 5 to 7 inches: loam
Bs1 - 7 to 11 inches: loam
Bs2 - 11 to 18 inches: channery loam
R - 18 to 28 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 11 to 24 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Tunbridge, Very Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Mountaintop, mountainflank, side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial till derived from granite and gneiss and/or phyllite and/or mica schist

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
Oa - 3 to 5 inches: highly decomposed plant material
E - 5 to 8 inches: fine sandy loam
Bhs - 8 to 11 inches: fine sandy loam
Bs - 11 to 26 inches: fine sandy loam
BC - 26 to 28 inches: fine sandy loam
R - 28 to 38 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Monadnock, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Mountainflank, mountaintop, side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Loamy supraglacial meltout till derived from phyllite and/or granite and gneiss and/or mica schist over sandy and gravelly supraglacial meltout till derived from phyllite and/or granite and gneiss and/or mica schist

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
E - 3 to 8 inches: fine sandy loam
Bs1 - 8 to 10 inches: fine sandy loam
Bs2 - 10 to 12 inches: fine sandy loam
Bs3 - 12 to 22 inches: gravelly fine sandy loam
BC - 22 to 25 inches: gravelly fine sandy loam
2C1 - 25 to 45 inches: gravelly loamy sand
2C2 - 45 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

LWE—Lyman-Tunbridge-Monadnock complex, 35 to 60 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2wlph
Elevation: 430 to 2,200 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 52 degrees F
Frost-free period: 60 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Lyman, very stony, and similar soils: 40 percent
Tunbridge, very stony, and similar soils: 20 percent
Monadnock, very stony, and similar soils: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lyman, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial till derived from granite and gneiss and/or phyllite and/or mica schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loam
E - 3 to 5 inches: fine sandy loam
Bhs - 5 to 7 inches: loam
Bs1 - 7 to 11 inches: loam
Bs2 - 11 to 18 inches: channery loam
R - 18 to 28 inches: bedrock

Properties and qualities

Slope: 35 to 60 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 11 to 24 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Tunbridge, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial till derived from granite and gneiss and/or phyllite and/or mica schist

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
Oa - 3 to 5 inches: highly decomposed plant material
E - 5 to 8 inches: fine sandy loam
Bhs - 8 to 11 inches: fine sandy loam
Bs - 11 to 26 inches: fine sandy loam

BC - 26 to 28 inches: fine sandy loam
R - 28 to 38 inches: bedrock

Properties and qualities

Slope: 35 to 60 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Monadnock, Very Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial meltout till derived from phyllite and/or granite and gneiss and/or mica schist over sandy and gravelly supraglacial meltout till derived from phyllite and/or granite and gneiss and/or mica schist

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
E - 3 to 8 inches: fine sandy loam
Bs1 - 8 to 10 inches: fine sandy loam
Bs2 - 10 to 12 inches: fine sandy loam
Bs3 - 12 to 22 inches: gravelly fine sandy loam
BC - 22 to 25 inches: gravelly fine sandy loam
2C1 - 25 to 45 inches: gravelly loamy sand
2C2 - 45 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 35 to 60 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Hydric soil rating: No

LXC—Lyman-Tunbridge-Skerry complex, 3 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2tsv4
Elevation: 390 to 1,440 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 36 to 55 degrees F
Frost-free period: 60 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Lyman, very stony, and similar soils: 30 percent
Skerry, very stony, and similar soils: 25 percent
Tunbridge, very stony, and similar soils: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lyman, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Mountainbase, mountaintop, mountainflank, crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy supraglacial till derived from granite and gneiss and/or loamy supraglacial till derived from phyllite and/or loamy supraglacial till derived from mica schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loam
E - 3 to 5 inches: fine sandy loam
Bhs - 5 to 7 inches: loam
Bs1 - 7 to 11 inches: loam
Bs2 - 11 to 18 inches: channery loam
R - 18 to 28 inches: bedrock

Properties and qualities

Slope: 3 to 15 percent
Percent of area covered with surface fragments: 1.0 percent

Depth to restrictive feature: 11 to 24 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.03 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Skerry, Very Stony

Setting

Landform: Drumlinoid ridges
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from granite and gneiss

Typical profile

Oa - 0 to 3 inches: highly decomposed plant material
H1 - 3 to 5 inches: fine sandy loam
H2 - 5 to 25 inches: sandy loam
H3 - 25 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 15 percent
Percent of area covered with surface fragments: 1.0 percent
Depth to restrictive feature: 17 to 31 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 15 to 23 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C/D
Hydric soil rating: No

Description of Tunbridge, Very Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Mountaintop, mountainflank, mountainbase, side slope, crest
Down-slope shape: Convex

Across-slope shape: Convex
Parent material: Loamy supraglacial till derived from granite and gneiss and/or loamy supraglacial till derived from phyllite and/or loamy supraglacial till derived from mica schist

Typical profile

Oe - 0 to 3 inches: moderately decomposed plant material
Oa - 3 to 5 inches: highly decomposed plant material
E - 5 to 8 inches: fine sandy loam
Bhs - 8 to 11 inches: fine sandy loam
Bs - 11 to 26 inches: fine sandy loam
BC - 26 to 28 inches: fine sandy loam
R - 28 to 38 inches: bedrock

Properties and qualities

Slope: 3 to 15 percent
Percent of area covered with surface fragments: 1.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 14.03 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

NCB—Naumburg-Croghan association, gently sloping

Map Unit Setting

National map unit symbol: 9ldj
Elevation: 150 to 1,800 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Naumburg and similar soils: 50 percent
Croghan and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Naumburg

Setting

Landform: Outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy glaciofluvial deposits derived from granite and gneiss

Typical profile

Oa - 0 to 2 inches: highly decomposed plant material
H1 - 2 to 7 inches: loamy sand
H2 - 7 to 38 inches: sand
H3 - 38 to 65 inches: coarse sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 6.00 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Description of Croghan

Setting

Landform: Outwash plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy glaciofluvial deposits derived from granite and gneiss

Typical profile

H1 - 0 to 2 inches: loamy fine sand
H2 - 2 to 35 inches: loamy fine sand
H3 - 35 to 65 inches: sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: A
Hydric soil rating: No

RZ—Rumney-Podunk association, frequently flooded

Map Unit Setting

National map unit symbol: 9ldw
Elevation: 0 to 2,440 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 54 degrees F
Frost-free period: 80 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Rumney and similar soils: 40 percent
Podunk and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rumney

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium derived from schist and/or coarse-loamy alluvium derived from quartzite and/or coarse-loamy alluvium derived from granite and gneiss

Typical profile

Ap - 0 to 9 inches: fine sandy loam
Bg1 - 9 to 20 inches: fine sandy loam
Bg2 - 20 to 30 inches: sandy loam
Cg - 30 to 65 inches: loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Description of Podunk

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium derived from schist and/or coarse-loamy alluvium derived from quartzite and/or coarse-loamy alluvium derived from granite and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 18 inches: fine sandy loam
Bw2 - 18 to 30 inches: fine sandy loam
C - 30 to 65 inches: loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Hydric soil rating: No

SOC—Skerry-Becket association, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2x9p2
Elevation: 360 to 1,310 feet
Mean annual precipitation: 31 to 65 inches
Mean annual air temperature: 36 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Skerry and similar soils: 55 percent
Becket and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skerry

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, mountainbase, side slope, interfluve, nose slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Ap - 0 to 6 inches: fine sandy loam
Bs1 - 6 to 20 inches: gravelly fine sandy loam
Bs2 - 20 to 25 inches: gravelly fine sandy loam
Cd1 - 25 to 34 inches: gravelly loamy sand
Cd2 - 34 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Hydric soil rating: No

Description of Becket

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, mountainbase, side slope, nose slope, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam

Bs1 - 7 to 14 inches: fine sandy loam
Bs2 - 14 to 24 inches: gravelly sandy loam
BC - 24 to 33 inches: gravelly sandy loam
Cd - 33 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

SRC—Skerry-Becket association, 0 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2x9p4
Elevation: 30 to 1,440 feet
Mean annual precipitation: 31 to 65 inches
Mean annual air temperature: 36 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Skerry, very stony, and similar soils: 50 percent
Becket, very stony, and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skerry, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, mountainbase, side slope, nose slope, interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Oa - 0 to 2 inches: highly decomposed plant material
E - 2 to 4 inches: fine sandy loam
Bhs - 4 to 6 inches: fine sandy loam
Bs1 - 6 to 20 inches: gravelly fine sandy loam
Bs2 - 20 to 25 inches: gravelly fine sandy loam
Cd1 - 25 to 34 inches: gravelly loamy sand
Cd2 - 34 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: About 19 to 34 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C/D
Hydric soil rating: No

Description of Becket, Very Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainbase, mountainflank, side slope, nose slope, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
E - 2 to 4 inches: fine sandy loam
Bhs - 4 to 5 inches: fine sandy loam
Bs1 - 5 to 7 inches: fine sandy loam
Bs2 - 7 to 14 inches: fine sandy loam
Bs3 - 14 to 24 inches: gravelly sandy loam
BC - 24 to 33 inches: gravelly sandy loam
Cd - 33 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 5.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

SRD—Skerry-Becket association, 15 to 35 percent slopes, very stony

Map Unit Setting
National map unit symbol: 2x9p5
Elevation: 330 to 1,870 feet
Mean annual precipitation: 31 to 65 inches
Mean annual air temperature: 36 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition
Skerry, very stony, and similar soils: 55 percent
Becket, very stony, and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skerry, Very Stony

Setting
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile
Oa - 0 to 2 inches: highly decomposed plant material
E - 2 to 4 inches: fine sandy loam
Bhs - 4 to 6 inches: fine sandy loam
Bs1 - 6 to 20 inches: gravelly fine sandy loam
Bs2 - 20 to 25 inches: gravelly fine sandy loam
Cd1 - 25 to 34 inches: gravelly loamy sand
Cd2 - 34 to 65 inches: gravelly loamy sand

Properties and qualities
Slope: 15 to 35 percent

Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: About 19 to 34 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Hydric soil rating: No

Description of Becket, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
E - 2 to 4 inches: fine sandy loam
Bhs - 4 to 5 inches: fine sandy loam
Bs1 - 5 to 7 inches: fine sandy loam
Bs2 - 7 to 14 inches: fine sandy loam
Bs3 - 14 to 24 inches: gravelly sandy loam
BC - 24 to 33 inches: gravelly sandy loam
Cd - 33 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

STC—Skerry-Colonel association, 0 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2x9p8
Elevation: 260 to 1,410 feet
Mean annual precipitation: 31 to 65 inches
Mean annual air temperature: 36 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Skerry, very stony, and similar soils: 55 percent
Colonel, very stony, and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skerry, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, mountainbase, side slope, nose slope, interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Oa - 0 to 2 inches: highly decomposed plant material
E - 2 to 4 inches: fine sandy loam
Bhs - 4 to 6 inches: fine sandy loam
Bs1 - 6 to 20 inches: gravelly fine sandy loam
Bs2 - 20 to 25 inches: gravelly fine sandy loam
Cd1 - 25 to 34 inches: gravelly loamy sand
Cd2 - 34 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: About 19 to 34 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C/D
Hydric soil rating: No

Description of Colonel, Very Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountainbase, mountainflank, interfluve, nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Loamy lodgment till derived from granite and/or mica schist and/or phyllite

Typical profile

Oa - 0 to 1 inches: highly decomposed plant material
E - 1 to 2 inches: fine sandy loam
Bhs - 2 to 3 inches: fine sandy loam
Bs1 - 3 to 9 inches: fine sandy loam
Bs2 - 9 to 12 inches: fine sandy loam
BC - 12 to 18 inches: gravelly fine sandy loam
Cd - 18 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 15 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 11 to 25 inches to densic material
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Hydric soil rating: No

STD—Skerry-Colonel association, 15 to 35 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2x9p9

Elevation: 300 to 1,710 feet
Mean annual precipitation: 31 to 65 inches
Mean annual air temperature: 36 to 52 degrees F
Frost-free period: 90 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Skerry, very stony, and similar soils: 60 percent
Colonel, very stony, and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skerry, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist

Typical profile

Oa - 0 to 2 inches: highly decomposed plant material
E - 2 to 4 inches: fine sandy loam
Bhs - 4 to 6 inches: fine sandy loam
Bs1 - 6 to 20 inches: gravelly fine sandy loam
Bs2 - 20 to 25 inches: gravelly fine sandy loam
Cd1 - 25 to 34 inches: gravelly loamy sand
Cd2 - 34 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 21 to 43 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: About 19 to 34 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Hydric soil rating: No

Description of Colonel, Very Stony

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountainflank, side slope, nose slope
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Loamy lodgment till derived from granite and/or mica schist and/or phyllite

Typical profile

Oa - 0 to 1 inches: highly decomposed plant material
E - 1 to 2 inches: fine sandy loam
Bhs - 2 to 3 inches: fine sandy loam
Bs1 - 3 to 9 inches: fine sandy loam
Bs2 - 9 to 12 inches: fine sandy loam
BC - 12 to 18 inches: gravelly fine sandy loam
Cd - 18 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 15 to 35 percent
Percent of area covered with surface fragments: 1.1 percent
Depth to restrictive feature: 11 to 25 inches to densic material
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

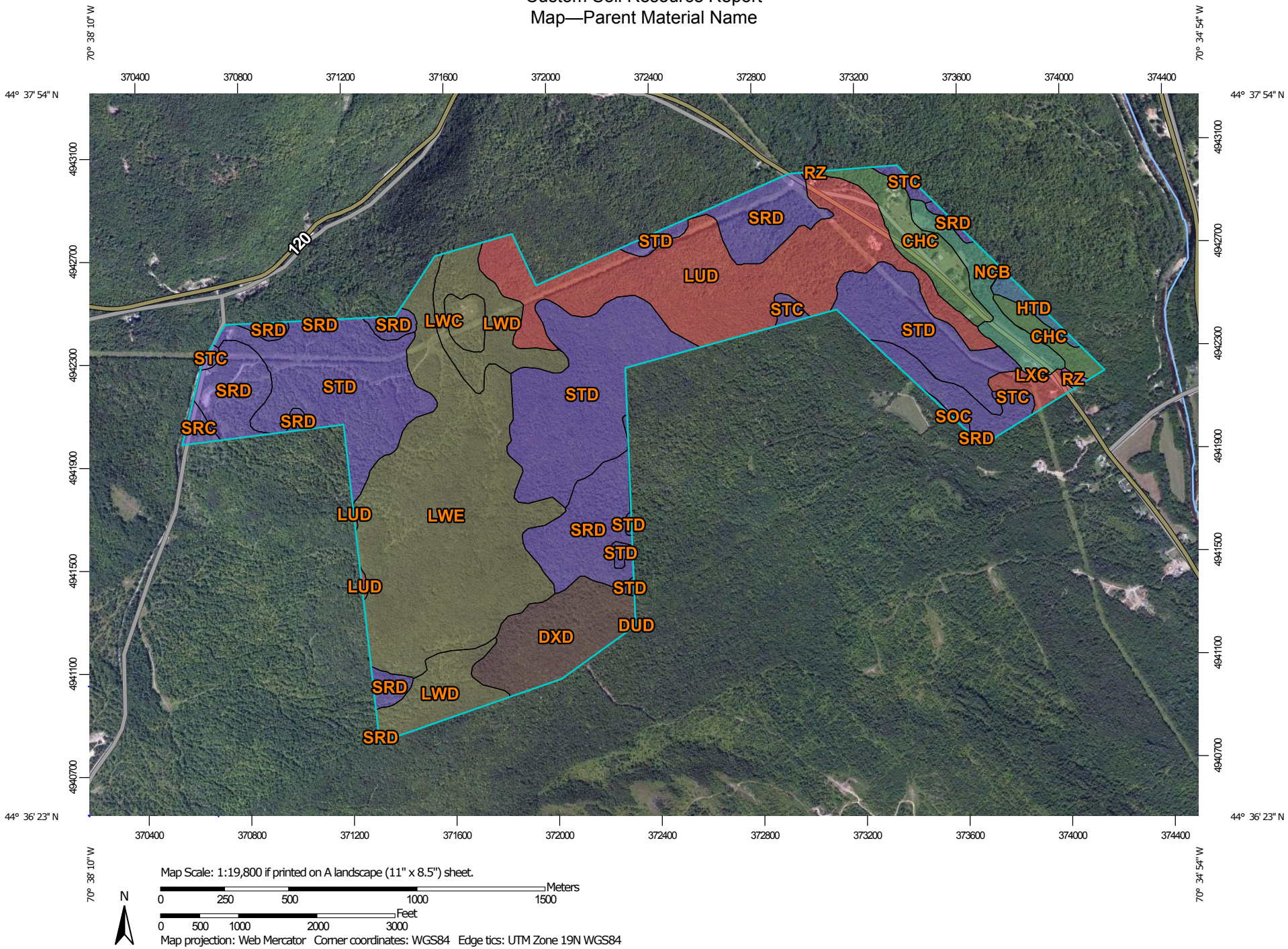
Parent Material Name

Parent material name is a term for the general physical, chemical, and mineralogical composition of the unconsolidated material, mineral or organic, in which the soil forms. Mode of deposition and/or weathering may be implied by the name.

The soil surveyor uses parent material to develop a model used for soil mapping. Soil scientists and specialists in other disciplines use parent material to help interpret soil boundaries and project performance of the material below the soil. Many soil properties relate to parent material. Among these properties are proportions of sand, silt, and clay; chemical content; bulk density; structure; and the kinds and amounts of rock fragments. These properties affect interpretations and may be criteria used to separate soil series. Soil properties and landscape information may imply the kind of parent material.

For each soil in the database, one or more parent materials may be identified. One is marked as the representative or most commonly occurring. The representative parent material name is presented here.

Map—Parent Material Name



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- coarse-loamy alluvium derived from schist and/or coarse-loamy alluvium derived from quartzite and/or coarse-loamy alluvium derived from granite and gneiss
- loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist
- loamy lodgment till derived from granite and/or loamy lodgment till derived from mica schist and/or loamy lodgment till derived from phyllite
- loamy supraglacial meltout till derived from granite and gneiss and/or mica schist and/or phyllite over sandy and gravelly supraglacial meltout till derived from granite and gneiss and/or mica schist and/or phyllite
- loamy supraglacial till derived from granite and gneiss and/or loamy supraglacial till derived from phyllite and/or loamy supraglacial till derived from mica schist
- loamy supraglacial till derived from granite and gneiss and/or phyllite and/or mica schist
- sandy glaciofluvial deposits derived from granite and gneiss
- sandy-skeletal glaciofluvial deposits
- Not rated or not available

Soil Rating Lines

- coarse-loamy alluvium derived from schist and/or coarse-loamy alluvium derived from quartzite and/or coarse-loamy alluvium derived from granite and gneiss
- loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist
- loamy lodgment till derived from granite and/or loamy lodgment till derived from mica schist and/or loamy lodgment till derived from phyllite
- loamy supraglacial meltout till derived from granite and gneiss and/or mica schist and/or phyllite over sandy and gravelly supraglacial meltout till derived from granite and gneiss and/or mica schist and/or phyllite
- loamy supraglacial till derived from granite and gneiss and/or loamy supraglacial till derived from phyllite and/or loamy supraglacial till derived from mica schist
- loamy supraglacial till derived from granite and gneiss and/or phyllite and/or mica schist
- sandy glaciofluvial deposits derived from granite and gneiss
- sandy-skeletal glaciofluvial deposits
- Not rated or not available

Soil Rating Points

- coarse-loamy alluvium derived from schist and/or coarse-loamy alluvium derived from quartzite and/or coarse-loamy alluvium derived from granite and gneiss
- loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist
- loamy lodgment till derived from granite and/or loamy lodgment till derived from mica schist and/or loamy lodgment till derived from phyllite

MAP INFORMATION

- loamy supraglacial meltout till derived from granite and gneiss and/or mica schist and/or phyllite over sandy and gravelly supraglacial meltout till derived from granite and gneiss and/or mica schist and/or phyllite
- loamy supraglacial till derived from granite and gneiss and/or loamy supraglacial till derived from phyllite and/or loamy supraglacial till derived from mica schist
- loamy supraglacial till derived from granite and gneiss and/or phyllite and/or mica schist
- sandy glaciofluvial deposits derived from granite and gneiss
- sandy-skeletal glaciofluvial deposits
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Oxford County Area, Maine
Survey Area Data: Version 19, Sep 11, 2017

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

Date(s) aerial images were photographed: Jun 20, 2010—Aug 29, 2010

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.

Table—Parent Material Name

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CHC	Colton-Adams complex, 0 to 15 percent slopes	sandy-skeletal glaciofluvial deposits	32.1	4.2%
DUD	Peru-Colonel association, 15 to 35 percent slopes, very stony	loamy lodgment till derived from granite and/or loamy lodgment till derived from mica schist and/or loamy lodgment till derived from phyllite	0.0	0.0%
DXD	Peru-Marlow association, 15 to 35 percent slopes, very stony	loamy lodgment till derived from granite and/or loamy lodgment till derived from mica schist and/or loamy lodgment till derived from phyllite	40.9	5.4%
HTD	Monadnock-Hermon association, 15 to 35 percent slopes, very stony	loamy supraglacial meltout till derived from granite and gneiss and/or mica schist and/or phyllite over sandy and gravelly supraglacial meltout till derived from granite and gneiss and/or mica schist and/or phyllite	4.9	0.6%
LUD	Lyman-Tunbridge-Becket complex, 15 to 35 percent slopes , very stony	loamy supraglacial till derived from granite and gneiss and/or loamy supraglacial till derived from phyllite and/or loamy supraglacial till derived from mica schist	120.2	15.9%
LWC	Lyman-Tunbridge-Monadnock complex, 0 to 15 percent slopes, very stony	loamy supraglacial till derived from granite and gneiss and/or phyllite and/or mica schist	7.3	1.0%
LWD	Lyman-Tunbridge-Monadnock complex, 15 to 35 percent slopes, very stony	loamy supraglacial till derived from granite and gneiss and/or phyllite and/or mica schist	50.1	6.6%
LWE	Lyman-Tunbridge-Monadnock complex, 35 to 60 percent slopes, very stony	loamy supraglacial till derived from granite and gneiss and/or phyllite and/or mica schist	165.8	21.9%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
LXC	Lyman-Tunbridge-Skerry complex, 3 to 15 percent slopes, very stony	loamy supraglacial till derived from granite and gneiss and/or loamy supraglacial till derived from phyllite and/or loamy supraglacial till derived from mica schist	6.8	0.9%
NCB	Naumburg-Croghan association, gently sloping	sandy glaciofluvial deposits derived from granite and gneiss	19.7	2.6%
RZ	Rumney-Podunk association, frequently flooded	coarse-loamy alluvium derived from schist and/or coarse-loamy alluvium derived from quartzite and/or coarse-loamy alluvium derived from granite and gneiss	1.1	0.1%
SOC	Skerry-Becket association, 3 to 15 percent slopes	loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist	0.7	0.1%
SRC	Skerry-Becket association, 0 to 15 percent slopes, very stony	loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist	3.2	0.4%
SRD	Skerry-Becket association, 15 to 35 percent slopes, very stony	loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist	91.2	12.1%
STC	Skerry-Colonel association, 0 to 15 percent slopes, very stony	loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist	22.4	3.0%
STD	Skerry-Colonel association, 15 to 35 percent slopes, very stony	loamy lodgment till derived from granite and gneiss and/or schist over sandy lodgment till derived from granite and gneiss and/or schist	189.4	25.1%
Totals for Area of Interest			**755.7**	**100.0%**

Rating Options—Parent Material Name

Aggregation Method: Dominant Condition

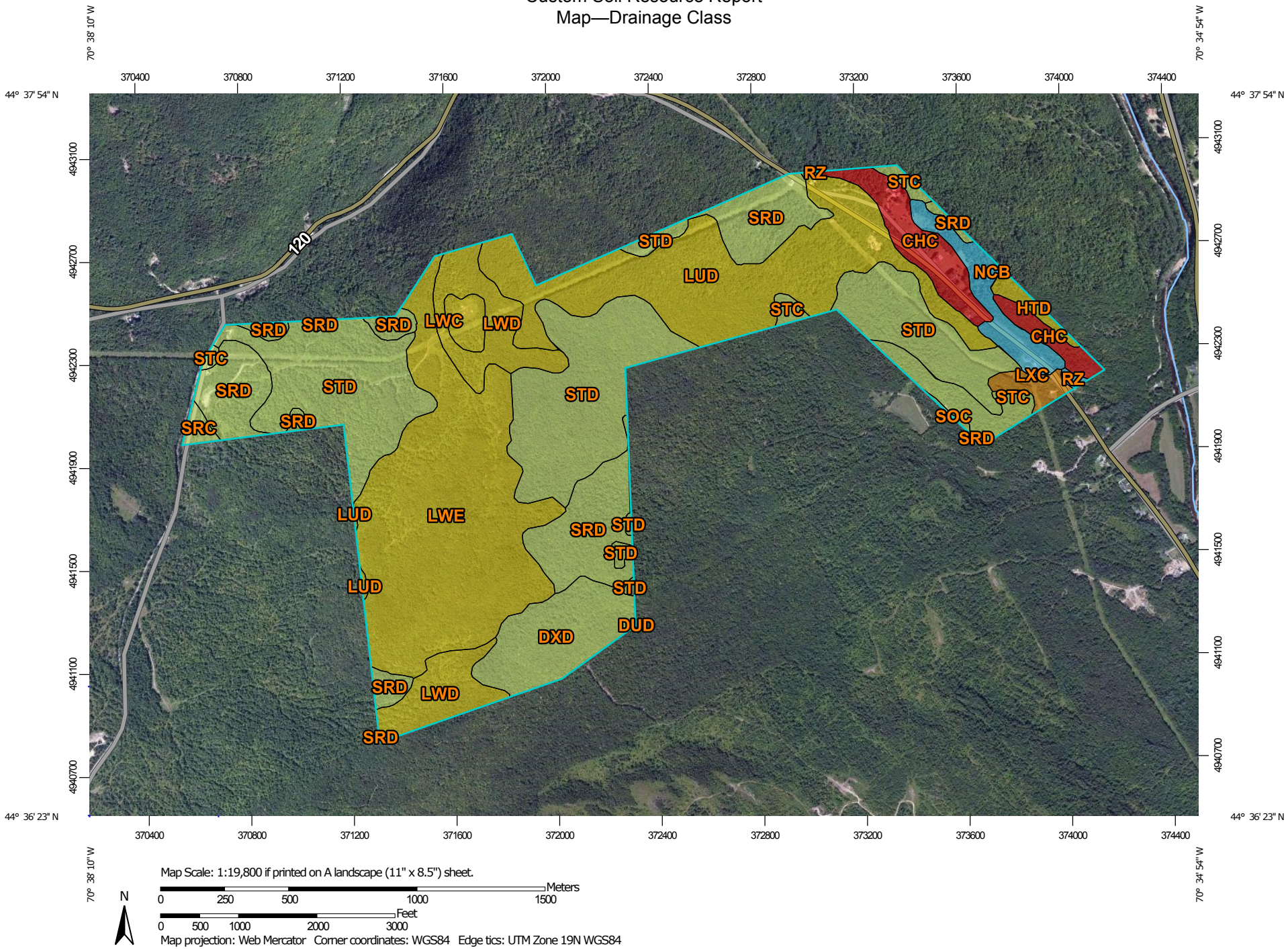
Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Drainage Class

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Map—Drainage Class



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

Soil Rating Lines

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

Soil Rating Points

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Somewhat poorly drained
- Poorly drained
- Very poorly drained
- Subaqueous
- Not rated or not available

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 1:20,000.

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: Oxford County Area, Maine
Survey Area Data: Version 19, Sep 11, 2017

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

Date(s) aerial images were photographed: Jun 20, 2010—Aug 29, 2010

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.

Table—Drainage Class

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CHC	Colton-Adams complex, 0 to 15 percent slopes	Excessively drained	32.1	4.2%
DUD	Peru-Colonel association, 15 to 35 percent slopes, very stony	Moderately well drained	0.0	0.0%
DXD	Peru-Marlow association, 15 to 35 percent slopes, very stony	Moderately well drained	40.9	5.4%
HTD	Monadnock-Hermon association, 15 to 35 percent slopes, very stony	Well drained	4.9	0.6%
LUD	Lyman-Tunbridge-Becket complex, 15 to 35 percent slopes , very stony	Well drained	120.2	15.9%
LWC	Lyman-Tunbridge-Monadnock complex, 0 to 15 percent slopes, very stony	Well drained	7.3	1.0%
LWD	Lyman-Tunbridge-Monadnock complex, 15 to 35 percent slopes, very stony	Well drained	50.1	6.6%
LWE	Lyman-Tunbridge-Monadnock complex, 35 to 60 percent slopes, very stony	Well drained	165.8	21.9%
LXC	Lyman-Tunbridge-Skerry complex, 3 to 15 percent slopes, very stony	Somewhat excessively drained	6.8	0.9%
NCB	Naumburg-Croghan association, gently sloping	Poorly drained	19.7	2.6%
RZ	Rumney-Podunk association, frequently flooded	Poorly drained	1.1	0.1%
SOC	Skerry-Becket association, 3 to 15 percent slopes	Moderately well drained	0.7	0.1%
SRC	Skerry-Becket association, 0 to 15 percent slopes, very stony	Moderately well drained	3.2	0.4%
SRD	Skerry-Becket association, 15 to 35 percent slopes, very stony	Moderately well drained	91.2	12.1%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
STC	Skerry-Colonel association, 0 to 15 percent slopes, very stony	Moderately well drained	22.4	3.0%
STD	Skerry-Colonel association, 15 to 35 percent slopes, very stony	Moderately well drained	189.4	25.1%
Totals for Area of Interest			**755.7**	**100.0%**

Rating Options—Drainage Class

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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APPENDIX D

AGENCY INQUIRY RESPONSES

STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION & FORESTRY
93 STATE HOUSE STATION
AUGUSTA, MAINE 04333

PAUL R. LEPAGE
GOVERNOR

WALTER E. WHITCOMB
COMMISSIONER

December 13, 2017

Steve Knapp
Kleinschmidt
141 Main Street
Pittsfield, ME 04967

Via email: steve.knapp@kleinschmidtgroup.com

Re: Rare and exemplary botanical features in proximity to: #4380, RoxWind Development, Roxbury, Maine

Dear Mr. Knapp:

I have searched the Natural Areas Program's Biological and Conservation Data System files in response to your request received December 11, 2017 for information on the presence of rare or unique botanical features documented from the vicinity of the project in Roxbury, Maine. Rare and unique botanical features include the habitat of rare, threatened, or endangered plant species and unique or exemplary natural communities. Our review involves examining maps, manual and computerized records, other sources of information such as scientific articles or published references, and the personal knowledge of staff or cooperating experts.

Our official response covers only botanical features. For authoritative information and official response for zoological features you must make a similar request to the Maine Department of Inland Fisheries and Wildlife, 284 State Street, Augusta, Maine 04333.

According to the information currently in our Biological and Conservation Data System files, there are no rare botanical features documented specifically within the project area. This lack of data may indicate minimal survey efforts rather than confirm the absence of rare botanical features. You may want to have the site inventoried by a qualified field biologist to ensure that no undocumented rare features are inadvertently harmed.

If a field survey of the project area is conducted, please refer to the enclosed supplemental information regarding rare and exemplary botanical features documented to occur in the vicinity of the project site. The list may include information on features that have been known to occur historically in the area as well as recently field-verified information. While historic records have not been documented in several years, they may persist in the area if suitable habitat exists. The enclosed list identifies features with potential to occur in the area, and it should be considered if you choose to conduct field surveys.

This finding is available and appropriate for preparation and review of environmental assessments, but it is not a substitute for on-site surveys. Comprehensive field surveys do not exist for all natural areas in Maine, and in the absence of a specific field investigation, the Maine Natural Areas Program cannot provide a definitive statement on the presence or absence of unusual natural features at this site.

MOLLY DOCHERTY, DIRECTOR
MAINE NATURAL AREAS PROGRAM

DEPARTMENT OF Agriculture Conservation & Forestry

PHONE: (207) 287-8044
FAX: (207) 287-8040
WWW.MAINE.GOV/DACF/MNAP

The Natural Areas Program is continuously working to achieve a more comprehensive database of exemplary natural features in Maine. We would appreciate the contribution of any information obtained should you decide to do field work. The Natural Areas Program welcomes coordination with individuals or organizations proposing environmental alteration, or conducting environmental assessments. If, however, data provided by the Natural Areas Program are to be published in any form, the Program should be informed at the outset and credited as the source.

The Natural Areas Program has instituted a fee structure of $75.00 an hour to recover the actual cost of processing your request for information. You will receive an invoice for $150.00 for two hours of our services.

Thank you for using the Natural Areas Program in the environmental review process. Please do not hesitate to contact me if you have further questions about the Natural Areas Program or about rare or unique botanical features on this site.

Sincerely,

Kristen Puryear | Ecologist | Maine Natural Areas Program
207-287-8043 | kristen.puryear@maine.gov

Rare and Exemplary Botanical Features within 4 miles of Project: #4380, Rox Wind Development, Roxbury, Maine

Common Name	State Status	State Rank	Global Rank	Date Last Observed	Occurrence Number	Habitat
Canada Mountain-ricegrass						
	SC	S2	G5	1959-09-01	6	Dry barrens (partly forested, upland)
	SC	S2	G5	1924-06-27	7	Dry barrens (partly forested, upland)
Mid-elevation Bald						
	<null>	S3	G2G3	2006-01-03	10	Rocky summits and outcrops (non-forested, upland),Alpine or subalpine (non-forested, upland)
Mountain Sandwort						
	SC	S3	G5	2006-01-03	2	Rocky summits and outcrops (non-forested, upland),Alpine or subalpine (non-forested, upland)
Red Pine Woodland						
	<null>	S3	G3G5	2006-01-03	12	Dry barrens (partly forested, upland)
Showy Orchis						
	E	S1	G5	1974-07-21	9	Hardwood to mixed forest (forest, upland)
Silverling						
	T	S1	G4	2000-10-01	3	Alpine or subalpine (non-forested, upland),Non-tidal rivershore (non-forested, seasonally wet)
Smooth Sandwort						
	SC	S3	G4	1926	8	Rocky summits and outcrops (non-forested, upland)

STATE RARITY RANKS

S1 Critically imperiled in Maine because of extreme rarity (five or fewer occurrences or very few remaining individuals or acres) or because some aspect of its biology makes it especially vulnerable to extirpation from the State of Maine.
S2 Imperiled in Maine because of rarity (6-20 occurrences or few remaining individuals or acres) or because of other factors making it vulnerable to further decline.
S3 Rare in Maine (20-100 occurrences).
S4 Apparently secure in Maine.
S5 Demonstrably secure in Maine.
SU Under consideration for assigning rarity status; more information needed on threats or distribution.
SNR Not yet ranked.
SNA Rank not applicable.
S#? Current occurrence data suggests assigned rank, but lack of survey effort along with amount of potential habitat create uncertainty (e.g. S3?).

Note: **State Rarity Ranks** are determined by the Maine Natural Areas Program for rare plants and rare and exemplary natural communities and ecosystems. The Maine Department of Inland Fisheries and Wildlife determines State Rarity Ranks for animals.

GLOBAL RARITY RANKS

G1 Critically imperiled globally because of extreme rarity (five or fewer occurrences or very few remaining individuals or acres) or because some aspect of its biology makes it especially vulnerable to extinction.
G2 Globally imperiled because of rarity (6-20 occurrences or few remaining individuals or acres) or because of other factors making it vulnerable to further decline.
G3 Globally rare (20-100 occurrences).
G4 Apparently secure globally.
G5 Demonstrably secure globally.
GNR Not yet ranked.

Note: **Global Ranks** are determined by NatureServe.

STATE LEGAL STATUS

Note: State legal status is according to 5 M.R.S.A. § 13076-13079, which mandates the Department of Conservation to produce and biennially update the official list of Maine's **Endangered** and **Threatened** plants. The list is derived by a technical advisory committee of botanists who use data in the Natural Areas Program's database to recommend status changes to the Department of Conservation.

E ENDANGERED; Rare and in danger of being lost from the state in the foreseeable future; or federally listed as Endangered.
T THREATENED; Rare and, with further decline, could become endangered; or federally listed as Threatened.

NON-LEGAL STATUS

SC SPECIAL CONCERN; Rare in Maine, based on available information, but not sufficiently rare to be considered Threatened or Endangered.
PE Potentially Extirpated; Species has not been documented in Maine in past 20 years or loss of last known occurrence has been documented.

ELEMENT OCCURRENCE RANKS - EO RANKS

Element Occurrence ranks are used to describe the quality of a rare plant population or natural community based on three factors:

- **Size**: Size of community or population relative to other known examples in Maine. Community or population's viability, capability to maintain itself.
- **Condition**: For communities, condition includes presence of representative species, maturity of species, and evidence of human-caused disturbance. For plants, factors include species vigor and evidence of human-caused disturbance.
- **Landscape context**: Land uses and/or condition of natural communities surrounding the observed area. Ability of the observed community or population to be protected from effects of adjacent land uses.

These three factors are combined into an overall ranking of the feature of **A**, **B**, **C**, or **D**, where **A** indicates an **excellent** example of the community or population and **D** indicates a **poor** example of the community or population. A rank of **E** indicates that the community or population is **extant** but there is not enough data to assign a quality rank. The Maine Natural Areas Program tracks all occurrences of rare (S1-S3) plants and natural communities as well as A and B ranked common (S4-S5) natural communities.

Note: **Element Occurrence Ranks** are determined by the Maine Natural Areas Program for rare plants and rare and exemplary natural communities and ecosystems. The Maine Department of Inland Fisheries and Wildlife determines Element Occurrence ranks for animals.

Visit our website for more information on rare, threatened, and endangered species!
http://www.maine.gov/dacf/mnap

4-C
Rare Species Survey Report

Stantec Consulting Services Inc.
30 Park Drive, Topsham ME 04086-1737

November 4, 2016
File: 195601220

Attention: Lindsay Deane-Mayer
Palmer Capital Corporation
Palmer Management Corporation
13 Elm Street, Suite 200
Cohasset, MA 02025

Reference: Rare Species Survey Report, Horseshoe Valley Wind Project, Roxbury, Maine

Dear Lindsay,

On September 8, 2016, Stantec Consulting Services Inc. (Stantec) completed a field survey of the proposed Horseshoe Valley Wind Project (project) area on North Twin Mountain in Roxbury, Maine (Figure 1). The purpose of the field survey was to characterize the existing terrestrial and aquatic habitats and evaluate their potential to support populations of three state-listed rare wildlife species: the state-threatened northern bog lemming (*Synaptomys borealis*), state-threatened Roaring Brook mayfly (*Epeorus frisoni*), and state-species of special concern northern spring salamander (*Gyrinophilus porphyriticus*). The field survey was initiated in response to an Information Request letter that Horseshoe Valley Wind received from the Maine Department of Inland Fisheries and Wildlife (MDIFW) on May 31, 2016. This letter indicated that these species may potentially be present within the project area and recommended that field surveys be conducted to determine their presence. Stantec subsequently completed targeted field surveys of potentially suitable habitat for these species. The report summarizes the results of the field surveys and habitat evaluations.

SURVEY METHODOLOGY AND SPECIES BACKGROUND

PRE-FIELD DESKTOP REVIEW

Prior to conducting the field surveys, Stantec reviewed existing natural resource information available for the project area. This included the results of a vernal pool survey and reconnaissance-level wetland survey completed by Kleinschmidt that identified locations of several "black spruce bogs" within the project area as well as intermittent streams (Appendix A). In addition, Stantec reviewed publicly available aerial photography, National Wetlands Inventory data, U.S. Geological Survey quadrangle maps, and National Hydrography Dataset to identify potential habitats to evaluate and survey.

In preparation for northern bog lemming field surveys, Stantec coordinated with Dr. Zachary Olson at the University of New England relative to accepted genetic sample collection procedures for determining northern bog lemming presence. Due to morphological and ecological similarities between northern bog lemming and southern bog lemming (*Synaptomys cooperi*), genetic testing is required to differentiate between these species in the absence of trapping efforts. Prior

to the field surveys, Dr. Olson provided Stantec with a bog lemming pellet sample collection kit that included sterilized vials filled with silica, laboratory grade ethanol, nitrile gloves, and the standardized pellet collection method.

NORTHERN BOG LEMMING

Limited references are available regarding the specific habitat requirements of northern bog lemming. The MDIFW reports that the species is known to occur in moist, wet meadows or boggy areas often in alpine settings or spruce-fir forests. It is reportedly found in association with springs or lush, mossy logs and rocks. In Maine, it is reported to occur in moist peat moss (*Sphagnum* spp.) boggy areas in both low and high elevation settings (MDIFW 2003). Additional northern bog lemming habitat characteristics cited by the MDIFW in their May 31, 2016 Information Request letter includes riparian areas at 1,000 feet in elevation or higher with an abundant herbaceous vegetation. In general, areas identified as potentially suitable northern bog lemming habitat within the project area included areas characterized as wetlands with scattered trees and shrubs of red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), and northern white cedar (*Thuja occidentalis*). The understories of these habitats contained a thick layer of peat moss and three-seeded sedge (*Carex trisperma*) over deep, mucky organic soils.

A minimum of 1 survey hour was spent meandering throughout each wetland containing potentially suitable northern bog lemming habitat. During the meander survey, rodent runways were inspected for the presence of green fecal pellets and a predominance of evenly cut graminoid vegetation lining the runway. According to Kurta (1995), bright green fecal pellets and evenly clipped stems of graminoid vegetation along well-defined runways are indicative of bog lemming activity. Bog lemming fecal pellets identified during the field survey were collected in accordance with the bog lemming pellet collection protocol provided by Dr. Olson and sent to him for genetic analyses.

Each bog lemming fecal pellet collection location was located with a Garmin® GLO GPS receiver. Data were collected on the associated habitat characteristics including dominant vegetation, hydrology, and evidence of past disturbances. Representative photographs were taken of bog lemming activity and general habitat characteristics.

NORTHERN SPRING SALAMANDER

Northern spring salamanders reach the northern limit of their distribution in the mountainous regions of western and northern Maine. Potentially suitable northern spring salamander habitat includes streams with perennial flow and a predominance of boulders, rock, and cobble substrate materials with limited to moderate embeddedness within finer substrate material. Typically, streams with potential northern spring salamander habitat have moderate to high gradients and are located in predominantly forested watersheds with hardwood and/or mixed forest communities within the immediate riparian areas.

A maximum of 1 survey hour was spent within each stream identified as potentially suitable northern spring salamander habitat. Survey efforts were limited to within, and immediately adjacent to (i.e., within 250 feet), the project area limits. During the survey effort, rocks and logs within and immediately adjacent to the wetted edge of the stream were turned over to look for northern spring salamanders. General data on the associated habitat characteristics were collected within each surveyed stream, including substrate composition, flow characteristics, bank dimensions, and riparian characteristics. The survey within each stream was deemed complete upon the location of a northern spring salamander or the total survey time reached 1 hour, whichever came first.

ROARING BROOK MAYFLY

Stantec evaluated streams within the project area for potential Roaring Brook mayfly habitat. Based on a literature review and Stantec's past experience with this species, habitat typically characterized as potential Roaring Brook mayfly habitat include coldwater high-gradient streams located above 1,000 feet in elevation that have good water clarity and that are well-oxygenated (Swartz et al. 2004, Burian et al. 2008). These streams also contain a predominance of coarse substrate materials including ledge, boulders, cobbles, and gravels. Mesohabitats (medium-scale habitats) within the streams are dominated by runs, riffles, and/or cascades or plunges. Because the Roaring Brook mayfly is most readily identifiable in late September when final instar (i.e., pre-emergent) larvae would be expected, no in-stream sampling was completed for this species at the time of the September 8, 2016 field surveys. In addition, a scientific collection permit from the MDIFW would be necessary to complete sampling for this species.

RESULTS

PRE-FIELD DESKTOP REVIEW

Kleinschmidt identified 5 "black spruce bogs" and 2 intermittent streams on their *Horseshoe Survey Area 05-16-2014* figure that was provided to Stantec (Appendix A). A further review of additional information indicated that the proposed electrical corridor crosses an unnamed perennial tributary to the Swift River at approximately 700 feet in elevation. Using this information, field surveys were targeted within the "black spruce bog" areas to evaluate northern bog lemming habitat and the perennial stream to evaluate northern spring salamander habitat. The additional wetland and stream resources were briefly inspected during the field survey to assess potential habitat conditions for the target species.

NORTHERN BOG LEMMING

Meander surveys were completed along the North Twin Mountain ridgeline to evaluate and characterize the existing "black spruce bog" wetland as identified by Kleinschmidt. Based on the field surveys, two small wetlands were identified as potential northern bog lemming habitat: Wetland Area 1 and Wetland Area 2 (Figure 2). Stantec characterized these areas as woodland

wetlands with red spruce and balsam fir trees with an understory of hoary sedge (*Carex canescens*), cinnamon fern (*Osmundastrum cinnamomea*), bunchberry (*Cornus canadensis*), three-seeded sedge, yellow birch (*Betula alleghaniensis*) saplings, and peat moss. The deep organic soil was saturated near the surface at the time of the field survey. These two potential northern bog lemming habitats are hydrologically connected along the ridgeline by areas of recently harvested forest that were unsuitable habitat for the northern bog lemming.

Within these potentially suitable wetland habitats, Stantec followed rodent runways through vegetation and under coarse woody debris to locate bog lemming activity (e.g., fecal pellets and clippings of vegetation). Bog lemming fecal pellets were located in Wetland Area 1. Stantec collected 8 pellets for genetic analyses. Based on Dr. Olson's genetic analyses, none of the bog lemming samples were northern bog lemming (Appendix B).

Bog lemming activity was not observed in Wetland Area 2. Rodent activity observed in this wetland consisted of brown fecal pellets in well-defined runways. The additional areas identified as "black spruce bogs" by Kleinschmidt as well as other wetlands were not suitable northern bog lemming habitat. Recent forest harvest operations had disturbed the vegetation, hydrology, and soil of these other wetlands through clearing of vegetation and rutting of substrates by forest harvest machinery. Representative photographs of bog lemming activity and associated habitats are included in Appendix C.

NORTHERN SPRING SALAMANDER

One stream containing potentially suitable northern spring salamander habitat was located within the project area. The stream is an unnamed perennial tributary to the Swift River near the eastern terminus of the proposed electrical corridor and is adjacent to Route 120 and an existing transmission line with an electrical substation (Figure 2). The stream flows southerly and contains a cobble-sand-gravel substrate with occasional boulders. The coarse substrate material is moderately embedded (e.g., 30–50% embedded) by fine substrate material. The bankfull width averages approximately 18 feet. At the time of the field survey, the wetted width averaged between 6–7 feet. No northern spring salamander specimens were observed during the one-hour survey period. The stream flows offsite under a culvert adjacent to the project area. The stream has been disturbed by adjacent development. Representative photographs of this stream are included in Appendix C.

Other streams observed within the project area were intermittent streams that were dry at the time of the field surveys with abundant detritus in the stream channel and no evidence of recent flow. These streams do not contain suitable northern spring salamander habitat.

ROARING BROOK MAYFLY

No streams with potentially suitable Roaring Brook mayfly habitat were identified within the project area. The perennial stream identified near the eastern terminus of the electrical corridor was

located at only 700 feet in elevation and contained a predominance of moderately embedded substrate material. Therefore, this stream is not considered suitable habitat.

Please let me know if you have any questions concerning the information contained in this report.

Regards,

STANTEC CONSULTING SERVICES INC.

Matt Arsenault
Botanist / Ecologist
Phone: (207) 406-5488
Fax: (207) 729-2715
matt.arsenault@stantec.com

Attachment: Figure 1 – Site Location Map
Figure 2 – Rare Species Survey Map
Appendix A – Kleinschmidt Wetland Reconnaissance Figure
Appendix B – Genetic Analysis Results
Appendix C – Representative Photographs

c. Adam Gravel, Stantec

November 4, 2016
Lindsay Deane-Mayer

Reference: Rare Species Survey Report, Horseshoe Valley Wind Project, Roxbury, Maine

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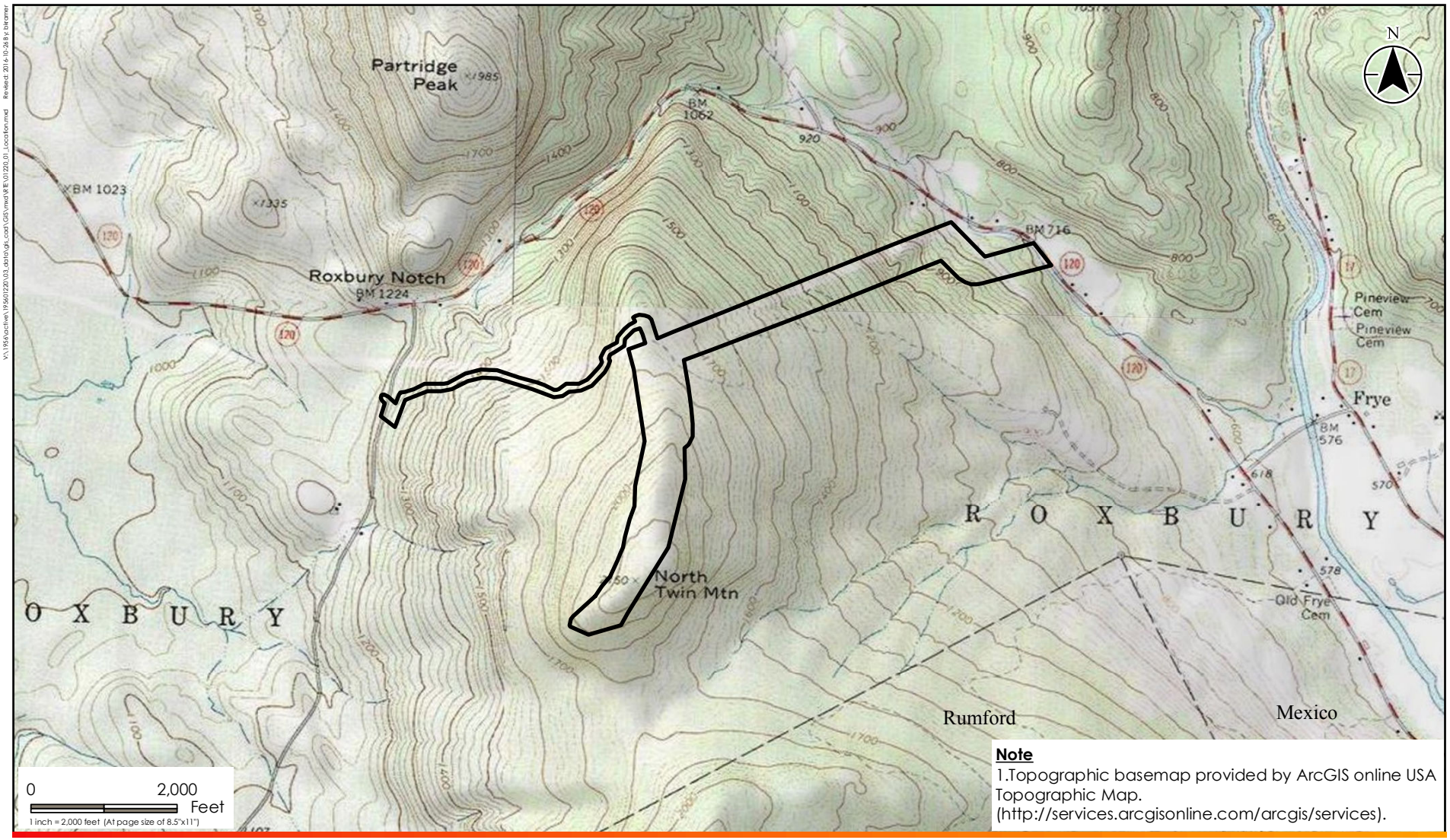
November 4, 2016
Lindsay Deane-Mayer

Reference: Rare Species Survey Report, Horseshoe Valley Wind Project, Roxbury, Maine

FIGURES



Note

1.Topographic basemap provided by ArcGIS online USA Topographic Map. (http://services.arcgisonline.com/arcgis/services).

195601220

Stantec

30 Park Drive
Topsham, ME USA 04086
Phone (207) 729-1199

Prepared by EMK on 2016-10-24
Quality Review by KWH on 2016-10-25
Independent Review by MPA on 2016-10-26

01220_01_Location.mxd

Legend

Approximate Project Area

Client/Project

Palmer Management Corporation
Horseshoe Valley Wind Project
Roxbury, Maine

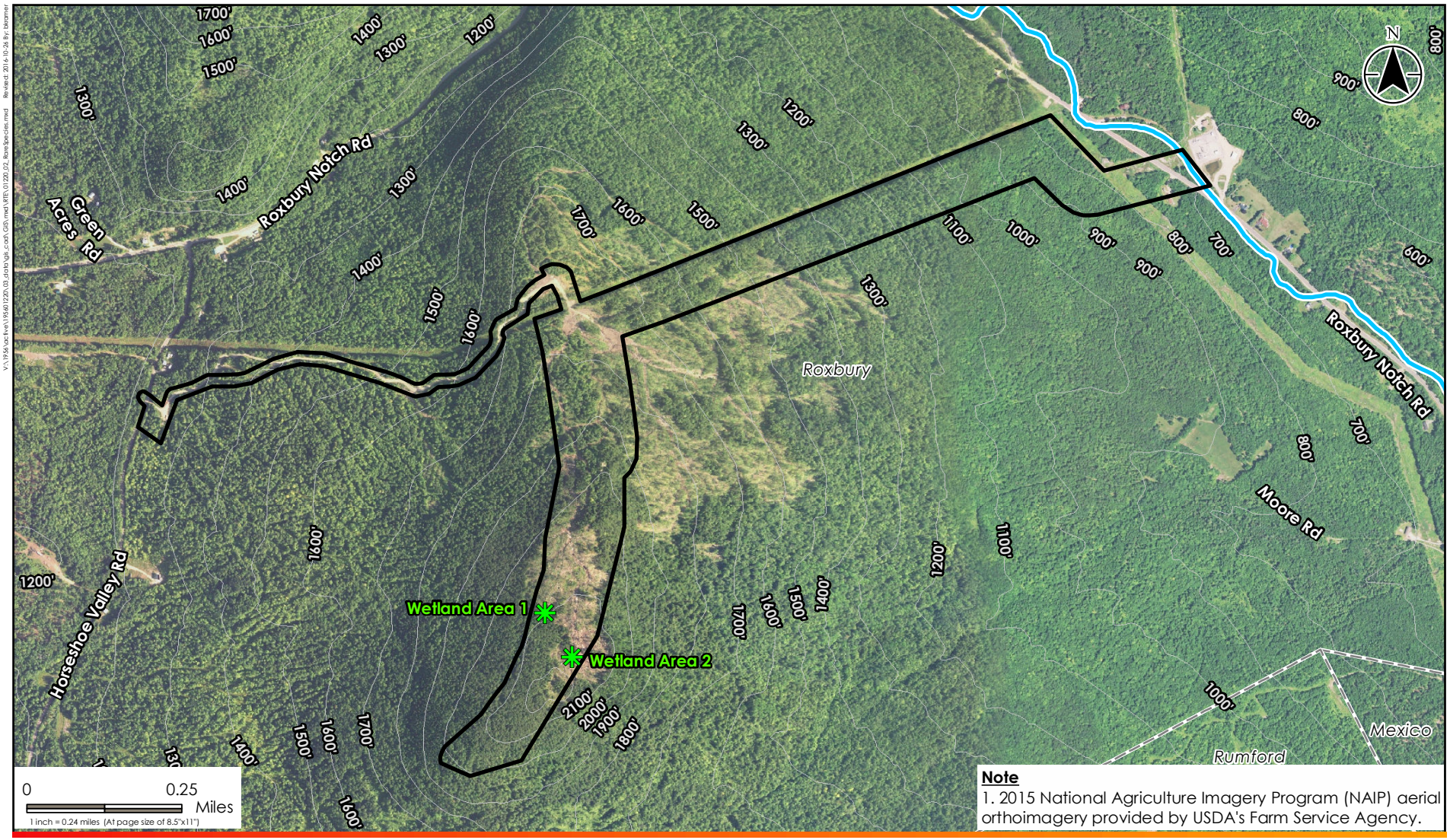
Figure No.

1

Title

Site Location Map

10/26/2016



Stantec

30 Park Drive
Topsham, ME USA 04086
Phone (207) 729-1199

Prepared by EMK on 2016-10-24
Quality Review by KWH on 2016-10-25
Independent Review by MPA on 2016-10-26

01220_02_RareSpecies.mxd

Legend

- Northern Bog Lemming Survey Wetland
- Northern Spring Salamander Survey Stream
- USGS Contour
- Approximate Project Area
- Town Boundary

195601220

Client/Project
Palmer Management Corporation
Horseshoe Valley Wind Project
Roxbury, Maine

Figure No.
2

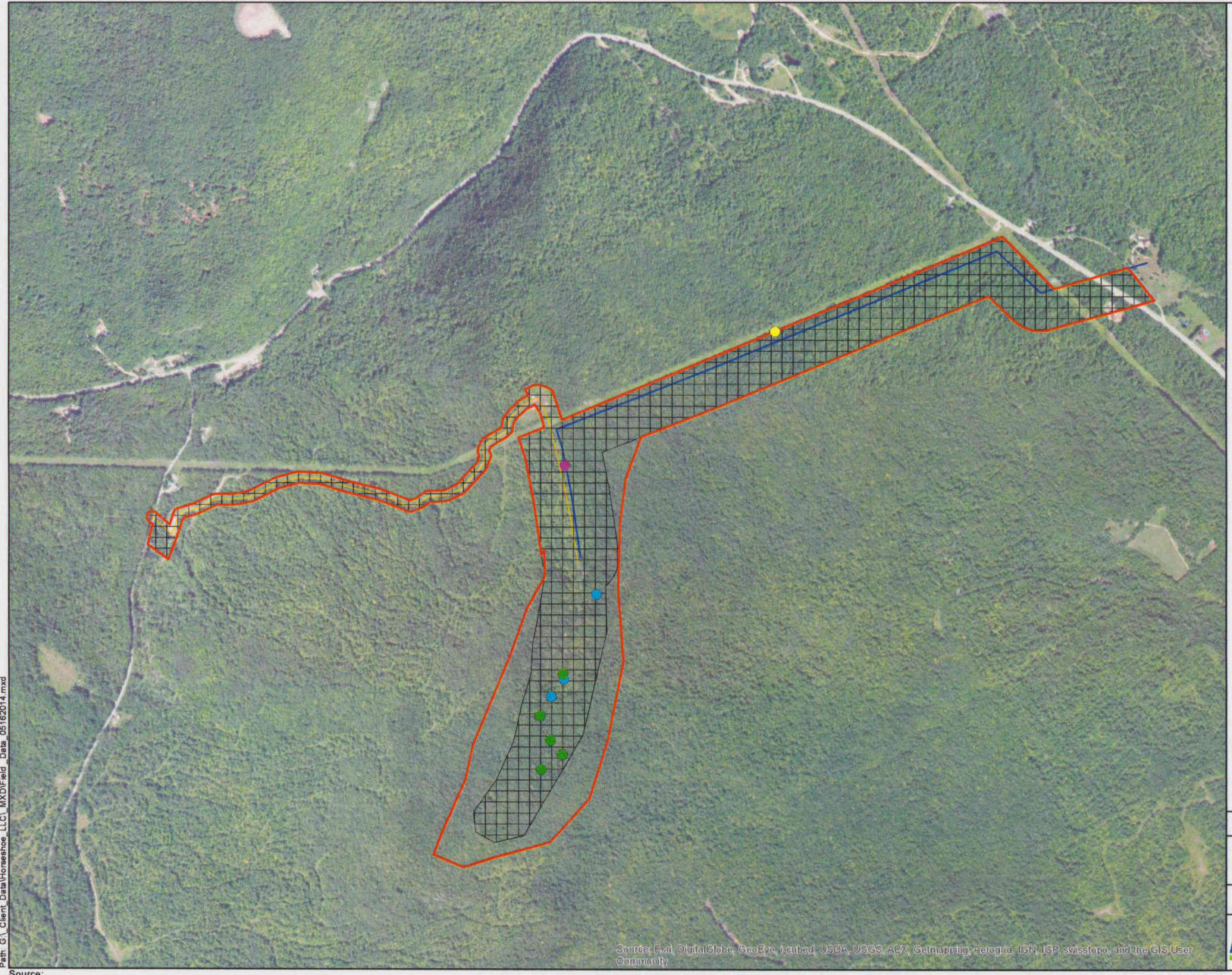
Title
Rare Species Survey Map

10/26/2016

November 4, 2016
Lindsay Deane-Mayer

Reference: Rare Species Survey Report, Horseshoe Valley Wind Project, Roxbury, Maine

APPENDIX A – KLEINSCHMIDT WETLAND RECONNAISSANCE FIGURE



N

Legend

Comment

- Intermittent Stream
- Black Spruce Bog
- ABA
- Disturbed Wetland
- Vernal Pool Survey Area
- Survey_grid
- Access Road
- Gen-Lead

800 400 0 800

Scale In Feet

Kleinschmidt Project No. 0704059.01
January, 2010

HORSESHOE VALLEY WIND, LLC

HORSESHOE
SURVEY AREA 05-16-2014

MAP 1 OF 1

Kleinschmidt
141 Main St., PO Box 650
Pittsfield, ME 04967
Telephone: (207) 487-3328
Fax: (207) 487-3124
www.KleinschmidtUSA.com

Path: G:_Client_Data\Horseshoe_LLC_MXD\Field_Data_05162014.mxd

Source:

November 4, 2016
Lindsay Deane-Mayer

Reference: Rare Species Survey Report, Horseshoe Valley Wind Project, Roxbury, Maine

APPENDIX B – GENETIC ANALYSIS RESULTS

From: Zach Olson
To: Arsenault, Matt
Cc: Zach Olson
Subject: sample results
Date: Thursday, November 03, 2016 2:23:41 PM
Attachments: 11-3-16 Stantec samples.pdf

Hi Matt,

I'm attaching a gel image for your records and for your client. I'm not sure how familiar you are with gel electrophoresis images, so here's a synopsis of what you're seeing:

The image contains 'lanes' that start with the wells at the top of the image and run down to the bottom of the image. We add our DNA product (white bands in the image) to the well at the top, apply an electrical charge, and the DNA moves towards the bottom. As it does that, the shorter fragments of DNA move farther/faster than larger fragments of DNA, so we're using the gel to sort DNA by size. Wherever we can see a white 'band' in a lane, there's a bunch of DNA fragments of that size that all migrated together.

The 8 samples you sent me are bracketed (lane 1 and 10) with a size standard that we can use to gauge the size of fragments in the unknown samples (lanes 2-9). Fragment size is measured in base-pairs (bp) and the size standard starts at the bottom with 25 bp, 50, 75, 100, 150, 200 bp etc. on up the lanes as indicated by the labels on the right.

Each of the samples you sent me has two bands <100bp, and then a gap until ~140bp or so. The presence of the 72 bp band and the absence of a band at 123 bp means that none of these samples are NBL.

I've spoken with my business office here at UNE, and it is a lot more complicated than I had thought to issue an invoice for this sort of thing. I'll be developing a contract for use in the future, but let's just call these samples a good test run for me and the method with no charge to you or your client. I'll keep you updated as we learn more about determining NBL presence/absence using field collections. We've collected pellets from most of the known NBL sites in the state, and my students and I are working to apply the lab method to see where NBL are and are not.

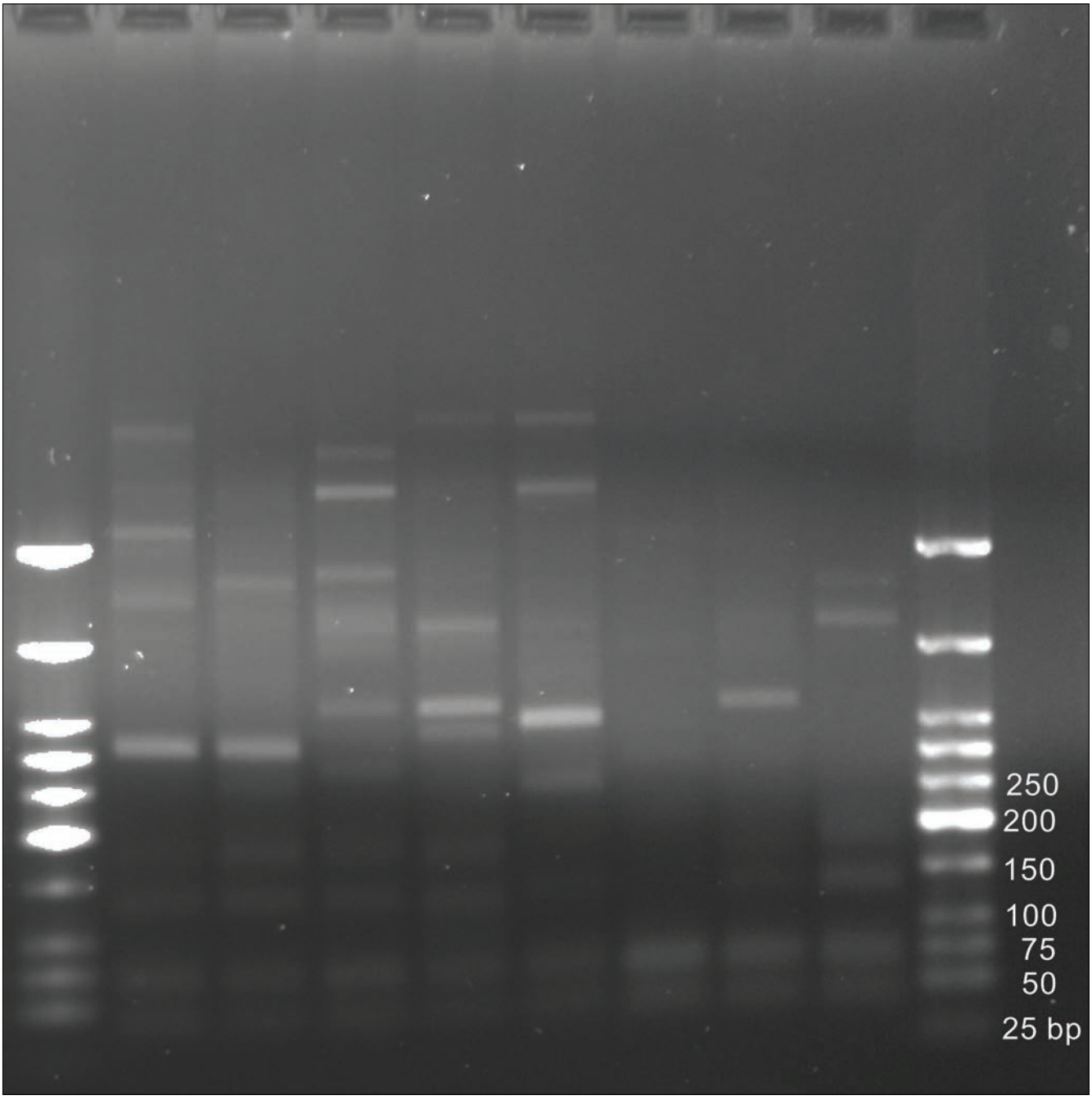
Hope all is well!

Zach

Zachary H. Olson, Ph.D.
Assistant Professor of Animal Behavior
Department of Psychology
University of New England
11 Hills Beach Rd.
Biddeford, ME 04005

Ph: (207) 602-2766

11-3-16 Stantec samples



Location: C:/Bog lemmings
Printed: 11/3/2016 1:24:22 PM

November 4, 2016
Lindsay Deane-Mayer

Reference: Rare Species Survey Report, Horseshoe Valley Wind Project, Roxbury, Maine

APPENDIX C – REPRESENTATIVE PHOTOGRAPHS

November 4, 2016
Lindsay Deane-Mayer

Reference: Rare Species Survey Report, Horseshoe Valley Wind Project, Roxbury, Maine

Photo 1. Wetland Area 1 northern bog lemming survey area. Stantec. September 8, 2016.

Photo 2. Green fecal pellets (circled in red) collected for genetic analyses in Wetland Area 1. Stantec. September 8, 2016

November 4, 2016
Lindsay Deane-Mayer

Reference: Rare Species Survey Report, Horseshoe Valley Wind Project, Roxbury, Maine

Photo 3. Wetland Area 2 northern bog lemming survey area. Stantec. September 8, 2016.

Photo 4. Non-bog lemming activity in Wetland 2. Stantec. September 8, 2016.

November 4, 2016
Lindsay Deane-Mayer

Reference: Rare Species Survey Report, Horseshoe Valley Wind Project, Roxbury, Maine

Photo 5. Wetland with unsuitable northern bog lemming habitat. Stantec. September 8, 2016.

Photo 6. Unnamed perennial tributary of Swift River surveyed for northern spring salamander. Stantec. September 8. 2016.

November 4, 2016
Lindsay Deane-Mayer

Reference: Rare Species Survey Report, Horseshoe Valley Wind Project, Roxbury, Maine

Photo 7. Intermittent stream with unsuitable habitat for northern spring salamander or Roaring Brook mayfly. Stantec. September 8, 2016.

4-D

Northern Long-Eared Bat (Myotis septentrionalis) Acoustic Survey and Bicknell's Thrush (Catharus bicknelli) Survey

Stantec

Memo

To:	Lindsay Deane-Mayer Palmer Capital Corporation Palmer Management Corporation	From:	Laura Berube Stantec Consulting Services Inc.
File:	195601220	Date:	October 28, 2016

Reference: Northern Long-Eared Bat (*Myotis septentrionalis*) Acoustic Survey and Bicknell's Thrush (*Catharus bicknelli*) Survey, Horseshoe Valley Wind Project, Roxbury, Maine

INTRODUCTION

Palmer Management Corporation retained Stantec Consulting Services Inc. (Stantec) to conduct field surveys to determine presence or probable absence of the northern long-eared bat (*Myotis septentrionalis*) and Bicknell's thrush (*Catharus bicknelli*) in areas of potentially suitable habitat associated with the Horseshoe Valley Wind Project (Project) in Roxbury, Maine. Northern long-eared bats are federally threatened[1] and state-listed endangered in Maine and Bicknell's thrush are considered state species of special concern in Maine. Survey methods consisted of ultrasonic acoustic surveys for bats and audio broadcast/listening surveys for Bicknell's thrush.

The Project consists of the installment of 5 wind turbines and associated infrastructure along a 1 kilometer (km) section of North Twin Mountain ridgeline reaching approximately 2,200 feet that runs north to south below and west of Maine State Route 120 in Roxbury, Maine. The Project is assumed to qualify for the small wind certification program under Maine law (less than 3 acres stripped, graded and not revegetated and occupying less than 20 acres. See 35-A §3456 and 38 MRSA §480-II). The Project will result in removal of potential northern long-eared bat habitat totaling approximately 1 km of linear forested habitat along the ridgeline proposed for turbines. Since existing access roads and transmission lines already cross the ridgeline, it is assumed that additional clearing will not be needed in these areas. Habitats within a 5-mile buffer surrounding the Project area include fragmented and contiguous forested areas, agricultural lands and residential homes, and a 920-acre pond (Ellis Pond) approximately 3 miles northwest of the Project. The existing 22-turbine Record Hill Wind Project is located approximately 0.75 miles north of the Project across Maine State Route 120, and Black Mountain Ski Resort is approximately 3 miles south of the Project.

The acoustic bat survey was conducted according to the U.S. Fish and Wildlife Service's (USFWS) 2016 Range-wide Indiana Bat Summer Survey Guidelines (USFWS Guidelines) which the USFWS recommends also be applied to northern long-eared bat surveys throughout the species' range. The goal of the acoustic survey was to determine if this species is actually utilizing areas of potential habitat at the Project during the summer maternity season in 2016. Bicknell's thrush was an identified species for the Project in the Maine Department of Inland Fisheries and Wildlife's (MDIFW) letter to Palmer Management Corporation dated 31 May 2016. Field surveys were conducted based on the MDIFW Curtailment Policy and Wind Power Preconstruction Study Recommendations (MDIFW

[1] The northern long-eared bat, whose range encompasses Roxbury, Maine, where the Project is located, was listed as a federally threatened species on 2 April 2015 under the Endangered Species Act with a final 4(d) Rule effective on 14 January 2016.

Recommendations) dated June 2015. This report summarizes methods and results of the acoustic bat and Bicknell's thrush surveys.

NORTHERN LONG-EARED BAT ACOUSTIC SURVEY

METHODS

Field Survey

We determined the appropriate number of acoustic bat survey sites based on the USFWS Guidelines, which require 1 survey site (2 detector nights) to be sampled per 1 km of suitable summer habitat for linear projects. For the purposes of this survey, we assumed that all forested areas provide potential roost habitat for northern long-eared bats. As such, we conducted the survey at 1 site within the Project area (Figure 1). The site was surveyed for 2 nights, resulting in 2 detector nights at the Project. We selected the survey site according to the criteria in the USFWS Guidelines, positioning the detector in a potential flight corridor that could be suitable as northern long-eared bat foraging habitat. Once deployed, we photographed the detector and recorded its location using a Garmin™ eTrex GPS unit. Appendix A includes photographs of the detector site.

Stantec used a zero-crossing Anabat detector (Titley Scientific© Anabat SD1) and placed the detector in a customized weatherproof box with a 90-degree angle PVC-elbow to protect the directional microphone. We mounted the detector on a temporary metal pole at a height of approximately 3 meters (m) above ground vegetation height, at least 3 m from vegetation or obstruction in every direction of the microphone, and with minimal vegetation within 10 m from the microphone. The microphone was oriented horizontally (0°) at a magnetic bearing of 67° along the transmission corridor. We programmed the detector to record from 1930 through 0600, thereby sampling the full period from more than 30 minutes before sunset until more than 30 minutes after sunrise. We confirmed proper detector function prior to deployment by conducting a microphone "scratch test" (confirming detection of ultrasound in front of the microphone) and estimated effective detector range in the field using the same method. We set the detector to operate with a sensitivity of 6.5 and a data division ratio of 16.

We left the detector in place until weather conditions as reported by the nearest weather station (KMEWELD2 in Weld, Maine) met the parameters outlined in the USFWS Guidelines for 2 nights: temperatures do not fall below 50°F (10°C) during the first 5 hours of survey period; precipitation, including rain and/or fog, does not exceed 30 minutes or continue intermittently during the first 5 hours of the survey period; and sustained wind speeds are not greater than 9 miles/hour for 30 minutes or more during the first 5 hours of the survey period.

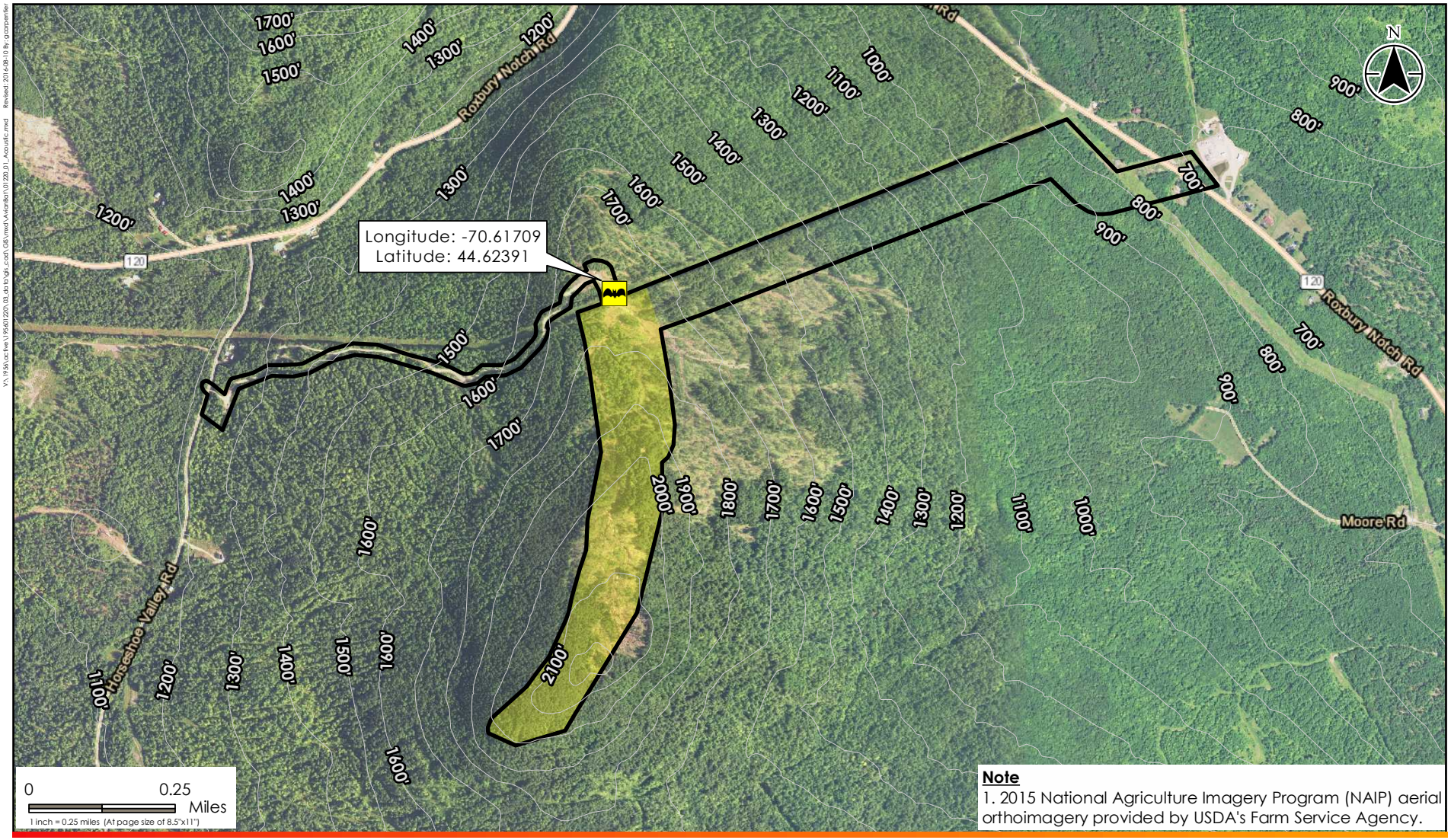
Following the first 2 weather-appropriate nights of data collection, we inspected the detector in the field to confirm that it had operated successfully (i.e., we conducted a microphone "scratch test" and checked the sensitivity, battery, and voltage) and downloaded data using CFCread software (Version 4.4u, Titley Electronics). We inspected nightly folders to see whether they contained files, which typically indicate that a detector was recording bats or other ultrasonic signals. We also reviewed the status file generated by the detector to confirm that the detector recorded between

the intended start/stop times and was functioning properly. Once we confirmed that the detector operated properly during 2 nights, we removed the detector from the field.

Data Analysis

Stantec performed a coarse visual analysis of the data and confirmed that bats were recorded. Through visual analysis it did not appear that any high frequency bats were recorded. We proceeded to analyze the data using Kaleidoscope Pro Software (Kaleidoscope) version 3.1.7 (classifier version 3.1.0), which has been approved by the USFWS as suitable for analyzing zero-crossing data. We used default software settings as recommended by the manufacturer and selected Maine as the region for analysis. We based presence or probable absence of northern long-eared bats on the maximum likelihood estimate (MLE) generated by Kaleidoscope for each detector night. A MLE of less than 0.05 indicates probable presence and a MLE greater than 0.05 indicates unlikely presence[2]. Data files have been archived electronically and are available upon request.

[2] According to USFWS Guidelines, a maximum likelihood estimator (MLE) created by any of the approved acoustic identification programs at a given site on a given night that is less than 0.05 indicates probable presence of the species.

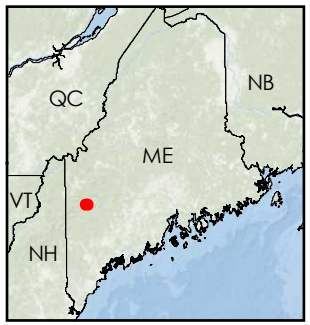


Stantec

30 Park Drive
Topsham, ME USA 04086
Phone (207) 729-1199

Prepared by DLJ on 2016-07-06
Quality Review by GAC on 2016-07-07
Independent Review by LSB on 2016-07-07

01220_01_Acoustic.mxd



Legend

- Acoustic Detector
- Approximate Project Area
- Approximate Proposed Turbine Area/Bicknell's Thrush Survey Area
- USGS Contour

195601220
8/10/2016

Client/Project
Palmer Management Corporation
Horseshoe Valley Wind Project
Roxbury, Maine

Figure No.
1

Title
Northern Long-eared Bat
Bicknell's Thrush Survey
Location Map

Reference: Northern Long-Eared Bat (*Myotis septentrionalis*) Acoustic Survey and Bicknell's Thrush (*Catharus bicknelli*) Survey, Horseshoe Valley Wind Project, Roxbury, Maine

RESULTS

Habitat Survey

The Project area consists of primarily forested habitat along the North Twin Mountain ridgeline with a transmission corridor bisecting the northern portion of the ridgeline and a dirt road from Horseshoe Valley Road to the west to where the transmission corridor bisects the ridgeline. Dominant tree species in the forested habitat includes red maple (*Acer rubrum*), American beech (*Fagus grandifolia*) and paper birch (*Betula papyrifera*). We observed trees exceeding 3" diameter breast height containing exfoliating bark and no snags near where the detector was placed. As such, the Project area includes forested habitat that could provide potential roosting habitat for northern long-eared bats, although forest clearing associated with the Project will be confined to the upper elevations along the top of the ridge, where conditions are presumably harsher than the lower elevation surrounding areas. The understory in the forested habitat near where the detector was placed contained approximately 30% closure (Appendix B). The detector was placed parallel to forested habitat in the transmission corridor which was dominated by grass and sedge species.

Acoustic Analysis

The acoustic bat survey occurred on the nights of 27 and 30 June 2016, when weather conditions met the criteria specified by the USFWS (listed above), yielding 2 detector nights at the Project. Appendix B includes completed datasheets for the detector site.

The detector recorded bats during both nights of survey. Kaleidoscope did not identify any calls as northern long-eared bats. Even when no calls are identified as a certain species, Kaleidoscope still calculates nightly MLEs for that species. Kaleidoscope computed a MLE of greater than 0.05 for northern long-eared bats during both nights, indicating that this species was not likely present at the Project area during the survey period per the USFWS Guidelines (Table 1). Kaleidoscope did identify calls of big brown bat, hoary bat, and silver-haired bat, none of which are federally or state-listed species. Kaleidoscope computed a MLE of less than 0.05 for hoary bat only, on the night of 27 June, indicating that this species was likely present at the Project area during the survey period per the USFWS Guidelines (Table 1).

Table 1. Number of files identified to species and maximum likelihood estimator (in parentheses) calculated by Kaleidoscope Pro Software 3.1.7 (classifier version 3.1.0) during the 2016 acoustic bat survey at the Horseshoe Valley Wind Project in Roxbury, Maine.

Night of	big brown bat	silver-haired bat	hoary bat	eastern red bat	tri-colored bat	eastern small-footed bat	little brown bat	northern long-eared bat
27-Jun-16	0 (1)	1 (0.69)	1 (0.03)	0 (1)	0 (1)	0 (1)	0 (1)	0 (1)
30-Jun-16	1 (0.69)	2 (0.16)	0 (1)	0 (1)	0 (1)	0 (1)	0 (1)	0 (1)

Reference: Northern Long-Eared Bat (*Myotis septentrionalis*) Acoustic Survey and Bicknell's Thrush (*Catharus bicknelli*) Survey, Horseshoe Valley Wind Project, Roxbury, Maine

CONCLUSIONS

The acoustic bat survey conducted at the Horseshoe Valley Wind Project followed USFWS Guidelines. The detector operated successfully for 2 nights and bat activity occurred on both nights. No northern long-eared bat calls were identified and the nightly MLE for northern long-eared bats was greater than 0.05 for each detector night indicating that northern long-eared bats were not likely present at the Project during the survey period.

BICKNELL'S THRUSH SURVEY

METHODS

To determine possible presence of Bicknell's thrush at the Project, a Stantec biologist conducted surveys by meandering along the North Twin Mountain ridgeline where turbine locations are proposed. At approximately every 200 m to 300 m along the ridgeline, the biologist broadcasted Bicknell's thrush calls and listened for approximately 1 to 2 minutes for response calls. The biologist also documented any birds seen or heard while onsite at the Project during the northern long-eared bat survey and the Bicknell's thrush survey.

RESULTS

The survey was conducted between 0430 and 1000 on the morning on 28 June 2016. Elevations at the Project reach approximately 2,200 feet and no preferred Bicknell's thrush habitat (stunted spruce-fir forest at elevations above 2,700 feet) was observed during the field survey. Also, no Bicknell's thrush responded to broadcasts or were observed visually or audibly while at the Project. Bird species that were observed incidentally during the surveys at the Project are presented in Table 1.

Table 1. Incidental bird species observed during surveys at the Horseshoe Valley Wind Project, June 2016.

Species Common Name	Species Scientific name
American crow	*Corvus brachyrhynchos*
American robin	*Turdus migratorius*
black-and-white warbler*	*Mniotilta varia*
black-capped chickadee	*Poecile atricapillus*
black-throated blue warbler	*Setophaga caerulescens*
blue-headed vireo	*Vireo solitarius*
chestnut-sided warbler*	*Setophaga pensylvanica*
common raven	*Corvus corax*
common yellowthroat	*Geothlypis trichas*
dark-eyed junco	*Junco hyemalis*
golden-crowned kinglet	*Regulus satrapa*
great crested flycatcher	*Myiarchus crinitus*

Reference: Northern Long-Eared Bat (*Myotis septentrionalis*) Acoustic Survey and Bicknell's Thrush (*Catharus bicknelli*) Survey, Horseshoe Valley Wind Project, Roxbury, Maine

Species Common Name	Species Scientific name
hermit thrush	*Catharus guttatus*
indigo bunting	*Passerina cyanea*
mourning dove	*Zenaida macroura*
mourning warbler	*Geothlypis philadelphia*
northern flicker	*Colaptes auratus*
northern parula	*Setophaga americana*
pileated woodpecker	*Dryocopus pileatus*
red-eyed vireo	*Vireo olivaceus*
scarlet tanager	*Piranga olivacea*
veery*	*Catharus fuscescens*
white-throated sparrow*	*Zonotrichia albicollis*
winter wren	*Troglodytes hiemalis*
yellow-rumped warbler	*Setophaga coronata*
* Maine state species of special concern.	

CONCLUSIONS

Bicknell's thrush are typically found in stunted spruce-fir forest at elevations above 2,700 feet. Elevations at the Project reach approximately 2,200 feet, however, based on comments made by MDIFW in their letter on 31 May 2016, we surveyed for Bicknell's thrush at the Project for possible presence. No suitable forest characteristics were identified during the field survey and no Bicknell's thrush responded to broadcasts or were observed visually or audibly while at the Project indicating that Bicknell's thrush were not likely present at the Project during surveys.

STANTEC CONSULTING SERVICES INC.

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Attachment: Appendix A – Detector Setup Photographs
Appendix B – Acoustic Survey Datasheets

October 28, 2016
Lindsay Deane-Mayer

Reference: Northern Long-Eared Bat (*Myotis septentrionalis*) Acoustic Survey and Bicknell's Thrush (*Catharus bicknelli*) Survey, Horseshoe Valley Wind Project, Roxbury, Maine

APPENDIX A – DETECTOR SETUP PHOTOGRAPHS

Stantec

October 28, 2016
Lindsay Deane-Mayer

Reference: Northern Long-Eared Bat (*Myotis septentrionalis*) Acoustic Survey and Bicknell's Thrush (*Catharus bicknelli*) Survey, Horseshoe Valley Wind Project, Roxbury, Maine

Photo 1: Anabat SD1 detector in weather proof casing deployed in the transmission corridor at the Horseshoe Valley Wind Project for northern long-eared bat surveys in June 2016. The detector is located approximately 3 m above vegetation height, oriented horizontally to the ground, and facing 67°. A 3-ring binder is placed at the bottom of the detector for scale.

October 28, 2016
Lindsay Deane-Mayer

Reference: Northern Long-Eared Bat (*Myotis septentrionalis*) Acoustic Survey and Bicknell's Thrush (*Catharus bicknelli*) Survey, Horseshoe Valley Wind Project, Roxbury, Maine

Photo 2: Anabat SD1 detector in weather proof casing deployed in the transmission corridor at the Horseshoe Valley Wind Project for northern long-eared bat surveys in June 2016. The arrow indicates the 90-degree angle PVC-elbow attached to the weather proof casing over the detector, protecting to microphone from adverse weather conditions and funneling sound from the potential flight corridor to the microphone.

Stantec

October 28, 2016
Lindsay Deane-Mayer

Reference: Northern Long-Eared Bat (*Myotis septentrionalis*) Acoustic Survey and Bicknell's Thrush (*Catharus bicknelli*) Survey, Horseshoe Valley Wind Project, Roxbury, Maine

APPENDIX B – ACOUSTIC SURVEY DATASHEETS

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: Horseshoe Valley Wind Date: 6/27/16

Township/Range/Section: Roxbury, Maine

Lat Long/UTM/ Zone: 44.62391, -70.61709 Surveyor: Joel Perkins

Brief Project Description

Proposed small wind project on North Twin Mountain Ridgeline in Roxbury, Maine.

Project Area

	Total Acres	Forest Acres	Open Acres
Project	~121	~ 113	~ 8

Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres- no clearing
	~1 km (linear project)	0	0

Vegetation Cover Types

Pre-Project	Post-Project
Hardwood and mixed forest w/ a transmission Corridor dominated by grass/sedge species	N/A

Landscape within 5 mile radius

Flight corridors to other forested areas?

Yes

Describe Adjacent Properties (e.g. forested, grassland, commercial or residencial development, water sources)

Mostly forested. Some agricultural and residential developement, Record Hill Wind project, Ellis Pond, Black Mountain Ski resort, Rt. 120 and 17.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)? Approximately 8 miles west of Mount Blue State Park, 15 miles east of Grafton Notch State Park, and 8 miles southwest of Bureau of Parks and Lands property at Tumbledown Mountain.

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area
Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): 1

Transmission corridor over ridge w/ recently logged area

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
				None
Pools/Ponds (# and size)		Open and accessible to bats?		
Wetlands (approx. ac.)	Permanent	Seasonal		

Forest Resources at Sample Site

	Canopy (> 50')	Midstory (20-50')	Understory (<20')
Closure/Density	1	3	3
Dominant Species of Mature Trees	Maple - Beech - Birch		
% Trees w/ Exfoliating Bark	1 (for all trees combined)		
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)
	5	3	1
No. of Suitable Snags		0	

1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81-100%

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR ~~INDIANA BATS~~ NLEB? Yes

Additional Comments:

The area was recently logged w/in last 18 months.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

NLEB Presence/Absence Acoustic Survey Datasheet - Stantec

Project Name: HORSESHOE VALLEY
Site ID: HS_01
Weather Station Provider: WEATHER UNDERGROUND
Surveyor Initials: JSP
Lat. (+/- error): N 44.62391 +/- 16 FT
Weather Station ID: KMEWELD7
Deployment Date: 20160628
Long. (+/- error): W070.61709 +/- 16 FT

Sampling Location Specific Characteristics - Check all that apply

- [x] Forest Canopy Opening
- [ ] Near water
- [x] Recently logged with remaining potential roost trees
- [x] Road and/or stream corridor with open tree canopy or canopy height > 10m
- [x] Woodland edge
- [x] Other - Describe: TRANSMISSION CORRIDOR

Additional Habitat Notes:
RECENTLY LOGGED W/I LAST 18 MONTHS
DOMINANT SPECIES:
MAPLE
BEECH
BIRCH

Unit Specific Deployment Characteristics - Must meet all criteria

If any criteria are answered 'NO' justification is required

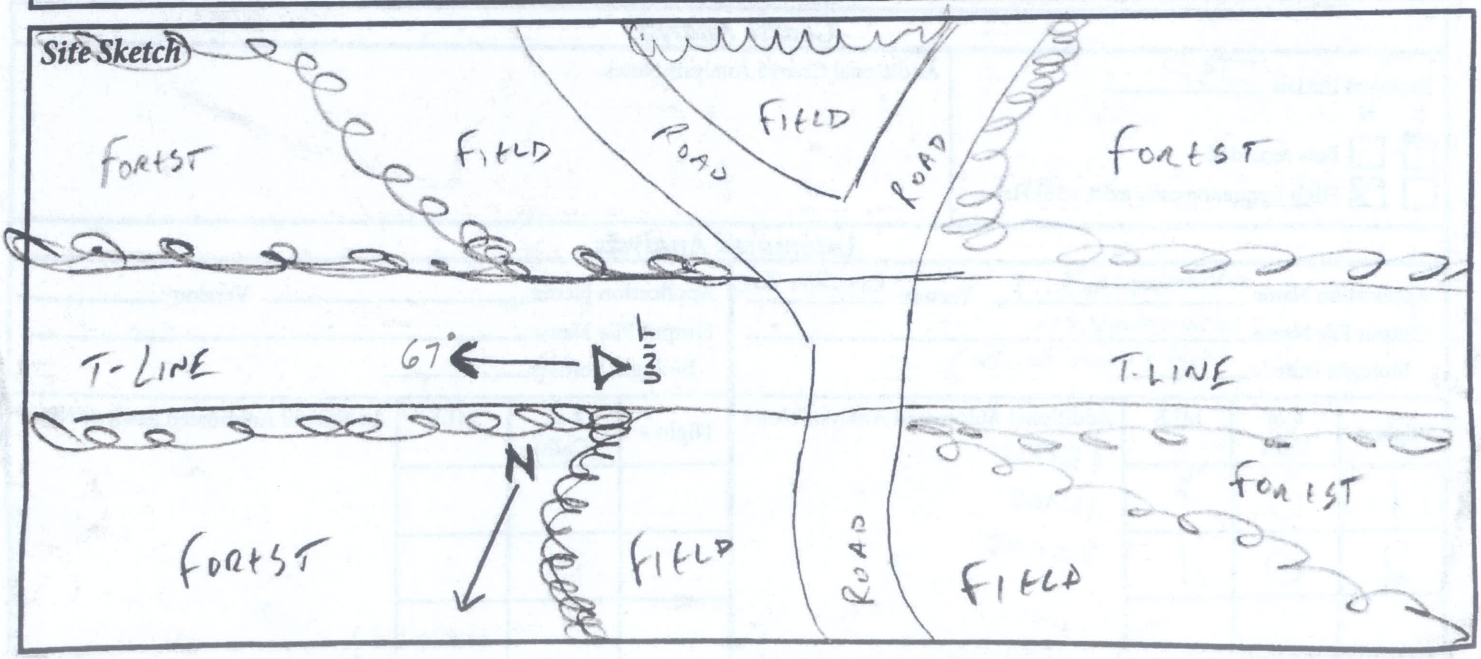
Y	N	
[x]	[ ]	> 3 m in any direction from vegetation or other obstructions
[x]	[ ]	Minimal or no vegetation within 10m in front of microphone
[x]	[ ]	Parallel to woodland edge
[x]	[ ]	>15m from known or suitable roosts
[x]	[ ]	>3 m above ground level
[x]	[ ]	>200m from adjacent acoustic sampling location
[x]	[ ]	Within expected flight height

Horizontal Mic DIRECTION: 67°
Vertical mic Orientation: ≈ 0°

Unit Information

Make/Model: ANABAT SD2
Data Division Ratio: 16
Recording Schedule START: 1930
Serial Number: 80903
Sensitivity: 6.5
Detection Range (m): 30
STOP: 0600
Housing/Weatherproofing description: PVC Box w/ PVC 90° ELBOW

Site Sketch



Daily Survey Data

Sampling Night # 1 Survey Date 20160627

Y	N	
X		Microphone operating normally
X		Other unit operations normal
X		Nightly temperatures >50F for first 5 hours
X		No fog/rain that exceeds 30 minutes or continues intermittently for first 5 hours
X		Sustained wind speeds not >9mph for 30 min for first 5 hrs

Additional Survey Notes

Daily Survey Data

Sampling Night # 2 Survey Date 20160630

Y	N	
X		Microphone operating normally
X		Other unit operations normal
X		Nightly temperatures >50F for first 5 hours
X		No fog/rain that exceeds 30 minutes or continues intermittently for first 5 hours
X		Sustained wind speeds not >9mph for 30 min for first 5 hrs

Additional Survey Notes

Daily Survey Data

Sampling Night # _____ Survey Date _____

Y	N	
		Microphone operating normally
		Other unit operations normal
		Nightly temperatures >50F for first 5 hours
		No fog/rain that exceeds 30 minutes or continues intermittently for first 5 hours
		Sustained wind speeds not >9mph for 30 min for first 5 hrs

Additional Survey Notes

Daily Survey Data

Sampling Night # _____ Survey Date _____

Y	N	
		Microphone operating normally
		Other unit operations normal
		Nightly temperatures >50F for first 5 hours
		No fog/rain that exceeds 30 minutes or continues intermittently for first 5 hours
		Sustained wind speeds not >9mph for 30 min for first 5 hrs

Additional Survey Notes

Coarse Analysis

Biologist Initials JSP

Y	N	
X		Bats recorded
	X	High frequency calls exist >35kHz

Additional Coarse Analysis Notes

Automated Analysis

Application Name Kaleidoscope Pro 3.1.7 Version Classifier 3.1.0
Output File Name idsummary.csv
Biologist Initials LSB (Laura Berube)

Night #	# of Calls	MLE	Additional Automated Analysis Notes
1	0	1	1 EPFU
2	0	1	1 LACI
			3 LANO

Application Name _____ Version _____
Output File Name _____
Biologist Initials _____

Night #	# of Calls	MLE	Additional Automated Analysis Notes

4-E
Soil Survey Report

Roxbury Wind Project

Soil Survey Report

February 21, 2018

Prepared for:

Palmer Management Corporation
13 Elm Street, Suite 200
Cohasset, MA 02025

Prepared by:

Stantec Consulting Services, Inc.
30 Park Drive
Topsham, ME 04086

Sign-off Sheet

The accompanying soil profile descriptions and soil survey maps, and this soil narrative report entitled “Roxbury Wind Project Soil Survey Report”, dated February 21, 2018, were completed in accordance with the standards adopted by the Maine Association of Professional Soil Scientists, February 1995, as amended, and prepared by Rodney D. Kelshaw CSS #552.

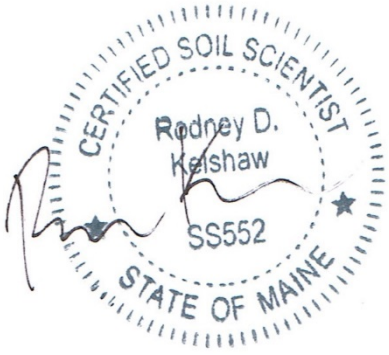


Table of Contents

1.0 INTRODUCTION

At the request of Palmer Management Corporation, Stantec Consulting Services Inc. (Stantec) completed a soil survey for the proposed Roxbury Wind Project (Project) in Roxbury, Maine. The purpose of this report is to describe the soil types identified within the survey area of the proposed wind farm site and how these soils may affect development of the site for this project. The project consists of four proposed turbine locations and associated infrastructure, including access roads and an electrical collector line that will extend from the turbines to an existing substation.

This soil survey is a compilation of on-site soil investigation data supported by publicly available information from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil surveys for Oxford County. Two classes of soil survey were performed, and this report was developed to meet the typical requirements of the Maine Department of Environmental Protection (MDEP) Site Location of Development Act (Site Law) and the Maine Land Use Planning Commission (LUPC) for wind power projects. It includes information on the ability or limitation of the soil to support the activities inherent to the construction and operation of the proposed project.

2.0 SITE DESCRIPTION

The soil survey study area (site) is located on the southern side of State Route 120 and east of Horseshoe Valley Road in Roxbury, Maine (Figure 1). The site is approximately 89 acres; situated on the North Twin Mountain ridgeline. It also includes proposed access along an existing aggregate road extending from Horseshoe Valley Road to the ridgeline and a proposed electrical collector line that extends along the southern side of an existing transmission line corridor from the ridgeline, easterly to an existing substation located on the eastern side of Route 120. At the time of the on-site survey the existing/proposed access road had not been recently maintained and several severe washouts were present.

The site is currently undeveloped, with the primary use being forestland. The history of timber harvesting on the site has resulted in a mixed-growth forest composed of multiple-aged stands. Dominant tree species are spruce (*Picea* sp.), balsam fir, (*Abies balsamea*), maple (*Acer* sp.), and birch (*Betula* sp.). There is an existing network of timber trails throughout the site, most dominant in the northern section. Due to the high rate of timber harvesting the site contains many areas that are disturbed from use of large scale timber harvesting equipment. These roads and ruts intercept surface and subsurface runoff which is then concentrated in small, discrete areas that hold water for extended periods and function similar to wetlands, although do not meet the parameters to be mapped as such. There is also a meteorological tower located at the site; however, it recently blew down and was in disrepair at the time of the on-site survey.

3.0 PURPOSE

The purpose of the soil survey is to provide project engineers with site-specific soil information which will be used to design project components and for project permitting. The soil investigation is performed to obtain information that will make possible a taxonomic classification for the various soils that exist on-site; particularly in areas of proposed development, including the proposed access road corridor, within the proposed turbine pad sites, and along the proposed electrical collector line corridor.

This report identifies soil limitations including soil drainage, physical properties, depth to bedrock, and other limiting factors. Knowing the depth to bedrock will affect project design for roads, anchoring of turbines, blasting requirements, and identify sources for road building materials. Hydrological Soil Group (HSG) ratings, which are based on site specific soil data, are part of the calculations for stormwater runoff curve values used for stormwater control design and culvert location and sizing. Information from this report may be used to plan temporary erosion and sediment control to be implemented during project construction, as well as permanent stormwater management during operation of the project.

A soil survey is tailored to the specific project, and as such, the report may not be suitable for other uses because the soil limitations and properties that are suitable for one type of project may not be suitable for a different project. Potential limitations for development identified in this report are intended for this specific project and should not be used for any other purpose. The accompanying soil survey maps depict the location and extent of soils found on the site (Figures 2-1 through 2-9 and Figure 3).

4.0 METHODS

This report and map were completed in accordance with the standards adopted by the Maine Association of Professional Soil Scientists (MAPSS) in the "*Guidelines for Maine Certified Soil Scientists for Soils Identification and Mapping*" (revised 2009)[1] and follows the standards detailed in the USDA NRCS "*Soil Survey Manual*"[2]. Two classes of soil survey were completed for this survey. A Class L (linear) soil survey was conducted for the proposed turbine array; which includes the turbine pads, access roads and crane paths, and collector line within the turbine array area. A Class D (medium intensity) survey was conducted for the proposed electrical collector line corridor from the ridgeline to the existing substation on State Route 120.

The soil survey site boundary was determined based on the proposed turbine layout from November 2017, and consisted of a 100-foot wide survey area primarily along the existing access road from Horseshoe Valley Road to the ridgeline, a polygon of variable width extending from 300 feet north of the northernmost turbine to 300 feet south of the southernmost turbine, and an approximately 100-foot wide corridor extending along the southern side of the existing cleared distribution line from the ridgeline, easterly to the substation at State Route 120. The locations of the

[1] Maine Association of Professional Soil Scientists. 2009. *Guidelines for Maine Certified Soil Scientists for Soils Identification and Mapping*.
[2] Soil Science Division Staff. 2017. *Soil Survey Manual, ed*. C. Ditzler, K.Scheffe, and H.C. Monger USDA Handbook 18. Government Printing Office, Washington, D.C.

turbines currently depicted on the soil survey maps are a revised proposed turbine layout, from February 2018, and therefore does not match all turbine locations that were being proposed at the time of the soil survey fieldwork.

Kleinschmidt Associates (KA) performed a wetland delineation and stream mapping of the site and Stantec was provided the shapefile data which was used to help determine hydric soil boundaries and surface water flow for stormwater planning. Stantec observed the KA wetland feature boundaries on-site, and dug test pits in several wetlands mapped by KA to obtain detailed soil information. The soil boundaries depicted within the Class D soil survey area is the NRCS county soil survey shapefile data that was supplemented with on-site KA wetland and stream data. Stantec also field verified sections of this mapping and obtained on-site soil data with auger borings and test pits in limited areas.

Soils are described using the standard soil terminology developed by the USDA NRCS and the MAPSS Key to Soil Drainage Classes, as well as a list of regional indicators for identification of hydric soils *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regional Supplement.*[3] Soil types identified are depicted on the proposed project site plans at a scale of 1 inch equals 100 feet for the Class L survey area (Figures 2-1 to 2-9) and at a scale of 1 inch equals 500 feet for the Class D survey area (Figure 3).

A State of Maine Certified Soil Scientist (CSS) conducted the on-site soil survey on November 14 and 15, 2017. Temperatures were approximately 40 degrees Fahrenheit on both days, there was a light snow cover on the soil surface which did not impede data collection and there was no frost in the ground. Recent climatic conditions were typical for this time of year. For site orientation, an iPad equipped with a mapping grade Global Positioning System (GPS) and base layers including an aerial photograph, topography, NRCS soil boundaries, project site boundaries, proposed turbine locations, and KA identified wetlands and streams was used.

Fieldwork consisted of documenting soil morphology and characteristics with hand dug test pits, borings, and existing ditch cuts and borrow areas to a depth of bedrock, refusal, or limit of the soil auger. Other factors used to determine soil characteristics were changes in vegetation, slope, aspect, and observations of exposed bedrock and surface stones. Test pits, boring locations, some exposed bedrock, map unit boundaries, and other pertinent site features were recorded in the field using a mapping grade GPS. Test pit locations were chosen where representative soil descriptions could be collected to determine the soil series or phase. To aid in development of the accompanying soil survey maps the auger borings and changes in topography were used to determine the soil series and map unit boundaries.

5.0 SOIL MAP AND MAP UNIT DESCRIPTION

5.1 SOIL MAP REQUIREMENTS

The Class L (for Linear Projects) standards were developed by MAPSS to provide minimum soil information necessary to allow for the design and construction of long but narrow projects with little or no adjacent development. Class D (Medium Intensity) surveys are designed to be utilized for projects that will require minor to moderate soil

[3] U.S. Army Corps of Engineers. 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0)*, ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-12-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

disturbance or design that will require site specific soil information. These standards were the basis of this soil survey and are detailed in Appendix D: MAPSS Standards for Soil Surveys. The accompanying soil figures/maps meets the requirements of Class L and D soil surveys, as outlined by the MAPSS Guidelines. The soil survey map units are designed according to the standards of the National Cooperative Soil Survey, and the soils are classified at the series level according to the current Keys to Soil Taxonomy. Soil map units are phases of soil series.

Soil map unit boundaries are observed throughout their length and their placement corresponds to changes in soil and/or landforms. Map unit boundary placement is based on observed soil characteristics, using observations of vegetation, landforms, and other site features as indications of changes in soil condition.

5.2 SOIL MAP UNITS

Soil map unit boundaries are depicted on the attached soil survey maps (Figures 2-1 through 2-9 and Figure 3). These figures depict the size and location of the soil map units relative to each other and existing site features. Every map unit is composed of the named soil and smaller areas of other soil series or phases (inclusions). On this site, the inclusions are typically located along the map unit boundary. These inclusions are listed in each soil map unit description (Appendix E). Most inclusions have properties or patterns that are similar to those of the dominant soil in the map unit and generally do not affect use and management.

A soil survey map unit consists of a portion of the landscape composed of the identified soil components and associated landscape properties, such as similar topography, aspect, configuration, stoniness, vegetation, depth to seasonal groundwater table, depth to bedrock, depth to impermeable layer, kinds of soil (soil horizons) and miscellaneous land area. The soils within an area enclosed by a map unit boundary have a minimum of 75 percent of the soil(s) that provide the name of that map unit or similar (soils that differ so little from the named soil(s) in the map unit that there are no important differences in interpretations). No one similar soil is greater than the named soil(s). The total amount of dissimilar soils (soils that differ sufficiently from the named soil(s) to affect major interpretations) do not exceed 25 percent of the map unit.

6.0 SOIL CHARACTERISTICS AND FINDINGS

On-site soils identified were formed in supraglacial loamy soil over bedrock and loamy mantle overlying glacial till. Soils formed in glacial till are Becket, Westbury, Monadnock, and Wambeck. Soils that formed in supraglacial loamy deposits are Lyman and Tunbridge. Appendix A is the Site Law Form E Soil Condition Summary Table, Appendix B is Site Law Form F Soil Profile/Classification Information, the table in Appendix C lists the mapped soil series and some important properties of each, Appendix D is the MAPSS Standards for Soil Surveys, Appendix E are the Map Unit Descriptions for the Class L survey area, and Appendix F is a glossary of terms.

6.1 BECKET-WESTBURY COMPLEX (BW)

This map unit was mapped within the proposed electrical collector corridor that extends from the ridgeline to the substation; on the foot slope of the ridge near State Route 120. Becket and Westbury soils are loamy mantle overlying dense glacial till. They are very deep and located on drumlins and glaciated uplands. Becket soil is well

drained whereas Westbury soil is somewhat poorly drained. This map unit contains poorly drained phases of the soil that are inclusions mapped as wetlands.

6.2 HUMAN-TRANSPORTED MATERIAL (HT)

Human transported material is soil patent material that was moved horizontally onto a pedon from a source area outside of that pedon by purposeful human activity. This is the existing aggregate base road and associated staging areas/log landings. These were primarily created by excavation of adjacent soil from what are now ditches or borrow areas and placed for the road construction.

6.3 LYMAN-TUNBRIDGE-ROCK OUTCROP COMPLEX (LR)

Lyman and Tunbridge sandy loam soil formed in loamy supraglacial till on glaciated uplands. Lyman soil is shallow to bedrock and somewhat excessively drained whereas Tunbridge soil is moderately deep and well drained. The dominant soil depth is between 10 and 20 inches, however, there are inclusions of deep soil with dense till, and exposed bedrock outcrops. These soils were mapped on pinnacles along the ridgeline.

6.4 LYMAN-TUNBRIDGE-BECKET, COMPLEX (LU)

This map unit was the dominant soil mapped within the proposed electrical collector line corridor along most of the side slope and near the base of the slope along Route 120. Lyman and Tunbridge sandy loam soil formed in loamy supraglacial till on glaciated uplands. Lyman soil is shallow to bedrock and somewhat excessively drained whereas Tunbridge soil is moderately deep and well drained. Becket soils are loamy mantle overlying dense glacial till, very deep and located on drumlins and glaciated uplands. Becket soil is typically well drained however, inclusions in this map unit include drainage classes from poorly to well drained and the poorly drained phases are inclusions mapped as wetlands. This map unit is dominantly between 10 and 20 inches to bedrock with large areas of soil that reaches greater than 60 inches to bedrock. These deeper soils also contain areas that are extremely cobbly. This complex also contains less numerous, dissimilar inclusions of very shallow soil and exposed bedrock.

6.5 MANUFACTURED LAYER (ML)

A manufactured layer is an artificial, root-limiting layer below the soil surface. Horseshoe Valley Road and State Route 120 are paved and short sections of these roads cross through the western and eastern ends of the site.

6.6 MONADNOCK FINE SANDY LOAM (MO)

Monadnock soil is very deep, well-drained soil that formed in loamy over sandy melt-out glacial till on hills and mountains on glaciated uplands. Monadnock was mapped in a large bench on the south-central portion of the ridgeline. Phases of this soil with poorer drainage are inclusions located along wetland boundaries.

6.7 MONADNOCK, POORLY DRAINED (MP)

The Mondanock, poorly drained map unit is a large pocket of very deep, sandy melt out on the ridgeline near the southern end of the site. It is a poorly and very poorly drained/hydric phase of this soil series and is mapped as a wetland. Monadnock was mapped in a large bench on the south-central portion of the ridgeline.

6.8 TUNBRIDGE, POORLY DRAINED (TP)

This map unit is a phase of Tunbridge that is poorly drained/hydric soil and mapped as wetland. It is mapped in depressions/pockets within the larger area mapped as Tunbridge.

6.9 TUNBRIDGE-LYMAN-ROCK OUTCROP COMPLEX (TR)

This map unit is similar to Lr, however the dominant soil depth is between 20 and 40 inches. This is the most dominant map unit across the Class L soil survey site and encompasses most of the ridgeline area and the higher elevations along the existing road.

6.10 WAUMBEK FINE SANDY LOAM (WA)

Waumbek soils are very deep, moderately well drained soils formed in stony, sandy till on glaciated uplands. This map unit contains phases of this series that are very stony, very gravelly, and/or well drained. This soil is mapped primarily along the lower elevations of the existing road on the western side of the site.

6.11 WAUMBEK FINE SANDY LOAM, POORLY DRAINED (WP)

Waumbek soils are very deep soils formed in stony, sandy till on glaciated uplands. This map unit is a poorly drained phase of Waumbek; which is also mapped as wetland. This map unit contains phases of this series that are very stony, or very gravelly. This soil is mapped primarily along the lower elevations of the existing road on the western side of the site.

7.0 CONCLUSIONS AND SURVEY LIMITATIONS

Results of this soil survey conclude that this site will require major engineering techniques to overcome the limiting factors for a proposed wind power generating facility. However, with proper planning, engineering, and construction techniques, the soils are appropriate for the proposed project and are not significantly dissimilar than limitations at other wind power projects constructed in Maine. The difference at this site is the scale and proportion of the limitations. The three most significant limitations are steep slopes, bedrock, and stormwater control.

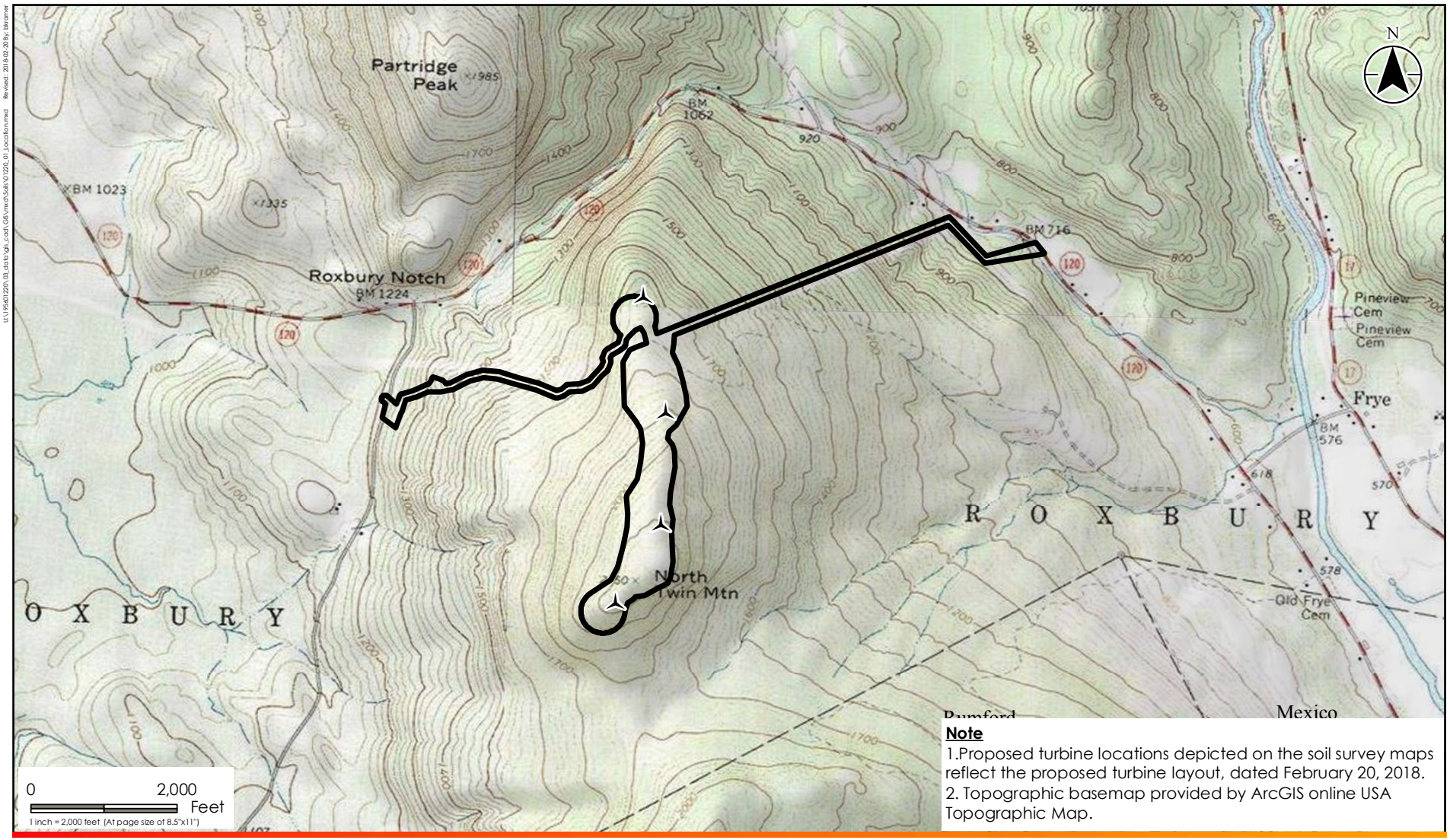
Development in or disturbance of the wetlands should be avoided and minimized, if possible, because it typically requires additional local, state, and federal oversight and permitting. The soil drainage in poorly and somewhat poorly drained soil can also be a concern for construction and long-term project use, such as rutting, freeze/thaw cycles, and other issues associated with a high-water table. The steep slopes increase the likelihood for soil erosion in areas of soil disturbance. Increasing the ridgeline impervious area can also increase stormwater surface flow quantity and

velocity. Engineering techniques to control stormwater flow and runoff during construction will be extremely important to minimize the potential for impacts to downslope resources. Long term engineering controls that can be utilized include vegetated buffers and structures that do not constrict surface and subsurface flow.

The scope of this investigation was conducted in accordance with the Class L and D soil survey standards and guidelines established by MAPSS. The conclusions and recommendations presented in this soil report are based on data obtained from on-site investigation and supplemental USDA/NRCS soil maps and information. This soil report and associated soil figures were prepared for exclusive use by Palmer Management Corporation for specific application to their proposed construction of the Roxbury Wind Project.

FIGURES

Figure 1. Site Location Map



Note

1.Proposed turbine locations depicted on the soil survey maps reflect the proposed turbine layout, dated February 20, 2018.
2. Topographic basemap provided by ArcGIS online USA Topographic Map.

195601220

Stantec

30 Park Drive
Topsham, ME USA 04086
Phone (207) 729-1199

Prepared by EMK on 2018-01-16
Review by RK on 2018-01-17

01220_01_Location.mxd

Legend

- Proposed Turbine Location
- Site Boundary

Client/Project

Palmer Management Corporation
Roxbury Wind Project
Roxbury, Maine

Figure No.

1

Title

Site Location Map

2/21/2018

Figure(s) 2-1 through 2-9. Class L Soil Survey Maps

Stantec

Legend

- Proposed Turbine Location
- Test Pit
- Auger Boring
- Rock Outcrop
- Survey Area
- Stream
- Wetland
- 2' Contour
- 10' Contour
- Stormwater Feature

CERTIFIED SOIL SCIENTIST
Rodney D. Kershaw
SS552
STATE OF MAINE

Soil Map Units

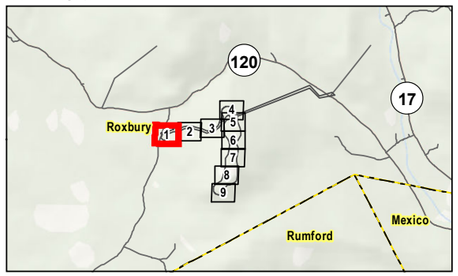
- BwC - Becket-Westbury complex, 8-15% slopes (HSG C/D)
- BwD - Becket-Westbury complex, 15-35% slopes (HSG C/D)
- Ht - Human Transported Material (HSG N/A)
- LrD - Lyman-Tunbridge-Rock Outcrop complex, 15-35% slopes (HSG D)
- LrE - Lyman-Tunbridge-Rock Outcrop complex, >35% slopes (HSG D)
- LuD - Lyman-Tunbridge-Becket complex, 15-35% slopes (HSG D/C)
- MI - Manufactured Layer (HSG N/A)
- MoC - Monadnock fine sandy loam, 8-15% slopes (HSG C)
- MpB - Monadnock, poorly drained, 3-8% slopes (HSG D)
- TpC - Tunbridge, poorly drained, 8-15% slopes (HSG D)
- TpD - Tunbridge, poorly drained, 15-35% (HSG D)
- TrC - Tunbridge-Lyman-Rock Outcrop complex, 8-15% slopes (HSG D)
- TrD - Tunbridge-Lyman-Rock Outcrop complex, 15-35% slopes (HSG D)
- TrE - Tunbridge-Lyman-Rock Outcrop complex, >35% slopes (HSG D)
- WaC - Wambeck fine sandy loam, 8-15% slopes (HSG B)
- WaD - Waumbek fine sandy loam, 15-35% slopes (HSG B)
- WaE - Wambeck fine sandy loam, >35% slopes (HSG B)
- WpC - Waumbek fine sandy loam, poorly drained, 8-15% slopes (HSG D)
- WpE - Waumbek fine sandy loam, poorly drained, >35% slopes (HSG D)

0 100 200 Feet

1 inch = 100 feet (At original document size of 11x17)

Notes

1. Proposed turbine locations depicted on the soil survey maps reflect the proposed turbine layout, dated February 20, 2018.
2. 2' contours shown on this plan were originally created and compiled for the former First Wind Longfellow Wind Project and obtained from SGC Engineering, LLC.
3. Orthoimagery: NAIP 2015



Project Location
Roxbury, Maine

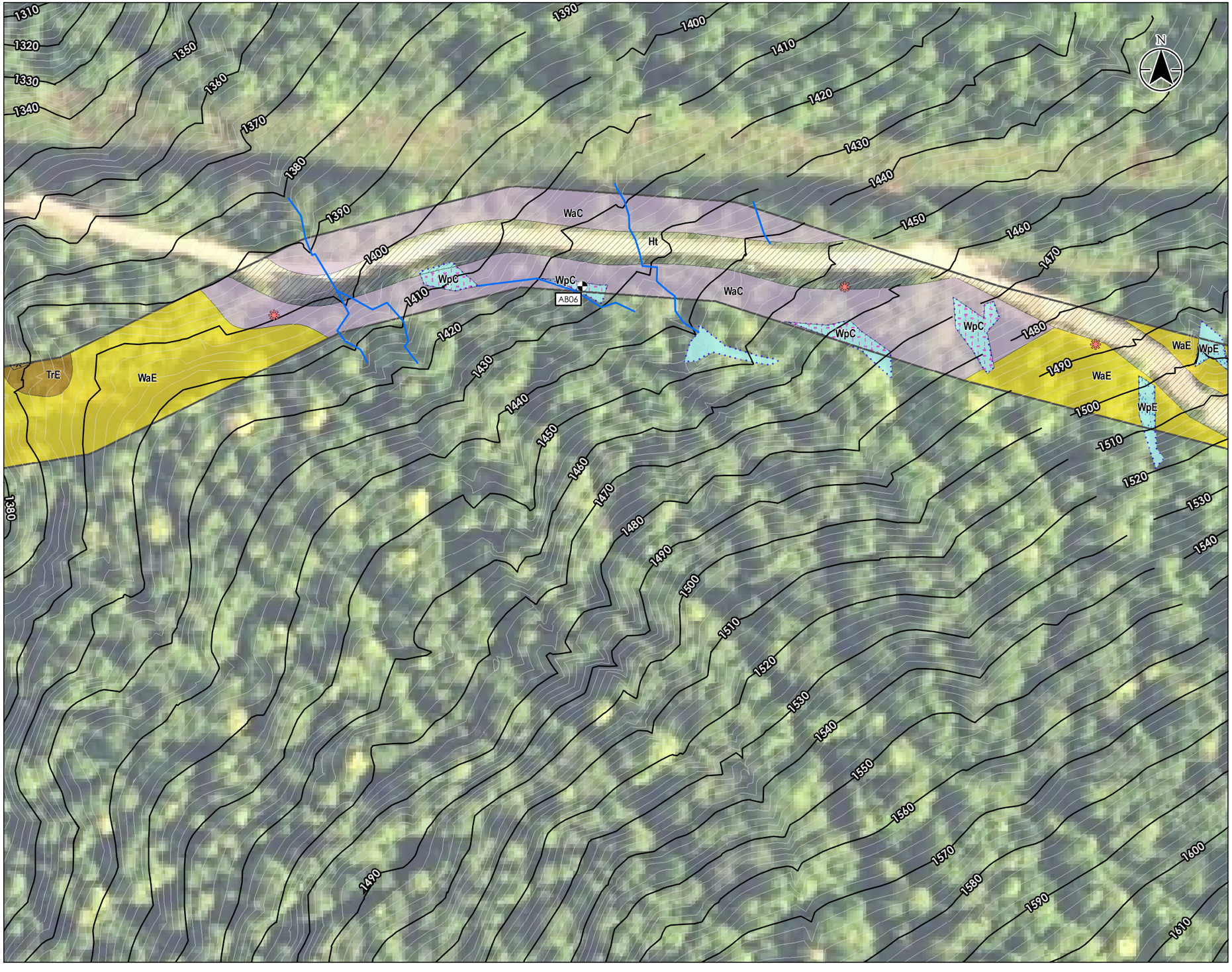
195601220
Prepared by EMK on 2018-01-16
Review by RK on 2018-01-17

Client/Project
Palmer Management Corporation
Roxbury Wind Project
Roxbury, Maine

Figure No.
2-1

Title
Class L Soil Survey Map

2/21/2018



Stantec

Legend

- Proposed Turbine Location
- Test Pit
- Auger Boring
- Rock Outcrop
- Survey Area
- Stream
- Wetland
- 2' Contour
- 10' Contour
- Stormwater Feature

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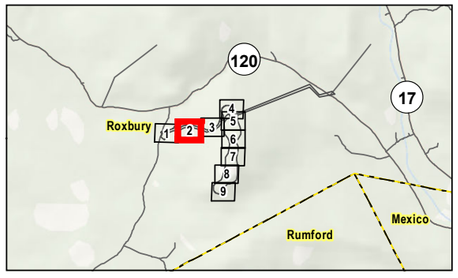
0 100 200 Feet

1 inch = 100 feet (At original document size of 11x17)

CERTIFIED SOIL SCIENTIST Rodney D. Kershaw SS552 STATE OF MAINE

Notes

1. Proposed turbine locations depicted on the soil survey maps reflect the proposed turbine layout, dated February 20, 2018.
2. 2' contours shown on this plan were originally created and compiled for the former First Wind Longfellow Wind Project and obtained from SGC Engineering, LLC.
3. Orthoimagery: NAIP 2015



Project Location
Roxbury, Maine

195601220
Prepared by EMK on 2018-01-16
Review by RK on 2018-01-17

Client/Project
Palmer Management Corporation
Roxbury Wind Project
Roxbury, Maine

Figure No.
2-2

Title
Class L Soil Survey Map

2/21/2018

Stantec

Legend

- Proposed Turbine Location
- Test Pit
- Auger Boring
- Rock Outcrop
- Survey Area
- Stream
- Wetland
- 2' Contour
- 10' Contour
- Stormwater Feature

CERTIFIED SOIL SCIENTIST
Rodney D. Kershaw
SS552
STATE OF MAINE

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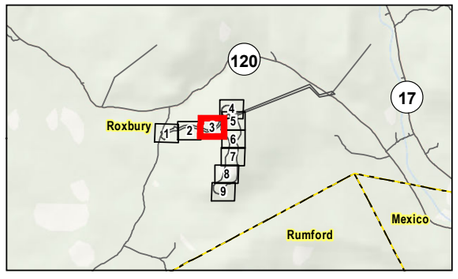
3. Orthoimagery: NAIP 2015



Project Location
Roxbury, Maine

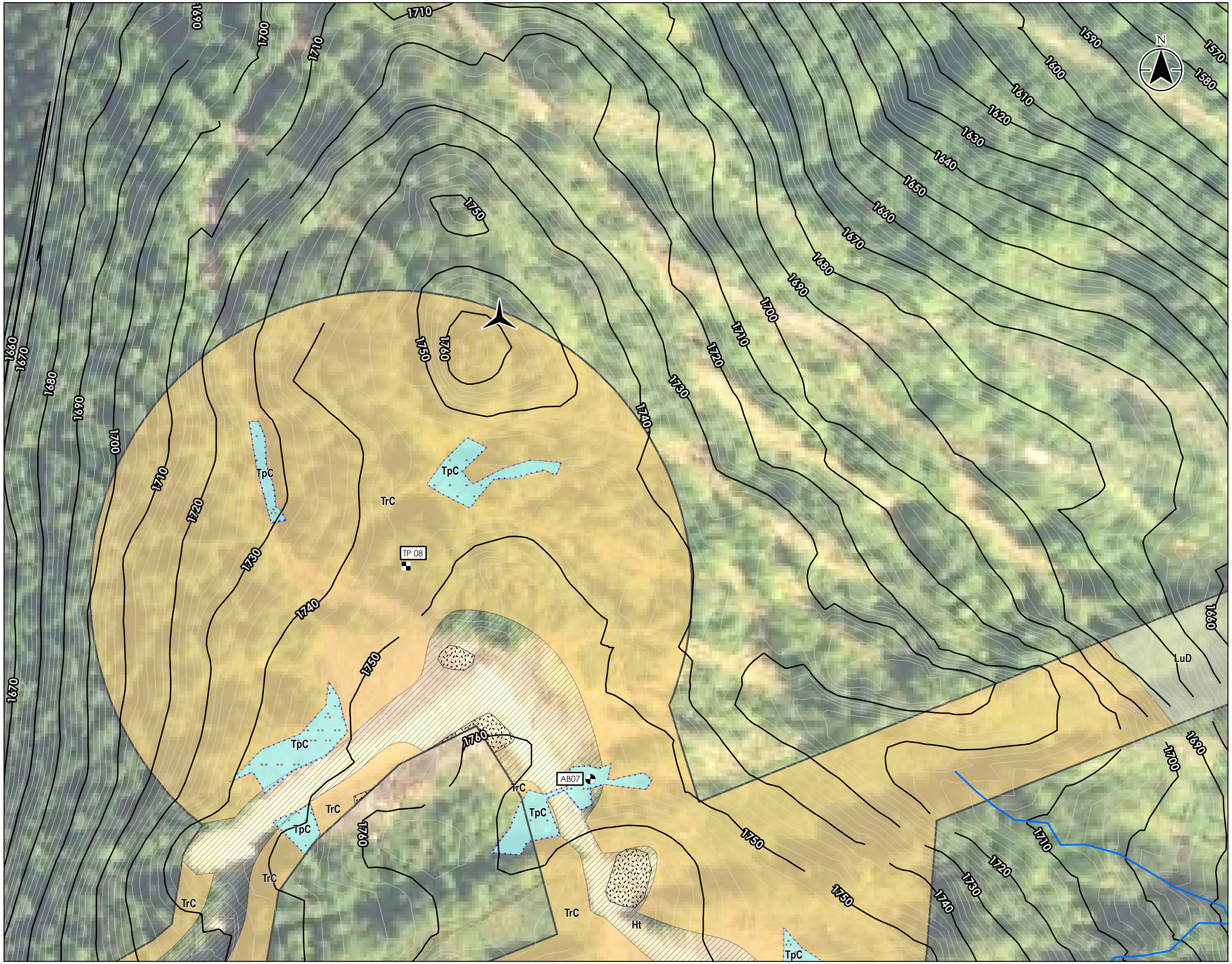
195601220
Prepared by EMK on 2018-01-16
Review by RK on 2018-01-17

Client/Project
Palmer Management Corporation
Roxbury Wind Project
Roxbury, Maine

Figure No.
2-3

Title
Class L Soil Survey Map

2/21/2018



Stantec

Legend

- Proposed Turbine Location
- Test Pit
- Auger Boring
- Rock Outcrop
- Survey Area
- Stream
- Wetland
- 2' Contour
- 10' Contour
- Stormwater Feature

Soil Map Units

- BwC - Becket-Westbury complex, 8-15% slopes (HSG C/D)
- BwD - Becket-Westbury complex, 15-35% slopes (HSG C/D)
- Ht - Human Transported Material (HSG N/A)
- LrD - Lyman-Tunbridge-Rock Outcrop complex, 15-35% slopes (HSG D)
- LrE - Lyman-Tunbridge-Rock Outcrop complex, >35% slopes (HSG D)
- LuD - Lyman-Tunbridge-Becket complex, 15-35% slopes (HSG D/C)
- Ml - Manufactured Layer (HSG N/A)
- MoC - Monadnock fine sandy loam, 8-15% slopes (HSG C)
- MpB - Monadnock, poorly drained, 3-8% slopes (HSG D)
- TpC - Tunbridge, poorly drained, 8-15% slopes (HSG D)
- TpD - Tunbridge, poorly drained, 15-35% slopes (HSG D)
- TrC - Tunbridge-Lyman-Rock Outcrop complex, 8-15% slopes (HSG D)
- TrD - Tunbridge-Lyman-Rock Outcrop complex, 15-35% slopes (HSG D)
- TrE - Tunbridge-Lyman-Rock Outcrop complex, >35% slopes (HSG D)
- WaC - Wambeck fine sandy loam, 8-15% slopes (HSG B)
- WaD - Waumbek fine sandy loam, 15-35% slopes (HSG B)
- WaE - Wambeck fine sandy loam, >35% slopes (HSG B)
- WpC - Waumbek fine sandy loam, poorly drained, 8-15% slopes (HSG D)
- WpE - Waumbek fine sandy loam, poorly drained, >35% slopes (HSG D)

CERTIFIED SOIL SCIENTIST Rodney D. Kelshaw SS552 STATE OF MAINE

0 100 200 Feet

1 inch = 100 feet (At original document size of 11x17)

Notes

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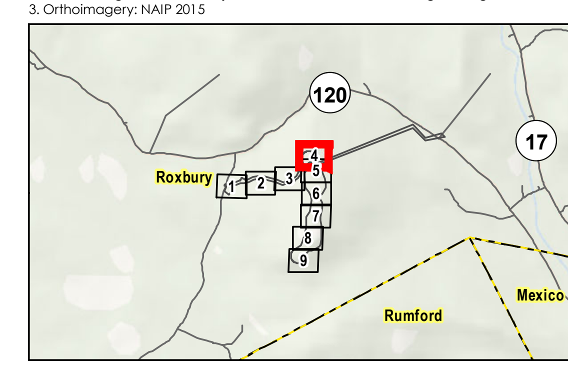


Project Location
Roxbury, Maine

195601220
Prepared by EMK on 2018-01-16
Review by RK on 2018-01-17

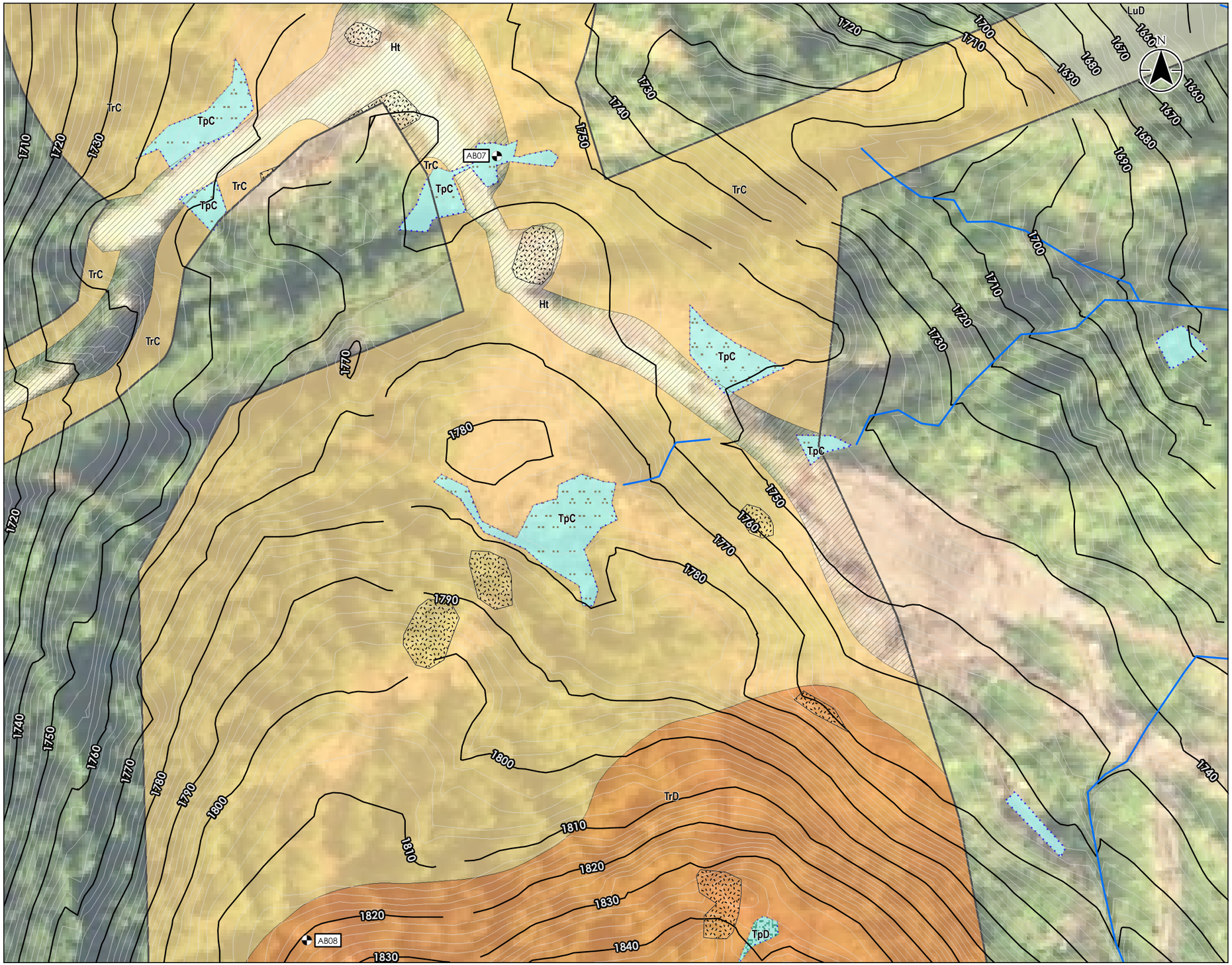
Client/Project
Palmer Management Corporation
Roxbury Wind Project
Roxbury, Maine

Figure No.
2-4

Title
Class L Soil Survey Map

2/21/2018

U:\195601220\03 data\gis cad\GIS\mxd\Soils\01220 02 SoilSurvey LClass.mxd Revised: 2018-02-20 By: bkramer



Stantec

Legend

- Proposed Turbine Location
- Test Pit
- Auger Boring
- Rock Outcrop
- Survey Area
- Stream
- Wetland
- 2' Contour
- 10' Contour
- Stormwater Feature

Soil Map Units

- BwC - Becket-Westbury complex, 8-15% slopes (HSG C/D)
- BwD - Becket-Westbury complex, 15-35% slopes (HSG C/D)
- Ht - Human Transported Material (HSG N/A)
- LrD - Lyman-Tunbridge-Rock Outcrop complex, 15-35% slopes (HSG D)
- LrE - Lyman-Tunbridge-Rock Outcrop complex, >35% slopes (HSG D)
- LuD - Lyman-Tunbridge-Becket complex, 15-35% slopes (HSG D/C)
- MI - Manufactured Layer (HSG N/A)
- MoC - Monadnock fine sandy loam, 8-15% slopes (HSG C)
- MpB - Monadnock, poorly drained, 3-8% slopes (HSG D)
- TpC - Tunbridge, poorly drained, 8-15% slopes (HSG D)
- TpD - Tunbridge, poorly drained, 15-35% (HSG D)
- TrC - Tunbridge-Lyman-Rock Outcrop complex, 8-15% slopes (HSG D)
- TrD - Tunbridge-Lyman-Rock Outcrop complex, 15-35% slopes (HSG D)
- TrE - Tunbridge-Lyman-Rock Outcrop complex, >35% slopes (HSG D)
- WaC - Wambeck fine sandy loam, 8-15% slopes (HSG B)
- WaD - Waumbek fine sandy loam, 15-35% slopes (HSG B)
- WaE - Wambeck fine sandy loam, >35% slopes (HSG B)
- WpC - Waumbek fine sandy loam, poorly drained, 8-15% slopes (HSG D)
- WpE - Waumbek fine sandy loam, poorly drained, >35% slopes (HSG D)

0 100 200 Feet

1 inch = 100 feet (At original document size of 11x17)

CERTIFIED SOIL SCIENTIST Rodney D. Keshaw SS552 STATE OF MAINE

Notes

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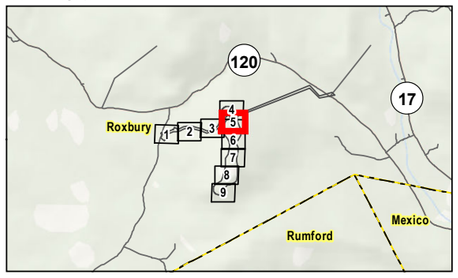


Project Location
Roxbury, Maine

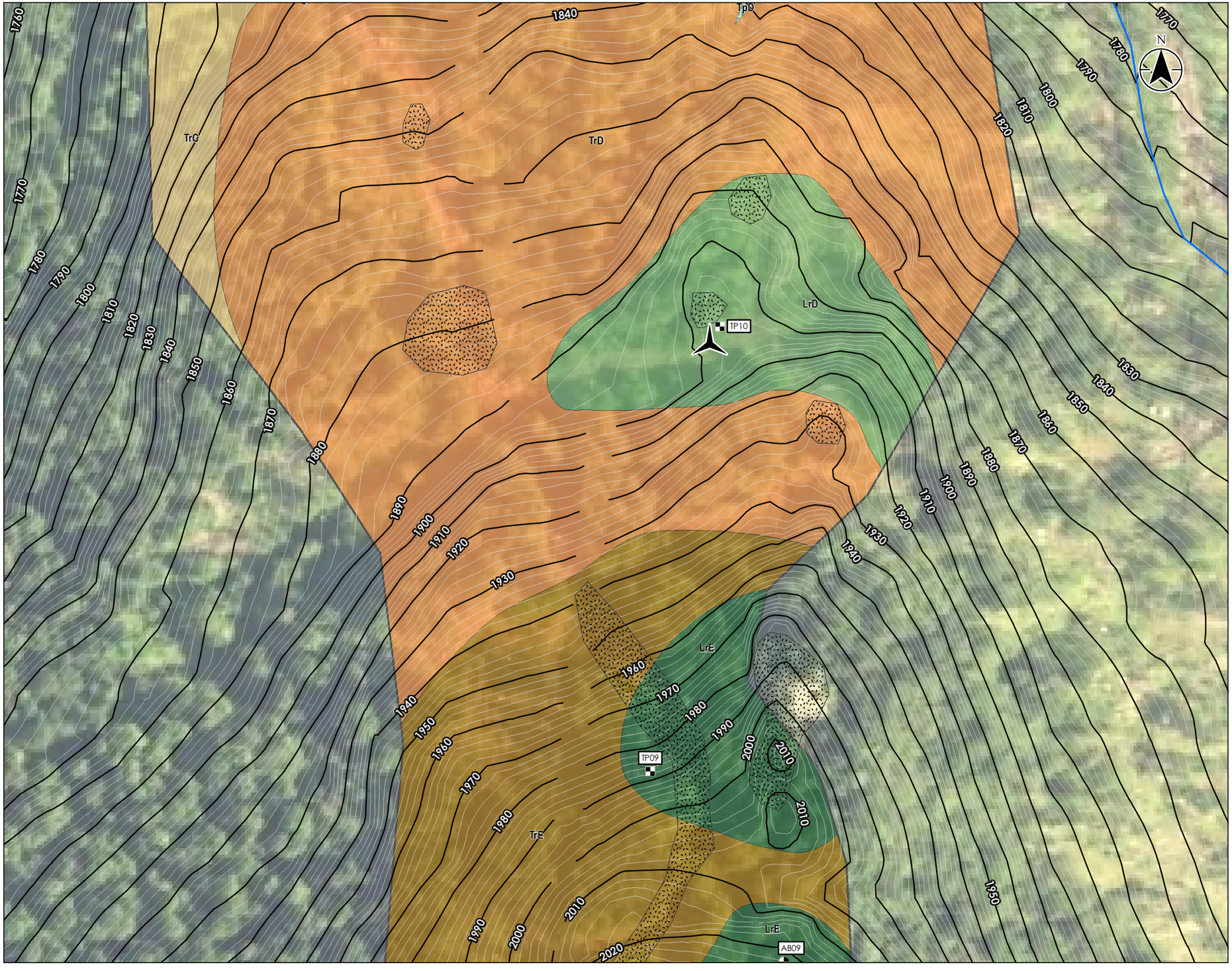
195601220
Prepared by EMK on 2018-01-16
Review by RK on 2018-01-17

Client/Project
Palmer Management Corporation
Roxbury Wind Project
Roxbury, Maine

Figure No.
2-5

Title
Class L Soil Survey Map

2/21/2018



Stantec

Legend

- Proposed Turbine Location
- Test Pit
- Auger Boring
- Rock Outcrop
- Survey Area
- Stream
- Wetland
- 2' Contour
- 10' Contour
- Stormwater Feature

Soil Map Units

- BwC - Becket-Westbury complex, 8-15% slopes (HSG C/D)
- BwD - Becket-Westbury complex, 15-35% slopes (HSG C/D)
- Ht - Human Transported Material (HSG N/A)
- LrD - Lyman-Tunbridge-Rock Outcrop complex, 15-35% slopes (HSG D)
- LrE - Lyman-Tunbridge-Rock Outcrop complex, >35% slopes (HSG D)
- LuD - Lyman-Tunbridge-Becket complex, 15-35% slopes (HSG D/C)
- MI - Manufactured Layer (HSG N/A)
- MoC - Monadnock fine sandy loam, 8-15% slopes (HSG C)
- MpB - Monadnock, poorly drained, 3-8% slopes (HSG D)
- TpC - Tunbridge, poorly drained, 8-15% slopes (HSG D)
- TpD - Tunbridge, poorly drained, 15-35% (HSG D)
- TrC - Tunbridge-Lyman-Rock Outcrop complex, 8-15% slopes (HSG D)
- TrD - Tunbridge-Lyman-Rock Outcrop complex, 15-35% slopes (HSG D)
- TrE - Tunbridge-Lyman-Rock Outcrop complex, >35% slopes (HSG D)
- WaC - Wambeck fine sandy loam, 8-15% slopes (HSG B)
- WaD - Waumbek fine sandy loam, 15-35% slopes (HSG B)
- WaE - Wambeck fine sandy loam, >35% slopes (HSG B)
- WpC - Waumbek fine sandy loam, poorly drained, 8-15% slopes (HSG D)
- WpE - Waumbek fine sandy loam, poorly drained, >35% slopes (HSG D)

CERTIFIED SOIL SCIENTIST
Rodney D. Kershaw
SS552
STATE OF MAINE

0 100 200 Feet

1 inch = 100 feet (At original document size of 11x17)

Notes

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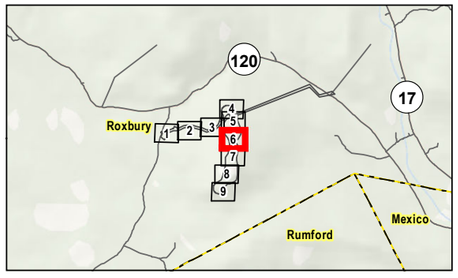


Project Location
Roxbury, Maine

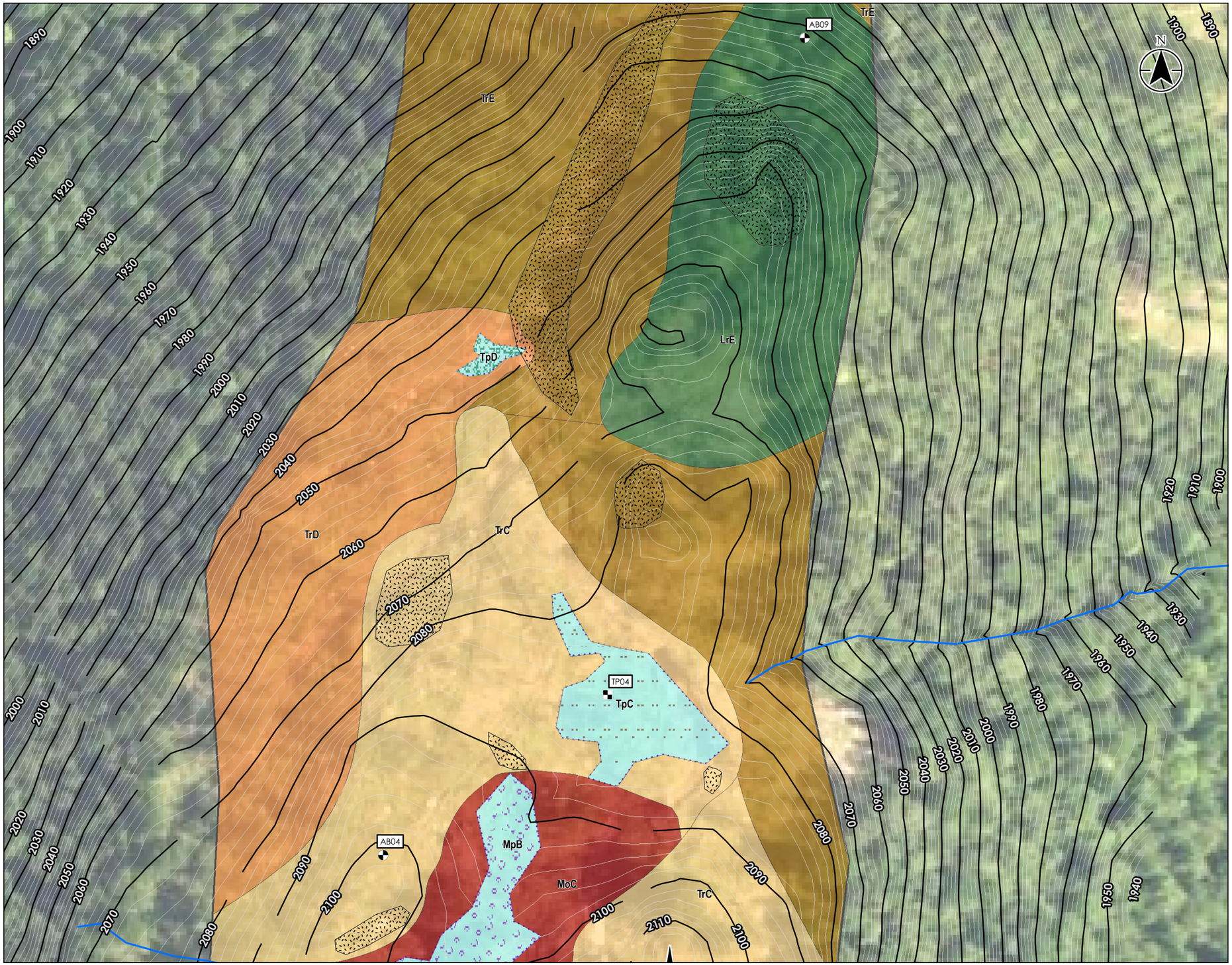
195601220
Prepared by EMK on 2018-01-16
Review by RK on 2018-01-17

Client/Project
Palmer Management Corporation
Roxbury Wind Project
Roxbury, Maine

Figure No.
2-6

Title
Class L Soil Survey Map

2/21/2018



Stantec

Legend

- Proposed Turbine Location
- Test Pit
- Auger Boring
- Rock Outcrop
- Survey Area
- Stream
- Wetland
- 2' Contour
- 10' Contour
- Stormwater Feature

Soil Map Units

- BwC - Becket-Westbury complex, 8-15% slopes (HSG C/D)
- BwD - Becket-Westbury complex, 15-35% slopes (HSG C/D)
- Ht - Human Transported Material (HSG N/A)
- LrD - Lyman-Tunbridge-Rock Outcrop complex, 15-35% slopes (HSG D)
- LrE - Lyman-Tunbridge-Rock Outcrop complex, >35% slopes (HSG D)
- LuD - Lyman-Tunbridge-Becket complex, 15-35% slopes (HSG D/C)
- MI - Manufactured Layer (HSG N/A)
- MoC - Monadnock fine sandy loam, 8-15% slopes (HSG C)
- MpB - Monadnock, poorly drained, 3-8% slopes (HSG D)
- TpC - Tunbridge, poorly drained, 8-15% slopes (HSG D)
- TpD - Tunbridge, poorly drained, 15-35% (HSG D)
- TrC - Tunbridge-Lyman-Rock Outcrop complex, 8-15% slopes (HSG D)
- TrD - Tunbridge-Lyman-Rock Outcrop complex, 15-35% slopes (HSG D)
- TrE - Tunbridge-Lyman-Rock Outcrop complex, >35% slopes (HSG D)
- WaC - Wambeck fine sandy loam, 8-15% slopes (HSG B)
- WaD - Waumbek fine sandy loam, 15-35% slopes (HSG B)
- WaE - Wambeck fine sandy loam, >35% slopes (HSG B)
- WpC - Waumbek fine sandy loam, poorly drained, 8-15% slopes (HSG D)
- WpE - Waumbek fine sandy loam, poorly drained, >35% slopes (HSG D)

CERTIFIED SOIL SCIENTIST — Rodney D. Keshaw — SS552 — STATE OF MAINE

0 100 200 Feet

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Notes

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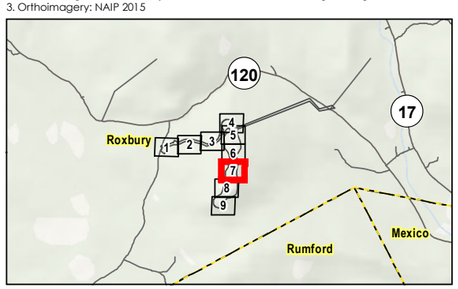


Project Location
Roxbury, Maine

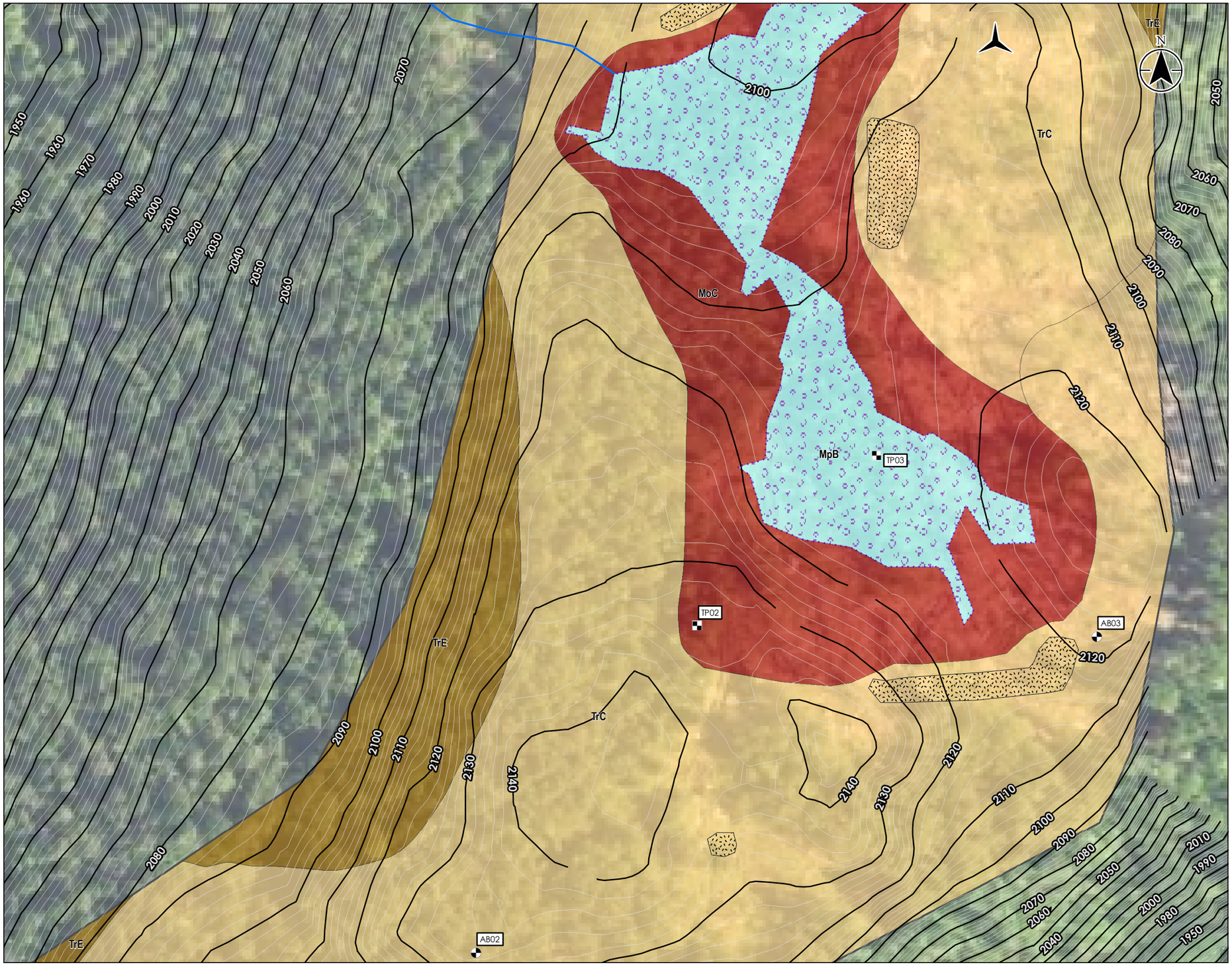
195601220
Prepared by EMK on 2018-01-16
Review by RK on 2018-01-17

Client/Project
Palmer Management Corporation
Roxbury Wind Project
Roxbury, Maine

Figure No.
2-7

Title
Class L Soil Survey Map

2/21/2018



Stantec

Legend

- Proposed Turbine Location
- Test Pit
- Auger Boring
- Rock Outcrop
- Survey Area
- Stream
- Wetland
- 2' Contour
- 10' Contour
- Stormwater Feature

Soil Map Units

- BwC - Becket-Westbury complex, 8-15% slopes (HSG C/D)
- BwD - Becket-Westbury complex, 15-35% slopes (HSG C/D)
- Ht - Human Transported Material (HSG N/A)
- LrD - Lyman-Tunbridge-Rock Outcrop complex, 15-35% slopes (HSG D)
- LrE - Lyman-Tunbridge-Rock Outcrop complex, >35% slopes (HSG D)
- LuD - Lyman-Tunbridge-Becket complex, 15-35% slopes (HSG D/C)
- Ml - Manufactured Layer (HSG N/A)
- MoC - Monadnock fine sandy loam, 8-15% slopes (HSG C)
- MpB - Monadnock, poorly drained, 3-8% slopes (HSG D)
- TpC - Tunbridge, poorly drained, 8-15% slopes (HSG D)
- TpD - Tunbridge, poorly drained, 15-35% (HSG D)
- TrC - Tunbridge-Lyman-Rock Outcrop complex, 8-15% slopes (HSG D)
- TrD - Tunbridge-Lyman-Rock Outcrop complex, 15-35% slopes (HSG D)
- TrE - Tunbridge-Lyman-Rock Outcrop complex, >35% slopes (HSG D)
- WaC - Wambeck fine sandy loam, 8-15% slopes (HSG B)
- WaD - Waumbek fine sandy loam, 15-35% slopes (HSG B)
- WaE - Wambeck fine sandy loam, >35% slopes (HSG B)
- WpC - Waumbek fine sandy loam, poorly drained, 8-15% slopes (HSG D)
- WpE - Waumbek fine sandy loam, poorly drained, >35% slopes (HSG D)

0 100 200 Feet

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CERTIFIED SOIL SCIENTIST Rodney D. Kershaw SS552 STATE OF MAINE

Notes

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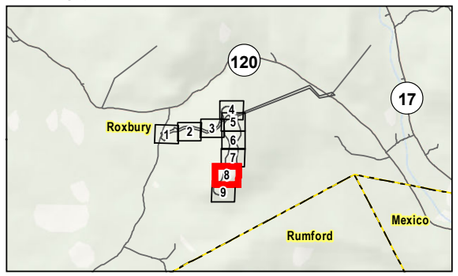
3. Orthoimagery: NAIP 2015



Project Location
Roxbury, Maine

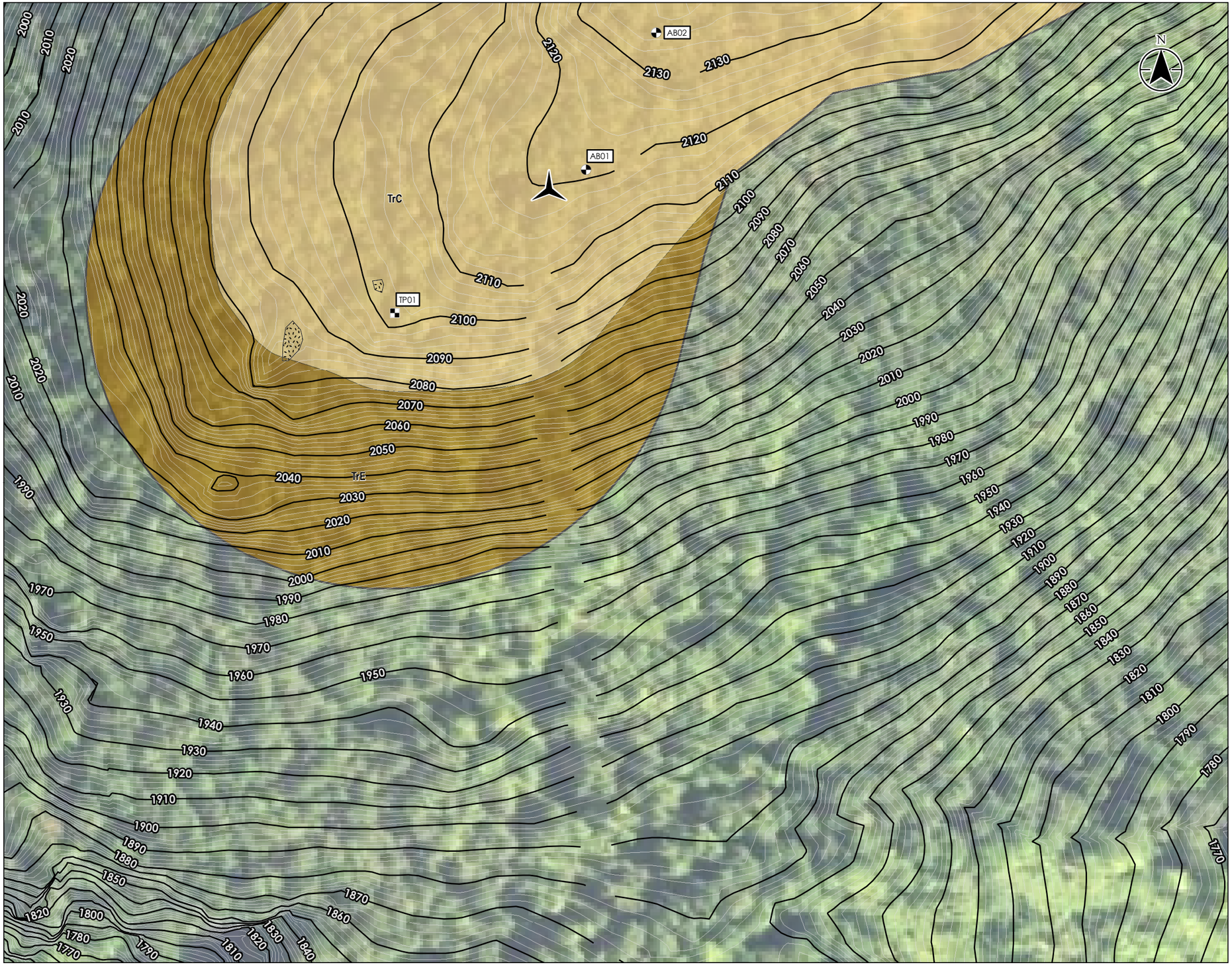
195601220
Prepared by EMK on 2018-01-16
Review by RK on 2018-01-17

Client/Project
Palmer Management Corporation
Roxbury Wind Project
Roxbury, Maine

Figure No.
2-8

Title
Class L Soil Survey Map

2/21/2018



Stantec

Legend

- Proposed Turbine Location
- Test Pit
- Auger Boring
- Rock Outcrop
- Survey Area
- Stream
- Wetland
- 2' Contour
- 10' Contour
- Stormwater Feature

Soil Map Units

- BwC - Becket-Westbury complex, 8-15% slopes (HSG C/D)
- BwD - Becket-Westbury complex, 15-35% slopes (HSG C/D)
- Ht - Human Transported Material (HSG N/A)
- LrD - Lyman-Tunbridge-Rock Outcrop complex, 15-35% slopes (HSG D)
- LrE - Lyman-Tunbridge-Rock Outcrop complex, >35% slopes (HSG D)
- LuD - Lyman-Tunbridge-Becket complex, 15-35% slopes (HSG D/C)
- MI - Manufactured Layer (HSG N/A)
- MoC - Monadnock fine sandy loam, 8-15% slopes (HSG C)
- MpB - Monadnock, poorly drained, 3-8% slopes (HSG D)
- TpC - Tunbridge, poorly drained, 8-15% slopes (HSG D)
- TpD - Tunbridge, poorly drained, 15-35% (HSG D)
- TrC - Tunbridge-Lyman-Rock Outcrop complex, 8-15% slopes (HSG D)
- TrD - Tunbridge-Lyman-Rock Outcrop complex, 15-35% slopes (HSG D)
- TrE - Tunbridge-Lyman-Rock Outcrop complex, >35% slopes (HSG D)
- WaC - Wambeck fine sandy loam, 8-15% slopes (HSG B)
- WaD - Waumbek fine sandy loam, 15-35% slopes (HSG B)
- WaE - Wambeck fine sandy loam, >35% slopes (HSG B)
- WpC - Waumbek fine sandy loam, poorly drained, 8-15% slopes (HSG D)
- WpE - Waumbek fine sandy loam, poorly drained, >35% slopes (HSG D)

0 100 200 Feet

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CERTIFIED SOIL SCIENTIST
Rodney D. Keshaw
SS552
STATE OF MAINE

Notes

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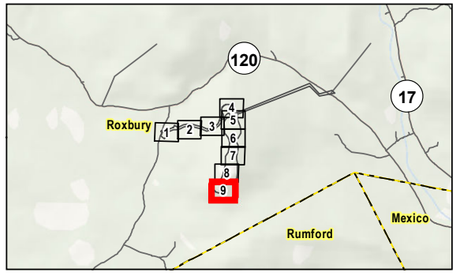


Project Location
Roxbury, Maine

195601220
Prepared by EMK on 2018-01-16
Review by RK on 2018-01-17

Client/Project
Palmer Management Corporation
Roxbury Wind Project
Roxbury, Maine

Figure No.
2-9

Title
Class L Soil Survey Map

2/21/2018

Figure 3. Class D Soil Survey Map

Stantec

Legend

- Proposed Turbine Location
- Test Pit
- Auger Boring
- Rock Outcrop
- Survey Area
- Stream
- Wetland
- USGS 20' Contour

Soil Map Units

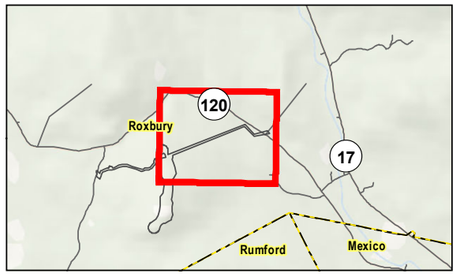
- BwC - Becket-Westbury complex, 8-15% slopes (HSG C/D)
- BwD - Becket-Westbury complex, 15-35% slopes (HSG C/D)
- Ht - Human Transported Material (HSG N/A)
- LrD - Lyman-Tunbridge-Rock Outcrop complex, 15-35% slopes (HSG D)
- LrE - Lyman-Tunbridge-Rock Outcrop complex, >35% slopes (HSG D)
- LuD - Lyman-Tunbridge-Becket complex, 15-35% slopes (HSG D/C)
- TpC - Tunbridge, poorly drained, 8-15% slopes (HSG D)
- TpD - Tunbridge, poorly drained, 15-35% (HSG D)
- TrC - Tunbridge-Lyman-Rock Outcrop complex, 8-15% slopes (HSG D)
- TrD - Tunbridge-Lyman-Rock Outcrop complex, 15-35% slopes (HSG D)
- TrE - Tunbridge-Lyman-Rock Outcrop complex, >35% slopes (HSG D)

CERTIFIED SOIL SCIENTIST
Rodney D. Keshaw
SS552
STATE OF MAINE

0 500 1,000 Feet

1 inch = 500 feet (At original document size of 11x17)

Notes
1. Proposed turbine locations depicted on the soil survey maps reflect the proposed turbine layout, dated February 20, 2018.
2. Coordinate System: NAD 1983 StatePlane Maine West FIPS 1802 Feet
3. Orthoimagery: NAIP 2015



Project Location
Roxbury, Maine

195601220
Prepared by EMK on 2018-01-16
Review by RK on 2018-01-17

Client/Project
Palmer Management Corporation
Roxbury Wind Project
Roxbury, Maine

Figure No.
3

Title
Class D Soil Survey Map

2/21/2018

Appendix A FORM E: SOIL CONDITIONS SUMMARY TABLE

FORM E 2/02

SOIL CONDITIONS SUMMARY TABLE

SUMMARY LOG OF SUBSURFACE EXPLORATIONS AT PROJECT SITES

Project Name:	Applicant Name:	Project Location (municipality):
Roxbury Wind Project	Palmer Management Corporation	Roxbury

Lot No.	Exploration Symbol (TP 1, B 2, etc.)	🖩 or 🖮 if at SSWD Field	Description of subsurface materials by: ● Soil profile/condition (if by S.E.), ● Soil series name (if by C.S.S.), or by ● Geologic unit (if by C.G.)	Depths to (check one): ☑ inches ☐ cm — Mottling (seasonal watertable)	Bedrock	Firm or Restrictive Layer	Limit of Exploration	Ground Surface Slope (%)
	TP 1	☐	Tunbridge stfsl, mwdr	25	29	N.O.	29	3-8
	TP 2	☐	Monadnok sl, pdr	0	N.O.	24	48	3-8
	TP 3	☐	Bucksport muck	0	N.O.	N.O.	48	3-8
	TP 4	☐	Tunbridge, pdr	0	39	N.O.	39	3-8
	TP 5	☐	Waumbek fsl	23	N.O.	34	70	8-15
	TP 6	☐	Waumbek fsl	23	N.O.	34	60	15-35
	TP 7	☐	Waumbek ls	23	N.O.	29	60	15-35
	TP 8	☐	Tunbridge sl, swpdr	10	22	N.O.	22	8-15
	TP 9	☐	Abram fsl	N.O.	5	N.O.	5	15-35
	TP 10	☐	Tunbridge fsl	N.O.	29	N.O.	29	8-15
	TP 11	☐	Becket excobfsl, pdr	0	N.O.	20	26	8-15
		☐						
	AB 1	☐	Tunbridge fsl	N.O.	21	N.O.	21	3-8
	AB 2	☐	Tunbridge fsl	N.O.	24	N.O.	24	3-8
	AB 3	☐	Tunbridge fsl	N.O.	29	N.O.	29	8-15
	AB 4	☐	Abram fsl	N.O.	4	N.O.	4	8-15
	AB 5	☐	Waumbek vstsl	10	N.O.	18	18	15-35
	AB 6	☐	Waumbek ls, pdr	7	24	N.O.	24	8-15
	AB 7	☐	Tunbridge ls, pdr	0	24	N.O.	24	8-15
	AB 8	☐	Lyman fsl	N.O.	17	N.O.	17	15-35
	AB 9	☐	Abram fsl	N.O.	5	N.O.	5	15-35
		☐						
		☐						
		☐						
		☐						
		☐						
		☐						
		☐						
		☐	N.O. = Not Observed					
		☐						
		☐						

INVESTIGATOR INFORMATION AND SIGNATURE

Signature:	Date: 2018-02-08
Name Printed/typed: Rodney Kelshaw	Cert/Lic/Reg. # 552

Title: ☑ Licensed Site Evaluator ☑ Certified Soil Scientist ☐ Certified Geologist ☐ Other:

CERTIFIED SOIL SCIENTIST Rodney D. Kelshaw SS552 STATE OF MAINE affix professional seal

DEP Form E Rev. 9/01

Appendix B FORM F: TEST PIT/AUGER BORING LOGS

FORM F 2/02

SOIL PROFILE / CLASSIFICATION INFORMATION

DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT PROJECT SITES

Project Name:	Applicant Name:	Project Location (municipality):
Roxbury Wind Project	Palmer Management Corporation	Roxbury

Exploration Symbol: TP01 ☒ Test Pit ☐ Boring

1 " Organic horizon thickness Ground surface elev. 2100

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	fsl		black / reddish gray	
6–12	cobfsl	VERY FRIABLE	very dusky red	NOT OBSERVED
12–18	fsl		dark reddish brown	
18–24	sl			
24–30			brown	C,2,F
30–36	BEDROCK			
36–42				
42–48				

soil data by S.E.	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock
soil data by S.S.	Soil series/phase name: Tunbridge	☐ Hydric ☒ Non-hydric			Hydrologic Soil Group: D

Exploration Symbol: TP02 ☒ Test Pit ☐ Boring

3 " Organic horizon thickness Ground surface elev. 2140

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	cobfsl	VERY FRIABLE	brown	ORGANIC STAINING
6–12				
12–18	sl		light olive brown	C,2,P
18–24	cobsl		olive	
24–30				
30–36				
36–42				
42–48				

soil data by S.E.	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock
soil data by S.S.	Soil series/phase name: Monadnock, poorly drained	☒ Hydric ☐ Non-hydric			Hydrologic Soil Group: D

Exploration Symbol: TP04 ☒ Test Pit ☐ Boring

12 " Organic horizon thickness Ground surface elev. 2100

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	vcobsl	FRIABLE	light olive gray	C,2,d
6–12				
12–18	fsl		light brownish gray	
18–24				
24–30				
30–36	BEDROCK			
36–42				
42–48				

soil data by S.E.	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock
soil data by S.S.	Soil series/phase name: Tunbridge, poorly drained	☒ Hydric ☐ Non-hydric			Hydrologic Soil Group: D

Exploration Symbol: TP09 ☒ Test Pit ☐ Boring

6 " Organic horizon thickness Ground surface elev. 1960

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	fsl	VERY FRIABLE	reddish gray / dark rd. brown	NOT OBSERVED
6–12				
12–18	BEDROCK			
18–24				
24–30				
30–36				
36–42				
42–48				

soil data by S.E.	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock
soil data by S.S.	Soil series/phase name: Abram	☐ Hydric ☒ Non-hydric			Hydrologic Soil Group: D

INVESTIGATOR INFORMATION AND SIGNATURE

Signature:	Date: 2018-02-08
Name Printed/typed: Rodney D Kelshaw	Cert/Lic/Reg. # CSS 552

Title: ☒ Licensed Site Evaluator ☒ Certified Soil Scientist ☐ Certified Geologist ☐ Other:

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FORM F 2/02

SOIL PROFILE / CLASSIFICATION INFORMATION

DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT PROJECT SITES

Project Name:	Applicant Name:	Project Location (municipality):
Roxbury Wind Project	Palmer Management Corporation	Roxbury

Exploration Symbol: TP 10 ☒ Test Pit ☐ Boring

3 " Organic horizon thickness Ground surface elev. 1930

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0			weak red	
6			grayish brown	
12		VERY FRIABLE	dark reddish brown	NOT OBSERVED
18	fsl		dark brown	
24			dark yellowish brown	
30				
36	BEDROCK			
42				
48				

soil data by S.E.	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock
soil data by S.S.	Soil series/phase name: Tunbridge		☐ Hydric ☒ Non-hydric	Hydrologic Soil Group: D	

Exploration Symbol: TP05 ☒ Test Pit ☐ Boring

1 " Organic horizon thickness Ground surface elev. 1260

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0			brown	
6	fsl	VERY FRIABLE	yellowish red	NOT OBSERVED
12				
18	cobfsl cobsl	FRIABLE	yellowish brown	
24			light olive brown	
30	fsl		olive gray	c,2,f
36	vcobls			
42				
48		70+"		

soil data by S.E.	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock
soil data by S.S.	Soil series/phase name: Waumbek		☐ Hydric ☒ Non-hydric	Hydrologic Soil Group: B	

Exploration Symbol: AB06 ☐ Test Pit ☒ Boring

0 " Organic horizon thickness Ground surface elev. 1930

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0			brown	NOT
6	ls		black	OBSERVED
12	sl	VERY FRIABLE	brown	c,2,d
18	ls		olive	m,2,d
24				
30		LOI	24"	
36				
42				
48				

soil data by S.E.	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock
soil data by S.S.	Soil series/phase name: Waumbek, poorly drained		☒ Hydric ☐ Non-hydric	Hydrologic Soil Group: D	

Exploration Symbol: _____ ☐ Test Pit ☐ Boring

_____ " Organic horizon thickness Ground surface elev. _____

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0				
6				
12				
18				
24				
30				
36				
42				
48				

soil data by S.E.	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock
soil data by S.S.	Soil series/phase name:		☐ Hydric ☐ Non-hydric	Hydrologic Soil Group:	

INVESTIGATOR INFORMATION AND SIGNATURE

Signature:	Date: 2018-02-08
Name Printed/typed: Rodney D. Kelshaw	Cert/Lic/Reg. # CSS 552

Title: ☒ Licensed Site Evaluator ☒ Certified Soil Scientist ☐ Certified Geologist ☐ Other:

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Appendix C SOIL SURVEY TABLE

Map Unit Symbol	Map Unit Name	Hydrologic Soil Group
BwC	Becket-Westbury complex, 8-15% slopes	C/D
BwD	Becket-Westbury complex, 15-35% slopes	C/D
Ht	Human Transported Material	N/A
LrD	Lyman-Tunbridge-Rock Outcrop complex, 15-35% slopes	D
LrE	Lyman-Tunbridge-Rock Outcrop complex, >35% slopes	D
LuD	Lyman-Tunbridge-Becket complex, 15-35% slopes	D/C
Ml	Manufactured Layer	N/A
MoC	Monadnock fine sandy loam, 8-15% slopes	C
MpB	Monadnock, poorly drained, 3-8% slopes	D
TpC	Tunbridge, poorly drained, 8-15% slopes	D
TpD	Tunbridge, poorly drained, 15-35% slopes	D
TrC	Tunbridge-Lyman-Rock Outcrop complex, 8-15% slopes	D
TrD	Tunbridge-Lyman-Rock Outcrop complex, 15-35% slopes	D
TrE	Tunbridge-Lyman-Rock Outcrop complex, >35% slopes	D
WaC	Waumbek fine sandy loam, 8-15% slopes	B
WaD	Waumbek fine sandy loam, 15-35% slopes	B
WaE	Waumbek fine sandy loam, >35% slopes	B
WpC	Waumbek fine sandy loam, poorly drained, 8-15% slopes	D
WpE	Waumbek fine sandy loam, poorly drained, >35% slopes	D

Appendix D MAPSS STANDARDS FOR SOIL SURVEYS

A Class L Soil Survey (for Linear Projects)

This standard is designed to provide the minimum soil information necessary to allow for the design and construction of long but narrow projects with little or no adjacent development. Class L map units shall be made on the basis of parent material, slope, soil texture, soil depth to dense till or bedrock and soil drainage at the Class A High Intensity map unit size.

1. Map units will not contain dissimilar, limiting, individual inclusions larger than 1/8 acre. Dissimilar, limiting inclusions may total more than 1/8 acre per map unit delineation, in the aggregate, if not contiguous.
2. Scale of 1 inch equals 100 feet or larger (e.g. 1" = 50')
3. Ground control – base line and test pits for which detailed data are recorded are located to sub-meter accuracy under the direction of a qualified professional.
4. Base map – with two-foot contour lines.

A Class D (Medium Intensity) Soil Survey

1. Map units may contain dissimilar, limiting, individual inclusions larger than five-acres provided that each dissimilar, limiting inclusion is smaller than the minimum map unit size utilized. Dissimilar, limiting inclusions may total more than 1/8 acre per map unit delineation, in the aggregate, if not contiguous.
2. Scale of 1 inch equals 2,000 feet or larger (e.g. 1" = 1,320')
3. Ground control – as determined by the mapper.
4. Base map – as determined by the mapper.

Appendix E CLASS L SOIL MAP UNIT DESCRIPTIONS

SOIL SURVEY REPORT

February 21, 2018

Map Unit: **Lyman-Tunbridge-Rock outcrop complex**
Classification: Lyman: Loamy, isotic, frigid Lithic Haplorthods
Tunbridge: Coarse-loamy, isotic, frigid Typic Haplorthods
Map Unit Symbol: LrD, LrE

SETTING
Parent Material: Loamy supraglacial till
Landform: Glaciated uplands
Position in Landscape: Ridge summits and shoulders
Slope Gradient Range: (D) 15-35%, (E) >35%

COMPOSITION AND SOIL CHARACTERISTICS
Drainage Class: Lyman: Somewhat excessively drained
Tunbridge: Well drained
Depth to Water Table: Lyman: < 20" to bedrock with no water table
Tunbridge: 20 to <40" to bedrock with no water table

Typical Profile Description:
Lyman:
0 – 2" Hemic
2 – 4" Very dusky red, fine sandy loam, sbk, VFR
4 – 7" Grayish brown, fine sandy loam, sbk, VFR
7 – 13" Dark reddish brown, fine sandy loam, sbk, VFR
13 – 17" Dark brown, fine sandy loam, sbk, VFR
17" Bedrock

Tunbridge:
0 – 3" Hemic
3 – 5" Very dusky red, fine sandy loam, sbk, VFR
5 – 7" Grayish brown, fine sandy loam, sbk, VFR
7 – 13" Dark reddish brown, fine sandy loam, sbk, VFR
13 – 23" Dark brown, fine sandy loam, sbk, VFR
23 – 32" Dark yellowish brown, fine sandy loam, sbk, VFR
32" Bedrock

Hydrologic Group: D
Soil Erosion K Factor: 0.37
Potential for Frost Action: Moderate
Saturated Hydraulic Conductivity: Moderately High
Depth to Bedrock: 0 to <40"
Hazard to Flooding: None

INCLUSIONS (within mapping unit)
Similar: Abram
Dissimilar: None Observed

USE AND MANAGEMENT

On this site these soils are located on ridge summits and shoulders with some of the steepest slopes. The transition from exposed bedrock outcrops to moderately deep soil is rapid and the pattern complex; with the dominant depth to bedrock being shallow. This map unit occupies only a small portion of the site and the locations of the map units are avoidable for project components such as roads and turbine pads. If construction is proposed in these areas then blasting will likely be required; however, the blast rock remnants typically create high value road building materials since it is resistant to erosion and alteration from large vehicle traffic. These soils are susceptible to erosion so disturbance should be minimized by the use of erosion control devices and sediment controls should be installed downslope of these areas prior to work to avoid off-site sedimentation.

SOIL SURVEY REPORT

February 21, 2018

Map Unit: **Monadnock, fine sandy loam**
Classification: Coarse-loamy over sandy or sandy-skeletal, isotic over mixed, frigid Typic Haplorthods
Map Unit Symbol: MoC

SETTING
Parent Material: Loamy over sandy melt-out till
Landform: Glaciated uplands
Position in Landscape: Pockets on ridge summits
Slope Gradient Range: (C) 8-15%

COMPOSITION AND SOIL CHARACTERISTICS
Drainage Class: Well drained
Depth to Water Table: >40”

Typical Profile Description:
0 – 10” Very dark red, sandy loam, sbk, VFR
10 – 20” Dark reddish brown, sandy loam, sbk, VFR
20 – 48+” Brown, Coarse loamy sand, sbk, FR

Hydrologic Group: C
Soil Erosion K Factor: 0.32
Potential for Frost Action: Moderate
Saturated Hydraulic Conductivity: High
Depth to Bedrock: >40”
Hazard to Flooding: None

INCLUSIONS (within mapping unit)
Similar: Monadnock moderately well and somewhat poorly drained
Dissimilar: Monadnock poorly drained, Lyman, Tunbridge

USE AND MANAGEMENT

This map unit is located in a large bench on the main ridgeline. It is composed of deeper soil within the shallower Tunbridge-Lyman-Rock outcrop complex. The depth of this soil reduces the potential for blasting for typical road construction. Slopes are less steep in this map unit so the potential for erosion is reduced, however the map unit encompasses some wetland areas so construction activities should use erosion control devices and sediment controls should be installed prior to work to avoid erosion and sedimentation of wetlands and other adjacent resources. Due to the high rate of timber harvesting in the area the site contains many areas that are disturbed from use of large scale timber harvesting equipment. These roads and ruts intercept surface and subsurface runoff which is then concentrated in small, discrete areas that hold water for extended periods and function similar to wetlands, although do meet the parameters to be mapped as such. These small inclusions could pose issues for construction activities due to the high water table.

SOIL SURVEY REPORT

February 21, 2018

Map Unit: **Monadnock, poorly drained**
Classification: Coarse-loamy over sandy or sandy-skeletal, isotic over mixed, frigid Typic Endoaquods
Map Unit Symbol: MpB

SETTING
Parent Material: Loamy over sandy melt-out till
Landform: Glaciated uplands
Position in Landscape: Pockets on ridge summits
Slope Gradient Range: (B) 3-8%

COMPOSITION AND SOIL CHARACTERISTICS
Drainage Class: Poorly drained
Depth to Water Table: 0”

Typical Profile Description:
0 – 3” Very dusky red, sapric
3 – 13” Brown, cobbly fine sandy loam, sbk, VFR; organic stripping, oxidized root channels
13 – 23” Light olive brown, sandy loam, sbk, VFR; hcr 20%, d
23 – 51+” Olive, coarse sandy loam, sbk, VFR

Hydrologic Group: D
Soil Erosion K Factor: 0.17
Potential for Frost Action: Moderate
Saturated Hydraulic Conductivity: High
Depth to Bedrock: >60”
Hazard to Flooding: None

INCLUSIONS (within mapping unit)
Similar: Monadnock somewhat poorly drained
Dissimilar: Tunbridge, Lyman, Monadnock

USE AND MANAGEMENT

This map unit encompass a discrete area within the larger Monadnock map unit. It formed in a concave depression in the landscape that retains groundwater for a duration long enough to form hydric soil. It is mapped as wetland and alteration of this area should be avoided or minimized. This area possesses a high water table and may pose limitations for construction, such as rutting or compaction and higher susceptibility to frost action.

These soils are susceptible to erosion so disturbance should be minimized by the use of erosion control devices and sediment controls should be installed prior to work to avoid disturbance of the adjacent resource.

SOIL SURVEY REPORT

February 21, 2018

Map Unit: **Tunbridge, poorly drained**
Classification: Coarse-loamy, isotic, frigid Typic Endoaquods
Map Unit Symbol: TpC, TpD

SETTING
Parent Material: Loamy supraglacial till
Landform: Glaciated uplands
Position in Landscape: Pockets on ridge summits
Slope Gradient Range: (C) 8-15%, (D) 15-35%

COMPOSITION AND SOIL CHARACTERISTICS
Drainage Class: Poorly drained
Depth to Water Table: 0”

Typical Profile Description:
0 – 10” Dark reddish brown, mucky sandy loam, m, VFR
10 – 14” Dark grayish brown, loamy sand, sbk, VFR ; hcr 15%, P
14 – 22” Light olive brown, loamy sand, pl, FR; free water
22 – 24” Light olive brown, loamy sand, pl, FI
24” Bedrock

Hydrologic Group: D
Soil Erosion K Factor: 0.17
Potential for Frost Action: Moderate
Saturated Hydraulic Conductivity: High
Depth to Bedrock: 20 to <40”
Hazard to Flooding: None

INCLUSIONS (within mapping unit)
Similar: Lyman poorly drained, Tunbridge somewhat poorly drained
Dissimilar: Tunbridge, Lyman, Monadnock

USE AND MANAGEMENT

These map units encompass small, discrete areas within the larger Tunbridge-Lyman-Rock outcrop complexes. They formed in concave depressions in the landscape that retain groundwater for a duration long enough to form hydric soil. They are mapped as wetland and alteration of these areas should be avoided or minimized. These areas possess a high-water table and may pose limitations for construction, such as rutting or compaction and higher susceptibility to frost action.

If construction is proposed in these areas then blasting will likely be required; however, the blast rock remnants typically creates high value road building materials since it is resistant to erosion and alteration from large vehicle traffic. These soils are susceptible to erosion so disturbance should be minimized by the use of erosion control devices and sediment controls should be installed downslope of these areas prior to work to avoid off-site sedimentation and impact to adjacent wetland.

SOIL SURVEY REPORT

February 21, 2018

Map Unit: **Tunbridge-Lyman-Rock outcrop complex**
Classification: Tunbridge: Coarse-loamy, isotic, frigid Typic Haplorthods
Lyman: Loamy, isotic, frigid Lithic Haplorthods
Map Unit Symbol: TrC, TrD, TrE

SETTING
Parent Material: Loamy supraglacial till
Landform: Glaciated uplands
Position in Landscape: Ridge summits, shoulders and backslopes
Slope Gradient Range: (C) 8-15%, (D) 15-35%, (E) >35%

COMPOSITION AND SOIL CHARACTERISTICS
Drainage Class: Tunbridge: Well drained
Lyman: Somewhat excessively drained
Depth to Water Table: Tunbridge: 20 to <40" to bedrock with no water table
Lyman: < 20" to bedrock with no water table

Typical Profile Description:
Tunbridge:
0 – 3" Hemic
3 – 5" Very dusky red, fine sandy loam, sbk, VFR
5 – 7" Grayish brown, fine sandy loam, sbk, VFR
7 – 13" Dark reddish brown, fine sandy loam, sbk, VFR
13 – 23" Dark brown, fine sandy loam, sbk, VFR
23 – 32" Dark yellowish brown, fine sandy loam, sbk, VFR
32" Bedrock

Lyman:
0 – 2" Hemic
2 – 4" Very dusky red, fine sandy loam, sbk, VFR
4 – 7" Grayish brown, fine sandy loam, sbk, VFR
7 – 13" Dark reddish brown, fine sandy loam, sbk, VFR
13 – 17" Dark brown, fine sandy loam, sbk, VFR
17" Bedrock

Hydrologic Group: D
Soil Erosion K Factor: 0.37
Potential for Frost Action: Moderate
Saturated Hydraulic Conductivity: Moderately High
Depth to Bedrock: 0 to <40"
Hazard to Flooding: None

INCLUSIONS (within mapping unit)
Similar: Abram, Tunbridge somewhat poorly to moderately well drained phases
Dissimilar: Tunbridge poorly drained, Becket, Monadnock

USE AND MANAGEMENT

These map units encompass the largest portion of the site and are located on ridge summits, shoulders and backslopes. They encompass areas with some of the steepest slopes. The transition from exposed bedrock outcrops to moderately deep soil is rapid and the distribution of series within the map unit is complex and undulating. This undulating topography creates pockets where phases of poorly drained to moderately well drained drainage classes developed. The poorly drained areas are hydric soil, are mapped as wetland and alteration of these areas should be avoided or minimized. The areas with high water tables may pose limitations for construction, such as rutting or compaction and higher susceptibility to frost action and erosion. The deeper Becket and Monadnock soils are located in pockets in the bedrock along the map unit boundaries with other deeper soils.

If construction is proposed in these areas then blasting will likely be required; however, the blast rock remnants typically create high value road building materials since it is resistant to erosion and alteration from large vehicle traffic. These soils are susceptible to erosion so disturbance should be minimized by the use of erosion control devices and sediment controls should be installed downslope of these areas prior to work to avoid off-site sedimentation.

SOIL SURVEY REPORT

February 21, 2018

Map Unit: **Waumbek, fine sandy loam, poorly drained**
Classification: Sandy-skeletal, isotic, frigid Typic Haploaquads
Map Unit Symbol: WpC, WpE

SETTING
Parent Material: Stony, sandy till
Landform: Glaciated uplands
Position in Landscape: Back and Toeslopes
Slope Gradient Range: (C) 8-15%, (E) >35%

COMPOSITION AND SOIL CHARACTERISTICS
Drainage Class: Poorly drained
Depth to Water Table: 0”

Typical Profile Description:
0 – 1” Brown, loamy sand sediment, free water
1 – 7” Black, loamy sand, ma, VFR, free water
7 – 10” Brown, sandy loam, ma, VFR, hcr 8%, d
10 – 24” Olive, loamy sand, ma, F, hcr 20%, d

Hydrologic Group: D
Soil Erosion K Factor: 0.17
Potential for Frost Action: Moderate
Saturated Hydraulic Conductivity: High
Depth to Bedrock: <60”
Hazard to Flooding: None

INCLUSIONS (within mapping unit)
Similar: Naskeag somewhat poorly drained, Waumbeck well drained
Dissimilar: Lyman, Tunbridge

USE AND MANAGEMENT

This map unit is located on the back and toeslopes within the project area where the access road is currently proposed; along the edge of the existing aggregate base road that extends to the ridgeline. They formed in concave depressions in the landscape that retain groundwater for a duration long enough to form hydric soil. They are mapped as wetland and alteration of these areas should be avoided or minimized. These areas possess a high-water table and may pose limitations for construction, such as rutting or compaction and higher susceptibility to frost action. The loamy/coarse textured soil of this map unit are also highly susceptible to erosion; particularly in the more steeply sloping areas. Erosion and sediment controls should be installed prior to commencement of construction activities to avoid erosion and sedimentation of adjacent wetlands and streams.

SOIL SURVEY REPORT

February 21, 2018

Map Unit: **Waumbek, fine sandy loam**
Classification: Sandy-skeletal, isotic, frigid Aquic Haplorthods
Map Unit Symbol: WaC, WaD, WaE

SETTING
Parent Material: Stony, sandy till
Landform: Glaciated uplands
Position in Landscape: Backslopes and footslopes
Slope Gradient Range: (C) 8-15%, (D) 15-35%, (E) >35%

COMPOSITION AND SOIL CHARACTERISTICS
Drainage Class: Moderately well drained
Depth to Water Table: 40 - <60”

Typical Profile Description:
0 – 1” Black, fibric
1 – 4” Brown, fine sandy loam, sbk, VFR
4 – 13” Yellowish red, fine sandy loam, sbk, FR
13 – 15” Yellowish brown, fine sandy loam, sbk, VFR
15 – 17” Brown, cobbly fine sandy loam, sbk, FR
17 – 24” Light olive brown, cobbly fine sandy loam, sbk, FR
24 – 35” Olive gray, fine sandy loam, m, FR; hcr 15%, d
35 – 70+” Olive gray, very cobbly loamy sand, m, FR; hcr 30%, d

Hydrologic Group: B
Soil Erosion K Factor: 0.17
Potential for Frost Action: Moderate
Saturated Hydraulic Conductivity: High
Depth to Bedrock: <60”
Hazard to Flooding: None

INCLUSIONS (within mapping unit)
Similar: Naskeag somewhat poorly drained, Waumbeck well drained
Dissimilar: Lyman, Tunbridge

USE AND MANAGEMENT

This map unit is located on the back and toeslopes within the project area where the access road is currently proposed; along the edge of the existing aggregate base road that extends to the ridgeline. There are streams and other surface drains that extend downslope that carry significant amounts of surface water across the site which are currently eroding the adjacent road. The loamy/coarse textured soil of this map unit are also highly susceptible to erosion; particularly in the more steeply sloping areas. These surface water features are depicted on the soil survey map as “Stormwater Features” and project engineers should plan for additional stormwater management in these areas. Erosion and sediment controls should be installed prior to commencement of construction activities to avoid erosion and sedimentation of wetlands and other adjacent resources. The coarser textured soils may also be suitable sources of aggregate for road and other site construction.

Appendix F GLOSSARY

Complex: Two or more dissimilar major components that occur in a regularly repeating pattern or in an unpredictable pattern.

Limiting Dissimilar Soil: Generally, map unit delineations contain soils other than those identified in the map unit name. These minor soil components reduce the purity of the soil map unit. Minor components that most detract from purity because they are the most dissimilar to the mapped name and are the most limiting for use.

Soil Drainage Class:

- Excessively Drained: Soil depth is less than 25 cm (10 inches) to bedrock; or has a sandy or sandy-skeletal particle-size class with a loamy cap less than 25 cm (10 inches) thick.
- Somewhat Excessively Drained: Soil depth is 25 to 50 cm (10 to 20 inches) to bedrock with a loamy or loamy-skeletal particle-size class; or soil depth is 50 cm (20 inches) or greater to bedrock with a sandy or sandy-skeletal particle-size class with a loamy cap 25 cm (10 inches) thick or greater.
- Well Drained: Soil depth is at least 50 cm (20 inches) to bedrock and has a texture of loamy very fine sand or finer and redoximorphic features, if present, are 100 cm (40 inches) or more below the mineral soil surface.
- Moderately Well Drained: Has redoximorphic features at a depth of 40 cm (16 inches) to less than 100 cm (40 inches) below the mineral soil surface.
- Somewhat Poorly Drained: Is not VERY POORLY or POORLY DRAINED and has redoximorphic features at a depth of less than 40 cm (16 inches) below the mineral soil surface.
- Poorly Drained: Has dominant textures in the upper 50 cm (20 inches) (below the A-horizon if present) of loamy fine sand or coarser and has redoximorphic features within 18 cm (7 inches) of the mineral soil surface; or has dominant textures in the upper 50 cm (20 inches) (below the A-horizon if present) of loamy fine sand or coarser and has a Bh- or Bhs-horizon with value/chroma of 3/3 or less that begins within 18 cm (7 inches) of the mineral soil surface and is direclty underlain by a horizon that has redoximorphic features; or has an A-horizon that is 18 cm (7 inches) thick or greater with value/chroma of 3/2 or less and a textures in all sub-horizonswithin 50 cm (20 inches) of the mineral soil surface of loamy fine sand or coarser and has redoximorphic features directly below the A-horizon; or has a depleted or gleyed matrix within 50 cm (20 inches) of the mineral soil surface and redox depletions with value of 4 or more and chroma of 2 or less in ped interiors that are less than 18 cm (7 inches) below the mineral soil surface; or has an A-horizon that is 18 cm (7 inches) thick or greater with value/chroma of 3/2 or less and has a depleted or gleyed matrix within 50 cm (20 inches) of the mineral soils surface and has redox depletions with value of 4 or more and chroma of 2 or less in ped interiors or a depleted or gleyed matrix directly beneath the A-horizon.

SOIL SURVEY REPORT

February 21, 2018

Soil Depth:

- Very Shallow: < 10 inches of mineral soil above bedrock
- Shallow: 10 to < 20 inches of mineral soil above bedrock
- Moderately Deep: 20 to <40 inches of mineral soil above bedrock
- Deep: 40 to <60 inches of mineral soil above bedrock
- Very Deep: >60 inches of mineral soil above bedrock

Soil Map Unit: Designed to efficiently deliver soil information to meet user needs for management and land use decisions. They can appear on maps as individual areas (i.e. polygon), points, or lines. They are a collection of areas defined and named the same in terms of their major soil components, miscellaneous areas, or both.

Soil Phase: These terms are added to a map unit component name to covey important information about a map unit and differentiate it from other map units on the map unit legend.

Soil Series: Represents a three-dimensional soil body having a unique combination of properties that distinguish it from neighboring series.

4-F

DRAFT - RoxWind: Incidental Take Plan for the little brown bat (Myotis lucifugus) & eastern small-footed bat (Myotis leibii)

DRAFT

RoxWind:
Incidental Take Plan for the little brown bat (*Myotis lucifugus*) & eastern small-footed bat (*Myotis leibii*)

Prepared for:

RoxWind LLC by its manager
Palmer Management Corporation
13 Elm Street, Suite 200
Cohasset, MA 02025

Submitted to:

Commissioner Chandler Woodcock
Maine Department of Inland Fisheries and Wildlife (MDIFW)
State House Station 41, Augusta ME 04441-0441

Prepared by:

Lindsay Deane-Mayer
Palmer Management Corporation
13 Elm Street, Suite 200
Cohasset, MA 02025

Submitted: February 13, 2018

Updated: March 19, 2018

1. INTRODUCTION

Palmer Management Corporation, on behalf of RoxWind LLC ("RoxWind"), prepared this Incidental Take Plan (ITP) for the little brown bat (*Myotis lucifugus*) and the eastern small-footed bat (*Myotis leibii*) in accordance with provisions of the Maine Endangered Species Act (Title 12 M.R.S., Chapter 925, Subchapter 3, §12808-A). MDIFW regulations [Chapter 8.06(B).6] endorse the development of "Specific Activity ITPs" to address accidental mortality of these two listed bat species. This ITP is part of RoxWind's application submitted to the Maine Department of Environmental Protection for Siting Certification for Small-Scale Wind Energy Developments ("Small Wind Certification").

2. PROJECT DESCRIPTION

This ITP pertains to RoxWind's proposed 4-turbine wind project on North Twin Peak in Roxbury, Maine. The project is designed to conform to the State's Small Wind Certification process. Of particular note, it will create fewer than 3 new acres of impervious area and occupy, when complete, fewer than 20 acres. Due to the project's small size compared to other wind projects proposed in the State, its individual environmental impact will be proportionally smaller as well.

The project has been in development since 2012 when the landowner entered into a lease agreement for the permitting, construction and operation of a wind energy project. Since then, a temporary meteorological tower was erected on site to verify the wind resource and energy analyses have been undertaken. In addition, the project has completed environmental studies and received determinations of no hazard from the Federal Aviation Administration.

The turbines are sited along the ridgeline of North Twin Mountain. In the Town of Roxbury's zoning ordinance, this area is designated as being within its "Mountain District." The Mountain District has been identified by the Town as appropriate for wind energy development. The project has been presented to the Town at multiple Selectmen and Planning Board hearings starting in 2014. RoxWind submitted a Building Permit application to the Town of Roxbury's Planning Board to construct and operate the project on February 22, 2018, and held a Public Informational Meeting in the Town on March 7, 2018. RoxWind anticipates that the Town Building Permit will be subject to RoxWind also obtaining a Small Wind Certificate from the State.

Access to the site is by an existing road that will be improved for the project during construction. The project design will minimize site impacts by revegetating a portion of the road's width after the equipment is erected and commissioned. An existing transmission line runs through a portion of the property and the project is designed so that its generator lead will follow the existing corridor down toward the utility substation.


RoxWind
Turbine Locations
Legend
T1
T2
T3
T4
120
Google Earth
© 2018 Google
N
1000 ft

3. SUMMARY OF CONSULTATIONS WITH MDIFW

RoxWind has consulted with MDIFW on multiple occasions, commencing in 2016.

RoxWind submitted an information request to MDIFW, and in response, MDIFW issued a letter, dated May 31, 2016, addressing Endangered, Threatened, and Special Concern Species – specifically listing Bats, Golden Eagle, Northern Bog Lemming, Roaring Brook Mayfly, Bicknell's Thrush, and Northern Spring Salamander as species that may occur on the site and worthy of additional investigation. In the same letter, MDIFW also requested a copy of the vernal pool study that was completed for the site.

RoxWind responded by commissioning Stantec Consulting Services, Inc. to investigate the presence of the aforementioned species on the site and the appropriateness of the site to host such species. In addition, RoxWind and its consultants have reviewed available reports of environmental monitoring from a nearby wind project. These site specific studies, along with the vernal pool study, were submitted to MDIFW for review and comment on November 23, 2016. After review of the submittals, MDIFW agreed, as of January 27, 2017, with the studies' conclusions that the species listed in the May 31, 2016 letter, excepting bats, were not identified on site.

The remainder of this ITP document will focus on bats that are known to inhabit the State of Maine and proposed mitigation that has been discussed among the parties.

Through numerous discussions with MDIFW, RoxWind understands that MDIFW is having, has had or plans to have, conversations with operating and proposed wind projects to discuss the implementation of protective protocols to decrease the probability of bat takings.

To initially address MDIFW's identification of bats in its May 2016 response to RoxWind's information request, RoxWind commissioned a bat acoustic monitoring study that followed USFWS Guidelines. The study concluded that no northern long-eared bats, the only Maine bat at the time of the study listed as a Threatened Species under the Federal Endangered Species Act, were recorded during the monitoring period.

While the monitoring did not detect northern long-eared bats, RoxWind and MDIFW continued conversations regarding designing the project to integrate operational curtailment as a measure to provide protection to the eight species of bats known to reside in Maine, during specific periods of concern.

4. PROJECT ACTIVITIES COVERED BY THE INCIDENTAL TAKE PLAN

This Incidental Take Plan covers all reasonable activities at the site necessary for the ongoing permitting and future construction, operation and maintenance of this wind energy facility.

5. ANALYSIS OF POTENTIAL ALTERNATIVES

All operating wind energy facilities in Maine have the possibility of incidental impacts to bats during their operation. These impacts are not unique to wind energy facilities as bats have historically been impacted by other large developments – both during and after construction. The only alternative to provide 100% certainty that the wind energy facility would not endanger any bat would be to ban the development, construction and operation of wind energy facilities. Of course, wind energy facilities provide significant environmental benefits when compared to other energy sources and thus their installation and potential negative impact on bats cannot be considered without also factoring in the potential environmental benefits for bats and other species, including humans, arising from cleaner air and reduced climate change.

6. CONSERVATION MEASURES

It is unknown how the general bat population will recover in future years as a result of the impact of white-nose syndrome. Due to this uncertainty, and the project's projected 25-year or longer operating design, RoxWind proposes the conservation measures outlined in this Section 6.

Through discussions with MDIFW, it was determined that curtailment practices are presently the preferred method to minimize bat fatalities.

MDIFW and RoxWind have worked collaboratively to create an operating protocol, to be implemented seasonally following commissioning, that would remain in effect for the operating life of the project or until there is cause to reopen the protocol to allow for more operational flexibility for the project. These causes may include, but are not intended to be limited to, (i) technological advancements that could be implemented which provide similar levels of bat protection while allowing the project to increase production, (ii) MDIFW's determination that curtailment is no longer required for operating or proposed wind energy projects to protect bat species, or (iii) additional research or guidance becomes available that supports decreased levels of overall curtailment.

<u>Proposed Conservation Measures Protocol</u>

Commencing daily ½ hour before dusk and concluding ½ hour after dawn of the following day:

A) April 15 – July 15: Cut-in wind speed is increased from manufacturer's designed speed to 6 m/s
B) July 16 – September 15: Cut-in wind speed is increased to 6.9 m/s
C) September 16 – September 30: Cut-in wind speed returns to 6 m/s
D) October 1 – April 14: No adjustments to cut in wind speed, wind turbines operate as designed by manufacturer.

Notes:

1) The aforementioned levels of curtailment are agreed upon with the underlying assumption that there will be no required formal species monitoring during the operational life of the project.
2) While no formal monitoring will be required of the site, RoxWind will inform its operators to report any observed takings of endangered, threatened, or special concern species.
3) RoxWind will have the right to operate, irrespective of this protocol, in periods of time when ISO-NE (or any successor to ISO-NE) determines that there is a capacity shortage (or other such phrase, meant to represent a need for operating assets to be/stay on line).
4) The curtailment settings will be automated by RoxWind in consultation with the turbine manufacturer.
5) All wind speeds will be measured at the hub height by each wind turbine.
6) Technological advances that could decrease the required level of curtailment may include, among other things, bat detectors that integrate with the SCADA system, bat deterrence systems, physical changes to the wind turbines to decrease the likelihood of bat take, or other technology that decreases the likelihood of bat impact.
7) New research may include, among other things, more precisely defined operating parameters that allow the turbines to operate more regularly while providing similar levels of protection to bat species of concern.

7. MONITORING

7.1. Compliance documentation: An annual operations summary demonstrating compliance with curtailment requirements (Section 6.0) in the previous calendar year will be submitted to MDIFW by March 1 of the following year. The summary document will be a table of curtailment events from the previous year's curtailment season and shall include a log of the evenings that the curtailment conditions occurred, a verification that the turbine(s) automatically curtailed, and notes explaining any discrepancies between the two prior log entries.

A separate log will also be submitted to MDIFW listing any observed takings of endangered, threatened, or special concern species identified by operators (Section 7.4), with a picture and corresponding date of such observation.

7.2. Site inspections: MDIFW personnel can visit the facility to search for bat fatalities with 24-hour written notice to parties identified in the ITP. Such notice shall provide reasonable cause, the requested date and time, and the number of personnel anticipated on-site for such inspection. MDIFW shall coordinate its visit with site operators to ensure safety protocols are followed and that the site is entered and exited securely.

7.3. MDIFW has determined that implementation of conservation measures (Section 6.0) in this ITP will minimize potential losses of little brown bats and eastern small-footed bats to the maximum extent practicable. (Attach written documentation from MDIFW as Appendix A.) Accordingly, no further pre- or post-construction monitoring for bats is necessary unless agreed to by all parties as ITP amendments (Section 8.0).

7.4. Conservation measures (Section 6.0) in this ITP are intended to fully minimize or mitigate potential losses to little brown bats and eastern small-footed bats as the measures meet the level of curtailment requested by MDIFW.

While no formal monitoring will be required of the site, RoxWind will inform its operators to report any observed takings of endangered, threatened, or special concern species, including documenting such observation with a picture recording the finding and noting the date of such observation in a log.

8. AMENDMENT PROCEDURE

8.1. Compliance Periodic Review: The ITP will be reviewed at least once every five years on anniversary dates of the commencement of operation of the project. This provision will be tracked by MDIFW in Appendix B.

8.2. Changes in Project Permits: The ITP will be reviewed during any future permit changes that influence the risks for incidental take of bats. Concurrence with existing terms or appropriate changes will be identified in sequential Appendices (C, D, E, etc.) over the duration of the Plan. All parties to the ITP and a representative of the permitting agency must sign and date their concurrence.

8.3. Substantive Changes: Either party may initiate re-evaluation of the ITP by written notice to all parties to seek changes in conservation measures or other major provisions. Appropriate triggers for potential revisions of the ITP may include (but are not limited to) new science regarding changes in the status or activity of bat populations, demonstrated efficacy of deterrents or technological advances to minimize bat mortality, etc.

8.4. Transfer of ITP provisions to subsequent project owners or operators: Terms of this ITP may be adopted without change by new owners or operators in the future. All parties to the ITP must sign and date their concurrence as an appendix to the plan.

9. SIGNATURES

_____ _____

Chandler Woodcock, Commissioner MDIFW date

permittee signature(s), title(s)	date
permittee signature(s), title(s)	date
permittee signature(s), title(s)	date

PROJECT NAME:	RoxWind LLC
PROJECT GENERATING CAPACITY:	15.2 megawatts (MW)
Developer / Applicant Name and Address:	RoxWind LLC, c/o Palmer Management Corporation 13 Elm Street, Suite 200, Cohasset, MA 02025
Operator / Applicant Name and Address:	See Developer/Applicant above.

Township(s): List where all turbines are planned / installed

Roxbury, Maine

☐ Check if digital GIS coverage of all turbine locations has been submitted to MDIFW.

Project status: (check one)	◉ Planned	○ Under construction	○ Operational
Commercial operation date: 9/1/2020		- check if estimated startup	☑
Anticipated life of project: 20-30 years			

Permits / applications: List all federal, state, or municipal permits (authority, type, ID #, issuance date OR pending)

- Municipal: Planning Board Approval, Building Permit (to be filed as of 2/13/18)
- Federal Aviation Administration: determination of no hazard, issued 7/26/2017
- Maine DEP: Small wind certification, NRPA (permit by rule) (to be filed as of 2/13/18)
- USACE: Category 1 Self-Verification Notification Form (to be filed as of 2/13/18)

Turbines:	Manufacturer and Model		
4 #	GE - 3.8 (or similar)		
Power	Manufacturer's cut-in speed		Manufacturer's cut-out speed
3.8 MW	3 meters /second		25 meters /second
Blade length	Mast height	Elevations of turbine pads	
130 meters	85 meters	1970 meters (mean)	1750 - 2150 meters (range)

Turbines: List site #s in the appropriate physiographic category for each turbine location.

Summits	Saddles	Other ridgelines
1,2,3,4		All four turbines run along the ridgeline
Flatlands		Side-slopes

Turbine site #s where clearings within 100 meters exceed the lay-down area and crane path dimensions: NA

Signature	Title	Date