RAPID ECOLOGICAL ASSESSMENT

Of the

GOODWIN TOWN FOREST
Hanover, NH

View of classic old growth talus slope on the Goodwin Town Forest

Prepared for the

TOWN OF HANOVER PLANNING DEPARTMENT

And the

HANOVER CONSERVATION COMMISSION

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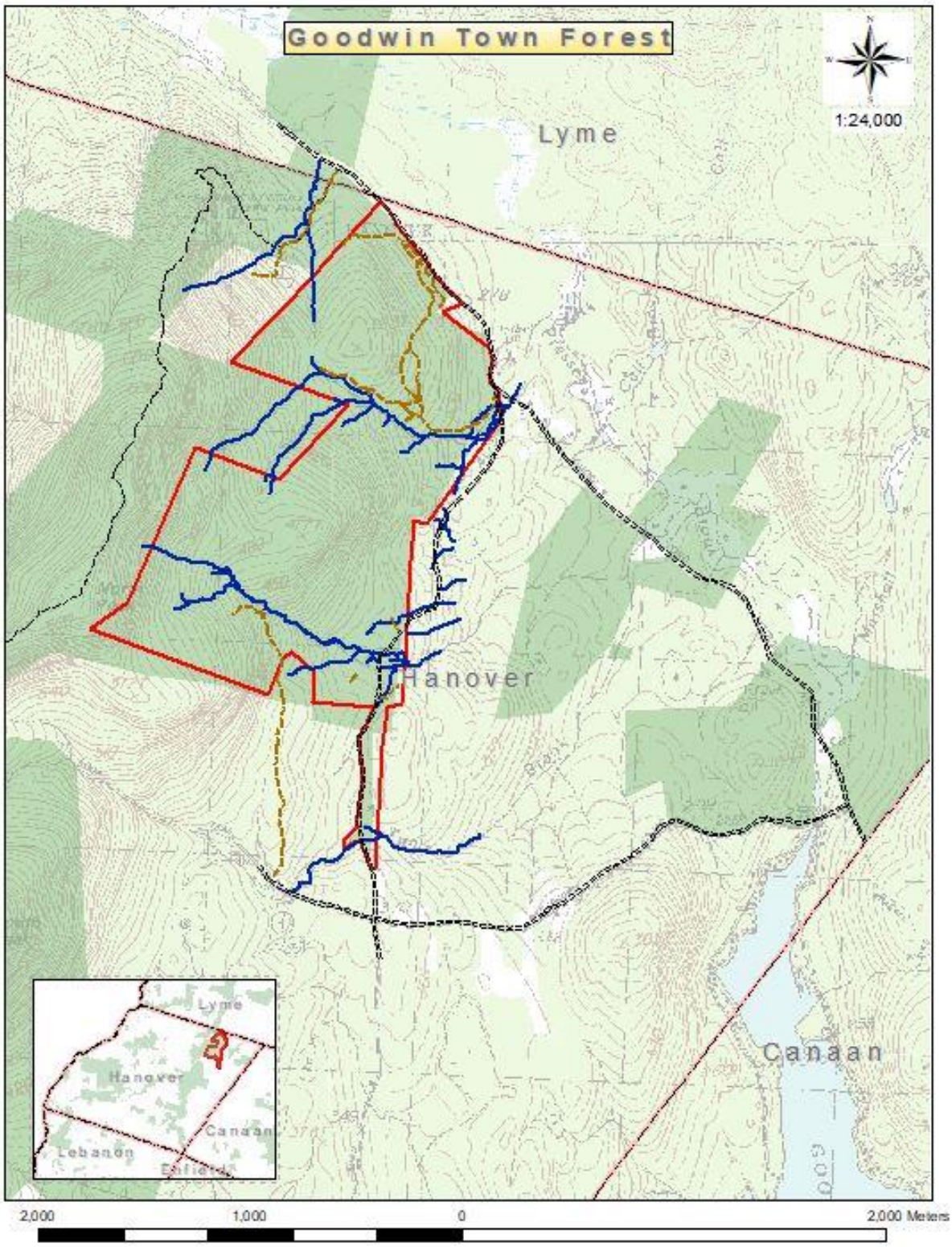

[Boundary Note: The above map and those in the Appendix represent the best non-survey approximation of the town forest boundaries, as checked by GPS and using aerial photography and Lidar. All boundaries have been recently blazed and painted by Jeff Smith, except for the western part of the southern line, which was not discernible in the field.]

EXECUTIVE SUMMARY

Between May 2019 and May 2020 Ecosystem Management Consultants of Sandwich, NH completed fieldwork for a Rapid Ecological Assessment (REA) of the 564-acre Goodwin Town Forest (GTF) in the northeast part of Hanover, New Hampshire. The purpose of the REA was to accomplish the following objectives:

a) identify significant ecological areas
b) check proposed timber management sites for ecological condition & sensitivity
c) identify any rare, threatened or endangered species, and
d) assess landscape level biodiversity for consideration in open space plan

Besides receiving the pertinent location information of the GTF and getting a personal tour from members of the Planning Department and Conservation Commission, EMC also received and reviewed the Goodwin Town Forest Management Plan (FMP) by Jeff Smith of Butternut Hollow Forestry, which was drafted in May 2018 and updated in April 2019. During the twelve-month study time period a number of critical resources were reviewed, mapped, and analyzed in support of the above goals:

1) Wetlands and water resources
2) Topography, soils, and unique geologic features
3) Natural communities
4) Rare & endangered flora and fauna
5) Wildlife habitat and usage
6) Significant ecological areas

In light of objective #2 above, special consideration was given to the identified timber management areas, especially those labeled as “NC,” or Non-Commercial. These provided an excellent starting point for the identification of significant ecological areas (SEA), as well as survey sites for rare and endangered species.

Four field days were completed during the year-long study period, with two occurring in spring and two in summer. Three of the site visits occurred in 2019 and preceded a preliminary presentation to the town on July 10, 2019. A final field survey was conducted this past spring in order to rectify some boundary inconsistencies and to conduct a follow-up search for rare species.

A total of 25 species of mammals, 33 species of birds, 11 species of amphibians, 1 species of reptile, and 2 fish were observed. In addition, the attached species lists includes 9 species of mammals, 159 species of birds, 1 species of amphibians that were reported or that could hypothetically occur in the study area.

As for plants, a total of 363 species of vascular plants were identified, 46 of which are non-native species according to the USDA plant list (www.plants.usda.gov). Two species of plants were listed as “state watch”

species (S3), and one as state indeterminate (IND). Only two species of listed invasive species were found in very small amounts near Goose Pond Road.

Twenty-eight cover types represented by 101 units were identified in the Goodwin Town Forest, of which 16 cover types conform to identifiable natural communities according to *The Nature of New Hampshire* (Sperduto and Kimball 2011). The remainder were artificial forest and non-forest types (e.g. skid road) that could not easily be classified as a particular natural community.

Fourteen separate units (132.6 ac.) among 9 cover types and/or natural communities were included in those areas identified a *significant ecological areas* or SEAs. These types were designated as SEAs on the basis of rare, unusual, sensitive, and/or fragile characteristics that would be unalterably compromised by human intrusion. These data compare favorably with the "NC" areas designated in the FMP, which identified nine areas (94.8 ac.).

All of the 14 SEAs met the general definition of "High Conservation Value Forests" as described in the 2018 FMP. Many were considered rare by the New Hampshire Natural Heritage Program, and ranked either as an S2 (generally 6 – 10 high quality occurrences in the state) or S3 (generally 20 – 100 high quality occurrences in the state). Eight of the 14 SEAs were in an old growth condition and showed no evidence of past cutting or pasturage. Three others contained late successional forest elements with significant biodiversity, largely owing to the calcium-rich bedrock.

Most of the remaining potential forest management areas have been harvested during the past 60 or so years, and many still contain evidence of skid trails and stumps. Whereas access from the south end of the GTF along Tunis Road is impracticable owing to past roadway damage and inundation, potential access from Goose Pond Road can provide continued access for future management activities. That being said, much of the western part of the forest is very rocky and steep, and is best treated as indicated in the FMP as Non-Commercial areas.

The Town of Hanover is to be commended on its foresight in protecting this invaluable property, both for its ecological uniqueness, its proximity to the Appalachian Trail, and for its contribution to the large, unfragmented block of land in the northeast part of the town.

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I. Introduction

The Goodwin Town Forest (GTF) in Hanover, New Hampshire includes roughly 265 acres of mixed upland and lowland forests on the east slope of Moose Mountain the northeast part of the town. The Class V Goose Pond Road abuts the north side of the main lot (Map 14 Lot 9) that was given to the town prior to 1980. The Class VI portion of Tunis Road runs most of the length of the lower lot (Map 14 Lot 12) and rejoins the main lot just before Goose Pond Road (see map above). The GTF varies in elevation from approximately 860 feet at Goose Pond Road in the northeast corner, to over 2215 feet on the north summit of Moose Mountain in the southwest corner. Slopes range from near flat to over 60% with several talus slopes and ledges offering vertical drops.

The lot is fully forested, although there are some open woodlands where bedrock is at the surface. As a 'bedrock-controlled' site, the GTF contains mostly thin glacial tills over shallow ledge. Several forest zones can be considered "woodlands" by virtue of large glacial talus boulders, which inhibit permanent growth of trees. Many of these areas were both devoid of any attempts at clearing for pasturage or harvesting of lumber, and so remain in an old growth state. As described below, 'primeval forest' is present across nearly one fifth of the GTF landscape.

Water resources on the two parcels are primarily restricted to intermittent and perennial streams. These streams are clear and cool, since they have their origins above 2,000 feet in elevation atop Moose Mountain. The latter ridge provides the watershed divide for the entire property, wherein the GTF mostly represents the upper watershed catchment for Pressey Brook that drains southeasterly into Goose Pond in Canaan. A few scattered forested swamps can be found on the property, most of which lie along Tunis Road. Some of these swamps have been impacted so as to create ephemeral pools that support obligate breeding amphibians in the spring.

Nearly all of the upland wildlife species common to the region were observed and/or recorded during the study time period. Common species included moose, deer, bear, raccoon, coyote, red fox, bobcat, porcupine, snowshoe hare, plus a number of small mammals. Bird species were mostly those associated with boreal hardwood and mixed hardwood-conifer forests such as red-eyed vireo, ovenbird, hermit thrush, black-throated green warbler, black-throated blue warbler, red-breasted nuthatch, black-capped chickadee, winter wren, scarlet tanager, and red crossbill. The few amphibians that were found in the mostly upland landscape included redback salamander, red-spotted newt, green frog, wood frog, and American toad. Only one reptile, garter snake, was recorded.

The following report provides a more in-depth synopsis of these natural resources, and considers them in the context of future land use of the town forest. Sensitive ecological resources are highlighted, including the aforementioned SEAs, rare plant and animal species, and forestry considerations. Final recommendations for future land use are contained in the last section. Pertinent maps that support the descriptive narrative can be found in Appendix A, and species lists can be found in Appendix B. Finally, the slide show of preliminary findings that was given on July 10, 2019 to the town can be found in Appendix C.

Fig. 1 Tunis Brook in the south part of the property is one of the largest perennial streams on the GTF

II. Methods

Office

Salient literature resources were reviewed prior to conducting the rapid ecological assessment. These included maps that were in the possession of the Hanover Planning Department, the 2018 Butternut Hollow Forestry Forest Management Plan (FMP), the 2019 update of the FMP, and various map resources held by the Hanover Conservation Commission. Instrumental in EMC's orientation to the property was the local knowledge of James Kennedy of the HCC and Vicki Smith of the Hanover Planning Department. Ms. Smith provided the initial GIS data on the property, which was very useful in preparing for the fieldwork. These data included various shapefiles that were created by Jeff Smith of Butternut Hollow Forestry for the purposes of the FMP, and the most recent conservation data layer for the town of Hanover. GIS resources were viewed in both ArcGIS 10.x and ArcPro 2.3 platforms. The state's web map service was used for Lidar imagery, and the latest hydrography, topography, and soil map layers were loaded onto these platforms for critical review.

Field

Field surveys utilized a hand-held iPhone and the GaiaGPS app for locating waypoints and routes. These were transferred as kml files and converted for use as shapefiles in ArcGIS 10.x. Features were also recorded using a Canon 60SXIS digital camera, which was post-processed using Microsoft and Affinity software. An emphasis was placed on recording property boundaries, the boundaries of natural communities,[1] rare plant and animal species, water resources, and potential constraints to various land uses such as forestry, recreational trails, etc. Digital field data was then used to analyze and delimit various natural resources that appear on the attached maps. This entailed a combination of both field and GIS data analysis, with a heavy reliance on aerial photography and Lidar imagery. A sample of the latter relative to water resource mapping is shown below:

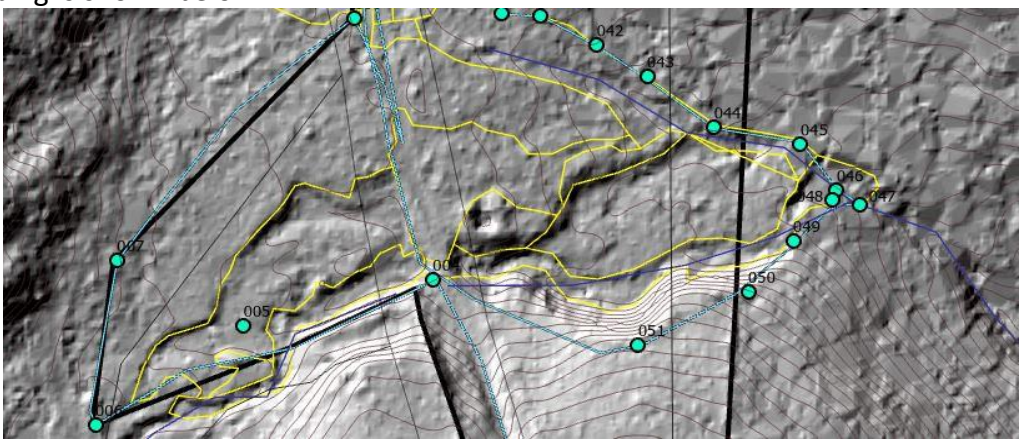

Fig. 2 Sample Lidar image of southern part of GTF showing alignment of water resources

[1] Natural communities are defined as naturally occurring assemblages of plants and animals in their physical environment. These assemblages are dependent on a number of independent variables such light, water, soil, and time.

III. Findings

A. Geology and Soils

The Goodwin Town Forest is underlain by a series of bedrock types that date back to the time of the first fish species, or roughly 440 – 465 million years ago (MYA). The Ordovician time period was a time when thousands of feet of sediment built up in shallow seas off the (then) coast of North America and were subsequently compressed and metamorphosed during a continental collision event tens of millions of years later. The interbedded layers of volcanic lava materials (dark gray) and volcanic ash layers (light gray) can be seen in the uppermost formation on the property, known as the Ammonoosuc Volcanics, or Oalx in the map below. Upwelling magma during the onset of the continental collision resulted in the formation of the Granodiorite/Tonalite (Oo2-3A) igneous rocks roughly 440-450 MYA. This formation makes up most of the central part of the GTF and is responsible for most of the very large talus boulders. Lastly, the late Ordovician magmatic upwelling created the Oliverian Biotite Granite (Oo1b) that underlies the eastern part of the property.

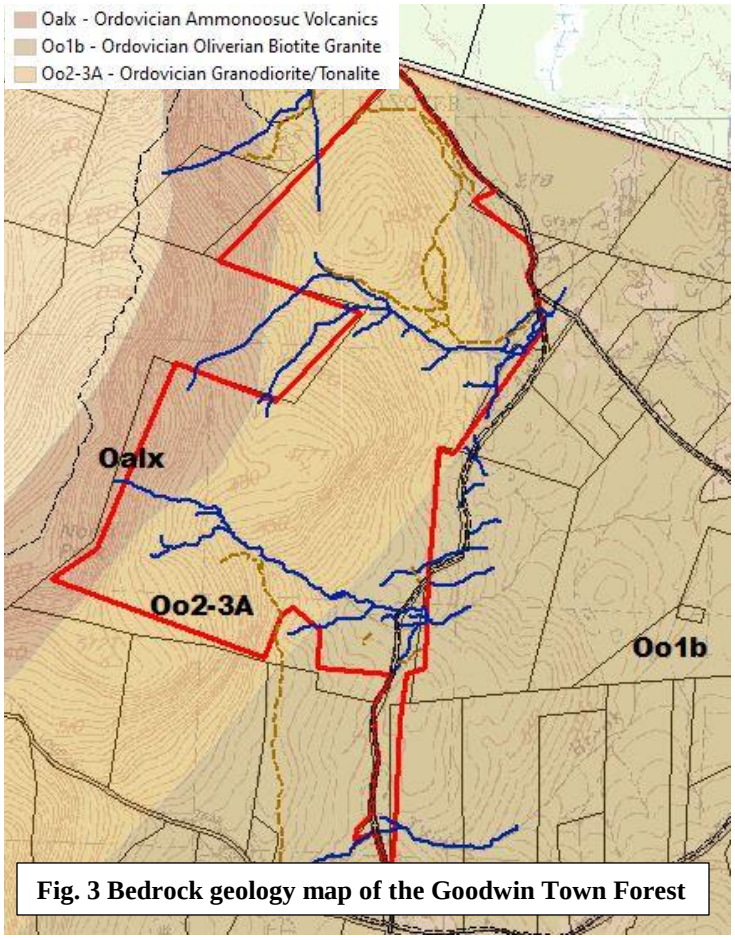

Fig. 3 Bedrock geology map of the Goodwin Town Forest

Soils that have formed over these formations have been strongly influenced by the physical and chemical properties of the rock, especially as it pertains to water and nutrients. Since the Ammonoosuc Formation mica schists are horizontally layered and dip easterly, calcium-rich groundwater has had a chance to enrich the soils on the eastern face of Moose Mountain with a corresponding increase in surface weathering. The latter has encouraged the slow build-up of *colluvium*, a term used to describe the deep pockets of organic-rich soil that accumulates between rock fragments. As a result, the lower edge of the Oalx zone contains rich soils that favor lush vegetation that is growing in high pH humus.

This can be contrasted with the talus and ledge system in the north part of the property, where similarly thin soils and open ledge have sparse amounts of colluvium and much less plant diversity. These areas are controlled by a lower calcium fraction in the granitic bedrock, and as result are mapped at “semi-rich” versus “rich.” Soils in the lower slopes of the property have even less enrichment, and consequently have many more softwoods that tend to further acidify the surface soil layers. The only exception to this was the somewhat enriched seeps that were found in and along Tunis Road (e.g. see description of the black ash swamp below).

In general, soils on the Goodwin Town Forest are thin, moderate in terms of growth potential for vegetation, and very stony. Stones cover greater than 15% of the landscape in most parts, and upwards of 75% of the surface in the talus boulder fields. Both slope and large rock fragments are therefore a severe limiting factor for most land uses both past and present, on the property.

Fig. 4 Granodiorite boulder on lower edge of main talus boulder area in central part of property

B. Water Resources

The upper watershed position and steep slopes of the Goodwin Town Forest suggests that the predominant form of surface water is flowing in channelized streams. Over 7 miles of streams were initially recorded by Butternut Hollow Forestry, and with some modification using field data and Lidar imagery, this figure was refined to 4.8 miles of perennial streams and 2.5 miles of intermittent streams. The drainage density of 8.3 miles per square mile is about average for the region.

Of the perennial streams, Butternut Forestry identified three named reaches, all of which drain easterly toward the 3rd order Pressey Brook near Goose Pond Road. Traveling south to north, the first named brook to be crossed is Tunis Brook (as depicted above), which lies at the base of the first hill that is descended on Tunis Road. Homestead Brook is then encountered as one reaches the main part of the GTF near the cellar hole area. This stream descends the north peak of Moose Mountain and includes nearly all of the upper watershed in the southern part of the GTF. The last named perennial stream along Tunis Road is Moose Brook, so called, which flows off of the north shoulder of Moose Mountain and descends along an old skid road before exiting the property near the north gate on Goose Pond Road. The only other sizable perennial stream on the GTF drains the northwest part from near the spruce-clad summit in the north section of the property.

Stationary surface waters lie in small pockets throughout the lower, east part of the GTF, but are relatively insignificant in terms of size. The largest unit is slightly over three acres and lies astride Tunis Road after one flattens out at the base of the first hill. This forested swamp is mostly comprised of a Red Maple-Sphagnum Basin Swamp, and contains some deep organic soils. The next largest wetland is just to the north along Tunis Road and is roughly 2.5 acres in size. Although this basin lies at the divide between Tunis Brook and Homestead Brook, it contains a fair amount of groundwater discharge that provide a steady supply of water and nutrients to the basin. As a result, a number of seepage-associated plants occur in this basin, including enough black ash to warrant its designation as a “Northern Hardwood-Black Ash-Conifer Swamp.” This natural community type is rather rare in the state, and it is the only one on the Goodwin Town Forest.

In general, wetlands make up about 2.3% of the GTF, (excluding streams), and just six small wetland complexes were found. Although each of these complexes have good value in terms of localized wildlife, they do not have the same kind of flood storage or wildlife habitat value as their cohorts downstream along Pressey Brook.

Finally, it should be noted that there were four artificially impounded areas along Tunis Brook that are serving as ‘pseudo’ vernal pools. Each of these are marked on the accompanying water resources map, even though they do not meet the strict definition of a vernal pool according to the state wetlands rules (Env-Wt 104.44). Whereas they

contain ample amounts of water and obligate breeding amphibians (spotted salamanders), they are unnatural and are a result of deep skidder ruts that have been created along Tunis Road. As such, it is this author's opinion that they should not be treated as jurisdictional vernal pools when doing work in the area.

Fig. 5 Tunis Road along the flat stretch bordered by basin swamps with deep ruts

Fig. 6 Spotted salamander eggs in Tunis Rd pools on 5/19/2019

C. Natural Communities

As noted above, natural communities are naturally occurring aggregations of plants, animals, and other organisms in their physical environment. Many of these organisms are dependent on certain abiotic condition in order to live. Food sources, the presence of water, and the size of the natural community are among the most important factors that regulate their occurrence and longevity on the landscape. These factors change over time in accordance with natural processes such as succession, blowdowns, hurricanes, and climate shifts.

Nearly all of the natural communities that are recognized on the Goodwin Town Forest are forested.[2] This is reflected by the fact that the GTF is roughly 95.5% covered by a closed canopy. Whereas this is not unusual in a state that is roughly 97% forested, what is unusual about the GTF is the relative age of the trees. Owing to the steep slopes, shallow soils, and abundance of surface stones on the GTF landscape, this area was not easily converted to pasture or logged when the area was first settled by colonists in the late 18th century. This fact is clearly evident in the size and age of some of the forest canopy trees, which include yellow birches in excess of 44 inches wide, white ash trees in excess of 125 feet tall, and red oak boles more than 17 feet around. Tree ages of all dominant species regularly exceed 350 years. This fact not only makes the natural communities of the GTF highly intact, it also underscores their characterization as *High Conservation Value Forests* (HCVFs) by the town's forester.

An additional factor that has provided great potential for many of the GTF forests to be classified as *exemplary*,[3] is the fact that the aforementioned nutrient enrichment from the surrounding bedrock has enhanced both their growth potential and the occurrence of rare plants. Whereas only two field site visits surveyed the richer, old growth sites on the upper slopes of Moose Mountain, several rare plants were found (see below). More are likely, especially given the calcium-bearing bedrock and pristine condition of many of the forests of the GTF.

<u>Natural Community Types</u>

A total of 16 natural community types were identified for the Goodwin Town Forest. These included the boreal and temperate forest types dominated by northern hardwoods (i.e. beech, sugar maple, and yellow birch), red spruce, hemlock, and (some) red oak. Combinations of canopy dominants of these species were found in the following:

[2] Note that in the latest treatment by the NH Natural Heritage Program (DNCR), some slight changes have been made to the designation of some of the 169+/- natural communities. These changes are ongoing and should be checked before utilizing the information in this document.

[3] The term "exemplary" is reserved by the NH Natural Heritage Bureau for either very rare natural community types or ones that are more common but in exceptional condition. It is suspected that virtually all of the old growth forests of the GTF would be classified as "exemplary" by the NHB.

1) Beech Forest
2) Hemlock Forest
3) Hemlock-Beech-Oak-Pine Forest
4) Hemlock-Oak-Northern Hardwood Forest
5) Hemlock-Spruce-Northern Hardwood Forest
6) High Elevation Spruce-fir Forest
7) Northern Hardwood Forest
8) Rich Mesic Forest
9) Semi-Rich Oak-Sugar Maple Forest

In general, the hardwood dominated forests occupied the middle elevations of the GTF and the softwoods were found in the uppermost and lowermost slopes of the GTF. The softwood types were generally more acidic in nature and the hardwood types were moderate in terms of pH. On the two extremes were the High Elevation Spruce-fir Forest on the north summit of Moose Mountain, and immediately below it the Rich Mesic Forest that was comprised of sugar maple, white ash, and yellow birch. As noted above, both of these forest types were completely dependent on abiotic factors such as surface stones, soil depth, and water availability, and both were easily identified by their understory growth of herbaceous vegetation. In the case of the spruce-fir forest, for example, very few herbaceous plants were present owing to the extreme acidity, although mountain woodfern, twinflower, and Clintonia managed to be found here and there. In sharp contrast, the Rich Mesic Forest was virtually covered with as much as 45 species of herbaceous plants, including several uncommon to rare species such as wild ginger and Dutchman's breeches.

In between were several other bedrock-controlled natural communities with an intermediate pH, including the Semi-Rich Oak-Sugar Maple Forest and the Northern Hardwood Forest, which were both quite similar with the exception of the occurrence of red oak. The latter was present largely on account of periodic natural disturbance events, which in the case of one 'SROSM' natural community was due to the hurricane of 1938. This storm blew down much of the northern hardwoods canopy and left a number of oaks to grow up in its wake. At the edge of this community the crest of the ridge along the south boundary was exclusively red oak dominant on very thin ledgy soils and was therefore mapped as Red Oak Rocky Ridge.

Fig. 7 Red Oak Rocky Ridge along the south boundary

Virtually all of the above nine natural community types had portions of them represented by old growth conditions. Od growth was determined by the following six factors:

1) Large-bole trees in the canopy
2) Multi-layered understory
3) Periodic canopy gaps from natural blowdowns
4) Self-replacing understory of the same dominant species
5) Coarse woody material in all stages of decomposition
6) Undisturbed soil integrity (i.e. no evidence of human disturbance)

In all, a total of eight areas were identified as old growth forests and/or woodlands, with an approximate sum of 100 acres. The most common natural community type that was found to be in an old growth condition was the Semi-Rich Oak-Sugar Maple Forest, which was understandable considering how difficult it would have been to pasture sheep or cut trees on these very steep and rocky sites.

Lowland forest natural communities included the following naturally occurring types:

10) Hemlock-Cinnamon Fern Forest/Swamp
11) Northern Hardwoods-Black Ash-Conifer Swamp
12) Red Maple-Sphagnum Basin Swamp
13) Red Maple-Sensitive Fern Swamp
14) Seasonally Flooded Red Maple Swamp

Again, the dominant canopy trees were the evident namesake of the natural community, although other hardwood and/or softwood species were typically found at these sites as well. The Hemlock-Cinnamon Fern/Forest was found to be a mix of hydric and non-hydric soils in a mostly somewhat poorly drained condition. A good example of this was just above and to the west of the cellar hole area. The swamp with the black ash, as noted above, was along Tunis Road and occurred as a result of groundwater seepage, which kept it quite wet and filled with enough nutrients to support black ash. All three red maple swamps also occurred along Tunis Road, with the southernmost having a small floodplain that apparently was being over-topped by floodwater from time to time. During the survey time period, this area was being impounded by beavers, however, and so the flooding was more periodic rather than seasonal.

Fig. 8 No. Hardwood-Black ash-Conifer Swamp

D. Wildlife Habitat Resources

A running tally of wildlife species was kept during all of the field outings. Mammals were recorded on the basis of visual or aural observation, tracks, scat, browse, claw marks, scent, dens, hair, and bones. No attempt was made to document population distribution or health, nor complete any quantifiable measurements. Birds were tallied on the basis of the first observation per locale, wherein a minimum of one individual had to have been observed directly visually or aurally in order for it to be tallied. The bird occurrence tally in the attacked Appendix B offers some guidance on the abundance of bird species by frequency. Other vertebrates were recorded on the basis of direct observation. Notes are included, however, about certain species on the basis of anecdotal reports. Hypothetical species that should occur on the property, but were not detected during the survey time period, were also included in the species lists.

A total of 25 species of mammals were directly observed, another three species were reported, and six other species were considered hypothetical. Frequent sign of moose, deer, bear, coyote, fox, raccoon, bobcat, porcupine, snowshoe hare, and several small mammals were recorded. The latter group included regular sightings of chipmunk, red squirrel, gray squirrel, red-backed vole (sign), deer mouse (sign), and flying squirrel (sign). Given the elevation and latitude, the northern flying squirrel was suspected as the likely resident. Several small insectivores were also noted, including the tunnels of hairy-tailed mole, star-nosed mole, masked shrew, and short-tailed shrew.

Bird species totaled 33 species, all of which were assumed to be breeders on the property. Commonly occurring passerines included, in their order of frequency, ovenbird, red-eyed vireo, black-throated blue warbler, yellow-bellied sapsucker, hermit thrush, black-throated green warbler, winter wren, yellow-rumped warbler, blue jay, and black-capped chickadee, red-breasted nuthatch, and scarlet tanager. Positive breeding evidence (i.e. nests, feeding young, territory defense, etc.) was found for all of these species. Less common, yet indicative bird species included eastern wood-pewee, Canada warbler, northern waterthrush, and chimney swift. The wood-pewee occurred wherever oaks were common, the Canada warbler occurred in the brushier woodlands, the northern waterthrush occurred in the basin swamps along Tunis Road, and the chimney swift was seen flying in and out of large yellow birch snag in one off the old growth areas. The latter was an exciting find, since this species appears to be in decline region wide, and old growth snags are purportedly their only natural habitat, which has largely disappeared from the landscape.

Fig. 12 Porcupine resting in large oak near south boundary

Other vertebrates were sporadically encountered, with the largest diversity comprised of amphibians. The above-noted "vernal pools" contained evidence of spotted salamander and wood frog. Red-spotted newts and redback salamanders were commonly seen while traversing moist upland forests, and green frogs and eastern toads were widely scattered in and along streams and in small temporary pools. A short stream survey of Tunis Brook turned up both northern dusky and two-lined salamanders, and they should be expected to occur in the other perennial stream systems as well. The warmer weather in July yielded both treefrog and spring peeper calls from various parts of the forest. Pickerel frog was only seen along Tunis Road on the way into the property.

The absence of water was likely responsible for the absence of more reptile species. Only a single garter snake was observed in the northwest corner near the parking lot. The GTF habitats are not conducive for other open-ground loving snakes, nor permanent water-loving turtles. Only two fish species were observed – several blacknose dace were seen in Tunis Brook and one trout fry was photographed also in Tunis Brook. Both Homestead Brook and Moose Brook were deemed large enough to support these two species as well, although it is

Fig. 10 red-spotted newt (eft)

uncertain whether other small minnows could occur such as longnose dace or slimy sculpin.

Fig. 11 Eastern brook trout fry in Tunis Brook

E. Significant Ecological Areas (SEAs)

A total of 14 significant ecological areas were identified on the Goodwin Town Forest. These were identified on the basis of rarity, condition, and sensitivity to human disturbance. These included nine forested areas, three woodlands, and two wetland areas. All of the rare to uncommon natural communities were included, as well as all old growth areas. The total acreage of SEAs was 132.6 acres, or roughly one quarter of the Goodwin Town Forest. Of this acreage, approximately 100 acres was comprised of natural communities in an old growth condition.

The following natural communities that were included in one or more SEA along with their rarity ranks are as follows:

a) Northern Hardwood-Black Ash-Conifer Swamp S2
b) Red Oak Rocky Woods S2S3
c) Semi-Rich Oak-Sugar Maple Forest S2S3
d) Rich Mesic Forest S3
e) Northern Hardwood Seepage (not mapped) S3
f) Birch-Mountain Maple Wooded Talus S3
g) Circumneutral Seep (not mapped) S3

The two smallest SEAs, the seep communities, were embedded within a larger SEA. Otherwise, the map and table in Appendix A depicts which natural communities were selected for SEA designation and where they are located. With few exceptions, each SEA falls within or includes one or more of the “Non-Commercial” or NC areas mapped by Jeff Smith. His tally of nine NCs totaled 94.5 acres and conformed closely with the nine areas mapped for this project. Whereas Jeff’s NCs were mapped as a single unit, this

REA mapping broke out of the sub-units and expanded three of them to include additional areas of concern.

IV. Recommendations and Next Steps

The task of managing a town forest necessarily rests upon the voices of the residents in the town that by proxy have a say in its management. A typical first step is to hire a forester to conduct a timber stand inventory in order to map and manage a town forest for timber and wildlife. Fortunately, the town of Hanover has had the foresight to hire an "ecological forester" who has considered quite a bit more than trees and wildlife in his plan. It should therefore be no surprise that the findings of this report in many ways reflect the findings in the Butternut Hollow Forestry's management plan.

That being said, through the process of presenting preliminary findings to the town, and having extensive conversations with the Conservation Commission, the Town Planners, and the town's forester, a few more salient recommendations for management have come to light. Herein it would be appropriate to include these as a follow-on to the FMP findings, and to include a few other essential perspectives relative to the value of the Goodwin Town Forest to both the town and to the region as a whole.

1) **The Goodwin Town Forest contains a number of unique resources that are lacking in nearly every town forest in the Upper Valley –** the presence of over 100 acres of old growth forest on a single town forest is practically unheard of. The quality and the character of these forests and woodlands have withstood the test of time through the colonial period and active agricultural period in the early 19th century. They have even withstood the potential tests of mechanical logging in recent years that have made previously uneconomical timber stands merchantable in the eyes of the landowner. At the very least, and in concert with the sound recommendations of Butternut Forestry, all old growth stands should be left as is for the enjoyment of future generations and for the protection of ecological integrity of the forest reserves in the region.
2) **Lower Tunis Road should be closed to vehicular traffic of any kind –** it is clear that previous use and abuse of this Class VI road has resulted in an untenable degradation of the isolated, uncommon, and in the case of the black ash swamp, *rare* wetland resources. In spite of the engineering potential to upgrade this road for future use as an access for timber management, the cost and limited return on such an investment precludes any common sense resolve to upgrade it. Whereas its use as a footpath, ski trail, or other low-impact right-of-way has potential, that too will require considerable effort and expense on the part of the town. Allowing it to revert 'back to nature' and using the Goose Pond Road access seems to be the only logical alternative to this perennial problem.
3) **The cellar hole area should be treated very carefully in terms of future vehicular access –** I have designated an SEA at this site to underscore the

significance and more importantly, the sensitivity of the area to damage. High water tables occur throughout the area, and include several intermittent streams, the perennial Homestead Brook, a large seepage swamp, and a created vernal pool. The crossing by Tunis Road lacks adequate drainage culverts or underdrains and this has exacerbated a wetland creation situation on both sides of the road. The historic value of this site also underscores its need to be protected from timber management activity, and adequate access to potential management units to the west exist north of the intermittent stream that lies at the north edge of the area.

4) **Timber management areas would benefit from the creation of a landing in the northeast corner of the forest –** as discussed with Jim Kennedy and as surveyed on May 19, 2019 (and subsequently on July 8, 2019), there are few options in this hemlock-dominated area for suitable ground free of boulders and high water tables. There was at least one site southwest of a small forested swamp that appeared adequate, however. This site will require some grubbing and smoothing work, and possibly some fill, but could be utilized without excessive impacts to wetlands, wildlife, or high quality forest resources. An off-road site would also provide some security for temporary operations that require the use of timber harvesting equipment.
5) **Trails, if created, should avoid most if not all significant ecological areas, and should not provide a link to the Appalachian Trail –** whereas the latter is likely prohibited by existing protections, the disconnect with the AT is advisable to prevent excessive use and/or the creation of social trails that could impact the sensitive rare plant and/or old growth areas. The existing loop trail that runs across the north part of the GTF is suitable for use and enhancement as needed (i.e. water bars, gravel additions, brushing out, periodic relocations if eroded, etc.). A careful assessment of suitability for mountain biking should be conducted, however, as it was evident that unauthorized use by trail-creators and mountain bikers was already a concern.
6) **Further inventories of rare plants and the designation of exemplary natural areas should be a part of long-term planning for the forest –** aside from the known rare natural communities and old growth stands, there is a high likelihood that other rare species could occur. The presence of several S3 plant species (e.g. *Carex albicans var. albicans, Elymus hystrix var. hystrix,* and *Elymus trachycaulus ssp. trachycaulus*) suggests that other rare, calciphilic plants likely occur on the GTF. The near absence of invasive plant species (only a few coltsfoot and glossy buckthorn were seen along Goose Pond Road) suggests that this site has retained a great deal of integrity in spite of alterations of nearby forests and woodlands. Taking a closer look at the upper steep slopes with semi-rich to rich site characteristics would yield valuable information about long-term management of these areas.

In sum, the findings of this REA suggest that the town of Hanover owns an incredible "jewel" of natural resources that should not be treated as a 'typical' town forest. The

high quality woodlands, its remoteness, rare species and natural communities, and contribution to the largest unfragmented block of land in the town makes it of especial importance for the future. It is therefore hope of this author that the integrity of this landscape be properly valued and held in high regard for future generation to enjoy.

ACKNOWLEDGMENTS

The author would like to thank the Hanover Planning Department, specifically Vicki Smith, for her cooperation, patience, and dedication to the sound management of this town forest. He would also like to thank the Hanover Conservation Commission for their willingness to support an above-average inventory of town land, and especially to Jim Kennedy for his thoughtful advice and coordination of all things GIS. An additional debt of gratitude is due Jeff Smith of Butternut Hollow Forestry for his gracious support of all maps and management plan documents that made this assessment much easier.

Jim Kennedy with a four-legged pal on the Goodwin Town Forest

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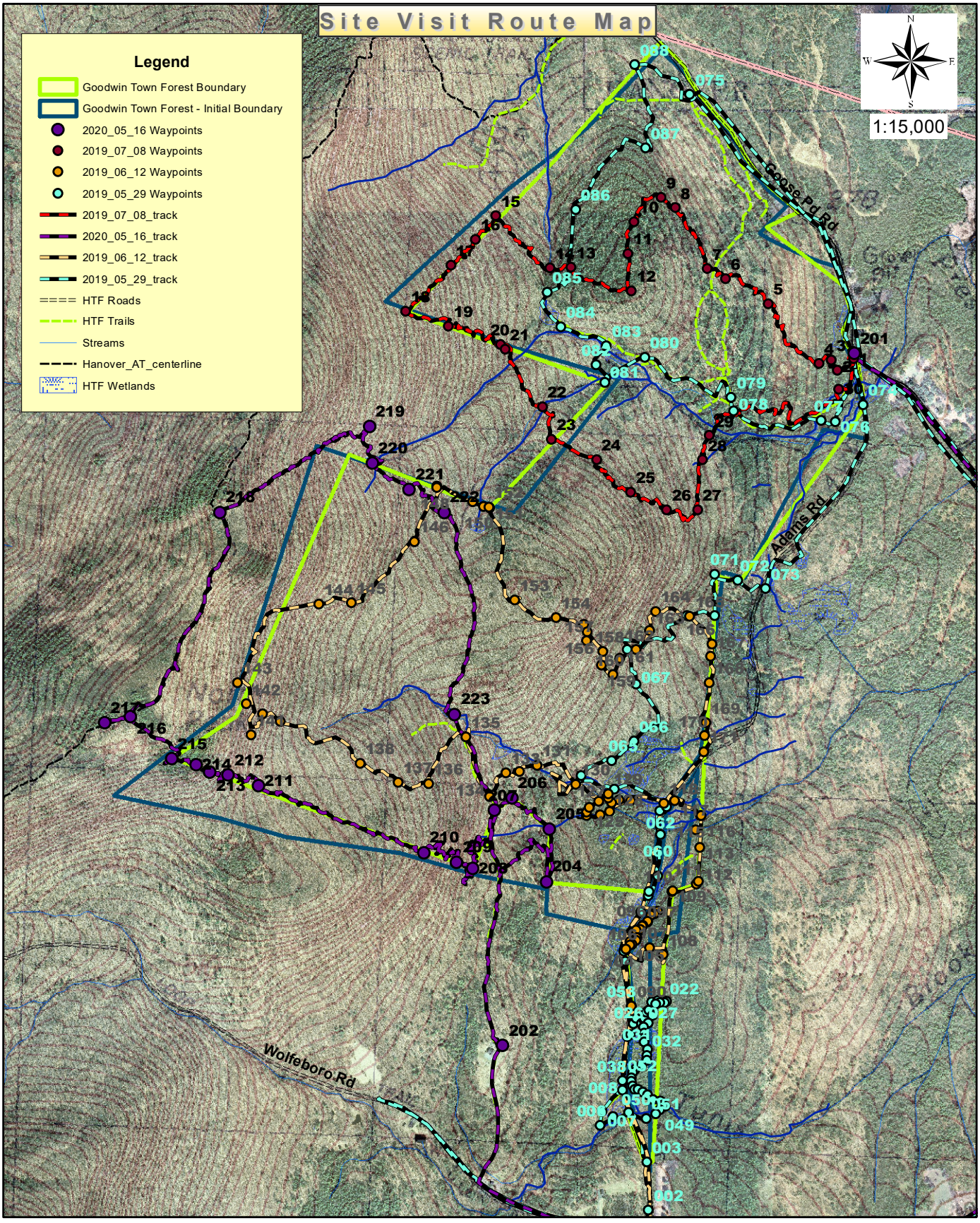
Appendix A

List of Maps

Hanover Town Forest

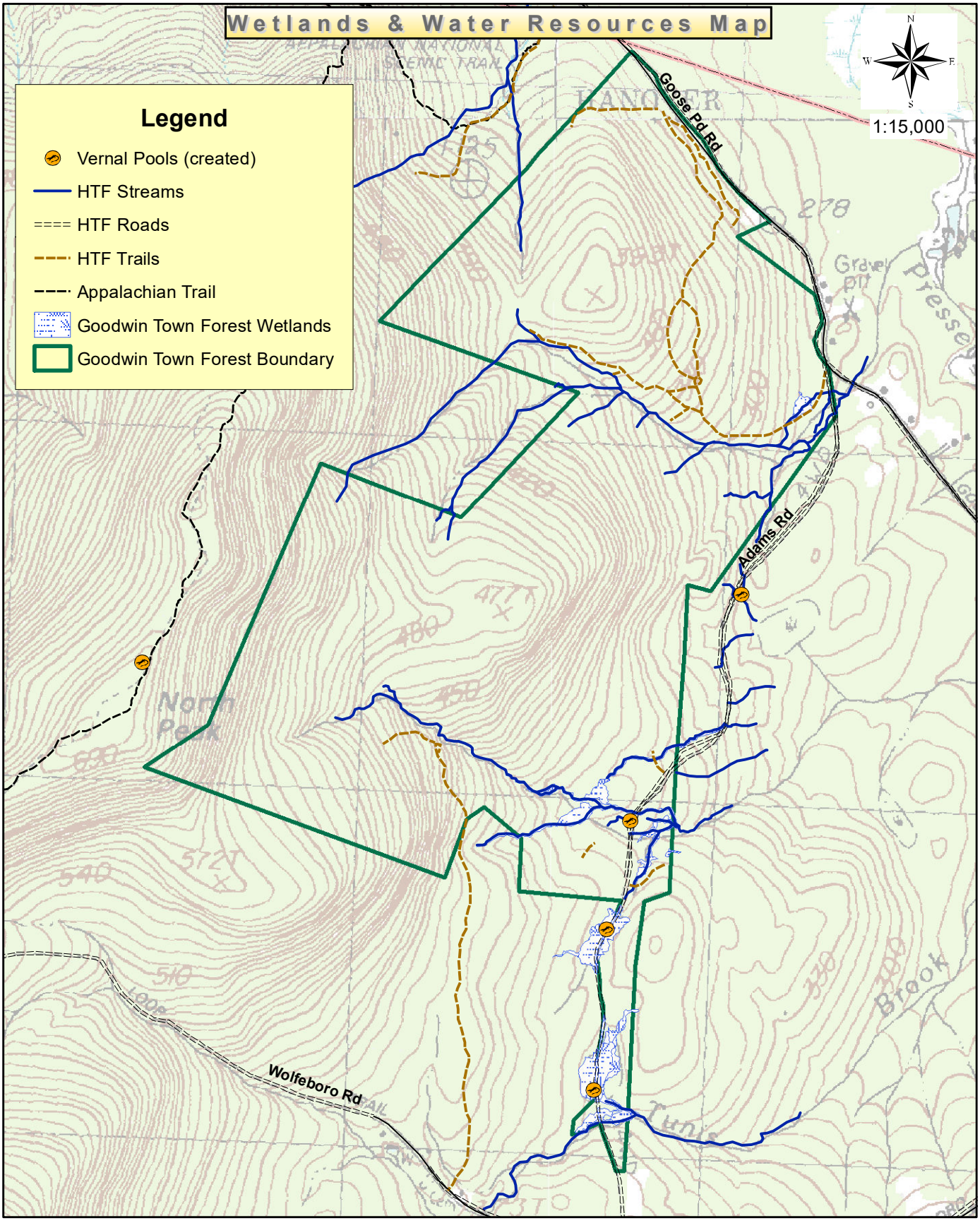
Site Visit Route Map



VdP/EMC July 2020

Hanover Town Forest

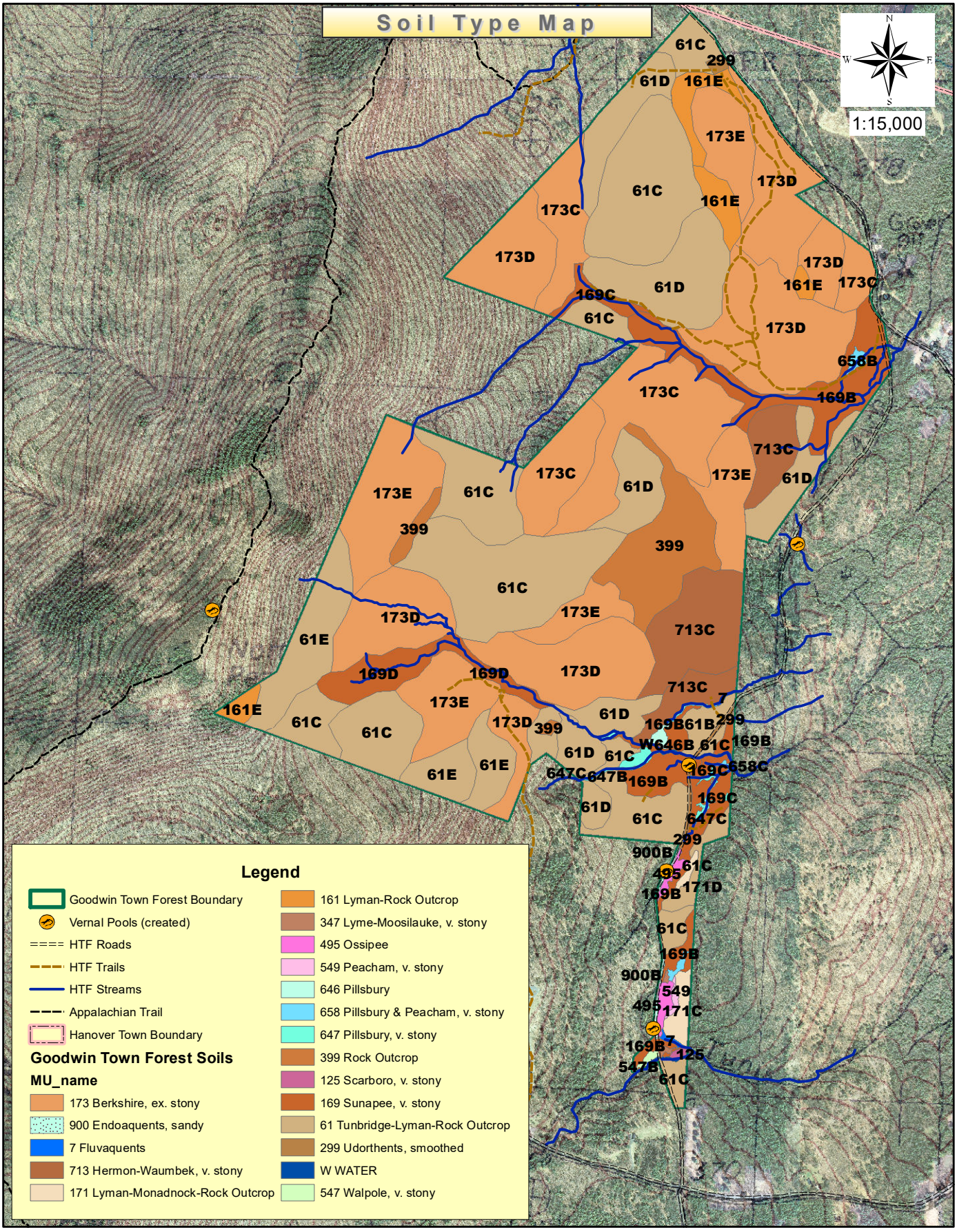
Wetlands & Water Resources Map



VdP/EMC July 2020

Hanover Town Forest

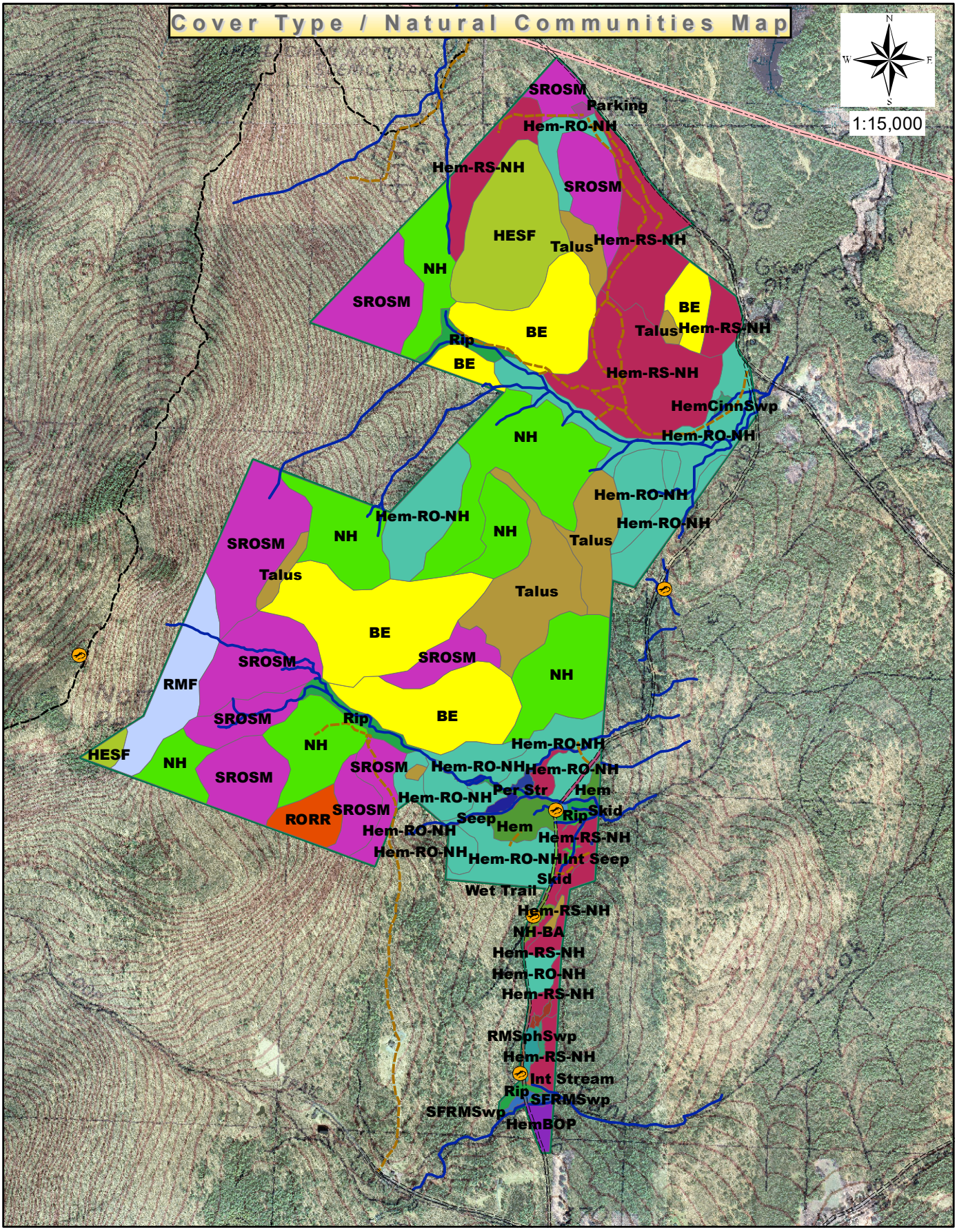
Soil Type Map



VdP/EMC July 2020

Hanover Town Forest

Cover Type / Natural Communities Map



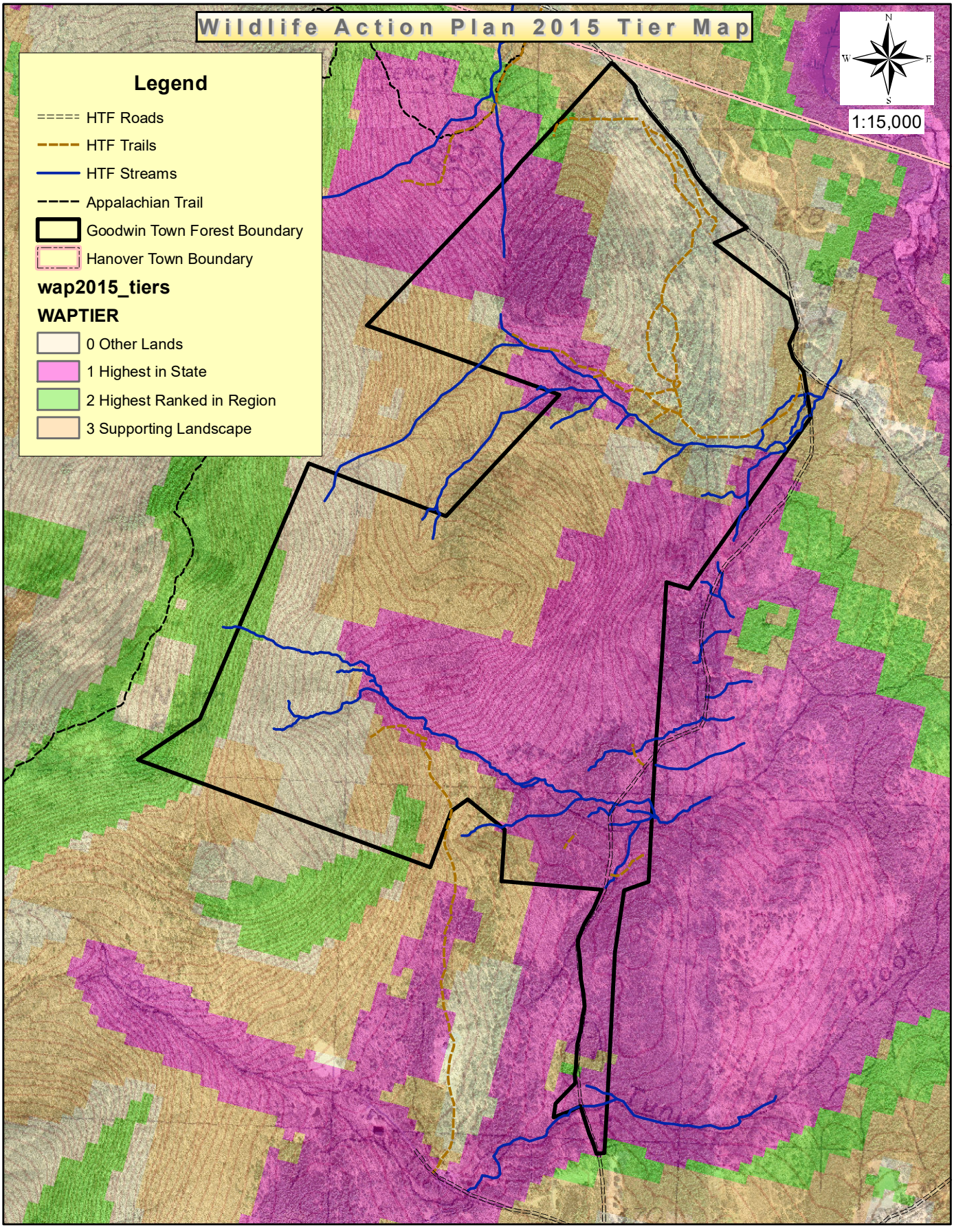
1,200 600 0 1,200 Meters

VdP/EMC July 2020

Hanover Town Forest

Cover Type / Natural Communities Legend

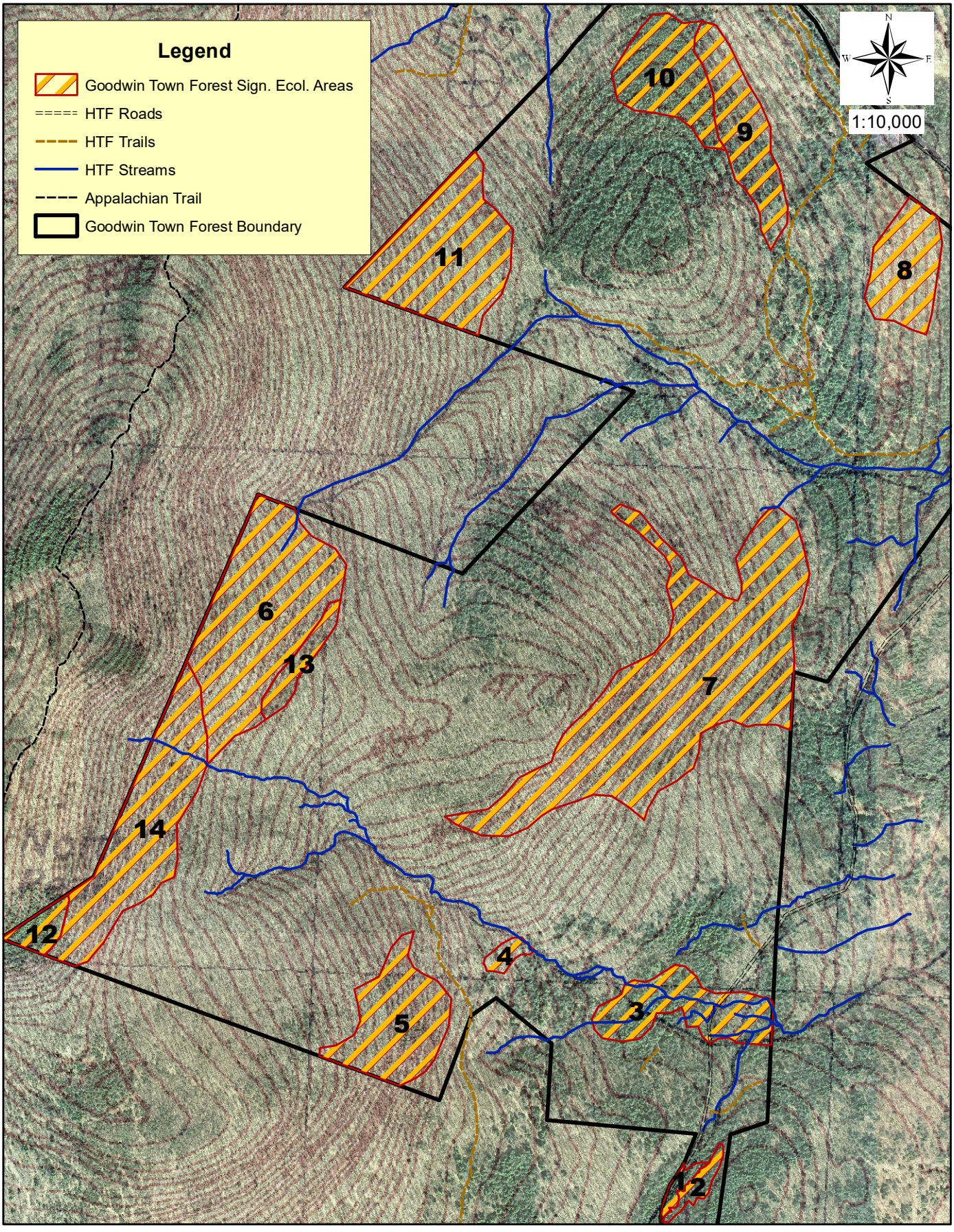
Hanover Town Forest



VdP/EMC July 2020

Hanover Town Forest

Significant Ecological Areas Map



VdP/EMC July 2020

Hanover Town Forest

Significant Ecological Areas Table

Id	Name	Descrip	ACRES	Area
1	Black Ash-NH-Conifer Swamp	old growth seepage/basin swamp	0.7097	30916.920
2	YB-MM wdd talus, buffer	old growth talus slope/ledge	1.0866	47334.314
3	Riparian zone/seepage	lower stream braid & seepage area, cellar hole	7.6435	332954.29
4	Talus slope & cascades	small talus boulder extendiing to stream	0.8700	37898.133
5	Semi-rich old talus RO-NH	steep talus, rocky ridge, inoperable	9.3600	407723.99
6	Semi-rich NH-RO Forest	late succ. & old growth, steep talus common	19.522	850416.18
7	Semi-rich OG forest/wdd talus	Late succ. to old growth semi-rich wds	37.957	1653411.7
8	Semi-rich Talus Forest/Wdld	YB-SM-RO-AB, some openings	6.6429	289365.11
9	Semi-rich YB-MM Wdd Talus	Inoperable, some enriched colluvium	7.6802	334551.33
10	High Elevation Spruce-Fir	Thin soils, some pine, uncut area	7.7263	336561.00
11	Semi-rich RO-SM Forest	Steep, many ledges & talus areas	14.429	628570.21
12	High Elevation Spruce-Fir For.	late successional forest/woodland	1.6971	73926.381
13	Semi-rich Wooded Talus	old growth trees, steep talus	2.1215	92414.146
14	Rich Mesic Forest	rare plants & old growth, steep talus	15.176	661101.35

Appendix B.

Species Lists

GOODWIN TOWN FOREST MAMMAL SPECIES LIST
(Including Hypothetical Species)

Scientific Name	Common Name	Observational Sign
MAMMALS	(Taxonomy follows Zoological Record Volume 134)	
Marsupiala – Didelphidae		
Didelphis virginiana	Opossum	reported for the area
Artiodactyla - Cervidae		
Alces alces	Moose	track, barking, scat
Odocoileus virginianus	White-tailed deer	sighting, track, browse, scat, scrape
Carnivora - Canidae		
Canis latrans sp.	Eastern coyote	howls, track, scat
Vulpes vulpes	Red fox	track, scat
Urocyon cinereoargenteus	Gray fox	rep. for area
Carnivora - Felidae		
Lynx rufus	Bobcat	claw marks, track
Carnivora - Mustelidae		
Mustela erminea	Ermine or Short-tailed weasel	scat
Mustela frenata	Long-tailed weasel	track, scat
Mustela pennanti	Fisher	scat
Mustela vison	Mink	reported for area
Lutra canadensis	River Otter	reported for area
Mephitis mephitis	Striped Skunk	track, odor
Carnivora - Procyonidae		
Procyon lotor	Raccoon	track, scat, claw marks
Carnivora - Ursidae		
Ursus americanus	Black bear	track, bite & claw marks, excavation, trail, ‘nests’
Insectivora - Soricidae		
Sorex cinereus	Masked shrew	tunnels
Blarina brevicauda	Short-tailed shrew	odor, tunnels
Insectivora - Talpidae		

Parascalops breweri	Hairy-tailed mole	tunnels & mounds
Chondylura cristata	Star-nosed mole	tunnels & mounds

Lagomorpha - Leporidae

Lepus americanus	Snowshoe hare	browse, scat

Rodentia – Castoridae

Castor canadensis	beaver	old browse

Rodentia - Erethizontidae

Erethizon dorsatum	Porcupine	sighting, carcass, track, browse, scat

Rodentia - Muridae

Clethrionomys g. gapperi	Red-backed vole	tunnels, scat
Peromyscus maniculatus	Deer mouse	scat, tunnels, chews
Microtus pennsylvanicus	Meadow vole	reported for area
Microtus pinetorum	Pine vole	(hypothetical)
Zapus hudsonicus	Meadow jumping mouse	(hypothetical)
Napeozapus insignis	Woodland jumping mouse	(hypothetical)
Ondatra zibethicus	Muskrat	observed nearby

Rodentia - Sciuridae

Glaucomys spp.	Flying squirrel	nest, cavities, chew marks on acorns
Tamias striatus	Eastern chipmunk	sighting, track, chew marks, tunnels
Tamiasciurus hudsonicus	Red squirrel	sighting, track, chew marks, tunnels
Sciurus carolinensis	Gray squirrel	sighting, drey, claw marks

Chiroptera

Myotis ludovicianus	Little brown bat	(hypothetical)
Eptesicus fuscus	Big brown bat	(hypothetical)

TOTAL SPECIES: 25 observed, 3 reported for area, 6 hypothetical

SPECIES LIST: AMPHIBIANS, REPTILES & FISHES
Of the MINK BROOK HIGHLANDS AREA, Hanover, NH
(Including Hypothetical Species)

July 2008 – June 2009

Code	Scientific Name	Common Name	Obs. Type
Am	Ambystoma maculatum	spotted salamander	eggs, larvae, adults (reported)
Nv	Notophthalmus viridescens	red-spotted newt	juveniles, adults
Df	Desmognathus fuscus	northern dusky salamander	juvenile
Eb	Eurycea bislineata	northern two-lined salamander	adults
Gp	Gyrinophilus porphyriticus	stream salamander	(hypothetical)
Pci	Plethodon cinereus	redback salamander	adults
Ba	Bufo americanus	eastern American toad	juveniles, adults
Hv	Hyla versicolor	gray treefrog	adults
Pcr	Pseudacris crucifer	northern spring peeper	adults
Rca	Rana catesbeiana	bullfrog	tadpoles, adults
Rcl	Rana clamitans	green frog	adults
Rs	Rana sylvatica	wood frog	juveniles, adults
Rp	Rana palustris	pickerel frog	adult
Css	Chelydra serpentina	snapping turtle	(reported)
Cpp	Chrysemmys picta picta	eastern painted turtle	(reported)
Gi	Glyptemys insculpta	wood turtle	9-yr old female found
Ns	Nerodia sipedon sipedon	northern water snake	(hypothetical)
Ts	Thamnophis sirtalis sirtalis	eastern garter snake	adult
Ov	Opheodrys vernalis vernalis	smooth green snake	(hypothetical)
Sf	Salvelinus fontinalis	eastern brook trout	(reported)
Cco	Catostomus commersoni	white sucker	(hypothetical)
Sco	Semotilus corporalis	fallfish or roach	(hypothetical)
Ra	Rhinichthys atratulus	blacknose dace	adults
Rc	Rhinichthys cataractae	longnose dace	adults

TOTAL SPECIES: **Amphibians: 12 + 6 hypothetical**
Reptiles: 4 + 2 hypothetical
Fish: 3 + 2 hypothetical

GOODWIN TOWN FOREST BIRD SPECIES TALLY BY DATE										
	5/29/19	6/12/19	7/8/19	5/16/20		TOTALS			List by Rel. Frequency	
					Count	Sum	Rel. Freq		SPECIES	REL. FREQ
COLO					0	0	**0.00**		OVEN	**15.09**
RTLO					0	0	**0.00**		REVI	**13.84**
PBGR					0	0	**0.00**		BTBW	**6.29**
HOGR					0	0	**0.00**		YBSA	**5.66**
RNGR					0	0	**0.00**		HETH	**5.66**
DCCO					0	0	**0.00**		BTGW	**5.66**
AMBI					0	0	**0.00**		WIWR	**4.40**
GBHE					0	0	**0.00**		MYWA	**4.40**
GREG					0	0	**0.00**		BLJA	**3.77**
GRHE					0	0	**0.00**		BCCH	**3.77**
BCNH					0	0	**0.00**		RBNU	**3.14**
SNGO					0	0	**0.00**		SCTA	**3.14**
CAGO					0	0	**0.00**		EAWP	**2.52**
ATBR					0	0	**0.00**		BHVI	**2.52**
WODU					0	0	**0.00**		DOWO	**1.89**
ABDU					0	0	**0.00**		HAWO	**1.89**
MALL					0	0	**0.00**		NOWA	**1.89**
BWTE					0	0	**0.00**		SCJU	**1.89**
AGWT					0	0	**0.00**		WBNU	**1.26**
RNDU					0	0	**0.00**		BRCR	**1.26**
BLSC					0	0	**0.00**		NAWA	**1.26**
SUSC					0	0	**0.00**		BLAC	**1.26**
WWSC					0	0	**0.00**		AMGO	**1.26**
BUFF					0	0	**0.00**		BWHA	**0.63**
COGO					0	0	**0.00**		RUGR	**0.63**
HOME					0	0	**0.00**		CHSW	**0.63**
COME					0	0	**0.00**		SWTH	**0.63**
TUVU					0	0	**0.00**		AMRO	**0.63**
OSPR					0	0	**0.00**		NOPA	**0.63**
BAEA					0	0	**0.00**		BLAW	**0.63**
NOHA					0	0	**0.00**		CAWA	**0.63**
SSHA					0	0	**0.00**		RBGR	**0.63**
COHA					0	0	**0.00**		PUFI	**0.63**
NOGO					0	0	**0.00**		COLO	**0.00**
RSHA					0	0	**0.00**		RTLO	**0.00**
BWHA				1	1	1	**0.63**		PBGR	**0.00**
RTHA					0	0	**0.00**		HOGR	**0.00**
AMKE					0	0	**0.00**		RNGR	**0.00**
MERL					0	0	**0.00**		DCCO	**0.00**
PEFA					0	0	**0.00**		AMBI	**0.00**
RUGR		1			1	1	**0.63**		GBHE	**0.00**
WITU					0	0	**0.00**		GREG	**0.00**
VIRA					0	0	**0.00**		GRHE	**0.00**
SORA					0	0	**0.00**		BCNH	**0.00**
AMCO					0	0	**0.00**		SNGO	**0.00**
BBPL					0	0	**0.00**		CAGO	**0.00**
KILL					0	0	**0.00**		ATBR	**0.00**
GRYE					0	0	**0.00**		WODU	**0.00**
SOSA					0	0	**0.00**		ABDU	**0.00**
SPSA					0	0	**0.00**		MALL	**0.00**
SESA					0	0	**0.00**		BWTE	**0.00**
LESA					0	0	**0.00**		AGWT	**0.00**

GOODWIN TOWN FOREST BIRD SPECIES TALLY BY DATE										
	5/29/19	6/12/19	7/8/19	5/16/20		TOTALS			List by Rel. Frequency	
					Count	Sum	Rel. Freq		SPECIES	REL. FREQ
SBDO					0	0	**0.00**		RNDU	**0.00**
COSN					0	0	**0.00**		BLSC	**0.00**
AMWO					0	0	**0.00**		SUSC	**0.00**
BOGU					0	0	**0.00**		WWSC	**0.00**
RBGU					0	0	**0.00**		BUFF	**0.00**
HEGU					0	0	**0.00**		COGO	**0.00**
GBBG					0	0	**0.00**		HOME	**0.00**
COTE					0	0	**0.00**		COME	**0.00**
BLTE					0	0	**0.00**		TUVU	**0.00**
RODO					0	0	**0.00**		OSPR	**0.00**
MODO					0	0	**0.00**		BAEA	**0.00**
BBCU					0	0	**0.00**		NOHA	**0.00**
YBCU					0	0	**0.00**		SSHA	**0.00**
BANO					0	0	**0.00**		COHA	**0.00**
EASO					0	0	**0.00**		NOGO	**0.00**
GHOW					0	0	**0.00**		RSHA	**0.00**
BAOW					0	0	**0.00**		RTHA	**0.00**
NSWO					0	0	**0.00**		AMKE	**0.00**
CONI					0	0	**0.00**		MERL	**0.00**
WPWI					0	0	**0.00**		PEFA	**0.00**
CHSW				1	1	1	**0.63**		WITU	**0.00**
RTHU					0	0	**0.00**		VIRA	**0.00**
BEKI					0	0	**0.00**		SORA	**0.00**
RBWO					0	0	**0.00**		AMCO	**0.00**
YBSA	3		4	2	3	9	**5.66**		BBPL	**0.00**
DOWO		2		1	2	3	**1.89**		KILL	**0.00**
HAWO	1		1	1	3	3	**1.89**		GRYE	**0.00**
NOFL					0	0	**0.00**		SOSA	**0.00**
PIWO					0	0	**0.00**		SPSA	**0.00**
OSFL					0	0	**0.00**		SESA	**0.00**
EAWP	1	3			2	4	**2.52**		LESA	**0.00**
ALFL					0	0	**0.00**		SBDO	**0.00**
WIFL					0	0	**0.00**		COSN	**0.00**
LEFL					0	0	**0.00**		AMWO	**0.00**
EAPH					0	0	**0.00**		BOGU	**0.00**
GCFL					0	0	**0.00**		RBGU	**0.00**
EAKI					0	0	**0.00**		HEGU	**0.00**
HOLA					0	0	**0.00**		GBBG	**0.00**
NSHR					0	0	**0.00**		COTE	**0.00**
BHVI	1	1	1	1	4	4	**2.52**		BLTE	**0.00**
YTVI					0	0	**0.00**		RODO	**0.00**
WAVI					0	0	**0.00**		MODO	**0.00**
PHVI					0	0	**0.00**		BBCU	**0.00**
REVI	8	8	6		3	22	**13.84**		YBCU	**0.00**
BLJA	1	3		2	3	6	**3.77**		BANO	**0.00**
AMCR					0	0	**0.00**		EASO	**0.00**
CORA					0	0	**0.00**		GHOW	**0.00**
PUMA					0	0	**0.00**		BAOW	**0.00**
TRES					0	0	**0.00**		NSWO	**0.00**
NRWS					0	0	**0.00**		CONI	**0.00**
BANS					0	0	**0.00**		WPWI	**0.00**
CLSW					0	0	**0.00**		RTHU	**0.00**

GOODWIN TOWN FOREST BIRD SPECIES TALLY BY DATE										
	5/29/19	6/12/19	7/8/19	5/16/20		TOTALS			List by Rel. Frequency	
					Count	Sum	Rel. Freq		SPECIES	REL. FREQ
BARS					0	0	**0.00**		BEKI	**0.00**
BCCH	2	1		3	3	6	**3.77**		RBWO	**0.00**
BOCH					0	0	**0.00**		NOFL	**0.00**
ETTI					0	0	**0.00**		PIWO	**0.00**
RBNU	2	1		2	3	5	**3.14**		OSFL	**0.00**
WBNU				2	1	2	**1.26**		ALFL	**0.00**
BRCR	1	1			2	2	**1.26**		WIFL	**0.00**
CAWR					0	0	**0.00**		LEFL	**0.00**
HOWR					0	0	**0.00**		EAPH	**0.00**
WIWR		3	2	2	3	7	**4.40**		GCFL	**0.00**
GCKI					0	0	**0.00**		EAKI	**0.00**
RCKI					0	0	**0.00**		HOLA	**0.00**
BGGN					0	0	**0.00**		NSHR	**0.00**
EABL					0	0	**0.00**		YTVI	**0.00**
VEER					0	0	**0.00**		WAVI	**0.00**
BITH					0	0	**0.00**		PHVI	**0.00**
SWTH	1				1	1	**0.63**		AMCR	**0.00**
HETH	1	2	5	1	4	9	**5.66**		CORA	**0.00**
WOTH					0	0	**0.00**		PUMA	**0.00**
AMRO	1				1	1	**0.63**		TRES	**0.00**
GRCA					0	0	**0.00**		NRWS	**0.00**
NOMO					0	0	**0.00**		BANS	**0.00**
BRTH					0	0	**0.00**		CLSW	**0.00**
EUST					0	0	**0.00**		BARS	**0.00**
AMPI					0	0	**0.00**		BOCH	**0.00**
CEWA					0	0	**0.00**		ETTI	**0.00**
BOWA					0	0	**0.00**		CAWR	**0.00**
BWWA					0	0	**0.00**		HOWR	**0.00**
TEWA					0	0	**0.00**		GCKI	**0.00**
NAWA	2				1	2	**1.26**		RCKI	**0.00**
NOPA	1				1	1	**0.63**		BGGN	**0.00**
YEWA					0	0	**0.00**		EABL	**0.00**
CSWA					0	0	**0.00**		VEER	**0.00**
MAWA					0	0	**0.00**		BITH	**0.00**
CMWA					0	0	**0.00**		WOTH	**0.00**
BTBW	2	1	3	4	4	10	**6.29**		GRCA	**0.00**
MYWA	2		1	4	3	7	**4.40**		NOMO	**0.00**
BTGW	3	5	1		3	9	**5.66**		BRTH	**0.00**
BLAC	1		1		2	2	**1.26**		EUST	**0.00**
PIWA					0	0	**0.00**		AMPI	**0.00**
PRWA					0	0	**0.00**		CEWA	**0.00**
PAWA					0	0	**0.00**		BOWA	**0.00**
BBWA					0	0	**0.00**		BWWA	**0.00**
BLAW				1	1	1	**0.63**		TEWA	**0.00**
BAWW					0	0	**0.00**		YEWA	**0.00**
AMRE					0	0	**0.00**		CSWA	**0.00**
OVEN	6	7	3	8	4	24	**15.09**		MAWA	**0.00**
NOWA	2	1			2	3	**1.89**		CMWA	**0.00**
LOWA					0	0	**0.00**		PIWA	**0.00**
MOWA					0	0	**0.00**		PRWA	**0.00**
COYE					0	0	**0.00**		PAWA	**0.00**
WIWA					0	0	**0.00**		BBWA	**0.00**

GOODWIN TOWN FOREST BIRD SPECIES TALLY BY DATE										
	5/29/19	6/12/19	7/8/19	5/16/20		TOTALS			**List by Rel. Frequency**	
					Count	Sum	**Rel. Freq**		**SPECIES**	**REL. FREQ**
CAWA		1			1	1	**0.63**		BAWW	**0.00**
SCTA	1	2	1	1	4	5	**3.14**		AMRE	**0.00**
EATO					0	0	**0.00**		LOWA	**0.00**
ATSP					0	0	**0.00**		MOWA	**0.00**
CHSP					0	0	**0.00**		COYE	**0.00**
FISP					0	0	**0.00**		WIWA	**0.00**
VESP					0	0	**0.00**		EATO	**0.00**
SAVS					0	0	**0.00**		ATSP	**0.00**
GRSP					0	0	**0.00**		CHSP	**0.00**
FOSP					0	0	**0.00**		FISP	**0.00**
SOSP					0	0	**0.00**		VESP	**0.00**
LISP					0	0	**0.00**		SAVS	**0.00**
SWSP					0	0	**0.00**		GRSP	**0.00**
WTSP					0	0	**0.00**		FOSP	**0.00**
WCSP					0	0	**0.00**		SOSP	**0.00**
SCJU	1			2	2	3	**1.89**		LISP	**0.00**
LALO					0	0	**0.00**		SWSP	**0.00**
SNBU					0	0	**0.00**		WTSP	**0.00**
NOCA					0	0	**0.00**		WCSP	**0.00**
RBGR		1			1	1	**0.63**		LALO	**0.00**
INBU					0	0	**0.00**		SNBU	**0.00**
BOBO					0	0	**0.00**		NOCA	**0.00**
RWBL					0	0	**0.00**		INBU	**0.00**
EAME					0	0	**0.00**		BOBO	**0.00**
RUBL					0	0	**0.00**		RWBL	**0.00**
COGR					0	0	**0.00**		EAME	**0.00**
BHCO					0	0	**0.00**		RUBL	**0.00**
BAOR					0	0	**0.00**		COGR	**0.00**
PIGR					0	0	**0.00**		BHCO	**0.00**
PUFI				1	1	1	**0.63**		BAOR	**0.00**
HOFI					0	0	**0.00**		PIGR	**0.00**
RECR					0	0	**0.00**		HOFI	**0.00**
WWCR					0	0	**0.00**		RECR	**0.00**
CORE					0	0	**0.00**		WWCR	**0.00**
PISI					0	0	**0.00**		CORE	**0.00**
AMGO	1	1			2	2	**1.26**		PISI	**0.00**
EVGR					0	0	**0.00**		EVGR	**0.00**
HOSP					0	0	**0.00**		HOSP	**0.00**
Total # Spp.	23	19	12	19	**33**					
Total Freq.	45	45	29	40		**159**				
							100.00			

Appendix C

Slide Show of Preliminary Findings Given on July 10, 2019

HANOVER (GOODWIN) TOWN FOREST

Dr. Rick Van de Poll

Ecosystem Management Consultants

Sandwich NH

A LAND OF REMARKABLE RESOURCES

Goodwin Town Forest July 10, 2019

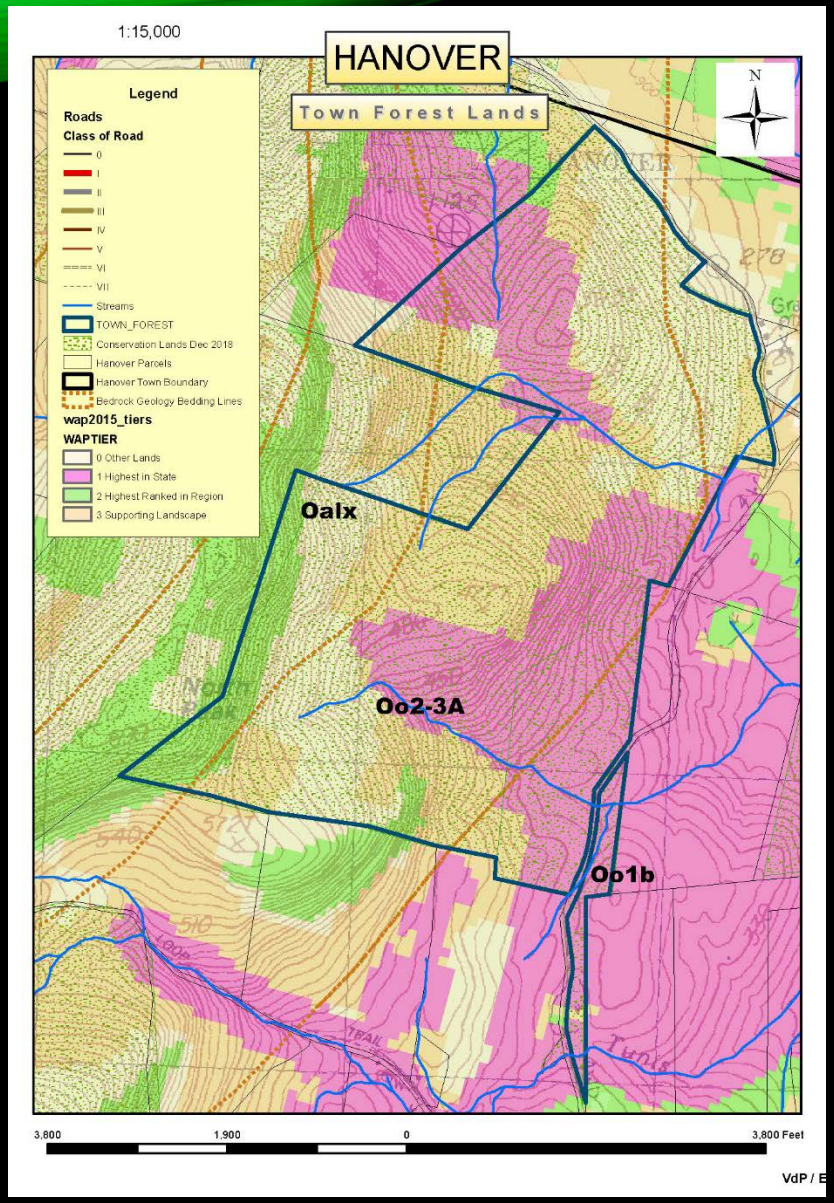
A LAND OF REMARKABLE RESOURCES

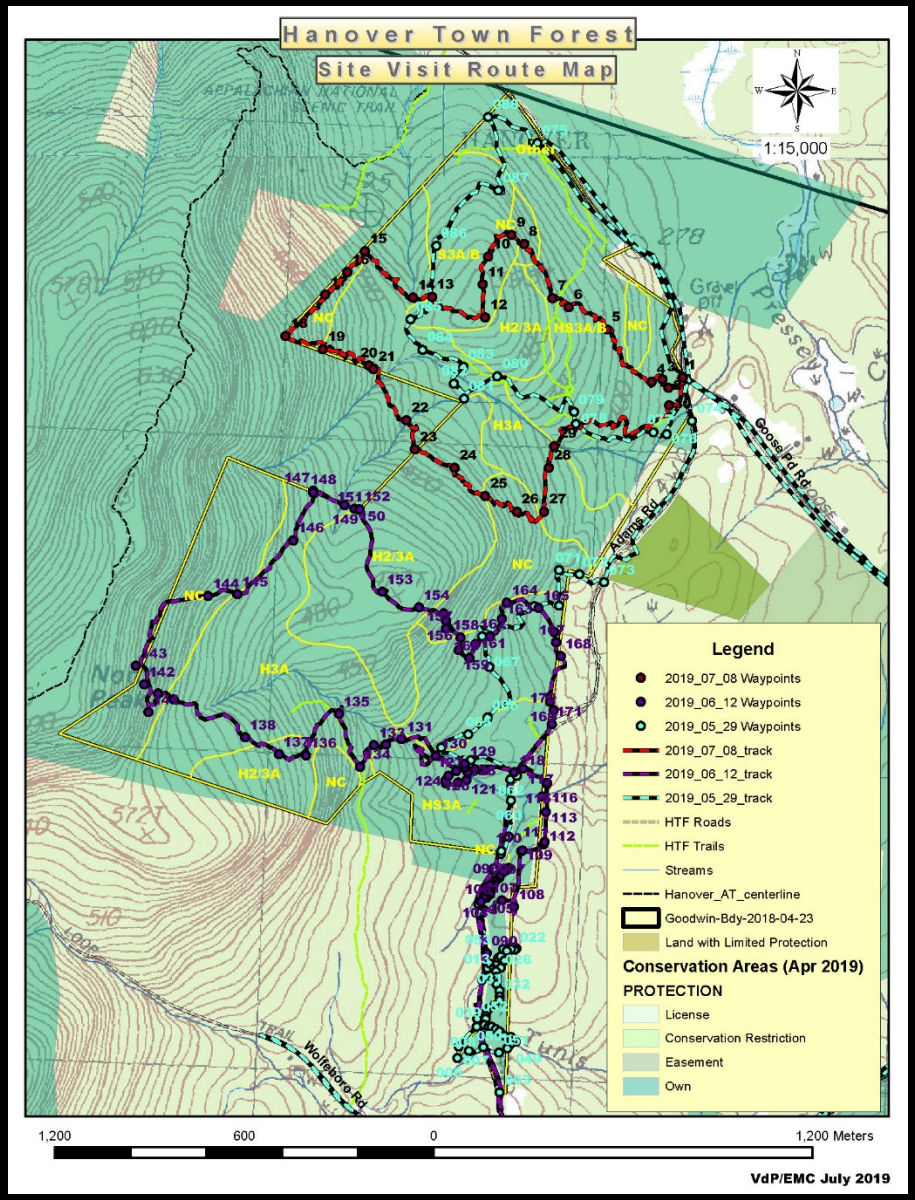
Goodwin Town Forest July 10, 2019

A LAND OF REMARKABLE RESOURCES

Goodwin Town Forest July 10, 2019

MAP REVIEW





Goodwin Town Forest July 10, 2019

REPORTS REVIEW

Brief report of field review of proposed mountain bike trail route through the Goodwin Town Forest, Hanover, NH

Date/time of visit: 18 May 2011 approx. 8:45am – 3:15pm

Botanical review by Alice Schori in consultation with & guided by John Taylor of UVTA

No State-listed rare, threatened or endangered plants were observed during this spring review of the outer flagged trail loop at Goodwin Town Forest. The presence of rare species that would appear later in the season cannot be ruled out by this visit but seems unlikely.

The only **invasive alien species** seen was coltsfoot (*Tussilago farfara*), which is abundant in the wet log landing area adjacent to Goose Pond Road. Since this population is not affecting a rare plant population, the considerable and sustained effort it would take to get rid of it is probably not worth the effort.

Two additional trail sections that parallel Goose Pond Road from the log landing to Tunis Road, and one further upslope and marked in blue on a field map, were not reviewed. Those trail sections are not proposed for work in 2011.

There were a few **suggested minor edits** of the trail to accommodate findings of rich soil indicator plant species [blue cohosh (*Caulophyllum thalictroides*), downy yellow violet (*Viola pubescens*), baneberry (*Actaea* sp.), and miterwort (*Mitella diphylla*)] and a moderate edit already proposed by UVMBA due to additional water crossings and rocky terrain on the eastern slope that had a higher incidence of moose sign suggesting a possible yarding area under hemlocks.

Additional observations:
Although no rare species were found, some of the rich soil indicator species are somewhat uncommon in New Hampshire, so it is nice to avoid going through patches of them, if possible.

There is a nice **diversity of habitats** in the areas traversed by the proposed trail, with mixed northern hardwoods, some at least semi-rich mesic forest with much sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghaniensis*), areas dominated by beech (*Fagus grandifolia*), hemlock (*Tsuga canadensis*) groves, younger areas dominated by white birch (*Betula papyrifera*) and striped maple (*Acer pensylvanicum*), some spruce-fir (*Picea rubens* and *Abies balsamea*) areas, and occasional red oak (*Quercus rubra*), white pine (*Pinus strobus*), and black cherry (*Prunus serotina*). Old stone walls, occasional rock outcrops, old snags, and the occasional fallen, hollow log add interest for visitors and habitat for various animals.

The forest has a **good variety of shrubs, wildflowers, and ferns**, so the trail should be of interest to pedestrians as well as bikers. Some of the species observed include:

Goodwin Town Forest July 10, 2019

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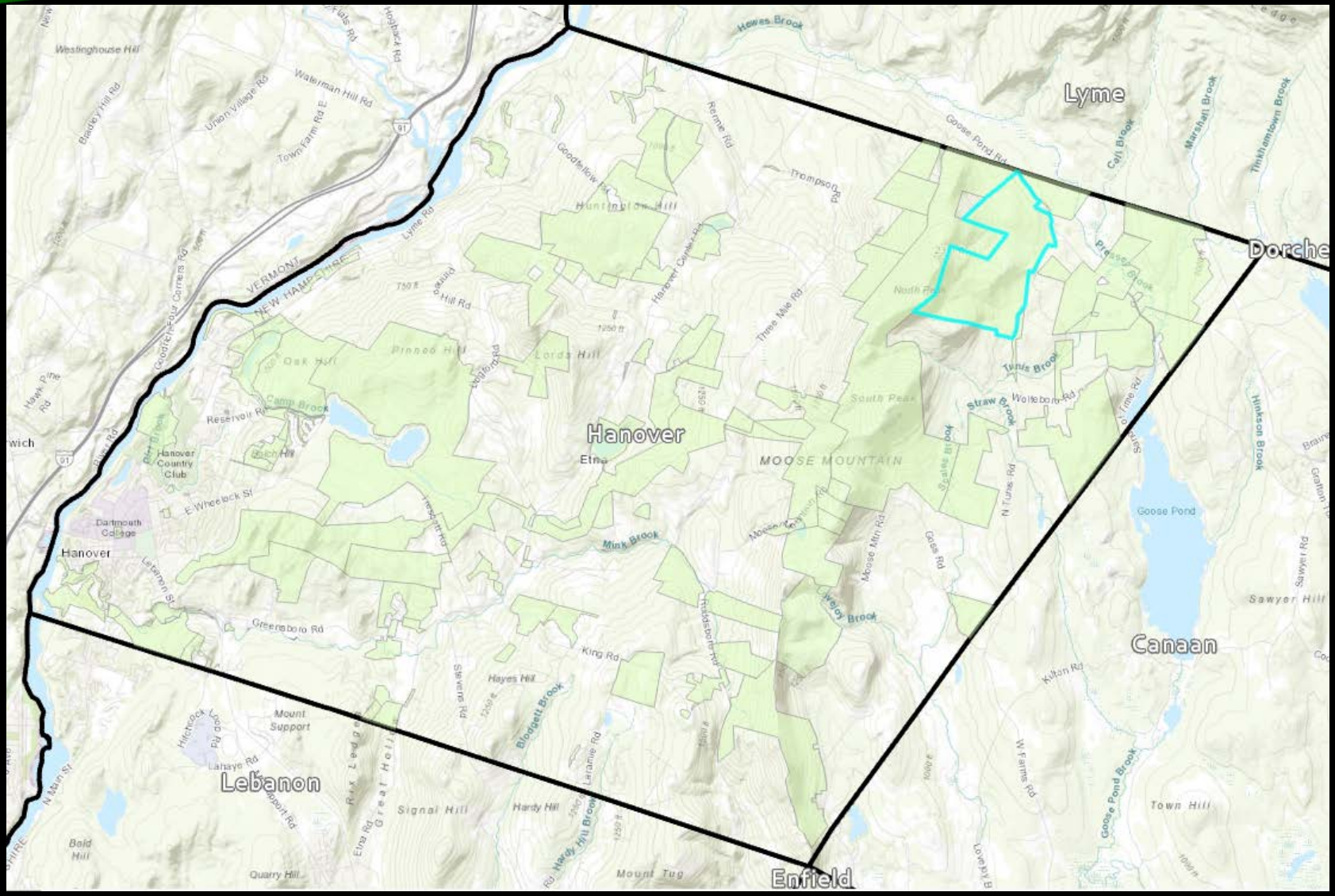
MAP PREPARATION



Goodwin Town Forest July 10, 2019

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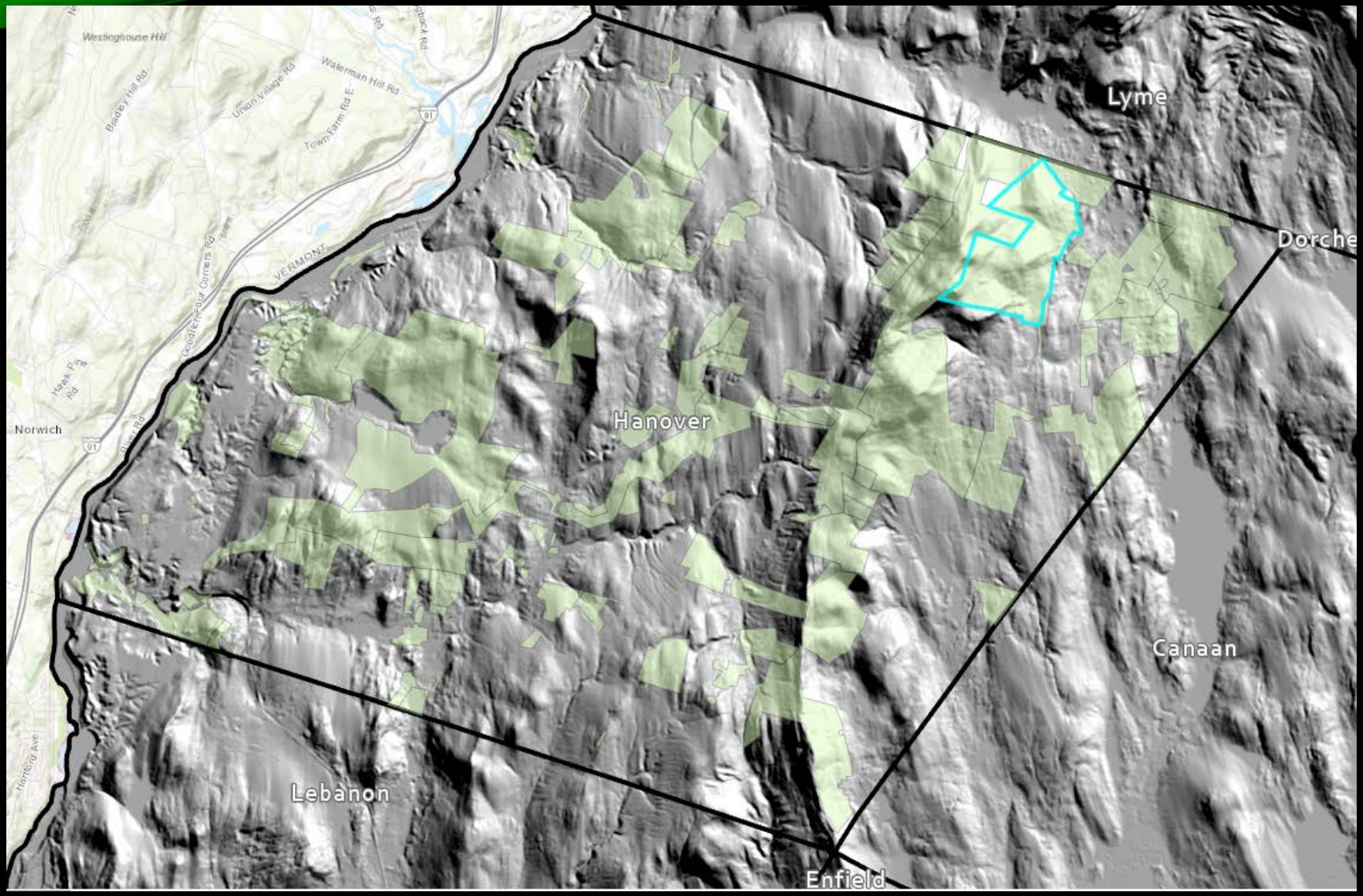

Goodwin Town Forest July 10, 2019

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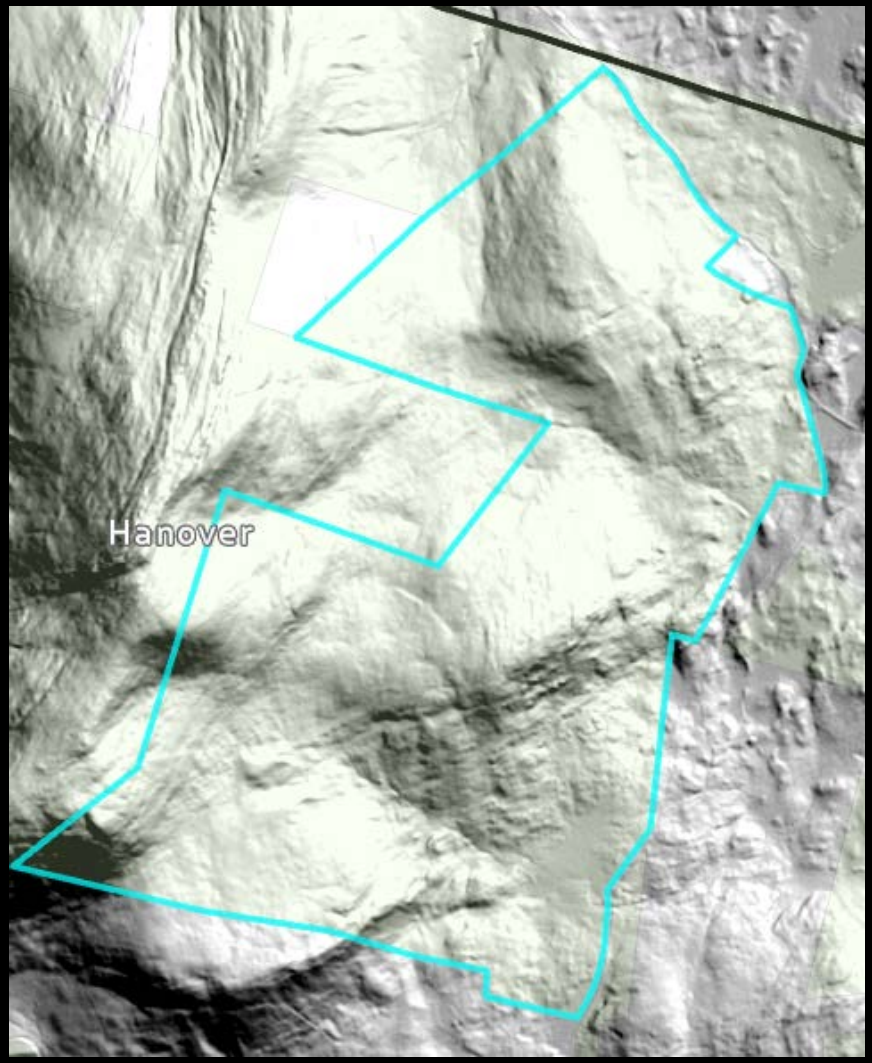
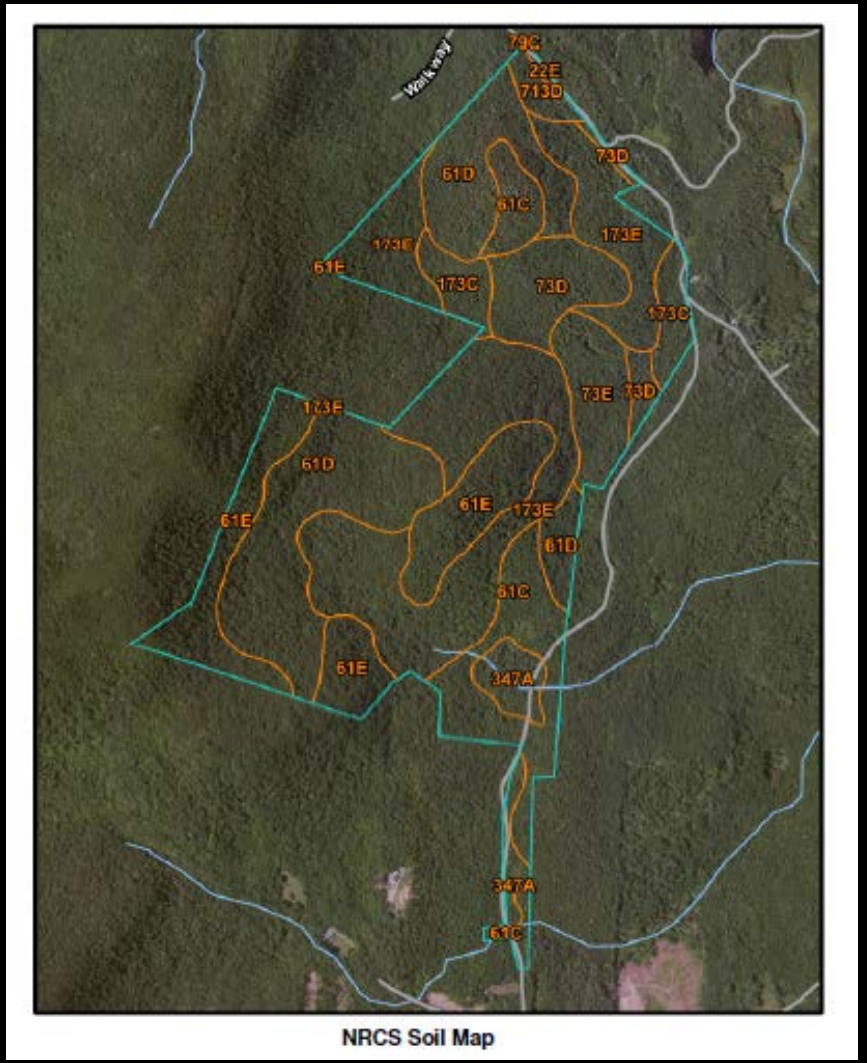
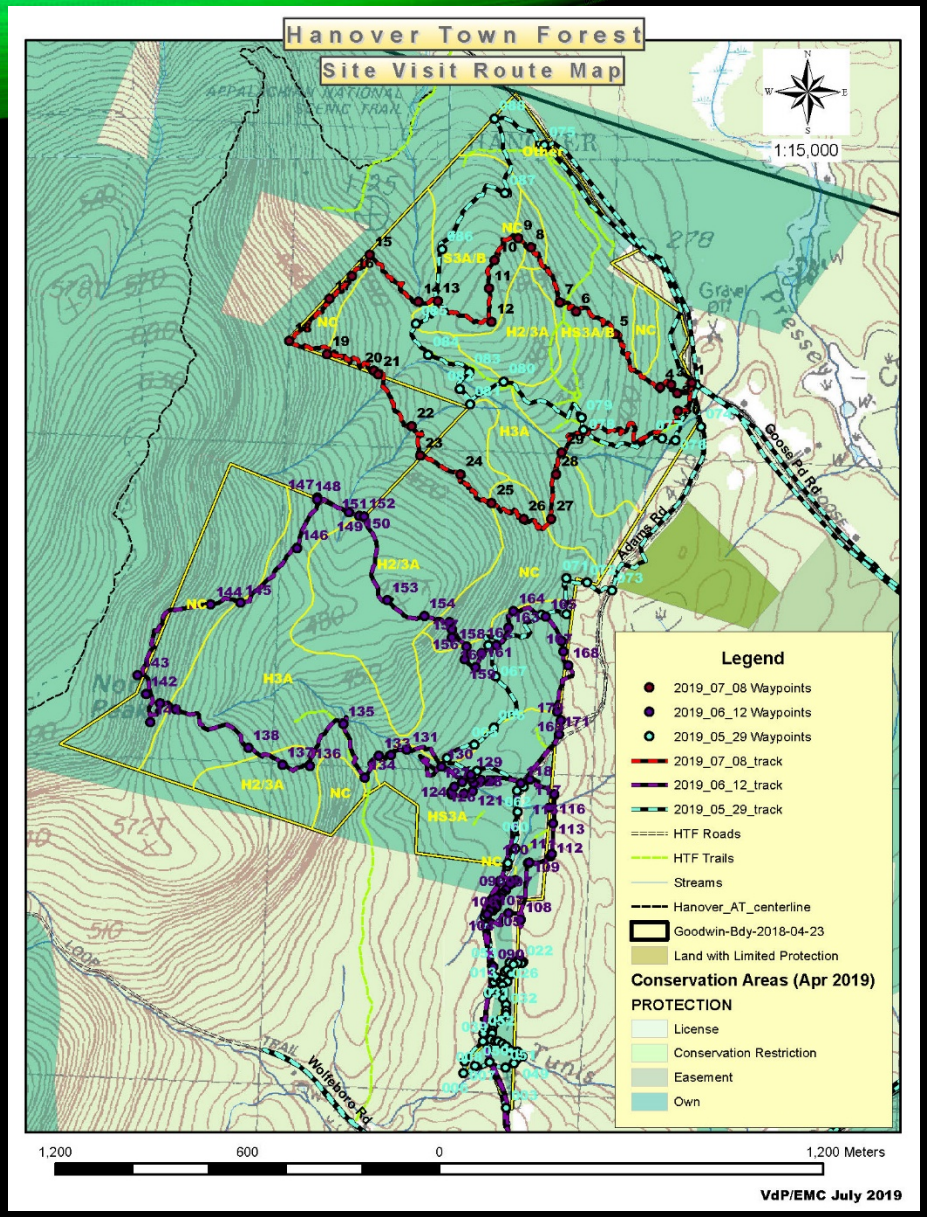




NRCS Soil Map



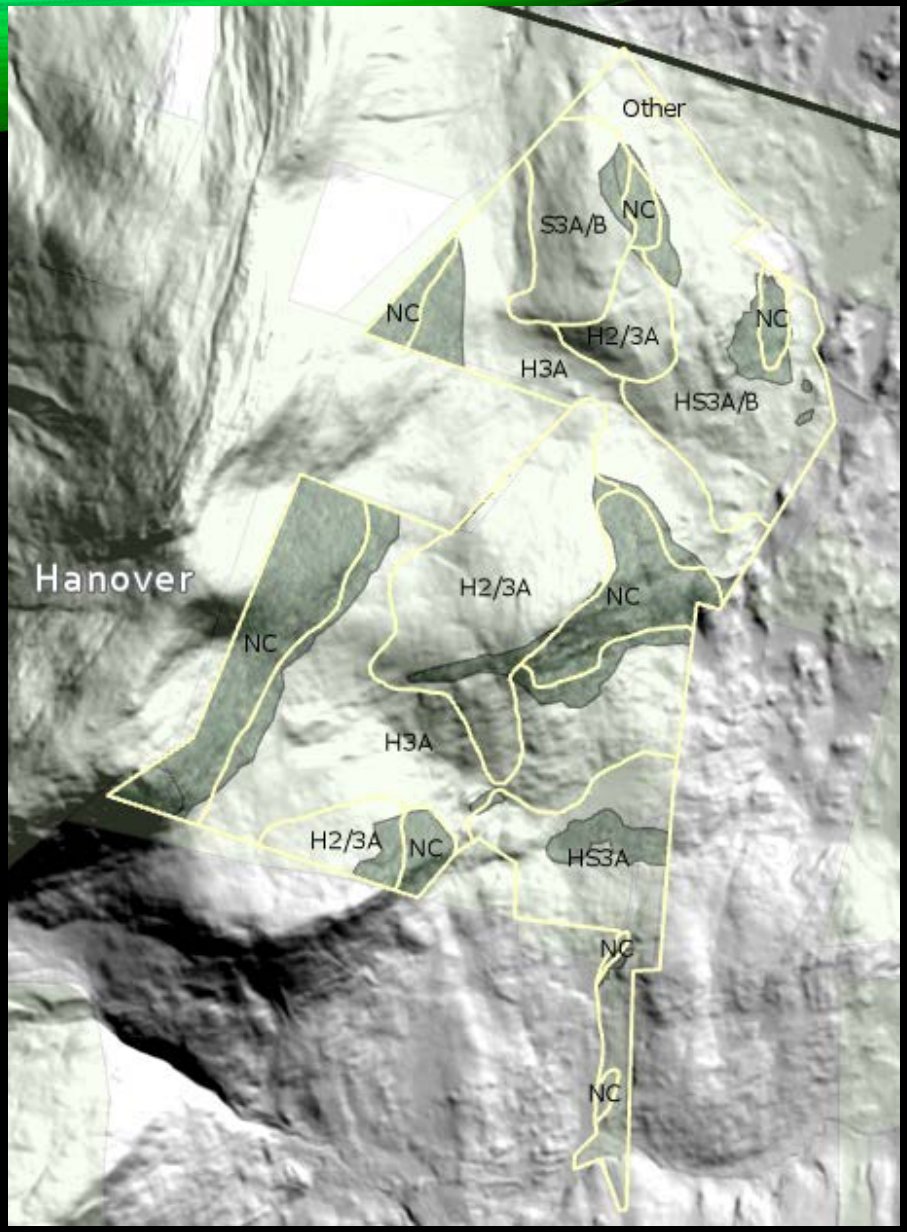
FIELD EFFORT

- Three site visit days
- All forest types visited
- Boundaries checked
- Old growth areas mapped
- Significant ecological areas surveyed/noted
- Trail/road access concerns studied

HIGHLIGHTS

- Non-commercial timber stands (NC) conformed somewhat with field evidence
- Most NC areas expanded
- Most SEA's included late successional or old growth features that are largely inoperable
- More wetlands defined

Goodwin Town Forest July 10, 2019



HIGHLIGHTS

- Non-commercial timber stands (NC) conformed somewhat with field evidence
- Most NC areas expanded (N=8, 95 ac. versus N=10, 145 c.)
- Most SEA's included late successional or old growth features that are largely inoperable
- More wetlands defined

HIGHLIGHTS

- Several created vernal pools found in Tunis Road
- Some rare plants found (S3 status – state watch)
- Exceptional wildlife habitat found for bear, bobcat, moose, deer
- Over 85 acres of old growth forest identified

WHAT IS A VERNAL POOL?

- Definition (General):

- Vernal Pools are temporary surface waters that are inundated in winter, typically dry up in summer, and support the breeding of specific vertebrate and invertebrate animals that require these conditions.

PRIMARY INDICATOR SPECIES

- Ambystomid Salamanders

Jefferson's-Blue Spotted Complex

ACKNOWLEDGMENTS

- Town of Hanover Conservation Commission
- Town of Hanover Planning Department
- Jim Kennedy, Forester, Wetland Scientist
- Jeff Smith, Forester
- Alice Schori, Botanist