FOREST and WILDLIFE MANAGEMENT PLAN

for the

GLEN OAKES CONSERVATION AREA

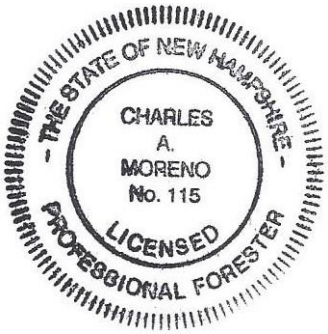
Fremont, New Hampshire

Prepared for:
The Fremont Conservation Commission

Prepared by:
Charles A. Moreno, LPF
Consulting Forester, Forest Ecologist

Moreno Forestry Associates
Center Strafford, New Hampshire
(603) 234-0444

Original Plan: December 2009. Updated Plan: May 31, 2018



Charles Moreno, LPF #115
Consulting Forester, Forest Ecologist

Report Copy # _____

FOREST and WILDLIFE MANAGEMENT PLAN

for the

GLEN OAKES CONSERVATION AREA

Fremont, New Hampshire

May 31, 2018

The author of this forest management plan, Charles A. Moreno, certifies that the contents of the plan, except where footnoted, but including all written material, maps (base information referenced), plan format and organization, are original to the author.

The purpose of this plan is to provide natural resources information and forest and wildlife management recommendations to the Fremont Conservation Commission, citizens of Fremont, and others interested in the management of the Glen Oakes Conservation Area, Fremont, New Hampshire. Copying of this plan by any other individual or organization, including any written material, plan content and/or format, requires appropriate citation and/or the written permission of Charles A. Moreno, Consulting Forester. Any revisions to the plan cannot be made under the author's name without the author's written permission.

Contents

MAPS

Grid

0 1000 2000 3000 4000 ft

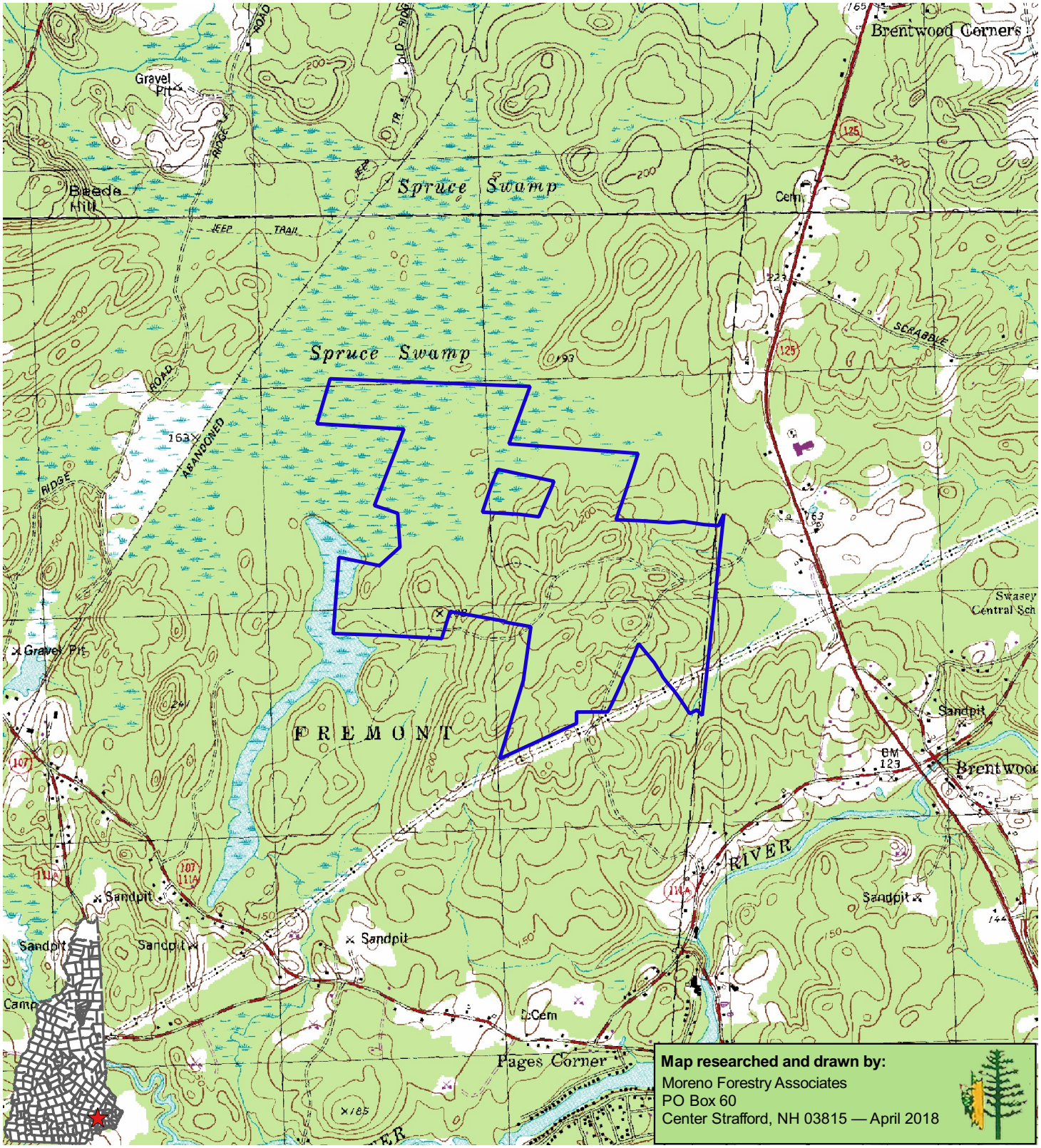
1:24,000

Parcel boundary information and USGS Topographic 1:24,000 dataset provided by NH GRANIT.

Locus Map *of the Town of Fremont's*

GLEN OAKES CONSERVATION AREA

Fremont, New Hampshire
387.9± Acres



Map researched and drawn by:
Moreno Forestry Associates
PO Box 60
Center Strafford, NH 03815 — April 2018

Map researched and drawn by:

Moreno Forestry Associates
PO Box 60
Center Strafford, NH 03815 — May 2018

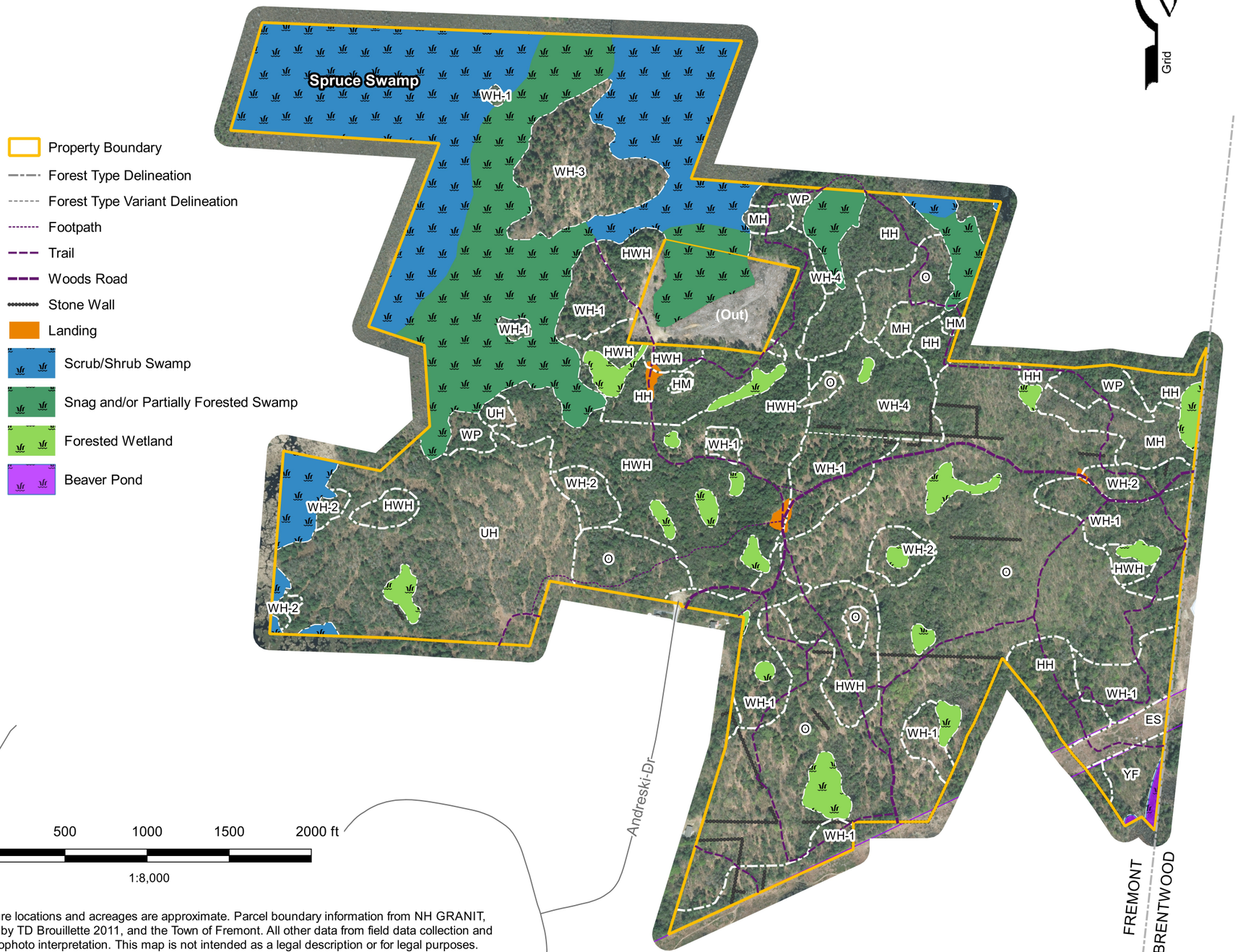
Map of the Town of Fremont's

GLEN OAKES CONSERVATION AREA

Fremont, New Hampshire
387.9± acres

Showing Forest Types

—Fremont Tax Map 2 Lot 156-2-1 &
Map 4 Lot 86—



- Property Boundary
- Forest Type Delineation
- Forest Type Variant Delineation
- Footpath
- Trail
- Woods Road
- Stone Wall
- Landing
- Scrub/Shrub Swamp
- Snag and/or Partially Forested Swamp
- Forested Wetland
- Beaver Pond

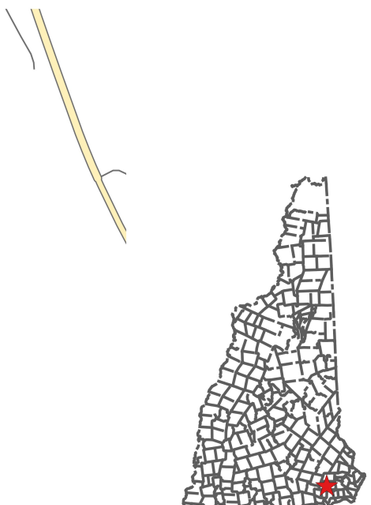
0 500 1000 1500 2000 ft

1:8,000

Feature locations and acreages are approximate. Parcel boundary information from NH GRANIT, survey by TD Brouillette 2011, and the Town of Fremont. All other data from field data collection and orthophoto interpretation. This map is not intended as a legal description or for legal purposes.

-- Forest Type Key --

		Acres
O	Oak	92.6±
UH	Upland Hardwood	37.7±
MH	Mixed Hardwood	7.7±
WP	White Pine	5.4±
WH	White Pine / Hardwood	63.1±
HWH	Hemlock / White Pine / Hardwood	46.7±
HH	Hemlock / Hardwood	21.9±
YF	Young Forest	2.4±
HM	Hemlock	0.8±
	Upland Forest	**278.2±**
	Scrub-Shrub Wetland	59.1±
	Forested Wetland	45.3±
	Landings	2.8±
ES	Early Successional Habitat	2.4±
	Wetland / Non-Forested	**109.6±**



Map researched and drawn by:
Moreno Forestry Associates
PO Box 60
Center Strafford, NH 03815 — May 2018

Map of the Town of Fremont's

GLEN OAKES CONSERVATION AREA

Fremont, New Hampshire
387.9± acres

Showing Physical and Natural Features

—Fremont Tax Map 2 Lot 156-2-1 &
Map 4 Lot 86—

Grid

- Property Boundary
- Woods Road
- Trail
- Footpath
- Boulder
- Cellar Hole
- Primitive Graveyard
- Culvert
- Significant Tree - Hardwood
- Significant Tree - Softwood
- Vernal Pool
- Well
- Landing
- Landing/Opening
- Town Boundary
- Stone Wall
- Stream
- Powerline Corridor (PSNH)
- Scrub/Shrub Swamp
- Snag and/or Partially Forested Swamp
- Forested Wetland
- Beaver Pond

Spruce Swamp
Out
Barred Owl Path
Forest Loop
Pike Trail
Link Trail
Homestead Trail
Woodland Trail
Andreski Dr
FREMONT
BRENTWOOD

Historical Interest Points

- *A* - Cleaved rock
- *B* - Westerly cellar hole
- *C* - Stone culvert
- *D* - Easterly cellar hole
- *E* - Old family cemetery
- *F* - Hand-dug stone well
- *G* - Possible remains of bog iron mining

Access Points

- *1* - Andreski Drive cul-de-sac; parking available
- *2* - Northeastern woods road entrance
- *3* - Southeastern entrance via power line
- *4* - Southern entrance via power line
- *5* - Northern entrance via SELT Garrison property

Significant Tree Index

1. Red oak, 22" DBH, next to old well
2. Black gum, 18"
3. Black gum, 17"
4. Red maple, 20", in wetland, old tree
5. Pair of large-crowned beeches
6. Black birch, 20"
7. Beech, 24", healthy
8. Beech, 24", healthy
9. Red maple, 20", old, w/ multiple burls
10. Sugar maple, 32"
11. Shagbark hickory, 25"
12. Sugar maple, 24"
13. Sugar maple, 34"
14. Sugar maple, 30", next to seep
15. White pine, 28", bowed
16. Yellow birch, 26"
17. Sugar maple, 28"
18. Red oak, 30", forked
19. Old big-toothed aspen with porcupine den
20. Grove of basswood, sugar maple, hophornbeam
21. Beech, 27"
22. White ash, 25"
23. White oak, 26" & red oak, 25", porcupine tree
24. White pine, 50" pasture pine
25. Black birch, 24", 140+ years old

Feature locations and acreages are approximate. Parcel boundary information from NH GRANIT, survey by TD Brouillette 2011, and the Town of Fremont. All other data from field data collection and orthophoto interpretation. This map is not intended as a legal description or for legal purposes.

0 500 1000 1500 2000 ft

1:8,000

Map researched and drawn by:
Moreno Forestry Associates
PO Box 60
Center Strafford, NH 03815 — May 2018

Map of the Town of Fremont's

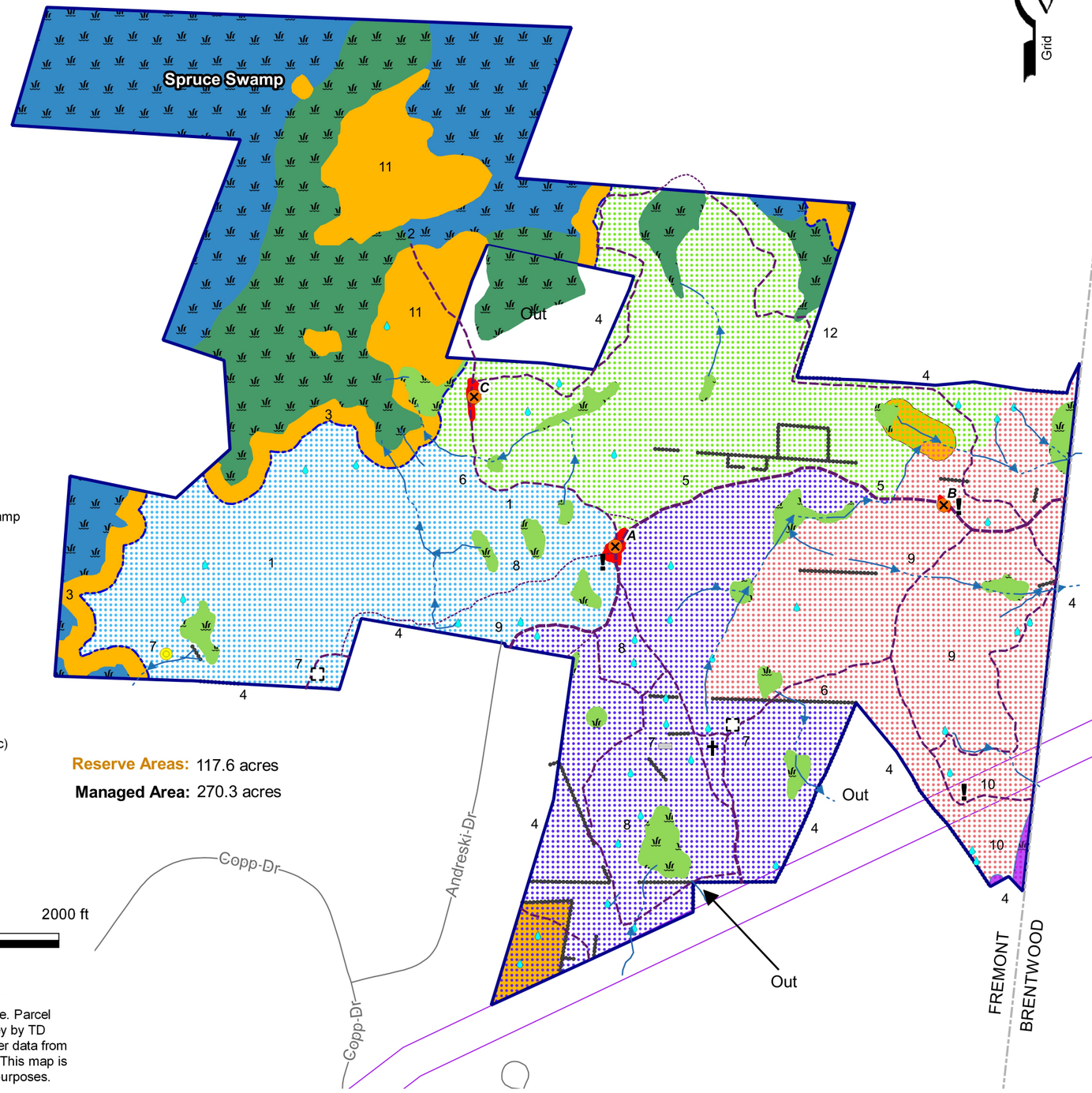
GLEN OAKES CONSERVATION AREA

Fremont, New Hampshire
387.9± acres

Showing Management Recommendations

—Fremont Tax Map 2 Lot 156-2-1 &
Map 4 Lot 86—

Grid



- Property Boundary
- Footpath
- Trail
- Woods Road
- Proposed Trail
- Invasive Species
- Cellar Hole
- Primitive Cemetery
- Old Stone Culvert
- Vernal Pool
- Well
- Landing
- Stone Wall
- Powerline Corridor
- Landing/Opening
- Reserve Areas
- Town Boundary
- Intermittent Stream
- Scrub/Shrub Swamp
- Snag and/or Partially Forested Swamp
- Forested Wetland
- Beaver Pond

Compartments

- 1 - West (65.6 ac)
- 2 - South (67.7 ac)
- 3 - East (67.0 ac)
- 4 - North (70.0 ac)
- 5 - Spruce Swamp & Reserve (117.6 ac)

Reserve Areas: 117.6 acres

Managed Area: 270.3 acres

0 500 1000 1500 2000 ft

1:8,000

Management Recommendations

1. Trail-less area for uninterrupted forest habitat.
2. Allow restoration of wetland conditions by abandoning former island crossing.
3. 100-foot "Prime Wetlands" buffer along Spruce Swamp.
4. Property boundary maintenance.
5. Minor road upgrade.
6. Maintain trail crossings on seasonal streams.
7. Protect historic features.
8. Vernal pool management.
9. Mast (wildlife food source) tree management.
10. Establish forest regeneration and/or early-successional growth.
11. Maintain as reserve area.
12. Proposed trail connection to adjacent SELT property.

Feature locations and acreages are approximate. Parcel boundary information from NH GRANIT, survey by TD Brouillette 2011, and the Town of Fremont. All other data from field data collection and orthophoto interpretation. This map is not intended as a legal description or for legal purposes.

Map researched and drawn by:
Moreno Forestry Associates
PO Box 60
Center Strafford, NH 03815 — May 2018

Map of the Town of Fremont's

GLEN OAKES CONSERVATION AREA

Fremont, New Hampshire
387.9± acres

Showing Habitat Types

—Fremont Tax Map 2 Lot 156-2-1 &
Map 4 Lot 86—

Grid

- Property Boundary
- Woods Road
- Trail
- Footpath
- Vernal Pool
- Landing/Opening
- Town Boundary
- Stone Wall
- Stream
- Powerline Corridor (PSNH)
- Scrub/Shrub Swamp
- Snag and/or Partially Forested Swamp
- Forested Wetland
- Beaver Pond

Core Habitats

- Dense softwood thermal cover habitat
- Early-successional and/or young forest habitat
- Major mast-production (acorn) habitat
- Transition softwood-hardwood habitat
- Vernal pool network area

Spruce Swamp

Out

Out

Out

NH-Route-125

Copp-Dr

Copp-Dr

Andreski-Dr

FREMONT

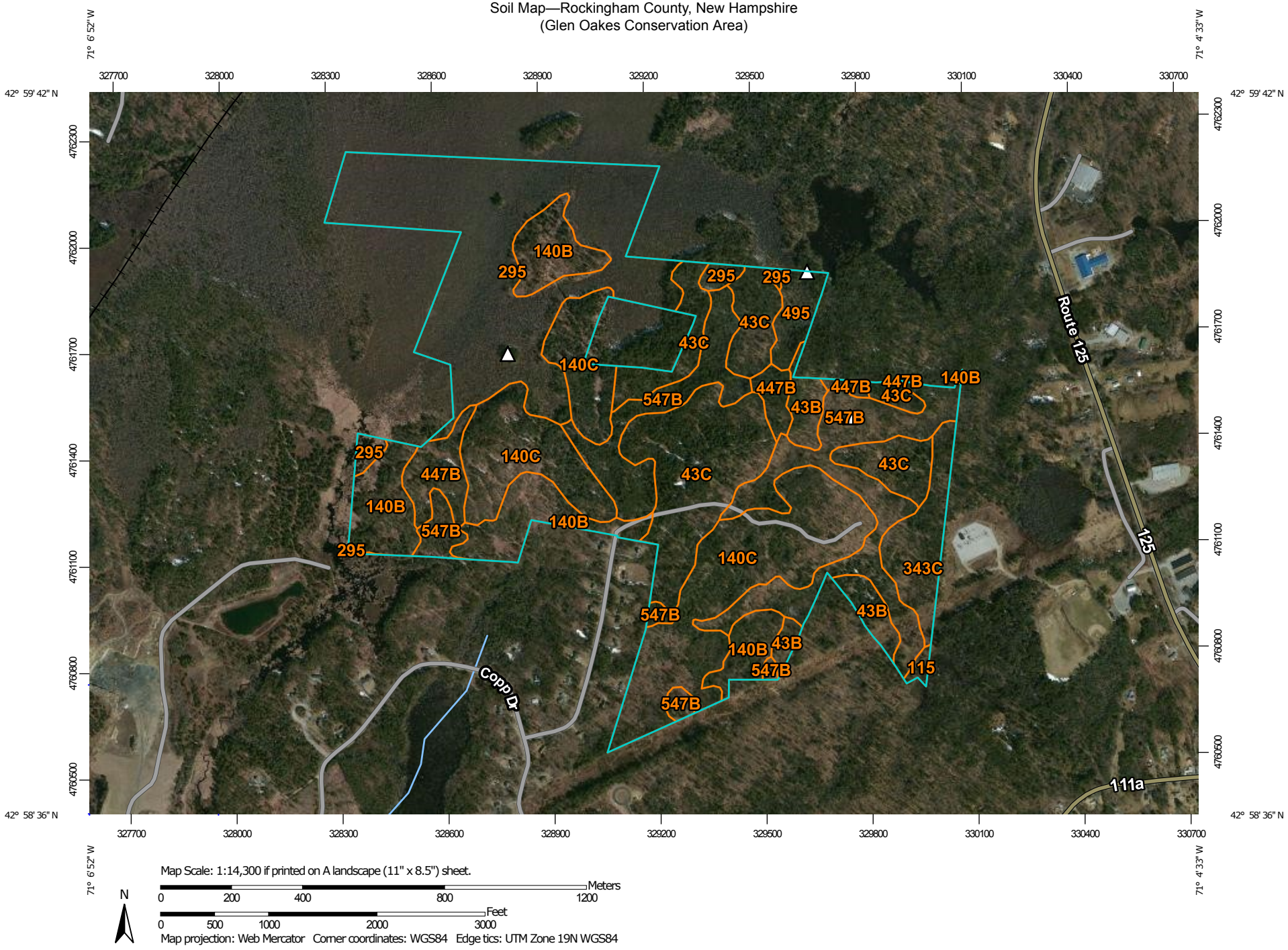
BRENTWOOD

Feature locations and acreages are approximate. Parcel boundary information from NH GRANIT, survey by TD Brouillette 2011, and the Town of Fremont. All other data from field data collection and orthophoto interpretation. This map is not intended as a legal description or for legal purposes.

0 500 1000 1500 2000 ft

1:8,000

Soil Map—Rockingham County, New Hampshire
(Glen Oakes Conservation Area)



Map Scale: 1:14,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

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

INTRODUCTION

INTRODUCTION

This forest management plan was prepared for the 387.9± acre community-owned woodland and wetland tract in Fremont, New Hampshire known as the "Glen Oakes Conservation Area". The property includes part of the exceptional natural area, Spruce Swamp, which together with the tract's fine upland forest, provides rich and diverse habitat for wildlife. Additionally, the property's hiking trail network offers an attractive, local recreational destination.

The purpose of the plan is to guide the management and protection of the Glen Oakes' forest, wildlife, and water resources, as well as to manage recreational activity. The plan also addresses the purposes of the property's conservation easement, which was amended in 2012 to include additional protected acreage. The easement is held by the Society for the Protection of New Hampshire Forests.

This plan updates the detailed forest management plan (C. Moreno, 2009) which covered the original 312.8 acre Glen Oakes property. This updated edition includes natural resource information for the adjacent 76 acre parcel known as the "Smith parcel", which the town acquired in 2012 and added to the Conservation Area.

The update also re-examines the property's natural resources, forest types, forest structure, timber, habitats, recreational uses, and management logistics. The Fremont Conservation Commission was consulted to re-visit and confirm management objectives. From this foundation, the long-term (30+ year) forest management strategy and recommendations were synthesized. The new plan also includes detailed GIS mapping of the property.

The plan is a "working" document; over time, updating will reflect ongoing management activities, natural disturbances, new resource concerns, and evolving conditions and community objectives.

This project was performed under contract with the Fremont Conservation Commission. The author of this forest and wildlife management plan, Charles Moreno, certifies that the plan's entire contents, including all written material, maps, plan format, and organization are original to the author.

Charles Moreno, Consulting Forester
NH Licensed Professional Forester #115

May 31, 2018

MANAGEMENT PLAN FEATURES

Comprehensive forest and land management involves:

1. **Natural resource assessment**. The plan provides in-depth natural resource analysis, including soils, wetlands, forest, wildlife, and timber. These resources are assessed, mapped, and summarized. A forest inventory was conducted, with statistical analysis, to establish baseline data of the Conservation Area's timber volume and value, and species composition.

2. **Recommendations**. The plan specifies sustainable forest and wildlife management practices for the next 30+ years. The plan also outlines the community's recreational policies for the property.

3. **Implementation**. The plan examines logistical considerations and organizes comprehensive forest management in a financially and ecologically optimal manner.

GIS mapping of the Glen Oakes Conservation Area is an important feature of this plan. Based on comprehensive fieldwork, various map layers accurately depict the lay of the land, summarizing substantial natural resource information in an easily assimilated visual format. The plan includes detailed mapping of physical and natural features, forest types, wildlife habitat, and management recommendations.

This introductory chapter contains the management objectives for the Glen Oakes Conservation Area, which the Fremont Conservation Commission identified and considered for this community property. These long-term objectives are the underpinning for the recommendations presented in this plan.

Recommendations for the Glen Oakes Conservation Area are based on the management objectives as well as a detailed study of the property's natural resources. A capsule summary of the management plan's recommendations are found in this *Introduction*. The recommendation summary covers the following areas:

- Access
- Boundary lines
- Forest education
- Insects and disease
- Invasive plants
- Recreation
- Silviculture
- Water quality protection
- Wildlife

The other plan chapters cover background information for the property, the logistical considerations of property management and community use, wildlife and habitat assessment, forest assessment, and summary information in the *Appendices*.

Glen Oakes Conservation Area

FOREST MANAGEMENT OBJECTIVES

The recommendations in this stewardship plan are based on long-term management objectives which the Fremont Conservation Commission (FCC) has established for the Glen Oakes Conservation Area. Broadly, the objectives are: a) to maintain a healthy forest, b) which is managed for near-natural structure and characteristics, and c) that provides diverse wildlife habitat. d) Light recreational uses (including hunting) and e) educational opportunities are encouraged. f) Water quality, wetlands, soils, rare plant and animal species, and historic features are to be protected. Management of the forest includes periodic silvicultural harvests for the purposes of maintaining forest health, biodiversity, and wildlife habitat. Details of these objectives are summarized in the following tables:

NATURAL RESOURCE SUMMARY

Natural Resources	Landowner Priority	Relative Resource Value	Comments
Forest Health	High	High	The Fremont Conservation Commission (FCC) desires a healthy, diverse, and increasingly valuable forest. Silvicultural management encourages near-natural forest conditions, i.e., developing a multi-aged forest with ample young growth, mid-aged trees, and centuries-old "legacy" trees; maintaining diverse native plant species; and retaining features such as snags, cavity trees, and deadfall. The applied forest improvement practices promote future value growth by removing low quality trees and encouraging healthy, valuable timber.
Wildlife Habitat	High	High	Silvicultural practices complement and enhance woodland wildlife habitat. Besides Spruce Swamp, specialized habitats include a network of active vernal pools, extensive oak-mast forest, and young forest growth. Protecting and maintaining these habitats for a diversity of wildlife, both vertebrate and invertebrate, is encouraged.
Species of Greatest Conservation Need	High	High	Spruce Swamp provides habitat for an endangered plant, weak stellate sedge, as well as the endangered mussel, brook floater, and the endangered Blanding's turtle. Turtles also utilize adjacent forested uplands and vernal pools. The endangered dragonfly, ringed bog haunter is also found.
Soils	N/A	Good	Chatfield-Hollis-Canton is the main upland forest soil. Areas of Canton, solely, are also found. Forested wetlands are mostly underlain by Walpole fine sandy loam. Preventing erosion and naturally increasing soil fertility are management objectives.
Water Resources	High	High	The property contains several seasonal streams, and a number of small forested wetlands, most of which serve as vernal pools. Over 40 vernal pools are located in the Conservation Area. Spruce Swamp is the main surface water feature, covering ¼ of the parcel's acreage. Protecting surface water features is a priority.

PROPERTY USES

Property Management and Uses	Landowner Priority	Comments
Woodland Access	Medium	The woodlands contain an access road and three landings that provide core management access. While minor upgrades are needed, it is unnecessary to expand existing road access. Recreational trails traverse the forest, with the exception of a designated trail-less area in the westerly section. Trails are absent in this area to allow for wildlife breeding habitat that is free from regular disturbance.
Recreational Use	High	Light, non-motorized trail-based recreation is an important community use of the Conservation Area. Activities include walking, snowshoeing, skiing, and nature observation. The land is not posted; hunting is allowed.
Cultural Features	High	The property has two cellar holes and a primitive cemetery. Extensive stonewalls are found in the formerly settled southeastern area of the property. Other subtle historical features include evidence of granite mining and possibly the slag pile for a bog mining (bog iron or ochre clay?) operation. Preserving these features is an important management concern.
Forest Aesthetics	High	The FCC is interested in maintaining a "natural" forest appearance. Harvest operations, including wildlife projects and TSI, are to be thoughtfully prepared and neatly carried out.
Invasive Plants	Medium	The Conservation Area woodlands are largely free of exotic, invasive plants. The power lines may provide a vector for these plants. Annual monitoring and immediate removal of exotic plants is a priority objective for maintaining forest health. Invasive plant control is most effective when their presence is low, and prior to overtaking a large area.
Boundaries	High	Upland property bounds are to be blazed and painted, with maintenance scheduled on a 10-year basis.
Timber Production	Medium	The growth of high quality sawtimber, especially white pine, red oak, and black birch is a key silvicultural objective over time.
Timber Income	Low	While cutting timber strictly to produce revenue is not the FCC's goal, some income will be generated from the sale of trees that are harvested for forest health/improvement purposes. The FCC plans to re-invest this income into the management of the Conservation Area or use it for other conservation purposes.
Forest Stand Improvement (regeneration and young growth)	High	Non-commercial forest stand improvement (FSI) work is a critical investment for establishing a diverse, vigorously growing future forest. FSI may also be tailored to enhance wildlife habitat. Timber sale income can be reinvested, at least in part, to fund FSI projects.

MANAGEMENT RECOMMENDATIONS

WOODLAND ACCESS – The tract's main access point is the Andreski Drive cul-de-sac, a suitable entrance for all recreational and forest management uses. The property's internal road and trails network is substantial and adequate; while minor modifications are needed, expansion is unnecessary. In addition to the expense, expanding the access network disturbs habitat and invites degradation of water resources.

Recreational Access:

- A new trail traverses perimeter areas of the Smith parcel, connecting the original Glen Oakes tract to the Kelliher Memorial Forest, a SELT conservation area.
- The FCC named the trails, and a trails committee has blaze-painted the trails and installed signs.
- New or extended woods roads or trails are *not recommended.* The current network is almost 5 miles long.
- Maintain the entire west area as a "trail-free" zone.
- Install seasonal stream fords on recreational trails.
- Do not restore the road crossing to the island in Spruce Swamp, which has been flooded by beaver.

The junction of the Link and Homestead trails with clear signage.

Forestry Access:

- The three existing landing sites provide full forest management access. The landings may need modification to accommodate specific logging crews.
- Retiring skid trails, post-harvest, is recommended.
- Conduct harvesting during dry or frozen ground conditions.
- Continue to discourage use of motorized recreational vehicles on the Conservation Area, with the exception of snowmobiles on snow-protected ground.


Landing "A" as seen from the Link Trail.


Landing "B" as seen from the Barred Owl Trail.

PROPERTY LINES – Property lines are fully surveyed, but not currently demarcated.

- Axe-blaze and paint all perimeter boundaries lines in upland property areas (16,600± feet), according to surveying protocol.
- Use brush-on surveying (long-lasting, outdoor) paint.
- Re-paint blazes every 10 years.

CULTURAL FEATURES – Protect, investigate, and study the Conservation Area's Native American and early-American cultural sites. Some sites are known, others await discovery.

- Conduct archeological examination of the slag pile area ("G" on *Physical and Natural Features Map*).
- Document the property's cellar holes using the Town of Lyme's non-invasive cellar hole protocol.

The primitive Moses Leavitt cemetery.

FOREST EDUCATION – The Conservation Area provides an evolving model of resource management and land stewardship. The property has potential for outdoor learning and nature observation by the public.

- Publicize educational uses to local schools. Conduct field tour/workshop for teachers and students.
- Link with NH Project Learning Tree.
- Organize field tours for townspeople, landowners, students, etc.
- Develop an interpretive trail guide.

FOREST INSECTS and DISEASES

The table below summarizes the ***current*** prevalence of various pathogens and insects affecting local forests, and the susceptibility of the *Glen Oakes Conservation Area* forest. Over time, silvicultural management will improve the forest's resilience to pathogens, insects, storm events, and climate change.

Pathogen or Insect	Species *Most* Affected	Prevalence	Susceptibility
Beech bark disease	Beech	Widespread	Moderate
Nectria canker	Black birch, yellow birch	Moderate	Moderate
Strumella canker	Red oak	Low	Low
White pine blister rust	White pine	Low	Low
Caliciopsis pine canker	White pine	Moderate	Moderate
Needlecast diseases	White pine	Moderate	Moderate
Hemlock wooly adelgid	Hemlock	Increasing	Moderate
Elongate hemlock scale	Hemlock	Low	Low
Gypsy moth	Oaks, birches, hemlock	Low	High
Emerald ash borer	White ash, black ash	Increasing	Low
Red pine scale	Red pine	Moderate	None

- Adaptive management involves techniques that adjusts to a variety of changing conditions. For the Conservation Area these include a) encouraging tree species diversity, b) promoting healthy trees, c) ensuring ample natural regeneration, especially of imperiled species, and 4) the removal of unhealthy trees, particularly to control an infestation, or to salvage substantial timber value. Promoting structural diversity of the forest—mixed-aged forest—also builds resilience.

INVASIVE PLANTS – With the exception of the powerline corridor (where Japanese barberry and honeysuckle were observed) and at landing sites, there is no present observed incidence of exotic, invasive plants on the Conservation Area. Potential vector areas for infestation are the powerlines (as noted), the woods road and trails, and the Andreski Drive cul-de-sac area. In addition, exotics can invade Spruce Swamp through dispersed seed. Annual monitoring and immediate control response should remain high-priority management concerns.

Honeysuckle and barberry along the powerline corridor.

- In upland vector areas, annually monitor for Oriental bittersweet, Japanese barberry, honeysuckle, autumn olive, and Japanese knotweed especially along powerlines.
- In forest areas, in addition to vector areas, monitor for glossy buckthorn, Japanese barberry, and burningbush. Buckthorn, a serious invasive, may insidiously appear within the forest in a wide variety of sites—from wet to dry.
- In Spruce Swamp and other open wetlands, maintain vigilance for purple loosestrife and *Phragmites* (common reed).
- Upon discovery of even one plant, carry-out immediate removal. This action is critical to check the spread of invasive plants into the surrounding forest.

A sizeable glossy buckthorn specimen at the margin of Landing "A".

- Hand-pulling and piling of plants is a primary control technique, especially in areas where plants are dispersed or in low densities. For high density or established/persistent areas, stem cutting followed by stem or foliar treatment, may be the most effective control method.
- After initial control efforts, annual monitoring and follow-up control is needed, especially since the seed bank will germinate and/or plants may re-sprout. Do not allow the treated plants to produce seed.
- Spark the interest of Conservation Area abutters in control efforts on their own lands.
- Re-invest timber sale proceeds into invasive plant control. Also, organize volunteer efforts.

RECREATION – Continue to allow benign recreational usage of the property, especially uses with minimal effect on habitat, wetlands, streams, water quality, natural features, or plants.

- Discourage all forms of motorized wheeled vehicles, as is current town policy.

- Continue to allow snowmobiling with at least 6 inches of snow cover as per town policy.
- Encourage hiking, running, skiing, snowshoeing, hunting, geo-caching, and nature-watching/study/photography.
- Periodically review policies for horseback riding, mountain biking and dog sledding. Currently, detrimental impacts to the trails from these uses were not observed.
- Mark unnamed trail connectors.
- Do not expand trail system.
- Post trails maps online for download. Stock kiosk with trail maps.
- Post "No Wheeled Vehicles" signs at all property entry points.
- Install/maintain appropriate fords on trails at all stream crossings.

SILVICULTURAL – See "Forest Management" section for detailed forest management specifications.

- Manage primarily for forest health, habitat enhancement, maintaining species diversity, and to improve forest growth.
- Silviculture should encourage near-natural, established-forest conditions over time.
- Apply silviculture comprehensively by management area, on a 12 to 15± year harvest cycle.
- Follow sustainable management, i.e., harvesting less timber volume than the amount the forest is able to replenish during the 12 to 15-year harvest cycle interim.
- Invest in non-commercial, forest stand improvement (FSI) to help establish mid-successional regeneration, improve forest growth, and enhance habitat.
- Pursue the long-term reintroduction of American chestnut, when disease-resistant seedlings become available.
- Reinvest timber income into the management of the Conservation Area. Consider timber revenue as a bi-product, not the goal of silvicultural management, thereby avoiding conflict with ecological, forest health, and community-use objectives.
- Engage ecologically-trained professional foresters to select and mark trees for harvest prior to cutting in order to reflect silvicultural prescriptions and to control the magnitude of cutting. Foresters should be hired by the town to represent the town's interests and to work closely with the Fremont Conservation Commission.


Chestnut sprout along the Forest Loop.

- **The long-term target ratio of variously aged forest (326± acres) on the parcel is:**
    - Early-successional and young forest (1-40± year forest) – 6% of area (20± acres) – including early-successional, *Upland Hardwood* young forest, and the landing sites. An adjacent owner's 7-acre clearcut adds additional area to this habitat.
    - Mid-successional, multi-aged forest (mainly 40-150± years) – 68% of area (223± acres).
    - Older growth, multi-aged forest (reserve areas—allowing the development of 150+ year forest, including forested wetlands) – 25% of area (83± acres).

WATER QUALITY PROTECTION – Protecting the Conservation Area's surface and subsurface water resources from degradation is a major management objective and conservation easement purpose.

- Discontinue use of the trail that crosses the wetland to access the forested island within Spruce Swamp.
- Remain outside the 100-foot upland buffer along Spruce Swamp conferred by "Prime Wetlands" designation. NHDES regulations require that recreational (including trails) or forestry activities must not occur in the prime wetland buffer without a waiver.
- Install appropriate, low-impact fords where trails cross through streams. This avoids rutting of streambeds and stream siltation. Install thoughtfully-planned fords, such as timber mat bridges, bog bridges, or stepping stones, that are tailored to the crossing.
- For harvest operations, reconnoiter and plan necessary stream and/or wetland crossings. Minimize the number of crossings. The logging contractor submits and works within appropriate wetland permitting, and applies New Hampshire Best Management Practices (BMP's).


A stream crossing on the Forest Loop.

- Maintain minimal harvest buffers (not to exceed 10% of basal area) within 50 feet of vernal pools and 25 feet of streams.

WILDLIFE – Wildlife habitat is managed in conjunction with harvesting, forest stand improvement, and volunteer projects. Town policy promotes responsible hunting and trapping. Wildlife can be monitored through periodic surveys.

- Silviculturally manage the forest towards a mixed-aged condition.
- Encourage stratification of forest canopy layers.

- Encourage the growth of broad-crowned, mast-producing oaks and hickories. Diversify the property's mast sources.
- Retain dense shrub vegetation in wetlands including Northern arrowwood, winterberry holly, highbush blueberry, sweet pepperbush, and speckled alder. Maintain hemlock wildlife corridors.
- Establish minimal harvest buffers around vernal pools. Allow the natural accumulation of forest deadfall and woody debris for amphibian and reptile habitat.
- Maintain the tract's early-successional habitats on a 5 to 20± year re-clearing rotation.
- Retain substantial numbers of "legacy" trees (150+ years old).
- Retain snags, stubs, cavity trees, and downed woody debris.
- Set-up bat boxes and waterfowl nesting boxes.
- Maintain the Conservation Area free of exotic, invasive plants.

A cavity in a pine snag with recent wildlife activity.

- Allow responsible hunting in the Conservation Area.
- Adopt a trapping policy, as recommended, for the Conservation Area.
- Establish an online wildlife sighting register for the Conservation Area (also, town-wide).
- Conduct periodic wildlife surveys such as bird counts, winter tracking observations, mammal checklists, etc.

GENERAL INFORMATION

LOCATION and GEOGRAPHY

The Glen Oakes Conservation Area ("Glen Oakes") property is located at the end of Andreski Drive, north of NH Route 107 (a.k.a. Main Street) in Fremont, New Hampshire, approximately 2± miles east of Fremont's center. It lies in the southern area of a 2,000+ acre block of open space that includes Spruce Swamp, the largest wetland in Rockingham County. The parcel encompasses 89.7± acres of this exceptional wetland, as well as 6,600± feet of upland forest frontage along the swamp's southeastern edge. Glen Oakes lies adjacent to other open space lands including the Brentwood Recreation Area (east), Phillips Exeter Academy Woodlands and Southeast Land Trust's Kelliher Memorial Forest (north), and Fremont's Oak Ridge Town Forest (in close proximity to the west). The *Locus Map* (page 6) illustrates the property's location in the greater landscape.

On a landscape level, Glen Oakes is located in New Hampshire's coastal plain, about 16 miles from the Atlantic Ocean. The area lies within the Gulf of Maine Coastal Lowland ecoregion subsection[1]. The sea moderates the area's climate, allowing the northerly extension of the Appalachian oak-pine forest. Southerly species such as white oak, black oak, black tupelo, shagbark hickory are found on the property.

The soils underlying the property's upland forest are generally glacial tills, with ledge often near the ground surface. Organic peat soils underlie wetlands. The parcel's topography is level to gently rolling. Elevations range from 170± feet above sea level at Spruce Swamp to the highest point of land, a small knoll containing a primitive cemetery, at 240± feet. The property lies within the Exeter River watershed.

REFERENCE INFORMATION

Area: Property total – 387.9± acres

- Upland Forest..... 278.3± acres
- Wetlands (incl. Spruce Swamp)..... 104.4± acres
- Landings / Powerline..... 5.2± acres

Deeds:

- RCRD Book 4592, Page 1047. Property acquired on 12/5/2005.
- RCRD Book 4592, Page 1054. Conservation Easement Deed; granted to Society for the Protection of New Hampshire Forests (SPNHF) in December 2005.
- RCRD Book 5302, Page 2373. Smith Parcel acquired 4/2/2012.
- RCRD Book 5302, Page 2384. A conservation easement was granted on the new parcel acreage to the Society for the Protection of New Hampshire Forests (SPNHF), and added to the original conservation easement deed in April 2012.

[1] Keys, J.E. and C.A. Carpenter. 1995. Ecological Units of the Eastern United States: First Approximation. U.S. Department of Agriculture, Forest Service.

Reference Plans:

- "Subdivision and Lot Consolidation Plat of Land, Fremont, N.H., Prepared for Fremont Conservation Commission," T.D. Brouillette Land Surveying, September 15, 2005. RCRD Plan # 33045.
- "Plat of Land in Fremont, N.H., Prepared for Fremont Conservation Commission," T.D. Brouillette Land Surveying, February 2, 2011. RCRD Plan # 37008.

Tax Maps: Fremont Tax **Map 2, Lot 156-2-1** & **Map 4, Lot 86**.

A mossy island in a vernal pool.

CONSERVATION EASEMENT PROVISIONS

A conservation easement deed was executed for the Glen Oakes Conservation Area on December 8, 2005; the Smith Parcel, acquired in 2012, was subsequently incorporated into this easement. While the Town of Fremont owns, manages, and uses the property, the conservation easement is held and monitored by the Society for the Protection of New Hampshire Forests (SPNHF). The easement protects the property in perpetuity from development and exploitation.

Conservation easement clauses that are relevant to management activities on the land are summarized below. This brief, non-comprehensive summary does not replace referencing the conservation easement document itself for full comprehension of the easement's terms and obligations.

1. Purpose: The protection of the Spruce Swamp and associated uplands influential to influence the wetland's hydrology. The protection of 6600± feet of undeveloped frontage along Spruce Swamp.
2. Purpose: The protection and conservation of open spaces, i.e., the easement area remains undeveloped, and the land's capacity to produce economically valuable agricultural and forest products is not impaired.
3. Purpose: The scenic enjoyment by the general public of the property's "forest roads". To provide public access to the property and Spruce Swamp for outdoor recreation and/or education.
4. Purpose: Protect surface and ground water resources on and under the property
5. Purpose: Conserve the property's mix of upland and wetland wildlife habitats.
6. Use limitation: Agriculture and forestry are allowed as long as activities are not detrimental to the Easement's purposes or impair the property's scenic qualities.
7. Use limitation: Forestry to be performed in accordance with a written management plan, submitted to SPNHF at least 30 days before implementation.
8. Use limitation: Forestry shall be performed in accordance with the following goals: a) Maintain soil productivity; b) Protect water quality, wetlands, and riparian areas; c) Improve forest quality; d) Conserve property's scenic qualities; e) Protect unique and fragile natural areas (esp. Spruce Swamp fen system) and any species of concern; f) Protect historic/cultural features; and g) Conserve native flora and fauna.
9. Use limitation: Ancillary structures such as woods roads, culverts, trails, or educational kiosks may be introduced as long as they are not detrimental to the easement purposes (several stipulations are specified).
10. Use limitation: No dumping of man-made materials. No mining or quarrying, except if related to the easement's forestry, recreational, or educational purposes, such as excavated gravel for a woods road.
11. Use limitation: The land may be temporarily posted during forest harvesting or other forest management activities.
12. Reserved right (Landowner): Right to withdraw groundwater for public water supply subject to a number of contingencies in the easement.

PROPERTY HISTORY

NATURAL and LAND USE HISTORY

Looking back through time, the primeval forest that occupied the Glen Oakes Conservation Area uplands probably included a species mixture variously dominated by American beech, American chestnut, northern red oak, white oak, shagbark hickory, and eastern hemlock. Birch, maple, and pine species were also part of the mix, their presence dependent on soils and disturbance patterns. Forest disturbance—fire, wind, ice, human-caused clearing—created an assortment of forest ages, with trees ranging from new seedlings to 500+ years.

Humans undoubtedly played a part in the forest's history after glaciation. The Red Paint People lived along the New Hampshire and Maine coastline thousands of years ago. They prized "red ochre" (iron oxide), which is found along Spruce Swamp. Within the last millennia, the Squamscott Indians inhabited the area, also using red ochre.[2] These early inhabitants may have cleared sections of the forest as well as mined veins of iron oxide in the Conservation Area. An unnatural ridge along the edge of Spruce Swamp and adjacent wetlands was discovered during field research for this management plan (labeled "G" on the *Physical and Natural Features Map*, page 8). This appears to be a slag pile from mining an area that is now a small forested wetland. Early history points towards the mining of red ochre, while post-European settlement mining was likely for bog iron. An archeological investigation is warranted.

The Leavitt homestead cellar hole.

European settlers left their mark starting in the early 18th century, cutting specimen white pines for ship masts, and later (±1740-60's), clearing and settling the land. The Davis and Leavitt cellar holes are located in the Conservation Area, in the western and eastern sections, respectively. A primitive cemetery for the Moses Leavitt family is located on a small knoll near their old homesite.[3] Stonewalls and an old stone culvert, presumably along a long-abandoned cart path, are further evidence of the Leavitt family homestead.

While forest has reclaimed the land, with a century-worth of growth obscuring the very existence of these former farms, the early settlers had a vast impact on the forest environment. Simply put, the "new" forest lacks complexity. Forest structure is largely even- or two-aged, lacking multiple generations of trees. As with much of New Hampshire, old trees, 300 to 500+ years, are absent—the oldest trees in the Conservation Area are a mere century old. Furthermore, entire species, both plant and animal, are extirpated or persist with a radically altered presence. American chestnut and butternut, for example, are barely viable species; large carnivores, including mountain lion and gray wolf, are lost.

[2] "Natural Resources Inventory", Rockingham Regional Planning, 2008, (Chapter 4.24). Based on earlier writing by author, Matthew Thomas, in "History of Fremont New Hampshire", page 300.
[3] Ibid.

With the return of the forest after over a century as pastureland, numerous species have made a comeback. For example, the natural restoration of a multitude of vernal pool dependent amphibians and invertebrates in the Conservation Area is dramatic.

Timber harvesting has been the most significant disturbance type on the Conservation Area since the 1900's. Early harvesting involved firewood cutting for local brickyards, and lumber for a nearby box mill. After World War II, the Conservation Area forest was heavily-cut, with white pine lumber sent to the nearby Spaulding and Frost cooperage. Oakes Kent Lawrence, Jr. purchased the harvested woodlands in the early 1950's and in time began forest management. Weeding and thinning of the young forest, followed by firewood thinning, and more recently (1995-2003±), partial sawtimber and biomass harvesting, occurred during the Lawrence Family ownership tenure.[4]

The present forest consists of variously mixed hardwood, white pine, and hemlock stands that are generally 40 to 140± years of age. The forest has not had an acute natural disturbance since the Town of Fremont's acquisition in 2005. A light improvement harvest was conducted in the central area in 2013, with further management planned for the summer of 2018.

ACQUISITION HISTORY

In 2000, the Fremont Conservation Commission recognized Spruce Swamp as the "most distinctive and valuable environmental feature of Fremont", worthy of major conservation focus.[5] In 2003, the community designated Spruce Swamp as its first "Prime Wetland". Thereafter, joining forces with the Society for the Protection of New Hampshire Forests (SPNHF), the town rallied to raise the funds for the purchase of the property from the Lawrence Family on December 5, 2005. A conservation easement held by SPNHF (executed on December 8, 2005) protects the land from development and exploitation, with ownership held by the Town of Fremont for the enjoyment of its citizens "in perpetuity".[6] In April of 2012, also in concert with SPNHF, the Town purchased from the Smith Family an adjacent 76-acre parcel, abutting the existing Conservation Area to the northeast, and incorporated this acquisition into the conservation easement held by SPNHF.

Turkey tail fungus is commonly found on decaying branches, trunks, or stumps.

[4] Ibid.
[5] Ibid and the 2001 Annual Town Report
[6] Ibid.

Photos: Historic Features

Photo #1 – Unmarked gravestone in Leavitt Family Cemetery.

Photo #2 – Cleaved rock, probably quarried for foundation stone.

Photo #3 – This boulder pile which was quarried for foundation stones.

Photo #4 – Unusual markings on a flat-faced stone.

WATER RESOURCES

Surface Waters

The Glen Oakes Conservation Area lies in the Exeter River watershed, where all its surface waters flow. Spruce Swamp—at 800± acres, the largest wetland in Rockingham County—is the key surface water feature of the Conservation Area, which includes about 11% of the swamp's area within its borders. Spruce Swamp is ecologically significant not only for its extent, but for its relatively pristine character and the rich diversity of wetland communities. Wetland natural community systems in the swamp include exemplary examples of *Medium level fen system* and *Poor level fen/bog system*. The swamp also provides habitat for at least six rare or endangered species documented by the New Hampshire Natural Heritage Bureau—weak stellate sedge, ringed boghaunter, Blanding's turtle, spotted turtle, Northern black racer, and brook floater. Spruce Swamp was designated Fremont's first prime wetland in March 2003.

Less conspicuous, yet ecologically valuable, is the property's exceptional array of vernal pools. Over 40 in number, the pools vary in character from open water to shrub/scrub to forested basin wetlands. These pools collectively provide important habitat to crustaceans, insects, amphibians, and reptiles. Many of the pools lie in close proximity to one another in the south-central area of the property.

The Conservation Area also contains a number of seasonal streams with associated forested wetlands. Finally, a relatively small beaver pond overlaps into the south-easternmost corner of the property. This recent impoundment includes open water with snags and fallen logs, both excellent habitat features.

The property's surface waters are mapped and illustrated on the *Physical and Natural Features Map*, on page 8 of this report.

Subsurface Waters

An extensive stratified-drift aquifer underlies much of Spruce Swamp, including some of the Conservation Area. The swamp and gravelly Hinckley soil areas west of the swamp (off-property) provide recharge capacity to this aquifer, which serves as an increasingly used water source (private residential wells) for the community.

Recommendations

- Do not expand existing recreational trails, as this may entail additional stream crossings.
- Install appropriate fords where recreational trails currently cross streams.

A stream crossing on the Barred Owl Trail.

A stream crossing on the Forest Loop.

- Forest harvesting activity should strictly follow NH Best Management Practices (BMP's) for fording streams and working in the vicinity of forested wetlands.
- Maintain a 100-foot no-harvest buffer around Spruce Swamp, unless future conditions warrant activity. The prime wetlands waiver process must be followed.
- Schedule harvesting for frozen or snow-covered ground in winter, or during dry summer/fall conditions.
- Control exotic, invasive plants by mechanical means where possible, avoiding the use of herbicides.

Photos: Wetlands

Photo #1 – Beaver pond south of powerlines.

Photo #2 – Vernal pool.

Photo #3 – Open water area and scrub/shrub vegetation in Spruce Swamp.

Photo #4 – Snags in a section of recently beaver-inundated forest in Spruce Swamp.

SOIL RESOURCES

Terrain and Topography

The soils underlying Glen Oakes Conservation Area's forested uplands are primarily glacial tills, with copious rocks and scattered surface boulders. Some areas are shallow-to-ledge, containing ledge outcrops. Parent material is generally granitic. Unlike nearby lands, the parcel lacks outwash or alluvial soils. Much of the uplands are level to gradually sloped (0 to 8%), though some small knolls have side slopes up to 15±%.

Wetland soils include poorly-drained rocky till that underlie seasonal streams, and deep mucky peat under the parcel's palustrine water bodies, including Spruce Swamp.

Soil types delineations are illustrated on the *Soils Map* (page 11).

Soil Types

Canton (43 and 343) gravelly fine sandy loam – This deep and well-drained glacial till underlies extensive upland forest on the Glen Oakes Conservation Area primarily in the parcel's central and easterly areas. The surface layer of *Canton* is typically rocky, but the Conservation Area's eastern section is strewn with boulders. *Canton's* substratum (below 2½ feet) contains loamy sand and varying amounts of silt. The seasonal high-water table is below 6 feet, and the soil becomes wet only during spring thaw or after extended rainy periods. *Canton* has above average productivity, supporting tall tree growth. White pine and red oak grow well.

Chatfield-Hollis-Canton (140) complex – Underlying much of westerly and central area of the parcel, this soil complex is variable. Low ridges contain shallow-to-bedrock *Hollis* soils (bedrock within 18 inches of the soil surface), with knobs areas of exposed ledge. Broad areas of *Chatfield*, a somewhat deeper glacial till (bedrock 2 to 3 feet down), and *Canton*, a deep well-drained till, intermix with the ledgy pockets. Most areas are reasonably well-drained. The soil ranges from low productive potential on ledgy outcrops, to substantially productive for both red oak and white pine in loamy areas.

Scituate-Newfields (447) complex – These intermixed sandy loams (till) underlie small areas in the property's west and northeast. Soils range from moist uplands to somewhat poorly-drained forested wetlands. The water table is seasonally high and the soils are prone to wetness during spring and late fall (when logging equipment easily creates ruts). These soils are productive for mixed hardwood growth. White pine grows well, but trees are prone to blowdown in moister areas due to shallow rooting.

Freetown (295) mucky peat – This very poorly-drained mucky peat underlies saturated and seasonally flooded areas, primarily Spruce Swamp. Some of the property's vernal pools contain this soil type, as do wetlands with little or no tree growth. *Freetown's* peat layer is deep, with bedrock more than 5 feet below the soil surface.

Natchaug (495) mucky peat – This very poorly-drained mucky peat soil underlies a wetland in a northern-central portion of the Smith Parcel area of the Conservation Area. *Natchaug's* peat layer is deep, with bedrock more than 5 feet below the soil surface.

Walpole (547) very fine sandy loam – This stony, poorly-drained very fine sandy loam underlies the parcel's main drainageways and some vernal pools or forested wetland pockets. Wetland hardwood trees and shrubs—species whose root systems can endure periods of water saturation—are associated with

this soil. On the Glen Oakes Conservation Area, red maple, highbush blueberry, and winterberry holly typically occupy these sites.

Recommendations

- Schedule harvest operations for dry summer through mid-fall conditions (June-October), or frozen/snowy ground in winter (late Dec-early March) to avoid unnecessary rutting of ground.
- Avoid equipment travel on poorly-drained soil areas.
- Use brush matting or wood corduroy to stabilize crossings on poorly drained soils. Pre-plan all crossings, and use the minimum number of crossings needed to access the woodlands.

NATURAL COMMUNITIES

Natural communities are recurring aggregations of plants and animals found in particular physical environments[7]. On the Glen Oakes Conservation Area, these environments include wetland and upland forest sites. The Spruce Swamp area contains two exemplary natural community systems: ***Medium level fen system*** and ***Poor level fen/bog system***. These systems are classified as exemplary due to their extent and lack of alteration.

Several wetland natural communities are found within the ***Medium level fen system.*** These include an extensive area of *Sweet pepperbush wooded fen*, a rare natural community in New Hampshire that is found only in the state's coastal plain. This somewhat minerotrophic peatland is dominated by 3-foot tall shrubs, with some taller shrub cover. Along with sweet pepperbush, highbush blueberry and winterberry holly dominate. Poison sumac was also noted. Separated sedge, endangered in New Hampshire, is also found in this natural community[8].

The ***Poor level fen/bog system*** includes extremely acidic peatlands, which are in Spruce Swamp's interior. The *Leather-leaf - sheep laurel dwarf shrub bog* natural community is hummocky, with a few tall shrubs and trees. The *Black spruce – larch swamp* natural community is nutrient-poor "bog forest"[9]. In Spruce Swamp it contains black spruce, highbush blueberry, and black huckleberry—an interesting comingling of northern and southern species.

The Glen Oakes Conservation Area upland forest is representative of a) the *Mesic Appalachian oak-hickory forest* natural community, which lies on acidic soils and has a typical red oak-white pine-black oak-red maple tree canopy, as well as b) *Hemlock-beech-oak-pine forest*, found in the hemlock-dominated central property areas and the Smith Parcel. A heath shrub layer (esp. lowbush blueberry) is mostly absent. The herbaceous layer in both natural communities includes partridgeberry, wintergreen, sarsaparilla, and club mosses. The somewhat enriched soils underlying the pine/hardwood stands in a few pockets of the property's south central and east area may be indicative of *Semi-rich Appalachian oak-sugar maple* forest, due to the presence of sugar maple, basswood, and hophornbeam. However, these small pockets are more appropriately classified as enriched soil inclusions within the *Mesic Appalachian oak-hickory forest*, rather than as a separate community.

---

[7] Natural Communities of New Hampshire, by Dan Sperduto and William Nichols, pp 1.
[8] Ibid. pp 179-180
[9] Ibid. pp 104-105

PROPERTY LOGISTICS and COMMUNITY USE

CONSERVATION AREA ORGANIZATION

MANAGEMENT COMPARTMENTS

The organization of a large property into management areas, or "compartments", assists in planning and implementing recommendations. A management compartment is a section of land within the property that is readily defined by surrounding physical features such as a woods road, stream, wetland edge, and/or stonewall. Each compartment has a distinct access strategy, and silvicultural operations are conducted systematically on a compartment basis. A compartment may contain certain areas that are not actively managed; these areas are designated as reserves *within* the compartment.

Accordingly, the 387.9± acre Glen Oakes Conservation Area is organized into ***five management compartments***, as follows:

Management Compartment (MC)	Compartment Name	Acreage		
		Total MC	Managed	Reserve
MC #1	**The West Woodlands**	65.6	63±	2.6±
MC #2	**The South Woodlands**	67.7	60±	7.7±
MC #3	**The East Woodlands**	67.0	62.5±	4.5±
MC #4	**The North Woodlands**	70.0	61±	9±
MC #5	**Spruce Swamp/Reserves**	117.6	0	117.6
TOTALS		387.9	246.5	141.4

Management Compartment #1 **(MC #1), the West Woodlands**, covers 65.6± acres, and is accessible from Landing A. MC #1 encompasses 63± acres of upland forest, and 2.6± acres of embedded minor wetlands, west of the main woods road from Andreski Drive. This compartment does not include the 100 foot prime wetlands buffer along Spruce Swamp, which must be delineated when implementing forestry so that harvesting activity does not overlap into this reserve area.

Management Compartment #2 **(MC #2), the South Woodlands**, covers 67.7± forested acres. All forestry and habitat work in MC #2 is accessible via Landing A. 60± upland forest acres are designated for management, while the 3.3± acre southwesterly corner and 4.4± acres of scattered wetland pockets are withheld as reserves. MC #2 encompasses the land bordered by the main woods road and Landing A, the powerlines, the property line, and a seasonal stream in the central property area.

Management Compartment #3 **(MC #3), the East Woodlands**, covers 67.0± forested acres, with 62.5± readily accessible to forest management, via Landing B. Embedded wetland pockets cover approximately 4.5 acres which are considered reserves. Vegetation in the powerlines (2± acres) is regularly mowed by utility contractors, an activity which syncs with the habitat management goals in the Conservation Area. The 3± acre pocket south of the powerlines is remote, but is still accessible for periodic habitat treatments.

Management Compartment #4 **(MC #3), the North Woodlands**, covers 70.0± forested acres, including most of the former Smith Parcel. 61± acres are readily accessible to forest management, mostly via Landing A. A small section in the northwesterly corner may be accessed from Landing C to avoid a stream/wetland crossing. Embedded forested wetlands and drainage areas cover approximately 9± acres which are considered reserves.

Management Compartment #5 **(MC #5), Spruce Swamp and Reserves**, totals 117.6± acres. It contains the property's Spruce Swamp acreage, the 100-foot prime wetlands upland buffer along Spruce Swamp, and three forested reserve islands that are isolated from the main property. MC #5, in its entirety, is withheld from active management. This reserve status does not imply a completely hands-off approach: The Conservation Commission may implement the control of invasive plant species, the restoration of threatened species, water quality management, and wildlife monitoring. In addition, the Town is likely to allow limited trapping (see "Trapping Policy" section).

PLAN IMPLEMENTATION BY COMPARTMENT

Implementing a suite of recommendations is complicated from a priority and scheduling context. Some recommendations are a one-time occurrence, such as situating a new trail. Many tasks are annual, including monitoring for and removing invasive plant species, surveying wildlife species, and trail maintenance. Re-painting property lines is a 10-year maintenance task.

Implementing a forest and habitat management plan over the long term is complex. Scheduling involves long-term commitment (100+ years), and cyclical implementation. A core concept for organizing forestry and habitat recommendations in the Glen Oakes Conservation Area is that a ***12-year implementation cycle*** will be used. In other words, improvement work on any particular location will occur once every 12± years. Furthermore, the entire suite of forestry and habitat treatments for each compartment should be completed before initiating treatment of the next management compartment. After 12 years, the first compartment will be re-visited for the next cycle of forest and habitat work, and so forth, on the 12± year cycle.

The following schedule is established to implement habitat recommendations in each management compartment:

Management Compartment	**Forestry & Wildlife Treatment Schedule**		
	1st Cycle	**2nd Cycle**	**3rd Cycle**
MC #2: South Woodlands	**2013**	2027±	2039±
MC #4: North Woodlands	2018	2030±	2042±
MC #3: East Woodlands	2021±	2033±	2045±
MC #1: West Woodlands	2024±	2036±	2048±
MC #5: Spruce Swamp/Reserves	**Reserve - No Treatment**		

This scheduling cycle will continue to repeat indefinitely. It is noted, that specific forestry and habitat recommendations, though projected into the future at the present time, should be reviewed and updated on a 20 to 25 year basis, to take into account changing conditions and unforeseen environmental disturbances.

In practice, it is likely that all habitat treatments in one compartment will not be completed in a specific year or within one year's time. Treatments can be completed within the course of the 3-year window before moving to the next compartment. It is preferable to complete the work in the early years of the 3-year treatment windows.

FOREST TYPES

The Glen Oakes Conservation Area forest varies widely in structure and species composition. Forest types define the distinctive character of various forest sections: A ***forest type*** represents forest areas with a distinguishing set of species homogeneous that results from similar soils, hydrology, land uses, and disturbance history.

Seven forest types were delineated in the Glen Oakes Conservation Area as part of the forest assessment phase of this management plan. These are illustrated in the *Forest Type Map*, and described in detail in the "FOREST RESOURCES" chapter of this plan. Descriptions of each forest type explain their natural history and their distinctive characteristics. Wildlife and timber attributes are summarized. The silvicultural management of each forest type is discussed, with corresponding prescriptions for wildlife and forest management.

The forest types have ***variants***. Though variant areas are broadly similar in species composition or the type of site they occupy, there are differences in the proportions of species, and/or the age and spacial structure of the forest type. Explanation is made of these variations, with the main variant(s) described in detail.

A ***stand*** is a pocket of a particular forest type, which is located separately from other pockets of the same forest type. In the *Forest Type Map* (page 7), the forest types are delineated as stands with the cumulative acreage calculated for each forest type.

Silvicultural prescriptions generally apply to the managed areas of the forest types. Non-extractive treatments, such as invasive plant control or controlled burning, may be applied in the reserve areas. Silvicultural treatments in reserve areas does not include the removal of timber. Though prescriptions vary between different forest types, all forest types/stands within one management compartment are usually treated concurrently during a harvest, each to their own specification.

LIST OF FOREST TYPES

Forest Type	
Oak Forest	92.6± acres
Upland Hardwood	37.7± acres
Mixed Upland Hardwood	7.7± acres
White Pine	5.4± acres
White Pine/Hardwood	63.1± acres
Hemlock/White Pine/Hardwood	46.7± acres
Hemlock/Hardwood	21.9± acres
Hemlock (Variant 4 of Hemlock/Hardwood)	0.8± acres
Young Forest	2.4± acres

WILDLIFE HABITAT

In this management plan, the term "wildlife habitat" connotes an area with a broadly similar environment that provides food, water, cover, and space for a particular animal species or group of species. The attributes that define an environment are *physical*, i.e., terrain, aspect, hydrology, etc., and *natural*, i.e., vegetative structure, density, and composition.

In the *Wildlife Habitat Map* (page 10), six core habitats are delineated; these are described in the *Wildlife Resources* section. Habitat features, such as vernal pools, which further enhance the core habitats are mapped or described.

Each core habitat of the Glen Oakes Conservation Area contains broad similarity in both physical and vegetative attributes. For example, the Spruce Swamp core habitat has similar hydrology (wetland environment) and vegetative structure (open water—emergent—shrub/scrub—flooded forest), but contrasts with the upland mast forest core habitat (well-drained, rocky soils containing mid-aged, considerably-stocked red oak). Each core habitat has a distinct set of food, water, cover, and spatial characteristics that attract and serve a corresponding set of wildlife.

Wildlife habitat is also described in detail in the woodland-specific areas of vegetative similarity—the forest types. The natural characteristics of these habitats are described, as are their value to wildlife. Wildlife species utilizing, or potentially utilizing, each forest type are listed. Habitat is described in the context of amphibian, reptile, avian, and mammal species. Recommendations to perpetuate or enhance these habitats, on a forest type level, are specified as an integral part of the silvicultural prescriptions.

A wood frog observed along one of the Conservation Area's many vernal pools.

LIST OF CORE WILDLIFE HABITATS

In the Glen Oakes Conservation Area:

- Spruce Swamp
- Early-successional and/or young forest habitat
- Mast-production habitat
- Dense softwood thermal cover habitat
- Transitional softwood-hardwood habitat
- Vernal pool network area

NATURAL COMMUNITIES

Natural communities are recurring assemblages of plants and animals found in particular physical environments[10]. Statewide classification is based on typical plant species composition (tree, shrub, herbaceous) for sites with similar climate, elevation, soils, and hydrology. Natural community interpretation is broader than forest type and variant delineations, since the latter also takes into account the vast permutations in vegetation and structure that occur temporally through site disturbance—both natural and human-caused. Thus, only two natural community types were identified for the upland forest areas, with small inclusions of a potential third community. By contrast, the Conservation Area's wetlands, particularly Spruce Swamp, represent a variety of natural communities. While exemplary natural communities are discussed in this study, full delineation of the wetland natural communities was beyond the scope of the plan.

From a forestry perspective, the species component of a natural community provides a template for ecological management. A primary focus of silvicultural management of the Glen Oakes Conservation Area forest is the restoration of "naturalness"—defined by complex forest structure and the biological diversity appropriate to the natural community.

[10] Natural Communities of New Hampshire, Sperduto and Nichols, 2004.

FOREST ACCESS

CURRENT CONDITIONS

The main public access point to the Glen Oakes Conservation Area is via the gravel cul-de-sac at the end of Andreski Drive. The cul-de-sac perimeter is used informally for parking, while a trailhead kiosk provides maps and property information.

The primary route into the Conservation Area is a 3,600± foot long woods road that starts at the cul-de-sac and traverses the property in a north, and then east, direction. The road continues off the property at the town line boundary, where it enters the adjacent conservation property owned by the Town of Brentwood. This woods road, with two landing sites, serves as core access for forest management. Landing A provides staging access to forestry activity in Management Compartments (MC) #1, #2 and #4. Landing B provides access to forestry in MC #3. Maximum skidding distances will be about 2,800± feet. The road also serves as a primary recreation corridor, with a number of trails leading from the road.

The picturesque Barred Owl Trail where it travels parallel to the SELT Garrison property.

Recreational trails traverse the central and eastern area of the property. Ranging over 4 miles, the trails form four circuits including the Barred Owl Path, the Forest Loop, Homestead Loop, and the Woodland Loop. Side trails lead off property, while several connector links access between the trail loops. All trails are on MC's #2, 3, or 4.

MC's #1 and #5, the western and Spruce Swamp/reserves sections of the tract do not contain official trails. Thus, nearly 50% of the Tract area is trail-less. The trail-less condition is favorable for wildlife and avoids heavy recreational use of the forest reserve areas. Human activity along trails may diminish nearby breeding habitat for some wildlife species.

Two unofficial trails, both likely to be retired, exist: 1) A trail continues past Landing C, across private property and on towards an island within Spruce Swamp. This forested island was heavily cut about 2003±; the access road to the island has since been flooded by beaver, rendering foot traffic difficult, except on frozen conditions. Due to the prime wetlands status of Spruce Swamp, restoration of this access route is not feasible. 2) A footpath (the Pike Trail) follows the southerly boundary line of MC #1. This minor trail accesses a second cellar hole before exiting the property onto adjacent private land.

Forest Access Recommendations

In total, nearly 5 miles of woods roads, trails, and footpaths exist on the Glen Oakes Conservation Area, providing recreational access through 3/4 of the forest acreage. Parking at the main cul-de-sac access point has proven adequate. In addition, with minor upgrades, forest management will be fully served by the existing road system.

An important management objective, as defined by the Fremont Conservation Commission, is to maintain adequate internal access system to fully implement silvicultural and wildlife management, while providing

recreational and fire protection access. This objective is qualified in the sense that overbuilt access is not desirable, since the remote qualities of certain Conservation Area sections are highly valued as well.

Recommendations:

- Further extension of the road and trail system is not recommended, as the present network is extensive, reaches a variety of interesting features, and is situated to minimize disruption from forest management.
- Continue to focus trail-based recreational use in MC's #2, #3 and #4.
- Maintain the interior of MC #1 and the upland forest reserves in MC #5 as trail-free habitat areas.
- Do not restore the road crossing that has been flooded by beaver into the Spruce Swamp island.
- Install and maintain effective trail fords across seasonal streams to minimize recreational use impact to the streams. Stepping stones, "bog bridges", simple footbridges, or construction mats are possible structures. A wetland notification permit is likely needed for the structures.
- In conjunction with silvicultural activity in MC #3 (2021±), do minor grading and widening of the woods road between Landings A and B.

The now permanently-inundated connection to the island in Spruce Swamp.

- If Landing C is used, minor road upgrading is necessary.
- Woods road maintenance grading may be needed to Landing A prior to the next harvest, though the logging contractor will typically incorporate this into their project.
- Avoid harvesting operations during spring thaw and wet seasons to preclude extensive damage to woods roads and forest rutting.
- Block remote woods road entry points with visible boulders to discourage unauthorized large wheeled vehicles. The main entrance is gated.

COMMUNITY USE

Community use of the Glen Oakes Conservation Area for recreation and educational purposes are a major management objective. Public usage must be balanced with the purposes of the conservation easement and the objectives of protecting water resources, maintaining quality wildlife habitat, and promoting natural forest conditions.

Recreational Policy

Recreational use of the Conservation Area is primarily trail-based. Town policy, established in 2007 by the Fremont Board of Selectmen, allows the following:

- All pedestrian uses, such as hiking, running, snowshoeing, and skiing.
- Horseback riding, non-motorized bicycles (mountain bikes), and dog sledding—only on established trails.
- Snowmobiling on designated, signed trails, after December 15th, and only when there is at least 6 inches of snow cover.

Off-trail activities include hunting, fishing, nature observation, orienteering, and geo-caching. These are all permissible as long as there is no environmental impact, including littering of the forest or removal/damage to structures, trails, natural features, or plants. Hunting and fishing also must follow these caveats:

- Done in strict accordance of state laws.
- Only temporary tree stands are allowed, with owners' name and address, and only between September 1 and January 1. Permanent tree stands are not permitted.

Trapping policy has been researched and summarized in the "Conservation Area Trapping Policy" section in the "WILDLIFE RESOURCES" chapter. Limited trapping may be allowed by the Board of Selectmen in the future.

The public is not allowed to do following activities in the Glen Oakes Conservation Area:

- Use of any motorized vehicles, except for snowmobiles, vehicles for handicap access, or vehicles for forest management, the latter two which must be pre-authorized by the Selectmen.
- Camping or campfires.
- Layout, construction, or maintenance (without authorization) of trails.
- Litter.
- Removal or damage to any property features except for game harvested under a hunting, fishing, or trapping license.
- Installation of a permanent tree stand.

Recommendations:

- Trail signs have been installed, and trails color-marked. It is recommended that trail blazes be painted, rather than to nail metal tags to the trees.
- Stock kiosk with trail maps. Post trail map on-line for downloading.

- Post “no-wheeled vehicle” signs at all property access points.
- Install appropriate fords on trails at all stream crossing points.

Educational Uses

As community property, the Glen Oakes Conservation Area has the potential to serve as a visible, evolving example of careful resource management and forest stewardship. The parcel can provide an outdoor location for students, conservation groups, landowners, and others to observe and learn about nature, and forest and wildlife management activities.

Individuals also use the Conservation Area for bird watching and other natural observation. The Conservation Commission may consider developing an interpretive trail to provide visitors information about forest management activities and natural/historical features.

Recommendations:

- Publicize educational uses of the Conservation Area to local schools. Conduct a field tour/workshop for teachers and students.
- Link with New Hampshire Project Learning Tree to promote nature education for students.
- Organize forest tours to illustrate management to townspeople and town officials, landowner and conservation groups, land trusts, university classes, and other conservation commissions.
- Develop an interpretive trail guide with corresponding forest stations.

Community Volunteer Projects

Students, Scouts, community groups, and other local volunteers may be available to provide community service. There are specific projects within the Conservation Area that will benefit the land and the community, as well as provide educational experiences for the participants. In some cases, the volunteers must be trained to conduct the activity. The Conservation Commission should be consulted by any potential volunteers prior to organizing an activity. The Conservation Commission can prioritize projects, establish goals and guidelines, and oversee the implementation. The following project list provides a scope of the potential:

- Plan, construct, and install stream fords on trails.
- Maintain no-wheeled vehicle postings.
- Conduct a multi-season bird survey.
- Monitor/survey winter mammal tracks.
- Continue to conduct vernal pool surveys.
- Construct and set-up bat boxes and/or wood duck boxes.
- Pick-up and remove litter or trash.
- Invasive plant removal teams.

WILDLIFE RESOURCES

WILDLIFE RESOURCES

Wildlife usage of the Glen Oakes Conservation Area is dependent on the property's habitats, as well as features that enhance these habitats, and the continuity of habitat on adjacent open space lands. While habitat is varied and nuanced, six core habitats were identified that contain broad similarity in both physical and vegetative attributes. The core habitats include wetland and upland types which are illustrated in the *Wildlife Habitat Map*. Descriptions of the core habitats follow. Detailed descriptions of the woodland-specific core habitats are found in the forest type descriptions.

Core Habitats

Spruce Swamp, at 800± acres, the largest freshwater wetland in Rockingham County, is an outstanding resource that has not been marred by development. This dynamic ecosystem has notable variety of site conditions including recently-flooded snag forest; forested wetland; extensive scrub/shrub; deep, medium, and shallow-water emergent; bog areas; and open water, both ponded and riparian. New Hampshire Natural Heritage Bureau lists Spruce Swamp as habitat for an endangered mussel, brook floater, and a threatened reptile, Blanding's turtle, which also utilizes the surrounding upland forest. Other amphibians and reptiles include: Pickerel frog, bullfrog, ribbon snake, spotted turtle, painted turtle, and snapping turtle. Birds include a migratory waterfowl such as mergansers (common and hooded) and potentially, pied-billed grebe. Wood duck, black duck, great blue heron, green heron, and kingfisher are all visitors, as well as occasional osprey, and possibly, bald eagle. Yellowthroats, yellow warblers, and northern waterthrush are examples of songbirds that utilize the swamp's shrubby areas. Kingbirds are found in shallow-water areas with stubs or snags. Mammals that utilize Spruce Swamp include moose, deer, raccoon, beaver, muskrat, mink, and otter. Bats (little brown, big brown) hunt over the open water environs.

Snags characterize much of Spruce Swamp.

In addition to the extent and variety of wetland natural communities, habitat features that enhance Spruce Swamp include: The abundance of snags, stubs, and downed woody material; the extensive dense shrub cover; the interlaced shallow water ponded areas; extensive hummocky terrain; and the presence of vegetative species near the edge of their range such as black spruce and poison sumac, which contribute to plant diversity. Hummocks and large woody debris from old blowdowns provide potential denning sites for amphibians, reptiles, and mammals. Snags and decaying trees provide cavities, though mostly smaller diameter. These are used by primarily by small primary and secondary cavity-using birds for feeding and nesting.

Management recommendations for Spruce Swamp are generally to protect it from human disturbance, particularly activities that may: Pollute soils or water; artificially raise or lower water levels; impede water flow or otherwise change hydrology; fill or excavate wetlands; or introduce non-native fauna or flora. In the future, management may be necessary to control invasive plants such as purple-loosestrife, or

optimize habitat for an endangered animal species, for example, but these efforts should be carefully planned in conjunction with the NH Wildlife Action Plan, and executed with all applicable permits.

Dense pine and mixed hardwood sapling growth in a young forest pocket.

Early-successional and young forest habitats are typically characterized as containing dense seedling and sapling tree growth. In a harvested forest, many of the trees are coppice from cut stumps, therefore the species mix may include hardwoods that are mid or late successional, such as black birch and beech. In areas that have remained open, such as fields, meadows, powerline corridors, or transitional edges, forest growth is typically dominated by "pioneer" species. These species are at least partly early-successional, and include, black cherry, gray birch, quaking aspen, white pine, white birch, red maple, speckled alder, and black willow. In both young forest and early successional situations, shrubs, brambles, and vines are important vegetative elements. This vegetation provides two important habitat components: Dense, low cover, and food, particularly soft mast such as blackberries. Habitat enhancements include perches provided by taller trees both scattered or along edges. These components are especially favorable to songbirds and raptors, as well as mammals including moose, snowshoe hare, and cottontail rabbits. Fledglings of avian species associated with older hardwood forest, such as wood thrush and ovenbird, will utilize brushy, early successional openings.

Cavity trees provide refuge and food sources for various wildlife species.

In the Conservation Area, the *UH2* forest type contains "aging" young forest growth which originated from strip cutting in 2003±. Upland early-successional forest growth is found in the powerline corridor and the adjacent UH3 forest type, which was clearcut about 2002±. Though not part of the Conservation Area, the entire upland forest (7± acres) on the landlocked "out" parcel was clearcut in 2013. This forest opening now provides an extensive pocket of valuable young forest habitat embedded in the surrounding older forest and adjacent to a snag swamp area in Spruce Swamp.

Young forest and early successional management will consist of perpetuating or creating these conditions on about 6+% of the property's upland area (20+ acres), mostly in areas that currently contain young growth. Specific prescriptions are found in the "SILVICULTURAL PLANNING" chapter. These areas are augmented by the adjacent property's clearcut, and substantial scrub/shrublands contained within Spruce Swamp.

Mast-producing forest dominates a large area of the Conservation Area interior, principally represented by the *Upland Hardwood (UH*) forest type. Red oak dominates the tract's *UH* areas, with lesser amounts of black oak, white oak, beech, and shagbark hickory. These species produce hard mast, in the form of acorns, beechnuts, and hickory nuts. Acorns rank among the most important wildlife foods in our local forests, utilized by a great variety of animals (turkey, deer, flying squirrels, bear, blue jays, etc.). White oak

acorns are a preferred hard mast type. Older oaks and hickories with a well-developed crown are important for copious acorn production.

Red oak is a dominant component of mast-producing forest.

An abundance of cavity trees enhances the upland hardwood forest habitat. Some of the cavity trees are mid to large-diameter which are preferred by pileated woodpeckers and tree-denning mammals. Also, occasional large-crowned hardwoods, particularly beech, have a triple upper-trunk branching habit that provides ideal raptor nest sites.

A silvicultural objective is maintaining the abundance and diversity of hard mast producing species. This diversity includes understory shrubs such as beaked hazelnut, and may eventually (2045±) comprise the re-introduction of disease-resistant American chestnut. Over the long-term, the recommended silviculture *encourages the plentiful retention* of healthy, large-crowned mast producers, ranging from 100 to 200+ years of age in the Conservation Area.

Softwood thermal cover habitat is primarily represented by well-established stands of *Hemlock/White Pine/Hardwood (HWH)* and *Hemlock/Hardwood (HH).* Hemlock's dark evergreen shading is most significant where hemlock is found in all three general canopy layers—understory, mid-story, and overstory. Snow depths tend to be less under the hemlock's thick foliage, encouraging deer, grouse, and snowshoe hare to settle under their canopy. Mid-summer temperatures are also moderated under the cooling shade. Sapling hemlock provides moderate food value to wildlife, but more importantly, year-round travel cover. Wildlife utilizes travel corridors in the Conservation Area where dense lower and mid-canopy hemlock borders seasonal streams and wetland edges.

Hemlock/hardwood forest type.

Habitat enhancers include supercanopy white pine, with crowns that are positioned above the forest's main canopy. These larger pines provide good perch/roost sites for owls, hawks, and ravens as well as seed for songbirds and squirrels. Scattered red oaks within the thermal stands provide mast. Also, embedded in this core habitat, are several seasonal streams, small forested wetlands, and vernal pools. A variety of fruit-bearing wetland-forest shrubs were noted including sweet pepperbush, nannyberry, northern arrowwood, winterberry holly, and highbush blueberry. The berries (soft mast) from these shrubs are available in stages from mid-summer to early winter, and thus provide an ongoing food source for migratory and over-wintering birds.

It is recommended that the hemlock component be silviculturally maintained on the property, particularly in the vicinity of forested wetlands and along riparian edges. In hemlock areas, silviculture will favor multi-aged growth and canopy layers. Hemlocks, and other tree species, should be well represented as saplings mid-aged, and older growth.

Transitional softwood-hardwood mixed forest include areas with combined mast hardwoods and softwood cover, mostly pine; mesic hardwoods (yellow and black birch, red maple, white ash); and some enriched sites (with sugar maple, hophornbeam, and basswood). The *White Pine/Hardwood* forest type, largely constitutes this habitat. Red oak remains a primary species, supplementing the adjacent mast forest habitat. White pine is found individually and in small groups; the generally open foliage provides only light thermal cover. Scattered hemlocks, by contrast, within this core habitat, contribute appreciable wildlife cover.

White pine/hardwood forest type.

Habitat enhancers include enriched sites with diverse tree species, which in turn, increase the variety of seeds and mast. A few vernal pools provide critical habitat (see below). The accumulation of coarse woody debris is somewhat variable, but includes large diameter tree trunks in areas. Cavity trees and hollow downed woody debris enhance habitat for flying squirrels, opossum, and gray fox.

A network of vernal pools—approximately 40—mainly in the property's central area, represents a unique core habitat in the Glen Oakes Conservation Area. The vernal pools include shallow open water habitat, as well as shrub and light forest cover, typically with highbush blueberry, winterberry holly, sweet pepperbush, and red maple, and generally .05 to .5 acres in area. The pools are ephemeral—generally flooding during the spring and/or fall, and usually drying out during the summer. The resulting fish-free habitat provides critical breeding sites for many amphibians, reptiles, and fresh-water crustaceans. Wood frogs, spring peepers, pickerel frogs, spotted salamanders, and fairy shrimp were some of the species noted in several vernal pools that were analyzed in April 2008 and 2009. The surrounding upland forest and nearby forested wetlands are vital to the year-round activities of several of these species.

The longevity of flooding—hydroperiod—is an important factor in the quality of vernal pools. Many of the species associated with vernal pools occur in greatest abundance when the hydroperiod is at least four months from the time breeding begins. Highly functional pools do not dry until late July or later[11]. Several of the larger, deeper, shaded pools in the Conservation Area have an intermediate hydroperiod, particularly in wetter years.

[11] "The Importance of Hydroperiod in Wetland Assessment", Matt Tarr and Kimberly J. Babbitt, UNH

POTENTIAL, LIKELY, OR OBSERVED WILDLIFE SPECIES

Potential (P)
Likely (X)
Observed (O)
Unlikely/Unknown (U)

Common Name	Scientific Name	Occurrence
Amphibians		
Blue-spotted Salamander	*Ambystoma laterale*	P
Spotted Salamander	*Ambystoma maculatum*	O[1]
Marbled Salamander	*Ambystoma opacum*	O[2]
Red-spotted Newt	*Notophthalmus v. viridescens*	O[1]
Northern Dusky Salamander	*Desmognathus f. fuscus*	P
Redback Salamander	*Plethodon cinereus*	O
Four-toed Salamander	*Hemidactylium scutatum*	P
Northern Spring Salamander	*Gyrinophilus p. porphyriticus*	O[2]
Northern Two-lined Salamander	*Eurycea b. bislineata*	O[2]
Eastern American Toad	*Bufo a. americanus*	O[1]
Fowler's Toad	*Bufo woodhousii fowleri*	O[2]
Northern Spring Peeper	*Hyla c. crucifer*	O[1]
Gray Treefrog	*Hyla versicolor*	O[1]
Bullfrog	*Rana catesbeiana*	O[1]
Green Frog	*Rana clamitans melanota*	O[1]
Wood Frog	*Rana sylvatica*	O
Northern Leopard Frog	*Rana pipiens*	X
Pickerel Frog	*Rana palustris*	O[1]
Reptiles		
Common Snapping Turtle	*Chelydra s. serpentina*	X
Common Musk Turtle	*Sternotherus odoratus*	X
Spotted Turtle	*Clemmys guttata*	P
Wood Turtle	*Clemmys insculpta*	P
Eastern Box Turtle	*Terrapene c. carolina*	U
Eastern Painted Turtle	*Chrysemys p. picta*	O
Blanding's Turtle	*Emydoidea blandingii*	O[2]
Northern Water Snake	*Nerodia s. sipedon*	X
Northern Brown Snake	*Storeria d. dekayi*	X
Northern Redbelly Snake	*Storeria o. occipitomaculata*	X
Common Garter Snake	*Thamnophis s. sirtalis*	O
Ribbon Snake	*Thamnophis sauritus*	X
Northern Ringneck Snake	*Diadophis punctatus edwardsi*	X
Northern Black Racer	*Coluber c. constrictor*	X
Eastern Smooth Green Snake	*Opheodrys v. vernalis*	X
Eastern Milk Snake	*Lampropeltis t. triangulum*	X

Birds

Common Loon	*Gavia immer*	O[2]
Pied-billed Grebe	*Podilymbus podiceps*	P
American Bittern	*Botaurus lentiginosus*	X
Least Bittern	*Ixobrychus exilis*	U
Great Blue Heron	*Ardea herodias*	O
Green Heron	*Butorides virescens*	X
Black-crowned Night Heron	*Nycticorax nycticorax*	P
Canada Goose	*Branta canadensis*	O
Wood Duck	*Aix sponsa*	O
American Black Duck	*Anas rubripes*	X
Mallard	*Anas platyrhynchos*	X
Blue-winged Teal	*Anas discors*	P
Green-winged Teal	*Anas crecca*	P
Common Goldeneye	*Bucephala clangula*	U
Bufflehead	*Bucephala albeola*	U
Hooded Merganser	*Lophodytes cucullatus*	P
Common Merganser	*Mergus merganser*	P
Red-breasted Merganser	*Mergus serrator*	U
Double-Crested Cormorant	*Phalacrocorax auritus*	U
Turkey Vulture	*Cathartes aura*	O
Bald Eagle	*Haliaeetus leucocephalus*	P
Osprey	*Pandion haliaetus*	P
Northern Harrier	*Circus cyaneus*	U
Sharp-shinned Hawk	*Accipiter striatus*	X
Cooper's Hawk	*Accipiter cooperii*	X
Northern Goshawk	*Accipiter gentilis*	P
Red-shouldered Hawk	*Buteo lineatus*	O[1]
Broad-winged Hawk	*Buteo platypterus*	O[1]
Red-tailed Hawk	*Buteo jamaicensis*	O[1]
Rough-legged Hawk	*Buteo lagopus*	P
American Kestrel	*Falco sparverius*	P
Merlin	*Falco columbarius*	U
Peregrine Falcon	*Falco peregrinus*	U
Ring-necked Pheasant	*Phasianus colchicus*	U
Ruffed Grouse	*Bonasa umbellus*	O
Wild Turkey	*Meleagris gallopavo*	O
Virginia Rail	*Rallus limicola*	P
Sora	*Porzana carolina*	P
Common Moorhen	*Gallinula chloropus*	P
American Coot	*Fulica americana*	P
Killdeer	*Charadrius vociferus*	U
Spotted Sandpiper	*Actitis macularia*	P
Upland Sandpiper	*Bartramia longicauda*	U
Common Snipe	*Gallinago gallinago*	P

American Woodcock	*Scolopax minor*	O
Herring Gull	*Larus argentatus*	U
Rock Dove	*Columba livia*	U
Mourning Dove	*Zenaida macroura*	O[1]
Black-billed Cuckoo	*Coccyzus erythropthalmus*	U
Yellow-billed Cuckoo	*Coccyzus americanus*	P
Common Barn-Owl	*Tyto alba*	U
Eastern Screech-Owl	*Otus asio*	P
Great Horned Owl	*Bubo virginianus*	X
Snowy Owl	*Nyctea scandiaca*	U
Barred Owl	*Strix varia*	O[1]
Long-eared Owl	*Asio otus*	U
Northern Saw-whet Owl	*Aegolius acadicus*	X
Common Nighthawk	*Chordeiles minor*	U
Whip-poor-will	*Caprimulgus vociferus*	P
Chimney Swift	*Chaetura pelagica*	U
Ruby-throated Hummingbird	*Archilochus colubris*	O[2]
Belted Kingfisher	*Ceryle alcyon*	O[2]
Yellow-bellied Sapsucker	*Sphyrapicus varius*	O[2]
Red-headed Woodpecker	*Melanerpus erythrocephalus*	U
Red-bellied Woodpecker	*Melanerpes carolinus*	O
Downy Woodpecker	*Picoides pubescens*	O[1]
Hairy Woodpecker	*Picoides villosus*	O[1]
Northern Flicker	*Colaptes auratus*	O[1]
Pileated Woodpecker	*Dryocopus pileatus*	O[1]
Eastern Wood-Pewee	*Contopus virens*	O[1]
Olive-sided Flycatcher	*Contopus cooperi*	X
Alder Flycatcher	*Empidonax alnorum*	X
Willow Flycatcher	*Empidonax traillii*	X
Least Flycatcher	*Empidonax minimus*	O[2]
Eastern Phoebe	*Sayornis phoebe*	O[1]
Great Crested Flycatcher	*Myiarchus crinitus*	O[1]
Eastern Kingbird	*Tyrannus tyrannus*	O[1]
Horned Lark	*Eremophila alpestris*	O[2]
Purple Martin	*Progne subis*	U
Tree Swallow	*Tachycineta bicolor*	O
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	P
Bank Swallow	*Riparia riparia*	U
Cliff Swallow	*Hirundo pyrrhonota*	U
Barn Swallow	*Hirundo rustica*	P
Blue Jay	*Cyanocitta cristata*	O[1]
American Crow	*Corvus brachyrhynchos*	O[1]
Common Raven	*Corvus corax*	X
Black-capped Chickadee	*Parus atricapillus*	O[1]
Tufted Titmouse	*Parus bicolor*	O[1]
Red-breasted Nuthatch	*Sitta canadensis*	O[1]

White-breasted Nuthatch	*Sitta carolinensis*	O[1]
Brown Creeper	*Certhia americana*	X
House Wren	*Troglodytes aedon*	X
Winter Wren	*Troglodytes troglodytes*	X
Marsh Wren	*Cistothorus palustris*	X
Golden-crowned Kinglet	*Regulus satrapa*	U
Blue-gray Gnatcatcher	*Polioptila caerulea*	P
Eastern Bluebird	*Sialia sialis*	U
Veery	*Catharus fuscescens*	O[1]
Hermit Thrush	*Catharus guttatus*	O[1]
Wood Thrush	*Hylocichla mustelina*	O
American Robin	*Turdus migratorius*	O[1]
Gray Catbird	*Dumetella carolinensis*	O[1]
Northern Mockingbird	*Mimus polyglottos*	X
Brown Thrasher	*Toxostoma rufum*	X
Cedar Waxwing	*Bombycilla cedrorum*	X
Northern Shrike	*Lanius excubitor*	U
European Starling	*Sturnus vulgaris*	U
Solitary Vireo	*Vireo solitarius*	X
Yellow-throated Vireo	*Vireo flavifrons*	O
Warbling Vireo	*Vireo gilvus*	U
Red-eyed Vireo	*Vireo olivaceus*	O[1]
Blue-headed Vireo	*Vireo solitarius*	O[1]
Blue-winged Warbler	*Vermivora pinus*	U
Nashville Warbler	*Vermivora ruficapilla*	X
Yellow Warbler	*Dendroica petechia*	O[1]
Chestnut-sided Warbler	*Dendroica pensylvanica*	O[2]
Magnolia Warbler	*Dendroica magnolia*	X
Black-throated Blue Warbler	*Dendroica caerulescens*	O[1]
Yellow-rumped Warbler	*Dendroica coronata*	O
Black-throated Green Warbler	*Dendroica virens*	O[1]
Blackburnian Warbler	*Dendroica fusca*	O[2]
Pine Warbler	*Dendroica pinus*	O[1]
Prairie Warbler	*Dendroica discolor*	O[2]
Black-and-white Warbler	*Mniotilta varia*	O[1]
Northern Parula	*Setophaga Americana*	O[2]
American Redstart	*Setophaga ruticilla*	O[2]
Prothonotary Warbler	*Protonotaria citrea*	U
Ovenbird	*Seiurus aurocapillus*	O[1]
Northern Waterthrush	*Seiurus noveboracensis*	O[1]
Louisiana Waterthrush	*Seiurus motacilla*	U
Common Yellowthroat	*Geothlypis trichas*	O[1]
Canada Warbler	*Wilsonia canadensis*	O[2]
Scarlet Tanager	*Piranga olivacea*	O[1]
Northern Cardinal	*Cardinalis cardinalis*	O[1]
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	O[2]

Indigo Bunting	*Passerina cyanea*	P
Eastern Towhee	*Pipilo erythrophthalmus*	O[2]
American Tree Sparrow	*Spizella arborea*	P
Chipping Sparrow	*Spizella passerina*	O
Field Sparrow	*Spizella pusilla*	O
Vesper Sparrow	*Pooecetes gramineus*	U
Savannah Sparrow	*Passerculus sandwichensis*	U
Grasshopper Sparrow	*Ammodramus savannarum*	U
Fox Sparrow	*Passerella iliaca*	U
Song Sparrow	*Melospiza melodia*	O[2]
Swamp Sparrow	*Melospiza georgiana*	X
White-throated Sparrow	*Zonotrichia albicollis*	O[1]
Dark-eyed Junco	*Junco hyemalis*	O
Lapland Longspur	*Calcarius lapponicus*	U
Snow Bunting	*Plectrophenax nivalis*	U
Bobolink	*Dolichonyx oryzivorus*	U
Eastern Meadowlark	*Sturnella magna*	U
Red-winged Blackbird	*Agelaius phoeniceus*	O
Common Grackle	*Quiscalus quiscula*	O
Brown-headed Cowbird	*Molothrus ater*	O
Northern Oriole	*Icterus galbula*	P
Pine Grosbeak	*Pinicola enucleator*	U
Purple Finch	*Carpodacus purpureus*	O[2]
House Finch	*Carpodacus mexicanus*	U
Pine Siskin	*Carduelis pinus*	U
American Goldfinch	*Carduelis tristis*	O
Evening Grosbeak	*Coccothraustes vespertinus*	P
House Sparrow	*Passer domesticus*	U

Mammals

Virginia Opossum	*Didelphis virginiana*	X
Masked Shrew	*Sorex cinereus*	X
Water Shrew	*Sorex palustris*	X
Smoky Shrew	*Sorex fumeus*	X
Northern Short-tailed Shrew	*Blarina brevicauda*	X
Hairy-tailed Mole	*Parascalops breweri*	P
Eastern Mole	*Scalopus aquaticus*	U
Star-nosed Mole	*Condylura cristata*	X
Little Brown Myotis	*Myotis lucifugus*	X
Northern Myotis	*Myotis septentionalis*	U
Keen's Myotis	*Myotis keenii*	U
Small-footed Myotis	*Myotis leibii*	U
Silver-haired Bat	*Lasionycteris noctivagans*	U
Eastern Pipistrelle	*Pipistrellus subflavus*	U
Big Brown Bat	*Eptesicus fuscus*	X

Red Bat	*Lasiurus borealis*	U
Hoary Bat	*Lasiurus cinereus*	U
Eastern Cottontail	*Sylvilagus floridanus*	P
New England Cottontail	*Sylvilagus transitionalis*	U
Snowshoe Hare	*Lepus americanus*	O
Eastern Chipmunk	*Tamias striatus*	O[1]
Woodchuck	*Marmota monax*	X
Gray Squirrel	*Sciurus carolinensis*	O[1]
Red Squirrel	*Tamiasciurus hudsonicus*	O[1]
Southern Flying Squirrel	*Glaucomys volans*	X
Northern Flying Squirrel	*Glaucomys sabrinus*	X
Beaver	*Castor canadensis*	O[1]
Deer Mouse	*Peromyscus maniculatus*	X
White-footed Mouse	*Peromyscus leucopus*	X
Southern Red-backed Vole	*Clethrionomys gapperi*	X
Meadow Vole	*Microtus pennsylvanicus*	X
Woodland Vole	*Microtus pinetorum*	X
Muskrat	*Ondatra zibethicus*	X
Southern Bog Lemming	*Synaptomys cooperi*	U
Norway Rat	*Rattus norvegicus*	U
House Mouse	*Mus musculus*	U
Meadow Jumping Mouse	*Zapus hudsonius*	X
Woodland Jumping Mouse	*Napaeozapus insignis*	U
Porcupine	*Erethizon dorsatum*	O[1]
Coyote	*Canis latrans*	O[1]
Red Fox	*Vulpes vulpes*	X
Gray Fox	*Urocyon cinereoargenteus*	X
Black Bear	*Ursus americanus*	X
Raccoon	*Procyon lotor*	O
Fisher	*Martes pennanti*	O
Ermine	*Mustela erminea*	O
Long-tailed Weasel	*Mustela frenata*	X
Mink	*Mustela vison*	X
Striped Skunk	*Mephitis mephitis*	X
River Otter	*Lutra canadensis*	X
Bobcat	*Lynx rufus*	P
White-tailed Deer	*Odocoileus virginianus*	O[1]
Moose	*Alces alces*	O[1]

O = Observed by C. Moreno during 2008-2009 or 2015-2018 forest management plan fieldwork.
[1] Also observed during a May 2011 "BioBlitz" event.
[2] Only recorded GOCA observation is from May 2011 "BioBlitz" report.

NOTES:

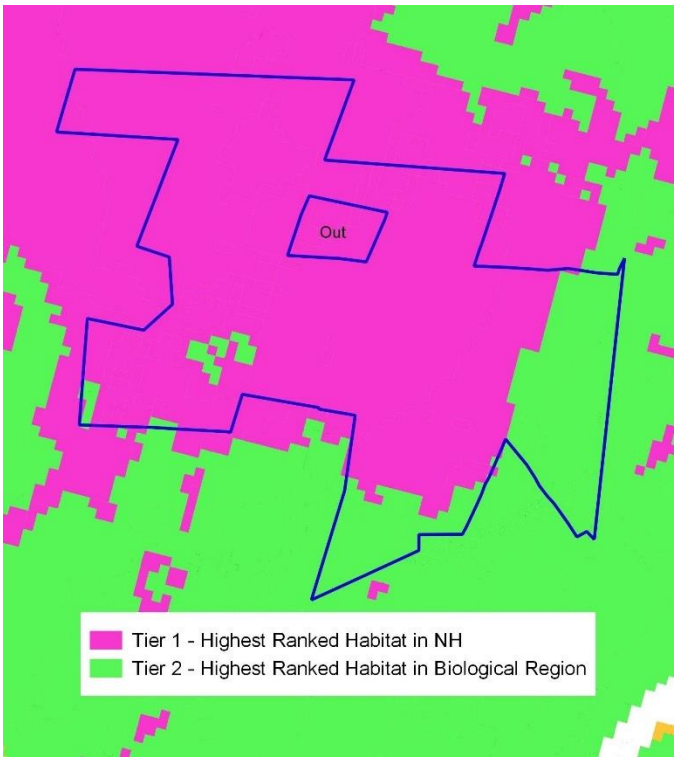
- In addition to direct sightings, "observed" wildlife includes observed evidence of particular species such as tracks, scat, nests, tree or ground dens, tree scrapes, as well as, amphibian egg masses and bird song.

- Wildlife species listed as “likely” were not observed directly or indirectly, however, the Conservation Area contains the habitat and/or habitat features that likely attracts at least occasional presence of these species.
- The property contains some habitat suitable for species listed as “potential”. However, these species are less likely to be found due to 1) rarity of the species, such as Canada warbler; or 2) habitat characteristics are not optimal, usually because the habitat is not extensive. For example, the property lacks extensive fallow/abandoned field/young forest, with only portions of the powerline corridor potentially qualifying, perhaps enough to attract Eastern towhee.

WILDLIFE SPECIES OF GREATEST CONSERVATION NEED

Interface with NH Wildlife Action Plan

In 2001, Congress established a "State Wildlife Grants" program that provided funds to state wildlife agencies for the conservation of fish and wildlife, and their habitats. Each state was charged with developing a comprehensive wildlife conservation plan as a proactive effort to keep species off rare species lists, and in the process save taxpayer dollars. Spearheaded by the New Hampshire Fish and Game Department (NH Fish & Game), with partners in the conservation community, the New Hampshire Wildlife Action Plan was created to directly address the "species in greatest need of conservation." As part of the Wildlife Action Plan (WAP), NH Fish & Game identified wildlife species at risk (those with low and declining populations), assessed the condition of wildlife habitats, and evaluated risk factors for species and habitats. [12]



NH Fish & Game has identified 160 species of greatest conservation need (SGCN) in the state, along with their associated habitats. The species include freshwater mussels, insects, fish, amphibians, reptiles, birds, mammals, and four species of game animals. On the Glen Oakes Conservation Area, the natural range of 48± SGNC species overlaps with, or lies in close proximity to, the Conservation Area. The SGCN table on the next page summarizes the preferred habitats for these 48 species, and their likelihood for occurrence on Glen Oakes.

Using the ecological regions first described by the US Forest Service, WAP identifies 10 ecoregions in New Hampshire; the Glen Oakes Conservation Area, is situated within the *Gulf of Maine Coastal Plain ecoregion*. There are 7 watershed groupings in the state; the Conservation Area lies within the *Tidal Coastal Watershed*. 19 large-scale habitats have been classified for New Hampshire, including five matrix forest types and four freshwater habitats.[13] The matrix forest types in the Glen-Oakes Conservation Area are *Hemlock-Hardwood-Pine Forest* and *Appalachian Oak-Pine Forest*. The relevant wetland habitats include *Marsh and Shrub Wetlands*, *Peatlands*, and *Vernal Pools.*

The majority of the Conservation Area (310 acres; 80%), including Spruce Swamp, qualifies as "Highest Ranked Habitat in NH", recognized as featuring the best quality habitat in the state. The remaining area (78 acres; 20%) qualifies as "Highest Ranked Habitat in the Biological Region". Since the completion of the

[12] New Hampshire Fish and Game Department. 2009. New Hampshire Wildlife Action Plan website.
[13] Ibid.

2009 Glen Oakes management plan, WAP has been updated and now considers the entirety of the Conservation Area to occupy high-quality habitat.

WAP provides a "coarse filter", landscape-level classification of New Hampshire's habitats. The forest type and habitat assessments researched and prepared for this Forest and Wildlife Management Plan are a refinement of the broad classifications. For example, the vernal pool network in the Conservation Area was not captured by WAP mapping, but through detailed property analysis, have now been identified and mapped. WAP classification as a small-scale habitat—vernal pool—is now possible. The extensive forest type described and mapped as "Upland Hardwood" in this management plan, is perhaps most representative of the *Appalachian Oak-Pine Forest* habitat. Thus, the property's forest type delineations are a refinement of the broad habitat classifications in WAP. Interfacing of these delineations with WAP will provide a clearer picture of the landscape level classifications.

Species of Greatest Conservation Need

The following table provides a list of invertebrates, amphibian, reptile, bird, and mammal species of conservation concern as identified in the NH Wildlife Action Plan (WAP) that may occur *in the Fremont area* (within the *Tidal Coastal Watershed*). Several of the species are unlikely to be found on the Glen Oakes Conservation Area due to the property's available habitats.

The table on the next page cross-references the local (48) SGNC species with the matrix forest types and freshwater habitats found (as mapped in the WAP) on the Conservation Area. The third column, "Habitat Type", describes the species' preferred habitat. The last column lists the likelihood of species occurrence at the Glen Oakes Conservation Area, as follows: Observed (O) during fieldwork for this management plan; "Likely" (X) to use the forest; "Potential" (P); and "Unlikely" or "Unknown" (U). Gold-colored entrees are species that WAP added to the list in 2015.

Common Name	WAP - Habitat	Habitat Type	Conservation Area occurrence?
Freshwater Mussels			
Brook floater	WRS	Slow-moving streams	X
Creeper	WRS	Small streams and rivers	P
Eastern pond mussel	WRS	Slow-moving streams	P
Triangle floater	WRS	Streams	P
Fish			
American eel	WRS	Freshwater accessible from ocean	P
Banded sunfish	WRS	Ponds, low-lying streams, acidic waters	P
Bridle shiner	WRS	Slow-moving streams	P
Redfin pickerel	WRS	Slow-moving acidic streams	P
Swamp darter	WRS	Small streams	P
Amphibians			
Blue-spotted salamander	VP, HHPF, AOPF, MSW, PTL, TS	Deciduous forest, wooded swamps	P
Reptiles			
Black racer	SH, AOPF, HHPF	Fields, meadows, marshes, woodlands	X
Blanding's turtle	MSW, PTL, VP	Marsh & shrub wetlands, upland forest	O[2]
Eastern ribbonsnake	MSW, PTL, VP	Marsh & shrub wetlands	X
Spotted turtle	MSW, VP, PTL, TS	Vernal pools, emergent marshes	P

Smooth greensnake	SH, MSW, PTL	Fields, meadows, dense vegetation	X
Wood turtle	SH, WRS	Sandy-bottomed streams	P
Birds			
American black duck	MSW	Marsh & shrub wetlands	X
American kestrel	SH	Open areas covered by short ground vegetation	P
American woodcock	SH, MSW, AOPF, HHPF, TS	Early successional	O
Bald eagle	WRS, AOPF, HHPF, MSW	Large lakes, rivers, estuaries	P
Black-billed cuckoo	SH	Shrub- and sapling-dominated habitat, open woodlands/forest edges	P
Blue-winged warbler	SH	Shrubland	U
Brown thrasher	SH	Shrubland	U
Canada warbler	HHPF, NHCF, LSFF, NS, TS	Dense understory wetland forest edge	O[2]
Cerulean warbler	AOPF	Mature deciduous forest	U
Chimney swift	DH, LSFF, AOPF, HHPF, NHCF	Expansive forests; large hollow trees	X
Eastern towhee	SH, AOPF, PTL	Early successional	O[2]
Field sparrow	SH	Shrubland	U
Golden-winged warbler	SH	Early successional	U
Least bittern	MSW	Marsh & shrub wetlands	U
Northern goshawk	AOPF, HHPF, LSFF, NHCF	Older mixed forest, deep woods	P
Pied-billed grebe	MSW, PTL	Marsh & shrub wetlands	P
Prairie warbler	SH	Shrubland	O[2]
Purple finch	AOPF, HHPF	Open softwood-hardwood forest	O[2]
Ruffed grouse	HHPF, NHCF, AOPF, GR, LSFF, MSW, SH	Upland forest, early successional	O
Scarlet tanager	AOPF, HHPF	Mature and mixed forest	O[2]
Sedge wren	MSW	Marsh edges	
Veery	AOPF, HHPF, FH, NHCF, NS, TS	Early successional	O[1]
Wood thrush	AOPF, HHPF	Established upland forest	O
Mammals			
Big brown bat	HHPF, AOPF, TS	Forests with openings and streams	P
Eastern red bat	HHPF, AOPF, TS	Hardwood/softwood forest	U
Hoary bat	HHPF, AOPF, TS	Hemlock forest	U
Little brown bat	HHPF, AOPF, TS	Forests with openings and streams	U
Moose	AOPF, HHPF, MSW, SH, TS	Marsh & shrub wetlands, young forest	O[1]
New England cottontail	SH	Dense early successional	U
Northern long-eared bat	HHPF, AOPF	Older trees, ponds, clearings	U
Silver-haired bat	HHPF, AOPF, TS	Hardwood clearcuts, ponds, streams	U
Tricolored bat	HHPF, AOPF, TS	Deciduous trees	U

[1] Also observed during a May 2011 "BioBlitz" event.

[2] Only recorded GOCA observation is from May 2011 "BioBlitz" report.

Species highlighted in **gold** were added to the State's list of Species of Greatest Conservation Need in the time elapsed between management plan versions.

The WAP habitats are encoded in the table as:

- AOPF: Appalachian Oak Pine Forest
- HHPF: Hemlock Hardwood Pine Forest
- MSW: Marsh and Shrub Wetlands
- PTL: Peatlands
- SH: Shrublands
- TS: Temperate Swamps
- VP: Vernal Pools
- WRS: Warmwater Rivers and Streams

Discussion

The Wildlife Action Plan states that the greatest danger for New Hampshire's wildlife is conversion of habitats into "surfaces and structures—in a word, development"[14]. With the community purchase and conservation easement protection of the Glen Oakes Conservation Area, the major component of conservation has been accomplished—the exceptional habitat within this property will not be lost to development. Furthermore, the conservation easement obligates careful stewardship of the land, including its wildlife habitat, by the Town of Fremont.

The recommendations for habitat management in this plan are the second phase of habitat conservation. Management is forest type specific, but broad-based to benefit indigenous wildlife in general, where there is opportunity. In the future, species specific measures may be implemented, in conjunction with the New Hampshire Wildlife Action Plan. For example, sections of the parcel may be deemed to hold habitat management opportunities for New England cottontail, whip-poor-will, or Canada warbler. The 2025± management plan update may consider species specific measures, particularly as the scientific knowledge collected in WAP continues to expand.

[14] Ibid.

CONSERVATION AREA TRAPPING POLICY

Introduction

Population studies of furbearing species in relatively small spatial areas are generally inconclusive because most of these species range widely, over thousands of acres. In addition, population studies are expensive: for example, a 2010 population study for bobcat in New Hampshire involving two multi-town study areas (about 200 sq. miles) at the cost of $300,000[15]. There is a lack of cost-effective, scientific methodology for determining sustainable trapping levels for various species on a given property less than 1,000 acres. New Hampshire Fish & Game advocates trapping seasons, licensing of trappers, limits on the number of trappers allowed on a property, and safety regulations. Rule-of-thumb averages and knowledge of local conditions are used. Trappers have a self-interest in not over-trapping an area, as this renders their economically marginal pursuit more difficult. Trained volunteers can periodically inventory the presence of furbearers (in addition to other wildlife) on the Conservation Area using one of three methods described below.

Establishing Trapping Policy

Beaver is a commonly trapped animal. Unlike other furbearers, beavers remain in a given area during the November – April 10th trapping season. A rule-of-thumb estimate of the local beaver population can be made by determining the number of active lodges. Generally, 5 to 6 beaver (2 adults, 3 to 4 young) are associated with an established lodge. There are 2± active lodges on the property in Spruce Swamp, and one in the southeast property corner below the powerline corridor. A trapper should only remove adults if trapping annually; or trap up to 2/3rds the population one year, but then skip a year before returning. The first method is more conservative, and thus preferable for the Glen Oakes Conservation Area.

The trapping of other furbearers is more nuanced. Animals such as otter cover considerable territory, up to 20 sq. miles, travelling in and out of any given wetland system. A conservative approach is to limit annual trapping to between 1 - 5 individuals of most other species, or not allow trapping of other furbearers at all. Furthermore, trapping on the Conservation Area would be limited to one, experienced trapper annually, thus avoiding conflict and potential confusion on the number of animals trapped. The Town can select *the* trapper by lottery, or a selection process based on experience and references.

The following guidelines and suggested safety policies are recommended:

Proposed Trapping Policy and Regulations

General Policy:

- Presently, trapping is allowed for beaver only on the Glen Oakes Conservation Area. This policy will be reevaluated by the Fremont Conservation Commission in the future.
- Only one (1) trapper is allowed to trap in the Conservation Area annually.

[15] Pat Tate, Wildlife Biologist, NH Fish & Game, personal communication.

- Any trapping on the Glen Oakes Conservation Area requires written landowner permission from the Town Selectmen in conjunction with the Fremont Conservation Commission.
- Trappers shall apply to the Fremont Conservation Commission by October 1st, presenting a statement of qualifications including a NH license.
- Trapper shall submit or make an annual report to the Fremont Conservation Commission by June 1st.
- The Fremont Conservation Commission reserves the right to revoke trapping privileges if town policies or NH law are violated.

Trapper Qualifications:

- All trappers must be licensed by the State of New Hampshire.
- Trapper membership and participation in the NH Fur Trappers Association is desirable to demonstrate continuing education efforts.
- Trapper should be a New Hampshire resident, preferably from the local area, to allow daily trap checks.

Trapping Requirements:

- Traps must be checked at least once *each* calendar day.
- Traps must be checked in the early morning hours (4 AM to 6:30 AM). Daily

trapping activity must be concluded by 6:30 AM.

- *All* water traps, including Conabear-type, must be submerged (12" or deeper).
- Water-based traps may not be placed in vernal pools.
- Any land-based Conabear-type trap must be set in a tree, at least 5 feet above ground. The trap must be set 5 feet above snow level immediately after a snowstorm.
- All land-based traps must be set at least 100+ feet from trails.
- All land-based trapping to be concluded by January 15th.

2017 – 2018 New Hampshire Trapping Seasons and Limits

Species	Habitat Quality[16]	Trapping Season	Bag Limit	Other
Wetland				
Beaver	Good	Nov 1 – Apr 10	No limit	
Mink	Good	"	"	
Muskrat	Good	"	"	
Otter	Good	"	Ten (10)	Requires seal by NH F &G
Upland				
Bobcat	Low	None	Zero (0)	Trapping not permitted.
Coyote	Good	Nov 1 – Mar 31	No limit	
Fisher	Fair	Dec 1 – Dec 31	Five (5)	Requires seal by NH F &G
Fox, Gray	Good	Nov 1 – Jan 15	No limit	
Fox, Red	Fair/Good	"	"	
Opossum	Good	Nov 1 – Jan 15	"	
Raccoon	Good	"	"	
Skunk	Good	"	"	
Weasel	Good	Nov 1 – Apr 10	"	

Furbearer Inventories

The presence of furbearers on the property can be monitored using one (or all) of three inventory methods[17]. Inventories should be standardized, i.e., taken be trained volunteers who are employing similar methods and standard data sheets. The Fremont Conservation Commission will then compile and maintain records. The three methods are[18]:

- Mammal Checklist – Observer lists all mammal (including furbearers) sign that are seen or heard during a particular time, usually a week.
- Predator Scent Post Survey – Series of scent posts are set-up and monitored, most likely by the Conservation Commission or a designated individual.
- Snow Track Survey – Observer(s) identify, count, and record on a map, all mammal tracks in the snow along a trail or road segment, or transect. Surveys must be conducted on fresh snow in favorable snow conditions.

Mammal inventories may provide a useful tool to monitor furbearer presence in the Conservation Area over time. The Conservation Commission may then reevaluate trapping policy in the future.

[16] Based on the suitability of observed habitat conditions at the Glen Oakes Conservation Area and surrounding land to meet the basic requirements for each listed species.
[17] "A Landowner Guide to Inventorying and Monitoring Wildlife in New Hampshire", by Malin Clyde, et. al, UNH Cooperative Extension, September 2004, pages 44 – 49.
[18] Ibid.; please refer to "Guide" for further methodology details.

WILDLIFE RECOMMENDATIONS

General Summary:

Silvicultural measures to complement existing wildlife features and habitat:

- Promote forest diversity, particularly, tree age, density, and species mix.
- Throughout the forest, stratify tree-canopy layers, to maintain vertical cover and habitat.
- Practice multi-aged silviculture to promote good representation of young, mid-aged, and older-growth forest.
- Increase overall average mature forest upper canopy trees age to 125+ years.
- Retain old residual trees throughout the forest indefinitely, i.e., 150+ years. Designate these as "legacy" trees.
- Retain dead trees, snags, cavity-trees, potential den trees, and downed woody biomass.

Other measures:

- Conduct wildlife surveys including: birds (migratory and breeding counts), mammal (sign, sighting, winter tracks), amphibians (in wetlands).
- Set-up bat boxes within forest.
- Maintain constant vigilance with exotic, invasive plants. Implement eradication efforts, where plants are discovered.

Spruce Swamp

- Designate Spruce Swamp and its forested islands as reserve areas.
- Designate the 100-foot Prime Wetlands buffer as a reserve.
- Monitor for sources of pollution or other agents that may degrade water quality or wetland functionality.
- Monitor for wetland invasive plant species.

Forested Wetlands, Stream Riparian Areas, Vernal Pools

- Preserve wildlife cover vegetation, especially in and around wetlands.
- Maintain wildlife corridors, specifically by promoting shrubby vegetation or areas of young hemlock along streams and between wetlands.
- Encourage desirable native, wetland wildlife shrubs—winterberry holly, highbush blueberry, silky dogwood, speckled alder, arrowwood, northern wild-raisin—in wetlands or wetland edges.
- Maintain minimal harvest buffers along riparian strips (25 feet on either side of stream) and around vernal pools (50 ft), where harvesting is limited to less than 10% of basal area, and harvested trees

are either diseased, declining, or of concern for forest health reasons. Harvesting may also be used to enhance wildlife habitat, such as wetland shrub growth.

- Promote an increase of large woody debris on forest floor in surrounding upland areas.

Upland Mast Forest

- Retain abundant, healthy mast trees, especially large-crowned oaks, beech and hickory.
- Retain trees with large, widely spaced branches as potential raptor and turkey perch/roost sites. Beech with triple-forked trunks are desirable hawk nesting sites.
- Desirable native, upland wildlife shrubs include: Staghorn and smooth sumac, beaked hazelnut, witch-hazel, maple-leaved viburnum, nannyberry. Desirable native vines or cane plants include: Grapevine, Virginia creeper, blackberry, raspberry, and dewberry.

Softwood Thermal Cover

- Maintain areas of dense young and/or older hemlock, both scattered and in groves, for yarding, thermal cover, and travel corridors.

Mixed Forest

- Encourage growth of scattered aspen groves.
- Manage for a variety of hardwood species, especially those not found in other property areas such as basswood and hophornbeam.

Early Successional Forest

- Maintain at least 9% of the upland forest area as young forest or early successional growth.
- Maintain early-successional habitat area on a 15± year rotation.

FOREST RESOURCES

FOREST CONDITIONS and MANAGEMENT

Summary of Conditions

Forests found in New Hampshire's coastal plain, including the Glen Oakes Conservation Area, lie within the northerly extent of the Appalachian oak-pine forest. The tree species mix of this forest region changes noticeably within 25 miles of the seacoast. For example, just a few miles north, shagbark hickory and black oak are no longer found, while red spruce and balsam fir—signature species of the boreal forest—begin to appear on the landscape.

Defining characteristics of the present Conservation Area forest are that: 1) The oldest trees, with the exception of the remote island area within Spruce Swamp, are about 140± years of age; 2) The forest is not structurally complex—most stands even-aged, two-aged, or three-aged; and 3) The forest has a somewhat low diversity of tree, shrub, and herbaceous species. Logging has been the prime disturbance medium in this forest since its establishment from abandoned pastureland. As time progresses, the even-aged character of the forest will evolve. Silvicultural management of the Glen Oakes Conservation Area is intended to promote forest health, enhance wildlife habitat, and provide a moderate, sustainable income stream that will cover management costs of the property. The silvicultural treatments recommended in this plan are mild or light, aiming to remain similar to the prevailing mild natural disturbance regime of the seacoast area. If a large natural disturbance were to occur, silviculture will respond to the disturbance either through salvage and restoration, or allowing areas to naturally evolve from the effects of the disturbance.

A detailed forest type analysis of the Glen Oakes Conservation Area follows in Chapter 5, "FOREST RESOURCES", with silvicultural prescriptions specified over time.

Timber Outlook

The Glen Oakes Conservation Area contains a substantial volume of good-quality red oak sawtimber and veneer, most of which is in the 10 to 20± inch diameter range. White pine sawtimber stocking is variably sparse, with the greatest concentrations found mixed with hardwoods and/or hemlock. The western areas of the property were heavily harvested in the recent past and presently contain small diameter pine. The overall forest also contains a considerable inventory of lower quality hardwood and hemlock growth.

The total acreage recommended for silvicultural management on the Glen Oakes Conservation Area is 243± acres, or 60% of the tract area (this includes early-successional/young forest acreage). According to the property's updated forest inventory prepared for this plan, *conservative harvesting for improvement purposes will* ***net*** *about $35,000±* from the sale of timber on this acreage. *This estimate assumes sustainable management on a 12 year harvest cycle.* Though there will likely be variation between areas, harvesting should not exceed an average of $200±/acre, assuming similar pricing to the data in Table #1 "Timber Valuation".

To remain consistent with the management objective of improving forest health and growth, harvests should emphasize the removal of low-quality, poorly growing trees, while providing growing space to promising timber, and promoting regeneration. Careful logging is a critical element of a successful outcome. Tree selection and marking in advance of cutting by an experienced forester is also crucial to insure that the forest is not over-harvested, growth is optimized, and the full host of ecological factors are considered.

An indicator of sustainable silvicultural management is that harvesting does not exceed the rate of forest growth. Over time, the value of timber should increase on a per acre basis. Presently, timber value on the property averages about $940±/acre, substantially below the forest's potential. With careful management, including judicious harvesting, the value of pine and hardwood timber inventory can increase to $1200+/acre in 20± years (using constant dollar analysis). Long-term, this value should clearly exceed $2,000/acre, and be maintained at this higher value level by retaining a substantial inventory of large, high-quality trees. A higher timber inventory level allows a proportionally greater income cashflow.

Another indicator of sustainable management for the Conservation Area is that white pine, red oak, black birch, and shagbark hickory seedlings—mid-successional species—are successfully established after harvesting. New growth should be established naturally, without the expense of planting.

Non-commercial forest stand improvement (FSI) work is important for establishing regeneration and to optimize long-term forest growth and value. Essentially, FSI involves the thinning and release of trees that are too young to have commercial value, including the seedling and sapling growth that regenerates after a harvest. Since marketable forest products are not produced, FSI is a cost operation that is motivated by a desire for a substantially healthier, more valuable future forest.

Sustainable Management

To allow an adequate period of growth, commercial harvests should follow a periodic schedule or "harvest cycle". Due to the acquisition of the Smith Parcel, ***the Conservation Area now contains four active management compartments***. To prevent too much time-elapse between treatments and to allow for management continuity, a 12± year harvest cycle is now recommended. Generally, no area should be harvested more than once within this interval, thus allowing the forest to fully recover the volume and density of timber removed. Furthermore, measures should be taken (as specified in the silvicultural prescriptions) to insure adequate levels of natural regeneration, particularly of mid-successional species. Finally, timber value per acre should increase and surpass the previous value during the harvest cycle interim. At the end of each 12-year harvest cycle, these three factors—*fully recovered timber volume, abundant natural regeneration (especially mid-successional species), and an increased value per acre*—are key indicators of sustainable forest management.

Best Management Practices (BMP's)

Forest management necessitates the use of heavy equipment to establish/maintain access (excavator, dozer, York rake), and for improvement harvesting (skidder, harvester, forwarder), timber processing (landing loader, chipper), and transport (log trucks, trailers). Depending on the scale of operation, some or all of the listed equipment may be employed; if thoughtlessly used, the property's water and soil resources can be impacted.

The following Best Management Practices (BMP's) for logging on the Glen Oakes Conservation Area are intended to protect surface water quality and minimize impact to wetlands and soils. The list is not necessarily all-inclusive and should be revisited at the time of harvest planning.

LOGGING BMP's to PROTECT SURFACE WATERS, WETLANDS, and SOILS:

- Time harvest operations for summer through mid-fall *dry conditions* (June-October), or frozen/snowy ground in winter (late Dec-early March), to avoid unnecessary rutting of ground.
- During tree marking process, Forester considers optimum stream crossing layout, as well as, buffers (minimal harvest) around vernal pools and along riparian areas. This information is then conveyed to the logging contractor for consideration and implementation.
- Logging contractors to file NH DES Wetland Permit for Timber Harvest Activity. Logging contractor agrees to follow NH BMP provisions as stated on permit.
- Stream crossings require temporary poled fords or bridging. 3 to 4 construction mats installed side by side over a stream or wetland create an effective crossing.
- Chipper debris or treetops can be used as woody matting to stabilize soft soils and approaches to stream crossings.
- Logging equipment should not enter into forested wetlands, except where a permitted crossing is necessary.
- Tree harvesting in buffer areas, i.e., near vernal pools (50± feet) or riparian filter strips (25± feet), may range from 0 to 10±% basal area removal, and be judiciously limited to removals for forest health (diseased or declining) or wildlife habitat enhancement purposes. A Professional Forester should make on-the-ground selection decisions. Avoid logging disturbance to the ground surface within the buffer.
- When servicing equipment, the logger can use absorbent padding to protect soil from inadvertent spills. Contractor should carry a spill kit on the project site.
- Where possible, service equipment off-site, prior to the project.

FINDINGS

Timber Volume and Value:

- The Glen Oakes Conservation Area (not including Spruce Swamp) contains standing timber volumes as follows:

  1,297,550± board feet of sawtimber

  Softwood – 763,733± BF

  Hardwood – 533,816± BF

  25,012± tons of chipwood/softwood pulp

  3,540± cords of firewood

- The total timber stumpage value is currently $295,000, of which approximately $256,000 is accessible timber.
- On a per acre basis, timber value averages $943±/accessible upland acre.
- White pine sawtimber accounts for over one-third (36%) of the property's timber value.
- Red oak sawtimber accounts for nearly one-third (31%) of the property's timber value.
- Cumulatively, all other sawtimber, pulp, firewood, and chipwood on the Glen Oakes Conservation Area accounts for the remaining 33% of timber value.

Tree Species Composition

- White pine and red oak are the property's dominant species, accounting for 26.2 and 18.5% of tree species composition (by basal area), and 48.7 and 28.2% (including pallet grade wood) of total timber volume, respectively.
- Oak (red, black, and white) accounts for 31.5% of the property's forest composition.
- Beech and hemlock are the most commonly found regeneration in the Conservation Area, indicating overstory shading and the corresponding successional trend. White pine seedling/sapling growth is sometimes found in small openings, as are black and yellow birch, the latter in moist areas. Red maple sprout growth is also found. Red and white oak seedlings/saplings are uncommon.

Tree Quality and Density

- White pine quality is variable, with the best growth in the Smith parcel and the eastern and central portions of the Conservation Area. The western area was heavily harvested and contains smaller, poorer quality pines.
- Red oak quality is above average, including grade-sawtimber and high-quality veneer, in addition to lower-grade pallet logs.
- The Glen Oakes Conservation Area is well-stocked with timber, except for the western portions of the property, which were heavily harvested in the late 1990's or early 2000's. Forest regeneration in the more recently harvested areas is promising.

TIMBER VALUATION

VALUATION OF STANDING TIMBER – TOTAL MERCHANTABLE VOLUME

PRODUCT/ SPECIES	TOTAL VOLUME	% OF VOLUME[1]	UNIT PRICE	TOTAL VALUE	% OF VALUE[2]
Sawtimber					
White Pine	620.3 MBF	48.7%	$170 / MBF[3]	$ 105,450	35.7%
Red Oak[4]	267.0	21.0%	$ 340	$ 90,792	30.8%
Hemlock	138.5	10.9%	$ 30	$ 4,155	1.4%
Oak Pallet	92.3	7.2%	$ 100	$ 9,228	3.1%
Red Maple	66.1	5.2%	$ 70	$ 4,626	1.6%
Black Oak[4]	30.8	2.4%	$ 220	$ 6,769	2.3%
Sugar Maple	13.0	1.0%	$ 250	$ 3,261	1.1%
White Oak	11.8	0.9%	$ 100	$ 1,180	0.4%
White Birch	9.9	0.8%	$ 45	$ 445	0.2%
Beech	7.8	0.6%	$ 30	$ 234	0.1%
Black Birch	5.3	0.4%	$ 140	$ 744	0.3%
White Ash	4.6	0.4%	$ 170	$ 776	0.3%
Yellow Birch	4.2	0.3%	$ 140	$ 584	0.2%
Hickory	2.3	0.2%	$ 75	$ 170	0.1%
TOTALS	1,273.8± MBF			$ 228,415	
Chipwood/Pulp	24,594± Tons	@ $1 / Ton		$ 24,594	8.3%
Firewood	3,510± Cords	@ $12 / Cord		$ 42,120	14.3%
			Grand Total	$ 295,129	100%
			Rounded	**$ 295,000**	
			Available Value[5]	**$ 254,800**	

[1] % of total sawtimber volume
[2] % of overall value, including logs, pulp, chipwood, and firewood
[3] Adjusted to include pallet grade logs
[4] Includes veneer and grade logs
[5] Includes only timber that is currently accessible for harvest

Timber Volume Estimate Notes:

1) MBF = One thousand board feet

2) Sawtimber volume totals include veneer, grade log, and pallet log totals for each species, except where otherwise noted. Unit prices are average combined value of veneer and grade logs, with discount for pallet logs.

   Note: Pallet log % of total volume figures for the following species is:

   White Pine – 24%±

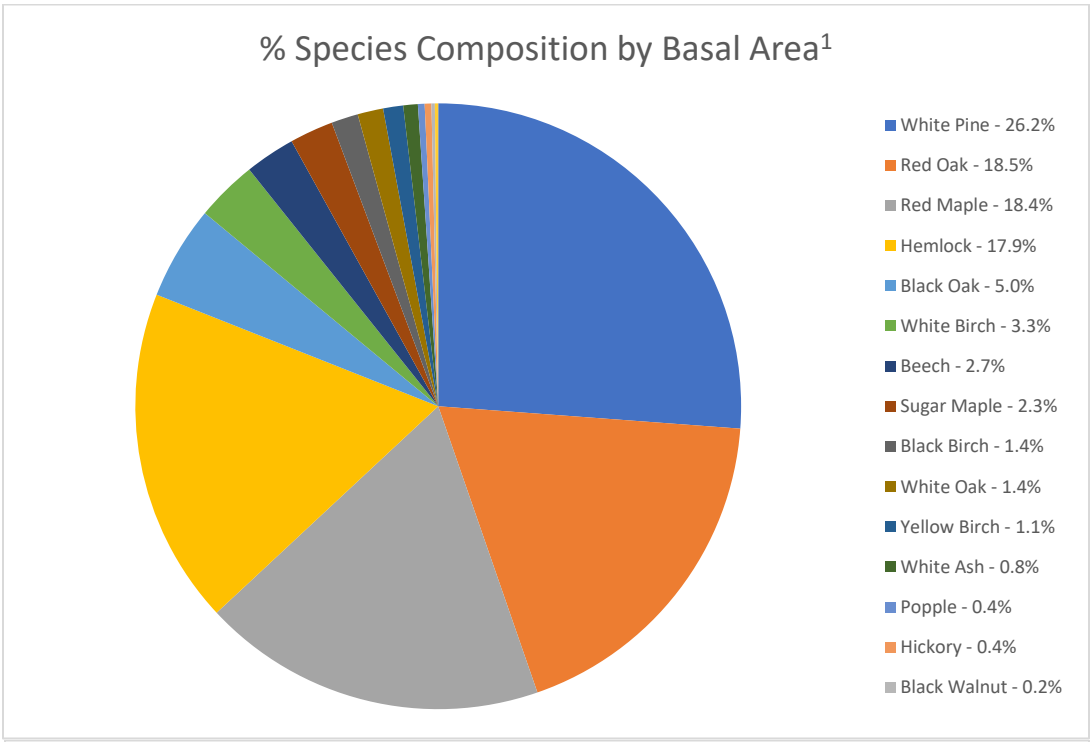
   Black Oak – 50%±

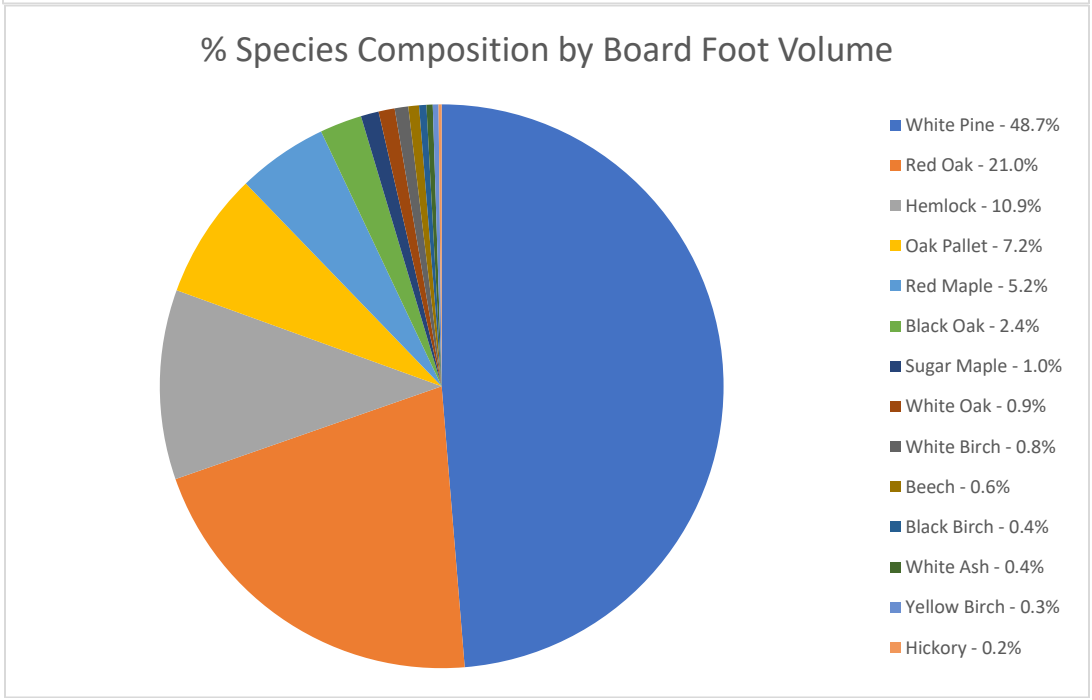
   Red Oak – 22%±

3) Softwood pulp conversion is 2.2 tons per cord, and it includes hemlock and white pine. Estimate assumes approximately 1 ton of top wood pulp per MBF of softwood sawtimber. Furthermore, all other potential pulp either from full trees or tree top wood tips, is accounted for as chipwood.

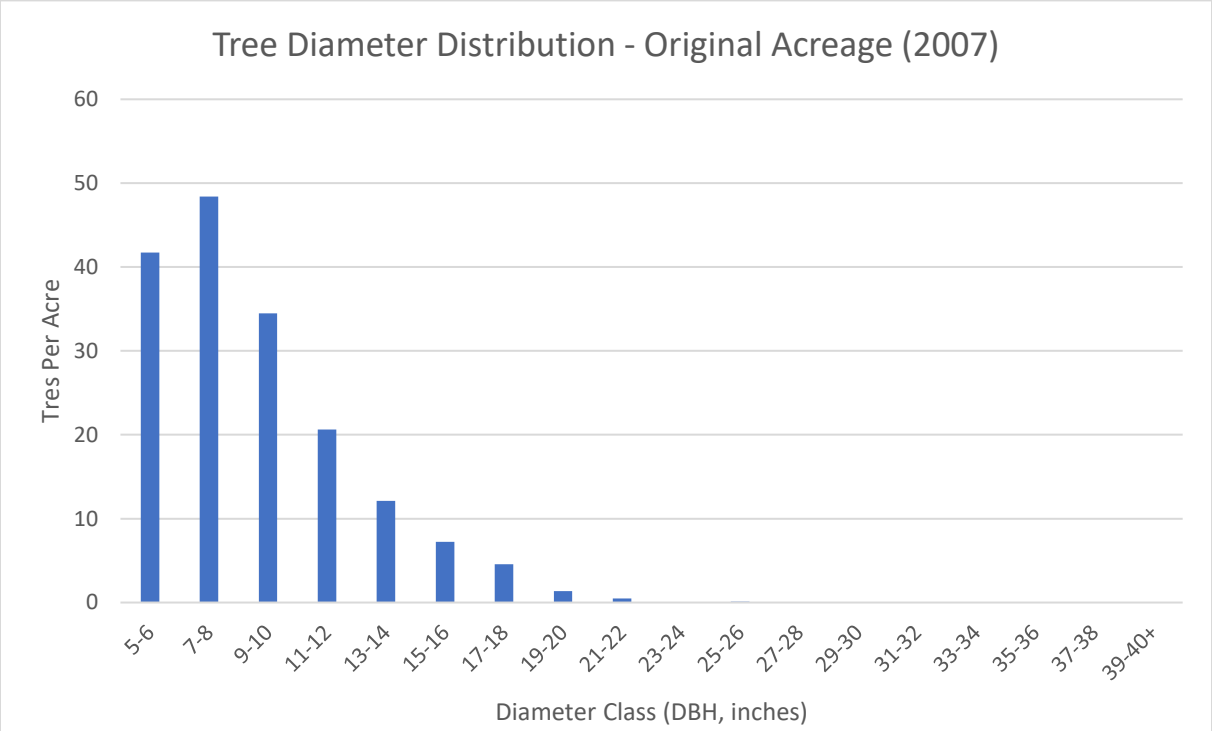
4) Chipwood estimate assumes 105 tons of total biomass per acre (105 tons/acre – 10.6 tons/acre sawtimber – 25.8 tons/acre firewood = 69 tons/acre chipwood/pulp. Therefore, 69 tons/acre chipwood x 231 forested acres = 15,939± tons).

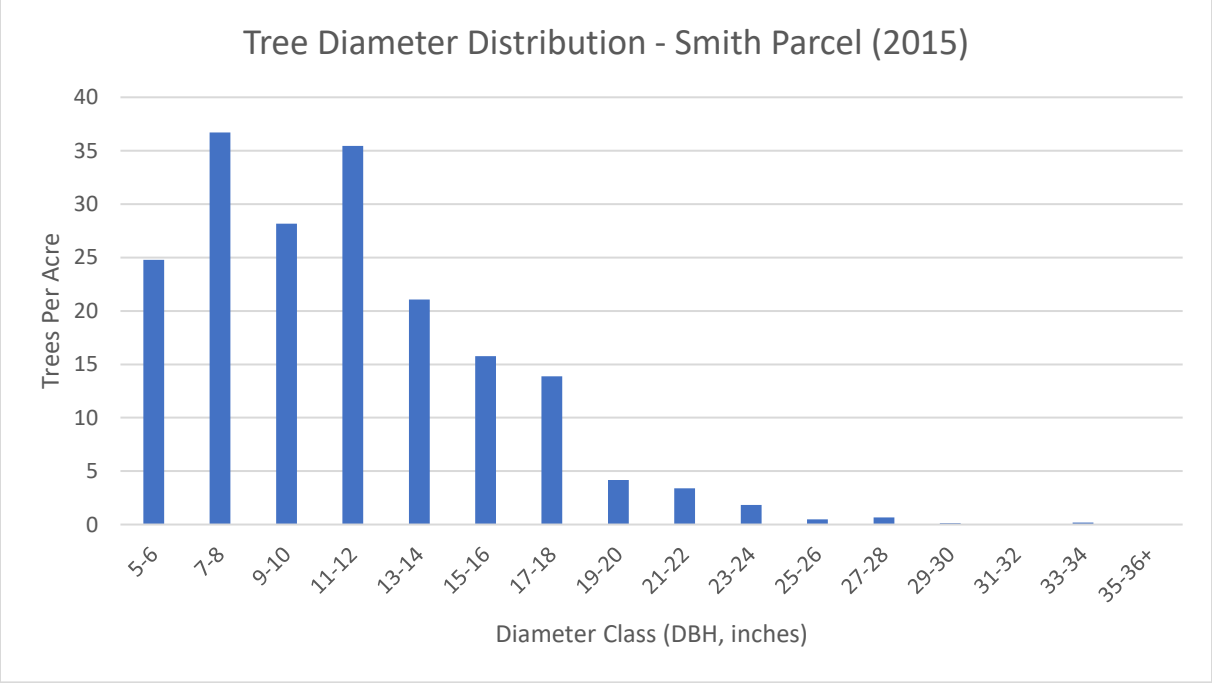
SPECIES COMPOSITION





[1] Assumes that following the 2013 harvest, basal area percentages of component species were not appreciably changed.





SUSTAINABLE HARVEST TIMBER VOLUMES

For Various Cutting Cycle Scenarios

PRODUCT/ SPECIES	ACCESSIBLE[1] VOLUME (2018)	Estimated (Maximum) Sustainable Volume Removals HARVEST CYCLE 12± YEARS	15± YEARS	25± YEARS
Sawtimber				
White Pine	536.0± MBF	120.0± MBF	155.2± MBF	290.6± MBF
Red Oak	230.7	46.4	59.9	110.9
Hemlock	119.7	17.6	22.5	40.5
Oak Pallet	79.7	14.3	18.3	33.6
Red Maple	57.1	10.2	13.1	24.1
Black Oak	26.6	4.8	6.1	11.2
Sugar Maple	11.3	2.0	2.6	4.8
White Oak	10.2	1.8	2.3	4.3
White Birch	8.5	1.5	2.0	3.6
Beech	6.7	1.2	1.6	2.8
Black Birch	4.6	0.8	1.1	1.9
White Ash	3.9	0.7	0.9	1.7
Yellow Birch	3.6	0.6	0.8	1.5
Popple[2]	2.4	0.5	0.6	1.2
Hickory	2.0	0.4	0.5	0.9
TOTALS	1,103.1± MBF	222.8± MBF	287.5± MBF	533.5± MBF
Chipwood/Pulp	21,251± Tons	4,275± Tons	5,513± Tons	10,210± Tons
Firewood	3,033± Cords	350± Cords	446± Cords	790± Cords
	TOTAL VALUE	$ 49,500±	$ 63,800±	$ 118,200±

[1] Includes only timber that is currently accessible for harvest
[2] No current market for popple (aspen) sawlogs but there may be in the future

Discussion:

The table above estimates the harvestable timber volume, by species/product, that the Glen Oakes Conservation Area is capable of re-growing using three harvest interval scenarios, each allowing for a periodic net increase in timber volume. This table projects the *maximum* sustainable cut, not necessarily informed by or reflective of sustainable silviculture. It is meant as an informative outlook only and its utility as an economic planning tool is limited by a) market volatility, b) advances in logging technology, c) varying growth rates with climate change, and d) other unaccounted-for stochastic factors. The silvicultural prescriptions recommended in the future may result in different atual volumes extracted.

SILVICULTURAL PLANNING

FORESTRY AND WILDLIFE MANAGEMENT SPECIFICS

Charles Moreno, Consulting Forester, Ecologist
Strafford, New Hampshire // (603) 234-0444

FOREST TYPES and PRESCRIPTIONS

The Conservation Area's *Forest Types Map* on page 7 illustrates the forest type locations.

A. OAK FOREST (O) – 92.6± ACRES

Brief: ***Oak Forest*** is the most extensive forest type, characterized by a well-established, red oak-dominated overstory. There are two variants.

Description: Today's oak forest likely stems from forest established soon after the Civil War, as indicated by remnant hemlocks aged at 130+ years. The "younger" variant**, A1**, covers a substantial area of the main parcel and sections of the Smith parcel. The 80 to 105± year red oak high canopy is generally complete, or "unbroken", throughout this forest type, with the exception of areas that were lightly thinned in the recent past (mid-1980's and late 1990's, and more recently in 2013 in Compartment 2). Small canopy gaps exist in these more recently harvested areas; furthermore, seedling/sapling growth is now filling the forest floor beneath the canopy gaps. A slightly older variant, **A2**, is found in the Smith parcel, where it escaped logging for decades and generally contains 80 - 120+ year old forest.

80 to 100 year old red oak dominates the overstory of an oak stand in Compartment 3.

While the *Oak Forest* generally covers well-drained till sites (*Canton* soils) where red oak dominates, a few moist, enriched soil pockets with a wider variety of tree species are embedded within the forest type. Sugar maple, basswood, and shagbark hickory are found in these mesic pockets. Another distinction of the *Oak forest type* is that some areas contain a dense hemlock understory, however, they are classified as *Oak Forest* due to the oak overstory.

Timber – High quality red oak sawtimber and veneer (10 – 20± inch DBH) is developing, often averaging over 1,000 board feet/acre. The forest type contains few white pines—retaining most of the remaining pines as natural seed sources is arguably more valuable than the sawtimber they might contain.

Wildlife – This forest type exemplifies one of the key, defining habitat types of the Glen Oakes Conservation Area. Covering over 90 acres, the high oak canopy provides a significant local mast source. Acorns are a food staple for many mammal and avian species. Increasing the amount of less common upland mast-producing species such as white oak and shagbark hickory will stabilize mast availability, since acorn crops for each species vary considerably from year to year. Prior to succumbing to a ubiquitous blight (about 1915 in Fremont), American chestnut was a component species of the oak and upland hardwood stands. Potential reintroduction of blight-resistant chestnuts over the next 50 years will further enhance mast quality in this forest area. Allowing the development of large-crowned, old trees is also favorable.

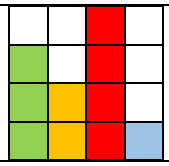
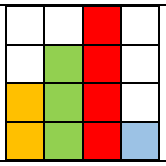
An unbroken high canopy of red oak is typical of the *Oak forest type*.

The *Oak forest type* is especially attractive to deer, gray fox, gray squirrel, and flying squirrels. Avian species utilizing this forest type include wild turkey, Cooper's hawk, broad-winged hawk, scarlet tanager, ovenbird, red-eyed vireo, and wood thrush.

Species Composition	**Variant A1 (Younger)**	**Variant A2 (Older)**
Primary[1]	RO	RO, BO
Secondary[2]	BO, WP, RM, HM, BE	BE, HM
Tertiary[3]	WO, WB, SH, BB, SM, YB	WP, RM, WO, WB. A few SM.
Regeneration (Saplings)	WP, BB	HM, BE
Regeneration (Seedlings)	HM, BE, RM, WP	HM, BE
Shrubs / Groundcover	WH, wintergreen, tree clubmoss, ground cedar	
Site	Xeric	Xeric

[1] Dominant tree species in the high canopy layers.
[2] A fairly common to less common tree species.
[3] Less common, or a unique tree species with only one or a few specimens in the forest type.

Forest Structure	**A1**	**A2**
Composition		
Stand Structure	Even-aged with inclusions	Even-aged
Structural Stage	Late-intermediate	Late intermediate to Mature
Stand Age	80-105± years;	90 – 120+
Tree Size		
DBH Range	9-22± inches	10-22± inches (up to 28")
Mean DBH	15± inches	15± inches
Avg. Max. Height	70± feet	70± feet
Stand Density		
Relative Stocking	Considerable	Considerable/Dense
Basal Area/Acre	130± ft^2/ac (average)	160± ft^2/ac (average)
Trees/Acre	100± trees/ac	130± trees/ac
Canopy Closure	70-100%	80-100%

Wildlife / Ecological	**A1**	**A2**
Habitat Features	An abundance of mast. Older trees, broad-crown structure.	
Canopy Structure / Stratification[1]		
Woody Deadfall[2]	Low accumulation, few large trunks	Substantial accumulation.
Invasive Plants	No observed incidence	No observed incidence

[1] CANOPY DENSITY (Rows): Not present (no fill); Light (blue); Moderate (gold); Substantial (green); Dense (red)
CANOPY LAYER (Columns): 1 = Understory 2 = Mid-story 3 = Overstory 4 = Supercanopy
[2] Degree of Forest Floor Woody Debris Accumulation

SILVICULTURAL PRESCRIPTION

Oak Forest

Objectives –

The intent of silvicultural treatment is to enhance and perpetuate the excellent mast production this forest type provides. Also, specifically to: 1) Promote the growth of broad-crowned red oak, including a significant component of 125 to 150+ year old oaks; 2) Increase and diversify mast-producing species, both in the overstory—white oak, shagbark hickory, perhaps some cherry—and understory—beaked hazelnut, maple-leaved viburnum, lowbush blueberry; 3) Broaden stand age-structure to include abundant young growth, and ample mid-aged and mature trees; 4) Regenerating the stand to include an increased white pine, black birch, white oak, and shagbark hickory composition; 5) Increase the per acre timber value; and 6) Long-term, the re-introduction of American chestnut in this forest type.

Structural Sequence: Even-aged/two-aged (present condition) → Two/three-aged (2025±) → Multi-aged (2050±)

Silvicultural Treatments:

Past (2013—Compartment 2):

> ***Crown thinning/Improvement harvest***. 5 to 10 feet of growing space was provided around the crowns of the healthiest, high quality hardwoods. Poor quality trees were harvested. White pine retained as future seed source.

First Treatment (Compartments 1, 3, and 4). 2018-2026±:

> ***Single-tree/micro-group selection/Liberation***. Remove trees individually or in groups of 6+ trees to create canopy gaps of up to 2500± sq. ft., removing all undesirable understory, as well. Approximately 3 micro-gaps per two acres (hectare). ***Crown thinning/Improvement harvesting*** in forest areas between gaps. ***FSI (non-commercial forest stand improvement)*** to be applied within the micro-openings as a follow-up in 2 to 5 years, to release favorable regeneration.

Second Treatment (All Compartments). 2027-2038±:

> ***Single-tree selection/New micro-groups/Expanded regeneration openings/Liberation***. Similar treatment as previous. In addition, harvest along edges of previous regeneration openings to release young growth and establish a new generation. Encourage pine, oak, and hickory regeneration. Apply ***FSI*** 2 to 5 years post-harvest to release favorable regeneration.

Third Treatment (All Compartments). 2039-2048±:

> ***Similar treatment as previous.***

B. UPLAND HARDWOOD (UH) – 37.7± ACRES

Brief: The *Upland Hardwood* forest type is older oak forest with embedded young growth strips (lineal inclusions of young growth).

Description: *Upland Hardwood forest* covers the western portion of the tract. In 2002±, 20 to 60± foot wide strips were cleared through the forest, creating a distinct structure. The established forest, of which 42±% was cleared, contains upland hardwoods dominated by red oak similar in composition to the *Oak forest type*. Beech saplings have ubiquitously overtaken the cleared strips, but red maple, red oak, white oak, and white pine saplings are also significant components. Regeneration is both from seed and stump sprouts, with beech thickets sprouting from root stock. In conjunction with the strip clearings, some trees were thinned from the remaining older stand areas, however, the overstory canopy of the thinned areas remains over 75% stocked. 50% or more of this stand's sawtimber stocking was removed in the 2002 harvest.

Narrow strip with regeneration.
Photo taken 6± years after clearing.

Timber – The residual older forest contains fine red oaks, mostly 10 to 18± inch DBH, which will continue to develop over the next 15 to 40± years (2060) as valuable sawtimber and veneer. In the near future, ***FSI treatment*** is recommended for the young growth within the strips. Careful thinning of saplings will favor vigorous, healthy growth and species diversity. Lack of silvicultural attention will result in a high proportions of beech in the future forest.

Wildlife -- This forest type provides well-situated transitional habitat between the open canopy/dense shrub cover of Spruce Swamp and the full canopy/less dense understory of the established forest in the Conservation Area interior. The proliferation of dense low cover and available browse as a result of the heavily cut strips provides complementary habitat for moose, deer, fox, snowshoe hare, beaver (on swamp edges), and turkey. Hawks perch on trees along strip edges to hunt small rodents and reptiles that find homes within the logging debris; bats utilize the strips as hunting flyways on spring and summer evenings. The wider strip openings may provide specialized habitat for yellow-billed cuckoo, eastern towhee, whip-poor-will, and northern flicker. However, as the young growth ages, it will be less attractive for all of these species. Consequently, re-clearing any strip that contains undesirable forest growth (such as a beech thicket) is recommended.

Lightly thinned older forest area.

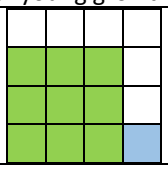
Wide strip-clearing with regeneration. Dense sapling growth now occupies these openings.

Additional habitat features are the residual oaks in the older forest areas; vernal pools in the central stand area (confirmed wood frog breeding); and a dense softwood/hardwood inclusion.

Species Composition	
Primary[1]	RO
Secondary[2]	WP, RM, BE, WO (in areas)
Tertiary[3]	WB, SH
Regeneration (in openings)	BE, RM, RO, WP
Regeneration (under canopy)	HM
Shrubs / Herbaceous	Blackberry, wintergreen
Site	Xeric

[1] Dominant tree species in the high canopy layers.
[2] A fairly common to less common tree species.
[3] Less common, or a unique tree species with only one or a few specimens in the forest type.

Forest Structure	
Composition	
Stand Structure	Two-aged, grouped: Established forest with young growth strip-inclusions.
Structural Stage	Mid to late-intermediate, and young
Stand Age	90 to 110± years. 15-20± years (inclusions)
Tree Size	
DBH Range	8-20± inches (older strata)
Mean DBH	14± inches (older strata)
Avg. Max. Height	65± feet
Stand Density	
Relative Stocking	Moderate/Considerable
Basal Area/Acre	105± ft^2/ac (average)
Trees/Acre	100± trees/ac
Canopy Closure	0-90%

Wildlife / Ecological	
Habitat Features	Embedded strips of young growth
Canopy Structure / Stratification[1]	
Woody Deadfall[2]	Moderate accumulation, no large trunks
Invasive Plants	No observed incidence

[1] CANOPY DENSITY (Rows): Not present (no fill); Light (blue); Moderate (gold); Substantial (green); Dense (red)
CANOPY LAYER (Columns): 1 = Understory 2 = Mid-story 3 = Overstory 4 = Supercanopy
[2] Degree of Forest Floor Woody Debris Accumulation

SILVICULTURAL PRESCRIPTION

Upland Hardwoods

Objectives –

Over time, silvicultural treatment intends to maintain the habitat attributes of maturing forest with embedded young growth. Specifically: 1) Promote the growth of broad-crowned red oak (for mast production) in the remaining older forest areas; 2) Retain mast-producing tree species that are less common in this stand—white oak and shagbark hickory; 3) Though optimally within 5 years, but logistically, at the same time as the next harvest, apply FSI treatment to the most promising sapling growth covering approximately 50% of the strip area; 4) Over the long-term, retain 30 to 40% of the stand's area as cleared or young forest (0 to 20± years of age), especially young growth areas with little prospect to grow as valuable timber; 5) Re-clear 50% of strip areas, and newly clear some of the older forest along the edges of the strips to maintain the old and young forest area ratio; 6) Retain and augment cavity tree, snag, and ground woody debris (CWD) composition.

Structural Sequence: Two-aged, grouped (present condition) → Three-aged, grouped (2025±)

Silvicultural Treatments:

2024±: **Older forest areas** – ***Improvement harvest/Crown thinning***; light cut with about 15% basal area removal. Also, clear new strips 10 - 50 feet wide (average 30± feet) of established forest along the edges of approximately 4000± feet of the previously cleared strips. This will establish about 3 acres of young forest habitat.

Strip cut areas – ***Biomass clearing*** of 50±% of original strip cut area, focusing clearings on poor species mix areas, and including some clearings near Spruce Swamp. Prior on-the-ground selection and layout of optimal clearings is a necessary step. This will replenish about 8 acres of young forest habitat.

2024±: **Strip cut areas** – ***Non-commercial FSI, inter-sapling release*** on 8± acres of promising sapling and young pole-sized (4-7 inch) growth containing a high proportion of oak, hickory, pine, or black birch.

2036±: **Older forest areas** – ***Crown thinning*** of mast forest. Delay clearing of additional strips until next harvest cycle, 12 years hence.

Strip cut areas – Repeat ***Brontosaurs or biomass clearing*** of young forest area, including new (2024±) strip edges.

2036±: **Strip cut areas** – ***Non-commercial FSI, weeding and thinning*** of pole-sized (4 -10 inch) trees using a chainsaw, on the 8± acres of promising young forest growth.

2050±: **Older forest areas** – ***Single-tree selection*** of mast forest. Evaluate whether additional edge strips should be cleared to optimize habitat.

Strip cut areas – Repeat ***Brontosaurus or biomass clearing*** of young forest areas.

C. MIXED UPLAND HARDWOOD (MH) – 7.7± ACRES

Brief: ***Mixed Upland Hardwood*** is a minor forest type describing three small stands in the Smith Parcel where beech and black birch, or other mixed hardwoods, dominate.

Description: While oak is present in the overstory, it does not dominate, unlike the tract's other hardwood stands. Beech, black birch, and red maple are the substantial components. Most white pine was harvested from these stands about 1950±. A hardwood mix that includes beech and black birch filled the harvested areas and is now large polewood. Residual hemlock, white pine, and mixed hardwoods constitute an older age class. The easternmost stand surrounds a seasonal drainage.

Timber – These stands have a lower sawtimber-production potential due to the species mix. Beech is typically diseased; grade sawlogs are few and are not desired by timber markets. In recent years, somewhat inconsistent markets for straight low-quality hardwood logs, including beech, have developed as material for construction mats.

Wildlife – Beechnuts are an important wildlife food relished by black bear and deer. Claw marks are sometimes found in the bark of beech which bear have climbed to access fresh mast in the crowns. Large beech are often hollowed by the bark disease, providing nesting and denning holes for birds and mammals. Beech with triple branching pattern may also provide nesting sites for hawks.

Pole hardwood mixed with older residuals in the mixed upland hardwood type.

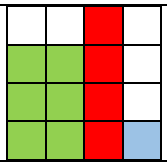
Full canopy cover only allows the successful regeneration of beech and hemlock, both shade tolerant species.

The easternmost mixed hardwood stand.

Species Composition	
Primary[1]	BE, BB
Secondary[2]	RO, RM
Tertiary[3]	HM, WP, SM, BO
Regeneration (Saplings)	HM, BE
Regeneration (Seedlings)	HM, BE
Shrubs / Herbaceous	
Site	Xeric, Mesic

[1] Dominant tree species in the high canopy layers.
[2] A fairly common to less common tree species.
[3] Less common, or a unique tree species with only one or a few specimens in the forest type.

Forest Structure	
Composition	
Stand Structure	Two-aged
Structural Stage	Late-intermediate
Stand Age	60-70±// 110-140± years
Tree Size	
DBH Range	8-22± inches
Mean DBH	12± inches
Avg. Max. Height	70+ feet
Stand Density	
Relative Stocking	Considerable/Dense
Basal Area/Acre	160± ft^2/ac
Trees/Acre	190± trees/ac
Canopy Closure	100%

Wildlife / Ecological	
Habitat Features	Varied mast sources.
Canopy Structure / Stratification[1]	
Woody Deadfall[2]	Substantial accumulation.
Invasive Plants	No observed incidence

[1] CANOPY DENSITY (Rows): Not present (no fill); Light (blue); Moderate (gold); Substantial (green); Dense (red)
CANOPY LAYER (Columns): 1 = Understory 2 = Mid-story 3 = Overstory 4 = Supercanopy
[2] Degree of Forest Floor Woody Debris Accumulation

SILVICULTURAL PRESCRIPTION

Mixed Upland Hardwoods

Objectives –

The intent of silvicultural treatment in the mixed upland hardwood stands is to improve the species mix from a diversity and timber standpoints, and create complex structure over time for wildlife and forest resilience purposes. Specifically: 1) Reduce the proportion of beech, retaining "beech islands" while

removing beech from much of the stand areas; 2) Retaining beech with outstanding wildlife value such as large hollow trees; 3) Favoring the establishment of natural herbaceous and groundcover layers for wildlife as the removal of beech provides more light to the forest floor; 4) Establishment and stratification of understory and mid-story canopy layers for wildlife and forest diversity; 5) The retention of old, large diameter trees for wildlife; and 6) Improvement of timber growth, and upgrade of quality.

Structural Sequence: Two-aged (present condition) → Three-aged (2030±)

Silvicultural Treatments:

First Treatment (Compartment 4). 2018-2020±:

Crown thinning/Improvement harvest in younger (polewood) pockets. Provide 5 to 10± feet of growing space around the crowns of the healthiest, high quality hardwoods. Harvest poor quality trees. White pine, red oak, and sugar maple to be retained as future seed source. ***Micro-group selection.*** Remove trees individually or in groups of 6+ trees to create canopy gaps of up to 2500± sq. ft., removing all undesirable understory, as well. Approximately 3 micro-gaps per two acres. ***FSI (non-commercial forest stand improvement)*** to be applied within the micro-openings as a follow-up in 2 to 5 years, to release favorable regeneration.

Second Treatment (Compartment 4). 2030-2032±:

Single-tree selection/New micro-groups/Expanded regeneration openings/Liberation. Similar treatment as previous. In addition, harvest along edges of previous regeneration openings to release young growth and establish a new generation. Encourage pine, oak, and sugar maple regeneration. Apply ***FSI*** 2 to 5 years post-harvest to release favorable regeneration.

Third Treatment (All Compartments). 2042-2044±:

Similar treatment as previous.

Pocket of older residual hardwoods in the mixed upland hardwood forest type.

D. WHITE PINE (WP) – 5.4± ACRES

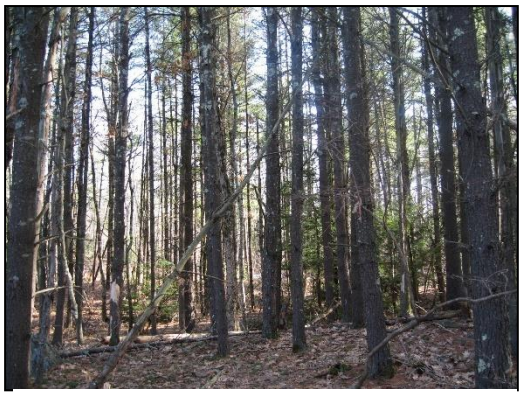
Brief: ***White Pine*** is a minor forest type, found as three small stands where white pine constitutes at least 80% of the overstory. There are two variants.

Description: The younger **D1** variant is a nearly pure stand of young to mid-aged white pine, found as a small pocket along the edge of Spruce Swamp. Though the adjacent forest was harvested in 2002±, it is likely that this stand escaped harvest because the trees (50± years of age at the time) were too small for use as sawtimber. Only one small strip was cut in 2002, resulting in some younger growth. This forest type was established after a 1950± clear cut; the resulting stand is presently even-aged, with all trees about 65± years of age, and averaging 12± inches in diameter.

The older **D2** variant is found in two areas of the Smith parcel. These even-aged pockets were likely established after clearcutting in the early 1900's. Trees are a century or more old. White pine dominates the overstory while hemlock covers the understory.

Timber – The **D1** stand is capable of producing excellent pine sawtimber if it is carefully thinned presently. Treatment entails light crown thinning, where the finest trees are selected and provided with sufficient growing space. The remaining pines will enter early sawtimber size beginning in 15 years, with individual timber trees maturing 50 to 75 hence. Harvesting is precluded in most of the stand—within 100 feet of Spruce Swamp—where prime wetlands regulations curtail management activities. The **D2** stands contain substantial larger sawtimber of mixed quality.

Wildlife – The tall pines alongside Spruce Swamp provide perches and roosting sites for red-shouldered hawks, great blue heron, little green heron, and barred owl. The sparse understory limits travel and escape cover for wildlife such as snowshoe hare and deer. Feeding opportunities are also scarce due to the lack of herbaceous ground cover. The white pine stands are also good habitat for red squirrel and pine warbler.



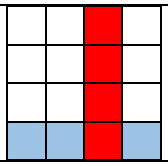
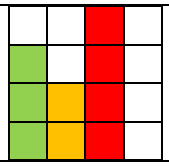
D1, younger variant: Dense 65-year old white pine.

Older white pine occupies the D2 variant.

Species Composition	**Variant D1 (Younger)**	**Variant D2 (Older)**
Primary[1]	WP	WP
Secondary[2]	RM, WO, WB, RO	RO
Tertiary[3]	HM, GB	HM, WB, BO, BE, RM. SM, rarely.
Regeneration (Saplings)	HM, BE; sparse due to overhead shading	Hemlock, due to shading.
Shrubs / Groundcover	LBB, sparse. Wintergreen, tree clubmoss	
Site	Xeric	Xeric, Mesic

[1] Dominant tree species in the high canopy layers.
[2] A fairly common to less common tree species.
[3] Less common, or a unique tree species with only one or a few specimens in the forest type.

Forest Structure	**D1**	**D2**
Composition		
Stand Structure	Even-aged with a strip inclusion	Even-aged
Structural Stage	Young/Mid-intermediate	Late-intermediate
Stand Age	65± years	90-115+ years
Tree Size		
DBH Range	6-16± inches	10 – 26± inches
Mean DBH	12± inches	14± inches
Avg. Max. Height	55± feet	80± feet
Stand Density		
Relative Stocking	Dense	Considerable
Basal Area/Acre	165± ft^2/ac	190± ft^2/ac
Trees/Acre	210± trees/ac	180± trees/ac
Canopy Closure	100%	80 – 100%

Wildlife / Ecological	**D1**	**D2**
Habitat Features	White pine seed and vertical structure.	
Canopy Structure / Stratification[1]		
Woody Deadfall[2]	Light accumulation, mostly small pine stems	Fair to good accumulation.
Invasive Plants	No observed incidence	No observed incidence

[1] CANOPY DENSITY (Rows): Not present (no fill); Light (blue); Moderate (gold); Substantial (green); Dense (red)
CANOPY LAYER (Columns): 1 = Understory 2 = Mid-story 3 = Overstory 4 = Supercanopy
[2] Degree of Forest Floor Woody Debris Accumulation

SILVICULTURAL PRESCRIPTION

White Pine

Objectives –

In the D1 stand, silvicultural treatment, while intended to enhance habitat and forest growth, will be limited in this stand due to Prime Wetland harvesting restriction imposed on the 100 foot upland buffer along Spruce Swamp. In the limited area that can be treated, specific objectives include: 1) Establishment of a natural herbaceous layer for wildlife; 2) Establishment and stratification of understory and mid-story

canopy layers for wildlife and forest diversity; and 3) Improvement of timber growth, and upgrade of quality. In the D2 stands, the silvicultural objective is to 4) Regenerate and establish a mixed age future stand with pine, oak, and other "mid-successional" species.

Structural Sequence: Even-aged (present condition) → Two-aged (2030±)

Silvicultural Treatments:

First Treatment

(Compartment 4). 2018-2020±:
Single-tree selection and Micro-group selection. Remove trees individually or in groups of 6+ trees to create canopy gaps of up to 2500± sq. ft., removing all undesirable understory, as well. Approximately 3 micro-gaps per two acres (hectare). ***FSI (non-commercial forest stand improvement)*** to be applied within the micro-openings as a follow-up in 2 to 5 years, to release favorable regeneration.

(Compartment 1). 2024-2026±:
Crown thinning/Improvement harvest in younger (polewood) pockets. Provide 5 to 10± feet of growing space around the crowns of the healthiest, higher-quality pines. Harvest poor quality trees. Retain mixed species for future seed source.

Second Treatment

(Compartment 4). 2030-2032±:
Single-tree selection/New micro-groups/Expanded regeneration openings/Liberation. Similar treatment as previous. In addition, harvest along edges of previous regeneration openings to release young growth and establish a new generation. Encourage pine, oak, and sugar maple regeneration. Apply ***FSI*** 2 to 5 years post-harvest to release favorable regeneration.

(Compartment 1). 2036-2028±:
Crown thinning/Improvement harvest, follow-up. Continue to provide growing space around the crowns of the finest pines. Harvest poor quality trees. Retain mixed species

Third Treatment

(Compartment 4). 2042-2044±:
Single-tree selection/New micro-groups/Expanded regeneration openings/Liberation. Similar treatment as previous.

(Compartment 1). 2048-2050±:
Single-tree selection and Micro-group selection.

D1 variant: Dense pine canopy.

E. WHITE PINE/HARDWOOD (WH) – 63.1± ACRES

Brief: ***White Pine/Hardwood*** is a major forest type. It covers substantial acreage, with over a dozen small stands. White pine and mixed hardwoods dominate the overstory, where hemlock is generally absent. This forest type has substantial structural variability: 4 variants are described.

Description: The ***White Pine/Hardwood*** *forest type* is found as over a dozen, dispersed stands ranging from <½ to 6± acres. Stands are scattered throughout property, including the islands in Spruce Swamp. All the variants contain an upland hardwood component in association with white pine, with variable prominence. This forest type primarily occupies well-drained uplands, though a few moist areas contain mesic hardwoods such as sugar maple, basswood, and hophornbeam, all rich site indicators. Pipsissewa, a trailing ground plant, also indicates an enriched site.


The E1 Variant: Well-established pine-hardwood mix.

The ***E1 variant*** has well-established red oak and white pine, typically 12 to 14 inches in diameter. This forest type probably developed from abandoned pasture or clearcutting in the World War I period. The even-aged, uninterrupted overstory canopy remained until a light 1995± sawtimber harvest. Sapling growth occupied the small forest openings; forest structure is now described as two-aged. The 2013 harvest is characterized as a thinning of this stand, with a few canopy openings created.

Red oak and white oak combine with white pine in the ***E2 variant.*** The variant stands are three-aged, with the mid-aged, large polewood cohort predominating. This cohort developed after substantial harvesting in the 1950's. 2000± harvesting resulted in a third age-class.


E2: Previously cut, 2 to 3-aged pine-oak mix.


E3: Partially harvested area with residual timber.

The ***E3 variant*** occupies the large island in Spruce Swamp which was heavily harvested in 2003±. An open mix of older white pine, red oak and white oak represent the remaining overstory, while pine and beech saplings and stump sprouts grow variably through the open canopy areas. Interestingly, the island appears to have been forested for much of the last two centuries; a hemlock stump from the 2003 island harvest was aged at about 200 years of age in 2008. The island may contain other 150+ year residuals that escaped harvesting. The island, now inaccessible by beaver flooding, has been delineated as a reserve area where forest harvesting will no longer be conducted.

E3: Residual 200-year log from island timber cut.

E3: Large 2003 timber harvest opening on island.

The ***E4 variant*** encompasses a couple of older stands in the Smith parcel that were established from a 1940± clearcut or older abandoned pasture not previously harvested. Red oak and white pine dominate, with substantial density. Trees are relatively tall, indicating good site conditions. The overstory is almost purely white pine in a few pockets.

Timber – The ***E1 variant*** contains good quality, developing white pine sawtimber (10 – 20± inches DBH), and some good quality red oak (9 to 18± inches). Good quality red oak and average (limby) white pine is found in the older ***E4 variant***. The ***E3 variant*** has lesser quality oak and pine. With improvement cutting, high quality mature sawtimber will develop over the next 15 to 50 years. Large pines and oaks represent valuable seed sources; silviculture should emphasize copious natural regeneration of these species.

Wildlife – This forest type provides supplementary mast—especially acorns—to adjacent oak and upland hardwood stands. As with the upland hardwood areas, diversifying mast sources is a long-term silvicultural goal. White oak is more abundant in areas, an important feature. In recently harvested openings, fruit-producing brambles and shrubs provide cover, food, and brows for a variety of species. Allowing the development of at least a dozen legacy (150+ years) trees per acre is also favorable consideration.

Vernal pools within this forest type support amphibian, avian, and mammal activity. Vernal pools were found to contain wood frogs, spotted salamander, red-spotted newt, spring peepers, leopard frog, and fairy shrimp, as well as caddisfly larvae, isopods, chironomid midges, and copepods. A moderate amount of coarse woody debris was noted. Increasing the amount of woody debris as a result of silviculture will enhance upland habitat for amphibians and reptiles associated with the vernal pools.

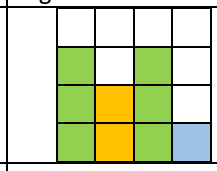
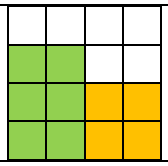
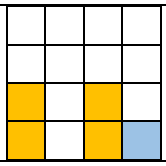
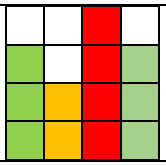
This forest type is attractive to deer, gray fox, gray squirrel, southern flying squirrel and white-footed mouse. Avian species utilizing this forest type include Cooper's hawk (potentially), broad-winged hawk, white-breasted nuthatch, black and white warbler, brown creeper, and hermit thrush.

Species Composition	**Variant E1**	**Variant E2**	**Variant E3**	**Variant E4**
Primary[1]	RO, WP, RM (variable)	RO, WO, WP	WP, RO, WO	WP, RO
Secondary[2]	BO, BE, WO, HM	BO	RM, WB, SH, BE, HM	WO, WB, BE
Tertiary[3]	SH, BB. Enriched sites contain sugar maple, basswood, hornbeam.	RM, SH	BO, BB, SM	SH, BO
Regeneration (Seedlings/Saplings)	WP, BE, HM, RO	WP; also RM, RO, BO in openings	WP, BE, RO	HM, BE

Shrubs / Groundcover	WH, wintergreen, partridgeberry, pipsissewa	Witch-hazel; blackberry (openings); Hazelnut (under canopy)	WH, blackberry	
Site	Xeric, Mesic	Xeric	Xeric	Xeric

[1] Dominant tree species in the high canopy layers.
[2] A fairly common to less common tree species.
[3] Less common, or a unique tree species with only one or a few specimens in the forest type.

Forest Structure	**E1**	**E2**	**E3**	**E4**
Composition				
Stand Structure	Two-aged	Three-aged, primarily	Two-aged with residuals	Even-aged, Two-aged
Structural Stage	Late-intermediate	Late-intermediate/ Young intermediate	Regenerating/Young & Late-intermediate/Mature	Late-intermediate
Stand Age	100-115± years	20± / 50-60± / 95-110± years	20± / 95-105± years. Possible residuals 150 to 200+ years old.	80 – 110± years
Tree Size				
DBH Range	9-23± inches	2-22± inches	9-24± inches	9-22± inches (30)
Mean DBH	13± inches	11± inches	n/a	13± inches
Avg. Max. Height	90± feet (oak) to 105± feet (white pine)	65± feet	75± feet	90± feet
Stand Density				
Relative Stocking	Moderate/considerable	Moderate	Moderate	Considerable
Basal Area/Acre	130± ft^2/ac	65± ft^2/ac (variable)	0-90± ft^2/ac (variable)	160± ft^2/ac
Trees/Acre	140± trees/ac	90± trees/ac	40± trees/ac	180± trees/ac
Canopy Closure	70-100%	0-90% (variable)	0-80%	90-100%

Wildlife / Ecological	**E1**	**E2**	**E3**	**E4**
Habitat Features	Light thermal cover. Abundance of mast. Some old trees.			
Canopy Structure/ Stratification[1]				
Woody Deadfall[2]	Some accumulation; few large trunks	Some accumulation, especially from recent harvesting	Moderate accumulation. Some large downed tree trunks	Substantial accumulation, including large trunks
Invasive Plants	No observed incidence			

[1] CANOPY DENSITY (Rows): Not present (no fill); Light (blue); Moderate (gold); Substantial (green); Dense (red)
CANOPY LAYER (Columns): 1 = Understory 2 = Mid-story 3 = Overstory 4 = Supercanopy
[2] Degree of Forest Floor Woody Debris Accumulation

SILVICULTURAL PRESCRIPTION

White Pine/Hardwood

Objectives –

For the managed stands, silvicultural treatment is intended to promote the growth of the healthy mid-aged red oaks and white pines which dominate this forest type. Specifically: 1) Encourage the development valuable timber—oak veneer and high-quality white pine; 2) Broaden stand age structure to include at least five age generations, including abundant young growth and mid-aged trees, while retaining ample mature trees; 3) Over time, the representation of mature trees should include at least 12 trees/acre that are 130 to 150+ years; 4) Initiate natural regeneration in stands to include diverse species, especially red oak and white pine, with increased amounts of white oak, shagbark hickory, black birch, and sugar maple; 5) Temper the progression towards increasing beech composition; 6) Enhance mast-production with healthy broad-crowned oaks and diversity of species; and 7) Long-term, re-introduce American chestnut to this forest type. Stands in Compartment 5 (Spruce Swamp and islands) are reserved from forest harvesting.

Structural Sequence: Two-aged and three-aged (present condition) → Three-aged (2030±) → Multi-aged (2045±)

Silvicultural Treatments:

Past (2013—Compartment 2):

> ***Crown thinning/Improvement harvest***. 5 to 10 feet of growing space was provided around the crowns of healthy, high quality pines and hardwoods. Poor quality hardwoods were harvested. White pine and red oak were retained as future seed sources.

First Treatment (Compartments 1, 3, and 4). 2018-2026±:

> ***Single-tree/micro-group selection/Liberation***. Remove trees individually or in groups of 6+ trees to create canopy gaps of up to 2500± sq. ft., removing all undesirable understory, as well. Approximately 3 micro-gaps per two acre. ***Crown thinning/Improvement harvesting*** in forest areas between gaps. ***FSI (non-commercial forest stand improvement)*** to be applied within the micro-openings as a follow-up in 2 to 5 years, to release favorable regeneration.

Second Treatment (All Compartments). 2027-2038±:

> ***Single-tree selection/New micro-groups/Expanded regeneration openings/Liberation***. Similar treatment as previous. In addition, harvest along edges of previous regeneration openings to release young growth and establish a new generation. Encourage pine, oak, and hickory regeneration. Apply ***FSI*** 2 to 5 years post-harvest to release favorable regeneration.

Third Treatment (All Compartments). 2039-2048±:

> ***Similar treatment as previous.***

F. HEMLOCK/WHITE PINE/HARDWOOD (HWH) – 46.7± ACRES

Brief: A major forest type, covering much of the tract's central area, as well as several small pockets. Characterized as containing hemlock, white pine, and upland hardwoods, with hemlock *in the overstory* or *upper mid-story.* Three structural variants are described.

Description: In addition to upland hardwoods and white pine, an abundance of hemlock characterizes this forest type. Hemlock is present in the upper canopy layers, not just in the understory as with other forest types. In all three variants, the matrix forest is well-established. It substantially persists in variants F1 and F3, but not F3, where timber harvesting has recently occurred.

F1: Typical densely-shaded forest floor with older trees.

In the ***F1 variant,*** 80 to 120+ year old hemlocks are found as co-dominant overstory trees. The proportions of hemlock, beech, red oak, maple, and the birches vary between areas. Timber harvesting and other disturbance has not recently occurred resulting in densely shaded areas that lack young forest and herbaceous growth. Other areas have few old hemlocks, and therefore contain a substantial hemlock understory. Witch-hazel is found in moist, lighted openings.

The ***F2 variant*** includes areas that were recently harvested primarily in Compartments 1 and 2. Skid trail openings and dense hemlock understory growth are variously evident. The residual overstory includes hemlock, pine, and hardwoods.

The ***F3 variant***, found in Compartment 4 (the former Smith parcel) consists of an ample white pine overstory and a dense hemlock midstory. Upland hardwoods are part of the overstory mix. This variant area has not been recently harvested.

While present, the Hemlock Wooly Adelgid has not (as of spring 2018) had substantial effect on the tract's hemlock stands. Efforts are underway to release a biological control that will help stem this exotic insect's threat to hemlock; however, widespread loss of hemlock and significant compositional change of the tract's hemlock stands may occur if adelgid control proves ineffective or arrives too late.

Timber – The ***F1 and F3 HWH variants*** contain substantial hemlock sawtimber and pulp volume, as well as white pine and red oak sawtimber. Pine quality varies from clear to heavily-limbed trunks, though most trees have grown straight and benefited from the protective shade of surrounding hemlocks. Red oaks average 1½ logs, with some veneer. In the original Glen Oakes forest, the ***F2 HWH variant*** area has had an active harvest history. These harvests were light and selective of pine (1950's), firewood and timber (1985±), and individual sawtimber trees (late 1990's). The 2013 improvement harvest in Compartment 2 removed poor quality trees. As a result of these past harvests, the remaining overstory includes good quality white pine (presently 10-18" DBH) and red oak (10-16").

F2: A small HWH inclusion within the previously harvested Compartment 1.

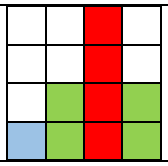
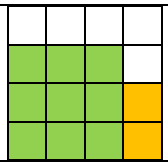
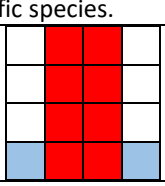
Wildlife - Covering an extensive area in the central portion of the conservation property, this forest type provides important transitional cover from open forest canopy to the west (Spruce Swamp and the *Upland Hardwood* strip openings) and the mast forest (*Oak Forest*) to the east. The forest canopy, including pine super-canopy, is generally well-stratified, though dense understory and herbaceous layer is limited in shaded areas. The dense hemlock foliage that characterizes this forest type affords thermal cover for wildlife both in winter (deer, snowshoe hare, grouse) and hot summer weather. Birds specific to the heavy softwood cover in this forest type include barred owl, black-throated green warbler, hermit thrush, blue-headed vireo, red-breasted nuthatch, and winter wren near Spruce Swamp and brushy wetland edges.

Several small forested wetland basins and vernal pools support amphibian, avian, and mammal activity. Vernal pools were found to contain wood frogs, spotted salamander, red-spotted newt, spring peepers, leopard frog, and fairy shrimp, as well as caddisfly larvae, isopods, chironomid midges, and copepods. A moderate amount of coarse woody debris was noted; woody debris provide critical upland shelter to many vernal pool inhabitants.

Species Composition	**Variant F1**	**Variant F2**	**Variant F3**	
			Overstory	**Midstory**
Primary[1]	HM, WP, RO	WP, HM, RM, RO, BB, WB, BE	WP	HM
Secondary[2]	WB, BE, RM	BO	RO, BB, WA, RM	
Tertiary[3]	WO, YB, BO	RP, YB	WO, WB, BO	
Regeneration (Saplings)	Sparse HM	HM, primarily. BE, RM, BB	Sparse HM, BE	
Shrubs / Groundcover	Sparse or missing in heavily shaded areas	WH, wintergreen, partridgeberry	Sparse or missing in heavily shaded areas	
Site	Xeric	Xeric	Xeric	

[1] Dominant tree species in the high canopy layers.
[2] A fairly common to less common tree species.
[3] Less common, or a unique tree species with only one or a few specimens in the forest type.

Forest Structure	**F1**	**F2**	**F3**
Composition			
Stand Structure	Two-aged with residuals	Three-aged	Two-aged with residuals or three-aged
Successional Stage	Mid-intermediate	Mid-intermediate	Late-intermediate
Stand Age	40-55± / 80-100± years	20± / 60± years (with 85-110± year old residuals)	60-75± / 95-115± / 130-150± years
Tree Size			
DBH Range	4-18± inches	7-24± inches	8-24± inches
Mean DBH	13± inches	13± inches	15± inches
Avg. Max. Height	70± feet	65± feet	90± feet
Stand Density			
Relative Stocking	Considerable/Dense	Variable: Moderate to Considerable	Dense
Basal Area/Acre	160± ft^2/ac	105± ft^2/ac	280± ft^2/ac
Trees/Acre	180± trees/ac	120± trees/ac	230± trees/ac
Canopy Closure	80-100%	90-100%	90-100%

Wildlife / Ecological	F1	F2	F3
Habitat Features	Dense thermal cover. Hemlock forest is valued by specific species.		
Canopy Structure / Stratification[1]			
Woody Deadfall[2]	Moderate; mostly small	Moderate to good – Variable abundance; some large decaying trunks	Good to excellent
Invasive Plants	None	Low/no incidence	None

[1] **CANOPY DENSITY (Rows): Not present (no fill); Light (blue); Moderate (gold); Substantial (green); Dense (red)**
CANOPY LAYER (Columns): 1 = Understory 2 = Mid-story 3 = Overstory 4 = Supercanopy
[2] **Degree of Forest Floor Woody Debris Accumulation**

SILVICULTURAL PRESCRIPTION

Hemlock/Pine/Hardwood

Objectives –

Over the next 50 years, the recommended silvicultural treatments are intended to maintain extensive dense softwood cover while broadening the range of tree generations and species diversity. Specifically: 1) Retain some (5 to 10 trees/acre) large, increasingly older, legacy trees, particularly hemlock, red oak, and black birch; 2) Retain hemlock cover while creating within-stand openings in areas less shaded by hemlock to allow the establishment of mixed hardwood growth; 3) Establish pockets of herbaceous growth and ground cover in densely shaded areas by creating openings; 4) Retain ample white pine, red oak, and black birch seed sources to assure natural regeneration of these species; 5) Apply single-tree selection within hemlock groves to minimize change to scenic qualities; 6) Release favorable young growth over time; 7) Grow broad-crowned oaks; and 8) Continue to monitor for the presence of hemlock wooly adelgid.

Structural Sequence: Two and three-aged (present condition) → Multi-aged (2045±)

Silvicultural Treatments:

Past (2013—Compartment 2):

> ***Single-tree/micro-group selection***. Focus was promoting mixed species natural regeneration in small regeneration openings, while providing growing space to large-crowned oaks.

First Treatment (Compartments 1, 3, and 4). 2018-2026±:

> ***Single-tree/micro-group selection/Liberation***. Remove trees individually or in groups of 6+ trees to create canopy gaps of up to 2500± sq. ft. Remove all undesirable understory within openings. Approximately 3 micro-gaps per two acres (hectare). ***Crown thinning/Improvement harvesting*** in forest areas between gaps. ***FSI (non-commercial forest stand improvement)*** to be applied within the micro-openings as a follow-up in 2 to 5 years, to release or thin favorable regeneration.

Second Treatment (All Compartments). 2027-2038±:

Single-tree selection/New micro-groups/Expanded regeneration openings/Liberation. Similar treatment as previous. Additionally, increase perimeter of previous openings to release previous regeneration and create space for another new forest generation. Encourage pine, oak, and hickory regeneration. Retain ample older generation (150+ years) as legacy trees.
Apply ***FSI*** 2 to 5 years post-harvest to release or thin sapling and small pol-sized growth.

Third Treatment (All Compartments). 2039-2048±:

Similar treatment as previous.

G. HEMLOCK/HARDWOOD (HH) – 22.7± ACRES

Brief: ***Hemlock/Hardwood*** is a major forest type, consisting of hemlock and upland hardwoods, with white pine largely absent. Forest structure varies greatly; four variants are described. The forest type is found only in Compartments 3 and 4.

Description: The HH forest type varies both in composition and structure: Hemlock is generally present in the mid-story and/or overstory typically in association with red oak, red maple, and sometimes beech. ***Variant G3*** has a nearly pure hemlock overstory. Due to its disturbance history, forest structure is highly variable. The two-aged (or even-aged with scattered older residuals) structure of ***Variant G1*** is due to heavy white pine harvesting that occurred between 1925 and 1955, depending on the stand. Older residuals 120 to 150± years old are found in these Smith parcel stands. Three-aged patches of ***Variant G2*** are found in the Smith parcel, which have a young age cohort that resulted from 1960's or 1970's harvesting. ***Variant G4***, found as one stand in Compartment 3, consists of young forest due to heavy timber harvesting in the recent past (1985 and 2000±), with interspersed older patches. Young growth—saplings and polewood—is mostly hemlock, black birch, beech, and red maple. Two older generations of residuals include red oak, red maple, hemlock, and beech. White pine is absent.

G4: Dense young forest with hemlock as the dominant component.

G3: A nearly-pure hemlock canopy typifies the G3 variant.

Timber – Hemlock, generally the predominant sawtimber in this forest type, continues as an undervalued commercial species. High-quality red oak is found in the older stands, though it may be desirable to retain many of these trees for their scenic, wildlife, and seed source values. Occasional red maple sawtimber is also found. As the younger cohorts of these stands age, additional hemlock, oak, and mixed hardwood sawtimber will develop. Due to the previous removal of quality trees, ***G4*** has no present timber value. Black birch and white pine regeneration can be encouraged for timber value in the distant future.

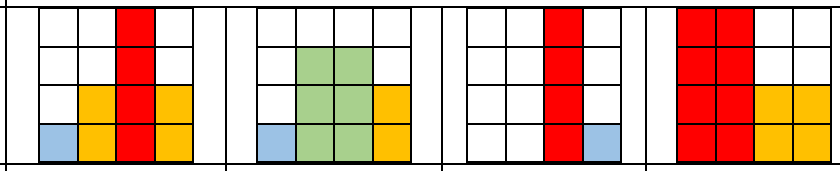
G2: A 2- to 3-aged hemlock/hardwood stand.

Wildlife **-** The dense hemlock foliage that characterizes this forest type affords thermal cover for wildlife both in winter (deer, snowshoe hare, ruffed grouse) and hot summer weather. Birds specific to the heavy softwood cover include barred owl, black-throated green warbler, and hermit thrush. Stands with dense hemlock understory provide escape cover and travel corridors for mammals and birds. Small openings in recently harvested areas contain mast-producing vegetation such as beaked hazelnut, blackberry and raspberries, prickly dewberry and grapevine.

Species Composition	**Variant G1**	**Variant G2**	**Variant G3**	**Variant G4**
Primary[1]	HM, RO, BE	HM, RM, RO	HM	RO, RM, HM, BE, BB
Secondary[2]	WO, RM, BB, WB	BE, WO, WP		BO, WB
Tertiary[3]	BO	GB, WB, YB, BO	YB	SM, SH
Regeneration (Saplings)	Sparse HM		HM	
Regeneration (Seedlings)				BE, HM, WP; BB in openings
Shrubs / Herbaceous				WH, HZ, blackberry, black raspberry, red raspberry, prickly dewberry, grapevine
Site	Xeric	Xeric	Xeric	Xeric-mesic

[1] Dominant tree species in the high canopy layers.
[2] A fairly common to less common tree species.
[3] Less common, or a unique tree species with only one or a few specimens in the forest type.

Forest Structure	**G1**	**G2**	**G3**	**G4**
Composition				
Stand Structure	2-aged	2-aged with residuals	Even-aged	Three-aged in patches
Successional Stage	Late-intermediate	Young- to late-intermediate	Mid- to late-intermediate	Young-intermediate
Stand Age	90-110± / 130-150± years	45± / 75-100± / 120-150± years	80-100± years	20± / 35± / 95± years
Tree Size				
DBH Range	9-22± inches	1-8 / 10-22± inches	6-20± inches	2-18± inches
Mean DBH	13± inches	9± inches		8± inches
Avg. Max. Height	65± feet	70± feet	65-70± feet	55± feet
Stand Density				
Relative Stocking	Considerable/dense	Considerable/dense	Dense	Light to moderate
Basal Area/Acre	200± ft^2/ac	155± ft^2/ac	220± ft^2/ac	50± ft^2/ac
Trees/Acre	220± trees/ac	315± trees/ac	400± trees/ac	145± trees/ac
Canopy Closure	90-100%	100%	100%	10-60%; variable

Wildlife / Ecological	**G1**	**G2**	**G3**	**G4**
Habitat Features	Winter and summer thermal cover. Good low cover in areas.			
Canopy Structure / Stratification[1]				
Woody Deadfall[2]	Favorable	Moderate	Moderate	Low
Invasive Plants	No observed incidence.			

[1] CANOPY DENSITY (Rows): Not present (no fill); Light (blue); Moderate (gold); Substantial (green); Dense (red)
CANOPY LAYER (Columns): 1 = Understory 2 = Mid-story 3 = Overstory 4 = Supercanopy
[2] Degree of Forest Floor Woody Debris Accumulation

SILVICULTURAL PRESCRIPTION

Hemlock/Hardwood

Objectives –

Barring significant disturbance, beech and hemlock will increasingly dominate this forest type to the detriment of a broad variety of species, including mast-producing trees, shrubs, and vines. The following recommendations intend to help redirect this successional trend: 1) Create small regeneration openings for mixed species growth by harvesting beech, poor quality hardwoods, and some larger hemlock; 2) Retain the species spectrum of hardwood residuals as seed sources, particularly oaks, and the stands' few sugar maple, shagbark hickory, and white pine; 3) Apply non-commercial forest stand improvement (FSI) to encourage favorable young growth; 4) Retain a substantial representation of old trees 120 – 150+ years); and 5) Retain patches of young hemlock for cover and travel corridors.

G1: Large hemlock residuals stand with mixed hardwoods. White pine was removed in a previous sawtimber harvest.

Structural Sequence: Even-aged/Two-aged/Three-aged (present condition) → Multi-aged (2045±)

Prescriptions:

First Treatment (Compartments 3 and 4). 2018-2023±:

> ***Micro and small group selection***. Remove groups of trees to create canopy gaps of 1/20 acre to ¼ acre in size. Remove all undesirable understory within openings. Approximately 1 regeneration opening per two acres (hectare).
> ***Crown thinning/Improvement harvesting*** in forest areas between the openings.
> ***FSI (non-commercial forest stand improvement)*** to be applied within the regeneration openings as a follow-up in 2 to 5 years, to release or thin favorable regeneration.

Second Treatment (Compartments 3 and 4). 2030-2035±:

> ***Expanded regeneration openings/Liberation/New openings.*** Increase perimeter of previous openings to release previous regeneration and create space for a new forest generation. Create new openings of similar size, 1 per two acres.
> ***Crown thinning/Improvement harvesting*** in forest areas between the openings.
> Apply ***FSI*** 2 to 5 years post-harvest to release or thin sapling and small pole-sized growth.

Third Treatment (Compartments 3 and 4). 2042-2045±:

> ***Similar treatment as previous***. Continually encourage pine, oak, birch, maple, and hickory regeneration. Retain ample older generation (150+ years) as legacy trees.

H. YOUNG FOREST (YF) AND EARLY SUCCESSIONAL (ES) – 4.8± ACRES

Status: Minor in area, this forest type includes the Conservation Area's powerline easement and an adjacent young growth stand. Early-successional growth includes brambles and shrubs, as well as pioneer forest species such as black cherry, quaking aspen, white birch. Early-successional species are rich in food sources as well as cover.

Description: Forest Type H is characterized as two contiguous areas of early-successional and young forest growth in the southeastern section of the Conservation Area. It includes a 2.4 ± acre powerline corridor that contains a variety of early-successional field and forest tree species, as well as shrubs and brambles. This vegetative condition is maintained on a 3 to 5 year mowing cycle by the utility company. Lying immediately south of the powerlines is a 2.4± acre pocket of young polewood that was established by a 2002 clearcut. Trees are generally 4 to 8 inches in diameter, regenerating both from seed and coppice (sprout) origin. A variety of tree, shrub, and vine species are present.

Powerline--early successional growth.

Timber **–** The powerline acreage has no timber growth potential. The young forest stand lies isolated from the rest of the Conservation Area by the powerline corridor. Due to this stand's remote location, it is unlikely that commercial forest management will ever be feasible. However, this forest stand can be managed for wildlife purposes by periodically re-clearing the stand to establish wildlife cover and perpetuate young forest conditions. All areas should be monitored for the presence of invasive plants; the powerline in particular provides a vector for the spread of exotic plants.

Wildlife **–** The young forest stand lies between two high-quality habitats: 1) The powerline corridor, which will remain as early-successional vegetation, and 2) A ponded beaver impoundment to the south and east. This shallow-water swamp contains snags, cavity trees, downed logs (turtle use), and grassy hummocks on the edges. Dense hardwood growth provides travel cover between habitats.

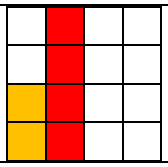
The powerline contains dense, true early-successional forest growth. This area provides outstanding habitat for snowshoe hare and a variety of birds including: Red-tailed hawk, wild turkey, willow flycatcher, chipping sparrow, song sparrow, and Eastern Towhee.

Forest Type C: Young hardwood growth.

Species Composition	**Early-successional/Young Forest**	
	Powerline	***Young Forest***
Primary[1]	WP, QA, RO, WB, RM	BE
Secondary[2]	n/a	RM, WP, BB, SH
Tertiary[3]	n/a	RO, WO, WB, BTA, QA, BC
Shrubs / Herbaceous	Witch-hazel, common juniper, steeplebush, meadowsweet	Witch-hazel, staghorn sumac, hazelnut, highbush blueberry, sweet pepperbush, meadowsweet, blackberry, grapevine
Site	Xeric	Xeric

.

Forest Structure	**Young Forest Area**
Composition	
Stand Structure	Even-aged
Successional Stage	Young (sapling/young polewood)
Stand Age	10-20± years
Tree Size	
DBH Range	<1-8± inches
Mean DBH	3± inches
Avg. Max. Height	25-40± feet
Stand Density	
Relative Stocking	Dense
Basal Area/Acre	n/a
Trees/Acre	1000+ stems/acre

Wildlife / Ecological	
Habitat Features	Dense cover and a wide variety of fruit-bearing shrubs
Canopy Structure / Stratification[1]	
Woody Deadfall[2]	Low accumulation
Invasive Plants	Honeysuckle and barberry observed; likely others present

[1] CANOPY DENSITY (Rows): Not present (no fill); Light (blue); Moderate (gold); Substantial (green); Dense (red)
CANOPY LAYER (Columns): 1 = Understory 2 = Mid-story 3 = Overstory 4 = Supercanopy
[2] Degree of Forest Floor Woody Debris Accumulation

SILVICULTURAL PRESCRIPTION

Young Forest/Early-successional

Objectives –

The main objective for this forest type is to perpetuate the early-successional forest condition. Retaining a 5± acre area of young growth provides distinct and valuable habitat for wildlife, since most of the Conservation Area's interior consists of well-established forest.

Timber management is unfeasible for the young forest stand due to poor access, but, habitat management is a good alternative. As the stand grows, its habitat value decreases. Partial or total re-clearing of the stand may will promote early-successional growth, and the stand will continue to serve as an extension of the powerline habitat.

The powerline area is maintained in early-successional condition by Eversource, which currently uses a 3 to 5 year Brontosaurus mowing cycle. For efficiency and cost-savings, it may be possible to link the young forest clearing with the powerline mowing as one operation, with the young forest re-cleared once every 10 to 12 years.

Structural Sequence: Even-aged (present condition)→Even-aged (2045).

Silvicultural Treatment:

Every three to five years beginning in 2018:

- ***Invasive plant monitoring/removal:*** In powerline are and young forest stand.
- The powerline is ***re-cleared*** on a 3 to 5 year cycle by the utility company.

Once every 12 to 15 years in conjunction with utility clearing work:

- ***Brontosaurus clearing*** of young stand. Re-clear to establish and perpetuate early-successional growth.

APPENDICES

APPENDIX A: SPECIES LIST

NATIVE TREES

DECIDUOUS

Spp Code	Common Name	Scientific Name
AC	American Chestnut	*Castanea dentata*
EL	American Elm	*Ulmus americana*
BW	Basswood	*Tilia americana*
BE	Beech	*Fagus grandifolia*
BTA	Bigtooth Aspen	*Populus grandidentata*
BB	Black Birch	*Betula lenta*
BC	Black Cherry	*Prunus serotina*
BO	Black Oak	*Quercus velutina*
BG	Black Tupelo (Black Gum)	*Nyssa sylvatica*
GB	Gray Birch	*Betula populifolia*
HH	Hophornbeam	*Ostrya virginiana*
IW	Ironwood (Blue Beech)	*Carpinus caroliniana*
	Pin Cherry	*Prunus pennsylvanica*
QA	Quaking Aspen	*Populus tremuloides*
RM	Red Maple	*Acer rubrum*
RO	Red Oak	*Quercus rubra*
SAS	Sassafras	*Sassafras albidum*
SH	Shagbark Hickory	*Carya ovata*
SM	Sugar Maple	*Acer saccharum*
WA	White Ash	*Fraxinus americana*
WB	White Birch	*Betula papyrifera*
WO	White Oak	*Quercus alba*
	Willow	*Salix spp.*
YB	Yellow Birch	*Betula alleghaniensis*

EVERGREEN

Spp Code	Common Name	Scientific Name
BSP	Black Spruce	*Picea mariana*
HM	Hemlock	*Tsuga canadensis*
PP	Pitch Pine	*Pinus rigida*
RP	Red Pine	*Pinus resinosa*
RSP	Red Spruce	*Picea rubens*
WP	White Pine	*Pinus strobus*

NATIVE SHRUBS & VINES

Spp Code	Common Name	Scientific Name
ARR	Arrowwood	*Viburnum recognitum*
	Black Huckleberry	*Gaylussacia baccata*
	Black Raspberry	*Rubus occidentalis*
	Blackberry	*Rubus allegheniensis*
	Buttonbush	*Cephalanthus occidentalis*
	Chokeberry	*Pyrus spp.*
GR	Grape	*Vitis spp.*
	Hawthorn	*Crataegus spp.*
HZ	Hazelnut	*Corylus spp.*
HBB	Highbush Blueberry	*Vaccinium corymbosum*
HOB	Hobblebush	*Viburnum alnifolium*
	Juniper	*Juniperus spp.*
	Leatherleaf	*Chamaedaphne calyculata*
LBB	Lowbush Blueberry	*Vaccinium angustifolium*
	Maleberry	*Lyonia ligustrina*
	Maple-Leaved Viburnum	*Viburnum acerifolium*
	Meadowsweet	*Spiraea latifolia*
NAN	Nannyberry	*Viburnum lentago*
	Northern Bayberry	*Myrica pensylvanica*
	Northern Bush-Honeysuckle	*Diervilla lonicera*
	Partridgeberry	*Mitchella repens*
	Poison Ivy	*Toxicodendron radicans*
	Poison Sumac	*Toxicodendron vernix*
	Prickly Dewberry	*Rubus hispidus*
	Red Raspberry	*Rubus idaeus*
	Rose	*Rosa spp.*
	Serviceberry (Juneberry, Shadbush)	*Amelanchier spp.*
	Sheep Laurel	*Kalmia angustifolia*
	Smooth Sumac	*Rhus glabra*
SA	Speckled Alder	*Alnus incana spp. rugosa*
	Spicebush	*Lindera benzoin*
	Staghorn Sumac	*Rhus typhina*
	Steeplebush	*Spiraea tomentosa*
	Swamp Azalea	*Rhododendron viscosum*
	Sweet Pepperbush	*Clethra alnifolia*
	Sweetfern	*Comptonia peregrina*
	Winterberry Holly	*Ilex verticillata*
	Wintergreen	*Gaultheria procumbens*
WH	Witch Hazel	*Hamamelis virginiana*

NATIVE GROUNDCOVER & FERNS

Common Name	**Scientific Name**
Blue Ground-Cedar	*Diphasiastrum tristachyum*
Bracken Fern	*Pteridium spp.*
Christmas Fern	*Polystichum acrostichoides*
Cinnamon Fern	*Osmunda cinnamomea*
Hay-scented Fern	*Dennstaedtia punctilobula*
Interrupted Fern	*Osmunda claytoniana*
Lady Fern	*Athyrium filix-femina*
Marginal Wood Fern	*Dryopteris marginalis*
Marsh Fern	*Thelypteris palustris*
New York Fern	*Thelypteris noveboracensis*
Northern Ground-Cedar	*Lycopodium complanatum*
Pipsissewa	*Chimaphila umbellata*
Polypody Fern	*Polypodium spp.*
Royal Fern	*Osmunda regalis*
Sensitive Fern	*Onoclea sensibilis*
Spotted Wintergreen	*Chimaphila maculata*
Tree Clubmoss	*Lycopodium obscurum*

NON-NATIVE SPECIES

Glossy Buckthorn	*Frangula alnus*
Honeysuckle	*Lonicera* spp.
Japanese Barberry	*Berberis japonica*

NOTE: The tree and shrub species lists are complete, or near complete, for the Conservation Area. The groundcover, vines, and ferns lists are not comprehensive.

APPENDIX B: VERNAL POOL OBSERVATIONS[A]

Selected Vernal Pools - April 2008 & 2009

Vernal Pool A
audible – wood frog[B]
observed - fairy shrimp[B], predaceous diving beetle larva[C], mosquito larva, water mite

Vernal Pool B
observed – wood frog[B], spring peeper[C], water strider

Vernal Pool C
audible – wood frog[B]
observed – wood frog egg mass[B], pickerel frog egg mass[C], spotted salamander egg mass[B], red-spotted newt[C], fairy shrimp[B], caddisfly larva[C], water strider, water mite

Vernal Pool D
observed – whirligig beetle[C], predaceous diving beetle larva[C], water strider

Vernal Pool E
observed – wood frog egg mass[B], water strider

Vernal Pool F
observed – fairy shrimp[B], mosquito larva, amphipod

Vernal Pool G
audible – wood frog[B]
observed – fairy shrimp[B], red eft, water mite

Vernal Pool H
observed – red eft, mosquito larva, amphipod

[A]NOTE: Observations are based on brief visits to each of 8 vernal pools and did not include wildlife sampling or long-term tracking efforts. Therefore, the species lists should not be considered comprehensive.

[B]Obligate vernal pool species – are dependent on vernal pools for at least part of their life cycle, typically breeding activity.

[C]Facultative vernal pool species – will utilize vernal pools for at least some portion of their life cycle.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
43B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	11.2	2.9%
43C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	62.2	16.0%
115	Scarboro muck, coastal lowland, 0 to 3 percent slopes	1.1	0.3%
140B	Chatfield-Hollis-Canton complex, 0 to 8 percent slopes, rocky	41.8	10.8%
140C	Chatfield-Hollis-Canton complex, 8 to 15 percent slopes, rocky	82.7	21.3%
295	Freetown mucky peat, 0 to 2 percent slopes	92.5	23.8%
343C	Canton gravelly fine sandy loam, 8 to 15 percent slopes, extremely bouldery	14.1	3.6%
447B	Scituate-Newfields complex, 3 to 8 percent slopes, very stony	13.4	3.5%
495	Natchaug mucky peat, 0 to 2 percent slopes	6.7	1.7%
547B	Walpole very fine sandy loam, 3 to 8 percent slopes, very stony	62.4	16.1%
Totals for Area of Interest		**387.9**	**100.0%**

APPENDIX D: TIMBER INVENTORY SPECIFICATIONS

The original Glen Oakes Conservation Area tract, owned by the Town of Fremont and comprising 312.1± acres was cruised in December 2007 using the variable-radius plot sampling technique. Data were collected from 107 prism plots arranged in a grid pattern covering the forest. The average sampling intensity was 1 sample point per 2.1± forested acres.

In April 2015, an additional 76± acres comprising the newly acquired Smith parcel were cruised using similar techniques. Data was collected from 36 additional prism plots. The two inventories were then combined, using standard growth rates to update the two data sets by 10 years and 3 years, respectively, from which May 2018 total timber volumes were correlated.

Aerial photos and reconnaissance of the property were employed to delineate forest types into multiple strata for statistical purposes.

A summary of inventory and statistical specifications follows:

1) 2007 inventory (initial 312.1 acre holding):
   Statistical error around the total sawtimber[1] volume estimate: ±11.4%
   589,199 Board Feet ±67,307 BF
   Statistical error around the total firewood volume estimate: ±13.0%
   2,378 cords ± 309 cords
2) 2015 inventory (76-acre Smith Parcel acquisition):
   Statistical error around the total sawtimber volume estimate: ±23.6%
   579,551 Board Feet ±136,790 BF
   Statistical error around the total firewood volume estimate: ±16.8%
   801 cords ± 134 cords
3) Confidence level: 90%
4) Sample plot layout
   a. Systematic sample
   b. Spacing: 300’ x 300’ grid (2007 cruise); 303’ x 303’ (2015 Smith Parcel cruise)
5) Plot type and number: 143 prism plots (107 during 2007 cruise, 36 during 2015 Smith Parcel cruise)
6) Number of strata: Four (2007 cruise); one (2015 Smith Parcel cruise)
7) Angle-gauge: 20-factor prism
8) Tree scaling/grading specifications:
   a. Diameter: All merchantable trees > 5 inches DBH measured
   b. Stem DBH measurements: 1 inch increments
   c. Top diameters (merchantable heights)
      - Firewood – 4”, straight stem
      - Sawtimber: White pine: 8 inches
        Other softwoods: 10”
        Hardwoods: 10”
   d. Grades:
      - Veneer (black and red oak; black, and yellow birch; sugar maple)
      - Grade sawlogs (Hardwood and softwood)
      - Pallet logs (Hardwood and softwood)

[1]Total sawtimber includes grade logs, veneer, and pallet logs of all species.

New Hampshire Natural Heritage Bureau

DRED - Division of Forests & Lands
172 Pembroke Road, Concord, NH 03301
Phone: (603) 271-2214 Fax: (603) 271-6488

To: Charles Moreno
Moreno Forestry Associates
PO Box 60
Center Strafford, NH, 03815

From: Sara Cairns, NH Natural Heritage Bureau
Date: 2018-05-15
Re: Review by NH Natural Heritage Bureau of request dated 2018-05-09

NHB File ID: 2974
Project type: Landowner Request
Town: Fremont, NH
Location: Map 2 Lot 156-2-1 & Map 4 Lot 86 (Town of Fremont)

I have searched our database for records of rare species and exemplary natural communities on the property(s) identified in your request. Our database includes known records for species officially listed as Threatened or Endangered by either the state of New Hampshire or the federal government, as well as species and natural communities judged by experts to be at risk in New Hampshire but not yet formally listed.

NHB records on the property(s):

	Mapping Precision	% within tract	Last Reported	Listing Status		Conservation Rank	
Invertebrate Species (For more information, contact Kim Tuttle, NH F&G at 271-6544)				**Federal**	**NH**	**Global**	**State**
Ringed Boghaunter *(Williamsonia lintneri)*	High	26	2012	--	E	G3	S2
Natural Community				**Federal**	**NH**	**Global**	**State**
Medium level fen system	High	38	2002	--	--		S3
Plant species				**Federal**	**NH**	**Global**	**State**
weak stellate sedge *(Carex seorsa)*	High	96	2002	--	E	G4	S1

NHB records within one mile of the property(s):

	Last Reported	Listing Status		Conservation Rank	
Invertebrate Species (For more information, contact Kim Tuttle, NH F&G at 271-6544)		**Federal**	**NH**	**Global**	**State**
Ringed Boghaunter *(Williamsonia lintneri)*	2012	--	E	G3	S2

NOTE: This review *cannot* be used to satisfy a permit or other regulatory requirement to check for rare species or habitats that could be affected by a proposed project, since it provides detailed information only for records actually on the property.

New Hampshire Natural Heritage Bureau

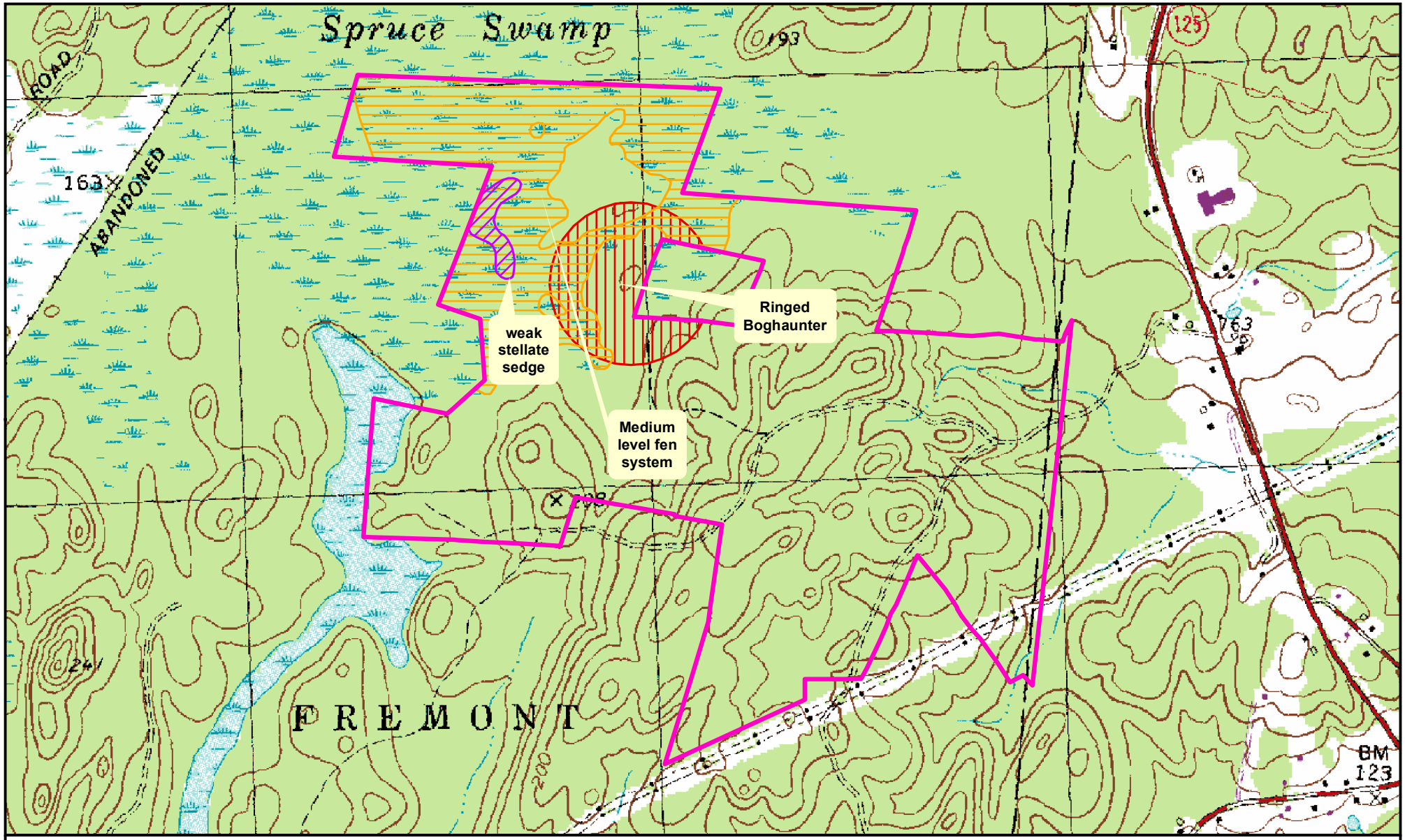
DRED - Division of Forests & Lands
172 Pembroke Road, Concord, NH 03301
Phone: (603) 271-2214 Fax: (603) 271-6488

Martha's Pennant *(Celithemis martha)*	2011	--	--	G4	S2
Natural Community		**Federal**	**NH**	**Global**	**State**
Sweet pepperbush wooded fen	2009	--	--		S2
Poor level fen/bog system	2009	--	--		S3
Medium level fen system	2002	--	--		S3
Plant species		**Federal**	**NH**	**Global**	**State**
weak stellate sedge *(Carex seorsa)*	2002	--	E	G4	S1
Vertebrate species (For more information, contact Kim Tuttle, NH F&G at 271-6544)		**Federal**	**NH**	**Global**	**State**
Bridle Shiner *(Notropis bifrenatus)*	2014	--	T	G3	S2
Spotted Turtle *(Clemmys guttata)*	2013	--	T	G5	S2
Blanding's Turtle *(Emydoidea blandingii)*	2013	--	E	G4	S1
Northern Black Racer *(Coluber constrictor constrictor)*	2012	--	T	T5	S2

Listing codes: T = Threatened, E = Endangered SC = Special Concern
Rank prefix: G = Global, S = State, T = Global or state rank for a sub-species or variety (taxon)
Rank suffix: 1-5 = Most (1) to least (5) imperiled. "--", U, NR = Not ranked. B = Breeding population, N = Non-breeding. H = Historical, X = Extirpated.

A negative result (no record in our database) does not mean that no rare species are present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

NOTE: This review *cannot* be used to satisfy a permit or other regulatory requirement to check for rare species or habitats that could be affected by a proposed project, since it provides detailed information only for records actually on the property.



Natural Heritage Bureau Landowner Report

Project ID Number: 2974

NOTE: Any rare species and/or exemplary natural communities in this area are not shown unless they occur, at least in part, within the property bounds.

0 0.1 0.2 Mile

	# of Records
Property Bounds	
Plant Occurence:	*1*
Animal Occurence:	*1*
Natural Community:	*0*
Ecological System:	*1*

N W E S

DEPARTMENT OF RESOURCES AND ECONOMIC DEVELOPMENT
NEW HAMPSHIRE
FORESTS & LANDS

New Hampshire Natural Heritage Bureau - Animal Record

Ringed Boghaunter ***(Williamsonia lintneri)***

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G3: Rare or Uncommon
State:	Listed Endangered	State:	S2: Imperiled

Description at this Location

Quality Rank: Not Ranked
Quality Comments:

Detailed Description: 2012: Spruce Swamp South: Species observed on 5/11. 2011: Glen Oakes: 2 observed on 5/11. 1 observed on 5/21. Spruce Swamp North: Observed on 5/21. 2 exuviae collected on 5/29. Spruce Swamp South: 2 observed on 5/13. 4 observed on 5/29. 1 observed on 6/2.
General Area:
General Comments:
Mgmt Comments:

Location

Survey Site Name: Spruce Swamp
Managed By: Fremont, Town of

County: Rockingham
Town(s): Fremont
Size: 92.7 acres
Elevation:

Precision: High

Directions:

Dates documented

First reported: 2011-05-11
Last reported: 2012-05-11

New Hampshire Natural Heritage Bureau - Ecological System Record

Medium level fen system

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	
State:	Not Listed	State:	S3: Rare or Uncommon

Description at this Location

Quality Rank: Good
Quality Comments:

Detailed Description: 2004: Poor level fen/bog system at same site, split EO's.2002: Most of the southern and east central area is classified as a sweet pepperbush wooded fen, with abundant Clethra alnifolia (sweet pepperbush) and other southern plants. It is remarkably large (200+ acres) and characterized by a dense tall shrub layer with sweet pepperbush, Ilex verticillata (winterberry), Vaccinium corymbosum (highbush blueberry), Viburnum dentatum var. lucidum (northern arrow-wood), Spiraea alba (meadow-sweet), Nemopanthus mucronatus (mountain holly) and a sparse to moderate herb layer. The second community occurs at the northern tip of the peatland complex and is classified as a leatherleaf - sheep laurel dwarf shrub bog. It is characterized by a dense layer of Chamaedaphne calyculata (leatherleaf), lower abundance of Kalmia angustifolia (sheep laurel) and Rhododendron canadense (rhodora), over a dense carpet of Sphagnum fallax. Widely scattered old snags are still evident (ca. 15-20 years old). A denser area of black spruce and larch is evident to the west of the leatherleaf fen, visited earlier and classified as a highbush blueberry - mountain holly wooded fen. Some areas may have dense enough tree cover to be classified as black spruce - larch swamp. 1998: Contains two sizable peatland communities. Internal variation in shrub height and vegetative composition may be found to correspond to other wetland community types. 1990: An extensive swamp, including a black spruce swamp with generally 50% or less spruce cover. Dominant species are Picea mariana (black spruce), Vaccinium corymbosum (highbush blueberry), Nemopanthus mucronatus (mountain holly), and Ilex laevigata (smooth winterberry). Also as part of this community, there is a red maple shrub swamp with generally higher diversity of herbaceous species. 1969: Extensive area of boreal and temperate swamp associations with very little open water.

General Area: 1998: Five or more upland "islands" are embedded within the larger wetland complex, particularly at the west margin of the wetland adjacent to the railroad tracks. Adjacent wetland communities may include red maple swamp and transitional areas between mineral soil red maple woodland swamps and organic soil sparse-woodland/shrub thickets. Beaver-influenced areas occur in the northeast and southwest sections of the wetland complex. Most of the wetland complex lies on the east side of the old railroad track bed, although a sizeable emergent marsh and other wetland communities continue on the west side of the track to the southwest. Other than the railroad bed, the landscape context for this large wetland complex is good. There were no noticeable buildings or other evidence of recent human-related disturbance seen from the portion of the wetland surveyed. 1990: Extensive "dead" areas to the north grading into unhealthy, partial red maple cover to the south. 1969: Drainage from the bog area goes in two directions - north and south. Several small glacial eskers rise a few feet above the swamp, on which grows Quercus alba (white oak), Quercus rubra (red oak), and Quercus velutina (black oak), along with Pinus strobus (white pine) and occasional Acer rubrum (red maple).

General Comments: 2002: A north-south transect through the middle of the swamp revealed a better understanding of this complex wetland system and some new boundary delineations. 1998: This site requires more field work to better understand its land-use history and community composition, classification, delineation, and condition. Less well-known locations include a large area (ca. 100 acres) to the southeast and another large area (ca. 100 acres) to the southwest. 1969: The area in general is distinguished by the variety and quality of its forest association containing varying amounts of black spruce and also by the presence in some abundance of several species of shrubs at essentially the northern limits of their range.

Mgmt Comments:

Location

Survey Site Name: Spruce Swamp
Managed By: Fremont, Town of

County: Rockingham
Town(s): Fremont
Size: 206.5 acres
Elevation: 160 feet

Precision: High

Directions: Best accessed from the Rockingham Recreation Trail (an abandoned railroad track). From Brentwood Corners, North Road goes west to Lyford Crossing. From here, the old rail bed leads south about 1 mile to the western edge of the swamp. Same location may also be reached from the south at the trail's intersection with Rte. 107 in Fremont. All other approaches cross several parcels of private land.

Dates documented

First reported: 1969
Last reported: 2002-10-02

New Hampshire Natural Heritage Bureau - Plant Record

weak stellate sedge *(Carex seorsa)*

Legal Status		Conservation Status	
Federal:	Not Listed	Global:	G4: Widespread and apparently secure but with cause for longterm concern
State:	Listed Endangered	State:	S1: Critically Imperiled

Description at this Location

Quality Rank: Fair

Quality Comments: Based on plants observed. Population size and rank could be increased with additional field work.

Detailed Description: 2002: More than 20 plants observed in a ca. 0.1 hectare area. The plants form moderate to large tussocks. 1969: Specimen collected.

General Area: 2002: Sweet pepperbush wooded fen within a larger, exemplary, poor-intermediate level fen system. Associated species include Decodon verticillatus (coastal water willow), Clethra alnifolia (sweet pepperbush), Vaccinium corymbosum (highbush blueberry), Lycopus americanus (American water horehound), Ilex verticillata (winterberry), Osmunda regalis [var. spectabilis] (royal fern), Carex trisperma var. trisperma (three-seeded sedge), Gaylussacia baccata (black huckleberry), Carex folliculata (follicled sedge), and Sphagnum fallax (peat moss). Dominant species are I. verticillata, C. alnifolia, and Nemopanthus mucronatus (mountain holly). 1969: Spruce swamp.

General Comments: 2002: More plants are likely to be found with additional search effort aimed specifically at this plant.

Mgmt Comments:

Location

Survey Site Name: Spruce Swamp

Managed By: Fremont, Town of

County: Rockingham

Town(s): Fremont

Size: 3.5 acres

Elevation: 165 feet

Precision: High

Directions: Best accessed from the Rockingham Recreation Trail (an abandoned railroad track). From Brentwood Corners, North Road goes west to Lyford Crossing. From here, the old rail bed leads south about 1 mile to the western edge of the swamp. Same location may also be reached from the south at the trail's intersection with Rte. 107 in Fremont. All other approaches cross several parcels of private land. [The Carex plants are ca. 0.5 mile SE of the recreation trail, near the southern limit of the fen] (2002). Fremont Spruce Swamp (1969).

Dates documented

First reported: 1969-07-08

Last reported: 2002-10-02

APPENDIX F: REFERENCES

Author Unknown. 2005. Forest Notes Summer 2005. The Society for the Protection of New Hampshire Forests. Pages 5 – 7.

Author Unknown. 2008. Fremont Natural Resources Inventory. Rockingham Regional Planning Commission. Section 4.24.

Author Unknown. 2008. NHB File #419. New Hampshire Natural Heritage Bureau.

Cobb, Boughton. 1963. A Field Guide to the Ferns. Houghton Mifflin Company. Boston. 281 pp.

DeGraaf, Richard M. and Mariko Yamasaki. 2001. New England Wildlife: Habitat, Natural History, and Distribution. University Press of New England. Hanover. 482 pp.

Kenney, Leo P. and Matthew R. Burne. 2001. A Field Guide to the Animals of Vernal Pools. Massachusetts Division of Fisheries & Wildlife, Natural Heritage & Endangered Species Program & Vernal Pool Association. 77 pp.

Martin, Alexander C., Herbert S. Zim, and Arnold L. Nelson. 1951. American Wildlife & Plants: A Guide to Wildlife Food Habits. Dover Publications, Inc. New York. 500 pp.

Moore, Richard B. 1990. Geohydrology and Water Quality of Stratified-Drift Aquifers in the Exeter, Lamprey, and Oyster River Basins, Southeastern, New Hampshire. Water Resources Investigations Report 88-4128. U.S. Geological Survey. Plate 4.

Newcomb, Lawrence. 1977. Newcomb's Wildflower Guide. Little, Brown and Company. Boston, New York. 490 pp.

New Hampshire Fish and Game Department. 2005. New Hampshire Wildlife Action Plan.

Petrides, George A. 1972. A Field Guide to Trees and Shrubs. Houghton Mifflin Company. Boston. 428 pp.

Sperduto, Daniel D. 2005. Natural Community Systems of New Hampshire. New Hampshire Natural Heritage Bureau and the Nature Conservancy. 125 pp.

Sperduto, Daniel D. and William E. Nichols. 2004. Natural Communities of New Hampshire. New Hampshire Natural Heritage Bureau and the Nature Conservancy. 229 pp.

Tarr, Matt and Kimberly J. Babbitt. 2008. The Importance of Hydroperiod in Wetland Assessment: A guide for community officials, planners, and natural resource professionals. University of New Hampshire Cooperative Extension. 23 pp.

Thomas, Matthew E. 2004. History of Fremont, NH, Olde Poplin.

USDA, 1994. Soil Survey of Rockingham County, New Hampshire, Part 1. United States Department of Agriculture. 98pp.

USDA, 1994. Soil Survey of Rockingham County, New Hampshire, Part 2. United States Department of Agriculture. 140pp.

West Environmental, Inc. 2007. Town of Fremont Wetland Evaluation Report. 13 pp.

APPENDIX G: FORESTER PROFESSIONAL QUALIFICATIONS

CHARLES MORENO, LPF
Consulting Forester, Forest Ecologist

New Hampshire Licensed Professional Forester #115
Maine Forester License #2000

EDUCATION

B.S. FORESTRY – University of New Hampshire, Magna Cum Laude, May 1980
SAF Study Tour of France – Three-week study of French silvicultural methods, September 1983
AFF Study Tour Germany/France/Switzerland—Mixed-aged silvicultural methods, Oct 2016

PROFESSIONAL SERVICE and AFFILIATIONS

Forest Stewards Guild – Board of Directors (1999-2005), Chair (2005)
Society of American Foresters (SAF) – NH Chairman (1996)
New Hampshire Tree Farm Program – Executive Committee (1984-87) Society for the Protection of New Hampshire Forests

WORK EXPERIENCE

1980 - Present	**FORESTRY CONSULTANT**, founder and proprietor of Moreno Forestry Associates. Thirty-eight years experience managing private and public forests in New Hampshire. Projects include forest and wildlife management planning and implementation, ecological assessments, forest inventory and appraisals, timber sales, mapping, forest taxation and litigation, forest improvement and habitat enhancement, and conservation plans for towns, corporations, and private landowners. 40,000+ acres under management.
1984 - Present	**TOWN FOREST MANAGER** for the Towns of Exeter, Londonderry, Candia, Plaistow, Atkinson, East Kingston, Deerfield, Epping, Brentwood, Sandown, Rye, Pittsfield, Chichester, Derry, Dover, Barrington, Strafford, Northwood, Rollinsford, and Rochester developing/implementing multiple-use plans for publicly-owned forests.
1988 - Present	**FOREST MANAGER** for multiple forest properties owned by conservation organizations, land trusts, and schools. Prepared and presented numerous workshops and field tours teaching silviculture, wildlife habitat management, natural history, forest ecology, low impact harvest techniques, and other topics.
1990 - Present	**FOREST CONSULTANT** for environmental studies, forest appraisals, and/or project management including Pease Tradeport (Newington, NH), Emerald Necklace (Boston, MA), Trust for Public Lands, Southeast Land Trust, and Siemon Family Charitable Trust.
2009 - Present	**TECHNICAL SERVICE PROVIDER (TSP)** for Natural Resources Conservation Service (NRCS). Approximately 50 management plans completed, as well as project management for forest improvement, habitat enhancement, invasive control, & woods road construction.

PROFESSIONAL RECOGNITION

New Hampshire Outstanding Forester Award (Society of American Foresters) – 2001
National Outstanding Tree Farm Inspector Award – 1999
Austin Cary Practicing Professional Award (New England SAF) – 1998
NH Wildlife Stewardship Award – 1995
Outstanding New Hampshire Tree Farm Award – 1987, 1992, 2002, & 2006
NH Tree Farm Inspector of the Year – 1985, 1990, 1992, 1993 & 1998
Xi Sigma Pi (Forestry Honor Society) – 1978
Eagle Scout (1976)