



FOREST and WILDLIFE MANAGEMENT PLAN

for the

GLEN OAKS CONSERVATION AREA **Fremont, New Hampshire**

Prepared for:
The Fremont Conservation Commission

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December 30, 2009

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Report Copy # _____

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GLEN OAKES CONSERVATION AREA Fremont, New Hampshire

December 30, 2009

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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. No part of this plan, including all written material, maps, plan format and organization, is to be used, copied or reproduced for any other purpose, particularly commercial purposes, without proper citation to the author, Charles A. Moreno, Consulting Forester, *and* the express written permission of the author.

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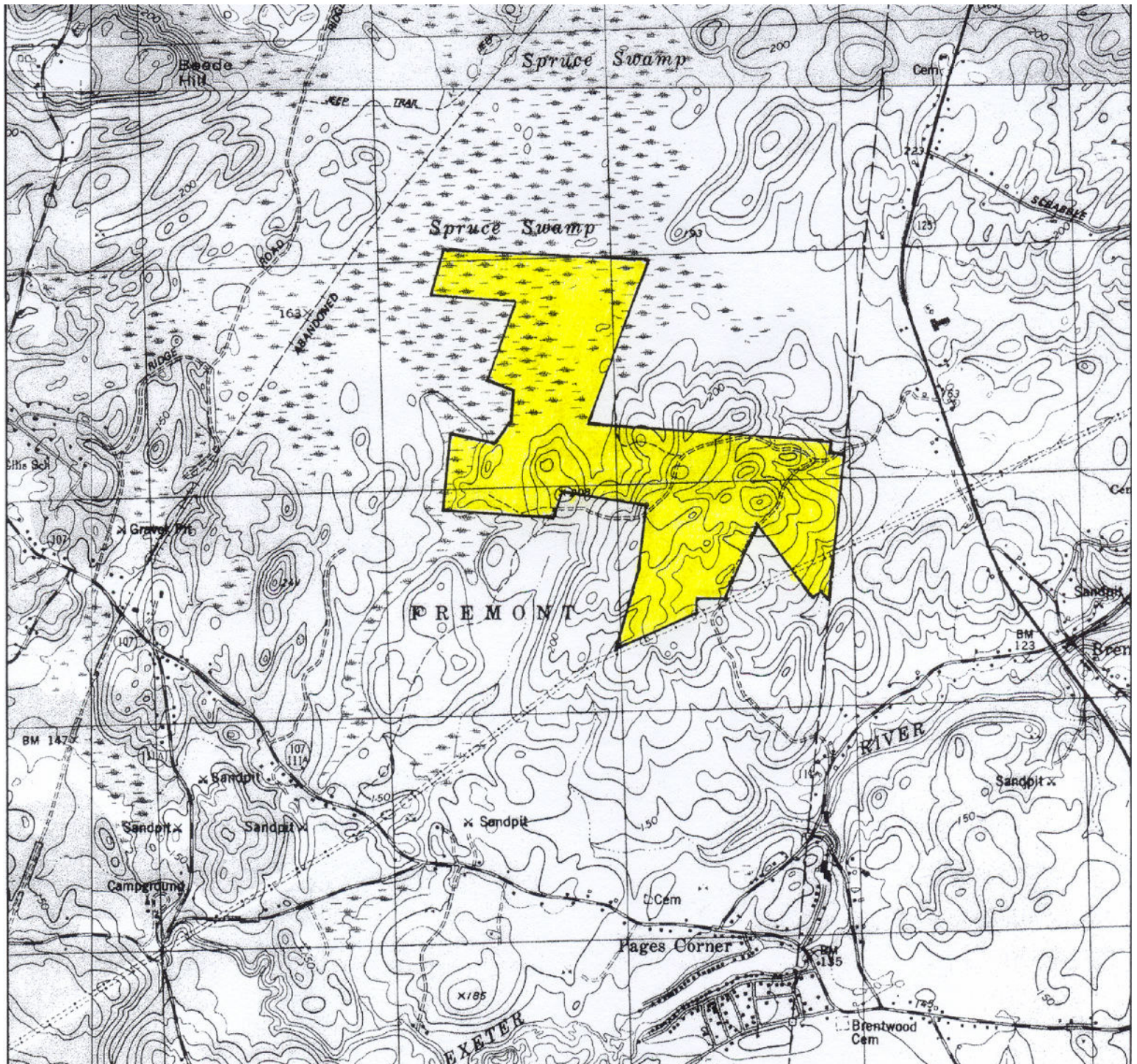


MAP SCALE:



1 inch = 2000± feet

Locus Map
of the
Glen Oaks Conservation Area
Fremont, New Hampshire
312.08± Acres



USGS Topographic Maps, "Kingston," "Epping," and "Sandown" Quadrangles, 1997, Maptech. Inc.

MAP LEGEND

— Property Line	○ Old well
— Stonewall	— Seasonal stream
— Barbed wire	● Vernal pool
— Woods road	— Forested wetland
— Trail	— Shrub swamp
— Footpath	— Emergent/ponded wetland
— Landing	— Snags
— Culvert	— Boulder
— Old cellar hole	— Significant tree
— Old cemetery	

SIGNIFICANT TREE INDEX

- 1- Red oak, 22" DBH, next to old well
- 2- Black gum, 18"
- 3- Black gum, 12"
- 4- Red maple, 20", in wetland, old tree
- 5- Pair of large-crowned locusts
- 6- Black birch, 20"
- 7- Beech, 24", healthy
- 8- Beech, 24", healthy
- 9- Red maple, 20", old, w/ multiple hurls
- 10- Sugar maple, 10"
- 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", 10' old
- 19- Old ing-nodded aspen with porcupine den
- 20- Grove of basswood, sugar maple, lophomykion

HISTORICAL INTEREST POINTS

- A - Cleaved rock.
- B - Wasterly cellar hole.
- C - Stone culvert.
- D - Easterly cellar hole.
- E - Old family cemetery.
- F - Hand-dug, stone well.
- G - Possible remains of log tree, mirring.

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.

MAP REFERENCES:

Aerial Photos: USGS 1952, 1974; Termsurvey 1998;
Google Earth 2004; and Terrain Navigator 2008.
Perimeter Survey: "Subdivision and Lot Consolidation
Plan of 1 and 1/2" for Fremont Conservation Commission,
by T.D. Brookshire Land Surveying, July 2005.
Property Re-examination:
Morano Forestry Associates, 2007 & 2008.

MAP RESEARCHED and DRAWN BY:

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May 2008

Natural and Physical Features Map

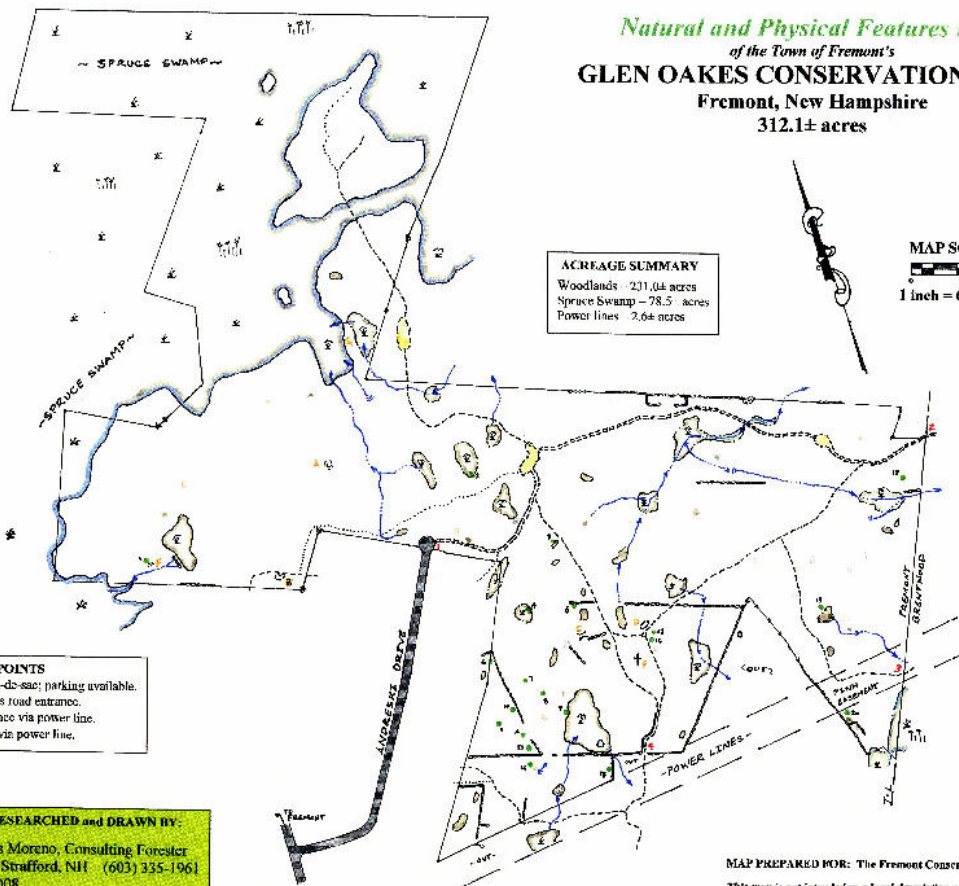
GLEN OAKS CONSERVATION AREA Fremont, New Hampshire 312.1± acres

ACREAGE SUMMARY

Woodlands - 231.0± acres
Spruce Swamp - 78.5± acres
Power lines - 2.6± acres

MAP SCALE:

1 inch = 600± feet



MAP PREPARED FOR: The Fremont Conservation Commission
This map is not intended as a legal description or for legal purposes.

Forest and Wildlife Management Plan

for the

GLEN OAKES CONSERVATION AREA

Fremont, New Hampshire

INTRODUCTION

This forest management plan was prepared for a 312.08± acre community-owned woodland and wetland property in Fremont, New Hampshire, known as the “Glen Oakes Conservation Area”. The property includes a portion of Spruce Swamp, one of the most significant natural areas in Rockingham County. This prime wetland and the parcel’s extensive upland forest provide rich and diverse habitat for wildlife. The property also serves as an attractive “back-country” recreational destination for area residents.

The purpose of this plan is to guide the management and protection of the Conservation Area’s forest, wildlife, and water resources, as well as manage recreational activity on the property. The plan also addresses the purposes and specifications of a conservation easement (2005) on the property held by the Society for the Protection of New Hampshire Forests.

To prepare the plan, forest inventory and multiple walk-through examinations of the property were conducted during December 2007 to June 2009. Natural features, forest types and vegetation, wildlife habitat, historical features, and management logistics were carefully discerned and examined. Wildlife—amphibians, reptiles, birds, and mammals—was inventoried over various seasons. Forest structure, composition, and timber stock were analyzed. Recreational use was observed.

This forest analysis, in concert with interviews of the Fremont Conservation Commission to identify management objectives, forms the basis for the plan. From this foundation, the long-term (30+ year) forest management strategy and recommendations were synthesized. The plan is a “working” document; over time it may require updating to reflect the ongoing management activities, unforeseen natural disturbances and conditions, as well as evolving community interests and 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
December 2009



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MANAGEMENT PLAN FEATURES

Comprehensive forest and land management involves:

- 1) *Natural resource assessment.* The plan provides an 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 determine the Conservation Area's timber volume and value.
- 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

Maps of the Glen Oakes Conservation Area are an important feature of this plan; they summarize a great deal of information in an easy-to-assimilate visual format. The maps may also prove useful to anyone trekking through the property. 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 has considered and identified 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 and map of all the management plan recommendations are also 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 assorted summary information in the appendices. Maps are inserted in the relevant chapters.



Glen Oaks Conservation Area

FOREST MANAGEMENT OBJECTIVES

The recommendations in this stewardship plan are based the long-term management objectives which the Fremont Conservation Commission has established for the Glen Oaks Conservation Area. On a broad perspective, 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 will be encouraged. f) Water quality, wetlands, soils, rare plant and animal species, and historic features will be protected. Management of the forest will include periodic timber harvests for the purposes of maintaining forest health and wildlife habitat. Details of these objectives are summarized in table form:

NATURAL RESOURCE SUMMARY:

Natural Resources	Landowner Priority	Relative Resource Value	Comments
Forest Health	High	High	The Conservation Commission desires a healthy, diverse, and increasingly valuable forest; Silvicultural management will encourage near-natural forest conditions, i.e., developing a multi-aged forest that includes 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. Forest improvement practices will promote future value growth by removing low quality trees and encouraging healthy, valuable timber.
Wildlife Habitat	High	High	Silvicultural practices will compliment and enhance woodland wildlife habitat. Besides Spruce Swamp, specialized habitats include a network of active vernal pools, an oak-mast forest, and extensive sections of young forest growth. Protecting and maintaining these habitats for a diversity of wildlife, both vertebrate and invertebrate, will be encouraged.
Threatened and Endangered Species	High	High	Spruce Swamp provides habitat for an endangered plant, separated sedge, and an endangered mussel, brook floater, as well as the state-threatened Blanding’s turtle.
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 contains an access road and two landings that provide core management access. While minor upgrades are needed, it is unnecessary to expand existing road access. Recreational trails cover much of the remaining forest, with the exception of the westerly section. Trails are not encouraged in this section to provide wildlife breeding habitat that is free from regular disturbance.
Recreational Use	Medium-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 welcome.
Cultural Features	Medium-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 (red ochre?) operation. Preserving these features is an important management concern.
Forest Aesthetics	High	The Conservation Commission is interested in maintaining a “natural” (versus “manicured”) appearance in the forest. Harvest operations, including wildlife projects and TSI, should 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 serve as a vector for these plants in the future. Annual monitoring and immediate removal of any 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 Conservation Commission’s goal, some income will be generated from the sale of trees that are harvested for forest health/improvement purposes. The Conservation Commission plans to re-invest this income into the management of the Conservation Area, or use it for other conservation purposes.
TSI	High	While non-commercial timber stand improvement (TSI) work is a cost operation, it is often critical in establishing young forest growth and dramatically improving the quality of this growth. TSI can also be tailored to enhance wildlife habitat. Any timber sale income should be at least partially invested to fund TSI projects.



MANAGEMENT RECOMMENDATIONS

Access – Current access into the property via Andreski Derive adequately serves recreational and forest management uses with only minor modifications needed. Expansion of road/trail access will disturb habitat and may invite degradation of water resources.

- No new or extended woods roads or trails are recommended.
- Maintain westerly area interior as a “trail-free” zone.
- Two existing landing sites will provide full forest management access, presently.
- Upgrade seasonal stream fords on recreational trails.
- Do not restore road crossing to island in Spruce Swamp.
- Harvesting skid trails should be “retired” (not improved) after use.
- 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.

Boundary Lines – Property lines are fully surveyed, but are not demarcated.

- Axe-blaze and paint *all* perimeter boundaries lines in upland property areas (16,600± feet).
- Use brush-on surveying (heavy-duty) paint.
- Re-paint every 10 years.

Cultural Features – Protect, investigate, and study the Conservation Area’s Native American and early-American cultural sites, both known or presently undiscovered.

- Conduct archeological examination of the slag pile area (“G”).

Forest Education – The Conservation Area may provide a model of careful resource management and land stewardship. The property has good potential for outdoor learning and nature observation by the public.

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

Insects and Disease – From an insect and disease perspective, the Glen Oaks Conservation Area has no acute infestation or pathogen affecting the forest presently. Individually diseased trees should be removed during improvement harvesting.

- Remove diseased trees as follows:
 - White pine – White pine blister rust
 - Red oak – Strumella canker
 - Black birch, yellow birch, white birch – Nectria canker, cinder conk.
 - Beech-beech bark (or scale) disease
 - Red maple-Nectria
 - Ash decline
- Maintain vigilance for potential future insects, which have not been found in the immediate vicinity, especially:
 - Woolly adelgid – Affects hemlock, stripping foliage and causing fairly rapid death.

- CONTINUED -



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- Asian longhorn beetle – Affects maple and other hardwoods, causing mortality.
- Emerald ash borer – Attacks white ash and black ash, causing rapid death.
- Forest management should address any insect and disease concerns silviculturally, i.e., encouraging healthy trees of a variety of species while removing afflicted diseased trees.

Invasive Plants – There is presently virtually no incidence of exotic, invasive plants on the Conservation Area. Potential vector areas for infestation are the powerlines, 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.

- In upland vector areas, annually monitor for Oriental bittersweet, Japanese barberry, and autumn olive, especially along powerlines.
- In forest areas, in addition to vector areas, monitor for glossy buckthorn, Japanese barberry, and burningbush. Buckthorn, a serious invasive, insidiously crops up 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.
- Upon discovery, carry-out immediate action is to check the spread of invasive plants into the surrounding forest.
- Utilize pulling and collecting technique as primary control effort, followed by cutting and stem or foliar treatment, as treatment for more established or persistent infestations.
- After initial control efforts, annual monitoring and follow-up control is needed to keep invasive plants out.
- Try to interest abutters in control efforts on their own lands.
- Re-invest timber sale proceeds into invasive plant control.

Recreation – Continue to allow benign recreational usage of the property that has little or no affect 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-study.
- Allow horseback riding, mountain biking, and dog sledding on established trails
- Mark and color code existing trails. Do not expand trail system.
- Stock kiosk with trail maps.
- Post “no-wheeled vehicle” signs at all property entry points.
- Install appropriate fords on trails at all stream crossings.

Silvicultural – See “Forest Management” section for *detailed* future management specifications.

- Manage primarily for forest health, habitat enhancement, and to improve forest growth.
- Silviculture should encourage near-natural established-forest conditions over time.
- Apply silviculture comprehensively by management area, on a 15± year harvest cycle.
- Follow sustainable management, i.e., harvesting less timber volume than the amount the forest is able to replenish during the 15-year harvest cycle interim.
- Invest in non-commercial timber stand improvement (TSI) to help establish mid-successional regeneration and improve forest growth.
- Pursue the long-term reintroduction of American chestnut, when disease-resistant seedlings become available.

- CONTINUED -



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- Reinvest timber income into the management of the Conservation Area. Consider timber revenue as a bi-product, not the goal of silvicultural management to avoid conflict with ecological and community-use objectives.
- A professional forester should always be engaged to select and mark trees for harvest prior to cutting in order to reflect silvicultural prescriptions and to control the extent of cutting.
- The long-term target ratio of variously-aged forest (233.6±acres) on the parcel is:
 - Early-successional and young forest (1-40± year forest) – 9% of area (20± acres)
 - Mid-successional, multi-aged forest (mainly 40-150± years) – 72% of area (170± acres)
 - Older growth, multi-aged forest (reserve areas—allowing the development of 150+ year forest, including forested wetlands) – 19% of area (44± 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.

- Retire the trail that crosses the wetland to access the Spruce Swamp island.
- Respect the 100-foot upland buffer along Spruce Swamp which “prime wetlands” designation confers—no recreational or forestry activities are to occur without a waiver.
- All recreational trails should properly ford stream-crossing points, to avoiding rutting wetland bed or siltation of stream(s). Install thoughtfully-designed fords, such as corduroy, bog bridges, stepping stones, footbridges, etc. where needed.
- For harvest operations, reconnoiter and plan necessary stream and/or wetland crossings. Minimize the number of and/or wetland crossings. Logging contractor should submit and work within appropriate wetland permitting.
- Maintain minimal harvest buffers (not to exceed 10% of basal area) within 50 feet of vernal pools and 25 feet of streams.
- Contractors should study and apply New Hampshire Best Management Practices Maintain when conducting a harvest operation.

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

- Silviculturally manage forest towards a multi-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 arrowwood, winterberry holly, highbush blueberry, sweet pepperbush, speckled alder. Maintain hemlock wildlife corridors.
- Establish minimal harvest buffers around vernal pools, but increase the accumulation of coarse woody debris for amphibian and reptile habitat.
- Maintain early-successional habitat on a 15 to 30 year rotation.
- Retain old residual trees (150+ years).
- Retain snags, cavity trees, and downed woody debris.
- Set-up bat boxes and waterfowl nesting boxes.
- Maintain the Conservation Area free of exotic, invasive plants.
- Allow responsible hunting in the Conservation Area.
- Adopt a trapping policy, as recommended, for the Conservation Area.
- Establish an on-line wildlife sighting register for the Conservation Area (also, town-wide).
- Conduct periodic wildlife surveys such as bird counts, winter tracking observations, mammal checklists, etc.



RECOMMENDATIONS KEY

- 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: Harvesting access requires shutter permission.
- 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.

FORESTRY PROCEDURES KEY

- (Yellow) Early-successional and young growth management.
- (Red) Improvement/Crown Thinning—Full forest canopy management.
- (Tan) Improvement/Regeneration establishment or release—Partial canopy management.
- (Light green or blue) Reserve areas, including wetlands.

Map Legend

- Property line
- Management compartment bound
- Stone wall
- Wire fence
- Woods road
- Trail
- Landing
- Wetland
- Seasonal stream
- Forestry procedure demarcation

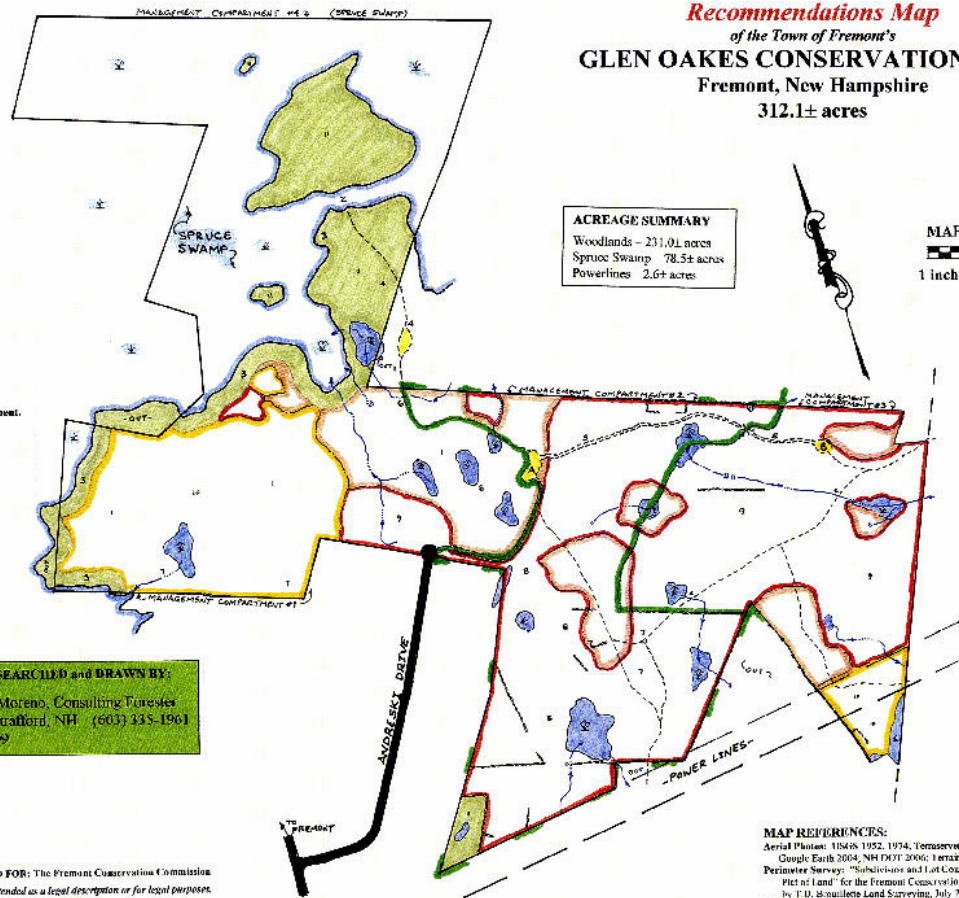
MAP RESEARCHED and DRAWN BY:
Charles Moreno, Consulting Forester
Center Stratford, NH (603) 335-1961
June 2009

MAP PREPARED FOR: The Fremont Conservation Commission
This map is not intended as a legal description or for legal purposes.

Recommendations Map of the Town of Fremont's GLEN OAKS CONSERVATION AREA Fremont, New Hampshire 312.1± acres

ACREAGE SUMMARY
Woodlands - 231.0± acres
Spruce Swamp - 78.5± acres
Powerlines - 2.6± acres

MAP SCALE:
1 inch = 600± feet



MAP REFERENCES:
Aerial Photos: 1948, 1952, 1954, TerraServer 1998;
Google Earth 2004, NH DOT 2006, Terrain Navigator 2008.
Perimeter Survey: "Subdivisions and Lot Consolidation
Plot n° 1 and n° 2" for the Fremont Conservation Commission,
by T.D. Stouffville Land Surveying, July 2005.
Property Recommendations:
Charles Moreno, Moreno Forestry Associates, 2008 & 2009.

GENERAL INFORMATION

LOCATION and GEOGRAPHY

The Glen Oaks Conservation Area property is located at the end of Andreski Drive, north NH Route 107 (aka, Main Street) in Fremont, New Hampshire, approximately 2± miles east of Fremont's center. It lies in the southerly area of a 2,000+ acre block of open space that includes Spruce Swamp, the largest wetland in Rockingham County. The parcel encompasses 78.5± acres of this exceptional wetland, as well as, 6600± feet of upland forest frontage along its southeasterly edge. The Conservation Area lies adjacent to other open space lands including the Brentwood Recreation Area (east), Exeter Academy Woodlands (north), and Fremont's Oak Ridge Town Forest (in close proximity to the west).

The subject property is located on the New Hampshire coastal plain, about 16 miles from the Atlantic Ocean. The parcel's topography is level to gently rolling ranging from about 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 – 312.08± acres

- Woodlands.....231.0± acres
- Spruce Swamp.....78.5± acres
- Powerline.....2.6± acres

Deeds: RCRD Book 4592, Page 1047. Property acquired on 12/5/2005.
RCRD Book 4592, Page 1054 (Conservation Easement Deed).

Aerial Photos: USGS 1952, 1974, and 1998 series. NH DOT 2005 high resolution orthophotography.

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.

Tax Maps: Fremont Tax Map 2, Lot 156-2-1.



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CONSERVATION EASEMENT PROVISIONS

A conservation easement deed was executed on the Glen Oaks Conservation Area on December 8, 2005. 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 requisite reference to 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 Oaks 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 dependant 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 early history after glaciation. The Red Paint People lived along the New Hampshire and Maine coastline thousands of years ago. They treasured “red ochre” (iron oxide), which is found along Spruce Swamp. Within the last millennia, the Squamscott Indians inhabited the area, also using red ochre.¹ 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 *Natural and Physical Features Map*, page 2). 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.

European settlers left there 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.² 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 remain with radically changed presence. American chestnut and butternut, for example, are barely viable species; while large carnivores, including mountain lion and gray wolf, are lost.

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 dependant 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

¹ “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.

² Ibid.



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.³

The present forest consists of variously mixed hardwood, white pine, and hemlock stands that are generally 40 to 100± years of age. The forest has not had acute natural disturbance or been harvested since the Town of Fremont's acquisition in 2005.

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.⁴ 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”.⁵

³ Ibid.

⁴ Ibid and the 2001 Annual Town Report

⁵ Ibid.



Photos: Historic Features



Photo #1 – Unmarked gravestone in Leavitt Family Cemetery.



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



Photo #3



Photo #4



WATER RESOURCES

Surface Waters

The Glen Oaks 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 keystone surface water feature of the Conservation Area, which includes about 10% 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 three rare or endangered species documented by the New Hampshire Natural Heritage Bureau—separated sedge, Blanding’s turtle, 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 “Natural and Physical Features Map”, on page 2 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.
- 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. Prime wetlands waiver process must be followed.
- Time 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.

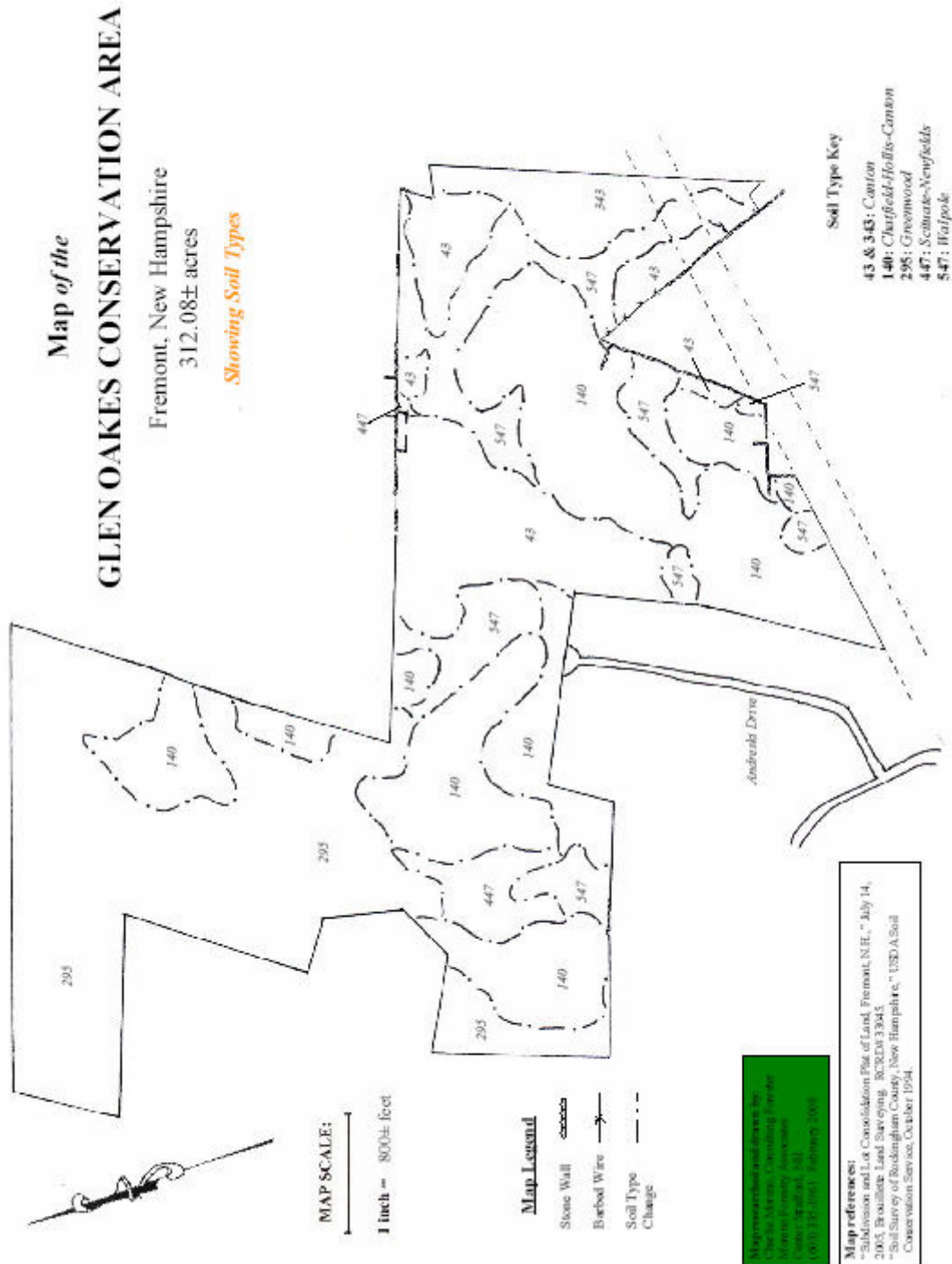


Photo #3 – Open water area and shrub/scrub vegetation in Spruce Swamp.



Photo #4 – Snags 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 underlying seasonal streams, and deep mucky peat under the parcel's palustrine water bodies, including Spruce Swamp.

Soil Types

Canton (43 and 343) gravelly fine sandy loam – This deep and well-drained glacial till underlies an extensive upland forest area on the Glen Oakes Conservation Area primarily in the parcel's central and easterly areas. The surface layer of Canton is gravelly fine sandy loam, with a substratum (below 2½ feet) of loamy sand with varying amounts of silt. While typically rocky, the easterly area also contains numerous boulders. Seasonal high water table is below 6 feet, with soils only wet during spring thaw or after extended rainy periods. Canton is of above average productivity, particularly for pine, supporting tall tree growth. Red oak also grows 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, 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 good productivity for both red oak and white pine in loamy areas.

Scituate-Newfields (447) complex – These intermixed sandy loams (till) underlie a small area in the westerly section of the property. Soils range from moist uplands to somewhat poorly drained forested wetland. This soil complex has a seasonally high water table and is prone to wetness, particularly during spring and in the late fall. Logging equipment can easily create soil ruts during wet seasons. These soils are productive soils for mixed hardwoods growth. While white pine grows well, trees may be prone to blowdown in moist areas.

Greenwood (295) mucky peat – This very poorly-drained mucky peat soil underlies saturated and seasonally flooded areas, primarily Spruce Swamp. The property's vernal pools contain this soil type, as are wetlands with little or no tree growth. Greenwood'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. 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 occupied 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.⁶ On Glen Oakes Conservation Area, these environments include wetland and upland forest sites. The Spruce Swamp area contains two exemplary natural community systems, due to their extent and lack of alteration.

The wetland natural communities found within the *Medium level fen system* include an extensive area of *Sweet pepperbush wooded fen*, which is a rare natural community in the state, found only in New Hampshire'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.⁷

The *Poor level fen/bog system* includes extremely acidic peatlands, which in Spruce Swamp are further in the swamp interior. The *Leather-leaf - sheep laurel dwarf shrub bog* natural community is hummocky, with few tall shrubs and trees. The *Black spruce – larch swamp* natural community is nutrient-poor “bog forest”⁸. In Spruce Swamp it contains black spruce, highbush blueberry, and black huckleberry, an interesting mix of northern and southern species.

The Glen Oakes Conservation Area upland forest is representative of 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. A heath shrub layer (esp. lowbush blueberry) is mostly absent; the herbaceous layer 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.

⁶ Natural Communities of New Hampshire, by Dan Sperduto and William Nichols, pp 1.

⁷ Ibid. pp 179-180.

⁸ Ibid. pp 104-105.



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 management compartment has a distinct access strategy, and silvicultural operations are conducted systematically on a compartment basis. Furthermore, a compartment may contain specific areas that are not actively managed; these areas are designated as reserves within the compartment.

Accordingly, the 312.1± acre Glen Oakes Conservation Area is organized into four management compartments, as follows:

- **The Westerly Woodlands** (Management Compartment #1) – 96.4± acres
- **The Central Woodlands** (Management Compartment #2) – 75.9± acres
- **The Easterly Woodlands** (Management Compartment #3) – 60.9± acres
- **Spruce Swamp** (Management Compartment #4) – 78.5± acres

Management Compartment #1 (MC #1), the Westerly Woodlands, covers approximately 96.4± acres. It encompasses all upland forest (and embedded minor wetlands) west of the main access road from Andreski Drive, as well as the forested island within Spruce Swamp. Areas accessible to silvicultural and habitat management currently cover 66.1± acres, and are accessible via Landing A. The remaining 34± acres include the island, the 100-foot prime wetlands upland buffer along Spruce Swamp, and a forest pocket accessible only by crossing abutting private property. This acreage to be withheld from active management will be designated as “reserve”.

Management Compartment #2 (MC #2), the Central Woodlands, covers approximately 75.9± forested acres, all accessible to management. MC #2 encompasses the land bordered by the main access road and Landing A, the powerlines, the property line, and a seasonal stream in the central property area. All forestry and habitat work in MC #2 is accessible via Landing A.

Management Compartment #3 (MC #3), the Easterly Woodlands, covers approximately 60.9± forested acres, with 54.2± readily accessible to management, via Landing B. Vegetation in the powerlines is regularly mowed by PSNH contractors, which is an activity in sync with habitat management goals in the Conservation Area. The 4± acre pocket south of the powerlines is more remote, but may still be periodically accessible for habitat management treatment.

Management Compartment #4 (MC #4), Spruce Swamp, contains all the Spruce Swamp acreage, 78.5± acres, on the property. This entire area, designated as Prime Wetlands by the Town of Fremont, will be withheld from active management. This reserve status does not imply a completely “hands-off” approach, as the Conservation Commission may consider future management of invasive plant species, 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

The implementation of recommendations is complex from a large-picture standpoint. Some recommendations are a one-time occurrence, such as situating a new trail. Many tasks are annual, including monitoring and removing invasive plant species, surveying wildlife species, and trail maintenance. Re-painting property lines is a 10-year maintenance task.

Perhaps most complex, from an organizational perspective, is forest and habitat management recommendations. These involve long-term commitment (100+ years), and cyclical implementation. A core concept to logistically organizing forestry and habitat recommendations in the Glen Oakes Conservation Area is that a ***15-year implementation cycle*** will be used. In other words, treatment of any given place will occur once every 15± 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 15 years, the first compartment will be re-visited for the next cycle of forest and habitat work, and so forth, on the 15± 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: Central Woodlands	2010±	2025±	2040±
MC #3: Easterly Woodlands	2015±	2030±	2045±
MC #1: Westerly Woodlands	2020±	2035±	2050±
MC #4: Spruce Swamp	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 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 in one year’s time. Treatments can be completed within the course of the 5-year window before moving to the next compartment. It is preferable to complete the work in the early years of the 5-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 a homogeneous forest area that results from similar soils, hydrology, land uses, and disturbance history.



Nine forest types were delineated in the Glen Oaks 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 for each forest type are also specified. The plan also specifies silvicultural goals for each forest type, with corresponding prescriptions for wildlife and forest management.

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, the forest types are delineated as stands with cumulative acreage calculated for each forest type. Silvicultural prescriptions are generally the same for all areas of one forest type, though there are exceptions for inaccessible or variable areas. 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

Upland Hardwood.....	77.5± acres
Upland Hardwood with Inclusions.....	39.8± acres
Upland Hardwood, Young.....	3.1± acres
White Pine/Hardwood, Older.....	35.2± acres
White Pine/Hardwood, Two-aged.....	7.1± acres
White Pine/Hardwood, Island—Heavily Cut.....	12.7± acres
Hemlock/Hardwood/Pine.....	34.2± acres
White Pine, Even-aged.....	3.1± acres
Hemlock/Hardwood.....	5.1± acres

WILDLIFE HABITAT

In this management plan, the term “**wildlife habitat**” connotes an area of similar environment that broadly provides food, water, cover and space for a particular animal species or group of species. Environmental similarities may be both physical, i.e., terrain, aspect, hydrology, etc, *and* natural, i.e., vegetative structure, density, and composition.

In the Wildlife Habitat Map and section, six **core habitats** are described. Each core habitat of the Glen Oaks 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) in contrast to 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, which attract and serve a corresponding set of wildlife. **Habitat features** are delineated in the core habitats which further enhance the habitat.

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.

LIST OF CORE WILDLIFE HABITATS

In the Glen Oakes Conservation Area:

- Spruce Swamp
- Early-successional and 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.⁹ 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 (or cover type) 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 one natural community type was delineated for the upland forest areas, with small inclusions of a potential second 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 compliment 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.

⁹ 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 edges are used informally for parking, while a kiosk provides a trail map and property information.

The primary route into the Conservation Area is a 3600± foot long woods road that starts at the cul-de-sac and traverses the property in a north, 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 will provide staging access to all forestry activity in Management Compartments (MC) #1 and #2. Landing B will provide 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.

MC's # 2 and #3, the central and easterly woodlands, are served by approximately 6000± feet of trail in addition to the road. The trails form a 1.1± mile loop from the end of Andreski Drive to the old cellar hole to Landing B and back. Other side trails continue off the property at access points along the powerlines.

MC #1 is served by a continuation of the woods road from Landing A to the northwest. This road/trail crosses through a corner of the adjacent property before continuing on towards an island within Spruce Swamp (2000± feet total distance). This forested island was heavily cut about 2003±; the access road to the island has since been flooded by beaver rendering even foot traffic difficult. Due to the prime wetlands status of Spruce Swamp, restoration of this access route is not feasible. Though previously used as a road, this access route can evolve back to a trail, since the areas once served by the road for timber harvesting will now be maintained as no-cut reserves.

A secondary trail, or footpath, (2000± feet) follows the southerly boundary line of MC #1. This minor trail accesses a second cellar hole before exiting the property onto adjacent private land. It is significant that most of the MC #1 interior is devoid of active recreational trails, since this allows for an expansive noise-free upland area for enhanced wildlife habitat. Constant human activity along trails may diminish nearby breeding habitat for some wildlife species.

Forest Access Recommendations

In total, nearly 14,000± feet (2.7± miles) of woods road, trails, and footpaths exist on the Glen Oakes Conservation Area, providing recreational access through 2/3rds 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 adequately serves needs.
- Continue to focus trail-based recreational use in MC #2 and #3.
- Maintain the interior of MC #1 as a trail-free wildlife zone.
- Do not attempt to 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”, or simple footbridges are possible designs.
- In conjunction with silvicultural activity in MC #3 (2015±), do minor grading and widening of woods road between Landings A and B.
- Woods road upgrading to Landing A is likely unnecessary.
- Harvest operations should be avoided during spring thaw and wet seasons to avoid damage to roads and forest rutting.
- Block property entry points with visible boulders to discourage unauthorized large wheeled vehicles.



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 (such as 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.
- Remove or damage any natural or physical features on the property except for hunting or fishing.
- Installation of a permanent tree stand.

Recommendations:

- Mark and color code trails.
- Stock kiosk with trail maps.
- 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 birdwatching and other natural observation. The Conservation Commission may consider developing an interpretive trail to educate visitors 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.
- 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. Certain projects within the Conservation Area may prove beneficial to the land and the community, as well as provide an educational experience for the participants. In some cases, the volunteer(s) 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.



HABITAT FEATURES

- Emergent shrub-scrub swamp
- Forested swamp
- Sedge
- Vernal pool
- Enriched soil area—species diversity
- Major seasonal stream

CORE HABITATS

- (Gray/blue) Spruce Swamp: 800-acre wetland including shrub and emergent swamp as well as open water habitat.
- (Light green and yellow) Early-successional and young forest growth habitat.
- (Red) Major mast-production (acorn) habitat.
- (Dark green with stripes) Dense softwood thermal cover habitat.
- (Brown) Transitional softwood-hardwood habitat.
- (Purple) Vernal pool network area.

Map Legend

- Property line
- Stone wall
- Wire fence
- Woods road or trail
- Forest opening (landing)
- Wetland
- Seasonal stream
- Core habitat demarcation

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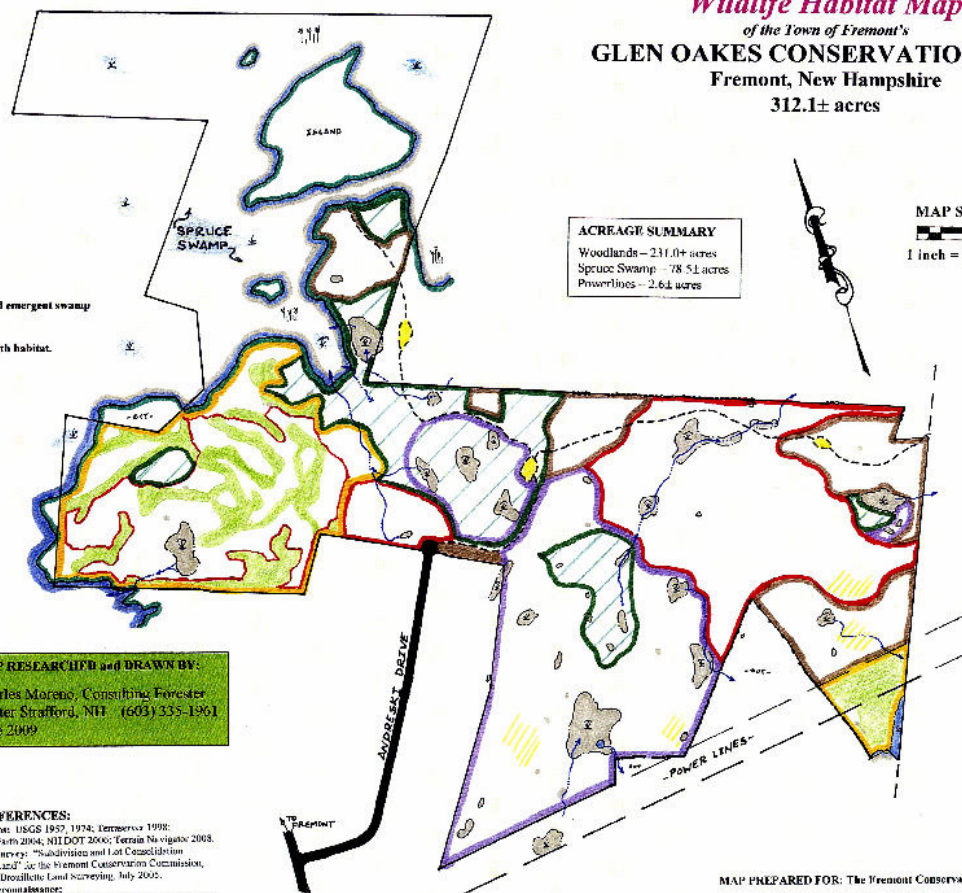
MAP REFERENCES:
Aerial Photos: 1862-1957, 1974; TerraServer 1998;
Google Earth 2004; NHDOT 2000; Terrain Navigator 2003.
Perimeter Surveys: "Subdivision and Lot Consolidation
Plan of Lizard" for the Fremont Conservation Commission,
by L.D. Drouillette Land Surveying, July 2002.
Property Reversion Letter:
Charles Moreno, Moreno Forestry Associates, 2008 & 2009.

Wildlife Habitat Map of the Town of Fremont's GLEN OAKS CONSERVATION AREA Fremont, New Hampshire 312.1± acres

ACREAGE SUMMARY
Woodlands—231.0± acres
Spruce Swamp—78.5± acres
Powerlines—2.6± acres

MAP SCALE:

1 inch = 600± feet



MAP PREPARED FOR: The Fremont Conservation Commission
This map is not intended as a legal description or for legal purposes.

WILDLIFE RESOURCES

Wildlife usage of the Glen Oakes Conservation Area is dependant on the property's habitats, features that may enhance these habitats, as well as the continuity of habitat on adjacent open space lands. While habitat is varied and nuanced, six core habitats have been 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 on the preceding page. Descriptions of the core habitats follow. More 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 a great variety of sites including recently-flooded snag forest; forested wetland; extensive shrub/scrub; 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, painted turtle, and snapping turtle. Birds include a variety of 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, northern harrier and 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.

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 habitat for amphibians, reptiles, and mammals. Snags and decaying trees provide cavities, in this case 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 essentially 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.



Early-successional and young forest habitat are typically characterized as containing dense sapling and seedling forest 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.

In the Conservation Area, Forest Type B contains a significant area of young forest growth which originated from recent strip cutting. Upland early-successional growth is found in the powerline corridor and the adjacent Forest Type C, which was clearcut about 2002±.

Young forest and early successional management will consist of perpetuating these conditions on at least 9% of the property’s upland area (20± acres), mostly in areas that currently contains this growth. Specific prescriptions are found in the “SILVICULTURAL PLANNING” chapter. Depending on futures needs for specific species of conservation concern, the area devoted to early-successional conditions may need expansion over the long-term.

Mast-producing forest dominates a large area of the Conservation Area interior, principally represented by Forest Types A, “Upland Hardwood”, and B, “Upland Hardwoods with Inclusions—Regeneration Openings”. Red oak dominates the upland hardwood forest type, with lesser amounts of black oak, white oak, beech, and shagbark hickory. Hard mast derives from these trees, 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 with a well-developed crown are important for copious acorn production.

Habitat enhancements include numerous cavity trees, including mid to large diameter hardwoods. Also, occasional large-crowned hardwoods, particularly beech, with a triple upper main stem branching habit that provides ideal raptor nest sites.

A silvicultural objective is to maintain the abundance, and encourage the diversity, of hard mast producing species. This diversity should include understory shrubs such as beaked hazelnut, and may eventually comprise the viable re-introduction of American chestnut. Over the long-term, healthy, large-crowned mast producers, ranging from 100 to 150+ years of age should be plentiful in the Conservation Area.

Softwood thermal cover habitat is primarily represented by well-established stands of “Hemlock/Hardwood/Pine”, which are delineated as Forest Type G. The dense evergreen foliage of hemlock is most significant, particularly in areas where hemlock is found in all three general canopy positions—understory, mid-story, and overstory. Snow depths tend to be less under the



thick foliage of hemlocks, such as those found in Forest Type F, 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.

Habitat enhancers include “super-canopy” white pine, with crowns that are positioned above the forest’s main canopy. These larger pines provide good perch/roost sites for owls and hawks, as well as seed to songbirds and squirrels. Also, scattered red oaks within these 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 important 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). Forest Types D, “White Pine/Hardwood, Older”, and I, “Hemlock/Hardwood, Heavily-cut”, constitute the major areas of 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.

Habitat enhancers include enriched sites with diverse tree species, which in turn, increases the variety of seeds and mast variety. 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 Oaks 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 important 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 critical 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 an intermediate, i.e., holding water for at least four months. These pools will typically not dry until late July or later.¹⁰ Several of the larger, deeper, shaded pools in the Conservation Area have an intermediate hydroperiod, particularly in wetter years.

¹⁰ “The Importance of Hydroperiod in Wetland Assessment”, Matt Tarr and Kimberly J. Babbitt, UNH



Potential (P), Likely (X), or Observed (O) Wildlife Species

Common Name **Scientific Name**

Amphibians

Blue-spotted Salamander	<i>Ambystoma laterale</i>	P
Spotted Salamander	<i>Ambystoma maculatum</i>	O
Marbled Salamander	<i>Ambystoma opacum</i>	
Red-spotted Newt	<i>Notophthalmus v. viridescens</i>	O
Northern Dusky Salamander	<i>Desmognathus f. fuscus</i>	P
Redback Salamander	<i>Plethodon cinereus</i>	O
Four-toed Salamander	<i>Hemidactylum scutatum</i>	P
Northern Spring Salamander	<i>Gyrinophilus p. porphyriticus</i>	
Northern Two-lined Salamander	<i>Eurycea b. bislineata</i>	X
Eastern American Toad	<i>Bufo a. americanus</i>	O
Fowler's Toad	<i>Bufo woodhousii fowleri</i>	P
Northern Spring Peeper	<i>Hyla c. crucifer</i>	O
Gray Treefrog	<i>Hyla versicolor</i>	O
Bullfrog	<i>Rana catesbeiana</i>	O
Green Frog	<i>Rana clamitans melanota</i>	O
Wood Frog	<i>Rana sylvatica</i>	O
Northern Leopard Frog	<i>Rana pipiens</i>	X
Pickerel Frog	<i>Rana palustris</i>	O

Reptiles

Common Snapping Turtle	<i>Chelydra s. serpentina</i>	X
Common Musk Turtle	<i>Sternotherus odoratus</i>	X
Spotted Turtle	<i>Clemmys guttata</i>	P
Wood Turtle	<i>Clemmys insculpta</i>	P
Eastern Box Turtle	<i>Terrapene c. carolina</i>	
Eastern Painted Turtle	<i>Chrysemys p. picta</i>	O
Blanding's Turtle	<i>Emydoidea blandingii</i>	X
Northern Water Snake	<i>Nerodia s. sipedon</i>	X
Northern Brown Snake	<i>Storeria d. dekayi</i>	X
Northern Redbelly Snake	<i>Storeria o. occipitumaculata</i>	X
Common Garter Snake	<i>Thamnophis s. sirtalis</i>	O
Ribbon Snake	<i>Thamnophis sauritus</i>	X
Northern Ringneck Snake	<i>Diadophis punctatus edwardsi</i>	X
Northern Black Racer	<i>Coluber c. constrictor</i>	X
Eastern Smooth Green Snake	<i>Opheodrys v. vernalis</i>	X
Eastern Milk Snake	<i>Lampropeltis t. triangulum</i>	X

Birds

Common Loon	<i>Gavia immer</i>	
Pied-billed Grebe	<i>Podilymbus podiceps</i>	P
American Bittern	<i>Botaurus lentiginosus</i>	X



Least Bittern	<i>Ixobrychus exilis</i>	
Great Blue Heron	<i>Ardea herodias</i>	O
Green Heron	<i>Butorides virescens</i>	X
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	P
Canada Goose	<i>Branta canadensis</i>	O
Wood Duck	<i>Aix sponsa</i>	O
American Black Duck	<i>Anas rubripes</i>	X
Mallard	<i>Anas platyrhynchos</i>	X
Blue-winged Teal	<i>Anas discors</i>	P
Green-winged Teal	<i>Anas crecca</i>	P
Common Goldeneye	<i>Bucephala clangula</i>	
Bufflehead	<i>Bucephala albeola</i>	
Hooded Merganser	<i>Lophodytes cucullatus</i>	P
Common Merganser	<i>Mergus merganser</i>	P
Red-breasted Merganser	<i>Mergus serrator</i>	
Double-Crested Cormorant	<i>Phalacrocorax auritus</i>	
Turkey Vulture	<i>Cathartes aura</i>	O
Bald Eagle	<i>Haliaeetus leucocephalus</i>	
Osprey	<i>Pandion haliaetus</i>	P
Northern Harrier	<i>Circus cyaneus</i>	
Sharp-shinned Hawk	<i>Accipiter striatus</i>	X
Cooper's Hawk	<i>Accipiter cooperii</i>	X
Northern Goshawk	<i>Accipiter gentilis</i>	P
Red-shouldered Hawk	<i>Buteo lineatus</i>	O
Broad-winged Hawk	<i>Buteo platypterus</i>	O
Red-tailed Hawk	<i>Buteo jamaicensis</i>	O
Rough-legged Hawk	<i>Buteo lagopus</i>	P
American Kestrel	<i>Falco sparverius</i>	P
Merlin	<i>Falco columbarius</i>	
Peregrine Falcon	<i>Falco peregrinus</i>	
Ring-necked Pheasant	<i>Phasianus colchicus</i>	
Ruffed Grouse	<i>Bonasa umbellus</i>	O
Wild Turkey	<i>Meleagris gallopavo</i>	O
Virginia Rail	<i>Rallus limicola</i>	P
Sora	<i>Porzana carolina</i>	P
Common Moorhen	<i>Gallinula chloropus</i>	P
American Coot	<i>Fulica americana</i>	P
Killdeer	<i>Charadrius vociferus</i>	
Spotted Sandpiper	<i>Actitis macularia</i>	P
Upland Sandpiper	<i>Bartramia longicauda</i>	
Common Snipe	<i>Gallinago gallinago</i>	P
American Woodcock	<i>Scolopax minor</i>	O
Herring Gull	<i>Larus argentatus</i>	
Rock Dove	<i>Columba livia</i>	
Mourning Dove	<i>Zenaida macroura</i>	O
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	P



Common Barn-Owl	<i>Tyto alba</i>	
Eastern Screech-Owl	<i>Otus asio</i>	P
Great Horned Owl	<i>Bubo virginianus</i>	X
Snowy Owl	<i>Nyctea scandiaca</i>	
Barred Owl	<i>Strix varia</i>	O
Long-eared Owl	<i>Asio otus</i>	
Northern Saw-whet Owl	<i>Aegolius acadicus</i>	X
Common Nighthawk	<i>Chordeiles minor</i>	
Whip-poor-will	<i>Caprimulgus vociferus</i>	P
Chimney Swift	<i>Chaetura pelagica</i>	
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	X
Belted Kingfisher	<i>Ceryle alcyon</i>	X
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	X
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	
Downy Woodpecker	<i>Picoides pubescens</i>	O
Hairy Woodpecker	<i>Picoides villosus</i>	O
Northern Flicker	<i>Colaptes auratus</i>	O
Pileated Woodpecker	<i>Dryocopus pileatus</i>	O
Eastern Wood-Pewee	<i>Contopus virens</i>	O
Olive-sided Flycatcher	<i>Contopus cooperi</i>	X
Alder Flycatcher	<i>Empidonax alnorum</i>	X
Willow Flycatcher	<i>Empidonax traillii</i>	X
Least Flycatcher	<i>Empidonax minimus</i>	X
Eastern Phoebe	<i>Sayornis phoebe</i>	O
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	O
Eastern Kingbird	<i>Tyrannus tyrannus</i>	O
Horned Lark	<i>Eremophila alpestris</i>	
Purple Martin	<i>Progne subis</i>	
Tree Swallow	<i>Tachycineta bicolor</i>	O
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	P
Bank Swallow	<i>Riparia riparia</i>	
Cliff Swallow	<i>Hirundo pyrrhonota</i>	
Barn Swallow	<i>Hirundo rustica</i>	P
Blue Jay	<i>Cyanocitta cristata</i>	O
American Crow	<i>Corvus brachyrhynchos</i>	O
Common Raven	<i>Corvus corax</i>	X
Black-capped Chickadee	<i>Parus atricapillus</i>	O
Tufted Titmouse	<i>Parus bicolor</i>	O
Red-breasted Nuthatch	<i>Sitta canadensis</i>	O
White-breasted Nuthatch	<i>Sitta carolinensis</i>	O
Brown Creeper	<i>Certhia americana</i>	X
House Wren	<i>Troglodytes aedon</i>	X
Winter Wren	<i>Troglodytes troglodytes</i>	X
Marsh Wren	<i>Cistothorus palustris</i>	X
Golden-crowned Kinglet	<i>Regulus satrapa</i>	
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	P
Eastern Bluebird	<i>Sialia sialis</i>	



Veery	<i>Catharus fuscescens</i>	O
Hermit Thrush	<i>Catharus guttatus</i>	O
Wood Thrush	<i>Hylocichla mustelina</i>	P
American Robin	<i>Turdus migratorius</i>	O
Gray Catbird	<i>Dumetella carolinensis</i>	X
Northern Mockingbird	<i>Mimus polyglottos</i>	X
Brown Thrasher	<i>Toxostoma rufum</i>	X
Cedar Waxwing	<i>Bombycilla cedrorum</i>	X
Northern Shrike	<i>Lanius excubitor</i>	
European Starling	<i>Sturnus vulgaris</i>	
Solitary Vireo	<i>Vireo solitarius</i>	X
Yellow-throated Vireo	<i>Vireo flavifrons</i>	P
Warbling Vireo	<i>Vireo gilvus</i>	
Red-eyed Vireo	<i>Vireo olivaceus</i>	O
Blue-headed Vireo	<i>Vireo solitarius</i>	O
Blue-winged Warbler	<i>Vermivora pinus</i>	
Nashville Warbler	<i>Vermivora ruficapilla</i>	X
Yellow Warbler	<i>Dendroica petechia</i>	O
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	X
Magnolia Warbler	<i>Dendroica magnolia</i>	X
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>	O
Yellow-rumped Warbler	<i>Dendroica coronata</i>	O
Black-throated Green Warbler	<i>Dendroica virens</i>	O
Blackburnian Warbler	<i>Dendroica fusca</i>	
Pine Warbler	<i>Dendroica pinus</i>	O
Prairie Warbler	<i>Dendroica discolor</i>	P
Black-and-white Warbler	<i>Mniotilta varia</i>	O
American Redstart	<i>Setophaga ruticilla</i>	X
Prothonotary Warbler	<i>Protonotaria citrea</i>	
Ovenbird	<i>Seiurus aurocapillus</i>	O
Northern Waterthrush	<i>Seiurus noveboracensis</i>	O
Louisiana Waterthrush	<i>Seiurus motacilla</i>	
Common Yellowthroat	<i>Geothlypis trichas</i>	O
Canada Warbler	<i>Wilsonia canadensis</i>	P
Scarlet Tanager	<i>Piranga olivacea</i>	X
Northern Cardinal	<i>Cardinalis cardinalis</i>	O
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	X
Indigo Bunting	<i>Passerina cyanea</i>	P
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	P
American Tree Sparrow	<i>Spizella arborea</i>	P
Chipping Sparrow	<i>Spizella passerina</i>	X
Field Sparrow	<i>Spizella pusilla</i>	O
Vesper Sparrow	<i>Pooecetes gramineus</i>	
Savannah Sparrow	<i>Passerculus sandwichensis</i>	
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	
Fox Sparrow	<i>Passerella iliaca</i>	
Song Sparrow	<i>Melospiza melodia</i>	X



Swamp Sparrow	<i>Melospiza georgiana</i>	X
White-throated Sparrow	<i>Zonotrichia albicollis</i>	O
Dark-eyed Junco	<i>Junco hyemalis</i>	O
Lapland Longspur	<i>Calcarius lapponicus</i>	
Snow Bunting	<i>Plectrophenax nivalis</i>	
Bobolink	<i>Dolichonyx oryzivorus</i>	
Eastern meadowlark	<i>Sturnella magna</i>	
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	O
Common Grackle	<i>Quiscalus quiscula</i>	O
Brown-headed Cowbird	<i>Molothrus ater</i>	O
Northern Oriole	<i>Icterus galbula</i>	P
Pine Grosbeak	<i>Pinicola enucleator</i>	
Purple Finch	<i>Carpodacus purpureus</i>	P
House Finch	<i>Carpodacus mexicanus</i>	
Pine Siskin	<i>Carduelis pinus</i>	
American Goldfinch	<i>Carduelis tristis</i>	O
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	P
House Sparrow	<i>Passer domesticus</i>	

Mammals

Virginia Opossum	<i>Didelphis virginiana</i>	X
Masked Shrew	<i>Sorex cinereus</i>	X
Water Shrew	<i>Sorex palustris</i>	X
Smoky Shrew	<i>Sorex fumeus</i>	X
Northern Short-tailed Shrew	<i>Blarina brevicauda</i>	X
Hairy-tailed Mole	<i>Parascalops breweri</i>	P
Eastern Mole	<i>Scalopus aquaticus</i>	
Star-nosed Mole	<i>Condylura cristata</i>	X
Little Brown Myotis	<i>Myotis lucifugus</i>	X
Northern Myotis	<i>Myotis septentrionalis</i>	
Keen's Myotis	<i>Myotis keenii</i>	
Small-footed Myotis	<i>Myotis leibii</i>	
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	
Eastern Pipistrelle	<i>Pipistrellus subflavus</i>	
Big Brown Bat	<i>Eptesicus fuscus</i>	X
Red Bat	<i>Lasiurus borealis</i>	
Hoary Bat	<i>Lasiurus cinereus</i>	
Eastern Cottontail	<i>Sylvilagus floridanus</i>	P
New England Cottontail	<i>Sylvilagus transitionalis</i>	
Snowshoe Hare	<i>Lepus americanus</i>	O
Eastern Chipmunk	<i>Tamias striatus</i>	O
Woodchuck	<i>Marmota monax</i>	X
Gray Squirrel	<i>Sciurus carolinensis</i>	O
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	O
Southern Flying Squirrel	<i>Glaucomys volans</i>	X
Northern Flying Squirrel	<i>Glaucomys sabrinus</i>	X



Beaver	<i>Castor canadensis</i>	O
Deer Mouse	<i>Peromyscus maniculatus</i>	X
White-footed Mouse	<i>Peromyscus leucopus</i>	X
Southern Red-backed Vole	<i>Clethrionomys gapperi</i>	X
Meadow Vole	<i>Microtus pennsylvanicus</i>	X
Woodland Vole	<i>Microtus pinetorum</i>	X
Muskrat	<i>Ondatra zibethicus</i>	X
Southern Bog Lemming	<i>Synaptomys cooperi</i>	
Norway Rat	<i>Rattus norvegicus</i>	
House Mouse	<i>Mus musculus</i>	
Meadow Jumping Mouse	<i>Zapus hudsonius</i>	X
Woodland Jumping Mouse	<i>Napaeozapus insignis</i>	
Porcupine	<i>Erethizon dorsatum</i>	O
Coyote	<i>Canis latrans</i>	O
Red Fox	<i>Vulpes vulpes</i>	X
Gray Fox	<i>Urocyon cinereoargenteus</i>	X
Black Bear	<i>Ursus americanus</i>	X
Raccoon	<i>Procyon lotor</i>	O
Fisher	<i>Martes pennanti</i>	O
Ermine	<i>Mustela erminea</i>	O
Long-tailed Weasel	<i>Mustela frenata</i>	X
Mink	<i>Mustela vison</i>	X
Striped Skunk	<i>Mephitis mephitis</i>	X
River Otter	<i>Lutra canadensis</i>	X
Bobcat	<i>Lynx rufus</i>	P
White-tailed Deer	<i>Odocoileus virginianus</i>	O
Moose	<i>Alces alces</i>	O

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 would likely attract at least occasional presence of this 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 that 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 CONCERN

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.¹¹

NH Fish & Game has identified 123 species of greatest need of conservation concern in the state, along with associated habitats. The species include freshwater mussels, insects, fish, amphibians, reptiles, birds, mammals, and four species of game animals (See Appendix D: NH WAP Table 2). WAP includes a suite of wildlife habitats that the species of concern are dependent on and which represent several spatial scales (see Appendix D: NH WAP Table 1).¹²

WAP identifies 10 ecoregions in New Hampshire; the Glen Oaks 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*.

Spruce Swamp ranks as “highest quality habitat” both for ecological condition in New Hampshire, and as compared to all habitats in the same ecoregion. A substantial section of the Conservation Area forest ranks as tier 3 supporting landscape.

WAP provides a “coarse filter”, landscape-level classification of New Hampshire’s habitats. The forest type and habitat assessments researched and prepared for the Glen Oaks Conservation Area Forest and Wildlife Management Plan are a detailed refinement of the broad classifications. For example, the vernal pool network in the Conservation Area was not captured by WAP, but through detailed analysis of the property, have now been identified. WAP classification as a small-scale habitat—vernal pool—is now possible. The extensive forest type described and mapped in detailed 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.

¹¹ New Hampshire Fish and Game Department. 2009. New Hampshire Wildlife Action Plan website.

¹² Ibid.

¹³ Ibid.



Species of Conservation Concern

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 occur or may occur in the Glen Oakes Conservation Area. Listing is based on data from the WAP watershed grouping cross-referenced with the matrix forest types and freshwater habitats found (as mapped in the WAP) on the Conservation Area.

Common Name	WAP - Habitat	Habitat Type	GOCA occurrence?
Brook floater	TCW	Slow-moving streams	L
Banded sunfish	MSW	Ponds, low-lying streams, acidic waters	
Blue-spotted salamander	OPF, HHP, VP	Deciduous forest, wooded swamps	P
Fowler's toad	OPF, HHP	Sandy alluvial lowlands, forests	P
Northern leopard frog	MSW, Ptl	Wet open meadows, shallow streams	X
Black racer	OPF, HHP	Fields, meadows, marshes, woodlands	X
Blanding's turtle	OPF, HHP, MSW, Ptl, VP	Marsh & shrub wetlands, upland forest	X
Ribbon snake	OPF, HHP, MSW, Ptl, VP	Marsh & shrub wetlands	X
Spotted turtle	OPF, HHP, MSW, Ptl, VP	Vernal pools, emergent marshes	P
Smooth green snake	OPF, HHP, MSW	Fields, meadows, dense vegetation	X
Wood turtle	OPF, HHP	Sandy-bottomed streams	P
American bittern	MSW	Marsh & shrub wetlands	X
American black duck	MSW	Marsh & shrub wetlands	X
American woodcock	OPF, HHP, MSW	Early successional	O
Bald eagle	OPF, HHP	Large lakes, rivers, estuaries	
Canada warbler	OPF, HHP	Dense understory wetland forest edge	P
Cerulean warbler	OPF, HHP	Mature deciduous forest	
Cooper's hawk	OPF, HHP	Mature upland forest	X
Common moorhen	MSW	Marsh & shrub wetlands	P
Eastern towhee	OPF, HHP, Ptl	Early successional	X
Golden-winged warbler	MSW	Early successional	
Great blue heron	MSW	Marsh & shrub wetlands	O
Northern goshawk	OPF, HHP	Older mixed forest, deep woods	P
Northern harrier	MSW	Marsh & shrub wetlands	P
Osprey	MSW	Lakes, rivers	P
Pied-billed grebe	MSW	Marsh & shrub wetlands	P
Purple finch	HHP	Open softwood-hardwood forest	P
Red-shouldered hawk	HHP, MSW	Riparian/open wetland-forest edges	O
Ruffed grouse	OPF, HHP	Upland forest, early successional	O
Sedge wren	MSW	Marsh edges	
Turkey*	OPF, HHP	Upland forest	O
Veery	OPF, HHP	Early successional	O
Whip-poor-will	OPF, HHP	Upland, open forest	P
Wood thrush	OPF, HHP	Established upland forest	P
Black Bear*	OPF, HHP	Forest w/ openings, wetlands, young growth patches	X
Bobcat	OPF, HHP	Early successional, rocky ridge upland forest	P
Eastern pipistrelle	OPF, HHP	Harvested open forests	



Eastern red bat	OPF, HHP, MSW	Hardwood/softwood forest	
Moose*	OPF, HHP, MSW	Marsh & shrub wetlands, young forest	O
New England cottontail	OPF, HHP, MSW	Dense early successional, swamps	
Northern myotis	OPF, HHP	Older trees, ponds, clearings	
Silver-haired bat	OPF, HHP, MSW	Hardwood clearcuts, ponds, streams	
White-tailed deer*	OPF, HHP	Mast forest, softwood cover, dense swamps, young growth	O

The WAP habitats are encoded in the table as:

OPF = Appalachian Oak-Pine Forest

HHP = Hemlock Hardwood Forest

MSW = Marsh and Shrub Wetlands

Ptl = Peatlands

VP = Vernal Pools

Also, for brook floater, a known occurrence is listed by the NH Natural Heritage Bureau, but only referenced in WAP by the Watershed Grouping of Tidal Coastal Watershed, or TCW.

Glen Oakes Conservation Area occurrence has either been observed (O) during fieldwork for this management plan, or listed as “likely” (L) or “potential” (P) based on the habitats found on the property.

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 obliges 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 new population study for bobcat in New Hampshire involves two multi-town study areas (about 200 sq. miles) at the cost of \$300,000¹⁵. 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 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 the mostly commonly trapped animal presently. 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 should 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 will be 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 will be allowed to trap in the Conservation Area annually.
- 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.

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



- 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.

2009 – 2010 New Hampshire Trapping Seasons and Limits

Species	Habitat Quality¹⁶	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 – Jan 15	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	"	

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.



Furbearer Inventories

The presence of furbearers on the property can be monitored using one (or all) of three inventory methods¹⁷. Inventories should be standardized, i.e., taken by trained volunteers who are employing similar methods and standard data sheets. The Fremont Conservation Commission will then compile and maintain records. The three methods are¹⁸:

- Mammal Checklist – Observer lists all mammal (including furbearers) signs 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 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.

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

General

Silvicultural measures to compliment 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 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—trademark 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 not much more than a century old; 2) The forest is not structurally complex, with most stands either even-aged or two-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, most of which is in the 10 to 18± inch diameter range. White pine sawtimber stocking is generally 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 smaller diameter pine. The forest also contains a considerable inventory of lower quality hardwood and hemlock growth.

The total area recommended for silvicultural management (not including early-successional) on the Glen Oakes Conservation Area is 170± acres. According to the forest inventory (2008) prepared for this plan, *conservative harvesting for improvement purposes will net about \$34,000± from the sale of timber on this acreage. This estimate assumes sustainable management on a 15 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 \$650±/acre, well below forest potential. With careful management, including judicious harvesting, the value of pine and hardwood timber inventory can increase to \$1000±/acre in 20± years (using constant dollar analysis). Long-term, this value should clearly exceed \$2,000/acre.

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 timber stand improvement (TSI) work is important for establishing regeneration and to optimize long-term forest growth and value. Essentially, it involves the thinning and release of trees that are too young to have commercial value, including sapling growth that regenerates after a harvest. Since marketable forest products are not produced, this improvement work tends to be a cost operation, albeit of great benefit.

Sustainable Management

To allow an adequate period of growth, commercial harvests should follow a periodic schedule or “harvest cycle”. Silvicultural treatment of the Glen Oakes Conservation Area is well suited for a 15± year harvest cycle. 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 15-year harvest cycle, these three factors—*fully recovered timber volume, abundant natural regeneration (especially mid-successional), 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, feller), 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 passed to the logging contractor for consideration and implementation.
- Logging contractors to file NH DES Wetland Permit for Logging Activity. Logging contractor to follow NH BMP provisions as stated on permit.



- Stream crossings require temporary poled fords or bridging.
- 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. Professional Forester should make on-the-ground selection decisions. Trees should not be felled into open water, and ground surface should not be disturbed by logging equipment within buffer.
- Logger should use absorbent padding to protect soil from inadvertent spills when servicing equipment. Contractor should have a spill kit on 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:

589,199± board feet of sawtimber

Softwood – 307,972± BF

Hardwood – 281,227± BF

15,939± tons of chipwood/softwood pulp

2,378± cords of firewood

- The total timber stumpage value is currently \$150,380.
- On a per acre basis, timber value averages \$651±/accessible upland acre.
- Red oak sawtimber accounts for about one-third (32%) of the property's timber value.
- White pine sawtimber also accounts for about one-third (32%) of the property's timber value.
- Cumulatively, all other sawtimber, pulp, firewood, and chipwood on the Glen Oakes Conservation Area accounts for the remaining 36% of timber value.

Tree Species Composition

- White pine and red oak are the property's dominant species, accounting for 26.3 and 19.5% of tree species composition (by basal area), and 47.4 and 34.3% (including pallet grade wood) of total timber volume, respectively.
- Oak, red, black, and white, account for 26% of property's forest composition.
- Beech and hemlock are the most commonly found regeneration in the Conservation Area. White pine, red oak, and red maple are the next most common seedling/sapling growth. Black and yellow birch are found in small pockets, particularly in moister areas.

Continued –



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Tree Quality and Density

- White pine quality is variable, with the best groves in the eastern and central portions of the Conservation Area. Most of the western areas of the property were heavily harvested recently and contain smaller diameter pines of poorer quality and vigor.
- Red oak quality is generally good, including mostly grade-sawtimber, with some low-grade pallet logs and lesser amounts of high-quality veneer.
- The Glen Oakes Conservation Area is generally well-stocked with timber, or young growth, except for some of the western portions of the property, which were fairly heavily harvested in the late 1990's or early 2000's. Regeneration in the more recently harvested areas, however, is promising.



TIMBER VALUATION

VALUATION OF STANDING TIMBER – TOTAL MERCHANTABLE VOLUME

Glen Oakes Conservation Area Fremont, New Hampshire

<u>PRODUCT/ SPECIES</u>	<u>TOTAL VOLUME</u>	<u>% of VOLUME¹</u>	<u>UNIT PRICE</u>	<u>TOTAL VALUE</u>	<u>% of VALUE²</u>
Sawtimber					
White Pine	279.1 MBF	47.4%	@ \$170/MBF ³	\$ 47,447	31.6%
Hemlock	28.9	4.9	\$ 25	722	<1
Popple	2.3	<1	\$ 20	46	<1
Beech	4.7	<1	\$ 20	94	<1
Black Oak ⁴	12.6	2.1	\$240	3,024	2.0
Red Oak ⁴	157.5	26.7	\$310	48,825	32.5
Oak Pallet	57.2	9.7	\$ 25	1,430	1.0
White Oak	9.0	1.5	\$ 75	675	<1
Red Maple	20.7	3.5	\$ 45	931	<1
Sugar Maple	10.9	1.8	\$200	2,180	1.4
Black Birch	4.5	<1	\$110	495	<1
Hickory	1.8	<1	\$ 20	36	<1
TOTALS	589.2± MBF			\$105,905	
Chipwood/Pulp	15,939± Tons	@ \$ 1/Ton		\$ 15,939	10.6%
Firewood	2,378± Cords	@ \$ 12/Cord		<u>\$ 28,536</u>	<u>19.0</u>
GRAND TOTAL				\$ 150,380	100%
ROUNDED				\$ 150,000	
AVAILABLE VALUE⁵				\$ 133,520	

June 2009

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.



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- 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).
- 5) As of June 2009, the Glen Oakes Conservation Area contains standing timber volumes, as follows:

589,199± board feet of sawtimber (90% Confidence Interval: ± 67,307 bf)

Softwood – 307,972± BF

Hardwood – 281,227± BF

15,939± tons of chipwood and softwood pulp

2,378± cords of firewood (90% Confidence Interval: ± 309 cords)



Forest Inventory Volume Summary
November 2009

Glen Oaks Conservation Area
Fremont, NH

Sawtimber Board Foot (BF) Volume per Acre												Firewood Vol/Acre (Cords)
WP	HM	BO	RO	WO	RM	SM	BB	BE	SH	PO		
Forest Types A, D, and E												
Mean	995	101	145	1280	0	104	35	0	15	16	19	13.9
Total	119212	12055	17411	153113	0	12508	4135	0	1793	1859	2279	1667
Forest Types B, C, and I												
Mean	898	45	93	594	187	56	0	94	0	0	0	7.6
Total	43111	2155	4455	28492	8967	2708	0	4534	0	0	0	366
Forest Types G and H												
Mean	1565	211	92	482	0	0	182	0	78	0	0	7.9
Total	58384	7888	3448	17997	0	0	6778	0	2923	0	0	293
Forest Type F												
Mean	4595	537	0	169	0	432	0	0	0	0	0	4.1
Total	58353	6814	0	2140	0	5485	0	0	0	0	0	52
VOLUME GRAND TOTAL:												2,378
AVAILABLE TIMBER VOLUME (BF):												2,326
Cords												

KEY:
* Trees > 9" diameter at breast height
Ac = acres
N = # of plots
BA = Basal Area (density) per acre
Mean = Average volume per acre
Total = Total volume by strata

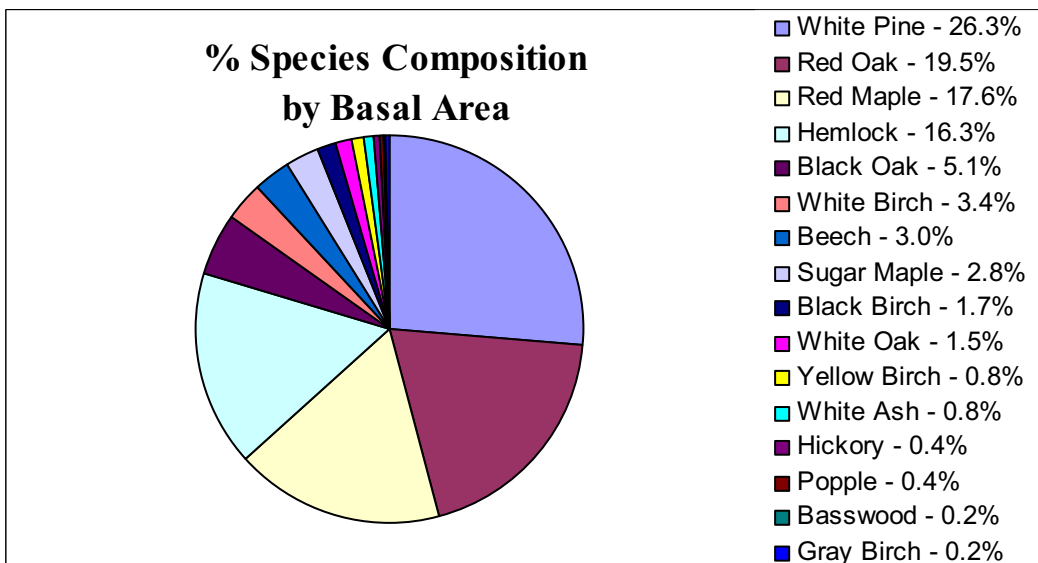
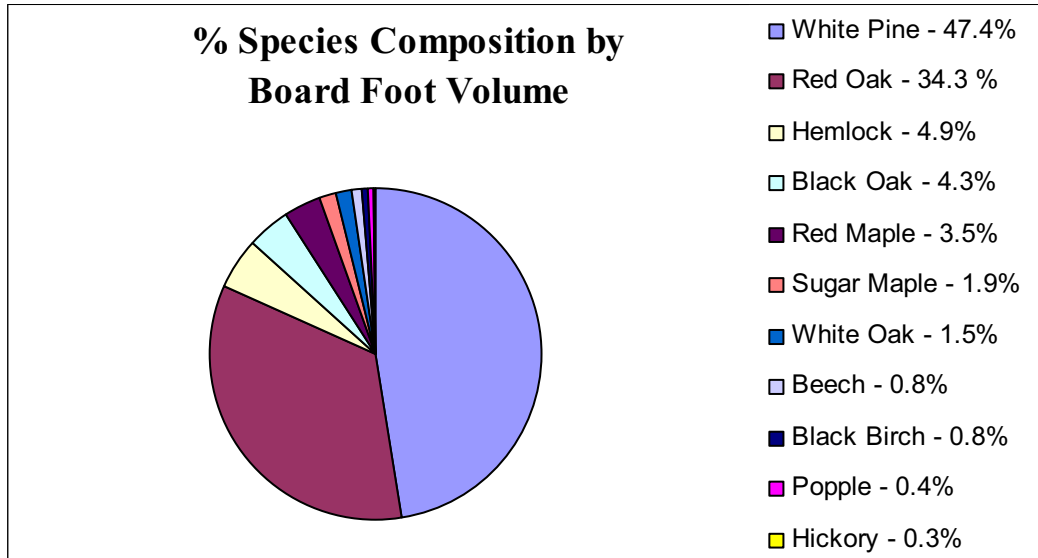
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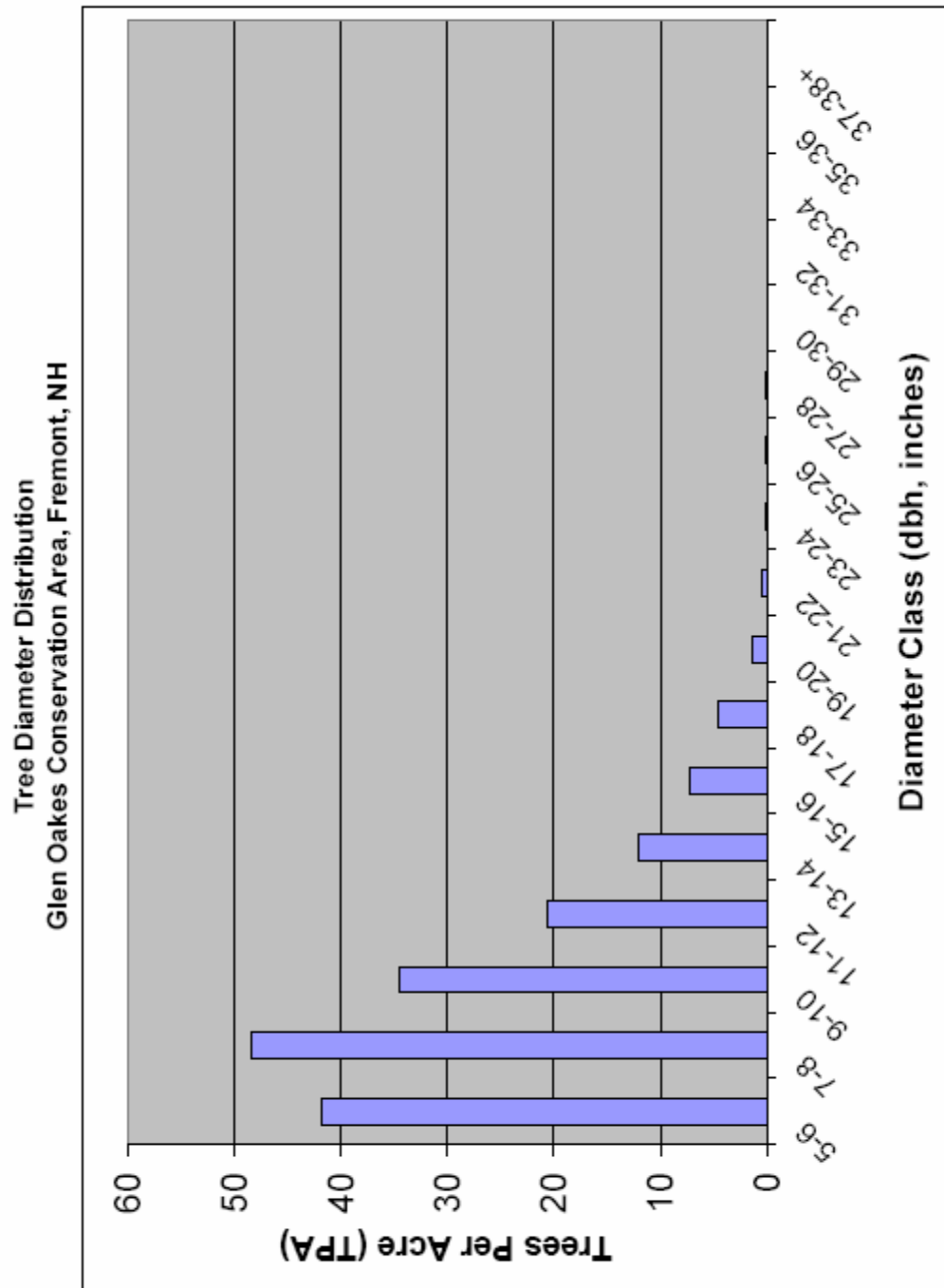


SPECIES COMPOSITION

% Species Composition by Board Foot Volume and Basal Area

Glen Oakes Conservation Area Fremont, New Hampshire





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SUSTAINABLE HARVEST TIMBER VOLUMES **In Various Cutting Cycle Scenarios**

Glen Oakes Conservation Area Fremont, New Hampshire

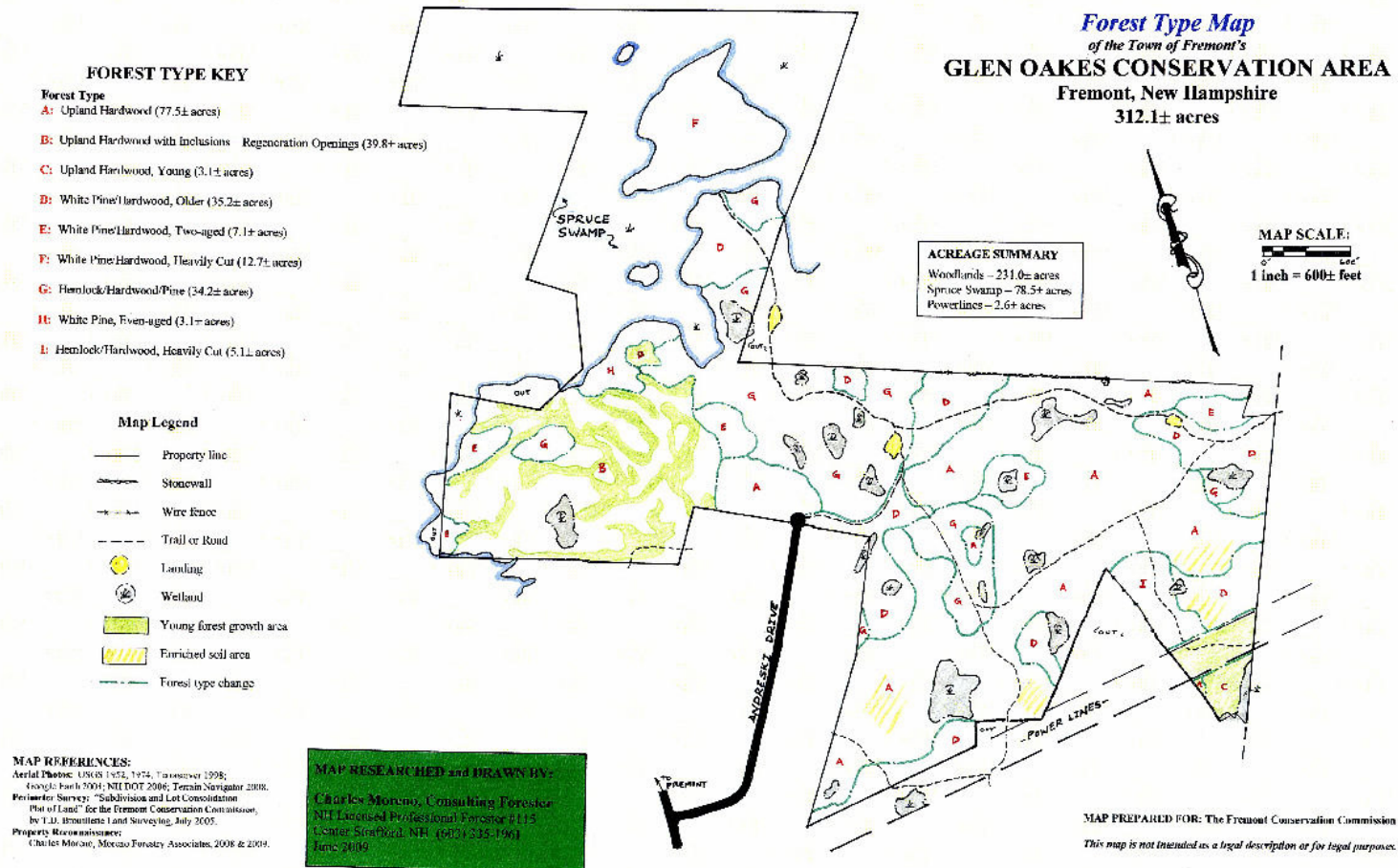
PRODUCT/ SPECIES	Estimated Sustainable Volume Removals HARVEST CYCLE		
	<u>12± Years</u>	<u>15± Years</u>	<u>25± Years</u>
<i>Sawtimber:</i>			
White Pine	59.0 MBF	71.6 MBF	108.9 MBF
Hemlock	4.6	5.7	9.0
Popple	0.4	0.5	0.8
Beech	0.8	1.0	1.6
Black Oak	2.3	2.8	4.3
Red Oak	30.2	36.8	56.6
Oak Pallet	10.4	12.7	19.6
White Oak	1.6	2.0	3.1
Red Maple	4.0	4.8	7.4
Sugar Maple	2.1	2.5	3.9
Black Birch	0.8	1.0	1.6
Hickory	0.3	0.4	0.6
<i>Totals:</i>	116.5± MBF	114.8± MBF	217.7± MBF
Chipwood/Pulp	3,799 Tons	4,602 Tons	6,908 Tons
Firewood	566 Cords	686 Cords	1,030 Cords
 TOTAL VALUE	 \$32,043±	 \$38,560±	 \$58,655±
AVAILABLE VALUE	\$28,450±	\$34,236±	\$52,078±

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. The net projected timber revenue to the town is listed below.

For example, assuming current stocking levels, the property is capable of re-growing about 59.0 MBF (MBF = One thousand board feet) of white pine sawtimber over the next 12 years, if 59.0 MBF were to be cut at present. Thus, 59.0 MBF of white pine is the sustainable harvest level if a 12 year harvest cycle is used. If less than 46.7 MBF were presently harvested, the forest will have a net increase in white pine volume after 12 years; conversely, if more is harvested, the forest will probably not fully recover the 59.0 MBF volume in the span of 12 years.





FOREST TYPES and PRESCRIPTIONS

The Conservation Area Forest Types Map—the 1st page of this Chapter—illustrates the forest type locations.

A. Upland Hardwood – 77.5± acres

Status: A major forest type. Extensive stand covers much of easterly property area; smaller stand at the end of Andreski Drive.

Description: This forest type is characterized as well-established, 95± year old oak forest, with nearly-full high canopy cover. A few scattered hemlocks were aged at 120± years, indicating that some areas have been forested since the Civil War. In areas, light recent logging in the mid-1980's and late 1990's, resulted in scattered small gaps that are filling in with inclusions of seedling/sapling growth. This forest type covers well-drained till sites (*Canton* soils) where red oak dominates, though a few moist, enriched soil areas contain a wider variety of tree species. Sugar maple, basswood, and shagbark hickory are found in these mesic areas. Some areas contain a dense hemlock understory; however, they are classified as this forest type due to the full upland hardwood overstory.



Upland hardwoods—red oak—typical of Forest Type A.

Timber – High quality red oak sawtimber and veneer (10 – 18± inch DBH) is developing, often averaging over 1,000 board feet/acre. The forest type contains few white pines; while containing sawtimber, these pines should generally be retained as a valuable natural seed source.

Wildlife – This forest type embodies one of the key, defining habitat types of the Glen Oaks Conservation Area. Covering nearly 80 acres, the high oak canopy represents 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 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 upland hardwood stands. Potential reintroduction of blight resistant chestnuts over the next 50 years will dramatically enhance the mast quality of this forest area. Allowing the development of some very old trees is also favorable.

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

Tree Species Composition –

Primary^a – Red oak.

Secondary^b – Black oak, white pine, red maple, hemlock, beech.

Tertiary^c – White oak, white birch, shagbark hickory, black birch, sugar maple.

Regeneration (seedlings) – Hemlock, beech, red maple, white pine (most common to least). Pockets where white pine and black birch seedling/saplings are more common. Chestnut sprouts -rare.

Shrubs/Herbaceous – Witch-hazel. Wintergreen, tree clubmoss, ground cedar.

^aDominant tree species in main canopy layer.

^bFairly common to less common tree species.

^cUnique tree species; or only one or a few specimens in the forest type.



Forest Type A – Continued

FOREST STRUCTURE

<i>Composition</i>	Stand Structure	Even-aged w/ inclusions.
	Silvicultural Stage	Mid to late-intermediate.
	Stand Age	85 - 100± years. 10-25± year (inclusions).
<i>Tree Size</i>	DBH range	8 - 18± inches
	Mean DBH	12± inches
	Avg. Maximum Height	65± feet
<i>Stand Density</i>	Relative Stocking	Considerable
	Basal Area/Acre	130± sq. ft./acre (average)
	Canopy Closure	70 - 100± %
<i>Ecological</i>	Canopy Stratification	Fair to good – Well-developed hemlock understory in areas. Also pine/hardwood sapling regeneration. Almost full overstory canopy. Mid-story generally less developed.
	Coarse Woody Debris (CWD)	Low accumulation, few large trunks.
	Invasive Plants	Low/no incidence

SILVICULTURAL PRESCRIPTION

Objectives –

Silvicultural treatment is intended to maintain and enhance the excellent mast stands this forest type encompasses. Specifically: 1) Promoting the growth of broad-crowned red oak, including a significant component of 125 to 150+ year old oaks; 2) Increasing and diversifying mast-producing species, both in the overstory—white oak, shagbark hickory, perhaps some cherry—and understory—beaked hazelnut, maple-leaved viburnum, lowbush blueberry; 3) Broadening of stand age structure to include abundant young growth, and ample mid-aged and mature trees; 4) Regeneration of the stand to include an increased white pine, black birch, white oak, and shagbark hickory composition; 5) Increase per acre timber value; and 6) Long-term, the re-introduction of American chestnut in this forest type.

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

Silvicultural Treatments:

2010±: *Crown thinning/Improvement harvest.* Provide 5 to 10 feet of growing space around the crowns of the healthiest, high quality hardwoods. Harvest poor quality trees. Retain white pine as future seed source.

2025±: *Single-tree/micro-group selection/Liberation.* Remove trees individually or in groups of up to 6 trees. Release any advance regeneration from previous cut. A new generation will become established in the micro--group openings, while stand quality is upgraded and growing space is provided to favored trees.

2040±: *Single-tree/Expanded micro-group selection/Liberation.* Similar treatment as previous, however, harvest along edges of previous group openings to release young growth and establish a new generation. Encourage pine, oak, and hickory regeneration.



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B. Upland Hardwood with Inclusions – 40.8± acres

Status: Major forest type, western property area only.

Description: In 2002±, trees were cleared in 20 to 60± foot wide strips, creating a distinct structure to this forest area. The established forest, of which 42±% was cleared, contains upland hardwoods dominated by red oak



Stand B: Wide strip-clearing with regeneration.

similar in composition to Forest Type A. Red maple, red oak, and beech seedlings are densely overtaking the cleared strips. Regeneration is both from seed and stump



Stand B: Narrow strip with regeneration.

sprouts, however, beech is also 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 70% full. 50% or more of this stand's sawtimber stocking was removed in the 2002± harvest.

Timber – The residual older forest contains fine red oaks, mostly 10 to 15± inch DBH, which should be allowed to develop over the next 15 to 40± years (2050) as valuable sawtimber and veneer. In 15± years (2025), attention should be given to the hardwood regeneration in the open strips, where careful thinning of saplings will favor vigorous, healthy growth and species diversity. Lack of silvicultural attention will result in a high proportion of a few species—beech and red maple—in the future forest.



Stand B: Lightly thinned older forest area.

Wildlife -- This forest type provides outstanding and 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 excellent complimentary 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 extensive strip openings within the older deciduous stand also provides specialized habitat for yellow-billed cuckoo, eastern towhee, least flycatcher, and northern flicker.

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 (Stand G).

Tree Species Composition –

Primary – Red oak.

Secondary – White pine, red maple, beech. White oak in areas.

Tertiary – White birch, shagbark hickory.

Regeneration –

➤ In openings – Beech, red maple, red oak, white pine. Seedling/sapling.

➤ Under canopy – White pine, hemlock, beech. Variable sapling density—sparse to dense.

Shrubs/Herbaceous – Blackberry, wintergreen.



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Forest Type B – Continued

FOREST STRUCTURE

<i>Composition</i>	Stand Structure	Two-aged, grouped: Established forest with open strip inclusions that are regenerating.
	Silvicultural Stage	Mid-intermediate and regenerating.
	Stand Age	100± years. 5 - 10± year (inclusions).
<i>Tree Size</i>	DBH range	8 - 18± inches
	Mean DBH	11± inches (older strata)
	Avg. Maximum Height	60± feet
<i>Stand Density</i>	Relative Stocking	Moderate/considerable
	Basal Area/Acre	95± sq. ft./acre (average)
	Canopy Closure	0 - 90± %
<i>Ecological</i>	Canopy Stratification	Good– Established forest areas include mostly full canopy and fairly dense understory/mid-story. This intermixes with the increasingly dense regeneration strips.
	CWD	Moderate accumulation; no large trunks.
	Invasive Plants	Low/no incidence

SILVICULTURAL PRESCRIPTION

Objectives –

Over time, silvicultural treatment is intended to balance maturing forest growth with the maintenance of young forest habitat attributes. Specifically: 1) Promoting 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) In 15 years, begin TSI treatment of sapling growth in approximately 50% of the cleared strip areas; 4) Over the long-term, continue to retain 30 to 40% of the stand's area as cleared or young forest (0 to 30± years of age); 5) Re-clear 50% of strip areas, and newly clear some of the older forest along the edges of the strips to maintain 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:

2020±: **Older forest areas** – *Improvement harvest/Crown thinning*; light cut of 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 – *Brontosaurus 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.



Forest Type B – Continued

- 2025±: **Strip cut areas** – Non-commercial TSI, *inter-sapling release* using a rotary brushsaw, on 8± acres of promising young forest growth containing a high proportion of oak, hickory, pine, or black birch.
- 2035±: **Older forest areas** – *Crown thinning* of mast forest. *Delay* clearing of additional strips until next harvest cycle, 15 years hence.
Strip cut areas – Repeat Brontosaurus *clearing* of young forest area, including new (2020±) strip edges.
- 2045±: **Strip cut areas** – Non-commercial TSI, *weeding and thinning* of young 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 *clearing* of young forest areas.



C. Early-successional/Sapling Hardwoods – 4.7± acres

Status: Minor in area, this forest type includes the Conservation Area's powerline easement and an adjacent young growth stand. Lying south of the powerline, this young stand functions as a slightly older extension of the early-successional forest occupying the powerline corridor.

Description: Forest Type C is characterized as two contiguous areas of early-successional and young forest growth in the southeastern section of the Conservation Area. It includes the 2.6 ± acre powerline



Forest Type C: Powerline--early successional growth



Forest Type C: Young hardwood growth.

corridor that contains a variety of early-successional field/forest tree and shrub species. This vegetative stage is maintained on a 3 to 5 year mowing cycle by PSNH. Lying immediately south of the powerlines is a 2.1± acre pocket of dense sapling growth that was established as a result of clearcutting in 2002±. Trees are all less than 3 inches in diameter, regenerating both from seed and coppice (sprout) origin. Several tree, shrub, and vine species were noted.

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 strictly 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 may serve as a vector for the spread of exotic plants.

Wildlife – The young forest stand in Forest Type C lies juxtaposed between two high-quality habitats: 1) The powerline corridor, which will remain as early-successional vegetation, and 2) A newly flooded (2000±) 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. The dense hardwood growth in the young forest stand provides good 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, field sparrow, chipping sparrow, song sparrow, and Eastern Towhee.

Species Composition –

Powerline

White pine, quaking aspen, red oak, white birch, red maple, witch-hazel, common juniper, stepplesh spirea, meadowsweet.

Young Forest Stand

Primary – Beech.

Secondary – Red maple, white pine, black birch, shagbark hickory.

Tertiary – Red oak, white oak, white birch, big-tooth aspen, quaking aspen, black cherry.

Regeneration (seedlings) – Both stands consist of the sapling and seedling species listed above.

Shrubs/Herbaceous – Witch-hazel is prevalent. Also, staghorn sumac, beaked hazelnut, highbush blueberry, sweet pepperbush, winterberry holly, meadowsweet, blackberry, and grapevine.



Forest Type C – Continued

FOREST STRUCTURE – Young Forest Area

<i>Composition</i>	Stand Structure	Even-aged.
	Silvicultural Stage	Regenerating.
	Stand Age	<10 years old.
<i>Tree Size</i>	DBH range	<1 - 3± inches
	Mean DBH	1± inch
	Avg. Maximum Height	20± feet
<i>Stand Density</i>	Relative Stocking	Densely
	Basal Area/Acre	N/A
	Canopy Closure	90 - 100± %
<i>Ecological</i>	Canopy Stratification	Low – Only the low canopy of developing regeneration is present. This layer is dense.
	Coarse Woody Debris (CWD)	Low accumulation.
	Invasive Plants	Low/no incidence

SILVICULTURAL PRESCRIPTION

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.

Due to difficult access, long-term timber management is not recommended for the young forest stand in Forest Type C. However, the stand should be reevaluated in 15± years to determine if its function of providing valuable travel cover has lapsed due to the aging of the present dense sapling growth. Partial or total re-clearing of the stand may then be considered solely for wildlife purposes using a Brontosaurus to re-establish cover habitat as well as promoting early-successional growth.

The powerline area will be maintained in a young early-successional conditions by PSNH, which currently uses a 3 to 5 year mowing cycle.

Structural Sequence: Even-aged (present condition)→Even-aged (2030). Periodically clear to re-establish early-successional/young forest growth conditions.

Silvicultural Treatment:

2010±: *No treatment*, but *examine* for the presence of exotic, invasive plants.

2025±: *Brontosaurus clearing* of young stand.

Monitor for the presence of invasive plants in conjunction with periodic (15± year) clearing work.

Plan and implement appropriate response if plants are detected.

2040±: *Re-evaluate* need for re-clearing: Implement on 15 year of 30 year cycle, depending on optimal habitat outcome.

Monitor for the presence of invasive plants. *Respond* as needed.



D. White Pine/Hardwood, Older – 35.2± acres

Status: A major forest type. Found in multiple (8) scattered stands ranging from ½ to 6± acres. Stands are scattered throughout property, including two small islands in Spruce Swamp.

Description: While the upland hardwood component of this forest type is similar to the extensive Forest Type A, white pine is also prominent in the overstory canopy. Well-developed red oak and white pine, 12 to 14 inches in diameter, are typical trees. 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 has occupied the scattered small forest openings; forest structure is now described as even-aged with inclusions of young growth.



Stand D: Typical well-established pine-hardwood mix.

This forest type primarily occupies well-drained uplands, though a few moist areas contain a mesic variant of the forest type. In addition to white pine, red oak, and some hemlock, these areas contain sugar maple, basswood, and hophornbeam, all indicators of richer site conditions. Pipsissewa, a trailing ground plant, is also an enriched site indicator.

Timber – Contains good quality, developing white pine sawtimber (10 – 18± inches DBH), and some good quality red oak (8 to 16± inches). With thinning and improvement cutting, high quality mature sawtimber will develop over the next 15 to 50 years. Management should emphasize copious natural regeneration of these species.

Wildlife – This forest type provides supplementary mast—especially acorns—to the adjacent upland hardwood Forest Type A. As with the upland hardwood areas, diversifying mast sources is a long-term silvicultural goal. Allowing the development of at least a dozen legacy (150+ years) trees per acre is also favorable.

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.

Tree Species Composition –

Primary – Red oak, white pine, red maple (variable).

Secondary – Black oak, beech, white oak, hemlock.

Tertiary – Shagbark hickory, black birch, sugar maple. Enriched sites contain sugar maple, basswood, hophornbeam.

Regeneration (seedlings) – White pine, beech, hemlock. Some red oak. Few chestnut sprouts.

Shrubs/Herbaceous – Witch-hazel. Wintergreen, partridgeberry, pipsissewa.



Forest Type D – Continued

FOREST STRUCTURE

<i>Composition</i>	Stand Structure	Even-aged w/ inclusions of young trees.
	Silvicultural Stage	Late-intermediate.
	Stand Age	75 – 85+.
<i>Tree Size</i>	DBH range	8 - 20± inches
	Mean DBH	12± inches
	Avg. Maximum Height	65± feet
<i>Stand Density</i>	Relative Stocking	Moderate/Considerable
	Basal Area/Acre	100± sq. ft./acre (average)
	Canopy Closure	70 - 100± %
<i>Ecological</i>	Canopy Stratification	Fair to good – Well-developed hemlock understory in areas. Also pine/hardwood sapling regeneration. Almost full overstory canopy. Mid-story generally less developed.
	Coarse Woody Debris (CWD)	Some accumulation; few large trunks.
	Invasive Plants	Low/no incidence

SILVICULTURAL PRESCRIPTION

Objectives –

Silvicultural treatment is intended to promote the growth of 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) Broadening of stand age structure to include 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 stand to include diverse species, especially red oak and white pine, with increased amounts of white oak, shagbark hickory, black birch, and sugar maple; 5) Restrict progression towards increasing beech composition; 6) Enhance mast-production with healthy broad-crowned oaks and diversity of species; and 7) Long-term, the re-introduction of American chestnut forest in this forest type.

Structural Sequence: Even-aged (present condition)→ Two-aged (2015±)→Multi-aged (2050±)

Silvicultural Treatments:

2010±: *Improvement harvest/ Crown thinning.*

2025±: *Single-tree/micro-group selection/Liberation.*

2040±: *Single-tree/Expanded micro-group selection/Liberation.*



E. White Pine/Hardwood, Two-aged – 7.1± acres

Status: A minor forest type. Found in multiple (4) scattered stands ranging from $< \frac{1}{2}$ to 3.5± acres. Stands lie scattered on the property.

Description: This forest type is represented by several small stands where white pine combines with red and white oak. Older residuals, 85 to 100± years, mix with a predominance of 50± year old trees. Recent harvesting (2000±) has also resulted in openings with seedling and sprout growth. The forest type is primarily two-aged with minor regeneration inclusions. In areas where recent harvesting is more extensive, and regeneration is free-to-grow, the forest type is more accurately described as including three age classes (cohorts).

Timber – The growth and quality of oak and pine in this forest type is fair. Most potential sawtimber trees are young or relatively undersized. Over time, these small stands may produce moderately valuable timber. Presently, larger white pines and oaks represent valuable seed sources.

Wildlife – This forest type provides supplementary mast—especially acorns—to adjacent upland hardwood Forest Types A and B. White oak is more abundant than other areas, especially near Spruce Swamp, is an important feature. Dense young growth, and a moderate accumulation of woody ground debris, both a result of recent logging, are also favorable features for wildlife.

Blackberry and stump sprouts in the harvested openings of this forest type provide fruit and browse for deer, raccoon, snowshoe hare, and squirrels, as well as ruffed grouse, rose-breasted grosbeak, gray catbird, veery, and Eastern towhee.

Tree Species Composition –

Primary – Red oak, white oak, white pine.

Secondary – Black oak.

Tertiary – Red maple, shagbark hickory.

Regeneration –

➤ In openings – Red maple, red oak, black oak, white pine. Seedlings and stump sprouts.

➤ Under canopy – White pine.

Shrubs/Herbaceous – Witch-hazel and blackberry (in openings); beaked hazelnut (under canopy).



Forest Type E: Previously cut, 2 to 3-aged pine-oak.



Forest Type E – Continued

FOREST STRUCTURE

<i>Composition</i>	Stand Structure	Two-aged with inclusions. Also, 3-aged.
	Silvicultural Stage	Late-intermediate/Young intermediate and regenerating.
	Stand Age	<10 / 40-50± / 85 – 100± years.
<i>Tree Size</i>	DBH range	10 - 20± inches
	Mean DBH	14± inches
	Avg. Maximum Height	60± feet
<i>Stand Density</i>	Relative Stocking	Moderate
	Basal Area/Acre	0 - 80± sq. ft./acre (variable)
	Canopy Closure	0 - 80± % (variable)
<i>Ecological</i>	Canopy Stratification	Good – Thinned older forest areas contain multiple canopy structure. Regeneration openings contain increasingly dense young growth.
	Coarse Woody Debris (CWD)	Some accumulation, especially from recent harvesting.
	Invasive Plants	Low/no incidence

SILVICULTURAL PRESCRIPTION

Objectives –

Silvicultural treatment is intended to upgrade and develop quality timber, while promoting the mixed-age condition of this stand over the long-term. Specifically: 1) Provide adequate growing space to the crowns of promising oaks, especially white oak, and pine; 2) Maintain/increase the proportion of white oak; 3) Broaden stand age structure to eventually include at least five generations (“cohorts”); 4) Create small openings to provide wildlife with mixed food sources; and 5) Promote white pine and oak regeneration by retaining sufficient seed trees.

Structural Sequence: Two/three-aged (present condition)→Multi-aged (2040±)

Silvicultural Treatments:

2010±: *Improvement harvest/ Liberation cut.*

2025±: *Single-tree/micro-group selection/Liberation.*

2040±: *Single-tree/Expanded micro-group selection/Liberation.*



F. White Pine/Hardwood, Island—Heavily Cut – 12.7± acres

Status: A relatively minor forest type, occupying the large island within Spruce Swamp only.

Description: Heavily harvested in 2003±, this forest type is characterized as an open mix of older white pine, red oak, and white oak, primarily. White pine seedlings and beech sprouts are growing in the variably sized openings. The island appears to have been forested for much of the last two centuries, as the stump of one recently harvested hemlock was aged at about 200± years. The island may contain other 150+ year residuals that have escaped harvesting.



Partially harvested area with residual timber.



Large 2003 timber harvest opening on island.

Timber – Though substantial sawtimber remains, the access road to the island has been flooded by recent beaver activity that has elevated the water levels in the surrounding swamp. Because the island has been isolated, and due to the “prime wetlands” status of Spruce Swamp, further silvicultural activity is unfeasible. The island is thus designated as modified reserve, though this status should be periodically reviewed, particularly if invasive plants, forest disease, or exotic pests require control or management.

Wildlife – The upland softwood/hardwood mix on the island contains maturing trees that provide a mast—oak, beech, hickory; and perch sites—especially on limby pines. A few very old trees contain cavity holes. This older forest was enhanced from a habitat standpoint by the 2003 timber harvest. An influx of young forest trees and shrubs has occupied the recently harvested openings providing cover, fruit and browse. Openings were made to the Spruce Swamp edge, which are now developing as an interesting wetland-upland low-cover ecotone.

This forest type, including the island interior and swamp edges, provides potential habitat for red-shouldered hawk, common yellowthroat, yellow warbler, song sparrow, common grackle, American goldfinch, alder flycatcher, blue-gray gnatcatcher, winter wren. Also, deer, raccoon, mink, and beaver.



Residual 200-year log from island timber cut.

Tree Species Composition –

Primary – White pine, red oak, white oak.

Secondary – Red maple, white birch, shagbark hickory, beech, hemlock.

Tertiary – Black oak, black birch, sugar maple.

Regeneration (seedlings/saplings) – White pine and beech. Some red oak.

Shrubs/Herbaceous – Witch-hazel, blackberry.



Forest Type F – Continued

FOREST STRUCTURE

<i>Composition</i>	Stand Structure	Two-aged w/ residuals.
	Silvicultural Stage	Late-intermediate/regenerating.
	Stand Age	<10 / 85 – 100± years. Possible residuals 150 to 200± years old.
<i>Tree Size</i>	DBH range	8 - 22± inches
	Mean DBH	13± inches
	Avg. Maximum Height	70± feet
<i>Stand Density</i>	Relative Stocking	Moderate
	Basal Area/Acre	0 - 90± sq. ft./acre (variable; avg. 45 ft ² ±)
	Canopy Closure	0 - 80% (average 40±%)
<i>Ecological</i>	Canopy Stratification	Fair – Variable overstory cover; some super- canopy pines. Mid-story somewhat light. Some understory, especially in openings.
	Coarse Woody Debris (CWD)	Moderate accumulation. Some large downed tree trunks.
	Invasive Plants	Low/no incidence

SILVICULTURAL PRESCRIPTION

Objectives –

Designate the Spruce Swamp islands as modified reserves, without active management. A management exception is monitoring: The islands should be periodically (3 to 5 years) reconnoitered for signs of exotic plants, insects, or diseases. If their presence is detected, devise a management strategy to control, mitigate, or eradicate the invading agent.

The purpose of a reserve area is to allow a section(s) of the forest to evolve randomly, following a natural course. With the exception of foreign agencies as described above, no management reaction will be made to salvage or mitigate timber damage that is caused by natural disturbance or senescence. Over the long-term, the reserve can serve as a “control” area to compare managed forest areas.

Structural Sequence: Modified reserve; no further silvicultural treatment.

Silvicultural Treatments: None.



G. Pine/Upland Hardwoods/Hemlock (34.2± acres) –

Status: A major forest type, five stands, widespread.

Description: In addition to upland hardwoods and white pine, an abundance of hemlock characterizes this forest type. *Hemlock is present in all canopy layers*, not just in the understory as with other forest types.



Typical densely-shaded Forest Type G area.



Forest Type G inclusion within Stand B.

In established areas, 100-year old hemlocks are found as co-dominant overstory trees. The proportions of hemlock, beech, red oak, and the birches vary between stands. While densely shaded areas lack young forest and herbaceous growth, areas with few older hemlocks contain a substantial hemlock understory. Witch-hazel is found in moist, lighted openings.

Timber - This forest type has had an active harvest history, though most harvests have been light and selective of pine (1950's), firewood and timber (1985±), and individual sawtimber trees (late 1990's). Future potential sawtimber includes good quality white pine (presently 10-18" DBH) and red oak (10-16"). 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.

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 Stand B strip openings) and the mast forest (Stand A) 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.

Tree Species Composition –

Primary – White pine, hemlock, red maple, red oak, black birch, white birch, beech.

Secondary – Black oak.

Tertiary – Red pine, yellow birch.

Regeneration (seedlings/saplings) – Hemlock primarily. Some beech, red maple, black birch.

Shrubs/Herbaceous – Witch-hazel. Groundcover-- Wintergreen, partridgeberry.



Forest Type G – Continued

FOREST STRUCTURE

<i>Composition</i>	Stand Structure	Three-aged
	Silvicultural Stage	Mid-intermediate
	Stand Age	10±(mostly overtopped)/ 50± / and 75 to 100+ year residuals
<i>Tree Size</i>	DBH range	6 - 22± inches
	Mean DBH	11± inches
	Average Max. Height	60± feet
<i>Stand Density</i>	Stocking (density)	Moderate to considerable
	Basal Area (BA)	100± sq. ft./acre (variable)
	Canopy Closure	90-100%
<i>Ecological</i>	Canopy Stratification	Good - main canopy and low understory, primarily.
	CWD	Moderate to good – Variable abundance; some large decaying trunks.
	Invasive Plants	Low/no incidence

SILVICULTURAL PRESCRIPTION

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: Three-aged (present condition)→ Multi-aged (2015+)

Silvicultural Treatments:

2010±: *Single-tree/micro-group selection.* Focus on naturally regenerating the stands.

Provide growing space to promote large-crowned oaks and to free existing regeneration.

2025±: *Single-tree/expanded micro-group selection.* Increase perimeter of previous openings to release previous regeneration and create space for another new forest generation. Retain ample older generation (100+ years) as legacy trees.

2040±: *Single-tree/expanded small-group selection.* Further increase perimeter of previous openings to release previous regeneration and create space for another new forest generation. Retain older generation (100+ years) legacy trees.

2045± *Inter-sapling release.* Non-commercial (TSI) treatment to thin pockets of favorable sapling and small pole-sized growth.



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Center Strafford, New Hampshire
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H. White Pine, Even-aged – 3.1± acres

Status: A minor forest type. Only one small stand found along the edge of Spruce Swamp.

Description: This forest type is distinguished as a nearly pure stand of young white pine. Though the adjacent forest was harvested in 2002±, it is likely that this stand escaped most harvesting 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 diverse young growth. This forest type was established after a 1950± clear cut; the resulting stand is presently even-aged, with all trees about 55± years of age, and averaging 10± inches in diameter.



Forest Type H: Dense 55-year old white pine.



Forest Type H: Dense pine canopy.

Timber – This stand is capable of producing excellent pine sawtimber if it is carefully thinned at present. Treatment entails a light crown thinning, where the finest trees are selected and provided with sufficient growing space. The remaining pines will mature as sawtimber beginning in 25 years, though individual timber trees may be grown for another century. Harvesting is precluded in most of the stand—within 100 feet of Spruce Swamp—where prime wetlands regulations curtail management activities.

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.

Tree Species Composition –

Primary – White pine.

Secondary – Red maple, white oak, white birch, red oak.

Tertiary – Hemlock, gray birch.

Regeneration (saplings) – Sparse due to overhead shading. Some hemlock and beech.

Shrubs/Herbaceous – Sparse low-bush blueberry. Some wintergreen and tree clubmoss.



FOREST STRUCTURE

<i>Composition</i>	Stand Structure	Even-aged with one strip inclusion.
	Silvicultural Stage	Young to mid-intermediate.
	Stand Age	55± years.
<i>Tree Size</i>	DBH range	5 - 14± inches
	Mean DBH	8± inches
	Avg. Maximum Height	50± feet
<i>Stand Density</i>	Relative Stocking	Dense
	Basal Area/Acre	160± sq. ft./acre
	Canopy Closure	100± %
<i>Ecological</i>	Canopy Stratification	Low – Dense overstory, with very limited lower canopies, including sparse herbaceous layer.
	Coarse Woody Debris (CWD)	Light accumulation, mostly small pine stems.
	Invasive Plants	No incidence

SILVICULTURAL PRESCRIPTION

Objectives –

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.

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

Silvicultural Treatments:

2010±: *Crown thinning.*

2025±: *Crown thinning.*

2040±: *Single-tree/micro-group selection/Liberation.*



I. Hemlock/Hardwood, 3-aged (5.1± acres)

Status: Minor forest type, one stand.

Description: Due to heavy timber harvesting in the recent past (1985 and 2000±), young forest growth predominates in this stand, though patches of older residuals are found. Young growth—saplings and small diameter trees (pole-sized)—is mostly hemlock, black birch, beech, and red maple. Older residuals are primarily red oak, red maple, hemlock, and beech. White pine is absent in this forest type.

Timber - This forest type has no present timber value, due to the previous removal of quality trees. However, black birch and white pine regeneration should be encouraged for the distant future (75+ years).

Wildlife - From a habitat perspective, this stand functions as a travel corridor between the powerline area and the adjacent oak forest to the north, Stand A. Along the powerline, the dense hemlock understory also provides escape cover for mammals and birds. Stand I contains a variety of mast-producing vegetation, including beaked hazelnut, blackberry and raspberries, prickly dewberry and grapevine. Many are found in the 1/10 acre openings created by the most recent harvest.



Forest Type I: Patchy, 3-aged hemlock-hardwood mix.

Tree Species Composition –

Primary – Red oak, red maple, hemlock, beech, black birch.

Secondary – Black oak, white birch.

Tertiary – Sugar maple, shagbark hickory.

Regeneration (seedlings) – Beech, hemlock dominate. Black birch in openings. Some white pine.

Shrubs/Herbaceous – Witch-hazel, beaked hazelnut in drier areas, blackberry, black raspberry, red raspberry, prickly dewberry, and grapevine.

FOREST STRUCTURE

<i>Composition</i>	Stand Structure	Three-aged in patches
	Silvicultural Stage	Young-intermediate
	Stand Age	<10 / 25± /85± years
<i>Tree Size</i>	DBH range	<1 -14± inches
	Mean DBH	6± inches
	Average Maximum Height	50± feet
<i>Stand Density</i>	Stocking (density)	Light to moderate
	Basal Area (BA)	40± sq. ft./acre
	Canopy Closure	10 - 60%, variable
<i>Ecological</i>	Canopy Stratification	Fair – Dense understory areas; some residual mid-story and overstory.
	Coarse Woody Debris (CWD)	Low accumulation.
	Invasive Plants	Low/no incidence



Forest Type I – Continued

SILVICULTURAL PRESCRIPTION

Objectives –

Without management, beech and hemlock will increasingly dominate this forest type to the detriment of a broad variety of species, including mast-producing shrubs and vines. The following recommendations intend to help redirect this successional trend: 1) Harvest beech, poor quality hardwoods, and some larger hemlock to create openings for mixed species growth; 2) Retain travel corridors of young hemlock; 3) Release black birch and white pine regeneration; 4) Retain the species spectrum of hardwood residuals, particularly oaks, sugar maple, and shagbark hickory; 5) Small harvest openings, especially near powerlines, will encourage fruit-bearing plants.

Prescriptions:

- 2010±: *Single-tree and expanded group selection.* Keep desirable hardwood seed sources. Release pockets of favorable regeneration. Larger openings will favor fruit-bearing plants.
- 2025±: *Expanded group selection/single-tree selection.* Follow-up with non-commercial TSI release cutting (*weeding and thinning*) of young growth, to promote pine, oak, and black birch.
- 2040±: *Similar treatment.*



Appendix A: SPECIES LIST

Glen Oaks Conservation Area Trees, Shrubs, Vines, and Ferns

Common Name

Scientific Name

-NATIVE TREES-

DECIDUOUS

Northern Red Oak	<i>Quercus rubra</i>
Black Oak	<i>Quercus velutina</i>
White Oak	<i>Quercus alba</i>
American Beech	<i>Fagus grandifolia</i>
American Chestnut	<i>Castanea dentata</i>
Red (Swamp, Soft, White) Maple	<i>Acer rubrum</i>
Sugar (Rock, Hard) Maple	<i>Acer saccharum</i>
White (Paper) Birch	<i>Betula papyrifera</i>
Yellow (Silver) Birch	<i>Betula allegheniensis</i>
Black (Sweet, Cherry) Birch	<i>Betula lenta</i>
Gray Birch	<i>Betula populifolia</i>
Black Cherry	<i>Prunus serotina</i>
Shagbark Hickory	<i>Carya ovata</i>
White Ash	<i>Fraxinus americana</i>
Basswood	<i>Tilia americana</i>
American Elm	<i>Ulmus americana</i>
Bigtooth Aspen (Popple)	<i>Populus grandifolia</i>
Quaking Aspen	<i>Populus tremuloides</i>
Black Gum	<i>Nyssa sylvatica</i>
Ironwood	<i>Carpinus caroliniana</i>
Hophornbeam	<i>Ostrya virginiana</i>
Sassafras	<i>Sassafras albidum</i>
Staghorn Sumac	<i>Rhus typhina</i>
Smooth Sumac	<i>Rhus glabra</i>
Poison Sumac	<i>Rhus vernix</i>

EVERGREEN

White Pine	<i>Pinus strobus</i>
Red Pine	<i>Pinus resinosa</i>
Pitch Pine	<i>Pinus rigida</i>
Eastern Hemlock	<i>Tsuga canadensis</i>
Red Spruce	<i>Picea rubens</i>
Black Spruce	<i>Picea mariana</i>



- NATIVE SHRUBS -

Speckled Alder
Sweet Pepperbush
Maleberry
Hobblebush
Huckleberry
Witch-Hazel
Northern Bayberry
Winterberry Holly
Hawthorn
Beaked Hazelnut
Serviceberry
Highbush Blueberry
Lowbush Blueberry
Nannyberry
Black Raspberry
Red Raspberry
Blackberry
Leatherleaf
Sheep Laurel

Alnus rugosa
Clethra alnifolia
Lyonia ligustrina
Viburnum alnifolium
Gaylussacia baccata
Hamamelis virginiana
Myrica pensylvanica
Ilex verticillata
Crataegus spp.
Corylus cornuta
Amelanchier spp.
Vaccinium corymbosum
Vaccinium angustifolium
Viburnum lentago
Rubus occidentalis
Rubus idaeus
Rubus allegheniensis
Chamaedaphne calyculata
Kalmia angustifolia

-NATIVE GROUNDCOVER, VINES, & FERNS-

Partridgeberry
Wintergreen
Prickly Dewberry
Tree Clubmoss
Pipsissewa
Spotted Wintergreen
Running Pine
Ground Cedar
Grape
Bracken Fern
Royal Fern
Christmas Fern
Marginal Wood Fern
Sensitive Fern
Cinnamon Fern
Common Polypody

Mitchella repens
Gaultheria procumbens
Rubus flagellaris
Lycopodium obscurum
Chimaphila umbellata
Chimaphila maculata
Lycopodium complanatum
Lycopodium tristachyum
Vitis spp.
Pteridium aquilinum
Osmunda regalis
Polystichum acrostichoides
Dryopteris marginalis
Onoclea sensibilis
Osmunda cinnamomea
Polypodium virginianum

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

Glen Oaks Conservation Area 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

^ANOTE: 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.

^BObligate vernal pool species – are dependent on vernal pools for at least part of their life cycle, typically breeding activity.

^CFacultative vernal pool species – will utilize vernal pools for at least some portion of their life cycle.





NEW HAMPSHIRE NATURAL HERITAGE BUREAU

DRED - DIVISION OF FORESTS & LANDS
PO BOX 1856 -- 172 PEMBROKE ROAD, CONCORD, NH 03302-1856
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: 2008-05-23

Re: Review by NH Natural Heritage Bureau of request dated 2008-05-22

NHB File ID: 419

Town: Fremont

Project type: Landowner Request

Location: Spruce Swamp, SE corner

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	
				Federal	NH	Global	State
Natural Community							
Medium level fen system	Good	39.7	2002	--	--	-	S3
Poor level fen/bog system	Good	0.8	2002	--	--	-	S3
Plant species							
Separated Sedge (<i>Carex seorsa</i>)	Good	100	2002	--	NH	Global	State
					E	G4	S1

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

	Last Reported	Listing Status		Conservation Rank	
		Federal	NH	Global	State
Vertebrate species (For more information on animal species, contact Kim Tuttle, NH F&G at 271-6544)					
Blanding's Turtle (<i>Emydoidea blandingii</i>)	2005	--	--	G4	S3
Invertebrate Species					
Brook Floater (<i>Alasmidonta varicosa</i>)	1953	--	NH	Global	State
			E	G3	S1

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.





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PHONE: (603) 271-2214 FAX: (603) 271-6488

Listing codes: T = Threatened, E = Endangered

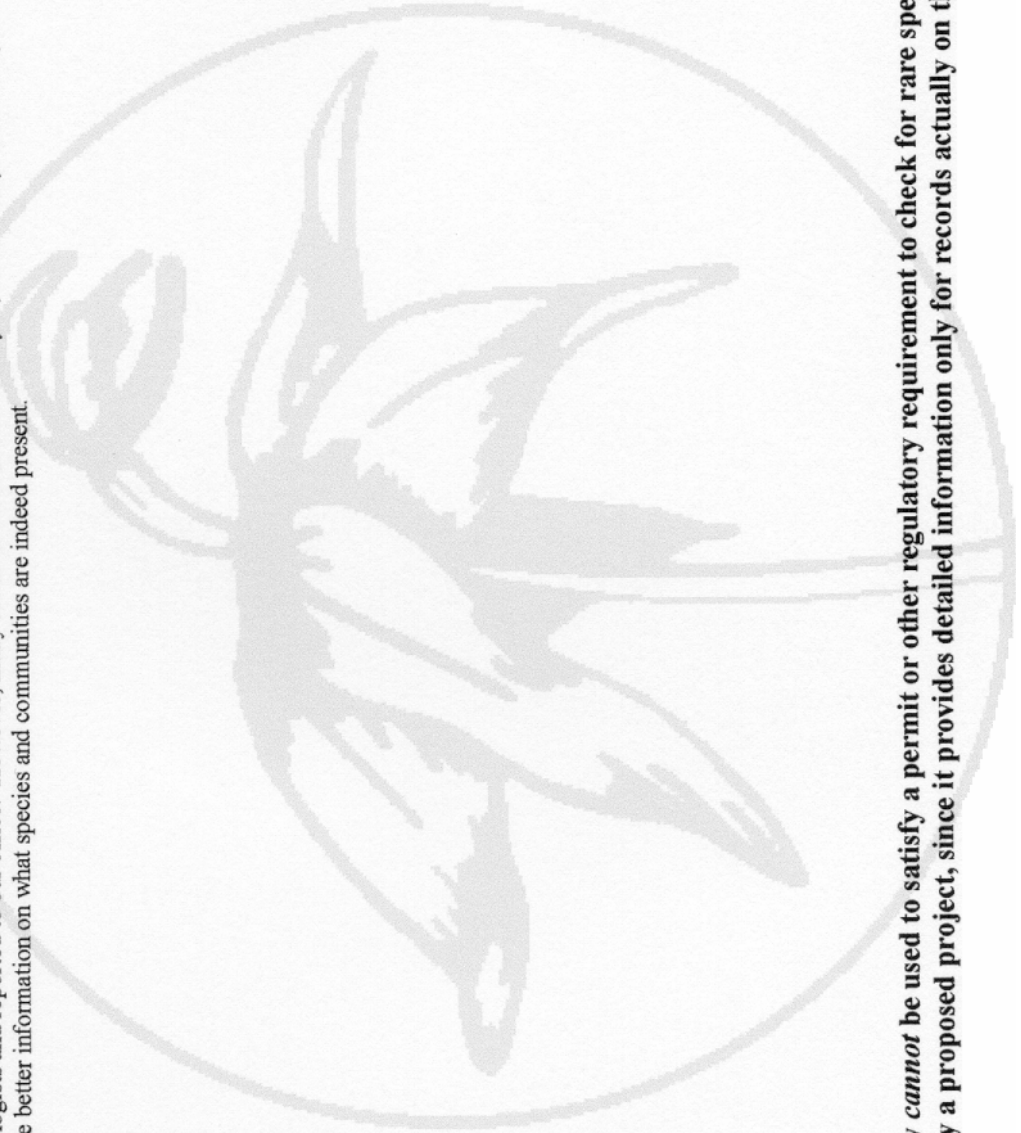
Rank prefix: G = Global, S = State,

Rank suffix: 1-5 = Most (1) to least (5) imperiled. "-." = U, NR = Not ranked.

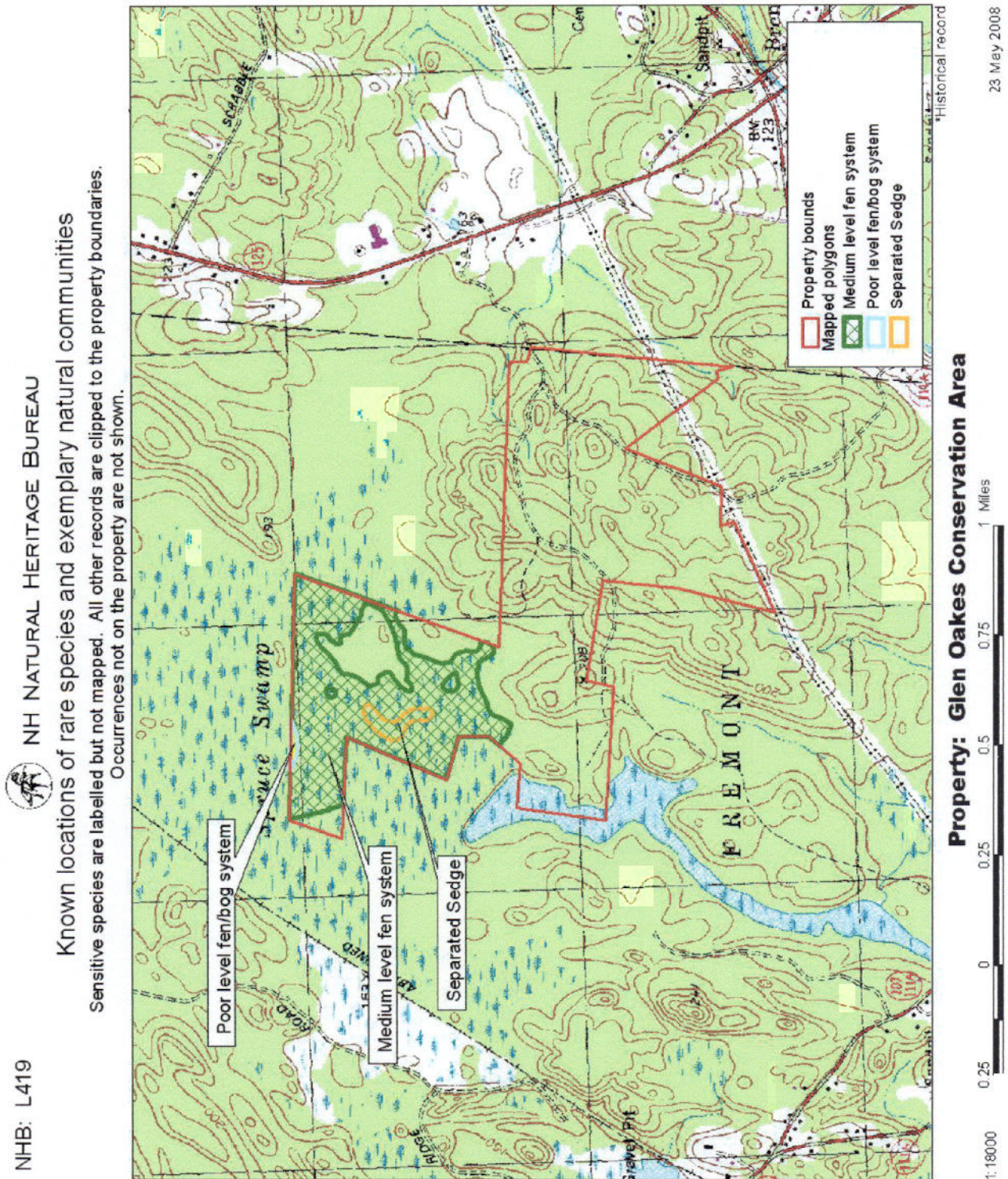
B = Breeding population, N = Non-breeding, H = Historical, X = Extirpated.

T = Global or state rank for a sub-species or variety (taxon)

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.

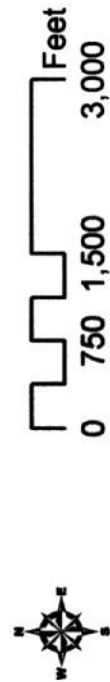
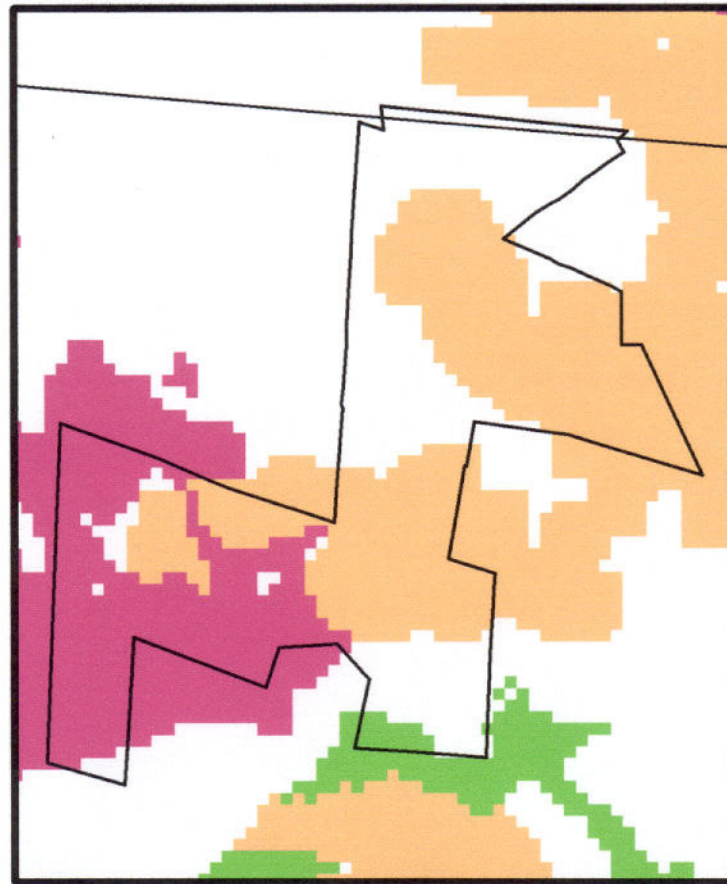


NOTE: This review *cannot* be used to satisfy a permit or other regulatory requirement to check for rare species or habitats that could be affected by a proposed project, since it provides detailed information only for records actually on the property.



New Hampshire Fish & Game Department Wildlife Action Plan Map

NH WAP Highest Quality Habitat in NH



- Legend**
- Glen Oaks
 - pbp
 - Highest quality habitat in NH (tier 1)
 - Highest quality habitat in biological region (tier 2)
 - Supporting Landscapes (tier 3)
 - Wildlife data not top ranked



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 Center Strafford, New Hampshire
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TIMBER INVENTORY SPECIFICATIONS

Glen Oakes Conservation Area Fremont, New Hampshire

The Glen Oakes Conservation Area, owned by the Town of Fremont and comprising 312.1± acres (**231± total forested acres/205.1± accessible forested 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. Aerial photos and reconnaissance of the property were employed to delineate forest types into four strata for statistical purposes.

A summary of inventory and statistical specifications follows:

- 1) Statistical error around the total sawtimber volume estimate: ±11.4%
(Total sawtimber includes grade logs, veneer, and pallet logs of all species).
589,199 Board Feet ± 67,307 BF
- 2) Statistical error around the total firewood volume estimate: ±13.0%
2,378 cords ± 309 cords
- 3) Confidence level: 90%
- 4) Sample plot layout
 - a. Systematic sample
 - b. Spacing: 300' x 300' grid
- 5) Plot type and number: 107 prism plots
- 6) Number of strata: Four
- 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, red, and white oak; black, and yellow birch; sugar and red maple)
 - Grade sawlogs (Hardwood and softwood)
 - Pallet logs (Hardwood and softwood)



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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.



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**State of New Hampshire
Licensed Professional Forester #115
Maine Forester License #2000**

FOREST MANAGEMENT PLANNING
WOODLAND APPRAISALS
TIMBER SALES
TIMBER STAND IMPROVEMENT
FOREST PRODUCT MARKETING
FOREST TAXATION
WILDLIFE MANAGEMENT
TOWN FOREST MANAGEMENT
LAND PROTECTION

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

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. Twenty-nine 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. 30,000+ acres under management.
1984- Present	TOWN FOREST MANAGER for the Towns of Exeter, Londonderry, Candia, Plaistow, Brentwood, East Kingston, Deerfield, Epping, Brentwood, Sandown, Rye, Pittsfield, Derry, Dover, Madbury, Strafford, and Rochester developing/implementing multiple-use plans for publicly owned forests.
1985- 1992	ALTON TOWN FORESTER. Consultant to the town on Current Use Assessment and NH Timber Tax matters.
1980- 1988	K-F TREE FARM, Forest Manager. Experience in all areas of woodland and wildlife management in this intensively managed, 700-acre property in Alton, New Hampshire. Selected as 1988 Belknap County Tree Farm of the Year.

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)



The Sign of Good Forestry

Inspector

ADDENDUM

An ongoing chronological log of all management and educational activities, including the rationale and relevant background information for each activity, is to be maintained as an addendum to this Forest and Wildlife Management Plan.

Date	Project or Activity/Location	Rationale/Background Information



Date	Project or Activity/Location	Rationale/Background Information

