

Effingham Wetlands Mapping

A survey of the South River North and Marstin Brook East Wetland Complexes



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About The New Hampshire Natural Heritage Bureau and The Nature Conservancy

The mission of the New Hampshire Natural Heritage Bureau, a partnership of The Nature Conservancy and the State of New Hampshire, is mandated by the Native Plant Protection Act of 1987 to determine protective measures and requirements necessary for the survival of native plant species in the state, to investigate the condition and degree of rarity of plant species, and to distribute information regarding the condition and protection of these species and their habitats.

The mission of The Nature Conservancy is to protect the plants, animals, and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive.

On the cover: Heath Pond Bog Natural Area and the Pine River East Wetland Complex. Photo © Joe Klementovich

Acknowledgements

This project would not have been possible without the support of many people. A special thanks is owed to Kamal Nath, Chairman of the Effingham Conservation Commission, who has been a passionate conservationist dedicated to the future of Effingham and the protection of the town's tremendous natural resources. Kamal spearheaded and did a tremendous job managing the grant for the larger town-wide wetlands mapping project, funded through the Moose Plate State Conservation Grant Program. Rick Van de Poll, Principal of Ecosystem Management, and the principal investigator of the town-wide wetlands mapping initiative, provided advice and support on this smaller effort to identify and map exemplary wetland complexes in Effingham. Doug Bechtel from The Nature Conservancy provided advice and guidance on the project and also reviewed drafts of the report. Photo credits have been included in the text, and many thanks to Joe Klementovich (<http://www.klementovichphoto.com/>) for providing the excellent cover photo of Heath Pond Bog. This report was co-authored by Jeffrey Lougee from The Nature Conservancy and Daniel Sperduto from the New Hampshire Natural Heritage Bureau and The Nature Conservancy.

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I. Introduction and Background

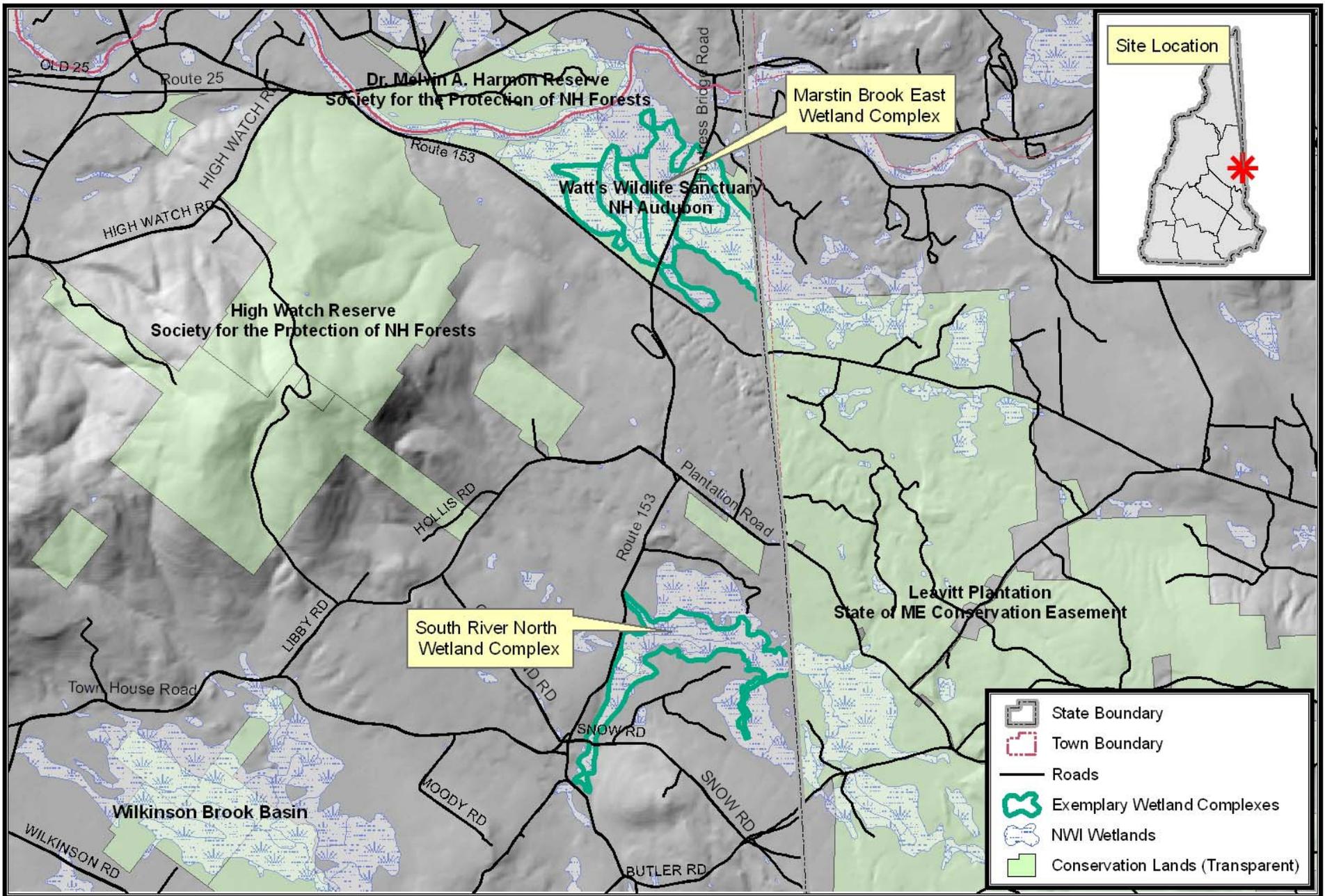
In 2005, the Town of Effingham was awarded a grant through the Moose Plate State Conservation Grant Program to map and assess the town's wetlands. To support this important project, The Nature Conservancy committed to providing match to the grant, largely consisting of in-kind staff time to:

1. Assist with documenting and mapping natural communities and rare species at two priority wetland complexes, and
2. Complete a GIS and field-based analysis of the integrity of 100 meter buffers for selected wetlands.

This report details the findings of field surveys conducted at the wetlands on the South River where it crosses the state line into Maine ("South River North"), and in the greater Watt's Wildlife Sanctuary area ("Marstin Brook East") (see Map 1). Surveys of these wetlands were completed, respectively, during the 2005 and 2006 field seasons. The survey team consisted of Daniel Sperduto, Senior Ecologist from the New Hampshire Natural Heritage Bureau (NHNHB), Jeffrey Lougee, Mt. Washington Valley Program Manager from The Nature Conservancy (TNC), Kamal Nath, Chair of the Effingham Conservation Commission (ECC). Dr. Rick Van de Poll, Principal of Ecosystem Management, joined the survey team for the South River North survey in 2005.

The Town of Effingham lies within a high priority matrix forest block identified by TNC through its ecoregional planning process. Matrix forest blocks represent the best remaining areas across the state and region to protect large, intact areas of unfragmented forests and wetlands. These areas have been shown to be critical for the protection of large mammals and other species with large home-ranges or territorial needs, as well as forest interior species, such as some song birds. Effingham lies within the 68,000+ acre Pine River Matrix Forest Block, which extends across the state line into Parsonsfield, Maine (Barbour et. al. 2000, Lougee, 2007).

In New Hampshire, The Pine River Matrix Forest Block is distinguished from other forest blocks due to the size and extent of the wetland complexes found in the block. These peatland ecosystems represent some of New Hampshire's largest and best condition wetland ecosystems. As of 2005, the NHNHB had documented two exemplary peatland ecosystems in Effingham, including the state's largest poor-intermediate level fen in the Wilkinson Brook Basin, and the



Data Sources:

Political Boundaries, NH GRANIT
 Wetland Complexes, TNC/NHNB, 2007
 NWI, National Wetlands Inventory
 Conservation Lands, Effingham Tax Maps, 2006
 Digital Elevation Model, NH GRANIT

**Map 1. Marstin Brook East and South River North Wetland Complexes
 Effingham, New Hampshire**

Scale: 1:45,000



state's largest, and highest ranked poor level fen/bog at Pine River East (Sperduto and Nichols, 2000).¹

We selected The South River North and Marstin Brook East sites for surveys due to their potential to represent additional wetlands of statewide conservation importance. These sites had not been previously surveyed by an ecologist from the New Hampshire Natural Heritage Bureau.

II. Methods

We selected the South River North and Marstin Brook East wetland complexes for surveys because of their large size, high diversity of National Wetlands Inventory (NWI) wetland types, and probability of having good condition and landscape context. We assessed these factors prior to field work by consulting USGS topographic maps, recent aerial photography, and NWI wetlands data. The combination of large size, high NWI diversity, and good condition and landscape context made these sites probable for supporting exemplary wetland natural communities and wetland ecosystems. Wetland ecosystems represent a coarser scale classification of wetlands, and may include several different wetland natural community types.²

We further prioritized survey locations within these wetland complexes using aerial photography and NWI wetlands data. Using these information sources, we designed field surveys to capture the diversity of wetland natural communities present, and to assess any areas of potential encroachment or impact into the wetland complexes.

We took a series of observation points within the wetland complexes following standard field protocols of NHHB. These observation points recorded percent cover of all plant species by strata, with notes being made on the condition and landscape context of the wetland complexes. Notes on condition include factors such as beaver activity, altered hydrology, or the presence of invasive species, while landscape context takes into account the surrounding area and the extent to which roads and/or development come within close proximity to the wetland complexes. In addition, we made notes on the surrounding upland natural communities. We recorded the location of observation points using a GPS (Global Positioning System) unit.

¹ Exemplary natural communities and ecosystems include all examples of rare types (such pine barrens) and high quality examples of common types (such as a hemlock-beech-oak-pine forest).

² For further information on the distinctions between "natural communities" and "ecosystems," please see Sperduto (2005) *Natural Community Systems of New Hampshire*. An online version of the report can be found at:

<http://www.dred.state.nh.us/divisions/forestandlands/bureaus/naturalheritage/documents/Finalsystemsreport.pdf>

We used field data to document the natural communities present in each wetland complex, and to also identify the larger wetland ecosystem type. We then ranked the wetland ecosystem using standard NHHNB methods to evaluate the size, condition, and landscape context of the system. We then assigned an overall rank to each system, giving it a ranking of either "Excellent" (A rank), Good (B rank), Fair (C rank), or Poor (D rank). We used these ranks to determine if the natural communities, or wetland ecosystems present represented "exemplary" examples (see Appendix I for an explanation of the ranking process).

We mapped the natural community and wetland ecosystem boundaries using field data, USGS topographic maps, and 2006 true color aerial photography. This information has been added to the New Hampshire Natural Heritage Program's "Biotics" database.

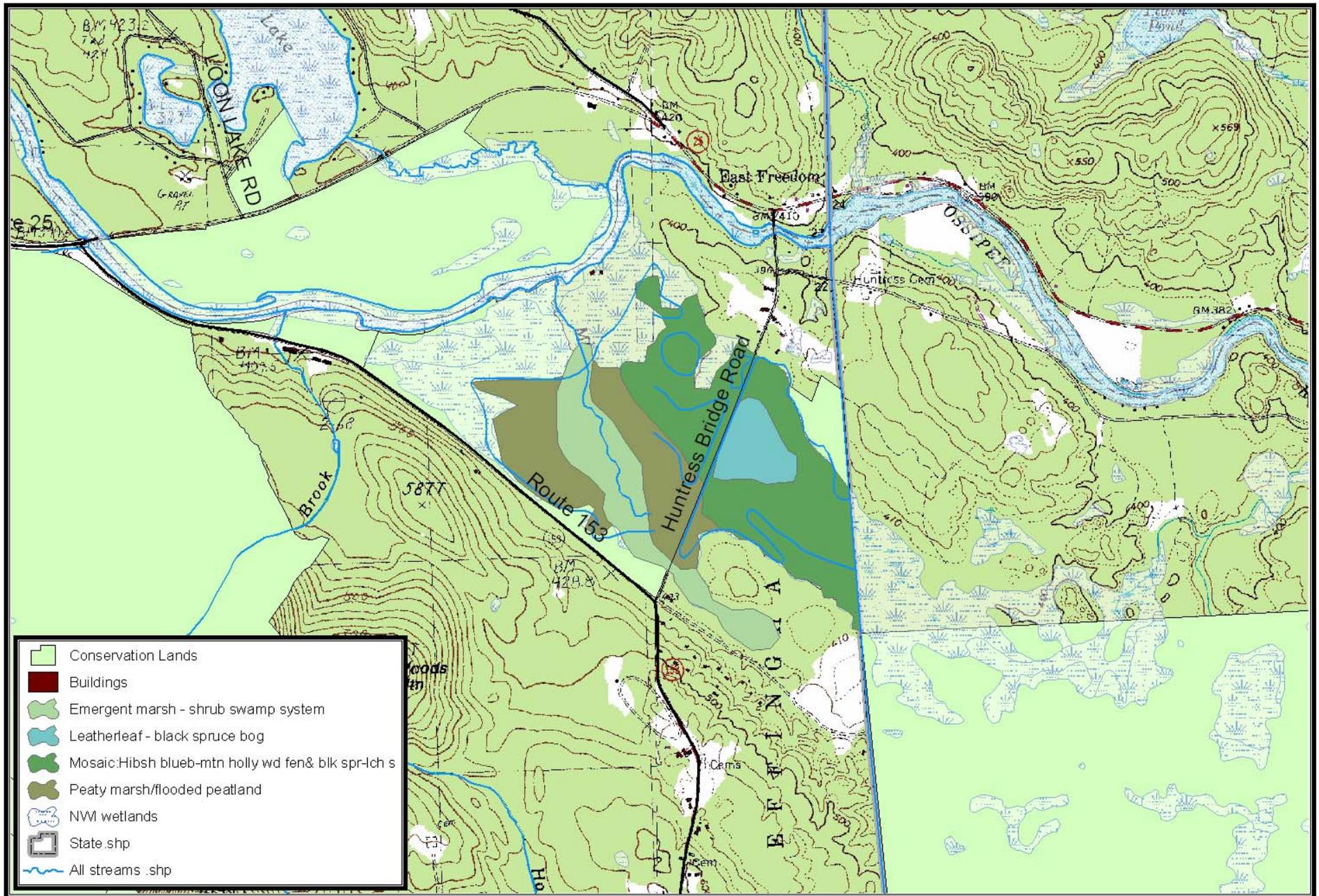
III. Results

Both the South River North and Marstin Brook East sites include exemplary wetland ecosystems. Tables 1 and 2 below summarize the findings for these sites. For a full description of the wetland natural communities and wetland ecosystems, please see Sperduto and Nichols (2004), Natural Communities of New Hampshire, and Sperduto (2005), Natural Community Systems of New Hampshire.

Marstin Brook East

The Marstin Brook East peatland is found on either side of Huntress Road from about 0.35 to 0.8 miles from the roads southern junction with Rt. 153 (see Map 2). The open bog portion of the system (leatherleaf – black spruce bog) can be accessed by going southwest from the road between 0.4 to 0.65 miles from Rt. 153. The swamp and shrub fen communities of this system surround the 26 acre leather-leaf bog to the northwest and southeast. The portion of the wetland adjacent to the system, further to the southwest, and closer to Marstin Brook is not part of the fen/bog system, although it is linked hydrologically.

Huntress road may have had some limited effect on the hydrology of this wetland, but perhaps not to a high degree as drainage is very slow and probably dominated by a south or southwestern directional flow that has not resulted in a major impounding effect. Beavers have probably had more effect on southwest side of the boundary towards Marstin Brook.



Data Sources:

Political Boundaries, NH GRANIT
 Wetland Complexes, TNC/NHNHB, 2007
 NWI, National Wetlands Inventory
 Conservation Lands, Effingham Tax Maps, 2006
 Buildings, Effingham Tax Maps, 2006
 Rivers and Streams, NH GRANIT

Map 2. Marstin Brook East Wetland Complex - Natural Communities Effingham, New Hampshire

Scale: 1:24,000



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| Table 1. Marstin Brook East Site Summary | |
|--|--|
| Ecosystem Type | Poor level fen/bog system (S3) |
| Size | 185 acres |
| Component Natural Communities | |
| Leather-leaf – black spruce bog (S3) | 26 acres |
| Highbush blueberry – mountain holly wooded fen (S3 S4) | These two communities form a 158 acre mosaic |
| Black spruce – larch swamp (S3) | |
| Ecosystem Rank | |
| Size | B |
| Condition | B |
| Landscape Context | B |
| Overall EO Rank | B “Exemplary” |
| Ecosystem Type | |
| | Emergent marsh – shrub swamp system |
| Size | 164 |
| Component Natural Communities | |
| Shallow, deep, and medium depth emergent marshes (various types) | 67 acres |
| Peaty marsh | 97 acres |
| Ecosystem Rank | Not ranked |

This poor level fen/bog system consists of three primary natural communities. The central and most open portion of the peatland has a classic example of a **leather-leaf - black spruce bog**, dominated by heath shrubs and scattered 1-4 m tall *Picea mariana* (black spruce) and *Larix laricina* (eastern larch). This community is the closest thing NH has to “muskeg” more common in boreal



Leather-leaf - black spruce bog, Marstin Brook East.
Dan Sperduto © Photo

Canada, with some of the spruce having the characteristic short, top-heavy “lolly-pop” form. Black spruce is generally more abundant than red spruce, which along with the dominance of heath shrubs, only a few sedge species, and no forbs is indicative of the very poor nutrient status of the peat soils. The dominant shrubs are *Chamaedaphne calyculata* (leather-leaf), *Gaylussacia baccata* (black huckleberry), *Kalmia angustifolia* (sheep laurel), and *Rhododendron canadense* (rhodora). Others include *Ledum groenlandicum* (Labrador tea), *Kalmia polifolia* (bog laurel), *Andromeda polifolia* var.

glaucophylla (bog rosemary), and *Nemopanthus mucronatus* (mountain holly). Peat mosses include *Sphagnum angustifolium* and *Sphagnum magellanicum*, among several others.



Black spruce - larch swamp, Marstin Brook East
Dan Sverduto © Photo

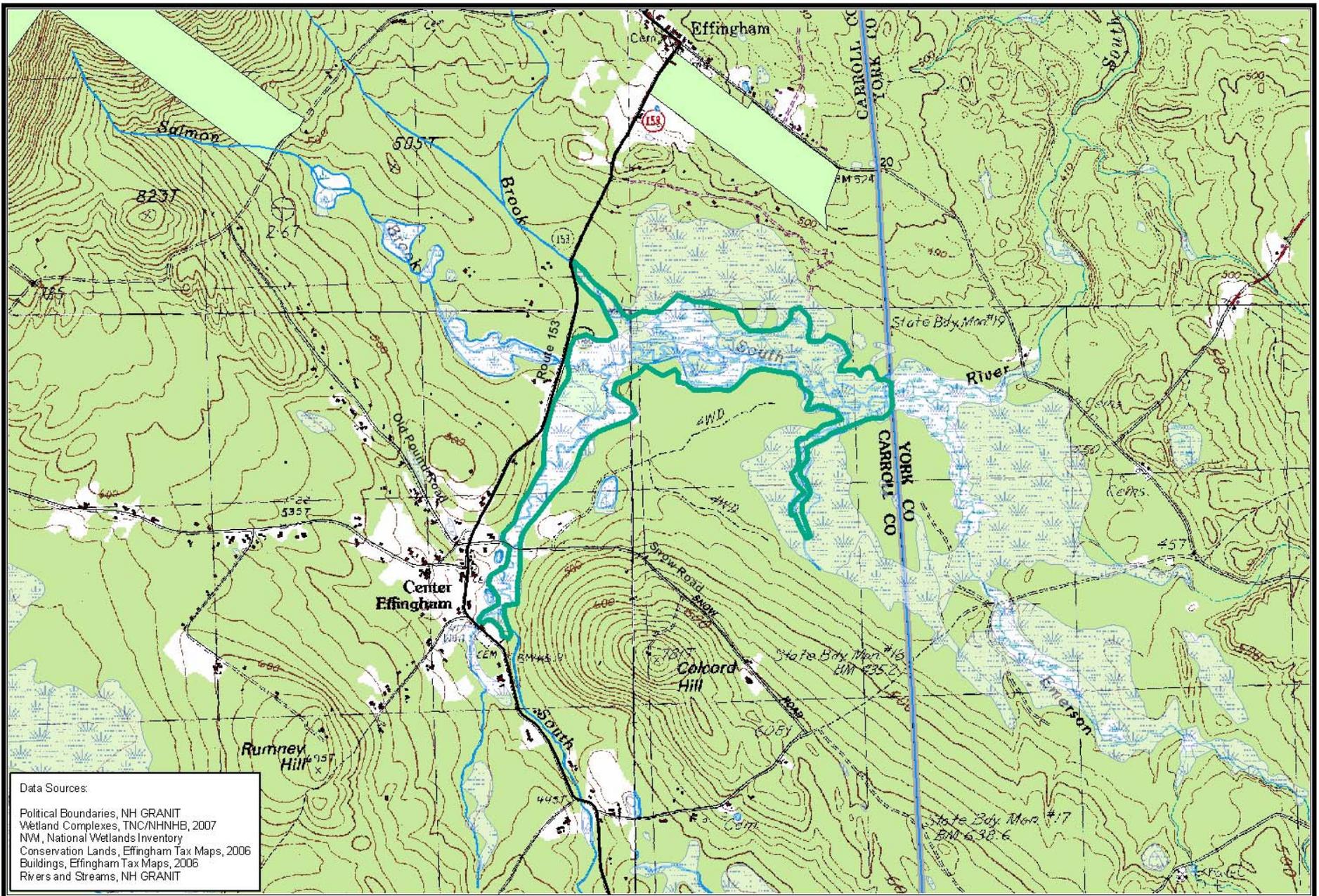
This leather-leaf black spruce bog transitions to more wooded areas consisting of a mosaic of two communities, **highbush blueberry - mountain holly wooded fen** and **black spruce - larch swamp**. The shrub fen is dominated by tall peatland shrubs, a sparse cover of tall black spruce and larch (to 10-15 m), more abundant herbaceous cover than the leatherleaf black spruce bog, and abundant sphagnum. The

swamp is similar but has higher and often taller tree cover than the shrub fen. Species found in both include black spruce and larch, mountain holly, *Gaylussacia baccata* (black huckleberry), rhodora, *Viburnum nudum* var. *cassinoides* (witherod), *Photinia melanocarpa* (black chokeberry), *Osmunda cinnamomea* (cinnamon fern), *Carex trisperma* var. *trisperma* (three-seeded sedge), and *Maianthemum trifolium* (three-leaved false Solomon's seal), and *Sphagnum fallax*.

South River North

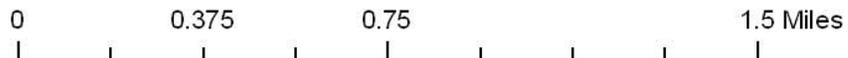
The South River North wetland complex is a large, diverse, and high quality marsh system along the very low gradient, meandering banks of the South River (see Map 3). Many marsh and shrub swamp communities are present ranging from aquatic bed communities at one end of the gradient to shrub thickets and seasonally flooded swamps at the other. Where the drainage is more stagnant and less prominently flooded (backwater coves and sluggish inlet streams), the marsh communities transition to fens, creating a shifting mosaic throughout the greater wetland complex. In areas marginal to surrounding uplands, where more seepage or perennially saturated soils are encountered, herbaceous seepage marshes occur.

Some of the dominant species in these various marsh communities include *Carex lacustris* (lake sedge), *Carex stricta* (tussock sedge), *Carex vesicaria* (inflated sedge), *Carex echinata* (prickly sedge), *Carex utriculata* (bottle-shaped sedge), *Calamagrostis canadensis* (bluejoint), *Glyceria canadensis* (rattlesnake manna grass), *Euthamia graminifolia* (flat-topped goldenrod), *Osmunda regalis* var. *spectabilis* (royal fern), *Clematis virginiana* (virgin's bower), *Alnus incana*



Map 3. South River North Wetland Complex
Effingham, New Hampshire

Scale: 1:24,000



-  Conservation Lands
-  Buildings
-  South River North Wetland Complex
-  NWI Wetlands
-  Rivers and Streams
-  State Boundary



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ssp. *rugosa* (speckled alder), *Viburnum lentago* (nannyberry) *Spiraea alba* var. *latifolia* (eastern meadowsweet), *Sparganium americanum* (lesser bur-reed) and *Vallisneria americana* (tapegrass).

| Table 2. South River North Site Summary | |
|---|-------------------------------------|
| Ecosystem Type | Emergent marsh – shrub swamp system |
| Size | 158 Acres |
| Component Natural Communities | |
| Tall gramanoid emergent marsh (S4) | |
| Peaty marsh (S4) | |
| Medium-depth emergent marsh (S4) | |
| Aquatic bed (S4S5) | |
| Herbaceous seepage marsh (S3) | |
| Mixed tall gramanoid – scrub-shrub marsh (S4S5) | |
| Highbush blueberry – winterberry shrub thicket (S4) | |
| Alder alluvial shrubland (S3) | |
| Alder – dogwood – arrowwood alluvial thicket (S4) | |
| Seasonally flooded red maple swamp (S4S5) | |
| Deep emergent marsh – aquatic bed (S4S5) | |
| Sweet gale – meadowsweet – tussock sedge fen (S4) | |
| Hairy-fruited sedge – sweet gale fen (S3) | |
| Ecosystem Rank | |
| Size | A- |
| Condition | B+ |
| Landscape Context | B |
| Overall EO Rank | B+ “Exemplary” |

The upland areas were not surveyed, but the forest to the south of the river contains at least some area of interesting lowland conifer flats, containing **red pine - white pine - balsam fir forest (S3)** and perhaps a southern expression of **lowland spruce – fir forest (S3)**, a natural community more commonly found further



Tall gramanoid emergent marsh, South River North
Jeffrey Lougee © Photo

north. These communities may grade together and be quite extensive on these “conifer” flats to the south of the river. Further investigation is needed in this area to determine the extent and distribution of these communities. Occurrences of lowland spruce – fir forest or swamp, mixing with pine may represent a natural community type currently not well described in the state.

IV. Discussion

Both the South River North and Marstin Brook East sites include exemplary wetland ecosystems of statewide conservation importance. The Marstin Brook East poor level fen/bog system is one of the largest in the state at 185 acres, and also includes one of the state’s largest occurrences of a leather-leaf – black spruce bog natural community at 26 acres. Both the poor level fen/bog ecosystem and the leather-leaf – black spruce bog natural community are considered rare in New Hampshire, and ranked “S3” by NHNHB, meaning there are generally between 21-100 occurrences across the state (see Appendix II for an explanation of state and global rarity ranks).

While the emergent marsh – shrub swamp system found at the South River North site is a common wetland ecosystem in New Hampshire, this occurrence is distinguished by its large size, and very high diversity of embedded natural communities. Of the thousands of occurrences in the state of this ecosystem type, less than 200 are larger than 150 acres in size.

Most the South River North site was historically flooded, and the 1937 USGS topographic map shows this area as “Lords Pond.” This flooding was undoubtedly the result of beaver impoundment, which is likely to happen again in the future at the site. Many sites like this have a repeated and periodic presence of beavers spread out over very long intervals. Based on USGS

topographic maps, the site appears to be a marsh since at-least 1944.

Threats

While the condition and landscape context of both wetland complexes was deemed to be good to excellent, several issues that impacted the scoring are worth noting. At the Marstin Brook East site, clearly the presence of



Marstin Brook East and the Greater Watt’s Wildlife Sanctuary with the Ossipee River in the foreground
Joe Klementovich © Photo

Huntress Bridge Road is a significant fragmenting feature, even though it may not be markedly affecting the hydrology. The road is a potential source of contaminants from vehicle use, may cause increased salinity along the road due to wintertime salting, and more importantly may serve as a vector for the introduction and spread of invasive plant species. Roads are known to be one of the primary means by which invasive species become established.

During the field survey, two populations of invasive plant species were observed with the larger Marstin Brook East site, although both were associated with the emergent marsh – shrub swamp system rather than the exemplary poor level fen/bog system. These populations included a large patch of common reed (*Phragmites australis*) within the Watt’s Wildlife Sanctuary, and a smaller occurrence of Japanese knotweed (*Polygonum cuspidatum*) along the roadside on Route 153. It will be important to monitor these populations over time and take steps to prevent their spread.

At the South River North site, the condition of the wetland complex was found to be good to excellent, although a few scattered *Lythrum salicaria* (purple loosestrife) were observed.



South River Marsh with Center Effingham in the Background
Jeffrey Lougee © Photo

However, in general this species and other wetland invasive plants were uncommon throughout the wetland complex, an indicator of a minimally disturbed wetland. These plants were uprooted when found and deposited in a tree in order for the plant to die and prevent shoots from further spreading the plant. The landscape context of the South River North site is good on the south and eastern side of the complex where the land is relatively undisturbed, while to the north and west, development and intensive forestry practices have degraded the buffers to the complex to some degree.

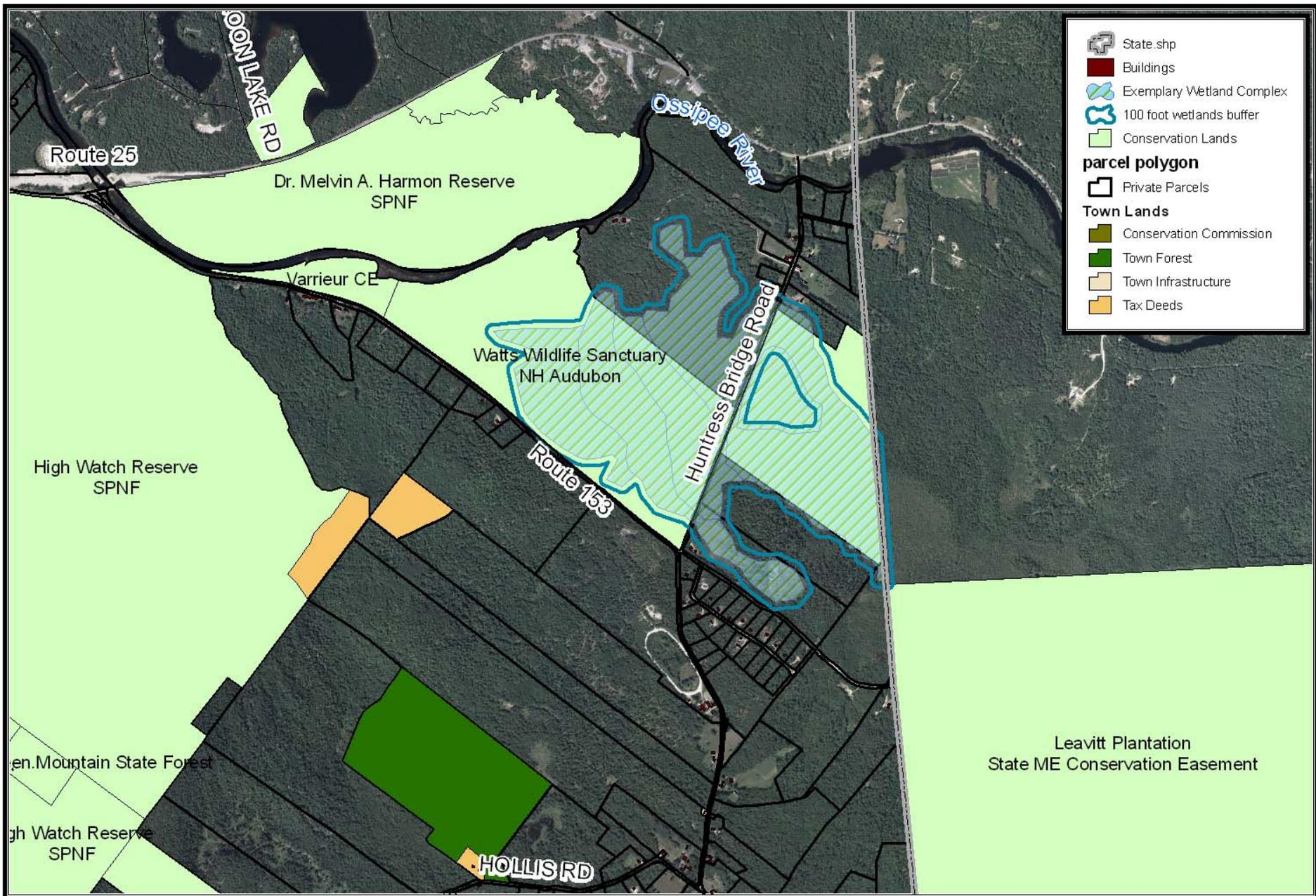
V. Current Protection Status and Recommendations

Table 3 below shows the current protection status of the Marstin Brook East and South River North sites. There are currently 428 acres of conservation land between the two sites, with the vast majority being the Watt’s Wildlife Sanctuary, owned and managed by NH Audubon, at Marstin Brook East.

| Table 3. Protection Status of Marstin Brook East and South River North | | | |
|---|--------------------|------------------------|------------------------------|
| Marstin Brook East | Total Acres | Acres Protected | Acres to be Protected |
| Poor level fen/bog ecosystem | 185 | 118 | 67 |
| Emergent marsh – shrub swamp ecosystem | 164 | 137 | 27 |
| South River North | | | |
| Emergent marsh – shrub swamp ecosystem | 158 | 9.8 | 148.2 |

Maps 4 and 5 show the current protection status and land ownership in the vicinity of Marstin Brook East and South River North. Future expansions of the Watt’s Wildlife Sanctuary will help to further protect Marstin Brook East, while a significant portion of the South River North site could be protected by putting a portion of town owned property on the south side of the complex under the management of the conservation commission. This 298 acre property owned by the town includes approximately 42 acres of the 158 acre South River North complex. This tract also includes the lowland “conifer flats” describe above, and may harbor exemplary occurrence of rare lowland spruce – fir forest and swamp, and red pine – white pine – balsam fir forest. Depending upon how these communities grade together, this property may include an example of a natural community not well described in the state, and uncommon elsewhere in New Hampshire.

It is important to note that the Marstin Brook East area serves as an important corridor between the undeveloped areas on Green Mountain, and the 9,000 acre Leavitt Plantation in Parsonsfield Maine. This area represents an excellent opportunity to link the Society for the Protection of New Hampshire Forest’s Highwatch Preserve with the Leavitt Plantation. This protected area would serve as an important wildlife corridor across the state line, and help to maintain the important ecological values of the Pine River Matrix Forest Block.

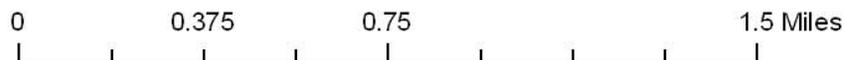


Data Sources:

Political Boundaries, NH GRANIT
 Wetland Complexes, TNC/NHNHB, 2007
 Conservation Lands, Effingham Tax Maps, 2006
 Buildings, Effingham Tax Maps, 2006
 Parcel Data, Effingham Tax Maps, 2006
 Air photography, USDA, 2003

Map 4. Marstin Brook East Wetland Complex - Land Ownership Effingham, New Hampshire

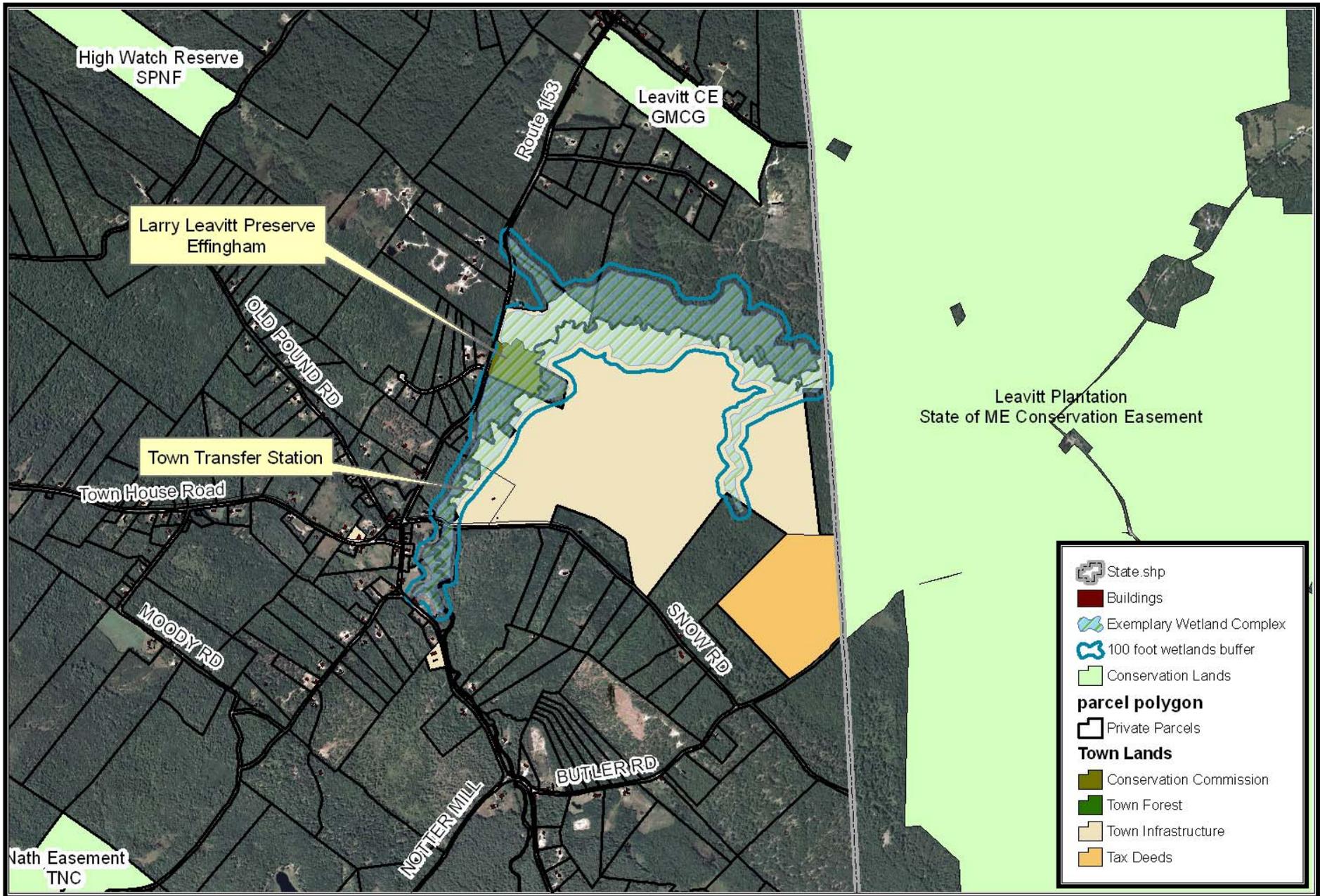
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Data Sources:

Political Boundaries, NH GRANIT
 Wetland Complexes, TNC/NHNB, 2007
 Conservation Lands, Effingham Tax Maps, 2006
 Buildings, Effingham Tax Maps, 2006
 Parcel Data, Effingham Tax Maps, 2006
 Air photography, USDA, 2003

Map 5. South River North - Land Ownership Effingham, New Hampshire

Scale: 1:24,000



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VI. Information Sources

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Appendix I. Explanation of Ranking Process for Exemplary Natural Communities³

EXEMPLARY NATURAL COMMUNITIES

NHB places particular emphasis on and gives conservation priority to “exemplary” natural communities. Exemplary natural communities include all examples of rare types (such as a rich mesic forest) and high-quality examples of common types. High-quality natural communities are identified as having relatively little human impact. These areas have greater potential to contain or achieve natural dynamics that are characteristic of the original community types. A forested natural community need not be “old growth” to obtain exemplary status. Typical exemplary forested natural communities have a variety of characteristic species, natural regeneration within forest gaps, multiple age classes, diverse structural characteristics, abundant standing and fallen woody debris, intact soil processes, and little direct evidence of human disturbance. Such characteristics can only be studied, preserved, and understood by having appropriate reference sites. Further, exemplary natural communities represent the best remaining examples of New Hampshire's flora, fauna, and underlying ecological processes. The effects of natural disturbances, such as the 1998 ice storm, do not preclude any natural community from being designated exemplary. Damages caused by natural disturbances, including ice storms, blowdowns, and fire, are part of the suite of natural processes influencing natural community dynamics. We take disturbance such as heavy ice damage into account when assessing natural communities, but if a community also displays exemplary attributes, including minimal human influence, then we are likely to classify it as such.

RARITY

NHB considers the rarity of a natural community or a species both within New Hampshire and across its total range. We identify the degree of rarity within New Hampshire with a state rank and throughout its range with a global rank. Ranks are on a scale of 1 to 5, with a 1 indicating critical imperilment, a 3 indicating that the species or natural community is uncommon, and a 5 indicating that the species or natural community is common and demonstrably secure. Species and natural communities considered to be globally rare or state rare are those designated G1-G3 or S1-S3, respectively. Some species are rare both globally and in New Hampshire (e.g., G2 S1), while others are common elsewhere but rare in New Hampshire (e.g., G5 S1). Many communities have not

³ This Appendix has been provided by the New Hampshire Natural Heritage Bureau

been assigned global ranks at this time, pending a comprehensive review of their status and distribution range-wide.

QUALITY RANKS

In addition to considering the rarity of a natural community or species as a whole, NHB ranks the quality of individual natural community occurrences and rare plant populations. These "Quality Ranks" give a more detailed picture of significance and conservation value. Quality ranks are based on the *size*, *condition*, and *landscape context* of a natural community or rare species population. These terms collectively refer to the integrity of natural processes or the degree of human disturbances that may sustain or threaten long-term survival. There are four quality ranks:

Rank Description

- A **Excellent Occurrence:**** An A-ranked natural community is a large example nearly undisturbed by humans or which has nearly recovered from early human disturbance and will continue to remain viable if protected. An A-ranked rare species occurrence is large in both area and number of individuals, is stable, exhibits good reproduction, exists in a natural habitat, and is not subject to unmanageable threats.
- B **Good Occurrence:**** A B-ranked community is still recovering from early disturbance or recent light disturbance by humans and/or may be too small in size to be an A-ranked occurrence. A B-ranked population of a rare species occurrence is at least stable, grows in a minimally human-disturbed habitat, and is of moderate size and number.
- C **Fair Occurrence:**** A C-ranked natural community is in an early stage of recovery from disturbance by humans and/or a small sized representative of the particular type of community. A C-ranked population of a rare species is in a clearly human-disturbed habitat and/or small in size and/or number, and possibly declining.
- D **Poor Occurrence:**** A D-ranked natural community is severely disturbed by humans, its structure and composition are greatly altered, and recovery is unlikely. A D-ranked occurrence of a rare species is very small, has a high likelihood of dying out or being destroyed, and exists in a highly human-disturbed and vulnerable habitat.

For example, consider a population of a rare orchid growing in a bog that has a highway running along one border. The population may be large and apparently healthy (large *size* and intact *condition*), but the long-term threats posed by disturbance at the bog's edge – its low-quality *landscape context* (pollution from

cars and roads, road-fill, garbage, altered hydrology, reduced seed dispersal, etc.) – may reduce the population's long-term viability. Such a population of orchids would receive a lower rank than a population of equal *size* and *condition* in a bog completely surrounded by a forest (i.e., with a higher quality *landscape context*).

NHB, in collaboration with other state heritage programs and The Nature Conservancy, is working to develop quality rank specifications for all of New Hampshire's natural communities and rare plant species. Unfortunately, limited time and incomplete knowledge, both on local and global scales, have prevented the development of thoroughly tested and peer reviewed quality rank specifications for most of New Hampshire's natural communities and rare species.

In the absence of rank specifications for each natural community, NHB uses broad guidelines for assigning preliminary quality ranks. The guidelines for assessing the size, condition, and landscape context for natural communities are described below.

SIZE

Occurrence size is a quantitative measure of area occupied by a species or natural community and accounts for such factors as population abundance, fluctuation, density, and area of occupancy for species. All else being equal, the larger a natural community is, the more viable it will be. Large size is correlated with increased heterogeneity of internal environmental conditions, integrity of ecological processes, species richness and size of constituent species populations and their respective viability, potential resistance to change, resilience against perturbations, and ability to absorb disturbances. Size is used in a relative sense with respect to the range of sizes exhibited by the particular natural community type.

CONDITION

Condition is a combined measure of the quality of reproduction (for species), development/maturity (for communities), degree of integrity of ecological processes, species composition, biological and physical structure, and abiotic physical factors within the occurrence. For example, old growth forests with little anthropogenic disturbance and intact biotic and abiotic factors, structures, and processes, would warrant an "A" rank for condition regardless of size.

Excellent Condition: Old growth or minimally disturbed by human impacts with recovery essentially complete, or in the case of disturbance-maintained communities (e.g., pitch pine/scrub oak barrens), the natural disturbance regime has prevailed continuously with no significant or irreversible

alterations by humans; ecological processes, species composition, and structural features are intact.

Good Condition: Mature examples with only minor human impacts or good potential for recovery from relatively minor past human impacts; ecological processes, species composition, and structural features are largely intact.

Fair Condition: Immature examples or those with significant human impacts with questionable recovery potential or in need of significant management and/or time to recover from present condition; ecological processes, species composition, and structural features have been altered considerably but not to the extent that the occurrence is no longer viable if managed and protected appropriately.

Poor Condition: Little long term viability potential.

LANDSCAPE CONTEXT

Landscape context is a combined measure of (a) the quality of landscape structure, (b) the extent (including genetic connectivity), and (c) the condition of the surrounding landscape that influences the occurrence's condition and viability. Dynamic natural community occurrences have a better long-term viability when they are associated with large areas of diverse habitat that support dynamic ecosystem processes. Potential factors to be considered include: (a) the degree of landscape fragmentation; (b) the relationship of a natural community to contiguous wetland or upland natural communities; (c) the influence of the surrounding landscape on susceptibility to disturbance; (d) the relative position in a watershed; (e) susceptibility of the occurrence to pollutants and hydrologic change (Chase *et al.* 1995); and (f) the functional relationship of the natural community to surrounding natural landscape features and larger-scale biotic and abiotic factors. For example, open peatlands are extremely sensitive to nutrient input, basin swamps are moderately sensitive, and streamside/riverside communities and seepage swamps are less sensitive. In general, landscape condition is weighted towards the immediate 30-300 m (100-1000') buffer area around the natural community where direct impacts of land use may be most significant. The adjacent 1.6-3.2 km² (1-2 mi²) area or relevant watershed area around the natural community is considered to a lesser degree. In turn, the larger area beyond the relevant watershed receives the least consideration. The actual size applied for a natural community varies according to the characteristics of the particular natural community and the specific context of the occurrence in the landscape.

Excellent Landscape Context: Natural community is embedded in a matrix of undisturbed, unfragmented surrounding natural communities that

have functional connectivity to the occurrence; past human disturbances that potentially influence the community are minimal or negligible.

Good Landscape Context: Surrounding landscape is largely intact and minimally fragmented, or human disturbance/fragmentation is of a configuration and magnitude that is consistent with maintaining the current condition of the occurrence, or disturbances can be managed to achieve viability.

Fair Landscape Context: Significant human impacts, development, fragmentation, and other disturbances characterize the landscape around the natural community and may affect the long term viability and condition of the occurrence.

Poor Landscape Context: Functional human impacts, fragmentation and loss of natural communities dominate the surrounding landscape; the occurrence is probably not viable, even with management.

Appendix II. Explanation of State and Global Ranks

Ranks describe rarity both throughout a species' range (globally, or "G" rank) and within New Hampshire (statewide, or "S" rank). The rarity of sub-species and varieties is indicated with a taxon ("T") rank. For example, a G5T1 rank shows that the species is globally secure (G5) but the sub-species is critically imperiled (T1).

| <i>Code</i> | <i>Examples</i> | <i>Description</i> |
|-------------|-----------------|---|
| 1 | G1 S1 | Critically imperiled because extreme rarity (generally one to five occurrences) or some factor of its biology makes it particularly vulnerable to extinction. |
| 2 | G2 S2 | Imperiled because rarity (generally six to 20 occurrences) or other factors demonstrably make it very vulnerable to extinction. |
| 3 | G3 S3 | Either very rare and local throughout its range (generally 21 to 100 occurrences), or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction because of other factors. |
| 4 | G4 S4 | Widespread and apparently secure, although the species may be quite rare in parts of its range, especially at the periphery. |
| 5 | G5 S5 | Demonstrably widespread and secure, although the species may be quite rare in parts of its range, particularly at the periphery. |
| U | GU SU | Status uncertain, but possibly in peril. More information needed. |
| H | GH SH | Known only from historical records, but may be rediscovered. A G5 SH species is widespread throughout its range (G5), but considered historical in New Hampshire (SH). |
| X | GX SX | Believed to be extinct. May be rediscovered, but evidence indicates that this is less likely than for historical species. A G5 SX species is widespread throughout its range (G5), but extirpated from New Hampshire (SX). |

Modifiers are used as follows.

| <i>Code</i> | <i>Examples</i> | <i>Description</i> |
|-------------|-----------------|--|
| Q | G5Q GHQ | Questions or problems may exist with the species' or sub-species' taxonomy, so more information is needed. |
| ? | G3? S3? | The rank is uncertain due to insufficient information at the state or global level, so more inventories are needed. When no rank has been proposed the global rank may be "G?" or "G5T?" |

When ranks are somewhat uncertain or the species' status appears to fall between two ranks, the ranks may be combined. For example:

| | |
|------------|--|
| G4G5 | The species may be globally secure (G5), but appears to be at some risk (G4). |
| G5T2T3 | The species is globally secure (G5), but the sub-species is somewhat imperiled (T2T3). |
| G4?Q | The species appears to be relatively secure (G4), but more information is needed to confirm this (?). Further, there are questions or problems with the species' taxonomy (Q). |
| G3G4Q S1S2 | The species is globally uncommon (G3G4), and there are questions about its taxonomy (Q). In New Hampshire, the species is very imperiled (S1S2). |