NRI: Table of Contents

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NRI: Introduction

1.1 Purpose of this Study

The purpose of this study is to provide a detailed inventory and analysis of natural resources in the environmentally sensitive area of New Ipswich, New Hampshire This area is approximately 32.5 square miles and includes land within the Souhegan, Squanacook, Millers, and Contoocook River watersheds. The information and analysis in this report is intended for four purposes:

1. To provide a compiled summary of the town's important natural resources.
2. To serve as the technical basis to support future comments or advocacy work related to the review of development projects in the area.
3. To provide a framework to help in developing a plan to manage and protect natural resources. This framework will allow the town to:
    - Set baselines of natural resources
    - Monitor current natural resources against baseline of natural resources
    - Integrate NRI with other town planning, minimizing impact on natural resources
4. To identify a set of priorities for natural resource protection:
    - What priorities should be set for the natural resources relative to each other (e.g. open space vs. wetlands)?
    - What priorities do we set between entities within a specific natural resource?
    - Which lands should be protected before other lands?
    - Which wetlands should be protected before other wetlands?
    - Helps to utilize scarce human and scarce economic resources more effectively
5. To evaluate existing management of natural resources:
6. To provide a compiled summary of the town's important natural resources.
    - Has existing level of protection saved encroachment on wetlands?
    - Have existing practices caused us to lose valuable habitat?
    - Has the quality of our surface water been declining?
    - Are town forests being managed effectively (i.e. for timber, habitat, recreation, revenue)?
7. To provide a guide for future municipal planning.
8. To aid in creating and refining town [state] policies and regulations
    - Do we need a stronger Wetland Buffer Ordinance?
    - Do we need a stronger Stream Buffer Ordinance?
    - Do we need a stronger Steep Slope Ordinance?
    - Do we need an Open Space Plan?
    - Do we need new or stronger state regulation?
9. To provide shareable information for:
    - Open space planning

- Greenway/wildlife corridor planning
- Trails system planning
- Parks and Ball Fields planning
- Planning Board
- Land Trusts
- Regional Planning Commission
- Other local/regional/state organizations

1.2 Study Area

New Ipswich occupies approximately 32.5 square miles in southwestern Hillsboro County. It is located in two ecoregions, the Southern New England Coastal Plains and the Vermont-New Hampshire Upland. The town is mostly forested with scattered farmsteads and fields occupying flatter areas. New Ipswich is composed of a series of small villages, with several located along the banks of the Souhegan River. Development pressures have recently increased, with several new subdivisions as well as scattered individual houses constructed.

1.3 Scope of the Study

This report was prepared by Daylor Consulting Group, Inc. of Braintree, Massachusetts ("Daylor"), Daylor's scope of work for this project included four major components:

1. Compiling and synthesizing existing databases and new sources related to natural resources and open space in the study area. This information is presented in sections 2, 3, and 4 of this report.
2. Field verification of these data sources and field acquisition of new information.
3. Integrating these data into composites or overlays and producing a series of maps derived from these data.
4. Documenting the methodology and findings of the natural resource inventory in a report, with prioritization of undeveloped lands for conservation planning.

1.4 Data Sources

In preparing this report, Daylor consulted a wide variety of existing data sources, including water quality and hydrologic studies, habitat studies from the state and from non-profit conservation groups and other sources, and from discussions with knowledgeable persons in the area. In addition, Daylor obtained geographic data in electronic GIS format from the Southwest Regional Planning Office and GRANIT, New Hampshire's statewide GIS provider. Although numerous sources were consulted as part of this study, this report cannot be considered an exhaustive

review of all data relevant to the study area. For more detailed information on the study area, the reader should consult the sources cited throughout this report and listed in Appendix A: References

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NRI: Natural History

New Ipswich is characterized by rugged, hilly terrain interspersed with gently rolling woodlands, open fields, stream corridors, and wetlands. At the western side of the town, the land rises abruptly along the north – south oriented Wapack Mountain range. The topography and consequential landscape of the town is controlled by the underlying bedrock and unconsolidated surficial geologic units. Fitted into this matrix of woods, fields, and wetlands is the community of New Ipswich, comprised of small villages.

2.1 Geology & Soils

2.1.1 Geology

Bedrock Geology

The bedrock in New Ipswich is comprised of three major geologic units, the metamorphic Littleton and Paxton Formations, and the igneous Fitchburg Plutonic Complex. The metamorphic bedrock types are silky-gray weathering feldspathic and sulfidic schists that have undergone only limited change from the original silt and mud sedimentary rocks from which they formed. The metamorphic bedrock was intruded by granites and tonolite, which was later deformed by uplift and folding. The more resistant of these rock types are responsible for the bedrock hills and outcrops in town.

Steep slopes, shallow water tables, shallow bedrock and hilly terrain used to be considered impediments to building. With modern equipment and current land prices, many parcels that were considered undevelopable in the past are now being developed by the introduction of large amounts of fill to provide separation for septic systems from ground water and deep cuts to facilitate roads and driveways. Septic outbreaks on these slopes may become more prevalent as building continues. Cut and fill operations may destabilize slopes resulting in increased bank failures with resultant erosion and sedimentation. These areas are becoming increasingly threatened as the demand for houses with scenic views of the Monadnock region overrides the higher costs of development.

Surficial (Glacial) Geology

During the Pleistocene Epoch, which began about 2 million years ago, glaciers advanced from the north. Evidence indicates that at least four advances and subsequent retreats occurred. The last glacial advance reached its maximum extent about 25,000 years ago, thereafter retreating to a position north of the Town 14,000 years ago. Most of the depositional and structural features were formed during the last glacial retreat.

There are three main classes of unconsolidated deposits in New Ipswich: glacial till, stratified drift, and alluvium. Most of the town is covered with varying depths of glacial till. Stratified drift deposits, where present, has been mined for sands and gravels.

Glacial till is a dense, heterogeneous, poorly sorted mixture of clay, silt, sand and subangular rocks and boulders that was smeared over bedrock by the overriding ice (dense till), or the same mix of particle sizes released from ice that melted in place (ablation till). This glacial till now forms a mantle over the bedrock averaging 20 feet in thickness on the uplands.

Stratified drift deposits are sorted, layered material deposited by glacial meltwater streams. Fine-grained deposits were deposited by low-energy, slower moving streams, and were generally carried further from the face of the receding glacier. Coarse sands and gravels were deposited by higher energy, fast flowing water near the face of the glacier. Most of the areas in town that are now borrow pits were formed as kames and kame terraces from sediments that flowed laterally across the melting ice lobes or outwash plains from materials deposited between the melting ice and bedrock hills or ice-dammed streams.

These sand and gravel deposits have great water storage capacity and have great potential as water yielding aquifers or recharge zones.

2.1.2 Soils

Soils form as the result of the interaction of five major factors: climate, parent material, plant and animal life, topography and time. The relative importance varies from place to place and one or more of the factors may dominate the kind of soil that forms in a particular area. In New Ipswich, the differences in parent material, drainage, topography and time have had the greatest influence in forming the various soils that have formed.

More than two-thirds of the soils in the study area formed in moderately coarse or coarse textured glacial till, but the characteristics of these soils differ greatly. Marlow, Monadnock, Becket, and Lyman soils formed in glacial till. Adams, Colton, and Naumburg soils formed in coarse textured glacial outwash. Ondawa, Podunk, and Rumney soils formed in alluvium on floodplains. These are medium and moderately coarse textured and have only slight profile development. Greenwood and other muck and peat soils formed in organic deposits that have accumulated in depressional areas since the retreat of the last ice sheet.

The predominant soil associations within the study area are the Monadnock-Lyme and Monadnock-Lyme-Tunbridge Associations. Both of these associations have loamy soils on uplands. The Monadnock-Lyme ranges from nearly level to steep topography, and has well drained to poorly drained drainage characteristics. The Monadnock-Lyme-Tunbridge association ranges from gently sloping to steep, and the drainage characteristics include well drained and somewhat excessively drained. The Marlow-Peru and Colton-Adams-Naumburg soil associations occupy lesser amounts of the town, but are of great importance. The Marlow-Peru association occurs from north to south near the center of the town. It has very deep soils, is nearly level to steep topographically, is well drained and moderately well drained, has loamy soils, and is located on uplands. The Colton-Adams-Naumburg association occurs at the northwestern corner of the town in the Tophet swamp area. This has very deep soils, ranges from moderately level to steep, with drainage classes of excessively drained, somewhat poorly drained, and poorly drained. It contains sandy soils formed on outwash plains and terraces. For location-specific soil type information, the reader should consult the USDA Soil Conservation Service soils maps for Hillsborough County West.).

2.2 Climate

The climate in this area, characterized by warm summers and cold winters, is subject to occasional hot spells. The average annual temperature is about 44.2ºF. Average long-term (1960-2001) annual precipitation at Peterborough is 44.68 inches. Precipitation averages slightly more than 3.7 inches per month throughout the year, with the driest month, February, averaging slightly less than 3 inches and the wettest, August, averaging about 4.1 inches, due to thunderstorm activity (http://www.erh.noaa.gov/er/gyx/climo/NH_STATS_NEW.htm). Annual snowfall is approximately 88 inches (NRCS, 1999).

2.3 Topography

Topography in New Ipswich ranges from 860 feet on the Souhegan River at the Greenville town line to 1881 feet at the summit of New Ipswich Mountain. Most of the rest of town is hilly, dissected with stream valleys and outwash plains. Slopes range from nearly flat to over 50 percent with much of the town being in the 8 to 25 percent slope range. The north-south oriented Wapack Range provides a dramatic change from the rolling hills and valleys located at the eastern side of the town.

2.4 Water Resources

The Town is rich in water resources. These provide a critical water source for natural communities such as the ponds, vernal pools, and wetlands formed as a result of glaciation. These same resources have been exploited and modified by past inhabitants of New Ipswich as expressed in the several dam sites, mills and villages that have sprung up around these sites. A relatively recent development of water resources was the PL-566 Flood Protection Program which funded construction of four flood-control dams in the town during the 1960's. The following is a discussion of the existing surface water resources in the study area:

2.4.1 Groundwater

The data set for stratified glacial deposit aquifers was obtained from GRANIT data sets. Currently there is no data set available for bedrock fracture aquifers. There are several aquifers underlying the study area consisting of glacial outwash and kame terraces. These aquifers are primarily located in the Souhegan and Gridley River valleys. Aquifer recharge and water quality is dependent upon the health and permeability of the watersheds supplying these aquifers. Figure 2 shows the location of these aquifers, which to this point has not been developed by a municipal system. However, the number of private wells has increased dramatically as a result of residential and commercial development.

It is foreseeable that new development, especially residential development, could grow to have a significant impact on water supply and quality over time. This is due to increased amounts of impermeable areas lowering the amount of water infiltrated into the ground, thus increasing surface runoff and nutrients in the water returned to the ground. By contrast, a public water system may distribute water up to a few miles from where it was pumped before it is returned to the environment by way of a septic system or wastewater treatment plant. During this transport, the water may be moved to a different sub-basin, or may be discharged directly to a surface water body rather than to the ground. For these reasons, pumping for agricultural usage generally has a smaller impact on an aquifer per volume pumped than pumping for public water supply systems.

2.4.2 Ponds

The ponds in the study area are of four primary types. These include: (1) Kettlehole ponds that were formed when blocks of ice from the retreating glaciers were buried in outwash sediments, subsequently melted and caused the surrounding sediments to collapse into round depressions. Many of these depressions remain filled with water today; (2) Bedrock controlled basins; (3) Through-flow; and (4) Dammed ponds, which may be a special case of through-flow, and includes both: A) manmade impoundments and B) beaver impoundments.

Water bodies have been classified into two size groups, less than ten acres and greater than ten acres. NH RSA Section 271:20 states: “All natural bodies of fresh water situated entirely in the state having an area of 10 acres or more are state-owned public waters, and are held in trust by the state for public use.” Within the town there are approximately 14 ponds less than 10 acres in size and 9-ponds greater than 10 acres.

The New Hampshire Department of Fish and Game (NHF&G) has identified numerous streams and ponds within the town as fresh water fisheries. Several of these water bodies have all been stocked in the past with a variety of trout species. Although historical stocking data for all ponds is not available, the healthier ponds provide recreational fishing opportunities for game and panfish enthusiasts. Commonly observed species include smallmouth and largemouth bass, chain pickerel, bluegill, pumpkinseed sunfish, white perch, and yellow perch.

2.4.3 Streams

Streams in New Ipswich occur within the watersheds of the Contoocook, Squanacook, Souhegan, and Millers Rivers. Third order and other named streams are listed below providing information on stream order, watershed area and significance.

New Ipswich lies primarily within headwaters of the 430 square mile Souhegan River Watershed. The major river drainages in the study area include the Souhegan, Contoocook, and Squanacook Rivers, all of which flow into the Merrimack River. The Millers River, on the west side of the Wapack Mountains, flows to the Connecticut. Boundaries of named subwatersheds that comprise the study area are delineated on the water resources map. These streams historically provided significant habitat for freshwater fishery species such as Atlantic salmon, shad, and eastern brook trout although the suitable habitat for these species has been significantly reduced as a result of dams, sedimentation and water pollution. Hydrologic alterations and temperature changes appear to be secondary factors in the local decline of these species.

Souhegan River

The West Branch of the Souhegan River originates in Fox Brook in New Ipswich. This tributary converges with the South Branch, which begins at Stodge Meadow Pond in Ashburnham, MA. These two third order tributaries converge at the head of Water Loom Pond, where the Souhegan becomes a fourth order stream. The river then flows easterly through the towns of Greenville, Wilton, Milford, Amherst, and Merrimack for 31 miles into the Merrimack River. Historically this river was used for waterpower to drive the numerous mills that were built along the stream as attested to by Water Loom Pond, the historic mills at High Bridge, and further downstream along the river. Four dams and reservoirs were built in New Ipswich as part of a program under PL-566, Watershed Protection and Flood Prevention Act, to alleviate flooding further downstream in the watershed. Portions of the impoundment areas are now conservation land under the auspices of the Conservation Commission.

The Souhegan has been designated as part of the NH Rivers Management and Protection Program. To be eligible for this program, a river must contain or represent either a significant statewide or local example of a natural, managed, cultural or recreational resource. The Rivers Management and Protection Program Act (RSA Ch. 483) lists nine river values and characteristics which may qualify a river for designation into the program. The resource values which qualify the rivers for designation are: geologic resources; wildlife, plant and fish resources; water quality; scenic values; historic and archaeological resources; community resources; managed resources; and recreational resources. The Souhegan supports many of these natural, managed, cultural, and recreational resource values and characteristics at a level of either statewide or local significance. The importance of the Souhegan to the Atlantic salmon restoration project has been recognized at the local, state, and federal levels. It is ranked as the best salmon nursery habitat in the region, and is key to the goal of the project. The river has also become an important educational tool as part of the Adopt-a-Salmon-Family program sponsored by the US Fish and Wildlife Service.

Squanacook River

The Squanacook River originates in Hoar Pond, the headwaters of Locke Brook, and Trapfall Brook on the flanks of Davis Hill, and flows into the Nashua River at the Shirley and Groton, Massachusetts town line. The headwaters have been ranked as “outstanding resource waters” and are ranked as coldwater fishery streams.

Contoocook River

The Gridley River flows northerly from the northwestern corner of New Ipswich into Sharon where it merges with the Contoocook. The Contoocook flows northeasterly to its confluence with the Merrimack at Penacook. A large wetland in a glacial outwash sand plain, regionally known as Tophet swamp, forms the headwaters of the Gridley. Within the study area, it is a low gradient stream for an extended length with descriptive names such as Swamp road in Sharon signifying the hydrologic characteristics and vegetative cover.

Miller River

The headwaters of the North Branch of the Miller River begin on the westerly slopes of Pratt and New Ipswich mountains. This stream flows southwesterly to Winchendon, MA where it joins the main stem of the Millers. The Millers then flows westerly to meet the Connecticut River at Millers Falls. As with the Souhegan, all of these rivers have been harnessed for waterpower wherever hydraulic drops occurred. Two breached, rock faced earthen dams were observed between Island Pond and Mountain Pond.

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2.4.4 Freshwater Wetlands

Wetlands have been difficult to define, as they are part of the continuous gradient between uplands and open water, and as such exhibit some of the characteristics of both. The most widely accepted definition is presented in the report entitled Classification of Wetland and Deepwater Habitats of the United States (Cowardin et al., 1979): Wetlands are lands transitional between terrestrial and aquatic systems where:

> “… water is usually at or near the surface or the land surface is covered by shallow water … Wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominately hydrophytes, (2) the substrate is predominately undrained hydric soil, and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.”

The National Wetland Inventory classifies wetlands according to the Cowardin classification. The Federal and the New Hampshire definitions of wetlands are derived from the Cowardin document. There are numerous ways of classifying different types of wetlands. This classification divides waters into five ecological systems: estuarine, palustrine, riverine, lacustrine, and marine, three of which are included in the study area: palustrine, riverine, and lacustrine. These systems are subdivided into classes and subclasses defining the bottom or plant community with increasingly greater precision. There are also modifying terms related to water regime and water chemistry. Although this classification does not provide particulars about specific wetland vegetation, it does provide sufficient detail for community wide planning activity.

The New Hampshire Natural Heritage Inventory (NHNHI) has developed a landscape classification scheme based on natural communities. These are recurring assemblages of species founding particular physical environments. Each natural community type is distinguished by three characteristics: (1) a definite plant species composition; (2) a consistent physical structure and (3) a specific set of physical conditions.

2.4.5 Vernal Pools

Vernal pools are temporary bodies of freshwater that provide essential breeding and nursery habitat for many vertebrate and invertebrate wildlife species. Many vernal pools are filled by spring rains and snowmelt, only to dry up during the hot, dry months of summer. However, they may also be filled by the rains of autumn and may persist throughout the winter. Vernal pools are often very small and shallow. In fact, some that support rich communities of vertebrate and invertebrate animals may measure only a few yards across. Nevertheless, vernal pools up to several acres in size also occur throughout New Hampshire.

Vernal pools typically lack fish populations, making them excellent breeding habitat for many amphibian species and larval and adult habitat for many insect species, as well as other wildlife. The wood frog (Rana sylvatica) and all species of mole salamanders (Ambystoma spp.) that occur in New Hampshire breed exclusively in vernal pools. Areas in the immediate vicinity of the pool provide these species with important non-breeding habitat functions, such as feeding, shelter and overwintering sites.

Although vernal pools are not protected per se by the New Hampshire Wetland Protection Act, their significance is becoming increasingly recognized as important wildlife habitat.

2.4.6 Vegetated Wetlands

Most wetlands in the study area are associated within areas under forest cover. From available GIS data, this study has identified three significant types of wetland communities: deep and shallow marshes, shrub-scrub wetlands, and forested swamps. Table 2-1: Characteristics of Wetland Communities by Type summarizes the general characteristics of each community including the state rank, setting, dominant vegetation, habitat values associated with it, observed/associated rare animals, and potential threats (Sperduto, D.D.1994). The state rank, developed by The Nature Conservancy for the New Hampshire Natural Heritage Inventory (NHNHI), reflects the community's rarity and threat within New Hampshire as follows:

S1 = Typically 5 or fewer occurrences, very few remaining acres or miles of stream, or especially vulnerable to extirpation in Massachusetts for other reasons.

S2 = Typically 6-20 occurrences, few remaining acres or miles of stream, or very vulnerable to extirpation in New Hampshire for other reasons.

S3 = Typically 21-100 occurrences, limited acreage or miles of stream in New Hampshire.

S4 = Apparently secure in New Hampshire.

S5 = Demonstrably secure in New Hampshire

Table 2-1: Characteristics of Wetland Communities by Type

Wetland Type	State Rank	Setting	Vegetation	Habitat Values	Associated Rare Animals	Threats
Bogs	S1-S3	Occur in bedrock and kettle depressions	Vegetation is in a ringed zonation pattern – outer ring of black spruce, tamarack, highbush blueberry and winterberry, and interior rings of leatherleaf and sedges and moss lawns. Sphagmum moss species.	May function as vernal pool habitat if open water remains standing for 2-3 months and no fish present; important amphibian breeding habitat	Spotted salamander, Jefferson Salamander, Blue-Spotted Salamander, Spotted Turtle, Pale Green Pinion Moth, Pitcher Plant Borer Moth and Bog Lemming.	Hydrologic alteration, nutrient enrichment from road and lawn runoff, and humans trampling on the peat mat.
Vernal Pools	S2, S3	Depressional settings in uplands and on floodplains	Sparsely vegetated to perennial or annual vegetation.	Obligate breeding habitat for several amphibian species.	Spotted salamander, Jefferson salamander, Blue-Spotted Salamander, pill clams, fairy shrimp, ringed boghaunter dragonfly.	Disturbance, altered hydrology, disturbance of vernal pool envelope (area within 100 feet of pool's edge)
Deep and Shallow Marshes (PEM)[1]	S3, S4	Occur in broad, flat areas bordering low-energy rivers and streams	Cattails, pickerel-weed, and wool-grass dominate deep marshes; tussock sedge and bluejoint dominate shallow marshes.	Deep marshes provide excellent habitat for waterfowl and shallow marshes for muskrats; both provide habitat for frogs and newts	Great Blue Heron, American Bittern, Northern Harrier, Marsh Wren, Spotted Turtle, Wood Turtle, Blanding's Turtle, Common Moorhen, American Bittern, Pied-Billed Grebe, King Rail, and Water Shrew	Filling and dredging; impoundments that alter natural water level fluctuations; nutrient inputs from roads, fields, or septic systems; invasive species (e.g., Purple Loosestrife and Phragmites)
Shrub Swamp (PSS)	S5	Occur in basin depressions, at pond margins, and along river and stream edges	Mixture of speckled alder, speckled alder, highbush blueberry, mountain holly, meadowsweet, buttonbush, winterberry, swamp azalea, silky dogwood, northern arrow-wood, and	Function as vernal pool habitat in the absence of fish and provide important amphibian breeding habitat	Jefferson Salamander, Blue-Spotted Salamander, Marbled Salamander, Spotted Turtle, Wood Turtle, Elderberry Long-Horned Beetle, Blanding's Turtle, Four-	Urbanization, highway construction, impoundments and agriculture. Introduction of exotic species (e.g., Purple Loosestrife and Phragmites)

			maleberry.		Toed Salamander, Water-willow Stem Borer,	
Wooded Swamp (PFO)	S5	Occur on flats where drainage or percolation is imperfect.	Includes all wetlands with at least 30% tree cover. The dominant species is red maple. With lesser amounts of black ash, green ash, American elm, black gum. Coniferous species include white pine, hemlock, spruces, and tamarack.	Pits of upturned trees may function as vernal pools. Hemlock and pine dominated areas may provide deer wintering areas.	Wood turtle, Jefferson salamander, Spotted salamander, Blue spotted salamander, Wood duck, Northern waterthrush, Wood frog	Urbanization, highway construction, impoundments and agriculture. Altered hydrology.

2.5 Biodiversity & Significance of Habitats

New Ipswich is ecologically highly variable due to its physical location, the varied topographic and hydrologic features distributed within the town. The elevated topography of spine of the Wapack Range and the Souhegan River provide major travel corridors for migration of numerous species of flora and fauna.

2.5.1 Native Plant Communities

Classification of native plant communities has again resulted in several schemes being developed that are dependent upon use and classification methodology. The Society of American Foresters (SAF) has developed a classification based on forest cover types, which are categories of forest defined by its vegetation composition (particularly its composition) and/or locality (environmental) factors. SAF forest cover types found in New Ipswich include several red spruce types; several white pine and hemlock types; northern hardwoods; white oak – black oak – red oak; northern red oak; and gray birch – red maple.

The NHNHI has developed a landscape classification scheme based on natural communities. These communities are recurring assemblages of species occurring on particular physical environments. Each natural community type is distinguished by three characteristics: (1) a definite plant species composition, (2) a consistent physical structure, and (3) a specific set of physical conditions.

The GRANIT classification utilizes computer classification of spectral data sets and includes three coniferous classes, mixed forest, and three deciduous forest classes. These are displayed on the Land Cover map (Figure 8) and is the land cover classification typically used in this report.

2.6 Wildlife and Wildlife Habitat

The conservation areas delineated through this project were areas of core habitat for the rare and/or endangered species as well as supporting habitat areas. The study area hosts several rare and/or endangered species. For the rare species occurrences lists in the New Ipswich please refer to **Appendix B: NHNHI List of Rare Species Occurrences by Town** (source: NHNHI website). A summary of the species observed and their significance is described below.

2.6.1 Mammals, Birds, Reptiles and Amphibians

The physical characteristics and vegetation cover of the study area creates a unique environment that supports many rare or endangered species in addition to the more common species. Indigenous animals that are most dependent on the unique characteristics of this area include species such as the Blanding's turtle that requires densely vegetated shallow ponds and marshes; several frogs, toads, and salamanders such as the blue-spotted salamander, Jefferson salamander, marbled salamander, spotted turtle, and wood turtle, all of which depend on vernal pools for reproductive success.

Although various mammals and birds may be observed in this area, the more significant species are more northern, boreal, species that are a function of the habitats and ecosystems located in the Wapack Range. The more commonly observed mammals include the red squirrel, gray squirrel, northern flying squirrel, eastern chipmunk, snowshoe hare, red fox, and white-tailed deer. Less common mammals include coyote, moose, fisher, black bear, and bobcat. Common birds include Golden-crowned kinglet, Blue-headed vireo, and species of wood warblers including Blackburnian, Yellow-rumped, and Magnolia. The unfragmented woods provide habitat for several thrush species, which may include Bicknell's in higher elevation spruce-fir forests. The region is known to host at least 9 of the 11 snake species of New Hampshire: redbelly snake, ringneck snake, milk snake, smooth green snake, black racer, redbelly snake, northern water snake, common garter snake and brown snake.

2.6.2 Fisheries

As stated earlier, the study area primarily lies within the Souhegan River Watershed, which provides habitat for a wide variety of water-dependant species. Local fisheries include several freshwater systems. The Souhegan River has been identified as ranked as the best salmon nursery habitat in the region, and is key to the goal of the restoring this species to the area. Anadromous species such as shad and Atlantic salmon are particularly sensitive to water level fluctuations, flushing flows, water velocities, and discharge volumes. They require attraction stimuli in the form of spring freshet flows to draw them back to their native streams, as well as sufficient flows for unobstructed passage to their spawning sites and to permit juvenile emigration to estuarine and marine environments. Smaller streams provide habitat for trout, which are supplemented by stocking of brook and rainbow trout. Ponds within the study area also support warm water fisheries, and are inhabited by smallmouth bass, chain pickerel, yellow perch, bullheads, sunfish, and minnow species.

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[1] Cowardin wetland classification abbreviations used: PEM – Palustrine emergent; PSS – Palustrine shrub-shrub; PFO – Palustrine forested.

NRI: Overlay and Map Development

3.1 Base Map

The base map (Figure 1) is composed of several layers of GRANIT data. These include USGS topographic maps, tax map parcel boundaries, latitude and longitude coordinates for Town boundaries, transportation networks, and utility networks. Tax map boundaries on the GIS data layers were adjusted on a parcel-by-parcel basis from updated data at the Town offices. The transportation network was modified slightly to reflect transfer of two class 6 roads to trail status. In New Ipswich, the utility network is limited to high-voltage electric transmission corridors as the Town does not have municipal water or sewer systems.

3.2 Water Resources Map

The water resources map (Figure 2) displays several categories of wetland types. To develop this map data sets from several sources were combined. Additional field data and photo-interpreted information were added to these files.

3.2.1 Wetlands

To create this overlay, a composite of National Wetlands Inventory (NWI) data and hydric soils was merged. Hydric soils are defined as soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper layers. In general, these soils are flooded, ponded, or saturated for one week or more during the growing season, i.e., the period when soil temperatures are above "biologic zero" (41^{o} F). Soil types in New Ipswich that are hydric include all histisols except folists, aquic suborders and aquic subgroups that are poorly or very poorly drained as listed in the following table.

Table 3.1 Hydric (Wetland) Soils Occurring in New Ipswich

Map Unit Symbol	Map Unit Name	Drainage Class
105	Rumney	Poorly
197	Borohemists, ponded	Very Poorly
214	Naumberg	Poorly
247	Lyme stony loam	Poorly
295	Greenwood mucky peat	Very Poorly
395	Chocorua mucky peat	Very Poorly
495	Ossipee peat	Very Poorly
549	Peacham stony muck	Very Poorly
646	Pillsbury loam	Poorly, Somewhat Poorly
647	Pillsbury stony loam	Poorly, Somewhat Poorly

In addition to these data files, supplemental information was inserted from the results of photointerpretation of 1999 color infrared (CIR) 1:15,840 scale photography. Hydric soils data were extracted from the National Resource Conservation Service (NRCS) Hillsborough County – West soil survey information. The original soil survey was a combined 2nd and 3rd order intensive survey designed for general agriculture and urban planning. For that survey, soil boundaries were identified by field observation and interpretation of remotely sense data. Boundaries were then verified by closely spaced traverses. These boundaries were drafted onto 1:20,000 (1"=1,667') scale orthophotographs. At that scale, the minimum size of soil mapping units was four acres.

The National Wetland Inventory classifies wetlands according to the Cowardin classification. This classification divides waters into five ecological systems: estuarine, palustrine, riverine, lacustrine, and marine, three of which are included in the study area: palustrine, riverine, and lacustrine. These systems are subdivided into classes ands subclasses defining the bottom or plant community with increasingly greater precision. There are also modifiying terms related to water regime and water chemistry. Although this classification does not provide particulars about specific wetland vegetation, it does provide

sufficient detail for community wide planning activity. These inventories were conducted by identifying wetlands through photointerpreting of 1:56,000 (1"=5,000') CIR photography without the advantage of supplemental data, such as topographic maps or soil survey information.

Supplemental information regarding wetlands, not shown on the soils or NWI data layers, was obtained by photointerpretation of 1:15,850 (1" = 1,320') scale CIR aerials flown in 2000. Field investigations were conducted to identify small wetlands and wetland extensions not identified on the hydric soils or NWI data sets. These data sets were supplemented by Global Positioning System (GPS) points for several locations. The focus of this fieldwork was on small headwater extensions of known wetland areas, and does not include all wetland areas in the town, but does provide a benchmark regarding the percentage of undocumented wetlands that occur within the town boundaries.

3.2.2 Streams

Two Granit GIS layers were combined to produce the stream data, these included National Hydrographic Data and the USGS water features layer. These USGS defined streams were separated into two classes: 4th order and or greater and 3rd order or less. The rationale for this distinction is that 4th order streams are regulated under Chapter 483-B, The Comprehensive Shoreland Protection Act, defines rivers as "meaning all year-round flowing waters of fourth order or higher …". In the list of 4th order streams prepared by the Office of State Planning, the Souhegan River from the juncture of South and West branches in New Ipswich to the juncture of the Merrimack River is the only listed river in the town. This classification becomes particularly important to New Ipswich as the Souhegan is one of two rivers in the state that are pilots for instream flow rules that would insure that minimum flows are maintained throughout the year.

3.2.3 Ponds

Ponds and lake locations were obtained from the USGS data hydrology data layer. These were separated into two size classes, less than 10 acres and 10 acres and greater. This distinction is due to legislation that defines water bodies of ten acres or larger as "great ponds" which are state-owned public waters, held in trust by the state for public use.

The State of New Hampshire classifies ponds (lakes) as follows:

NL (Natural Lake) are ponds greater than 10 acres in their natural (undammed) state
RD (Raised by **Dam)** are ponds greater than 10 acres due to a dam
AI (Artificial Impoundment) are man-made ponds greater than 10 acres (dammed or undammed

Ponds classified as **NL** and **RD** are defined as "**Great Ponds**", meaning the ponds are *state-owned public waters* AND the State of N.H. *owns the land under the pond*.

Ponds classified as **AI** are *state-owned public waters*, BUT the State of N.H. *does NOT own the land under the pond*.

Table 3-2: Significant Ponds Ranked by Size

Name	Size (acres)
Water Loom Pond	42.7
Island Pond	38.9
Pratt Pond	38.5
Dam Site #19	27.1
Mountain Pond	25.0
Dam Site #35	23.0
Dam Site #14	18.0
Wheeler Pond	10.0
Dam Site #13	9.7
Hoar Pond	8.5
Binney Pond	7.8

3.2.4 Aquifers

Stratified drift aquifers were mapped from an existing GRANIT GIS data layer that utilized US Geological Survey study reports and maps. Some aquifer locations have had, or actively show, indications of mining for sands and gravels in the stratified drift overburden. Currently, there is no information available pertaining to bedrock fracture aquifers for the Town. The largest contiguous stratified deposit aquifer is located at the northwest corner of town in the Tophet swamp area, forming the headwaters of the Gridley River. Other aquifers are located along tributaries of the of the Souhegan River including Gambol Brook that flows northeasterly into Temple before turning south to join the Souhegan in Greenville.

3.2.5 Watershed Boundaries

Watersheds were delineated for all named streams located in town on 7½' USGS topographic maps. These delineations are based upon the topographic divides. Although there may be instances where the subsurface (bedrock) watershed boundary may not be the same as topographic divide, this consideration was beyond the scope of this study. Watersheds were defined for the following streams:

Table 3-3: Watersheds and Subwatersheds

Name	Drainage System	Stream Order	Area (acres)	Significance
Souhegan River	Souhegan	4	4,167	Stocked with eastern brook trout and rainbow trout
Fox Brook	Souhegan	1	1,919	Stocked with eastern brook trout
Stark Brook	Souhegan	1	539	
Furnace Brook	Souhegan	2	2,942	
Pratt Pond Brook	Souhegan	2	1,336	
South Branch	Souhegan	3	1,756	
West Branch	Souhegan	3	1,358	
Gridley River	Contoocook	2	2,581	Stocked with eastern brook trout in Sharon
Locke Brook	Squanacook	2	1,411	
Binney Hill Brook	Millers	1	925	
N. Branch	Millers	2	1,328	

3.2.6 Wetland Demonstration Areas

Areas of special concern in regard to wetlands were the Craven Development area, an approximately 100-acre parcel located between Stowell and Thayer Roads and the 1,000 acre Hampshire Country School properties located between Binney Pond and the Rindge Town line. Global Positioning System (GPS) data points were identified along the edge of wetlands in this area to gain precision of the true location of wetland boundaries as opposed to the merged hydric soil and National Wetland Inventory data set. At the Craven Development site three wetland extensions were identified and a series of data points collected by GPS. At the Hampshire Country School site four wetlands were identified and boundary data also collected by GPS. These data points and the resultant wetland boundary are shown on the Water Resources Map. These wetland extensions were not utilized in analysis of the natural resources inventory as detailed survey would skew town wide results.

Based upon these investigations and inspection of the topography of the town, it appears that many of the additional wetlands and wetland extensions would be concentrated in the eastern portion of town where topography is flatter, and seepage wetlands exist near the bottoms of slopes. There is the possibility for upland wetlands to be located on topographic flat, and smaller dendritic wetland fingers and ephemeral streams may extend up slopes at the bases of hills.

3.3 Open Lands Map

The open lands map is composed of several GIS data sets together with supplemental information, which were combined to produce the composite open lands map. These data sets consisted of the following layers:

3.3.1 Conservation Lands

Conservation lands, by definition, are properties that are generally undeveloped and protected from future development. By mapping the Town's conservation lands (Figure 3) helps identify potential needs and opportunities for expanding these areas to provide links between protected areas, or to add protected buffers to environmentally sensitive areas.

Lands that receive some degree of protection can include a variety of public and privately owned lands. Public lands in New Ipswich include state and municipally owned parcels. The mere fact that land is in public ownership does not necessarily ensure that land is protected in perpetuity. Many towns run their conservation lands through a land trust who may then hold the development rights and provides oversight through periodic monitoring the restrictions placed on the property. Land trusts are private, nonprofit organizations that protect land through a variety of voluntary methods, including fee simple purchase and by acquiring conservation easements. Land trusts operating in the New Ipswich area include the Monadnock Conservancy, New England Forestry Foundation (NEFF), Society for the Protection of New Hampshire Forests (SPNHF), and the Harris Center for Conservation Education.

Conservation lands beyond the borders of the town may aid in forming corridors or large unfragmented blocks of land. For this reason, we have extended the boundaries one mile beyond the town boundaries to gain insight into adjacent protected lands, and other resources, in the surrounding area.

3.3.2 Recreation/Trails

New Ipswich is rich in recreational attributes that provide opportunities for hiking, warm and cold-water fishing, boating, and hunting and other outdoor recreational activities. With much of the land in private ownership, many owners allow the public to access and use their land for recreational purposes. Changes in land use, ownership, and misuse/overuse of recreational lands can threaten this availability of privately owned land for recreational use.

At the western section of town is the 21-mile Wapack Trail, a regionally recognized hiking trail that roughly follows the crest of the Wapack Range from Mount Watatic in Ashburnham, MA to North Pack Monadnock in Greenfield, NH. A side trail, nine-tenths mile in length, leads to the summit of Kidder Mountain. The Wapack trail connects with the 92 mile Massachusetts Midstate trail at the state line on the northerly side of Nutting Hill in Ashburnham. The Midstate trail leads south over Mounts Watatic and Wachusett to the Connecticut border. With the 113-mile combined trail length and the panoramic views provided from the crest of the Wapack range, this is an extensive and highly used hiking resource for literally millions of people in the New Hampshire and Massachusetts who live within a few hours drive. In order to preserve and maintain a wilderness recreational experience for hikers, a 500-foot buffer strip has been applied on both sides of the Wapack Trail.

The Town has recently reclassified two class six roads to trail status. These include the Whirlpool and Preston Hill trails. There is also a shorter public trail at the Town conservation land at flood control site 35 that follows the edge of the impoundment from the parking area via the shoreline towards the dam. Trail data was obtained from US Geological Survey topographic maps with additions digitized from "Guide to the Wapack Trail in Massachusetts & New Hampshire".

Access to water bodies for fishing and boating are detailed in the following table:

Table 3-4: New Ipswich Boat Access Sites

Water Body	Name	Facility Condition	Parking spaces	Site Restrictions
Dam Site 13	Dam Site 13	Poor	1	No
Dam Site 35	Dam Site 35	Average	10	Yes
Water Loom Pond	Roadside Access	Poor	2	No

Source: NH OSP (9/13/99)

3.3.3 Agriculture and Important Farmland Soils

Statistics on farming are available only on a county basis, thus, the statistics apply to all of Hillsborough county. The statistics are from the 1978 and 1992 Censuses of Agriculture. The most common types of farms in the county have traditionally been dairy farms, apple orchards, and vegetable farms. There continues to be a decline in agriculture with over 1,300 acres of farmland converted to development each year. Between 1978 and 1992 the number of farms dropped from 390 to 328. Dairy, row crops and orchards have declined, but there has been an increase in landscape plant propagation, beef, horses and specialty crops.

Most of the agriculture in New Ipswich is the production of hay. The base of the agricultural data set is the GRANIT cover type classification. This was correlated with field checked with photointerpreted data of the 1999 color infrared aerials. Two categories of agricultural land are displayed: active and inactive. Parcels were placed in the active agriculture category if fields, at a minimum, were being mowed. Areas where fields showed signs of having been abandoned, and where brush or tree growth invading the open areas, were classified as inactive farmland.

For this study Daylor utilized the GRANIT soils overlay to provide information on two criteria, highly productive soils and hydric (wetland) soils. These highly productive soils include Prime Farmland, Soils of Statewide Importance and Soils of Local Importance. Prime Farmlands, as defined by the USDA Natural Resources Conservation Service, is land best suited for food, feed, forage, and oilseed production. It may be cultivated land, pasture, woodland or other land, but it is not urban or built-up land or water areas. It is used either for food or fiber crops or is available for these crops. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources. Farming these soils results in the least damage to the environment.

Soils of Statewide Significance are lands, in addition to prime and unique farmlands, that are of statewide importance for the production of food, feed, fiber, and forage. Soils of Local Significance are lands of local importance for these crops. Areas of prime farmlands and soils of statewide significance are derived from the County Soil Survey, based upon soil unit criteria supplied by the New Hampshire NRCS at . These soil classes have increased significance when these areas coincide with current agricultural use. Areas of prime farmland and farmland of statewide significance either actively farmed or inactive are depicted on Figure 4, Agriculture/Soils Map.

Table 3-5 Prime, Statewide and Locally Important Farmland Soils

Prime Farmland

Map Symbol	Symbol Name	Farmland Class
142B	Monadnock fine sandy loam, 3–8 % slopes	All areas are prime farmland
558B	Skerry fine sandy loam	All areas are prime farmland
76B	Marlow loam, 3–8% slopes	All areas are prime farmland
78B	Peru loam, 3–8% slopes	All areas are prime farmland

Farmland of Statewide Importance

Map Symbol	Symbol Name	Farmland Class
142C	Monadnock fine sandy loam, 8 – 15% slopes	Farmland of statewide importance

Farmland of Local Importance

Map Symbol	Symbol Name	Farmland Class
143B	Monadnock stony fine sandy loam, 3-8% slopes	Farmland of local importance
143C	Monadnock stony fine sandy loam, 8-15% slopes	Farmland of local importance
36B	Adams loamy sand, 3-8% slopes	Farmland of local importance
559B	Skerry stony fine sandy loam, 0-8% slopes	Farmland of local importance
613B	Crogham loamy fine sandy loam, 3-8% slopes	Farmland of local importance

77B	Marlow stony loam, 3-8% slopes	Farmland of local importance
77C	Marlow stony loam, 8-15% slopes	Farmland of local importance
79B	Peru stony loam, 0-8% slopes	Farmland of local importance

Soil data for areas in Sharon, Cheshire County and for Ashby and Ashburnham, Worcester County, Massachusetts were not inserted into the one-mile extension of classified area on this overlay.

3.3.4 Contiguous Undeveloped Land (Unfragmented Land)

Unfragmented blocks of open space (Figure 4) are undeveloped sections of the landscape that are not dissected by roads. These undeveloped areas include forested areas, open water, wetlands, and agricultural lands. They may also include class 6 roads, a few houses, gravel pits and clear-cuts. These blocks are unrelated to ownership parcels. Unfragmented lands are of significance for wildlife, as well as identifying large areas of open space.

Unfragmented lands provide some of the most valuable wildlife land as it provides a range of contiguous natural habitats that may encompass many habitat types, supports a diverse array of native species and ensures the viability of these species. Large blocks of habitat can accommodate the cyclic changes that may occur naturally or due to anthropogenic influences. For example, the natural cycle of forest growth influenced altered by timber harvesting results in certain wildlife species utilizing particular areas and then moving to another area, only to return when that area returns to conditions that are hospitable again for their survival.

The size of these unfragmented areas varies depending where it is located. For example, in the southeastern part of the state where a large portion of the landscape has been developed for housing, an unbroken block in the hundreds of acres is significant. In northern New Hampshire where large ownerships by timber companies increases the size of what is designated significant. Within the Town of New Ipswich there is a pattern of fragmentation displayed, with the center of town and a corridor towards Greenville at the northeast showing the greatest amount. The least amount of fragmentation occurs along the spine of the Wapack Range where there are the greatest constraints on agriculture and steep grades and shallow soils pose constraints on residential development.

To delineate unfragmented blocks, roads were buffered by a 500-foot width, the area where it is assumed most development occurs. This results in fragmented blocks that are characterized by little or no development. We have categorized these resulting blocks into six acreage classes: 10 – 250, 250 – 500, 500 – 1,000, 1,000 – 3,000, 3,000 – 5,000, and >5,000. We have extended these blocks beyond the town boundary to illustrate the continuity of these areas as an aid in analysis.

3.4 Slope Map

Digitized USGS topographic map data with 10 foot or 3-meter contour intervals were used for the calculations of slope. An alternative data set was used in an attempt to construct a seamless slope map, however the slopes derived from this alternative, digital elevation model, were less than satisfactory, and analysis reverted back to the digitized topographic map data. Six classes were developed that correlate with the NRCS slope classes. Although these two methods correlate on the degree of slope within each class, there may be small areas where results are different due to dissimilar methods of creating these overlays. The NRCS data was derived from aerial photo-interpretation of slope within specified soil polygons. Slope classes are shown on Figure 5. Slope classes were developed according to the following table:

Table 3-6: Topographic Slope Classes

Slope Symbol	Standard Range	Lower Limit	Upper Limit
A	0 - 3	0	1 – 3
B	3 – 8	1 – 3	5 – 8
C	8 – 15	4 – 8	8 – 16
D	15 – 25	10 – 16	18 – 35

E	25 – 50	20 – 35	35 – 60
F	50% +	45 - 65	none

==========

New Ipswich has zoning regulations addressing construction in areas of steep slopes. Under this regulation, areas with slopes in excess of 15 degrees shall contain at least one contiguous acre of land that is less than or equal to 15 percent slope. This regulation also specifies a slope limitation of 25 percent as the maximum allowable for proposed development due to potential problems with sewage disposal systems, erosion, sedimentation, and bank failure. The two slope classes, E and F exceed this limit, hence are unbuildable. Locations with these steep slopes are located along the east and west flanks of the Wapack range, Whittemore Hill, a hill west of Hoar Pond, and smaller areas throughout the town.

3.4.1 Viewshed Analysis

New Ipswich is rich in visual resources encompassing a variety of pleasing view types to those traveling the various town roads. Many of the roads are wooded, with the dominant cover type being oak and maple hardwoods or mixed hardwood and conifers. In certain areas the woods give way to field land that has been used for pasture or hay crops. The many older residences in town, such as within Bank Village, enhances the New England village character. Single lot and larger areas of development have occurred throughout the town, with the resultant driveway cuts and scars in the landscape as developments creeping up hillsides, detracting from the visual resources.

At first glance, it is somewhat surprising that the Wapack Range is not more prominent as a view from many positions in town. However given the hilly nature of the town, the fact that most roads either follow valleys or cut across slopes, and the heavily wooded landscape, it becomes apparent that most views are either fleeting, hidden by vegetation or that vantage points are not accessible.

A viewshed is defined as all the places that can be seen, at least theoretically, from a single location. This is also referred too as line-of-sight viewing, where any surfaces above the sight line are in view, and any objects either below, or blocked by a nearer object, are not visible. Viewshed analysis is a key component of visual impact assessment study. The objectives of viewshed analysis are to inventory the extent of the view within the corridors, and to inventory the existing quality and potential quality of the viewsheds. The goals of viewshed analysis are to preserve and enhance the quality of the scenic beauty of the rural landscape and to aid in development of the existing landscape with a minimum impact to the existing scenic qualities.

For the purposes of this study, slopes greater 15 percent and ridgetops and hilltops have been classified as the areas that will form the primary focus of distant views (Figure 7). These areas will require some form of protection or control of development to protect and maintain these potential views. Views from particular locations were not evaluated to allow vistas that may be created in the future due to development or land clearing activities have equal standing. Views within town have been classified into several categories including: Fields and pasture, wooded hills, streams and water features, enclosed views, and residential. Areas of concentration meeting the requirements of steep slopes and visible ridge and hilltops are shown on Figure 7, Viewshed Map, are concentrated along the Wapack Range at the westerly side of town, from Emerson Hill northeasterly along Page Hill Road and Main Street, and from Whittemore Hill northerly to a hill located between Wilton and Greenville Roads.

Daylor has located spot locations, vantage points, providing inklings of areas that offer near, midrange and distant views. The focal point, or target of many of these views includes the Wapack range, Whittemore Hill and other hills in town. There are other areas where the principle focus point is either water or fields, or these features may form the foreground leading the viewer's eye to distant hills. Photographs of New Ipswich views in are located in Appendix D, with photo locations displayed on Figure 7.

To protect viewsheds for present and future generations some governmental organizations, e.g., Napa and Monterey Counties, CA, Cumberland, MD, and Lyme, NH, have enacted viewshed protection ordinances setting forth hillside development standards to minimize the impacts of man-made structures and grading on views of existing landscapes and open spaces as seen from designated public roads. A

typical ordinance pertains to new developments that are planned for hillsides with slope areas greater than 15 percent or that may be within 25 vertical feet of a major or minor ridgeline. New Ipswich currently has a steep slope ordinance that prohibits development on slopes in excess of 25 percent, but does not have any restriction relating to ridgetops. In the future, the Town may decide to focus on views from certain “scenic” roads or certain vista locations.

3.5 Habitats and Ecosystems Map

New Ipswich is covered with a mosaic of plant and water assemblages that have been categorized into cover types that are illustrated in Figure 8. This classification was produced by computer analysis of various spectral bands collected by Landsat satellite multispectral scanner imagery, and may have used images from different seasons as an aid in classification. The classification scheme for New Ipswich includes four coniferous forest types, three deciduous forest types, three wetlands, four agricultural, and three developed types.

3.5.1 Rare Plants and Animal Species and Exemplary Communities

The NH Natural Heritage Inventory (NHNHI) program was initiated in 1986 as a derivative of the Nature Conservancy national program of inventorying rare plants. The NHNHI mission was mandated by the Native Plant Protection Act of 1987 (NH RSA 217-A) 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 their habitats. This program works closely with the NH Fish and Game Department endangered wildlife program authorized by the New Hampshire Endangered Species Conservation Act (RSA 212-A). The NHNHI maintains a database of known rare plant populations and exemplary natural communities.

NHNHI records and tracks rarity of both state and federal levels using a scale from 1 to 5 with 1 indicating “critically imperiled,” 3 denoting “uncommon,” and 5 indicating “common.” Information is also maintained on the relative quality of rare populations and natural community occurrences. It is important to note that there has not been a comprehensive biodiversity inventory of New Hampshire, therefore a negative report, i.e., no records in the NHNHI database, should not be interpreted as there is no rare plant or exemplary natural community present.

The actual locations of data sites maintained by NHNHI are generalized prior to distribution by GRANIT due to the data’s sensitive nature. Rather than displaying point locations, a large diameter circle shows the generalized location of a rare species population or an exemplary community. These general location circles are illustrated on Figure 10.

3.5.2 Wildlife Corridors

Wildlife travel corridor is a general phrase used to describe a variety of different habitats that allow movements of wild animals over both short and long distances. These can range from small and local, such as a vole trail under snow to a major river corridor utilized by migrating birds. There are several underlying factors that make these corridors so important. These may be frequently used travel routes where an animal feels secure in their normal movements to feeding, watering, and resting spots. Larger animals follow natural features such as streams and ridgelines. During spring migration, many songbirds follow major river valleys up-gradient, to follow smaller and smaller tributaries until they reach their home range in the breeding grounds. Travel corridors also provide avenues for genetic exchange, thus insuring maintaining health and vigor of animal populations.

Wildlife corridors mapped for this study (Figure 10) include streams and their riparian corridors. Daylor has placed 300-foot buffers around all lakes and streams, wetlands over 20 acres, smaller wetlands dominated by emergent vegetation and riparian zones. This provides information on the most productive wetland habitats as well as streams and rivers that function as wildlife travel corridors between wetland habitats. This also displays major riparian habitats that are important to many birds, reptile and amphibian species that require dense shrubs, moist soils and wetland vegetation typical of these areas. Many of these riparian areas also serve as connections between large, undeveloped tracts of land.

3.5.3 Other Significant Wildlife Habitat

Although most all portions of the landscape constitute habitat for some species of New Hampshire's wildlife, but some habitat is more important to wildlife than other habitats. Also, habitat interconnectivity or interspersion of habitat types becomes critical for many species. For example, a vernal pool may offer ideal habitat for spotted salamanders to breed and for their young to metamorphose, but if this pool is surrounded by parking lots the site becomes a population sink and will lose its entire population over time.

Additional significant wildlife habitat in New Ipswich include the following:

- Habitat used by rare species or species of special concern.
  - A great blue heron rookery located in the southwestern corner of the town.
  - High elevation spruce-fir forests, especially those located at the northern ends of New Ipswich and Barrett Mountains, which may support Bicknell's thrush, a songbird restricted primarily to high elevations and spruce-fir forests.
- Riparian areas and large wetlands.
  - Riparian areas along watercourses, especially those areas that maintain connections between river corridors, wetlands, and unfragmented lands. Large wetlands or wetland complexes, such as the Tophet swamp area, which support a variety of reptiles, amphibians and other water-dependent wildlife.
- Steep south-facing slopes.
  - Deer and other wildlife may use open area with slopes steeper than 10 percent as winter resting grounds rather than more herding in deeryards. The increased solar radiation results in less snow cover, increased warmth, and possibly increased shrubby material for winter browse. The topographic position also protects these areas from chilling north winds. There are significant areas of these southerly facing slopes on hillsides scattered through the town as illustrates on Figure 11.

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NRI: Analysis of Natural Resource Inventory Data

To this point, we have defined the various resources of the community, provided information on their spatial location and illustrated co-occurrences that occur. Due to considerations of resources, availability of time, and the infrequency of availability of target parcels for acquisition or other protection methods, it becomes important to set priorities for resource protection. Setting priorities becomes a balancing act between: scarcity of a resource, immediate threats, ease of protection, presence of already protected lands, and the desires of the town. With the presence state of knowledge regarding these resources, the Conservation Commission has chosen to give equal weighting to resources identified in this study, and to concentrate on areas with the greatest number of co-occurrences.

4.1 Most Important Resources and Resource Co-Occurrences

Key resources have been identified and their locations delineated on the associated maps. In some instances these are single resource occurring in a location and in other cases there is a co-occurrence of multiple overlapping resources. Three GIS maps have been produced indicating co-occurrences of resources. These include: Significant Wildlife Co-Occurrences (Figure 13), Non-Wildlife Co-Occurrences Composite (Figure 14), and a merger of these two forming a Natural Resources Composite Co-Occurrences map (Figure 15).

4.2 Resource Importance

The importance of a particular resource varies from town to town depending upon perceived needs. Some resources, such as water supplies, are important to the health and safety of the town and may be more appropriately protected through regulation. Others, such as recreational areas, are probably more appropriately protected through purchase or voluntary initiatives. To add to the balancing act, it becomes important to focus protection efforts on two levels: broad scale protection of the priority lands outlined on the final composite map, Figure 13, and point protection for individual occurrences or priorities within each type.

4.3 Threats to Continued Resource Availability

The impact current land use regulations and land use trends, as well as economic factors have on natural resources can threaten their future availability or condition. A build-out analysis using current zoning and subdivision regulations would aid in determining which resources are at the greatest risk. Daylor recommends that New Ipswich conduct a build-out analysis utilizing current and proposed zoning regulations to reflect the impact on the resource base.

4.4 Regional Importance of Selected Natural Resources

Natural and manmade features such as the Wapack Range, Wapack Trail and the Souhegan River straddle several communities and are important regional and national resources. To insure protection of these will require cooperative efforts with adjacent communities and other volunteer organizations. Classification has been extended one mile beyond the town boundaries to gain insight as to what resources are present and other attributes of these resources within this area.

Several extensions of areas of importance within New Ipswich immediately are recognized as being regional resources. These include preserved land along the Souhegan River in Greenville, Mason and Wilton; lands along the Gridley River including the Perry Reservation in New Ipswich, Rindge and Sharon, the Annett State Forest in Rindge; numerous parcels along the Wapack Range and Trail, ranging from Watatic Mountain Wildlife Management Area in Ashburnham to the Wapack National Wildlife Refuge in Greenfield.

NRI: Open Space

This section summarizes the land in the study area in terms of its ownership and level of protection. The open space map (Figure 3) shows the location of protected open space in New Ipswich. Protected open space is defined as any land that is permanently protected from development by virtue of its ownership, deed restrictions, or other mechanisms. Temporarily protected open space is any land enrolled in one of the state's current use tax assessment categories. Unprotected open space does not have any protection from development but it serves a significant conservation and/or recreation function.

Open space information presented in the map and Appendix C is derived from GRANIT with updated parcel information for New Ipswich from assessor's maps and files. This process was used to identify land owned by various non-profit conservation groups. Several parcels of this type were identified through this process.

A review of the open space information reveals several patterns within the study area. First, the Wapack Range serves as the core of a relatively large matrix of protected and unprotected open space bounded roughly by Timbertop Road on the west and Poor Farm and Boynton Hill Roads on the east. While only a small portion of this core area is permanently protected, the lack of roads and public access, and topography unfavorable for development in the area has allowed it to remain intact. Secondly, the Tophet Swamp area includes two parcels owned by the Society for the Protection of New Hampshire Forests, which join a large contiguous block of protected land in Sharon and Rindge. Other protected properties are scattered throughout the town, typically occurring as isolated parcels. The four flood control sites and protected lands adjacent to the Souhegan River could provide focal points for expanded protection of this regionally important stream.

There are several large contiguous blocks of land that provides both advantages and disadvantages for conservation efforts. Advantages include working with few owners and lower per unit prices if tracts are purchased either outright or purchasing development rights or obtaining conservation easements. The general character of the land and the area might lead to rezoning this portion of the town to larger tracts as has been done in the Town of Lyme, NH, which has a 50 acre minimum lot size in their Mountain and Forest District. Disadvantages include the fact that many developers search out larger parcels for large-scale development.

The open space map also reveals that the Town of New Ipswich has extensive land holdings within the study area. These parcels range from isolated lands with little conservation value to large holdings in environmentally sensitive areas. Some of these parcels are currently being

administered by the Conservation Commission, with other parcels administered by other town departments. Since almost none of the Town of New Ipswich lands are protected from development, one possible cost-effective conservation strategy for the study area might be to work with the Town to designate Town-owned land with high conservation value as protected open space under the auspices of the Conservation Commission. An alternative low-cost method of protecting these lands would be to have another organization (land trust, conservation district) hold a conservation easement or the development rights to these lands. This action would require passage of a warrant article enabling such a transfer.

5.1 Co-Occurrences and Priority Analysis

Co-occurring resources analysis is a composite of several of the individual data fields used in the inventory. The purpose of the co-occurrence and priority analysis is to synthesize the information presented above into an overall ranking of resources and locations that can help conservation organizations and municipalities determine where to direct their efforts for maximum effect. This analysis begins with plots of simultaneous occurrences of natural resources and supplemental factors such as ownership or buffers, being found at the same location, i.e., co-occurrences.

5.1.1 Co-Occurrences of Resources

Maps 13, 14, and 15 illustrate the areas with the highest concentrations of co-occurrences of resources. Multiple co-occurrences at a particular site signifies the relative importance of natural resources, and the relative value of that location.

- Map 13: Significant Wildlife Co-occurrences Map illustrates the locations of numbers of wildlife habitat co-occurrences, combining the following resources:
    - Unfragmented lands
    - Protected lands
    - Agricultural lands
    - Wetland habitat, including streams, ponds, NWI locations and hydric
    - New Hampshire Natural Heritage Inventory locations
    - Wildlife corridors
    - Deer yards
    - Additional significant habitat (>10 percent south facing slopes and 100 year floodplain)

- Map 14: Non-wildlife Co-occurrence Composite Map illustrates the co-occurences of inventoried natural resources other than wildlife habitat. The following resources were combined for this overlay:
    - Unfragmented lands
    - Protected lands

- Surficial aquifers
- Wetlands, including streams, ponds, NWI locations and hydric soils
- Prime agricultural soils
- Steep slopes > 25%
- Viewshed slopes and ridges
- Viewshed points

- Map 15: Natural Resources Composite Map merges the two co-occurrence overlays described above in order to provide an overall representation of locations where there are concentrations of natural resources and the number of these co-occurrences. The various colors on the maps indicate the number of co-occurrence at a single point.

These areas of highest concentration of resources co-occurrences are located at the following locations:

- **Tophet Swamp Area:** A large portion of this area is conserved as conservation land owned by the Forest Society and the Town. An ownership gap exists between these properties along Route 124, with three parcels controlling much of the remainder of Tophet swamp. The wetlands themselves are protected through the Wetland Protection Act, and New Ipswich regulations further protect a 100-foot buffer immediately adjacent to the wetlands. The sandy soils provide excellent egg laying sites for turtles. If adequate property was acquired in this area, it could provide upland access to conservation land on the west side of BarrettMountain and the Arnett State Forest on the west. This would link two large blocks of unfragmented land. We recommend that uplands in this area be acquired, either through purchase or easement, to provide a travel corridor between these protected lands.

- **Wapack Range Ridge and Trail:** The Wapack ridge is unique in southern New Hampshire where the Trail extends for nearly four miles along the ridge of the New Ipswich Mountains with uninterrupted views to the east and west. To the north and south of this ridge, the trail descending into low lying country of rather ordinary status. We recommend that the ridgeline be protected as a regional resource. The lower lying portions of the trail could be relocated if required, therefore these portions of the trail system would not rank as high for protection as the ridge. There are several large parcels that occupy the ridge crest and flanks, some of which are in protected status. Recommended action would be providing protection through purchase, conservation easement, or large lot zoning. Priority is high. Money for trail related issues may be available through

the NH Division of Parks and Recreation, Bureau of Trails.

- **Kidder Mountain:** The wooded and rocky slopes of Kidder Mountain provide a distant mountain view focal point for much of the eastern side of New Ipswich. This extension of the Wapack Range rates moderately for wildlife habitat co-occurrences and moderately high for non-wildlife co-occurrences. A logging operation on the westerly side of the mountain is not evident from the normal viewpoints. Much of the eastern face of the mountain has slopes over 25 percent, and therefore is unbuildable under current zoning regulations. Priority for the eastern side of the mountain is relatively low with the exception of preserving the focal point for the view of much of the eastern portion of town. There is scattered development on the western side of Wildcat Hill that forms the western side of Kidder Mountain.

- **Binney Pond:** Portions of this area are included in the Binney Pond State Forest. There are large undeveloped tracts on either side of the state forest. Parcels west and north of Binney Pond, which a portion of the Wapack Trail traverses, are owned by the Hampshire Country School. Recommended action would be to provide protection through purchase, conservation easement, or large lot zoning. Priority is rated as moderate as the pond itself is currently protected, but monitor activities of large landowners.

- **Dam Site 35:** A parcel is owned by the New Hampshire Water Resources Department, and administered by the Conservation Commission. There are several other parcels that have wetlands associated with the impoundment located on them. As flowage rights impact the development potential of these properties, they currently afford some protection to natural resources, and are considered low priority for further action. Streams and their buffers flowing into and out of this area have relatively low numbers of co-occurrences, but are important to maintain wildlife travel corridors and water quality.

- **Upper reaches of Fox Brook:** This area lies at the foot of New Ipswich Mountain and contains a large wetland complex and is mapped as a deer yard. Land parcels are relatively large, with no road frontage for most of them. Land to the west and south are owned by Forestland Preservation, whose name implies that they hold land for sustained management of forest products, and may provide some protection to these adjacent lands. The extensive area of wetland provides a moderate amount of protection from development or subdivision. Suggested priority for further conservation action on these

lands is moderate.

- **Souhegan River Corridor**: This area contains aquifers along the West and South Branches, scattered wetlands of various types, and riparian habitat. Land adjacent to the South Branch near Flood control site 19 has been subdivided and developed with single-family houses, although the upper reaches of the pool score relatively high for natural resources co-occurrences. The river downstream of the confluence of the South and West Branches becomes a fourth order stream, and subject to Comprehensive Shoreline Protection Act provisions. The protection of this reach of the river is enhanced by the fourth order status that limits disturbances, coupled with New Ipswich zoning regulations that limit development within 100 feet of wetland boundaries provide control over development immediately adjacent to the stream corridor.

The Town owns four parcels adjacent to the river, ranging in size from 0.2 to 5.05 acres. The Town of Greenville owns a parcel along the river in New Ipswich, located between the river and the highway. Two class VI roads near the western bank of Water Loom Pond, Whirlpool and Preston Hill Road, have recently been converted to trails. Water Loom pond, created by the damming of the Souhegan River, is used for recreational pursuits by townspeople including picnicking, swimming, and fishing. A short distance below High Bridge the river again becomes a dead water stream, being backed up from the dam in downtown Greenville.

To maintain and improve the health of the stream and the riparian community through this area, several techniques can be employed. Road repairs or improvements should be required to utilize Best Management Practices (BMP's) for prevention of erosion and sedimentation. Recent innovations should be utilized for modification or replacement of bridges and culverts to minimize scour (Johnson, P.A. 2002) and facilitate travel corridors of wildlife (Jackson, S. 2002). Tree cover should be maintained to minimize thermal rise of the water.

5.1.2 Priority Analysis

The importance of the various resources varies from town to town, depending upon perceived needs. Multiple overlapping resource features, co-occurrences, can pinpoint "hot spots" with regard to protection strategies, however key single resource values should not be overlooked. Single resource, such as water, are becoming more important regionally as populations soar and increased demands for this resource become evident as recently expressed by the USA Springs Bottling plant proposed for Nottingham, and the proposed

sale of the Pennichuck Water Works, which supplies Nashua, to an out-of-state company.

The New Ipswich Conservation Commission has opted not to establish priorities for resource protection at this time. Rather, they have made the wise decision to analyze the results of the Natural Resource Inventory and determine if further studies are needed, additional information required, and solicit input from other interested parties in Town to establish priorities and goals that will reflect the perceived needs and goals of New Ipswich.

To aid in establishing priorities for protection and conservation of New Ipswich's natural resources, answers to several questions must be pursued.

What are the locations in town that have the most important resource values, and where are resource co-occurrences?
The co-occurrences overlays provides detailed information where concentrations of natural resources occur, and can provide helpful information for land protection projects and land use planning measures. Important single resources, such as aquifers that may provide future water supplies, may receive high priority for protection.

Why is this resource valuable to the town?
The value of a resource to the town, be it a potential aquifer or critical habitat component, can help suggest an appropriate protection strategy. Water supply resources, for example, are important to the health and safety of the town and may appropriately protected through regulation. Others resources, such as recreational areas, may be more appropriately protected by purchase.

What are the threats to the continued availability of this resource or group of resources?
To assess the threats to resource availability and continuance involves evaluating the land use trends and current land use regulations as well as economic factors on that resource. To properly assess these threats to New Ipswich's natural resource base a build out analysis using current zoning regulations with various scenarios of economic factors.

What natural resources have been identified that are important to other towns or the region?
As natural resources are not contained by political boundaries, protection of important resources, such as the Wapack Range and Souhegan River will require cooperative efforts between adjacent communities.

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NRI: Conservation Guidelines

A goal of this study is to synthesize all of the factors discussed in Sections 1 through 5 to provide the Town of New Ipswich with specific recommendations for prioritizing their conservation efforts. These recommendations were developed based on three criteria described below.

The criteria for priority ranking and action recommendations were analyzed as follows:

- **Level of Protection:** Various weights can be assigned levels of protection currently in place on specific parcels. For example, the highest weight would be for properties owned fee simple by the conservation organizations or the Town; less weight would be given tor parcels that a conservation organization controls a conservation easement or other restrictive covenant; less protection is offered by active tree farms and properties that are enrolled in current use assessment; followed by parcels within a zoning conservation overlay zone; and finally other parcels that have no restrictions placed on them would be classified as unprotected.

  A caveat should be placed on ownership of a parcel of land by a town. To change the intended use of a parcel requires passage of a warrant article at a town meeting. This could be the change from conservation land to the site of a new school. To insure that such changes cannot occur, some towns have run ownership of conservation land through a land trust before taking title.

- **Value for On-Site Resources:** On-site resources include locations, habitats and ecosystems. “Critical” on-site resources include the Wapack Trail and environs, and the main stem of the Souhegan River. “Significant” on-site resources include the NHNHI designated rare species and exemplary plant community locations. These locations have been identified as “critical” on-site resources because it indicates the area may provide favorable habitat for the survival of that species. It is unclear whether these areas are more critical for biological conservation than adjacent areas with a similar habitat type or whether they are simply better sampled with regard to rare species.
- **Value of Off-Site Resources:** Off-site resources include viewsheds, catchment areas in a watershed as they contribute to the aquifer recharge, unspecified wildlife habitat and areas that contribute to wildlife travel corridors and all other open lands in the study area which are identified as “significant” for off-site resources.

6.1 Guidelines for Land Protection Activities

Land protection measures can utilize several basic techniques including:

fee simple acquisition of land; conservation easements which separate the development rights to a property and place restrictions on its use; deed restrictions which are placed in a deed at the time of property transfer; mutual covenants which are similar to deed restrictions, and are often used by a group of landowners who share a resource; and zoning ordinances which can be tailored to adequately protect certain natural resources.

Based on the criteria discussed above, the highest priority lands for acquisition were determined to be unprotected areas that possess multiple co-occurrences of on-site resources, and face development pressures within the next few years. Most of these areas are privately owned. A few smaller areas of land are also identified as first priority for acquisition or other methods of protection.

Second priority lands for acquisition include areas that are unprotected and possess significant on-site and critical off-site resources. These lands are scattered throughout the study area and form the transition from first priority to third priority lands.

A land acquisition strategy for this area should balance the protection of first priority lands with the protection of second priority lands. Many of the first priority lands will likely be developed within the next 10 to 20 years if they are not acquired or otherwise protected. On the other hand, these lands may be more expensive to acquire because they are more imminently developable. Even though the second priority lands are less likely to developed in the near future, it may be a worthwhile use of land acquisition funds to purchase these lands before they increase further in value and before they are fragmented by development.

6.2 Guidelines for Advocacy and Project Review Activities

While it is not possible to acquire or permanently protect all of the significant lands within the study area, it may be possible to guide development and land management so as to preserve some resource values even on lands that will be developed in the future. Examples of such areas are lands that provide conservation value as connecting landscapes between critical habitat areas, areas with few natural resource co-occurrences, as well as areas contributing to the region’s overall hydrologic system. In these areas, the New Ipswich Conservation Commission and their conservation partners should try to guide development away from areas of sensitive natural resources by participating in local and state project review and permitting processes.

Another type of land area are those parcels already protected from development, but contain critical resources that require appropriate land management practices. For example, bog communities require control of supplemental nutrients and sediments to prevent invasion by plants that require higher nutrient levels, and must not be used for most recreational purposes due to damage of the peat mat by trampling. In these areas the Town may want to work with neighboring local and state governments as well as other conservation groups to ensure that land management practices support natural resource values.

6.3 Detailed Natural Resources Studies

We recommend that additional studies be undertaken to gain further insight of the natural resources of New Ipswich. These studies can be expanded according to the Town's specific needs and goals. The purpose of these detailed studies is to collect additional information that supports the primary goals of the Natural Resource Inventory or to gain additional information about a specific site. These studies need not be done all at the same time, but could be spread out as time and resources allow. Specific additional studies might include such areas as:

1. Water resources evaluation:
    - Favorable Gravel Well Analysis
    - Water Quality Monitoring
    - Dam and impoundment/flowage rights
2. Wetland Studies:
    - New Hampshire Natural Heritage Inventory classification of wetlands
    - Vernal Pool Inventory
    - Prime Wetland Assessment
3. Agricultural Land Assessment
    - Agricultural types
    - Current Use Assessment Properties
    - Conservation Easements
4. Forest Resources:
    - Productive
    - Certified Tree Farm Locations
    - Unusual Forest Types
    - Current Use Assessment Properties
    - Conservation Easements
5. Undeveloped Shorelands
    - Great ponds
    - Fourth order streams
6. Cultural and Natural Resource Features

- Archaeological and historic sites
- Scenic areas and designated scenic roads
- Recreation Areas
- Unique geologic resources/waterfalls

7. Build-out Analysis
    - Perform analysis based upon current zoning regulations.
    - Perform analysis scenarios based on alternative proposed zoning changes.

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