CHAPTER III

NATURAL RESOURCES

A. INTRODUCTION

The Town of Hudson lies on the eastern banks of the Lower Merrimack River in south central New Hampshire. The Town shares its southern border with the State of Massachusetts and its western border with the City of Nashua. As a result, Hudson has experienced significant suburban development as people realize that they can commute within the Greater Boston area and still live in a relatively rural town. Impacts from this growth make it important to understand, inventory and plan for the protection of the Town's remaining natural resources.

A unique set of constraints to development may exist on each parcel of land due to the specific topography, soils, water resources, and flora and fauna that could be present. In addition, the abundance and diversity of natural resources in Hudson, including wetlands, ponds, streams, fields and forests, provide opportunities for a variety of land uses while contributing to the overall quality of life in the community. The Natural Resources Chapter considers these constraints to development in planning for the future growth of the community. This chapter considers: 1) upland resources such as topography, soils and forest land; 2) water resources; 3) flora and fauna; 4) existing and potential conservation lands; and 5) recommendations.

B. UPLAND RESOURCES

1. Topography

Topography generally relates to the surface configuration of the land. The topography of an area can be described by two measurable characteristics — Elevation and Slope. A brief description of each of these factors is given below, along with an explanation of their importance in planning for land use and development within the Town.

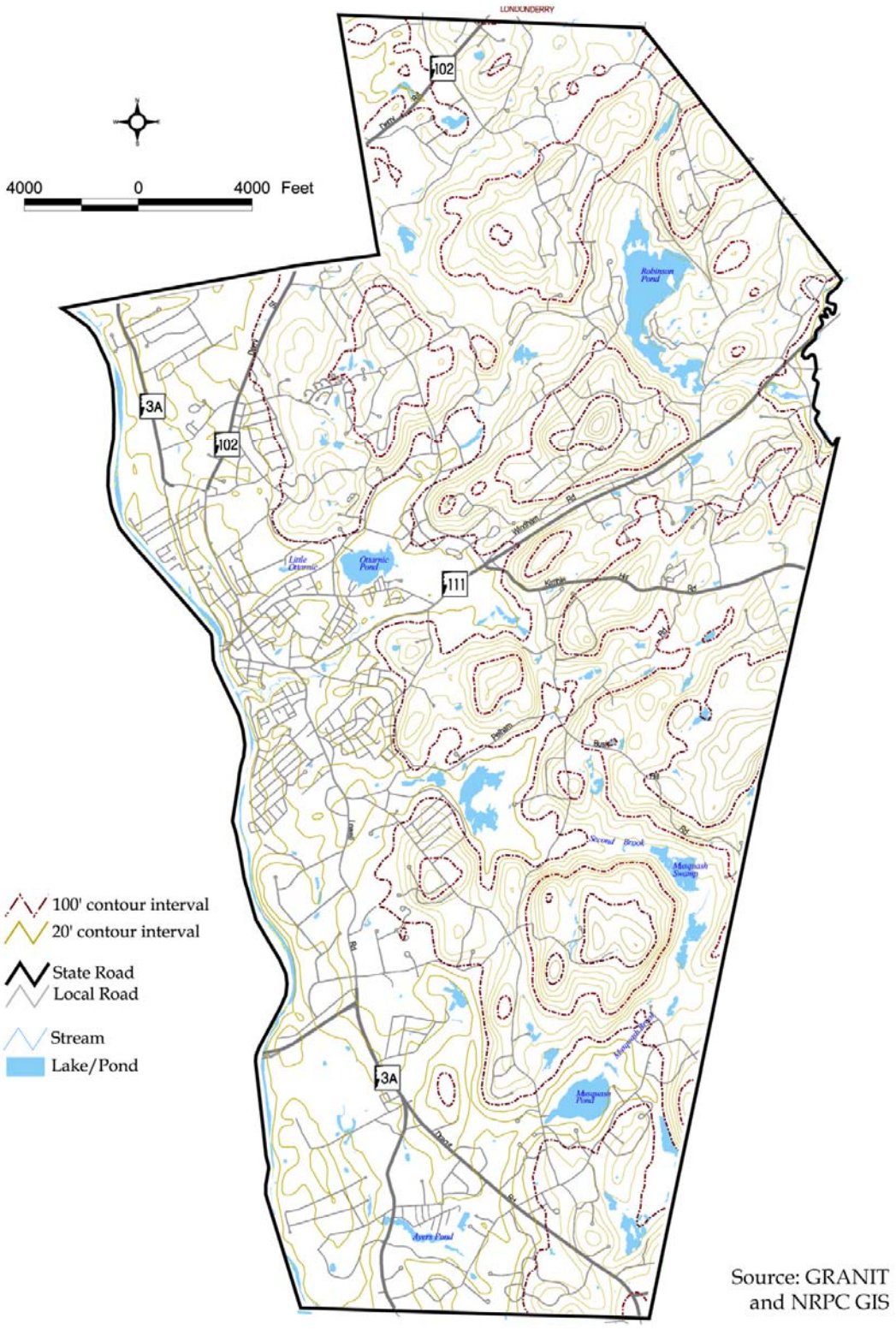
a. Elevation

Elevation defines the relative height of a piece of land at a given point. So that measures of elevation are comparable, they are expressed in terms of feet above Mean Sea Level (feet aMSL). Elevations in Hudson vary from the lowest point at 100 feet aMSL along the Merrimack River, to 510 feet aMSL in between Musquash Swamp and Pond in the southeast part of Town. The eastern half of the Town is dominated by higher elevations and steep slopes. The western half of the Town is slightly flatter, which indicates the former riverbed location during the glacial retreat and forms the watershed boundary for the Merrimack River mainstem. Map III-1 illustrates the topography for the Town of Hudson.

b. Slope

Slope refers to the relative steepness or pitch of a piece of land. Measurements of slope are expressed in percentages and are calculated by dividing the difference in elevation of two points by the distance between the points (i.e., change in elevation/distance = % slope). Thus, land with 0% slope has constant elevation and is perfectly level. Likewise, land with 100% slope has a pitch equivalent to a 45-degree angle. The mapping of slopes is a valuable tool in determining areas where slope conditions may require special design considerations or other precautionary measures. The following slope categories are recommended for consideration in planning for the future land uses in Hudson and are illustrated on Map III-2.

Map III-1. Topography



25+% Slope - Land areas in this category are among the most difficult to develop. A 25% slope represents a 25-foot vertical rise in elevation in a 100-foot horizontal distance. The central part of Hudson, near Musquash Swamp contains the few areas in Town where the slopes are 25% or greater. These areas will require extreme care and usually need special engineering and landscaping to be developed properly. The major problem of development on slopes of 25% or more is that in general steep slopes have a very shallow layer of soil covering bedrock. Proper safeguards must be applied to such sites to minimize hazards to downslope areas, and these safeguards usually mean costly and often problematic engineering and landscaping solutions.

For these reasons, active land uses on steep slopes should be avoided wherever possible, or approached with extreme caution and subjected to a thorough review by the Conservation Commission, Town Engineer and/or designated representative of the safeguards to be employed. The Minimum Lot Requirements for the Subdivision of Land require that, "the Minimum Lot Area…shall contain no slopes in excess of 25%".[1] In addition to the Minimum Lot Requirements, the Planning Board and Town should consider preserving such areas as open space and limiting their use for intensive development where possible. Where slopes in this category are to be developed, those involved should consult the principles, methods, and practices found in the Erosion and Sediment Control Design Handbook for Developing Areas of New Hampshire (1981 and amended in 1987), that has been prepared by the Hillsborough County Conservation District.[2]

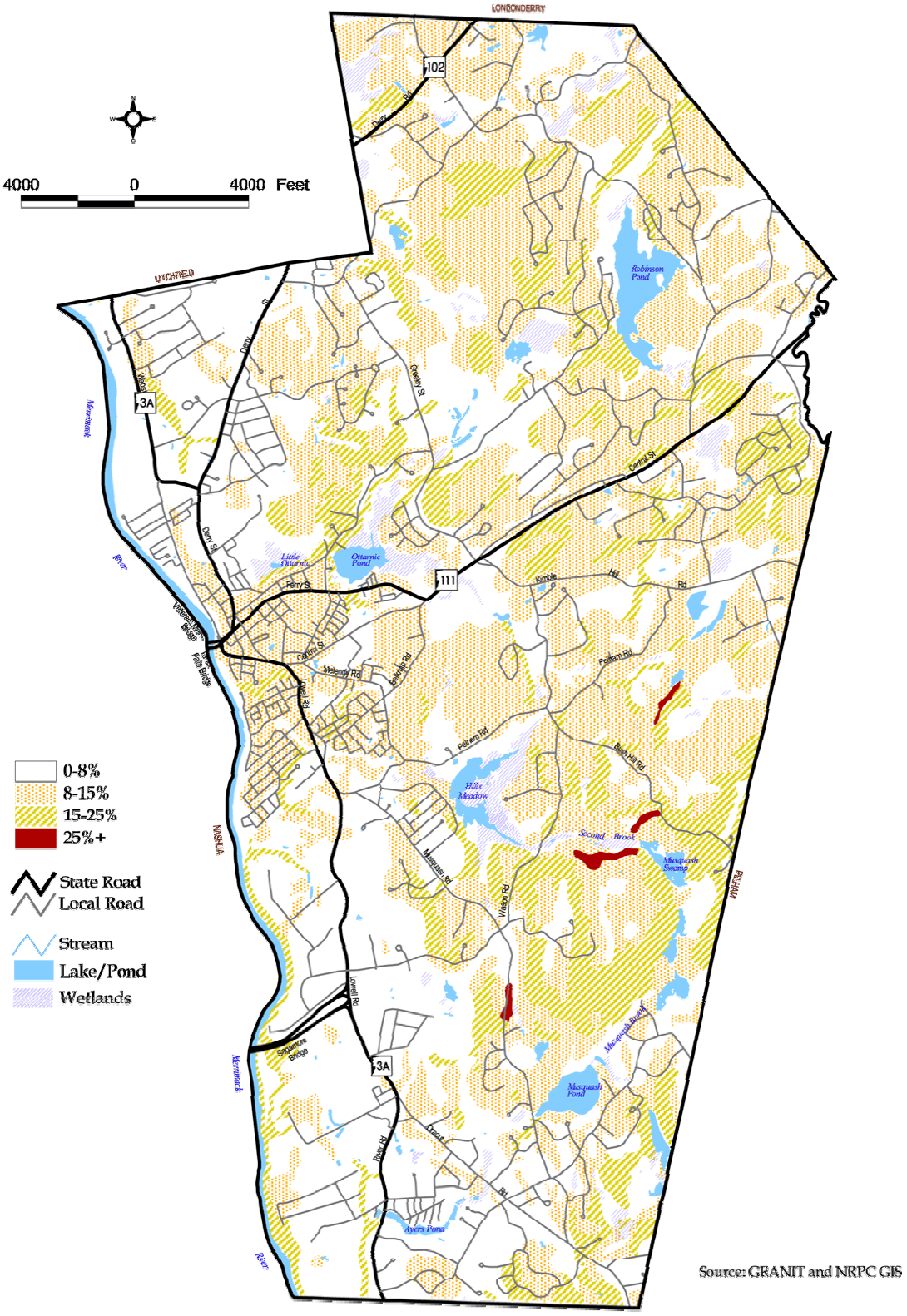
15-25% Slope - Areas in this slope category present similar challenges as areas with slopes greater than 25%. Development of these areas should only be undertaken with extreme care, recognizing the sensitivity of the environmental factors involved. In general, the steeper the slope, the shallower the soil layer covering bedrock. In addition, the velocity of surface water run-off can increase with the steepness of the slope, thereby increasing the potential for erosion and decreasing the potential for absorption of surface run-off.

The above conditions suggest that effective development of the site will increase the costs of on-site waste disposal, site stabilization and landscaping. Road construction is also more difficult and costly under these slope conditions and will result in increased volume and velocity of run-off to adjacent roadway areas. If proper safeguards are not applied, substantial hazards and potential damage to downslope property could result. For these reasons, active land uses should be avoided or approached with extreme caution.

Areas with 15-25% slopes are scattered throughout the Town, with three concentrations in the north central, central and southwestern part of Hudson. These areas are more suitable for open space. Preserving these areas as open space and maintaining the natural vegetative cover retains the absorptive capacity of the soil and minimizes the erosion potential.

[1] Town of Hudson, *2002 Zoning Amendments to the Hudson Zoning Ordinance,* 2001.
[2] Hillsborough County Conservation District, *Erosion and Sediment Control Design Handbook for Developing Areas of New Hampshire* , 1981 and amended in 1987.

Map III-2. Slope



8-15% Slope - Land areas with slopes in this category present many of the same problems that are associated with the 15%+ category. Here too, the high erosion susceptibility and the low absorption potential make site development and subsurface sewage disposal difficult. The severity of these conditions, however, may be less hazardous than on steeper slopes.

Overcoming site conditions may also be less costly and difficult on these slopes if approached with caution and sufficient foresight. Approximately one third of the Town is comprised of slopes in this category. A closer examination of specific parcels in this category will determine where problematic conditions may occur, and at what cost these conditions can be overcome.

0-8% Slope - Land areas in this slope category are generally considered to be well-suited for development. Land in this slope category is concentrated on the western side of Town along the banks of the Merrimack River and adjacent to many of the waterways in Hudson. These moderately sloping areas are preferred for active use. Their relative flatness does not pose severe erosion potential, and the velocity of the surface water run-off is sufficiently slow to allow absorption of the water into the soil. In addition, soil layers on slopes of 0-8% are usually of sufficient depth to allow for the absorption and purification of run-off and septic system effluent. (This will depend on the specific soil conditions found on particular sites with slopes in this category.) Overall, slopes of this nature are capable of supporting a wide variety of land uses.

One exception to the above comments, however, must be noted. Areas of 0-3% slope at low elevations, or with poorly or very poorly drained soils, have been found to have a high water table (at or near the surface) throughout a majority of the year. These areas pose substantial problems to site preparation, construction, and effective subsurface sewage disposal. But generally, flat, well-drained areas are usually quite suitable for active use and development.

The slope categories, as described above and shown on Map III-2 are intended to serve as a general guide to community planning. Local variations will require site inspection by the Town Engineer and/or designated representative to determine the existence and severity of problems to be overcome if developed. The slope data should be considered in conjunction with soils data and water resource data in determining the overall natural ability of the land to support development.

2. Soils

a. Soils in General and Limitations for Septic Systems

Soils are the most important determinant of the land's development capability, especially in unsewered areas. A soil's depth to water table, susceptibility to flooding, slope, depth to bedrock, stone cover, and permeability present potential constraints to the construction of roads, buildings and septic disposal systems.

The Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service (SCS) has devoted extensive time and resources to compiling soil surveys, which analyze the physical and chemical properties of different types of soils. From this information they have determined the suitability of soils for use, and the limitations and potentials affecting the use of soils for particular purposes.

Soils with *high* limitations for septic systems comprise approximately 40% of Hudson's land area. Concentrations of these soils are located primarily in the northern and southern parts of Town, with scattered concentrations in the central part. Soils with *moderate* limitations for septic systems comprise approximately 40% of the Town's land area. Concentrations of these soils are located primarily in the central part of Town along the Merrimack River and in the northern area adjacent

to the Londonderry Town line, with scattered concentrations throughout the central part. Soils with *slight* limitations for septic systems comprise approximately 20%of the Town's land area. Concentrations of these soils are located in the central part of Hudson. Appendix III-1 lists soils by their limitations for septic systems. The soils are illustrated on Map III-3.

Hudson bases minimum lot sizes for residential development on the presence of both water and sewer service facilities.[3] A single-family residence on Town water and sewer, for example, requires a minimum lot size of 30,000 square feet (ft^2) or 0.70 acres. Without public water and sewer, the residence requires 43,560 ft^2 for a single family and 60,000 ft^2 for a duplex. The Town does not permit construction of multi-family houses without Town water and sewer.

b. Agricultural Soils

The importance of agricultural lands as a valuable, rapidly diminishing resource has increased at national, state and local levels. Nationally, the US Department of Agriculture (USDA) estimates that one million acres of farmland are lost each year to the advancing urban sprawl that is sweeping the country. In New Hampshire, more than two-thirds of the State's farmlands have been removed from agricultural production over the last fifty years.

The USDA has identified soil types that are best suited for crop production based on soil quality, growing season and moisture supply. The three agricultural soil classifications recognized by USDA in New Hampshire are discussed below. Specific agriculture soils having national or statewide importance are listed in Appendix III-2. The location of these soils is illustrated on Map III-4.

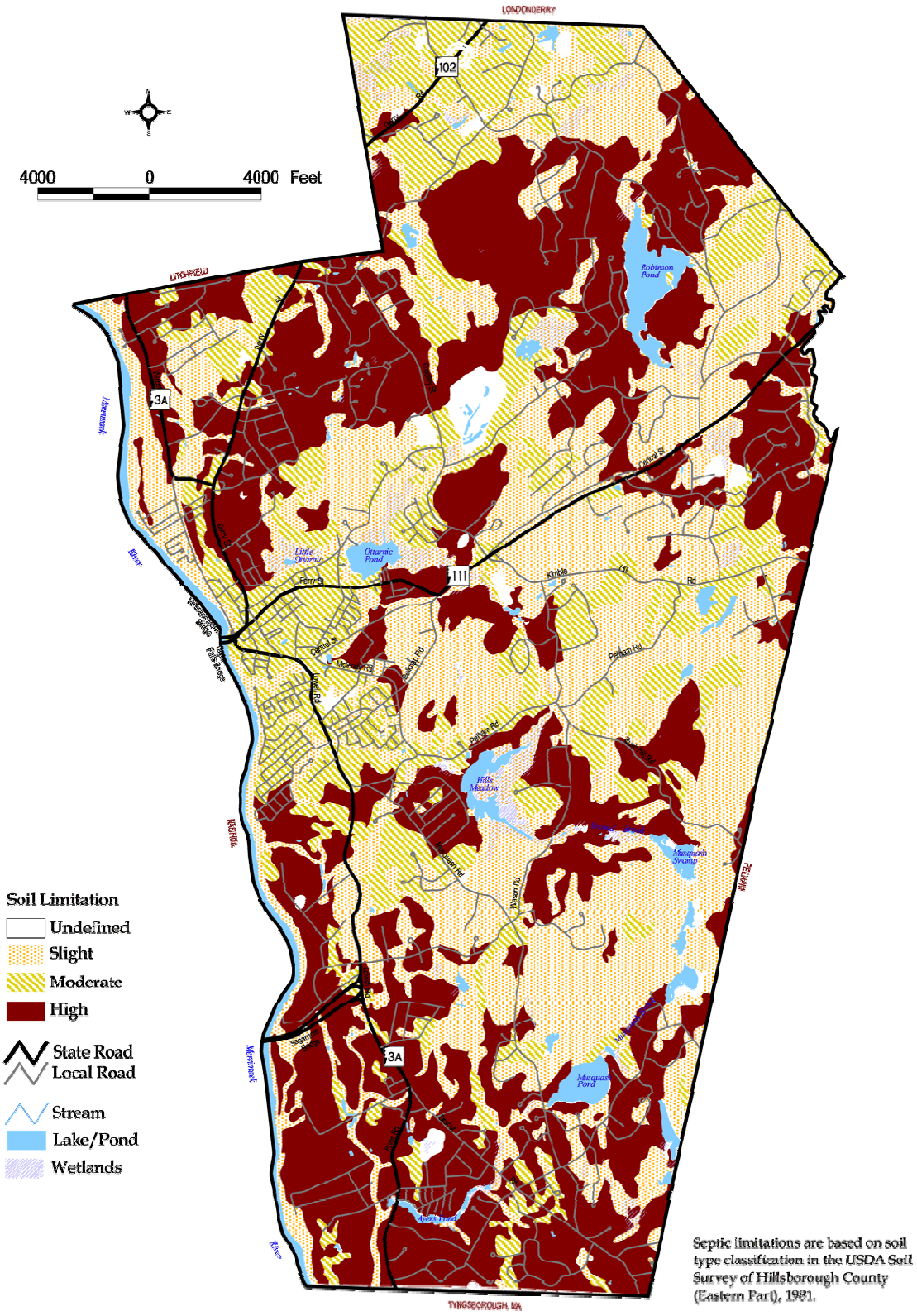
Prime Farmland - These lands are best suited for producing food, feed, forage, fiber or oil seed crops. Their soil quality, growing season, and moisture supply make them suitable for producing sustained high yields of crops economically when treated and managed according to modern farming methods. They can be farmed continuously without degrading the environment, and usually require little investment and energy for maintaining their productivity. These soils are rated among the best in the country for farming uses. Prime farmland soils are primarily located along the Merrimack River in the 500-year floodplain.

Farmlands of Statewide Importance - These lands are rated as being of statewide importance for the production of food, feed, fiber, forage and oilseed crops. They are important to agriculture in New Hampshire but exhibit some properties, which exclude them from Prime Farmland status such as erodibility or droughtiness. They can be farmed satisfactorily by greater input of fertilizer and erosion control practices, and will produce fair to good crop yields when managed properly. The Farmlands of Statewide Importance are scattered throughout Hudson and are commonly found adjacent to the wetlands in Town.

Farmlands of Local Importance - These lands are rated as having local importance because they are already being actively farmed. Since they are now under active farm management, they are important to the role agriculture plays in the Town's economic, cultural and conservation picture.

[3] *Town of Hudson Zoning Ordinance 2001, Chapter 334-27.1., General Requirements* states that, "*A lot with one or the other (water or sewage) will be treated as having neither.*"

Map III-3. Soil Limitations



Important agricultural soils are illustrated on Map III-4. These soils are limited in Hudson and located along the Merrimack River and scattered along the valleys. The ability to farm many of the areas that do contain important agricultural soils is also limited. Hudson limits agricultural activity to the Business District, the General District (formally the Rural District) and the General–One District. Most of these areas, however, have been developed for non-agricultural purposes or are not currently used for agricultural purposes. In addition, many of the important soils are not located in these districts (see Map III-4). For example, the land area adjacent to the Merrimack River in the northwest section of Hudson is identified as prime agricultural soil; however, it is in the Residential District in Hudson which does not allow for agricultural activity.

Although agriculture is not extensive in Hudson, the remaining areas are still an important resource that provide local seasonal produce and planting materials; provide open space; serve as an educational resource and contribute to the rural character of the Town. Efforts should be taken to encourage existing farmlands to remain in agricultural production. In addition to the existing farmlands, it is important to protect the important agricultural soils that are not currently in use, especially in districts where agriculture uses are not allowed. The Trust for New Hampshire Lands Program and the Land and Community Heritage Investment Program could provide resources to protect important agricultural lands through the acquisition of development rights on these properties.

c. Construction Materials

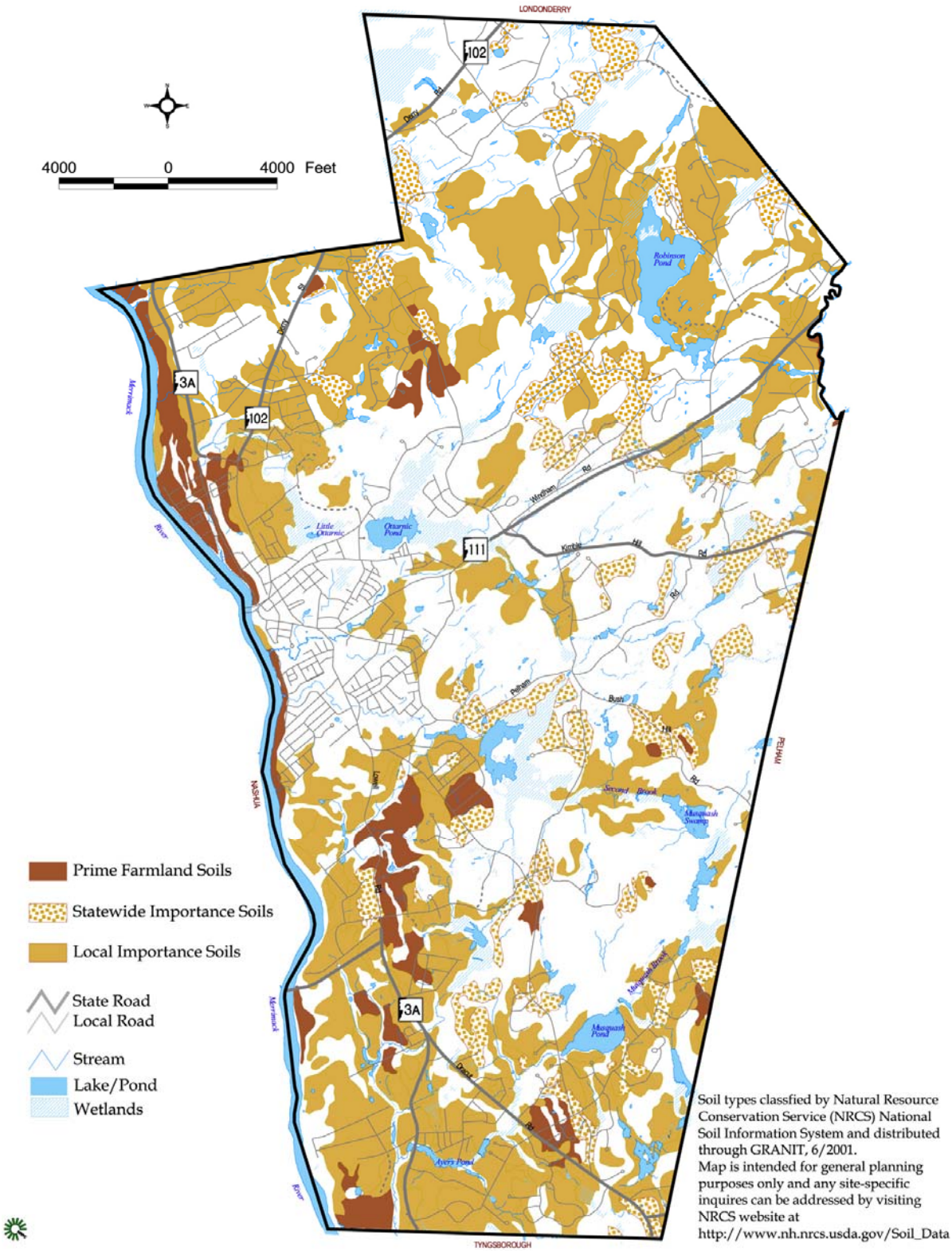
The NRCS rates the suitability of soils as sources of construction materials. Sand and gravel resources are particularly important materials for road construction; however, active excavation sites are few in Hudson. Most of the probable sources of sand and gravel deposits are within developed areas of Town. Hudson permits mining and quarrying in the Business District, the General District (formally Rural) and the General-One District.

New Hampshire Revised Statutes Annotated, Chapter 155-E, Local Regulation of Excavations, requires that communities provide "reasonable opportunities for excavation" of some of the commercial earth resources within their borders. The statute further requires that municipal master plans summarize known sources of construction materials and the location and estimated extent of existing excavation sites.

Excavation regulations adopted by the Planning Board in 1981 require a permit from the Planning Board for most clearing, grading, transporting, removal and excavation projects or other disturbance of land.[4] A copy of the application must also be sent to the Conservation Commission. Within 12 months after the expiration of the permit or completion of the project, the owner of the site must restore the site to meet a variety of minimum conditions such as: 1) spreading the original topsoil or strippings on disturbed areas to a minimum four-inch depth; 2) ensuring the area is left as free draining as practicable; 3) trees shall be planted with two-year old plants or plants furnished under a standard nursery order and shall be included in Trees and Shrubs in New Hampshire – A Guidebook for Natural Beauty Projects. Among the conditions of approval are adequate signage, parking and fencing; provisions for drainage during and after completion of operations; control of siltation, noise and dust; and limitations on standing water.

[4] *Town of Hudson, New Hampshire, Subdivision and Site Plan Regulations*. Chapter 200-3. Permit Required; exemptions.

Map III-4. Important Agricultural Soils



3. Forests

Forests were the dominant landscape characteristic after the retreat of the glaciers. Before 1623 and the colonization of New Hampshire, southern New Hampshire was 93% forested with the remaining 7% being marsh or ponds. By 1850, at the height of agricultural development in New Hampshire, only 20% was forest, while the remaining 80% of Hillsborough County was cleared for livestock grazing, growing livestock feed and raising crops for home consumption. Agriculture began to decline during the 1860's with the western migration and industrialization of the northeast. These fields slowly gave way to scrub trees and conifers generally took over the abandoned farmlands and meadows. During the 20th century, foreign disease and pests have changed forest composition and were responsible for the decline or destruction of the American Beech, American Elm and the American Chestnut. The introduction of the chestnut blight from Asia around 1904 killed most of the mature chestnuts within 20 years.

According to the Society for the Protection of New Hampshire Forests, *New Hampshire's Changing Lands*,[5] reforestation began to stabilize during the 1960's. The peak and downturn of forest cover began in the 1970's and 1980's when population gains and development increased throughout the State. Around 1983, New Hampshire reached an estimated high of 87% forest cover, which has not been seen since 1700. Satellite analysis in 1993 indicated that the forest cover was approximately 83%. This makes New Hampshire the second most forested state in New England after Maine.

The area's climate is ideal for the growth of forest trees. South central New Hampshire receives approximately 43 inches of precipitation per year. Among the common tree species found in Hudson's forests are White Pine, White Oak, Red Oak, American Beech, White Birch, Black Birch, Sugar Maple, Red Maple and Eastern Hemlock.

White pine has been the predominant tree harvested since colonial times. Hillsborough County is still a leader in white pine saw log production while red oak and sugar maple command a good market price. Deciduous and mixed forest types are dominant in Hudson and are widely scattered throughout the Town as illustrated on Maps III-5 and III-6. Many species of birds and mammals require large, unbroken tracts of forest in order to sustain their populations. Preserving unfragmented forest blocks helps retain the Town's scenic beauty and provides wildlife corridors for larger mammals.

Silviculture activities in Hudson consist of predominately small Christmas tree and firewood sales. Small woodlots continue to be selectively cut as supplemental income. Performance standards and plan review for silvicultural activities are regulated by the State through timber harvesting and water quality laws. Regulation prohibits the placement of slash and mill waste in or near waterways and limits clear-cutting near great ponds and streams. These requirements may mitigate some water quality impacts associated with timber harvesting.

Table III-1 provides a summary of Hudson's forest facts derived from *New Hampshire's Changing Landscape*. The forest and habitat data provided in that report is derived from 1992 – 1993 Landsat satellite imagery, the most recently available data source on forest resources on a regional level. Forest blocks of greater than 10 contiguous acres are illustrated on Map III-5. Forest blocks of greater than 500 contiguous acres are illustrated on Map III-6.

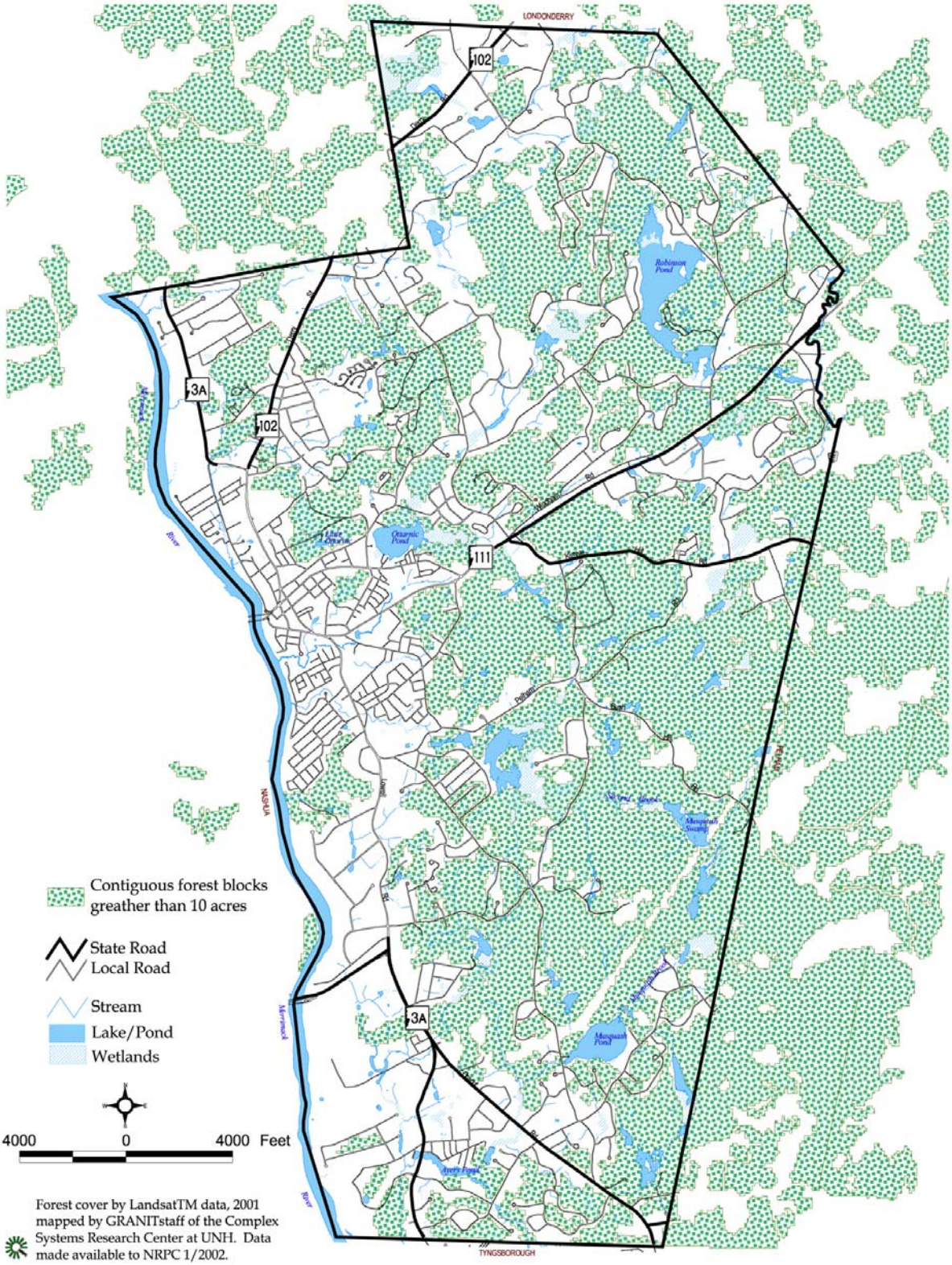
[5] The Society for the Protection of New Hampshire Forests, *New Hampshire's Changing Lands*, 1999.

Table III-1. Hudson Forest Facts

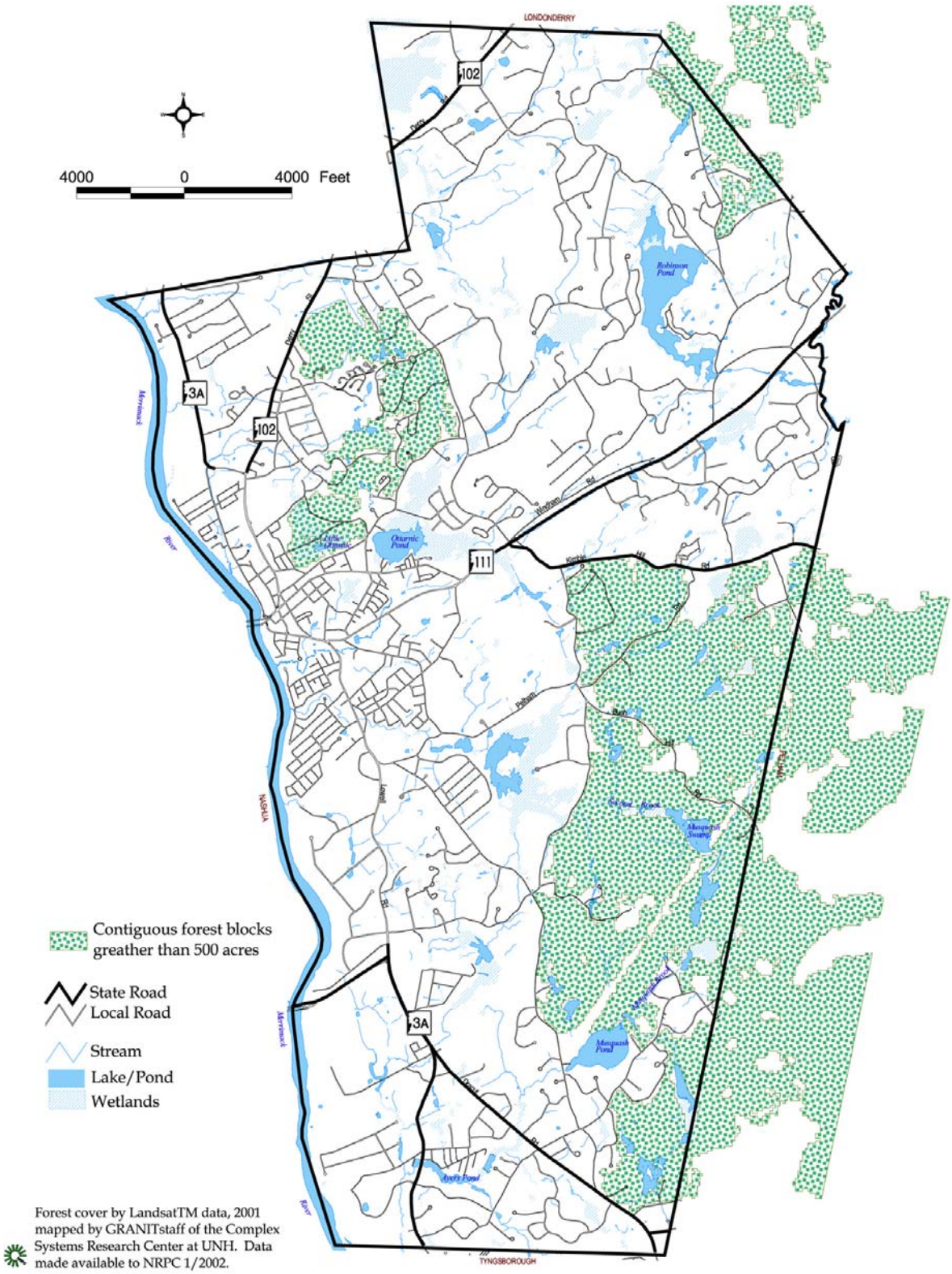
Area and Percentage in Forest (1993)	10,268.7 acres or 56.0%
Total area in Forest Blocks greater than 500 acres	2,837.20 acres
Number of Forest Blocks greater than 500 acres	3 forest blocks > 500 acres
Average and Median Size of all Forest Blocks	107.0 acre average and 38.1 acre median
Percentage of Forest Blocks greater than 10 acres that are protected	8.3 % blocks greater than 10 acres are protected
Predicted Decline in Forest Land Area by 2020	2,198.3 acres
Predicted % Decline in Forest Block Size by 2020	22.4% percent decline

Source: Society for the Protection of New Hampshire Forests, *New Hampshire's Changing Landscape*, 1999, based on 1992-1993 Landsat Thematic Mapper data.

Map III-5. Forest Blocks Greater Than 10 Acres



Map III-6. Forest Blocks Greater Than 500 Acres



C. WATER RESOURCES

Water is essential to every element of community life. Like air, water is constantly in motion - running above and below the ground's surface across Town, State and national boundaries. The natural system of water in Hudson is extremely important in planning for growth. Above ground, water is used by residents for fishing, swimming and boating. Water is drawn from the ground to supply the entire Town with a potable drinking water source. Conscious and careful planning of the land uses in the Town must be adhered to if hazards to the health and well-being of community residents are to be avoided.

1. Surface Water Resources

Surface water resources provide storm drainage, storage, groundwater recharge, wildlife habitat, water supplies and active or passive recreation. Although surface water represents a small portion of land area, the water resources in Town form an extensive network that connects surface water with groundwater. Because of this interconnection, all of the Town's surface waters are important in order to protect local water supplies and need to be considered when planning for the Town's existing and future growth. The Town's water resources, including watershed boundaries, are illustrated on Map III-7.

Hudson's most prominent surface water resource is the Merrimack River. The Merrimack River forms the entire western boundary of the Town and serves as a regional water supply and recreational resource. The Merrimack River also receives discharge from several of the region's wastewater treatment plants (including the City of Nashua and the Town of Merrimack) and much of the stormwater system. The Merrimack River is one of 12 rivers in the state protected under the Rivers Management and Protection Act. Activities within one quarter of a mile of the River are regulated by the State and reviewed by the Lower Merrimack River Local Advisory Committee (LMRLAC).[6] The Town should develop a working relationship and maintain active membership with groups such as the LMRLAC and non-profits like the Merrimack River Watershed Council[7] to coordinate the development of the Merrimack River corridor.

Another important water resource in Hudson is Musquash Brook and its associated ponds and wetlands. Musquash Brook originates in western Pelham near the Town border and flows into Hudson through a series of ponds and into Limit Brook, which empties into the Merrimack River in Tyngsborough, Massachusetts. Single-family residences comprise nearly half of the land area within the Musquash and Limit Brook watersheds. Despite the increased development, however, this area constitutes one of Hudson's highest quality natural resources because of the diverse wildlife habitat and the numerous recreational opportunities available to the Town and the region.

One critical surface water resource that attracts a lot of community attention is Robinson Pond. Robinson Pond is the largest water body in Hudson. Residents of Hudson and nearby towns use the pond for swimming, boating, nature walks in the Town-owned conservation land, fishing, and bird watching. Much of the Robinson Pond watershed is developed which is contributing an increased amount of nutrients into the pond, resulting in a eutrophic condition. Efforts to improve the condition of the pond include regular water quality monitoring and outreach to residents in the Robinson Pond watershed encouraging them to adopt good stewardship practices.

[6] http://www.des.state.nh.us/rivers/rsa483.htm
[7] http://www.merrimack.org

This section of the natural resources chapter briefly examines Hudson's surface water resources, with an emphasis on water quality, including potential threats as well as solutions to safeguard and enhance water quality. In this endeavor, it has been discovered that a comprehensive watershed-based approach is the most effective in safeguarding water quality. Therefore, this discussion will start with a description of the major watersheds in Hudson, followed by a discussion of rivers, streams and other water resources located within the major watersheds.

a. Watersheds, Rivers and Streams

A watershed is defined as a geographic area consisting of all land that drains to a particular body of water. Watersheds vary in size, shape and complexity. Watersheds are delineated by identifying the highest topographic points in a given area, and determining the direction in which water will flow from these high points. All water bodies have their respective watersheds. Major rivers, such as the Merrimack River also typically contain many sub-watersheds and tributaries. All of the perennial streams identified in Table III-2 are tributaries in the larger Merrimack River watershed, with individual watersheds for each stream (see Map III-7).

Table III-2. Perennial Streams in Hudson

Name	Total Length (miles)	Length in Hudson (miles)	Dammed or Free Flowing	Class[8]
Musquash Brook	2.7	2.7	free	B
Limit Brook	2.6	2.6	free	B
Second Brook	2.5	2.5	dammed	B
First Brook	1.5	1.5	dammed	B
Merrill Brook	1.9	1.9	dammed	B
Glover Brook	1.0	1.0	dammed	B
Reeds Brook	2.1	2.1	free	B
Chase Brook	2.3	1.5	dammed	B
Merrimack River	116	6.8	dammed	B

Sources: NRPC, 2003 and *Hudson Conservation Plan, November 1990.*

Each of the perennial streams in Hudson has a watershed. The water quality in each of these streams is directly related to the land use and activities that take place within each watershed, which are not always defined by municipal boundaries. Because the drainage area of any given water body may extend beyond a town's borders, intermunicipal coordination of land uses in each watershed is important in ensuring effective management and protection of the water resource. One example is the Musquash Brook Watershed, which is located in both Hudson and Pelham, with about one-quarter of its watershed area in Pelham and the remainder in Hudson. Map III-7 illustrates each watershed area in Hudson. Table III-3 below provides area statistics for each watershed.

[8] The class represents the desired level of water quality for the stream and does not necessarily reflect actual conditions. The classification of B means the stream either meets or has a goal of achieving the fishable and swimmable criteria established under the Clean Water Act.

Map III-7. Water Resources

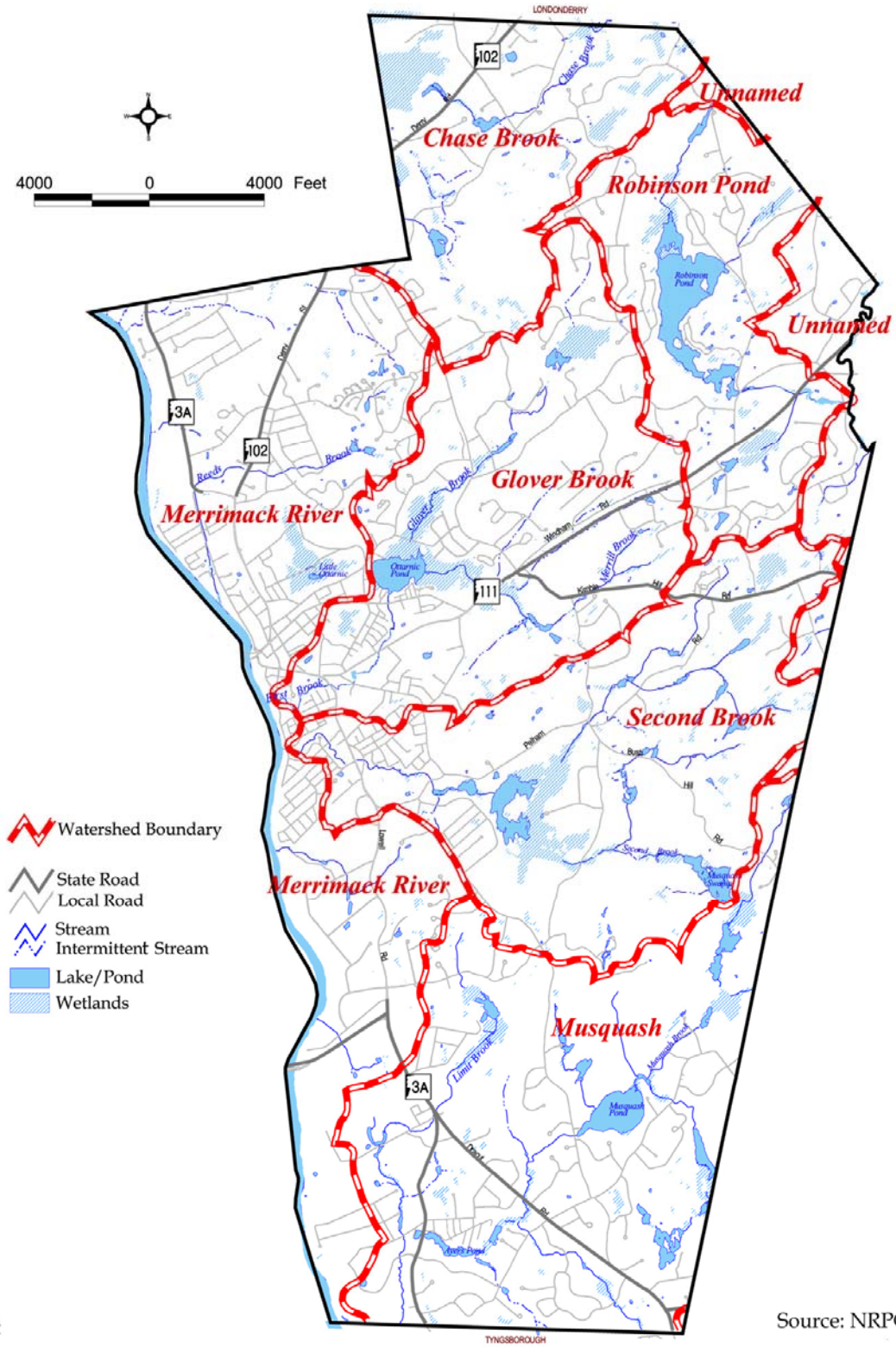


Table III-3. Watersheds in Hudson

Watershed	Acres in Hudson	Percentage of Hudson
Merrimack River primary watershed	3,999	21%
Musquash Brook watershed	3,840	20%
Unnamed watershed	580	3%
Second Brook watershed	3,323	18%
Glover Brook watershed	3,060	16%
Beaver Brook	107	1%
Chase Brook watershed	1,888	10%
Robinson Pond	1,976	11%
Total area	**18,773**	**100%**

Source: NRPC as delineated on USGS quadrangle maps.

Because all of these systems are connected in the greater Merrimack River watershed, it is important to remember that small disturbances in the perennial streams and their watersheds can alter water quality and quantity in the larger streams and rivers such as the Merrimack River. Erosion, flooding and contamination can occur in the smaller streams from stormwater. The cumulative impacts of development, from the smallest stream to the largest river, have an impact on both water quality and quantity in a community.

b. Lakes and Ponds

Hudson's lakes and ponds are also a very important surface water resource, providing wildlife habitat, water supply, flood control, and outdoor recreational opportunities. An inventory of Hudson's lakes and ponds is found in Table III-4.

Table III-4. Lakes and Ponds in Hudson

Name of Water	Area (acres)	Average Depth (feet)	Class	Trophic Class	Type
Ayers Pond	12	5.5	B	Eutrophic	Dammed
Benson's Pond	1.8	~ 6	B	NA	Dammed
Little Ottarnic Pond	2	NA	B	NA	NA
Ottarnic Pond	34	12	B	Eutrophic	Dammed
Melendy's Pond	1.5	NA	B	NA	NA
Musquash Pond	32	NA	B	NA	NA
Robinson Pond	88	29.5	B	Eutrophic	Natural
Unnamed Pond (Musquash Brook)	52.7	9.8	B	Eutrophic	Natural

Source: NH DES, *Survey Lake Data Summary*, November 2000.
Hudson Conservation Plan, November 1990.
Dave Clark, *Benson's Property Water Control Structures,* 2002.

The trophic class of a lake indicates its stage in the natural aging process, called eutrophication that all water bodies undergo. Generally, three classifications are used: oligotrophic - high transparency with low levels of nutrients and vegetation and high levels of dissolved oxygen; mesotrophic - elevated levels of nutrients and vegetation and decreased levels of dissolved oxygen; and eutrophic - low transparency, rich in nutrients, abundant aquatic vegetation and low levels of dissolved oxygen. All of the lakes and ponds in Hudson are classified as eutrophic. The natural aging process can be accelerated by excessive nutrient loading which encourages weed and algal growth, and in turn speeds up the deposition of decaying vegetation as organic sediments on the lake's bottom.

Robinson Pond is an example of the acceleration of eutrophication in a pond. The pond has become a popular location to build both summer camps and year-round single-family homes. Due to the intense development, increased amount of nutrients from lawn fertilizers, failing septic tanks and other natural conditions, Robinson Pond is experiencing high levels of phosphorous. Through support from the NH Department of Environmental Services members of the Friends of Hudson Natural Resources (the Friends) group are continually monitoring water quality in the pond and educating watershed residents on best management practices for septic maintenance, application of fertilizers, disposal of yard waste, buffers, and invasive species of aquatic plants. Communication between the Friends and the Planning Board and Conservation Commission is essential to improve and protect Hudson's surface water resources.

2. Groundwater Resources

A substantial portion of water in Hudson is below the ground's surface. Groundwater is water that is stored in the pore or fracture spaces between the individual particles of soil, sand, gravel, bedrock, etc. In essence then, the ground acts as a sponge (called an aquifer) which filters and stores large amounts of potable water. These supplies are tapped by drilling or digging wells to obtain water for domestic consumption. The amount of water which can be obtained in this manner is determined by the nature of the material holding the water. For example, per unit volume of material, sand and gravel deposits generally have a higher potential for yielding large amounts of water than do deposits of till and bedrock. The three different types of groundwater aquifers include: saturated stratified drift, saturated unconsolidated till and bedrock. Each source varies as to the quantity of groundwater present and how it moves. Each is described below and illustrated on Map III-8.

Stratified Drift Aquifers - Stratified drift aquifers are made up of sand and gravel materials. The materials were deposited by the melting of glacial ice similar to rivers that deposit sand or gravel bars today. The deposits may be quite extensive, and are layered or "stratified." Their course texture allows for large volumes of water to be stored and their high porosity allows groundwater to flow through quite readily. For these reasons, stratified drift aquifers are a prime source of water for municipal and other large-volume users. Water usage will vary depending on the type of development. In the absence of a municipal water supply system, the mapping of groundwater potential can be helpful in deciding where various land uses might be best located and limiting the maximum amount of growth.

Till Deposits - Till deposits contain a mixture of clays, sands and gravels of varying grain sizes. These deposits do not have the capacity to store or transmit large volumes of water; however, they can provide sufficient volumes to supply individual residences or small community wells.

Bedrock Aquifers - Bedrock aquifers are composed of fractured rock or ledge, where groundwater is stored in the fractures. These aquifers are very complex because bedrock fractures decrease with depth, "pinch out" over short distances, and do not carry much water. Wells drilled in bedrock that do not "hit" a fractured area will come up dry. If the well encounters an extensive fracture system,

then groundwater yields may be high. On the average, bedrock aquifers yield smaller volumes of groundwater than wells drilled in stratified drift.

Hudson has a nearly continuous stratified drift aquifer along the Merrimack River that measures approximately 10 square miles or 36% of the total land area in Town (see Map III-8). The most productive aquifer is located around Ottarnic Pond and extends northeast along Glover Brook and southwest to the Merrimack River.[9] This aquifer contains the largest volume of recoverable stored groundwater within Hudson. Several wells, with capacities ranging from 100 to 400 gallons per minute (gal/min), are located in this aquifer near Ottarnic and Melendys Ponds. The USGS study, *Hydrogeology of Stratified Drift Aquifers and Water Quality in the Nashua Regional Planning Commission Area*, describes the additional stratified drift aquifers in Hudson.[9]

The area along NH 102 near Alvirne High School in northern Hudson contains a permeable kame delta deposit which supplies water to individual households. According to Map III-8 this area has a moderate transmissivity rate of 2000-4000 square feet per day. Transmissivity is the ability of water to move through the ground. The higher the square footage per day, the more water the ground is carrying through it. Other permeable stratified drift aquifers, such as the one located adjacent to the border of Londonderry and another located on the border of Tyngsborough are medium yield but lack the aerial extent and saturated thickness to support large-municipal water systems requiring more than 100 gallons per minute.[10]

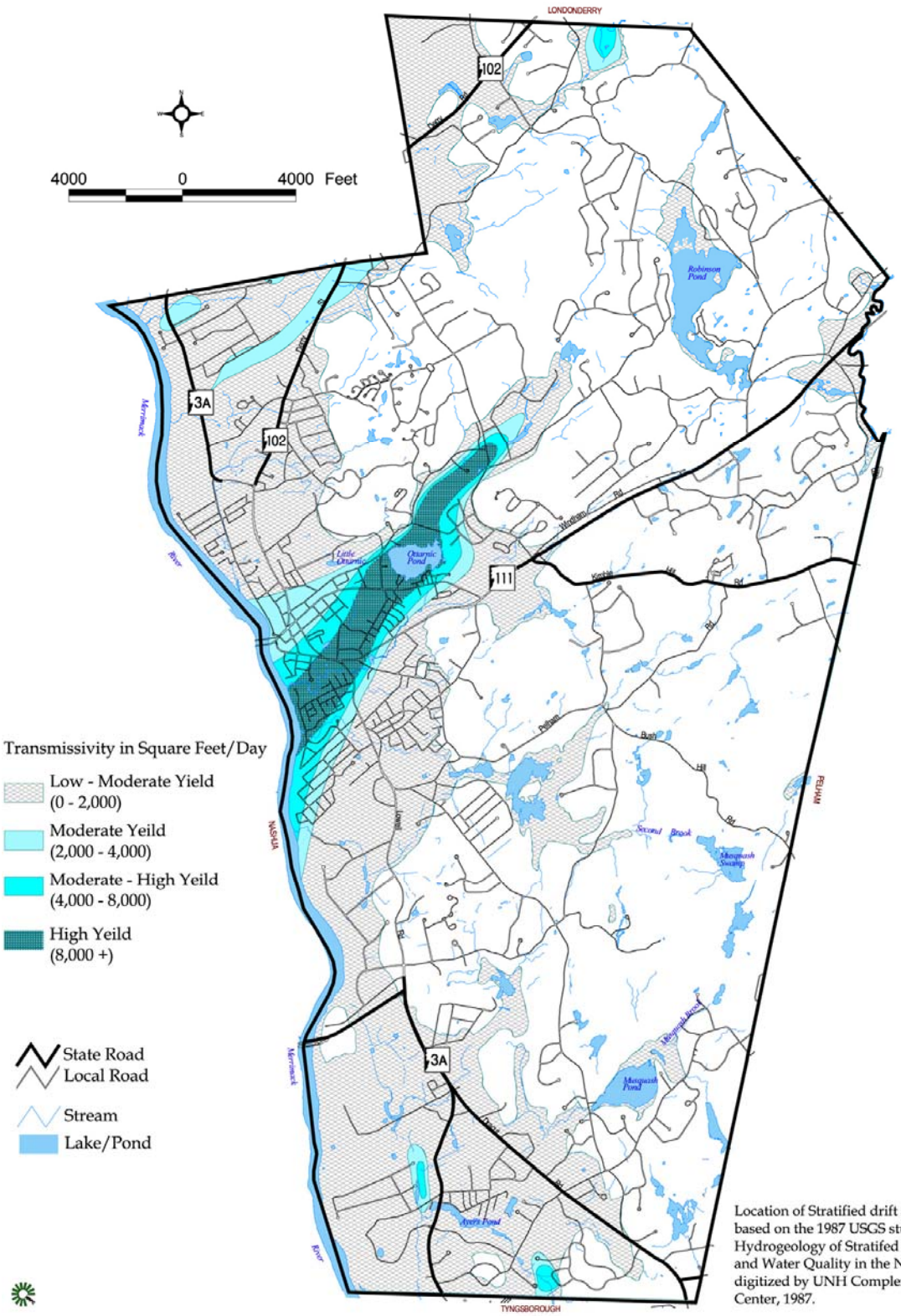
As mentioned previously, surface water and groundwater are interconnected. Precipitation falls in areas referred to as watersheds formed by a series of connecting ridges which create a basin. Surface water, flowing through a system of interconnected wetlands, brooks, streams, rivers, is encompassed by the drainage basin or watershed. A watershed can be subdivided into smaller subwatersheds.

In a watershed, groundwater is recharged in stratified drift aquifers in two ways. The area of direct recharge is the land surface directly overlying the stratified drift deposit. Water infiltrating the earth materials within this area has a "direct" route to the groundwater resource. The indirect recharge is the land surface outside the direct recharge area, but within the surrounding watershed, which contributes water to the groundwater system. Watershed management and protection can be used to provide a framework for a comprehensive water resource protection strategy, of which aquifer protection is a part.

In order to protect Hudson's groundwater resources, greater attention should be given to the location and extent of the aquifers in Town and action taken to protect these resources. One method of protecting groundwater resources is by adopting an aquifer conservation district. An aquifer conservation district protects existing and potential groundwater supplies and recharge areas from harmful developments or land use practices.

[9] United States Geological Survey, Water Resources Investigations Report 86-4358, *Hydrogeology of Stratified Drift Aquifers and Water Quality in the Nashua Regional Planning Commission Area, South-Central New Hampshire, 1987.*
[10] Hudson Conservation Commission, *Hudson Conservation Plan, November 1990.*

Map III-8. Aquifers



Location of Stratified drift aquifers is based on the 1987 USGS study of Hydrogeology of Stratifed Drift Acquifers and Water Quality in the NRPC area, digitized by UNH Complex Systems Center, 1987.

3. Floodplains

Floodplains are areas adjacent to watercourses and water bodies, which are susceptible to the natural phenomenon of flooding during periods of high run-off. The unpredictable nature of flooding requires the application of precautionary measures to avoid substantial damage to life and property in areas susceptible to floods.

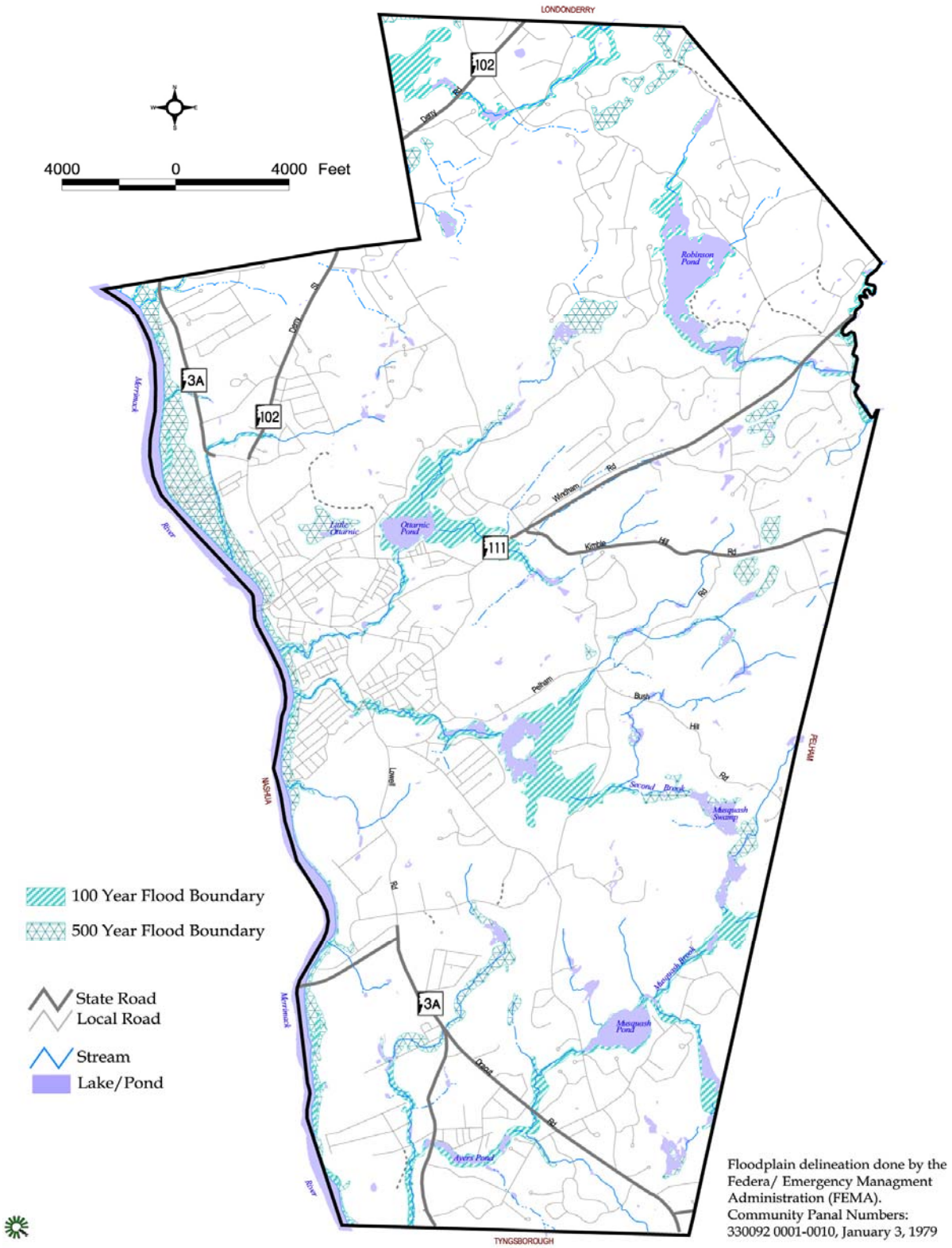
Two methods are available to avoid the problems presented by periodic flooding. Protective measures can be applied to structures already located, or proposed for location, on floodplain areas. Preventive measures can also be used to regulate the types of development permitted in these areas so as to minimize the potential hazards to life and property of community residents and landowners. To employ either approach requires the identification of affected properties.

Floodplain areas cover over 2,000 acres or approximately 11% of the area in Town. Most of the floodplain area is located along the east bank of the Merrimack River and in the Second Brook and Ottarnic Pond Watersheds as indicated on Map III-9. The only way to change the floodplain boundary is for the owner or the Town to submit a Letter of Map Revision and proof to the Federal Emergency Management Agency (FEMA) stating that the designated area is no longer subject to flooding, although it may have been at one time.

The Town of Hudson requires a floodplain permit for all proposed developments in any special flood hazard areas. The special flood hazard areas are determined by the various zones within the 100-year flood elevation as defined in the Community's Flood Insurance Study, the Federal Insurance Rate Map and the Flood Hazard Boundary Map. While the Town of Hudson allows development in special flood hazard areas upon approval, the applicant must also obtain permits required by federal or state law, including Section 404 of the Federal Water Pollution Control Act Amendments of 1972. These permits must be provided by the applicant prior to approval by the Town Engineer. In addition, there are certain qualifications that a structure or structures must meet in order to receive a building permit, including the following: 1) all new construction and substantial improvements of residential structures have the lowest floor, including the basement, elevated to or above the one-hundred-year flood level; and 2) proposed structures to be located on slopes in special flood hazard areas…shall include adequate drainage paths to guide floodwaters around and away from the proposed structures.[11]

[11] *Code of the Town of Hudson,* Chapter 218-4(E)(5) – Duties of the Engineer. http://www.ci.hudson.nh.us/

Map III-9. Floodplains



4. Wetlands

Wetlands have recently received much scientific and regulatory attention as recognition of their role in hydrologic and ecological processes has increased. Among the functions wetlands perform are aquifer recharge, flood control, erosion and sedimentation control, water purification, and provision of nursery grounds and habitat for numerous species of plants, animals and fish. A number of endangered and threatened species are found only in wetlands.

Wetland definitions vary according to the agency or organization delineating the wetland. The U.S. Fish and Wildlife Service definition of wetlands is based on the location of the water table and the presence of standing water, the presence of plant species commonly found in wetland habitats, and soil type. Four federal agencies (the U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS), the Army Corps of Engineers and the Environmental Protection Agency) agreed in 1989 on a definition of wetlands that considers three parameters: soils, wetland vegetation and hydrology. The NH Wetlands Board uses a three-part definition for wetlands based on hydric (saturated) soils, hydrology (water table at or near the surface), and wetland vegetation. For purposes of regulation, Hudson, like many communities in New Hampshire, defines wetlands as areas of poorly and very poorly drained soils (see Table III-5). Wetland soils in Hudson are illustrated on Map III-10.

Table III-5. Very Poorly and Poorly Drained Soils in Hudson

Very Poorly Drained Soils	Poorly Drained Soils
Borohemists (BoA, BpA)	Leicester-Walpole Complex (LtA, LvA, LvB)
Chocorua Mucky Peat (Cu)	Pipestone (PiA, PiB)
Greenwood Mucky Peat (Gw)	Ridgebury (ReA, ReB, RbA)
Scarboro (So, Sr)	Rippowan (Rp)
	Saugatuck (Sn)

Source: US Department of Agriculture, Soil Conservation Service, *Soil Survey of Hillsborough County New Hampshire, Eastern Part*, October 1981.

The proximity of these soils to low-lying areas or to surface waters is evidence supporting the sensitivity of these areas and their importance as wetlands. The amount and location of incoming run-off, slope, accessibility of natural drainage features, and seasonal wet conditions are all important points to consider in documenting the importance or sensitivity of a particular wetland.

Map III-10 illustrates that wetland areas are, for the most part, located adjacent to or close to open water, the Town's rivers, streams and ponds. This relationship is the result of a localized high water table and the source of greater quantities of soil water during periods of high stream flow. There are also some scattered pockets of wetland soils throughout the Town, usually at the bottom of low-lying areas or depressions.

The significant wetland systems in Hudson include: Musquash Brook-Pond, Second Brook-Mile Swamp, Ottarnic Pond-Glover Brook-Merrill Brook, Robinson Pond and Chase Brook.[12] Many of

[12] Hudson Conservation Commission. *Hudson Conservation Plan*. November 1990.

these wetlands form contiguous systems, designating them high in ecological value. The value of these connected systems are diminished, however, when land use alteration (such as filling) causes portions of these systems to become fragmented.

All of the wetlands along the Merrimack River are included in the 1987 Environmental Protection Agency Region I document, Priority Wetlands in New England. This document identifies high quality wetlands or wetlands that are vulnerable to environmental degradation. The document lists the following resource values for the Merrimack River wetlands: waterfowl, fisheries, flood storage and protection, habitat for anadromous fish (i.e., those that ascend rivers from the sea for breeding) and identification by the U.S. Fish and Wildlife Service as a key river in the anadromous fish restoration program.

Regulatory methods of protecting wetlands from pollution and destruction include requirements for erosion and sedimentation control plans and enforcement of those plans, minimum setbacks for buildings and septic system leachfields, minimum vegetative buffer requirements and prime wetland designation. Hudson's Wetland Conservation District zoning permits only the following uses: forestry and tree farming, agriculture (including grazing, cultivation and harvesting of crops), water supply wells, conservation areas and nature trails, and some uses that are permitted by special exception as long as they do not adversely affect wetlands.[13]

New Hampshire Revised Statutes Annotated, Chapter 482-A:15, enables a municipality (acting through its Conservation Commission) to designate certain areas as prime wetlands. Prime wetland designation accomplishes the following:

- Identifies wetlands considered important locally by virtue of their size, unspoiled character, uniqueness, fragility and/or other special characteristics.
- Notifies landowners, developers, and the NH Wetlands Board that the municipality strongly believes that certain wetlands should remain in their natural state.
- Provides assurance that the Wetlands Board will give special consideration to applications for dredge and fill permits in prime wetlands (as long as the Conservation Commission notifies the Board that the permit application is for a proposed project in a prime wetland.)

The New Hampshire Method of Evaluating Wetlands was developed in 1991.[14] A prime wetland is worthy of extra protection because of its unspoiled character, uniqueness or fragility. All prime wetlands must have over 50% hydric A soil, which are very poorly drained soils. The New Hampshire Method uses a ranking system based on 12 criteria. These criteria are as follows: Ecological Integrity, Wildlife Habitat, Fin Fish Habitat, Educational Potential, Aesthetic Quality, Water Based Recreation, Flood Control Potential, Groundwater Use Potential, Sediment Trapping, Nutrient Filtering, Urban Quality of Life Potential, and Historical Site Potential.

One step the Hudson Conservation Commission could take to protect wetlands is to perform a functional evaluation of the Town's wetlands, which may lead to designation of prime wetlands. The prime wetlands in Hudson do not currently receive additional protection under the Wetland Conservation District. Prime wetlands provide special services to the community which necessitate additional protection to preserve their value and function. Wetlands should be classified, mapped and evaluated separately within each watershed identified in Table III-3. This level of detail

[13] *Town of Hudson Zoning Ordinance 2001.* Article IX – Wetland Conservation District. Chapter 334-35. Uses within Wetland Conservation District.
[14] Amman, A., and A. L. Stone, *A Method for the Comparative Evaluation of Non-Tidal Wetlands in New Hampshire,* 1991.

regarding wetlands will assist the Town in making land use decisions that reduce or eliminate development impacts on natural resources.

The next step in protecting wetlands is to set the priority of wetland areas based on their location and the need for the benefits they provide. For example, wetlands adjacent to a stream may warrant a higher priority for protection than an isolated wetland "pocket." The outcome of these efforts would be a protection plan or strategy involving where and how protection is needed.

Other available methods to gain better control of important wetland areas is through Town regulations, conservation easements, deed restrictions, and the fee-simple purchase of development rights or land. Since overcoming the problems in the development of sites with these conditions is quite costly, and since hazardous conditions may result if improperly developed, these areas are recommended for use as open space. This restriction will allow these areas to continue their functions as unique wildlife habitats and as natural purification sites for the recharge-discharge of groundwater supplies.

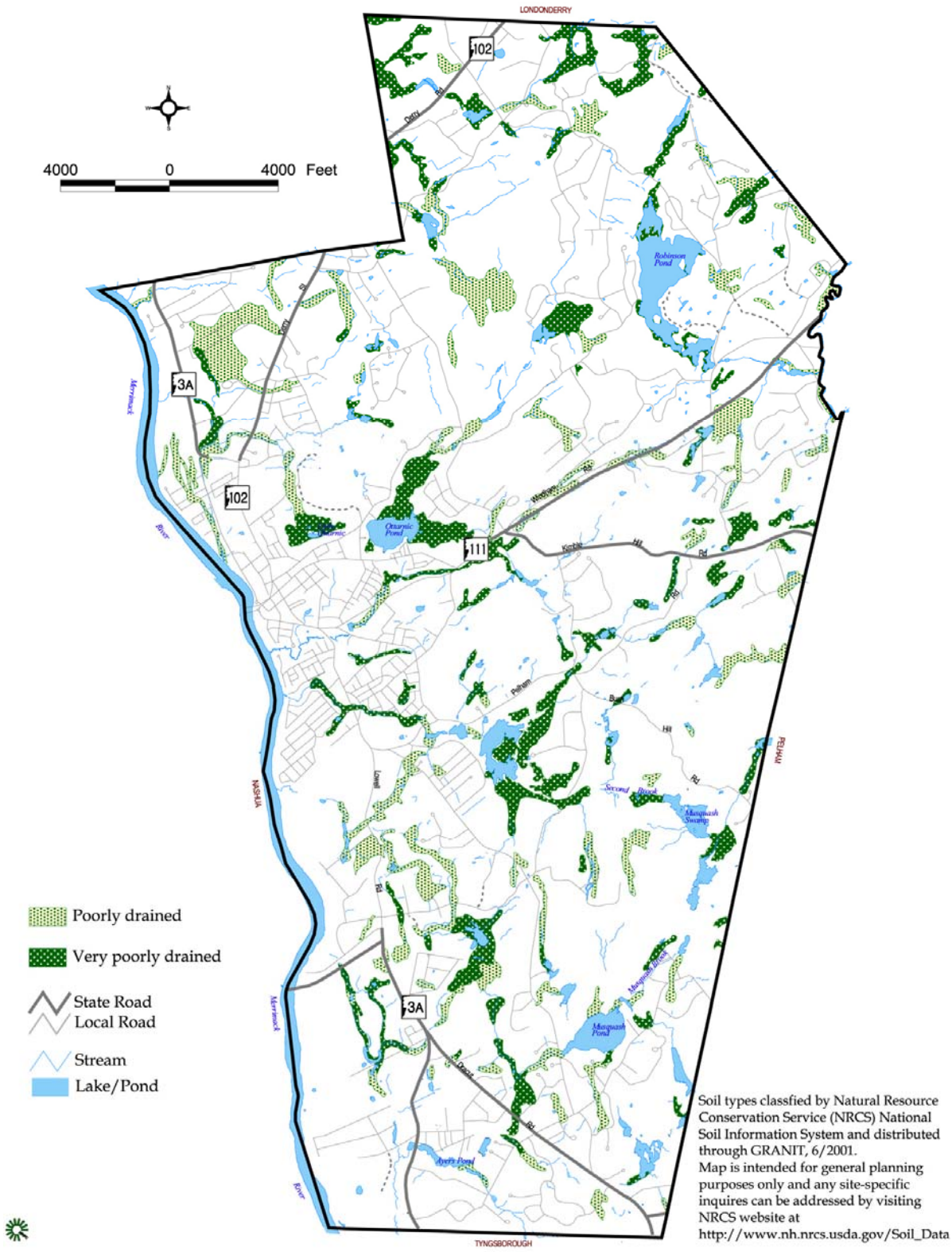
5. Water Supply

All water supplied to Town residents comes from groundwater sources. These sources are tapped by drilling or digging wells to obtain water for consumption. Hudson's public water supply comes from three wells (Dame, Ducharme and Weinstein) located in the Town of Litchfield. The Dame and Ducharme wells draw water from the Darrah Pond Aquifer in Litchfield. Pennichuck Water Works supplements Hudson's water supply with water from the treatment plant during periods of high demand through the Taylor Falls Pump Station at Ferry Street. Specific information regarding water supply in Hudson is discussed in detail in Chapter VIII: Community Facilities.

The presence and location of major groundwater supplies demand careful consideration in the Town's planning efforts. Map III-8 illustrates areas of groundwater favorability. It should be noted that all groundwater supplies are connected and thus have potential for both depletion and contamination. While water quality issues remain important, water quantity issues have recently become more pressing, especially in the southeastern portion of New Hampshire.

While no specific studies or activities can currently be referenced with regards to water supply within the Town of Hudson, issues relating to instream flow in the State are currently being addressed and may apply to the Merrimack River in the coming years. Keeping up-to-date on the instream flow rules will help the town adhere to any potential regulations that are passed.

Map III-10. Wetlands



6. Water Quality and Watershed Protection

A direct connection between surface and ground waters has been established which verifies the need for a more comprehensive approach to planning at the watershed level. Communities must take actions to eliminate potential pollution sources in all areas in the watershed including wetlands, floodplains, surface water bodies and water courses and adjacent lands and lands located over major groundwater sources. The most important step that can be taken by local officials to protect the quality of all surface and ground water supplies in the watershed is to minimize, if not eliminate altogether, polluting uses and activities on the land, especially those located directly adjacent to surface waters or over major groundwater supplies.

Activities and land uses which are known to be harmful to water quality in a watershed include: road salt storage and application; municipal and private landfill operations; salvage yards; subsurface sewage disposal systems (especially faulty or overused systems, and a concentrated number of systems in one location); underground storage of bulk oil, gas, or other polluting substance; and agricultural uses which entail cumulative pesticide and fertilizer use and concentrations of organic pollutants and residential application of yard products.

In the interest of protecting water quality, local officials may deem it beneficial to restrict or prohibit some or all of the above practices in certain areas of Town. These restrictions are invoked to protect the public health and well-being of present and future generations, and are imposed with the specific purpose and intent of protecting the public welfare. Examples of some of the restrictions that can be, or are currently being used are protective buffers and shoreland protection.

a. Buffers

The importance of surface water resources in the protection of water quality requires that they be treated with care in the land use planning process. It is recommended that land adjacent to surface water resources be protected by restricting their development from active use; however, these areas can be safely developed within a protective buffer to meet the community's needs for recreation and open space.

A protective buffer can be defined as the width of land adjacent to streams or lakes between the top of the bank or top of slope or mean water level and the edge of other land uses. Riparian buffer zones are typically undisturbed areas, consisting of trees, shrubs, groundcover plants, duff layer, and a naturally vegetated uneven ground surface, that protect the water body and the adjacent riparian corridor ecosystem from the impact of these land uses.[15] Buffers perform many functions such as:[16]

- Filter nutrients
- Regulate surface water flow
- Reduce sediments moving off-site
- Stabilize streambanks
- Provide flood protection
- Provide wildlife habitat

Buffers also provide protective greenways that minimize any land use impacts that may be created by permitted development. This not only protects the water quality, but also enhances

[15] State of Vermont, Agency of Natural Resources, *Riparian Buffer Procedure,* July 2001.
[16] Sohngen, Brent, Ohio State University, *What are the Benefits of Buffers?* March 2000.

the value of the surface water resources by allowing them to continue to support a community of wildlife within and around them. In addition, the connected surface water resource then serves as the basis for a natural system of open space around which development can occur.

The State of New Hampshire has not adopted a standard buffer width; however, current scientific literature and standards from other states define a "reasonable" minimum buffer width of 100 feet.[17] A larger buffer is recommended for sensitive wetlands (bogs, fens, white cedar swamps), prime wetlands, endangered or threatened species protection, or to support wildlife habitat more thoroughly.

The Town of Hudson Zoning Code, Wetlands Conservation District, protects a fifty-foot buffer around all wetland areas, surface water bodies and areas of poorly drained or very poorly drained soils. Intense land uses adjacent to the buffer may require additional evaluation. Consideration should be given to adopting a 100-foot buffer in existing high density areas or areas of anticipated increased density. A larger buffer will help protect the receiving waters from additional pollutant loads and increased flow associated with development.

b. Comprehensive Shoreland Protection Act

The Comprehensive Shoreland Protection Act establishes minimum standards for the future subdivision, use and development of shorelands of the state's public waters. When repairs, replacements, improvements, or expansions are proposed for existing development, the law requires these alterations to be consistent with the intent of the Act. Development within the protected shoreland must always comply with all applicable local and state regulations. Protected shoreland includes all natural fresh water bodies without artificial impoundments, artificially impounded fresh water bodies, rivers, coastal water, and all land located within 250 feet of the reference line of public waters. Natural woodland buffers must adhere to the following:

1. Where existing, a natural woodland buffer must be maintained within 150 feet of the reference line.
2. Tree cutting is limited to 50% of the basal area of trees, and maximum of 50% of the total number of saplings in a 20-year period.
3. A healthy, well-distributed stand of trees must be maintained.
4. Stumps and their root systems must remain intact in the ground within 50 feet of the reference line.

The Shoreland Protection Act only regulates activities along Ayers Pond, Ottarnic Pond, Robinson Pond, and an unnamed Pond along Musquash Brook.[18] A guide to developing community Shoreland Protection Ordinances is being developed by the Office of State Planning and participating Regional Planning Commissions to assist communities in protecting the surface waters that are not covered under the Shoreland Protection Act. The Town should remain aware of the progress of this guide and consider adopting a Shoreland Protection Ordinance to protect the remaining surface waters in Hudson.

[17] Schloss, Jeffrey and Frank Mitchell, University of New Hampshire, *Promoting Watershed Based Land Use Decisions in New Hampshire Communities: Geographic Information System Aided Education and Analysis,* October 2002.
[18] NH Department of Environmental Services: http://www.des.state.nh.us/asp/cspa/wb2.asp

7. Threats to Surface and Groundwater Resources

Rivers, streams, lakes, ponds and groundwater resources face a myriad of threats. The two main categories of pollution are point source and non-point source pollution. Point sources of pollution are those that can be traced back to an identifiable source, such as a pipe or sewer outfall. Non-point sources of pollution are more diffuse in origin, such as agricultural and urban stormwater runoff, septic system effluent, snow dumps, road salt, soil erosion, etc. The NH DES, *New Hampshire Non-Point Source Management Plan*, lists the various forms of non-point source pollution in order of priority for abatement efforts.

The list is based on the following factors:[19] 1) danger to public health; 2) magnitude and pervasiveness of the potential threat; 3) potential impacts to receiving waters; 4) professional judgement; 5) ability of existing regulatory programs to control pollution; 6) adequacy of existing education programs to promote pollution control; 7) public perception; and 8) comments of Non-Point Source Management Plan Subcommittee.

The list of non-point source pollution, in order of priority, is: 1) urban (stormwater) runoff; 2) hydrologic and habitat modifications; 3) subsurface waste disposal systems; 4) junk, salvage, and reclamation yards; 5) construction activities; 6) marinas; 7) road maintenance; 8) unlined landfills; 9) land disposal of biosolids; 10) land disposal of septage; 11) agricultural activities; 12) timber harvesting; 13) resource extraction; 14) storage tanks (above ground and underground); and 15) golf courses and landscaping.

In 1998, the Town of Hudson proposed a pilot *Groundwater Protection Program* to protect potential future sources of drinking water. The program identified numerous potential contaminant sources (PSCs) within the study area that was chosen near Little Ottarnic Pond. A potential contaminant source is defined as a human activity or operation upon the land surface that "*poses a reasonable risk that regulated contaminants may be introduced into the environment in such quantities as to degrade the natural groundwater quality.*"[20] Table III-6 contains a list of the 19 activities identified as PCSs in the Groundwater Protection Act of 1991. This list, in turn, was expanded into specific PSCs in the study area in Hudson. This list can be found in Appendix III-3. The list was developed in 1998, however, and should be updated to reflect changes in land uses. These and other threats to groundwater quality in Hudson are illustrated on Map III-11.

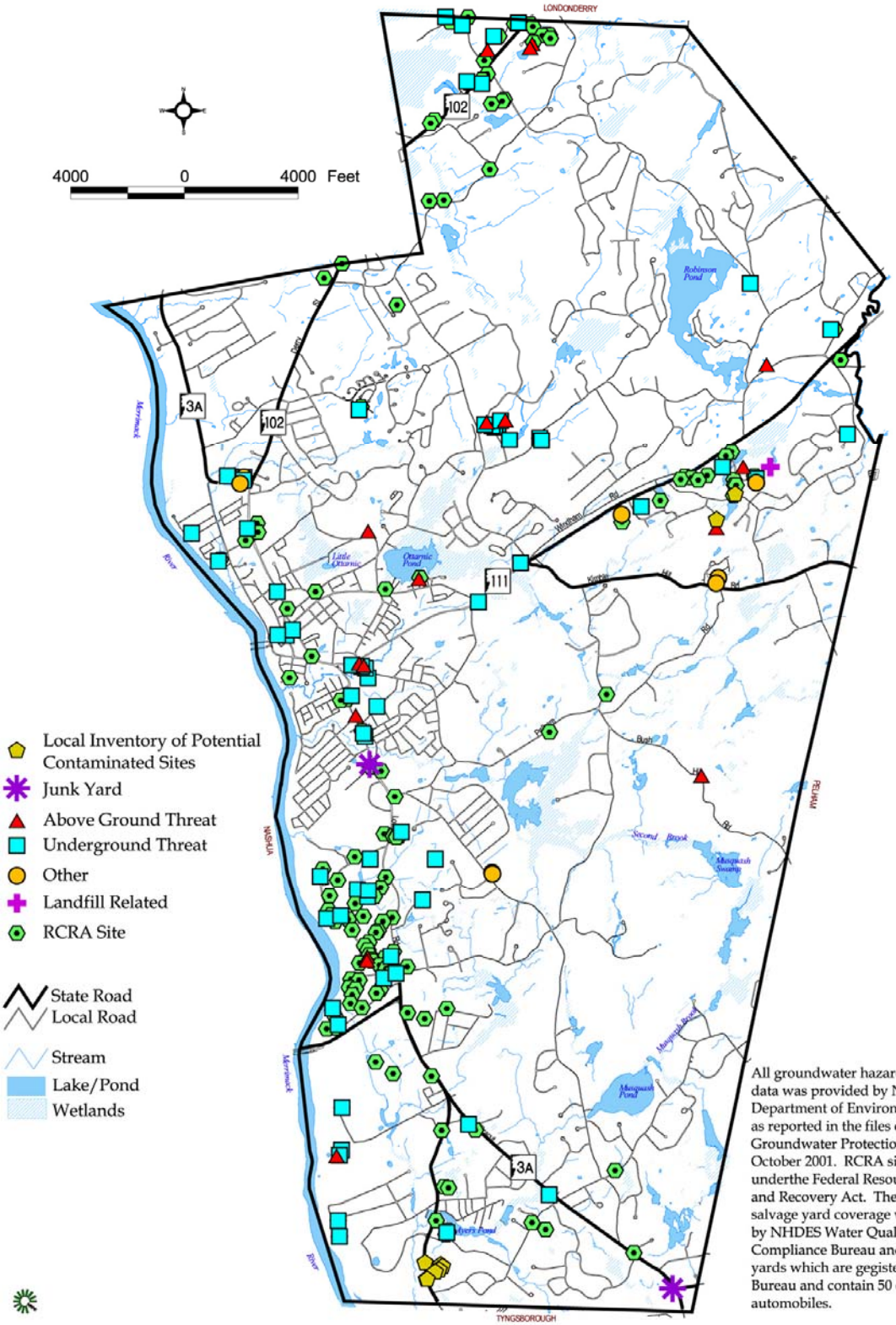
Table III-6. Categories of Potential Contaminant Sources

Vehicle service and repair shops	Salt storage and use
General service and repair shops	Snow dumps
Metalworking shops	Cleaning services
Manufacturing facilities	Food processing plants
Underground/above-ground storage tanks	Concrete, asphalt and tar manufacture
Waste and scrap processing and storage	Cemeteries
Transportation corridors	Hazardous waste facilities
Septic tanks	Stormwater infiltration ponds or leaching catch basins
Laboratories and certain professional offices (medical, dental, veterinary)	Fueling and maintenance of earth moving equipment
Uses of agricultural chemicals	

Source: *Town of Hudson Groundwater Protection Program*, NRPC, December 1998.

[19] NH Department of Environmental Services, *New Hampshire Non-Point Source Management Plan*, 1999.
[20] Nashua Regional Planning Commission, *Town of Hudson Groundwater Protection Program*, December 1998.

Map III-11. Potential Threats to Groundwater Quality



This section briefly examines some of the issues and trends in point and non-point source pollution and actions that can be taken to address this pollution. The focus is on non-point source pollution and urban runoff in particular, now acknowledged as being the most serious threat facing surface and groundwater resources today. The recommendations that follow this discussion will mention several "best management practices" (BMPs) that address non-point source pollution and stormwater runoff in particular. BMPs are variously defined as technical guidelines for preventing pollution caused by particular activities, and recommended treatment or operational techniques to prevent or reduce pollution. Some of the major sources of surface and groundwater contamination are discussed below.

a. Stormwater Runoff

The development of land for residential, commercial or industrial purposes increases the amount of impervious surface area within any given site due to the construction of buildings, roads, driveways, parking lots and other improvements. Impervious surfaces reduce the natural infiltration of stormwater into the ground, thereby, reducing recharge of groundwater resources. This is particularly true where stormwater is discharged into a storm drainage system that exports stormwater off of a site and out of a watershed. Increased imperviousness results in direct stormwater discharges into streams and rivers, which results in the alteration of the natural flow of the stream, causing erosion and sedimentation, loss of aquatic wildlife habitat and increased flood hazards.

Stormwater runoff is also a principal non-point contamination source of surface and groundwaters. Potential contaminants found in stormwater runoff include: nutrients such as phosphorous, nitrates, heavy metals, floatables and solids, pathogens such as viruses and bacteria, organic compounds including oils, grease, MTBE, and pesticides and herbicides. These materials can lead to the degradation of surface and groundwaters. The U.S. Environmental Protection Agency (US EPA), through a program called the *National Pollutant Discharge Elimination System* (NPDES),[21] aims to prevent and control non-point pollutant sources. The first phase of this program, appropriately referred to as the "Phase I Stormwater Rules," regulated the municipal stormwater systems and discharges of medium and large municipalities (those with populations greater than 100,000).

In May 2003, the EPA expanded the NPDES program to include stormwater systems within the urbanized areas of municipalities with populations less than 100,000.[22] These Phase II rules also impact construction activities between 1 and 5 acres, whereas Phase I regulated construction activities of greater than 5 acres. In order to comply with Phase II requirements, regulated municipalities are required to submit a Notice of Intent (NOI). This NOI includes a stormwater management plan that addresses the six minimum control measures required by the EPA.

The stormwater management plan was designed to reduce the discharge of pollutants to the maximum extent practicable, to protect water quality and to satisfy the water quality requirements of the Clean Water Act. It contains 6 minimum control measures: 1) public education and outreach; 2) public participation and involvement; 3) illicit discharge detection and elimination; 4) construction site runoff control; 5) post-construction runoff control; and 6) pollution prevention and housekeeping.

[21] www.epa.gov/npdes.
[22] Comprehensive Environmental Inc., *Phase II Stormwater Rule Summary and How Municipalities Can Prepare for Compliance*; 2000.

In April 2002, the Planning Board amended the Town of Hudson Subdivision of Land Regulations, Section 289-20. Flood, Stagnant and Stormwater to require a Stormwater Management Report be prepared for any site or subdivision plan in Hudson. The report must provide, among other things, a stormwater drainage plan that is certified by a licensed professional engineer and proves that "all drainage shall be designed to achieve a zero increase in run-off for both peak and volume…".[23] In Hudson, the stormwater drainage plan is seen as the single most important element of the entire site plan.

b. Road Salt

Excessive salting of roads and improper salt storage create the potential for sodium, calcium and chloride contamination of the groundwater, which can pose health threats to humans, endanger animals and plants and corrode metal and concrete.

In order to avoid contamination of public water supplies, municipalities establish no-salt routes which encompass areas adjacent to public water supplies and areas where on-site wells are located near roadways. Other areas are treated with a mixture of salt and sand. A more expensive method is the use of Calcium Magnesium Acetate (CMA) which is biodegradable and non-toxic to the environment.

Another alternative is to identify critical portions of roads in Town that can be designated for a conversion to "low salt" or "no salt" status on a prioritized basis over a specified time period. The Town can also request that the State use alternative de-icers on certain state maintained roads in priority areas.

c. Subsurface Sanitary Waste Disposal

Septic system failures from improper design, installation, or maintenance allow nutrients, particularly nitrogen and sometimes bacteria and viruses to leach into water resources. The first receptor of these contaminants is often a nearby private well, but surface waters may also be affected. Septic system leachate, along with stormwater runoff, may contribute to excessive algae growth in surface waters which, in turn, decreases the amount of oxygen available to fish, decreases sunlight penetration and clogs waterways. In most cases, older septic systems and cesspools pose the greatest threat to groundwater and surface water quality. The EPA considers new systems meeting today's heightened standards to be passive and durable systems that can provide acceptable treatment despite a lack of attention by the owner.

d. Underground Storage Tanks

Leaks in improperly equipped underground storage tanks (USTs) are difficult to detect and may go unnoticed for a long time. Even a small leak of only a few gallons can contaminate millions of gallons of ground water. The State regulates USTs where the cumulative volume of all tanks at the facility is 1,100 gallons or more. Some tanks, including those containing non-petroleum based chemicals and those containing heating oil for on-site residential consumption are exempted. As of 2003, 68 USTs in Hudson were registered with the NH DES Subsurface Water Bureau.[24]

[23] *Town of Hudson, New Hampshire, Subdivision and Site Plan Regulations.* Chapter 289-20(C) – Flood, Stagnant Water and Stormwater.
[24] http://www.des.state.nh.us/asp/onestop/ORCB_Query.asp

D. WILDLIFE AND PLANTS

Hudson's natural resource base provides a habitat for many plant and animal species. A variety of habitats such as wetlands, forests, fields, rivers, and streams are essential to support a diversity of species in quantities healthy enough to ensure continuation of the species. Maintaining quality habitats is crucial to the continuation of all plant and animal species.

The New Hampshire Natural Heritage Inventory (NHI), a program of the Department of Resources and Economic Development, tracks threatened and endangered species and exemplary natural communities in the State. Using a ranking system developed by the Nature Conservancy, the NHI assesses the rarity of a species on a global and state level. State listing ranks are defined by New Hampshire Code of Administrative Rules (RSA 217-A:3). The NHI records list five terrestrial (forest) and two palustrine (wetland) exemplary natural communities in Hudson. Five of the seven listed are ranked as the highest importance in New Hampshire. The rating is based on a combination of how rare the community is and how large or healthy it is in the Town.

There are 170 natural community types described by the New Hampshire Natural Heritage Inventory Program. Natural communities are basically groupings of plants that occur together in recurring patterns based on water, soils, climate, and nutrients. These communities represent intact examples of New Hampshire's native flora (plants) and fauna (animals). Appendix III-4 provides a complete NHI listing of the 56 exemplary natural communities or rare species for Hudson.

It is recommended the Town take advantage of the University of New Hampshire's Community Environmental Outreach Program (CEOP) and Natural Resources Senior Projects for a plant biodiversity survey. Documenting the flora and fauna in Hudson will allow the Town to plan around these resources, and provide them with protection from future development.[25] These are inexpensive programs and the range of possible projects is limited only by the needs of the community and the availability of students to match those needs.

1. Mammals

Mammals commonly found in Hudson include: raccoons, opossums, skunks, muskrats, beavers, porcupines, woodchucks, white-tailed deer, squirrels, mice, bats, foxes, rabbits and other indigenous species that are adapted to living near humans and urban activities. Sightings of coyote, otter, black bear, ermine, mink and fisher cats have increased in Hudson as they have in other municipalities. Larger mammals that require extensive habitat areas or species that require solitude are occasionally sighted in the Town. It is recommended that the Conservation Commission and interested citizens participate in the "Keeping Track" Program.[26] This program uses animal tracks to identify habitats and feeding grounds in a systematic manner for a variety of mammals. The information gained can be the start of an inventory and a monitoring system of prime habitats for future conservation.

2. Birds

Bird species vary according to the season; however, they are also dominated by those species commonly found in southern New Hampshire. Doves, woodpeckers, chickadees, and jays are found throughout the year while warblers, sparrows, hummingbirds, wrens, swallows, robins, and several species of raptors are generally seasonal residents. In addition there are owls, wild turkeys, woodcocks, spruce grouse, blue herons, pileated woodpeckers, cardinals, bluebirds, and red-tail hawks. Other species such as ducks and geese may nest in the wetlands and ponds and many pass through the Town during spring and fall migrations.

[25] http://www.unh.edu/ppe/bluepages/05environmental.pdf
[26] www.keepingtrackinc.org.

3. Other Species

In addition to the highly visible species, habitats for other less visible species such as turtles, frogs, toads, salamanders, snakes and numerous insects are present in the Town. The NHI lists the Persius Dusky Wing (insect) and the Brook Floater (mollusk) as threatened or endangered in New Hampshire. The Eastern Box Turtle is also found in Hudson and is listed as a species with very high importance. A detailed listing of threatened or endangered plant species is provided in Appendix III-4.

4. Vernal Pools

Vernal pools or "spring" pools are essential for the life cycle of many invertebrates and amphibians. These temporary forested wetlands serve as a home to many of these species which feed on the nutrients from fallen leaves. Vernal pools can range in size from a few square feet to several acres. Vernal pools are generally associated with forested wetlands, but can also be found within larger wetlands, such as oxbows in river floodplains or scrub-shrub wetlands.

Most vernal pool animals do not live their entire lives in the pool but migrate in response to snow melt and early spring rains. The pools generally dry up by mid to late summer. Depending on the groundwater, some pools will refill in the autumn. Mole salamanders and wood frogs spend 90% of their lives in the surrounding uplands, perhaps as far as a quarter mile from the pool. Adults migrate to the pool for a few weeks to reproduce and surviving juveniles leave before the water dries.

Other organisms (e.g., snakes, turtles, insects, and birds) migrate from nearby wetlands to breed or feed in the productive pool waters. These animals return to more permanent wetlands. Other animals develop entirely in the pool and most survive the dry season. Fingernail clams and air-breathing snails burrow beneath the leaves that remain to await the return of water. Fairy shrimp deposit eggs in the dry pool that hatch after the pool refills.

5. Plants

Plant species in Hudson are again dominated by those species commonly found in southern New Hampshire. The NHI records indicate the presence of 13 plant species in Hudson that are either threatened, endangered or of special concern. A detailed listing of threatened or endangered plant species is provided in Appendix III-4. The Conservation Commission should consider developing an inventory and a monitoring system of the areas containing flora of special concern for future conservation.

6. Invasive Species

Invasive species are non-native plants or insects that were introduced to an area by visitors (humans and/or wildlife) from other continents, states, ecosystems and habitats. Invasive species are of concern because they reproduce rapidly, spread over large areas of the landscape and have few, if any, natural controls, such as herbivores/predators and disease, to keep them in check. Many invasive plants, in particular, share important characteristics including: 1) spreading aggressively; 2) producing a large number of seeds that survive to germinate; 3) dispersing seeds through various means such as wind, water, wildlife and people.[27] Some common invasive plants in New Hampshire include: Burning bush, Japanese barberry, Multiflora rose, Purple loosestrife, and Norway maple (see Appendix III-6 for a full list of invasive species that are proposed to be prohibited and restricted in the State of NH).[28] Some invasive plants are still sold in local nurseries,

[27] National Park Service/U.S. Fish and Wildlife Service, *Plant Invaders of Mid-Atlantic Natural Areas*, September 2002.
[28] University of New Hampshire Cooperative Extension, Forestry, Wildlife and Water Resources Programs

unbeknownst to the public. The Planning Board and Conservation Commission should pay special attention to reviewing landscaping plans to ensure that invasive species are not planted in Hudson.

E. EXISTING AND POTENTIAL FUTURE CONSERVATION LANDS

1. Existing Conservation Land

a. Land Protected through Public and Private Ownership or Zoning

Hudson contains very few permanently protected conservation lands. Approximately 1,100 acres, or 5.9% of Hudson's total land area of 18,773 acres is protected either through public ownership or private conservation efforts. The existing conservation land is illustrated in Map III-12. Many of these parcels currently have no permanent means of protection; however, they do provide opportunities for recreation and other important ecological functions. Research in the Assessing Department indicated that many of the Town-owned parcels in Hudson do not have deed restrictions for permanent protection as conservation land. All Town-owned and private land which is existing or potential conservation land is listed in Appendix III-5. The preservation of these parcels is of tremendous importance to the protection of watersheds, farms and forests, wildlife habitats, greenways, trails and scenic vistas in the Town. It is recommended that the Town take appropriate action to ensure that these parcels are permanently protected from future development or any adverse activities on the parcels.

The Town has an Open Space Development (OSD) Ordinance that encourages more efficient patterns of development which conserve open and green spaces, farmland, wildlife habitats, water resources, scenic areas and other natural resources. This is achieved by reducing the individual lots in a subdivision by up to 50% of the minimum lot size requirements established in the Zoning Ordinance. The remainder of the land after the lots are reduced "shall be dedicated to permanent open space, conservation land or recreation.[29] OSDs are allowed in any zoning district and may be designed for any use or combination of uses permitted in the district where the OSD is located. Off-site compensatory open space may also be permitted by the Planning Board in lieu of on-site open space as long as it is deemed ecologically, culturally, historically, and/or recreationally important.

The Open Space Development Ordinance has been very successful in Hudson. Eight open space developments have been implemented in Town within the past ten years, with an average of 20 acres of open space protected per subdivision. Two of the most notable OSDs in Hudson are the Pond View Subdivision on Greeley Street and Royal Oak Estates on Gabrielle Drive. Each OSD goes through a rigorous review process to determine the appropriate number of lots. OSDs not only protect open space in Hudson, but also reduce development costs related to utilities, roads and landscaping. The Planning Board should continue to encourage developers to consider OSDs as a means of protecting additional open space in Hudson.

b. Land in "Current Use"

The New Hampshire legislature has recognized the importance of open space and has found that its preservation is in the public interest:

It is hereby declared to be in the public interest to encourage the preservation of open space, thus providing a healthful and attractive outdoor environment for work and recreation of the State's citizens, maintaining the character of the State's landscape, and conserving the land, water, forest, agricultural and wildlife resources. It is further declared to be in the public interest to prevent the loss of open space due to property

Newsletter, *What is an Invasive Plant and Why Should We Care?*, Winter 2002.
[29] *Town of Hudson Zoning Ordinance 2003,* Article XI – Open Space Development, Chapter 334-51(A).

taxation at values incompatible with open space usage. Open space land imposes few if any costs on local government and is therefore an economic benefit to its citizens. (RSA 79-A:1)

The current use program provides reduced property assessments for forests, farmland and wetlands of 10 acres or greater and for active farms of less than 10 acres with a minimum $2,500 gross value of product; however, the program only provides short-term protection because open land enrolled in the program can easily be converted to other uses. Land coming out of current use is subject to a land use change tax of 10% of the fair market value at the time of the change. In Hudson, 100% of the tax is earmarked for use by the Conservation Commission to purchase land for conservation purposes; however, land use change monies collected need to be spent within the year they are collected or they are transferred into the General Fund. According to the Hudson Assessing Department, as of June 2003, approximately 3,798 acres of land in Hudson is in current use.[30]

c. Transfer of Development Rights

The Transfer of Development Rights (TDR) program is an alternative local zoning technique that addresses both growth and preservation of open space in municipalities. Through a town's zoning ordinance, landowners are given the option of preserving their property by selling (transferring) the development rights – instead of the land itself – to developers for projects in designated growth areas in the community. This allows communities to focus growth in specific areas of town (i.e., town centers) while preserving open space, farmland, environmentally sensitive areas, historic landmarks or other community assets without using public funds. It also allows landowners to retain ownership and use of their land while allowing developers to increase the density and profit of projects.

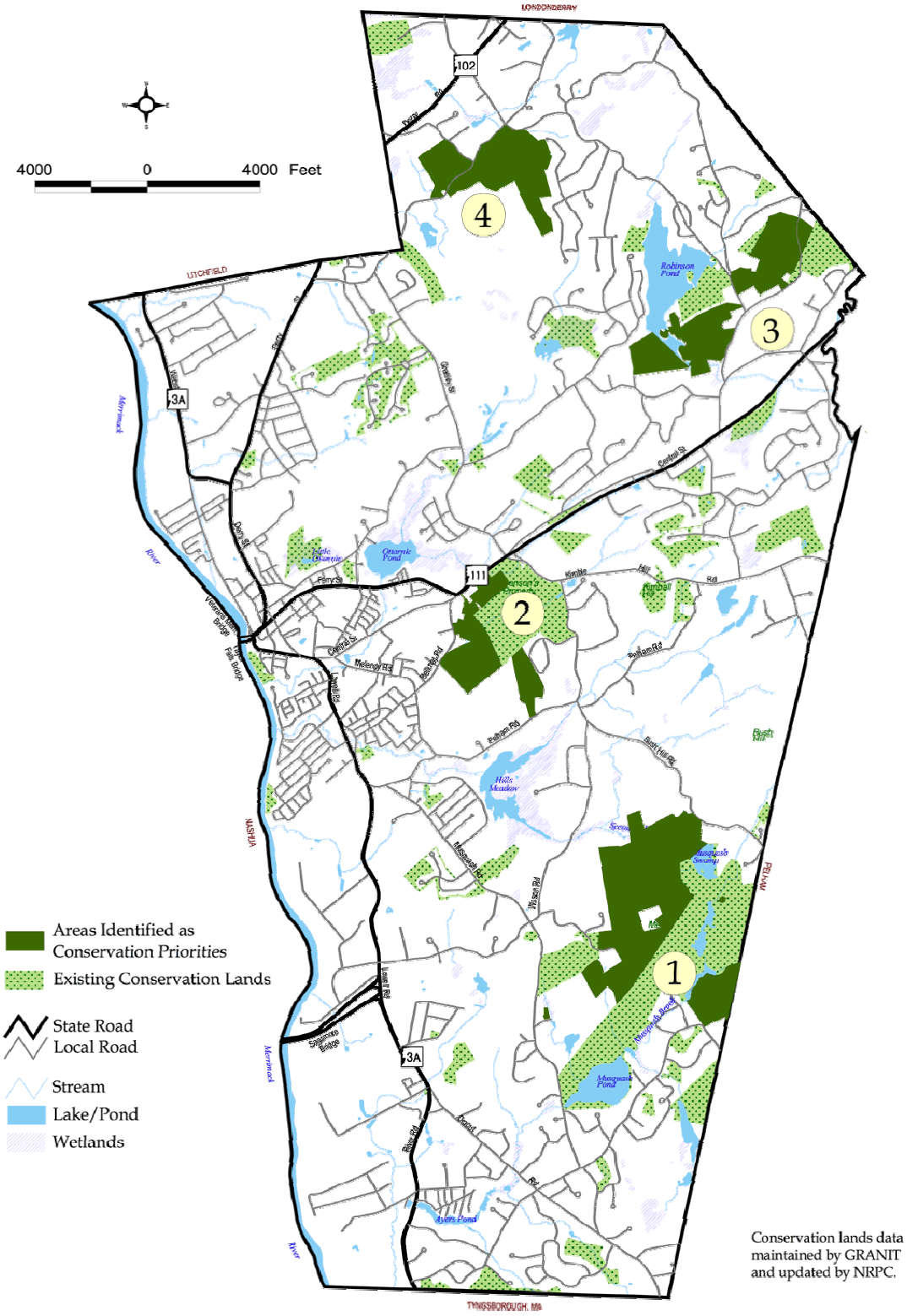
TDRs can be enacted in all of New Hampshire communities, but in order to be successful, a community must demonstrate the following conditions:[31]

- Be experiencing growth pressure, so there is sufficient demand for new development;
- Have public support for increasing density and providing infrastructure for the designated growth area(s);
- Have a united community vision and understanding of TDRs via thorough master planning and public participation;
- Set up a streamlined program to administer the TDR program.

In addition to these conditions, questions about market viability and expected TDR values, incentives, taxation, and permanency would need to be resolved. The NH Office of Energy and Planning (formerly Office of State Planning), NH DES and the Environmental Protection Agency New England provide information on establishing a TDR program and assist communities with developing local programs.

[30] Town of Hudson Assessing Department, June 2003.
[31] EPA New England, *Transferable Development Rights: Using Market Forces and Master Planning to Manage Growth and Environmental Quality*. February 2001.

Map III-12. Existing and Potential Future Conservation Land, 2003



2. Priorities for Future Conservation Efforts

Protecting open space is a high priority in the Town of Hudson. The 1990 Conservation Plan, the *1996 Hudson Master Plan*, and the 1998 Community Profile identified the protection of open space as a priority. The Town has made progress in this area over the past decade, with the acquisition of the Musquash Conservation Land and the purchase of development rights for the Bicentennial Farm. Voters supported the purchase of the Benson's Wild Animal Park property for use as a park and recreational trails. At the March 2003 Town Meeting, the Town voted overwhelmingly to support the purchase of a conservation easement on the Ingersoll Farm that was purchased with Land and Community Heritage Investment program (LCHIP) funds[32]. Voters also recently supported a number of other open space questions on the ballot, including an effort to pursue the purchase of the remaining part of the Nadeau Farm.

Land in Hudson is currently being prioritized for permanent protection through the efforts of the Hudson Conservation Commission and the Friends of Hudson Natural Resources. The following section discusses the methods being used to identify and permanently protect open space in Hudson.

a. The Regional Environmental Planning Program (REPP)

As part of a state-wide effort with funding provided by the NH Department of Environmental Resources (NH DES), the Nashua Regional Planning Commission has been working with member communities, regional and state organizations to identify the natural and cultural resource protection needs and priorities for the region.

The Regional Environmental Planning Program (REPP) has been a response to these statewide conservation efforts.[33] During Phase One of the program representatives of each of NRPC's member communities were provided a series of maps containing region-wide natural/cultural resource information, a base map of their own community, instructions and a summary of municipal conservation goals. Information collected from communities has been digitized and compiled into a first phase report that includes a map showing the location and type of resource. During Phase Two, the communities were asked to further prioritize the resources identified in the first phase. Phase Two asks each community to identify the top five natural and cultural resource priorities. Phases Three through Five were primarily devoted to creating detailed Geographic Information System (GIS) data layers. Phases Six and Seven will focus on updating the priorities set in Phase Two and assisting the communities in developing a more regional view of open space protection. Current conservation priorities for the Town of Hudson are shown in Table III-7 and illustrated on Map III-12.

Table III-7. Conservation Priorities

Number on Map III-12	Priority	Size in Acres	Description
1	1	440	Musquash Brook and Gumpas Pond Watersheds
2	2	140	Addition to Benson's Park
3	3	205	Robinson Pond Watershed
4	4	146	Nadeau Farm

Source: NRPC, *Regional Environmental Protection Program*, 2003 Update.

[32] Parcel information for the Ingersoll Farm Property was not available at the time of this writing.
[33] NRPC, *Regional Environmental Planning Program,* 2000.

b. Potential Wildlife and Recreational Corridors

Musquash Brook and Gumpas Pond Watersheds –These watersheds were chosen as the top regional priority for the Towns of Pelham and Hudson because they are significant in terms of water resources and wildlife habitat. The area contains a vast network of beaver ponds and wetlands and remains in a near natural condition. The New Hampshire Natural Heritage Inventory has identified several species, which are considered rare, threatened, or endangered in the state.

The site also contains historic resources and scenic vistas. This region was one of the first areas settled in Hudson. The area is dotted with old cellar holes, farm roads (including Old Stage Road in Pelham), stone walls, culverts and dams, and other significant historical resources. Native archeological sites have also been found in this area.

The Nash-Hamblett (a.k.a. Musquash Conservation Land, 416.5 acres) and Guertin (50 acres) properties already provide some protection to the watershed within Hudson. Pelham has several protected properties in this area, including the Fisher Family Trust and the newly acquired James and Diane Fisher parcel. The New England Forestry Foundation owns protected property in both towns that abuts the property proposed for protection.

The goal of both communities is to connect these existing conservation lands into a large, regional greenway, maintaining this relatively unfragmented wildlife habitat in its current undeveloped state. Another goal is to extend the protected area laterally, adding width to the long, narrow area that is currently protected. Extension of this protection to another Hudson priority, the Second Brook watershed (which also has some protection) would increase the value of this habitat even further

Addition to Benson's Park – The Town of Hudson is in the process of acquiring the 165-acre former Benson Wild Animal Farm from the NH Department of Transportation (NH DOT) for use as a passive recreation and natural resource education park. The Town is negotiating with the NH DOT for use of some portion of the Benson's property. The addition of all or portions of the only remaining open space adjacent to Benson Park will greatly enhance the quality of the Park for present and future generations, adding to the social, educational, and ecological benefits of the property.

Roughly 100 acres of additional land is the only remaining portion of the Merrill Brook watershed that has not been converted to residential or commercial development. The other 40 acres in the southern portion are in the Second Brook watershed. Approximately 65% of the land is steeply sloped oak-dominated forest interspersed with rock outcroppings and intermittent streams. The age of the older trees is probably in the 60-80 year range. A two-acre shrub-dominated pond is located at the higher elevation of the forested land. This pond is heavily vegetated with buttonbush and other wetland shrubs and supports an abundant and diverse frog population indicating a healthy ecosystem. The northern section of the land is at a lower elevation and is dominated by a mature red maple forested wetland.

Nadeau Farm – The Nadeau Farm was one of the last remaining working farms in a rapidly developing section of the State. The original farm is 197 acres. Three generations of dairy farmers have grown hay and silage for their herds on this land. The farmhouse, which was sold, served as an 18th century tavern and home of one of the founders of Hudson.

The property lies within a very rapidly growing area in the state. Residential development is the dominant land use near most of the Nadeau Farm boundary. The Nadeau Farm property is

being evaluated for residential development potential by several speculators. Approximately 51 acres of the farm have already been sold, with the potential for the remaining 146 acres to be developed as well. However, in March 2003, voters approved a petition article to support efforts by the Town to purchase the development rights to the property.

c. Land and Community Heritage Investment Program (LCHIP)

The Land and Community Heritage Commission (LCHC) was established under Senate Bill 493 in 1999 "…to determine the feasibility of a new public-private partnership to conserve New Hampshire's priority natural, cultural and historic resources." In 2000, Senate Bill 401 was presented in order to provide the LCHC with $3 million to begin a matching grant program for local land conservation efforts.

A program called the Land and Community Heritage Investment Program (LCHIP) will carry out the goals of Senate Bill 401 and the LCHC. The New Hampshire General Court created LCHIP in order to:

> *"…conserve and preserve this State's most important natural, cultural, and historical resources through the acquisition of lands, and cultural and historical resources, or interests therein, of local, regional, and statewide significance, in partnership with the State's municipalities and the private sector, for the primary purposes of protecting and ensuring the perpetual contribution of these resources to the State's economy, environment, and overall quality of life."*[34]

LCHIP was designed to achieve this mandate by providing grants to eligible applicants. Applicants must provide at least a 50% match (at least half of which must be in cash) to be eligible for funding through the program. Communities can use the conservation priorities established through the REPP process to propose parcels and projects for grant funding through LCHIP.

The Town of Hudson, in conjunction with the Towns of Windham and Londonderry, submitted an LCHIP application for the Ingersoll Tri-Town Tree Farm in the northern corner of Town. The three towns were successful in obtaining $300,000 to obtain an easement over 204 acres of land that is designated as a certified tree farm. The easement is being held by the Society for the Protection of New Hampshire's Forests.

[34] www.LCHIP.org

F. RECOMMENDATIONS

1. Topography

- Consider an amendment to the Zoning Ordinance, subdivision and site plan regulations to adopt a Slope Conservation Overlay District to protect the most severe slopes in Town from unsuitable development. Development of land with slopes greater than 15% should be approached with extreme caution, giving consideration to the problems presented by these slopes. Active use or development of slopes greater than 25% should be avoided. As these areas are best suited for open space, reserving them for that purpose will minimize the potential for erosion and allow for maximum absorption of surface water run-off thus protecting down-slope residents.
- New development should be focused in areas with slopes of less than 15%, giving consideration to the other factors which affect the development suitability of these areas.

2. Soils

- The Planning Board should continue to consider soil potentials and limitations when reviewing the intensity of development.
- The Town's agricultural lands are recognized as an important and endangered resource with few State or local incentives for keeping viable agricultural lands in production. To protect this valuable resource, the Town should take steps to protect active and idle agricultural lands from development for other uses and create incentives which encourage agricultural lands to be kept in, or returned to, productive farm use. The Trust for New Hampshire Lands Program or the Land and Community Heritage Investment Program may assist the Town in this endeavor.
- Farm protection should be pursued for existing or undeveloped lands with Prime or State designated soils.

3. Forests

- The Conservation Commission and interested citizens should consider participating in the "Keeping Track" Program. This program uses animal tracks to identify habitats and feeding grounds in a systematic manner for a variety of animals. The information gained can be the start of an inventory and a monitoring system of prime habitats for future conservation.
- Take advantage of the University of New Hampshire's Community Environmental Outreach Program (CEOP) and Natural Resources Senior Projects. These are inexpensive programs and the range of possible projects is limited only by the needs of the community and the availability of students to match those needs.

4. Water Resources and Watersheds

- Restrict and strictly monitor development of land adjacent to surface water resources. As these areas are a vital interface between surface and groundwater supplies, they are best suited for open space and have the potential for forming the basis of an open space system serving all developable areas of the community.
- Enforce the Shoreland Protection Act on all regulated water bodies in Hudson.
- Adopt a shoreline protection ordinance consistent with the state model to permit the regulation of shoreline development on non-regulated water bodies at the local level.
- Protect prime wetlands and important surface waters by amending the Wetlands Conservation District Ordinance to increase the 50-foot buffer to 100 feet from the edge of the wetland or surface water. This buffer will protect the natural habitat surrounding wetlands and surface waters that is crucial to the proper functioning of these water resources. This should especially

be considered along surface water resources in areas of existing or anticipated increased density to protect the receiving waters from additional pollutant loads and increased flow associated with development.

- Continue to protect the Floodplain Hazard Areas to reduce losses due to flooding.
- Water supply wells located on till deposits are shallow in depth and very susceptible to land use related contamination (septic systems, fuel storage, fertilizers, road salt, etc.). The Town should consider increasing the setback of future land-uses to these water supply wells.
- Perform a functional evaluation of the Town's wetlands, leading to the designation of prime wetlands. This includes classifying, mapping and evaluation of all of the wetlands within each watershed in Town.
- Provide additional protection to prime wetlands under the Wetland Conservation District. Prime wetlands provide special services to the community that need additional protection in order to preserve their value and function.
- Encourage the appropriate use, conservation and development of the Merrimack Riverfront. This can be done in part by working with the NH DES Rivers Management and Protection Program, the Lower Merrimack River Local Advisory Committee and other protection groups.
- Adopt a Shoreland Protection ordinance consistent with the state model to protect water bodies not covered under the state Comprehensive Shoreland Protection Act.
- Adopt an aquifer conservation district to protect existing and potential future groundwater supplies and recharge areas from harmful developments or land use practices.
- Establish intermunicipal coordination of land uses in each watershed that spans Town boundaries, such as the Musquash Brook Watershed, to ensure effective management and protection of the water resource. This coordination might include delineation of watersheds that cross Town boundaries and coordinating reviews of land uses that may affect these watersheds.
- Develop a protection plan or strategy which identifies where and how to protect wetland areas based on their location and the benefits they provide.
- Encourage land use boards to keep up-to-date on the status of the instream flow rules which will help the Town adhere to any potential regulations that are passed.
- Update the Potential Contamination Sources list (Appendix III-3) developed for the Town of Hudson Groundwater Protection Program in December 1998 to reflect changes in land uses.
- Establish low salt/no-salt routes or consider the use of Calcium Magnesium Acetate in areas adjacent to public water supplies and where on-site wells are located near roadways.

5. Wildlife and Plants

- Maintain a 50-foot undisturbed, shady buffer around vernal pools.
- Consider legal easements on all Town Forests to preserve the land for recreation and permanently protect the land for forestry, recreation and wildlife habitat.
- Inventory all existing trails using a Geographic Positioning System (GPS) and create a trail system map and signage for all Town forests.
- Review all landscaping plans submitted with subdivision and site plans for invasive plant species.

6. Conservation

- Pursue the fee purchase, purchase of development rights or other conservation measures to protect the remaining open space properties. Legal easements should be placed on all conservation properties.
- Conduct thorough research on existing Town-owned land that is not currently protected as conservation land and take appropriate action to ensure that these parcels are permanently protected from future development or any adverse activities on the parcels.
- Encourage the Land Use Change Tax to be directed to the Conservation Fund. Eliminate the provision that requires Land Use Change Tax funds be transferred to the General Fund if not spent by the Conservation Commission on land purchases within the year the funds are collected. This will allow the Conservation Commission to accrue funds for land purchases from year to year.

APPENDIX III-I

Soil Limitations to Septic Systems for Hudson, NH

Slight Limitations to Septic Systems

Symbol	Soil Name and Slope	
CaB	Canton fine sandy loam	0-8%

Moderate Limitations to Septic Systems

Symbol	Soil Name and Slope	
CaC	Canton fine sandy loam	8-15%
CmB	Canton stony fine sandy loam	3-8%
CmC	Canton stony fine sandy loam	8-15%

Severe Limitations to Septic Systems

Symbol	Soil Name and Slope	
AgA	Agawam fine sandy loam	0-3%
AgB	Agawam fine sandy loam	3-8%
BaA	Belgrade silt loam	0-3%
BaB	Belgrade silt loam	3-8%
CaD	Canton fine sandy loam	15-25%
CmD	Canton stony fine sandy loam	15-25%
CmE	Canton stony fine sandy loam	25-35%
CnC	Canton very stony fine sandy loam	8-15%
CnD	Canton very stony fine sandy loam	15-35%
CpB	Chatfield-Hollis-Canton complex	3-8%
CpC	Chatfield-Hollis-Canton complex	8-15%
CsB	Chatfield-Hollis complex	3-8%
CsC	Chatfield-Hollis complex	8-15%
CtD	Chatfield-Hollis-Rock outcrop complex	15-35%
DeA	Deerfield loamy fine sand	0-3%
DeB	Deerfield loamy fine sand	3-8%
HsA	Hinckley loamy sand	0-3%
HsB	Hinckley loamy sand	3-8%
HsC	Hinckley loamy sand	8-15%
HsD	Hinckley loamy sand	15-35%
MoB	Montauk fine sandy loam	3-8%
NnA	Ninigret very fine sandy loam	0-3%
PbB	Paxton fine sandy loam	3-8%
PbC	Paxton fine sandy loam	8-15%
PfB	Paxton stony fine sandy loam	3-8%
PfC	Paxton stony fine sandy loam	8-15%
PfD	Paxton stony fine sandy loam	15-25%
PhB	Pennichuck channery fine sandy loam	3-8%
PhC	Pennichuck channery fine sandy loam	8-15%
PHd	Pennichuck channery fine sandy loam	15-25%
SsA	Scituate fine sandy loam	0-3%
SsB	Scituate fine sandy loam	3-8%
StA	Scituate stony fine sandy loam	0-3%
StB	Scituate stony fine sandy loam	3-8%
StC	Scituate stony fine sandy loam	8-15%
WdA	Windsor loamy sand	0-3%
WdB	Windsor loamy sand	3-8%
WdC	Windsor loamy sand	8-15%
WdD	Windsor loamy sand	15-35%
WoB	Woodbridge loam	3-8%
WvD	Woodbridge stony loam	3-8%

Source: US Department of Agriculture, Soil Conservation Service, *Soil Survey of Hillsborough County, NH, Eastern Part*, 1980.

APPENDIX III-2

Important Agricultural Soils in Hudson, NH

Prime Farmlands

Symbol	Soil Name and Slope	
Om	Occum fine sandy loam	high bottom
PbB	Paxton fine sandy loam	3-8%
Pu	Pootatuck fine sandy loam	Unknown
WoA	Woodbridge loam	Unknown
WoB	Woodbridge loam	3-8%

Statewide Importance

Symbol	Soil Name and Slope	
CaB	Canton fine sandy loam	0-8%
CaC	Canton fine sandy loam	8-15%
PbC	Paxton fine sandy loam	8-15%
PhB	Pennichuck channery fine sandy loam	3-8%
PhC	Pennichuck channery fine sandy loam	8-15%
SsB	Scituate fine sandy loam	3-8%

Source: US Department of Agriculture, Soil Conservation Service, Soil Survey of Hillsborough County, New Hampshire, Eastern Part, 1980.

APPENDIX III-3

Identified Potential Contaminant Sources in Hudson

Business Name	Street Address	Tax Map#	Source	Threat Class	Verified Use	Public Sewer
Acme Pressure Washing	9 Melendy Rd	48-102	Hudson Employment List	PCS	N	Y
Autocrat Redesign	9 Winn Ave	48-20	RCRA Sites List	PCS	N	
Autoworld Of Nashua	120 Ferry St	57-125	Hudson Employment List	PCS	Y	Y
Bills Family Auto Center	64 Lowell Rd	48-64	Hudson Employment List	PCS	Y	
Brox Industries, Inc.	Barretts Hill Rd	30-9	AllSites List	AST	N	
Chamberlain, Thos. C. Dr.	49 Derry Rd	55-64	Hudson Employment List	PCS	Y	Y
Christ Robt T Dmd.	50 Derry Rd	55-19	Hudson Employment List	PCS	Y	Y
Cuff, Richard W. Dmd.	59 Ferry St	51-127	Site Observation	PCS	Y	Y
Drg Automotive Machine	76 Derry Rd	55-24	Hudson Employment List	PCS	N	Y
Dumont-Sullivan Funeral Home	50 Ferry St	51-106	Hudson Employment List	PCS	Y	Y
Dyna Tune	38 Ferry St	51-102	Hudson Employment List	PCS	Y	Y
Fashion Neckware Co Inc/Joshua Douglas	10 Roosevelt Ave	48-93	AllSites List	UIC	N	Y
Finish Exterior Systems	10 D St	48-67	Hudson Employment List	PCS	Y	Y
Gagnon, W. D. MD	182 Central St	58-5-1	Hudson Employment List	PCS	Y	Y
Hair We Are Face and Body Spa	28 Lowell Rd	48-52	Hudson Employment List	PCS	Y	Y
Heritage Hair Salon	188 Central St	58-5	Hudson Employment List	PCS	Y	Y
Hi-Lites Hair Salon	77 Lowell Rd	45-145-1	Hudson Employment List	PCS	N	Y
Hudson Alignment	32 Cross St	48-10-1	Hudson Employment List	PCS	Y	Y
Hudson Animal Hospital	208 Central St	20-18	Hudson Employment List	PCS	Y	Y
Hudson Dry Cleaner	30 Lowell Rd	48-11	Hudson Employment List	PCS	Y	Y
Hudson Hair Styling	23 Burnham Rd	58-6	Hudson Employment List	PCS	N	Y
Hudson Paving and Excavtion, Inc.	19 Barrett Hill Rd	30-11	RCRA Sites List	PCS	N	
Hudson Sunoco Inc	74 Lowell Rd	46-22	Hudson Employment List	LUST	Y	Y
Joks Auto Wholesale & General Auto	5 Lakeside Ave	57-112-1	RCRA Sites List	PCS	N	
Kays Home Style Laundromat	80 Lowell Rd	46-23	Hudson Employment List	PCS	N	
Li'l Squirt Car Wash	184 Central St	58-5-2	Hudson Employment List	PCS	Y	Y
Lowell Rd Pump Station Replacement (2 Sites)	Lowell Rd	47-95/47-85	AllSites List	SITEEVAL	N	
MacDuffie Petroleum	26 Derry Rd	50-28	Hudson Employment List	PCS	Y	Y
Micromatic Machine Co	28 Riverside Ave	47-8	RCRA Sites List	PCS	N	

APPENDIX III-3 (continued)

Identified Potential Contaminant Sources in Hudson

Business Name	Street Address	Tax Map#	Source	Threat Class	Verified Use	Public Sewer
Former location of Public Works Dept.	8 Melendy Rd	52-31	AllSites List	AST	Y	
Sunnyside Cemetery	Central St	52-124	Site Observation	PCS	Y	
Tates Garage	36 Lowell Rd	48-56	Hudson Employment List	PCS	Y	Y
Westview Cemetery	Ferry St	20-2,20-29	Site Observation	PCS	Y	
Willards Auto Radiator Shop	56 Lowell Rd	48-61	RCRA Sites list	PCS		

Source: Nashua Regional Planning Commission, Town of Hudson Groundwater Protection Plan, December 1998. Original list verified through the Verizon phonebook by NRPC staff, 2003.

Threat Class:

AST	Registered Aboveground Storage Tank Facility
LUST	Leaking Underground Storage Tank Project
OPUF	On-Premise Use Facility Containing Fuel Oil
SITEEVAL	Unsolicited Site Assessment
UIC	Underground Injection Control
PCS	Potential Contamination Source

****Verified use indicates whether or not the specific use was verified as present on –site.***

Note: Specific uses from the Hudson Employment list are consistent with the NH Groundwater Protection Act definition of a Potential Contamination Source (PCS) were selected from that list and added to an existing state-wide inventory of site remediation projects and groundwater hazards list (AllSites). Sites identified during a windshield survey are noted as Site Observation.

APPENDIX III-4

New Hampshire Natural Heritage Bureau Inventory

Rare Species and Exemplary Natural Communities List

			# Locations Listed in the last 20 Years		
Flag	Species or Community Name	Federal	State	Town	State
	Natural Communities – Terrestrial				
***	SNE Dry Central Hardwood Forest on Acidic Bedrock or Till	-	-	3	15
***	SNE Dry Central Hardwood Forest on Acidic Bedrock or Till	-	-	1	15
***	SNE Dry Rich Forest on Acidic/Circumneutral Bedrock or Till	-	-	3	11
***	SNE Floodplain Forest	-	-	1	47
**	SNE Rich Mesic Forest	-	-	1	12
	Natural Communities – Palustrine				
**	Atlantic White Cedar Basin Swamp	-	-	1	28
***	Inland New England Acidic Pond Shore/Lake Shore Community	-	-	1	12
	Plants				
	Arethusa (Arethusa bulbosa)	-	E	Historical	21
*	Atlantic White Cedar (Chamaecyparis thyoides)	-	-	1	44
**	Bird's-Foot Violet (Viola pedata var linearilobа)	-	T	2	12
	Blunt-Leaved Milkweed (Asclepias amplexicaulis)	-	T	Historical	12
*	Blunt-Lobe Woodsia (Woodsia obtusa)	-	T	2	8
***	Bulbous Bitter-Cress (Cardamine bulbosa)	-	E	1	5
**	Early Buttercup (Ranunculus fascicularis)	-	E	1	2
**	Fern-Leaved Foxglove (Aureolaria pedicularia var intercedens)	-	E	1	6
	Flaccid Sedge (Carex flaccosperma var glaucodea)	-	E	Historical	1
**	Four-Leaved Milkweed (Asclepias quadrifolia)	-	T	2	9
	Fringed Gentian (Gentiana crinita)	-	T	Historical	28
	Goat's-Rue (Tephrosia virginiana)	-	E	Historical	6
***	Hairy Bedstraw (Galium pilosum)	-	E	1	5
**	Hairy Stargrass (Hypoxis hirsuta)	-	T	3	13
***	Hoary Mt. Mint (Pycanthemum incanum)	-	E	4	5
	Inflated Sedge (Carex bullata)	-	E	Historical	5
	Long-Fruited Anemone (Anemone cylindrica)	-	-	Historical	11
	Maryland Tick-Trefoil (Desmodium marilandicum)	-	E	Historical	4
	One-Sided Rush (Juncus secundus)	-	E	Historical	6
	Pink Azalea (Rhododendron nudiflorum)	-	E	Historical	2
***	Prostrate Tick-Trefoil (Desmodium rotundifolium)	-	T	3	9
	Purple Milkweed (Asclepias purpurascens)	-	-	Historical	4
***	River Birch (Betula nigra)	-	T	1	12
**	Rue Anemone (Anemonella thalictroides)	-	T	2	5
	Siberian Chives (Allium schoenoprasum var sibiricum)	-	T	Historical	7
***	Sickle-Pod (Arabis canadensis)	-	T	3	7
***	Skydrop Aster (Aster patens var patens)	-	T	3	10
*	Slender 8-Flowered Fescue (Festuca octoflora var tenella)	-	E	1	3
	Slender 8-Flowered Fescue (Festuca octoflora var tenella)	-	E	Historical	3

continued, next page

APPENDIX III-4 (Continued)

New Hampshire Natural Heritage Inventory

Rare Species and Exemplary Natural Communities List

			# Locations Listed in the last 20 Years		
Flag	**Species or Community Name**	**Federal**	**State**	**Town**	**State**
	Plants ***(continued)***				
*	Slender Bush-Clover (Lespedeza virginica)	-	T	2	6
	Slender Knotweed (Polygonum tenue)	-	E	Historical	3
	Slender Pinweed (Lechea tenuifolia)	-	E	Historical	2
	Slender-Flowered Muhlenbergia (Muhlenbergia tenuiflora)	-	-	Historical	3
**	Small Bidens (Bidens discoidea)	-	E	1	9
**	Smooth-Forked Chickweed (Paronychia canadensis)	-	T	2	7
**	Smooth-Forked Chickweed (Paronychia canadensis)	-	T	4	7
	Spiked Needlegrass (Aristida longespica var geniculata)	-	E	Historical	4
*	Sprout Muhlenbergia (Muhlenbergia sobolifera)	-	T	1	6
***	Swamp Azalea (Rhododendron viscosum)	-	T	10	42
	Torry's Mountain Mint (Pycanthemum torrei)	-	E	Historical	1
*	White-Topped Aster (Sericocarpus linifolius)	-	T	1	6
**	Wild Garlic (Allium canadense)	-	E	1	5
	Wild Lupine (Lupinus perennis)	-	T	Historical	37
	Wild Senna (Cassia hebecarpa)	-	E	Historical	10
	Vertebrates – Reptiles				
**	Blanding's Turtle (Emydoidea blandingii)	-	-	1	57
	Eastern Box Turtle (Terrapene carolina)	-	-	Historical	6
	Vertebrates – Fish				
	Banded Sunfish (Enneacanthus obesus)	-	-	Historical	8
	Invertebrates – Mollusks				
**	Brook Floater (Alasmidonta varicosa)	-	E	1	30
**	Eastern Pondmussel (Ligumia nasuta)	-	-	1	4
	Invertebrates - Insects				
	A Geometrid Moth	-	-	Historical	2
**	Cobweb Skipper (Herperia metea)	-	-	1	5
**	Horace's Dusky Wing (Erynnis horatius)	-	-	1	1
	Persius Dusky Wing (Erynnis persius persius)	-	E	Historical	6
**	Wild Indigo Duskywing (Erynnis baptisiae)	-	E	1	1

Listed E = Endangered T = Threatened

Flags
**** = Highest Importance
*** = Extremely High Importance
** = Very High Importance
* = High Importance

These flags are based on a combination of: 1) how rare the species or community is, and 2) how large or healthy its examples are in that town. Please contact Natural Heritage Inventory at (603) 271-3623 for more information.

APPENDIX III-5

Existing and Potential Town-owned Conservation Land

Parcel	Parcel ID	Acres	Book/Page	Confirmed Conservation Land (Y/N or NC)	Type of Conservation Land
West Road Landfill	41-13	38 acres	N/A	N	
Robinson Road (two small lots)	38-8	0.93 acres	2647/0705	NC	
	38-10	1 acre	4804/1530	NC	
Griffin Road Bend	40-1	2.92 acres	3084/0717	NC	
Robinson Pond – Recreation area	36-5	45.7 acres	N/A	N	
Robinson Pond – Parker Preserve	? (not listed)	NA		N	
Robinson Pond – Outlet (not Town-owned)	31-80-17	2.85 acres	3442/0355	N	
Pinewood Drive	35-67-62	46 .28 acres	5273/1202	Y	Conservation Easement
Alvirne High School	29-18	45 acres	N/A	N	
	29-19	150 acres	N/A	N	
Little Ottarnic Pond	60-1	17 acres	5925/1401	N	
Claveau Wildlife Area (not Town-owned)	61-40	3.036 acres	6040/1458	N	
Merrifield Park	58-43	5.77 acres	2232/267	NC	
Merrill Park and Trail	47-139	9.3 acres	N/A	N	
	51-10	1.25 acres	N/A	N	
	51-11	0.91 acres	N/A	N	
George Street	57-67	4.5 acres	N/A	NC	
Lion's Hall	52-60	0.75 acres	6256/0309	N	
	52-72	8.84 acres	5640/585	N	
Benson's Park (not Town-owned yet)	20-25	165.81 acres	5351/1727	Not Yet	

Parcel	Parcel ID	Acres	Book/Page	Confirmed Conservation Land (Y/N or NC)	Type of Conservation Land
	20-13	22 acres	6745/1224	Not Yet	
Daniel Webster Drive	25-158	1.3 acres	N/A	NC	
Greeley Field	25-3-1	N/A	5557/0408	NC	
Industrial Drive	32-7	10.8 acres	6105/0398	N	
Town Forest	27-52	55 acres	N/A	Y	Needs more research, deed refers to Cons Comm
Jette Field	46-120	3.5 acres	N/A	NC	
	46-119	0.77 acres	N/A	NC	
Birchcroft Riverfront (2 parcels)	44-18	5.33 acres	N/A		
	45-9-1	1.9 acres	5595/261		
Radcliffe Drive	45-25-2	N/A	N/A	Y	Conservation Easement
	45-25-3	N/A	N/A	Y	
	45-25-4	N/A	N/A	Y	
	45-25-5	N/A	N/A	Y	
	45-25-6	N/A	N/A	Y	
Birchcroft Cluster	45-161-3	1 acres	N/A	NC	
	44-136	1.6 acres	N/A	NC	
	44-134	0.17 acres	N/A	NC	
	44-139	0.17 acres	N/A	NC	
	44-135	0.17 acres	N/A	NC	
	44-110-1	0.6 acres	N/A	NC	
	44-132	0.17 acres	N/A	NC	
	44-133	0.11 acres	N/A	NC	

Parcel	Parcel ID	Acres	Book/Page	Confirmed Conservation Land (Y/N or NC)	Type of Conservation Land
	44-137	0.75 acres	N/A	NC	
	44-138	1 acre	N/A	NC	
Glenn Drive	14-52	6.4 acres	2875/0453	NC	
	14-43	1 acre	N/A	NC	
Burns Hill Landfill	15-7	16.867 acres	N/A	N	
Guertin Parcel	11-59	49.97 acres	5193/0866	N	
Musquash Conservation Area	9-2	189 acres	5135/1646	More research needed	
	9-5	18 acres	5177/1025	N	
	16-3	50 acres	N/A	N	
	12-36-2	203.5 acres	N/A	N	
Hills Family Park	9-86	5.4 acres	N/A	NC	
	9-34-15	6.63 acres	3993/0028	N	
	9-88	1 acre	5103/1762	N	
	12-34	10.078 acres	2592/0702	NC	
Davenport Road	8-109	22.97 acres	5559/1880	N	
Schaeffer Circle	6-3	20.58 acres	2739/0041		
Country Woods Subdivision	6-42, 6-53	36.93 (total)	5107/0585	Y	Conservation and Access Easement
Winslow Farm	2-20	12 acres	5258/1828	N	
Rena Avenue	8-27	1.2 acres	2992/0016	NC	
	8-21	0.28 acres	N/A	NC	
Gordon Street Water Tower	2-13	2.46 acres	2886/0970	NC	
Ayers Pond Road	5-109	2 acres	3020/7780	NC	
	5-19-1	0.5 acres	3084/7210	NC	

Parcel	Parcel ID	Acres	Book/Page	Confirmed Conservation Land (Y/N or NC)	Type of Conservation Land
Wason Road	15-19	1.05 acres	3084/0720	NC	
	11-35-1	0.923 acres	N/A	NC	
Hardy Road	10-18	1.3 acres	6434/2147	NC	
Woodridge Drive	14-103	0.47 acres	6256/0310	NC	
Webster Street	54-3	1.183 acres	6230/0481	NC	
Bear Path Lane	21-6-14	4.66 acres	6292/0612	NC	
Woodland Drive	16-5-9	8.603 acres	6357/1607	Y	Open Space Subdivision
Derry Road	28-93	28.1 acres	6454/1407	N	

Source: Town of Hudson Assessor's Office.

APPENDIX III-6

Proposed New Hampshire Prohibited Species[35]

(* indicates that the species is currently regulated by the DES)

Plants

Ailanthus altissima	Tree of Heaven
Alliaria petiolata	Garlic Mustard
Berberis vulgaris	European Barberry
*Butomous umbellate**	Flowering Rush
*Cabomba caroliniana**	Fanwort
Celastrus orbiculatus	Oriental Bittersweet
Cynanchum nigrum	Black Swallow-wort
Cynanchum rossicum	Pale Swallow-wort
*Egeria densa**	Brazilian elodea
Elaeagnus umbellate	Autumn Olive
Heracleum mantegazzianum	Giant Hogweed
*Hydrilla verticillata**	Hydrilla
*Hydrocharis morsus-ranae**	European Frogbit
Iris pseudacorus	Water-flag
Ligustrum obtusifolium	Blunt-leaved Privet
Lonicera x bella	Showy Bush Honeysuckle
Lonicera japonica	Japanese Honeysuckle
Lonicer morrowii	Morrow's Honeysuckle
Lonicera tatarica	Tartarian Honeysuckle
Lythrum salicaria	Purple loosestrife
*Myriophyllum aquaticum**	Parrot Feather
*Myriophyllum heterophyllum**	Variable Milfoil
*Myriophyllum spicatum**	European Water-Milfoil
*Najas minor**	European Naiad
*Nymphoides peltata**	Yellow Floating Heart
*Phragmites australis**	Common Reed
Polygonum cuspidatum	Japanese Knotweed
*Potomogeton crispus**	Curly-leaf Pondweed
Rhamnus cathartica	Common Buckthorn
Rhamnus frangula	Glossy Buckthorn
Rosa multiflora	Multiflora Rose
*Trapa nutans**	Water Chestnut

[35] New Hampshire Department of Agriculture, New Hampshire Invasive Species Committee, http://www.state.nh.us/agric/pdf/topics/hyperlinks/proposed_restricted_(watch)_species_list.pdf

Proposed New Hampshire Prohibited Invasive Species List with Condition:

Plants

Euonymus alatus	Burning Bush
Acer platanoides	Norway Maple
Berberis thunbergii	Japanese Barberry

Proposed New Hampshire Prohibited Invasive Species List:

Insects

Acarapis woodi	Honeybee Tracheal Mite
Adelges tsugae	Hemlock Woolly Adelgid
Aeolesthes sarta	City Longhorned Beetle
Anoplophora glabripennis	Asian Longhorned Beetle
Callidellum rufipenne	Cedar Longhorned Beetle
Dendrolimus sibircus	Siberian Silk Moth
Fiorinia externa	Elongated Hemlock Scale
Hylurgus lingniperda	Redhaired Bark Beetle
Ips typographus	European Spruce Bark Beetle
Lymantria dispar	Asian Gypsy Moth
Popillia japonica	Japanese Beetle
Pyrrhalta viburni	Viburnum Leaf Beetle
Rhizotrogus majalis	European Chafer
Symantria monacha	Nun Moth
Tetropium fuscum	Brown Spruce Longhorn Beetle
Varroa destructor	Varroa Mite

PROPOSED NEW HAMPSHIRE RESTRICTED SPECIES

(WATCH SPECIES)

Plants

Ampelopsis brevipedunculata	Porcelain Berry
Centaurea maculosa	Spotted Knapweed
Circium arvens	Canada Thistle
Coronilla varia	Crown Vetch
Elaeagnus angustifolia	Russian Olive
Euonymus fortunei	Wintercreeper
Glyceria maxima	Sweet Reedgrass
Ligustrum vulgare	Common Privet
Lonicera maakii amur	Honeysuckle
Lysmachia nummularia	Moneywort
Microstegium vimineum	Japanese Stilt Grass
Phalaris arundinacea	Reed Canary Grass
Populus alba	White Poplar
Pueraria lobata	Kudzu
Robinia pseudoacacia	Black Locust
Ulmus pumila	Siberian Elm

APPENDIX III-7

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This chapter of the Hudson Master Plan update is intended to supplement, and not replace, the findings and recommendations of any earlier studies.

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