CHAPTER III
NATURAL RESOURCES

A. INTRODUCTION

Natural resources and living systems form the basis of community environmental health and well being, as we know it in Litchfield. Through the leadership of the Conservation Commission, the Planning Board produced this section of the Master Plan in hope that it alerts citizens to the fragility of the natural environment and aids understanding of conservation mechanisms. People are only one part of the total environment structure, but they may have the ability to shift the ecosystem to an unsustainable condition.

Understanding components of natural systems, resource limits and the relationships between subsystems is commonly referred to as 'resource-based planning', or 'environmental constraints analysis'. Resource-based planning forms the basis for the planning recommendations provided in this master plan. Characteristics of the land present a series of constraints and opportunities that define the type, extent and intensity of land use that may occur within the community.

This chapter describes major elements of the natural environment that collectively represent Litchfield. It is an attempt to define the carrying capacity of the local environment. It assumes that sustainable systems are ones that are in balance, are appropriately conserved, operate without acute dysfunction, and will be sustained and available for the betterment and enjoyment of all future generations. Understanding the capabilities of land and natural systems helps achieve development that is harmonious with nature and promotes the long-term benefit of the community.

B. LITCHFIELD AREA OF COVER

The total area in Litchfield is 15.1 square miles or 9,660 acres. It is the smallest municipality in the region with less than five percent of the 321.2 square miles covered by the 12 municipalities. Although it is the smallest municipality covered by the NRPC, it is apparent that there is extensive natural diversity within the thousands of acres covered by the Town.

C. TOPOGRAPHY & SLOPE

Topography is the general form of the land surface, with elevation and slope as the two major components. Elevation is the measure of the height of a given point of land relative to mean sea level. Slope is a measure of the pitch, or grade of land between two points.

In general, topography varies from Merrimack River floodplain to the uplands above the River that consist of flat areas, wetlands, and gently rolling hills. The peak elevation is 357 feet above mean sea level at Rocky Hill south of the Litchfield State Forest. The lowest elevation is approximately 100 feet above sea level at several points along the Merrimack River. Generally, eastern tiers of Town slope downwards to the Merrimack River in the west. The southern tier of Litchfield is generally lower in elevation than the north part. Areas of steeper slopes are demonstrated within stream corridors, in floodplain banks along the Merrimack River, and around Rocky Hill.

Slope is a limiting factor when determining the development potential of land. Slope is generally evaluated in conjunction with the other environmental factors: geology, soils and hydrology. Slope is critical when siting septic systems to ensure adequate drainage and filtration. Increases in slope result in corresponding increases in the difficulty and cost of site development.

Generally, slopes of 0 to 3 percent are not well drained and are often associated with wetlands. Lands with slopes of 3 to 8 percent and good soil conditions are usually considered ideal for development because constraints are minimal. Development on slopes of 8 to 15 percent requires additional planning to provide proper drainage and soil stabilization. While areas with slopes of 15 to 25 percent are developable, shallow soils and increased erosion potential require site specific considerations to alleviate negative impacts.

D. SOILS

Soils are a principal determinant of land development capability, particularly in areas that rely on subsurface waste disposal (septic systems). Depth to water table and bedrock, susceptibility to flooding, slope and permeability are factors affecting the suitability of sites for roads, buildings, septic systems and wells. Often there are high water tables in Litchfield; many parts of Town demonstrate soils with close (five feet or less) proximity to seasonal high water tables. Wet soils are important links to the larger hydrogeologic systems influence and influence the ability to build on land. Noteworthy concentrations of fertile soils occur along the Merrimack River -- these prime agricultural soils represent a significant natural resource to both the community and region, which should be preserved from future development.

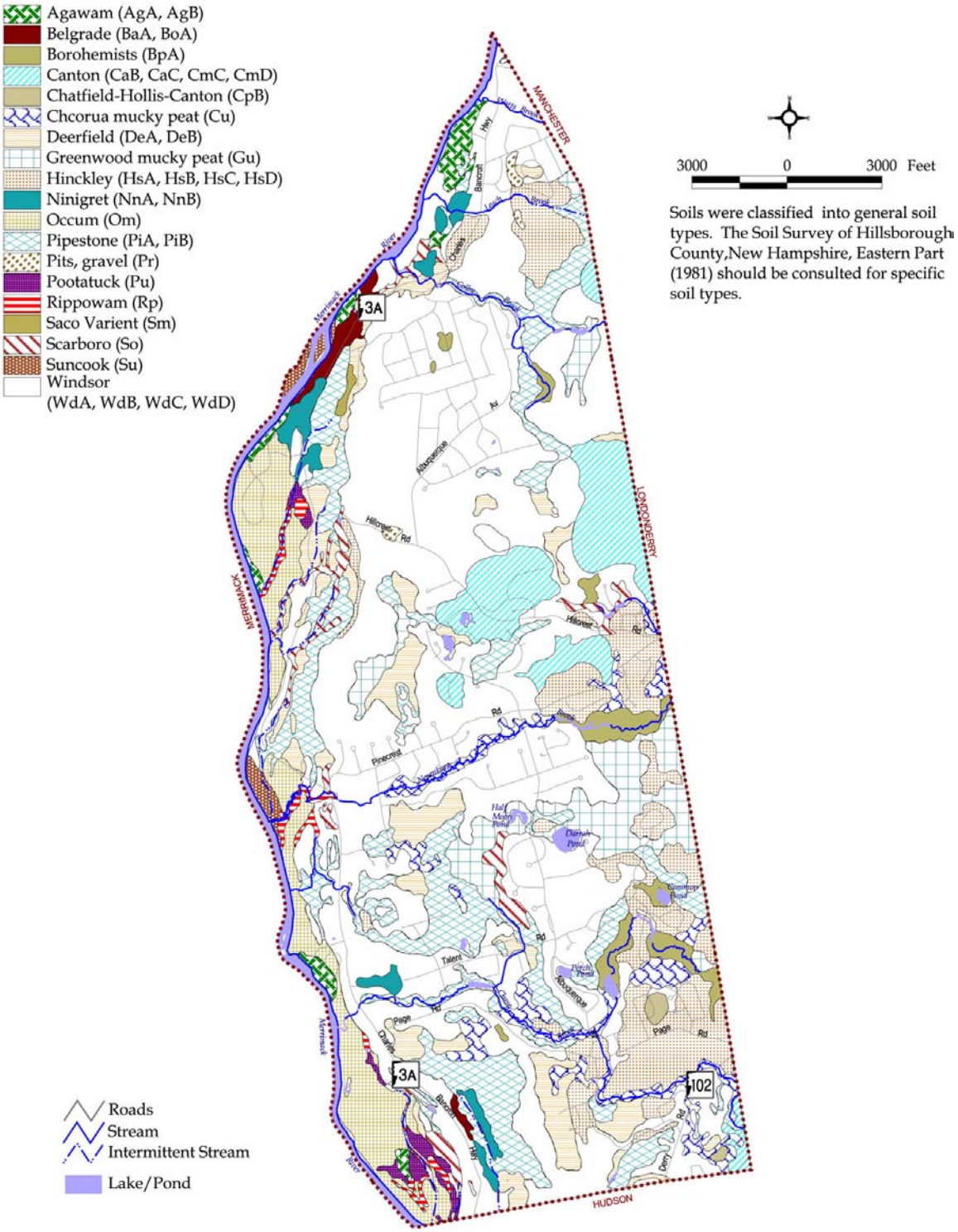
The USDA Soil Conservation Service (SCS), now known as the Natural Resources Conservation Service (NRCS), conducted extensive analyses of soil conditions in Hillsborough County in the 1970s. The *Soil Survey of Hillsborough County, New Hampshire, Eastern Part* (1981) delineates soil boundaries in Litchfield and describes the characteristics of individual soil types. Each soil is evaluated and rated with regard to development potential for specific uses such as crops and pasture, forestry, recreation, wildlife habitat, building site development and the location of sanitary (septic) facilities.

The soil survey maps are at a scale of 1:20,000, with the smallest units mapped at 3 acres. This information is not accurate below a gross scale. It is likely that a map unit may consist of more than one soil type when examining an actual location. The name and symbol for each unit is based on the dominant soil type in an area. Because of these limitations, the information provided in the *Soil Survey* is most useful for general planning like this Master Plan. It is recommended to require more accurate and precise on-site soil evaluations, such as site specific soil mapping, during subdivision and site planning to ascertain the suitability of the soils at a specific site for a proposed use.

Generally, Litchfield soils are sands and gravel at a variety of grain sizes, in slight to moderate slopes, and containing varying degrees of humic (decayed vegetative) materials. The majority of lands are stratified drift deposits, such as fine-grained glacial sediments and more stony soils, which are by-products of the ice age. The *General Soil Map* (SCS, 1981, Page 152) aggregates the majority of soils in the 'Hinkley-Windsor' group, "…deep, nearly level to steep, excessively drained, gravelly and sandy soils; on terraces." Hinckley soils are a major source of gravel and Windsors are a good source of sand. It is the very fine sandy alluvial soils on the Merrimack River banks that are renowned as the finest 'prime' agricultural soils in New Hampshire. The most common soils series are depicted in Map III-1 and the 'Agriculture' section maps prime soils.

The most common soil, covering over 4,050 acres, is Windsor loamy sands (41 percent of land surface). Windsor soils are rapidly permeable and excessively drained. As defined by SCS, these soils demonstrate slight to moderate limitations for siting septic systems; especially when situated within

Map III-1: Soils



steeper slopes. The highest concentrations of Windsors are north of Hillcrest Road and east of Albuquerque Avenue.

Windsor and Hinckley soils demonstrate an average depth to seasonal high water table of five feet. This relatively thin cover, combined with rapid permeability, means that there is not a high degree of natural treatment before contaminant-laden stormwater would percolate into groundwater. Similarly, if septic systems are improperly constructed or maintained, there is a potential for human waste to enter groundwater supplies. In sandy areas if soils are excavated too close to groundwater, the remaining permeable soils may not adequately protect groundwater supplies. The permitting of gravel excavations (RSA 155-E) provides the Planning Board with ample opportunity to protect the groundwater under such sites. Other alternatives to protect soil and groundwater resources are:

- Education on proper septic system Operation and Maintenance (O&M);
- Implementing aquifer and wellhead protection measures;
- Groundwater-monitoring initiatives; and
- Zoning and building code enforcement to promote resolution of problems and pollution prevention.
- Promoting development on other than agricultural and wetland soils.

The other prevalent soils are different wetland soils caused by the high water table. Most common at 1,172 acres (12 percent of the land surface) are Piperstone loamy sand. Other prevalent wet soils are deep muck and seasonally wet Deerfield sands.

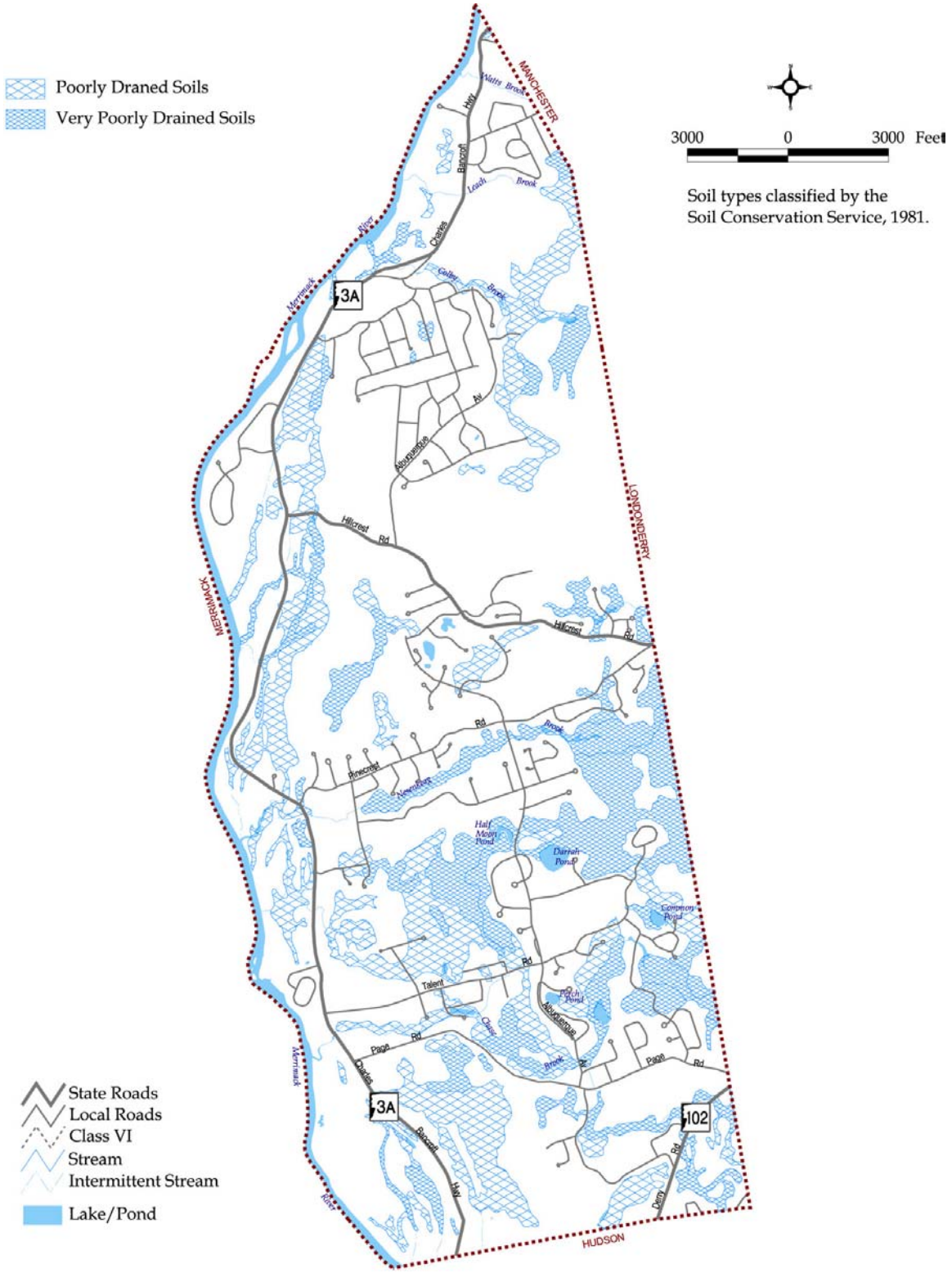
1. Soil Suitability for Septic Systems

Since the entire Town is served by septic systems, the septic tank absorption field category in the SCS Manual is significant for Litchfield. The characteristics of reference soils for the septic system absorption field include:

- The area is located on a gently sloping area of five percent slope;
- The depth to the high water table and bedrock is greater than ten feet;
- The area is not subject to flooding;
- There are less than three percent surface stones; and
- The soil has a percolation rate of twelve to fifteen minutes per inch.

Map III-2 illustrates the estimated 1,750 acres, or 18 percent of Town, covered with wetland soils with low or very low potential for septic absorption fields based on these criteria. Many of the most poorly drained soils are located north of Page Road and south of Pinecrest Road. The incapacity of Hinkley and Windsor soils to hold moisture is an attribute that may make it difficult to contain wastes within the confines of septic system leachfields before effective treatment is completed. The 1991 Master Plan (page II-21) warned that soils present a significant obstacle to development. Specifically, it identified potential for some prevalent soils to percolate too rapidly to effectively treat sewage effluent. It cautioned that a 75-foot septic setback from wells and wetlands might not be adequate for public health protection. In the 1997, the septic system setback from delineated wetlands has been enlarged to 100 feet and a 75-foot well radius remains in effect. It is recommended to also extend the well protection radius to 100 feet in order to promote adequate separation of wells and sanitary waste disposal and promote public health.

Map III-2: Wetlands



The Town should continue to monitor whether any incidences of groundwater problems occur within these soil series. Some other mechanisms that the local public sector could consider utilizing to aid the evaluation of groundwater quality are, monitoring wells and voluntary septic inspections.

2. Site Specific Soil Mapping Standards

The Society of Soil Scientists of Northern New England (SSSNE) recently adopted the 'Site Specific Soil Mapping Standard for New Hampshire and Vermont'. The standard classifies soils to the series level, consistent with maps found in the *Soil Survey*. The new standards replace the High Intensity Soil Survey (HISS) method used in many communities to determine site suitability. In 2000, the Planning Board amended the subdivision and site plan regulations to require the use of Site Specific Soil Standards for future development applications.

This subsection has provided a general discussion of Litchfield soil resources. Most biological activity, as well as high levels of nutrients and organic matter, occurs in the top few inches of soil. The application of appropriate building development practices will help promote soil conservation and biological diversity as well as other benefits such as erosion control and the protection of local water quality.

E. AGRICULTURE

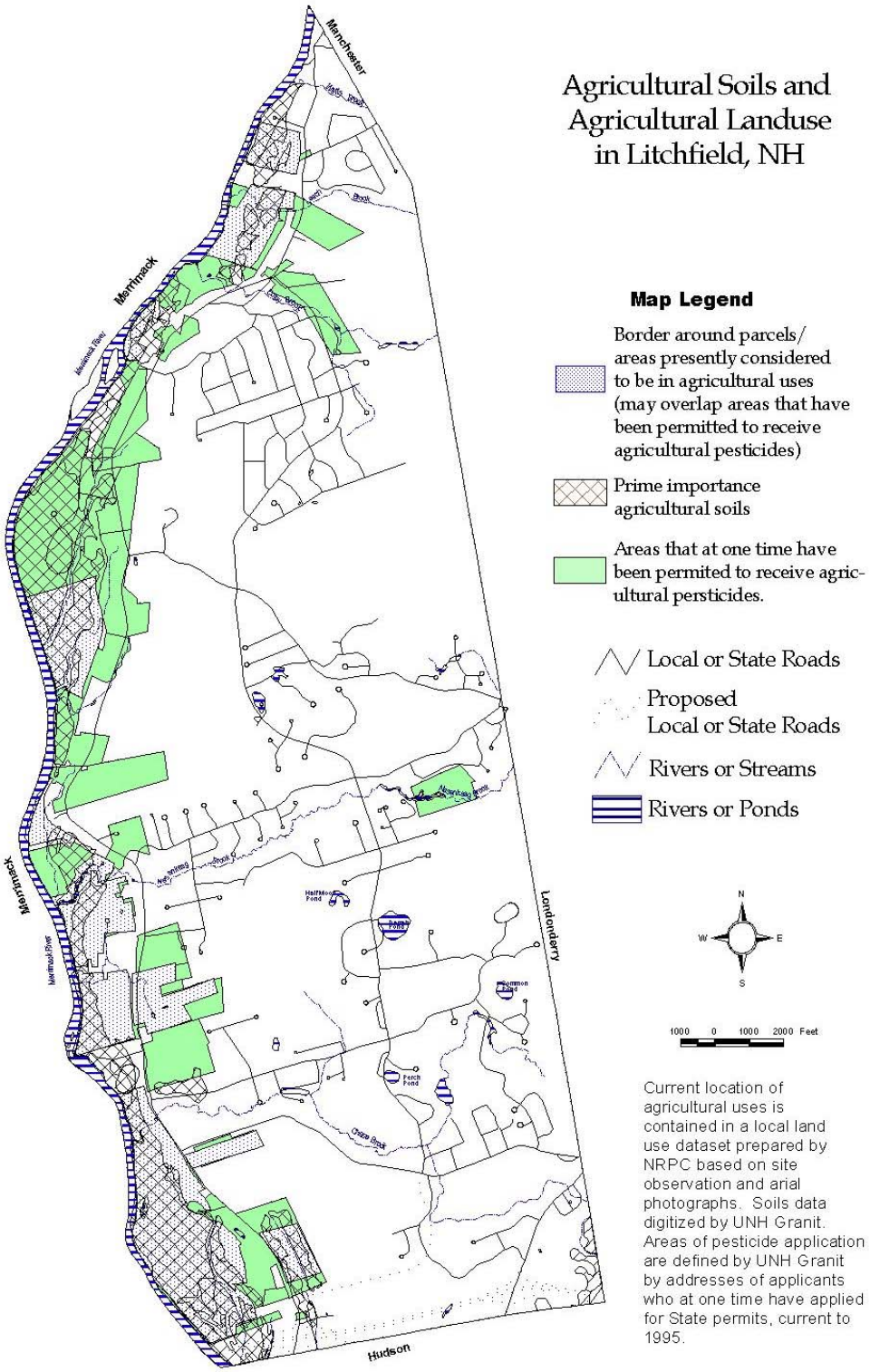
Map III-3 illustrates active agricultural lands in Litchfield. Agriculture is a major local economic activity and is of social and aesthetic importance because these lands contribute to Litchfield's heritage and image as a rural, agrarian community. Agricultural uses also provide food security and protect environmentally important and sensitive lands. There are 868 acres of 'Prime' agricultural soils within Litchfield and 19 acres of soils classified as 'Statewide' importance. Prime agricultural soils cover nearly one tenth of all Town lands, although not all of the prime and statewide soils are being actively farmed for crops. There are also numerous instances, estimated up to an additional 400 acres, where farming occurs on land not classified as prime soil, bringing the total farmland to approximately 1,200 acres.

Many of the largest vegetable and plant farms (often known as truck farms) in the region are in Litchfield. Vegetable farming was the fourth most common type of farm operation, and vegetables were the third most prevalent type crops in 1974 in Hillsborough County. Sweet corn, squash, tomatoes and cabbage are commonly grown vegetables. Other crops raised in Litchfield are fruits, trees, garden plants, sod, alfalfa and corn. Litchfield is home to the largest certified organic farm in New Hampshire.

According to the 1997 USDA Census of Agriculture, outside of lands used to raise hay or corn for grain or silage, there were 7,000 acres in the state used to grow vegetables or fruit. If 600 acres in Litchfield are used for one of these two purposes, this represents 8.6 percent of all New Hampshire lands used for these purposes. Like the rest of the region, farming has decreased in recent years because of economic conditions and conversions of open agricultural land to built development to service commercial and residential growth. While it is difficult to define how much of the existing active farmland can be preserved, large parcels of the best soils would have the highest chance of economic viability for agriculture.

Given that open land places less of a tax burden on the Town and residents than residential or commercial developments, providing a tax incentive for active agricultural land would not significantly increase the tax burden on other residents. Decreasing the tax burden on land used for agriculture is good for farmers and those searching to maintain Litchfield's rural lifestyle.

Map III-3: Active Agricultural Lands



Source: NRPC, *Land Evaluation and Site Assessment for Agricultural Land*, Town of Litchfield, 2000

Farmland Preservation is an important natural resources protection goal of the Conservation Commission and the community at large. Agricultural preservation helps meet the future demand for food resources; in addition, it provides a physical buffer to major proposed road and bridge projects. Farmland protection is also a regional environmental preservation priority. One local focus is 89 acres of prime agricultural soils with Merrimack River frontage that forms an ecological and aesthetic buffer to the northern Commercial Zone. It is also contiguous with 64 acres already protected by the Town and a local land trust. The area abuts several Merrimack River Islands and is prime habitat.

F. WETLANDS

Wetlands are low-lying, nearly level, swampy areas characterized by a water table at or near the land surface. The *Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire* (1991), hereafter the NH Method, technically defines wetlands as:

> *"…those areas.…inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."*

Once considered a nuisance, wetlands are increasingly recognized for their role in maintaining hydrologic and ecological stability. Wetlands perform functions such as natural flood control and stream flow regulation, erosion control, and water purification, while also providing nursery grounds and habitat for numerous wildlife species. Wetlands are widely distributed throughout Town, but are concentrated in the lower-elevation southern and eastern parts of Litchfield. Local wetlands are also located in stream corridors and small, isolated wetlands and bogs. The figure Watersheds and Surface Water Resources shows the location of areas of poorly and very poorly drained soils as well as surface water bodies and watershed boundaries. The Litchfield Zoning Ordinance defines wetlands based on soil type such as the presence of poorly or very poorly drained soils and upon the presence of hydric plant species. Table III-1 lists wetland soil types found in Litchfield.

Table III-1: Wetland Soils, Litchfield, New Hampshire

Symbol	Soil Map Unit
Poorly Drained	
Bg	Binghamville silt loam
LeA	Leicester-Variant loam
LsA	Leicester-Variant stony loam
LtA	Leicester-Walpole complex, 0-3% slope
LtB	Leicester-Walpole complex, 3-8% slope
LvA	Leicester-Walpole complex stony, 0-3% slope
LvB	Leicester-Walpole complex stony, 3-8% slope
PiA	Pipestone loamy sand, 0-3% slope
RbA	Ridgebury loam, 0-8% slope
ReA	Ridgebury stony loam, 0-3% slope
ReB	Ridgebury stony loam, 3-8% slope
Rp	Rippowam fine sandy loam
Sn	Saugatuck loamy sand
Very Poorly Drained	
BoA	Borohemists, nearly level
Cu	Chocorua mucky peat
Gw	Greenwood mucky peat
Sm	Saco Variant silt loam
So	Scarboro mucky loamy sand
Sr	Scarboro stony mucky loamy sand

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

1. Wetlands Conservation

The Litchfield Conservation Commission from 1996 to 1999 has been actively categorizing wetlands in Town according to the NH Method. The information collected describes the current condition and functions of many of the larger wetlands. Such an inventory may be used to:

- Designate significant wetlands as 'prime wetlands'.
- Show how natural hydrological systems flow, or operate, compared with proposed development(s).
- Develop indexes, or baseline information, on current wetland conditions that could be used as the basis for developing indicators that would be monitored over time to define the relative health of wetlands, or used to identify potential wetland protection policy designs.
- For educational purposes by local students, educators, or scientists.

The wetlands inventory is an important reference document and building block to understand more fully, how wetlands function in the community. The study does not involve an inventory of many smaller wetlands, vernal pools, and intermittent streams due to resource and time limitations. Furthermore, the methodology does not provide overall scores or automatic ratings that would identify the most important wetlands. A prime wetlands designation would provide these areas with greater protection at the State level and will increase scrutiny of projects adjacent to these areas. Utilizing this approach, the highest order or most ecologically significant wetlands can be afforded more protection.

The Conservation Commission in 1998 during phase one of the Regional Environmental Priorities Program (REPP) facilitated by the NRPC, identified protection priorities, with many of the priority sites consisting of wetlands. The Musquash Swamp in Londonderry is part of a large wetlands complex in multiple municipalities. The REPP process identified protecting the swamp as a priority. It promotes developing greenbelt and wetland linkages between contiguous open lands around the Litchfield State Forest, and Sawmill and Colby Brooks in Litchfield, with the Musquash Swamp in Londonderry. The REPP process also resulted in the Conservation Commission identifying other high priorities for wetland protection within Litchfield. Wetland protection priorities are primarily in the eastern side of Litchfield and include: Half Moon Pond, Common Pond, the Watts Brook property, the Weinstein property and an area on Stage Road.

The Weinstein property, located between the Page Road and Woodburn Road neighborhoods, comprises approximately 148 acres and was targeted to preserve wetlands and a public water supply area. The Half Moon Pond area, located between Stark Lane and Nesenkeag Drive, the Common Pond area, near the Londonderry line north of Chase Road, and the Watts Brook land in the extreme north by Temple drive represent opportunities to protect valuable wildlife habitat. Common Pond and Half Moon Pond have been identified by the Natural Heritage Inventory (NHI) as habitat for rare plant and animal species. Half Moon Pond is a unique and sensitive wetland complex containing a rare dragonfly site listed on the NHI.

The Wetland Conservation District permits the following activities in wetlands: forestry/tree farming; agriculture; wells and well lines; wildlife refuges; parks and recreation uses suitable in wetlands; conservation areas and nature trails; open space and minimal impact crossings for roads and driveways. In addition, wetland areas cannot be used to satisfy minimum lot size requirements. Septic tanks and leachfields must be set back 100 feet from the edge of the wetland and no structures can be erected within 75 feet from the edge of a wetland. A 50 foot naturally vegetated buffer and 200 foot buffer for vernal pools. When human activities are proposed that could adversely impact wetlands, these must be carried out with Best Management Practices, BMPs. For definitions and the complete Wetlands Conservation District ordinance language, refer to the Town of Litchfield, NH Zoning Ordinance.

With regard to wetland regulations, the Conservation Commission and the Planning Board should work together to evaluate existing rules and procedures and make recommendations for upgrades to improve the effectiveness and efficiency of the regulations. One recommended change would be to require maintenance of a natural vegetative buffer within 50 to 100 feet of all wetlands. The advantage of increasing the buffer is that vegetated buffers help decrease nonpoint source pollution by stabilizing soil and preventing erosion. Vegetative buffers also help decrease the velocity of runoff by physical means and remove excess nutrients and other contaminants by physical, biological and chemical means contained in runoff from roads, residential, agricultural and commercial sources.

Reviews of stormwater drainage system designs and road layouts in subdivisions, and examination of proposed development versus wetlands environmental impacts in site planning, should focus on preserving adequate buffers and ensuring that the potential impacts are not too concentrated in specific locations. If there are ecological impact concerns associated with a development, there are numerous habitat-based methods for impact assessment and prediction that the Board could require project proponents to carry out to inform the Board. Similarly, there are an increasing number of environmental technologies that can help prevent and mitigate potential problems. Standard forms and procedures could be developed for use by the Board to evaluate potential impacts and design options.

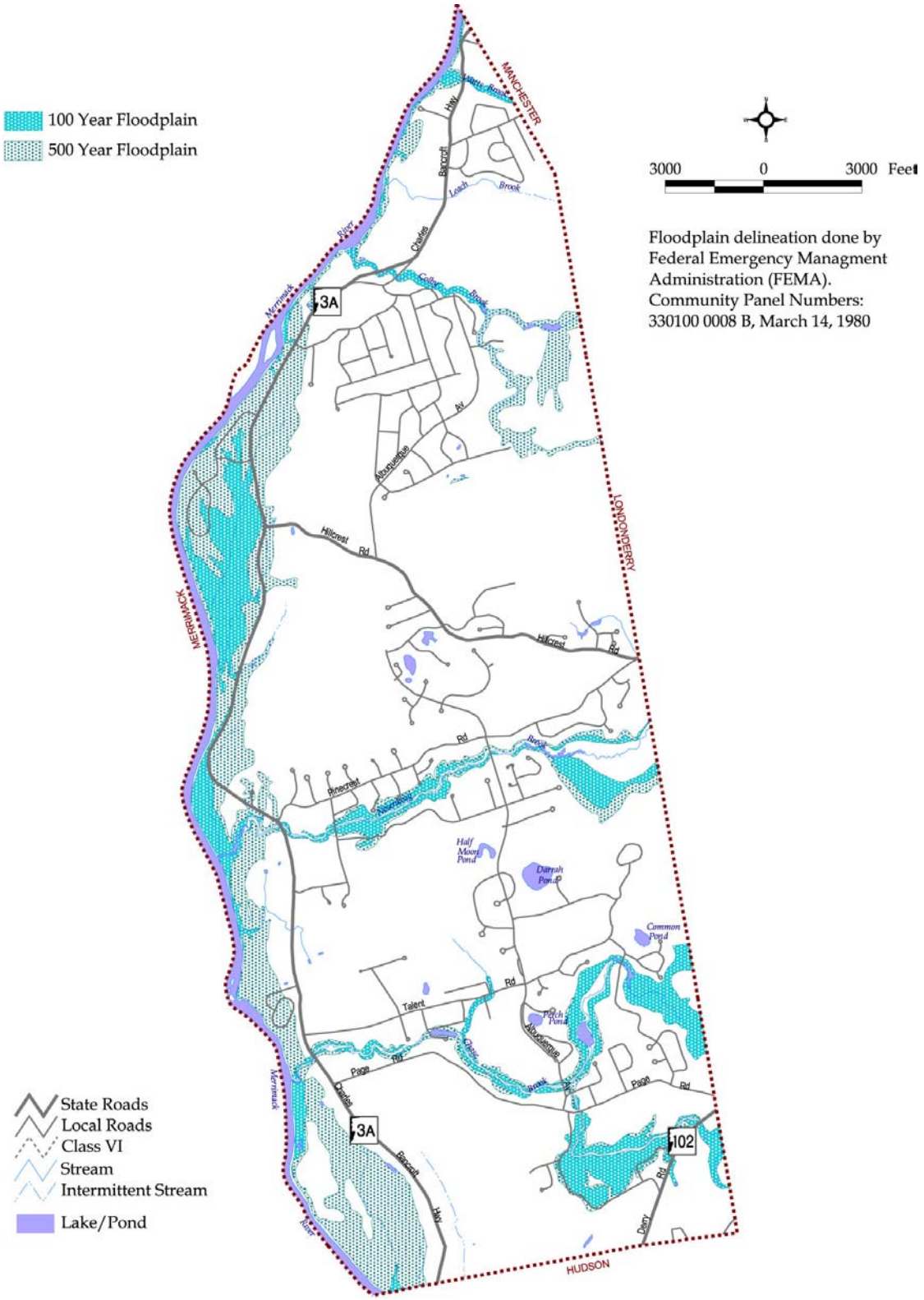
G. FLOODPLAINS

Floodplains are areas subject to routine or seasonal flooding due to low elevations relative to adjacent streams. During periods of high runoff, floodwaters can damage buildings located within the

floodplain. Historically, settlement often occurred in floodplains since they were open, accessible and had fertile soils. To protect against the societal risks encountered from flooding, the Federal Emergency Management Administration (FEMA) conducted studies and mapped floodplain throughout the region under the National Flood Insurance Act of 1973. As a result of these efforts, most communities have adopted restrictions governing development in floodplains. Three FEMA floodplain zones are delineated and assigned a flood insurance zone designation based on the probability of a flood event, as follows:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood. There is a one percent chance that this level of flooding will occur in any given year.
Zone B:	Areas between Special Flood Hazard Area (Zone A) and the limits of the 500-year flood, including areas of 500-year floodplain protected from the 100-year flood by dike, levee or other water-control structures; also areas subject to certain types of 100 year shallow flooding where depths are less than 1 foot; and areas subject to 100 year flooding from sources with drainage areas less than I square mile.
Zone C:	Areas of minimal flooding.

Map III-4: Floodplains



As shown on Map III-4, the location of 100-year floodplain (Zone A) is in three primary locations:

- Along the Merrimack River (shoreline of 48,613 feet or 9.2 Miles);
- Along the length of Nessenkeag Brook; and
- Along Chase Brook.

The total floodplain in Litchfield translates into 831 acres, which equals 9 percent of Town. Floodplain plays an important role in storm surge and run-off management. Every effort should be made to ensure that development does not occur in the Floodplain.

H. SURFACE WATERS

The Merrimack River, the most prominent water body in the area, runs 7.9 miles along the western edge of Litchfield and covers 243 acres of Town. Overall, the Merrimack River watershed, which is that portion of the land area contributing runoff to a surface water body, covers more than 5,000 square miles in New England and is a major watershed in New Hampshire. The four main brooks that run east to west and connect wetlands are also defining features of the community.

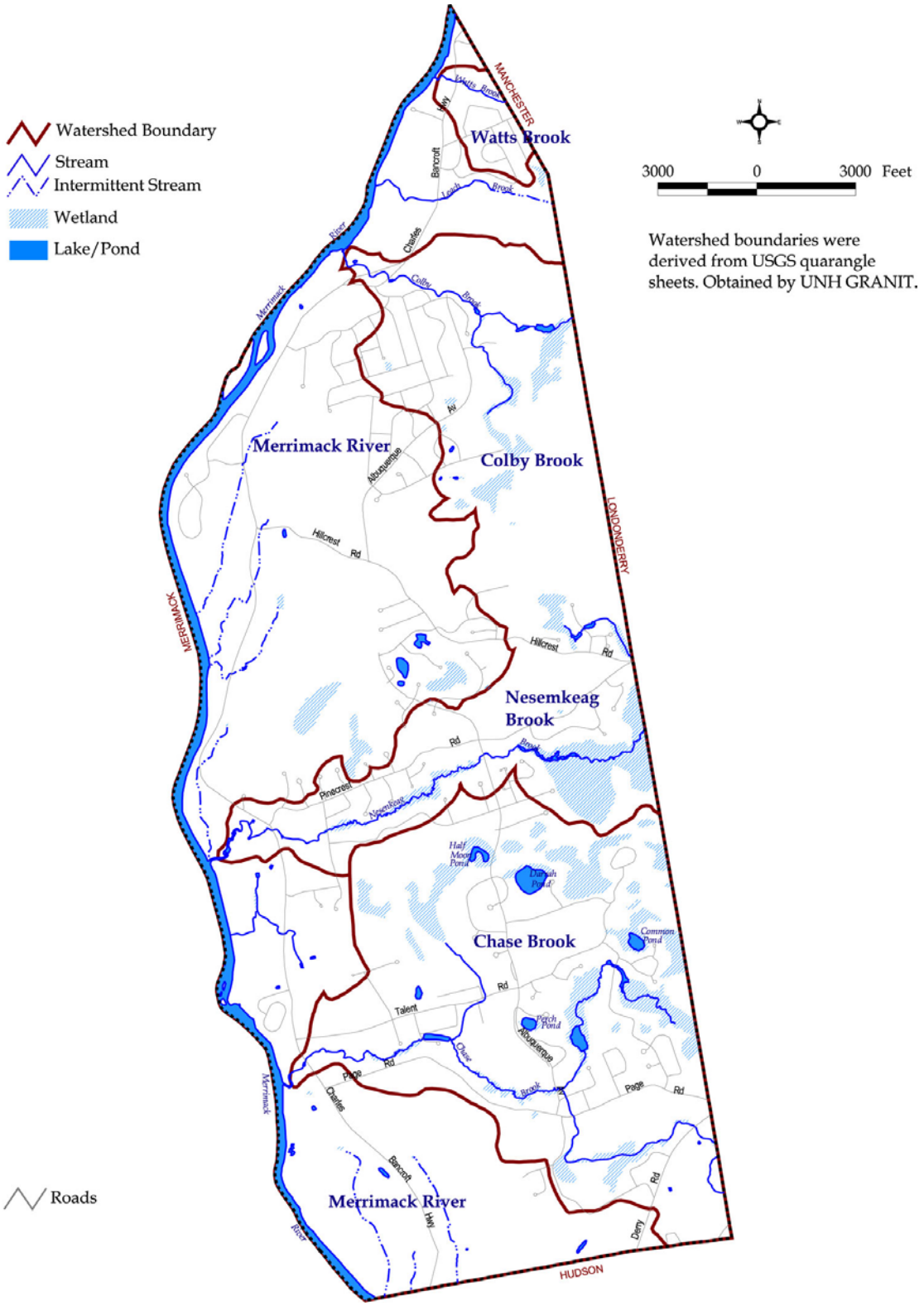
The *Litchfield Water Resources Management and Protection Plan* by the Planning Board in 1990 presents comprehensive descriptions of local waters. There are five main watersheds in Litchfield. Map III-5, *Watersheds and Surface Water Resources* identifies local watersheds. All local watersheds drain into the Merrimack River. Two areas adjacent to the river, covering approximately 4,500 acres (half of Town) drain directly into the river without entering another brook or stream. Other watersheds in decreasing acres of coverage within Litchfield are: Chase Brook; Nesenkeag Brook; Colby Brook and Watts Brook. Fifteen hundred and seventy three acres of Chase Brook are in Litchfield, representing 27 percent of that watershed. The Colby Brook watershed covers 1,131 acres, which is 12 percent of Litchfield, and just less than two-thirds of that watershed. In addition to the nearly eight miles of Merrimack River Shoreline, there are 104,700 linear feet, or nearly 20 miles, of perennial and intermittent streams. The major perennial streams are:

- Nesenkeag Brook – 3.7 miles (79 percent) of total 4.7 in Litchfield;
- Chase Brook – 3.4 miles (60 percent) of total 5.7 in Litchfield.
- Colby Brook – 1.5 miles totally in Litchfield
- Watts Brook – 0.4 miles (20 percent) of total 2.1 in Litchfield;

The major ponds in Litchfield are:

- Darrah Pond – 12 acres – this is the only local pond covered by the CSPA. This oligotrophic water body is 22 feet deep with a low supply of nutrients, contains little organic matter, and is characterized by high transparency and DO.
- Common Pond – 6 acres
- Duck Pond – 6 acres
- Half Moon Pond - 6 acres
- Perch Pond - 4 acres; and
- Rocky Hill Pond - 3 acres

Map III-5: Watersheds and Surface Water Resources



1. Surface Water Quality

The Merrimack River was once among the dirtiest rivers in New England. The Litchfield Water Resources Management and Protection Plan notes that as recently as the late 1980 parts of the river close to Litchfield were not meeting Class B standards for bacteria. However, water quality has improved incrementally and today the part of the river adjacent to Litchfield meets the Class B standard, meaning that the river is still not clean enough to drink. The same plan notes that in 1988 all major ponds in Litchfield were also rated class B.

The Merrimack River Watershed Council document *Merrimack River Water Quality Project – Greater Nashua Area*, 1992, notes that individual actions influence water quality and flow. This collaborative study was conducted to answer questions: 1) Does the Merrimack River and it tributaries meet NH water quality stands for dissolved oxygen? 2) Are the rivers safe for contact recreation, such as swimming? And 3) are total phosphorous and associated nutrient enrichment cause for concern? The follow-up *Nashua Monitoring Project 1991-1995 Summary Report* also provides further research on the same subjects. Both reports are based on water sampling conducted by volunteers, including in Litchfield. This monitoring data will provide a valuable database for tracking the quality of local water resources.

Dissolved Oxygen (DO) is an important indicator since aquatic plants and animals need it to survive. Generally, from 1991 to 1995 the Merrimack River met the NH standards for DO of 75 percent saturation in Class B waters and the NH standard for bacteria in Class B waters. The 1992 study concluded that when and where sampled, the river is safe for prolonged contact based on the bacteria contaminants studied.

Nearly 2/3 of sites sampled in 1992 contained Total Phosphorus (P) levels greater than the level of concern. There does appear potential for nutrient enrichment within the river. Sources of this contamination may be urban area wastes, including lawn fertilizers as well as agriculture and natural runoff. Often higher densities of development convey higher P levels, especially if there is not adequate on site minimization or treatment of stormwater runoff. The Planning Board should strive to identify and incorporate P mitigation measures in development closest to local surface waters, particularly brooks that do not have as rigorous of setback requirements as the Merrimack River.

2. Lower Merrimack River Advisory Council (LMRAC)

In addition to the Planning Board and Conservation Commission, the Lower Merrimack River Local Advisory Committee has been working to monitor and protect Merrimack River shoreline. Once one of the ten dirtiest rivers in the Country, significant improvements in water quality have resulted in increased development pressure along the shoreline. The Merrimack River is the most significant surface water resource in the region and recreational use of the River has increased significantly in recent years. There have been local attempts to acquire conservation easements along the River through the development review process and the Town has acquired some significant riverfront parcels in the past five years. Riparian forest buffers the tree-lined areas along streams and rivers provide a critical role in the protection and enhancement of water resources. The USDA (1997) describes streamside forests as:

> *"…Extremely complex ecosystems that help provide optimum food and habitat for stream communities as well as being useful in mitigating or controlling nonpoint source pollution."*

Forests along streams host species important to the stream biome, moderate against an adverse influence of light and temperature change, as well as help prevent topsoil erosion.

To guard against uncoordinated, unplanned and piecemeal development along shorelines in New Hampshire, the Comprehensive Shoreland Protection Act (CSPA) was implemented in July 1994. In 1997,

the part of the Merrimack River passing through Litchfield was included as subject to the protection provided by the CSPA. Generally, the CSPA standards are designed to minimize shoreland disturbance to protect public waters, while still accommodating reasonable levels of development in the protected areas. RSA 483-B became fully effective on July 1, 1994, and sets minimum standards to protect and conserve public water bodies in the State. These are natural ponds or artificial impoundments of ten acres or larger and fourth order or higher rivers. The Act states in Section V(a)(1):

> *"Where existing, a natural woodland buffer shall be maintained within 150 feet of the reference line. The purpose of this buffer shall be to protect the quality of public waters by minimizing erosion, preventing siltation and turbidity, stabilizing soils, preventing excess nutrients and chemical pollution, maintaining natural water temperatures, maintaining a healthy tree canopy and understory, preserving fish and wildlife, and respecting the overall natural condition of the protected shoreland."*

Refer to the complete Revised Statute Annotated (RSA) 483-B to understand the full details of this law, such as directions for the use of fertilizers and the placement of structures.

I. GROUNDWATER

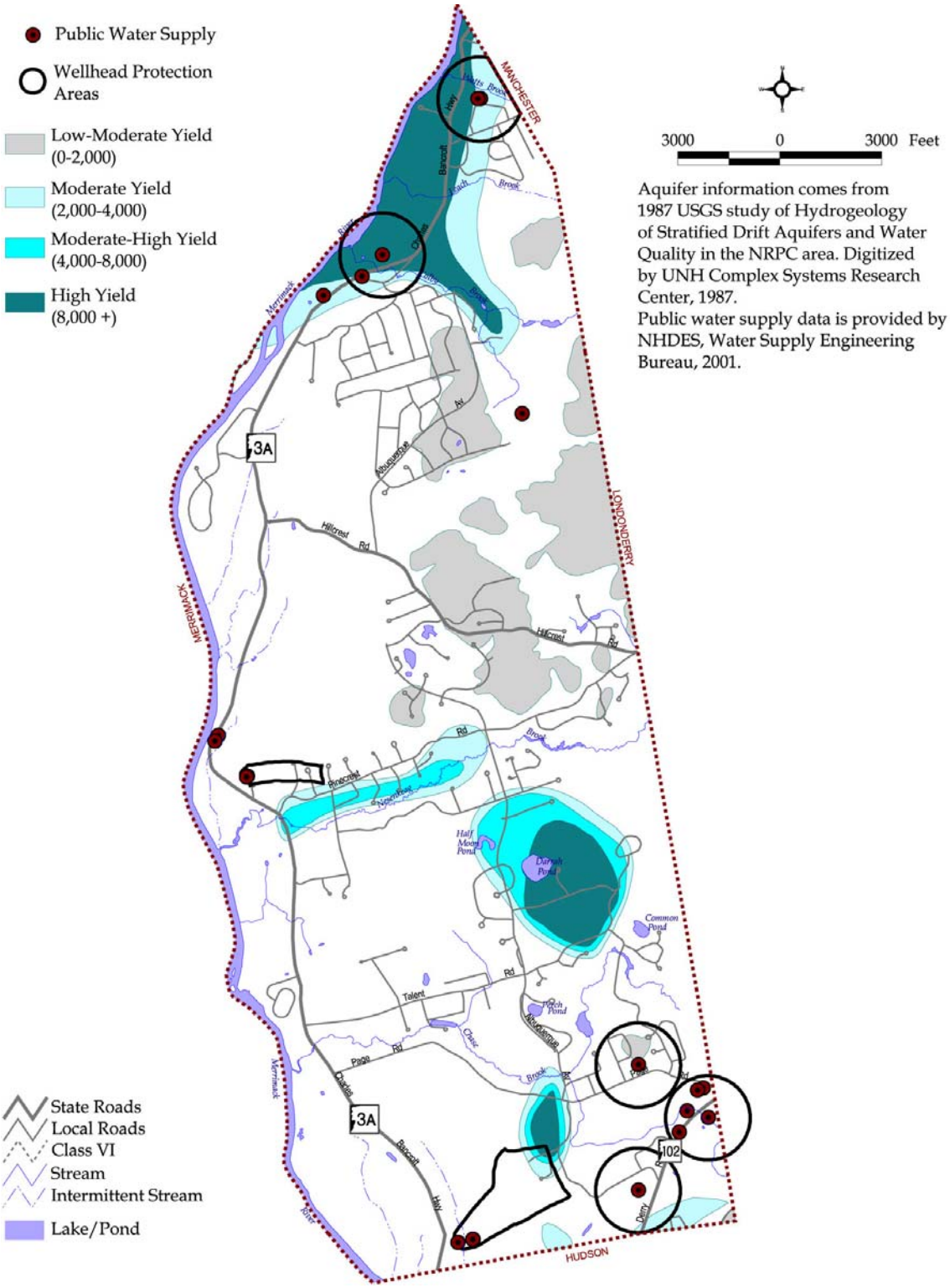
In addition to surface water, groundwater is the other major source of water supply. Groundwater is an abundant and ubiquitous natural resource in Litchfield. Stratified drift aquifers with potential to yield water underlay 94 percent of the Town - Litchfield ranks among the top three municipalities in the State in terms of the amount of area underlain by stratified drift aquifers that possess some ability to store and transmit volumes of water. Many of these locations have an ability to store and transmit large volumes of water. This section describes the location and characteristics of hydrogeological features and protection of replenishable - but also depletable - groundwater resources.

As depicted on Map III-6, approximately 14.1 square miles of stratified-drift aquifers exist in Litchfield scattered throughout Town and varying in saturated thickness and transmissivity. There are cross-sections of saturated soils more than 100 feet deep in Litchfield. One location of aquifers with zones of transmissivity greater than 2,000 feet squared per day is in the north of Town by the Manchester border extending south into the commercial zoning districts by Colby and Roberts Roads. Another area of high transmissivity is in the southeast part of Town by Albuquerque Avenue and Talent Road. In some cases, the transmissivity of the aquifers exceeds 8,000 feet squared per day. Because of their ability to store and transmit large volumes of water, these stratified drift aquifers are important sources of future water supply for residences and businesses within the Town as well as in the larger region.

The USGS study by Topin titled *Hydrogeology of Stratified Drift Aquifers and Water Quality in the Nashua Regional Planning Commission Area, South-Central New Hampshire*, describes the stratified drift aquifers in Litchfield:

> *Located on the eastern side of the Merrimack River….the predominant stratified material (in Litchfield) is fine-grained glacial sediment of Glacial Lake Merrimack (Koteff, 1976). Several good aquifers, in northern and central Litchfield are permeable, coarse sand gravel with a saturated thickness greater than 100 ft in some places.*

Map III-6: Stratified Drift Aquifer Resources



Large quantities of water are pumped from the coarse-grained sand and gravel aquifer centered about Darrah Pond. This aquifer is in a segment of a buried valley occupied by Darrah Pond delta deposits (Koteff, 1976); the deposits are more than 100 ft thick southeast of Darrah Pond, and their transmissivity is greater than 8,000 ft^2/d. The coarse-grained of the aquifer are bounded on the west by fine-grained materials. The Darrah Pond well (w-59) has a capacity of 100 gal/min and serves part of central Litchfield. Darrah Pond is the only significant source of water available for induced infiltration into this area.

Northwest of Darrah Pond, two wells (W-56, W-57) are located in the coarse-grained sand and gravel along Nesenkeag Brook, and each yield less than 100 gal/min. The aquifer along the brook is not as extensive as the Darrah Pond aquifer; its saturated thickness is less than 40 ft, and transmissivity is less than 8,000 ft^2/d.

South of the Darrah Pond aquifer, another coarse sand and gravel aquifer, located near Cutler Road, also is within the same buried valley that follows a north-south course through central Litchfield. The saturated thickness is greater than 60 feet and transmissivity is greater than 8,000 ft^2/d. The Weinstein production well (W-36) in this area yields more than 500 gal/min. Additional production capacity from this area probably is limited by potential interference with well W-36 that taps from this small aquifer.

Saturated thickness of the coarse sand and gravel aquifer along Colby Brook exceeds 40 ft, and transmissivity is less than 8,000 ft^2/d. Based on the extent and saturated thickness of permeable material at well W-1 to W-6, W-34 and W-35 (transmissivity averages 7,000 ft^2/d), the yield of this aquifer potentially is as large as that from aquifers near Darrah Pond and Nesenkeag Brook.

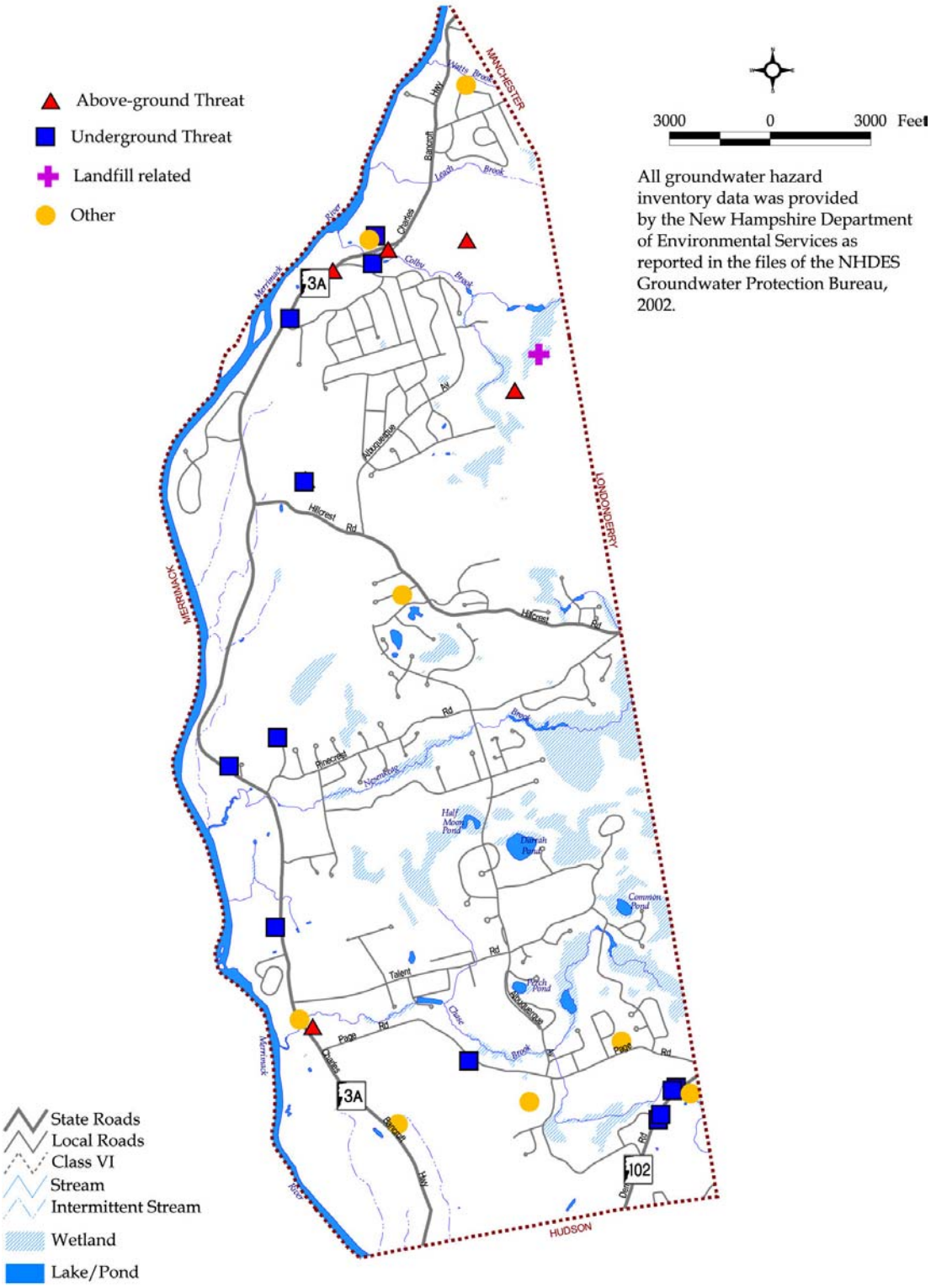
The 1990 *Litchfield Water Resources Management and Protection Plan* by the Planning Board comprehensively examines existing water resources and their management and protection. The document analyzes bedrock and till aquifers as well as stratified drift aquifers. The study cites a 1983 study *Nashua, New Hampshire Regional Groundwater Investigation* by Metcalf and Eddy, Inc. noting that the potential yield from aquifers in Litchfield was medium to high with groundwater acceptable for potable use, with the exception of naturally occurring manganese. Drinking water standards have become more restrictive under the Clean Water Act and Safe Drinking Water Act amendments that occurred since the 1983 Metcalf and Eddy, Inc. study.

The 1987 USGS study indicated that the yield of community water supply systems in the NRPC Region (surface and groundwater) was 22 MGD (million gallons per day) and analytical modeling indicated that an additional 12 MGD could be obtained from regional aquifers, with potential for increased amounts where yields could be augmented by induced recharge of surface water. At that point, it was estimated conservatively that the Darrah Pond Aquifer total sustained yield was approximately 2.3 MGD. This would represent approximately 6.4 percent of the total estimated yield of the aquifers in the region.

1. Potential GroundWater Quality Threats

Activities associated with Nonpoint pollution sources (NPSs) represent the greatest threat to surface and groundwater resources contamination in Litchfield. NPSs include urban runoff from automobiles, septic system, garden fertilizers, pesticides, and other common contaminants entering stormwater run-off on commercial and residential properties. The Town should undertake all measures within its control to decrease the impacts of NPSs on surface and ground water quality. Potential ground water contamination and point sources are depicted on Map III-7.

Map III-7: Potential Groundwater Contamination Point-Sources



In considering potential impacts to groundwater, contamination may occur in the form of quantity or quality. Indicators of groundwater quality include pollutant types such as: fecal pathogens; nutrients; organic micropollutants, heavy metals, salinity and acidity. In addition to impacts that can be expected in any urban area, major land uses that present potential to influence groundwater quality are:

- land discharges of sewage within individual lot septic systems;
- agricultural development; and
- gravel excavations.

The USGS study showed that groundwater contamination in the region occurred from point sources as well as from widespread application of highway deicing chemicals as evidenced by elevated sodium levels in groundwater. It is recommended that the Town investigate potential policies to promote protection of wellhead areas and areas above high transmissivity aquifers. In addition, the Town should continue to encourage the NH DOT to investigate options to its current road salting policy.

One common source of groundwater pollution is releases from improperly designed or maintained septic systems. The NHDES requires that all new systems are permitted by the State and in 1999, the Town instituted lot size requirements for residential properties that mandate one acre of contiguous dry land within a lot proposed for development. New lot sizing requirements should promote separation of septic systems from wet soils and underlying aquifers. Besides using land use regulation to protect this resource, it may be worthwhile to examine the extent that existing systems are being adequately maintained by local property owners. Public education initiatives have also occurred by the Conservation Commission to inform citizens about the importance of septic maintenance. Darrah Pond is located over the largest area of high yield aquifer and contributes to the aquifer recharge; therefore, this may be an important area on which to focus such efforts.

Although there were approximately 1,200 acres under active agricultural use in 1997, farmland areas may decrease due to potential for conversion into residential and commercial uses. While cultivation with agrochemicals does represent a potential risk to water quality, there would appear to be many conservation tools, best management practices, and technical assistance resources available to local farmers that may be instituted outside of land use controls to prevent adverse groundwater impacts from farming.

Gravel excavations present potential for hydraulic disturbance as well as for introduction of moderate drinking water impacts, such as if fine silt enters aquifers. State and local regulations concerning gravel excavations provide significant guidance on the conduct of such operations to protect natural resources; however, the Planning Board or its staff should have resources and expertise to adequately monitor the extent that gravel excavations are conducted in conformity with permit requirements. For instance, it may be difficult to evaluate whether specific operations or activities are causing impacts on water quality or aquifer integrity since these are often hard to detect due to limited local inspection and enforcement capabilities.

It is recommended that the Board, and/or an expert consultant, on annual basis, review gravel operations for compliance with local rules and procedures. In the future, permit applicants should be required to institute additional land use practices that provide for groundwater protection as well as provide funds to support routine oversight of the activity. Among the land use techniques available to the Planning Board to prevent adverse groundwater impacts from gravel excavations are: specifying the land reclamation techniques required; sediment basins; water quality monitoring; and buffers from high transmissivity aquifers or community wellheads.

2. Aquifer and Wellhead Protection

To protect future drinking water supplies the 1991 Master Plan (page IX-2) urged adoption of an aquifer protection overlay district and conservation ordinance. This objective has not been realized, although pressure from residential development and limited commercial development has continued since 1991. While Litchfield does have Floodplain and Wetland conservation districts, the underlying groundwater resources do not always correlate with wetlands and floodplains on the surface of the land. Development translates into threats to drinking water supplies from septic systems, as well as other suburban stormwater runoff sources such as: automobiles, pesticides, fertilizers, road salts and others. In addition, because of the large scale and unique practices of many businesses, these uses often present potential to contaminate water supplies as point sources. This subsection examines the rationale for adopting drinking water supply protection measures, such as wellhead and aquifer protection.

Map III-7, *Potential Groundwater Contamination Point Sources,* shows the location of potentially hazardous land uses identified in the NH DES *All-Sites List* database (1998), as supplemented by NRPC. The NH Department of Environmental Services Water Supply and Pollution Control Division maintains and distributes the *All Sites Listing* comprised of several sub-lists including: the Groundwater Hazard Inventory, the Hazardous Waste Site Inventory, the list of large underground storage tanks, the list of lined and unlined landfills and dump sites, and a list of junkyards. The Town should update this list regularly.

The aquifer centered near Leach and Colby Brooks is in the vicinity of six commercial uses on the All-Sites List. These represent current and former businesses with underground storage tanks (USTs); operations using hazardous chemicals, and other sites listed through various U.S. EPA and NH DES water quality protection programs. While much of the Colby/Leach Brook aquifer is currently undeveloped open space, these point sources do have potential to contaminate the aquifer and Merrimack River.

The advantage of preventing against emissions from point and non-point sources is that it is orders of magnitude less costly to practice prevention versus utilizing treatment after the release of a hazardous material to remediate contaminants and restore water quality to decent conditions. Map III-6, found on page III-19, shows that there are active wells in all four of the areas of highest aquifer recharge. It appears that the public water supply wells are not currently threatened by identified point sources.

One proactive way to protect aquifer quality is by regulating businesses and other uses at the local level to ensure that incompatible land uses do not occur near the most important aquifer recharge areas. Three methods commonly employed in the NRPC region are: 1) prohibiting certain uses; 2) ensuring that if development does occur it is at a sufficiently low density; and 3) requiring that the uses employ rigid controls on potentially hazardous substances and practices. Best management practices (BMPs) specify universally accepted industrial and commercial practices that are proven to be feasible to use and at the same time help minimize the potential for accidental contaminant releases.

Seven of the communities in the NRPC region had aquifer protection ordinances as of November 1998. Amherst, Brookline and Hollis are examples of communities that limit the amount of impervious surface and specify prohibited uses within aquifer protection districts. Merrimack provides for the use of BMPs by businesses as a way to protect local water quality while also providing opportunities for commercial economic development. For BMPs to succeed the Planning Board should evaluate which monitoring and enforcement practices could be instituted as permit requirements (such as routine monitoring reports completed and submitted by applicants), or within the local public administration such as at the level of Building Inspector, to ensure compliance with applicable regulations. Any ordinance should include provisions for updates that follow the new and most recent BMPs.

A major aquifer with potential to receive adverse impacts in the event of an acute or chronic contaminant release from a commercial operation is the commercial zone overlaying the Weinstein Well by Cutler Road. Currently there are no existing commercial uses within by this wellhead; however, there is increased future development potential in this area associated with construction of the Circumferential Highway. Therefore, this area may be a good candidate for undertaking definite steps to achieve wellhead protection, depending on whether stakeholders focus future actions in areas expected to develop, or in the ones already experiencing development.

All of the major aquifers: Darrah Pond, Nesenkeag Brook, Weinstein Well and Colby/Leach Brook face threats from non-point pollution sources. As noted in the Groundwater 'Potential Threats' subsection, non-point pollution is by far the greatest risk to groundwater quality. With a golf course and 1,000 acres of farmland, another potential non-point source of groundwater contamination is herbicides and pesticides.

In addition to adopting specific mechanisms to regulate land uses or conserve land from development near wells, another tactic that could help achieve a higher degree of pollution prevention is fostering public education and awareness about how residential activities translate into adverse impacts on water quality. One major initiative to achieve pollution prevention is the Nashua Regional Household Hazardous Waste Collections initiative.

Although it is imperative to protect all water resources, based on the location of existing wells, the highest priorities for protection appear to be around the Weinstein, Darrah Pond and Nesenkeag Wells. Comparing these moderate and high transmissivity aquifers versus the Map x 'Open Space in Litchfield' (page x) shows that areas around Nesenkeag Brook are developed, as are portions of the Colby/Leach Brook and Darrah Pond aquifers. Given current levels of development, the Weinstein well aquifer may be a good one on which to develop a local prototype for aquifer protection.

The *Guide to Wellhead Protection* identified five steps to implementing local wellhead protection programs are:

1. Form a local wellhead protection team.
2. Define and Map Protection Areas.
3. Inventory Potential Sources of Contamination.
4. Manage Protection Areas; and
5. Plan for the Future.

Combining the skills and resources of the Planning Board and Conservation Commission, with collaboration from NRPC and Pennichuck Water Works would provide strong analytical capacity to undertake wellhead protection. One wastewater treatment option that is recommended for further study in Litchfield by the Planning Board is instituting fixed line sewer systems or other innovative community (also known as package) treatment systems in critical areas to relieve the potential for contamination on water resources. If such a link were to be made with adjoining municipalities at the point of constructing a bridge across the Merrimack River, this technology would be beneficial to minimizing septic contamination within the highest recharge areas. In addition, State and Federal financial aid and in-kind resources are available to help undertake necessary studies, such as groundwater mapping, as well as to finance the implementation of wellhead protection measures once the preferred protection program is fully designed.

J. FOREST RESOURCES AND TREE PROTECTION

Forests are a major natural resource and landscape feature in Litchfield. Statewide the amount of developed land is increasing 2.5% each year. In spite of this, New Hampshire is 83% forest (2nd to Maine) and timber industries are 3rd largest (after tourism and manufacturing). Hillsborough County leads the state in white pine sawlog production. Red oak and sugar maple from the region are sought by export buyers. Forest resource protection should occur in Litchfield at the macro level to preserve large contiguous tracts of forest as well as at the micro level during site development as a way to preserve local environmental character and natural integrity in these developing areas.

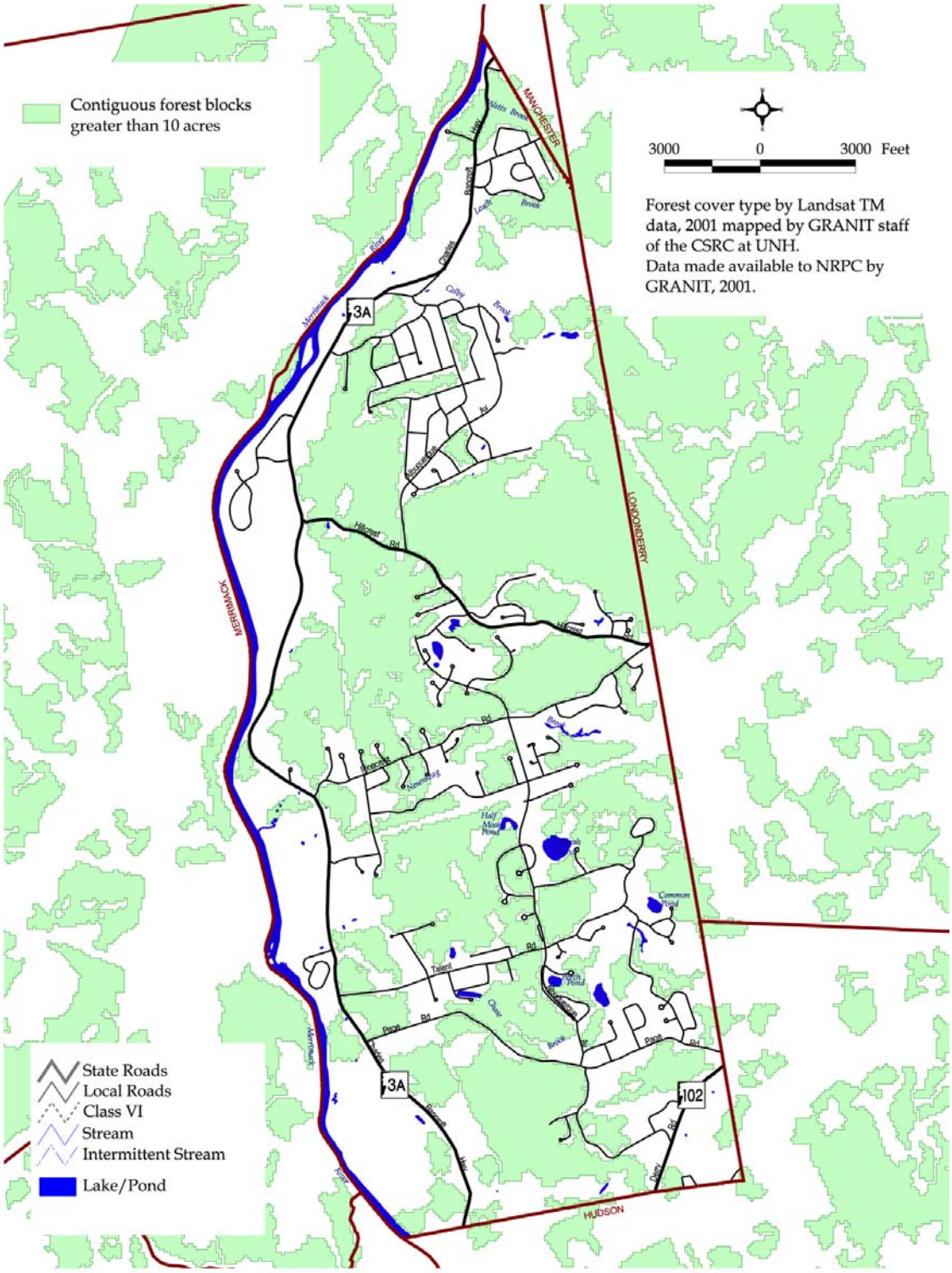
Protecting forests have long been a local priority, demonstrated by establishment of the Litchfield State Forest and open space preserves achieved by the Conservation Commission. Litchfield is located in the rapidly growing southern tier of the State; therefore, it is important to examine patterns of forest resource use and threats. The highest densities of contiguous forests are around the Litchfield State Forest, east of Route 3A, and on the northern border with Londonderry (see Map III-8). Based on a review of a 1998 aerial photograph of Litchfield, approximately 65 to 70 percent of Town lands are mature forests and wetlands. The remainder is farmland, buildings, cleared land, parking lots, roads and excavations. Since 1985 forests declined approximately eight percent, equaling 4/5 of one percent (0.8%) per year forest loss over the last 13 years.

Forests are a critical component of the natural landscape, integral to local ecosystem health and sustainability. Numerous technical assistance and financial resources are available to help ensure that forests are conserved to the greatest extent possible. The Town should identify major forest stands experiencing disease or decline as well as evaluate the feasibility of adopting forest protection provisions for unique areas. Important natural environments would receive special attention. The REPP process discussed below has identified a number of local priorities that represent large tracts of contiguous forest. Most open space priorities are either in the east or west part of Town. The Planning Board should continually monitor for forest preservation opportunities that arise between the Hudson Town line and Robyn Avenue which could provide forest links between the east and west parts of Litchfield.

The scenic and natural beauty is a major community resource -- and forests are a primary component of this rural character. To say that trees are key to Litchfield character is not an overstatement. Forests also:

- Build soils;
- Attenuate noise;
- Provide shade, reduce 'heat island' impacts of development and promote energy conservation;
- Prevent soil erosion;
- Promote water quality protection;
- Reduce air pollution;
- Increase property values; and
- Increase Biodiversity.

Map III-8: Forest Blocks Greater Than 10 Acres



1. Subdivision and Street Trees

A windshield survey of sites under construction in spring 1999 showed that deforestation is a problem in Litchfield. Some one-acre lots were denuded of trees and vegetation, with the topsoil torn-up by construction vehicles and prone to erosion. In some instances, it appears difficult to reestablish trees. Trees need a complex ecosystem including groundwater, soil, sunlight, bacteria and fungi to become established. If some of these factors are eliminated by site construction, then it takes years for them to become re-established.

It is feasible to promote and enhance rural-agrarian community character by improving site plan regulation and managing tree clearance at the stage of reviewing subdivision plans. Some forest and tree preservation objectives are:

- Maintaining trees and requiring replacement plantings to retain natural environments along local roads and on individual lots.
- Attenuating noise and preventing visual blight.
- Using forest wind breaks to prevent erosion of agricultural soils.
- Stabilizing soils by steep slopes and riparian corridors.
- Wetland and critical habitat protection and correction of chronic ecological damage and wildlife habitat transformation.
- Retaining higher densities of trees on sites undergoing development and promoting forest maintenance in the post-development period.
- Conserving dense bands of forests, or greenbelts, at widths of 200 or more feet that link natural areas, provide wildlife travel corridors, provide treed recreation spaces, and generate buffers between incompatible and high density uses.

The benefits of retaining trees in communities are well documented. Just as people pay a premium for sites along golf courses or farms, many studies conclusively show that people will pay more for lots with higher tree densities. One comprehensive review of the benefits of tree and forest conservation is *Tree Conservation Ordinances* (1993) by Durksen and Richman. They show that specimen trees increase the value of average lots. In subdivisions, treed lots often have higher selling prices. In addition, there is extensive evidence that community appearance has a significant influence on the local business environment and the ability to attract commercial development.

The Planning Board should evaluate the potential adoption of a tree preservation ordinance. The first step recommended is a study of forest characteristics to identify prevalent and threatened species and confirm that the goals above are appropriate. Other additional techniques may be:

- Producing an inventory of 'specimen' or 'monarch' trees by species, age, size, or other factors, to identify individual trees to preserve, possibly through a street tree maintenance and replacement program in the Routes 3A and 102 corridors. A memorial tree program may be a low cost way to raise revenues and build community.
- Establishing criteria to guide the preservation of woodland on sites undergoing development. This type of information could also be prepared to aid local reviews of alteration of terrain permits.
- Developing guidelines for reforestation of open lots proposed to receive development, roads, or excavation.
- Upgrading the role of landscaping planning within site planning.

Trees are a major physical and aesthetic feature of Litchfield. Regulating landscaping and tree clearance is a subject that the Planning Board should become involved with to a greater extent. On private property, new home construction should recognize the value of retaining undamaged trees or planting trees as needed. Simply having mature hardwood trees on the south side of a house will reduce the winter heating costs and summer cooling costs by 10%. Leaving trees around residences also reduces the area devoted to lawns, and the impacts of fertilizers, pesticides and watering. Trees also help residences blend into the landscape.

K. UNIQUE NATURAL HABITATS & BIOLOGICAL COMMUNITIES

Biological diversity and habitat are important natural resources. Animals and birds need space for breeding and need to move between protected areas for food. Space is also needed to raise young without human pressures from dominant or invasive species. A diverse community of plants and animals depends on space arranged in a way that wildlife can use and survive within.

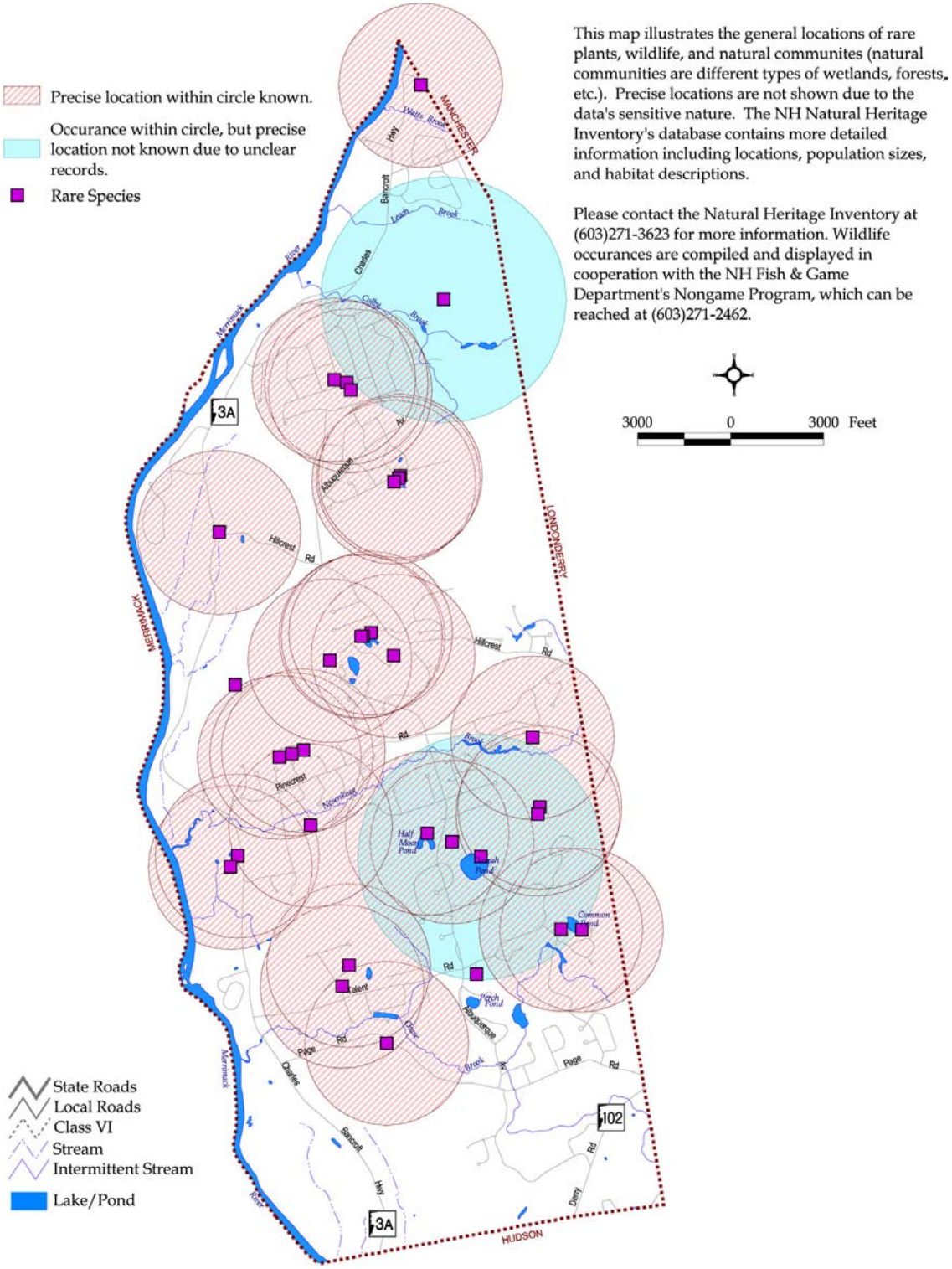
A high quality natural environment is crucial to the health and well being of the community, both in a physical and social sense. Natural systems in Litchfield are complex, dynamic, and important to sustaining life. Throughout the world, including Litchfield and the region, there are scientific indications that many biological systems are in a state of imbalance and are rapidly changing. The change that results is often the loss of species and habitat. Common construction practices and land use practices are often a major influence on such change. In contemporary times, the land consumption rates per capita are higher than at any time in the last fifty years. The concept of sprawl is part of the mainstream vocabulary and it is often possible to identify the adverse ecological impacts of development that consumes, alters, or damages high degrees of natural resources per unit area of land.

It is important to preserve adequate natural space throughout Litchfield. Furthermore, it is important to identify the most unique biological species, communities, and habitat to sustain and preserve these for future generations. As land development is piecemeal and chaotic, it is also important to consider how to preserve habitat across areas larger than individual properties, such as in greenbelts and at natural scales that support the continued viability of species and habitats.

The New Hampshire Natural Heritage Inventory (NHI) is a program of the Division of Forests and Lands at the NH Department of Resources and Economic Development, designed to determine protective measures and requirements necessary for the survival of native plant species in the State. For Litchfield, see Map III-9. The three major NHI functions are:

- Inventorying the occurrence of sensitive species and biodiversity;
- Tracking 4,000 plant, animal and natural communities; and
- Interpreting, or communicating, information to aid the protection of rare species and exemplary natural communities.

Map III-9: Natural Heritage Inventory



The NHI is useful to identify areas of unique biological heritage within communities; however, it is important to note that the NHI is based on surveys on private property with landowner permission only. Since fewer than approximately 15 percent of Town lands are public, there may be a far greater range of unique and special habitats and species in the community, although these may not have been identified in the NHI.

It is important to understand the types and diversity of habitat in the community. However, preparing specific lists of habitats and species, and prioritizing ones to value most is risky because it may appear to dismiss others, restrict future options, and possibly be incorrect or misleading. With this caveat stated, the January 1998 NHI document *Rare Plants, Rare Animals, and Exemplary Natural Communities in New Hampshire Towns: Hillsborough County* provides information on the occurrence of special habitats and species within Litchfield. It also interprets the relative importance of natural communities or rare species within the context of the rest of New Hampshire.

In Litchfield, 15 species or communities are listed by the NHI (Map III-9). Among these, four palustrine (wetland) natural communities are excellent or good examples of a globally rare species or community. There are also many natural communities, plants and vertebrate reptiles that are rare in the State. Five plant species are listed as endangered or threatened at the State or Federal level. As natural communities do not recognize political boundaries, adjacent communities also possess unique wildlife habitat and large natural areas contiguous with Litchfield, such as the Musquash Swamp.

The Conservation Commission is concerned with the proper utilization and protection of natural resources and may conduct research into the local lands and water. At the Planning Board, level local regulations contain a site analysis provision that promotes the layout of subdivisions so that development is located to preserve natural features of site, to avoid environmentally sensitive areas, and to minimize negative impacts. This review is informed by identification of positive and negative development characteristics of the site, such as threatened and endangered species, among other factors. Similarly, site planning requires provision for environmental factors, including natural features. It is a policy to require evaluations of habitat on sites proposed for development and to promote preservation of the most significant natural habitat features on the site, especially that which links with high quality habitat in adjacent areas. The Planning Board should also update site plan and subdivision regulations to clarify the requirements that applicants must follow regarding identification of natural resources and measures to protect wildlife.

Other options available to bolster Town official potential to make informed decisions regarding wildlife protection are:

- Listing specific types of habitat or species to protect;
- Requiring applicants to inventory species or habitat according to a standard scientific method;
- Listing the size or areas of trees or vegetation sufficient in a scientific sense to provide effective food sources and habitat;
- Quantifying habitat removal or alteration within a development site;
- Identifying mitigation efforts that are intended to address the negative effect of a proposed land use on wildlife habitat, along with quantitative and qualitative definition of the intended outcomes.

In contemporary times environmental protection and the application of environmental science according to standardized methods is a growing aspect of land use decision making and the economy overall. A high quality of life is crucial to a healthy and sustainable community. Maintaining high quality wildlife and improving existing habitat should be primary goals of this master plan. Therefore it is recommended that performing a comprehensive ecological review be a requirement of all major subdivisions and all site plans with over one acre disturbed area. This requirement could be waived at the discretion of the Planning Board. It is also recommended that the Conservation Commission be involved in evaluating the potential impact of a proposed development.

L. PROTECTED OPEN SPACE, GREENWAYS, CORRIDORS AND BUFFERS

In Litchfield there are 27 sites identified as protected open space in Litchfield. These conservation parcels are protected as Town lands, public parks, recreational uses, through conservation easements, or through agricultural preservation restrictions. Together these constitute 830 acres or nearly nine percent of Town lands. The Litchfield State Forest, at 337 acres, is the largest protected area.

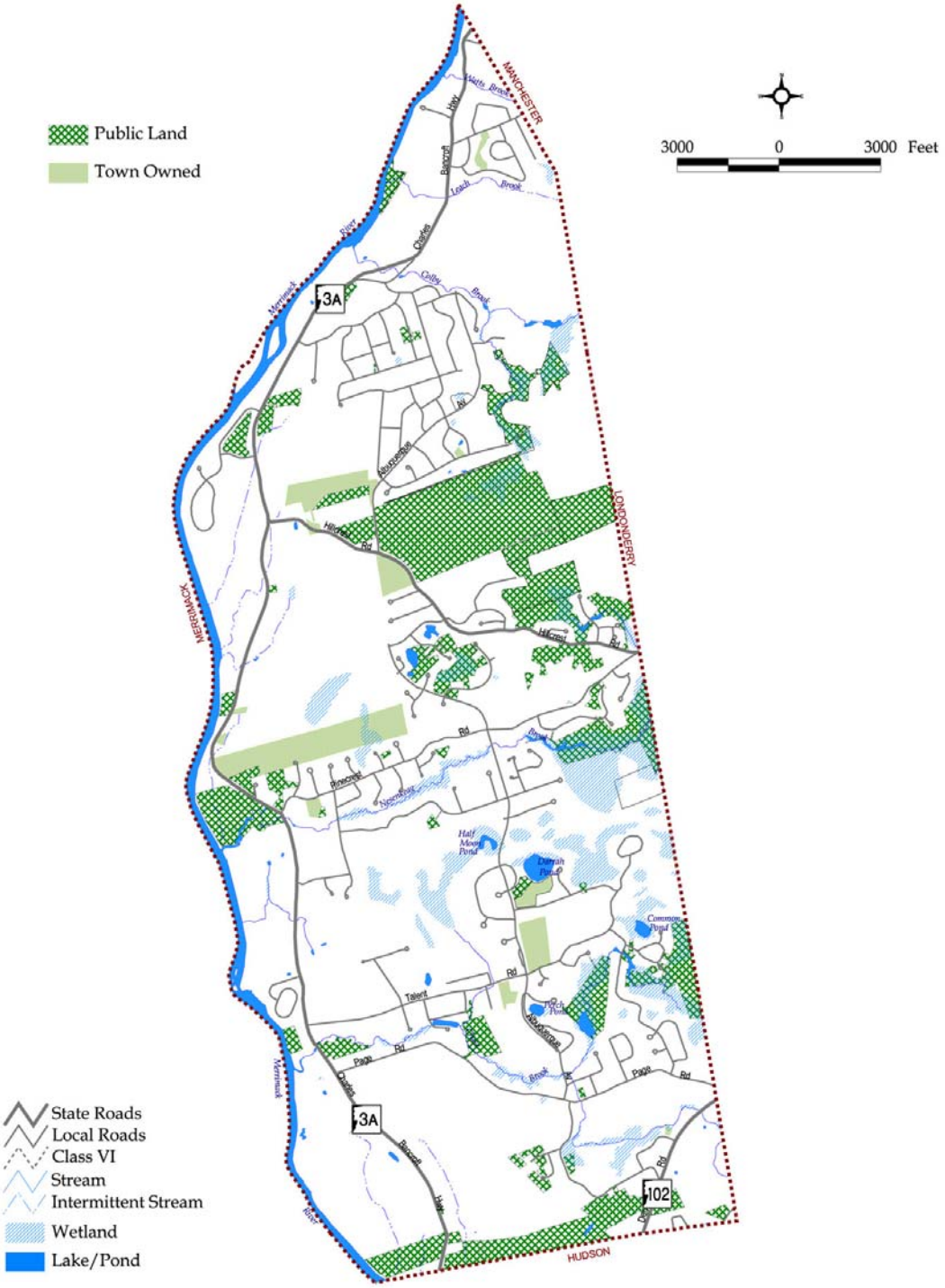
Permanently preserved open space is concentrated in and around the Litchfield State Forest, near the Merrimack River, and in the Chase Brook Watershed. There have been significant riverfront parcel acquisitions in Litchfield over the past five years, including the Moore's Fall Conservation Area, which was added to in 1998. Table III-2 identifies conservation lands, the acreage, and the types of conservation mechanism used in Litchfield. The Town has 14 parcels in fee ownership. Map III-10 illustrates conservation lands in Litchfield.

Table III-2: Protected Open Space In Litchfield

Property Name	# Acres	Cons. Type
Litchfield State Forest	337.4	FO
Town of Litchfield Land[1]	220.0	FO
Bixby Meadow	94.5	FO
Litchfield School Conservation Area	58.8	FO
McElwain - Agric. Pres. Rest.	45.4	AR
McElwain	18.8	CE
Calawa/Landay - Agric. Pres. Rest.	17.3	AR
Duck Pond Lot	8.9	FO
Calawa/Landay - Agric. Preservation Rest.	8.3	AR
Merrimack River Boat Access	7.7	FO
Rocky Hill Pond Lot	4.1	FO
Town of Litchfield Land	3.8	FO
Duck Pond Lot	3.7	FO
Parker Park	3.3	FO
Alvirne High School Tree Farm	0.9	FO
Grassy Pond – NHDES-State*	161.6	FO
Map, Lot 23 – Abuts Library to North*	15.7	FO
Map 17, Lot 10 – Off Colonial Dr. (Mitigation)*	52.9	FO
Total	1063.1	-

Source: NH Land Conservation Investment Program, 1995.
*** Town of Litchfield Tax Map, April 2002**
Codes: FO = Fee Ownership; AR = Agricultural Restriction; CE = Conservation Easement.
Note: 1.) Town of Litchfield Lands consists of 14 individual parcels.

Map III-10: Conservation Lands



In recent years, greenway development has become an important open space preservation goal in Litchfield. 'Greenbelts' are swatches of open lands linked in contiguous patterns with the connections between open space providing wildlife habitat and space for public recreation. Greenway corridors enable wildlife migration and often connect larger reservations or different types of natural environments. For example, greenbelts could connect the Merrimack River environment to forested uplands west of Route 3A. The Conservation Commission is promoting a greenway corridor between the Musquash Swamp in Londonderry and the Litchfield State Forest. As noted earlier, 'riparian buffers' provided along a stream provide water resource protection.

Corridors may serve multiple functions and go beyond connecting natural features to joining recreational and cultural sites as well. In all cases, the greater the corridor width, the more adequate it is to wildlife and social uses. The reason why larger buffers are useful is that adjacent land uses encroach on the greenway. A buffer 100 feet from a wetland or conservation feature looks substantial on a subdivision plan, but residential uses may expand their activities into the setback, thereby putting pressure on natural communities and reducing some of the value of the greenway. Developers should be encouraged to provide as much buffering beyond the ordinance requirements as possible. Another way to promote development of greenways could be through the adoption of an open space development overlay zoning district.

Open space in whatever form, fields, woods or wetlands, is an essential element of Litchfield's environmental character. For maximum environmental advantage, the space able to be set aside is more effective if it can be contiguous. For instance, the open space fraction of one a commercial site should be designed to abut that of an adjoining subdivision or protected open space. Through this mechanism, land would be less fractured. It must be emphasized that land that does not appear to have potential as a part of a greenway should not be dismissed as having low preservation value. Common benefits of greenways are:

1. Protecting ecologically sensitive or endangered corridors, and providing important connecting links among reserved areas and ecosystems.
2. Enhancing neighborhood quality of life, and creating a greater community "sense of place."
3. Providing local routes for hiking and other passive forms of recreation.
4. Raising property values and increasing the community appeal to new business sites.

To these ends and the general environmental enhancement of the Town the following recommendations are offered:

1. There are many private and governmental sources for grants to benefit conservation, land rights acquisition and recreation. Many factors affect the successful application for these funds, including: knowledge of grant availability, knowledge of particular local needs and issues, skill in grantsmanship, and time to assemble an application. Litchfield should develop mechanisms to identify grant sources, match them to needs, establish priorities and perfect application processes.
3. Town planning and the zoning ordinance should incorporate the concepts and objectives of the greenways section of this plan.
4. The Town should expand its efforts to preserve and protect open space, as they may become available through purchase of development rights.
5. Residents who seek to preserve the open space should be able to find support from Town agencies and policies and the Town should encourage landholders to take steps to preserve the character of undeveloped parcels.
6. A joint subcommittee of the Recreation and Conservation Commissions should be empowered to explore properties on which conservation and active recreation activities could be compatible.

7. The Conservation Commission and other Town officials should actively pursue with their counterparts in adjoining Towns' policies and programs that will compliment conservation.
8. Areas protected by conservation restrictions need to be monitored regularly for compliance with their specific provisions by professional staff. If it is appropriate, deeds could also be examined to evaluate the potential wording of development restrictions.

M. LOCAL CONSERVATION PRIORITIES IN LITCHFIELD

The 1998 Litchfield Community Profile facilitated by New Hampshire Cooperative Extension shows that the participants support local conservation initiatives. In Litchfield, a great deal of forward-looking planning has occurred to identify what are the key environmental features in the community and what are the conservation priorities.

In 1998, NH DES initiated the Regional Environmental Planning Program in anticipation of state legislation to create a public-private partnership to protect New Hampshire priority natural resources. In 1998 and 1999 Litchfield participated in the REPP for the NRPC Region by identifying local resources, describing the attributes and characteristics of the natural resource, and then defining the most pressing pieces for preservation. The REPP project has been used in concert with a grant obtained from the New Hampshire Charitable Foundation to address how best to preserve farmlands along the Merrimack and Route 3 corridors. Farmland preservation is the highest priority of the Conservation Commission and is considered both a local priority as well as a regional priority.

Table III-3 lists open space locations identified as community priorities for open space preservation. The priority locations are targeted for future conservation in the REPP process. The planning process to identify key priorities highlight the rapidly growth in the region.

Table III-3: Priority Open Space Parcels

Parcel	Size (Acres)
Weinstein Property	144.3
Half Moon Pond	110.2
Chase Brook Buffer	104.4
Litchfield State Forest	72.1
Common Pond	20.9
Rocky Hill Area	20.1
Garden Street	2.9
Total	474.9

Source: Litchfield Conservation Commission, 2001

Some important parcels are listed below.

- The *Weinstein Property* is a high priority, and listed in the Regional Priority Report, due to its pristine land near a major public water supply well. In addition, its water, ecology and the presence of species of concern rank this property high. Potential impacts are from housing development and possibly, construction related to the circumferential highway. It is important to secure the land through purchase, conservation easements or development rights in order to protect this resource. The land can sustain conservation and passive recreation uses.

- *Half Moon Pond and the Surrounding Area* – A 475 acre area around Half Moon Pond and the Chase Brook Watershed contains a bog, transitional bog, wetlands, forested wetlands, farmland and associated uplands that could support significant biodiversity and protect groundwater in the area. The bog ecosystem has endangered species identified and documented by New Hampshire Natural Heritage Inventory. The prime farmland parcels are also listed in the Regional Priority Report.

- *Chase Brook Corridor* – 245 acres of nearly pristine land located near public water wells in this swath represent prime wildlife habitat and migratory corridor. This area has demonstrated species of special concern, is often used for local hunting and fishing, and abuts some public properties.

- *Watts Brook Property* - Litchfield's top preservation priority, is the Town's 'northern gateway'. It is a priority for preservation because it would help preserve agricultural lands along the Merrimack River, maintain a historic agricultural base and preserve the rural character. This site represents a water, land, forestry, ecological, wildlife habitat, and passive recreation resource. This segment of the river and floodplain forest are known perching area and winter roosting area for Bald Eagles. Furthermore, this site could help provide mitigation against continued regional growth and the construction of the Airport Access Road and the Circumferential Highway, the latter of which is expected to greatly impact resources of the Town, including the environment by the river.

- *Farmland Preservation* – There is approximately 90 acres of prime agriculture soils with Merrimack River frontage that would provide an ecological and aesthetic buffer to the northern Commercial Zone if preserved. Contiguous with 64 acres already in protection by the Town and a land trust, the site abuts several islands and prime wildlife habitat. It provides Bald Eagle roosting area and contains clusters of large, old trees that provide a scarce, but necessary eagle nesting spots

N. REGIONAL CONSERVATION PRIORITIES IN LITCHFIELD

The regional open space preservation priority within the REPP in Litchfield is Farmland Preservation. Farmland protection is key to maintaining the rural agricultural heritage in the community.

The Conservation Commission identified 19 parcels in the NH Route 3A corridor as priorities for preservation. Farmland preservation would preserve prime agricultural soils, a resource for farming. Preservation of agricultural areas would also provide open space. In the Southern tier of Town, preserved farmland would present a buffer between the community, the Circumferential Highway, and

adjacent open space in the second tier. Some of farmlands, such as in the Half Moon Pond area, would forestall development, where there is an imminent threat of change. In many cases, maintenance of farmland would protect important wetland and surface water bodies. Many farmlands also have critical wildlife habitat, including shoreline along the Merrimack River. Some of the preserved farmland could provide locations for passive recreation.

It is not possible here to describe key open space protection programs at the state, federal and non-profit level. By partnering with other interested public and non-governmental organizations outside the community, there is a greater potential for success obtaining resources to address well-defined problems and strategies.

O. CONCLUSION

The existing natural resource base provides a framework within which human activity takes place. One main factor constraining physical development in Litchfield is extensive water resources, including groundwater, wetlands and wet soils. Another major characteristic of the local natural environment is the extensive agricultural soils. The layout of these resources should guide which areas are suitable for future growth. People need to recognize that natural resource conservation is the key to a sustainable ecosystem for all forms of life including themselves and their descendents.

P. RECOMMENDATIONS

The Planning Board recommends implementation of the following initiatives:

- *Protect Farmland*. The Town should evaluate if funds set aside for agricultural lands protection and preservation are comparable to the high priority it is assigned. Officials may want to develop policies to provide additional tax incentives for maintaining large blocks of active agricultural land. Open space development, such as clustering, used in conjunction with this goal can help protect large tracts of farmland to maintain the resource so it remains viable, while still enabling development. The Planning Board may want to make a policy statement in support of agriculture, recognizing the right to farm and making some traditional farm nuisances, such as noise, permissible.
- *Extend the Well Protection Radius to 100 Feet.* It is recommended to also extend the well protection radius to 100 feet in order to promote adequate separation of wells and sanitary waste disposal and promote public health.
- *Organize for Aquifer, Wellhead and Water Supply Protection*. A systematic program needs to be designed and implemented to preserve the most vital water reserves, in the ground and on the land surface. This should occur in conjunction with farmland and open space preservation and pollution prevention, such as improved stormwater treatment and management. The Board should monitor whether there is an incidence of problems with septic systems. Continuing education for staff, the Board and the public on household hazardous waste and BMPs application will inform people why there is a need for preventative action and how to achieve resource protection. This may be a platform to pursue natural greenbelt corridors development. The area around Darrah Pond is a good location to focus first. This program should investigate road salt application practices and potential alternatives. Evaluating the feasibility of implementing fixed-line sewer treatment, or other larger-scale community treatment systems, in sub-areas of Town is complementary to this program, as is development of a GIS.
- *Reduce Sprawl*. Land and resource consumption rates are high. Impact assessment should be used more often by the Board to understand the comprehensive range of impacts associated

with development. The Board should further investigate adoption of innovative zoning mechanisms and incentives to promote reduced land consumption. Higher density development should be promoted in more instances for business and residences. Open space development, growth boundaries, agricultural zoning, and transfer of development rights are techniques available.

- *Integrate the Wetlands Functional Classification System into the Local land Use Planning Process.* As the wetlands document is finalized, a prime wetland designation should be adopted to afford more protection to wetlands. The Board should also attempt to adopt a 50-foot conservation restriction off all wetlands.
- *Promote Tree Retention in Subdivisions and Commercial Developments.*
- *Pursue Forest Greenbelt Development and Open Space Acquisition.* Continue to inventory natural systems and identify the most important ecological habitat, contiguous tracts and key linkages. Visual resources are discussed in the Historic Resources chapter, but it is important to emphasize that viewsheds are a natural resource and form an important part of community character; thus, there should also be attention to these resources in long-range environmental planning and during development review
- *Develop a Local Geographic Information System (GIS).* Numerous computer technologies can be used for development review and planning. The Planning Board should conduct a GIS Needs Assessment to determine what specifically a local GIS will be designed for, how to pay for it, and how to implement this system.
- *Actively Conduct Public Relations.* The Planning Board and Conservation Commission should develop a Web Page and print materials to educate the public about issues and environmental planning initiatives. One good topic may be soil conservation, with investigation of how to promote prime agricultural soils preservation and reduction of 'soil stripping'.
- *Shoreline Protection*. A local shoreline program should be considered for adoption as part of the zoning ordinance and fashioned after the state model shoreline protection ordinance.
- *Stormwater Treatment and Control.* The effectiveness of treatment and management systems implementation in subdivisions, site plans and public projects is related to the potential for adverse impacts to groundwater from non-point and point sources.
- *Staffing Assistance.* Options should be explored regarding the potential to hire an experienced conservation professional who would provide assistance with resource planning, conservation, education, monitoring and enforcement.