CHAPTER IV
NATURAL RESOURCES

A. INTRODUCTION

The Town of Pelham lies in the eastern reaches of the Lower Merrimack River Basin in south central New Hampshire. The Town shares a border with the State of Massachusetts and as a result has experienced significant growth as people realize that they can commute to the Boston area and still live in a relatively rural Town. This growth makes it even more important to understand and inventory the Towns remaining natural resources.

In analyzing the Town's natural resources, it is important to understand that a unique set of constraints to development may exist on each parcel of land due to the specific soils and slope conditions that may be present. In addition, the abundance and diversity of natural resources in Pelham (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. Improper shoreline buffers will have negative impacts on water quality and the general health and function of the Town’s wetlands, streams, groundwater and ponds.

A thorough understanding of the natural resource base is extremely important in determining the limits of growth and guiding future development in the community. The information that follows is a guide to the consideration of these constraints in planning for the future growth of the community. This chapter considers: 1) general natural characteristics such as topography and soils; 2) water resources; 3) forests; 4) wildlife; 5) existing and potential conservation lands; and 6) recommendations.

B. GENERAL NATURAL CHARACTERISTICS

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 (ft. AMSL). Elevations in Pelham vary from approximately 120 feet above mean sea level (aMSL) near Beaver Brook in the south-central portion of Town, to 575 feet aMSL on top of Jeremy Hill, the Town's highest point. The western third of the Town is dominated by higher elevations and steep slopes, which sometimes abruptly, give way to the relatively flat land of the Beaver Brook valley bisecting the center of Pelham. The eastern third of the Town is also hilly, but with slopes and elevations that are more moderate than found to the west

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 Pelham and are illustrated on Map IV-1.

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, and is twice as steep as the steepest section of Pelham's roads! 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 generally steep slopes have only a very shallow layer of soil covering bedrock. Because of this, safe septic system installation is very difficult, storm water run-off is accelerated rather than absorbed, and soil erosion potential increases. Road and driveway construction to steep slope sites is more difficult and costly, and also increases the amount and velocity of surface run-off. Proper safeguards must be applied to such sites to minimize hazards to downslope properties, and these safeguards usually mean costly and often problematic engineering and landscaping solutions.

For these reasons, active use of steep slope sites 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. If possible, the Planning Board and Town should consider preserving such areas as open space and limiting their use for intensive development. 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.[1]

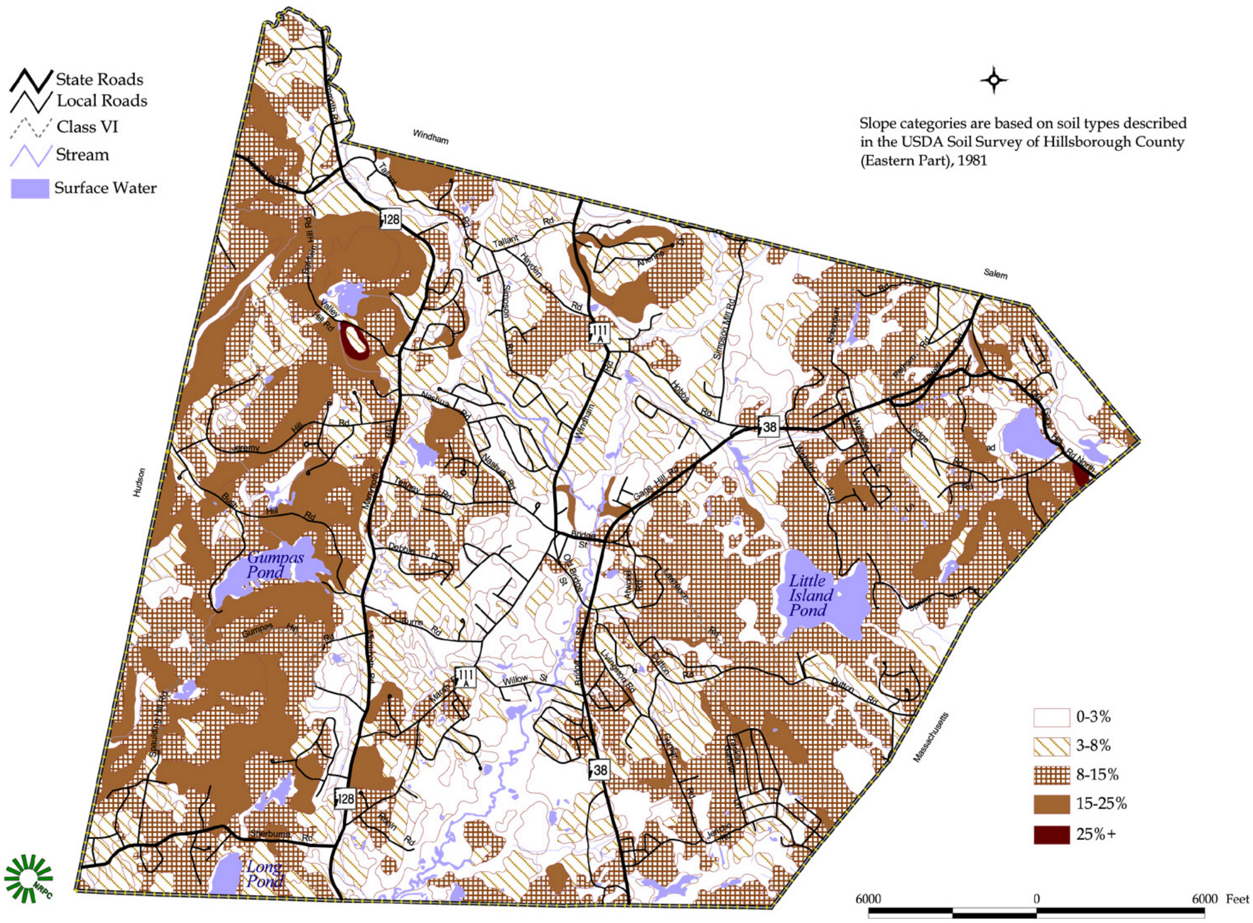
15-25% Slope - Areas in this slope category present substantial problems to their development. Development of these areas should only be undertaken with extreme care, recognizing the sensitivity of the environmental factors involved. In general, the steeper the slope, the shallower the soil layer covering 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 on-site waste disposal, and stabilization and landscaping of the site, will be quite costly to be developed effectively. Road construction is also more difficult and costly under these slope conditions and will result in increased amount 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 slopes greater than fifteen to twenty-five percent are generally found in the western part of Town and are more suitable for open space. By preserving these areas as open space their absorption capacity is maximized and just allowing the natural vegetative cover to remain in place minimizes the erosion potential. In addition, these slopes pose severe limitations to development on soils of lesser slope because of the limitations on any needed future public facilities which would have to cross adjacent steep or other limiting soils conditions.

[1] Hillsborough County Conservation District, Erosion and Sediment Control Design Handbook for Developing Areas of New Hampshire , 1981 and amended in 1987.

Map IV-1: 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. A closer examination of specific parcels in this category will determine which problematic conditions may be overcome, and at what cost.

0-8% Slope - Land areas in this slope category are generally considered to be well suited for development. 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 zero to eight percent are usually of sufficient depth to allow 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. (Pooling may occur in some instances.) 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.

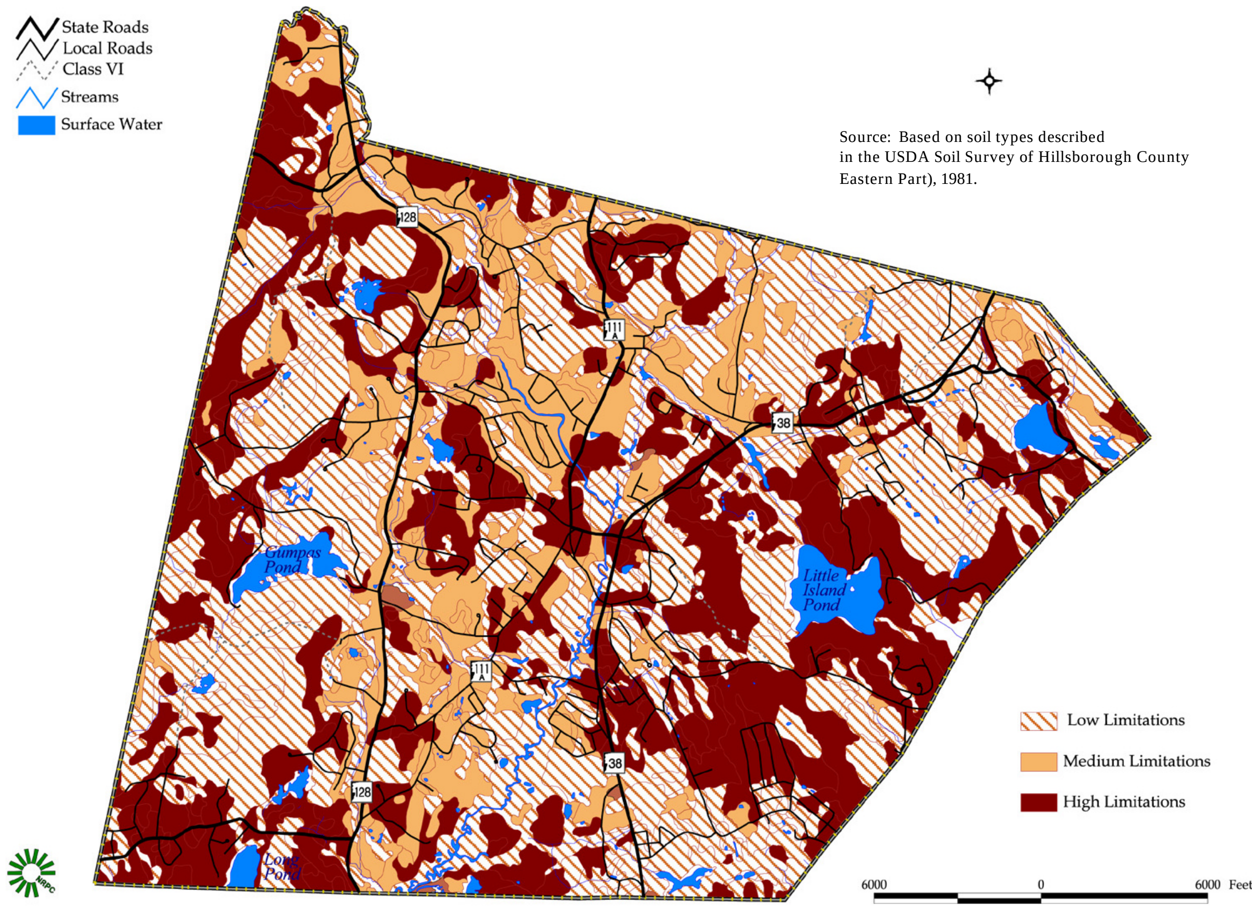
The slope categories, as described above and shown on Map IV-I on the previous page, are intended to serve as a general guide to community master planning. They are by no means the final word as to where development should or should not take place. Local variations will require site inspection by the 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

Soils are the foundation upon which all land use occurs. Soil conditions are the most important factor in determining the capability of land to support development. They are especially important in Pelham, where the soil material is the sole medium for the purification of wastewater generated by residents.

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. Of special importance to Pelham is the NRCS research on the suitability of soils for use as septic tank absorption fields. Since the Town relies solely on subsurface disposal of wastes, this information is a valuable planning tool in targeting future growth to areas where hazards to the public health will be avoided. The results of the research were summarized into an overall rating of the soils for the particular use. The rating indicates which soils have low, moderate, or high limitations for use with septic systems. These soil types are listed in Appendix IV-1 and illustrated on Map IV-2.

Map IV-2: Soil Classifications for Septic Systems



a. Low Limitation

Soils in the low limitation class have the best potential for active uses. Soils in this class have properties generally favorable for use involving septic tank absorption fields. The limitations for using soils in this manner are considered to be minor and can easily be overcome. These areas could support active use, pending the consideration of other factors affecting their suitability for development. Since the Town contains only a small amount of land in this class, efficient use of these areas should be actively encouraged if not required. Innovative zoning techniques can make efficient use of these soils while setting aside less suitable soils for less intensive uses.

b. Moderate Limitation

Soils in the moderate limitation class have intermediate potential for supporting septic tank absorption fields. They have properties moderately favorable for septic systems; however, limitations may be overcome through careful consideration and planning in the design and maintenance of septic systems. These areas are identified to alert interested parties that soil conditions do not preclude their development, however, additional consideration and cost may be necessary for development of specific site. Here again, the short supply of land in this class mandates efficiency in its development. Innovative zoning techniques may offer one method of solution; however, such proposals must be sensitive to the limitations, which place these soils in the 'moderate' class.

c. High Limitation

Soils in the high limitation class have the poorest potential for supporting septic tank absorption fields. Soils given this rating have one or more properties that are unfavorable for septic use. This designation, by itself, does not preclude all development but alerts developers and local officials that substantial effort and cost may be necessary to make the site suitable for development. The extent to which corrective measures are required will depend on the individual site and should be ascertained through site inspection by the Town Engineer and/or designated representative.

Because Pelham relies totally on septic systems, the soil potential for septic tank absorption fields has the greatest impact on development capability. There are 5,318 acres (approximately 64% of total land area) of agricultural and vacant land left in Pelham has a medium, low or very low limitation for septic. It is recommended that the soils with a high or very high limitations for septic, which comprise acres (26% of total land area) be set aside as open space. This does not mean that areas with high limitations are undevelopable; however, any proposals for development in these soils should receive close scrutiny. Specific soil types are addressed in more detail by the Planning Board in the current Subdivision Regulations. Appendix VI-I contains a list of the soil types in Pelham and their potential for development of septic systems.

Permeability is another critical soil characteristic that is important to consider when siting septic systems. Permeability is the rate of downward movement of water through a saturated soil measured in number of inches per hour. The two permeability categories of concern are rapid and very rapid, 6-20 inches and more than 20 inches per hour respectively. Soil with this rapid permeability will transmit water quite rapidly, meaning that contaminants can easily and quickly reach surface waters and groundwater. Because of this, soils with rapid and very rapid permeability are poor filters for septic system effluent as indicated in the *Soil Survey of Hillsborough County*.[2]

[2] United States Department of Agriculture, Soil Conservation Service, *Soil Survey of Hillsborough County New Hampshire, Eastern Part*, October 1981.

For many years, the Town has relied on a soils analysis method prepared by the SCS which examines the various limitations of each soil type relative to the soils effectiveness for subsurface septic system installation and operation. Although a new soil classification system was developed by the SCS recently, it is useful to briefly review the former method, which was used for so many years. For the earlier method, the Soil Conservation Service evaluated the following soil properties in determining the suitability of soils for use with septic tank absorption fields:

1. Permeability of soil;
2. Depth to water table;
3. Depth to bedrock;
4. Steepness of slope;
5. Stoniness / Rockiness of soil; and
6. Susceptibility to flooding.

It has been common practice for communities to require that soil maps and information be submitted as part of a completed application for subdivision or site plan review. A certified soil scientist in accordance with either the High Intensity Soil Map Standards (HISS) or the Order 1 Soil Map Standards prepares these maps. Both Standards are currently being phased out of use by the year 2002. The Society of Soil Scientists of Northern New England has recently combined the better features of both soils mapping techniques into Site Specific Soil Mapping Standards (SSSMS).[3] The SSSMS meet the criteria of the National Cooperative Soil Survey of the USDA / NRCS. This means that maps prepared in accordance to the SSSMS classify soils to the series level, which is consistent with the maps found in the county soil surveys. The SSSMS are the most current standards available that can be used for a variety of land use activities. The recently adopted Pelham Subdivision Regulations require the use of the Site Specific Soil Mapping Standards. However, the Pelham Site Plan Regulations do not specifically require the use of SSSMS.

d. 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 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 gone out of production over the last fifty years. There are a few small farms remaining. The last orchard in Town was recently sold for residential development.

Currently, New Hampshire farmers produce only about fifteen percent of the food needed to feed its growing population. The State is heavily dependent upon outside food suppliers, which are subject to their own local growth situations and national / regional economic pressure. Thus, inflationary pressures on the various sectors of the economy will continue to escalate the price that New Hampshire residents will pay for food in the future.

As growth continues within the State, so too will the pressures to take agricultural lands out of production in favor of development. A number of factors contribute to the incentive for this conversion of agricultural lands. First, rising land values and a strong demand for housing act as an incentive to the development of agricultural lands, many of which are quite suitable for active use and less costly to develop. Additionally, inequitable assessment and taxing procedures act as a disincentive to farming uses (and as incentives for sale of farmland) by placing a heavy tax burden on the farmer. And finally, the farmer’s difficulties in obtaining the capital and credit needed to maintain an efficient farming operation hurts his ability to compete with the more

[3] Society of Soil Scientists of Northern New England, *Site Specific Soil Mapping Standards*, 1999.

affluent developers for the use of the land. It must be recognized that the re-establishment of agricultural uses on land once developed may require an investment of manpower, capital, and technical resources, which is highly unfeasible.

For these reasons it is important that steps be taken now to protect the Town's remaining productive and idle farmlands. The local economy provides a market for locally produced goods. In return, local farming operations can provide employment opportunities, and can reduce the cost of food by eliminating a significant transportation cost add-on. The Town's important agricultural lands (identified by soil types) are illustrated on Map IV-3. A complete list of soils is in Appendix IV-2. The agricultural lands indicated have been divided into three groups of important farmlands based on the character of the soils and their suitability for crop production.

Prime Farmland - These lands are best suited for producing food, feed, forage, fiber or soil 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. The SCS has identified 5 soil types in Pelham considered Prime Farmland Soils.

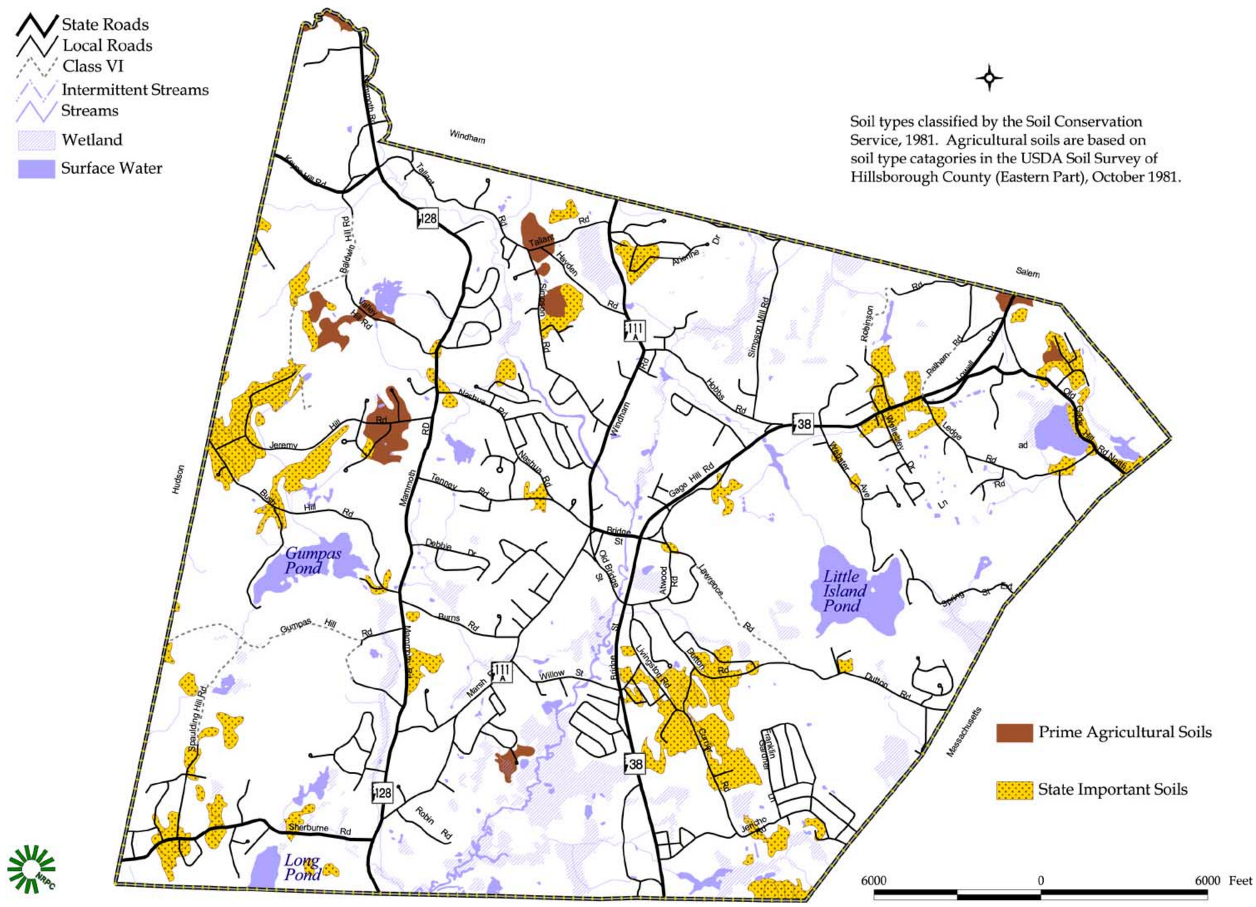
Farmlands of Statewide Importance - These lands are rated as being of statewide importance for the production of food, feed, fiber, forage, and oilseed crops. They are important to agriculture in New Hampshire but exhibit some properties, which exclude them from Prime Farmland status (such as erodibility 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 SCS has identified 6 soil types as constituting farmlands of statewide importance.

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.

Land in the first two classes is considered to be of importance to the food-producing ability of the State. Consideration should be given to steps by which these and the locally important farmlands may be protected and encouraged to remain in agricultural production. The Trust for New Hampshire Lands Program and the Land and Community Heritage Investment Program could be one such means of protecting important agricultural lands through development rights acquisition of these properties.

A listing of the soils situated within the Town are grouped according to their potential for, or limitation to, active use and development is included in Appendix IV-1 and 2. The list is intended for use as a reference in reading and understanding the implications of the soils. These are designed to provide an assessment of the soils' suitability for development and to alert officials and developers to the potential problems, which may require attention in the development process. As such, this information should be given primary consideration in the Town's master planning efforts.

Map IV-3. Important Agricultural Soils



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 Pelham is extremely important in planning for growth, as the ground is the sole medium through which septic waste water is purified and from which drinking water is drawn. The safe conduct of both of these practices must be enforced 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. The Town's major streams are Beaver Brook, Golden Brook, Island Pond Brook and Gumpas Pond Brook. Over 35 miles of perennial streams flow through Pelham. Although they may represent a small portion of the Town's land area, because of the extensive network they form, they are an important resource to consider relative to the Town's existing and future growth. Because of the interconnection between surface waters and groundwater, all of the Town's surface waters are important when you consider the need to protect local water supplies.

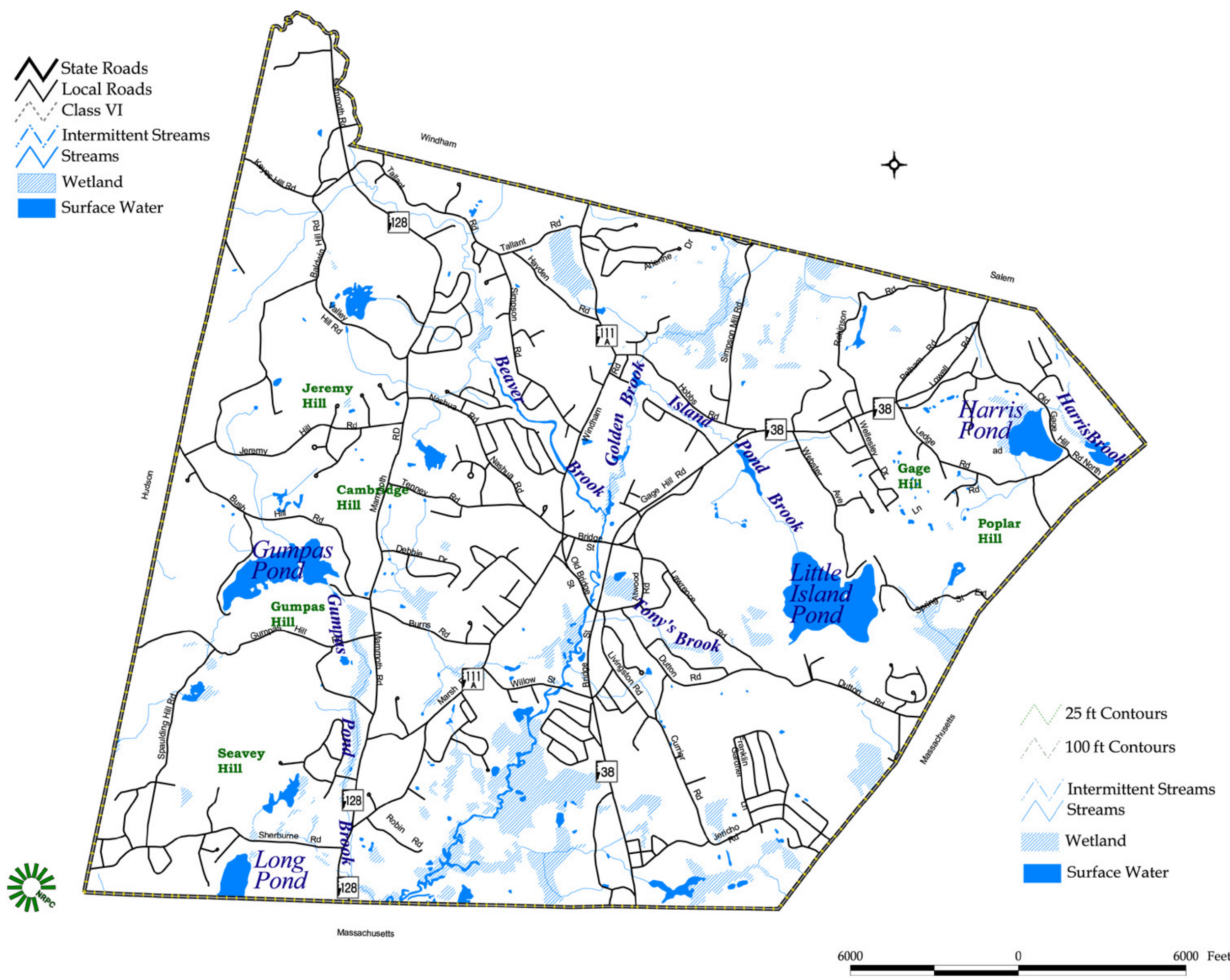
Water quality classifications are established by the legislature. The classification represents the desired level of water quality for the stream and does not necessarily reflect actual conditions. In many instances water quality in a river or stream does not meet the standards of the legislative classification. All of the streams in Pelham have a legislative water quality classification of B. This means they either meet or have a goal to achieve the fishable and swimmable criteria established under the Clean Water Act. Characteristics of Pelham's perennial streams are summarized in Table IV-1 and Water Resources are illustrated on Map IV-4.

Table IV-1: Perennial Streams in Pelham

Name Number	Total Length In Miles	Miles in Pelham	Start Elevation	End Elevation	Stream Order	Feeder Streams
Beaver Brook	26.8	9.8	300	60	4th	62.6
Two-a	1.2	1.2	310	170	2nd	0.75
Three-a	1.2	1.2	260	140	1st	0
Four-a	1.2	1.2	270	140	2nd	1.3
Five-a	0.6	0.6	170	140	1st	0
Golden Brook	5.8	1.3	180	130	3rd	11.2
Seven-a	2.4	2.1	185	140	1st	0.1
Harris Pond Brook		0.8	160	150	2nd	0.8
Eight-b	0.8	0.8	190	150	1st	0
Island Pond Brook	1.7	1.7	140	130	2nd	0.8
Bartlett Brook		0.4	170	160	1st	0
Thirteen-a	5.5	4.2	190	120	2nd	3.2
Thirteen-b	1.3	1.1	140	130	1st	0
Thirteen-c	1.4	1.3	190	130	1st	0
Thirteen-d	0.5	0.5	140	130	1st	0
Tony's Brook	0.9	0.9	150	130	1st	0
Fifteen-a	2.3	2.3	170	140	2nd	1.4
Gumpas Pond Brook	2.5	2.5	220	135	3rd	2.6
Eighteen-a	1.6	0.7	310	200	2nd	0
Nineteen-a	0.8	0.8	290	140	1st	0

Source: NRPC, Pelham Water Resources Management Plan, 1988.

Map IV-4: Water Resources



Pelham'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 Pelham's lakes and ponds are shown in Table IV-2 below:

Table IV-2: Lakes and Ponds in Pelham

Name of Water	Size	Description
Gumpas Pond	Area: 89.9 acres	Class: Meso
	Shoreline: 2.7 miles	Max. Depth Sounded: 24 feet
	Average Depth: Unknown	Elevation: 201
Harris Pond	Area: 45.7	Class: Meso
	Shoreline: 1.1 miles	Max. Depth Sounded: 22 feet
	Average Depth: Unknown	Elevation: 152
Little Island Pond	Area: 155.0	Class: Meso
	Shoreline: 4.8 miles	Max. Depth Sounded: 55 feet
	Average Depth: Unknown	Elevation: 145
Long Pond	Area: 120.5	Class: Oligo
	Shoreline: 3 miles	Max. Depth Sounded: 25 feet
	Average Depth: 13 feet	Elevation: 151

Source: NH Department of Environmental Services, *Survey Lake Data Summary*, November 2000.

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. These areas can be safely developed within a protective buffer to meet the community's needs for recreation and open space.

Buffers consisting of a herbaceous layer (groundcover / vines), understory plants consisting of shrubs, grasses, sedges, and trees ranging from 1 to 15 feet, and mature trees are recommended for maximum nutrient uptake and wildlife habitat. The State of New Hampshire has not adopted a standard buffer width. It is generally recommended in scientific literature, however, that a minimum 100-foot buffer be used. There are many considerations when considering the width of buffers including but not limited to hydrology, topography, and the presence of threatened or rare and endangered species.

The buffers will 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 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.

2. Shoreline Protection Act

The Shoreline 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 impound fresh water bodies, rivers, coastal water, and all land located within 250 feet of the reference line of public waters. Long Pond, Harris Pond, Little Island Pond, Gumpas Pond, and Beaver Brook below the junction of Golden Brook must adhere to the Act. Natural woodland buffer s must adhere to the following:

1. Where existing, a natural woodland buffer must be maintained.
2. Tree cutting limited to 50% of the basal area of trees, and 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 musty remain intact in the ground within 50 feet of the reference line.

3. Groundwater Resources

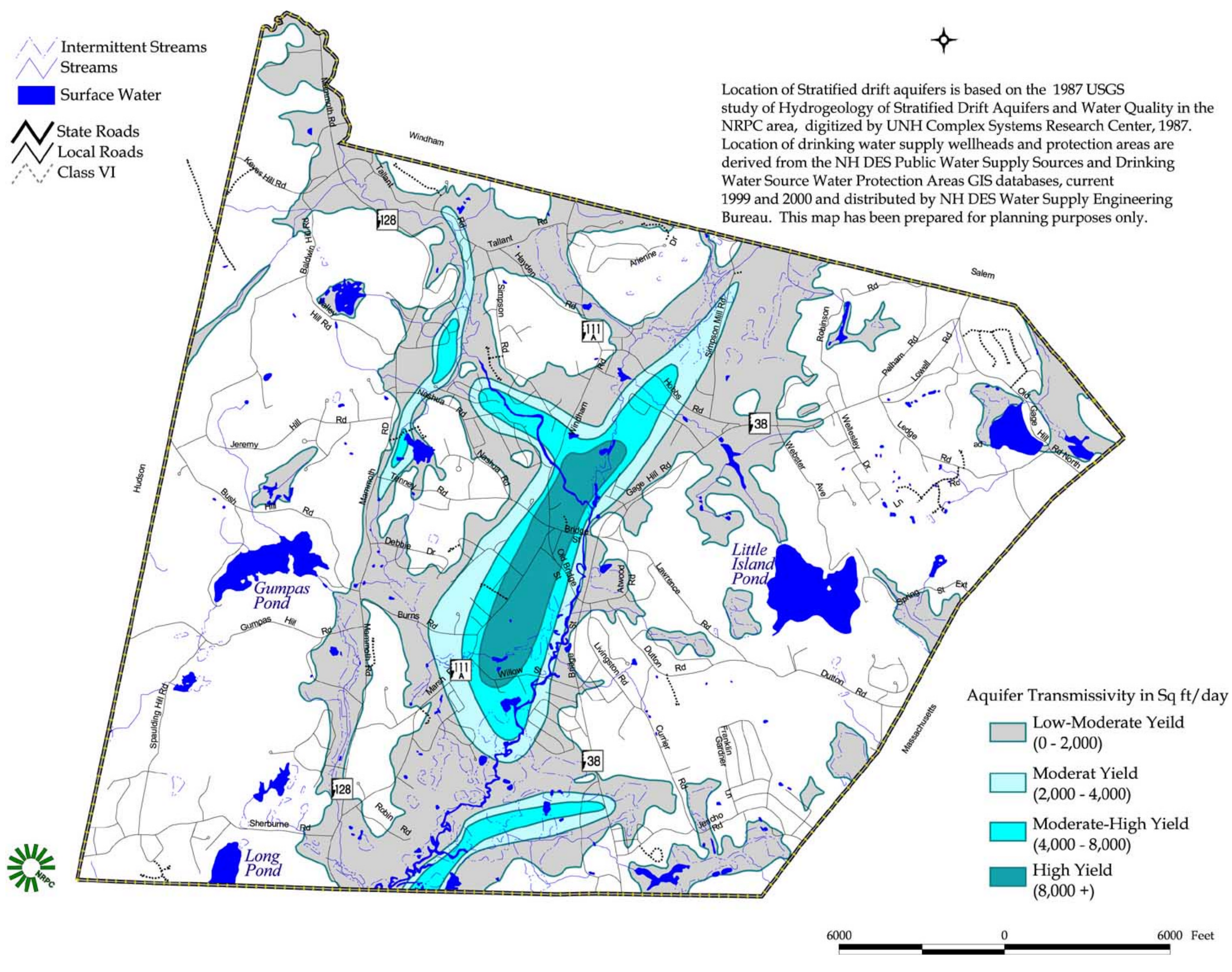
A substantial portion of water in Pelham is below the ground's surface. Groundwater is water that is stored in the pore or fracture spaces between the individual particles of soil, sand, gravel, bedrock, etc. In essence then, the ground acts as a sponge (or more correctly, aquifer) which filters and 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 in greater detail below and illustrated on Map VI-5.

Groundwater from stratified drift deposits, unconsolidated till deposits and bedrock provides water for residential, commercial and industrial users in Pelham. Stratified drift aquifers are composed on well sorted sands and gravels, which generally have the potential to yield large quantities of water. Stratified drift deposits as depicted on the Aquifer Map underlie approximately 11.5 square miles or thirty-six percent of the total Town area. The United States Geological Survey study, *Hydrogeology of Stratified Drift Aquifers and Water Quality in the Nashua Regional Planning Commission Area*,[4] described Pelham's stratified drift aquifers. The aquifers are also described in detail in the *Water Resources Management and Protection Plan*.[5]

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 wells are drilled into rock containing fractures and can provide substantial volumes of water. Well completion reports on file with NH DES Subsurface Systems Bureau, indicate a range in depth of 75 feet to 1,000 feet for bedrock wells.

[4] 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.*
[5] Nashua Regional Planning Commission, *Water Resources Management and Protection Plan, 1988*.

Map IV-5: Aquifers



a. 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 as they have a potential to yield large volumes of water to a well. 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 limit the maximum amount of growth.

Aquifers are porous and transmit water along with any pollutants or contaminants it may contain. The potential for contamination will depend on the nature and intensity of the uses located over the aquifer and recharge sources in the watershed. These are uses, which in many cases depend on the aquifer for potable water supplies. The potential for contamination is also further compounded by the dynamic nature of water. Pollutants discovered at one point may originate from a distant water gradient source. Thus, the delineation of aquifers and the drainage basins which feed them can help officials in determining the impact of uses which occupy land areas important to the recharge of groundwater supplies.

High Potential **-** Wells located within these areas by systematic groundwater exploration should yield sufficient quantities of water to meet or augment municipal and industrial requirements.

Medium Potential **-** Shallow wells and infiltration galleries located in these areas by systematic groundwater exploration should yield sufficient water for small municipal and rural water districts, commercial and light industrial use.

Low Potential **-** These areas, in which hardpan and ledge are at or near the surface, have low potential to yield water. Wells in till and bedrock commonly yield sufficient water for single family domestic use. In places where wells penetrate saturated zones or fractures in bedrock, wells may yield more than 40 gals./min. Wells in these areas will not support large sustained yields.

In the *Aquifer Delineation Study* for the Nashua area the USGS first considered the availability of existing hydrogeologic information in and around these potential areas. Additional field mapping, well borings (50), and material sample testing were conducted to fill data gaps. Field work included twenty-two seismic refraction lines (a combined total length of almost eight miles). This was done to provide depth-to-water-table and bedrock subsurface information.

Due to the unpredictable nature of till and bedrock aquifers and the cost of exploring them geophysically, they were not included in this study. This study covers only stratified drift deposit aquifers located within the region. The principle new data developed in this study include: the location and extent of watershed areas; the location and extent of the stratified drift material (both surface area and depth); water table elevation; saturated thickness of stratified drift deposits; individual aquifer characteristics including type of material, transmissivity and direction of groundwater flow; and, groundwater quality sampling results.

Location and Extent of Watershed Areas **-** As mentioned previously, surface water and groundwater are interrelated. Precipitation falls in areas referred to as watersheds formed by a series of connecting ridges. Surface water, flowing through a system of interconnected wetlands, brooks, streams, rivers, is encompassed by a drainage basin or watershed. A watershed can be subdivided into smaller subwatersheds. Watersheds are particularly important to consider when production wells are located adjacent to surface water bodies. Watershed management and protection may provide a framework for a comprehensive water resource strategy, of which aquifer protection is but a part. However, caution should be exercised in the use of watershed protection exclusively as a groundwater strategy.

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.

Location and Extent of Stratified Drift Deposits - Location and extent of stratified drift deposits is determined from existing surficial geology mapping, SCS Soil Survey information, and additional fieldwork. The extent of these deposits are delineated on a USGS 7.5 minute (7.5'), 1:24,000 scale (one inch = 2000 feet) topographic base map. The map line showing the deposit boundary actually represents the location where the composition of the glacial deposit changes from stratified drift to till or bedrock. The actual width of this change (represented by a line on the map) may vary. In some cases, the geologist conducting the surficial geology mapping noticed a "clean break," while in other instances a "transition zone" was identified.

The depth of existing stratified drift deposits is important information used in evaluating an aquifer. To determine this, the hydrogeologist does "seismic profiling" while in the field. From the results of this field work a subsurface profile or cross-section is developed. Using numerous seismic lines and consulting other data, a better picture is put together of what actually exists below the ground.

Water Table Elevation - Water table elevation is the position of the water table in relation to the Mean Sea Level reference point. Similar to mapping the ground surface with topographic contours, the water table is mapped in feet above Mean Sea Level (ft. AMSL). The water table contour interval (vertical space between lines) is ten feet. The contour information was developed from seismic profiling, well completion and test boring reports. These reports have limitations that the hydrogeologist must incorporate into the analysis. These include seasonal variations of well measurements, the effects of nearby pumping wells, and the reliability factor of well completion reports submitted to the NH Water Well Board (WWB).

Saturated Thickness of Stratified Drift Materials - From the information provided on the maps, it is possible to determine how far one would have to dig through the unsaturated materials to hit the water table. A location is identified from the topographic contours, and then the ground surface elevation established (e.g., 350 ft. AMSL). Then the water table elevation is subtracted from the ground surface elevation. This results in the number of feet of unsaturated material (e.g., 350 ft. - 300 ft. = 50 ft.). Saturated thickness is determined by combining depth to bedrock and water table level information. Within the total thickness of a stratified drift deposit, this is the zone of saturation. Saturated thickness is shown on the aquifer maps using contour lines of 10, 20, 40, 60, 80, and 100 feet.

Material Type, Transmissivity, and Rate and Direction of Flow - The type of material (fine, coarse, sand, gravel, etc.) is an important factor in determining the quantitative characteristics of an individual aquifer. In classifying aquifers for this study, the hydrogeologist mapped four categories of material type: predominantly coarse; predominantly fine; coarse over fine with coarse materials over 25% of total thickness; and, fine over coarse with buried coarse materials at least ten feet thick.

The capacity of an aquifer to transmit water is referred to as its rate of transmission, or transmissivity. A transmissivity value for an aquifer is determined from the material samples test data. Aquifer transmissivity values are mapped using contour lines representing 0-2, 2-4, 4-8, and over 8 thousand square feet per day. The greater the "T" value, the more groundwater the aquifer will transmit.

Velocity or rate of groundwater flow is also a function of material type, porosity, and slope (hydraulic gradient) of the water table. Very coarse (porous) materials with steeper hydraulic gradients are expected to have higher anticipated rates of flow. In reverse, finer (less porous) materials with flatter hydraulic gradients are expected to have lower rates of flow.

Direction of flow is determined from reading the groundwater table contours. Groundwater flow does not always follow surface topography so having water table contour information will help alleviate the guesswork. Arrows are used to show direction of groundwater flow on the maps.

Groundwater Quality Sampling Results **-** Groundwater quality monitoring was done in conjunction with USGS fieldwork. Testing of samples collected was made possible through EPA grant funds. A total of 46 water samples were tested. The results show that overall water quality in the Nashua region is very good. Localized groundwater contamination incidents have been recorded at certain sites within the region. These incidents have been associated with specific land use problems on or near the site. The water quality study done for the region analyzed past information, located new sampling sites, performed ureter quality testing, and prepared final analysis, findings and recommendations.

b. Till Aquifers

Till aquifers are also made up of glacial deposited earth materials. The main differences between till and stratified drift aquifers are material porosity and thickness. Till is a mixture of clay, silt, and gravel materials. These materials were ground-up from solid rock by the glacier. Little groundwater can flow through such small individual pore spaces. In addition, till was deposited by glaciers on the tops and sides of valleys, making till deposits relatively thin compared to those of stratified drift. Wells drilled in till usually yield only small volumes of groundwater which may be adequate for private residential use.

Aquifers composed of glacial till materials may not be considered as good a water supply source as stratified drift aquifers, but for individual home owner needs they may supply shallow drilled or dry wells with marginal to adequate water yields. For the most part, those areas within Pelham not mapped in the USGS aquifer study would be considered as till deposits. There may also be small, scattered areas where bedrock is not covered by glacial till and is exposed at the surface. Glacial till deposits also have been mapped and can be delineated using USGS and Department of Resource and Economic Development (DRED) surficial geology maps. The SCS Soil Survey also lists those soil series', which likely have developed from glacial till deposits.

In those areas not mapped as stratified drift, any water supply wells relying on till deposits will be shallow in depth, and possibly seasonal in duration. The water table levels and yields will likely fluctuate greatly, corresponding to the seasonal variations in precipitation and drought. Because these wells are also close to the surface of the ground, they are 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 in order to prevent the unnecessary contamination of someone's water supply.

c. 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 then wells drilled in stratified drift.

As mentioned above, it is the fractures in the solid bedrock that carries groundwater. Unfortunately, locating bedrock fractures requires high-technology fieldwork and is very costly. Bedrock fractures are also hard to locate because of all the glacial material that may be covering them. The presence of fractures also depends on the type of bedrock involved and depth.

Bedrock aquifers are recharged from the same source as stratified drift and till aquifers. Surface water can directly enter the fractures exposed at the surface, or soak into the overlying material and then enter any fractures that may exist along the material-bedrock contact. The latter is the main way bedrock aquifers are recharged. Knowing just where this takes place for a particular fracture or fracture zone is extremely difficult, primarily due to the complex interconnecting nature of fractures, and the large area they may cover (e.g., an entire watershed).

Locating water supply wells in bedrock is often a hit or miss proposition. If one is drilling in a high fracture area, then there is a good chance the well will intercept a fracture and yield sufficient quantities of water. However, if the bedrock is not highly fractured, the chance of hitting a fracture decreases substantially. The Town is fortunate to have both stratified drift and till aquifers to provide a steady water source.

4. 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 domestic consumption. In general, the sand and gravel soil deposits, which comprise most of the community, are capable of yielding sufficient potable water for individual household consumption.

The presence and location of major groundwater supplies demand careful consideration in the Town's planning efforts. Map IV-5, Aquifers, indicates areas of groundwater favorability. It should be noted that all groundwater supplies are connected and thus contamination of one supply will over time lead to the contamination of other supplies in varying degrees. The Town should be conscious of this in its planning efforts and take steps necessary to protect these major sources of groundwater.

The most important steps that can be taken by local officials to protect groundwater supplies should be aimed at minimizing, if not eliminating altogether, polluting uses and activities on the land located directly over major groundwater supplies. Non-point sources are those polluting activities, which cannot be identified by a specific point or location. (For example, a pipe discharging raw sewage or chemicals into a stream would be a "point source," while a local landfill would be a "non-point source." Non-point sources of pollution can be just as damaging to water quality as point sources.

Since the Town must rely on groundwater sources for present and future supply, it must also take a serious look at ways to protect the supplies from potential pollution sources in all areas that are tied into the groundwater system, including wetlands, floodplains, surface water bodies and water courses and adjacent lands and lands located over major groundwater sources. Potential pollution uses which have been commonly acknowledged to date 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 the public supplies of water, local officials may deem it beneficial to restrict or prohibit some or all of the above practices in certain areas of Town. While this is recognized as restriction of the individual property-owner's rights of ownership, it also must be recognized that such actions are invoked to protect the public health and well-being of present and future generations, and such restrictions are imposed with the specific purpose and intent of protecting the public welfare.

5. Sewage Disposal

In Pelham, it is impossible to study the future of the Town's water supply without considering the impacts of current sewage disposal methods. As in many communities, the sole means of disposal in Pelham is through subsurface sewage disposal systems on each individual home site. Map IV-2 illustrates the Soil Conservation Service's determination of the suitability of soil types for use as septic tank absorption fields. This map shows that 64**%** of the Town's area is comprised of soils, which have a low or moderate limitation for such use. Consideration of this information will be important in making decisions on the locations of future land uses. This is especially true in Pelham where water supply and sewage disposal rely on the natural capabilities of the soil.

The NH Department of Environmental Services Subsurface Systems Bureau (Bureau), formerly the Water Supply and Pollution Control Commission, has developed minimum standards for the design and construction of subsurface sewage disposal systems. The Bureau is the statewide permitting authority and is responsible for reviewing and approving all proposed facilities for the treatment of wastes. As such, it is constantly under fire from local authorities and developers alike for alleged inconsistencies and problems in its approval and enforcement activities. The Bureau has made it clear that the regulations it administers are “minimum” guidelines that are enforceable statewide and individual municipalities are encouraged to enact more stringent guidelines, which are more sensitive to local conditions.

NH RSA 147[6] empower communities to develop Health Codes that they feel are applicable to its own particular circumstances. Thus, if deemed beneficial, Pelham could enact health ordinances governing the design, inspection, construction, repair and replacement of subsurface disposal systems as a means of protecting local water quality. If such an ordinance were adopted, the Town would then take on the responsibility of administration and enforcement, as well as defense of legal challenges. This latter condition presents problems in that the financial and manpower resources for administration and enforcement are not readily available.

It is recommended that the Town begin to explore the means by which sewage disposal practices may be regulated at the local level. Several examples of local regulation exist in the southern New Hampshire area, and can serve as models for the Town to study. In studying the various approaches used elsewhere, local officials should consider how these approaches can be applied in Pelham and what level of resources are needed to be committed to ensure that local regulation is effective in protecting water quality.

[6] State of New Hampshire, *RSA 147:14, Drainage and RSA 147:17-a, Private Sewage Systems.*

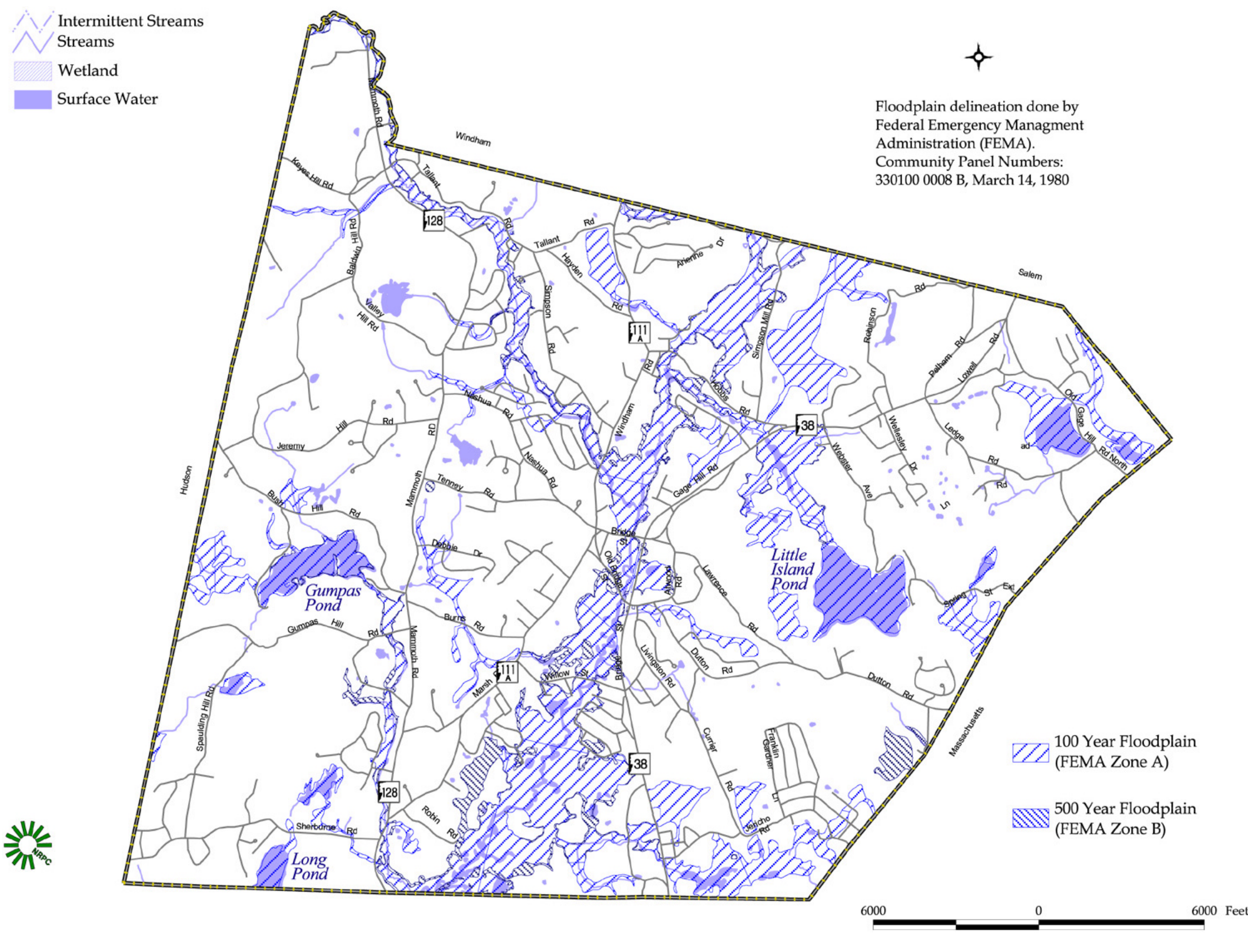
6. Floodplains

Floodplains are areas adjacent to watercourses and water bodies, which are susceptible to the natural phenomenon of flooding during periods of high run-off. Flooding is the process through which the exchange of water from surface to groundwater stores is accomplished. 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.

Pelham has participated in the National Flood Insurance Program since 1980. Floodplain areas cover over 2,600 acres or approximately 15% of the area in Town. Most of the floodplain area is located in the Beaver Brook valley as indicated on Map IV-6. 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 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 Recreation-Conservation-Agricultural (RCA) Zoning District protects some of these areas but it is strongly recommended that the remaining floodplains be removed from consideration for development for active use. At the present time, the RCA Zoning pose no hardship to affected property owners; however, it reduces the potential for flooding by limiting permitted uses to open space or limited agricultural uses.

Map IV-6: Floodplains



7. Wetlands

Existing wetlands include those areas where the soils are particularly sensitive to development. Wetlands perform many unique functions within the hydrologic system of each watershed. Wetlands provide: a vital link between incoming precipitation and aquifer recharge; flood storage and prevention; erosion control; water purification of sediment, contaminants, and problem nutrients. They also provide important habitat to a variety of vegetation and animal life, including aquatic plants, insects, amphibians, fish and waterfowl.

The role education plays in understanding the importance and sensitivity of wetlands cannot be overestimated. Promoting the development of school and public environmental education programs that utilize the outdoors as natural classrooms is one way of increasing community awareness. The designation of wetland areas is the first step in developing any kind of protection plan or strategy. Wetland designation involves determining the location or extent of any areas that support typical wetland soils and vegetation. The existence of either wetland soils or vegetation is the result of water table characteristics, which cause frequent flooding, or saturation of the soil.

Nothing can replace the field survey when it comes to identifying wetlands. Trained botanists, wetland scientists, ecologists, soil scientists, and hydrologists, when working in the field, can provide the highest level of information needed. This information should be incorporated into any land use decision-making process. In 1987 the Conservation Commission prepared the *Pelham Prime Wetlands Study*[7] based on nine criteria. The criteria included the following: Flora, Fauna, Food chain production, Hydrology, Historical, Archaeological and / or Scientific Significance, Geomorphologic Features, Aesthetics, Size, and other considerations. The Study identified 46 areas initially and narrowed the list down to 11 for further consideration. Seven wetlands were chosen for inclusion in a zoning overlay district at Town Meeting in 1988.

The New Hampshire Method of Evaluating Wetlands was developed 1991.[8] A prime wetland is a wetland that is worthy of extra protection because of it s 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.

In 1999, the Town contracted with the University of New Hampshire to continue the evaluations started in 1987.[9] Using the New Hampshire Method, the assessment concluded that three additional wetland systems were worthy of prime wetland status. The three wetlands were Little Island Pond, St. Patrick's Convent School and the Sherburne Road Bog and Wetland. The Pelham Memorial School Wetland did not meet the hydric A soil requirement for the New Hampshire Method and cannot be designated as a prime wetland according to the New Hampshire Code of Administrative Rules.[10] However, this wetland system did rank high in the 12 categories and should be protected.

[7] Pelham Conservation Commission, *Pelham Prime Wetland Study*, 1987.
[8] Amman, A., and A. L. Stone, A Method for the Comparative Evaluation of Non-Tidal Wetlands in New Hampshire, 1991.
[9] University of New Hampshire, *Pelham Prime Wetland Assessment*, 1999.
[10] State of New Hampshire, *RSA 482-A:15, Prime Wetlands.*

There are two other sources of information and technical assistance presently available to local Planning Boards. One is the Hillsborough County Soil Conservation District and SCS Soil Survey. The other is the US Fish and Wildlife Service, National Wetlands Inventory classification system and map products.

Significant technical and scientific expertise has gone into the development of the Hillsborough County Soil Survey. The District also offers technical assistance at the local and regional levels to make the best use of this information. In mapping the region's soils, the SCS has delineated those soils having poor to very poor drainage based on individual soil properties. Soils in these categories are in Table IV-3.

Table IV-3: Very Poorly and Poorly Drained Soils in Pelham

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

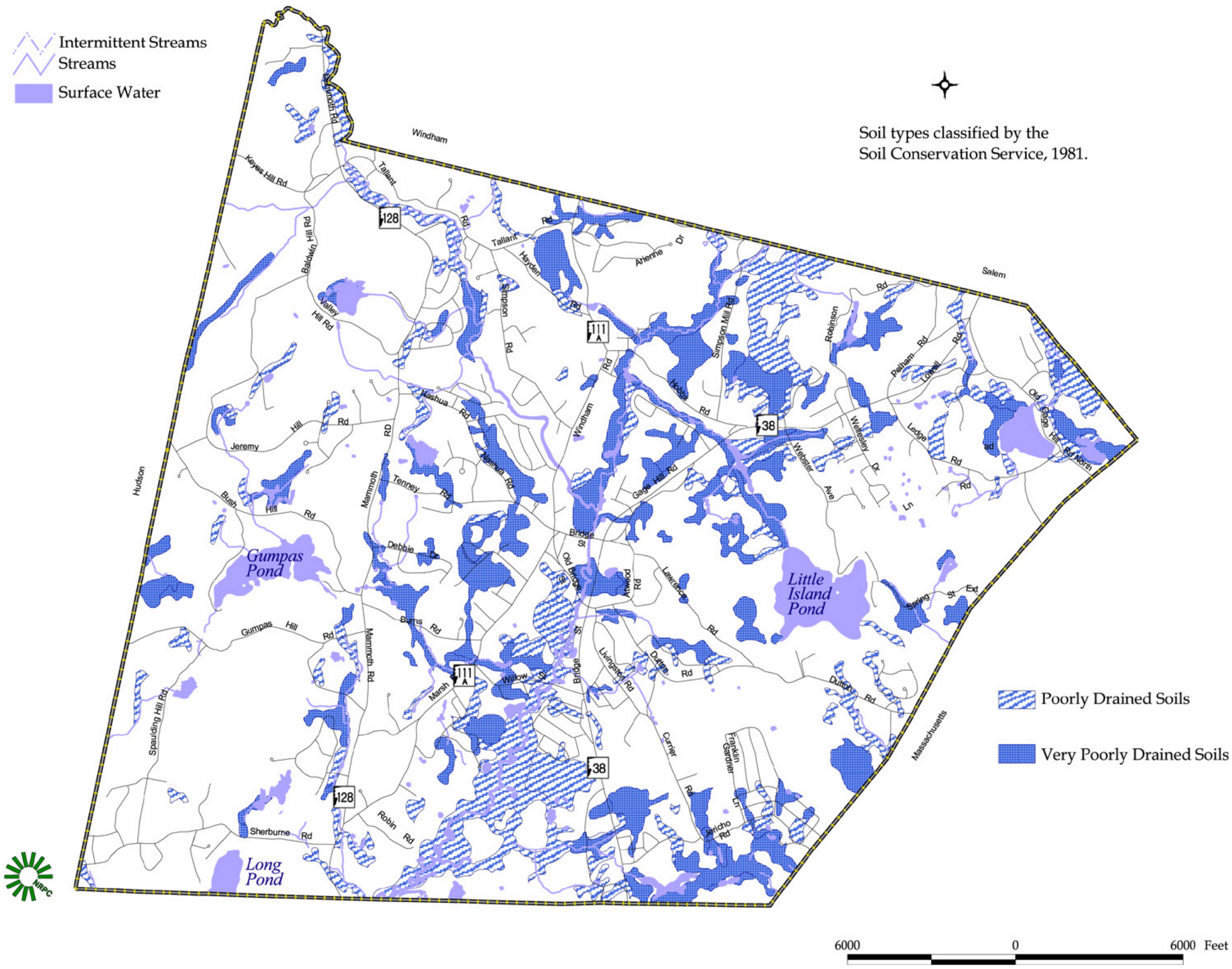
Source: *Soil Survey of Hillsborough County New Hampshire, Eastern Part*, US Department of Agriculture,
Soil Conservation Service, October 1981.

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 of sensitivity of a particular wetlands.

Map IV-7 illustrates those SCS wetland soils that exist within the Town. From this map, major concentrations of these soils are found to exist. Wetland areas are for the most part located adjacent to or very near open water as found in the Town's rivers, streams and ponds. This relationship is the result of a localized higher 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 next step in protecting wetlands would be to set the priority of wetland areas based on their location and the need of 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 ways to gain better control of wetland areas considered important would be 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.

Map IV-7: Wetlands



8. 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 Department of Environmental Services, *New Hampshire Non-Point Source Management Plan*,[11] lists the various forms of non-point source pollution in order of priority for abatement efforts. The list is based on the following factors:

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, in order of priority, is: 1) Urban (stormwater) runoff; 2) Hydrologic and habitat modifications; 3) Subsurface 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.

The 2001 draft *Groundwater Protection Recommendations and Implementation Plan* [12] identified junkyards, hazardous materials and septic systems were the top groundwater threats in Pelham. The Town's Junkyard and Automotive Recycling Regulation requires that all existing and proposed junkyards be licensed. Pelham has prohibited new junkyards within its Aquifer Overlay District but should enforce licensing requirements for junkyards operating prior to the Overlay District. State regulations apply to sites with two or more unusable vehicles. The Department of Environmental Services estimates that there may be as many as 40 sites that contain two or more vehicles.[13] The regulation of hazardous materials is generally done at the state and federal level. The NH Department of Environmental Services has identified 51 hazardous waste generators in Town.

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. Potential threats to groundwater quality in Pelham are illustrated on Map IV-8.

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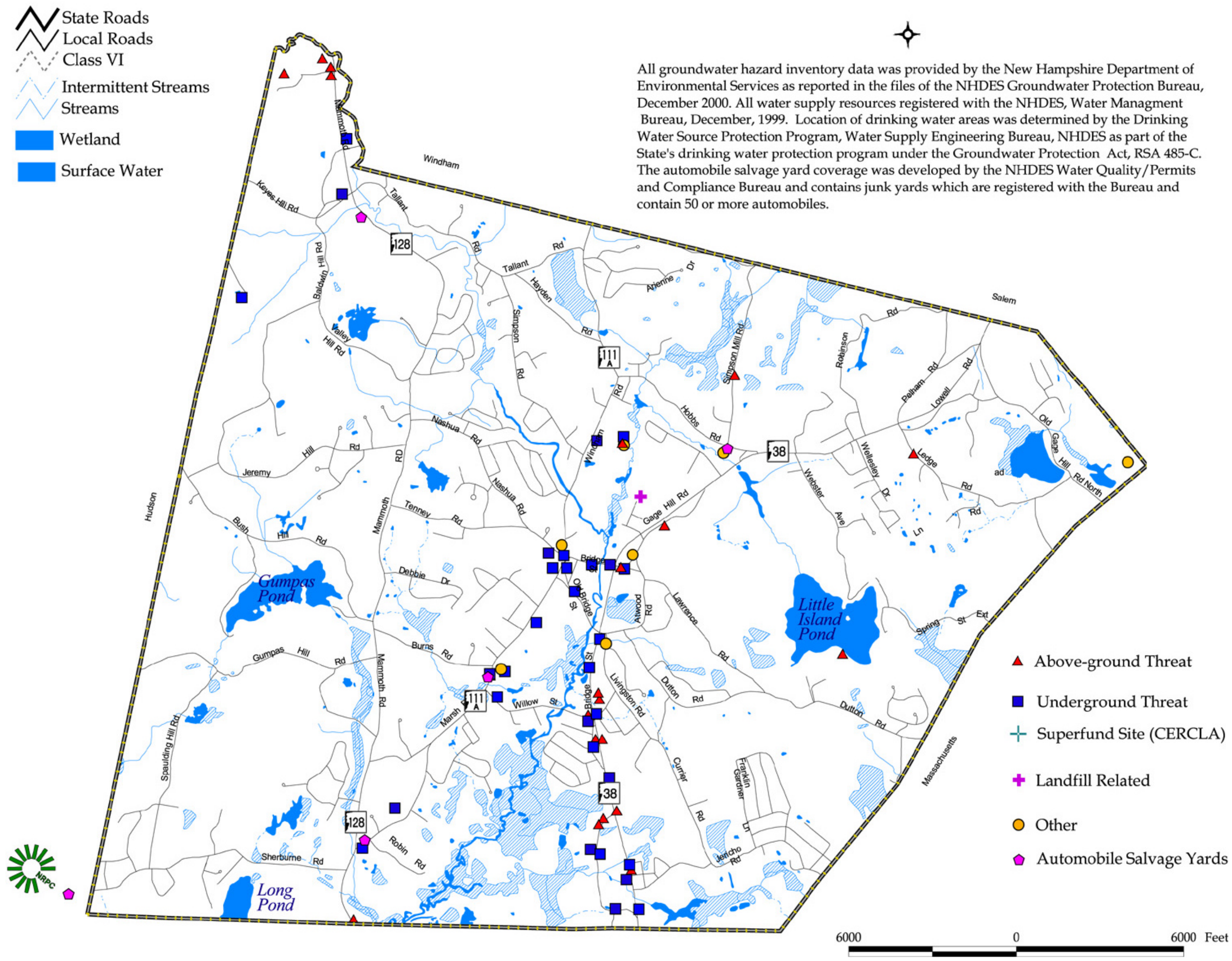
[11] NH Department of Environmental Services, *New Hampshire Non-Point Source Management Plan*, 1999.

[12] Comprehensive Environmental, Inc., *Town of Pelham: Groundwater Protection Recommendations and Implementation Plan,* 2001.

[13] Phone conversation with Comprehensive Environmental Inc., 2002.

Map IV-8: Potential Threats to Groundwater Quality



a. Stormwater Runoff and Phase I and II Stormwater Rules

The development of land for residential, commercial or industrial purposes necessarily 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. Development can also reduce groundwater recharge through increased evaporation that can result from land clearing. Where increased imperviousness results in direct stormwater discharges into streams and rivers, the result is often 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 nonpoint 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 virus and bacteria, organic compounds including oils, grease, MBTE, and pesticides and herbicides. All of these materials singly and in combination can lead to the degradation of surface and groundwaters. The United States Environmental Protection Agency (EPA), through a program called the *National Pollutant Discharge Elimination System* (NPDES),[14] aims to prevent and control non-point pollutant sources. The first phase of this program, appropriately referred to as the "Phase 1 Stormwater Rules," regulated the municipal stormwater systems and discharges of medium and large municipalities (those with populations greater than 100,000).

The Phase II rules, which go into effect in March of 2003, will focus on stormwater systems within the urbanized areas of municipalities with populations less than 100,000.[15] In addition, the Phase II rules will also impact construction activities between 1 and 5 acres, whereas Phase 1 regulated construction activities of greater than 5 acres. In order to comply with Phase II requirements, regulated municipalities must submit a Notice of Intent (NOI) by March 2003. This NOI must include a stormwater management plan that addresses the six minimum control measures required by the EPA.

The six minimum control measures are: 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. The Phase II rules mention the "operator," who is the entity responsible for maintaining stormwater conveyances and drainage systems. Stormwater conveyances include anything that can carry water, including ditches and swales. In most communities, these activities fall under the purview of the Department of Public Works or Highway Department. The stormwater management plan must be 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. Although stormwater management plans must be submitted by March, 2003, full implementation is required by 2008, giving communities 5 years in which to implement their plans.

The preparation of a stormwater management plan that addresses the 6 minimum controls will take time and the coordination of many in municipal government and the private sector. It may be advisable to establish a "Phase II Committee" to begin to address these matters well before the March 2003 plan deadline approaches.

[14] www.epa.gov/npdes.

[15] Comprehensive Environmental Inc., *Phase II Stormwater Rule Summary and How Municipalities Can Prepare for Compliance*; 2000.

b. Road Salt

No-salt routes generally 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. The Town salt storage facility off the Windham Road was built in 1995. It is a three-sided, 3840 square foot covered structure with a paved floor. The State Department of Transportation, which maintains Route 38, Sherburne Road, Route 128 and portions of Route 111A operates under a clear pavement policy.

Excessive salting of roads and improper salt storage create the potential for sodium, calcium and chloride contamination of the ground water, which can pose health threats to humans, endanger animals and plants and corrode metal and concrete. In June 2001, the Pelham Conservation Commission and NRPC completed a *Proposal for Alternative Winter Road Maintenance* study.[16] This study recommends that the Town consider using an alternative de-icer such as Calcium Magnesium Acetate (CMA); however, the study recognizes that this chemical is substantially more expensive than road salt and recommends that its use could be limited to identified problem areas. Another recommendation is that critical portions of roads 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 on 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 2002, 38 USTs in Pelham were registered with the NH Department of Environmental Services Subsurface Water Bureau.

9. 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% open space being marsh or ponds. Many major changes have affected the ecosystem in southern New Hampshire since that time. 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 other crops for home consumption. Most of the changes historically are associated with population and economic opportunities. Agriculture began to decline during the 1860’s with the western migration and industrialization of the northeast. The Amoskeag Mills in Manchester (incorporated in 1831 and by 1910 was the largest textile mill in the world, employing 17,000 workers)

[16] Pelham Conservation Commission and NRPC, *Proposal for Alternative Winter Road Maintenance* Study, 2001.

and the mills in Lowell and Lawrence drew workers (particularly females) from rural communities to the cities. These fields slowly gave way to scrub trees. 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' document *New Hampshire's Changing Lands*,[17] 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 after Maine. The forest industry is the third largest in the state after tourism and manufacturing.

South central New Hampshire receives approximately 43 inches of precipitation per year. Most of this precipitation is evenly distributed throughout the year, though there can be occasional droughts in the summer. The area's climate is ideal for the growth of forest trees. Among the common tree species found in Pelham's forests are White Pine, White Oak, Red Oak, American Beech, White Birch, Black Birch, Sugar Maple, Red Maple and Eastern Hemlock.

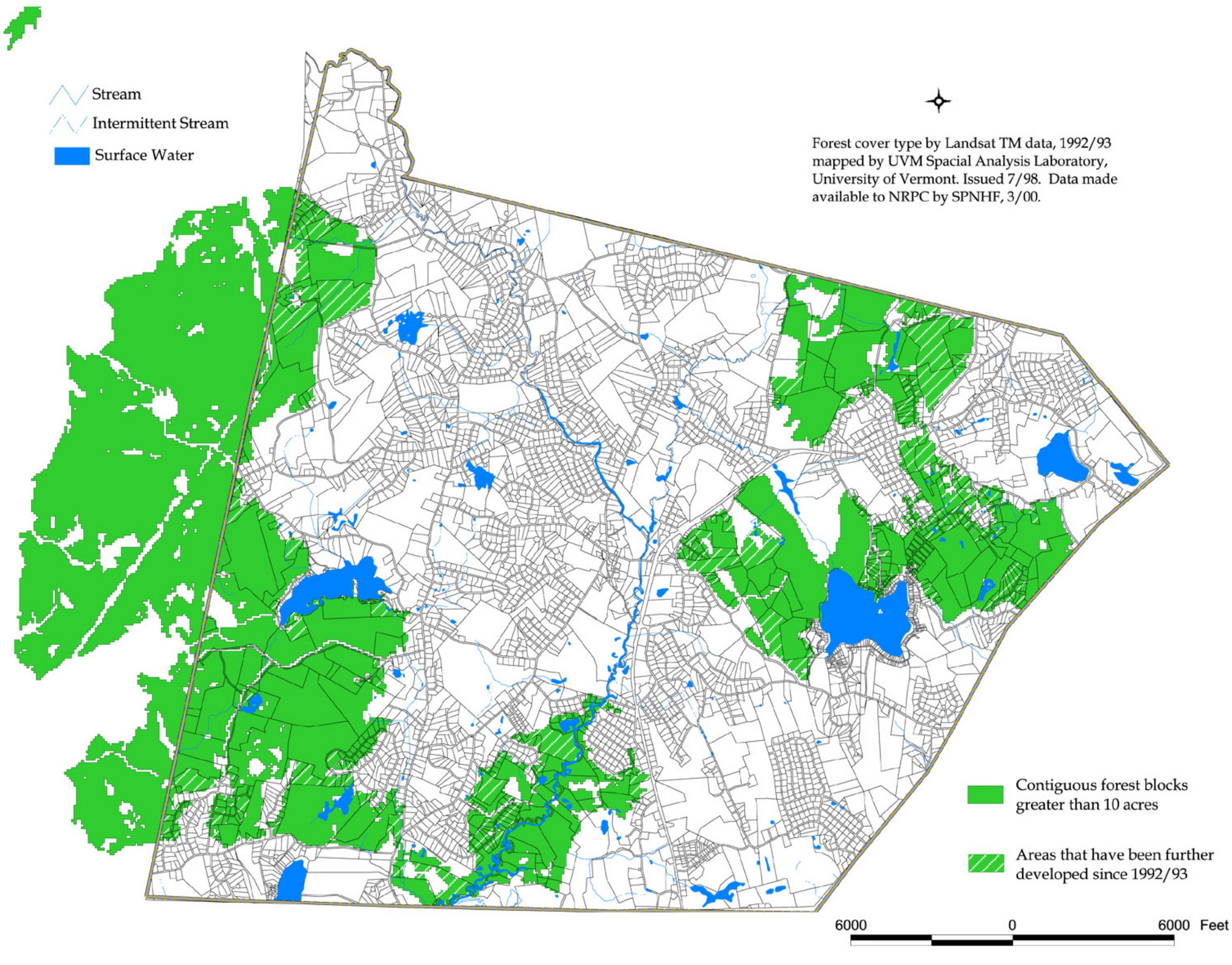
White pine has been the predominant tree harvested since colonial times. Hillsborough County is still a leader in white pine sawlog production. Red oak and sugar maple command a good market price. Deciduous and mixed forest types are dominant in Pelham and are widely scattered throughout the Town as illustrated on Map IV-9 and IV-10. 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 Pelham consist of predominately small Christmas tree and firewood sales. Firewood is still widely used as supplemental heat source in the winter. 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 to some degree water quality impacts associated with timber harvesting.

Table IV-4 provides a summary of Pelham'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 IV-9. Forest blocks of greater than 500 contiguous acres are illustrated on Map IV-10. In both cases, areas of forest have been lost since the map data of 1992-1993 was released (these areas estimated and are illustrated as striped on the maps).

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

Map IV-9: Forest Blocks Greater Than 10 Acres



Map IV-10: Forest Blocks Greater Than 500 Acres

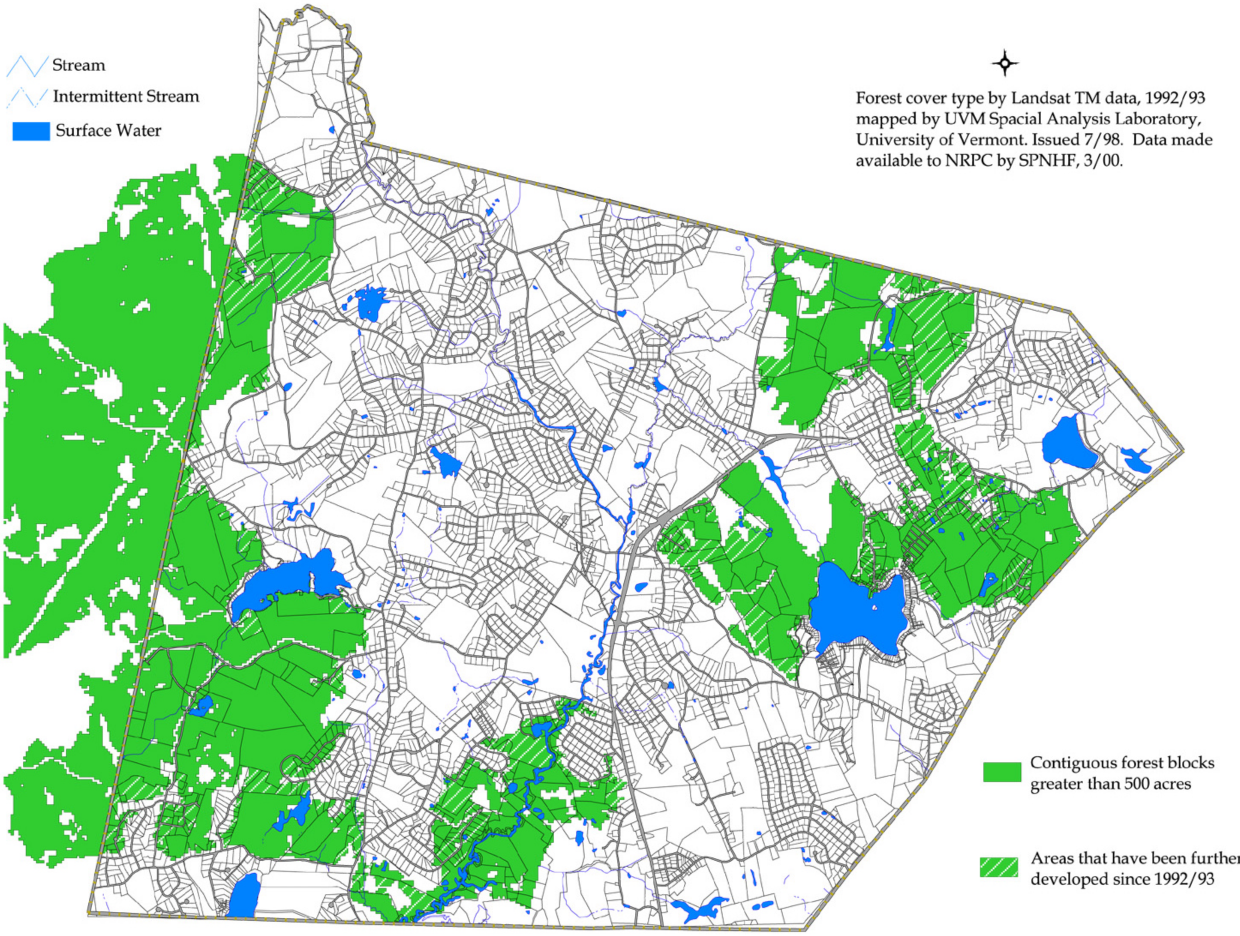


Table IV-4: Pelham Forest Facts

Area and Percentage in Forest (1993)	11,181.0 acres or 66.8 percent
Total area in Forest Blocks > 500 acres	3,118.48 acres
Number of Forest Blocks > 500 acres	5 forest blocks > 500 acres
Average and Median Size of all Forest Blocks	132.4 acre average and 61.2 acre median
Percentage of Forest Blocks > 10 acres that are protected	8.8 percent blocks> 10 protected
Predicted Decline in Forest Area by 2020	1,886.0 acres predicted to decline
Predicted % Decline in Forest Block Size by 2020	27.6 percent decline predicted

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

10. Wildlife and Plants

Pelham'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 five terrestrial (forest) and two palustrine (wetland) exemplary natural communities. 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 IV-3 provides a complete NHI listing of the fifty-six exemplary natural communities or rare species for Pelham.

a. Animals

Animal species commonly found in Pelham 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 Pelham as they have in other municipalities. Moose have also been sighted in recent years. Larger animals that require extensive habitat areas or species that require solitude such as black bears and are occasionally sighted in the Town. It is recommended that the Conservation Commission and interested citizens participate in the "Keeping Track" Program.[18] 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.

[18] www.keepingtrackinc.org.

b. 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.

c. 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 Blanding's Turtle, Eastern Box Turtle, Banded Sunfish, and two species of mollusks (invertebrates) as threatened or endangered in New Hampshire.

d. 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 of 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.

e. Plants

Plants species in Pelham are again dominated by those species commonly found in southern New Hampshire. The NHI records indicate the presence of forty-six threatened, endangered or species of concern plant species in Town. Among the most noteworthy of the Town's important natural communities is the unique collection of plant species found in the vicinity of Jeremy Hill. The unusually high number of plant species listed in Pelham is an indication of the uniqueness and importance of the Town's natural areas. A detailed listing of threatened or endangered plant and animal species is provided in Appendix IV-3.

D. EXISTING AND POTENTIAL FUTURE CONSERVATION LANDS

1. Existing Conservation Land

a. Land Protected through Public and Private Ownership or Zoning

Pelham contains a very few permanently protected conservation lands. 2,312 acres of Pelham's total land area of 17,157 acres is protected either through public ownership, private conservation efforts or through the Town's Recreation-Conservation-Agricultural Zoning District. These parcels are widely distributed throughout Town. The parcels are illustrated on Map VI-11. The preservation of these parcels is of tremendous importance to the protection of the visual quality, water quality, farms and forests, wildlife habitats, greenways, trails and remaining rural character of the Town.

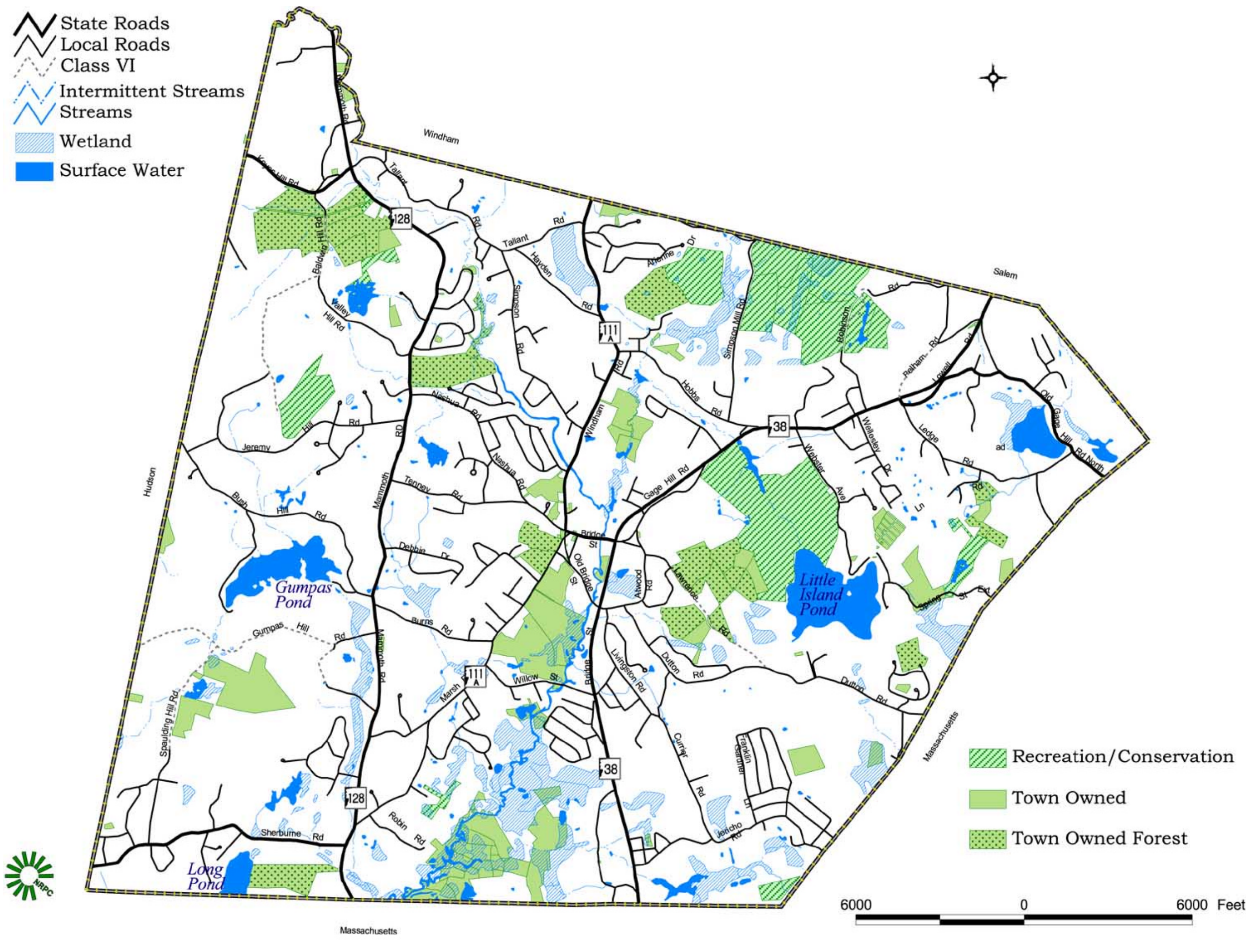
b. Land in "Current Use"

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

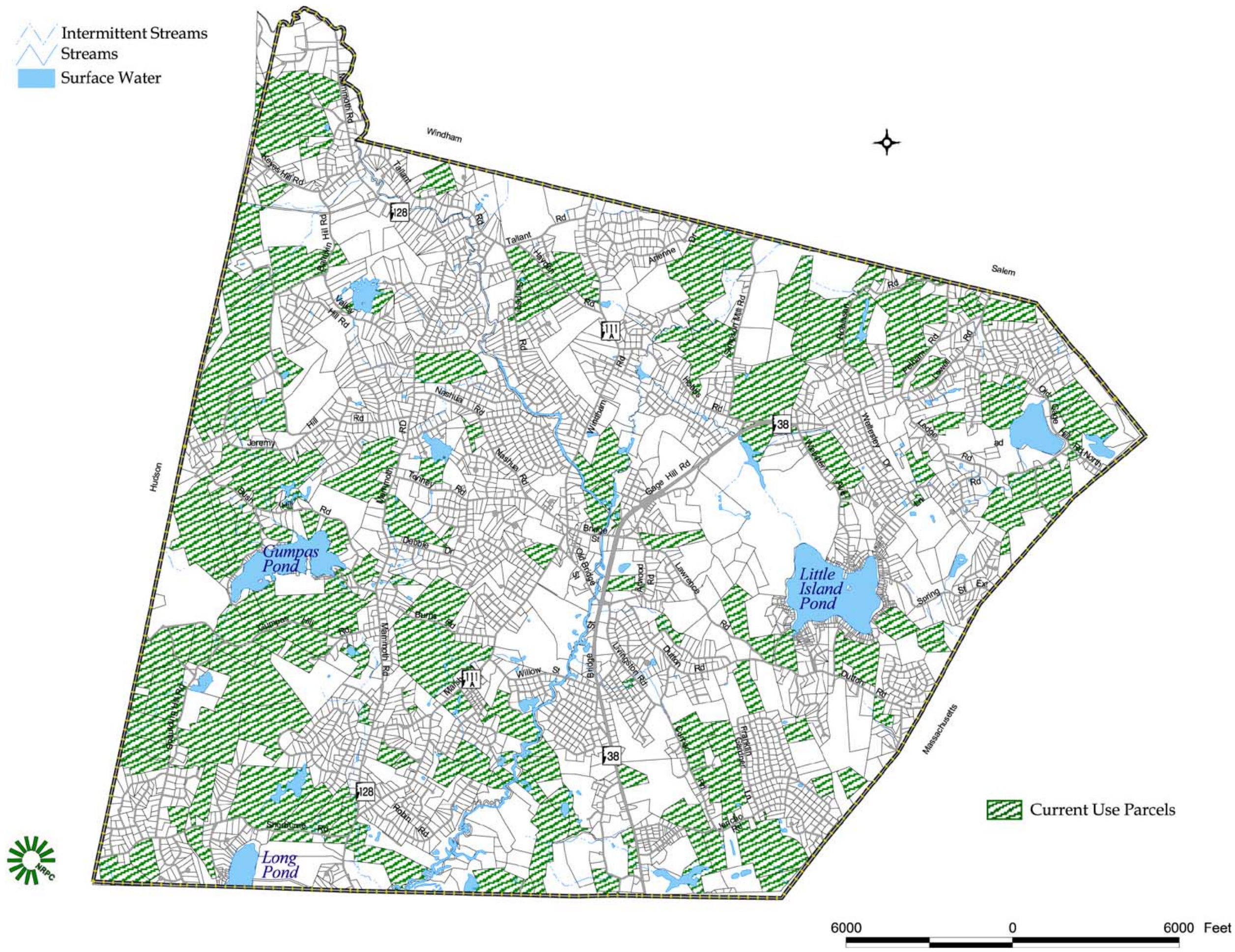
> *It is hereby declared to be in the public interest to encourage the preservation of open space, thus providing a healthful and attractive outdoor environment for work and recreation of the State's citizens, maintaining the character of the State's landscape, and conserving the land, water, forest, agricultural and wildlife resources. It is further declared to be in the public interest to prevent the loss of open space due to property 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 ten acres or greater and for active farms of less than ten acres with a minimum $2,500 gross value of product. However, the program only provides short-term protection because enrolled open land 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. Seventy five (75%) percent of that tax goes into a Conservation Fund to purchase land for conservation purposes. According to the NRPC GIS database, 4,798 acres of land was enrolled in the "current use" program in 2002. This land is illustrated on Map IV-12.

Map IV-11: Existing Conservation Land, 2002



Map IV-12: Land in Current Use, 2002



2. Priorities for Future Conservation Efforts

a. The Regional Environmental Planning Program (REPP)

As part of a state-wide effort with funding provided by the New Hampshire Department of Environmental Resources (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.[19] 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 their top five natural and cultural resource priorities. Phases Three through five have been primarily devoted to creating detailed Geographic Information System (GIS) data layers. Current conservation priorities are shown in Table IV-5.

Table IV-5: Conservation Priorities

Number on Map IV-11	Priority	Size in Acres	Description
1	1	130	Abuts the Pelham Fish and Game Club and includes farmland, wetland, forest and historic house and barn. Last farm of this size in Pelham. Provides a natural corridor that connects to the “southeast lands” in Windham.
2	2	129	Located in proximity to Musquash Conservation District, Gumpas Pond and protected land held by New England Forestry Foundation. Includes mostly forest. Provides additional open space in regional wildlife corridor.
3	3	200	Located immediately north of Little Island Pond and includes summer camp, forest, trails, dock and beach. Purchase of development rights would ensure camp will continue to operate and land preserved.

Source: NRPC, *Regional Environmental Protection Program*, 2001.

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. This region was one of the first areas settled in Pelham and Hudson. The area is dotted with old cellar holes, farm roads, stone walls, culverts and dams and other significant historical resources. The Nash-Hamblett (Musquash Conservation Land, 416.5 acres) and the Guertin (50 acres) properties already provide some protection to the watershed in Hudson. Pelham has several protected properties in this area, including the Fisher Family Trust and the James and Diane Fisher parcel. The New England Forestry Foundation also owns land in both towns.

[19] NRPC, *The Regional Environmental Planning Program*, 2000.

Northeast Pelham Greenway – This corridor is also has the potential of inter-municipal joining conservation lands in Windham, referred to as the Southeast Lands to the Dracut, Massachusetts line. The area has fields, forests and wetlands that provide prime habitat for moose, deer and other animals. There are two Prime Wetlands within this tract of land. The Girl Scout Camp and the land along Dutton Road comprise a large area of the Little Island Pond watershed. The greenway would run through Pelham just east of Simpson Mill Road the capped landfill, provide wildlife movement through Pelham Fish and Game Land, the Helgence property, Pine Valley Golf Course, Little Island Pond Prime Wetland and its surrounding upland areas, the watershed along Dutton Road, as well as the Girl Scout Camp to the Peabody Town Forest via the powerlines and the land surround the Peabody Town Forest. The area from Dutton Road to the Dracut line provides additional movement for wildlife since it is forested. The powerlines provide much needed field and brush habitat for a variety of animal and bird species as was noted in the Prime Wetland Study in 1999.

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."*[20]

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. The next grant round for LCHIP funds will take place in the spring of 2002. Communities will use the conservation priorities established through the REPP process to propose parcels and projects for grant funding through LCHIP.

The bill, as introduced, dedicated full funding of LCHIP at the $12 million level. The House Resources, Recreation, and Development Committee voted to amend the bill to $4 million for LCHIP in 2002. The amended bill does not include the real estate transfer tax as the dedicated funding source, but relies on the state's general fund after 2002. There are opportunities for Pelham to apply to this program.

[20] www.LCHIP.org

E. 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 fifteen percent should be approached with extreme caution, giving consideration to the problems presented by these slopes. Active use or development of slopes greater than twenty-five percent 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.

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.
- New development should be focused in large areas with slopes of less than fifteen percent, giving consideration to the other factors which affect the development suitability of these areas.
- Site Specific Soil Mapping Standards and enforcement actions should continue to be required in the subdivision regulations as a means of verifying actual site conditions, to determine the extent to which development is feasible and to ensure that approved development is constructed according to the approved site and subdivision plans. The non-residential site plan regulations should be reviewed and revised as necessary to require the use of SSSMS.

3. Water Resources

- Land adjacent to surface water resources is restricted from development or strictly monitored in its active use. 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 around all great ponds.
- Consideration is given to the protection of surface water and groundwater supplies within the Town's boundaries as they are the life-blood of the community. Groundwater supplies exist which are capable of supporting higher intensities of development. However, these must be protected from contamination in the absence of a municipal waste treatment system.
- Protect existing wetlands and surface waters by amending the Wetlands Ordinance to increase the 50’ buffer 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.

- Continue to implement the Floodplain Overlay Zoning District 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.
- Take advantage of the University of New Hampshire's Community Environmental Outreach Program (CEOP)[21] and Natural Resources Senior Projects to continue prime wetland evaluations and designations.
- It is recommended that development of wetland areas continue to be restricted in the future through the Town's Wetland Conservation ordinance. This, combined with active enforcement of State regulations governing the location of septic system and along with the possibility of the Town adopting greater setback distances than the State's minimum, will ensure that these areas may continue to perform the natural functions for which they are best suited.
- Improve the licensing checklist to include the review of the National Pollution Discharge Elimination System permit, especially the facility's Stormwater Pollution Prevention Plan.
- Enforce licensing requirements of all junkyard facilities.
- Prepare a stormwater management plan that addresses the 6 minimum controls outlined under the EPA's Phase II Stormwater Regulations.
- Pursue further protection measures through the Department of Environmental Services.

4. Forests and Wildlife

- Utilize the Forestland Evaluation and Site Assessment (FLESA)[22] for future forest planning and components of the program on all Town owned lands.
- Maintain 50 foot undisturbed, shady buffer around vernal pools and 100 foot buffer on property lines abutting forests and all surface waters.
- Consider legal easements on all Town Forests to preserve the land for recreation and permanent protection.
- Inventory all existing trails using Geographic Positioning System (GPS) and create a trail system map signage for all Town forests.
- Initiate a long-term insect monitoring plan for Hemlock Woolly Adelgid, weevils, and others.
- Take advantage of the University of New Hampshire's Community Environmental Outreach Program (CEOP) and Natural Resources Senior Projects for a plant biodiversity survey. 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.

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[21] http://ceinfo.unh.edu/Water/Documents/WRcomcon.htm

[22] North Country and Southern New Hampshire Resource Conservation and Development Area Councils, *Planning for the Future of Local Forests*, 2001.

5. 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.
- Allocate 100% of the Land Use Change tax to the Conservation Fund to help contribute towards increasing the number of protected open space parcels and provide matching funds for potential funding sources.
- Farm protection should be pursued for existing or undeveloped lands with Prime or State designated soils.
- Establish a Capital Reserve Fund to raise funds for land protection.
- 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.
- The Pelham Fish and Game land, the golf course, Camp Runnels and the watershed of the pond, Little Island Pond Prime Wetland and the surrounding uplands along with the Peabody Town Forest and the surrounding lands with powerline easements should be recognized as a greenway corridor and expanded so that movement of wildlife can continue to Dracut.

APPENDIX IV-1

Soil Limitations to Septic Systems

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%
Has	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 IV-2

Important Agricultural Soils in Pelham

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 IV-3

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
	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 lineariloba)	-	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 IV-3 (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

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 IV-4

Sources

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

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