

# **TOWN OF PLYMOUTH, NEW HAMPSHIRE**

## **NATURAL RESOURCES INVENTORY**

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## INTRODUCTION AND OBJECTIVES

The Town of Plymouth, New Hampshire contains approximately 28.2 square miles (18,048 acres) of land and 0.3 square miles (192 acres) of inland waters. There were 625 residents in Plymouth when the 1790 census was taken. The population has grown to 6,162 residents according to the 2003 census. Plymouth has a fluctuating student population beyond these figures because of Plymouth State University. The Town has cohabitated with two large rivers: the Baker River flowing west to east in the northern end of town; and the Pemigewasset River which flows north to south along the eastern border.

Plymouth contains a wide range of ecological habitats including deep rich prime agricultural sites, riparian floodplains, emergent and scrub-shrub wetlands, and adjacent forested uplands. Many panoramic vistas exist throughout the Town. Plymouth is a typical New Hampshire rural town that has progressed through the agricultural, industrial, and current eras. Presently, farming has declined dramatically while forestry, retail, and tourism have become the main providers of economy.



A view of farmland along the Baker River floodplain in Plymouth

As is true of many communities of its size, Plymouth has a municipal Drinking Water System and Sewerage Disposal System for the downtown area which meets Environmental Protection Agency regulations within the Clean Water Act. With its large stratified drift aquifers found mainly along the Baker and Pemigewasset Rivers the Town recognized a need to become more proactive in addressing the needs of the Town with a focus on sustaining Natural Resources, especially water quality. As with many communities, development and transportation corridors tend to follow along the river valleys and flatter topography. This is exemplified in Plymouth where nearly three quarters of the town's topography is steeper sloped (15% and more).

This project provides a base Natural Resource Inventory with digital data that can be integrated with other available and future data. For example, data from this project is compatible with existing GIS data from other projects such as The Baker River Watershed

## Natural Resource Inventory for Plymouth, NH

Management Plan which encompasses Warren, Wentworth, Rumney, and Plymouth in a larger watershed-wide initiative.

One of the goals of this project is to provide inventory, management, and planning tools for the Town, as Plymouth faces increased use of its natural resources and development pressures, especially in areas that directly affect the river corridors. Another goal of the project is to integrate all existing data for Plymouth, with data created and field verified from this project. This produces a seamless comprehensive Town-wide composite, and provides an educational and planning tool, as well as promotes conservation of riparian habitat, wetlands, and unique co-existing natural resource features throughout the town.

Measurable objectives of this project include the following:

1. Provide the Town of Plymouth with the ability to integrate existing GIS coverages with those currently under development, and future GIS data, in a compatible format stored and retrievable in one comprehensive database.
2. Incorporate natural resources, scenic vistas, riparian buffers and other related elements for comprehensive planning.
3. Hold a public meeting to increase awareness of the values of the Town including scenic view areas, recreation areas, riparian buffer habitat, and wetlands with associated wildlife habitat.
4. Ability for the Town to provide hardcopy printouts of spatial data, on standard 8½" x 11" paper, as requested or needed.
5. Ability of the Town to continually build upon and update the digital database

### **METHODOLOGY**

Plymouth's Conservation Commission chair, Dominick Morocco, was the project officer. The Town partnered with Watershed to Wildlife, Inc. (WTW) in a contractual arrangement for technical assistance, and to integrate the data to create a comprehensive GIS project. Members of the Commission dedicated time to work with WTW. The Commission met with WTW to provided information and highlight areas for fieldwork. Throughout the project WTW communicated with the Commission periodically to give updates of the work as it progressed.

#### ***Field Work***

Fieldwork was conducted to get an overall view of Plymouth with a focus on previously identified targeted areas. This work included inventories and assessments on several mountains, wetland complexes, beaver ponds, and floodplain habitat along the Baker and Pemigewasset rivers. In some cases Class VI roads and established trails were followed, while in other cases compass based orienteering and topographic maps were used. GPS data were collected at points of interest including monuments, brook crossings, vernal pool locations, dense softwood stands, and confluences with rivers. In addition, photographs were taken with a digital camera along points of interest throughout the Town. During fieldwork sessions, any rare or endangered species found were noted and located on a map.

### ***Gather Existing Digital Data***

Existing maps and data for the Town of Plymouth were collected. The following table shows which maps were obtained, their scale, and the national mapping standard accuracy measure. Since many decisions are based on parcels as they relate to rivers, roads, trails, ponds, wetlands and other features, it is important to point out the working accuracies of these data sources. Combining these sources in various overlays provides an excellent overview and planning tool but does not replace the need to perform site-specific investigations for many developmental requests. Please refer to the table below to better understand some of these accuracy issues.

**Accuracies of Existing Maps**

<b>Data</b>	<b>Source</b>	<b>Ratio</b>	<b>Scale</b>	<b>National Mapping Standard Accuracy</b>
1992 and 1998 DOQ	GRANIT - .sid version	1:5,000	1" = 416.7'	Acceptable accuracy within 12.48 feet
Topographic	GRANIT	1:24,000	1" = 2,000'	Acceptable accuracy within 60 feet
Roads and Trails, Power Lines, Railroads, Hydrology, Conservation lands, and NHB Data	GRANIT	1:24,000	1" = 2,000'	Acceptable accuracy within 60 feet
Soils	NRCS	1:20,000	1" = 1,667'	Acceptable accuracy within 50 feet
Geology & Aquifers	USGS & NH-DES	1:24,000	1" = 1,667'	Acceptable accuracy within 50 feet
National Wetland Inventory	U.S. Fish and Wildlife Service	1:24,000	1" = 2,000'	Acceptable accuracy within 60 feet
GPS Points	Garmin III plus	N/A	N/A	Generally within 30' but dependent upon satellite availability, PDOP, refraction, and topology.

### ***Compile Existing Data into Autocad and Arcview***

Digital data was gathered from GRANIT, Natural Resource Conservation Service (NRCS), NH-DES, and the US Fish and Wildlife Service. GRANIT data includes the following:

1. DOQs
2. Topographic map
3. Hydrology (rivers, streams, lakes and ponds)
4. Roads and trails
5. Power lines and rail roads

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Existing available maps were then integrated using AutoCAD and Arcview software. Using the 1998 and 1992 Digital Orthographic Quadrants (DOQ), USDA 2003 aerial photography, topographic maps, and soils maps, features were digitized and overlaid onto a base map. These include: Baker and Pemigewasset River riparian buffers, permanent openings, waterbodies, and dense softwood stands. Potentially significant wildlife habitat areas were noted.

Wetlands were reviewed and analyzed using the DOQ, National Wetland Inventory (NWI) and NRCS soils maps (specifically hydric soil units). New Hampshire requires that three parameters be met for classification as a jurisdictional wetland: the presence of hydric soil; sufficient hydrology; and hydrophytic<sup>1</sup> vegetation. When soils maps alone are used, they could potentially over-estimate the number of wetlands throughout the town. This is particularly true given that up to 35% of a soil classification can be inclusions (this could include upland areas within NRCS hydric soil units or wetland areas within NRCS upland units). On the other hand, examining the DOQs alone under-represents the number of wetlands, because only open water, emergent, and scrub-shrub wetlands are easily identified. Forested wetlands are often missed using aerial photography alone. Some types of wetland delineations require extensive fieldwork beyond the scope of this project. In 1985, the PCC hired consultants to inventory and evaluate several wetlands throughout the Town. These include all types of wetlands and are incorporated into this NRI.

Prime farmland, farmland of statewide importance, and farmland of local importance throughout Plymouth were determined using the NRCS soils map data. Data was displayed in ArcView and queried so only those soils classified as important farmland was displayed in the Town. Much of the prime farmland, additional farmland of statewide importance and some of the additional farmland of local importance are now used for crops (including hayland). Land used for pasture, woodland, recreation, or land uses other than urban, built-up or disturbed areas will still qualify as prime farmland, additional farmland of statewide importance, or additional farmland of local importance. The rationale for this approach is that land not already committed to irreversible (urban) uses is still available for cropping. Three categories of important farmlands have been described by the NRCS and they are:

1. Prime Farmland as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained yield of crops in an economic manner. These soils are generally flat and free of stones.
2. Farmland soils of statewide importance are lands, in addition to prime farmland, that are of statewide importance for the production of food, fiber, forage and oilseed crops. Criteria used to define this agricultural land were determined by State and local agencies in New Hampshire. The soils on the list are important to agriculture in New Hampshire, yet they exhibit some properties that exclude them from prime farmland. These soils can be farmed satisfactorily by greater inputs of fertilizer, soils amendments and erosion control practices than those necessary for prime agricultural farmland. They produce fair to good crop yields when managed properly.

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<sup>1</sup> Plants that are adapted to growing in wet habitat and, because of their presence, are indicators that a wetland may exist.

3. Farmland of local importance is land, in addition to prime and statewide farmland, that is of local importance for the production of food, fiber, forage and oilseed crops. The criteria used to define this farmland were determined by local agencies in Grafton County. Relative values from 100 to 0 were assigned to each of the county's soils based on each soil's potential to grow corn silage or grass-legume hay. The local agencies then determined that soils with relative value of 54 or greater would qualify as farmland of local importance.

Permanent openings (or areas dominated by grasses, forbs, brambles, or shrubs) were digitized from the DOQs. The regions digitized include only those openings managed as permanent opening habitat. They do not include clear-cuts where the intent is for timber harvesting and regeneration for future logging. Dense softwood (or conifer) cover areas were also digitized from the DOQs. These areas have been recognized as significant wildlife habitat and could be deer and moose wintering areas. Existing Riparian Zones were digitized from the DOQs. Riparian buffer habitat includes shrubs and trees along the Baker and Pemigewasset River. Areas which have been maintained as grassland or are paved were not included in the digitization of adequate riparian buffer.

Steep slopes were determined using the NRCS soils maps. Data was displayed in ArcView and queried so only those soils map units with 15% slope and greater were displayed in ArcView.

All maps are displayed at the end of this report with the features described above. All information gathered, compiled, and mapped for this report is maintained by the Plymouth Conservation Commission in digital format.

### ***GIS Training Workshop and Installation of Project Data***

Installation of all project data, including a GIS ArcView Project was done on a computer in Plymouth. A two-hour 'hands on' training session in accessing and viewing the data, and plotting maps was conducted for Conservation Commission members that had an interest in providing GIS access for the Town of Plymouth. Future training was offered at a per diem rate.

## RESULTS

### ***Rivers and Large Waterbodies***

The Pemigewasset River borders Plymouth on the East and flows for 29,069 feet or 5.5 miles through the Town. Being the largest river in Plymouth, it is a valuable natural resource for the Town. The Pemigewasset River is a rocky-cobbly to sandy bottomed river. Protecting the biological diversity and scenic values along these two rivers have been priorities for several years. There are no dams along either of these major rivers in Plymouth providing free flowing waters. This contributes to the success of coldwater trout habitat, further enhanced by the NH Fish and Game department's annual stocking program. There are also ongoing efforts to return salmon to these rivers in Plymouth.

Historically, much of this area was farmland. The Town of Plymouth used to contain several active farms; now a few beef and vegetable crop farms exist, but are a very small part of the economy. Today, this area mostly contains single-family homes and retail centers including a super WalMart store.



Good riparian buffers along the Baker River in Plymouth

Although there are several tributaries entering the Pemigewasset River, the largest one in Plymouth is the Baker River located in the northern end of Plymouth, which flows for 29,672 feet, or 5.6 miles. The Baker River confluence with the Pemigewasset is about 4.4 miles downstream of the northern Plymouth townline, located behind the Plymouth State University field house and athletic fields. Its source is Mount Moosilauke just north of the Town of Warren, NH. It flows northwest to southeast for a total of approximately 36.5 miles, with the last 5.6 miles within Plymouth. Numerous smaller tributaries flow either directly into

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the Pemigewasset River or indirectly via the Baker River, such as Clay Brook, Reed Brook, Glove Hollow Brook, and additional unnamed drainages. An interesting anomaly in these brook names is that the topographic maps display a Clay Brook in the northern and central part of Plymouth and a second Clay Brook located in a small stretch of southern Plymouth; the northern Clay Brook flows in a northerly direction with its confluence in the Baker River, and the southern Clay Brook flows in a easterly direction with its confluence in the Pemigewasset River.

Erosion is an issue of concern along the Pemigewasset and Baker Rivers. This is partly due to the abundance of sandy soils found in this area, but is also enhanced by sections of inadequate vegetative buffers, human activities, and impervious surfaces along the miles of riverbank frontage. As future development occurs along the floodplain, careful planning, maintenance of riparian buffers, and stormwater runoff control will be essential.

A portion of Loon Lake (approximately 2/3) lies in Plymouth and is the largest pond/lake located in Plymouth. Several small unnamed ponds are in Plymouth, with many of the larger ponds associated with wetland complexes and have limited water based recreational uses (i.e. swimming and picnicking). On the other hand, the extensive networks of wetlands around and connecting ponds, contains excellent wildlife habitat.

All water bodies offer recreational and/or wildlife value for Plymouth, its immediate abutters, and the entire region. Swimming, kayaking, canoeing, and 'tubing' are common occurrences in both the Baker and Pemigewasset Rivers. Tourism accounts for a large portion of income for central and northern New Hampshire, and these waterbodies are significant components. The Baker and Pemigewasset Rivers in the Town of Plymouth also attract anglers.



One of many wildlife ponds in Plymouth

### **Wetlands**

Wetlands are the core of life for the majority of plant and animal species. They contain diverse habitats with numerous edge habitat needed by many species. It is estimated that  
Town of Plymouth

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riparian areas and wetlands are utilized by over 90% of the region's wildlife species and provide the preferred habitat for over 40% of local species. Future trails and observation points overlooking these wetlands provide excellent opportunity for wildlife viewing.

Based on National Wetland Inventory (NWI) data there are approximately 1,592 acres of wetlands in Plymouth, (8.8% of the land mass). Based on NRCS data, there are approximately 2,146 acres of hydric soils in Plymouth, (11.9% of the land mass). New Hampshire requires three parameters in defining wetlands; hydrophytic vegetation, hydric soils, and hydrology. Although excellent tools, generally NWI data under represents the size and number of wetlands, and NRCS hydric soil data alone over represents the size and number. Field determinations will be necessary to accurately delineate all wetlands in the town. These can be incorporated over time with additional field verification.



Large scrub-shrub and forested wetland complex located near Clay Brook and the base of Plymouth Mountain. There is very little open water in this wetland, but it contains excellent food and cover for wildlife.

Wetland areas are constantly changing through time. The general trend without severe weather is for wetlands to slowly fill-in over time. The process begins with open water. As time passes, submerged plants appear. Floating-leaved plants, such as water lilies, follow these. Then further emergent plants such as reeds, sedges, and wetland grasses follow. Shrubs such as high bush cranberry (*Viburnum trilobum*), sweet gale (*Myrica gale*), and bog rosemary (*Andromeda glaucophylla*) begin to appear. Heaths such as leatherleaf (*Chamaedaphne calyculata*) and labrador tea (*Ledum groenlandicum*) appear among the shrubs. Trees such as black spruce (*Picea mariana*) and tamarack (*Larix laricina*) then emerge. Balsam fir (*Abies balsamea*), red maple (*Acer rubrum*) and gray birch (*Betula populifolia*) swamps follow the spruce and tamarack. This natural successional process is often referred to as eutrophication.

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On the other hand, there are several environmental and human-induced reasons for wetlands to actually increase in size. Some examples of these include:

- Human development including damming or excavation could increase wetland sizes, or create new wetlands
- Severe weather changes – an increase in rain will increase the wetland area, whereas a drought may diminish the area
- The cyclic movements of beaver as hardwood saplings regenerate in early succession.



Beaver activities have influenced this reach of Clay Brook

- Human activities such as logging and landscape alteration can dredge out wetland areas or increase the amount of runoff into wetlands.

Vernal pools are unique and often isolated wetlands. A vernal pool is a temporary body of water which provides essential breeding habitat for certain reptiles, amphibians, and crustaceans – such as wood turtles, wood frogs, spotted salamanders, and fairy shrimp. They fill annually from precipitation, runoff, and rising groundwater. Vernal pools are usually dry by the middle of summer, making them uninhabitable for fish, and therefore a safer environment for amphibians. Vernal pools vary in size, shape, and location.

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A vernal pool part way up Plymouth Mountain at approximately 1,100 feet. No obligate species were documented at this time of year (October), but this site should be revisited next spring.

The Town of Plymouth contracted with *Natural Resource Consulting Services* of Concord, NH in 1985 to perform an inventory and assessment of wetlands. This work is important to carry forth, especially if the Town desires to designate Prime Wetlands in the future. Below is a table summary of the results of that study:

<b>Wetland #</b>	<b>Area (acres)</b>	<b>Proposed Name</b>
1	5.29	Batcheldor Moat
2	5.74	None Given
3	6.86	Glovers Brook Wetland
4	3.34	Inkell Wetland
5	0.85	Downing Wetland
6	2.76	Riverside Cemetery Oxbow
7	16.47	Langdon Park Wetland, Rand Oxbow
8	2.18	McGlaughlin Oxbow
9	6.23	Carpenter Oxbow
10	21.25	Cod of Bullock Wetland
11	2.56	Chestnut Hill Oxbow
12	5.89	Peters Oxbow
13	4.89	Cooper Wetland
14	1.76	Loizeaux Oxbow
15	11.86	Fletcher Wetland
16	11.91	Cleveland Wetland
17	4.52	Smith Wetland
18	17.13	Yankee Arrowhead Wetland

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<b>Wetland #</b>	<b>Area (acres)</b>	<b>Proposed Name</b>
19	2.19	Clifford Wetland
20	5.20	Yeaton Wetland
21	94.74	None Given
22	4.90	None Given
23	0.78	Bover Wetland
24	2.39	Allen Wetland
25	31.40	Klose Wetland
26	46.33	Loon Pond Brook Wetland
27	59.32	Chaison Road Wetland
28	6.70	Bolman Wetland
29	3.51	Derrickson Wetland
30	0.66	Barney Wetland
31	4.24	Nims Wetland
32	12.48	Walter-Newton Wetland
33	15.77	Glove Hollow Wetland
34	1.11	Yeaton Wetland #2
35	6.37	Young Oxbows
36	4.06	Smith Wetland
37	6.57	Robie Wetland
38	5.99	Riverside Lands Wetland
39	8.52	Stein-Hawkenson Wetland #1
40	4.84	Stein-Hawkenson Wetland #2
41	30.57	Ahern-Huchins Wetland
42	7.95	Jacques Wetland
43	0.32	Railroad ROW Wetland
44	12.15	McIver Wetland
45	3.22	Perkins Wetland
<b>Total</b>	<b>513.77</b>	

WTW has integrated data from this project into the GIS database in the form of point locations for each wetland.

### ***Riparian Habitat***

The Town of Plymouth is fortunate to have two major rivers within its borders. Both the Pemigewasset and Baker Rivers contain many acres of riparian habitat rich in plant and wildlife species. Within these periodically flooded areas are upland and wetland soil base habitats with a multitude of ‘edges’ creating unique opportunities for plant and animal species to thrive. The diverse riparian habitat in Plymouth includes scrub-shrub, grassland, meadow, and forest. These areas support numerous songbirds, including ground nesters, raptors, ducks, herons, bank swallows, and many other avian species too numerous to list.

Along the rivers in Plymouth, riparian buffer widths range from 0 feet to over 1,000 feet with several areas throughout the town having only a few feet and a few areas having over 300 feet of shrub or tree riparian buffer. One of the factors is the past agricultural practices utilizing the excellent floodplain soils for farming, often right up to the edge of the

river banks. Another is development and homes with lawn or access to the river areas right up to the top of the river bank. The riparian buffer widths are adequate for approximately 75% of the floodplain areas, but should be widened for the remaining 25% of river frontage areas. Fortunately, the 0 to 100 foot buffer areas are scattered and not contiguous.

Among other things, riparian buffers provide travel corridors containing shelter, food, and birthing places for numerous terrestrial mammals such as white-tailed deer, moose, black bear, raccoons, skunks, red and gray fox, coyote, weasel, mink and smaller mammals. Closely linked to the above mammals are the numerous beaver, muskrat, and river otter that utilize the rivers, ponds and open water while frequenting the shoreline and various vegetated habitats.

The Town of Plymouth has plentiful wildlife, in part due to its riparian habitat areas. The importance of maintaining, and in many cases, increasing these areas cannot be overstated. As development pressures and natural resource management increase, the effect on these areas needs to be carefully weighted with a balance found to prevent loss of the functionality of this habitat. It is intended that digital tools such as those produced from this project will assist Plymouth in assessing proposed future impacts before they occur. Retaining existing buffers, and promoting the growth of additional riparian buffers are critical to maintain water quality, minimize erosion, improve fisheries habitat, maintain wildlife travel corridors, and minimize flooding.

### ***Forested Flood Plains***

Floodplain forests are unique natural communities that occur on periodically flooded land along river corridors. Their uniqueness and location adjacent to riparian habitat and rivers provide valuable wildlife habitat for breeding birds, spring migratory birds, insect populations, and amphibians that utilize vernal pools as part of their life cycle. Generally, larger patches of forested floodplains exhibit greater species richness and support greater diversity of wildlife. Migratory and breeding bird populations associated with floodplain forests include downy and hairy woodpeckers, American robins, gray catbirds, warbling vireos, and song sparrows. White pine, eastern hemlock, red and white oak are abundant along the Plymouth reaches of the Pemigewasset and Baker rivers, and are the dominant tree species in much of the floodplain. The strong root system of these species is important in controlling bank erosion. This is evident at numerous sites along the Plymouth floodplain where stable banks and buffers exist where these species are abundant. On the other hand, bank erosion is occurring along agricultural fields and areas that lack adequate mature tree cover.

Throughout Plymouth and New Hampshire red maple swamps are also common examples of forested flood plains. In New Hampshire, red maple swamps are home to such rare species as the marbled salamander. They are the principal forest type used by breeding wood ducks in the northeast. Songbirds (e.g., Canada warbler, veery) and birds of prey (e.g., red-shouldered hawk, barred owl) also have an affinity for red maple swamps. Nearly 50 species of mammals utilize red maple swamps, including black bears, white-tailed deer, moose, and bats.

## **Permanent Openings**

As is the situation in most all of New Hampshire, the Town of Plymouth has experienced a significant loss of working farms. As the percentage of non-developed, permanent openings in New Hampshire has decreased significantly over the past 50 years, the state is encouraging landowners to create or maintain permanent openings as important wildlife habitat. These permanent openings dominated by grasses, forbs, brambles, or fruiting shrubs, provide necessary habitat for about 22% of New England's wildlife species, and seasonally important habitat to nearly 70% of species. The eastern bluebird and northern harrier are two examples of species of concern in New Hampshire, which rely on retaining permanent openings.

Permanent openings in general also have the advantage of creating edge habitat. Wherever an open area meets the forest the area of transition will attract the largest diversity of species, both plant and animal. Generally, there will be species adapted to permanent openings, those adapted to forested habitat, and those who specialize in the transition zone area who will frequent these edge habitats.

Approximately 1,017 acres of land is managed for permanent openings, including agriculture, exist in Plymouth. This is nearly 5.6% of the total town's land area, and is below the average of 10% openings throughout the State of NH. Some of the larger permanent openings border the Pemigewasset and Baker Rivers. Retaining permanent openings will be beneficial to the diversity of wildlife and vegetation throughout the town.

## **Forested Lands**

As with surrounding New Hampshire towns, the Town of Plymouth contains large acreage of forest. Since 1900, much of Plymouth's land mass has been devoted to forestry, and harvesting has occurred as growth cycles have warranted. Typical tree species that grow in this location are red and white oak (*Quercus rubra* and *Quercus alba*), white pine (*Pinus strobus*), white birch (*Betula papyrifera*), yellow birch (*Betula lutea*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*), poplar (*Populus* spp.), eastern hemlock (*Tsuga Canadensis*), red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), and tamarack (*Larix laricina*).

Over 80% of Plymouth contains forested habitat. Forested areas include hardwood stands, mixed hardwood and softwood stands, and softwood stands. Most of these forested habitats are mixed-wood or hardwood stands of varying age classes. Over, 1,157 acres or 6.4% of Plymouth's land area contains dense softwood cover. Some of these stands are important deer wintering areas, which cover only about 3% of land base in New Hampshire. For the area to be considered a deer yard two basic elements must be met: (1) Core area identified by concentrations of dense softwoods, and; (2) Mixed hardwood and softwoods adjacent to, or within the core area will provide accessible forage.

Many of the dense softwood stands scattered throughout Plymouth are quite small in size (5 to 15 acres), however there are a few larger ones ranging from 50 to 125 acres. Many are lowland softwood stands, associated with watercourses and riparian habitat. Even though deer or moose may not use the smaller softwood stands in the winter, many other smaller mammals and birds rely on them. They provide shelter from harsh winter weather by reducing snow accumulation and wind speeds, while allowing access to food supplies and escape from predators.



Forested land of all types is found throughout Plymouth. There is a large diversity of forest types; the majority being mixed hardwood with some dense softwood stands. This softwood stand is a potential deer wintering area.

## **Soils**

The nature of soil has a profound effect on plant growth. Whether it is rich with organic material, very poorly drained, or sandy, will affect the type of vegetation adapted to grow in those conditions. Scientists can learn much about the soil type by examining the vegetation. At the same time, examining the soil will predict the type of vegetation that can grow in the area.

Soil information is critical in making sound land use decisions. By examining soil types and morphology many predictions are made regarding forest management, erosion potential, and development possibilities. For example, residential development should be located away from areas with unstable soil conditions, high water tables, and slow percolation rates due to constraints for building foundations and septic system placement.

Soil information is also an excellent indicator of critical resource areas such as wetlands, agricultural lands, forestlands, and wildlife habitat. In descriptions of soil types, the NRCS evaluates soil types according to their capacity for agriculture, woodland, community development, recreation, and wildlife habitat.



This potential vernal pool site contains saturated, organic soil that would be classified as a hydric soil.

Several factors exert a major influence on soil development. These include climate, time, topography, parent material, biota, and human activities. Studying soil can also lead to an understanding of how that soil was formed. For example, along the Pemigewasset and Baker Rivers, floodplain soils exist. These soils have been formed by sediment being deposited from past floodwaters. These types of soil are classified as Alluvium (deposited by running water); a distinction from Lacustrine (sedimentation from still water – lakes or ponds). As another example, soils with a deep, rich top layer (or A horizon) indicate that the area has been used for agriculture for many years. Throughout the forested areas of Plymouth, spodosol soils continue to develop under the acidic organic litter. These soils take many years to develop identifiable horizons and typically have an albic or “E” horizon just under the organic or “O” horizon. The “E” horizon is generally 1 to 3 inches thick and is described as looking similar to wood ash. The phenomenon is caused by the actions of water and acidic decomposition or fallen needles and leaves stripping off the normal coatings of clay and or iron oxides. The spodosols are relatively young soils.

A parameter sometimes overlooked in soils is that of pH. New Hampshire soils are commonly slightly acidic due to the influence of granite, referencing the term ‘The Granite State’. There are a few areas in Plymouth where there are calcareous soils of ‘sweeter’ higher pH due to small pockets of calcium within the granite bedrock. Such areas often offer opportunities for unique habitat and rare plant life (at least to northern NH).

ArcView compatible shape files of the NRCS soils map and the USGS geologic bedrock of the Town of Plymouth has been included with the digital data. It is important to recognize that these delineations are limited in detail as they are Category II and III Levels derived from large grid fieldwork done in 1983 and USGS Quadrant maps at 1:24,000 scale. Although a great tool for planning and conservation purposes, the soil delineations are also

limited for site-specific use in that minimum area polygons are three acres in size and can contain up to 35% inclusions of various soils and slopes.

### ***Prime, State and Local Farmland***

As stated in the methodology section, prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It can be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It is either used for food or fiber crops, or is available for those crops. The soil qualities, growing season, and moisture regime are needed for a well-managed soil to produce sustained high yield crops. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment. Another factor that influences farmland along the Pemigewasset and Baker Rivers is the presence of an abundant volume of moving water. The fact that water reacts much more slowly than air to temperature changes provides a microclimate within the floodplain area, offering cooler temperatures in the extreme heat of summer and warmer temperatures (including the formation of fog) in the cooler fall temperatures extending the growing season.

Throughout the town of Plymouth there are 4,552 acres (7.1 mi<sup>2</sup>) of land classified as important farmland. This represents 25% of land base in Plymouth. There are approximately 2,409 acres of USDA classified prime farmland found throughout Plymouth. Most of these soil types lie in the Pemigewasset and Baker River flood plains. Additionally, Plymouth has 884 acres of farmland of statewide importance. Lastly, 1,259 additional acres of farmland has been classified as local importance. These last soils are scattered throughout the town.

Decision-makers must be aware of the long term implications of various land use options for the production of food, fiber, forage and oilseed crop, and the trade-offs involved. Actions that put high quality farmland in irreversible uses should be initiated only if those actions are clearly in the public interest.

### ***Stratified-Drift Aquifers***

There are three types of groundwater aquifers: Stratified-drift; till; and bedrock. The basic difference is that stratified drift and till aquifers are composed of unconsolidated glacial deposits (loose earth materials), while bedrock aquifers are solid rock. In stratified drift aquifers, the materials are sorted sand and gravel. In till aquifers, the material is a gravel, sand, silt and clay mixture. In bedrock aquifers, the rock is fractured.

Stratified-drift aquifers are an important source of ground water for commercial, industrial, domestic, and public-water supplies in the State of New Hampshire. Approximately 14% of land surface in the State is underlain with Stratified-drift aquifers. In and around Plymouth they consist of stratified, sorted, principally coarse-grained sediments (sands and gravels) deposited by glacial melt-water during the time of deglaciation.

Approximately 6.3 mi<sup>2</sup> (4,010 acres) or 22.2% of the area of Plymouth is underlain with Stratified-drift and Till Aquifers. These are located mostly along the Pemigewasset and Baker River floodplain, but also found in other areas of the Town.

Wells used by communities and private landowners draw groundwater from aquifers. The stratified-drift aquifers represent the greatest potential groundwater source for the Town of Plymouth. These aquifers represent potential usable water sources for municipal purposes and should be protected to insure their future quality and availability.

## **Slope**

Slope is the amount of rise or fall in feet for a given horizontal distance. It is expressed in percent. A 15% slope means that for a 100-foot horizontal distance, the rise or fall in height is 15 feet. Slope is one significant aspect of landform, which presents limitations for development. As slopes become steeper, the expense of building increases. Furthermore, increased slope means there is a greater chance of erosion, structural problems, and water pollution problems. In general, slopes greater than 25% are considered too steep to provide adequate sites for structures such as roads, homes, and septic systems. On steep slopes, soils are usually shallower, the volume and velocity of surface water runoff is higher, and the erosion potential is greater than on flatter areas. The consequences of erosion are loss of soil resulting in sedimentation of surface waters and loss of the productive capacity of the land.

The NRCS soils maps were used to determine areas with slopes equal to and greater than 15%. Approximately 9,453 acres or 52.4% of land throughout Plymouth contains slopes that are over 15%. Of this nearly half, or 4,127 acres (22.9% of land area in Plymouth) contains slopes over 25%. These contain areas where development would be restrictive. The flat land throughout Plymouth is located mostly along and around the Pemigewasset River and Baker River floodplains. These flatlands, though, are often associated with flood hazard areas, especially if the water table is high.

A positive aspect of Plymouth's steep slopes is the opportunity for panoramic views in numerous locations throughout the Town. Identification and proper planning are important to Plymouth to maintain these viewsheds. (Please refer to the section on 'Scenic Resources' in this report).

## **Rare Species and Exemplary Natural Communities**

The Town of Plymouth has potential for numerous occurrences of these species and communities due to the unique diverse habitats throughout. Based on the NH bedrock geology data, some of these occurrences are due to calcareous soils which are rare, as mentioned in the 'soils' section of this report. There are some documented plants and one animal species occurrences in this area with ongoing studies.

The northern harrier (*Circus cyaneus*) is slowly making a comeback in NH. Plymouth, with 5.6% permanent openings and mowed fields, provides potential habitat for these raptures as well as others. The wood turtle (*Clemmys insculpta*) is a rare reptile species documented in Plymouth. Wood turtles are typically associated with streams and slow rivers, but range widely across the terrestrial landscape as well.

The abundance of steep slopes, rock outcrops, and wetland complexes in Plymouth suggest that other plant and animal species exist, but need further investigation and documentation.

Below is a list of rare, threatened, or endangered species documented throughout the Town of Plymouth. Most of these species have historical occurrences, which mean that they have not been seen for over 20 years. Data was obtained from the New Hampshire Natural Heritage Bureau.

**New Hampshire Natural Heritage Inventory  
Rare Species and Exemplary Natural Communities throughout Plymouth<sup>2</sup>**

Species Name	Listed?		# Locations reported in last 20 years	
	Federal	State	Town	State
<b>PLANTS</b>				
Andrews' Gentian ( <i>Gentiana andrewsii</i> )	-	T	Historical	7
Loesel's Twayblade ( <i>Listera loeselii</i> )	-	T	Historical	25
Sweet Goldenrod ( <i>Solidago odora</i> )	-	T	Historical	12
<b>VERTEBRATES - Reptile</b>				
Wood Turtle ( <i>Glyptemys insculpta</i> )	-	-	Historical	65

1

**Listed?** E = Endangered T = Threatened  
**Flags** \*\*\*\* = Highest importance  
 \*\*\* = Extremely high importance  
 \*\* = Very high importance  
 \* = High importance

These flags are based on a combination of (1) how rare the species or community is and (2) how large or healthy its examples are in that town. Please contact Natural Heritage Inventory at (603) 271-3623 to learn more about this or other ways of setting priorities.

New Hampshire is home to more than 500 species of vertebrate animals. Many of these animals live in Plymouth and the surrounding towns. The number would be considerably larger if a complete list of invertebrates (insects, crustaceans, clams and snails) were included. About 75 percent are nongame wildlife species - not hunted, fished or trapped. Twenty-one species are endangered and thirteen are threatened in the state. The New Hampshire Fish and Game Department maintains a list of Endangered or Threatened animal species in New Hampshire, which is shown below. Little information is available relative to their occurrence in Plymouth, but their habitats, when identified should be protected.

**Endangered and Threatened Wildlife in New Hampshire - Effective 05-05**

**ENDANGERED**

Common Name	Scientific Name
<b>MAMMALS</b>	
Canada lynx	<i>Lynx canadensis</i>
Small-footed bat	<i>Myotis leibii</i>
<b>BIRDS</b>	
Pied-billed grebe	<i>Podilymbus podiceps</i>
Bald eagle*	<i>Haliaeetus leucocephalus</i>
Northern harrier	<i>Circus cyaneus</i>
Golden eagle	<i>Aquila chrysaetos</i>
Peregrin falcon	<i>Falco peregrinus</i>
Piping plover*	<i>Charadrius melodus</i>
Upland sandpiper	<i>Bartramia longicauda</i>
Roseate tern*	<i>Sterna dougallii</i>
Common tern	<i>Sterna hirundo</i>
least tern	<i>Sterna antillarum</i>

## Natural Resource Inventory for Plymouth, NH

Common Name	Scientific Name
purple martin	<i>Progne subis</i>
sedge wren	<i>Cistothorus platensis</i>
<b>FISH</b>	
Sunapee trout	<i>Salvelinus alpinus</i>
Shortnose sturgeon*	<i>Acipenser brevirostrum</i>
<b>REPTILES</b>	
Timber rattlesnake	<i>Crotalus horridus</i>
<b>AMPHIBIANS</b>	
Marbled salamander	<i>Ambystoma opacum</i>
<b>INVERTEBRATES</b>	
Dwarf wedge mussel	<i>Alasmidonta heterodon</i>
Brook floater	<i>Alasmidonta varicose</i>
Frosted elfin butterfly	<i>Incisalia irus</i>
Karner blue butterfly*	<i>Lycaeides Melissa samuelis</i>
Persius dusky wing skipper	<i>Erynnis persius persius</i>
Ringed bog hafter dragonfly	<i>Williamsonia lintneri</i>

### THREATENED

Common Name	Scientific Name
<b>MAMMALS</b>	
Pine marten	<i>Martes Americana</i>
<b>BIRDS</b>	
Common loon	<i>Gavia immer</i>
Osprey	<i>Pandion haliaetus</i>
Cooper's hawk	<i>Accipiter cooperii</i>
Arctic tern	<i>Sterna paradisaea</i>
Common nighthawk	<i>Chordeiles minor</i>
Three-toed woodpecker	<i>Picooides tridactylus</i>
Grasshopper sparrow	<i>Ammodramus savannarum</i>
<b>REPTILES</b>	
Eastern hognose snake	<i>Heterodon platyhinus</i>
<b>INVERTEBRATES</b>	
Pine pinion moth	<i>Lithophane lepida lepida</i>
Pine barrens Zanclognatha moth	<i>Zanclognatha Martha</i>
Cobblestone tiger beetle	<i>Cicindela marginipennis</i>

To learn more about threatened or endangered species or unique communities, contact the New Hampshire Natural Heritage Bureau office of NH Division of Forest and Lands for plant species (271-3623), or the Nongame and Endangered Species Program of the NH Fish and Game Department (271-2461).



With the abundance of mature forest and rock outcrops, future studies for rare, endangered, or threatened species seem warranted in Plymouth.

### ***Scenic Resources***

Plymouth's location on the Pemigewasset and Baker Rivers, along with its general hilly topography, provides residents and tourists with abundant scenic resources. In recent years, population growth throughout the state and region has caused people to appreciate the natural scenery northern New Hampshire has to offer. Along the roads throughout Plymouth, visitors and residents have panoramic views of mountains, rolling hills, and the Pemigewasset and Baker Rivers. From many vantage points the views include landscape scenery dominated by mature forest. The combination of abundant steep slopes along with Plymouth's trails and class VI roads provide for numerous panoramic views throughout the Town.

Another means to obtain a view the landscape is from the air. Plymouth has a small airport with a grass-covered airstrip (approximately 2330' long) located on the Old Fairgrounds Road in the northwestern part of town. This offers a unique opportunity for Plymouth residents and visitors to fly over the town for a "birds-eye" landscape view, and is particularly popular during the fall foliage.

## Natural Resource Inventory for Plymouth, NH



The left photo shows the Plymouth Airport with a couple of small aircraft ready to go. To the right is an example of one of the many scenic views found throughout Plymouth.

The following are some of Plymouth's many scenic vista points.

- Plymouth Mountain Natural Area
- Class VI road off Old Hebron Road
- Loon Lake
- The Rail Trail along the Baker River

Presently, the Town of Plymouth has one road designated as a Scenic Town Road; Old Hebron Road.



An scenic view towards the Tenny Mountain Ski Area.

### **Conservation Land**

At the time of this study, there are approximately 1,497 acres of conservation land in Plymouth. This is equivalent to 8.3% of the land area. There are additional areas under conservation easement, but their exact size and location have not been entered into the GRANIT database at this time. A conservation easement on private land is a property right

Town of Plymouth

## Natural Resource Inventory for Plymouth, NH

that can be bought or sold. It allows property owners to put limitations on their property when an easement is sold, or for another person to set limitation upon the property owner when an easement is purchased. There are efforts by a few landowners in the town to conserve and connect smaller parcels into one larger, contiguous area of land for conservation.



Diverse natural resource features were found in this wetland complex near Plymouth Mountain and Pike Hill. This is the headwaters of Georges Brook flowing into Sanborn Bay of Newfound Lake in Hebron.

One of the areas already in conservation is 1,177 contiguous acres located on parts of Plymouth Mountain and Pike Hill with several nearby wetland complexes. This area contains a large conserved area containing diverse habitat and connectivity.

### ***Habitat Area Summary Table***

The table-below is a summary of different habitat areas displayed in acres, square miles, and as a percentage of Plymouth's land area.

<b>Habitat Type</b>	<b>Number of Acres</b>	<b>Number of Square Miles</b>	<b>Percentage of Town Land Area</b>
Plymouth Town Boundary	18,048	28.2	100%
Dense Softwood Cover	1,157	1.8	6.4%
Wetland Complexes (from NWI data)	1,592	2.5	8.8%
Hydric Soils (from NRCS soils data)	2,146	3.4	11.9%
Aquifers	4,010	6.3	22.2%
Permanent Opening	1,017	1.6	5.6%
Prime Farmland	2,409	2.0	13.3%
Farmland of Statewide	884	1.4	4.9%

## Natural Resource Inventory for Plymouth, NH

Habitat Type	Number of Acres	Number of Square Miles	Percentage of Town Land Area
Importance			
Farmland of Local Importance	1,259	6.7	7.0%
Steep slopes – 15% and greater	9,453	14.8	52.4%
Steep slopes – 25% and greater	4,127	6.4	22.9%
Conservation Lands	1,497	2.3	8.3%

### DISCUSSION – FUTURE APPLICATIONS AND BENEFITS

This project has compiled natural resource data into a digital database and GIS format. It contains a database with a comprehensive, updateable, digital inventory of the entire Town. It is also anticipated that efforts from this project will aid in future work and inventories, as well as provide data for future development in the Town of Plymouth.

It is anticipated that results from this study will help the Town of Plymouth in many ways. Town-wide zones based on habitat and vegetation can be identified and classified. Data gathered from this work will also assist the Planning and Select Boards and the Conservation Commission in determining possible conflicts for future development. Perhaps the most powerful advantage of this project is that future studies and events can be integrated to build upon this database indefinitely.

Based on results from this study Watershed to Wildlife, Inc. and the Plymouth Conservation Commission have identified areas for additional work. They include the following:

1. By identifying existing riparian buffers, the Town can examine areas where new buffers should be established or where existing ones should be extended and protected. Riparian landowners should be encouraged to retain, enhance, or improve buffers along the riverfront. Depending on the goals of the landowners, they should be encouraged to grow shrub and tree buffers as wide as possible. Further discussions on this topic can be found in the Baker River Watershed Management Plan done by the Baker River Watershed Association, and can be applied to both major rivers flowing through Plymouth.
2. There are numerous wetland complexes adjacent to the Pemigewasset and Baker Rivers. The importance of wetlands in floodplains cannot be over emphasized. It is hoped that the Town will pursue ways to study the functionality and vulnerability of these wetlands, with a long-term goal of prime wetland designations.
  - a. The wetland inventory and evaluation conducted in 1985 for the Town of Plymouth, has some valuable wetland data, which can be expanded to include a more comprehensive and updated inventory of wetlands and their functional ratings throughout Plymouth.

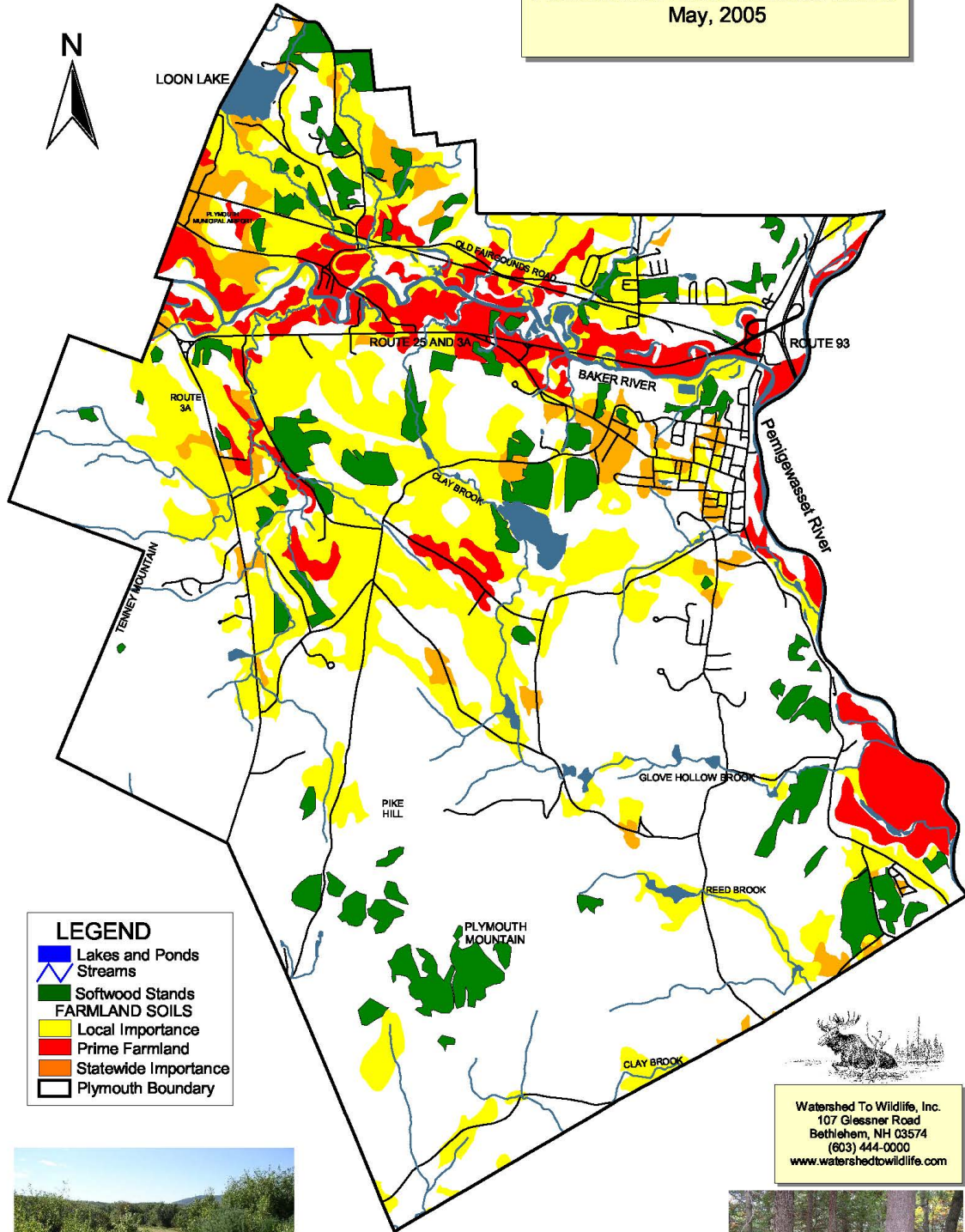
## Natural Resource Inventory for Plymouth, NH

- b. Data generated from the 1985 project should be incorporated into the existing GIS database in a compatible format.
3. Based on results from this project, there are less than average dense softwood stands in Plymouth. This suggests that maintaining the existing stands for the benefit of the deer, moose and other wildlife populations is very important.
4. The potential for a population increase throughout the Town make it wise for landowners to sustainably conserve their land, particularly along the Pemigewasset and Baker Rivers. By taking a proactive approach to deal with future development pressures, the scenic vistas and beauty will remain as impressive (or even better) tomorrow as they are today. Scenic easements are types of conservation easements that make protection of scenic resources possible.
5. It is hoped that Plymouth will continue to work with other organizations and agencies throughout the region to share future data as it becomes available. This will avoid an all-to-common problem of separate entities replicating work. Below are a couple of examples:
  - a. In 2003, the Baker River Watershed Association completed a management plan for the Baker River Watershed and incorporated that data into this project. Information from this study should be offered to the communities within the watershed.
  - b. By collaborating and sharing data with local elementary, high schools, academies, and colleges, Plymouth can continue to update its natural resource inventory. The NRCS soils office, NH Fish and Game Department, and UNH Cooperative Extension offer services to Plymouth. These agencies are examples of partners for future work.
  - c. Examples of future work include habitat transects, further wetland identification and delineation (possibly with Designated Prime Wetland options), water quality testing, monitor well sampling, and species counts.

Long-term usages of the end project include: assisting the Town and others in determining “least-impact” sites for telecommunication towers; guiding refinement of the Master Plan based on impacts of the Baker River and the Pemigewasset River corridors; empowering the Town to digitally produce “what-if” scenarios with visual plots for proposed development in the Town of Plymouth. Furthermore, the Town is in a position to request that all future development plans be delivered in digital format, which would build upon the initial database as well as update the tax maps for assessment at little cost to the Town.

# Natural Resource Inventory for Plymouth, NH

Town of Plymouth, NH  
 Natural Resource Inventory  
 Farmland and Dense Softwood Stands  
 May, 2005



**LEGEND**

- Lakes and Ponds
- Streams
- Softwood Stands
- FARMLAND SOILS**
- Local Importance
- Prime Farmland
- Statewide Importance
- Plymouth Boundary

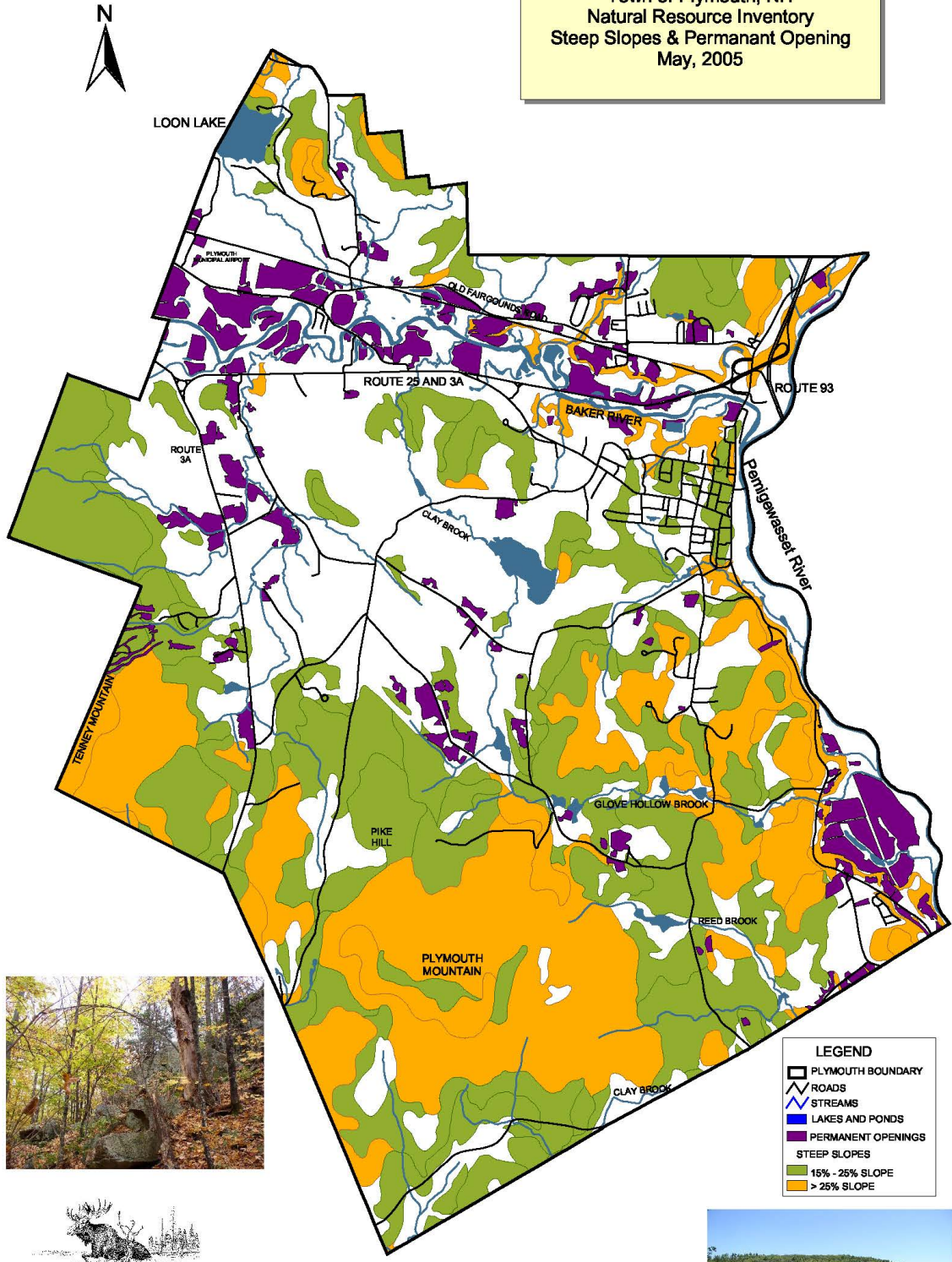
Watershed To Wildlife, Inc.  
 107 Glassner Road  
 Bethlehem, NH 03574  
 (603) 444-0000  
[www.watershedtowildlife.com](http://www.watershedtowildlife.com)





# Natural Resource Inventory for Plymouth, NH

Town of Plymouth, NH  
 Natural Resource Inventory  
 Steep Slopes & Permanent Opening  
 May, 2005



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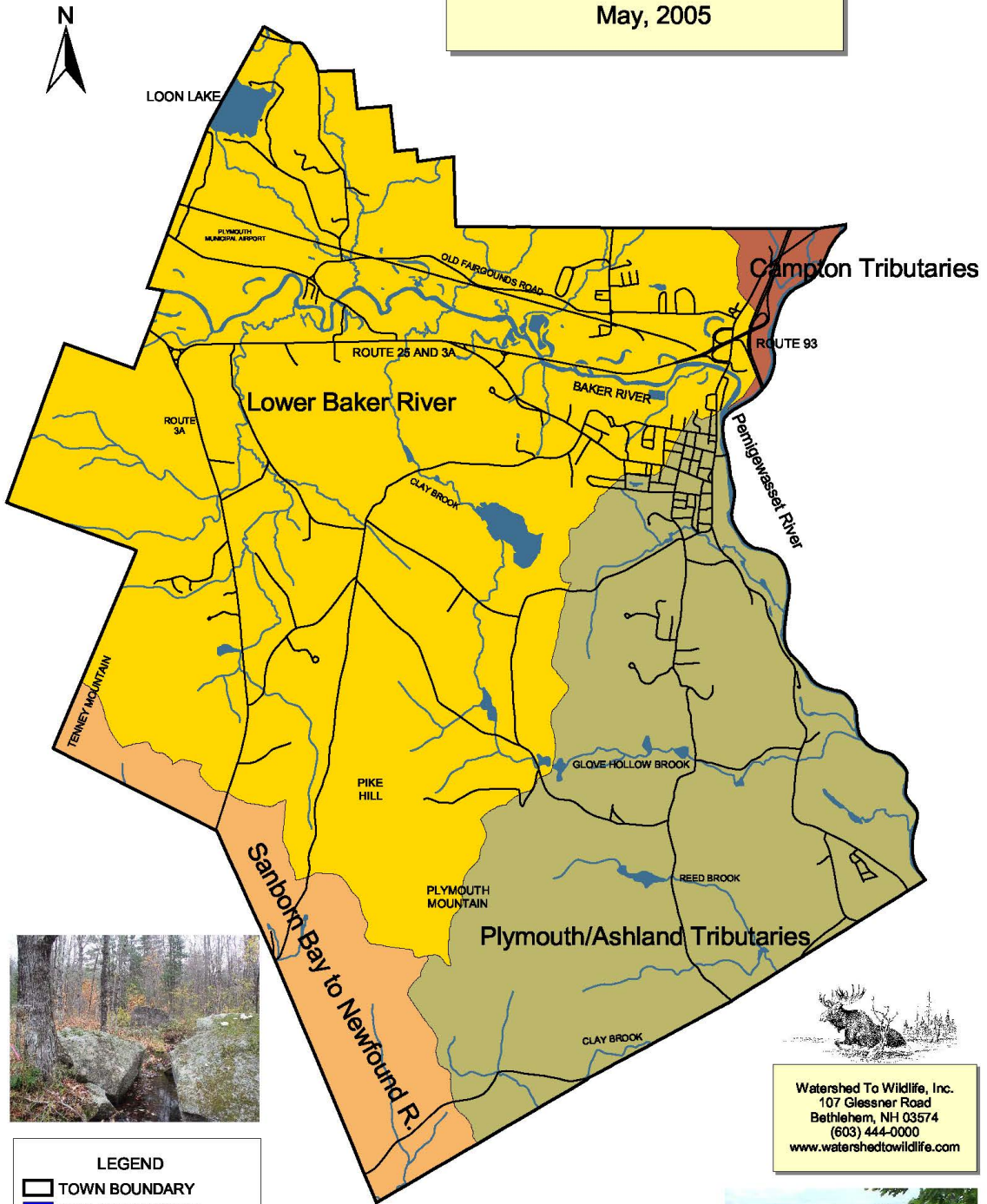
2000 0 2000 4000 Feet

- LEGEND**
- PLYMOUTH BOUNDARY
  - ROADS
  - ~ STREAMS
  - LAKES AND PONDS
  - PERMANENT OPENINGS
  - STEEP SLOPES
  - 15% - 25% SLOPE
  - > 25% SLOPE



# Natural Resource Inventory for Plymouth, NH

Town of Plymouth, NH  
 Natural Resource Inventory  
 Sub-Watersheds  
 May, 2005

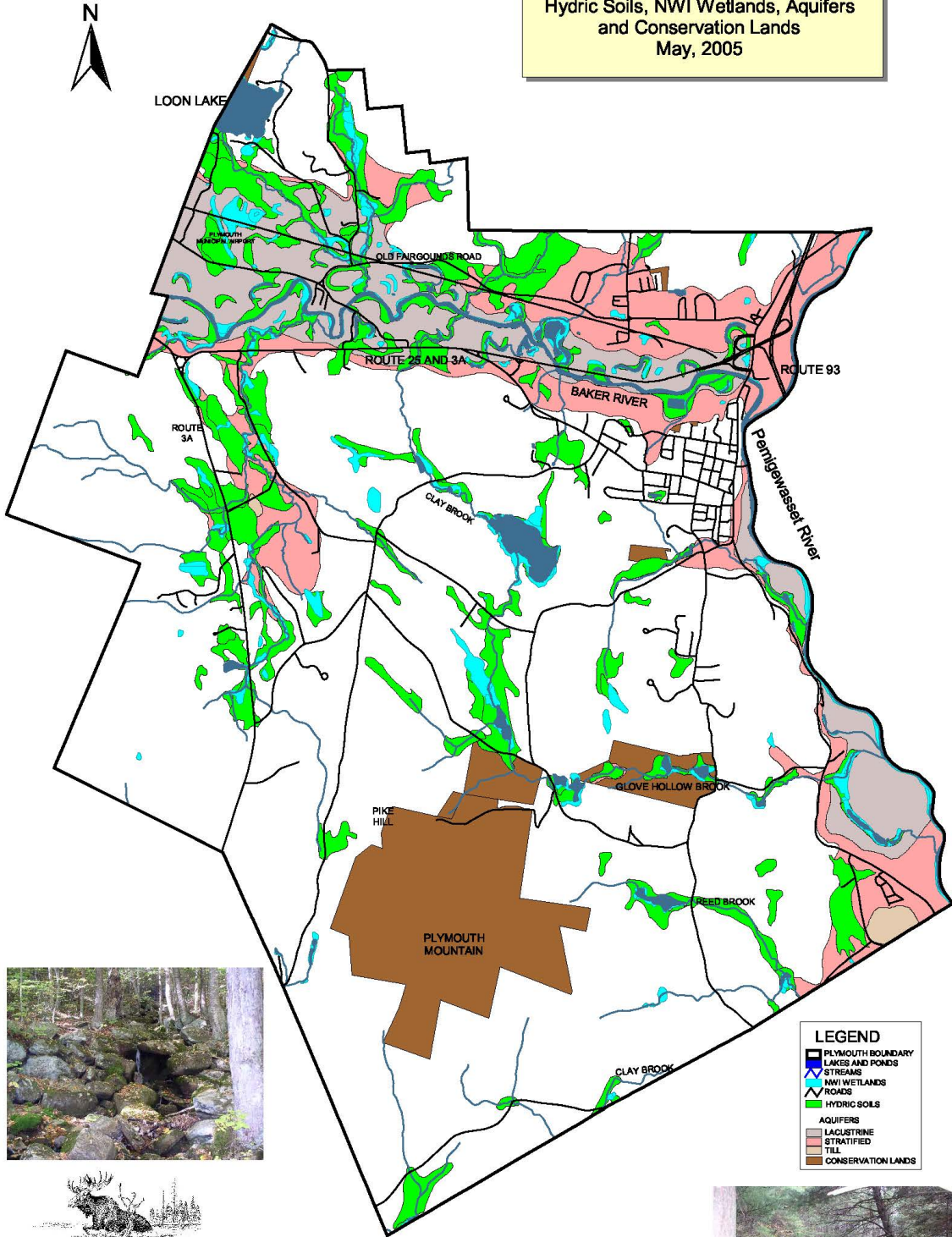


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# Natural Resource Inventory for Plymouth, NH

Town of Plymouth, NH  
 Natural Resource Inventory  
 Hydric Soils, NWI Wetlands, Aquifers  
 and Conservation Lands  
 May, 2005



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