Chapter 3
Natural Resources

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1.0 INTRODUCTION

Littleton depends heavily on its natural resources. Much of the economy, tax base, recreation, quality of life, and water supply are all primarily derived from Littleton's natural resources. The type and distribution of the Town's natural resource base influences the location and type of development within the community. The information provided in this chapter will allow the Town's people to determine compatible future uses for certain land areas. It has become evident that some areas are better suited for particular uses than others.

In February of 2003, the Littleton Conservation Commission completed a natural resources inventory with the assistance from Lobdell Associates, Inc. The intent of the *Littleton Natural Resources Inventory* is to assist the Conservation Commission and other local officials in making informed decisions about Littleton's natural resources.

This chapter of the Master Plan is based on the *Littleton Natural Resources Inventory* and examines the natural resources located in the Town of Littleton. Unlike many other area towns that have substantial portions of their land in federal or state ownership, most land in Littleton is privately owned. Thus, the future of the natural resources base is dependent on decisions that are made at the town and individual level. Littleton does not exist in isolation. It is hoped that this chapter, and the inventory it is based on, will alert residents of Littleton to the importance of the natural integrity of the entire region, and their responsibility for it.

2.0 SUMMARY OF NATURAL RESOURCE INVENTORY FINDINGS

Like so many things in nature, the pieces of Littleton make the whole. The *Littleton Natural Resource Inventory* and this master plan identify how the natural and man-made pieces fit together. This holistic approach allows us to understand how the present landscape was shaped by the past and how it may change in the future.

Some natural resource issues to consider are:

- **Littleton is part of a larger landscape,** sharing features with the broad Connecticut River Valley and White Mountains Regions. Changes in land ownership, pressure for development, increasing demands for recreation, loss and fragmentation of habitat – the problems that confront the Littleton region are the same problems that confront Littleton itself.

- **Littleton has extensive areas of undeveloped land that provide habitat for a variety of animals.** At present, many of the lands remain relatively unfragmented by roads or other developments.

- **Littleton is a desirable location for development** for many reasons which include exceptional views, the small community, the access to recreation, and the natural setting. Slope steepness and the presence of wetlands will prohibit development in some areas, but buildable land still exists. As growth from crowded urban areas to the south increases, pressures of Littleton will also increase.

- **Littleton has clean, clear water** that supports native fish, migratory birds, and residents alike. These waters are vulnerable to contamination by development, logging, septic discharge, and urban runoff among other things.

- **Wetlands occupy a relatively small percentage of Littleton's total area.** However, the existing wetland buffer flooding, control erosion, provide plant and animal habitat, etc. The wetlands identified as having high values are of particular importance, based on size and soil type. Wetlands are regulated somewhat by state and federal regulations. Local oversight is covered by the Zoning Ordinance and Subdivision Regulations.

- **Littleton's forest structure and composition is greatly changed from pre-settlement conditions.** Present-day forests are largely second and third-growth northern hardwoods.

- **Moore Reservoir offers exceptional natural and recreational opportunities.** The Town should increase its participation with the current ownership to enhance the fishery, wildlife habitat and recreational facilities.

- In New Hampshire, **State regulations exist on timber harvesting practices** such as clear cutting, herbicide treatment, monoculture plantations and high elevation cutting.

- **Soils in Littleton vary in composition but overall are poorly to moderately well suited for traditional agriculture operations.** The main deterrents to agricultural land use are steep slopes and development. The total area in use has declined sharply in the past century; many of the best agricultural land have gone out of use.

3.0 CLIMATE

New Hampshire's climate is considered moderate to cool, as is the case with many Northeastern states based on data gathered by the National Oceanic and Atmospheric Administration. Littleton's climate is largely a product of the Town's elevation, latitude, position in the Connecticut River Valley and location on the east coast of North America. Cold, dry air masses originating in sub-arctic North America and warm, moist air from the Gulf of Mexico influence the climate, resulting in relatively cold winters and moderate summers. Littleton generally has its hottest temperature in July and the coldest in January. Highest recorded temperature was 95 degrees and the lowest minus 34 degrees. The coldest mean temperature year was 1989 and the warmest 1994.

Precipitation is rather evenly distributed through the year. In the warmer part of the year, rainfall comes from showers and thunderstorms which frequently accompany the passage of frontal system. Frontal precipitation in the colder season is occasionally supplemented by coastal "northeasters" which can bring heavy snowfalls. Over the past 30 years June, July, and August have been the wettest months, often the result of heavy thunderstorms. But precipitation can have extreme variations. For example, in August of 1957 only 0.57 inches of rain was recorded compared to 1962 when 8.66 inches was observed. The greatest amount of snow falls in December, but it snows at least one inch on average 30 days per year. With regard to growing season, it averages 122 days with a 50% chance that the last frost will occur before May 25th and a 50% chance the first frost will be after September 23rd. It should be noted here that the precipitation is measured in liquid inches and includes the snowfall in liquid equivalent.

3.1 Land Use Implications and Potential Actions

Land Use Implications

Littleton's climate has a direct impact on the landscape. Here are a few items to consider related to the climate in Littleton:

1) With precipitation distributed evenly throughout the year, Littleton has the ability to replenish its many lakes, ponds, streams and aquifers. This sustains the health of the surface waters and recharges groundwater reserves.

2) The variety of seasons contributes to the character of the area and the variety of recreational and economic activities available. Air pollution threatens the character of our seasons, and the quality of our water. Recognition of the role local activities have on the global problem of climate change will help to preserve these distinct seasons and the industries and character they support.

3) Snow storage or "dumping" in sensitive areas can have a negative impact on the natural systems in Littleton. Snow removed from streets and parking areas should be stored away from wetlands and water bodies. This will allow for a higher rate of filtering out of pollutants and infiltration of water as it melts.

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the impact of the climate on Littleton and the land use implications. This section will be used to identify the specific actions for Littleton to take upon completion of the Master Plan.

1) Encourage dealerships specializing in low emission vehicles to locate in Littleton.

2) Pursue the use of alternative fuels in town vehicles and the school but fleet.

3) Encourage carpooling and alternative modes of transportation (biking, walking, public transportation) to reduce automobile emissions in the region.

4.0 TOPOGRAPHY

Topography describes surface features of the land in terms of shape, relief and relative positions of natural features. Topography is usually expressed as elevation (height above sea level) and slope (change in vertical distance over horizontal distance).

Topography affects several natural processes, such as climate, drainage, erosion, wind patterns and vegetative growth, in turn affecting man's activities. Valleys act as transportation corridors which traditionally influences development patterns. This is evidenced by Littleton's greatest settlement in the Ammonoosuc River Valley.

Elevations in Littleton are greater on the east side of town than the west. The Town ranges in elevation from 650 feet above sea level at Fifteen Mile Falls on the Connecticut River as it flows out of town to 2,240 feet at the summit of Town's Mountain north of the village (see Table 3A). Littleton village itself lies at a general elevation of 800 feet.

Low-lying river valleys cover approximately 60 percent of the Town. These are about 1,200 feet above sea level and lower. The shape of the valleys generally follows a pattern similar to that of the major rivers associated with each: the Connecticut and Ammonoosuc.

High peaks are more prevalent in the eastern part of Town. An elongated range is present to the far east comprised of Town's Mountain and Mann Hill. Nearby are a number of high peaks in a crescent form; these include Parker Mountain and Wheeler and Farr Hills. A finite number of lower hills occur at Littleton's western end; Mining Hill and Albee Hill are examples. Slightly higher land is located west of Littleton village; Slate Ledge and Walker Mountain make up this are which is oriented generally in a north-south direction. Mt. Eustis is a relatively prominent hill which exists south of the village.

Table 3A Topographic Features of Littleton

Location	Elevation (in feet)
Towns Mountain	2,240
Mann Hill	2,141
Mount Misery	1,980
Main Street	830
Farr Hill	1,930
Parker Mountain	1,910
Walker Mountain	1,802
Slate Ledge	1,667
Mining Hill	1,380
Eustis Hill	1,371
Albee Hill	1,260
Reynolds Pond	1,041
Partridge Lake	846
Ammonoosuc River	680-840
Connecticut River	650-780

4.1 Land Use Implications and Potential Actions

Land Use Implications

Littleton's topography plays a major role in the location and impact of future development in Town. Here are a few items to consider related to Littleton's topography:

1) River valleys cover approximately 60% of the community, and are often the easiest areas to develop. These areas also contain all of the floodplain areas, most of the surface water bodies, and critical wetlands. Minimizing the impact of development in these areas is critical.

2) Development at higher elevations on the high peaks and lower hills in Littleton presents a different set of challenges and impacts. Without thoughtful site design these areas can greatly impact the scenic character of the community and disrupt scenic views. Access to these areas also provides an opportunity for increased environmental impacts (erosion, increased runoff rates, longer roadways, and fragmentation of habitat to name a few).

3) The variety of topography within Littleton contributes to wildlife habitat and recreational opportunities. Ensuring connections between these distinct areas will ensure the continued health of the organisms using them.

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the topography in Littleton and its land use implications. This section will be used to identify the specific actions for Littleton to take upon completion of the Master Plan.

1) Consider site plan review regulations to aid in design, and reduce the impact of development in sensitive areas.

2) Consider a ridgeline development ordinance to limit the impact of developments at higher elevations.

3) Pursue land protection opportunities that create corridors of contiguous open space.

5.0 SLOPE

Slope is the amount of rise or fall in feet for a given horizontal distance and is expressed in percent. A 6% slope means that for a 100 foot horizontal distance the rise or fall in height is 6 feet. Given Littleton's location within a mountainous terrain, slopes of greater than 25% exist on the sides of some hills and slopes of 8 – 15% are the majority in the Town. (see Map 4.1 in the Littleton Natural Resources Inventory). The slope of the land can have a great effect on development and percent slope can greatly impact the economic and physical feasibility of development. The steeper the slope, the more it will cost for septic systems, driveways, foundations, etc. Additionally, as the slope increases so does the potential for an increase in erosion, stormwater runoff, and nutrient movement. Poor soil conditions combined with steep slopes can present significant development constraints.

Slopes in Littleton have been placed into five categories: 0-3%, 308%, 8-15%, 15-25%, and greater than 25%. Generally, slopes over 25% are considered undevelopable. Slopes between 15 and 25 percent are difficult and costly to develop. Slopes under 15% are considered optimal for development.

5.1 Land Use Implications and Potential Actions

Land Use Implications

Slopes within Littleton also play a major role in the location and impact of future development in Town. Here are a few items to consider related to slopes in Littleton:

1) The majority of Littleton is covered in slopes of 8-15% which are considered optimal for development. This will have an effect on the future development pattern of the community.

2) As steeper slopes are developed costs increase for both the property owner and the community. Construction and maintenance of roads becomes more costly on steeper slopes. Problems with erosion, stormwater runoff, and non-point pollution are also increased.

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the topography in Littleton and its land use implications. This section will be used to identify the specific actions for Littleton to take upon completion of the Master Plan.

1) Consider site plan review regulations to aid in design, and reduce the impact of development on steep slopes.

2) Consider strengthening regulations relative to erosion and sediment control.

3) Consider adoption of a steep slope ordinance.

6.0 GEOLOGY

6.1 Bedrock Geology

Littleton is located in the middle of complex bedrock formations of granite and granodiorite rock. Granodiorite differs very little from granite in composition and appearance. Both of these plutonic rocks were formed during the Taconic orogeny (mountain building event) that occurred on the order of 345 million years ago. Other formations exist including metasedimentary rock (such as schist and gneiss) along the Connecticut River.

Two inactive fault lines cross into Littleton. A fault is a crack in the earth's surface layer along which there is movement. This movement along fault lines is the cause of earthquakes. Littleton's two faults are not currently active and pose little threat to the population of Littleton. Earthquakes have been recorded in Littleton, but they have been minor.

There are some earth-mineral resources present in the bedrock of Littleton due to its geologic history. At this time, none of them are economically valuable or abundant enough to be mined.

6.2 Surficial Geology

Surficial geology is concerned with those materials above bedrock. The surface layer of weathered material, soil, is not included in the study of surficial geology. Surficial deposits are unconsolidated, loose conglomerations of rock fragments.

Surficial deposits in Littleton are glacial in origin. As the climate warmed and the ice retreated, it deposited two major types of material – till and glacial outwash deposits. Till is composed of a mixture of soil and rock fragments that were scoured loose by the moving ice, carried for a distance, and then deposited. It is generally highly compacted and contains many large angular stones and boulders. Glacial melt waters also caused outwash deposits. They are the stratified sand and gravel deposits. Outwash deposits are important economically for mining purposes, but they also serve as major groundwater-recharge areas.

6.3 Land Use Implications and Potential Actions

Land Use Implications

Littleton's geology has an effect on land use decisions and impacts future development in Town. Here are a few items to consider related to the geology in Littleton:

1) The use of outwash deposits in commercial sand and gravel operations could alter the performance of these areas as ground water recharge areas. As material is removed and the geology is altered, water will not be filtered and stored in the same manner. This could result in a reduction in the amount of water available to future generation.

2) The impacts of sand and gravel operations are often also cited as concerns. Increased truck traffic, noise, erosion, and airborne particles often create problems for abutters and should be mitigated.

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the geology in Littleton and its land use implications. This section will be used to identify the specific actions for Littleton to take upon completion of the Master Plan.

1) Using RSA 155:E, determine if further local regulations are needed.

7.0 SOILS

With the retreat of the last glacier, the climate warmed and plan and animal life gradually returned to the region. The rock debris deposited by the glacier was weathered and eroded. Organic matter from dead and decaying plants and animals was added to this mineral material and with the passing of time, soil was formed.

Soil is that part of the surface of the earth that supports plants, animals, and humans. There are over 1,000 different soils in the Northeast with over 70 of them represented in Littleton. Soils information is an intricate part of a natural resources analysis because it provides a wealth of data concerning the capability of land to support various land uses. Soils differ from one another in their physical, chemical and biological properties. Soil properties which affect its capability include depth, permeability, wetness, slope, susceptibility to erosion, flood hazard, stoniness, etc.

7.1 The Soil Survey

Soil scientists from the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) collected the soil information for Littleton. As they walked over the land, they sampled the soil to depths of 40 inches or more and each soil was examined for characteristics such as color, texture, structure, etc. From this information, lines were drawn on aerial photographs outlining the boundaries of the different soils. Numbers were placed within each mapping unit to identify the type of soil found. Map E, in Appendix 1, shows the variety of soil types and complexity of soil positions on the landscape.

One important note in using a soils map is that changes from one soil to another are not usually abrupt, but are gradual. Thus, the line on the map represents a transition zone rather than an absolute boundary. Because of the scale of the map, mapping units are not 100% pure. On-site soil investigations are necessary for determining exact soil boundaries.

Soil Condition Groups

The over 70 soil mapping unit soils found in Littleton can be broken down into seven natural categories or groups:

<u>Group 1 – Wetland Soils</u>
These are poorly and very poorly drained soils that are wet most of the year. The water table is at or near the surface 7 to 12 months of the year. See Chapter 3, section 9, on wetlands in Littleton.

Group 2 – Seasonally – Wet Soils
Included in this group are moderately well-drained soils that have a water table of 1 to 1 ½ feet below the ground and where the soil is wet from late fall to late spring.

Group 3 – Floodplain Soils
These soils are subject to periodic flooding. Their formation has been the result of sediment deposited from past floodwaters. The areas of flood plain soils are concentrated in small areas along the Ammonoosuc River.

Group 4 – Sand and Gravelly Soils
These well drained to excessively well-drained soils are formed in sand and gravel deposits. This group often has economic and is found within aquifer areas.

Group 5 – Shallow to Bedrock Soils
This group of shallow to bedrock soils is the dominant soil type in Littleton. These soils have formed on a thin layer of glacial till which is underlain by bedrock. Steep slopes with exposed bedrock are common in some of these soils.

Group 6 – Compact Till Soils
The soils in this group are well drained and have formed in compact glacial till. A hardpan layer is generally found about 2-3 feet below the ground surface. Water moves down-slope on these soils over the hardpan layer and comes to the surface as seep spots.

Group 7 – Deep Loose Till Soils
This group consists of well-drained sands or loamy soils that have formed in glacial till. The water table is commonly more than four feet below the ground and bedrock is more than 5 feet below the surface. The soils contain many angular stones of varying sizes.

7.2 Land Capability and Lot Size

Each soil-mapping unit found in New Hampshire has been rated for its ability to support a residential or commercial lot, based on a formula that has water quality as its primary concern. Potential pollution sources considered where septic systems, lawns, and impermeable surfaces. The assessment of suitability was based on a report by the NHDES entitled "Environmental Planning For Onsite Wastewater Treatment in NH". The formula, which uses nitrogen loading as its benchmark for pollution, was applied to each soil type and a minimum soil based lot size was determined for each mapping unit. Table 5.2 in the Natural Resources Inventory lists the soil mapping units found in Littleton and the recommended minimum lot size. Lots on the best soils that are capable of utilizing the most nutrients onsite, require a 35,500 square foot lot, which is the minimum. As the soils decrease in their ability to utilize nitrogen, the lot sizes increase.

7.3 Land Use Implications and Potential Actions

Land Use Implications

The soils within Littleton play a major role in the location and impact of future development in the community. Here are a few items to consider related to soils in Littleton:

1) soil characteristics such as depth, permeability, wetness, and slope can be used to evaluate land to determine development suitability and dwelling unit densities.

2) Locating new development in areas without water and sewer infrastructure requires taking a much closer look at the ability of the soils on the lot to handle a well and septic system discharge. Soil information should be used as a determinant of what constitutes an environmentally sound building lot to prevent degradation of the environment and negative impacts on abutting property owners.

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the soils in Littleton and their land use implications. This section will be used to identify the specific actions for Littleton to take upon completing of the Master Plan.

1) Base lot sizes in the rural areas of town (not served by water and sewer) on land capability, taking into consideration the current soil based lot-size regulations.

2) Evaluate future sewer and water line extensions on the land capability of the area being included and the desired development pattern.

8.0 WATER RESOURCES

Water is our most precious natural resource. Water moves continuously in an inter-dependent fashion known as the water cycle. All water is involved in this cyclical movement that continues indefinitely. With increased land use and human activity, the water cycle can become damaged. Humans not only take water out of the cycle (drinking water, for example) but can also put polluted water back into the cycle (such as acid rain). However, with good planning and conservation, plentiful clean water should be available for all uses.

8.1 Watersheds

Surface water is precipitation that does not soak into the ground but runs off into streams, ponds, lakes, and rivers. On the average, 1/3 of the annual precipitation is "runoff". Littleton has an abundance of surface water that provides great recreational and economic benefits to the town.

Watersheds are the catch basins for all precipitation falling from the sky. Rain or snow falling within the confines of a watershed's interconnected ridge crests or high points eventually becomes surface and groundwater.

A watershed is usually associated with a particular river or stream that it feeds. For example, the Ammonoosuc River drains the eastern part of Littleton, to the Connecticut River in Woodsville. Each tributary to the Ammonoosuc, such as Dells Brook, has a subwatershed of its own. While groundwater flows may follow the same watershed boundaries, it is not assured and determining accurate groundwater flow can be an expensive and difficult task.

Watershed location is very important for a community to consider in its planning efforts. Quite often a particular watershed lies entirely within a single community, while larger watersheds almost never do. The larger the watershed, the greater the possibility that some part of it will lie in one or more neighboring communities. Water resources management in a community up-watershed may have a substantial impact on the water resources of a neighboring community down-watershed. The watershed approach to water resources planning is important because watersheds are the main units of surface and groundwater recharge. The size and physical character of the watershed has a large influence on the amount of water that ultimately will end up as surface water and groundwater. Land use within a watershed may be an important factor in water quality, therefore, it is very important for communities to work together in order to plan effectively for protection of water resources.

Littleton is all within the Connecticut River Watershed. The western portion of town drains directly into the Connecticut River, while the remainder of the town drains into the Ammonoosuc River, with Walker Mountain, Wheeler Hill, Parker Hill and Mann's Hill forming the drainage divide from south to north. Littleton is divided into 7 subwatersheds, the boundaries of which are shown on Figure 3C. Subwatersheds #2, 3, 4, and 5 drain into the Ammonoosuc from the west side of town and watershed #6 from the east side. Watershed #1 drains directly into the Connecticut via a series of small streams.

Watershed #7 is the portion of the Partridge Lake watershed that is in Littleton, draining towards the Ammonoosuc.

The Connecticut River is one of the major water bodies of New England. The river is 410 miles long and drains 11,260 square miles of land in four states and the Province of Quebec. It is used for transportation, logging, fishing, hydropower, drinking water, irrigation, industrial uses, and recreational activities of all kinds. The headwaters of the Connecticut are located in a small boggy lake in Pittsburgh, New Hampshire, known as the Fourth Connecticut Lake. It flows south to become the border between New Hampshire and Vermont and flows through Massachusetts and Connecticut to empty into Long Island Sound at Old Saybrook Connecticut. In Littleton, the river forms the entire western boundary of the town, about 16 miles, and has drainage areas of over 1,600 square miles, with the State of Vermont on the opposite shore. The entire section is part of the Fifteen-Mile Falls Hydroelectric project and consists of Moore Reservoir and Moore Dam as well as Comerford Reservoir and Comerford Dam, the dam being in Monroe.

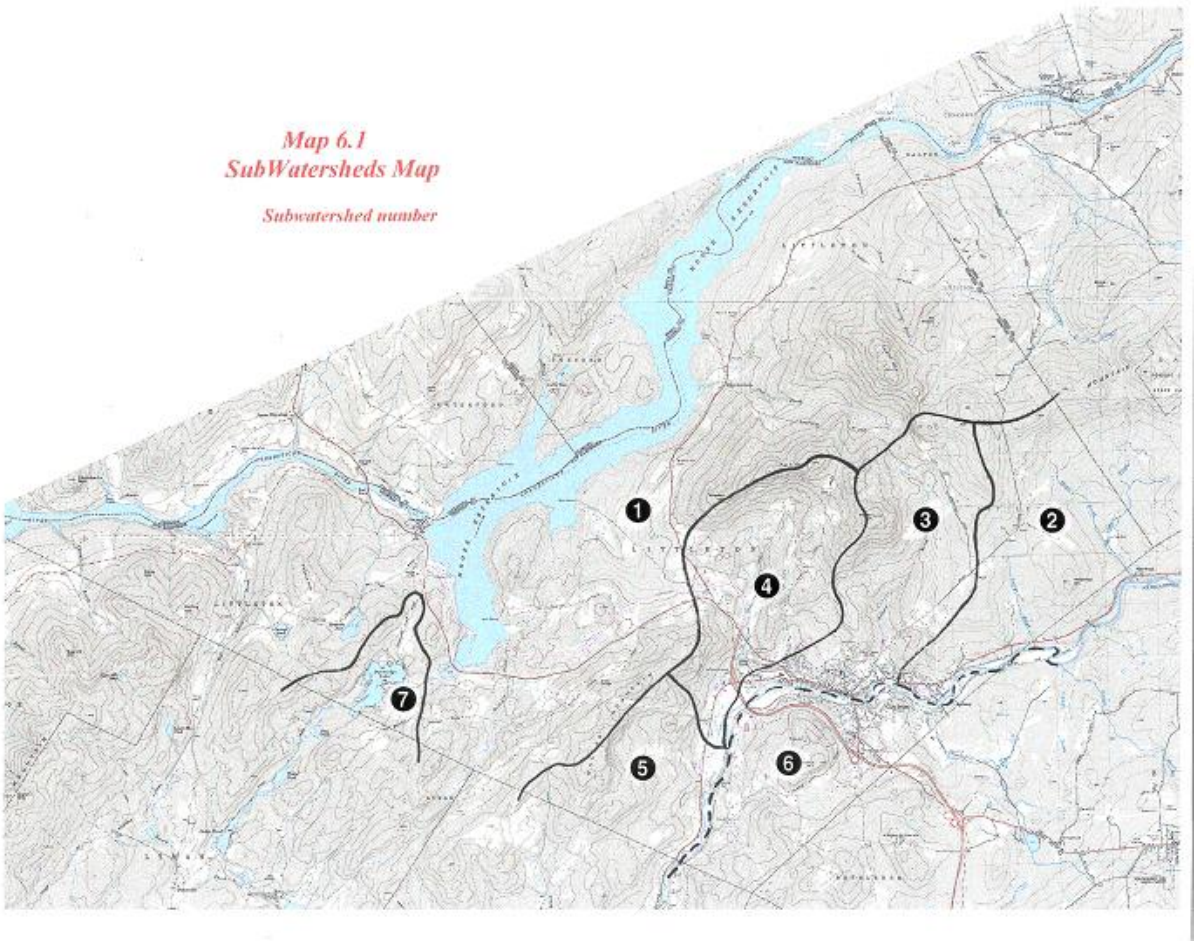
The Ammonoosuc River is a 395 square mile subwatershed of the Connecticut River, as shown in Table 3C, #2-7, and Figure 3D. The Ammonoosuc River is 55 miles long, starting at the Lake of the Clouds on Mt. Washington and flowing southwest until it flows into the Connecticut River in Woodsville. Approximately six miles of the river flow through Littleton. The river is a fast flowing mountain stream with a wide fluctuation in the flows. Peak flows of over 10,000 cfs have been measured at the nearest USGS gauging station in Bethlehem, while a 7-day; 10-year low flow average is only 26.9 cfs. The Ammonoosuc River is a 4th Order stream and thus comes under the rules of the NH Shoreland Protection Act.

Map C Appendix 1, Table 3B, and Figure 3C summarize the 7 subwatersheds in Littleton, with the extent in Littleton shown

Table 3B Littleton Subwatersheds

Subwatershed	Drains To	Extent in Littleton (acres)
1 – Connecticut River	Connecticut	21,380
2 – Fowler/Alder Brooks	Ammonoosuc	2,451
3 – Palmer Brook	Ammonoosuc	2,207
4 – Dells	Ammonoosuc	2,720
5 – Lower Meadows	Ammonoosuc	2,052
6 – Eastern Side	Ammonoosuc	2,784
7 – Partridge	Ammonoosuc	646

Figure 3C Littleton Subwatersheds



In 1992, the Connecticut River was designated under the New Hampshire Rivers Management and Protection Program. The section of the river in Littleton is part of the so-called “Riverbend” section, which encompasses 70 miles of the river from Lancaster to Haverhill. A Riverbend Advisory Committee, made up of residents from both Vermont and New Hampshire meets regularly and has developed a River Corridor Plan with a number of watershed protection recommendations. The watershed has also been designated a wildlife refuge by the federal government and is called the Conte Wildlife Refuge, managed by the US Fish and Wildlife Service. In 1992, they developed a management plan for the river, as well. Additionally, the river received American Heritage River designation on July 30, 1998, one of just 14 rivers honored nationwide. The designation is the result of a valley-wide nominating effort lead by the Connecticut River Watershed Council and supported by over 250 communities, institutions, the Congressional delegation, and governors of the four watershed states. In 2007, the Ammonoosuc River was also designated under the New Hampshire Rivers Management and Protection Program.

8.2 SURFACE WATER

LAKES AND PONDS

Littleton has four lakes or ponds within its borders that are considered “Great Ponds”, over 10 acres in size. They are Moore Reservoir, Partridge Lake, Reynolds Pond, and Comerford Reservoir. Table 6.3 in the Natural Resources Inventory describes some physical characteristics of the surface waters in Littleton, as described by NH DES. Please note that there is no difference between the term “lake” and “pond”. These waterbodies are subject to the New Hampshire Shoreland Protection Act which regulates activities within the Shoreland area and enforceable by the Town and NH DES.

Fifteen Mile Falls

Moore and Comerford Reservoirs are part of the Fifteen Mile Falls Hydroelectric Project, which also includes the McIndoe Falls Reservoir and stretches some 15 miles on the Connecticut River from Monroe to Dalton. The three reservoirs and their dams are owned and operated by TransCanada. Associated transmission lines are still owned by New England Power Pool (NEPOOL), a volunteer organization of 100 electric utilities which coordinates power distribution throughout New England. The three facilities known as Fifteen-Mile Falls have the capability of producing 369 MW of power. The power is used to meet peak period demands and avoid the need to operate other fossil fuel generating units elsewhere on the grid. The Moore facility is the largest of the three and is the only one that can be used to significantly mitigate downstream flooding.

Moore Reservoir

Moore Reservoir is the largest body of water in Littleton and is the upper impoundment of the three dams that make up the Fifteen Mile Falls project. Other towns on the reservoir include Dalton, NH and Waterford and Concord, Vermont. The reservoir stretches eleven miles upstream of the 178-foot high dam which is located just upstream of the Route 18 Bridge. The reservoir has a surface area of 3,490 acres at normal maximum operating level (elevation 809) and a total impoundment storage of 223,722 acre feet, but normally at about 114,000 acre feet. The reservoir level can be dropped 30-40 feet and is usually brought down to its minimum in early spring to handle the spring runoff to mitigate flood damage downstream. The average depth of the reservoir is 59 feet with a maximum depth of about 150 feet. Land use around the reservoir is primarily forested, since TransCanada owns nearly all of the land along the shore.

Comerford Reservoir

Comerford Reservoir is the second largest body of water in Littleton and is the middle impoundment of the three dams that make up the Fifteen Mile Falls project. Other towns along its shores include Monroe NH, and Barnett and Waterford, VT. The reservoir stretches eight miles upstream of the 170-foot high dam which is located in Monroe about one mile downstream of the Monroe/Littleton town line. The reservoir has a surface area of 1,093 acres at normal maximum operating level (elevation 650) and a total impoundment storage of 32,270 acre feet, but normally at about 6,265 acre feet. The reservoir level can be dropped about 15 feet and is usually brought down to its minimum in early spring to handle the spring runoff to mitigate flood damage downstream. Land use around the reservoir is primarily forested but includes residential and agricultural uses as well since most of the land is privately owned.

USGen New England, the owners of the three hydro dams in the Fifteen Mile Falls area, have recently received a renewed license to operate the hydrodams from the Federal Energy Regulatory Commission (FERC), which included obtaining water quality certification under Section 401 of the Clean Water Act from both Vermont and New Hampshire. This segment of the Connecticut River in Littleton has been designated by the NH Legislature as Class B waters, meaning it is acceptable for fishing, swimming and other recreation purposes.

Upper Connecticut River Mitigation and Enhancement Fund

The Upper Connecticut River Mitigation and Enhancement Fund was set up in a settlement agreement for the re-licensing of the Fifteen Mile Falls (FMF) hydroelectric facilities. In 2002 a new federal operating license was issued, which upheld the terms of the earlier settlement agreement and included the concept of a Mitigation and Enhancement Fund. The fund is set up by annual contributions from the owner of the Fifteen Mile Falls project, with amounts related to the income derived from operating the dams. A minimum of $7.5 million over 15 years will be available. The purpose of the fund is to provide financial assistance to projects, activities, and endeavors that will restore, protect, and/or enhance the river ecosystem affected by the FMF hydroelectric project, or that will serve as mitigation for some of the impacts of the project.

The fund is available for projects within the Connecticut River watershed north of White River Junction. Eligible applicants include non-profit organizations, community organizations, educational institutions, and federal, state, and local government agencies. The grant decisions are made once a year in the fall.

Partridge Lake

Partridge Lake is located at an elevation of 846 feet in the south-central portion of Littleton along the Lyman town line. It drains to the south via Ogontz Lake and Ogontz Brook to the Ammonoosuc River in Lisbon. It is a natural pond with a small dam, which is actually located in Lyman. The 105 acre lake, of which about 100 acres is in Littleton, is heavily developed with over 70 seasonal homes and camps, many of which have been converted to year round use.

Reynolds Pond

Located about one-half mile northeast of Partridge Lake, Reynolds Pond is a very small body of water with a shallow depth and mucky bottom. With a small watershed, it is a natural pond with a small dam. Reynolds Brook flows to the north directly into the Connecticut River, entering at the Comerford boat launch.

Lake Water Quality

The New Hampshire Department of Environmental Services measures water quality in Moore Reservoir, Partridge Lake, and Reynolds Pond. Table 6.4 in the Natural Resources Inventory summarizes the water quality data for these lakes. Data for the Comerford Reservoir is no currently available.

Lake Trophic Levels

Lakes act as receptacles for sediment and nutrients carried into them from the surrounding watershed. Thus lakes go through a natural aging process called eutrophication. Eutrophication describes the nutrient levels present and the natural aging process of lakes. This is important because the more eutrophic a lake is the less likely it is to be useful for recreation, fish habitat, and other uses.

The NH DES has classified most of the lakes in New Hampshire relative to trophic state. All the lakes in the state are classified into one of three classes: oligotrophic, mesotrophic, and eutrophic. The water body with the clearest water and least algae problems is oligotrophic; the one with the most weed problems and murkiest water is eutrophic. Eutrophic lakes can experience algae blooms and summer fish kills. Lakes in Littleton are currently classified as either oligotrophic or mesotrophic.

Moore Reservoir has made tremendous progress in the past 25 years relative to its trophic level. In 1979, the reservoir was classified as eutrophic due to high algae levels and low dissolved oxygen. However, in the 1993 survey by NHDES, it jumped from eutrophic to oligotrophic. Improved wastewater treatment at municipal and industrial point pollution discharges upstream have been the cause of this dramatic water quality improvement, according to NHDES.

One other factor important to lake trophic levels is the flushing rate. This is defined as the number of times a volume of water equal to the lake's volume of water passes through the lake. Table 6.7 in the Natural Resources Inventory shows volume and flushing rates for Littleton's water bodies.

Streams & Brooks

In Littleton there are over 50 miles of permanent streams. Streams are classified by the State using the Strahler method, where the highest year round streams in a watershed are first order streams, their juncture yields a second order stream, the juncture of two second order streams yield a third order and the junction of third order streams yield a fourth order. A listing of fourth order streams and higher is prepared and maintained by the New Hampshire Office of State Planning and Energy Programs, in Littleton this includes the Connecticut and Ammonoosuc Rivers.

Stream Water Quality

Water quality problems in the Connecticut and Ammonoosuc Rivers dates back to before 1900 when sewage, industrial waste, and other pollutants were dumped directly into the river. In the early 1970's, water quality in both the Connecticut and Ammonoosuc were below state standards for a Class B (swimmable and fishable) surface water, with bacteria and pollutants present. After the passage of the Clean Water Act in 1971, the federal and state government spent a substantial amount of money to upgrade municipal sewage treatment plants and other point sources of pollution during the 1970's and 80's. Today, while the rivers do meet the limited Class B standards (see Figure 6.7 in the Natural Resources Inventory); there are still water quality issues. However, The Ammonoosuc River water quality is tested approximately six times a year. The results are available on the NHDES website.

Overall, the water quality has improved greatly over the past 25 years. Bacteria levels are generally down with only two of 22 samplings in the Connecticut River exceeding the Class B standard. All of the dissolved oxygen levels (important to cold water fisheries) were excellent. However, the NHDES water samples in the Ammonoosuc raise concerns with some indicators including conductivity, e-coli bacteria, phosphorous and some metals exceeding standards or aquatic guidelines for streams, which could lead to a lowering of the water quality classification from B back to C if the numbers rise.

Floodplains

Floods are a natural and normal occurrence in an area of high rainfall. During normal stream flow, water is carried in a river channel. But in times of high runoff, water rises over the banks and flows onto the floodplain. Floods only become a problem when man competes with nature for use of the land.

According to the Flood Insurance Rate Map for Littleton, prepared by the Federal Emergency Management Agency, there are a few areas of Littleton within the 100-year flood plain. These floodplain areas are mostly along the Ammonoosuc River (see Figure 6.8 in the Natural Resources Inventory). A 100-year floodplain is an area that has a 1% chance of flooding in any given year.

Dams

In the State of New Hampshire there are over 4,400 dams registered with the Department of Environmental Services. Twenty-eight of these are in the town of Littleton.

The most significant dams are Moore Dam on the Connecticut and the Apthorp on the Ammonoosuc. Many dams are inactive, meaning they no longer impound water. There are six of these on the Ammonoosuc, including some old timber and old stone dams that are barely visible. The majority of Littleton dams are small, privately owned dams that serve recreational, fire prevention, or farm-related purposes.

8.3 Water Supply

Aquifers

An aquifer represents a three dimensional area of earth materials that is saturated and from which water can be drawn. An aquifer can be composed of three different materials; sorted sand and gravel (called a stratified drift aquifer), glacial till (called a till aquifer) and fractured bedrock (called a bedrock aquifer). The amount of water that can be drained from an aquifer is a direct function of its porosity, of the space between the materials that makes up the aquifer. Therefore, the least consolidated type of aquifer, glacial till, will yield the most water.

Littleton's aquifers are stratified drift aquifers meaning they are made up of sorted sand and gravel. This type of aquifer yields substantially more water than bedrock.

There are three main aquifers in Littleton identified in the report "Geohydrology and Water Quality of Stratified Drift Aquifers in the Middle Connecticut River Basins, West Central New Hampshire", all of which have relatively low transmissions and are therefore not considered high yielding:

- Monroe II Aquifer – Located mostly in Monroe, it lies along the Connecticut River. Only a small portion of it is in Littleton.

- Littleton Esker Aquifer – Located on an island at the southern-most end of Moore Reservoir. It was test drilled by the town as a potential water source and was found to have over 70 feet of saturated thickness. It is not extensive.

- Salmon Hole Aquifer – Located along the Ammonoosuc River in Lisbon and Littleton, with its thickness and potential yields reduced from Salmon Hole north of Littleton

See Map D, Appendix 1,for the locations of the aquifers and the complete USGS report for more information.

Wells

There is municipal water serving much of Littleton's population; however some businesses and many residents rely on drilled or dug wells for their water supply. Since 1984, every well drilled in New Hampshire must be reported to the New Hampshire Department of Environmental Services (NHDES). Of the 243 wells reported in the town of Littleton to NHDES, 207 were drilled as new wells with about 36 of them drilled as replacement for an existing well. Wells in Littleton range in depth from 100' to 720' with the vast majority drilled in bedrock. A bedrock well makes use of a bedrock aquifer. A well drilled into a bedrock aquifer will be constantly filled with water that flows through cracks. A gravel aquifer is more porous and a well drilled into such an aquifer would yield more water than one drilled into a bedrock aquifer. Only four wells listed on the NHDES database are drilled in gravel.

There are several uses of wells in Littleton: domestic (serving one household); community (serving 25 or more persons); commercial or industrial, and agricultural. The majority of the wells in Littleton are domestic. In 2004, there were five wells that are used for municipal or commercial / industrial purposes, and there is one well that was drilled for agricultural purposes. There is a wellhead protection area for the Town well located on Broomstick Road.

It should be noted that according to the NHDES Water Division, the NHDES well database is known to be incomplete. The NHDES estimates that it contains only an estimated 80% of wells drilled after 1984, even though those who drill wells (individual citizens, contractors) are required to report their activity.

8.4 Land Use Implications and Potential Actions

Land Use Implications

The water resources within Littleton are abundant. Their protection will insure a healthy supply of potable water, healthy fisheries, recreation opportunities, and other benefits. Here are a few items to consider related to water resources in Littleton:

1) There is a direct correlation between activity within the watershed and the quality of lakes and ponds that are fed by those watersheds. All of the activities taking place on land will eventually impact both surface and ground water. This refers to both quality and quantity of groundwater. Mismanagement in the watershed will adversely affect the water bodies below.

2) Minimizing the amount of pollutants entering Littleton's waters will help avoid expensive future expenditures to treat and clean these waters.

3) Minimizing impervious surfaces in groundwater recharge areas will preserve the volume of the local water supply being stored as groundwater and in surface water bodies.

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the water resources in Littleton and their land use implications. This section will be used to identify the specific actions for Littleton to take upon completion of the Master Plan.

1) Be alert to the regional impact statute (NH RSA 36:54-58) when reviewing development proposals that may impact shared resources.

2) Be concerned with the quality of stormwater being discharged into surface waters through treatment of stormwater detention.

9.0 WETLANDS

One of the most important environmentally sensitive natural resources in Littleton is wetland. Unfortunately, little has been done to protect this important resource in Littleton. The foresight to protect them now will help insure clean groundwater, lakes, ponds, and streams, and a more balanced natural system in the future.

There are many reasons why wetlands are valuable to the community. Some of those reasons are flood control, erosion control, pollution, filtration, water supply, wildlife habitat, environmental health and diversity, recreation, and aesthetics. These are but a few of the important functions wetlands perform in helping protect the quality of water, land, and the community.

Wetlands perform all of these functions with no charge to society. Dams, tertiary sewage treatment plants, water purification plants dikes, and other sophisticated and expensive man-made water control measures all try to copy what wetland do naturally. It seems irrational to waste these natural resources and then have to replace them with expensive public investments. Each acre of wetland provides significant benefits to Littleton.

9.1 Wetland Delineation

Wetlands are difficult to define and delineate. Words such as swamp, bog, marsh, lowland, and floodplain, are often used but are confusing and overlapping. In New Hampshire, the yearly water cycle causes tremendous variation in the level of water in the particular area. During the Spring, an area might

have two feet of water on its surface while that same area in September may not have water on its surface at all. Any definitions of wetland must take this variation in water levels into account, and any delineation of wetlands requires the identification of the wetland – non-wetland boundary on the landscape.

For the purpose of this master plan, wetlands are defined as poorly and very poorly drained soils and freshwater marshes as delineated on the detailed soil survey of Littleton. This is the most comprehensive inventory of the Town available at this time and is useful in prime wetland designation.

9.2 Wetland Soil Survey

A soil survey is a map on which the natural soil is identified and its distribution delineated. Boundaries of individual soils are plotted on aerial photographs after a soil scientist has traversed the land digging test holes in order to identify the soil, as discussed in Section 7 of this chapter. However, a few comments on soil drainage are necessary here.

One of the characteristics soil scientists use to differentiate soil is drainage. Drainage is broken into five categories:

- Excessively well drained – water is removed from the soil very rapidly.
- Well drained – water is removed from the soil readily, but not rapidly. The depth to seasonal high water table is generally more than three feet.
- Moderately well drained – water is removed from the soil somewhat slowly. The water table is generally within three feet of the ground surface for three months of the year.
- Poorly drained – water is removed from the soils so slowly that the water table is at or near the surface seven to nine months of the year.
- Very poorly drained – water is removed from the soils so slowly that the water table remains at or on the ground surface more than nine months of the year.

Very poorly drained soils have a layer of much or peat that overlies the mineral soil material (sand, silt, or clay). The layer of organic matter could range in thickness from a few inches to several feet, depending on the soil forming processes. Poorly drained soils are relatively better drained so they have only a very thin layer of musk and peat, if any at all.

In Littleton there are 103 different wetlands, consisting of 62 with just poorly drained soils, 15 with just very poorly drained soils, and 26 with soils of both drainage classes (see Map 7.1 in the Natural Resources Inventory). A wetland is defined as a contiguous area of poorly or very poorly drained soils. Poorly drained soils occupy about 2,500 acres and very poorly drained soils occupy 725 acres. Wetlands make up about 10% of Littleton's total land area.

9.3 Prime Wetlands

The State of New Hampshire allows communities to designate "Prime Wetlands." The designation means that the NH Wetlands Bureau, when receiving applications for dredging or fillings wetlands, will pay extra attention to applications involving wetlands designated by the town as "prime". It provides an extra layer of protection at the state level. The first step in the designation process is an inventory and assessment of the town's wetland using the "NH Method."

In 1994, the Littleton Conservation Commission, with the assistance of Lobdell Associates, completed a wetland inventory and evaluation. The 48 wetlands with very poorly drained soils were analyzed and of these, 21 wetlands, as shown on Map E were extensively studied including a site visit, photographs, and analysis. Additionally, all 21 wetlands were evaluated using the "NH Method" and 14 functions and values were assessed.

While the study was completed, not wetlands were submitted to the NH Wetlands Bureau for Prime Wetland status. This would have required additional steps including a vote at a Town Meeting, preparing

a map of the wetland area, and submitting a Prime Wetlands Application to the NH Wetlands Bureau for approval. Thus Littleton has no Prime Wetlands designated.

9.4 Wetland Permitting

Impacting wetlands in Littleton is regulated by federal, state, and local regulations. The most comprehensive regulatory program is that of the NH Wetlands Bureau (NHWB). NH RSA 482-A authorized by the Department of Environmental Services (DES) to protect the State's wetlands and surface waters by requiring a permit for dredging, filling or construction of structures in wetlands or other waters of the State. RSA-482-A and the rules promulgated under that law require that projects be designed to avoid and minimize impacts to wetlands and other jurisdictional areas. The impacts that are proposed must be only those that are unavoidable. It is the responsibility of the applicant to document these considerations in the application for a permit.

According to DES rules, each project that requires a wetlands permit is classified in one of three categories according to the potential square footage impact of the project – minimum, minor, and major. Many projects quality for processing with the Minimum Impact Expedited application which may include repair and maintenance of a dock, installation of a culvert for driveway access to a single family house, or maintenance dredging of an existing pond.

Another type of project common to the North Country is wetland impacts due to logging. These projects are permitted through a notification process that must be filed at the same time as the "Intent to Cut" forms provided the operation is conducted in accordance with the publication, "Best Management Practices for Erosion Control on Timber Harvesting Operations in New Hampshire."

According to the NH Wetlands Bureau, 61 projects impacted wetlands in Littleton during a four year period (1990-2000), or about 15 per year. About 50% of these are forestry notification projects and require no permit. All other projects require permits. The Town Conservation Commission, by state law, has a 40-day period within which to submit comments to the Wetlands Bureau. The Littleton Conservation Commission attempts to communicate its opinion on each application submitted in Littleton.

In the case of projects impacting more than 10,000 square feet of wetland, applicants are now asked to propose mitigation to offset wetland loss. Mitigation can be through creating or restoring wetland or protection of an upland buffer by conservation easement. The Conservation Commission accepted a conservation easement under this new regulation for impacts related to a residential subdivision on Pine Hill (also known as Southwatch).

9.5 Land Use Implications & Potential Actions

Land Use Implications

The wetland resources within Littleton play a major role in the location and impact of future development in the community. Here are a few items to consider related to wetlands in Littleton:

1) The health of Littleton's wetlands is critical to the function of natural systems within the community. If they are destroyed or degraded Littleton's water resources (quantity and quality) will suffer, and many animal species will disappear.

2) It is important to point out that small wetlands (under three acres) are usually not shown on the USDA Natural Resource Conservation Service (NRCS) Soil Maps.

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the wetland areas in Littleton and their land use implications. This section will be used to identify the specific actions for Littleton to take upon completion of the Master Plan.

1) Work to implement the Littleton Prime Wetlands Study, and any proposed prime wetlands should be certified by the NH Wetlands Bureau.

2) The Town should support the formation of a wetland bank in the Ammonoosuc River Watershed.

10.0 POINT AND NON-POINT SOURCE POLLUTION

Within every watershed, the uses of the land and of the water have the potential to impact water quality. Water pollution can occur from two major sources: point and non-point. Point source pollution is one that can be linked to a specific pollutant or discharge point that can be identified and physically located. Non-point sources are more difficult to document, trace, or identify since there is generally not a specific point of discharge. The NH Department of Environmental Services should be contacted relative to the current status of individual sites.

10.1 Point Sources

Point Sources, Ground Water

In New Hampshire, NHDES regulates industrial and municipal discharges and privately owned wastewater management and wastewater treatment facilities which may have a potential impact on water quality due to a direct discharge to groundwater. A groundwater discharge permit is required for such activity. Currently there are no permitted groundwater discharges in Littleton.

Point Sources, Surface Water

A pipe discharging waste into a stream is an example of a point pollution source. Since the Clean Water Act of 1971, most discharges have to be treated prior to discharge and all discharges require a National Pollution Discharge Elimination System (NPDES) permit. DES issues NPDES permits after review and approval.

There is one NPDES permit issued in Littleton, the Town's sewage treatment plan outfall. The Town operates a wastewater collection and treatment facility on Meadow Street, which serves over 75% of the population. This facility discharges treated effluent into the Ammonoosuc River. The Town is responsible for maintenance of the facility and all of the collection lines on the system. The plant continues to run efficiently after over 35 years. The removal rate for 2012 was 99.2% for BOD and 97.4% for TSS, which are some of the best removal rates in the state.

10.2 Non-Point Sources

Potential Non-Point Pollution Sources

General and specific land use practices that are widespread throughout the study area can impact water quality. Some potential sources are the result of temporary or short-term land uses that require disturbing the soil, such as logging, construction, or agriculture operations. Others, such as stormwater runoff may be short in duration, but are continuous in nature. Non-point sources are more difficult to quantify than point sources because they impact water quality through unmonitored, intermittent, or incremental contamination and their impacts may be felt only over a long period of time. Other sources include waste disposal facilities (septic systems, landfills, junkyards, etc.), highway maintenance (sand, salt, and snow dumping), and hazardous waste.
Buffer strips along lakes and streams intercept and store surface runoff, allowing it to infiltrate rather than continue off site as runoff. This can reduce impacts from a variety of pollutants including phosphorus, sediment, pathogens, nitrates, and pesticides. A buffer's capacity to tie up pollutants depends on its width. The wider a buffer is, the more removal of pollutants occurs. A 100-foot buffer is recommended for infiltration.

10.3 Land Use Implications and Potential Actions

Land Use Implications

Point and non-point pollution sources have an adverse effect on the community. Their presence threatens both the immediate and long term health of the community. Here are a few items to consider related to pollution in Littleton:

1) Pollution contaminates soils and impacts water quality in the community. This results in damage to the environment and the need to engage in expensive treatment processes.

2) The recreation and tourism value of Littleton's natural resources is directly linked to their health and the absence of pollutants.

3) There is a direct correlation between impervious surfaces and increased non-point source pollution. Reducing impervious surfaces will reduce runoff rates and increase filtering.

4) Continue to monitor and document all underground storage tanks in Littleton.

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the existing and potential threat from pollution sources in Littleton and their land use implications. This section will be used to identify the specific actions for Littleton to take upon completion of the Master Plan.

1) Consider adopting site plan review regulations that create maximum impervious surface limits, and encourage the use of pervious structures for areas like parking lots.

2) Consider reducing the required road widths for new development.

3) Consider site plan review regulations that help manage non-point pollution and stormwater drainage.

4) Promote Best Management Practices (BMPs) to reduce non-point pollutants from industrial, commercial and residential developments.

5) Require maintenance plans for industrial, commercial and residential developments.

11.0 FOREST & AGRICULTURE LAND USE

History of Agriculture Lands in New Hampshire

In 1880, 64% of New Hampshire's land was in agriculture. New Hampshire ranks 48 out of 50 in the level of agricultural production in the U.S. One reason for this is that land suitable for agriculture is also excellent for development. Agricultural land is gently sloping, open and scenic. The agricultural land that remains undeveloped adds a special rural character to the Town while at the same time providing habitat for local wildlife. According to the New Hampshire Department of Agriculture the face of agricultural operations in New Hampshire is changing quickly. Niche markets including specialty crops and herds, customized farm products, and small scale operations are redefining agriculture.

In short, traditional agriculture and agricultural land uses in New Hampshire and Grafton County have declined substantially over the years. Land once used by small, non-mechanized farms has reverted back to forest land or has been developed. Miles of stone walls in mature forest stands are testimony to

an agricultural heritage in New Hampshire that has been lost over the past several decades. Littleton has certainly been part of that trend.

Existing Agricultural Land Use in Littleton

Traditional agricultural land use in Littleton today is minimal, since there is only one full-time farming operation. Littleton has one remaining dairy farm, but no land is currently being tilled for corn, grain, or other row crops. In Littleton, agriculture lands make up approximately 3.5% of the total land area.

The agricultural land in Littleton is most Commonly used for hay production, grazing of livestock, or is "idle", meaning kept open by "brush hogging" or mowing every year of two but not producing a crop. Hayland (defined as land producing hay or capable of producing hay with minimal land improvements or expense) makes up about 60% of Littleton's agricultural land.

Table 3D Agricultural Land Use in 2002

Use	Acres	% of Total Land Area
Hay land	**737**	**59**
Pasture	**205**	**16**
Idle	**315**	**25**
TOTAL	**1258**	**100**

Source: Lobdell Associates, 2002

Pastureland occupies about 16%. There are no large pastures or substantial numbers of animals utilizing any of the pasture areas. Idle land makes up about 25%, approximately 315 acres of the agricultural land in Littleton. This is land that is unused and generally unmowed. It is in the early stages of reverting back to woodland and may contain hardhack, small saplings, etc., at this time. Within ten years, it would be considered forested land if left unattended, with loss of views and valuable wildlife habitat.

No inventory of new niche market agricultural operations exists for Littleton, but there is an opportunity to encourage growth in this small but critical land use.

11.3 Land Use Implications and Potential Actions

Land Use Implications

Littleton's agricultural resources and activities have an effect on land use decisions and impact the character of the community. Here are a few items to consider related to agriculture in Littleton:

1) Preserving the possibility of farming in the future adds to the sustainability of the community. If agricultural resources are covered with homes and businesses they will not be viable options for producing goods locally in the future. This could become a necessity if global food distribution systems change.

2) There is an economic benefit when produce and products are generated locally, and the land does not require the high level of Town services that development demands.

3) Agricultural lands add to the visual and habitat diversity of the landscape, and contributes to the character of the community.

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the status of agriculture in Littleton and the associated land use implications. This section will be used to identify the specific actions for Littleton to take upon completion of the Master Plan.

1) Pursue protection of agricultural land through outright purchase, purchase of easement/development rights, and donations.

2) Consider requiring open space developments in areas involving agricultural land. Concentrate all the development on the non-agricultural land areas.

3) Work to make all of Littleton's land use regulations "farm friendly" and support non-traditional agricultural operations (small scale, seasonal, organic, specialty or "niche markets").

11.4 Forest Lands

Forest land has many uses. Timber harvesting is the most obvious use but other uses and functions include recreation, wildlife habitat, water quality protection, open space, scenic enhancement, etc. These are all-important uses for the people of Littleton both from a quality of life and economic standpoint.

Littleton has seen a decrease in the amount of forestland within the community during the years between 1950 and 2002, as shown in Table 3E. In 2004, there was about 10% less forestland in Littleton than fifty years ago. The rate in which forest land is being lost is accelerating due to increased subdivision activity for residential and other uses. Also, the amount of idle agricultural land once was being reforested and actually adding to the amount of forestland, has decreased significantly.

Table 3E Trends in Forest Land

Year	Acreage
1950*	27,067
1970*	26,363
1986**	25,219
1998***	24,669

Sources: *University of NH, **Littleton Master Plan, ***Landstat, 1998

11.5 Forest Type Inventory

Northern hardwood predominates as the major type of tree present with while pine being a strong second. Much of the forest land in Grafton County is a mix of hardwood and softwood species including white pine, hemlock, red spruce, balsam fir, black spruce, beech, red maple, sugar maple, yellow birch, red oak, black cherry, white ash, and white birch.

11.6 Forest Planning

From a planning perspective, woodland are not just a source of wood products or yield tax revenue. The forest industry also provides many area jobs.

Woodlands play an important role in providing areas for outdoor recreation, wildlife habitat, and scenic enjoyment. They play a role in the water quality of Littleton's lakes, ponds, and streams. All of these uses are sustainable and each can co-exist. Timber harvesting, while having dramatic visual impacts in some cases, is rather short-term. However, subdividing large woodland parcels into small lots for development can have a long term, nearly irreversible impact.

A study by the Society for the Protection of New Hampshire Forests (SPNHF) found that while New Hampshire remains predominately forested, the amount of forest cover will decline to 80% statewide within the next 20 years and of that, less and less will be committed to long term forest management in large tracts. Additionally, most landowners no longer rank timber production as their main reason for owning the land. Only 10% of the landowners include timber production as primary reason, with aesthetic enjoyment now more than 50% of the landowners' reason for owning the land.

It was found that parcels of land 500 acres or more are the most common for long term forest management due to economies of scale. In Littleton, only two parcels are over 500 acres, with one of those being the TransCanada land around Moore Dam.

With regard to the short-term impacts of logging, the Town has a built in mechanism to monitor logging operations – the notice of 'Intent to Cut'. Once an 'Intent to Cut' is filed, it is reviewed to determine if the logging operation is going to impact sensitive or critical natural resource areas, such as wetland, deer yards, fragile biotic communities, etc. Landowners and foresters could be educated to the need to carry out logging operations in a manner sensitive to important natural resources. It could also help to identify logging operations that are planned on areas used for recreation such as paths and trails. Steps could then be taken to work with landowners and foresters to temporarily close or re-route trails during the logging operations.

11.7 Land Use Implications and Potential Actions

Land Use Implications

Littleton's forest resources have an effect on land use decisions and impact the character of the community. Here are a few items to consider related to forest lands in Littleton:

1) Forest resources provide habitat, erosion control, water filtering, improved air quality, and temperature regulation. These resources also pay their own way in terms of Town services.

2) Responsible harvesting of forest resources supports the local economy and provides access to local forest products. The working landscape contributes to the character of the North Country.

3) Clear cutting and disregard of BMP's can result in erosion and non-point source pollution that creates problems for abutters and the community.

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the status of forestry in Littleton and the associated land use implications. This section will be used to identify the specific actions for Littleton to take upon completion of the Master Plan.

1) Littleton should continue to have a licensed forester inspect all logging jobs to insure compliance with wetland and erosion and sediment control regulations.

2) The minimum lot size in zones with valuable forest resources should be examined. Subdivision of land into small units makes logging difficult.

12.0 SCENIC VIEWSHEDS

Preservation of viewsheds is important to maintaining the rural and small town character of the Town as well as maintaining Littleton's attractiveness to tourists and locals. According to the natural resources inventory these scenic areas are identified as:

1. Northeast from Slate Ledge Road to Vermont and Moore Reservoir
2. North from Route 135S to Moore Reservoir
3. North from Hilltop Road to Moore Reservoir
4. Northwest from Route 18N to Vermont to the Connecticut River
5. Southwest from Route 18S to Moore Reservoir
6. West from Broomstick Road to Connecticut River
7. South from Broomstick Road to Cannon Mountain
8. South from Manns Hill Road to Mount Lafayette
9. East from Manns Hill Road to the Presidential Range
10. Overlooking town from Mount Sacred Heart on Grove Street
11. East from Mount Sacred Heart on Grove Street to Mount Eustis
12. Scenic outlook near the summit of Parker Mountain
13. Scenic outlook from Kilburn Crags
14. Scenic view from southbound lane on I-93 overlooking the town

Scenery and aesthetics, although subjective in nature, are significant natural resources that can be studied, analyzed, and protected. The NH Supreme Court has ruled that aesthetics is a legitimate local planning concern.

12.1 Land Use Implications and Potential Actions

Land Use Implications

Littleton's scenic views have an effect on land use decisions and impact the character of the community. Here are a few items to consider related to scenic views in Littleton:

1) Scenic views contribute to Littleton's community character. This is significant to residents and visitors alike.

2) Viewsheds are composed of many unique properties under different ownership. This makes preserving the scenic view difficult.

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the status of scenic views in Littleton and the associated land use implications. This section will be used to identify the specific actions for Littleton to take upon completion of the Master Plan.

1) Conduct an inventory of scenic resources and viewsheds within the community.

2) Pursue protection of key parcels within the identified scenic viewsheds, and provide guidelines for new development in these areas.

3) Consider conducting an inventory of all roads in Littleton to determine if they should be classified as scenic or non-scenic.

13.0 CONSERVATION LANDS

Conservation areas are those lands protected for the foreseeable future through outright preservation by governmental or conservation organizations or through conservation easements. As can be seen from Table 3F, compared to surrounding towns, Littleton has very little land in conservation since it does not contain any of the White Mountain National Forest.

Table 3F Area of Conservation Lands

Town	Population (2011)	Size (acres)	Conservation Lands (acres)	Percent of Town in Conservation Lands
Bethlehem	**2520**	**58205**	**32590**	**56**
Franconia	**1102**	**42124**	**31067**	**74**
Landaff	**415**	**18223**	**4965**	**27**
Lisbon	**1591**	**17065**	**129**	**1**
Littleton	**5913**	**34555**	**2718**	**8**
Sugar Hill	**562**	**11027**	**1732**	**16**

Source: US Census 2011, GRANIT

The information for conservation lands in Littleton shown in Table 3F most likely does not include all protected land in Littleton. Determining specific lands in Littleton that are protected is not an easy task, since information on easements, etc. is not necessarily readily accessible. Map H shows land that are protected as well as categories of land that may be protected.

13.1 TransCanada Lands

As part of the re-licensing of Fifteen Mile Falls by the Federal Energy Regulator Commission, US GEN (formerly owned by New England Power) agreed to place conservation easements on hundreds of acres, much of which is in Littleton. It is basically all of their open land but excludes the dam itself and other developed areas. This is by far the largest area of conservation land in Littleton.

13.2 Important Unprotected Land in Littleton

Besides the lands mentioned by type in this chapter that need conservation efforts, the Conservation Commission has identified the following specific areas that need protection for a wide variety of natural resources, wildlife and recreation purposes:

- Parker Mountain (between Farr Hill Road and Broomstick Hill Road and Manns Hill)
- The higher elevations of Walker Mountain Ridge
- Town's Mountain
- Mount Misery
- Dalton Ridge-west end
- West Littleton

13.3 Current Use

NH RSA 79A allows landowners to place certain types and sizes of land in a tax abatement program based on their current land use. Table 3G shows that 18,290 acres in Littleton are in current use, with 249 landowners and 412 lots involved. This acreage is slightly more than half of the total land area in Littleton and is up approximately 2,500 acres from a decade ago.

Table 3G Current Use for Littleton

Use	2012 (acres)	Percent	2002 (acres)
Forestry	16,967	93	14,386
Unproductive Forestry	N/A	N/A	460
Wetlands	639	3	175
Farmlands	684	4	700
Total	18,290	**100**	**15,721**

Source: Town of Littleton

While current use reduces the burden for landowners, land can be taken out of current use with payment of a penalty. Therefore, it does not provide absolute assurance of continued open space. The penalty is 10% of the assessed value of the lands.

Under state law, towns can vote to have all or a portion of the money collected for taking land out of current use to be placed in a conservation fund administered by the Conservation Commission. Over 120 towns in the state have voted to do this in order to provide a source of revenue for conservation studies and land protection efforts. Littleton is looking into taking this step.

13.4 Land Use Implications and Potential Actions

Land Use Implications

Littleton's conservation lands have an effect on land use decisions and impact the character of the community. Here are a few items to consider related to conservation lands in Littleton:

1) Conservation lands provide habitat, recreational opportunities, and protect critical natural resources. These resources also pay their own way in terms of Town Services.

2) Conservation lands contribute to Littleton's character as a community and support its quality of life.

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the conservation lands in Littleton and the associated land use implications. This section will be used to identify the specific actions for Littleton to take upon completion of the Master Plan.

1) Consider increasing efforts to secure conservation easements on undeveloped land with significant natural resources, and lands adjacent to permanently protected parcels (i.e. land along Moore Reservoir) in order to preserve contiguous corridors or undeveloped land.

2) Consider budgeting for land protection. Consideration should also be given to using a greater portion of the penalty payments received for land taken out of current use to help fund this activity.

3) Partner with other conservation based organizations working in Littleton and the region to increase funds, access a wider audience, and pursue land protection efforts that will benefit the community and the region.

14.0 WILDLIFE RESOURCES

According to the NH Fish and Game Department, many of the 420 species of animals and birds in the state can be found within the North Country. The diverse habitats of Littleton include wetlands, upland hardwood and softwood forest. The better known mammal species include moose, white-tailed deer, black bear, rabbit, squirrels, skunks, woodchucks, eastern coyote, beaver, muskrats, raccoons, otter, mink, bats, possum, red fox, fisher, and bobcat. Amphibians such as the spotted salamander, newts, toads, tree frogs, bullfrogs, and the morning spring peeper abound at the water's edge. Reptiles include four types of turtles and eleven species of snakes including garter, milk snake, and the back racer.

Nearly 200 species of birds can be found in their various habitats in the area including hawks, 25 species of warblers, many different species of finches, owls, and flycatchers. The population of the turkey vulture and the wild turkey have increased. Many different types of waterfowl reside in the area including Canada geese, mallards, blacks, wood ducks, and mergansers. Blue heron can often be seen in streams and wetland areas.

14.1 Endangered/Threatened Plants and Animals

Not all of New Hampshire's wildlife is thriving. The NH Fish and Game Department maintains a list of endangered or threatened animal species in New Hampshire. Migratory birds including the bald and golden eagle and osprey do pass over the area from time to time. In fact, for the last several years bald eagles have been regularly seen along the Connecticut River, and have been nesting in the area.

According to the New Hampshire Natural Heritage Inventory, a variety of rare plants, vertebrates, and natural communities are found in the town of Littleton. Though their exact locations are not revealed for obvious reasons, their basic locations are available in the Natural Resources Inventory.

14.2 Hunting

The Northeast is an excellent area for recreational hunting and Littleton's community of recreational hunters is strong. However, the number of licensed trappers has dropped. Littleton's natural resources currently support big game, such as deer and moose, and smaller game such as beaver, mink, hare, grouse, and woodcock. Ruffed grouse and woodcock are the most predominant small game species.

While not on a major flyway for migratory birds, Littleton does offer suitable habitat for both short-term migratory waterfowl and for resident birds. Water bodies that provide waterfowl habitat include Moore and Comerford Reservoirs, Ammonoosuc River, Partridge Lake, Dells, Reynolds and Caswell Ponds. Additionally, beaver ponds play a critical role for both migratory and nesting birds.

Some areas within the town of Littleton have been identified as deer wintering areas. These are areas that were mapped by the NH Fish and Game Department using aerial photography and are identified as those areas having a thick evergreen cover. The mapping of these wintering areas or "deer yards" as they are sometimes called, is over 25 years old and needs updating to account for logging, development, and regrowth.

14.3 Fishery

The lakes and ponds in Littleton also contain a wide range of fish species. The NH Fish and Game Department keeps records on predominant fish species found in the largest ponds and brooks organized by town. In the town of Littleton, fish species data are available for Comerford and Moore Reservoirs, Partridge Lake, and several streams.

The most detailed information available is for the Connecticut River. Comprehensive fisheries data was collected as part of the re-licensing requirement for Moore and Comerford hydrodams. The predominant species was yellow perch followed by rock bass and smallmouth bass. These three species represent

nearly three-quarters of the total fish caught. However, six varieties of cold water fish were also found including Atlantic salmon, brown trout, rainbow trout, and land locked salmon.

Information regarding the number and species of fish caught in Moore Reservoir is available from the NH Fish and Wildlife Department, Region 1 Office in Lancaster, NH.

14.4 Land Use Implications and Potential Actions

Land Use Implications

Littleton's wildlife resources have an effect on land use decisions and are impacted by them as well. Here are a few items to consider related to wildlife resources in Littleton:

1) Habitat is easily fragmented by new development. This disrupts the landscape and impacts wildlife movement and survival.

2) Wildlife resources are critical to many recreational activities that support open space conservation (i.e. hunting, fishing, and bird watching).

Potential Actions

There are an array of possible actions the Town may want to consider pursuing as it evaluates the status of wildlife in Littleton and the associated land use implications. This section will be used to identify the specific actions for Littleton to take upon completion of the Master Plan.

1) Consider protecting areas that are known to support or have the potential to support important wildlife.

2) Work to preserve corridors between habitats and protected open space to facilitate the movement of animals in the region and locally.

3) Provide opportunities for the public to learn about local wildlife and potentially view it.

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On September 12, 2013, the Board voted to make the Ammonoosuc River Corridor Management Plan as an appendix to the Natural Resources chapter of the Master Plan. This Management Plan can be accessed on the North Country Council website at www.nccouncil.org. Under the title "Projects", scroll down to "Assistance to Local River Advisory Committees" and then click on Ammonoosuc River. At the end of the paragraph, chose the Ammonoosuc River Corridor Management Plan and then select the option to download the plan adopted by the ARLAC on June 5, 2013.