VIII. NATURAL RESOURCES

Chapter VIII

Natural Resources

Introduction

The natural resources of Warner pervade all aspects of historic and present land use in Town. The town originated on the Warner River, which provided energy to run the mills. The railroad followed the course of the river, and the picturesque scenery and steep terrain drove the tourist industry. Today, it is Warner's rural character and natural environment that continue to attract residents and visitors. The Master Plan survey revealed that respondents thought that the natural environment was the town's most important quality. Furthermore, over 80% of the respondents felt that the protection of the natural environment was an important ongoing activity in town. Another indication of the public's sentiment on the environment was that 77% of the respondents rated potential environmental impacts as very important in reviewing development proposals.

Given that natural resources are so important to the community and permeate the land use planning process, this section of the Master Plan is intended to document many of the town's natural resources. This is not an exhaustive inventory, rather it points out the important natural resource concerns that may have an impact on land use planning. A more in-depth inventory of Warner's natural resources is currently underway. In 1998, the Conservation Commission completed a natural resource inventory of the Willow Brook watershed. This project demonstrates the level of investigation necessary to make informed land use planning decisions. See Appendix B for more information. It is recommended that the rest of the town receive this same level of scrutiny over the next ten years.

This section of the Master Plan begins with a number of goals and objectives. The body of the Chapter begins with a description of the town's watershed, followed by other resources and land use descriptions. The last resource section is wildlife habitat, which ties many of the resource descriptions together. The wildlife habitat in town can be seen as an indicator of how well Warner is protecting its natural resources. Like the canary in the coal mine, the abundance and diversity of wildlife in Warner, indicates the health of the overall ecosystem.

Natural Resource Goals, Objectives and Actions

The primary goal is to conserve and protect the natural resources of the Town**.**

Objective 1 Increase the amount of sensitive/priority areas within the Town that are protected through easements, covenants, or Town ownership.

Actions:

1) Identify sensitive/priority lands for protection.
2) Identify wildlife corridors and ensure that protected lands are connected to maximize protection.
3) Coordinate land protection with surrounding towns to establish vital wildlife corridors.
4) Encourage the donation of conservation easements to the town for the protection of open space and develop criteria for the acceptance of such easements.
5) Permanently protect town-owned lands for conservation purposes.
6) Use the timber tax revenues to expand the town forest.
7) Use income from the sale of timber on town lands to acquire additional forest land.
8) Examine opportunity acquisition as a means of land protection.

Objective 2. The Conservation Commission should continue to carry out watershed studies, such as the Willow Brook Watershed Study, to help the Town establish specific areas to be protected.

Actions:

1) Conduct natural resource inventories in each of the town's watersheds using the Willow Brook watershed project as a model. Identify priority conservation areas in each watershed and work to protect them, including the areas already identified in the Willow Brook watershed.
2) Recommendations for water quality:
   a) Create a citizen volunteer monitoring program in town; and
   b) Protect water quality by enforcing the 75' setback from streams and encouraging other Best Management Practices (BMPs). Also, help the NH Department of Environmental Services (DES) to enforce the Shoreland Protection Act, which applies to the Warner River.

Objective 3. Use the proceeds from the Current Use Tax for conservation purposes.

Actions:

1) Place all proceeds from the Current Use Change Tax and/or land transfer tax into the conservation fund.

Objective 4. Continue to promote the agricultural use of lands through the Current Use tax.

Objective 5. Encourage the use of sound land management practices for developed, forested and agricultural lands to promote diverse wildlife habitat.

Actions:

1) Strengthen town soil regulations. Adopt the site-specific soil standards and the recommendations from the current state interagency *ad hoc* committee on soils.
2) Inventory and identify significant wildlife habitats using the manual *Integrating Wildlife Habitat into Community Planning*.
3) The building regulations on unmaintained roads should be rigorously enforced.
4) Encourage the clustering of development to protect open space.

Objective 6. Investigate and enforce the use of stronger controls and protection for streams, ponds, floodplain and wetland areas.

Actions:

1) Enforce the 75 ft. setback from streams and more clearly define what activity is allowable within it.
2) Expand the 75 ft. setback provision to include wetlands and ponds.
3) Establish 100 ft. buffers around wetlands, streams and ponds that are not currently covered by the Shoreland Protection Act.
4) Document and protect floodplains and aquifers.
5) Acknowledge the importance of vernal pools and afford them adequate protection.
6) Protect the Warner River corridor.

Objective 7. Protect scenic ridgelines and hilltops, and encourage the responsible use of Mt. Kearsarge.

Actions:

1) The Planning Board should research the possibility of enacting a scenic ridgeline and slope protection ordinance to control the placement of buildings along scenic ridgelines and hilltops.
2) Opening of new roads for residential development outside of the village is premature. Building on Class 6 unmaintained roads should be discouraged in an effort to protect unfragmented forest lands.
3) Focus recreation in appropriate areas where there is currently access available, rather than opening up new areas.

Objective 8. Investigate alternative zoning regulations to protect forestry and agricultural activities.

Actions:

1) Document the importance of unfragmented lands in Warner for recreation, environmental quality and historical resources.
2) Create large lot zoning (50 acres) for forest areas in the Mink Hills. This zoning is for forest management purposes to ensure that the land remains used for forestry, and not residential development.

Objective 9. Protect important aquifers.

Actions:

1) Sand and gravel soils flank Route 103, Schoodac Road, and Poverty Plains Road. However, Warner's largest potential aquifer underlies this area. Protection of this resource should be considered.
2) Strictly enforce source water protection area.

Watersheds

A watershed is the area of land which drains into a particular body of water. Watersheds are useful units of ecological analysis because all the land in a watershed is connected by the water which flows through it. Watersheds, along with the streams and ponds in them, have great value for groundwater recharge and discharge, recreation and wildlife habitat. The watershed should be the unit of analysis for further natural resource inventories and land use planning endeavors.

The Town of Warner is located within the Merrimack River principal drainage basin and its land drains into three subbasins: the Blackwater River, the Contoocook River and the Warner River (CNHRPC, 1974). The town can be further broken down into smaller subwatersheds. In 1996, the Warner Conservation Commission began studying each of the subwatersheds beginning with the Willow Brook watershed. A summary of this study can be found in Appendix B. The Conservation Commission has determined that careful examination of the natural resources of each of the subwatersheds is crucial in determining priority areas for conservation. In future Master Plans, the natural resources in the town would be best presented as they fall in each subwatershed, as has been done in the Willow Brook plan in the Appendix.

Table 8-1 is a summary of each watershed, listing its name, into which river basin it drains, its acreage within the town boundary, the length of the stream, and any ponds or other notable features. Map 8-1 at the end of the chapter, the "Warner Subwatershed Map", shows the locations of each watershed.

The Warner River

As Table 8-1 indicates, all but seven of the 26 watersheds in Warner drain to the Warner River. The Warner River flows a total of 22 miles, 13.8 miles (63%) of which is within the Town of Warner. The river originates in Bradford and flows easterly and southeasterly through Warner and Webster, until it reaches its confluence with the Contoocook River in Hopkinton. Through Warner, the river drops 277 ft., from 641 ft. of elevation at the Bradford town line, to 364 ft. at the eastern border of Warner, for an average drop of 3.8 feet per 1,000 linear feet, or a slope of .38%.

The Warner River, at the Webster town line, has a drainage area of approximately 150 square miles, one third of which is within the Town of Warner.

The river serves as habitat for a number of fish and wildlife species. Among the most important attributes of the river are its water quality and floodplains. The water quality of the Warner River has been tested by the NH DES as part of its statewide ambient water quality testing program. Dissolved oxygen levels, a key determinant for fish viability are generally above standards in all parts of the river. Elevated bacteria counts have been measured at the covered bridge on Joppa Road but are not high enough to indicate serious contamination problems.

The Warner River is an important regional resource. Except for a couple of small dams, the Warner River is free-flowing, which is an unusual condition in New Hampshire. The free-flowing nature of the river, coupled with its locations and slope, have given the river an expansive floodplain area. This floodplain is home to many species of wildlife and is especially important for amphibians and waterfowl. The floodplain also protects the town from flooding.

Flooding is an important aspect of surface drainage to consider in land use planning. According to a 1986 study conducted by the Federal Emergency Management Agency (FEMA), the most severe flooding occurs in early spring as a result of snow melt and heavy rains. Heavy floods occurred in 1896, 1927, 1936, and 1954. The Warner River floodplain ranges from 45 to 1,050 feet in width with an average width of 246.7 feet. In Warner, there are 1,217 acres in flood Zone A, 963 acres in Zone AE and 126 acres in Zone B. Areas identified by FEMA as susceptible to the 100 year flood in the Town of Warner are shown on Map 8-2, at the end of this chapter.

The Town of Warner contains ponds with a total area of 175.4 acres, or 0.5% of the Town's area, as seen in Table 8-2. By statute, all of New Hampshire's natural bodies of fresh water ten acres or more in size, known as great ponds, are public water and are entrusted to the state for public use.

In addition, there are five unnamed ponds in Warner, including one that is 1.9 acres on Silver Brook, one that is 1.6 acres on Warner Brook, one that is 1.1 acres on an unnamed tributary, and two ponds that are 2.7 and 2.5 acres south of Pleasant Pond. There are also water bodies too small to be adequately mapped, or seasonal in nature.

Table 8-1
Warner Subwatersheds

#	Name	River Basin	Acres	Stream length	Other features
1	Blackwater River	Blackwater	1,991	10,600 ft.	Class “A" drinking water supply
2	Meadow Brook	Warner	2,066	28,670 ft.	Drains to Stevens Brook
3	French Brook	Warner	1,720	21,428 ft	Drains to Stevens Brook
4	Stevens Brook	Warner	967	12,376 ft	
5	Frazier Brook	Warner	2,076	23,079 ft.	
6	Knight Meadow Brook	Warner	381	6,827 ft.	
7	Willow Brook	Warner	2,342	18,480 ft.	Tory Hill Meadow is a priority conservation area.
8	Mud Pond Brook	Warner	481	3,445 ft.	Mud Pond is 3.5 acres.
9	East Sutton Brook	Warner	250	7,510 ft.	
10	Birch Hill Brook	Warner	58	3,630 ft.	
11	Schoodac Brook	Warner	1,208	8192 ft	
12	Meadow Pond Brook	Warner	632	5,447 ft.	
13	Warner River	Warner	6,985	72,864 ft.	
14	Simmons Pond	Warner	204	Intermittent	Simmons Pond is 16 acres.
15	Davis Brook	Warner	1,138	9,600 ft.	Tributary of Slaughter Brook.
16	Slaughter Brook	Warner	1,092	11,634 ft.	
17	Silver Brook	Warner	1,549	9,458 ft.	
18	Bartlett Brook	Warner	1,692	8,104 ft.	
19	Bible Hill Brook	Warner	448	5,700 ft.	
20	Ballard Brook	Warner	1,034	11,927 ft.	
21	Lake Massasecum	Warner	2,074	14,660 ft.	Several streams flow to the lake.
22	Warner Brook	Contoocook	2,695	15,224 ft.	
23	Long Pond	Contoocook	894	Intermittent	Drains to pond in Hopkinton.
24	Bear Pond	Contoocook	442	Intermittent	Contoocook Village water supply.
25	Hardy Spring Brook	Contoocook	419	3,430 ft.	

Table 8-2
Warner Ponds

Name	Watershed	Acres	Depth (ft)	Shoreline length
Bagley Pond	Frazier Brook	19	9	0.6 mi.
Bear Pond	Bear Pond	49	23	1 mi
Cunningham Pond	Warner Brook	22	--	--
Pleasant Pond	Warner River	15	20	0.7 mi
Simmons Pond	Simmons Pond	16	18	0.8 mi
Tom Pond	Warner River	31	14	1 mi.
Day Pond		7.5	--	--
Meadow Pond	Meadow Pond Brook	2.6	--	--
Mud Pond	Schoodac Brook	3.5	--	--

Sources:
Biological Survey of the Lakes and Ponds in Sullivan, Merrimack, Belknap and Strafford Counties, NH Fish and Game Department, Survey Report No. 8b

Characteristics Of Lakes, Ponds, And Reservoirs Of New Hampshire, With A Bibliography, U.S.G.S, Open-File Report 75-490

USGS 71/2 minute topography from GRANIT GIS.

Wetlands

Wetlands perform a variety of necessary environmental functions, including:

- Temporary flood control areas;
- Water quality maintenance by acting as a filter for silt, pollution, and absorbing water-borne chemicals and nutrients;
- Groundwater recharge and stream flow maintenance;
- Erosion buffers to protect upland areas;
- Timber production areas;
- Open space and recreational uses; and
- Wildlife habitat.

The State of New Hampshire uses three criteria to determine the presence of wetlands: wetland vegetation, hydric soils and hydrology which shows a flooding regime. This is in accordance with the 1987 Army Corps of Engineers wetland delineation manual. The National Wetlands Inventory (NWI) is an effort that maps wetlands across the nation based on soils and aerial photography. The NWI has determined that there are 1,710 acres of wetlands in Warner. (See map 8-3) However, the NWI is limited in that it does not always find small wetland, especially in conifer forests. The hydric soils of Warner have also been mapped by the Natural Resource Conservation Service (NRCS). The NRCS calculates that there are 2,399 acres of wet soils in Warner. This is likely an over estimate of wetlands since not all wet soils are wetlands. Therefore, the actual amount of wetlands is somewhere in between these two numbers.

The NWI uses the Cowardin system of wetland classification. This system differentiates wetlands by types, which is useful in understanding the functions and values of a particular wetland. The three main types of wetlands are lacustrine (associated with lakes), riverine (rivers) and palustrine (other wetlands). Palustrine wetland are further broken down as forested, emergent, scrub-shrub and unconsolidated bottom (open water). The wetland breakdown for Warner can be seen in Table 8-3.

Table 8-3
Warner Wetland Types

Wetland Type	Acreage
Lacustrine	191
Riverine	13
Palustrine	
- Forested	674
- Emergent	211
- Scrub-shrub	376
- Unconsolidated	245

Source: National Wetlands Inventory, USGS, from NH GRANIT system.

Wet soils consist of those soils that are poorly drained and very poorly drained. These soils are listed in Table 8-4 for Warner.

Table 8-4
Acreage of Poorly and Very Poorly Drained Soils

Soil Groups and Types	Acreage
Poorly Drained - Aga, AgB, AuB, RbA, RbB, RdA, RdB, Ru, Lm	1,375
Very poorly drained - organic base - Mp	594
Very poorly drained - mineral base - Mn, Sa, Sc	348
Marshes - Mh	82

Source: Soil Survey of Merrimack County, Soil Conservation Service.

Topography

Topography is the general lay of the land, of hills, valleys and flat areas that show how the area looks. The surficial physical features are a function of the underlying geologic processes and climate. The physical features can affect water drainage and runoff, soil formation, and vegetation. Topography also influences land use by affecting the suitability of the land for development and influencing both the type and cost of development.

The Town of Warner has a varied topography, from a low of 364 feet above sea level in the southeastern corner of Town, to a high of 2,937 feet at the summit of Mt. Kearsarge in the Kearsarge gore. In general, there are four significant geographical aspects of Warner's topography:

1. The northern section, which is characterized by high elevations and steep slopes, including Mt. Kearsarge (2,937 ft.), Black Mountain (2,560 ft.), and Little Mountain (2,360 ft.);

2. The northeastern section, which is characterized by a series of low rolling hills with flat marshy valleys in between;

3. The Warner River valley, which is characterized by a narrow valley from the Bradford town line, to Bagley, where the river floodplain widens, becoming more than a mile wide in some locations; and

4. The southern section, which forms the predominant topographic area, encompassing almost half of the Town's area. It is characterized by very steep slopes and closely packed hills with very small valleys. There are approximately 22 hill tops over 1,000 ft. of elevation, three of which are over 1,500 ft. in the Mink Hills.

Slope

Slope is defined as the ratio of change in vertical elevation to the change in horizontal distance. The degree of inclination of land influences soil erosion, runoff, and drainage capabilities. Land with steep slopes are more difficult to develop, and are more apt to adversely effect the environment than level sites. Therefore, slope is an important criteria in determining appropriate land use.

In order to categorize and discuss the limitations of slope, the Soil Conservation Service has divided slopes into the following categories and development limitations:

0-3% Flat - This is land which is essentially level. The slope would indicate easy accommodation of almost all land uses. Much of the land in this category within the Central Planning Region lies upon the floodplains of the major rivers. Other flat lands may have drainage problems if the soil proves to be relatively impermeable. Land with such drainage problems is generally best restricted to pasture and grazing, public open space, recreational use, or farming.

3-8% Gently Sloping - Land in this category is suitable for many uses. The slopes are not prohibitive for development, provide interest, and make for excellent natural drainage conditions. Most of this land may be found within the valley floors and river terraces of the planning region occupied by the glacio-fluvial deposits of the outwash plain.

8-15% Moderately Sloping - Slopes of this range begin to be restrictive for certain land uses, and may also prove too steep for most farming purposes. Low density residential development may be feasible if carefully planned and laid out. Most of this land is composed of glacial till deposits along the uplands of the region.

15-25% Steep Slopes - Substantial limitations exist for use of land in this category. Excavation and grading are almost always required, yet development, not intensive in its land coverage and carefully planned, may be accommodated with limited environmental impact.

Over 25% Very Steep Slopes - These lands are most subject to adverse environmental impacts and heavy construction costs. Intensive uses are prohibitive; however, the interest and amenity provided by such lands makes them a valuable recreational resource.

Slopes in Warner are shown on Map 8-4. Steep slopes are found in the Kearsarge Gore, and to the west of the Warner River. Flatter areas are located along the Warner River, in eastern Warner, and in the Davisville area of Warner.

Soils

Soils are the result of various natural processes taking place at, or near, the earth's surface. Their development is dependent upon five major factors: parent material, topography, climate, biotic factors, and time. Soil information plays a prominent role in the determination and classification of land for various land uses, and subsequently in the evaluation of the effects of those uses on selected natural and man-imposed systems. (Frederick & Luty, 1972) Thus, consideration of soil types and characteristics is important in land use planning.

In *Natural Resources Inventory* (CNHRPC, 1975), soils with similar characteristics for planning interpretations were formed into Planning Soils Groups. These soils groups are defined and assessed for their development potential below. The corresponding soils groups identified on the Land Capability Map of the 1967 Master Plan are given in parentheses.

Deep and Stony Soils (Till 1, Till 4)
Well over half the soils in the Region are from these unsorted glacial till deposits. They are generally found in the uplands and are deep to bedrock. Occasionally they have a deep pan layer. Includes the following soil types: Acton, Hermon, and Gloucester.

> *Development Potential* -
> While they provide good foundation characteristics, the deep and stony soils are usually difficult to excavate due to excessive stoniness. Much of these soils are on slopes too steep for development. However, where the slopes are gentle they have permeability characteristics generally suitable for septic tank absorption fields. Although steep slopes make landscaping and construction more difficult, they also offer a high potential for architectural design which takes advantage of the vistas and harmonizes with the surrounding topography and vegetation.

Hardpan Soils (Till 2)
These soils are very similar to those in the Deep and Stony group. However, between eighteen and thirty-six inches below the surface they have a very dense layer which inhibits permeability and root growth unless it is disturbed. Generally these are found in small oval hills or drumlins. Includes the following soil types: Paxton and Woodbridge.

> *Development Potential* -
> Although these soils are commonly less stony than those in the Deep and Stony group, they offer other severe limitations. The hardpan reduces permeability to such an extent that septic fields cannot function. It also hinders road or building excavation, since it is difficult to penetrate when dry and keeps the upper layers of soil heavy with water when wet. During the winter there is the potential danger from frost action, while the wet season presents a potential slide hazard along building excavations or road cuts.

Rocky Soils (Till 3 and Bedrock)
These soils have frequent rock outcroppings and are normally less than two feet thick above bedrock. However, they do contain pockets of deeper till soils. This group is generally found in rough terrain, on the top of ridges or mountains and along very steep slopes. Includes the following soil types: Canaan-Hermon, Gloucester, and Rock Outcroppings.

Development Potential -
Since rock is difficult to excavate and inappropriate for a leaching field, potential development must usually occur in the occasional pockets of deep soil. This requires a careful site investigation.

Sand and Gravel Soils (Outwash 1, Outwash 2)
These soils come from glacial outwashes and were laid down as stratified deposits of sand and gravel. They generally occur in valleys above the flood plain and have more gentle slopes than the deep and stony soils. While most of the soil series in this group are droughty all year, about eight percent have a seasonally high water table. Includes the following soil types: Agawam, Belgrade, Cotton, Duane, Hinkley, Merrimac, Ninigret, Sudbury, and Windsor.

Development Potential -
Where slopes are not a factor and any required drainage is provided for, these soils provide excellent conditions for all types of road and building foundations. Permeability is frequently so high, however, that caution must be taken not to pollute nearby wells, lakes, and streams. Excessive grading will expose sand or gravel which must be recovered with topsoil before landscaping. Where clean and graded deposits of sand or gravel exist, they are in demand as a construction material.

Wetland Soils (Map 3-2)
"A hydric soil is a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part." Source: *Field Indicators for Identifying Hydric Soils in New England, Version I,* 1995, NEIWPCC.

Development Potential -
Any sort of development is unsuitable due to standing water or the possibility of flooding.

Floodplain Soils (Map 3-1)
Formed from recent river and stream deposits over older sand and gravels, these soils are still subject to flooding.

Development Potential -
Frequent flooding makes these soils very poor sites for any sort of residential, industrial, or commercial usage.

Agriculture and Farmland Soils

Land use, for farming purposes in Warner, includes land whose soils are considered prime agricultural soils, as well as some land whose soils are not classified as prime. In order to identify and protect local farmland, Warner needs to consider not only soil type, but also what land is currently being farmed or has recently been farmed. Farmers may also rely on forest soils for maple products, firewood, timber, and Christmas trees.

In order to identify and inventory land considered the best for farming, the U.S. Department of Agriculture, Soil Conservation Service established a number of criteria for identifying important farmland groups based on soil types and characteristics. Important farmland in Merrimack County is defined as:

Prime Farmland

Prime farmland is land best suited for producing food, feed, forage, fiber, and oilseed crops, and is also available for pasture land or forest land, but not urban built up land. It has the soil quality, growing season, and the moisture supply needed to produce sustained high yields of crops economically when treated and managed according to modern farming methods.

The following soils qualify as prime farmland:

Symbol	Soil Type
AfA	Agawam very fine sandy loam, 0 to 3% slopes
NnA	Ninigret very fine sandy loam, 0 to 3% slopes
Of	Ondawa fine sandy loam
Oh	Ondawa fine sandy loam, high bottom
PaB	Paxton loam, 0 to 8% slopes
Po	Podunk fine sandy loam
WoB	Woodbridge loam, 0 to 8% slopes

Unique Farmland

Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality and/or high yields of a specific crop when treated and managed according to modern farming methods.

Unique farmland has the following characteristics:

1. It is used for a specific high-value food or fiber crop.
2. It has a moisture supply that is adequate for the specific crop. The supply is from stored moisture, precipitation, or a developed irrigation system.
3. It combines favorable factors of soils quality, growing season, temperature, humidity, air, drainage, elevation, aspect, or other conditions, such as nearness to market, that favor growth of a specific food or fiber crop.

Examples of unique farmland in New Hampshire include apple orchards, lowbush blueberry lands, vegetable truck gardens, and maple sugar bushes.

Additional Farmland of State-wide Importance

This is land, in addition to prime and unique farmlands, that is of state wide importance for the production of food, feed, fiber, forage, and oilseed crops. Criteria for defining and delineating this land was determined by State and local agencies in New Hampshire. The soils in this category are important to agriculture in New Hampshire, yet they exhibit some properties that exclude them from prime farmland. Examples of such properties are erodibility or droughtiness. These soils can be farmed satisfactorily by greater inputs of fertilizer, soil amendments, and erosion control practices. They produce fair to good crop yields when managed properly. Some of this land is currently forest, but tree age is generally 20 years or less.

The following soil types qualify as farmland of state-wide importance:

Symbol	Soil Type
AcB	Acton fine sandy loam, 0 to 8% slopes
AfB	Agawam very fine sandy loam, 3 to 8% slopes
BcB	Belgrade silt loam, 0 to 8% slopes
GcB	Gloucester sandy loam, 3 to 8% slopes
GcC	Gloucester sandy loam, 8 to 15% slopes
HmB	Hermon sandy loam, 3 to 8% slopes
HmC	Hermon sandy loam, 8 to 15% slopes
MmA	Merrimack sandy loam, 0 to 3% slopes
MmA	Merrimack sandy loam, 3 to 8% slopes
MmA	Merrimack sandy loam, 8 to 15% slopes
PaC	Paxton loam, 8 to 15% slopes
WoB	Woodbridge loam, 8 to 15%

Prime farmland soils and farmland soils of state-wide importance are generally located in the Warner River valley and on hilltops, such as Burnt Hill.

Additional farmland of local importance includes all land which is currently being farmed, but is not considered prime by soil type. Capital investments of $500 to $1,000 or more per acre are required to convert grown up land to agriculture. This investment has been made on land currently farmed in Warner, and is part of the value of the resource.

Aquifers

The two major sources for drinking water commonly used by towns are groundwater and surface water. Many communities initially utilized surface water as the primary source because of the ease of access and the ease in estimating the quantity available. Map 8-5 shows the major aquifers in Warner.

Until 1991, the Warner Village relied on Silver Lake Reservoir, on North Village Road, as its public water supply. This source was abandoned primarily because of State requirements for treatment of surface water supplies. The Warner Village Water District drilled a well near the Warner River, off Chemical Road and two years later, drilled a second well as a back-up in the same area. These sources provide abundant, clean water for the District's residents, businesses and public buildings.

The State of New Hampshire encourages communities to use groundwater as their source of drinking water because groundwater is less susceptible to surface pollution. The earth acts as a purifying mechanism to reduce minerals and other sediments that would normally have to be removed by filtration plants. It is important for the Town to identify the extent of its aquifers and their recharge areas to implement the protection of groundwater resources through planning and land use regulations.

Although all ground contains water to some degree, an aquifer is a geologic formation that is capable of yielding significant amounts of water to a well or spring. The three major types of aquifers are:

> Stratified Drift - Aquifers made up of sand and gravel materials. This aquifer is a prime source of water for municipalities or other large volume users.
>
> Till Aquifers - Till is a mixture of clay, silt, and gravel materials. These aquifers yield small volumes of water which may be adequate for small scale users such as private residential use.

Bedrock Aquifers - These aquifers are composed of fractured rock or ledge. If a well hits an extensive fracture system, the water yields may be high. On the average, these aquifers yield smaller volumes of groundwater than wells located within stratified drift.

In 1995, the US Geological Survey and the NH Department of Environmental Services released a report, titled "Geohydrology and Water Quality of Stratified-Drift Aquifers in the Contoocook River Basin, South-Central New Hampshire," which presents the results of extensive field work and mapping of the stratified drift aquifers in Warner. The amount of land underlain by these aquifers is 4,525 acres.

The sole source of water to the Warner River watershed is precipitation, which either returns to the atmosphere by evaporation; flows overland to streams, ponds or wetlands within the area; or infiltrates the soil. Some infiltration is stored temporarily as soil moisture and is subsequently returned to the atmosphere by evaporation, transpiration by plants or seepage into surface water bodies. The remainder percolates downward through porous rock materials to the water table, where it becomes ground water. Groundwater can reside in the saturated zone for many years, but it can also return to the atmosphere by evapotranspiration and seepage to surface water bodies.

The principal aquifer in Warner lies along the course of the Warner River from the area around Davisville to Tom Pond and northwesterly through the Village to the Exit 9 area. Extensions of this aquifer include Schoodac Brook into Webster, around Lake Winnepocket; and Stevens Brook along Interstate 89 and westerly along the Warner River and Route 103 to the Sutton Town line. Two isolated aquifers exist, one where the Lane River joins the Warner and a second along French Brook and Kearsarge Mountain Road, below Rollins State Park. The major aquifer in Warner is 6.5 square miles in area.

The Warner River aquifer contains a predominance of coarse-grained sediment, which was deposited by glacial meltwaters in kames and eskers. The maximum saturated thickness of the aquifer is approximately 120 feet near Tom Pond. This thick layer was deposited in a deep erosional bedrock channel that was scoured by sub-glacial meltwaters. Saturated thickness is generally less than 100 feet elsewhere in Warner. Estimated maximum transmissivity, a measure of capacity, exceeds 8,000 feet squared per day near Tom Pond, and transmissivities exceed 1,000 ft2/d westerly along the river. The aquifers in the Warner River watershed contain water with shorter residence times than water in other aquifers along the Contoocook River main stem. Hydraulic gradients of the Warner's aquifers are steeper than along the Contoocook because of the lenticular shape of the aquifers and the moderate to steeply sloping stream channel gradients. Municipal ground-water withdrawals are 0.05 million gallons per day from the municipal well by the Warner Village District. Total ground-water withdrawals for the entire Warner River basin by domestic and commercial users are estimated at 0.39 millions of gallons per day (Mgal/day). The total amount of ground-water storage from all deposits in the basin is 7,500 million gallons. The maximum potential average annual recharge to the stratified drift aquifer is estimated at 16 Mgal/d. The potential for additional aquifer yield is greatest at Tom Pond.

Aquifer yields along the Warner River are highly dependent on the capacity to induce infiltration from the Warner River because of minimal ground-water storage in the lens-shaped aquifer.

Source: US Geological Survey and the NH Department of Environmental Services, Geohydrology and Water Quality of Stratified-Drift Aquifers in the Contoocook River Basin, South-Central New Hampshire, 1995.

Bedrock Geology

The state of New Hampshire lies entirely within the Appalachian Highlands, which extend northeast from Alabama to Newfoundland. Formed millions of years ago, this area is characterized by folded and faulted paleozoic sedimentary and volcanic rock. These sedimentary and volcanic rock structures were thoroughly metamorphosed and penetrated by large and small bodies of igneous rocks. Igneous rocks are masses of rock that have been solidified from magma at depth.

The metamorphic bedrock in Warner is known as the Littleton Formation. These rocks were created about 360 million years ago from sedimentary sandstones and shales. These sedimentary rocks, formed in Devonian times, were transformed into metamorphic rock (shists and gneisses) due to extreme temperatures and pressures generated by the land rising and folding. Schists and gneisses are found throughout the central and eastern portion of Warner. These consist predominantly of gray mica schists with some mica-quartz schists and gray micaceous quartzites locally conspicuous (CNHRPC, 1974).

The igneous rock in Warner is of the New Hampshire plutonic series, probably formed in the Upper Devonian period. According to the Natural Resources Inventory (CNHRPC, 1974), the following igneous formations are found in Warner:

> Massasecum Pluton - This pluton is located in southwestern Warner, generally north of the Henniker town line along Route 114 and northwest into Lake Massasecum and Bradford. This rock type contains binary or Concord granite which is light gray to white in color with medium to coarse-grained biotite muscovite granite and quartz monzonite.
>
> Cardigan Pluton - This pluton is located in the western half of Warner, from just west of the village of Warner to the Bradford town line, excluding the Massasecum Pluton area. This rock type contains Kinsman quartz monzonite ranging from a quartz diorite to a quartz monzonite with granodiorite predominating. It is dark to light gray and generally coarse-grained.

Weare Pluton - This pluton is located in the northeast corner of Warner along the boundary of Webster and Salisbury. This rock type is the same as the Cardigan Pluton.

Kearsarge Pluton - This pluton stretches from the village of Warner up to and surrounding Kearsarge Mountain. This rock type consists of weakly foliated to nonfoliated, spotted biotite quartz diorite, tonalite, granodiorite and granite; garnet and muscovite may or may not be present.

The source for geology information is the Bedrock Geologic Map of New Hampshire, Lyons, John B., W.A. Bothner , R.H. Moench , and J.B. Thompson Jr . 1997, U.S. Geological Survey.

Forestry

Forest land is an important natural resource in Warner for many reasons. Forests provide income, not only to the town through timber taxes but also to Warner residents in the form of timber sale revenue, forestry related jobs, and transportation. Forest lands provide recreational opportunities, environmental benefits, and scenic open space. The forested landscape is also home to many species of wildlife who depend on the forest for food, shelter and migration areas.

Information provided to the Town through the collection of the timber tax, reveals the lumber yields in Warner in Table 8-5.

Table 8-5
Timber Tax Receipts

	Amount collected
1997	$21,707
1996	$28,486
1995	$25,511
1994	$30,493
1993	$23,712
1992	$25,937
1991	$15,972
1990	$23,129
1989	$15,094
1988	$16,896
1987	$24,464

As land is subdivided in Warner, woodlots become smaller, which tend to create a more fragmented forest structure as each parcel is individually managed. While not necessarily a bad trend, this does increase the difficulty in managing the long-term sustainability of the forest resource for a variety of uses. More disturbing, from a forestry perspective, is the gradual conversion of forest into developed areas. This carries the threat of permanently fragmenting wildlife habitat and creating conflict between forest management and residential quality of life.

Another forestry trend in Warner is the transition from a predominantly softwood forest to a predominantly hardwood forest. This is the result of the aging of the forest since agricultural lands were abandoned in the latter part of the 1800s and the early part of this century. Because of the slower regeneration rates of pine trees, as compared to that of hardwoods and the shade tolerance of hardwood seedlings, the selective harvesting practiced today will tend to favor the regeneration of hardwoods. Tim Fleury, the Merrimack County Forester, states that hardwoods require more time between harvests than softwoods, which means that more intensive forest planning is required to make sure that Warner's forests are properly managed to maintain present harvest rates.

Under the Current Use Tax program, the Town requires management plans for all timberland placed in current use. In addition to Current Use Tax, the Tree Farm Program is available to landowners to encourage forest management. This Federal program encourages management of woodlots for better species, better quality saw logs, more sustained yields, and maximum productivity, and is administered jointly in New Hampshire by the Society for the Protection of New Hampshire Forests and the New Hampshire Timberland Owners Association.

Wildlife Habitat

Warner's landscape supports a diversity of birds, mammals, fish, reptiles, amphibians and insects that are necessary to maintain a balanced ecosystem and enhance the quality of life. If this diversity is to continue in the face of growing human population, Warner residents must integrate wildlife habitat consideration into their land-use planning process.

Wildlife are a critical part of all natural ecosystems and of our cultural heritage. What once provided our ancestors with a steady supply of food, today provides for recreation, both for hunters and those interested in viewing wildlife. Wildlife habitat continues to be important for Warner residents. In the recent Master Plan survey, 75% of the respondents were in favor using zoning regulations to protect wildlife habitat and 80% were in favor of the Conservation Commission working with residents to identify important wildlife habitat and preserve it.

Wildlife habitat is defined as those areas that provide food, shelter, water and space necessary to survive. Although many native species of wildlife find some or all of their habitat requirements

in forests, everything is habitat of some kind. Below is a list of habitat types that have been identified as significant by the New Hampshire Fish and Game Department's booklet *Integrating Wildlife Habitat into Community Planning.*

Agricultural and other open lands

In the past, natural disturbances such as fire, hurricanes, ice storms, flooding and beaver activity combined to create open land habitat, such as grassy meadows and shrublands openings in the forest.

Increasing human influence on the landscape and more control over these natural disturbances have reduced the opportunity for this habitat dynamic to develop. Although agriculture created open habitat, much of this land has now reverted to forestland. Because Warner is now predominately forested, agricultural lands are particularly important for certain species.

The succession of abandoned forest land eventually created a habitat composed primarily of small trees and bushes. Like grasslands, these habitats have become increasingly rare or too small in size to support the species unique to shrublands. In addition to reverting farmland, shrubland can be found along powerline corridors and abandoned gravel pits. While these areas may appear to be devoid of habitat, they are key components of an effort to maintain habitat diversity.

In the Master Plan survey, 88% of the respondents felt that the current use assessment for agricultural uses should continue as a way of retaining active farms in town and 67% favored the acquisition of easements and development rights as way of preserving open areas.

Deer Yards

As winter settles in and snow depths increases, deer move to areas of dense softwood cover, which are often referred to as deer yards. These can vary in size from a few acres to over one hundred acres. The softwood trees that comprise these areas are most commonly hemlock but may include some spruce and fir at higher elevations. During winter, cover takes precedence over food and is critical to the survival of Warner's deer population. Without adequate deer yards, populations of deer may go through extreme fluctuations. The Willow Brook Project identified mature hemlock stands as priority areas for conservation due to their rarity in the watershed and their value for certain species.

Floodplains

Floodplains are very dynamic systems that provide habitat for many species of bird, reptiles, amphibians and mammals. The deep, moist soils of the floodplain support nut producing trees and abundant fruiting shrubs and vines. These food sources are important to a wide variety of wildlife species, especially during the late summer and fall as mammals prepare for hibernation

and birds beginning their long southward migration. Floodplains cover some 2,306 acres of Warner. See map 8-1. The Master Plan survey found that 77% of the respondents were in favor of town controlling the use of flood prone areas.

Habitat for Threatened and Endangered Species

State and Federal law define endangered species as one which is in danger of extinction over all or a significant portion of its range, and threatened species as one which is likely to become endangered in the foreseeable future. The NH Fish and Game Department currently list 34 animals as threatened or endangered under the authority of the Endangered Species Conservation Act of 1979. The US Fish and Wildlife Service also list five of these species as threatened or endangered under the Endangered Species Act of 1973.

Wildlife species have become endangered for a variety of reasons, including over-harvesting or trapping, adverse affects of pesticides, and habitat loss or alteration, just to name a few. None of the currently listed animal species find critical habitat in Warner. As species protection and management leads to recovering populations, species such as the osprey may find breeding habitat in town. Information on the latest status of these species is available from the NH Fish and Game Nongame and Endangered Species Program.

Habitat for Species of Special Concern

In addition to threatened and endangered species, there are other species of concern that warrant special attention but have no legal designation. The New Hampshire Natural Heritage Inventory tracks these species, as well as the threatened and endangered species. Biologists and experts in the state identify species of special management concern due to demonstrated population declines or suspected declines with insufficient data to make a determination. Several of these species are found in Warner. Habitats and potential habitats for these species should be identified and protection strategies developed. One key habitat that has already been identified are wetlands. All but one of the species on the state list is dependent on wetlands during their life cycle. This means that the protection of wetlands is tantamount to the protection of wildlife, especially species of concern.

Scarce Habitats and Special Land Features

Some landscape features, found within the broader habitat types, provide significant or unique habitats in Warner. Rock piles and outcrops provide denning sites for porcupines and bobcats, nest sites for turkey vultures and hibernation sites for snakes. Deep caves and old mine shafts provide hibernaculum for several species of bat, which are extremely rare in New Hampshire. Some habitat types are rare in certain regions of the state and thus provide very significant habitats within a regional context. Mt Kearsarge and the surrounding lands above 2,500 feet support a different forest community comprised of spruce and fir trees and provide rare breeding

habitat in this region for Swainson's and Bicknell's thrushes and blackpoll warblers.

Shorelines

The shorelines of major rivers and lakes provide important habitat for many wildlife species. This habitat type is among the most threatened in the state due to development. Warner still has several ponds with undeveloped shores, such as Simmons and Bear Ponds. These areas may provide nesting habitat for species such as spotted sandpipers and loons. Large trees along the shore serve as perch trees for piscivorous raptors, such as osprey and bald eagles, both of which use the area during migration. The Warner River corridor also has stretches of undeveloped riparian corridor that serve as a migration corridor for many birds and mammals. Eroding riverbanks provide nesting habitat for swallows and kingfishers.

A naturally vegetated shoreline also helps to protect the quality of the adjacent water thus protecting aquatic habitats for fish and invertebrates. Present town regulations provide a setback of 75 feet from all rivers, streams and ponds. The New Hampshire Comprehensive Shoreline Protection Act limits activities within 250 feet of the Warner River.

Unfragmented Blocks of Habitat

Unfragmented blocks of habitat are those large pieces of land with no roads and few or no human structures. These blocks provide some of the most important long-term wildlife habitats. Within these areas contiguous natural habitats supporting a diverse array of native wildlife can usually be found, ensuring that species common to the area remain common. The variety of habitat conditions also support wide ranging species such as moose, bear, fisher, and bobcat, which cannot survive in a fragmented landscape.

In unfragmented lands, there are large enough acres for habitat dynamics to effect the landscape over time, these changes can occur naturally or as a result of timber management practices and create a variety of habitats. This dynamic pattern of change allows wildlife to continue to adapt to land use changes, including human induced changes, as long as there is enough area that a variety of habitats are always available.

The impact of a fragmented landscape on wildlife is tremendous. Road construction and the associated development leads to mortality, introduction of non-native species, an increase the population of predators that benefit from a human presence such as skunks and raccoon, and the introduction of new domestic predators, such as dogs and cats.

Recently, the Warner Conservation Commission contracted with Complex Systems at the University of New Hampshire (UNH) to determine the amount of unfragmented lands in the town. This was accomplished using Geographic Information Systems (GIS) to look at all forested areas larger than 500 acres that were not fragmented by open fields, development, roads

or waterways. It was found that 75.8% of the town, or 26,910 acres, fit those criteria. Much of this land is located in the Mink Hills. The Master Plan survey found that 67% of the respondents would be in favor of protecting the forestry uses of these areas through large lot zoning of 50 acres or more.

Vernal Pools

Vernal pools are a unique type of wetland that are ephemeral in nature, supporting no fish population. These are critical breeding habitat for several species of amphibian, such as the spotted and Jefferson salamander, and important feeding location for many other species, including wading birds and spotted and Blandings turtles. These important natural resources can be impacted by changes in hydrology, the removal of a naturally vegetated buffer, as well as filling and dredging.

Wetlands

One third of Warner's native wildlife species rely on wetlands at some point during their lifecycle for feeding, breeding or cover. There are many different types of wetlands covering about 6% of the town's land area. These include shallow open water marshes, which are often created by beaver activity, to forested wetlands, which may appear dry for several months during the year. Beaver created wetlands play an important role in the ecology of our area. Many species of plant and animal have evolved since the last glacier to take advantage of the dynamic nature of a beaver pond. The hundred or so year cycle of forest to flooded pond to meadow to shrubland and back to forest again takes place throughout the landscape. It is important to allow for the dynamic nature of this activity to continue to support the variety of species that use these areas.

The value of wetlands as wildlife habitat is enhanced by the presence of a naturally vegetated buffer. The optimum width of the buffer varies with each species. However, a 1995 publication by the Audubon Society of New Hampshire suggests that a minimum buffer of 100 feet is necessary to both provide minimal habitat and protect the water quality of the wetlands and associated streams and ponds.

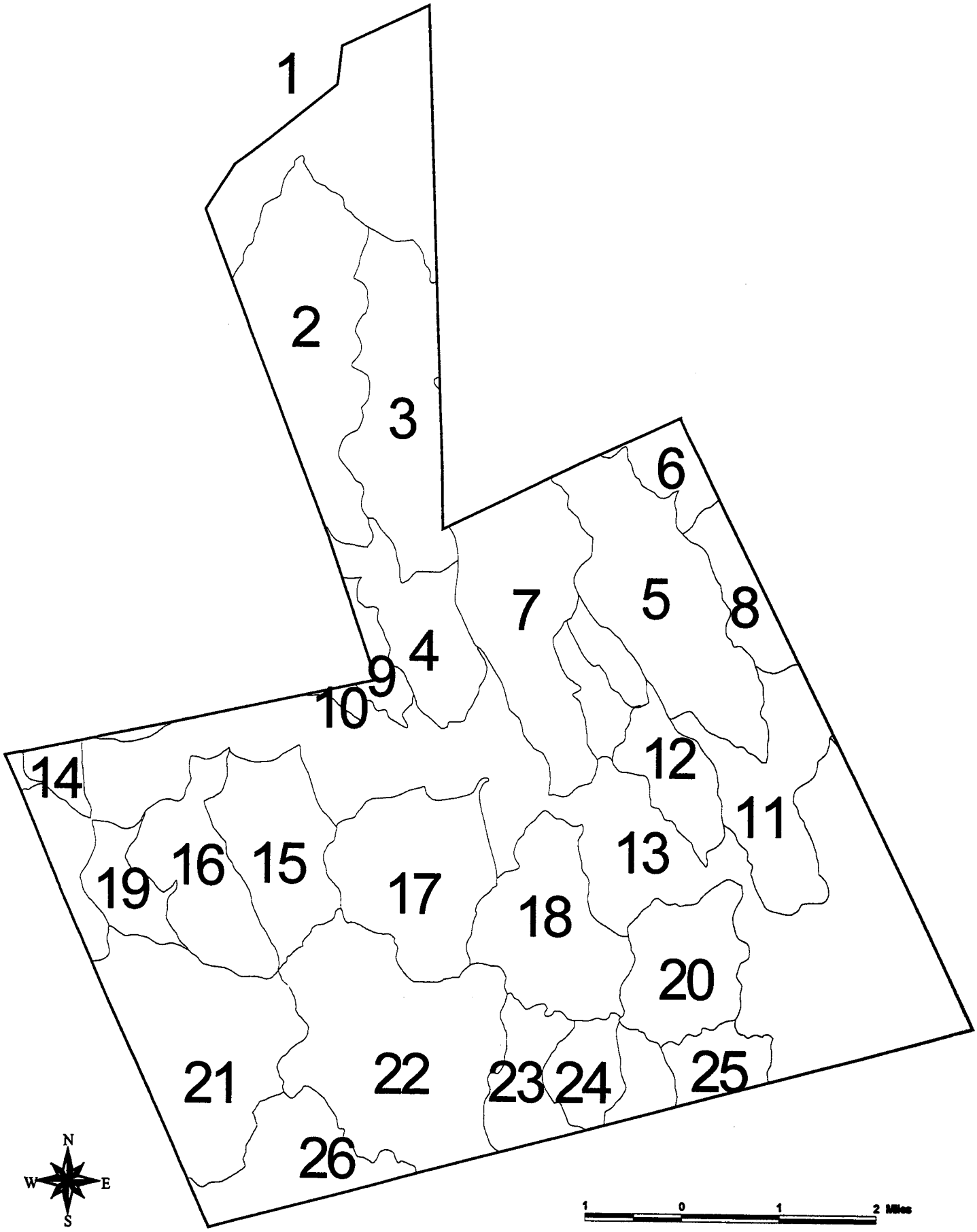
Wildlife Travel Corridors

Wildlife travel corridor is a term used to describe a variety of different habitats that allow the movements of wild animals over both short and long distances. Wildlife often travel among feeding, watering, and resting areas along the same path. These travel corridors develop in areas where animals feel secure in their movements. For deer it may be a strip of pine or hemlock through a hardwood forest, for a rabbit it might be a row of shrubs between two fields. Medium and large mammals follow natural features like streams and ridge lines and generally take the path of least resistance, often using wood roads to move. Seasonal changes may cause changes in the movement patterns of some animals. Deep snow will force deer into stands of large conifers, while warm spring rains will initiate the movement of salamanders and frogs to vernal pools.

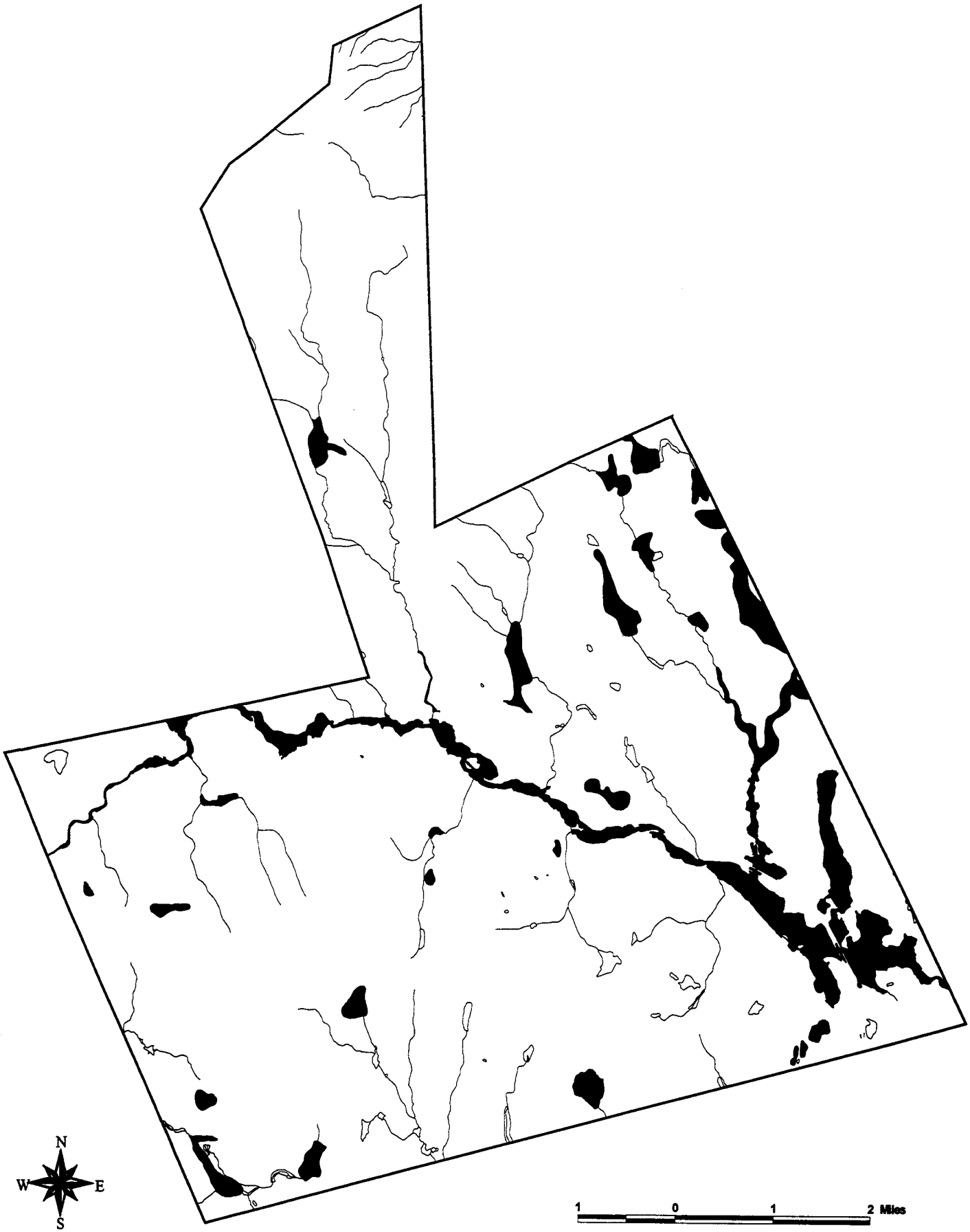
Migration routes often follow major river corridors. These can be of major importance to migrating birds returning in the spring. These areas usually see the first leaf-out and the first insect hatches, sources of food for birds. In the fall, these areas produce an abundance of berries and seeds, fueling the southward migration.

When planning to provide wildlife corridors, it is important to look at the distribution of conservation lands in the town and work on connecting these protected areas to support the movement of wildlife between these areas.

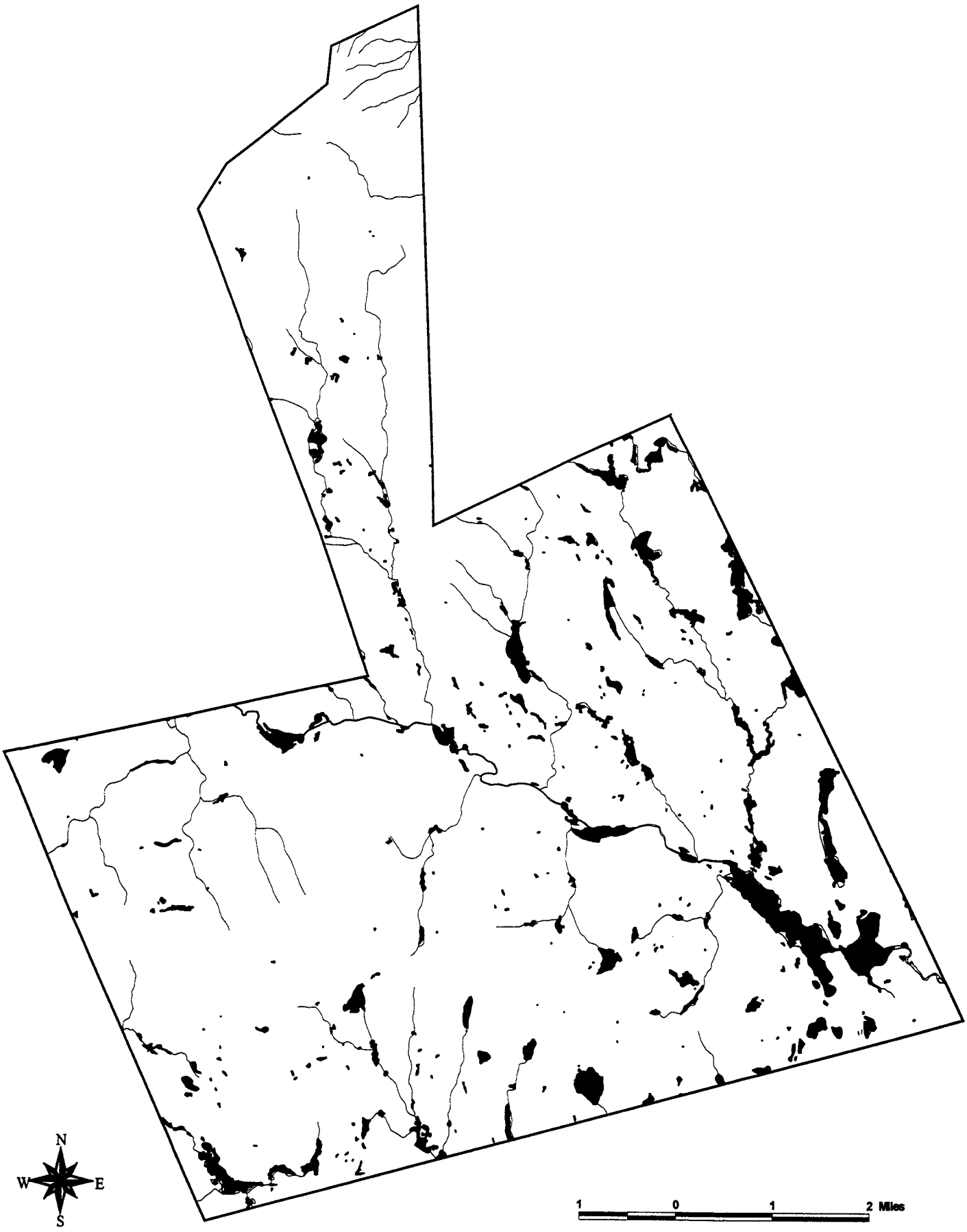
Map 8-1 Warner Subwatershed Map



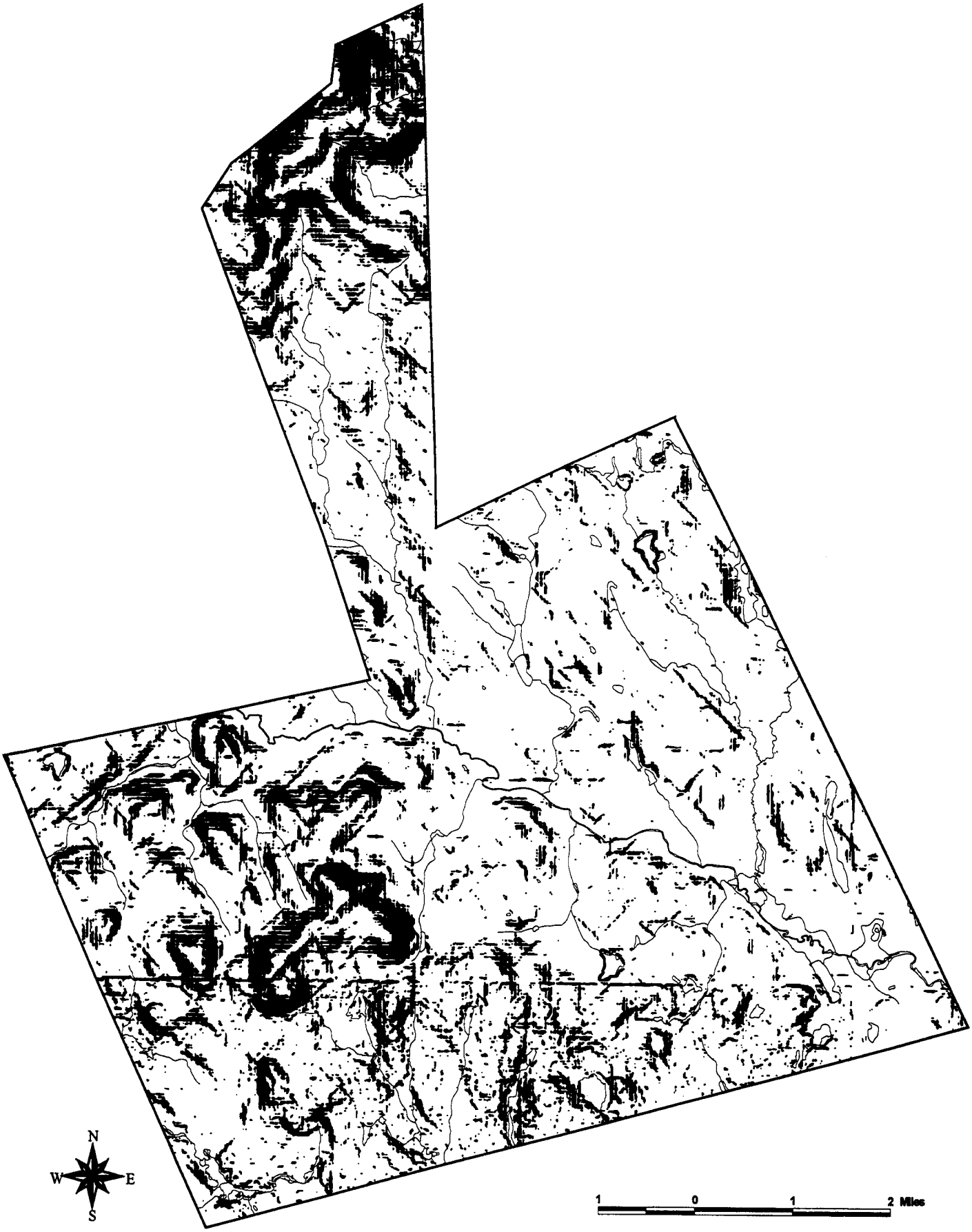
Map 8-2 Warner Floodplains



Map 8-3 Warner Wetlands



Map 8-4 Slopes greater than 25%



Map 8-5 Warner Aquifers