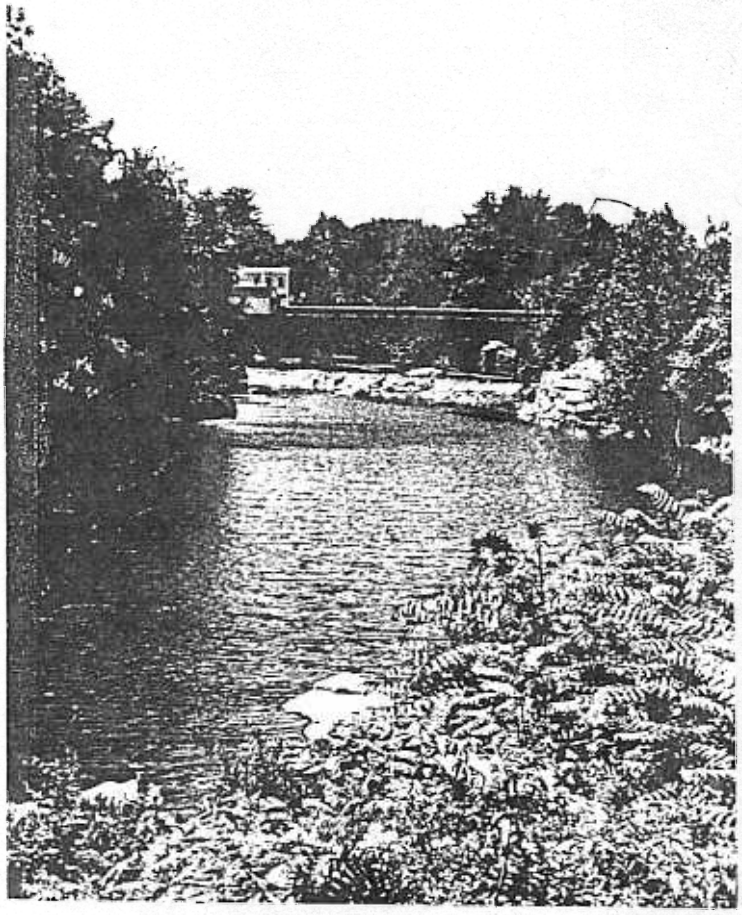
Souhegan River Corridor Study



Nashua Regional Planning Commission

June 1994

Souhegan River Corridor Study

Prepared by the

Nashua Regional Planning Commission

June 1994

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Chapter I.

Introduction

SOUHEGAN RIVER CORRIDOR STUDY

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CHAPTER I

INTRODUCTION

The extensive network of rivers and streams that meanders across the State is one of New Hampshire's most valuable resources. Early settlers relied on the rivers for transportation, water supplies and food, as well as for the floodwaters that annually provided fertile bottom lands for farming. In time, man learned to harness the power of the river to control flooding; to provide power for manufacturing processes; and eventually, to generate electricity. In addition, the urbanization and industrialization of the State created the need for disposing of large quantities of human and industrial waste and once again, the rivers were there to serve man.

Throughout history the Souhegan River has served man by providing transportation and food, by powering early mills, by supplying water for irrigation and drinking, and by carrying away wastes. Initially, the River was capable of accommodating all of the demands placed upon it by man. Eventually, however, the upper limits of the system were reached. No longer could the River effectively assimilate all of the wastes; the water became contaminated and unfit to drink; and the fish and other food sources died off.

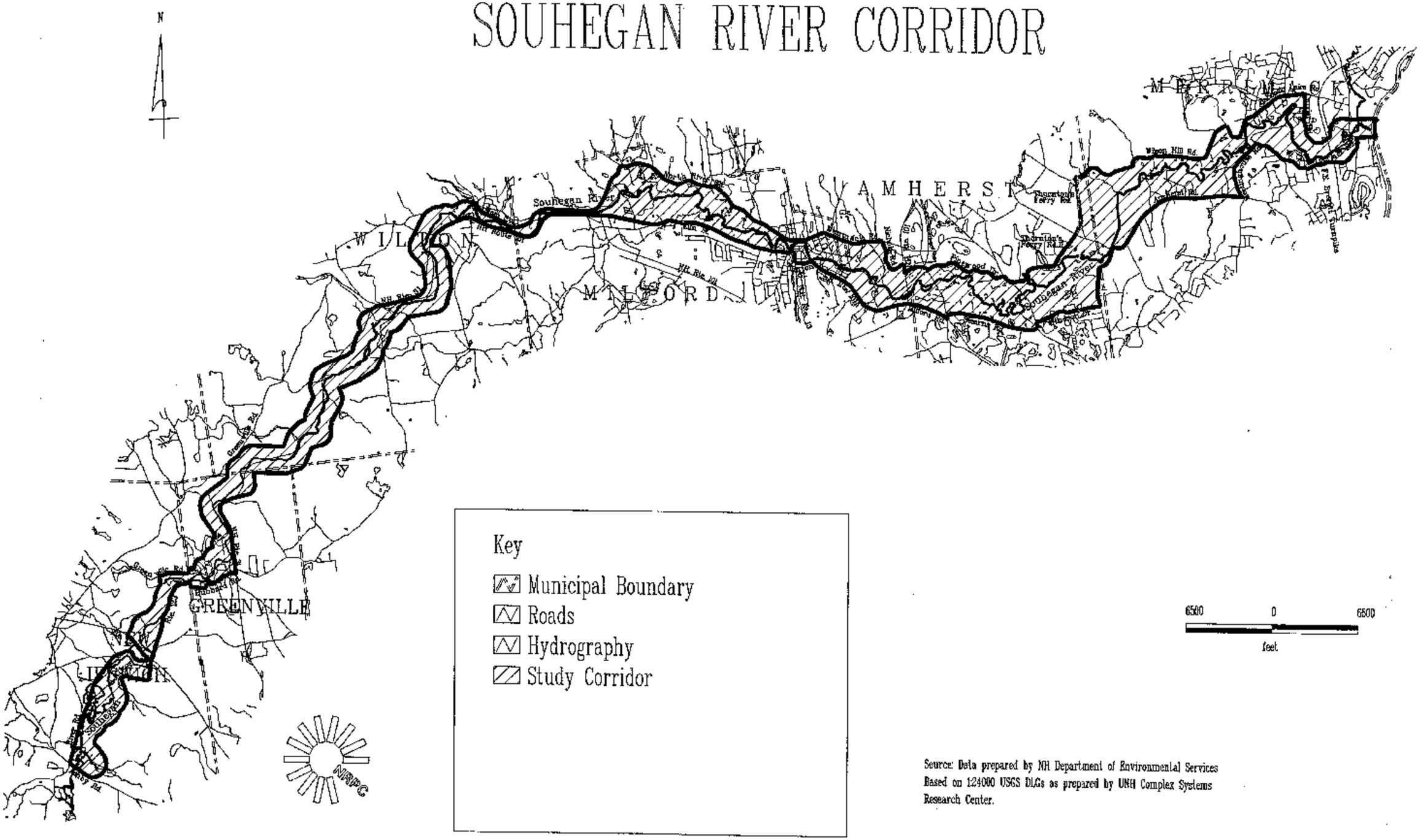
The passage of the Clean Water Act in 1972, amended in 1987, and the billions of dollars that have been spent on wastewater treatment have tremendously improved water quality in the State's rivers. No longer the stinking open sewers of the past, there is renewed interest in rivers and development within river corridors. As a multiple-use river, the Souhegan River supports many uses including water supply, wastewater assimilation, power generation, fish and wildlife habitat, recreation and scenic enjoyment. The capacity of the Souhegan River to support these numerous and competing uses, however, is limited. A balance between the many river uses and users must be attained to insure the continuation of the multiple-use capabilities of the Souhegan River.

The Souhegan River is formed by the convergence of the South Branch and the West Branch Souhegan Rivers in New Ipswich. From there it flows northeast through Greenville, Wilton, Milford, Amherst, Bedford and Merrimack to its confluence with the Merrimack River. The 171 square mile watershed includes portions of the following towns: New Ipswich, Temple, Greenfield, Lyndeborough, Wilton, Greenville, Mont Vernon, Milford, Amherst and Merrimack in New Hampshire and Ashby and Ashburnham in Massachusetts. The study corridor, as depicted on Map I-1, was delineated by using major roads where possible and a 1,000 foot buffer where roads do not exist.

The Souhegan River Corridor Study was conducted in two phases. Phase one involved the compilation of information on the natural and physical characteristics of the corridor, recreation use and potential, water quality and use, historic resources and existing land use and zoning. Phase two included an assessment of the information and the development of recommendations for managing river resources. Successful river management begins at the local level with sound land use practices. In addition, the study contains all of the information required to nominate the Souhegan River for designation under the State's Rivers Management and Protection Program is contained in this report.

Map I-1

SOUHEGAN RIVER CORRIDOR



Source: Data prepared by NH Department of Environmental Services Based on 124000 USGS DLGs as prepared by UNH Complex Systems Research Center.

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Chapter II.

Goals and Objectives

CHAPTER II

GOALS AND OBJECTIVES

After an initial discussion of the issues surrounding the Souhegan River, the Advisory Committee identified one goal and a series of objectives to guide the development of the Souhegan River Corridor Study. The Advisory Committee is comprised of representatives from the six communities along the river and other organizations and businesses with an interest in the river. The recommendations contained in Chapter VIII are designed to address and achieve the goal and objectives of this study.

Goal: A conserved, protected and soundly managed river and river corridor that preserves the character and integrity of the Souhegan River; improves and protects water quality; preserves significant natural, historic and scenic resources; and provides for the continued utilization of the Souhegan River for multiple uses.

Objectives:

1. Restore and protect water quality and quantity in the River.

2. Protect environmentally sensitive areas within the corridor such as wetlands, aquifers, wildlife/plant habitats, shorelines and steep slopes.

3. Encourage the six communities adjacent to the River to adopt local land use regulations that ensure responsible use, development and enhancement of the River corridor.

4. Encourage businesses within the corridor which rely on the River for water supply, waste assimilation and/or store or generate hazardous materials to utilize systems and methods which protect surface water and groundwater quality.

5. Increase public access to and use of the Souhegan River in appropriate areas.

6. Raise public awareness of, and appreciation for the Souhegan River and its natural, historic and scenic resources.

   Develop a greenbelt along the River shoreline to retain the existing character and to protect it from future development.

8. Maintain a variety of habitats to promote a diversity of wildlife within the corridor.

Chapter III.

Natural Resources

CHAPTER III

NATURAL RESOURCES

The initial step in the Souhegan River Corridor Study involves examining the physical and natural characteristics of the corridor. Despite the ability to engineer and design systems to work under almost any conditions, land uses and activities are still limited by the specific characteristics of the site. Farming on steep slopes, placing septic systems in wetlands and building structures in areas with a high potential for flooding are some examples of physical conditions constraining, if not prohibiting, land uses. In addition, ensuring a diversity of plant and animal species, and the continuation of rare, threatened and endangered species depends on conserving a variety of habitats. Once destroyed, it is difficult to recreate the specific habitat conditions required for many species. Scenic vistas and views are another component of the natural resource base that need to be conserved. The visual impacts of a single action, such as a clear cut or construction of an expansive building or structure, can have a profound impact on the visual quality of the river corridor. As with habitats, it is difficult to recreate a scenic view once it is destroyed. In many instances, however, the negative impacts of development can be avoided through proper planning for long-term conservation of the resource and through careful consideration of the physical and natural characteristics of the site prior to development.

GEOLOGY

The bedrock geology of the Souhegan River valley formed hundreds of millions of years ago during the Ordovician, Silurian and Devonian periods. The original sedimentary rocks, deposited by shallow seas that once inundated much of New Hampshire, were faulted, folded, exposed to high temperatures and pressures, and eroded. These processes transformed the sedimentary rock into the metamorphic rock that exists today. Molten magma from the earth's core intruded into the overlying metamorphic rocks forming igneous intrusions of which granite is the most common in New Hampshire.

According to the "Geologic Map of New Hampshire", 1955, there are three major formations underlying the Souhegan valley. The Merrimack Group located at the mouth of the Souhegan River is comprised mostly of purplish-brown biotite schists, gray quartz-mica schist, greenish-gray actinolite granulite and brown biotite-actinolite schist with garnet present throughout. The middle formation west of the Merrimack group to approximately the Wilton town line contains mostly pink to gray, medium- to coarse-grained, massive to foliated biotite granite, quartz monzonite and granodiorite. The Littleton formation, the remaining western portion of the valley, includes gray micaceous quartzite and gray coarse-grained mica schist, with such minerals as biotite, garnet, sillimanite, and locally, andalusite.

About 100,000 years ago, glaciers invaded and covered most of New Hampshire. This period of glaciation is the most significant factor in the development of the existing landscape. The enormous force of the ice as it invaded and receded, scraped and molded the earth's surface creating the high peaks and outwash plains that exist in New Hampshire today. In addition, meltwater channels blocked by debris formed great shallow lakes. Information from the "Surficial Geologic Map of the Milford Quadrangle," USGS, 1970, indicates that glacial Lake Merrimack, which began just south of the New Hampshire-Massachusetts line, extended up the Souhegan River to Milford center. Other deposits in the area contain sands and gravels which were lain down by meltwater streams controlled by bedrock spillways. Stream terrace deposits along the Souhegan River, cut into former glacial lake or glacial stream deposits, formed during late glacial time. Substantial alluvium deposits, light gray to white fine sands and silts, underlie the existing floodplains of the Souhegan River.

Streams flowing from the melting glaciers deposited sediments in layers of similar sized grains. Because of their ability to store and transmit high volumes of water, these stratified drift deposits are often excellent sources of groundwater. The relationship between glacial stratified drift deposits and aquifers is documented in a study conducted by the United States Geological Service in 1987, entitled Hydrogeology of Stratified-Drift Aquifers and Water Quality in the Nashua Regional Planning Commission Area, South Central New Hampshire. This study indicates that the Souhegan River, except for a section in southwest Wilton, is underlain by stratified drift deposits of varying thicknesses and textures. The USGS 1977 map "Availability of Ground Water in the Lower Merrimack River Basin, Southern New Hampshire", the predecessor of the 1987 study, indicates limited stratified drift deposits with high water yielding potential in the Souhegan River corridor west of Wilton. The towns of Merrimack, Milford, and Wilton rely on these deposits for present and future municipal water supplies. A more

detailed discussion of these aquifers and existing aquifer protection in the study corridor can be found in the section on groundwater in Chapter IV.

Sand and Gravel

The characteristics that make stratified drift deposits good sources of water also make them excellent sources of sand and gravel. The sorted deposits of sand and gravel provide a ready supply of an important and necessary construction material. The aquifer map in Chapter IV, Map IV-2, indicates that sand and gravel deposits are extensive in the study corridor. Improper removal of these materials and poor site restoration, however, can have a significant impact on surface water and groundwater quality. Since soil serves as a natural filter and removes suspended contaminants, the removal of too much soil can reduce the filtering capacity and increase the potential for contaminants to reach groundwater. Surface waters can be impaired by increased turbidity and sedimentation caused by erosion at excavation sites.

NH RSA 155-E, Local Regulation of Excavations, gives communities the authority to regulate excavations by adopting excavation regulations. Properly designed, implemented and enforced excavation regulation can protect sensitive surface water and groundwater resources from potential negative impacts. As always, local regulations can be more stringent than the provisions in the statute. The statute, however, specifically prohibits excavations "that would substantially damage a known aquifer, so designated by the United States Geological Survey" and excavations within 75 feet of a navigable river. In addition, the statute requires excavation sites be reclaimed and that a bond or other security to cover the cost of reclamation be placed with the regulator prior to any excavation of the site.

TOPOGRAPHY

Topography is the general form of the land surface. As previously discussed, New Hampshire's topography is largely due to the glaciers that covered the state until about 14,000 years ago. Since that time, numerous factors, such as wind, water, temperature, floods, earthquakes and man, have subtly and dramatically altered the landscape.

Elevation and slope are the two major components of topography. Elevation is the measure of the height of a given point of the land surface relative to mean sea level. Slope is a measure of the pitch or the steepness of the surface between two given points and is calculated by dividing the change in elevation, rise by the distance, run, between the two points (rise/run). The slope of the land is a critical determinant of its ability to support certain land uses. In addition, the changes in elevation and slope provide vantage points for viewing the surrounding landscape as well as subjects for the views.

The study corridor has been defined as the Souhegan River from the confluence of the West and South branches in New Ipswich to its confluence with the Merrimack River in Merrimack. Overall, the topography of the corridor varies widely from flat, expansive floodplains to rolling hills and steep embankments. Corridor elevations range from a high of 1,050 feet in New Ipswich to 50 feet in Merrimack. In its 31.8 miles, the River drops approximately 900 feet from New Ipswich, 950 feet above Mean Sea Level, to the Merrimack River, 50 feet aMSL, an average drop of 28 feet per mile. This average is misleading since there are places where the River drops off more quickly forming rapids in Greenville, Wilton and Merrimack. Of note is Wildcat Falls in Merrimack where the River drops 83 feet over a series of three falls.

Slope is one of the limiting factors to be considered when determining the development potential of a parcel of land. Information on slope is generally considered in conjunction with the other environmental factors of geology, soils and hydrology. Generally speaking, slopes of 0 to 3 percent are not well drained and are often associated with wetlands. Land with slopes of 3 to 8 percent and good soils is usually considered ideal for development because constraints are minimal, while development on slopes of 8 to 15 percent will require some additional planning to provide for proper drainage and soil stabilization. Areas of moderate slope, 15 to 25 percent, are sensitive to development and best suited for open space uses such as natural areas, hiking and nature trails, picnic areas, environmental education and outdoor recreation. With proper design, however, and providing other environmental conditions are favorable, these areas can successfully be developed for more intense uses. Slopes greater than 25 percent are very steep and highly susceptible to erosion if developed.

Areas with slopes greater than 25 percent are highly sensitive to development and should be protected to reduce the potential for erosion that could result in sedimentation and water quality problems in the River. The impact of soil erosion and sedimentation is discussed in more detail in Chapter IV under Nonpoint Source Pollution. To highlight the major points, erosion and the resulting sedimentation can increase the turbidity of the water, decrease available levels of oxygen, destroy important fishery habitats, decrease the capacity and lifespan of impoundments and modify the flow of the water such that streambank erosion is accelerated.

Steep slopes also present a number of problems when considering the development of recreation areas. Canoe launches located on steep banks, for example, would require major alterations of the site. Trails in steep slope areas would also have to be carefully designed and constructed. Foot traffic on steep slopes could negatively affect vegetative cover leaving open areas where runoff would concentrate, increasing erosion along the path and lower areas on the slope. In addition, steep slopes present a number of safety concerns, particularly for children, older adults and the physically challenged.

SOILS

Soil type is a critical factor in determining appropriate land uses and development potentials for a parcel of land. The Soil Conservation Service (SCS) has conducted extensive surveys and analyses of the soils of Hillsborough County. Information on the soils in the Souhegan River corridor can be found in the Soil Survey for Hillsborough County, Eastern Part and the Soil Survey for Hillsborough County, Western Part, published in 1981 and 1985 respectively. The Surveys delineate soil types and provide general information on the characteristics of each type. Each soil type is evaluated and rated with regard to development potential for specific land uses such as crops and pasture, forestry, recreation, wildlife habitat, building site development and sanitary facilities.

In addition to the maps delineating specific soil types, the Surveys also contain a general soil map that describes different soil associations. The general soil map defines broad areas that have a distinctive pattern of soils, relief and drainage. The information contained on the general soil map and in the description of the soil associations is useful in evaluating soils for general uses in large areas and is adequate for evaluating the soils within the Souhegan River corridor at this level. The soils within the Souhegan River corridor fall into 6 soil associations: Occum-Pootatuck-Suncook, Hinckley-Windsor, Colton-Adams-Naumberg, Marlow-Peru, Monadnock- Lyme and Monadnock-Lyman-Tunbridge. Each of the soil associations is completely described in the Surveys. Excerpts from these descriptions are presented below.

> The Occum-Pootatuck-Suncook association is composed of deep, nearly level, well drained, moderately well drained and excessively drained, loamy and sandy soils on floodplains. This association is dominant in the Milford and Amherst sections of the corridor north and south of the River. The soils in this association are well suited for agriculture.
>
> The Hinckley-Windsor association is typified by deep, nearly level to steep, excessively drained, gravelly and sandy soils on terraces. Most of the soils in this association are used for urban and suburban development for which they are well suited because of their poor moisture holding capacity. These soils represent the rest of the River corridor in Milford and Amherst, and the entire corridor in Merrimack.
>
> The Colton-Adams-Naumberg association is comprised of very deep, nearly level to very steep, excessively drained, somewhat poorly drained and poorly drained, sandy soils on outwash plains and terraces. This association is dominant along both sides of the River in Wilton. Colton and Adams soils are suited for urban development; however, they are poor filters for onsite sewage disposal due to rapid permeabilities. Colton soils are a good source of sand and gravel, and Adams soils are a good source of sand. Naumberg soils are limited for most uses by the seasonal high water table.
>
> The Marlow-Peru association is typified by very deep, nearly level to steep, well drained and moderately well drained, compact, loamy soils on uplands. This association is found along one stretch south of the River in Wilton and along both sides of the River at the confluence of its headwaters in New Ipswich. Most areas of this association are covered by forest comprised of

mixed hardwoods. The area is limited for most agricultural and urban uses; however, cleared areas are suitable for hay, pasture and apple orchards.

The Monadnock-Lyme association is characterized by very deep, nearly level to steep, well drained and poorly drained, loamy soils on uplands. This association encompasses the River corridor from the Wilton-Greenville Town line to Water Loom Pond. Most areas of this association are covered by mixed hardwood and conifer forests. Slope, surface stones and seasonal high water table limit this association for most urban uses.

The Monadnock-Lyman-Tunbridge association is composed of very deep to shallow, gently sloping to steep, well drained and somewhat excessively drained, loamy soils on uplands. The soils in this association are in mountainous areas and are generally forested. Depth to bedrock, slope and surface stones limit this association for most urban and agricultural uses. This association is located southeast of Water Loom Pond in New Ipswich.

Agriculture

The US Department of Agriculture has identified soil types that are best suited to crop production based on soil quality, growing season and moisture supply. These prime farmland soils are likely to produce the highest crop yields, require the least amount of economic inputs and cause the least environmental damage. Prime farmland is a very valuable but limited resource. The characteristics that make land prime for agriculture also make it prime for development.

Prime farmland in the Souhegan River corridor is limited. The most extensive areas are located in Amherst, north and south of the River, and in Milford, predominantly south of the River. Much of the prime farmland in Amherst has been converted to other uses, including golf courses and residential developments. In Milford, much of the prime farmland soil south of the River is used to grow corn and hay.

In addition to prime farmland soils, land in active agricultural production is another important community resource. Active agricultural operations within the River corridor are limited to a couple of operations in Merrimack and Wilton and more extensive areas in Amherst and Milford. Crops include corn, hay, produce, fruits and berries. Tuckahoe Turf Farms, which had a significant presence in the River corridor in the past, has ceased to operate in New Hampshire during the last two years.

Besides their importance for the production of food and fiber, agricultural lands are important to a community for other purposes. The open fields and farm buildings provide important open space and diversity in the landscape; supply diverse habitats for resident wildlife and migratory species; and maintain the presence of farming culture. To preserve this important resource, it is essential that productive farmland be maintained in parcels large enough to provide for efficient use of the land and to generate sufficient economic returns for the farmer.

FLOODPLAINS

Floodplains are areas adjacent to water courses and water bodies that are susceptible to flooding during periods of high surface water runoff. Flooding can cause a great deal of damage to structures and land uses located within the floodplain. In an effort to reduce flood losses, Congress created the National Flood Insurance Program in 1968. As part of the program, the Federal Emergency Management Administration (FEMA) and the Federal Insurance Administration (FIA) conducted studies and prepared a series of maps which identify the floodway, the 100 year floodplain and the 500 year floodplain. For the purposes of this study discussion will focus on the 100 year floodplain and all information is derived from the Flood Insurance Rate Maps for each community.

The Souhegan River watershed is highly managed for flood control. Historic flooding within the Souhegan River watershed caused substantial damage leading to a cooperative effort begun in 1957 to decrease the impact of flooding. The Souhegan River Watershed Project constructed 12 flood control dams on tributaries throughout the watershed from 1964 to 1976. The program estimated reductions in annual flood losses of 75 percent and major flood losses of 66 percent. The Flood Hazard Studies were conducted and the Flood Insurance Rate Maps developed after the flood control dams were constructed.

While there are floodplains adjacent to the River for its entire length, the most extensive floodplains are found in Amherst, Milford and Merrimack. The most substantial floodplains in Merrimack are located in the western part of Town between Wilson Hill Road and Amherst Road with an average width of 0.5 mile. The floodplain in Amherst is more extensive than anywhere else in the corridor, encompassing almost the entire River corridor between Boston Post Road and Stearns Road, and extending outside the corridor to NH Route 101A. The width of the floodplain in this area ranges from 1,400 feet to over 1 mile. The floodplain narrows to 200-400 feet through downtown Milford and begins to widen west of the oval. Floodplains dominate the River corridor between North River Road and Elm Street with a maximum width of about 4,000 feet. West of the river crossing at the NH Route 101-Elm Street intersection the floodplain follows the defined river channel and decreases significantly in width. Continuing west, the topography changes from broad flat floodplains to rolling hills decreasing the width of the floodplain.

Aside from transmitting floodwaters, floodplains provide areas for groundwater recharge, wildlife habitat, open space and recreation. These low intensity uses are highly compatible with the goal of alleviating the economic and human losses associated with flooding. Picnic areas, recreational facilities, parking areas, hiking, biking and skiing trails are just a few examples of low intensity uses for floodplains.

WILDLIFE

The Souhegan River corridor provides habitat for a diversity of wildlife species. This diversity provides many recreational opportunities for bird watching and hunting. A variety of habitats such as wetlands, forests, fields, rivers and streams are required to meet individual species needs and to maintain healthy breeding populations. Maintenance of quality habitat is key to the survival of all species.

Mammals represented in the River corridor are those commonly found in southern New Hampshire. These include raccoons, skunks, muskrats, beavers, porcupines, white tail deer, woodchucks, squirrels, mice, bats, rabbits and other indigenous species adapted to living near humans. The more rural stretches of the corridor may also provide habitat for larger animals that require extensive habitat areas, or species that require solitude such as moose, black bear and lynx.

The New Hampshire Natural Heritage Inventory (NHI), a program of the Department of Resources and Economic Development (DRED), is the agency responsible for cataloging and tracking endangered, threatened and rare animal species in the State. The agency uses a ranking system developed by the Nature Conservancy to assess the rarity of the species. The ranking system is composed of two components, a global rank, assigned by the Nature Conservancy, and a state rank assigned by the NHI. A copy of the ranking system is attached in Appendix A. The Heritage Inventory indicates the presence of two threatened species in the corridor, the eastern hognose snake and Woodhouse's toad. The general locations where these and other species have been sighted are depicted on Map III-1.

Depending on the season, the River corridor is host to a wide diversity of bird species. Similar to the animal species, the birds found in the corridor are those indigenous to southern New Hampshire. Species of gulls, doves, woodpeckers, chickadees and jays would be found throughout the year while other species such as warblers, sparrows, wrens, swallows, robins and several species of raptors are only seasonal residents. Other species including a variety of ducks, geese and herons nest in the area or migrate through the corridor.

FISHERIES

Native species of fish in the Souhegan River include small mouth bass, sunfish, pumpkin seeds, yellow perch, suckers and dace. In addition, the River is annually stocked with trout by the New Hampshire Department of Fish and Game. During 1992, 1,120 rainbow trout, 2,350 brown trout and 2,800 brook trout were released throughout the River corridor. When released, the trout are of a legal size for angling, representing what is called a "put and take" program.

The Souhegan River is an important part of the Merrimack River anadromous fish restoration program and is considered by fisheries biologists to be one of the most productive rivers in the watershed. The upper reaches of the Souhegan provide the appropriate habitat -- gravelly, sloping bottoms, water temperatures, oxygen levels and

food sources -- for excellent growth and survival of Atlantic salmon frye. An average of 100,000 Atlantic salmon frye are stocked in the Souhegan River annually. These salmon frye will remain in the river system for two years before making their way to the Atlantic ocean. The dams on the River are equipped with downstream fish passage measures only at this point since natural reproduction is not expected. The Merrimack River Basin Fish Passage Action Plan for Anadromous Fish, January 1988, calls for the construction of upstream passage at the Merrimack Village dam when a specific number of shad pass through the Amoskeag dam. All other upstream passage is deferred.

VEGETATION

As with wildlife and fish, the types of vegetation found in the River corridor are generally those species indigenous to southern New Hampshire. Typical species found in the corridor include white pine, hemlock, red maple, red oak, sycamore and numerous species of grasses and shrubs. The River corridor is primarily forested west of the NH Route 101 and 31 intersection in Wilton. A number of parcels in this stretch of the corridor are actively managed forest lands, including the Wilton Town Forest and two parcels owned by the Society for the Protection of NH Forests. Proper management of forest lands can ensure continued availability of quality wood products, provide diverse wildlife habitats and stabilize the River bank. The use of mechanisms designed to minimize the impacts of tree harvesting, called best management practices, can be utilized to protect the River from negative impacts. The NH Department of Resources and Economic Development has developed a guide, Best Management Practices for Erosion Control on Timber Harvesting Operations in New Hampshire, which outlines best management practices.

The New Hampshire Natural Heritage Inventory (NHI) is the agency responsible for identifying and recording the State's rare, threatened or endangered plant species. Plants are ranked using the Nature Conservancy system in the same manner as wildlife. NHI records indicate the presence of 9 threatened or endangered plant species and 2 exemplary natural communities within the River corridor. The nine plants are: Long's bitter cress, wild lupine, bird's foot violet, Siberian chives, skydrop aster, goat's rue, stiff tick-trefoil and giant rhododendron. Natural communities are "assemblages of plants and animals ecologically related to each other and their physical environment." These 2 areas represent intact examples of New Hampshire's native flora and fauna, and have been described by the NHI as having the following characteristics:

> Southern New England High-energy Riverbank Community - A broadly defined community occupying high-energy environments of riverbanks and shores. This community may be present as a narrow, continuous, zone of rocky shores or otherwise open riverbanks characterized by herbaceous and shrub vegetation and regularly scoured by floodwaters and ice.
>
> Southern New England Floodplain Forest - Floodplain forests characterized by silver maple in NH occupy regularly flooded alluvial terraces along the margins of major rivers. This is a broadly defined community as considerable floristic variation exists between high and low floodplain resulting from differences in the periodicity, intensity and duration of flooding. Deposition and erosion in the river channel through time generates successive point bars, particularly on meanders. A ridge and swale topography results with bands of vegetation corresponding to the flood regime.

The list of threatened plants and exemplary natural communities contains documented and historical occurrences of the species and is by no means a complete representation of the species limitations. Documented species could be found in other locations within the River corridor, as could other undocumented rare, threatened or endangered species. The continued existence of these species and communities within the Souhegan River corridor depends on the conservation of their habitats. The general locations of these species and ecological communities is depicted on Map III-1.

The grasses shrubs and trees found in the River corridor perform many important functions. First, they provide habitat for a diversity of wildlife species. Second, they stabilize the soil and buffer the impact of rain thereby aiding in the prevention of soil erosion. Third, they provide a vegetative buffer that filters nutrients and sediments from runoff while decreasing the velocity of flow. Fourth, they provide an effective screen between surrounding land uses and the River. And lastly, maintenance of a vegetative buffer preserves the natural setting and the aesthetics of the river bank.

Table III-1 lists the threatened and endangered plant and animal species in the River corridor. A full description of the Nature Conservancy ranking system and the scientific names of the species can be found in Appendix A.

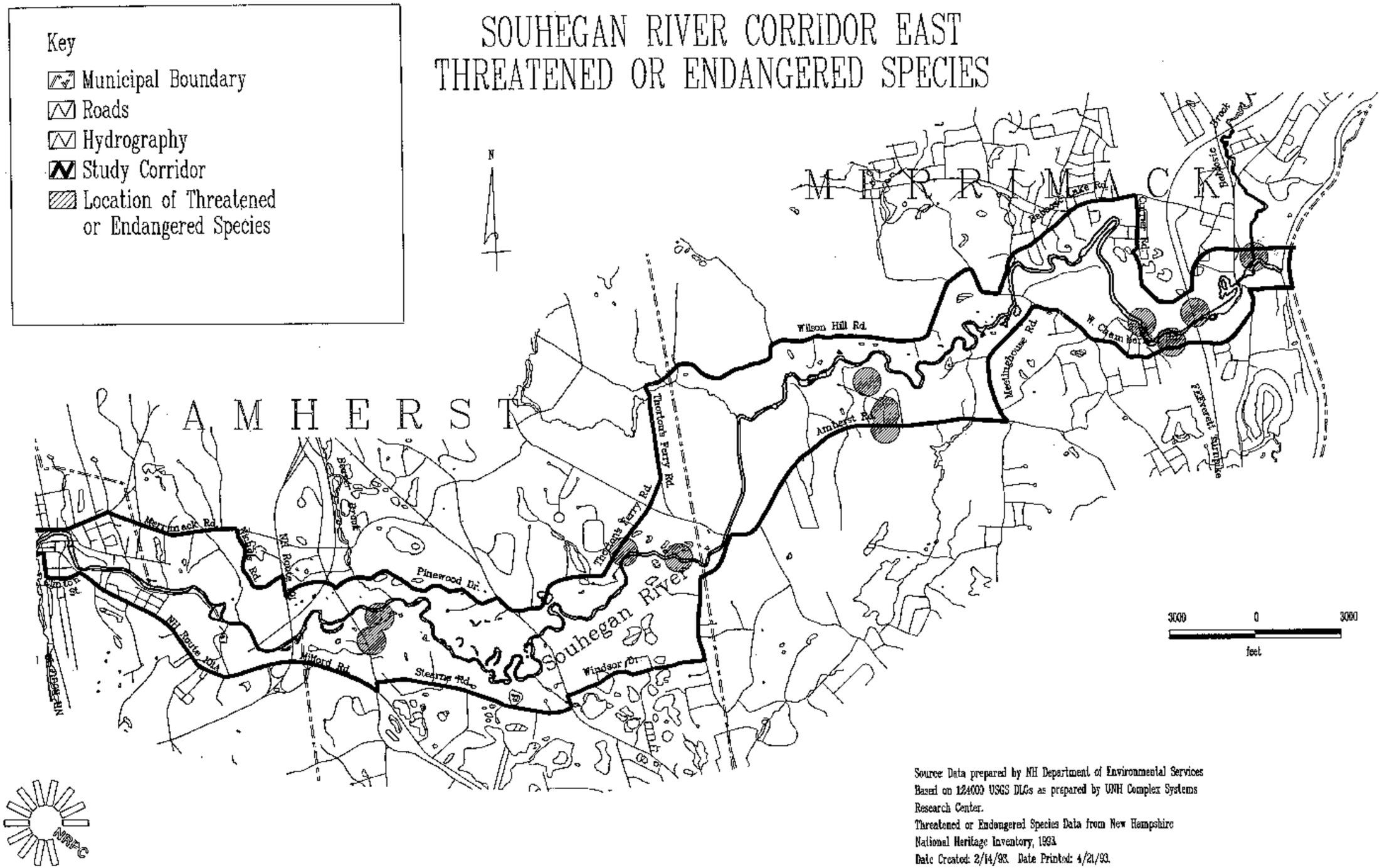
TABLE III-1

THREATENED AND ENDANGERED SPECIES IN THE SOUHEGAN RIVER CORRIDOR

Rank	Common Name
G3G4 S1	Long's Bitter Cress
G5 S1	Wild Lupine
G5 S2	Bird's Foot Violet
G5 S2	Siberian Chives
G5 SH	Wild Garlic
G5T5 S2	Skydrop Aster
G5 S1	Goat's Rue
G? SH	Stiff Tick-trefoil
G5 S3	Eastern Hognose Snake
G5 S2	Banded Sunfish
G5 S1	Woodhouse's Toad
G5 S2	Giant Rhododendron
S?	Southern New England High-Energy Riverbank Community
S2	Southern New England Floodplain Forest

Map III-1

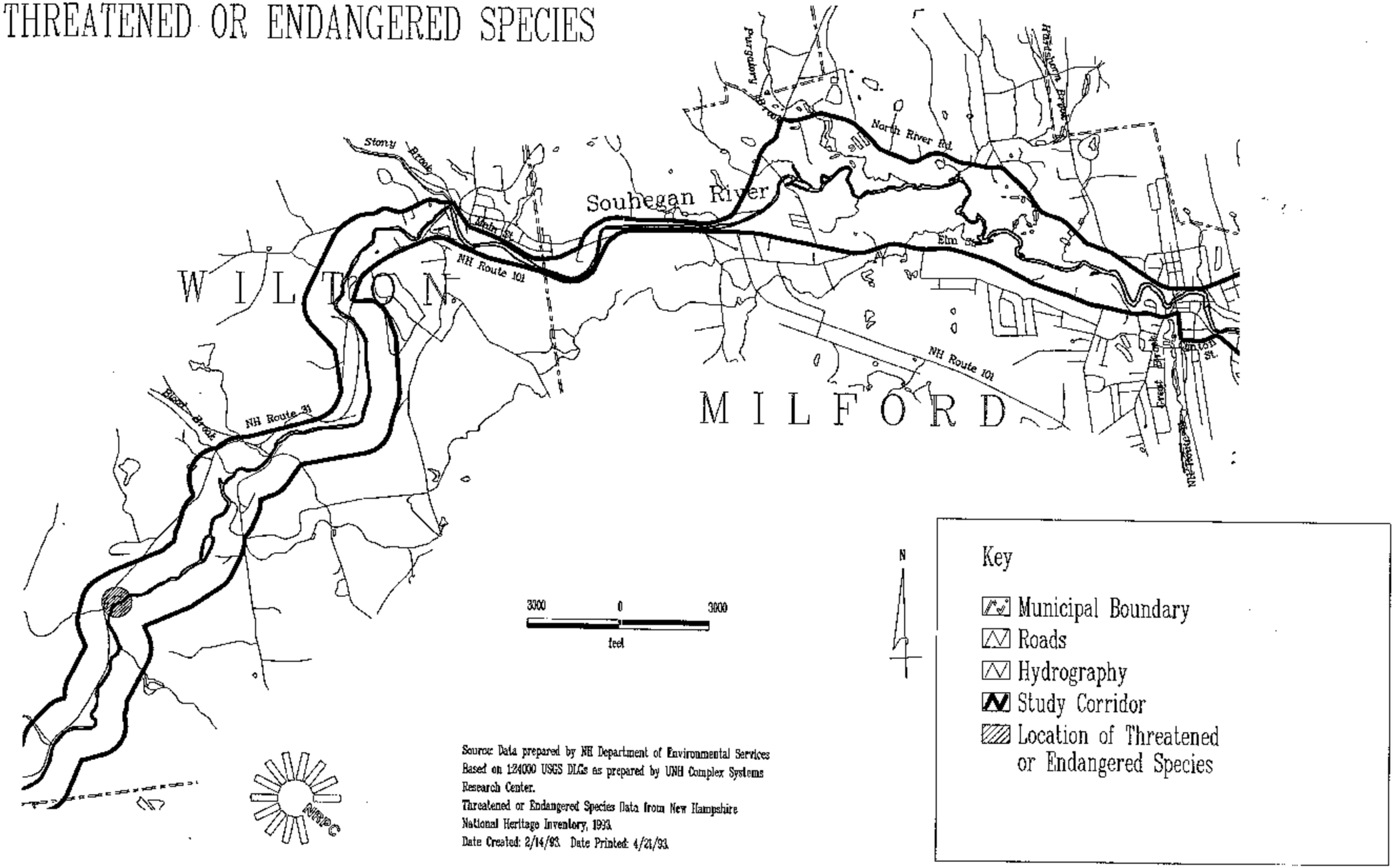
SOUHEGAN RIVER CORRIDOR EAST
THREATENED OR ENDANGERED SPECIES



Source Data prepared by NH Department of Environmental Services
Based on 1:24000 USGS DLGs as prepared by UNH Complex Systems Research Center.
Threatened or Endangered Species Data from New Hampshire National Heritage Inventory, 1993.
Date Created: 2/14/93. Date Printed: 4/21/93.

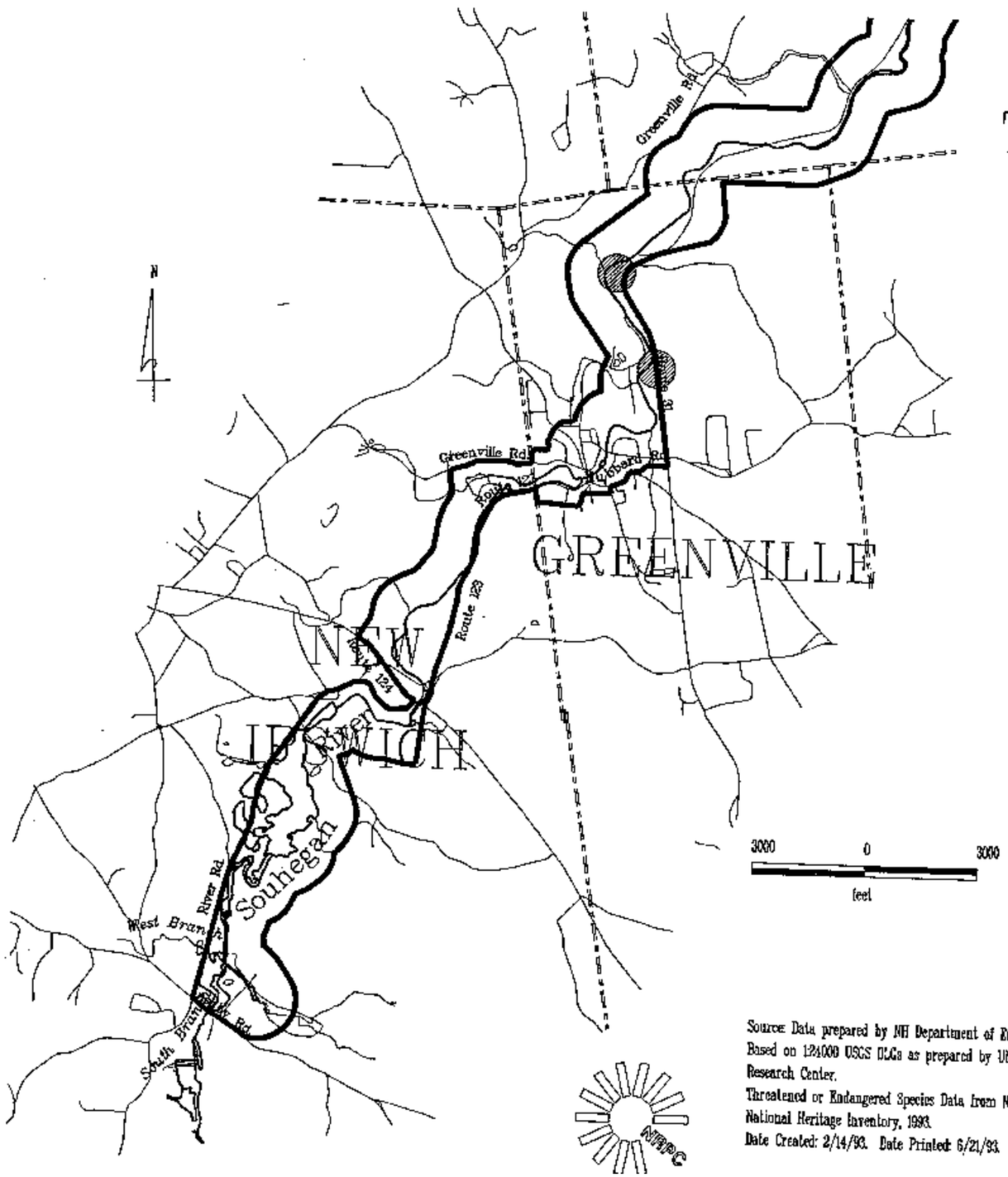
Map III-1

SOUHEGAN RIVER CORRIDOR CENTRAL THREATENED OR ENDANGERED SPECIES



Map III-1

SOUHEGAN RIVER CORRIDOR WEST THREATENED OR ENDANGERED SPECIES



Source: Data prepared by NH Department of Environmental Services
Based on 1:24000 USGS DLGs as prepared by UNH Complex Systems Research Center.
Threatened or Endangered Species Data from New Hampshire National Heritage Inventory, 1993.
Date Created: 2/14/93. Date Printed: 6/21/93.

Key

- Municipal Boundary
- Roads
- Hydrography
- Study Corridor
- Location of Threatened or Endangered Species

SCENIC VIEWS AND VISTAS

Essentially, the entire Souhegan River corridor is scenic, particularly those areas that are accessible to the public. The scenes of the Souhegan River are diverse, from untouched natural areas and waterfalls to agricultural lands and historic industrial buildings. Scenic views are found virtually wherever a bridge crosses the river, of note are the Everett Turnpike crossing, Turkey Hill and Seaverns Bridges in Merrimack, Boston Post Road and Route 122 crossings in Amherst, the Green Bridge, Wilton Road and the Swinging bridge crossings in Milford, the downtown, Route 101 and Green Bridge crossings in Wilton, the Green Bridge in Greenville and High Bridge in New Ipswich. In addition to the crossings, the River is also visible from the road in the western sections of the corridor, Milford, Wilton, Greenville and New Ipswich, where the river parallels NH Routes 101, 31 South and 123.

Other less accessible scenic views abound in the corridor. The view from below the dam looking upstream, near the confluence with the Merrimack River, is exceptional but is visible only from the river. Wildcat Falls, also in Merrimack, is a series of three separate falls which drop over 80 feet. The falls can be reached through the Town owned Eighty Acres conservation area. Above the falls is another set of rapids called Indian Ledges which is also scenic and can only be reached from the river. The Town of Amherst owns conservation land on the river, the Scott Land behind the school, which provides views of the floodplains. In Milford, the Swinging Bridge provides views of the McLane dam and the rapids below the dam; Keyes Field provides views of the river and the floodplains; the State fish hatchery land affords views of the river, Purgatory Brook and surrounding agricultural fields. In Wilton, the Horseshoe is a short gorge and a popular swimming hole; views of the river can be obtained from the Society for the Protection of New Hampshire Forest land on Route 31 south; and aesthetically pleasing views of the river can be had from the road in numerous locations. The Greenville Gorge can be reached by a short hike, as can the remains of an old hydro dam in the northern section of the Town. New Ipswich affords scenic views of the river near High Bridge and all around Water Loom Pond.

The views from the river itself include unspoiled natural areas, rapids and ledges, and the numerous wildlife and vegetation species found in the corridor. The banks of the river vary from rocky ledge and forests to floodplains and farmland and sandy banks. Canada Geese, ducks, herons and bank swallows are commonly seen along the Souhegan River.

Existing and future riverbank development can be designed to fit into the natural landscape. Buildings, structures and other site developments, for example, can be setback from the top of the bank and screened from the river by a vegetative buffer. Height limitations for buildings and structures can also be used to preserve the visual integrity of an area. In addition, planting vegetative buffers around existing developed areas will screen development from the river ad help stabilize the soil. Clearcuts or extensive thinning of existing tree stands can have negative impacts on the visual quality of a view or vista as well as create situations ripe for erosion. On the other hand, selective cuts and thinning can open up views that have been obstructed by growth. Proper siting and planning can ensure developments that are designed and constructed to fit harmoniously into the landscape.

Chapter IV.

Water Resources

CHAPTER IV

WATER RESOURCES

The Souhegan River is formed by the convergence of the South Branch and the West Branch Souhegan Rivers in New Ipswich. From there it flows northeast to its confluence with the Merrimack River in Merrimack. Major tributaries to the Souhegan River include: Furnace Brook, Temple Brook, Blood Brook, Stony Brook, Purgatory Brook and Tucker Brook. The 171 square mile watershed includes portions of the following towns: New Ipswich, Temple, Greenfield, Lyndeborough, Wilton Greenville, Mont Vernon, Milford, Amherst and Merrimack, New Hampshire and Ashby and Ashburnham, Massachusetts.

As a multiple-use river, the Souhegan River supports a number of uses such as wastewater assimilation, irrigation, recreation, hydropower, fisheries and wildlife. The capacity of the Souhegan River to sustain these numerous and competing uses is limited. A balance between the many river uses and users must be attained to insure the continuation of the multiple use capabilities of the Souhegan River.

The physical and natural characteristics and functions of the Souhegan River have been discussed in Chapter III. This chapter will focus specifically on the water issues related to the River, including water resources, water quality, water supply and hydropower.

WATER RESOURCES

The water resources in the Souhegan River corridor and throughout the watershed form an extensive network of streams, lakes, ponds, wetlands and groundwater. Actions affecting these areas such as chemical contamination, damming or dredge and fill may ultimately have an impact on the river. This section briefly discusses the major tributaries, ponds, wetlands and groundwater resources in the study corridor.

Tributaries

The Souhegan River watershed contains numerous tributary streams of varying sizes. These streams form an interconnected network which performs many functions such as providing fisheries and wildlife habitats, conveying floodwaters, supplying water, providing recreational opportunities and presenting scenic views. Because of this interconnected relationship, any activity with a negative impact on a stream, such as a chemical spill or an erosion problem will result in a corresponding negative impact on the stream or river into which it flows. Likewise, any positive impact on the stream, such as the elimination of leachate from malfunctioning septic systems , will have an overall positive impact on the receiving water. Therefore, the activities that take place within the Souhegan River watershed have a direct impact on the quality and the quantity of the water in the river.

Furnace Brook originates in New Ipswich and flows approximately 3.2 miles east to the Souhegan River near the Greenville line. Temple Brook originates in southeast Temple and flows approximately 4.2 miles northeast to West Wilton where it converges with Blood Brook. Blood Brook flows approximately 7 miles southeast from Sharon through Temple to West Wilton where it converges with Temple Brook to form Gambrel Brook which flows into the Souhegan River. Stony Brook, approximately 9.6 miles, flows southeast from Greenfield through Lyndeborough into downtown Wilton where it converges with the Souhegan River. Purgatory Brook originates in Mont Vernon and flows approximately 5.7 miles south to the Souhegan River in Milford. Tucker Brook originates in a wetland in southeast Wilton and flows approximately 4.5 miles northeast to its convergence with the Souhegan River in Milford. Baboosic Brook, the outlet of Baboosic Lake in Amherst, flows approximately 9.7 miles east across Merrimack and then south to its confluence with the Souhegan River. The characteristics of the major tributaries to the Souhegan River are summarized in Table IV-1.

TABLE IV-1
MAJOR TRIBUTARIES TO THE SOUHEGAN RIVER

Stream Name	*Length in Miles*	*Free-flowing or Dammed*	*Legislative Classification*
Furnace Brook	3.2	free-flowing	B
Temple Brook	4.2	dammed	B
Blood/Gambol Brook	7.0	dammed	B
Stony Brook	9.6	dammed	B
Purgatory Brook	5.7	free-flowing	B
Tucker Brook	4.5	free-flowing	B

Ponds

Water Loom Pond in New Ipswich is the only pond located in the study corridor. Approximately 46 acres in size and 2.1 miles in length, Water Loom Pond is an artificial impoundment created by the dam at the northern end of the pond. The 1970 NH Department of Fish and Game publication, entitled a Biological Survey of the Lakes and Ponds in Cheshire, Hillsborough and Rockingham Counties, found the pond to have the following characteristics: average depth six feet; maximum depth sounded ten feet; bottom composition: 50% sand, 40% muck and 10% rock; emergent vegetation common; submerged vegetation scant; and shore 50% wooded, 50% meadow. The 1992 New Hampshire Water Quality Report to Congress - 305(b) evaluated the trophic class of the state's lakes. The trophic classification system consists of four criteria used to measure the biological production of a lake as a result of both nutrient input and lake aging. The 305(b) Report classified Water Loom Pond as eutrophic, a nutrient rich water generally characterized by high levels of biological production.

Since Water Loom Pond was formed by damming the Souhegan River, any activities which affect water quality in the pond directly affect water quality in the River. Nutrients from improperly functioning septic systems and fertilizers, pesticides and other chemicals can have a negative impact on water quality in the pond and the River. In addition, nutrients and chemicals can accumulate in the sediments on the bottom of the pond and be released at a later time.

Regulations directly related to the protection of surface waters in the study corridor are limited. Amherst, Milford and New Ipswich are the only communities which regulate the use of land adjacent to surface waters. Amherst's watershed protection district establishes a 100 foot buffer along all surface water bodies, perennial and intermittent streams within which no buildings or septic systems can be located. Permitted uses within the district are limited to: trimming, pruning and thinning of vegetation according to forestry best management practices (BMPs); tree farming, timbering and forestry in accordance with BMPs; wildlife refuges; wharves, boat houses, footbridges or similar structures normally associated with use in on near the water; and amateur, non-profit sports and recreation uses subject to Planning Board site plan approval. The following surface waters are included in Milford's wetland conservation district: Souhegan River, Great Brook, Tucker Brook, Birch Brook, Purgatory Brook, Compressor Brook, Hartshorn Brook, Ox Brook, Mitchell Brook and Spaulding Brook, and Osgood, Railroad, Hartshorn, and Compressor ponds. The district establishes a 50 foot buffer from the recognized edge of the water body or water course in which no construction or ground disturbance shall occur. Activities permitted within the buffer include: conservation areas, nature trails and wildlife refuges; parks and recreational uses consistent with the purpose of the district; open space; forestry and tree farming in accordance with BMPs; agriculture including growing and harvesting of crops; buildings and structures that do not require a building permit; decks raised above the ground; and monitoring and water supply wells. The New Ipswich Zoning Ordinance establishes a 100 foot setback for structures, parking lots and leachfields from the normal bank of all

lakes, ponds, rivers, streams and brooks. Docks, boat landings, boat houses and saunas are exempt from the setback.

Wetlands

Once thought of as wastelands and areas to be filled, awareness of the important role wetlands play in the hydrologic and ecologic systems has increased significantly over the last decade. Wetlands perform many important functions such as flood control and natural stream flow regulation, erosion and sedimentation control, and water purification while providing nursery grounds and habitat for numerous species of vegetation and wildlife.

Wetlands are defined in a number of different manners by different agencies; however, the wetland definitions of the four federal agencies, the Army Corps of Engineers (CE), the Soil Conservation Service (SCS), the Environmental Protection Agency (EPA) and the Fish and Wildlife Service (FWS), are conceptually the same and include three basic elements -- hydrology, vegetation and soils -- for identifying wetlands. An attempt to develop a single, consistent approach for delineating wetlands that would satisfy the requirements of the four agencies resulted in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands, January, 1989. Despite the support of the four agencies, the Federal Manual met with great political opposition and wetland identification and delineation remains a tangled web. The Administrative Rules of the New Hampshire Wetlands Board define freshwater wetlands as follows:

> "those areas that are inundated or saturated by surface or ground water at a frequency and duration to support, and that under normal conditions do support a prevalence of vegetation typically adapted for life in saturated soil conditions." (Section 101.01)

The Wetland Board Rules also establish the 1989 Federal Manual as the standard by which wetlands will be identified and delineated.

Wetland definitions and district boundary determinations contained in the Zoning Ordinances of four communities in the study corridor, Merrimack, Amherst, Milford, Wilton and New Ipswich rely on poorly and very poorly drained soils as designated by the SCS Soil Surveys for Hillsborough County and/or other areas that through field identification meet the requirements for poorly or very poorly drained soils but are not so designated. Milford's definition also includes areas that support hydrophytic vegetation. The Greenville Zoning Ordinance does not contain any definition for a wetland or include wetland conservation districts.

When conducting the soil survey, the SCS divided Hillsborough County into two parts, eastern and western. The Geographic Information System (GIS) soil layer was used to develop wetland maps for the corridor, Map IV-1. Wetlands within the Souhegan River corridor, unlike other river systems, are somewhat limited in extent and confined to low-lying areas adjacent to the River and its tributaries. Within the corridor the most extensive wetlands are located in Amherst and Milford and are often connected to wetland systems along tributary streams. In addition, the limited extent of the wetlands in the corridor can be directly related to two factors. First, the topography in the western sections of the corridor is steep; steep slopes with shallow soils do not promote the development of wetlands. Second, the River flows through substantial deposits of stratified drift in the central and eastern portions; these porous deposits readily transmit water and therefore are not prime locations for wetlands to form.

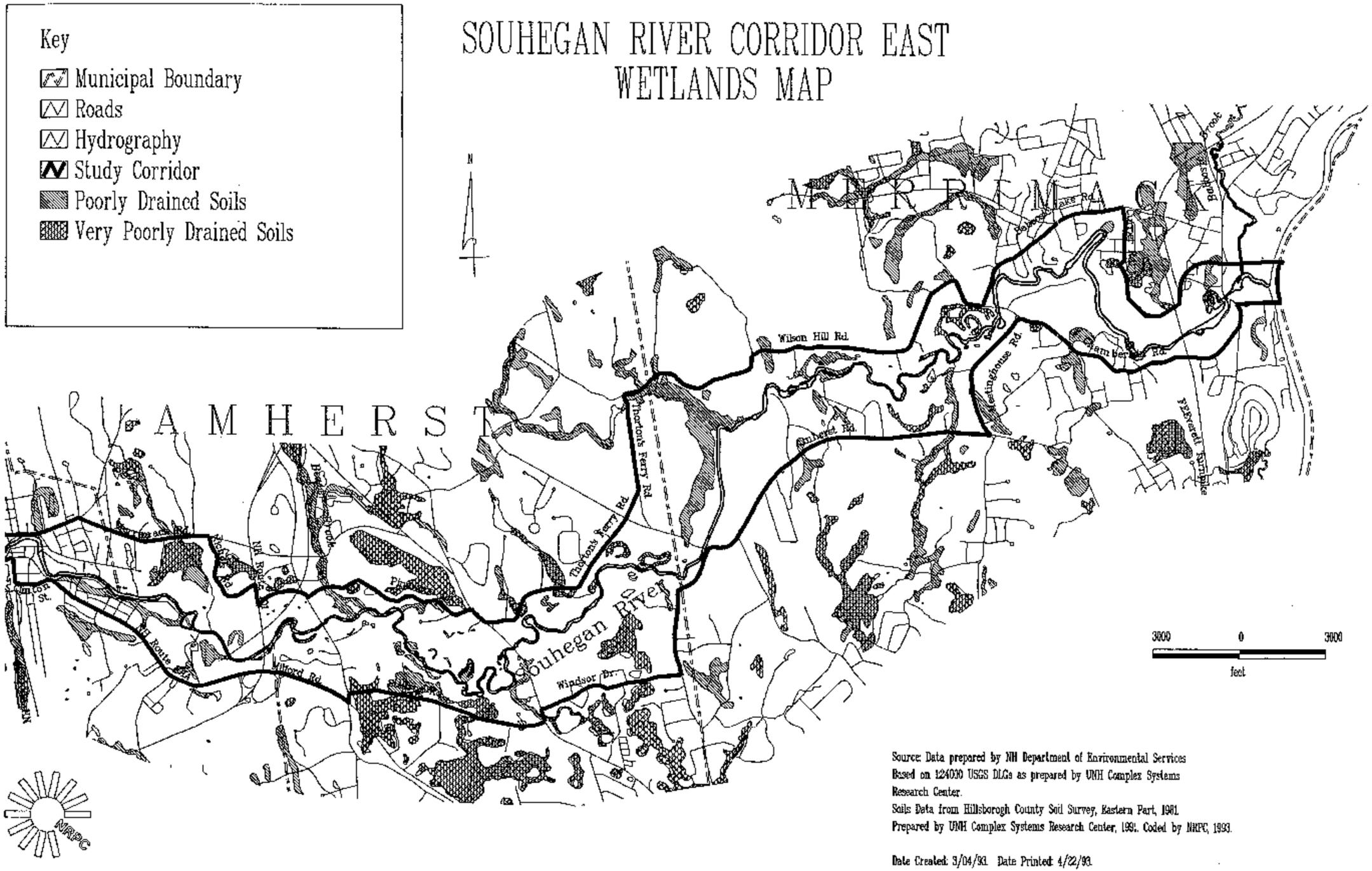
Wetlands deserve to be protected from degradation for a number of reasons. First, wetland areas provide suitable habitats for a diversity of wildlife species. Second, wetlands provide natural flood control. Third, wetlands are visually aesthetic and provide diversity in the landscape. And finally, wetlands provide a certain level of water purification by filtering sediments, nutrients and chemicals from surface water runoff. It is therefore, very important that the integrity of wetlands be preserved to maintain ecologic and hydrologic balance.

The ordinances of the six corridor communities provide a wide range of protection for wetlands. The Greenville zoning ordinance contains no formal protection mechanisms for wetlands. The Wilton, Milford, Amherst and Merrimack wetland conservation districts generally permit any use which does not result in the erection of any structure or alter the surface configuration of the wetland by the addition of fill or by dredging and that is otherwise permitted by the Zoning Ordinance. The Milford district establishes a 25 foot buffer from the

edge of the wetland in which no construction or ground disturbance shall occur. The typical uses such as conservation areas, parks and recreation uses, forestry and agriculture and small buildings which do not require a building permit are permitted in the buffer. The following uses are specifically prohibited within the buffer: septic tanks and leachfields, buildings or structures which would require a building permit, in-ground or above ground swimming pools, decks requiring inground foundations and stockpiling of manure. The Amherst district prohibits the erection of any structure within 50 feet of any wetland. In addition, the New Ipswich, Wilton, Milford and Merrimack districts permit certain uses by special exception which may include the erection of a structure, dredging, filling, draining or otherwise altering the surface configuration of the land, if it can be shown that the proposed use will not conflict with the purpose and intent of the district and if the proposed use is otherwise permitted by the zoning ordinance.

Map IV-1

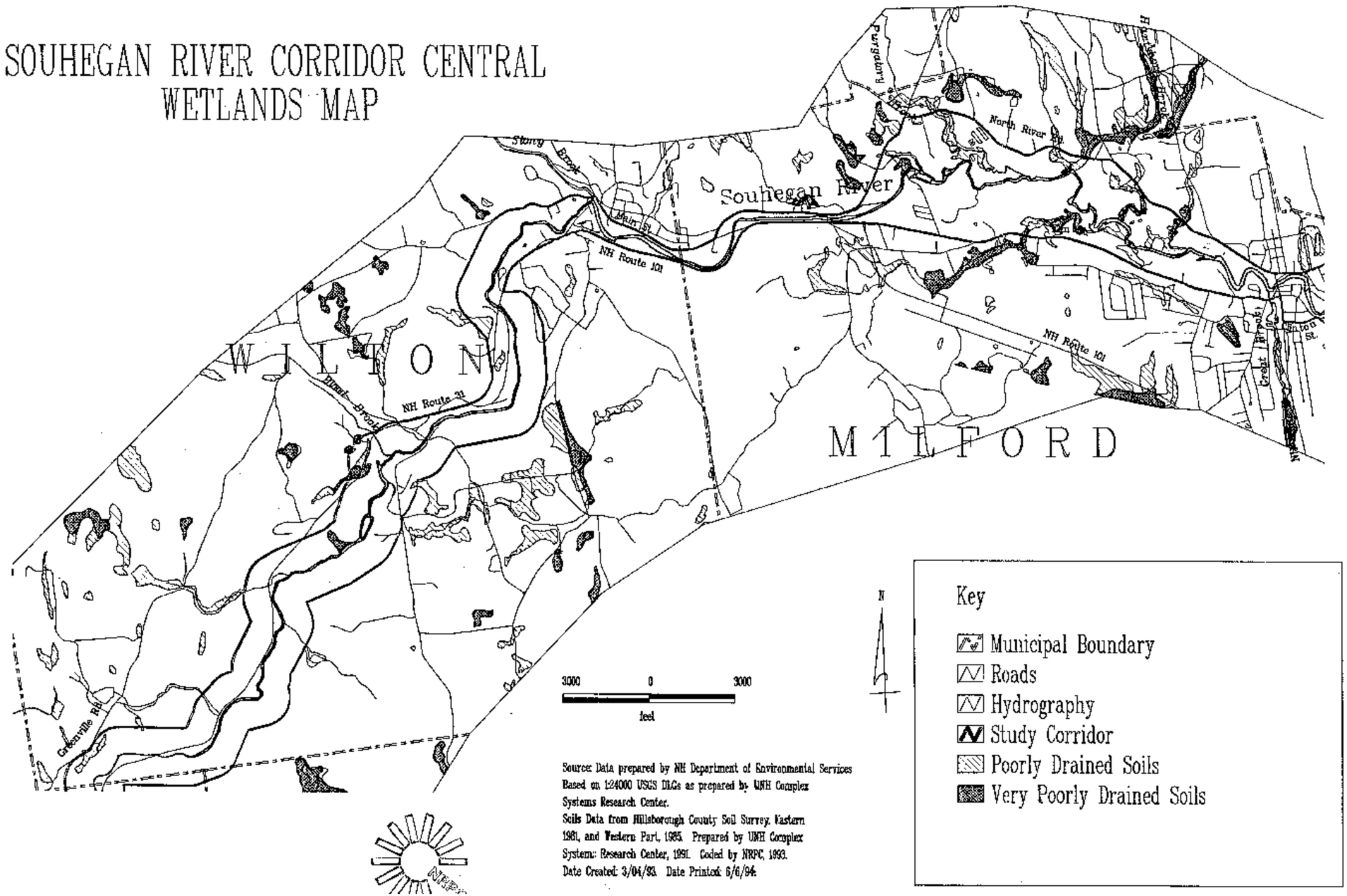
SOUHEGAN RIVER CORRIDOR EAST WETLANDS MAP



Source: Data prepared by NH Department of Environmental Services
Based on 124000 USGS DLGs as prepared by UNH Complex Systems Research Center.
Soils Data from Hillsborough County Soil Survey, Eastern Part, 1981.
Prepared by UNH Complex Systems Research Center, 1991. Coded by NRPC, 1993.

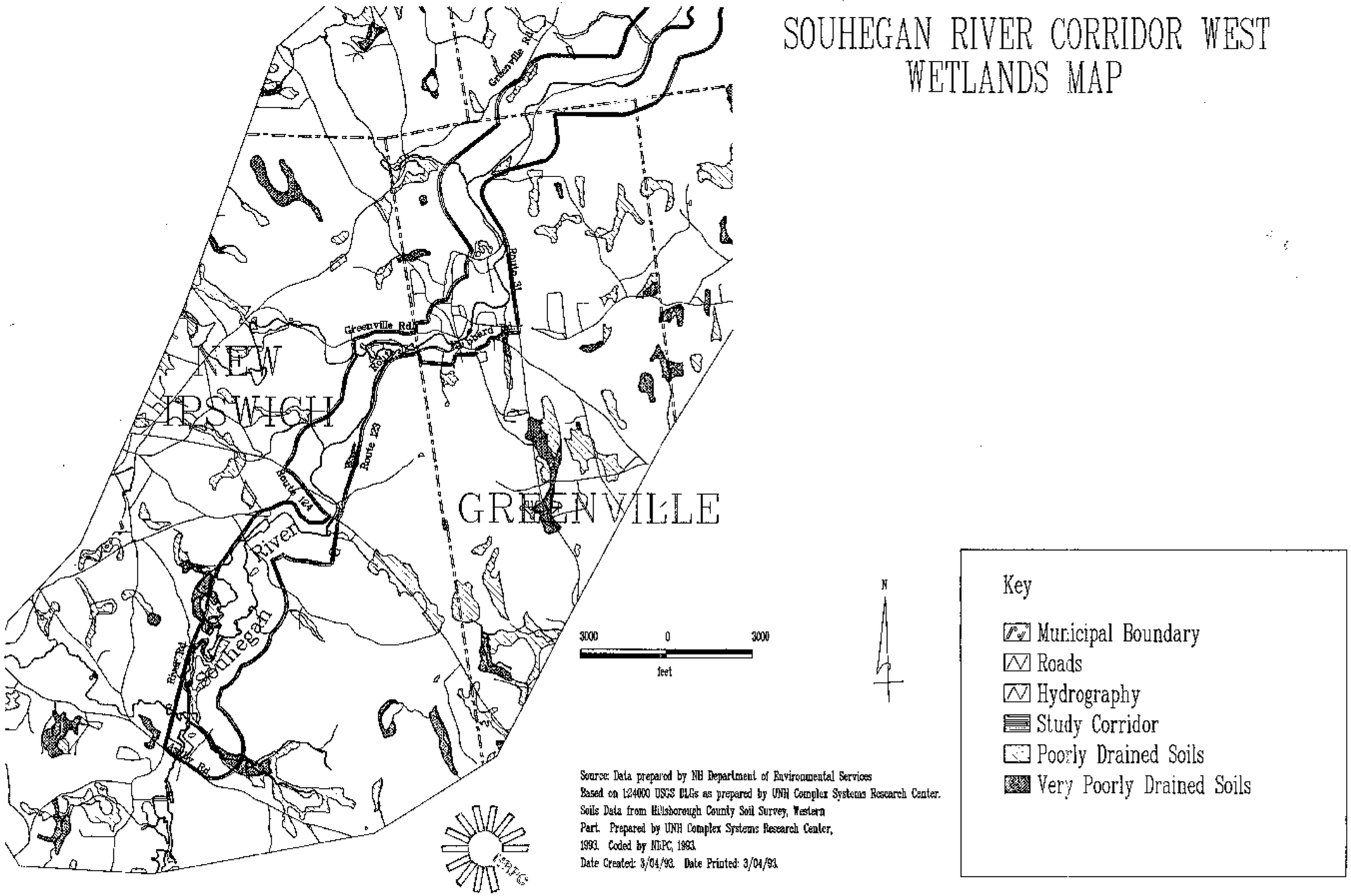
Date Created: 3/04/93. Date Printed: 4/22/93.

Map IV-1


SOUHEGAN RIVER CORRIDOR CENTRAL
WETLANDS MAP
Souhegan River
North River Rd
Purgatory
Stony Brook
Main St
NH Route 101
NH Route 31
Black Brook
Great Brook
Union St.
Gibbsville Rd
W I L T O N
M I L F O R D
N
3000
0
3000
feet
Source: Data prepared by NH Department of Environmental Services
Based on 1:24000 USGS DLGs as prepared by UNH Complex
Systems Research Center.
Soils Data from Hillsborough County Soil Survey, Eastern
1981, and Western Part, 1985. Prepared by UNH Complex
Systems Research Center, 1991. Coded by NRPC, 1993.
Date Created: 3/04/93. Date Printed: 6/6/94.
Key
Municipal Boundary
Roads
Hydrography
Study Corridor
Poorly Drained Soils
Very Poorly Drained Soils

Map IV-1

SOUHEGAN RIVER CORRIDOR WEST WETLANDS MAP



Groundwater

Stratified drift aquifers have been the focus of groundwater investigations in the northeast United States because of their ability to store and rapidly transmit large volumes of water. Stratified drift deposits are composed of sand and gravel that have been sorted and deposited by glacial meltwaters. Extensive, coarse deposits of stratified drift can store large volumes of water. The storage capacity of the aquifer is directly related to the size of the soil particles and the degree of sorting. The high porosity of the coarse grained aquifers allows groundwater to flow through quite readily. Porosity in a well sorted aquifer is greater than in a poorly sorted aquifer; thus, a coarse grained, well sorted aquifer has greater area for water storage. In addition, the larger pore size allows water to be transmitted more easily and therefore increases the speed of water withdrawal.

In 1987, The United States Geological Survey (USGS) completed a study of stratified drift aquifers in the NRPC region entitled Hydrogeology of Stratified Drift Aquifers and Water Quality in the Nashua Regional Planning Commission Area. The Souhegan River flows through stratified drift deposits from the Merrimack River west to the Wilton-Greenville Town line, the western limit of the USGS study. The stratified drift deposits in Merrimack are composed mostly of fine grained materials with some coarse grained deposits located along the Amherst border with transmissivities of less than 2,000 sq. ft./day. In Amherst, the River flows through coarse grained stratified drift overlaying fine grained stratified drift. Materials in this area consist principally of medium to coarse sand 10 to 30 feet thick overlaying significant thicknesses of clay, silt and fine sand. Transmissivities in this section range from less than 2,000 to 8,000 sq. ft./day with much of the corridor in the 6,000 to 8,000 sq. ft./day range. From the Amherst-Milford border west to the Wilton-Greenville border, the stratified drift deposits are predominantly coarse-grained with some small sections of coarse-grained stratified drift overlaying fine-grained stratified drift in Milford. Coarse-grained stratified drift consists principally of medium sand to cobble gravel. Again, transmissivities in this section range from less than 2,000 to 8,000 sq. ft./day. Detailed information for Greenville and New Ipswich is not yet available from the USGS; however, a 1977 study by John Cotton, *Availability of Ground Water in the Lower Merrimack River Basin, Southern New Hampshire*, provides a preliminary assessment of groundwater availability in these towns. The study indicates limited deposits of thin, medium to coarse grained sand or sand and gravel with a medium potential to yield water. The stratified drift deposits in the study corridor are depicted on Map IV-2.

It should be noted that although the USGS aquifer maps are more detailed than any previous investigation, they present generalized areas of expected high yield and low yield. Isolated areas of contrast to the prevailing aquifer type can be expected but will only be discovered by exploratory well drilling.

The most significant stratified drift deposits in the River corridor are located in Amherst and Milford. The Amherst aquifer along the Souhegan River extends from Merrimack to Milford. The central part of the aquifer is composed of 25 feet of coarse-grained material underlain by 75 feet of fine-grained materials. Transmissivity is greater than 8,000 sq. ft./day throughout this area. Milford's municipal water supply wells, the Curtis and Kokko wells, are located in this aquifer with average yields of 400 and 700 gal/min. respectively. The most productive aquifer in Milford is located in the central portion of the study corridor. Transmissivity in this portion of the aquifer exceeds 8,000 sq. ft./day. Six high yield wells with sustained yields of 200 to 500 gal/min. are located in this area, Milford's Savage and Keyes wells, the Milford fish hatchery well and three industrial wells. Potential exists for further siting of municipal well supplies in both aquifer areas. In addition, Wilton's two municipal water supply wells are located in the corridor as is the Monadnock Spring Water Company well.

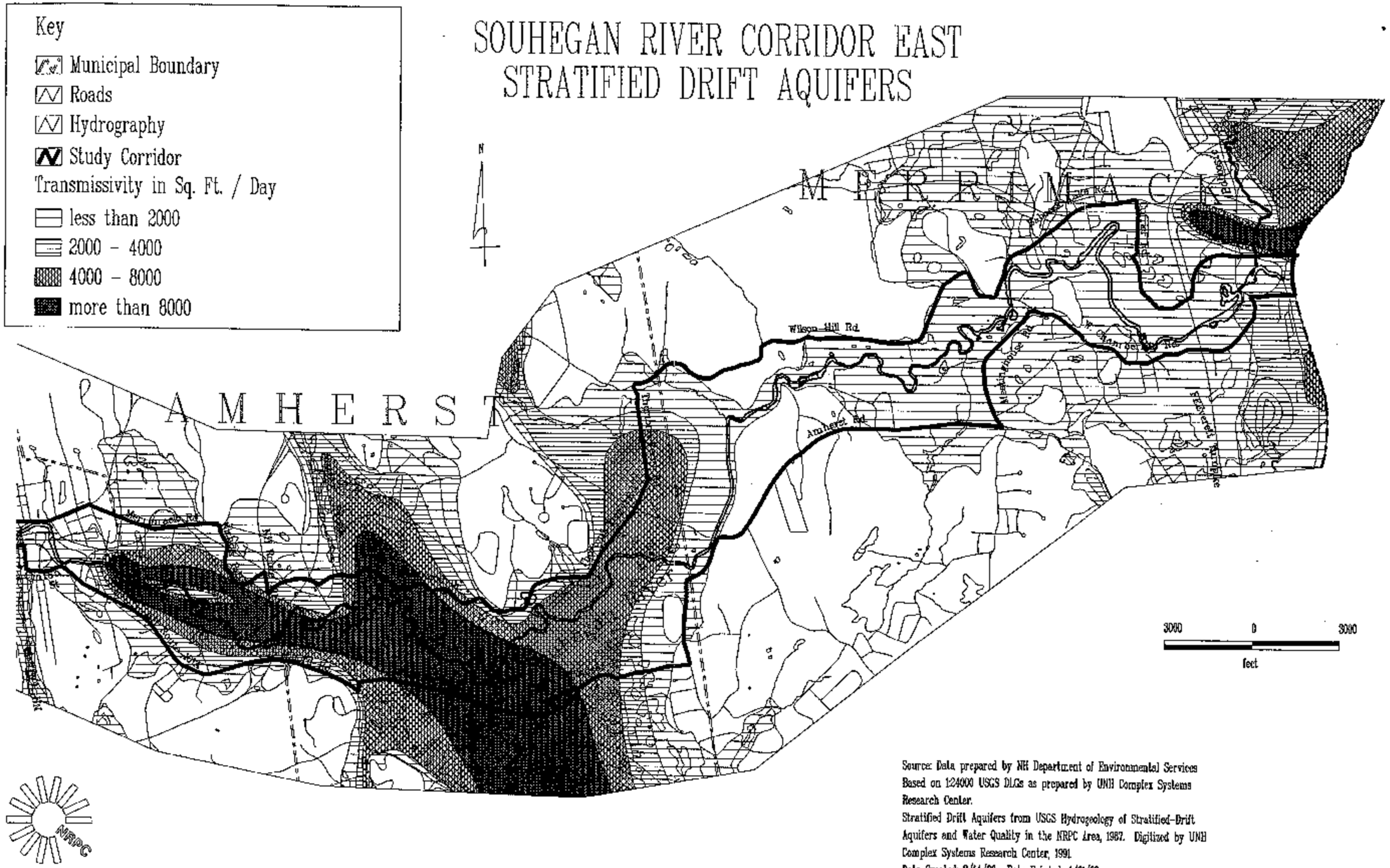
Land use can have a significant impact on groundwater quality. Groundwater can be contaminated by a number of activities such as leaking underground storage tanks, failed septic systems, leachate from chemical and solid waste sites, improper applications of pesticides and accidental spills. A small leak of a few gallons can contaminate millions of gallons of drinking water. Milford and Merrimack have first hand experience with groundwater contamination which has required the closure of municipal water supply wells in each community.

Merrimack, Amherst, Milford and Wilton have established aquifer protection districts to protect their groundwater resources. The regulations generally define the district, specify permitted and prohibited uses, establish performance standards, and address nonconforming and incorrectly designated areas. Wilton, Milford and Amherst use the maps from the 1987 USGS study to define the district boundaries and Amherst includes mapped primary and secondary recharge areas in its definition. Merrimack's district boundary is based on a 1988 study by Whitman and Howard entitled "Aquifer Conservation District" and divides the district into three areas the aquifer/primary recharge area, the secondary recharge area and the balance of the watershed.

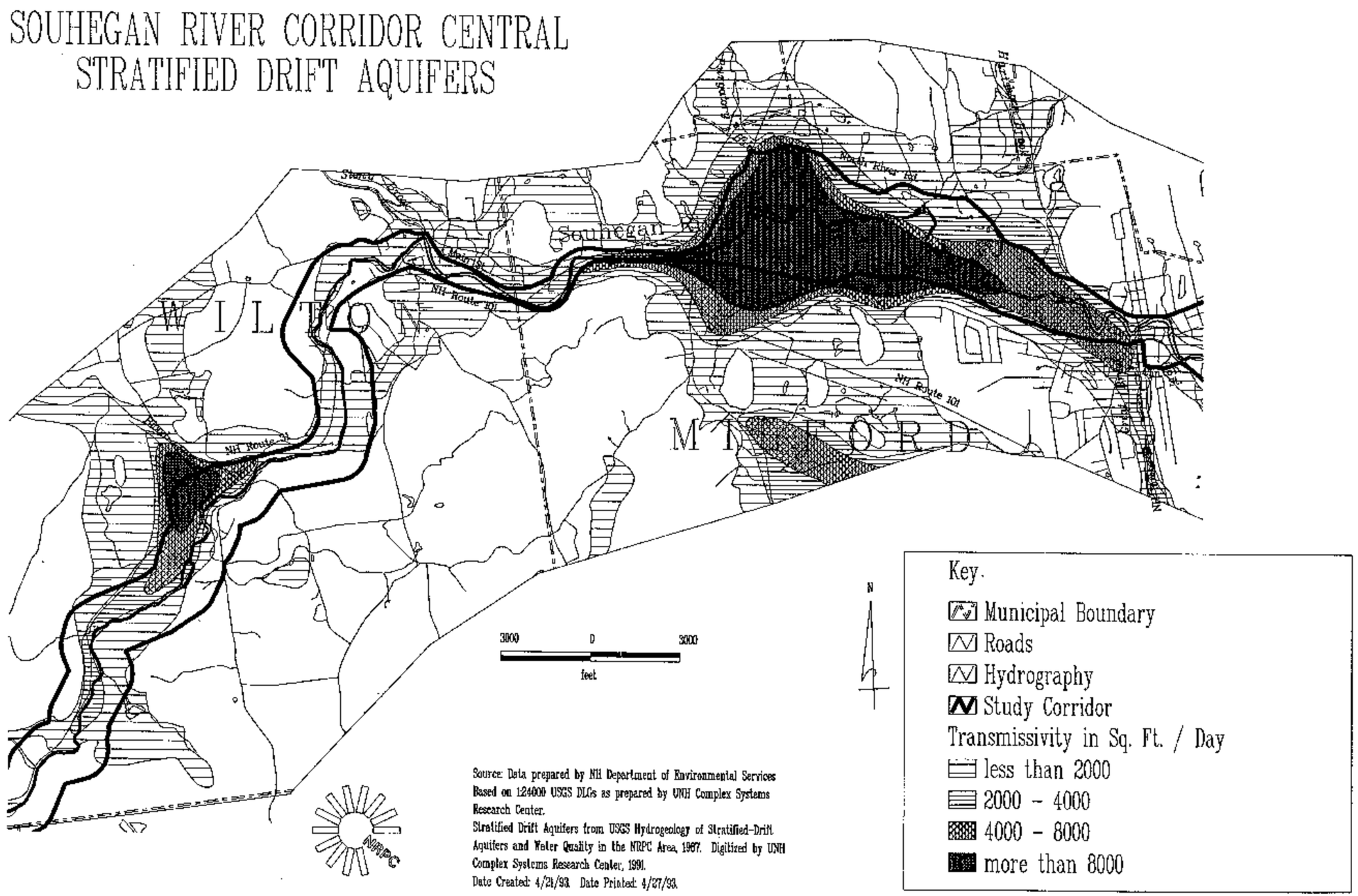
Uses typically permitted in the aquifer protection districts include those which pose a minimal threat to groundwater such as: industrial or commercial uses which discharge no non-human wastes on-site; industrial uses that discharge only noncontact cooling water; residential development; farming, gardening, nurseries, forestry, harvesting and grazing provided that fertilizers, herbicides, pesticides and other leachables are used appropriately and are not stored outdoors; activities designed for conservation of soil, water, plants and wildlife; outdoor recreation, nature study, boating, fishing and hunting where otherwise legally permitted; foot, bicycle and/or horse paths and bridges; and maintenance and repair of existing structures. Prohibited uses generally include those which pose a significant threat to the groundwater resource such as: disposal of solid waste; subsurface storage of petroleum products except under specific conditions; disposal of liquid or leachable non-human wastes except from one or two family residences; discharge of contact type process waters on-site; commercial animal feedlots; automotive service and repair shops, junk and salvage yards; bulk storage of toxic materials for resale or distribution; on-site handling, disposal, storage, processing or recycling of hazardous or toxic materials; outside unenclosed storage of road salt; and dumping of snow containing de-icing chemicals brought from outside the district.

As depicted on the aquifer maps, the Souhegan River flows through some of the most significant stratified drift deposits in the region. The characteristic that make these areas such good sources of water also suggest that contaminants can could readily be transmitted from groundwater to surface water and vice versa. The negative impacts of this relationship can be profound. Chemicals reaching the River can impact fish and wildlife species. Fish kills can result from just one incident while the impacts of other contaminants can only be assessed over time.

Map IV-2

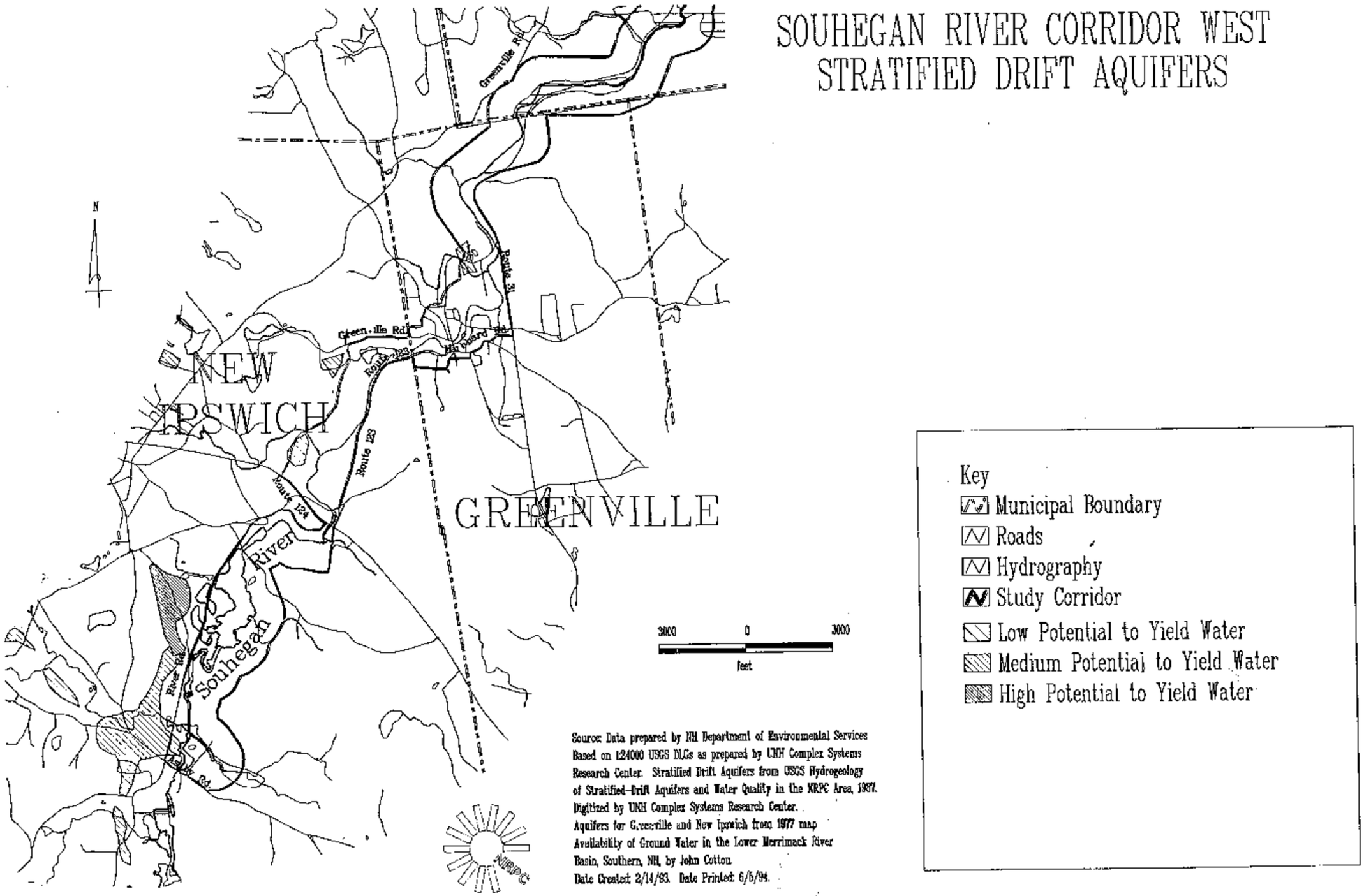

SOUHEGAN RIVER CORRIDOR EAST
STRATIFIED DRIFT AQUIFERS
Key
Municipal Boundary
Roads
Hydrography
Study Corridor
Transmissivity in Sq. Ft. / Day
less than 2000
2000 - 4000
4000 - 8000
more than 8000
MERRIMACK
AMHERST
Wilson Hill Rd.
Amherst Rd.
N
3000
0
3000
feet
NRPC
Source: Data prepared by NH Department of Environmental Services
Based on 1:24000 USGS DLGs as prepared by UNH Complex Systems
Research Center.
Stratified Drift Aquifers from USGS Hydrogeology of Stratified-Drift
Aquifers and Water Quality in the NRPC Area, 1987. Digitized by UNH
Complex Systems Research Center, 1991.
Date Created: 2/14/93. Date Printed: 4/21/93.

Map IV-2


SOUHEGAN RIVER CORRIDOR CENTRAL
STRATIFIED DRIFT AQUIFERS
Souhegan R.
W I L T O N
M A N C H E S T E R
NH Route 101
Key.
Municipal Boundary
Roads
Hydrography
Study Corridor
Transmissivity in Sq. Ft. / Day
less than 2000
2000 - 4000
4000 - 8000
more than 8000
3000
0
3000
feet
N
NRPC
Source: Data prepared by NH Department of Environmental Services
Based on 1:24000 USGS DLGs as prepared by UNH Complex Systems
Research Center.
Stratified Drift Aquifers from USGS Hydrogeology of Stratified-Drift
Aquifers and Water Quality in the NRPC Area, 1967. Digitized by UNH
Complex Systems Research Center, 1991.
Date Created: 4/21/93 Date Printed: 4/27/93.

Map IV-2

SOUHEGAN RIVER CORRIDOR WEST STRATIFIED DRIFT AQUIFERS



Source: Data prepared by NH Department of Environmental Services Based on 1:24000 USGS DLGs as prepared by UNH Complex Systems Research Center. Stratified Drift Aquifers from USGS Hydrogeology of Stratified-Drift Aquifers and Water Quality in the NRPC Area, 1987. Digitized by UNH Complex Systems Research Center. Aquifers for Greenville and New Ipswich from 1977 map Availability of Ground Water in the Lower Merrimack River Basin, Southern, NH, by John Cotton. Date Created: 2/14/93. Date Printed: 6/5/94.

WATER QUALITY

Two major types of pollution impacting the water quality of the Souhegan River and its tributaries, point sources and nonpoint sources (NPS). Point sources of pollution include discharges from one identifiable source such as a pipe. All point sources of pollution that discharge to surface waters are required to obtain a permit under the National Pollutant Discharge and Elimination System (NPDES). NPDES permits specify effluent limitations, compliance schedules and monitoring and reporting requirements. Under the NPDES process, discharges are categorized as municipal or industrial and classified as major or minor. A major municipal discharge would have one of the following characteristics: 1) a flow equal to or greater than 1 million gallons per day, 2) an impact on downstream uses, and/or 3) discharge upstream of a public water supply. The classification of major industrial discharges is based on a more complex point system that considers toxic pollutant potential, wastewater flow rate, type of wastewater (non-contact cooling water or process water for example), amounts of conventional pollutants, heat load, presence of downstream water supply and water quality limitations of the stream.

Nonpoint sources of pollution are not easily identified and in many instances have more than one origin. The primary categories of NPS, as listed in order of concern in the New Hampshire Nonpoint Source Pollution Management Plan, 1989, are landfills, construction activities, subsurface disposal systems, junkyards, urban runoff, sludge and septage disposal sites, agriculture, silviculture and road salt, not all of which apply to the Souhegan River. The complexity of determining the source of NPS pollution makes it difficult to regulate.

The Souhegan River has a legislative classification of Class B for its entire length. Class B waters are considered acceptable for primary contact recreation (swimming), fishing and, after adequate treatment, water supplies. Note, the legislative water quality classification is essentially a goal, all surface waters in New Hampshire are either Class A or Class B. This does not mean that a particular surface water meets the water quality standards for its legislative classification. Based on samples collected in 1990, 1991 and 1992 by the Department of Environmental Services (DES), the 1992 New Hampshire Water Quality Report to Congress - 305(b) found that of the 31.8 miles of the Souhegan River, 8 miles either did not support or only partially supported the River's Class B classification. A total of six miles did not support Class B standards because of bacteria violations and two miles only partially supported the standard because of dissolved oxygen and cadmium violations. It should be noted that if a site were monitored three times and violated the bacteria standards once the entire segment would be considered not supporting. The 305(b) report recommends further investigation to determine the source of the problem.

In addition to the testing done by the DES, the Merrimack River Watershed Council's citizen monitoring program samples eleven sites on the Souhegan River as indicated on Map IV-3. Seven of the sites are in the same location as the sites tested by the DES. This permits comparison of the DES and MRWC information. Water quality samples were gathered by volunteers during the summers of 1991 and 1992. The samples were analyzed for E. coli bacteria and dissolved oxygen; the 1992 samples were also tested for total phosphorous. The bacteria and dissolved oxygen tests are used to determine if the water quality in the river meets the standards established for Class B waters. Total phosphorous is an indicator of nutrient enrichment in fresh waters. The water quality data were first analyzed by lab staff and then reviewed and discussed by a panel of water quality experts.

Eight samples were collected bi-weekly from July 1 to October 14 during the 1992 sampling season. A total of 53 samples were collected and analyzed for bacteria, 50 contained bacteria colonies less than the instantaneous water quality standard of 406 colonies per 100 ml for Class B waters and three exceeded the standard. Sixty-six samples were collected and analyzed for dissolved oxygen. Of those, 53 had dissolved oxygen levels which exceeded the State's 75% saturation standard; however, each site did not meet the 75% saturation standard at least once during the sampling season. In general, the Souhegan River meets the applicable State water quality standards for bacteria and dissolved oxygen. Class B water quality standards for designated swimming areas must meet achieve a seasonal geometric mean of 126 colonies per 100 ml and an instantaneous count of 88 colonies per ml. Of the 53 samples collected, 27 violated the instantaneous standard, sites SoR50, SoR60 and SoR70 violated the standard four times and sites SoR90, SoR100 and SoR110 violated the standard three times. Four of the sites, SoR100, SoR70, SoR60 and SoR50 violated the standard for seasonal geometric mean. The conclusion is that prolonged water contact at these four sites could present a health risk. Comparing the 1991 and 1992 bacteria results reveals that six sites had lower levels in 1992 and five sites had higher levels in 1992

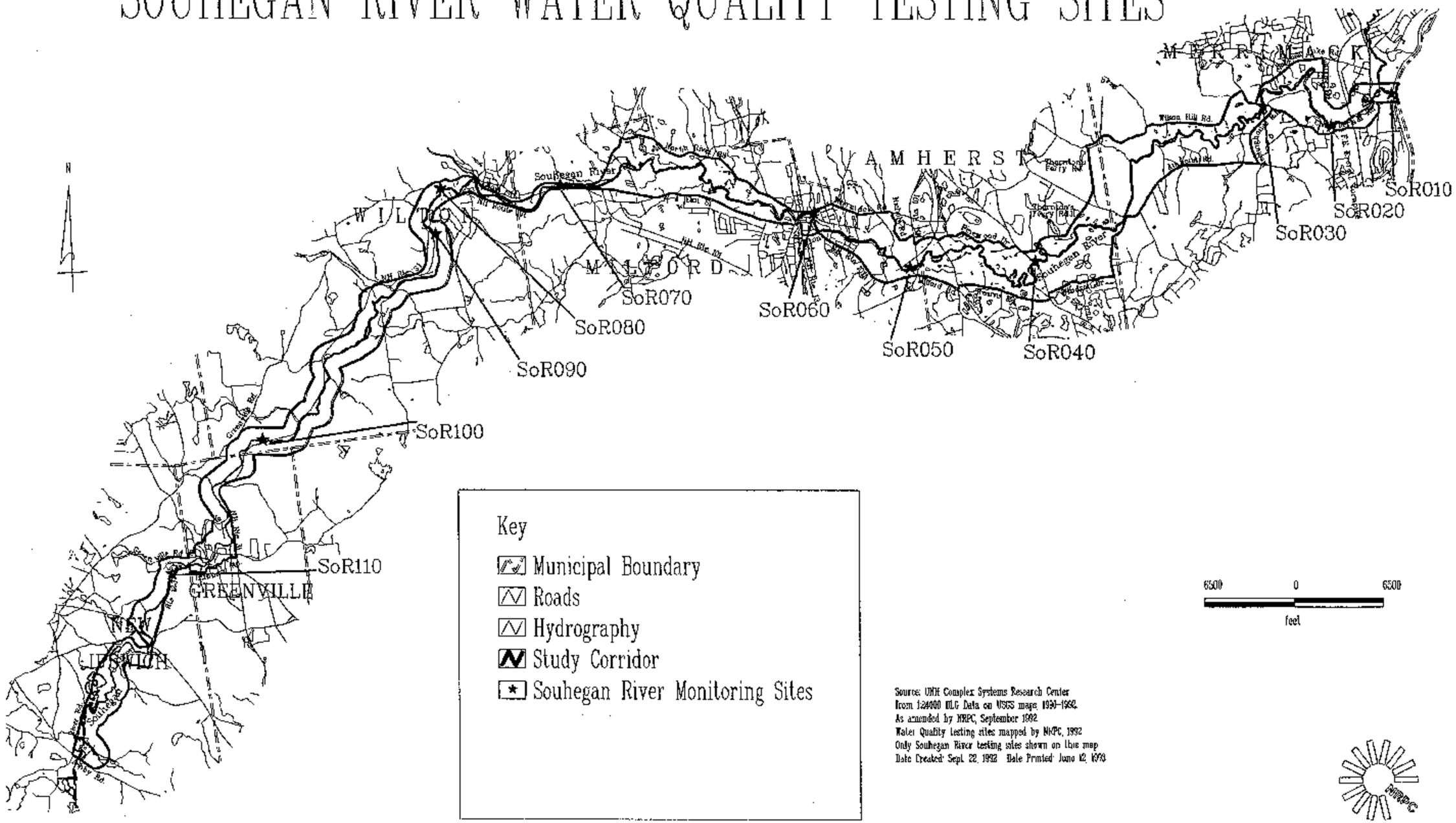
Forty-four samples were collected and analyzed for total phosphorous. Of those 32 contained levels less than the 0.05 mg/l level of concern while twelve exhibited levels greater than 0.05 mg/l. The six downstream sites, SoR10 through SoR70, exceeded the 0.05 level at least once while SoR50 exceeded the level each of the four times it was sampled. The levels at the six downstream sites indicate a cause for concern about possible nutrient enrichment in the River.

In addition to the regular testing conducted by the DES and the citizen monitoring program, the DES conducted a waste load allocation study on the Souhegan River in 1990. The Town of Amherst became concerned when the 1987 USGS aquifer study revealed that the Town's largest and most productive aquifer was zoned for industrial and commercial uses with subsurface waste disposal. To protect this valuable resource, the Town began investigating options to provide wastewater treatment to the area, including tying into the Milford WWTF and developing a treatment facility for the Bon Terrain industrial park with an indirect groundwater discharge adjacent to the Souhegan River. A waste load allocation study is required by the Water Quality/Permits Bureau to support a groundwater permit for an indirect discharge. The Town requested the assistance of the NH DES in conducting the wasteload allocation (WLA) study to determine the level of treatment required for the Bon Terrain facility to meet Class B water quality standards in the Souhegan River. The study was conducted to determine three things: 1) whether Class B dissolved oxygen standards could be met with the Milford Wastewater Treatment Facility (WWTF) discharging at its existing permit limits; 2) what level of treatment would be required at the proposed Bon Terrain facility in order to meet the legislatively designated Class B dissolved oxygen standards with the Milford facility discharging; and 3) what effect withdrawals would have on the water quality in the river, a historic withdrawal by Pennichuck Water Works and a proposed withdrawal by the Souhegan Regional High School.

Waste load allocation analyses are conducted to simulate the worst case situation. Therefore, the study was conducted during the summer months and assumed 7Q10 flows, the seven day low flow which occurs on the average of once every ten years. The 7Q10 flow for the Souhegan River at the gauge in Merrimack, as determined by the USGS, is 12.8 cfs. Six sites were monitored on the Souhegan River, one upstream and five downstream of the WWTF, and two sites were monitored on tributaries. The sites were sampled on two days at two flows, July 17-18 and September 4-5, 1990. The information obtained from the samples was input into a model to predict the water quality impact on the River of different discharge and withdrawal scenarios.

Map IV-3

SOUHEGAN RIVER WATER QUALITY TESTING SITES



Under current conditions and discharges from the Milford WWTF the model indicated that Class B dissolved oxygen standards would be met for the entire length of the River. The study, however, found that under 7Q10 low flow conditions if the Milford WWTF discharged at its design capacity at its present location in accordance with its NPDES permit, the standards for Class B dissolved oxygen would not be met. Recommendations to remedy the situation included:

1) Lower the maximum discharge flow from 3.3 cfs to 1.70 cfs during summer conditions. The Milford WWTF currently discharges at about 1.30 cfs.
2) Keep the present permit limits but move the outfall to an area below Beaver Brook.
3) Lower the Milford average weekly BOD_5 from 25 to 14 mg/l.

Based on these three recommendations, the study outlined the options available for the discharge at the proposed Bon Terrain facility and the changes required in the Milford WWTF parameters, and the impact on the WWTF if the wastewater from the Bon Terrain facility were pumped to Milford. The study also concluded that if both the school and Pennichuck withdrew water downstream of the WWTF outfall that Class B water quality standards would continue to be met downstream of Boston Post Road. The results of the study are currently being reviewed by Milford and Amherst.

Point Sources of Pollution

There are five active NPDES discharges to the Souhegan River, one major and one minor municipal wastewater treatment facility, one major and two minor industrial dischargers.

The Greenville WWTF, constructed in 1975, is a secondary treatment plant with a design capacity of 0.25 MGD. Average discharges are 0.12 MGD during the months of May to December when the Pilgrim Foods plant is operating and 0.10 MGD from January to April. Historically, Pilgrim Foods treated their wastewater on-site and discharged directly to the Souhegan River; however, repeated violations of their NPDES permit resulted in converting to a wastewater pretreatment program and sending the treated waste to the Greenville WWTF.

With a design capacity of 2.15 MGD and an average Daily discharge of 1.22 MGD, the Milford WWTF is classified as a major municipal discharge. Advanced secondary treatment places more stringent limitations on the effluent discharged from the facility. Milford is in the process of renewing its NPDES permit and anticipates stricter requirements for BOD, suspended solids and nitrification. In the future, the facility expects to be adding an alkalinity/pH adjuster to assist in achieving the nitrification and effluent pH limitations, and an effluent filtration system to meet the BOD standards.

The three industrial dischargers are Harcros Chemicals, Inc. in Merrimack, Hitchner Manufacturing Co., Inc. in Milford and Souhegan Wood Products, Inc. in Wilton. All three businesses discharge noncontact cooling waters. Harcros Chemicals does not record or report flows. Souhegan Wood Products daily discharge averages 15,000 gpd and they are currently investigating heat exchange systems which could reduce this discharge even further. Hitchner Manufacturing is the only major industrial discharge with an average daily volume of 300,000 gpd to an unnamed tributary of the Souhegan River. Hitchner is an excellent example of the achievements that can be made through conservation measures and advances in technology having reduced their discharge from 500,000 gpd in 1980 to 415,000 gpd in 1985 and 300,000 in 1993.

Nonpoint Pollution Sources

Nonpoint pollution sources (NPS) within the study corridor include landfills, hazardous waste sites, urban runoff, subsurface waste disposal, road salt, nutrients and pesticides. In 1982, the Water Supply and Pollution Control Division (WSPCD) conducted the statewide Inventory of Groundwater and Surface Water Potential Nonpoint Pollution Sources. The inventory identified such things as waste disposal sites, salt piles and road salting practices, snow dumps and areas with agricultural, urban and/or pesticide runoff. The NH DES in conjunction with the regional planning agencies has been updating the information contained in the 1982 study. The information presented below on NPS within the study corridor for each community has been obtained from the 1982 study, the updated nonpoint source information for each community and a review of the Waste Management Division files.

MERRIMACK

A 1987 hydrogeologic investigation of the Harcros Chemicals site, formerly New England Chemical, conducted by Dubois and King, Inc., found groundwater contamination from more than one source in more than one location. The groundwater on the site contains significant amounts of volatile organic compounds (VOCs) most notably chlorinated ethanes and ethanes, three benzene compounds and two ketone compounds from at least four different sources of chemical compounds on the site. Chemical distribution operations have been carried out on the site since 1953. Harcros is currently conducting a Phase II site investigation and developing a remedial action plan to deal with the contamination. Merrimack has experienced significant growth in residential development within the corridor during the past 20 years. Potential NPS from residential development includes effluent from failing or failed septic systems, and fertilizers and pesticides from lawns. Urban residential development is an increasing source of NPS from fertilizers and pesticides applied to lawns.

AMHERST

Two golf courses, the Amherst Country Club and Ponemah Greens, are located adjacent to the Souhegan River east and west of NH route 122. Potential NPS include nutrients from fertilizers and pesticides. Improper applications of fertilizers and pesticides, both residential and commercial can lead to increased concentrations in runoff, surface waters and groundwater. Excess nutrients in surface waters can result in an increase in growth of aquatic plants and algal blooms. A single episode of pesticide contamination could possibly cause a large number of fish and wildlife to be killed. Tuckahoe Turf Farms, another NPS from fertilizers and pesticides, has ceased operations in the region. In addition, there exist some serious bank erosion problems along the Amherst stretch of the River. While a certain amount of the erosion is natural, the majority of the problems have been caused by a loss of shoreline vegetation resulting from insensitive land use practices.

MILFORD

Milford has a number of potential NPS. Improper applications of fertilizers and pesticides from agricultural operations, turf farms, parks and cemeteries located along the river can lead to increased concentrations in runoff, surface water and groundwater. While Milford has the most agricultural land in the corridor of any community, agricultural operations have declined and Tuckahoe Turf Farms is no longer operating in the region. The old Town landfill is located near the River south of North River Road and is the site of the existing transfer station. The landfill, which was closed in 1980, is unlined. Leachate from the landfill is a potential NPS to the River.

There are two National Priority List Superfund sites in Milford, the Savage Well and Fletcher Paint. In 1983 volatile organic compound (VOC) levels which exceeded drinking water standards were discovered in the Savage Well and the well was shut down. Subsequent investigations traced the potential source of the contamination, and four manufacturing plants surrounding the well were identified as the potentially responsible parties (PRPs). In 1987, the PRPs agreed to conduct the remedial investigation and feasibility study of the site. The EPA held a public information meeting on the proposed plan for the site in July of 1991. Site remediation includes groundwater extraction at five locations and treatment to remove contamination from the ground water. Negotiations are in progress with the PRPs to implement the remedial design work necessary for clean-up of the site. The Fletcher Paint site consists of three areas: the Paint Works Plant on Elm Street, a storage facility on Mill Street and a drainage ditch which runs from the Mill Street facility through the Paint Works to the Souhegan River. In 1984, the Keyes municipal well was taken out of service because of VOCs and an investigation was begun to determine the source of the contamination. In 1985, EPA found VOCs, PCBs and heavy metals in the soil around the Paint Works and in Souhegan River sediments. In 1988, the EPA removed 863 drums from the site. In 1991, EPA's contractor began the remedial investigation of the site and the field work was completed in early 1992. Higher than expected levels of PCBs and paint waste were detected in the subsurface. Phase II studies called for additional monitoring wells and ground water, soil and sediment sampling which were conducted in the spring of 1993. Information of remedial actions is expected by 1994.

Urban runoff is also a NPS within the study corridor in Milford. Runoff from urban areas can carry with it gas, oil, road salt, sediments, anti-freeze, heavy metals and anything else that may be deposited on roads and parking areas.

WILTON

As with Milford, there are a number of NPS in Wilton. The Town landfill is located adjacent to the Souhegan River off of NH Route 101. The unlined landfill is in the process of being closed. Monitoring wells have been installed and samples are taken, and a preliminary closure design has been submitted to the DES. Leachate from the landfill is a potential NPS to the River. The Abbot Memorial Trust site is the only hazardous waste site in the Wilton portion of the study corridor. Cyanide was allegedly buried on this site; however, the presence of overhead wires, the mill raceway and an iron railing interfered with the magnetic survey for the detection of underground storage drums. Water from two surface stations and three well stations was tested for the presence of cyanide, and cyanate and ammonia, potential breakdown products of cyanide. Free cyanide was detected in the groundwater samples but not in the surface water samples. Since the original investigation, monitoring has shown a continued decrease in the levels of cyanide, cyanate and ammonia. The consultants concluded that since the area is served by municipal water, the cyanide in the groundwater does not pose a significant health threat.

Urban runoff is also a potential NPS threat in Wilton. The Wilton downtown directly abuts the River. Runoff from the buildings, roads and parking areas carries with it gas, oil, road salt, sediments, anti-freeze, heavy metals and anything else that may be deposited on roads and parking areas. In addition, snow is dumped in two locations downtown directly adjacent to the River. The snow can contain de-icing chemicals, sediments and other pollutants.

GREENVILLE

There are no hazardous waste sites or landfills located within the corridor in Greenville. Urban runoff from the Town center area is the only source of NPS pollution in the corridor. The contents of urban runoff have been discussed in the above sections on Wilton and Milford.

NEW IPSWICH

There are no hazardous waste sites or landfills located within the corridor in New Ipswich.

Road Salt

One potential NPS throughout the study corridor is road salt. Salting roads creates the potential for sodium and chloride contamination of surface water and groundwater. High levels of sodium and chloride in the drinking water supply can pose serious health threats to pregnant women, infants and people with heart, kidney or liver diseases, hypertension and other metabolic disorders. High salt concentrations can also cause problems for animals and plants, kill trees and corrode metals and concretes. Increased concern for water quality has led to reductions in salt applications particularly in areas impacting public surface water and groundwater supplies and areas with concentrations of individual wells. Communities can protect water quality and save money by minimizing their use of road salt. One major road salt problem facing the River is its proximity to state highways and state maintained roads, primarily NH Routes 101, 101A, 31 and 123. Existing State Department of Transportation policy is to salt all state maintained roads in the winter.

The DES Snow Disposal Guidelines recommend locating snow storage areas near flowing water. The storage area should be at least 25 feet from the high water mark of the surface water and a silt fence or equivalent barrier should be placed between the storage area and the high water mark. In addition, the area should be at least 75 feet from any private water supply well and 400 feet from any municipal wells. The site should be cleared of all debris prior to snow storage and all winter debris should be cleared from the site and properly disposed of no later than May 15.

Subsurface Waste Disposal

Subsurface disposal of wastes is another potential NPS problem in the study corridor. While portions of Merrimack, Milford, Wilton and Greenville are served by municipal sewer systems, the majority of the study corridor is still reliant on subsurface waste disposal. Nutrient rich effluent from failed or failing septic systems can

drain into the River and its tributaries causing bacterial contamination and creating optimum conditions for algal blooms and aquatic plant growth. The rate of septic system failure should be examined in all of the unsewered areas of the corridor to determine if a problem currently exists and to assess the potential for future problems.

Current State regulations require septic tanks and leachfields to be setback a minimum of 75 feet from surface waters, wetlands and open drainage areas. Communities have the authority to adopt regulations stricter than State standards. Increased setbacks and vegetative buffer strips would increase filtration of the effluent before it reaches the water body. Amherst, Wilton and New Ipswich require septic system setbacks greater than the State minimum. Amherst and New Ipswich have a standard septic system setback of 100 feet from lakes, ponds, rivers and streams. Wilton's Zoning Ordinance establishes a sliding scale for septic system setbacks (125, 100 and 75 feet) based on the characteristics of the receiving soil. The New Hampshire Supreme Court in the 1979 case Gillespie v. Freedom upheld a minimum septic tank and leachfield setback greater than the State standard.

Erosion and Sedimentation

Another potential NPS is soil erosion and sedimentation. Soil is eroded by wind and water when exposed to the elements through agricultural and silvicultural activities and through construction activities during land conversion. A portion of these eroded soil particles are transported by water into rivers streams, lakes and wetlands. Sediment is the largest nonpoint source of pollution in the United States. Since portions of the study corridor have experienced rapid growth during the last decade, this discussion will focus on development and construction activities. During land conversions, much, if not all, of the protective vegetative cover is stripped from the site resulting in an increase in the velocity and volume of surface runoff.

This increase results in a corresponding increase in the capacity of the runoff to transport soil particles. Turbidity and sedimentation are the two major surface water problems associated with soil erosion. Increased turbidity in streams, generally evidenced by a decrease in clarity, can prevent sunlight from penetrating to lower water levels inhibiting photosynthesis and decreasing available oxygen levels. The reduced levels of oxygen place additional stress on fish species and other aquatic organisms, while suspended soil particles themselves can damage sensitive gills. Once the particles settle out of the water, accumulated sediments can cover beds of aquatic vegetation and fish spawning habitats, and smother important food supplies such as macroinvertebrates.

There are a number of sites along the Souhegan River with erosion problems. While a certain amount of erosion is natural, in most instances along the River the erosion is caused by the activities taking place along the shoreline. Activities which remove the vegetation to the top of the bank disrupt the fragile balance provided by the trees, bushes and grasses and their root systems. Specific problem land uses along the Souhegan include recreation fields and golf courses, turf farms and other agricultural uses, and residential development. The problems caused by these activities could be minimized by simply maintaining a vegetative strip along the top of the riverbank. The vegetative strip would protect water quality by stabilizing the soil and by filtering out sediments and other pollutants from stormwater runoff. In addition, by stabilizing the riverbank with a vegetative strip the landowner would eliminate the loss of land from erosion.

A number of methods exist for controlling soil erosion and sedimentation ranging from simply retaining as much of the natural vegetative cover as possible to constructing drainage systems to manage stormwater runoff. Requirements for erosion and sedimentation control vary with each community. Information on soils can be useful in determining the erodibility of a soil and the extent of erosion control needed. The Merrimack, Amherst, Milford and Wilton subdivision and site plan review regulations and the New Ipswich subdivision regulations require that soil information be provided for all applications. Greenville's regulations do not require the provision of soil information. In addition, the subdivision and site plan review regulations for the towns of Merrimack, Milford, Wilton and New Ipswich specifically require stormwater management and erosion and sedimentation control plans as part of the development proposal while Amherst and Greenville do not.

The State of New Hampshire Water Supply and Pollution Control Division (WSPCD) regulates land disturbing activities under RSA 485-A:17 Terrain Alteration. Any activity which will disturb a contiguous land area of 100,000 square feet or more must submit a stormwater and erosion and sedimentation control plan and obtain a permit from the WSPCD prior to undertaking any activity on the site. The State Comprehensive Shoreland Protection Act RSA 483-B further requires that all activities within the protected shoreland, 250 feet measured from the ordinary high water mark, of any fourth order or higher river that will disturb a contiguous land

area of 50,000 square feet or greater obtain an alteration of terrain permit from the WSPCD. This applies to the Souhegan River from its convergence of the South and West Branches in New Ipswich to its confluence with the Merrimack River.

Effective stormwater management and erosion and sedimentation control is key to maintaining and improving water quality. It is critical that local development plans provide adequate control measures to minimize negative impacts on water quality.

Underground Storage Tanks

Underground storage tanks (USTs) are another potential NPS posing a substantial threat to both ground and surface waters. Leaks in USTs are difficult to detect and can go unnoticed for long periods of time while causing extensive contamination of water resources. A small amount of a petroleum based product can contaminate thousands of gallons of water. The rules developed for controlling nonresidential underground storage and handling of petroleum liquids, New Hampshire Code of Administrative Rules Part Ws 411 Control of Nonresidential Underground Storage and Handling of Oil and Petroleum Liquids, explicitly prohibit the discharge or disposal of oil to the surface waters or the groundwaters of the State. UST facilities with a cumulative storage capacity 1,100 gallons or more, or 110 gallons or more for motor fuels, are required to register and obtain a permit from the DES-WSPCD. Tanks with a volume less than 1,100 gallons, oil-transmission and oil-production facilities, residential fuel oil tanks for on-site consumption, and tanks for the storage of non-petroleum products are exempt from State regulations at this time. In addition, many tanks currently covered by Ws 411 may still not be registered with the WSPCD. There may also be abandoned tanks within the study corridor that pose potential threats to the area's surface and groundwater resources.

To reduce the potential impact of USTs on surface and groundwater, many communities have conducted underground storage tank inventories to locate existing and abandoned USTs and to determine their contents. Additionally, owners of abandoned tanks are provided with information and assisted with proper closure of the tank.

Hazardous and Toxic Wastes

The use, generation or storage of hazardous or toxic chemicals presents another threat to water resources. Facilities that treat, store or dispose (TSD) of hazardous wastes are regulated by the Federal Resource Conservation and Recovery Act (RCRA). The RCRA program addresses proper management of hazardous wastes and requires all TSD facilities to obtain an operating permit. The RCRA program regulates facilities that generate 1,000 kg or more of hazardous waste per month. The DES WSPCD Groundwater Protection Bureau reports seven RCRA facilities within the study corridor, two in Merrimack, two in Milford and two in Wilton.

The State of New Hampshire, Hazardous Waste Rules, 1988, regulate all generators of hazardous waste in two classifications: small generators - less than 100 kg per month; and large quantity generators - greater than 100 kg per month. Therefore, the State list of regulated facilities is much more extensive than the Federal list. The State list is updated monthly and a copy of the printout is on file for public review with the DES Waste Management Division, Bureau of Hazardous Waste.

WATER SUPPLY

Before discussing use of the Souhegan River as a water supply it is important to understand two things: water rights in New Hampshire and water flow characteristics of the river.

Water Rights

Water rights in New Hampshire, as throughout the eastern states, are based on the Riparian Doctrine and the Public Trust Doctrine. The basis of the Riparian Doctrine is that only persons owning land fronting on a natural watercourse possess the rights to use the water flowing by their land, i.e. property rights include flowing

water. Riparian use is further limited by the reasonable use rule. This rule allows a riparian owner to divert water for any purpose if the use is reasonable with respect to other riparian owners, that is, the use does not unreasonably interfere with a legitimate riparian use or pose burdens on downstream users. In most cases, riparian rights generally extend to the center of a navigable waterway while non-navigable rivers or streams may be privately owned. This ownership principle, however, is subject to the priority of higher rights where the rights of the public have greater priority than the rights of the individual, the Public Trust Doctrine. In addition, State statute RSA 271:20, defined public waters as "all natural bodies of fresh water having an area of ten acres or more" and such waters "are held in trust by the state for public use." The comprehensive Shoreland Protection Act, RSA 483-B, further defines public waters to include "Rivers, meaning all year-round flowing waters of fourth order or higher,..." and directs the Office of State Planning to maintain a list of fourth order or higher streams. The Public Trust Doctrine includes use of the river for recreation. The New Hampshire Legislature has on many occasions granted specific water rights to municipal and private water suppliers granting limited or unlimited use of specific streams or ponds. The issue of public water rights is currently being studied in New Hampshire.

Water Flow

Previous sections have focused on the issues of water quality, water rights and the many competing natural and manmade uses and users of the Souhegan River. Water in the Souhegan River is finite. Despite the fact that the River and its tributaries are highly regulated for flood control, water levels fluctuate greatly throughout the year. Heavy snow and rain may cause an excess in one year while drought conditions may be experienced in the next. In addition, one large withdrawal or the cumulative impact of a number of smaller withdrawals has the potential to create serious problems related to the quantity and quality of water available for other users. The challenge is to balance the water needs of the many competing uses of the river for fish and wildlife habitat, waste assimilation, hydropower, water supply and recreation to ensure the continuation of the multiple use capabilities of the River. The most important factor is maintaining water flows sufficient to sustain these multiple uses, a concept called minimum instream flow.

Souhegan River flows are measured in only one location just above Wildcat Falls in Merrimack. The station operated as a full station until 1976 when it was converted to a partial station which is used only during periods of extreme weather, to estimate flooding conditions or drought severity. The monthly average flows for the Souhegan River as reported in the USGS publication, Statistical Analysis of Stream Gauging Data, 1981, are contained in Table IV-2. Flows range from a high of 818 cfs in April to a low of 39 in September.

The 7Q10 flow, the lowest seven day sustained flow which occurs once in ten years, for the Souhegan River is 12.8 cfs. The 7Q10 flow rate is used as the minimum flow for waste assimilation in calculating waste loads. The waste load allocation study conducted by the NH DES determined that if the Milford WWTF discharged at its design capacity, 2.15 MGD, under 7Q10 flow conditions Class B water quality standards for dissolved oxygen could not be met; however, at the existing average daily flow of 1.22 MGD the standard would be met. This indicates that any further discharges to or withdrawals from the Souhegan River would have to be carefully considered and balanced with the existing demands on the river resource.

The fluctuation in flows may create problems between competing uses. Two uses that may coexist comfortably during periods of high water, such as waste assimilation and contact recreation, will not be compatible during low flows. Waste discharges could conceivably exceed their permit limitations and create serious water quality problems that would threaten health; reduce available water supplies; stress plant and animal species; and limit recreational use of the River. Optimum treatment of waste discharges can reduce adverse impacts on water quality during low flows.

The minimum flows required to sustain the diverse uses of a river have yet to be established. The NH DES Rivers Program and the Water Resources Division have been studying the issue of minimum instream flows. The New Hampshire Rivers Management and Protection Program, RSA 483, requires that minimum instream flows be established for all designated rivers. The results of the DES study have yet to be finalized and released for use.

TABLE IV-2
AVERAGE MONTHLY FLOWS
SOUHEGAN RIVER AT MERRIMACK, NH
1967-1976

Month	*Mean Flow (cfs)*
October	45
November	202
December	274
January	218
February	284
March	553
April	818
May	392
June	219
July	110
August	60
September	39

Source: USGS/S.L. Dingman and G.K. Capsis, 1981

Water Supply

Currently there are no surface water withdrawals for public water supplies from the Souhegan River; however, Pennichuck Water Works withdrew water from the River from 1965-1984 at a maximum rate of 10.8 cfs and maintains the right to withdraw water in the future. There are four municipal wells adjacent to the River, two in Milford and two in Wilton. Hydrogeological studies of these wells have indicated that the potential for induced recharge of the wells from the River is minimal.

The primary water uses of the Souhegan River are irrigation and hydropower. All facilities using 20,000 or more gallons of surface water or groundwater per day are required to register with the NH DES Water Management Bureau (WMB) and to provide information on average and daily water demand. Once registered, the facility must report its monthly water use to the WMB. According to WMB records there are 8 registered water withdrawals from the Souhegan River.

Three registered uses withdraw water directly from the Souhegan River for irrigation. Two of the withdrawals for irrigation are registered to the Amherst Country Club and Souhegan Woods Golf Club. Amherst Country Club, an 18 hole course, withdraws water from the river from April to October. In 1992, they reported the following monthly withdrawals (in gallons): April-54,800 gpd, May-2,189,100, June-3,825,100, July-3,183,400, August-3,483,500, September-4,609,200 and October-386,700. Souhegan Woods also withdraws water from April to October. In 1992, they reported the following monthly withdrawals (in gallons): April-5,148,000, May-3,430,000, June-6,480,000, July-4,680,000, August-4,230,000, September-7,200,000 and October-4,860,000. Irrigation is considered a consumptive use of water. Consumptive uses are those which result in transpiration by plants, evaporation, or out of basin transfers; water withdrawn from the river is consumed and returned at a significantly reduced rate. The WRD recently received a registration for a withdrawal in Amherst to irrigate 60 acres of agricultural land along the Souhegan River.

The other five registered withdrawals are for hydro facilities, two in Greenville, one in New Ipswich, one in Wilton and one in Milford. All five facilities are run-of-the-river; the water moves into the turbines and is almost immediately returned to the river. This is considered a nonconsumptive use since the water is returned to the source at the same rate as which it was withdrawn.

The list of registered water users does not reflect the total picture of the Souhegan River as a water supply. Some facilities which withdraw 20,000 or more gallons per day have not yet registered with the WMB. Also, there may be a number of withdrawals that are not required to register because they use less than 20,000 gpd.

The pressures on the Souhegan River to support consumptive and nonconsumptive water uses will only increase in the future. The impact of water withdrawals on waste assimilation and in-stream uses could be significant. Balancing these competing uses is essential to the continuation of the Souhegan as a multiple use river.

HYDROPOWER

Water has been used throughout history to generate power. Many of the Country's cities are situated along rivers and streams where the water could be harnessed to run mills. The Souhegan River exemplifies this history as it powered first saw and grist mills and later textile and other industrial mills. Today, many of those dams generate electricity. There are seven dams on the Souhegan River, one in New Ipswich, two in Greenville, two in Wilton, one in Milford and one in Merrimack. Five of the dams are operating hydro facilities, one is currently under construction and another is in the development stages.

All of the hydro dams on the Souhegan River are considered run-of-the-river facilities. This means that there is no significant ponding or holding back of water associated with the dam. Proceeding from west to east on the River, the dams include: Water Loom Falls dam in New Ipswich, Otis Falls and Chamberlain dams in Greenville, the Wilton Hydrosystems dam and Pine Valley dam in Wilton, the McLane dam in Milford and the Merrimack Village dam in Merrimack. Water Loom Falls, Otis Falls and Chamberlain Falls dams are all operated by Chamberlain Falls Hydro. The Water Loom Falls dam, reconstructed in 1979, is 200 feet long with a vertical drop of 21 feet. The facility produces 100 kwh of power. The Otis Falls dam, 100 feet wide with a vertical drop of 21 feet, was reconstructed in 1980 and produces 150 kwh of power. The Chamberlain Falls Dam is 80 feet wide with a vertical drop of 27 feet and was reconstructed in 1982. The facility generates 150 kwh of power. It should be noted that there is only about 800 feet of river between the Otis and Chamberlain dams. The Pine Valley facility in Milford was reconstructed and came on-line in 1987. The facility can produce 500 kwh of power under optimum water conditions. Water levels in the river curtail and even halt operations of the facility. The hydro facility at the McLane dam in Milford is currently under construction and is expected to be operational by 1994. Discussions are currently underway between the owner of the Merrimack Village dam and a hydro developer to develop a generating facility. All power generated by the hydro facilities on the Souhegan River is sold to Public Service Company of New Hampshire.

Dams have historically been a constant presence on the Souhegan River. The existing hydro facilities once powered the mills. The conversion of these facilities to the generation of power represents a responsible use of the River resource.

Chapter V.

Land Use

CHAPTER V

LAND USE

Land use throughout the Souhegan River watershed influences the quality and quantity of water in the River. Impervious areas such as parking lots or structures increase the volume of runoff. Expanded volumes result in increased velocity which in turn intensifies the erosive potential of the flow. Runoff from impervious areas carries with it road salt, oil, gasoline, anti-freeze, sediments, heavy metals and other pollutants that have an impact on water quality. Control of these impacts is best achieved at the local level through local zoning, subdivision and site plan review regulations, and enforcement of local, state and federal regulations.

Land use, road systems, property ownership and public access can have significant impacts on future development and the conditions of the Souhegan River. Land uses can change over time; however, it is highly unlikely that the existing uses of developed parcels within the corridor will change significantly in the near future. Changes are most likely to occur on those parcels currently in low intensity uses such as agriculture and vacant land or large industrial parcels that may be further subdivided.

Property ownership is another factor that influences future land use changes. Parcels currently owned by development corporations or local developers are more likely to be developed. In addition, large parcels under single ownership are often targets for purchase and subdivision by developers. Therefore, many land use changes in the study corridor will occur through transfers in property ownership. The economy and market demand will also significantly impact land use and development. A declining economy and decreased demand will slow the pace of development while a strong economy will have the opposite effect. In addition, land currently held for residential development, for example, may have a higher demand and command a higher price as commercial or industrial property.

Road systems transport people, goods and services to and from an area. The road network needs to contain major roads that provide access to the general corridor and minor roads that lead directly to the River. If people can easily get to the river then they will take advantage of the opportunities it offers. In addition to the road system, adequate parking at the destination is necessary to meet the demands of river users and to avoid conflict with surrounding neighborhoods. Therefore, a well developed road and parking network is essential to encouraging use of and facilitating access to the River.

While it is important to have a good road system to bring people to the River, it is more important for them to have a destination. Formal public access to the Souhegan River in the study corridor is somewhat limited despite the number of canoe put in/take out areas (two sites in Merrimack, two sites in Amherst, one in Milford, two in Wilton and two in Greenville).

This chapter examines the existing land use in each community, existing zoning regulations affecting the corridor, the existing road system and existing public access points.

LAND USE

Existing land use adjacent to the River varies significantly throughout the study corridor. Much of the land is undeveloped, particularly in the western communities. This is due in part to the physical constraints of the land, i.e., floodplains, steep slopes, proximity of the road, etc. Development patterns are different in each of the six communities. Therefore, land use for each community is discussed individually below.

MERRIMACK

East of Daniel Webster Highway, the study corridor is highly developed for industrial and commercial uses. West of D.W. Highway development is predominantly residential with some areas of public ownership, including the Town owned 80 Acres in the area of Wildcat Falls. The Town owns another parcel along the River accessible from Davidson Avenue and the Boy Scouts own a parcel across the River, Camp Whippoorwill. Land use in the far western section of the river corridor is very low density residential and vacant. Generalized land use for Merrimack is depicted on Map V-1.

AMHERST

A look at Amherst's generalized land use map, Map V-1, would indicate that much of the land in the corridor is vacant and undeveloped. This is somewhat misleading since there are two golf courses in the western section of the study corridor. In addition, Tuckahoe Turf Farms, which used to operate in this area, has ceased operations in the region. The dominance of the vacant land use category can also be related to the large expanses of floodplain within the corridor in Amherst. The rest of the study corridor is residential and the Town owns one piece of conservation land with River frontage.

MILFORD

Milford exhibits the greatest diversity in land use within the study corridor, with high density residential, residential, commercial, industrial, institutional and public lands, and vacant land categories represented. The eastern portion of the study corridor, near the Amherst line, is predominantly commercial with a small shopping center and a few restaurants and shops. The Milford Wastewater Treatment plant and Riverside Cemetery are located near the River. Approaching the Milford downtown land uses is mostly residential and multi-family. The Milford downtown is a mixture of commercial and residential/multi-family land use with some small parcels of Town owned land, east of the swinging bridge north of the River, Emerson Park, Elm Street Cemetery and Keyes Field. The next section of the corridor is dominated by commercial development south of the River and residential and vacant land north of the River. The State owns a significant area of land, the Milford fish hatchery, along the Souhegan River near its confluence with Purgatory Brook. The land across the River is used for agriculture, and the development rights to one parcel have been purchased by the State. The western section of the corridor is lightly developed with commercial and residential uses. There are two hazardous waste sites in the corridor in Milford, the Savage Well site and the Fletcher Paint site. Generalized land use for Milford is depicted on Map V-1

WILTON

In Wilton, the eastern portion of the study corridor is dominated by residential and commercial/industrial uses, including Souhegan Wood Products, Label Art, the Riverview Mill and the downtown businesses. West of the downtown along Route 101 the principal land use is residential with a few commercial businesses along 101. Along NH Route 31 south the corridor is sparsely developed with only a few residences and the River is close to the road. The NH Department of Transportation holds a scenic easement along a stretch of Route 31 in Wilton and Greenville. Generalized land use for Wilton is depicted on Map V-1.

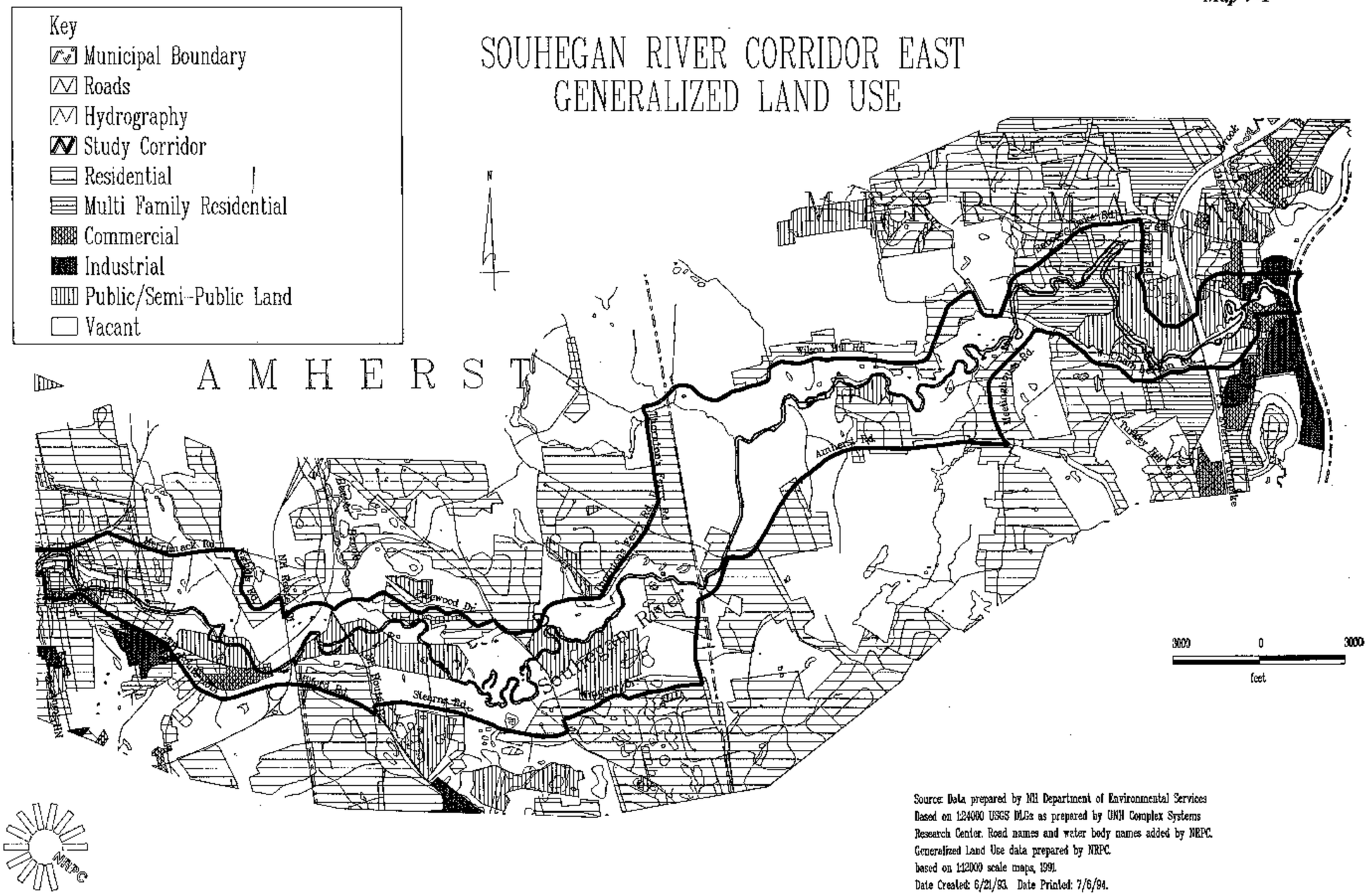
GREENVILLE

Land use within the study corridor in Greenville is predominantly vacant land in the northern section and residential in the village areas. Generalized land use for Greenville is depicted on Map V-1

NEW IPSWICH

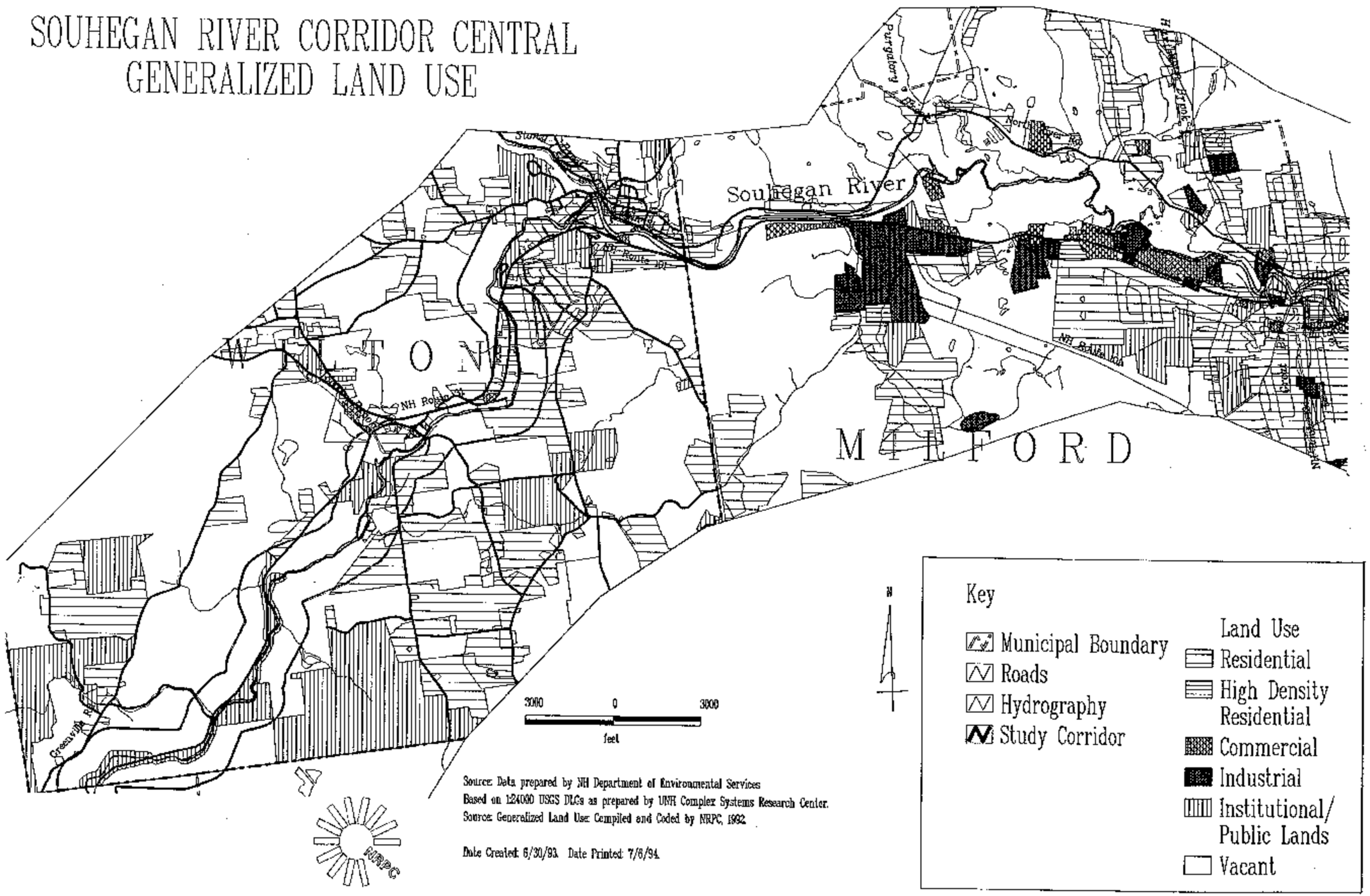
Land use within the study corridor in New Ipswich is chiefly vacant and residential. Generalized land use for New Ipswich is depicted on Map V-1.

Map V-1



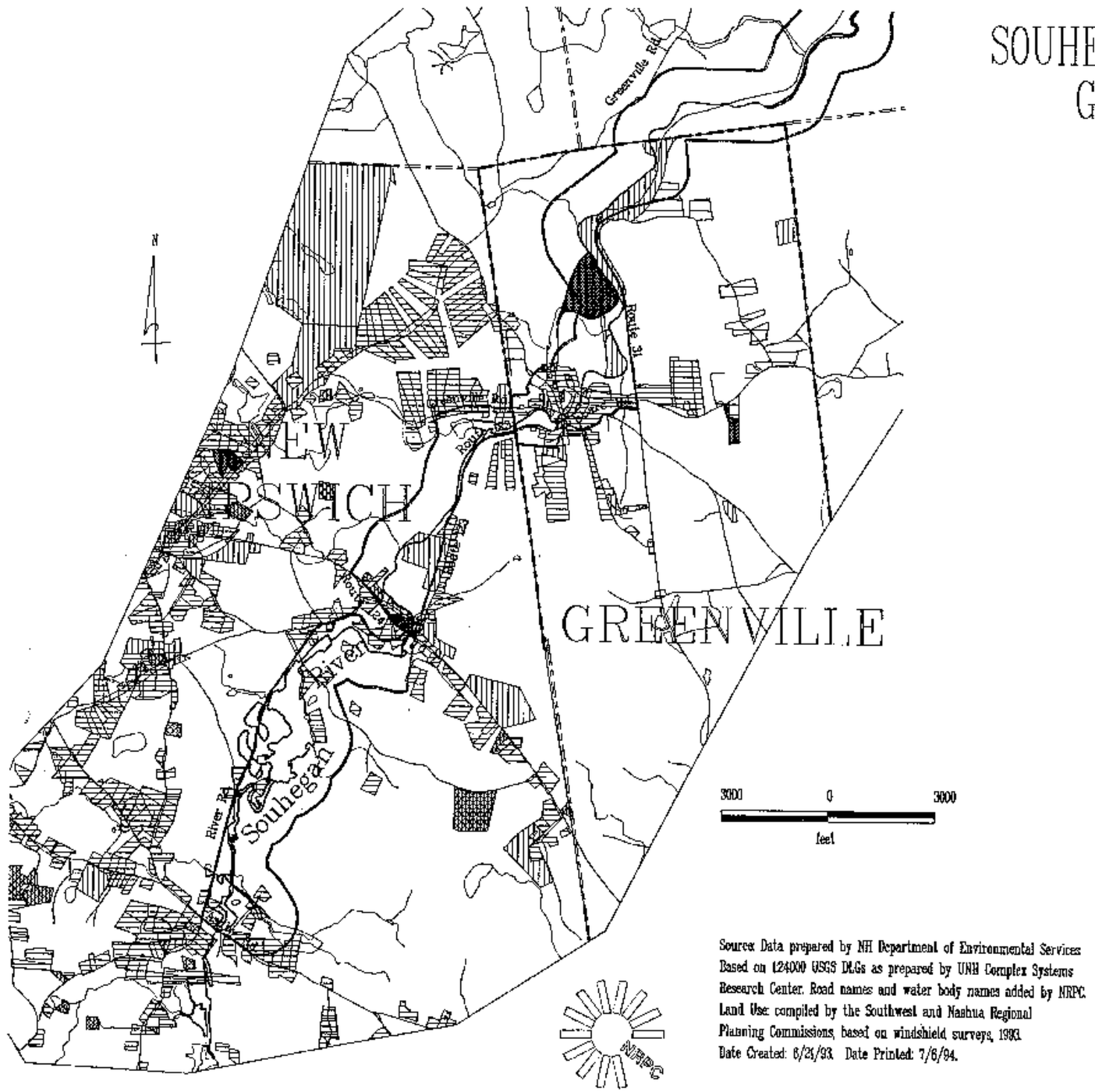
Source: Data prepared by NH Department of Environmental Services
Based on 1:24000 USGS DLGs as prepared by UNH Complex Systems
Research Center. Road names and water body names added by NRPC.
Generalized Land Use data prepared by NRPC
based on 1:12000 scale maps, 1991.
Date Created: 6/21/93. Date Printed: 7/6/94.

Map V-1


SOUHEGAN RIVER CORRIDOR CENTRAL
GENERALIZED LAND USE
Souhegan River
W I L T O N
M I L F O R D
NH Route 101
Greenville Rd
3000
0
3000
feet
Source: Data prepared by NH Department of Environmental Services
Based on 1:24000 USGS DLGs as prepared by UNH Complex Systems Research Center.
Source: Generalized Land Use: Compiled and Coded by NRPC, 1992.
Date Created: 6/30/93. Date Printed: 7/8/94.
NRPC
N
Key
Municipal Boundary
Roads
Hydrography
Study Corridor
Land Use
Residential
High Density Residential
Commercial
Industrial
Institutional/ Public Lands
Vacant

Map V-1

SOUHEGAN RIVER CORRIDOR WEST GENERALIZED LAND USE



Source: Data prepared by NH Department of Environmental Services Based on 1:24000 USGS DLGs as prepared by UNH Complex Systems Research Center. Road names and water body names added by NRPC. Land Use: compiled by the Southwest and Nashua Regional Planning Commissions, based on windshield surveys, 1993. Date Created: 6/21/93. Date Printed: 7/6/94.

Key

- Municipal Boundary
- Roads
- Hydrography
- Study Corridor

Land Use

- Residential
- High Density Residential
- Commercial
- Industrial
- Institutional/ Public Lands
- Vacant

EXISTING ZONING

Zoning is the principal tool available to municipalities for managing land use. Community's are granted the authority to zone by RSA 674:16 "for the purpose of promoting the health, safety or the general welfare of the community . . . ". The power to zone includes the right to adopt innovative land use controls such as performance standards, environmental characteristics zoning and open space design. One stated purpose for zoning that applies to river corridor management is "to assure proper use of natural resources . . ." (RSA 674:17). Therefore, the basis for protecting the Souhegan River corridor through the use of zoning is established in State statute as well within the power of the localities.

Each of the six communities has an adopted master plan, a zoning ordinance and subdivision regulations. Existing zoning for each community's portion of the study corridor is depicted on Map V-2. The information provided in this section is presented as an overview of the six communities' regulations. More detailed information can be obtained by examining the regulations of the individual communities.

MERRIMACK

The majority of the study corridor in Merrimack, all of the land west of the Everett Turnpike, is zoned for residential development. Zoning east of the turnpike is commercial and industrial. The uses permitted within each district include:

General or Limited Commercial: limited commercial permits stores for the sale of retail goods or services; business and professional offices; specifically excludes banks, automotive uses of all kinds, hotels and motels; permitted by special exception - restaurants, cafes, residential and accessory uses; general commercial permits stores for the sale of retail goods and services; business, professional and banking offices; research and development; restaurants and cafes; parking lots for transient motor vehicles; hotels and motels; and churches; permitted by special exception - accessory uses, residential, public facilities, sale or storage of new or used cars, commercial recreation and entertainment, and gasoline and automobile service stations.

Industrial: manufacturing industries; warehouse and wholesale uses; offices greater than 10,000 sq. ft.; public utilities; churches; gas stations; enclosed service and repair; sales service and repair of machinery and transportation equipment; freight and trucking terminals, offices and brokers; contractor yards; parking garages; animal hospitals and veterinary clinics; research and testing laboratories; fuel storage and distribution (bulk); printing establishments; contract cleaning establishments; industrial supply establishments; support uses to industrial district - restaurants, branch banks, offices, hotel/motel; and breweries and bottling facilities.

Residential: residential uses; home occupations; permitted by special exception churches and accessory dwelling units.

Minimum lot size in the commercial districts is 20,000 sq. ft. There is no minimum lot size for industrial developments; however, floor area ratios cannot exceed 0.4 for a one story building or 0.8 for a two story building and buildings must be set back a minimum of 100 feet from D.W. Highway. In addition, all developments in this district must be served by municipal water and sewer. Minimum lot size in the commercial districts is 20,000 sq. ft. with 125 feet of frontage. Floor area ratios are the same as the industrial district. Minimum lot size requirements in the residential district are based on soil type and the presence of municipal water and sewer. Cluster development of one, two or four unit residential structures is allowed in all residential districts with a minimum parcel size of 15 acres and municipal water and sewer. In addition, the Town has adopted a number of regulations to protect its natural resources, such as the floodplain conservation district, the wetland conservation district and the aquifer conservation district. The Town does not have any type of shoreline protection.

AMHERST

The entire study corridor in Amherst is zoned for residential development. Uses permitted in the residential district include: single-family and accessory buildings; planned residential development; home occupations; open space plan; amateur, nonprofit sports and recreation uses; and family daycare uses. Minimum lot size is two acres with 200 ft. of frontage for regular lots and 35 ft. of frontage for reduced frontage lots. The

open space plan calls for maintaining the overall density, two acres/unit, but allows for the development of residential units on 40,000 sq. ft. lots to encourage the maintenance of open space. Minimum parcel size for open space plans is ten acres in the residential district. The planned residential development standards allow for the development of different housing types at densities greater than required by the underlying zone. Density is determined by dividing the overall acreage by two and then multiplying that number by a factor which is based on the soil classification. Single-family attached and detached structures, and multi-unit structures with three to six units are permitted in planned residential developments. Minimum tract size for a planned residential development is 20 acres in the residential district. In addition, the Town has adopted a number of regulations to protect its natural resources such as a floodplain conservation district, a wetland conservation district and an aquifer protection district. The watershed protection district essentially is the same as a shoreline protection district.

MILFORD

Land within the Milford section of the study corridor is almost equally divided between commercial, industrial and residential districts. South of the River, the eastern section is zoned commercial and the western section is zoned industrial. Except for a small area near the downtown, all of the land in the corridor north of the River is zoned residential. The uses permitted within each district include:

> *Commercial*: retail and wholesale businesses; restaurants; filling stations, garages and parking lots; professional offices and banks; hospitals and/or medical facilities; schools, colleges, business or trade schools; hotels, motels and inns; churches; theaters and bowling establishments; laundries and dry cleaning; newspaper and job printing; funeral homes; the uses permitted in residence "A" and "B" districts; and elderly housing; permitted by special exception - dumps and junk yards, mobile homes and communication towers.
>
> *Industrial*: harvesting and processing of natural resources; and light industrial and manufacturing; permitted by special exception - uses permitted in the commercial/business district and residence "R" district except for residential uses.
>
> *Integrated Commercial-Industrial*: wholesale businesses; retail businesses; restaurants; professional offices and banks; hotels, motels and inns; daycare facilities; public utility uses; light industrial and manufacturing; distribution and mailing facilities; research and development laboratories; automotive service and repair; harvesting of natural resources; permitted by special exception - schools.
>
> *Residential District*: "A" district: single-family residences and accessory buildings; permitted by special exception home occupations, recreation and community center buildings, kindergartens and day nurseries, churches, and public utilities; "B" district: multi-family with municipal water and sewer; single-family and two-family dwellings; permitted by special exception - hospitals, schools and funeral homes; "R" district: uses permitted in "A" district; hospitals; schools; farm, agriculture or nursery; mobile homes; harvesting of natural resources; and recreational uses; permitted by special exception two-family residences and communication towers.

Minimum lot sizes in the commercial and industrial districts are 20,000 sq. ft./150 ft. of frontage with municipal water and sewer and 60,000 sq. ft./225 ft. frontage without water and sewer. Lot sizes and frontages in the integrated commercial-industrial district are the same as those for the commercial/industrial with water and sewer and 40,000 sq. ft./150 ft. of frontage without water and sewer. Residential minimum lot sizes are as follows: "A" - with water and sewer 15,000 sq. ft./100 ft. frontage, without 40,000 sq. ft./150 ft. frontage; "B" - with water and sewer 20,000 sq. ft./150 ft. frontage, without 60,000 sq. ft./225 ft. frontage; "R" - single-family 40,000 sq. ft./150 ft. frontage; two-family 80,000 sq. ft./225 ft. frontage. Cluster development is permitted in all residential districts with a minimum tract size of 5 acres with water and sewer or 20 acres without. Overall density is the same as would be permitted by the underlying zone and there are no minimum lot size, frontage or setback requirements. In addition, the Town has adopted a number of regulations to protect its natural resources such as a floodplain management district, a wetland protection district and an aquifer protection district. The wetland protection district includes surface waters.

WILTON

Residential and agricultural, and residential zoning dominates the Wilton section of the study corridor with a strip of commercially zoned land along NH Route 101 and some industrially zoned land along NH Routes 101 and 31 South. The uses permitted within each district include:

Residential: single-family and duplex dwellings and accessory uses; multi-family dwellings with 3 units; permitted by special exception - home occupations, bed and breakfasts, churches, synagogues, parish houses and convents, hospitals, emergency medical centers and clinics, civic and municipal buildings, schools and daycare centers.

Residential and agricultural: any use permitted in the residential district; and all general farming and forestry activities.

Commercial: any use permitted in the residential and agricultural district; duplex and multi-family dwellings, inns, tourist courts, cabins, and bed and breakfasts; restaurants and other retail establishments; garages, parking lots and filling stations; business and professional offices; theaters, halls, clubs and amusement centers; greenhouses and florist shops; funeral homes; and wholesale establishments in connection with permitted retail establishments, warehousing or merchandise for sale within the district.

Industrial: Manufacturing, compounding, processing, packing, treatment or warehousing of goods and products; research and/or testing laboratories; and offices; and commercial uses under the same terms and conditions as industrial uses.

Minimum lot size in the residential district is 0.5 acre with water and sewer and one acre without with 100 ft. frontage. Lot size in the residential agricultural district is either one, one and a half or two acres depending on soil conditions with 200 ft. of frontage. The commercial district does not establish a minimum lot size; however, it does establish a maximum lot coverage of 75 percent. The industrial district requires a two acre minimum lot size with 200 ft. of frontage and lot coverage cannot exceed 60 percent or 40 percent in the aquifer protection district. Cluster developments are permitted in the residential and agricultural district with a minimum tract area of 15 acres with 500 ft. of frontage; no minimum lot sizes or setbacks are established. In addition, the Town has adopted a number of regulations to protect its natural resources such as a floodplain conservation district, a wetland conservation district and an aquifer protection district.

GREENVILLE

Greenville's zoning within the study corridor is predominantly industrial and commercial with small sections of residential and rural/agricultural. The following uses are permitted in each district:

Rural/agricultural: single-family residences; convalescent or nursing homes; educational use, place of worship or public and semi-public nonprofit uses; veterinarian, commercial stable or kennel; general farming; roadside stands for the sale of produce grown on the premises; commercial agricultural uses; cemeteries; public utility installations; excavations of natural materials; accessory uses to permitted uses; home occupations; and start-up home businesses; permitted by special exception - inn or tourist home.

Residential: single-family residences; two-family residences; educational use, place of worship or public and semi-public nonprofit uses; public utility installations; accessory uses to permitted uses; home occupations; and start-up home businesses; permitted by special exception - multi-family housing and inn or tourist home.

Commercial: retail business establishments; professional offices; banks and financial institutions; real estate offices; restaurants, cafeteria, bakery and confectionery shops; grocery or general store; place of worship; inn or tourist home; indoor theater; private club; self-service storage centers; health care facilities; recreational facilities; building supply facilities; and accessory uses to permitted uses; permitted by special exception gasoline service station or garage, single-family residence, two-family residence, multi-family housing, and light industry.

Industrial: any industry whose use or process is not obnoxious or offensive by reason of gas, radiation, odor smoke vibration, liquid discharge, illumination, noise or appearance and which does not constitute a public hazard whether by fire, explosion or otherwise; plants for the processing and distribution of milk and dairy products for human consumption and for bottling or packaging beverages, pharmaceuticals, and toilet preparations perfumes and similar products; printing, publishing and general contractors; restaurant and cafeteria; and accessory uses to permitted uses; permitted by special exception - uses permitted in the C and C-I districts.

Minimum lot size and frontage requirements for single family buildings are one acre/150 ft. frontage with municipal sewer and two acres/200 ft. frontage without. Minimum lot sizes for multi-family buildings range depending on the number of units in the structure. A 0.5 acre minimum lot size is required within the commercial district and a five acre minimum lot size is required in the industrial district and minimum frontage for both is 200 ft. regardless of whether or not municipal or sewer service is provided.

NEW IPSWICH

The New Ipswich section of the study corridor is zoned rural except for one section just north of Water Loom Pond which is zoned Village District I. The following uses are permitted in each district:

Village District I: single-family dwellings and accessory uses; two-family dwellings and accessory uses; places of worship; permitted by special exception inns, bed and breakfasts, nursing and convalescent homes, daycare and day nurseries, and kindergartens, professional uses and home occupations, and multi-family dwellings.

Rural: any use permitted in Village District I and II; mobile homes; cluster developments on 10 acres or more; agricultural uses; recreational uses; roadside stands; greenhouses; stables and riding schools; summer camps; permitted by special exception - uses permitted by special exception in Village District I and II, commercial, business, industrial, excavations, group home, camping area, saw mills, slaughter houses, junk yard, heavy equipment business, light industry, veterinary clinics, kennels, residential cluster on tract less than ten acres.

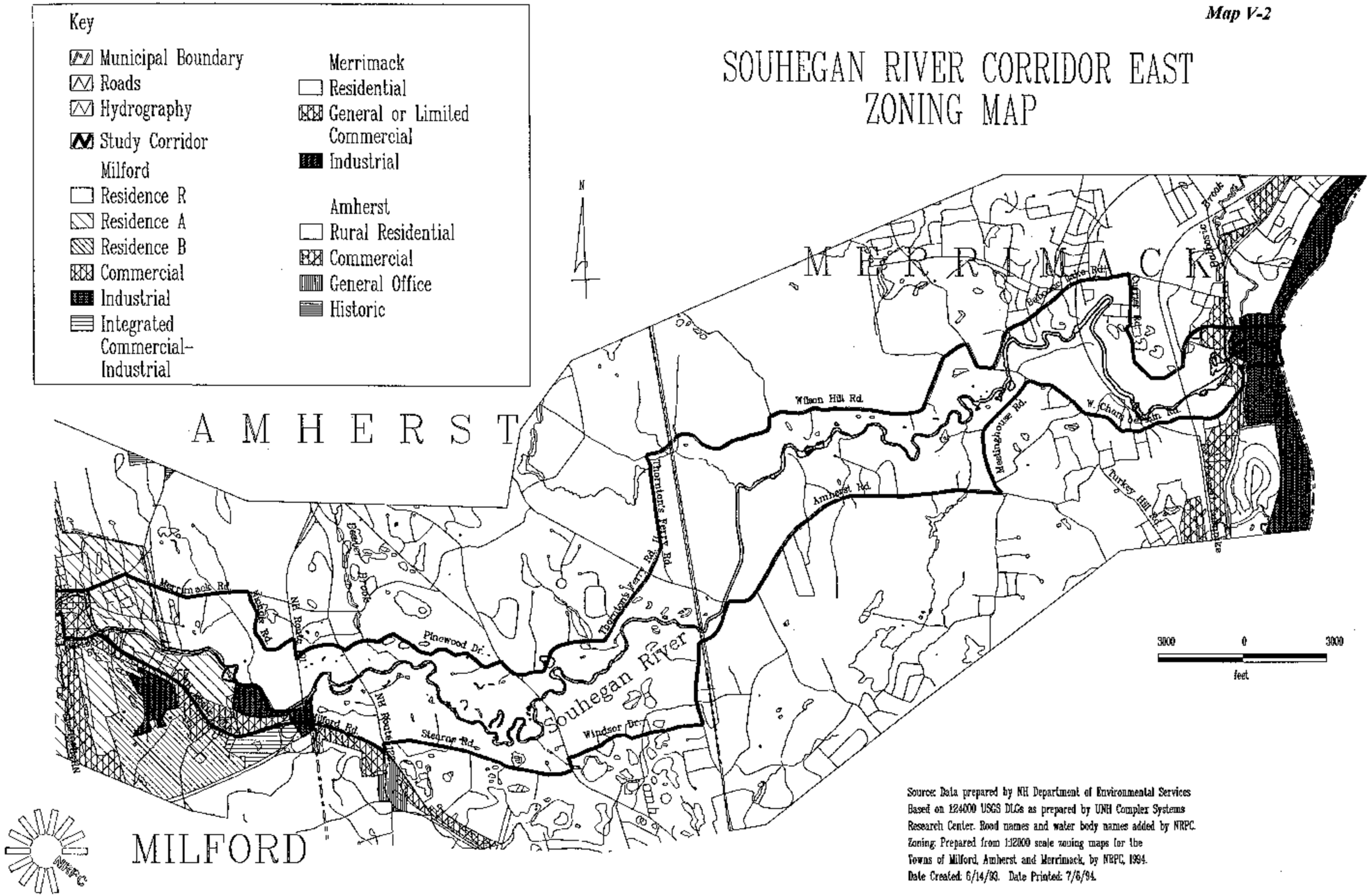
Minimum lot size in the Village District I is one acre with 200 ft. of frontage. Minimum lot size in the rural district is two acres with 200 ft. of frontage. All structures and parking lots must be set back 100 ft. from the normal bank of all lakes, ponds, rivers, streams and brooks. In addition, the Town has a floodplain district and a steep slope district.

As described, a variety of zoning districts are found in the River corridor. Some districts restrict land uses solely to residential uses while others allow a multitude of industrial and commercial developments. The dominant zone throughout the corridor is residential/rural residential. The significant threats to the river from these types of development are subsurface waste disposal and household applications of nutrients and pesticides. Groundwater and surface water contamination has occurred in a number of locations within the study corridor due to industrial and commercial land use activities and practices. The vacant industrially and commercially zoned lands adjacent to the river need to be developed with care to protect both surface water and groundwater quality.

Shoreline protection regulations could effectively be used to protect the River corridor from the negative impacts of future development and to ameliorate the impacts of existing development. For example, requiring minimum setbacks for site developments and maintenance of vegetative buffers can decrease the impact of riverfront development. These requirements protect water quality by providing a filter strip between the development and the River while maintaining the aesthetic character of the corridor. Maintenance of the vegetative buffer can also protect the River from the negative impacts of existing land uses. Limitations placed on the types of uses allowed within the shoreline zone will ensure that those land uses and activities that pose a significant threat to the river, such as landfills and junkyards, will be prohibited thereby reducing the potential impacts.

Map V-2

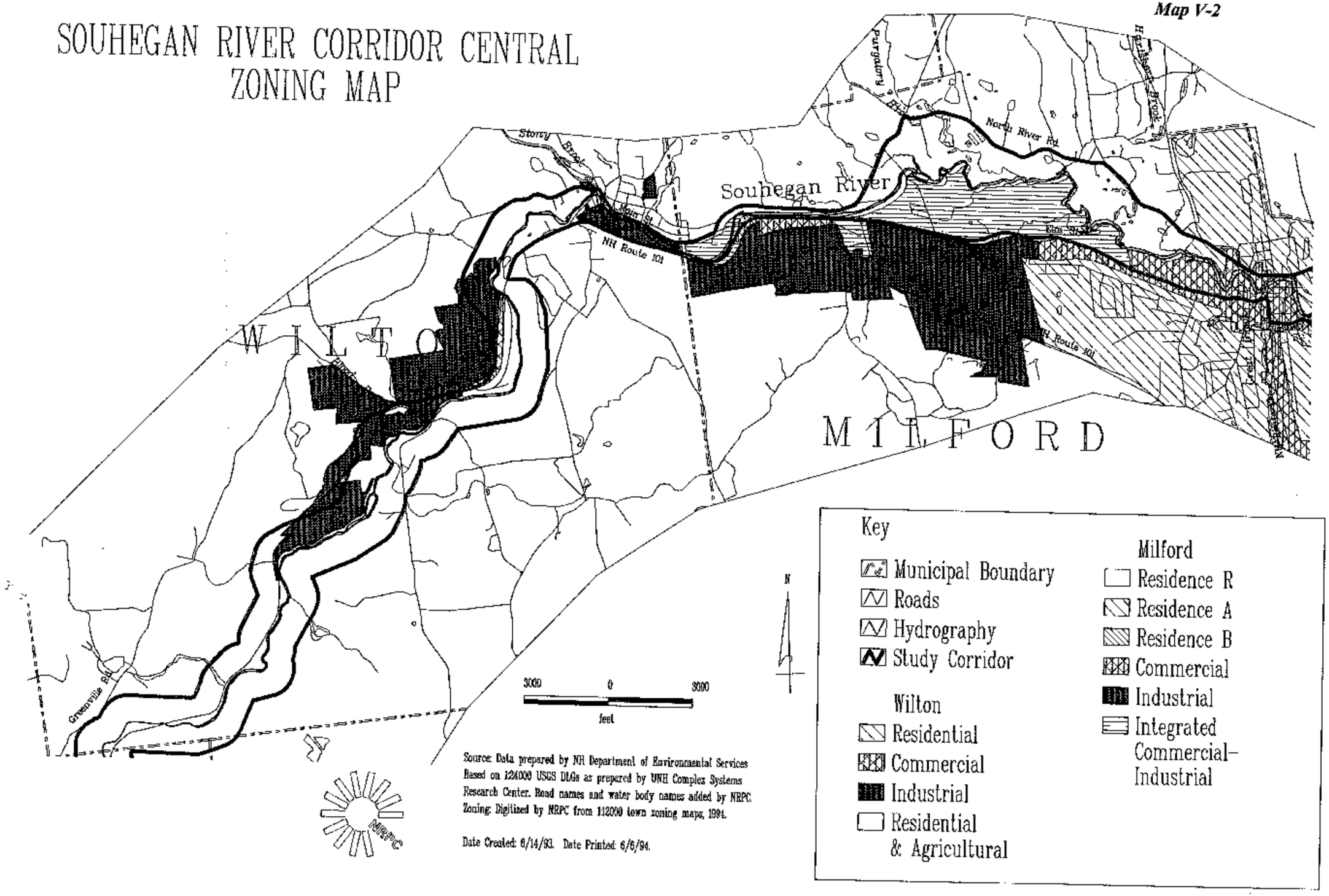
SOUHEGAN RIVER CORRIDOR EAST ZONING MAP



Source: Data prepared by NH Department of Environmental Services Based on 1:24000 USGS DLGs as prepared by UNH Complex Systems Research Center. Road names and water body names added by NRPC. Zoning: Prepared from 1:12000 scale zoning maps for the Towns of Milford, Amherst and Merrimack, by NRPC, 1994. Date Created: 6/14/93. Date Printed: 7/6/94.

Map V-2

SOUHEGAN RIVER CORRIDOR CENTRAL ZONING MAP

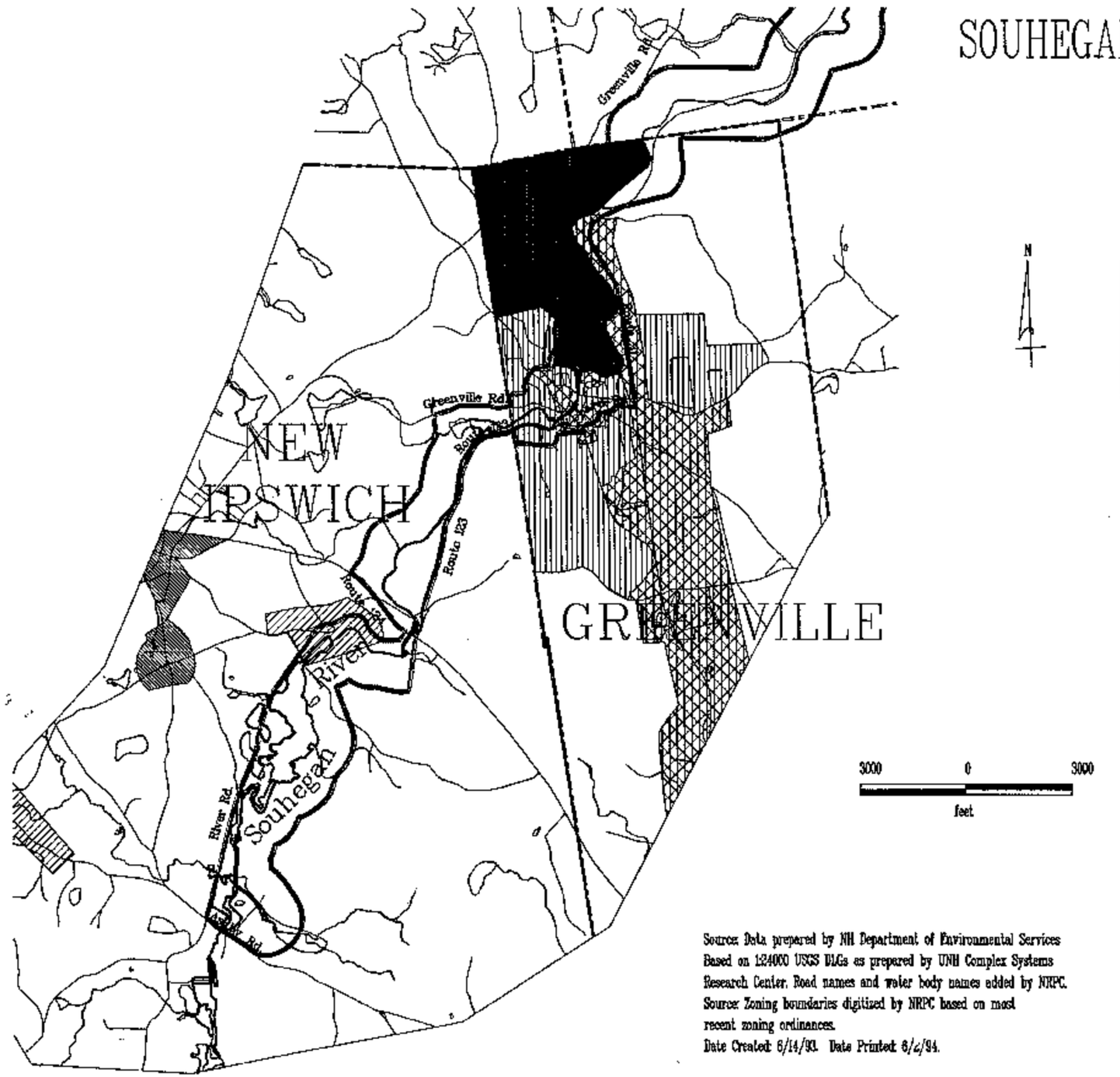


Source: Data prepared by NH Department of Environmental Services Based on 124000 USGS DLGs as prepared by UNH Complex Systems Research Center. Road names and water body names added by NRPC. Zoning: Digitized by NRPC from 112000 town zoning maps, 1994.

Date Created: 6/14/93. Date Printed: 6/6/94.

Map V-2

SOUHEGAN RIVER CORRIDOR WEST ZONING MAP



Source: Data prepared by NH Department of Environmental Services
Based on 1:24000 USGS DLGs as prepared by UNH Complex Systems
Research Center. Road names and water body names added by NRPC.
Source: Zoning boundaries digitized by NRPC based on most
recent zoning ordinances.
Date Created: 6/14/93. Date Printed: 6/2/94.

Key

- Municipal Boundary
- Roads
- Hydrography
- Study Corridor

Greenville

- Rural/Agricultural
- Residential
- Commercial
- Industrial

New Ipswich

- Rural
- Village District 1
- Village District 2

ROAD SYSTEMS

New Hampshire Routes 101, 101A and 31 South parallel the Souhegan River for much of its 31.8 miles. These routes carry thousands of cars each day and provide easy access to the River corridor from all over southern New Hampshire and northern Massachusetts. The western stretch of Route 31 South in Wilton even provides direct public access to the river in a couple of locations within the Department of Transportation's scenic easement. Major routes also provide public access where they cross the River. One such access is located in Amherst where Route 122 crosses the River and another exists in Merrimack at Seaverns Bridge. Additional access to the River is provided by collector and local roads. The opportunities that roadway river crossings and construction projects provide for developing public access to the River should not be ignored. The subject of public access should be brought up whenever roadway projects near the River are discussed at the state and local level.

PUBLIC ACCESS

The Souhegan River is by statute a public water with public trust interests and private riparian rights The legal basis for public access to public waters is contained in RSA 271:20 which states: "All natural bodies of fresh water having an area of 10 acres or more are public waters, and are held in trust by the State for public use; and no corporation or individual shall have or exercise in any such body of water any rights or privileges not common to all the citizens of this State." In further support of public access, the NH Supreme Court ruled that any member of the public "may exercise a common law right to boat, bathe, fish, fowl, skate and cut ice in and on its public waters" (Wicher v. State 87 Nh 405, 409 (1935)). Despite such status, the historic development of lands adjacent to rivers has been controlled by private property owners. Such ownership has served to limit and restrict opportunities for public access even though recreational use of rivers is part of the public trust.

While there seem to be very few legal access points along the Souhegan River, public access is actually quite good when compared to other rivers. The access points discussed below are depicted on Map V-3. There are two canoe/kayak access points in Merrimack at the Turkey Hill bridge and Seaverns bridge. There are no formal ramps at either facility and access is over the riverbank. A minimum amount of off-street parking is available at each site adjacent to the bridges. Undefined access down the riverbank can cause problems with loss of bank vegetation and erosion. Amherst also has two canoe/kayak access points. The first, at the Route 122 bridge, has off-street parking and a more defined launching area. The second access is near the bridge at Boston Post Road and is actually a set of stairs that go down the bank. This access is difficult to use at best.

In Milford, river access is available at Keyes Field, the MCAA fields, and near the Milford police station. Public access in Wilton is limited to the western section of the Town adjacent to the bridge on Isaac Frye Highway and within the NH DOT scenic easement. Both the *New England Whitewater Guide* and the *AMC River Guide* identify two access points in Greenville which are depicted on the map.

In addition to access for canoes and kayaks, consideration needs to be given to other types of access such as swimming holes, hiking trails and just plain enjoyment of the river. Map V-3 also identifies publicly owned lands, conservation and otherwise, and privately owned conservation lands within the corridor. Wherever there is access to water there will be wading and swimming. While there are few areas where the Souhegan River is actually deep enough to swim, there are numerous locations where people can and do wade to cool off in the summer. Swimming holes identified by the advisory committee include the Horseshoe and an area off Intervale Road in Wilton, the confluence with Purgatory Brook in Milford and the Amherst canoe launch near the Boston Post Road bridge. Of these areas, only the two sites in Wilton are not publicly owned. Legal public access to the swimming holes needs to be provided to ensure future enjoyment of the River resource. Access to the Horseshoe, in particular, is in danger of being lost to development.

Access to the River for hiking and scenic enjoyment is provided at the numerous public and private conservation and other lands within the corridor. These areas include the State owned land and Eighty Acres just west of the Everett Turnpike in Merrimack along with the Whippoorwill Boy Scout Camp and the Town conservation land further west on the River. In Amherst there are the Scott Land, the canoe launch and the two public golf courses along the River. Milford has the wastewater treatment plant property, the Town land east of the Swinging Bridge, Keyes Field and two cemeteries, the MCAA property and the State fish hatchery land. Public and semi-public land in Wilton includes the recycling center property, the Society for the Protection of New Hampshire Forests property, the Town forest and the Department of Transportation (DOT) scenic easement along Route 31 south. In Greenville there is the DOT scenic easement along Route 31 south. The Route 31 scenic easement in Wilton and Greenville measures approximately 2.7 miles with a minimum width of 100 feet or greater

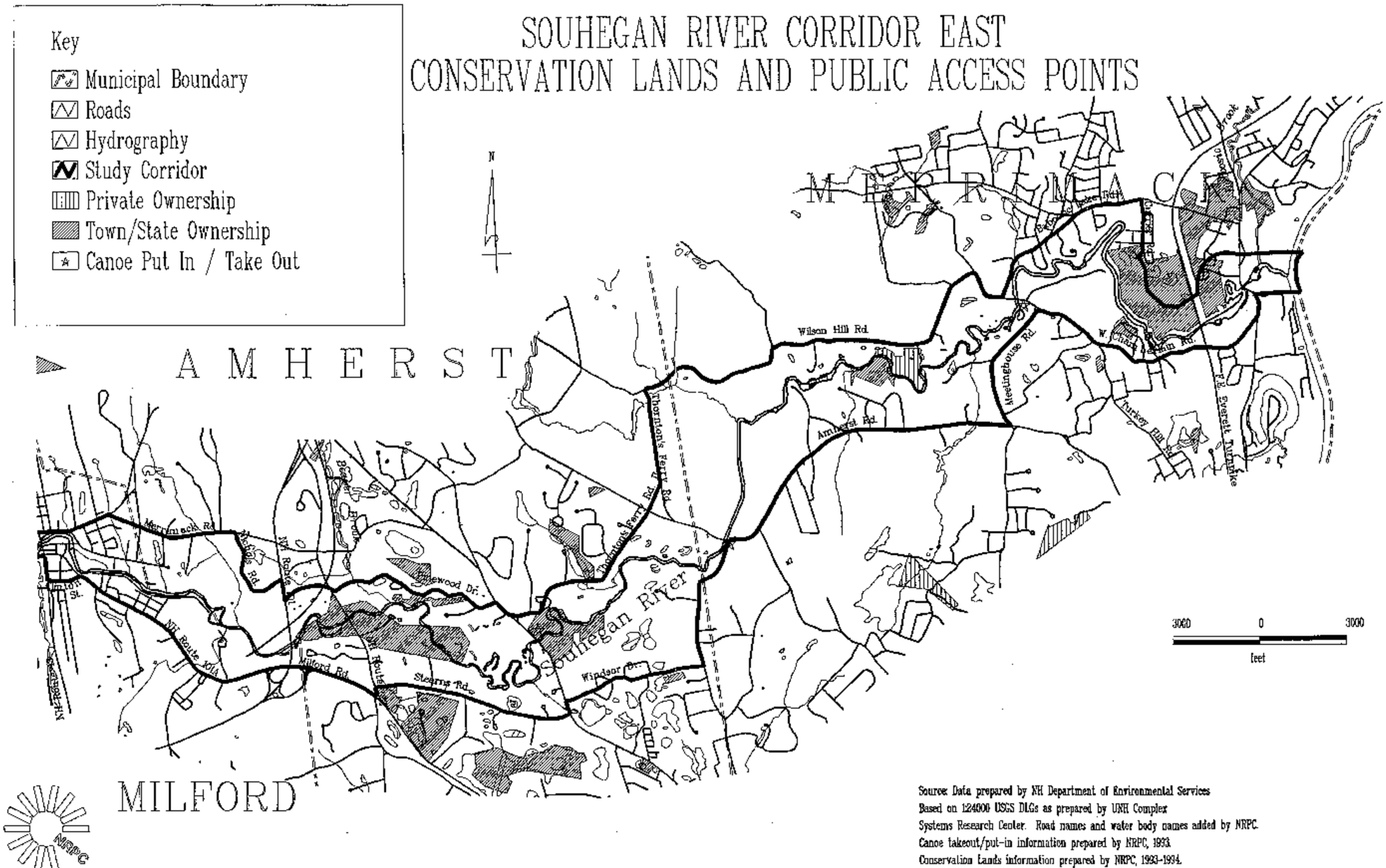
on either side of the Souhegan River. Activities within the easement are limited to those which do not affect the aesthetic beauty of the land viewed from the highway. The construction of buildings or structures, the display of signs, the construction of roads and ditches, and the removal of topsoil or any other material except for wood, timber or slash in accordance with specific provisions are prohibited within the easement. In New Ipswich there are three conservation easements along the river. All of these areas are depicted on Map V-3.

Informal hiking trails exist throughout the corridor. Milford and Merrimack are the only towns with formal hiking trails along the River, through the State fish hatchery land and within the Eighty Acres Town conservation land. The potential exists to link all of the conservation lands along the Souhegan River with a trail. A group of people in the region have been discussing the potential for developing a Souhegan River Trail.

Public access to the Souhegan River, while sufficient for existing levels of use, does not draw upon the full recreational potential of the river. Increased access will expand the public's recreational opportunities. Increased public use and awareness of the river will also produce a concerned and informed constituency willing to support activities to ensure continuation of the multiple-use capabilities of the Souhegan River.

Map V-3

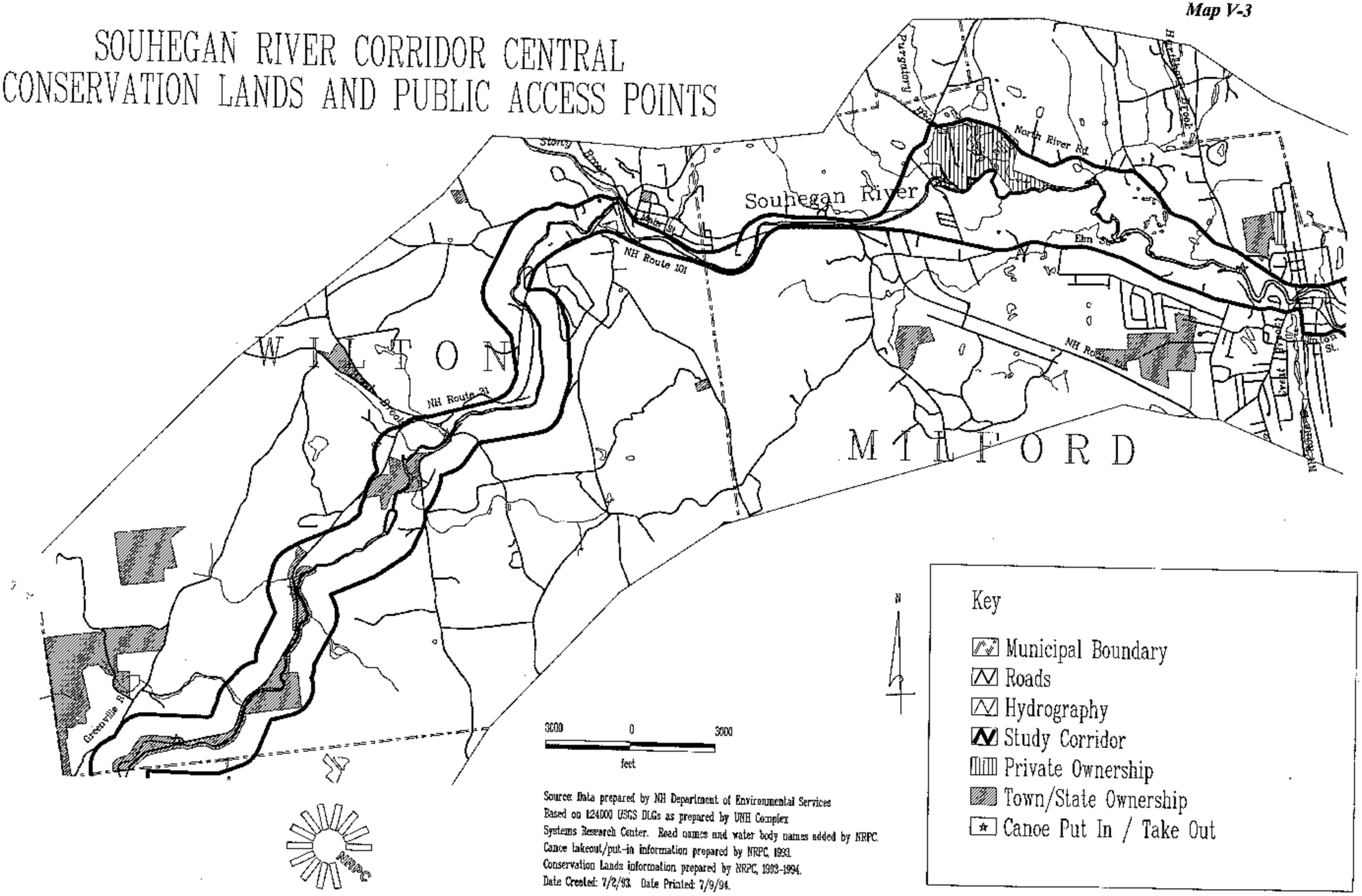
SOUHEGAN RIVER CORRIDOR EAST
CONSERVATION LANDS AND PUBLIC ACCESS POINTS



Source: Data prepared by NH Department of Environmental Services
Based on 1:24000 USGS DLGs as prepared by UNH Complex
Systems Research Center. Road names and water body names added by NRPC.
Canoe takeout/put-in information prepared by NRPC, 1993.
Conservation Lands information prepared by NRPC, 1993-1994.
Date Created: 7/2/93. Date Printed: 7/9/94.

Map V-3

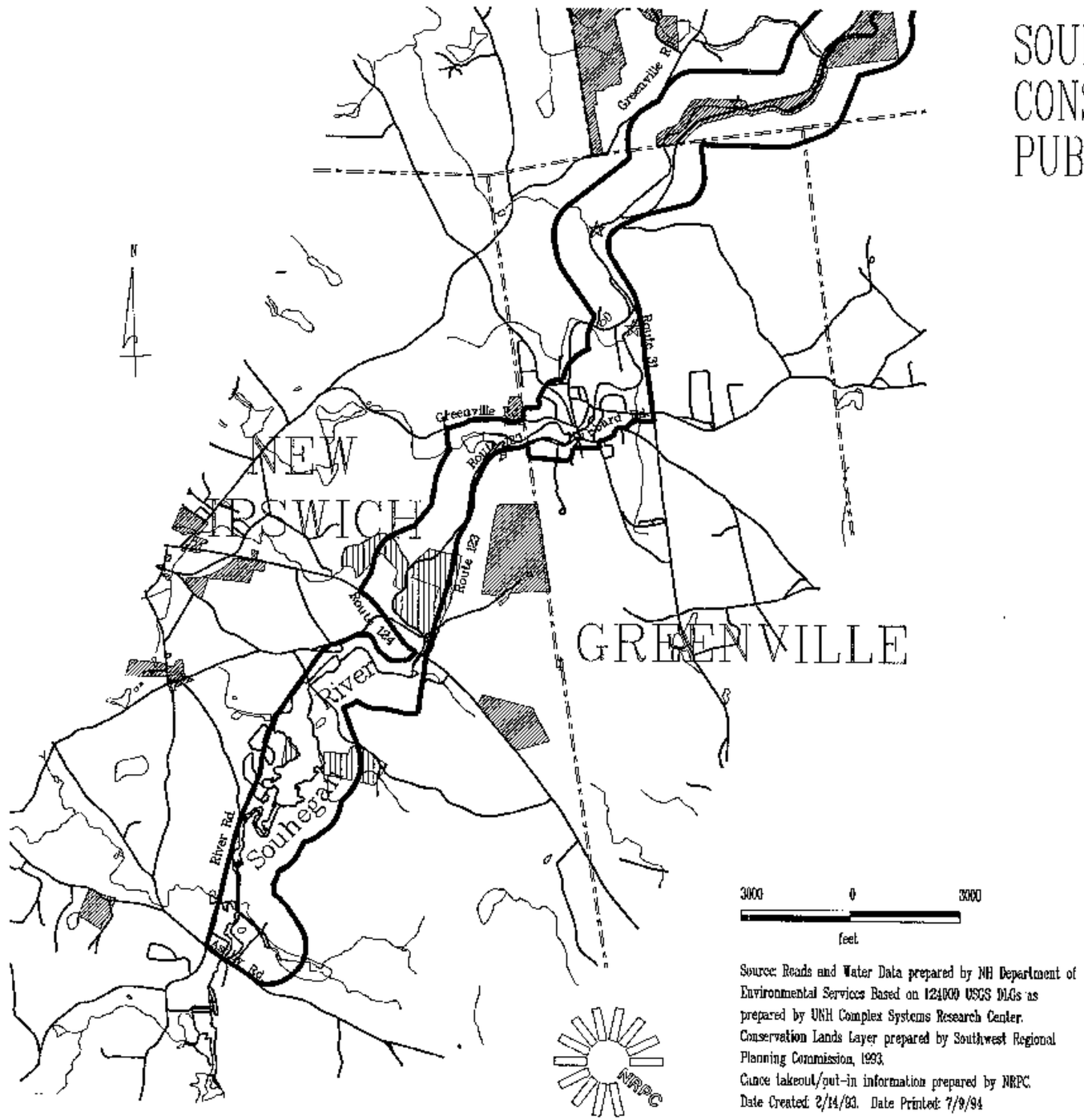
SOUHEGAN RIVER CORRIDOR CENTRAL CONSERVATION LANDS AND PUBLIC ACCESS POINTS



Source: Data prepared by NH Department of Environmental Services
Based on 1:24000 USGS DLGs as prepared by UNH Complex
Systems Research Center. Road names and water body names added by NRPC.
Canoe takeout/put-in information prepared by NRPC, 1993.
Conservation Lands information prepared by NRPC, 1993-1994.
Date Created: 7/2/93. Date Printed: 7/9/94.

Map V-3

SOUHEGAN RIVER CORRIDOR WEST CONSERVATION LANDS AND PUBLIC ACCESS POINTS



Source: Roads and Water Data prepared by NH Department of Environmental Services Based on 124000 USGS DLGs as prepared by UNH Complex Systems Research Center.
Conservation Lands Layer prepared by Southwest Regional Planning Commission, 1993.
Canoe takeout/put-in information prepared by NRPC.
Date Created: 2/14/93. Date Printed: 7/9/94

Key

- Municipal Boundary
- Roads
- Hydrography
- Study Corridor
- Private Ownership
- Town/State Ownership
- Canoe Put In / Take Out

Chapter VI.

Recreation

CHAPTER VI

RECREATION

The Souhegan River provides numerous recreational opportunities to the residents of the communities along its banks, to the region and to the State as a whole. Activities such as canoeing, kayaking, fishing and swimming take place on the River itself while its banks are used for hiking, cross country skiing, picnicking, bird-watching, nature study and overall enjoyment of the scenic views. Numerous state and federal studies have identified the need for increased recreation areas and facilities to serve an ever growing and changing population.

The increase in the region's population during the past 20 years has resulted in a corresponding expansion of overall demand for recreation. Demographic changes within the population have also had a significant impact on recreational demand. Americans are living longer and remaining active; single parent families are increasing; the alleged increase in leisure time is not evenly divided among the various sectors of the population; dual income families are common and often a necessity; and different income groups have access to different recreation opportunities. The overall result is a need for increased recreational opportunities of all types closer to the population centers.

The Souhegan River and its corridor can provide many recreational opportunities to meet these demands. The River corridor is situated such that the recreational opportunities it provides are available to a large and diverse population. Hiking and cross country skiing trails could follow the riverbank and connect with existing public and private parks and conservation areas. The River itself provides opportunities for canoeing, kayaking, fishing and swimming.

It is difficult to quantify existing recreational use of the Souhegan River because of a lack of information. No studies of type and quantity of recreational use have been conducted. It is safe to state, however, that the recreational opportunities provided by the Souhegan River are underutilized.

BOATING

Boating on the Souhegan River is limited to canoes and kayaks since there are few spots where the River is deep enough to accommodate larger watercraft. The western sections of the River from Greenville to Wilton provide whitewater canoeing and kayaking during the spring and other periods of high water. These sections of the river are identified as good intermediate whitewater by both the Appalachian Mountain Club's (AMC) ***River Guide***, and the ***New England Whitewater River Guide***. The AMC Guide classifies the rapids in this section as Class II, III and IV. This stretch of the River is very popular with canoers and kayakers because of early ice-out, it provides good training runs, the water is clean and the area is easily accessed. The Boston and New Hampshire AMCs and the Merrimack Valley Paddlers organize numerous trips on the Souhegan River every year.

The stretch of the River between Wilton and Milford provides limited opportunities for canoeing and kayaking because the water is generally very low and portages are required around the dams. Below the Route 122 bridge in Amherst the River is flat and provides excellent opportunities for family canoe outings. The water is shallow with a sandy bottom and there are numerous spots to picnic and wade. The Merrimack Chapter of the Merrimack River Watershed Council sponsors annual trips on this section of the River. Below the Seaverns Bridge in Merrimack, the River quickens as it flows through a series of ledges called Indian Ledges. Passage for canoes and kayaks at this point is again limited to periods of high water. The stretch of River below Seaverns Bridge is impassable to watercraft because of Wildcat Falls.

Access to the River for canoers and kayakers was discussed in the Land Use chapter. The importance of providing legal access for River users cannot be over emphasized. It is also important that sufficient parking be provided at put-ins and take-outs to alleviate problems with the surrounding neighborhood. River users should also respect the rights of the property owner by leaving the area in the same condition as they found it.

Despite the popularity of the Souhegan River in the spring, overall, the recreational opportunities for canoeing and kayaking are underutilized. The Amherst-Merrimack stretch of the river provides excellent opportunities for family canoeing throughout the summer. The memories of childhood experiences travel with us throughout our lives. From these experiences we can develop future constituencies for the Souhegan River.

SWIMMING

As discussed in the Land Use chapter, swimming in the Souhegan River is limited to a few areas where the River is deep enough. Wading and rock jumping, however, take place all along the River. Three areas identified by the advisory committee: the Horseshoe in Wilton, the confluence of Purgatory Brook in Milford, and the canoe launch in Amherst are used by residents for swimming. The Horseshoe is used extensively throughout the summer; however, it is located on private property. The Town of Wilton's attempts to purchase the Horseshoe a few years ago were unsuccessful. Given the change in the real estate market, the time may be right to again attempt to protect this historic swimming hole. The Milford site is accessible over property owned by the State and is therefore protected from future development. Wading and rock jumping take place all along the river. One popular location is in Wilton along the DOT's scenic easement on Route 31 south. Picnic tables and a limited amount of parking are provided in two locations along the easement and are popular with residents and travelers.

Water quality is also a limiting factor for swimming in the Souhegan River. The results of the Merrimack River Watershed Council's citizen monitoring program identified areas where the water quality poses a potential health risk for swimming. These areas are discussed in the Water Quality chapter and identified on Map IV-3.

FISHING

Fishing is a popular activity on the Souhegan River for such species as small mouth bass, rainbow trout, brown trout and brook trout. The NH Department of Fish and Game annually stocks the river with rainbow, brown and brook trout. When released, the trout are of a legal size for angling, representing what is called a "put and take" program. Access to the river for fishing is also of concern and needs to be addressed.

HIKING

Participation in hiking, walking and other trail activities like jogging and cross country skiing is increasing rapidly throughout the nation as evidenced by their high marks in the National Park Service's 1982-1983 Nationwide Recreation Survey. Walking ranked number one with a 53 percent participation rate. The Souhegan River corridor provides a natural route for walking and hiking in a scenic environment. Hiking currently takes place along the River in most locations where permitted on public property or by permission of the landowner. Public access is again the major problem with regard to use of the River corridor for hiking and the potential for developing a continuous trail along the River. The existing publicly owned properties have been discussed in the Land Use chapter and are depicted on Map V-3.

The potential for trail development along the Souhegan River is great. If developed, the trail would serve the recreational needs of a large population and further increase the River's constituency. A trail along the River could ultimately connect the existing public conservation and recreation areas. A regional group has begun discussing the potential of developing a continuous trail along the Souhegan River. Assistance in trail planning, design and construction is available from numerous trail organizations including: the NH Department of Parks and Recreation Trails Bureau, the AMC, Trailwrights and Friends of the Wapack Range.

Chapter VII.

Historic Resources

CHAPTER VII

HISTORIC RESOURCES

A discussion of the resources which characterize the Souhegan River corridor would be incomplete without consideration of man's use of the river through the years and the imprint which has been left by his historic structures and sites. Like other environmental resources, cultural resources are nonrenewable; and what is lost now through abuse, neglect or ignorance is lost forever.

Over the years, a wide range of uses have been found along the Souhegan River corridor. Indian footpaths were found along its banks by early settlers. Fords and fences were gradually succeeded by bridges. Early settlers established farms on the rich intervale lands. Soon, the tremendous potential of the force of the river attracted saw and grist mills, which were later supplanted by cotton, wool, shoe and woodturning mills, among others. Dams were constructed, initially to harness the water power of the river for manufacturing, later for the production of hydroelectric power. In some areas village centers were established on the banks of the river.

The following chapter presents an historic overview of the study area including discussions of significant archaeological and historic sites and resources. The various tools available for the preservation of these resources on the local, state and federal level are also discussed. The chapter does not attempt to be a complete and comprehensive inventory of all local resources, but is intended as a departure point for future action.

HISTORICAL DEVELOPMENT OF STUDY AREA

Over three hundred years ago a band of Penacook Indians settled on the banks of a river they named "Souhegan", roughly translated as "river of the plains". The Souhegan tribe hunted and fished the river; their trail followed the river through present day Milford, Wilton and Greenville. A 1652 scouting report indicated there were about 50 Indian families near the mouth of Salmon Brook and the Nashua River and many more along the banks of the Souhegan and Merrimack Rivers.

The year 1725 marked a turning point for the settlement of the region with the ending of the Captain John Lovewell's War. As a result of the defeat of the Souhegan and Naticook tribes and the retreat of most of the Indians, more rapid settlement and agrarian development ensued. Early settlers cleared the land and established sawmills to transform the felled logs into material for houses and barns. Each of the communities had its own early saw and grist mills on the Souhegan River.

Early settlements by Europeans were promoted by an abundance of physical features and attractions including meadow land, uplands ready for cultivation, fishing and trapping potential. Salmon were caught in the Souhegan as late as 1773 and 1774. The fur trade in particular was a significant catalyst in opening new lands to settlement. As beaver were successively trapped out of areas near the frontier trading posts, Indians began exploiting these resources in new regions that were increasingly remote from the European settlements. To maintain their business, traders followed; and as the Indians moved to new areas, European settlers moved into the abandoned clearings. By 1667, the fur trade with the Indians had become so important that the Provincial Court of Massachusetts passed an act regulating it.

By 1662 Passaconaway, chief of the Souhegan Indians, had lost or sold all of his land in the region and was forced to petition the Massachusetts General Court for a grant of land for a residence. The Court gave the Chief a piece of land north of the Souhegan River, measuring 1 1/2 miles wide and 3 miles long on both sides of the Merrimack River. The old township of Dunstable was chartered in 1673, comprised of sixteen neighboring communities in New Hampshire and Massachusetts, including portions of Amherst, Milford and Merrimack. Parts of the old township began breaking away as separate communities about 1740. After the southern boundary of New Hampshire was established in 1741, the towns that had been established under Massachusetts rule had to petition for new charters. On April 2, 1746 the land from Pennichuck Brook north to the Souhegan River became the Town of Merrimack. In 1750 the northern part of town, once part of Narragansett No. 5, later Bedford and consisting of land returned to the government by Chief Passaconaway and his son, was added along with a strip of land on the western boundary.

Amherst was incorporated in 1760 and included what was to become Milford, individually incorporated in 1794, including Amherst's southwest parish. Another early town was Monson, established in 1746 but only surviving 24 years. The township contained about six square miles and extended south of the Souhegan River from above Jones' Corner in Milford to a point below Danforth's Corner in Amherst. Due to the lack of a central location for a meetinghouse, Monson was distributed to Amherst and Hollis in 1770, including areas of what is now Milford, Brookline, Amherst and Hollis. As compensation for lands taken from them, in 1734 Groton was granted a triangular territory of 10,800 acres called Groton Gore, extending into the present day Milford, Wilton, Brookline, Mason and Greenville.

Masonian grants included what is now Wilton, New Ipswich and Greenville (formerly Mason Village). The Masonian grants date back to grants made to Captain John Mason, a London merchant, officer in the Navy and former Governor of Newfoundland, by James I in 1621 and 1622. The vast, loosely defined territories included much of southern New Hampshire and Massachusetts and became the subject of considerable dispute and litigation. After the deaths of Mason's heirs, charter titles purchased later by a company who gave grants to settlers became known as the Masonian Proprietors.

In 1736, the government of Massachusetts Bay granted a charter to inhabitants of Ipswich, Massachusetts for what was to become New Ipswich. The Masonian proprietors claim, confirmed in 1745, annulled the earlier grant. The act of incorporation of New Ipswich dates to 1762. The first permanent settlement of New Ipswich, that of Abijah Foster, dates to 1738. Early settlement was largely located along the banks of the river, in the vicinity of Town Hill. During the summer of 1748, the descent of about eighty Indians led to the desertion of the town for several months. Bridges over the river were in place as early as 1750 although the section of the river road from the High Bridge to the Mason (now Greenville) town line was not constructed until 1828.

The area known today as Wilton and Lyndeborough was known as Salem Canada from 1735 until 1749. Later grants were known as Number One (Wilton) and Number Two (Mason). The town of Wilton was first settled in 1739 and incorporated in 1762. As in many towns, the grantors of town set apart two lots of eighty acres each to encourage the building of saw and grist mills. By 1839 the town contained 8 sawmills, 5 grist mills, 3 tanneries, 2 fulling mills, one bobbin manufacturer, one cotton mill and one potato starch factory. The original town center of Wilton was located in the area known today as Wilton Center. During the 18th and early 19th Century, the village of West Wilton was the industrial core of the community. The availability of water power from Stony Brook and the Souhegan River, in conjunction with the advent of the railroad, increased the prominence of East Wilton. The first land grant in Mason dates to 1749. The town was incorporated in 1768. The village which grew near the mill and falls of the Souhegan was known as Mason Harbor, Mason Village and sometimes, Souhegan Village. In 1871 a proposition by James Chamberlin to buy the old town house at the center of Mason and build a new town building led to considerable division. As a result, in 1872, Mason Village was individually incorporated as Greenville.

In Merrimack the first four known settlers arrived in 1722. Their settlement was known as Souhegannock, later Souhegan. As early as 1735 a bridge was in place over the Souhegan River. There were three early mills in town including that of Daniel Stearns (later Fullers Mills). Simeon Cummings owned a mill at Atherton Falls while John Chamberlain owned a mill at Souhegan Falls near the present fire station. John Chamberlain was given three hundred acres of land to establish a saw mill and grist mill in Merrimack by the Brenton proprietors. He came here sometime prior to 1734 and built a mill at Souhegan Falls in 1744, where Route 3 crosses the Souhegan River today. Early on this village became known as Souhegan Village, later called Merrimack. In 1735, 120 acres were granted to Joseph Blanchard to erect a sawmill and corn mill on the Souhegan. Other mills were built along Baboosic Brook and Pennichuck Brook. A meetinghouse was built near Turkey Hill Bridge in 1756 at the center of the town. The meetinghouse burned in 1898 and a plaque on one of the original doorsteps marks the site.

The name "Milford" commemorates the settlement that grew up near the mill at the ford of the Souhegan River, built by John Shepard in 1741. Another early settler, John Burns paddled up the Souhegan and settled in the southern part of town. During the years when Indian attack was an imminent threat, an important garrison was located near the Peabody place on the north bank of the Souhegan River, with the next closest located in Lyndeborough. The town was also the location of an important river crossing in early days. It is said that in 1760 Col. John Goffe crossed the Souhegan in Milford on his way to Crown Point and in 1777 General John Stark crossed the river in Milford on his way to Bennington.

The earliest industrial development in the region consisted of saw and grist mills. The introduction of low priced flour and grain from the West put most of the local grist mills out of business. Steam powered plants and portable mills powered by steam and later gasoline, similarly made the earlier saw mills obsolete. In addition to the early sawmills and gristmills, the valuable water power afforded by the Souhegan attracted a number of industries to its banks in each of the communities, within the study area, except Amherst. In many cases successive mills were built on the same site, as water privileges were transferred and technology changed.

At one time ten cotton mills operated in the Town of New Ipswich. Today only a single brick mill at High Bridge survives. The first cotton factory built in the State of New Hampshire was erected in New Ipswich in 1803. The first mill went into operation in December 1804 and contained 500 spindles; a second factory was begun in 1807. Both factories were in operation well before any other factory was built in the state to make cotton yarn. After the introduction of the power loom, the original mills were replaced in 1821 and 1825 by the Waterloom Mill, manufacturing jeans, flannels and tickings. In 1854 the Columbian Manufacturing Company purchased the Mountain Mill, formerly called the Waterloom mill and erected a new factory (#3) for the manufacture of denim, containing 2190 spindles and 54 looms. In 1895 the mill, built on the site of the first cotton factory in New Hampshire, was condemned as unsafe and dismantled.

About 1825 two other cotton mills were put in operation on the Souhegan in New Ipswich. One of these was later rebuilt under the name of the Columbian Factory No. 2, which still exist as Warwick Mills. In 1845 the Columbian Manufacturing Company purchased the Souhegan water privilege near the high bridge and on the site of a burnt factory erected a large brick mill measuring 120 x 44, containing 3328 spindles and 100 looms for denims.

A Clothiers Works and Fulling Mill was built on the site of the Waterloom Mill in 1776. In 1800 it was purchased by Ephraim Hartwell who made linseed oil from local flax as well as oatmeal for druggists in Boston, who had previously had to import from Scotland. Other industries in town included making cigars, broadcloth, satinet, velvet, doors, chairs, carriages, blinds, coffins, barrels, matches, trunks, saddles, ink and soap. Many of these were made at Mill Village, now Smith Village and not all of these were manufactured on the Souhegan. Other factories on the banks of the Souhegan included an old iron works on the north branch which was converted in 1810 into a cotton factory, in 1826 to a sawmill, and c. 1850 to a bed manufactory. For a time, from about 1810 to 1826 woolens were manufactured on the north branch of the Souhegan by John Everett.

The earliest mills in neighboring Mason Village (later Greenville) were saw and grist mills built by Thomas and Charles Barrett about 1752 and later sold to Amos Dakin. The first dam above the bridge was made by Amos Dakin about 1788. Below the dam, on the south side of the river, a carding and fulling mill was built by John Everett about 1800. This was removed in 1829 to make way for the No. 1 mill. As in New Ipswich, the Columbian Manufacturing Company later built additional substantial brick mills on the Souhegan River, which belonged to and were managed by the same company, under the same agent as the New Ipswich mills. Chartered by the New Hampshire legislature in 1826, the Columbian Manufacturing Company built its No. 1 factory in Greenville in 1829 under the direction of company agent, Charles Barrett. The mill measured 100 feet long by 43 feet wide and initially contained 64 looms for weaving sheetings and shirtings. It was later expanded to contain 2946 spindles and 77 looms for making denims. In 1854, the company purchased the old grist and saw mills, on the site originally occupied by Amos Dakin's mills, and erected a building for dyeing and finishing, known as Mill No. 4. Mill No. 6 was constructed in 1872. The yarn for all of the Columbian Manufacturing Mills in New Ipswich and Mason was dyed at Mason and all the cloth from the mills was finished and packed there as well. At Mason in the late 19th century 15,384 pounds of cotton was consumed per week for a weekly production of 42,120 yards of denim or 2.19 million yards per year. At the New Ipswich mills, the weekly consumption was about 13,505 pounds and 1,909,400 yards of cloth were produced annually.

Two textile companies have operated in Milford during the course of its history. The first attempt to establish a manufacturing business in Milford occurred in 1810 and in 1813 the Milford Cotton and Woolen Manufacturing Company erected a factory on the south side of the river. In 1814 they began manufacturing cotton yarn and in 1824 began making cotton cloth by power loom, although they suspended business in 1833. The mill was later occupied by the American Thread Company and the Middlesex Linen Company, manufacturers of dress goods and linen toweling, employing about one hundred hands. Later mills which flourished in Milford include the Pine Valley Company, later Hillsborough Mills, which manufactured woolen carpet yarn. A mill was on this site as early as 1814. It burned down in 1839 and a new mill was built on the site in 1851, which subsequently burned down in 1872. The present building was constructed in 1873. At the turn of the century, the mill produced

$400,000 worth of carpet yarns, bed blankets, horse blankets and cassimeres, employing an average of two hundred persons.

During the 19th Century, Wilton became a leading manufacturing and commercial center for the region, specializing in the production of flannel and dress goods. The earliest textile manufacturer, the Wilton Manufacturing Company, was incorporated in 1829. The initial mill burned in 1839 and was rebuilt in 1849, initiating the manufacture of carpet yarn in 1851. The mill burned a second time in 1872. The Colony Brothers Mill, manufacturing blue and scarlet flannel woolens, constructed a large four story brick and stone mill in 1882 where two previous mills had burned. In the late 19th century the mill produced one million yards of flannels and dress goods, employing 75. Fires caused the downtown to be rebuilt three times in the late 19th century. The first fire in 1874 destroyed the Whiting Hotel, where the Town Hall is today, the Masonic Hall and the library in addition to numerous residences and other buildings. A fire in 1881 destroyed many of the buildings that had been rebuilt after the first fire including the Masonic Hall, bank and library. The third fire in 1885 again destroyed much of Main Street and at one point even endangered the railroad bridge crossing the Souhegan River. In 1932, Hillsborough Mills, which also had a large mill in Milford, took over the worsted mill in Wilton. The woolen mill in Wilton ceased operations about 1970 and was subsequently purchased by Label Art.

The first furniture factory in Merrimack was operated by Houghton and Henderson on the Souhegan. The business later made only tables and was operated by Thomas Parker, and later by David Jones, in 1929 by E.R. Bates and in 1945, by Dingott Furniture Co. A small bobbin shop also operated on the Souhegan and was later converted into an excelsior factory by Charles Nesmith. This factory, near the railroad station and later sold to Haseltine and Gordon, was destroyed by fire in 1946.

In the 1890s, Gordon Woodbury of Bedford erected a large shoe factory on the banks of the Souhegan River in Merrimack. In 1906 shoe manufacturers W.H. McElwain Co. purchased the large plant and water privilege at Souhegan Falls with the intention of enlarging the dam to generate hydro-electric power. Although W.H. McElwain died before this was accomplished, the company carried on the manufacture of sole leather and leatherboard until 1921, employing about one hundred men. In 1921, the International Shoe Co. purchased the McElwain property and operated the factory as a tannery. It was later occupied by the Gate City Poultry Company. Other local industries included a cement pipe manufacturer.

In the mid to late 19th Century, the existence or lack of rail opportunities was to have a major impact on the growth and direction of individual communities. For example, a lack of significant water power and a single rail station at the outskirts of town largely reduced Amherst to a small farming and residential town. The Boston and Maine station, south of the Souhegan River and the present 101A, no longer stands. New Ipswich, similarly found itself lacking in direct rail access. For other communities, the railroad and ready access to markets reinforced industrial development. In 1850 the Peterborough and Shirley Railroad (later the Greenville branch of the Fitchburg Railroad) began running through Mason to Mason Village as far as the river. Two years later the line was extended to its final terminus in the village at Main and Dunster Streets. In Milford, the railroad came at the peak of industrial activity. The town was well served by two lines and six flag stations. In the early 1900s sixteen trains, mostly freight, left town daily. The Wilton line connecting Milford and Nashua was completed in 1850. Two years later it was extended to Wilton and became known as the Wilton Railroad. A second line connecting Milford with Manchester opened in 1900. The covered railroad bridge built at East Milford over the Souhegan disappeared long ago. In Merrimack the Concord and Montreal Railroad followed the path of the Merrimack River, with a station convenient to industry located just south of where the Souhegan meets the Merrimack. This station still stands on Railroad Avenue. In addition to servicing the textile industry, the availability of rail made quarrying possible on a large scale, and also eased the transport of milk and eggs to Boston.

The textile industries and other factories that defined the region's industrial base for much of the 19th Century continued to flourish in the early 1900s. By the mid twenties, shoe factories began locating in the state, in Merrimack among other locations. By the end of World War II, however, the prosperity of the mills was threatened by a shift in the textile industries from northeast locations to more favorable southern climates. Some communities such as Merrimack were fortunate to attract an influx of other industries including electronics, defense and computer firms. Others including Wilton and Milford were able to maintain a strong manufacturing tradition while other more rural communities have seen their identities redefined to include the role of "bedroom community", reinforced by improvements to the transportation network such as the construction of the Route 101 Bypass in the early 1950s.

ARCHEOLOGICAL HISTORY AND RESOURCES

Indian settlements were once common along the banks of the Souhegan River. The River and its banks provided the native population with many readily exploitable resources including fish, migratory birds, flora and fauna. Prehistoric and historic archeological sites, such as Indian sites and cellar holes contribute to the understanding of a community's past in a way which no written record can. Although archeological resources are divided into prehistoric and historic categories, this section will deal only with resources dating until the Contact Period; historic archaeological resources are discussed later in this chapter.

Archeological sites can generally be categorized as semi-permanent villages, seasonal camps for fishing, hunting and/or gathering, quarries, workshops and burial grounds. Often sites include a combination of features. In predicting locations where archeological sites might be expected to occur, archaeologists take into account environmental conditions including proximity to water, soil conditions, slope and exposure. Yet, it should be noted that many "predicted" sites may be found to contain no significant resources after field investigation.

A primary requirement for any settlement would obviously be the availability of potable water from springs, lakes or streams. Water also provided a critical network for travel and a source of food. Soils were also an important consideration in determining residential sites. Sandy or light, gravely soils were most often selected in upland regions, and silty, alluvial soils were sought in river valleys. More permeable soils were preferred because of their rapid drying qualities and also because pits and burials excavated with sticks or hands were more easily worked in these soils. Level ground was preferred except where specialized activities dictated site selection. Residential sites are almost always found oriented toward the south or southwest to maximize periods of warmth and sunlight.

Archaeologists typically divide cultural prehistory into several distinct periods. The prehistoric sequence begins with the Paleo-Indian (12,000-10,000 years before present) and Early Archaic (10,000-8,000 B.P.) periods, continues through the Middle Archaic (8,000-6,000 B.P.) and Late Archaic (6,000-3,000), and concludes with the Woodland Periods, Early (3,000-1,900 B.P.), Middle (1,900-1,000 B.P.) and Late (1,000-1,600 A.D.). The Contact Period, which represents the initial period of European or Anglo-American settlement and interaction with the Indian population, only lasted about 50-60 years. European settlers first entered this region in the 1600's and by 1662 most of the Indian population had been decimated by disease or had relocated.

Occupation during prehistoric times along the Souhegan River is well documented and a number of sites have been recorded. Among the trails traveled by the native population was the Souhegan Trail, which followed the river through present day Milford, Wilton and Greenville. In late prehistoric time the valley of the Souhegan River provided an important link between the Merrimack valley and the lower Contoocook Valley and with Indian villages in the Lancaster, Massachusetts area. Traditionally, the Penacooks and Souhegans have been associated with the area. It is thought that a number of sites along the river can be directly associated with these trails while others were perhaps seasonal hunting/gathering stations. Several miles near the mouth of the river occupation was probably limited to a few small hunting or fishing stations. Although no large permanent or semi-permanent village sites have been located, they are suspected throughout a number of towns situated along the Souhegan. In recent years, a number of interesting discoveries have been made along the banks of the river, including the first documented Indian cemetery in New Hampshire. Within the study area, several prehistoric sites and districts of significance have been documented within one thousand feet of either side of the Souhegan River.

The Division of Historical Resources keeps on file a list of known archaeological sites throughout the state. These sites may be discovered during the review of cultural resources required of projects receiving federal funds, in the course of local construction or utility work, or through other means. This list does not necessarily reflect the quantity or quality of archaeological sites in a town. Listed below are the known archaeological sites in the study area. There are additional reports at the DHR which report on field investigations which have yielded no archaeological remains.

KNOWN ARCHAEOLOGICAL RESOURCES IN SOUHEGAN RIVER VICINITY ON FILE AT STATE HISTORIC PRESERVATION OFFICE

Site Name	*Site No.*	*Community*	*Time Period*
	44SW27HB5	Milford	
Jones Crossing	44SW27HB3	Milford	Woodland
Turkey Hill	NH44-1	Merrimack	prehistoric
	NH44-2	Milford	unknown
	NH44-7	Amherst	unknown
	NH44-8	Milford	unknown
Potter Site	NH44-12	Milford	prehistoric

Source: NH Division of Historical Resources.

SIGNIFICANT HISTORIC & ARCHITECTURAL RESOURCES

AMHERST

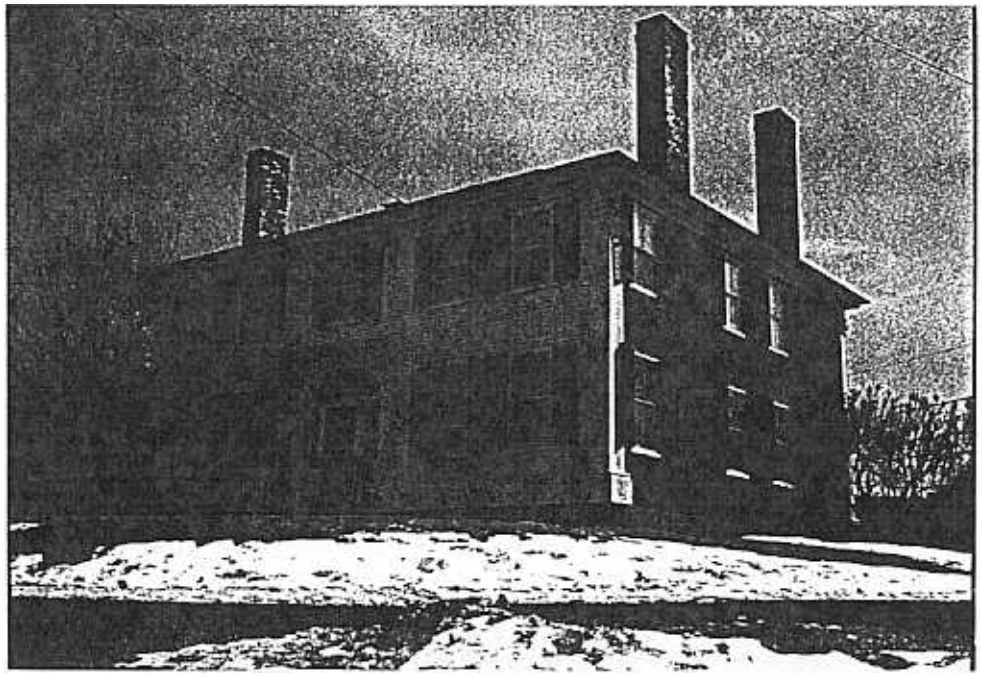
House, 44 Stearns Road (c. 1750)

A fairly rare local example of the classic cape form in a 3/4 variation. The structure appears to have been constructed between 1751 and 1756 by Isaac Farwell of Monson on 100 acres. In the 18th century, the farm was given the name Honey Pot Farm, due to its proximity to Honey Pot Pond. This house was determined eligible for the National Register as part of the Route 101A Bypass Project.

GREENVILLE

Dakin-Barrett House, Main and River Streets (1814)

This two story structure in the center of town is considered one of the finest brick-end Federal houses in the area, constructed in 1814 for Timothy Dakin.

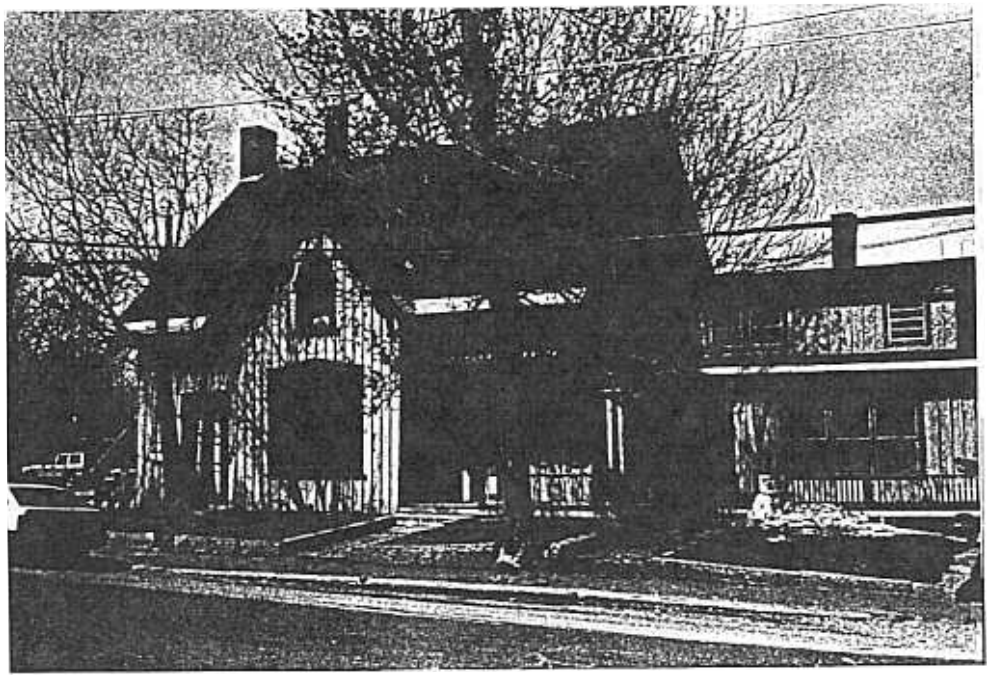


Dakin House, Main Street (c. 1780)

One of the earliest surviving structures in town, this saltbox style house was built by Thomas Dakin, son of first town resident Amos Dakin, in the 1780s.

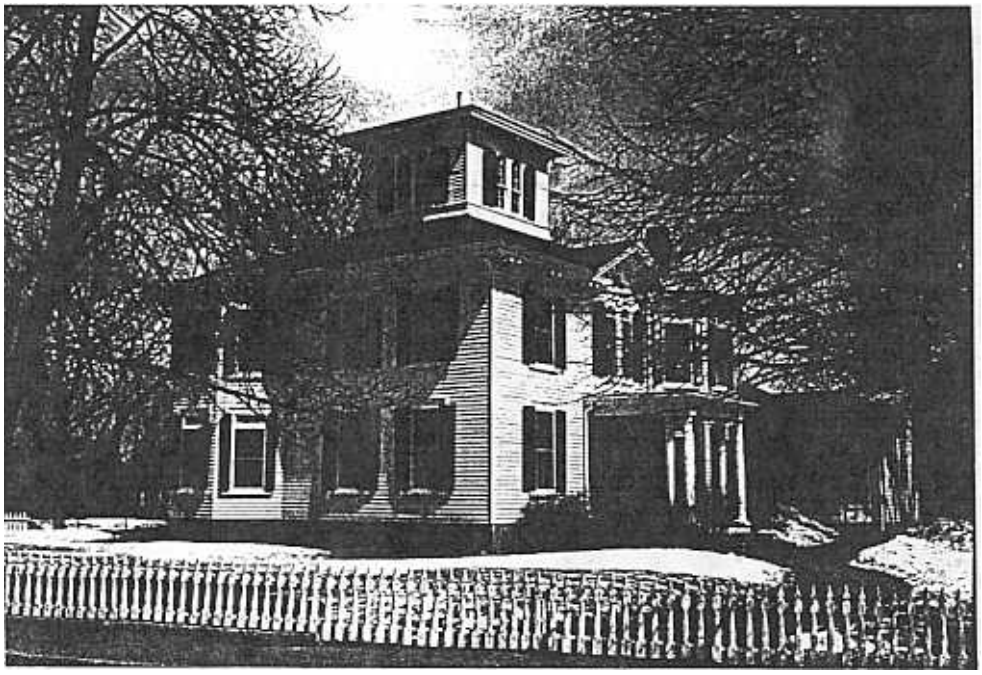
Gothic House, Main Street at Granite Ave. (c. 1850)

A textbook example of the Carpenter Gothic style, this board and batten cottage with decorative bargeboard and pointed arch windows was constructed by Deacon Merrill Dodge in the 1850s.



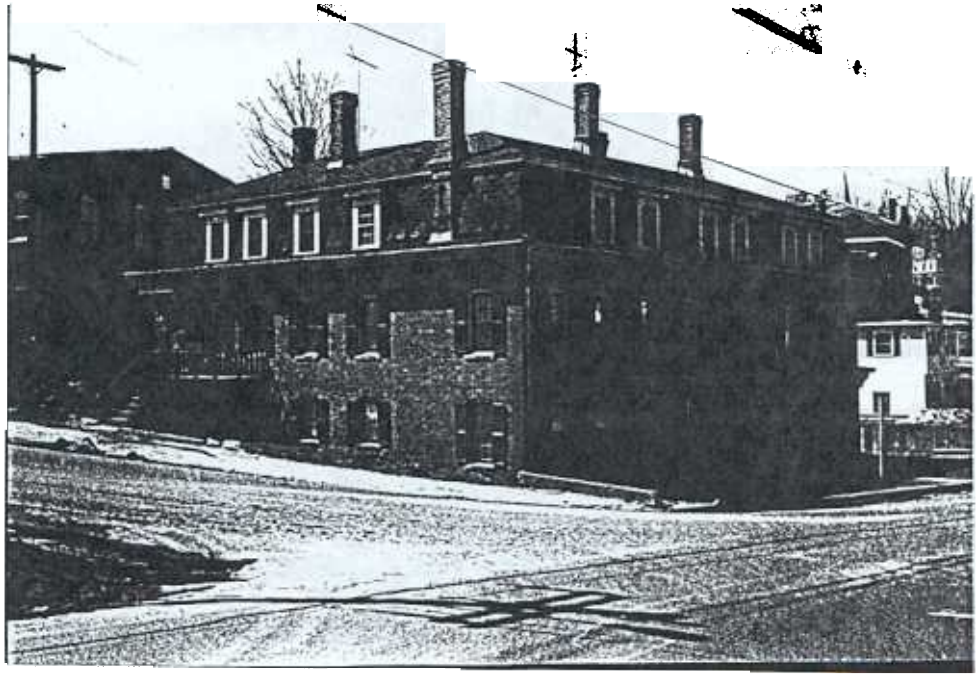
James Chamberlin House (c. 1860)
Town Hall, Main Street (1935)

This cupola capped, Italianate style house dating to the early 1860s was constructed for James Chamberlin, whose descendants still occupy the house. It was James Chamberlin who in 1871 proposed to buy the old town house at the center of Mason and build a new building, which led to the division of Greenville from Mason. Next door, the present Georgian Revival structure replaces the old Town Hall built in 1876 and destroyed by fire in 1935. Land for the original town house was purchased from James Chamberlin.

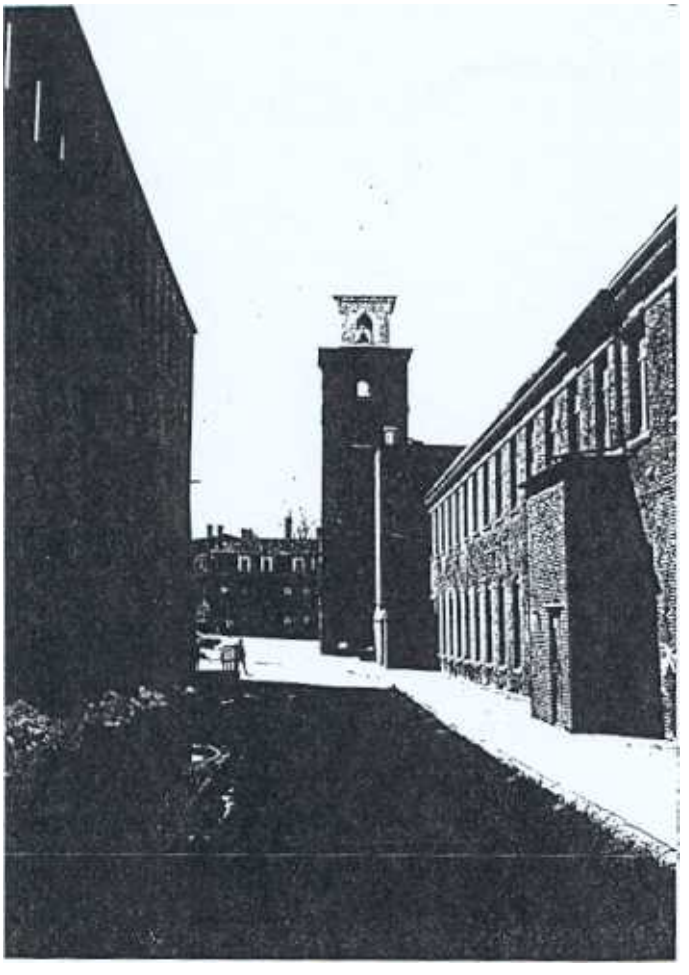


Columbian Manufacturing Co. Tenement, Main Street (c. 1860)

This brick, mansard roofed structure was constructed as mill housing by the Columbian Mills. Next door, a former carpenter shop and stable now serve as a firehouse and the Le Clair-Carey Post Home.



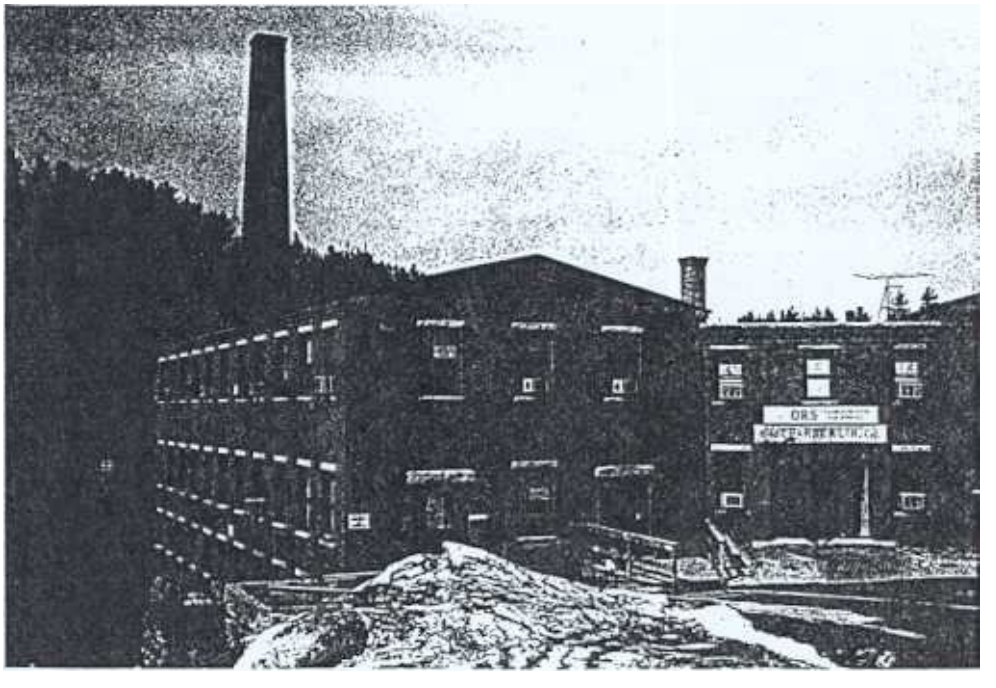
Across the bridge is the site of the first of the Columbian Manufacturing Company mills built in town, built in 1829 under the direction of mill agent, Charles Barrett. The mill was lowered in 1892 and later outfitted for hydro electric power.



Mill No. 4, Main and Mill Streets (1854-6)

Constructed by the former Columbian Manufacturing Company, this Gothic Revival brick mill has been converted into senior citizen housing.

Chamberlin Mill, Mill Street (1857)



Downstream from Mill No. 1 is the Chamberlin Mill, a brick mill and cabinet shop known for many years as the Chair Factory. Today it functions as engineering offices.

Across the bridge is Mill No. 6, built on land owned by Loami Chamberlin who died in 1853. It adjoined the Columbian Cotton Mills. As seen today, the mill is reduced in height from its original appearance and serves a hydroelectric function

MERRIMACK

O'Keeffe House, County Road (c. 1780)

An excellent example of the Georgian style, this 2 1/2 story house displays a characteristic large central chimney and transommed center entrance capped by an entablature lintel. The house appears to date to the late 18th century although the town history states that there was a house on this site, at Hickory Hollow, as early as 1748. The covered bridge which spanned the river near the house until 1967 was called both Seaverns and Field Bridge, after families living in this house.

Disco House, Wilson Hill Road (c. 1780)

Built on the south side of Wilson Hill Road with the River behind, the oldest part of this house is the cape style dwelling at the rear. A larger 2 1/2 story addition, just a single bay wide, was placed at right angles in front of the cape in the late 1700s.

Turkey Hill Cemetery and Site of First Meetinghouse, Turkey Hill Road (1771)

A granite stone, believed to be the original doorstep, is all that remains of Merrimack's first church and meetinghouse, which was erected in 1756 and burned in 1896. The walled-in section of the meetinghouse lot, Turkey Hill Cemetery is the first cemetery mentioned in town records. The oldest known grave in the cemetery dates to 1771; the cemetery was used for over 150 years.

Country Gourmet, 438 Daniel Webster Highway (c. 1820)

Now serving as a restaurant, this well-preserved early 19th century house in Merrimack Village displays a handsome semi-circular fanlight characteristic of the Federal style.

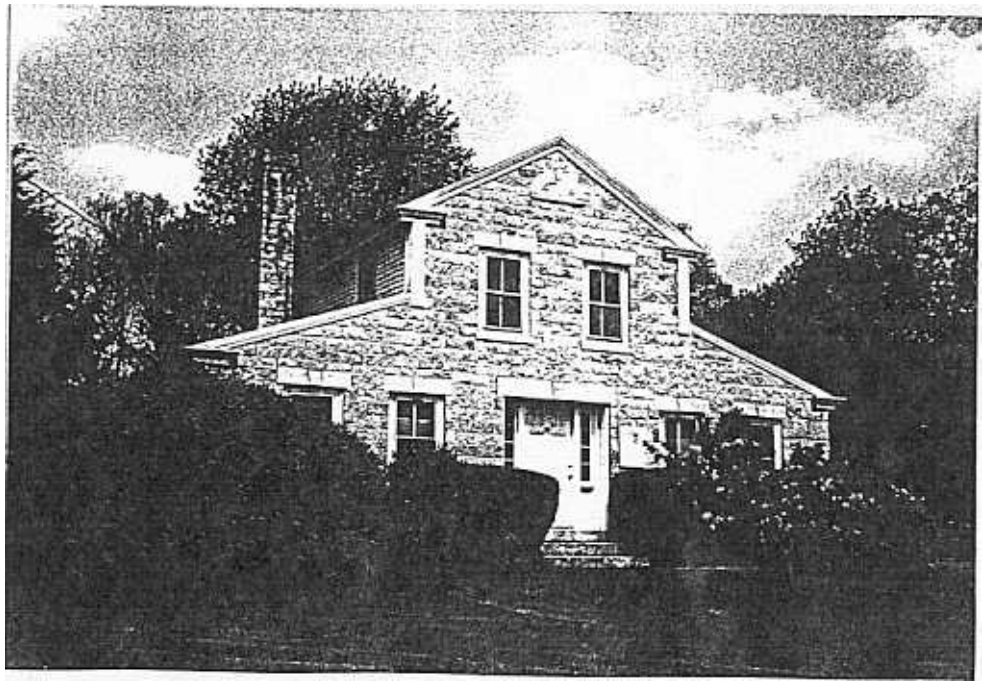
Former Train Station, Railroad Avenue (c. 1880)

Typical of train stations of the era, this clapboarded station displays a hip roof with overhanging eaves supported by large brackets. A small cluster of late 19th century houses are found along Railroad Avenue, built in response to the construction of the railroad and development of industries along the Souhegan.

MILFORD

Stone House, 74 Nashua Street (1818)

This unusual house, measuring five bays wide on the first floor and two above is Milford's only stone dwelling, built in 1818 by Benjamin Goodwin. A louvered fan decorates the attic.



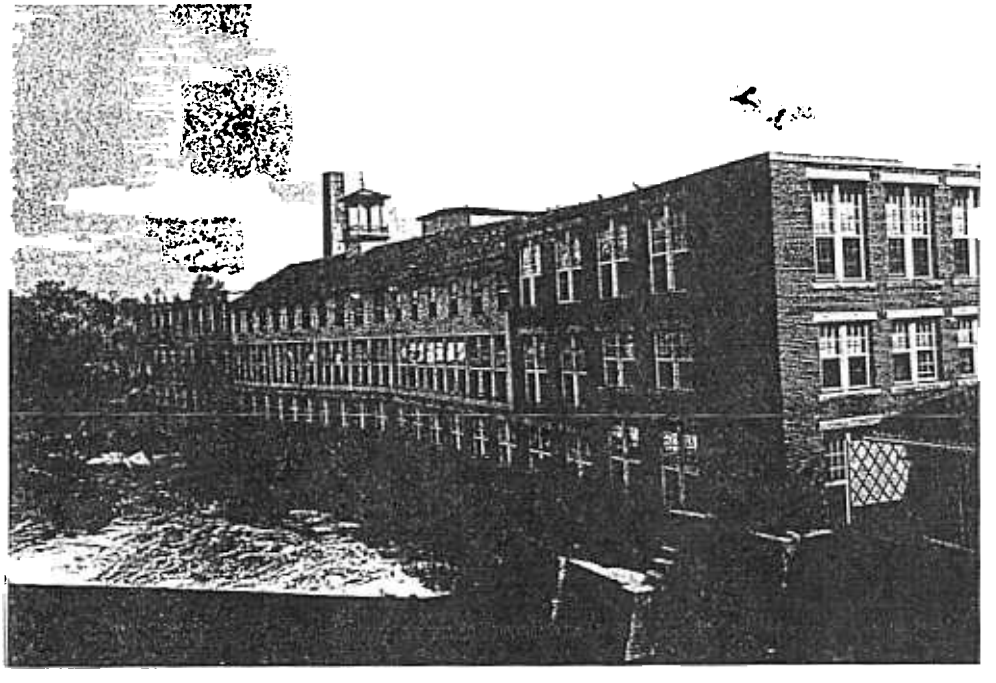
Humphrey Moore House, 43 Elm Street (1820)

This hip-roofed brick house was built in 1820 by Humphrey Moore. Moore was the first settled pastor in Milford, ordained in 1802, and married Hannah Peabody, daughter of one of first settlers. Ultimately Moore owned over 300 acres of meadow along Souhegan River.

North River Road Houses (late 18th-early 19th century)

Just outside of the study area on the north side of North River Road are several late 18th and early 19th century dwellings which historically included intervale lands on the south side of the road. These include the Abner Hutchinson House, erected in 1775 on a knoll surrounded by spruce and maple. In the 1890s the house was a popular vacation spot for summer boarders from Boston. Burnham's Tavern, also known as the Hutchinson Family Homestead, was built in two parts dating to 1773 and 1785.

Milford Cotton and Woolen Manufacturing Company Mill, Bridge Street



Listed on the National Register of Historic Places, this brick mill complex reflects more than a century of textile manufacturing in Milford. The first factory was built in 1813 and at the core of the factory is what may be the original wooden three story cotton mill probably rebuilt in 1838. The mill was first enlarged about 1860; other additions and alterations were made in 1883 and 1916

Savage Farm
475 Route 101
(opposite Old Wilton Road)

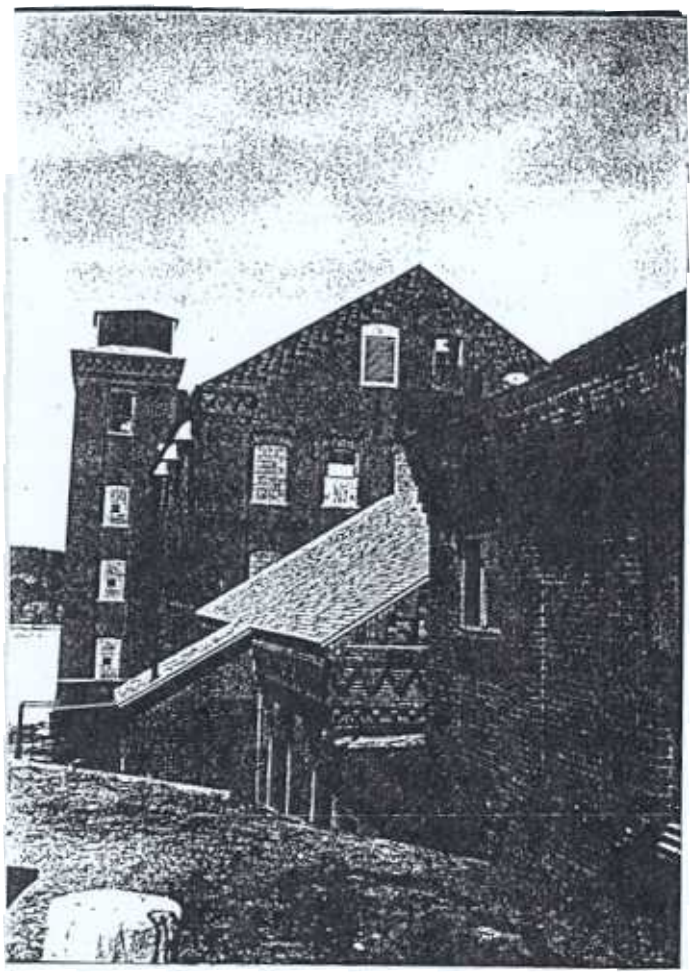
Pine Valley Mill (Hillsborough Mills), Route 101 (1873)

Although a mill was on this site as early as 1814, the present mill building was erected in 1873 for the manufacture of woolen carpet yarn. On the north side of North River Road are a pair of mill houses constructed in conjunction with the mill. The narrow strip of land between Route 101 and the railroad tracks also gave way to a row of humble dwellings in the late 19th century. A depot was formerly located south of the mill, on the south side of the train tracks.

Milford Town Hall, On the Oval (1870)

Listed on the National Register, Milford's Town Hall is an impressive brick building completed in 1870, displaying a combination of Italianate and Second Empire style detailing and designed by prominent Boston architect Gridley Bryant. Down the street, also facing the oval and bandstand, is Eagle Hall, Milford's first meetinghouse, built in 1784 but achieving its present appearance after it was moved in 1846.

NEW IPSWICH



High Bridge Mill,
Columbian Manufacturing Company, Rts. 123 and 124 (1875-6)

This five and one-half story brick textile mill was erected on the site of two earlier textile mills. Distinctive features include the picker house, cotton storage house and easterly stair tower, decorated by bold corbel tables and dentil molding strips common to factories of the era.

Jonas Woolson Farm, Country Club Road (1743 and later)

In 1899 eight men bought this farm on Sol Davis Hill which became the site of the New Ipswich Country Club. The original house was constructed in 1743.

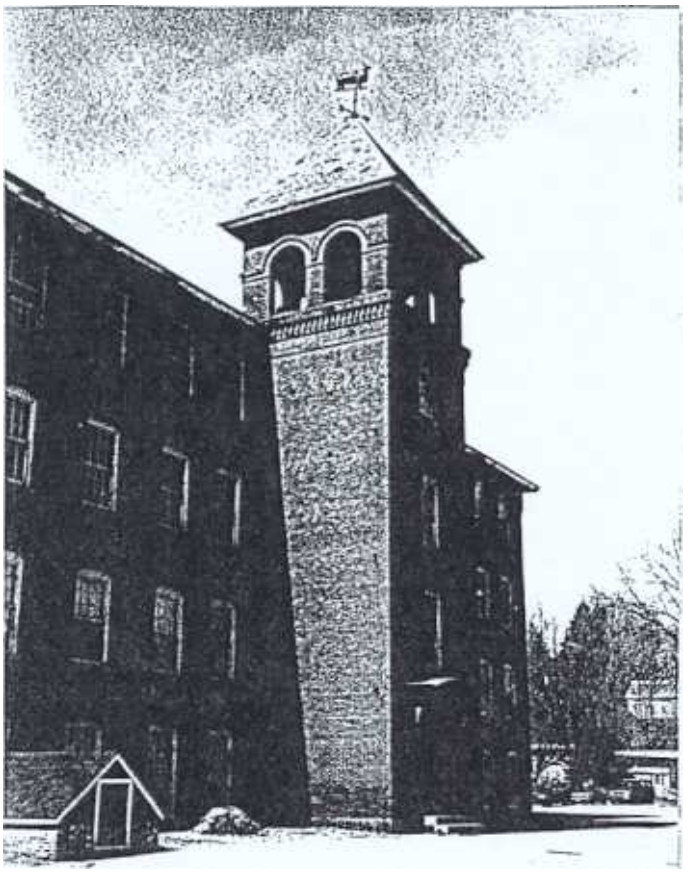
Bank Village, River Road (c. 1820 and later)

"Bank Village" commemorates the Manufacturers Bank which was chartered by the Legislature in 1820 with Charles Barrett as its first president. In 1845 a new building was erected in the middle of town and the bank was removed there. Today, a small cluster of impressive Federal and Greek Revival style homes are found in this locale.

WILTON

Downtown Wilton (late 19th century to present)

Because of the numerous fires, the architecture in the downtown predominantly dates to the late 19th and early 20th century and includes an interesting mixture of historically significant buildings. The centerpiece of the downtown is the Wilton Town Hall, a sophisticated example of Queen Anne architecture, designed by Merrill and Cutler of Lowell, Massachusetts. Built in 1883, the massive brick and granite building culminates in a monumental domed clock tower. The Wilton Public and Gregg Free Library is a small NeoClassical brick structure completed in 1907. Designed by the Boston architectural firm of McLean and Wright, the library is the only downtown structure listed on the National Register of Historic Places. The former Wilton National Bank is a neo classical stone building built in 1929.

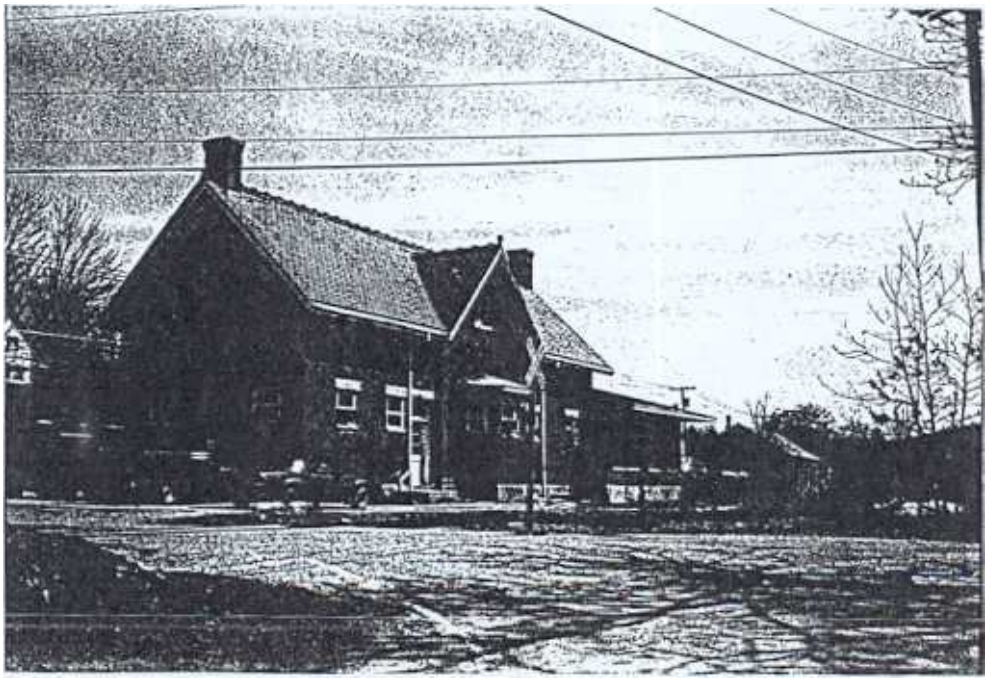


Colony Brothers Mill (Label Art)

Built in 1882 on the south side of the Souhegan River as the Colony Brothers Mill, this four story brick and stone structure later housed the Abbott Worsted Mill.

Former Passenger Station, Main Street (1893)

Celebrating its one hundredth birthday in 1993, this small brick passenger station was designed by Boston architect Alden Frink.



BRIDGE CROSSINGS AND HISTORIC BRIDGES

AMHERST

Ponemah Bridge:

Covered bridge across Souhegan near Poor Farm (now Amherst Country Club) replaced by iron bridge in 1914. Iron bridge replaced in 1974. Poor Farm housed on farm maintained by town since 1831 on Route 122 south of Souhegan; buildings burned in 1892.

Boston Post Road Bridge

Iron Bridge over Souhegan (replaced in 1974). Section of Boston Post Road from Souhegan Bridge to Stearns Road, known as Honey Pot section.

GREENVILLE

Railroad Bridge

At one time this was supposedly the highest bridge in New England, "one of the greatest works of art in New Hampshire, spanning the long distance from bluff to bluff, high above the swift waters of the Souhegan". Six hundred feet long and 100 feet high where it crosses the river, the ends of the bridge rest on abutments of stone with two piers of solid stone masonry, up to eighty feet high, originally supporting a latticed framework. The original wooden trestle railroad bridge was built in 1851, burned in 1907 and rebuilt in steel the following years. Today only the impressive stone supports remain.

Green Metal Bridge

Early 20th century metal bridge over the Souhegan.

MERRIMACK

Route 3 Bridge

The first bridge over the Souhegan River in Merrimack was known as Chamberlain's Bridge, constructed in 1751 just west of the granite bridge on Route 3 near the fire station. It was later replaced by an iron bridge which was east of the present bridge. The present arched granite bridge dates to the early 1900s.

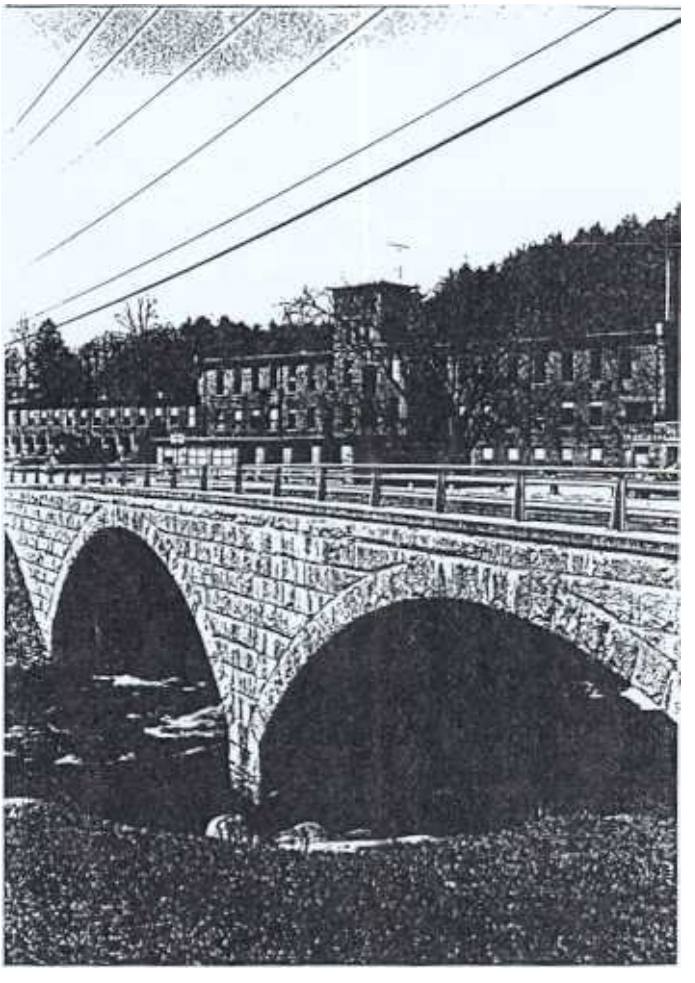
Severns Bridge

Historically Merrimack had two covered bridges, both of which were destroyed by arson in the late 1960s. The upper bridge over the Souhegan River was known first as Fields' Bridge, because it was built at Henry Fields' house prior to 1776. In 1859 a covered bridge was built at this location. Fields' Bridge was a single span of Town lattice design with round portals, measuring approximately 128 feet long and 16 feet wide. Fields' Bridge also, known as Severns Bridge, was destroyed by arson in 1967.

Turkey Hill

The site of Merrimack's first covered bridge, once one of the oldest in the state of New Hampshire. A bridge was built over the Souhegan at this location as early as 1751 although it is not clear whether this was a covered bridge. In 1830 Samuel Patterson was hired to build a bridge according to the plans of Ithiel Town. In 1859 this was replaced with another covered bridge of Town lattice design with an added arch measuring 133 feet long and 16 feet wide. The bridge burned in 1968 and has been replaced by a modern bridge accessible from Amherst Road.

MILFORD



County Bridge

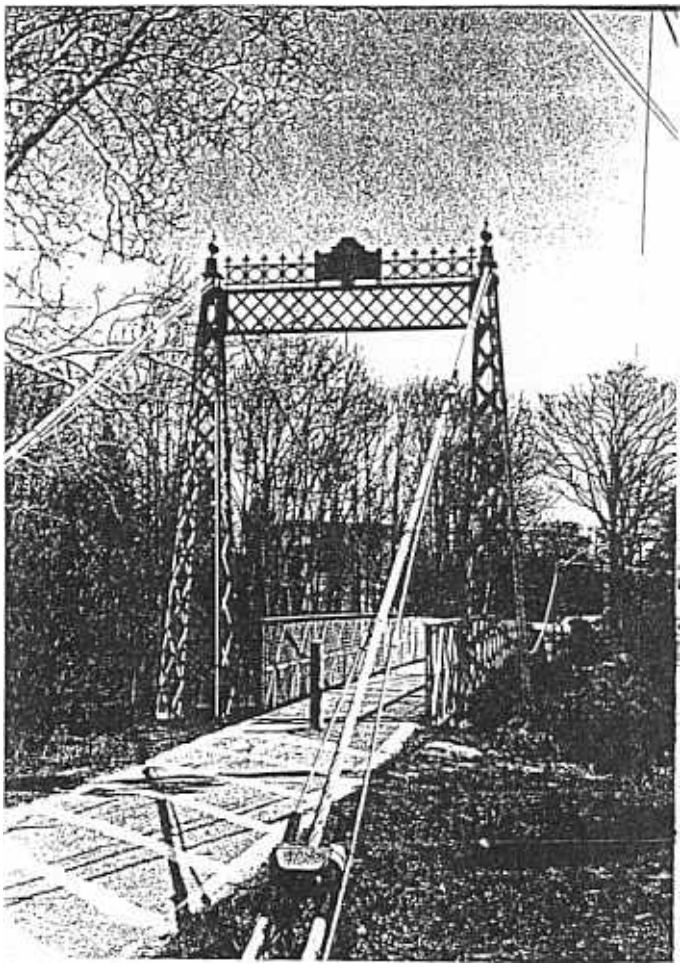
Located at the northwest corner of town where the Souhegan enters Milford, the first bridge built by the town at this location was a covered bridge built in 1799 and swept away in 1835. A Howe truss type double covered bridge was replaced by a later wooden bridge in 1900 and finally by the present granite arch bridge constructed by the Lovejoy Granite Company in 1917.

Green Bridge

It is said that this shallow crossing, known as Jone's Crossing, accommodated John Goffe on his way to Crown Point in 1760 and Gen John Stark on his way to Bennington in 1777. A single truss covered bridge was erected on this site in 1872. When this bridge burned in 1910 it was replaced by the present iron bridge, an important example of a single span high pratt truss structure.

Stone Bridge

In early times, this was the ford at Shepard's Mill from which Milford derived its name. The first bridge on this site was a footbridge built by John Shepard before 1758. A series of wooden public bridges followed culminating in a double stone bridge built first in 1845. The bridge was rebuilt and widened in 1931, at which time electric lights were installed.



Swing Bridge

The first footbridge at this site, connecting Bridge and Souhegan Streets, was built in 1850. The present iron footbridge was built in 1889, successor to two wooden footbridges.

NEW IPSWICH

High Bridge
The date of this old stone bridge suspended over a narrow chasm 80-90 feet deep is not known. The first bridge on the site dated to 1751.

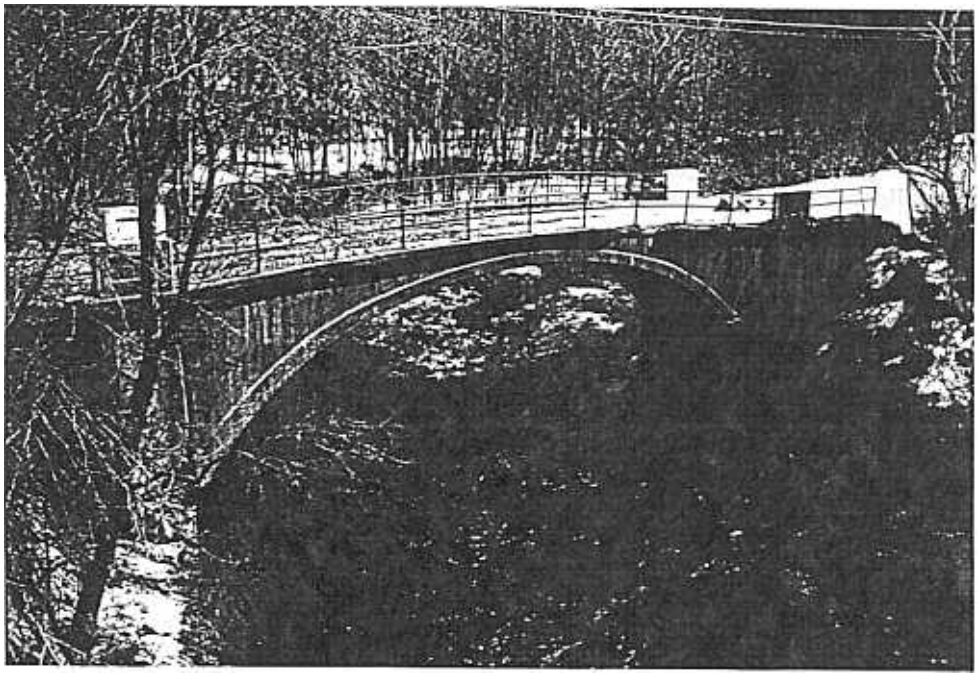
WILTON

Railroad Bridge:

An iron railroad bridge suspended over the Souhegan in the downtown area, supported by stone abutments.

Old Route 101 Bridge

Concrete bridge near eastern end of Intervale Road, designed and erected by the Sanders Engineering Company of Portland, Maine in 1916.



DAMS

GREENVILLE

Chamberlain Falls

Located near Mill Street bridge, adjacent to power house., the Chamberlain Falls Dam was built in 1876 and rehabbed in 1982. It measures 81.7 feet long, of granite block construction. One abutment consists of the powerhouse; the other is granite ledge.

Otis Falls

This concrete-faced stone masonry gravity dam is located on Main Street, adjoining #1 mill The Dam was originally built about 1834, rebuilt in 1936 and completely reconstructed again in 1982.

MERRIMACK

Merrimack Village Dam

Located just upstream from the granite Route 3 bridge and 1700 feet upstream from the confluence of the Souhegan and Merrimack Rivers. The Dam is 180 feet long with an ogee type spillway structure, gate structure and canal. The original dam was a gravity stone masonry dam constructed on bedrock. About 1934 a large concrete spillway was constructed over the old spillway and concrete apron at downstream base added. Downstream are the remains of the former International Shoe Company's foundation which burned in 1955.

NEW IPSWICH

Waterloom Falls

The original dam on this site was built in 1834, and reconstructed in 1980. Located east of River Road on Waterloom Pond. The old mill was abandoned about 1907 for site further down river.

WILTON

Pine Valley

Location of a small hydroelectric dam, date of construction is unknown.

HISTORIC PRESERVATION TOOLS

A wide range of preservation tools may be used to ensure that historic resources within the study area are preserved, treated with respect and enhanced. These can range from such non-regulatory options as public education -- conducting a historic resources survey, school projects on local history or establishment of markers commemorating sites of historic markers, to intermediate measures -- such as nominating structures to the National Register of Historic Places or working with a developer who might be unaware of the potential for archaeological resources in certain areas or the need to insure that new design is compatible with older structures and their surroundings. Lastly, a community may opt to use regulatory techniques such as establishing local historic districts or more permanent protection as is offered through the donation of easements. No one preservation tool, even one that is regulatory, can offer blanket protection. A balanced approach that includes education and regulation, embraced by private citizens and local officials alike, is critical to preserving historic resources.

Historic Resources Survey

Preservation through documentation is the most basic and yet the most essential element of a preservation strategy. In addition to providing a permanent written and photographic of a community's historic resources, a good inventory is the foundation for all other preservation tools. Firstly, data gathered in a survey may encourage a greater appreciation of historic structures and sites by local citizens and may be the impetus to get people aware of local resources and ready to think about protecting them. It can be used to prepare nominations for the National Register of Historic Places and can be used to establish local historic districts and set boundaries. Historic resource assessments are also necessary for accomplishing environmental reviews required in projects receiving Federal funding, such as transportation projects. Lastly, a complete historic resources survey can also help a community assess the net worth of its historic buildings and determine which ones are critical to preserve and which ones may be expendable if the need arises. In this way, a community can weigh proposed actions so that it does not inadvertently sacrifice its long-term assets in realizing immediate objectives.

The Merrimack Historic District Commission is currently beginning work on an historic resources survey for the town, with an emphasis on the Route 3 corridor. With the exception of areas surveyed by consultants working for the NH Department of Transportation, such as Route 101A in Amherst, survey work has not yet been conducted in any of the other communities.

National Register of Historic Places

The National Register of Historic Places is the official list of the Nation's resources worthy of preservation. Established by the National Historic Preservation Act of 1966, and administered by the National Park Service within the Department of the Interior, the Register lists properties of local, state and/or national significance in the areas of American history, architecture, archaeology, engineering and culture. Resources may be nominated individually or in groups as districts or as multiple resource areas and must generally be older than 50 years.

The primary benefit of National Register listing is the recognition it affords and the appreciation of local resources which is often stimulated through such recognition. The National Register also provides for review of effects which any federally funded, licensed or assisted project, most notably highway projects, might have on a property which is listed on the Register or eligible for listing. Register standing can also make a property eligible for certain federal tax benefits (investment tax credits) for the rehabilitation of income-producing buildings and the charitable deduction of donations of easements.

Contrary to many commonly held beliefs, National Register listing does not interfere with a property owner's right to alter, manage, dispose of or even demolish his property unless federal funds are involved. Nor does National Register listing require that an owner open his property to the public. National Register listing can be an important catalyst to change public perception and increase historic awareness but cannot in itself prevent detrimental alterations or demolition. Yet, it remains an important first step toward historic awareness, respect and protection.

Statewide there are nearly five hundred National Register listings of which approximately fifty are districts. The following list summarizes National Register properties in the study area communities. Of these, only the Milford Cotton and Woolen Manufacturing Company, the Milford Town Hall and the Wilton Public Library are

actually in the study area. Although presently the list is entirely composed of historic structures, it should be noted that archaeological sites and districts may also be listed. Each of the communities within the study area have additional resources which would be appropriate for listing on the National Register. Many of these are included in the section of this chapter entitled "Significant Historic Resources" and "Historic Bridges".

Properties in the Study Area Communities
Listed on the National Register of Historic Places

Community	*Property Name*	*Date Listed*
Amherst	Amherst Village Historic District	1982
Merrimack	Signer's House & Matthew Thornton Cemetery	1978
	McClure-Hilton House	1989
Milford	William Peabody House	1979
	Milford Cotton & Woolen Manuf. Co.	1982
	Milford Town Hall	1988
New Ipswich	New Ipswich Town Hall	1984
	Village District	
Wilton	County Farm Bridge	1981
	Wilton Public and Gregg Free Library	1982
	Oliver Whiting Homestead	1982
	Daniel Craigin Mill	1982
	Stonyfield Farm	1982

Source: NH Department of Historical Resources

Local Historic Districts

The term "historic district" can refer either to an historic district established by town meeting or, as has been previously discussed, to a National Register historic district. Both are useful preservation tools but are different in the way in which they are established and the protection they afford historic resources.

The creation and administration of a local historic district (under RSA 674:45) is the most comprehensive preservation tool available to local governments under New Hampshire state law. The purpose of an historic district is to protect and preserve areas of outstanding architectural and historic value from inappropriate alterations and additions which might detract from an otherwise distinctive character. Historic districts should preserve what is significant to a district while accommodating change and new construction in accordance with regulations based on a local consensus.

Historic districting can be an effective technique for protecting the character of an area. Unlike zoning which focuses on land use, an historic district focuses on exterior appearance and setting. In contrast to site plan review, historic districts allow local officials to control construction and alteration of single family dwellings. Effective districts take into account more than just buildings however, looking also at impacts to streetscapes, landscapes, contributing views and viewsheds. Historic districting may not work as well where properties are widely scattered. To protect very large land areas, districting is best combined with other techniques such as easements and open space development.

Within the study area, Merrimack has established a local historic district commission although it has not yet proposed any historic districts to a town meeting vote.

Heritage Commissions

Legislation enacted in 1992 (RSA 674:44-a) gives New Hampshire communities new abilities to recognize and protect historical and cultural resources. Unlike historic district commissions, whose responsibilities are limited to specific parts of a town, heritage commissions are intended to have a town-wide scope, not unlike what conservation commissions do for natural resources. The primary duty of a heritage commission is to advise and assist other local boards and commissions, including the planning board. However, heritage commissions can also accept and expend funds for a heritage fund and acquire and manage property and easements. In some communities heritage commissions are only advisory, in others commissions take on a more active role including assuming the responsibilities of an historic district commission.

Historic Markers

The State Historical Marker Program was originated by the New Hampshire Legislature in 1955 to erect appropriate markers commemorating events, people and places of historical significance to the State of New Hampshire. Communities who would like to be considered for one of the green iron markers submit a request to the State Highway Department and Division of Historical Resources. There is generally no cost involved for a marker on a state-maintained road. There is a charge of approximately $1,000 for a marker on a private road. Statewide there are approximately 150 state historical markers. Only one marker has been erected in the study area; it commemorates the first textile mill in the state, built in New Ipswich and is located on the south side of NH 123 and 124. There are many instances where these state markers could be used to effectively direct public attention to riverfront resources. Guides to trails and signage along trails which are used to educate the public about natural resources should similarly, where appropriate, be expanded to describe events and places of historical interest.

Easements

Preservation easements are one of the most effective and permanent tools for protecting significant historic properties. An easement is a property right that can be bought or sold through a legal agreement between a property owner and an organization eligible to hold easements. In New Hampshire, RSA 447:45-47 covers conservation, preservation and agricultural conservation restrictions, commonly known as easements. Just as a conservation easement can be used to protect open space, natural resources or archaeological remains from incompatible use and development, an architectural easement protects the exterior appearance of a building.

Easements provide property owners with two important benefits. First, the character of a property is protected in perpetuity. In addition, the donation of an easement may make the owner eligible for certain tax advantages. If the property is listed on the National Register, in return for giving an easement, an owner is eligible under the Tax Treatment and Extension Act of 1980 to make a deduction from his taxes. Donation of an easement may also reduce estate and local property taxes.

Easements are also extremely beneficial to a community. The costs of acquiring easements may be significantly lower than buying properties outright to protect valuable resources, particularly when easements can be acquired by donation. Significant resources can remain in private hands but are protected from inappropriate alterations as the organization holding the easement is given the right to review any proposed changes to the structure or the property.

If properly administered, easements are a superior method of conserving and protecting land, water and historic resources; perhaps better and longer lasting than zoning or locally designated historic districts.

Preserving Archaeological Resources

The preservation of areas of high potential for prehistoric and historic archaeological sites poses unique problems. In comparison to historic structures, archaeological resources are more difficult to identify and protect. Each site is unique and fragile. Once a site is disturbed, information is lost. While there is often an urgent need to keep the location of an important archaeological resource confidential, the same confidentiality will often preclude

public awareness. Increased river appreciation and usage can also represent indirect but very real threats to archaeological resources, even more so than to historic resources. The landscaping of areas, vandalism of the resources on land over which private control has diminished and a general increase in public access will all continue to diminish the cultural resource base. Acquisition of the land or development rights is often the only way to effectively preserve archaeological resources.

Rapid growth has undoubtedly obscured or obliterated many prehistoric archaeological sites in the River corridor. The few applicable laws that protect archaeological resources are primarily federal. As a result of these laws, large highway projects or projects which require review by a federal agency usually include an assessment of impacts to cultural resources. In addition, there are mining laws which allow review of projects for impacts and there is the possibility of review within the dredge and fill process.

However, since much of the region's growth is from private rather than public sources, archaeological evaluation is not required. In some cases such as the Hayward Farms property in Milford, cooperative developers have permitted recording of archaeological data which would otherwise be destroyed. The State Division of Historical Resources has very limited ability to review private projects for impact on archaeological resources. Developers may be asked to fund recovery of archaeological data by hiring a professional archaeologist as a consultant to evaluate a property for archaeological potential and/or survey the area for unknown archaeological sites. This procedure is dictated by law in many states but is not required in New Hampshire.

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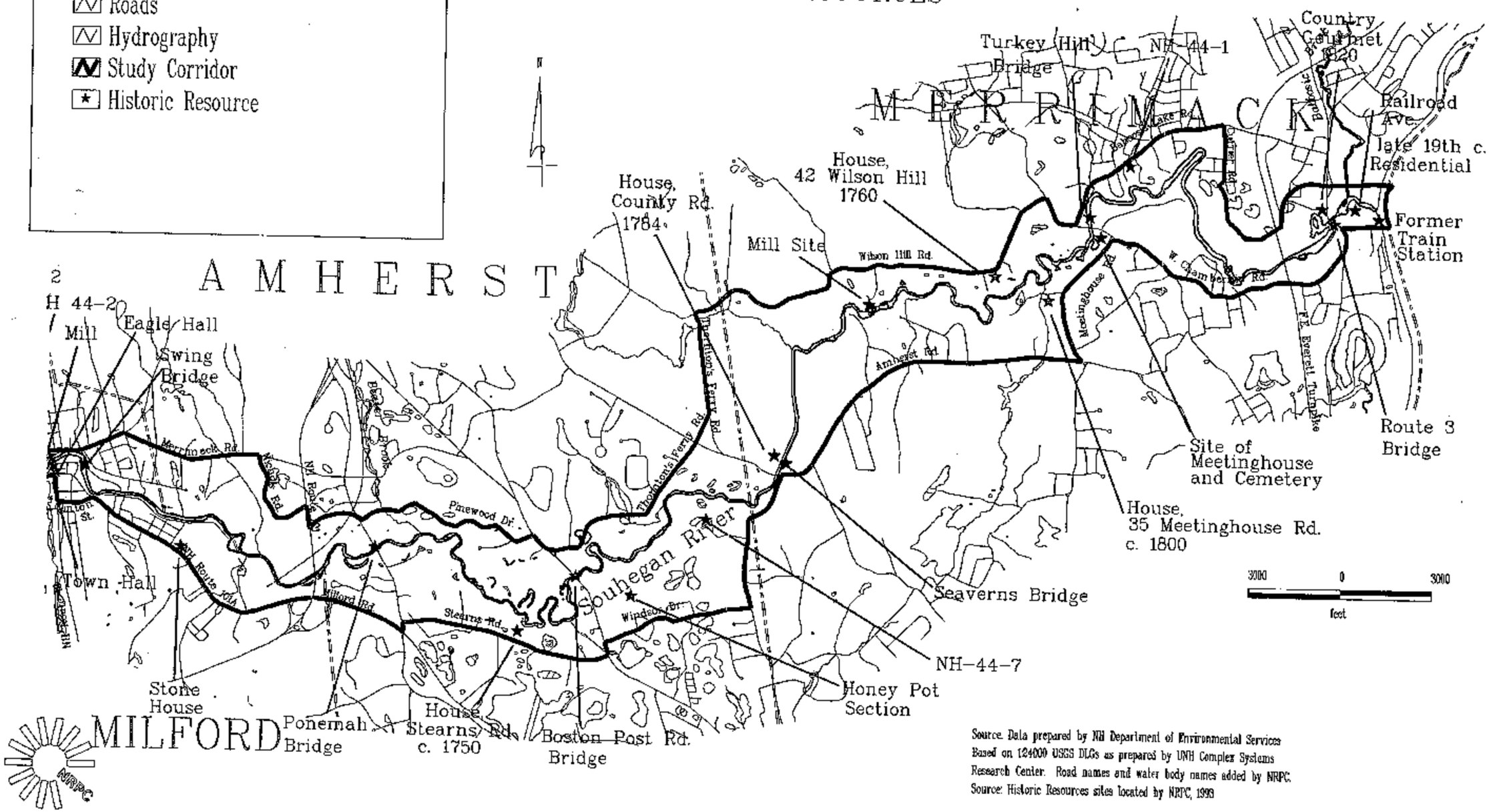
Map VII-1

SOUHEGAN RIVER CORRIDOR EAST
HISTORIC RESOURCES

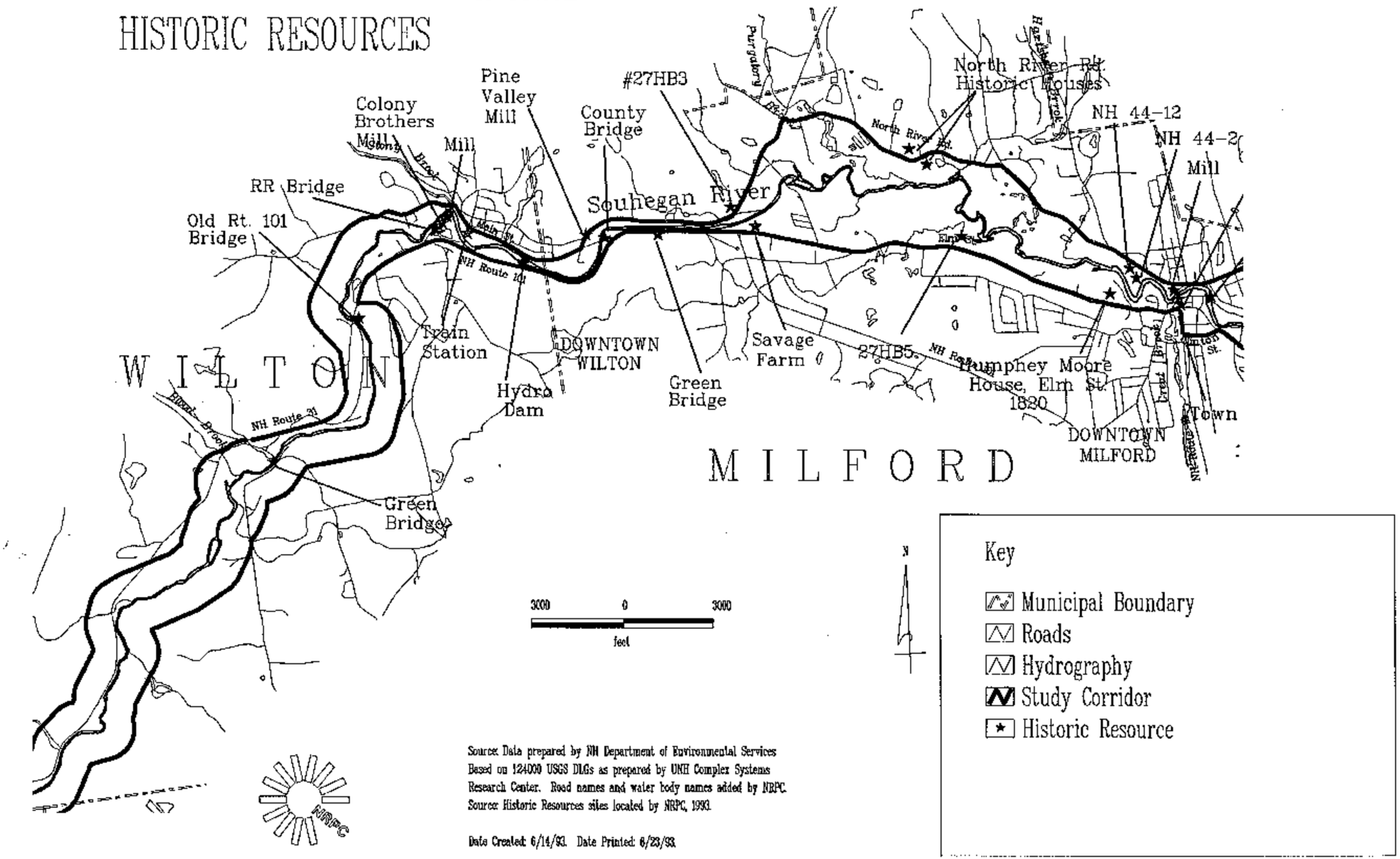


Source: Data prepared by NH Department of Environmental Services
Based on 124000 USGS DLGs as prepared by UNH Complex Systems
Research Center. Road names and water body names added by NRPC.
Source: Historic Resources sites located by NRPC, 1993

Date Created: 5/14/93 Date Printed: 6/23/93

Map VII-1

SOUHEGAN RIVER CORRIDOR CENTRAL HISTORIC RESOURCES

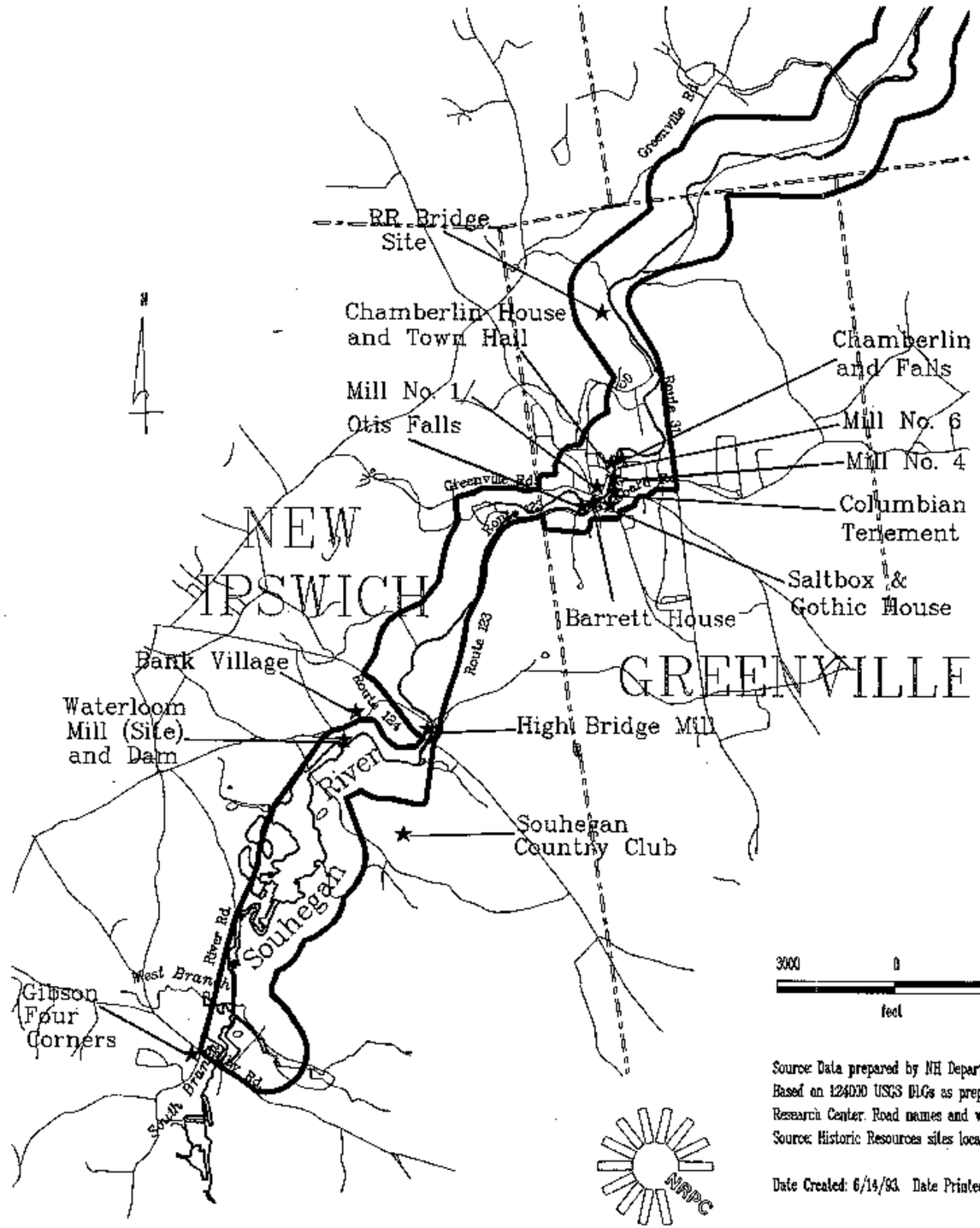


Source: Data prepared by NH Department of Environmental Services Based on 124000 USGS DLGs as prepared by UNH Complex Systems Research Center. Road names and water body names added by NRPC. Source: Historic Resources sites located by NRPC, 1993.

Date Created: 6/14/93. Date Printed: 6/23/93.

Map VII-1

SOUHEGAN RIVER CORRIDOR WEST HISTORIC RESOURCES



Key

- Municipal Boundary
- Roads
- Hydrography
- Study Corridor
- Historic Resource

Chapter VIII.

Recommendations

CHAPTER VIII

RECOMMENDATIONS

Previous chapters of the study have examined and analyzed the physical and natural characteristics of the Souhegan River corridor and the impacts of human uses on these resources. The issues and concerns identified in the study will need to be addressed in order to achieve a balance between the many River uses and users. Maintaining balance is essential to the continuation of the Souhegan as a multiple use river. Achieving this balance will require actions at all levels of government, local, state and federal, as well as at the household and individual levels. The recommendations contained in this Chapter are designed to address the goal and objectives established in Chapter II. While the recommendations in this Chapter are specifically made for the River corridor, many could and should be applied throughout the watershed.

COMMUNITY ACTIONS

Community actions will have the greatest influence on conservation and sound management of the Souhegan River corridor and its resources. Many of the problems and issues associated with the River are most effectively addressed at the local level. The majority of the recommendations require action at the local level, ranging from regulatory mechanisms such as zoning and code enforcement to education and volunteer activities. While many of the recommendations are designed to have direct impacts on specific activities or areas, indirect impacts are often achieved in other areas.

REGULATORY

Zoning, the principal tool for regulating local land use, is a low cost, effective mechanism for protecting dispersed resources such as wetlands, groundwater, surface water and shorelands. While existing local land use regulations furnish direct and indirect protection to the Souhegan River and its corridor resources, amendments to these regulations and adoption of additional regulations would increase the level of protection provided to the River.

1 Develop and adopt local shoreland protection regulations in all of the corridor communities. At a minimum, the regulations should include the provisions of the Comprehensive Shoreland Protection Act (RSA 483-B, effective July 1, 1994) which applies to all water bodies contained on the official list of public waters published by the Department of Environmental Services and fourth order or higher streams. With regard to streams in the corridor, the Act affects only the Souhegan River and one of its tributaries, Stony Brook in Wilton. The statute also grants communities the authority to enact shoreland protection regulations that are more stringent than the Act. The shoreland protection regulations developed at the local level should be broadened in scope to include the major tributaries to the Souhegan River. The Office of State Planning has developed a model Shoreland Protection Ordinance based on the Act to assist communities in drafting local ordinances.

2. Develop and adopt wetland protection regulations in Greenville. Wetland systems protect water quality by filtering sediments, nutrients and other chemicals from surface waters, and provide important wildlife habitat.

3. Develop and adopt minimum lot size requirements for developments in unsewered areas based on the capability of the soil for onsite wastewater treatment. An ad-hoc committee of experts studied onsite wastewater treatment in New Hampshire and recommended a soil based lot size system. In 1991 the Committee published a technical report, Environmental Planning for Onsite Wastewater Treatment in New Hampshire, and a model regulation for soil based lot sizes. The standards developed for soil based lot sizes have been incorporated into the Comprehensive Shoreland Protection Act.

4. Amend the Greenville subdivision and site plan regulations to require soil type and boundary information. Soil information can be used to assess the development potential of a parcel and is essential to establishing a soil based lot size system.

5. Amend the subdivision and site plan review regulations in the Towns of Amherst and Greenville to include requirements for stormwater management and erosion and sedimentation control plans for all major development proposals. Sediments from construction sites are a major source of nonpoint source pollution.

6. Develop and adopt regulations to restrict development on slopes greater than 25 percent in Greenville, Wilton, Milford, Amherst and Merrimack. New Ipswich is the only Town in the corridor that regulates development on steep slopes. Limiting development on steep slopes decreases the potential impacts of soil erosion on surface waters and is particularly important along the riverbank. The natural vegetation should be retained in steep slope areas and unvegetated areas should be replanted to stabilize the soil and inhibit erosion.

7. Amend the subdivision and site plan review regulations in the corridor communities to require information on presence or absence of threatened and endangered species and habitats on the site prior to approval. This information will allow the planning board to plan for habitat protection during the development review process.

8. Request conservation and pedestrian easements along the Souhegan River during the site plan and subdivision review processes in all corridor communities. These areas can be used to meet open space and recreation requirements. RSA 674:36 Subdivision Regulations and RSA 674:44 Site Plan Review Regulations authorize communities to include open space and recreation land criteria in the regulations and to consider these criteria when reviewing development proposals.

ENFORCEMENT

Enforcement is key to the effectiveness of any regulation. A regulation that is not enforced is useless. Local enforcement is often the most effective because it is the level closest to the violation and usually provides for the quickest action. The following recommendations are made to enhance enforcement of local, state and federal regulations.

1. Inform and educate enforcement officials on the local, state and federal regulations that apply to the Souhegan River to assure proper understanding of the regulations and the rationale behind them.

2. Provide qualified inspectors and adequate inspection programs to ensure adherence to the community's regulations, conformance with the conditions of the development approval and proper installation and maintenance of erosion and sedimentation control measures.

3. Assign individual members of the Planning Board and Conservation Commission to regularly monitor developments throughout the construction phase. This informal inspection process will identify potential problems and allow the town to deal with the situation before it becomes a major violation.

4. Report any violations of local, state or federal regulations to the appropriate agency. To facilitate citizen reporting of violations, the Conservation Commissions of the corridor communities should work jointly to develop and distribute informational brochures and fact sheets describing the regulations and identifying the appropriate contact for reporting a violation. The Department of Environmental Services has a series of fact sheets available that describe state regulations.

PUBLIC ACCESS

Public access to the Souhegan River is quite good when compared to other rivers in the state; however, the full recreational potential of the River is not recognized. Public awareness of and access to the numerous recreational opportunities provided by the Souhegan River needs to be improved.

Acquire and develop two formal canoe/kayak launches in each of the corridor communities. Public ownership of these areas will insure permanent public access. Two public access points in each community will allow users to plan for a variety of trip lengths and improve the potential for recreational boating on the River. Launches can be developed on existing publicly owned parcels where possible and/or parcels may be purchased or donated specifically for providing river access. In addition, improvements at the existing public launches in Merrimack, Amherst and Wilton could be made to eliminate/minimize any areas of erosion, to refine the parking areas, to identify the launching area along the bank.

2. Develop a continuous trail system along the Souhegan River. A number of the corridor communities have begun discussing a Souhegan River trail individually and in conjunction with each other. A committee in Milford is actively pursuing the development of a bike trail along the River.

3. Acquire conservation and pedestrian easements, by donation or purchase, across individual properties for the trail corridor.
4. Develop parking areas at strategic locations to provide parking for public access areas and investigate opportunities for developing shared parking programs with existing businesses/agencies in areas where it is appropriate.

5. Erect signs at existing areas and provide signs for future public access areas to identify their locations. Existing public access areas are inadequately marked and difficult to find. In addition, signs can be used to define the permitted uses and hours of operation.

6. Develop maps and brochures in each community and for the entire Souhegan River showing the location and the conditions of use for each public access point, the trail and shared parking areas, and significant natural and historic areas, and distribute the brochures at public offices and libraries.

EDUCATION

The Souhegan River is a multiple-use river. With proper management and stewardship the capacity of the River to support these many uses can be maintained for the benefit of future generations. River protection begins at the level of each individual household. Public education is one of the most effective components for successful management of the Souhegan River. It is important for people to realize the impacts of their individual actions on the Souhegan River and the environment. The following recommendations are made to promote public awareness of the Souhegan River.

1. Conduct a series of meetings to present to the public and discuss the information contained in the Souhegan River Corridor Study.

2. Develop a Souhegan River fact sheet containing highlights from the study and identifying ways that individuals can get involved, and distribute it throughout the corridor communities.

3. Involve the corridor community schools in Souhegan River activities to promote public awareness, to educate the students on the history of the River, its current conditions and potential threats, and to instill a connection to the River in the future leaders of the region.. The schools should continue to participate in the on-going river water quality education programs sponsored by the New Hampshire Department of Fish and Game and initiate the use of comprehensive river related curriculum.

4. Sponsor River related events and competitions such as canoe trips, clean-up days and photography contests to promote conservation issues and recreation opportunities, and to further develop individual connections to the River.

5. Utilize the power of the press to promote the issues and activities surrounding the Souhegan River. Publicize all public meetings, clean-up days, access dedications, recreation events and volunteer activities.

VOLUNTEER ACTIVITIES

Volunteers are a great source of manpower for accomplishing many of the Study's non-regulatory recommendations. River groups, community service organizations, scout troops, schools and individuals are always looking for community projects and ways to contribute to the community. The following recommendations represent only a few of the many volunteer activities related to the Souhegan River.

1. Establish a Souhegan River organization to carry on the implementation of the Corridor Study, develop a River constituency and provide a collective voice for the River. The Souhegan River is one of the few major rivers in the state that does not have a formal river organization. The river organization can pursue many of the recommendations of this study while providing a united voice for the River.

2. Continue to monitor water quality in the Souhegan River as part of the Merrimack River Watershed's volunteer monitoring network and examine the possibility of expanding the number of sites sampled. Through this program trained volunteer's collect water samples throughout the summer. The

information obtained through the program is analyzed to pinpoint water quality problems and to identify potential sources.

3. Develop a greenway along the Souhegan River to protect the shoreline from future development, to link together key publicly owned pieces of land, to protect significant wildlife habitats and corridors, and to provide open space and public access.

4. Obtain parcel ownership information for the shoreline of the Souhegan River. This information will be useful in many areas such as trail planning, greenway development and information dissemination.

5. Utilize local service organizations to assist with river related activities such as clean-up days, trail construction and maintenance, and the production and distribution of brochures.

STATE ACTIONS

In addition to community actions, recommendations can be made to increase the effectiveness of existing state regulations that pertain to activities within the Souhegan River corridor. The corridor communities should encourage the State to enforce existing regulations and to modify or adopt legislation that would provide additional protection to the Souhegan River corridor.

1 The corridor communities should consider the nomination of the Souhegan River for designation under the New Hampshire Rivers Management and Protection Program, RSA 483. Depending on the nomination category, the program establishes protection measures related to dams, hydro facilities, channel alterations, water quality, instream flows, interbasin transfers siting of solid and hazardous waste facilities and recreational use. The information required in the nomination forms is contained in this document.

2. Encourage the New Hampshire Department of Environmental Services to increase enforcement of existing environmental regulations for erosion and sedimentation control, stormwater management, subsurface waste disposal, water quality and dredge and fill of wetlands. Stricter enforcement of these regulations will protect the water quality and the shorelands of the Souhegan River.

3 Encourage the New Hampshire Department of Environmental Services to support volunteer water quality monitoring programs and to utilize the water quality information collected by the volunteers when assessing the water quality in the Souhegan River. The information collected by the volunteers can be used to identify problem areas that warrant further investigation by the Department.

4 Encourage the Department of Environmental Services to take a cumulative look at existing conditions and water use on the Souhegan River when considering reauthorization of existing water discharge permits or issuing new permits, licensing of hydropower facilities and registration of water withdrawals.

5. Encourage the Department of Environmental Services to work with businesses in the corridor to utilize systems and methods which protect surface and groundwater quality. This could include water conservation, source waste reduction and using less hazardous materials in their operations.

ORGANIZATIONAL INVOLVEMENT

Accomplishing the recommendations depends on the support and involvement of many organizations within each community. For example, municipal governments must not only support the general concept of developing a trail along the river but also be willing to commit funding, such as matching funds for land or easement purchases or purchasing signs to identify access areas. Other groups with a role in conserving the Souhegan River include: municipal planning boards and conservation commissions, private conservation and environmental organizations, regional planning commissions, county conservation districts and the soil conservation service.

MUNICIPAL GOVERNMENT

Municipal government in all of the corridor communities takes place at two levels. The Board of Selectmen as the governing body is responsible for the day-to-day operations of the Town. The local legislative body is the town meeting. The support of both groups is essential to the successful implementation of the recommendations. Since the majority of the recommendations requiring local action deal with the zoning ordinance and changes to the zoning ordinance must be voted on by the legislative body, it is essential for the voting population to understand the rationale behind any proposed changes and the benefits which will accrue to the Souhegan River and the other water resources in the community. This will require an extensive educational effort in all of the corridor communities. The support of the board of selectmen is important because of their responsibility to enforce municipal regulations. The success of any effort to protect the River corridor bears a direct relationship to the support and commitment of the municipal government.

PLANNING BOARD

As the municipal board responsible for drafting new zoning ordinances, amending existing regulations and administering the town's land use regulations, planning boards play a major role in protecting the Souhegan River and its watershed. While the board recommends changes to the zoning ordinance, they must ultimately be approved by the local legislative body. The planning board's job is to demonstrate the need for and the benefits of the proposed change to the regulation. Changes to the subdivision and site plan review regulations, however, can be made by a majority vote of the planning board after a public hearing; a town meeting vote is not required. The planning board can also use non-regulatory action to protect the River such as recommending changes to proposed designs and negotiating with developers for conservation easements.

The planning board in each community must understand the importance of protecting the Souhegan River corridor. As the initiators of land use regulations, planning board support is imperative since many of the recommendations will require the board to propose amendments to existing regulations or to develop new regulations for managing development in the River corridor. Other recommendations rely on the board's use of non-regulatory actions to obtain conservation and pedestrian easements along the River. Planning board support is therefore key to the success of protecting the Souhegan River corridor. The corridor community planning boards must be encouraged to use their regulatory and non-regulatory powers to pursue the objectives of this plan.

CONSERVATION COMMISSION

Conservation commissions are another local body closely involved with conserving the Souhegan River Corridor. Municipality's have the authority to create conservation commissions under RSA 36-A. Specific responsibilities listed in the statute include: conducting an inventory of the municipality's natural resources; coordinating the activity of unofficial bodies organized for similar purposes; and maintaining an index of the municipality's natural and scenic resources. In addition, conservation commissions may do the following: recommend to the governing body a program for the protection, development and sound utilization of all the areas in the index; acquire in the name of the municipality by gift or purchase the right to conservation lands and be responsible for their management and control; and provide public information on conservation issues.

Given these responsibilities, conservation commissions have a major role in protecting the Souhegan River. Therefore, the conservation commission in each community should take a lead role in developing a greenway/trail system along the Souhegan River. The conservation commissions in conjunction with the municipal recreation departments or commissions should identify key parcels along the River for public access and investigate alternative funding schemes for purchase and site development. The commissions could also conduct landowner contacts for obtaining conservation and pedestrian easements along the River. In addition, the commissions could be responsible for providing general conservation information to the residents of the communities.

REGIONAL PLANNING COMMISSIONS

The Nashua Regional Planning Commission and the Southwest Region Planning Commission serve as forums for intermunicipal issues and regional policy such as those surrounding the Souhegan River. In addition to addressing regional issues, the Commissions provide technical assistance to the individual member communities in many areas including master planning, revising zoning, subdivision and site plan review regulations, natural resource planning, transportation planning and protecting historic resources. Because of this the RPCs are the appropriate forum for discussing issues affecting the localities and the region.

The RPCs are committed to assisting the communities in protecting the Souhegan River corridor. As regional agencies, the NRPC and SRPC have a great deal of information about the communities within their regions. This document, for instance, is an example of the resources available to the RPCs and how the information can be used to evaluate the impacts of local actions. With this information, the RPCs can assist the communities in developing consistent regulations and methods to achieve the goal of protecting the River corridor. In addition, RPC staff can assist the communities with applications for funding, drafting designation forms and making landowner contacts.

SOIL CONSERVATION SERVICE

The Soil Conservation Service (SCS) can provide the communities with valuable information on soil and soil potentials. The SCS can assist the communities in developing setback and buffer requirements based on soil types; in evaluating wetlands and wetland impacts; in evaluating erosion problems; and in providing general information on erosion and sedimentation control. In addition, SCS staff can provide speakers for workshops, help individual landowners with site specific questions, and assist local land use boards with project reviews.

SOUHEGAN WATERSHED ASSOCIATION

The Souhegan Watershed Association (SWA) is a newly formed group whose focus is on protecting the resources of the Souhegan River and its watershed. The SWA can assist with and take a lead role in the implementation of many of the recommendations of the Corridor Study. The SWA should assume a leadership role in increasing public awareness of the Souhegan River.

Appendix A

APPENDIX A

THREATENED AND ENDANGERED SPECIES

THE RANKING SYSTEM DEVELOPED BY THE NATURE CONSERVANCY AND USED BY ALL STATE NATURAL HERITAGE PROGRAMS FOR "ELEMENTS" OF NATURAL DIVERSITY (RARE SPECIES AND EXEMPLARY NATURAL COMMUNITIES)

Each element is assigned a single global rank by specialists under the guidance of the national Science Department of The Nature Conservancy. State ranks within each state, in which the element occurs, are assigned by the state Heritage Program and will vary from state to state.

GLOBAL ELEMENT RANKS:

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor of its biology making it especially vulnerable to extinction. [Critically endangered throughout range.]

G2 = Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of other factors demonstrably making it very vulnerable to extinction throughout its range. [Endangered throughout range.]

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single state, a physiographic region) or because of other factors making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100. [Threatened throughout range].

G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.

G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GA = Accidental in North America (not part of the established biota, usually a species of bird).

GE = An exotic species established in North America (e.g., Japanese Honeysuckle).

GH = Of historical occurrence throughout its range, i.e. formerly part of the established biota, with the expectation that it may be rediscovered (e.g., Ivory-billed Woodpecker).

The New Hampshire Natural Heritage Inventory does not inventory GA or GE species.

STATE ELEMENT RANKS:

S1 = Critically imperiled in state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor of its biology making it especially vulnerable to extirpation from the state. [Critically endangered in state.]

S2 = Imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of other factors demonstrably making it very vulnerable to extirpation from the state. [Endangered in state].

S3 = Rare in state (on the order of 20+ occurrences). [Threatened in state].

S4 = Apparently secure in state.

S5 = Demonstrably secure in state.

SA = Accidental in state, including species which only sporadically breed in state.

SE = An exotic species established in state; may be native elsewhere in North America (e.g., house finch).

SH = Of historical occurrence in the state with the expectation that it may be rediscovered.

SU = Possibly in peril in state but status uncertain; need more information.

SX = Apparently extirpated from state.

The New Hampshire Natural Heritage Inventory primarily inventories elements in the S1 and S2 categories plus several selected elements ranked S3.

NHI INFORMATION FOR SITES IN THE SOUHEGAN CORRIDOR

grank	srank	localjuris	sname	scomname
G3G4	S1	GREENVILLE	CARDAMINE LONGII	LONG'S BITTER CRESS
	S?	GREENVILLE	SNE HIGH-ENERGY RIVERBANK COMMUNITY	
G5	S1	MERRIMACK	LUPINUS PERENNIS	WILD LUPINE
G5	S2	MERRIMACK	VIOLA PEDATA VAR LINEARILOBA	BIRD'S-FOOT VIOLET
G5	S2	MERRIMACK	ALLIUM SCHOENOPRASUM VAR SIBIRICUM	SIBERIAN CHIVES
	S?	MERRIMACK	SNE HIGH-ENERGY RIVERBANK COMMUNITY	
	S2	MERRIMACK	SNE FLOODPLAIN FOREST	
G5	SH	MERRIMACK	ALLIUM CANADENSE	WILD GARLIC
G5T5	S2	MERRIMACK	ASTER PATENS VAR PATENS	SKYDROP ASTER
G5	S1	MERRIMACK	TEPHROSIA VIRGINIANA	GOAT'S-RUE
G?	SH	MERRIMACK	DESMODIUM RIGIDUM	STIFF TICK-TREFOIL
G5	S3	AMHERST	HETERODON PLATIRHINOS	EASTERN HOGNOSE SNAKE
	S2	AMHERST	SNE FLOODPLAIN FOREST	
G5	S2	AMHERST	ENNEACANTHUS OBESUS	BANDED SUNFISH
G5	S1	AMHERST	BUFO WOODHOUSII	WOODHOUSE'S TOAD
G5	S2	WILTON	RHODODENDRON MAXIMUM	GIANT RHODODENDRON

GRANK	SRANK	COMMUNITY	COMMON NAME	SCIENTIFIC NAME
NHI INFORMATION FOR SITES IN THE SOUHEGAN WATERSHED, BUT NOT IN CORRIDOR				
G5	S4	AMHERST	AMBYSTOMA LATERALE	BLUE-SPOTTED SALAMANDER
G5	SH	AMHERST	CASSIA HEBECARPA	WILD SENNA
G5	S1	AMHERST	DESMODIUM MARILANDICUM	MARYLAND TICK-TREFOIL
G4	S3	AMHERST	EMYDOIDEA BLANDINGII	BLANDING'S TURTLE
G5	S3	AMHERST	CLEMMYS GUTTATA	SPOTTED TURTLE
	S?	AMHERST	SNE ACIDIC LEVEL FEN	
	S1	AMHERST	SNE LEVEL BOG	
	S1	AMHERST	CNE DRY TRANSITIONAL FOREST ON SANDY/GRAVELLY SOILS	
G4G5	S1	AMHERST	LIATRIS BOREALIS	NORTHERN BLAZING STAR
G5	S2	AMHERST	SOLIDAGO ODORA	SWEET GOLDENROD
G5	S4	AMHERST	AMBYSTOMA LATERALE	BLUE-SPOTTED SALAMANDER
G5	S3	PETERBOROUGH	LEPTOLOMA COGNATUM	FALL WITCH-GRASS
	S4	NEW IPSWICH	NNE ACIDIC ROCKY SUMMIT/ROCK OUTCROP COMMUNITY	
	S1	LYNDEBOROUGH	SNE DRY RICH FOREST ON ACIDIC/CIRCUMNEUTRAL BEDROCK/TILL	
G5	S2	MERRIMACK	ASCLEPIAS AMPLEXICAULIS	BLUNT-LEAVED MILKWEED
G5	S1	MERRIMACK	PYCNANTHEMUM VIRGINIANUM	VIRGINIAN MT. MINT
G5	S3	MERRIMACK	CENCHRUS LONGISPINUS	BURGRASS
G5	S1	MERRIMACK	ASCLEPIAS TUBEROSA	BUTTERFLY-WEED
G5	S1	MILFORD	LESPEDEZA VIRGINICA	SLENDER BUSH-CLOVER
G5	S1	MILFORD	AMBYSTOMA OPACUM	MARBLED SALAMANDER
G4	S3	MILFORD	EMYDOIDEA BLANDINGII	BLANDING'S TURTLE
G5	S3	MILFORD	ARDEA HERODIAS	GREAT BLUE HERON (ROOKERY)
G5	S1	MILFORD	ASCLEPIAS TUBEROSA	BUTTERFLY-WEED
G5	SH	MILFORD	CASSIA HEBECARPA	WILD SENNA
G4	S1	MILFORD	ADLUMIA FUNGOSA	CLIMBING FUMITORY