NATURAL RESOURCES

It can be said that a community is evaluated on the basis of its built environment. What kind of homes are found there, what are the schools like, is the business opportunity as evident as in other towns? All of these questions are applicable in understanding the Town but there is much more to Kingston. New Hampshire is known nationwide for its scenic beauty; beaches, mountains and lakes. Although Kingston has neither mountains nor coastal beaches it is unique in Rockingham County for its abundance of lakes and ponds. In addition the community has some of the finest groundwater resources in the state.

The specific objectives of this chapter are (1) to provide a broad-based inventory of natural resources in Kingston, identifying all current data sources; and (2), to provide a textural overview of the maps used to document the natural resources and to identify the sources that were used to develop the maps.

This chapter describes and explains what is included in a Natural Resources Inventory, and also details the Geographic Information Systems (GIS) used for mapping the natural resources. The chapter will also provide strategies which the town (particularly the Kingston conservation Commission) should consider employing to protect these resources. This information will serve as an important planning tool, and may serve as a blueprint for longer-term natural resource projects within and adjacent to Kingston. This Natural Resource Inventory will also help give individuals within the community a greater perspective of the important natural resources within the community, as well as an understanding of current and possibly future resource protection efforts.

A Natural Resource Inventory – an Overview

A natural resource inventory (NRI) provides listings and descriptions of important naturally occurring resources within a given locality. This natural resource inventory consists of three basic components. The first section includes inventory maps that show the location and extent of important resources. The Kingston NRI uses the Geographic Information Systems (GIS) map format and associated descriptions. The GIS map format provides an overview of the natural resources of the entire community. The second section consists of the database of source documents and other information on the characteristics of the mapped resources. The final part of the inventory is a narrative summary of the inventory's findings along with specific natural resource concerns and recommendations for future action on the part of Kingston.

The Importance of a Natural Resource Inventory

Natural resources are a vital part of a community's cultural and economic structure. Rapid growth can have adverse effects on a community's natural resource base, including loss of wildlife habitat, loss of recreational corridors and scenic vistas, contamination of surface and groundwater and increased erosion and flooding. Often, such degradation of resources is linked with a general degradation of a community's character. The future of a community's natural resource base depends on land-use decisions made at the local level. Creating an awareness and knowledge of your community's natural resource base through a natural resource inventory will allow for more informed decisions by providing information that will support careful land-use planning and improved resource protection measures.

Mapping of Natural Resources

The maps included in this natural resource inventory were produced using Geographic Information Systems (GIS) technology. This is a system that combines the ability to analyze, manipulate and store data, with the ability to produce digital maps of those data features (and attribute data). Using GIS, various types of mapped information or textual information can be combined on a digital map. This data can then be combined in a manner that shows different natural features at the same time. This provides the ability to view natural resources in a much broader context, allowing for a better understanding of the relationships between one resource type and another.

The GRANIT (Geographically Reference Analysis and Information Transfer) maps refer to a statewide GIS system being developed by the New Hampshire Office of Energy and Planning since 1984. The GRANIT system is designed primarily for land-use planning applications, made possible through the coordination of several state and federal agencies, the University of New Hampshire's Complex Systems Research Center and other affiliated agencies.

Components of the Natural Resources Inventory

The first step in producing a natural resources inventory is to inventory the natural resource data that has already been prepared for the community, including the identification of the different data resources. Kingston relied on existing sources of information and used computerized GIS mapping to illustrate the available natural resource data to create this inventory.

The following is a description of the features on each of the GIS maps produced for the natural resources inventory. Note that the data in each of the maps is limited by how current the map source data are. It is equally important to recognize that GIS maps only represent a fixed period in time. As more information becomes available, or new data is collected for the community, additional information can be added to the GIS data. The Inventory GIS maps can then be reproduced with the updated information.

The following is a listing of the features that appear on each of the maps produced for the Natural Resources Inventory as well as the source of that data:

1.0	**Base Map Features**	**Data Source/Date**
	Town Boundaries	GRANIT
	Roads	GRANIT/NHDOT/Kingston
	Surface Waters	GRANIT
	Topography	GRANIT
2.0	**Water Resources**	
	Watershed Boundaries	NHDES
	Surface Waters	GRANIT
	Aquifer/Groundwater Resources	USGS/GRANIT
	Wetlands	National Wetlands Inventory/ GRANIT
	FEMA Floodplain Data	Federal Emergency Management Administration
	Public Wells	NHDES
	Wellhead Protection Areas	NHDES
	Known or Potential Contamination Sites	NHDES
3.0	**Lands of Special Importance**	
	Town-Owned Properties (Protected and Unprotected)	Town of Kingston
	State-Owned Properties	Society of the Protection of NH Forests
	Conservation/Protected Lands	Rockingham Planning Comm.
	Recreation Areas	Town of Kingston
	Forestland	GRANIT
	Farm Lands	GRANIT/NRCS (1998)
	Wildlife Habitat	NH Heritage Inventory
	Bedrock Geology	NHDES
4.0	**Potential Land Use Constraints**	
	Zoning, building and land-use restrictions	
	Soils Limitations – Wetlands, Slopes	
	FEMA Floodplain Data	

1.0 BASE MAP FEATURES

The base map is digitized from 7.5 U.S. Geologic Survey (USGS) digital elevation files. [scale – 1:24,000] These files contain point elevation at 30-meter (99 feet) intervals. The base map includes the surface waters, topography based on 25' contours, and roads within the community.

2.0 WATER RESOURCES

In general, there is a direct relationship between land use and water quality; the right land use in the wrong area can degrade and/or contaminate both surface and groundwater, increase flood hazards, destroy water-based wildlife habitat, and interfere with the scenic and recreational value of the Town's water resources. Kingston's ground and surface waters represent important economic resources for the town. All residents are dependent on groundwater (or, in some cases, surface water) for their water supply. It is extremely important, therefore, that the potable quality of this resource be maintained. Alternative sources can only be developed at enormous expense.

Watershed Boundaries

Kingston's geographic boundaries encompass three major watersheds, which drain to the south by the Little River; to the north by the Exeter River; and in the central and largest portion of town, by the Powwow River.

Surface Water Resources (Ponds, Rivers, Wetlands)

Kingston has an abundance of water bodies that have proven to be economic, aesthetic and recreational resources for the Town, as well as being important ecological habitats for a variety of aquatic and terrestrial species. The protection of the shoreline for these environmentally sensitive water resources should be a primary concern for the Town.

Historically, surface water quality in Kingston has been threatened by nutrient enrichment, which can be traced to two sources: subsurface waste disposal systems and runoff from developed areas. Failed or improperly functioning septic systems in lakeshore developments allow untreated wastewater to enter water via surface runoff or subsurface infiltration. Runoff contains nutrients from two sources, namely "greywater" from streets and highways, and organic mineral matter from eroded soils, causing siltation of lakes and rivers. Improperly functioning and failed septic systems have been identified as the most serious threat to water quality in Kingston. In general, septic systems can be inadequate wastewater systems if they are improperly designed, located or maintained.

Ponds

Kingston has five great ponds, Country, Powwow, Great, Halfmoon and Greenwood. For designation purposes the State of New Hampshire (RSA 4-40a) defines any public water of greater than ten acres to be a great pond. Sections of these ponds have been intensively developed. The Powwow Pond system, which includes the entire shorelines of the Powwow River/Powwow Pond, Great Pond, and Country Pond are the Town's most significant water bodies.

Rivers

The Powwow River originates in the adjacent town of Danville, entering Kingston from the west and flowing into Great Pond. There is a small dam at the outlet of Great Pond that serves to control pond elevations only during periods of low to normal runoff. Downstream from Great Pond, the Powwow River flows to the southeast for a short distance before it is joined by drainage from Country Pond and forms Powwow Pond.

Country Pond elevations are controlled by Trickling Falls Dam at the outlet of Powwow Pond. Downstream from Powwow Pond, the river flows to the southeast to the mouth of the Merrimack River in Amesbury, Massachusetts. There have been a number of studies of the water quality of the ponds in town over the years in an effort to monitor water quality. The New Hampshire Department of Environmental Services instituted a citizen based water sampling program in the early 1990's to gather reliable water quality sampling over a long period of time so that pond health could be better evaluated. This program, called the Volunteer Lakes Assessment Program (VLAP) has nearly a 10 year sampling history that makes statistical evaluation of water quality data much more reliable scientifically. The annual results of this long standing volunteer effort are available for Great Pond and Powwow Pond through the NHDES.

Although these rivers are not used as a drinking water source by Kingston, the Exeter River is the main source of drinking water for the Town of Exeter. Since the Little River (North) is a major tributary of the Exeter River, its water quality must be protected and maintained to insure continued use as a municipal water supply. The Powwow River is a source of drinking water in Amesbury Massachusetts and as such protective measures in New Hampshire are important. NHDES has a water quality monitoring system for rivers that is operated by volunteers in the same way as the program for lakes. Called the Volunteer Rivers Assessment Program (VRAP), long term monitoring has been undertaken at two sites in Kingston; at Long Pond Road Bridge and at Country Pond outlet, Pond Street.

Wetlands

Wetlands are defined as "poorly and very poorly drained soils" in accordance with the National Cooperative Soil Survey conducted by the USDA Natural Resource Conservation Service, formerly the Soil Conservation Service. Wetlands also include marshes, ponds, bogs, swamps, and lakes. In Kingston, wetlands are freshwater systems. Generally, wetlands are transitional zones between surface water and upland sites and are commonly the sites of very productive ecosystems. While wetlands provide a variety of ecological functions and benefits, they also

pose significant development constraints. Wetlands restrict building development due to high water tables, poor drainage, slow percolation rates for septic systems, unstable conditions for foundations, and susceptibility to flooding.

Historically, wetlands were considered wastelands of little value to society and were often subject to waste dumping, filling and draining with little thought given to the consequences. More recently, scientific study has lead to a greater understanding of the importance of wetlands for maintaining and improving environmental quality. Wetland complexes provide critical ecologically and socially valuable functions, including:

- Flood control, serving as flood water storage areas
- Water quality, absorbing and filtering pollutants and sediments
- Water supply, helping to maintain groundwater and surface water levels
- Providing habitat areas for plants, fish and wildlife
- Providing unique opportunities for recreation and education
- Aesthetics, contributing to scenic value

Kingston has a large number of significant wetland areas, constituting approximately 29% of the Town's total land area according to calculation derived from the GRANIT system of land classification. Recognizing the increasing development pressure on the Town's wetlands, in 1982 the Planning Board proposed and the Town adopted a Wetlands Protection Ordinance designed to protect significant wetlands from inappropriate or harmful development.

AQUIFER AND GROUNDWATER RESOURCES

Kingston has some of the most significant groundwater resources in southeastern NH according to studies prepared by the US Geologic Survey (USGS). In order to better understand these resources a description as provided by USGS is offered below. This section is offered to provide better understanding of some of the properties required of high quality aquifers.

Aquifers are defined as "a geologic formation, group of formations, or part of a formation, that contains sufficient saturated permeable materials to yield significant quantities of water to wells and springs".

Groundwater refers to the "water beneath the water table in soils or geologic formations that are fully saturated".

Saturated thickness of an unconfined stratified-drift aquifer is the vertical distance between the water table and the bottom of the aquifer. In confined aquifers, saturated thickness is the distance from the top or overlying confining layer of the aquifer to the bottom of the aquifer. Saturated thickness is mapped separately for unconfined and confined aquifers. The maps of saturated thickness can be used in conjunction with other hydrologic data to indicate favorable areas for the placement of high-yielding production wells.

Transmissivity is a measure of the ability of an aquifer to transmit a fluid, calculated by multiplying the horizontal hydraulic conductivity by the saturated thickness (Heath, 1983). The transmissivity distribution in an aquifer reflects the combined effects of variations in both of these factors. An aquifer composed of well-sorted, coarse-grained material will have a much higher transmissivity than one with the same saturated thickness but composed of fine-grained material.

Description of the USGS Study

Southeastern New Hampshire's rapid population increase in the past few decades along with water quality concerns and the need to develop new public water supplies prompted the need for additional groundwater data. The US Geological Survey (USGS), in cooperation with the New Hampshire Department of Environmental Services (DES), Water Resources Division, initiated a 10-year program in 1983 to provide detailed maps of stratified-drift aquifers statewide. To do this, the state was divided into 14 regions based upon the drainage divides of the major watersheds. A drainage divide is a geographic area, based upon existing topography, that details the direction of water flow within the region.

For the purposes of the USGS study for the southeastern quadrant of New Hampshire, geohydrologic data for Kingston is located in two study reports. The USGS report 92-95 with corresponding plates includes data for the Exeter, Lamprey and Oyster River basins in southeastern New Hampshire (Moore, 1992). Hereinafter, for ease of reference, Moore's report will be referred to as the "Exeter" report. Maps corresponding to Kingston data in the Exeter report include Plate 3 which delineates the altitude of water table, data collection locations and surficial geology for stratified-drift aquifers and Plate 8 which delineates the saturated thickness, transmissivity and materials of stratified-drift aquifers.

The USGS Report 91-4025 includes data for the Lower Merrimack and Coastal River Basins (Stekl and Flanagan, 1992). This area includes the stratified-drift aquifer of the Powwow River and the Little River sub-basin of the lower Merrimack River basin. Hereinafter, Stekl and Flanagan's report will be referred to as the Merrimack report. The study area for the southeastern quadrant covered 351 miles, of which approximately 56 miles are underlain by stratified-drift aquifers.

The plates corresponding to each report include a legend illustrating transmissivity of the stratified-drift aquifers, signified by intensifying shades of blue. When referring to the plates, make note of the inconsistency between the reports in the legend regarding transmissivity. In the Exeter legends, plates 3 and 8, the lightest shade of blue corresponds to *less than 500' per day* whereas the Merrimack legends, plates 2 and 5, has the lightest shade of blue corresponding to *less than 1000' per day*.

Delineations of the aquifer boundaries are mapped at a scale of 1:24,000. Data for the delineation of Kingston's stratified-drift aquifers (sand and gravel geologic formations) boundaries and the extent of the silts and clays for the Merrimack study were based on published and unpublished surficial-geology maps provided by the Cooperative Geologic Mapping Program (COGEOMAP), in particular, a 1983 surficial geologic map produced by the COGEOMAP.

This cooperative mapping venture included participation from the Geologic Division of the USGS, the NH Department of Environmental Services and Office of the State Geologist. Lithological data was collected from auger holes. Data was also available from previous reconnaissance maps for the lower Merrimack River basin (Cotton, 1977). Subsurface data were obtained from published and unpublished sources of the USGS, New Hampshire DES, New Hampshire Department of Transportation, well-drilling contractors, towns and local town residents.

Stratified-drift aquifers have been mapped to show aquifer boundaries, water-table altitudes, general directions of ground-water flow, saturated thickness, and aquifer transmissivity, on a scale of 1:2000. The study also provides a description of the general geohydrology of till and bedrock as well as the water use and water-yielding characteristics of the bedrock aquifer. Statewide data is also provided for groundwater quality in the stratified-drift aquifers. This detailed geohydrologic information provided in the reports is useful to regional and local planners in making maximum use of existing groundwater resources and for locating and developing new resources.

Methods—Exeter, Lamprey and Oyster River Basins Study

Groundwater Site Inventory: Well, test boring, and spring information was collected from owners of domestic wells, municipalities, consultant reports, previous USGS reports (Bradley and Petersen, 1962; Cotton, 1987) and from well records provided by the New Hampshire DES, Water Resources Division. Additional information was provided by the New Hampshire DOT pertaining to bridge and highway borings.

Test Hole Drilling and Installation of Observation Wells: 57 test holes were drilled to obtain information on sediment particle-size, lithology, depth t water table, depth to bedrock and samples for water quality analysis. Periodic water levels were measured at USGS observation wells. Groundwater samples were collected in August and November of 1984, and November and December of 1985 for analysis of common inorganic, organic, and volatile organic constituents at selected USGS wells and municipal wells.

DESCRIPTION OF AQUIFER RESOURCES

Lower Merrimack and Coastal River Basins Study

The Kingston-Powwow River aquifer is the largest continuous aquifer in the study area (10.5 square miles), extending across the towns of Kingston, East Kingston and Newton (Plate 5). This aquifer is currently undeveloped and was identified by USGS as one of potential importance and selected for detailed hydrologic analysis. It is an example of an outwash plain composed of well-sorted glaciofluvial sand and gravel materials. One of two known productive zones of the aquifer is in a buried valley of thick glaciofluvial material along the axis of the Powwow River immediately south of Great Pond (Plate 2). Saturated thickness exceeds 100 feet in places and averages about 60 feet throughout the 1.5-mile length of the valley. Great Pond, the Powwow River, and Country Pond all connect to the buried valley and could provide large amounts of

recharge to this lightly populated aquifer section. Another productive zone of the aquifer is between Greenwood and Great Ponds. The topography of the area is that of a knob-and-kettle landscape characteristic of collapsed outwash formed from the melting of remnant ice blocks. Much of the coarse stratified drift was deposited against glacial ice and averages from 40 to 60 feet in saturated thickness. State ownership of land along the northeastern shore of Great Pond has kept this aquifer section relatively undeveloped.

A major hydrologic feature of the Kingston-Powwow River aquifer is the extensive area of surface water in contact with permeable stratified-drift deposits. Three ponds -- Great, Powwow and Country Ponds—overlie glaciofluvial-stratified drift. The Powwow River connects the ponds and is regulated by the Trickling Falls dam at the Eastern shore of the Powwow Pond. The ponds and river are a major control of the regional groundwater flow system and locally receive both surface water and groundwater discharge. Surface water outflow from this system is regulated to maintain a constant water level in the ponds throughout the recreation season (March through October). The river and the ponds could probably supply abundant induced recharge to properly located wells.

Findings

Using superposition modeling techniques to estimate water yields, results revealed that Kingston's stratified-drift aquifer along the Powwow River was one of five aquifers deemed to have the greatest potential to supply additional amounts of water. Water use for the entire aquifer is from on-site wells that supply individual homes, businesses, and schools. Most town residents are served by individual home wells. The potential yield was estimated to be 4.0 million gallons per day for the Kingston-Powwow River aquifer, with a contributing recharge area for supply wells estimated to be 4.9 square miles. Presently, this groundwater resource is undeveloped as a public supply. A private water company regulated by the NH Public Utilities Commission (PUC), Hampstead Area Water Company (HAWC) provides water to one elderly residential development. There are 56 connections serviced in this development. Although the service provided to this development is very limited in scope such development raises an interesting issue**.** Private water companies have the ability to completely change the way water is supplied within a community. As has been seen in Hampstead, residential housing development utilizing private community water supplies can result in significant residents being supplied water by a private entity. The Town of Kingston has taken the step of declaring itself a municipal water utility by way of a 2004 Town Meeting Vote. Even though this measure received support by a majority of voters it did not garner the two-thirds super majority approval needed for such an action. The Town will attempt this again at the 2006 annual town meeting. In this way the Town is positioned to purchase any infrastructure in place for providing residents with water if such actions are found to be in the best interests of Kingston residents.

Groundwater Quality

Groundwater samples for the USGS study were collected from 24 USGS observation wells and six municipal wells, in April and August of 1987 to characterize background water quality of the stratified-drift aquifers. The samples were collected at wells where the water quality is most

likely to reflect natural conditions. All samples were analyzed by the USGS National Water Quality Laboratory in Arvada, Colorado.

The water quality analysis revealed that the water is generally suitable for drinking and other domestic purposes. Groundwater in the region is generally soft, slightly acidic, and low in total dissolved solids. Groundwater quality samples meet the US EPA's primary drinking-water regulations.

Groundwater Quantity

The Town of Kingston is a participating member of the cooperative coastal watershed study evaluating groundwater quantity. Called the Seacoast Groundwater Availability Project, this study is a joint effort of the United States Geological Survey, NH Department of Environmental Services and communities in the 42-town coastal watershed. The goal of this project is to bring scientific information about the quantity of groundwater in the region in order to enable better resource management and planning at the local and regional levels.

FLOODPLAINS

Floodplains are depositional landforms produced by streams and rivers as a result of accumulation of sediment deposited by the river during flood periods. Flooding is a natural process of the riverine system and adjacent surface water network. Periodic flooding helps to fertilize soils, and helps to maintain their productivity and that of the river corridor. Floodplains are located along sensitive shoreline areas that provide habitat for a wide variety of animals and plants. In general, floodplains surround major water courses and are subject to seasonal flooding. During periods of flooding, enormous quantities of water are stored temporarily within floodplain soils, and within tributary wetlands. By storing and slowing floodwaters, the floodplain acts to reduce damage from floodwater likely to occur downstream. During such periods, groundwater reservoirs are also recharged by excess surface water. As the flood levels decline, the water stored is slowly released back into the stream or river. Natural vegetation and wetland soils slow the water flow during the flood and help prevent soil erosion. In this manner, wetlands and floodplains naturally moderate the extremes of flooding. A floodplain in its natural state is the most cost-effective method to reduce flood damage. Values traditionally associated with floodplains and river corridors include (1) riverbank stabilization/water quality, (2) recreation, (3) aesthetics, and (4) unique natural features.

The Federal Emergency Management Agency (FEMA) has designated flood hazard boundaries within Kingston on Flood Insurance Rate Maps (FIRM). Flooding from rivers and large brooks is a primary consideration in assessing the development potential of land. In 1975, the U.S. Department of Housing and Urban Development/Federal Insurance Administration mapped the flood hazard areas in Kingston for use in the flood insurance program. This flood zone was designated for the 100-year storm based on topography and previous flooding history. A 100-year flood refers to a one-percent chance of flooding each and every year. The 100-year flood is the standard by which floodplains are delineated, and this is the assumed worst extent of flooding that can reasonably be expected.

The 100-year flood zone surrounds the major watercourses flowing through Kingston. Flood prone areas include:

1. the shorelines of Mill, Country and Great Ponds;
2. the floodway of the Powwow River from the Newton town line north to Route 125;
3. a low-lying area adjacent to the Little River, east of the Dry Mill Road;
4. the floodway of the Little River extending approximately two miles along the river from the Brentwood town line.

Development should be located away from these low-lying areas due to the potential for flooding and the unstable soil conditions. More recently, the floodplains have been delineated by FEMA, with the most recent FIRM dated May 17, 2005. Maps are available for reference at the Kingston Town Office.

Public Wells

The NH Department of Environmental Services (DES) holds public well location data. For more information on public well data, including the well identification, well depth and well yield, contact the Water Resources Division of the NH DES. The public wells are shown on this map.

Kingston relies mainly on groundwater as the primary source of its water supply. Kingston has no municipal water system, nor any immediate available public water supply. Town residents and businesses rely exclusively on private wells. Due to increased growth, occasional shortages in water quantity and deterioration of water quality may require that a municipal water system be developed at some point in the future. Sporadic contamination from nitrates has been detected in private wells. The most likely sources of groundwater contamination in Kingston are:

1. improperly functioning septic systems;
2. salt contamination from winter spreading and year-round storage;
3. and toxic leachates from miscellaneous point sources (e.g., service stations, fuel storage, landfill and septage lagoons).

Although there are abundant surface water bodies in Kingston, none could be used for a municipal water source, given existing development patterns. Indications are, however, that the Town has sufficient groundwater resources to supply a municipal system servicing selected areas of town, provided the quality of the groundwater is maintained. In the Southeastern region of New Hampshire, Kingston's aquifer and groundwater resources are among the most plentiful, with 70 to 75% its land area having this underlying groundwater resource. Management issues regarding this critical resource will become increasingly important as the region's population continues to increase. Such increases are accompanied by industrial expansion, increased energy needs, changes in land use, and a steadily increasing demand for potable water.

KNOWN OR POTENTIAL CONTAMINATION SITES

The Groundwater Hazards Inventory is provided by the NH DES Groundwater Protection Bureau. This dataset includes the groundwater hazard inventory, including hazardous waste sites, landfills/dumps, community septic systems and Superfund sites.

Contamination of groundwater from human activities can come from many sources, described as point (specific) sources and non-point (general) sources. Activities that may degrade the quality of groundwater include landfill disposal of household and industrial wastes; storage and spreading of road deicing salt; agricultural practices, which include spreading of commercial fertilizers and spraying of pesticides; spreading or landfill disposal of sludge from municipal sewage systems; or leakage from fuel, septic (especially in densely populated areas), and chemical-storage tanks.

1) The Ottati-Goss hazardous waste site (known)

Extensive groundwater contamination has occurred at an uncontrolled hazardous-waste site, the Ottati and Goss/Great Lakes Container Corporation. The Ottati and Goss site is located on land west of State Route 125 in Kingston. The site was used for the storage and reconditioning of drums from 1955 through 1980. By 1980, the site contained an estimated 4,300 drums of unknown chemical waste (Goldberg-Zoino and Associates, 1986). Most of these drums were stored outdoors with no protection from the weather. Cleanup activities began in 1981 and drum removal operations were completed by the summer of 1982. A preliminary hydrogeologic investigation, by a private consulting firm (Ecology and Environment, Inc., 1982) has indicated an extensive groundwater contaminant plume that extends from the site towards Country Pond to the southeast. Another private consulting firm is completing a final RI/FS that will define the nature and extent of site contamination and identify the remedial action needed to complete cleanup activities at the site. [Reports available at town hall]

2) Kingston landfill and septage disposal areas (potential)

3) De-icing salt piles (potential)

There are five covered de-icing salt piles in Kingston, located on Newton Junction Road, Main Street near Kelley Road, Route 111, at Great Pond dam, and on Route 125 near the Brentwood town line.

4) Erosion sites (known)

Erosion sites are located predominantly in the western, more hilly sections of town. In addition to these specific (point) sources, general (non-point) sources include improperly functioning or failed septic systems, leaking fuel storage tanks, and improperly disposed household and automotive wastes.

3.0 LANDS OF SPECIAL IMPORTANCE

This map contains information on town and state-owned lands, conservation lands, recreation areas, and farmlands. For purposes of this inventory, lands included in this section can be referred to as open space—undeveloped land areas that have important ecological functions or natural resources that are worthy of conservation and protection. Open space areas include, but are not limited to, forests, farmland, fields, floodplains, wetlands and shorelands. Each of these map features is discussed in more detail in the following section

Town-owned Properties

This map features protected and unprotected town lands. As Kingston continues to grow and develop, the preservation of open space, conservation and recreation land becomes increasingly more important. The Conservation Commission has taken a very active role in this area. Conservation efforts should be made to protect the remaining agricultural land, forests and ponds. All of these areas contribute to Kingston's character and make it a desirable place to live.

Regarding unprotected town lands, the Town of Kingston adopted a Public Land Acquisition ordinance on March 11, 1986. This ordinance allows for the review of Town property by the Board of Selectmen, the Planning Board, and the Conservation Commission to determine if any Town parcel will have future suitable use as public land. Parcels identified for such future public use will not be auctioned off but will remain town land.

State-owned Properties

These properties include the Kingston State Park and Rockrimmon State Forest preserve.

Conservation/Protected Lands, Including Forest Resources

Conservation lands are generally undeveloped and are protected from future development. Kingston has less than 5% of its land designated as conservation land. As of 1998, 97 acres were under state ownership and 492 under municipal ownership for a total of 589 acres. This acreage equals about 4.64 percent of Kingston's total land acreage (12,704). The potential for connecting or maximizing existing protected parcels should be carefully considered by the Conservation Commission or other groups interested in land protection strategies.

Forestland is a major renewable resource, providing both commodities (wood products, maple syrup) and non-commodity benefits (water resource protection, air quality and energy conservation, wildlife habitat, recreation and scenic value). Forest resources serve a dual role, contributing both economically and environmentally.

Recreation Areas

Kingston is fortunate to have many recreation areas in town. The Kingston Recreation Commission is very active in providing a variety of recreational activities for the residents. The spread of residential development into new areas of town will mean that recreational facilities will be needed in these new areas. A good recreational program and adequate recreational facilities will benefit the whole town.

Farm Lands

Agricultural lands are areas that are capable of producing crops or that can be used for pasturing animals. These areas include hay fields, pasture, cropland, orchards and nurseries. Farmlands often contain some of the best soils in a community for crop production. Agricultural areas are an important component of a community's rural character while providing economic and social benefits. Local food production reduces the cost of transporting the goods to market, while delivering fresher products to the consumer. Indirect economic benefits of farming relate to the real estate value of the farmland itself compared to the cost of providing public services to residents. When residential subdivisions consume farmland, the cost to communities to provide municipal services for additional residents is typically greater than the increased property tax revenue. Farmlands are also well suited for many types of recreation, including hunting, cross-country skiing, and passive recreation such as hiking and bird watching. Other less obvious benefits of farmlands (as open space) include wildlife habitat and aquifer recharge.

The Town has a rich agricultural history and has taken regulatory steps to carry this tradition forward. A substantial portion of the northern section of Town has been zoned as Single Family Residential Agricultural. By creating this zone the Town intends to continue to provide for agricultural uses in the future. Kingston's active farms currently include certified tree farms, Christmas tree farms, and two horse farms and a cattle farm.

Wildlife habitat

When considering how to best plan for habitat protection, the challenge will be to conserve enough habitat quantity and diversity to support a variety of healthy native wildlife populations. Habitat diversity refers to the variety of landforms and vegetative cover in a given area, by combining open fields, woods, streams and marshes, ridges and valleys.

A major concern is that haphazard patterns of development have intruded into remote areas fragmenting the habitat. Fragmentation can result in the damage and loss to native plant species, a reduced breeding gene pool, loss of natural predators and increased susceptibility to disease. Large areas of open space should be protected from significant human activity and development. A minimum of 250 acres of open space is considered necessary for habitat protection by wildlife biologists.

Wildlife corridors should also be taken into consideration. These are tracts of undeveloped land that serve as migratory routes, traditional travel ways, and important linkages between significant habitat areas. These routes are often located along streams or rivers, and can be almost any type of land that is at least 200 feet in width, providing avenues for travel and discouraging habitat islands.

Bedrock geology

The geologic features of New Hampshire include a variety of land features and mineral resources. Volcanic activity, long periods of erosion and repeated glacial activity have formed the landscape over millions of years. An inventory of local geologic features includes items related to the underlying bedrock and to the surficial materials that lie on top of the bedrock. Bedrock forms the foundation for land and is commonly considered a solid, unbroken mass, although it may have numerous cracks and fissures. Bedrock-related materials refer to quarries, mines and faults. Above the bedrock and below the soil usually is a layer of unconsolidated earth material referred to by soil scientists as the "c horizon" or "parent material" of the overlying soil. Geologists refer to this material as "surficial deposits". These include the loose materials such as soils, clay, gravel and rocks. Maps of surficial geology identify bedrock outcrops, swamp deposits, permeability and drainage characteristics and sand and gravel deposits.

The surficial layer is important in an inventory in that its ability to transmit water and the location and depth of sand and gravel deposits indicate the presence of groundwater resources. Mineral resources can be related to both bedrock and surficial materials. In New Hampshire, the most valuable and widely available mineral resources are sand and gravel deposits. Kingston has significant sand and gravel resources as described in the soils chapter of this master plan

Information Sources:

The NH Department of Transportation utilizes the USDA Soil Conservation Service soil maps to inventory sand and gravel deposits. The NH DES Geology Unit has information on actively mined sites, including other mineral resources. The DES has compiled a "Bibliography and Index of New Hampshire Geology", which can be used to locate sources of printed materials and maps.

4.0 POTENTIAL LAND-USE CONSTRAINTS

Zoning, Building and Land Use Ordinances

Kingston's Master Plan includes descriptions of zoning, building and land use ordinances in order to control and guide the wise and appropriate use of land. Misuse of land can produce pollution from the improper placement of buildings and their wells and septic systems, and the placement of roads.

In order to protect the groundwater resources, the Town is currently considering or has in place a variety of groundwater protection techniques, including: land use restrictions, monitoring wells, excavation regulations, and limitations on impervious surfaces and coverage controls, regulation of on-lot sewage disposal, septage disposal permitting, and a wetlands protection ordinance.

Land use controls include the Aquifer Protection Ordinance, originally dated March 14, 1989, which specifies an Aquifer Protection District and accompanying regulations. Its purpose is to protect, preserve and maintain potential groundwater supplies and related groundwater recharge areas within a known aquifer identified by the USGS. The Shoreland Protection Ordinance, originally dated March 12, 1991, defines a Shoreland Protection District and accompanying regulations and is intended to manage shoreland land use as a way to protect the quality of surface water resources in town. The Wetlands Conservation District was adopted on March 9, 1982 and most recently amended in 1997. This district is intended to preserve the various environmental functions of a wetland including flood storage, pollution mitigation and wildlife habitat by prohibiting development in wetlands and adjacent buffer areas.

The Kingston Zoning Ordinance should be referred to for the details of each ordinance relative to definitions, boundaries, use regulations and administration

Soils

County soil surveys, available at the USDA Natural Resources Conservation Service (in Brentwood), provide information on soil characteristics and their suitability for various uses, as well as maps with approximate boundaries for soil types. The Rockingham County Soil Survey was updated in 1995. A soil survey identifies prime agricultural soils, along with the productivity and management limitations of various soils for forestry, suitability for recreational development and an assessment of wildlife habitat. These surveys can be used to locate areas of poorly drained soils, and the erosion potential of each soil type. Soils with high erosion potentials can be located by matching slopes with a gradient of 15% or more. The soil maps will also identify areas with limitations on septic system construction, such as soils with bedrock close to the surface and excessively drained soils that inadequately filter effluent.

Soil maps should be used as a way to determine the general characteristics of an area rather than to describe conditions on a specific lot without a site examination. A soil map delineates an area in which one soil type is dominant, but it is almost impossible to draw a boundary that does not include small areas of soils of a different type, called inclusions. In most instances, the inclusions have characteristics similar to those of the dominant soil. However, some inclusions have very different characteristics but occupy such a small area that separate delineation is impossible at the scale of a soil map.

FEMA Floodplain Restrictions

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Each Flood Insurance Rate Map provides 100-year flood elevations and delineations of the 100-year floodplain boundaries to assist communities in developing floodplain management measures. Kingston's Floodplain Development Ordinance

was adopted on March 10, 1992 and amended on March 8, 1994. This ordinance applies to lands designated as special flood hazard areas by FEMA in its Flood Insurance Study for the Town of Kingston, together with the associated Flood Insurance Rate Maps, with an effective date of May 17, 2005.

LAND PROTECTION STRATEGIES

The information included in this Natural Resources Inventory thus far has provided information regarding the various natural resources in Kingston and their importance. This section will provide a cursory review of open space protection techniques that are available to both the public and private sector entities. For purposes of this review, the methods for protection have been broken down into four categories: voluntary land protection techniques; public and quasi-public programs; land use regulations and zoning; and local conservation efforts and open space planning. It is important to include a description of these tools in the community master plan because many federal and state conservation programs view such a discussion as necessary if they are to support applications for project funding.

Voluntary Land Protection Techniques

Under this category, there are a number of methods available that can permanently protect privately held open space and conservation areas. They all involve the protection of land through the direct acquisition and control of the land, or some portion of the land. There are many different protection tools, and several outstanding publications that describe the methods in greater detail. References for these publications are made where appropriate. Voluntary land protection techniques may involve tax implications, discussed very briefly in this section. For more detailed information on potential tax benefits, a professional tax advisor should be consulted. The voluntary land protection techniques that are described here include: fee simple purchase, purchase and leaseback, purchase and resale or lease, purchase of development rights and conservation easements, donation of land, bargain sale, transfer of development rights, and options and right of first refusal. The Town of Kingston has been very successful in utilizing a number of these methods to protect valuable parcels of land from development.

a) Fee Simple Purchase; Purchase with leaseback or resale

Most lands are held in fee simple, that is, the holder of the title possesses all rights associated with the property. The most common method of protecting open space areas has traditionally been through the direct purchase of property. An important consideration is that open space lands protected using fee simple acquisition are often purchased at or close to fair market value based upon development potential. Purchasing open space lands at full market value can be prohibitively expensive, and can seriously limit the amount of land that can be protected.

Land purchased for conservation purposes will generate no property taxes, however, it will not demand much in the way of public services. There are at least two options that can be used to help recover the costs associated with a fee simple purchase: purchase and leaseback, and purchase and resale with covenants. The first option, purchase and leaseback, allows the

purchaser (community or conservation organization) to lease the land back for a particular use compatible with open space preservation (such as farming or forestry), thus recouping a portion of the land's purchase price. Lease agreements should be written in a manner that will protect the interest of the community while being sensitive to the landowner's needs. Another option, purchase and resale with covenants, allows the land to be resold with a deed committing the buyer to maintain the parcel as open space. As above, the new landowner could use the property for used that are compatible with open space preservation. The latter option is sometimes used to protect a portion of the land (i.e., the most environmentally sensitive) while allowing limited development on the remaining portion.

b) Conservation Easements and Purchase of Development Rights

These methods operate on the assumption that the right to develop a parcel is separable from the ownership of the land. They provide practical options for private landowners who wish to protect their land while retaining ownership.

Conservation easements provide permanent protection from uses of land that could damage or destroy its scenic, ecological, and natural resource values. Conservation easements are available for property with significant conservation values including forests, wetlands, farms, ranches, endangered species habitat, beaches, scenic areas, historic areas, and more. Generally, easements are donated (but they may be sold) to qualified non-profit conservation organizations or public agencies which ensures that the conditions of the easement are met over time. To be effective in land protection, the terms of the easement must run with the land and apply to all future owners. Easements may be tailored to fit the natural characteristics of the land, the personal needs of the owners, and the objectives of the organization or agency. Whether purchased or received as a donation, an easement can be a much less expensive method of permanent protection than fee-simple purchase for two reasons: First, the outright cost of acquisition will be less since not all of the land rights are being acquired. Second, the ongoing cost of ownership including maintenance, liability, and property taxes continue to be borne by the owner.

Development rights may also be referred to as scenic, conservation, or development easements. Easements which allow the holder to use the land for conservation or recreational purposes are called "affirmative" easements. Easements that prevent the landowner from doing something with the land (such as develop it) are termed "negative" easements.

The sale of a conservation easement is sometimes referred to as the purchase of development rights. Purchasing development rights allows the landowner to receive monetary compensation for the land's development value without having to convert the land to other uses. Once the development rights are sold, the owner still retains the other rights associated with property ownership. The owner is still responsible for property taxes, which should be assessed only on the non-development potential of the land. Thus, in a sense, the landowner is paid for not developing the land. There are several new tax incentives that make conservation easements more attractive, particularly with the passage of the Taxpayer Relief Act of 1997. Some of the additional tax benefits include an increase in Estate Tax exclusions, a reduction in Capital Gains tax rates, and several other options available for estate tax planning.

There are at least four methods by which communities and qualified conservation groups can acquire development rights: direct purchase of development rights, purchase and resale with restrictions, purchase and lease with restrictions, and donation of development rights and/or easements. By donating development rights, the landowner can receive a reduction in local property tax, federal income tax, capital gains tax, and estate tax. With all of these methods, the restrictions on development run with the land, and are written into the deed that are binding on future landowners.

c) Transfer of Development Rights (TDR)

This technique is an extension to the purchase of development rights concept. It relies on the separation of development rights from other land ownership rights and adds to that the shifting of those rights from one location or zoning district to another. A TDR program can protect critical resource areas by shifting development potential from one part of town to another. This technique is comparatively complex and has not been widely used in New England. Under the right circumstances, and with adequate administrative expertise, TDR can protect important conservation land at a very low cost to the community.

d) Donation of Land

In terms of program expense, the outright donation of open space lands is the preferable option. The benefits to the landowner are reductions in a variety of federal, state, and local taxes. There are at least five methods of donation: fee simple, less than fee simple, donation with a reserved life estate, donation of an undivided interest in the land (remainder interest), and donation by bequest.

e) Bargain Sale

This is the sale of property for less than its full market value. It can be considered a combination land sale and charitable contribution. One motivation for the landowner is the income tax benefit from the charitable donation. The amount deductible for income tax purposes is the difference between the land's fair market value and the actual sale price. Other benefits to landowners include cash from the sale, a capital gains tax reduction, the avoidance of brokerage fees, and a higher tax bracket which could otherwise result from a full value sale of the land. Any transfer of property, either in fee simple, development rights, or a conservation easement, may be the subject of a bargain sale. There are potential income and estate tax benefits of a bargain sale as well.

f.) Options to Purchase and Rights of First Refusal

If a community cannot afford to purchase a site immediately, an option to purchase or rights of first refusal, may allow a community some time to raise the necessary funds. An option establishes a price at which the community could purchase the land during a specified period of time. In essence, it reserves the land for purchase at a specified price. A right of first refusal is less specific; it simply guarantees the community the opportunity to purchase a site for a price equal to a bona fide offer from another interested party. If a Conservation Commission targets a

piece of property and the owner is not presently interested in selling, the Commission may consider seeking a right of first refusal. With a right of first refusal, if the parcel is put on the market, the Commission will have the right to purchase it before it is sold to another party.

Public and Quasi-Public Programs

There are a number of open space protection programs offered by various State and regional agencies, as well as several programs offered by quasi-public groups such as the Audubon Society, the Society for the Protection of New Hampshire Forests, the Nature Conservancy, and local or regional land trusts. Many of these quasi-public organizations work hand-in-hand with the State and local communities, while others work independently. The Kingston Conservation Commission plays a critical role in the conservation and preservation of open space in the community by implementing proactive land protection strategies. The Conservation Commission should be viewed as a resource for more detailed information regarding local conservation efforts and land protection strategies.

One of the more distressing realities of owning large parcels of open land in New Hampshire is the exceptionally high property tax rates. An important method of reducing this burden has been through the state-sponsored Current Use Assessment Program. This program typically reduced the property taxes assessed on undeveloped land by more than two-thirds and is vital to the preservation of open space in the region.

RECOMMENDATIONS FOR THE TOWN OF KINGSTON

1. The Town has been extremely proactive in using regulatory methods to protect natural resources. As has been enumerated above, the Town has adopted ordinances that provide protection to groundwater, shorelands, wetlands and floodplains. In addition, the Town's subdivision and site plan regulations incorporate erosion and sediment control requirements geared at insuring proper construction methods during development. By utilizing these best management practices development sites are required to manage stormwater so that erosion is minimized. The Town should be diligent in upholding the standards of these various ordinances and regulations so that the integrity of the Town's natural resources is maintained.

2. The Town should review the current erosion and sediment control regulations to insure that they achieve the goals of the US EPA Phase II stormwater regulations.

3. The Town has appropriated funds in the past for purchase of property so that it remains farmland or open space. The Town should consider undertaking the preparation of a Town-wide open space plan that could help local conservation efforts to determine appropriate future municipal purchase of conservation lands.

4. The Town should consider expanding the shoreland protection district into a watershed protection district. Such an action would allow the Town to look at surface waters with a broader view than is presently done with the shoreland ordinance.

5. The Town should review the results of the Coastal Watershed Groundwater Sustainability Study and implement any relevant recommendation offered.

6. The Town should continue to be proactive with respect to investigating a community-wide water system. Although a municipal system is not being recommended by the Kingston Master plan the town should make sure not to forgo any necessary actions that would allow such a system in the future.

7. The Town should consider establishing "viewshed" protection zones.

8. The Town should continue to support agricultural endeavors in the single family residential /agricultural zone. This zoning district was established to allow for the continuation of agricultural endeavors in the part of Town with the greatest degree of appropriate soils.

9. The Town should work with the State of New Hampshire regarding local water use rights. The Town should advocate the fullest participation possible for municipalities in any State legislation prepared with respect to the use of surface and groundwater resources.

10. The Town should consider adopting RSA 79-A:25, II which allows a municipality to allocate a portion or all of the land use change tax to be placed into a local fund for natural resource protection.