

Rockingham
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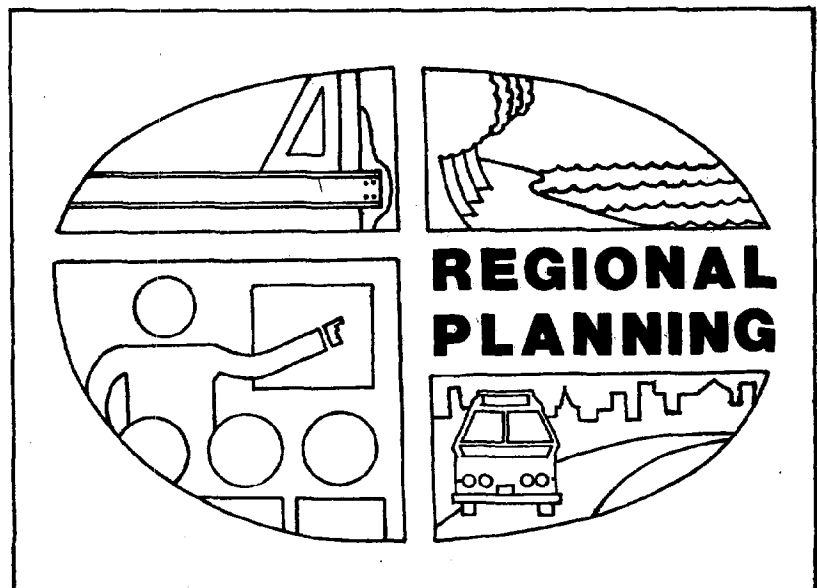
OPEN SPACE AND RECREATION PLAN

for the

TOWN OF GREENLAND

June, 1989

SB
483
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R63
1989



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Prepared for the

CONSERVATION COMMISSION

and the

PLANNING BOARD

by the

ROCKINGHAM PLANNING COMMISSION

U. S. DEPARTMENT OF COMMERCE NOAA
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PREFACE

"What are the natural features which make a township handsome? A river, with its waterfalls and meadows, a lake, a hill, a cliff or individual rocks, a forest, and ancient trees standing singly. Such things are beautiful; they have a high use which dollars and cents never represent. If the inhabitants of a town were wise, they would seek to preserve these things...for such things educate more than any hired teachers or preachers...

It would be worth the while if in each town there were a committee appointed to see that the beauty of the town received no detriment. If we have the largest boulder in the county, then it should not belong to an individual, nor be made into door-steps.

As in many countries precious metals belong to the crown, so here more precious natural objects of rare beauty should belong to the public.

Not only the channel but one or both banks of every river should be a public highway. The only use of a river is not to float on it."

- Henry David Thoreau
1861

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I. INTRODUCTION

I. INTRODUCTION

The Town of Greenland possesses a rich legacy of forest and fields, streams and marshes, hilltops and shores. Together, these exceptional natural resources provide the Town's citizens with clean water, habitat for wildlife, protection from flooding, aesthetic and recreational enjoyment, and, in general, a high quality of environment.

But these features are being continually threatened by development, and their conservation and recreational values will be lost if steps are not taken to protect them. The unprecedented population growth of recent years is resulting in increased traffic congestion on the roads, the development of forests and farms, decreased recreation opportunities, and the loss of scenic views. These trends will continue - to the detriment of both present and future generations - unless a coordinated plan for natural resource preservation is adopted.

The following plan incorporates natural resource planning principles in order to guide future development toward the most suitable lands, and away from sensitive resource-rich areas with high open space value. It identifies the Town's most important open spaces, and recommends strategies for their protection. Used in conjunction with Greenland's Master Plan, this document can serve as a useful guide for public officials and citizens in their efforts to achieve a balance of community growth and protection of the natural environment.

II. OPEN SPACE - GENERAL DESCRIPTION

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A. MULTIPLE RESOURCE VALUES

This plan provides the Greenland Conservation Commission with a general natural resources inventory of the Town. This inventory is used to examine present conditions, and identify any resource problems or opportunities. Using these areas of critical concern as a base, the plan presents recommendations and strategies for their protection.

For the purposes of this plan, open space is defined as sites having natural resources and features worthy of conservation or protection. It can be comprised of areas that contain forests, farmland, floodplains, or wetlands. Open space can also be scenic vistas, recreational areas, or historic sites.

Too often open space is considered to be merely lands that are not currently being used. The multiple resource values of open space lands are often overlooked. Open space values can be categorized as follows:

- 1) recreation;
- 2) forestry and agriculture;
- 3) environmental protection, (e.g. erosion control, flood retention, ground-water recharge);
- 4) habitat for flora and fauna;
- 5) aesthetics, (i.e., pleasant scenery, visual relief, maintenance of rural character);
- 6) education/research; and
- 7) historic/archeological sites.

It is difficult to quantify all of the benefits which open space provides, especially in monetary terms. Most public open space uses have a relatively low economic return in the short-term, and a low frequency of use for any one individual. Open space is usually considered to be a community resource; therefore public action and control are often the most practical sources of preservation efforts.

B. ECONOMIC CONSIDERATIONS

Traditional arguments favoring the preservation of open space have not rested upon economic considerations. Instead they have been based upon the need for conservation of natural resources, the need for public recreation facilities, and the attractiveness of green spaces. However, in addition to these factors, open space lands can produce substantial economic benefits. Open space creates economic values in the following ways:

- 1) Prevents public expenditures in the sense that other types of development can have a net cost to the Town, especially residential development;
- 2) Produces private income through commercial open space uses, including golf courses, agricultural business and timber harvesting;

- 3) Adds value to adjacent properties; and
- 4) Maintains the various "natural process" values which if disrupted may require enormous expenditures to restore. These values, which may be considered "avoided costs", are further described below.

A common argument against open space preservation is that it results in the loss of potential property tax revenues for the community. This statement may be generally valid for industrial and commercial development, but does not hold true for most residential development. For example, the residents of new neighborhoods, having made substantial personal investments in their new homes, expect to receive adequate public services (e.g., education, safety, road maintenance, etc.) in return for their property taxes. So, the "increased tax base" argument assumes that "residential development produces public revenues in excess of public costs." But, according to a study by the American Farmland Trust, this assumption has almost always proven false: "...the costs of the public services required to serve new residential communities usually exceeds the tax revenues generated by the them..." (source: Density - Related Public Costs, American Farmland Trust, Washington D.C., 1986). As a case study, the Trust evaluated the municipal finances for Loudoun County in Virginia. For every \$1.00 of tax revenue generated by the Residential sector, \$1.28 in residential services was expended. The fiscal impacts of residential development have been similar throughout New Hampshire. Therefore, as a general rule, conventional residential development rarely "pays for itself".

Another factor to consider when assessing the economics of maintaining open space is that once open space is developed, a wide array of private and public benefits are lost. Open space can provide sustained economic production which, over the long-term, may exceed those from development options. Examples of open spaces which provide direct monetary returns include a farm field, timber stand, campground, or golf course. In addition, user fees charged for income-producing lands owned by the Town could be contributed to a specific fund for open space acquisition.

An example of a less direct but measureable economic benefit is what has been termed "location rent", which is the added property value of a house or lot situated close to protected open space. According to the National Association of Home Builders, it is not uncommon for the value of building sites to be enhanced by 15 to 20 percent in the vicinity of park and recreation areas. The increased value to the landowner from preserved open space is shared by the municipality as well. Because relative property values are higher, assessed valuations and tax revenues are also higher.

In some circumstances, it is possible to express the "natural process values" of open space in the dollar terms of traditional economic analysis. For example, the value of fish production from a given water body can be calculated. After a flood occurs, the negative value of houses built within the floodplain can be determined by assessing the flood damage costs. The value of an aquifer can be calculated by determining the replacement cost (the cost of obtaining water elsewhere when the water supply has been polluted or the recharge rate diminished). But the intrinsic values of open space (e.g., scenic views, unique ecological areas, or historic sites) are more difficult to quantify. Still, these intrinsic values are important to consider because they are an integral part of the Town's character and natural heritage.

III. PHYSICAL CHARACTERISTICS AND LAND USE

III. PHYSICAL CHARACTERISTICS AND LAND USE

A. LOCATION AND SIZE

Greenland is located within the "first tier" and "second tier" boundaries of the New Hampshire Coastal Zone. It is bordered by the Great Bay as well as the City of Portsmouth and the towns of Rye, North Hampton, Greenland, Newmarket, and Newington (see Map 1 - "Location Map"). The Town boundaries encompass an area of 14.1 square miles (9,024 acres), and of that, approximately 2.6 square miles (1,664 acres) fall within Great Bay. Greenland also contains a "second tier" area of the New Hampshire Coastal Zone, along the tidal portion of the Winnicut River.

B. GEOLOGY

Introduction

Topography and soils influence the suitability of land for various uses. These land features are shaped primarily by surficial geology which in turn is a product of the most recent glacial period. The following discussion on geology is presented as a prelude to the Topography and Soils sections.

1. Bedrock Geology

In southeastern New Hampshire, bedrock was formed from layers of ocean-bottom sediments deposited and compacted over millions of years into sedimentary rock. These rock formations were transformed through uplifting, folding, and tremendous heat and pressure into metamorphic rock. Virtually all of the bedrock in Greenland falls into this category. Three types of metamorphic rock are found: the Eliot formation running in a north/south direction through the northwestern part of Town; the Rye Gneiss formation found in the southeast part of Town; and the Kittery formation running between the two.

This geologic process was augmented by the rising of molten rock of a volcanic origin. Once cooled and hardened, this material became igneous rock. Small traces of an igneous formation are found on the Greenland border near the Winniconic Mill, and on the Rye border. Map 2 - "Flood Hazards and Bedrock Geology" - depicts the fault lines of Greenland's bedrock formations.

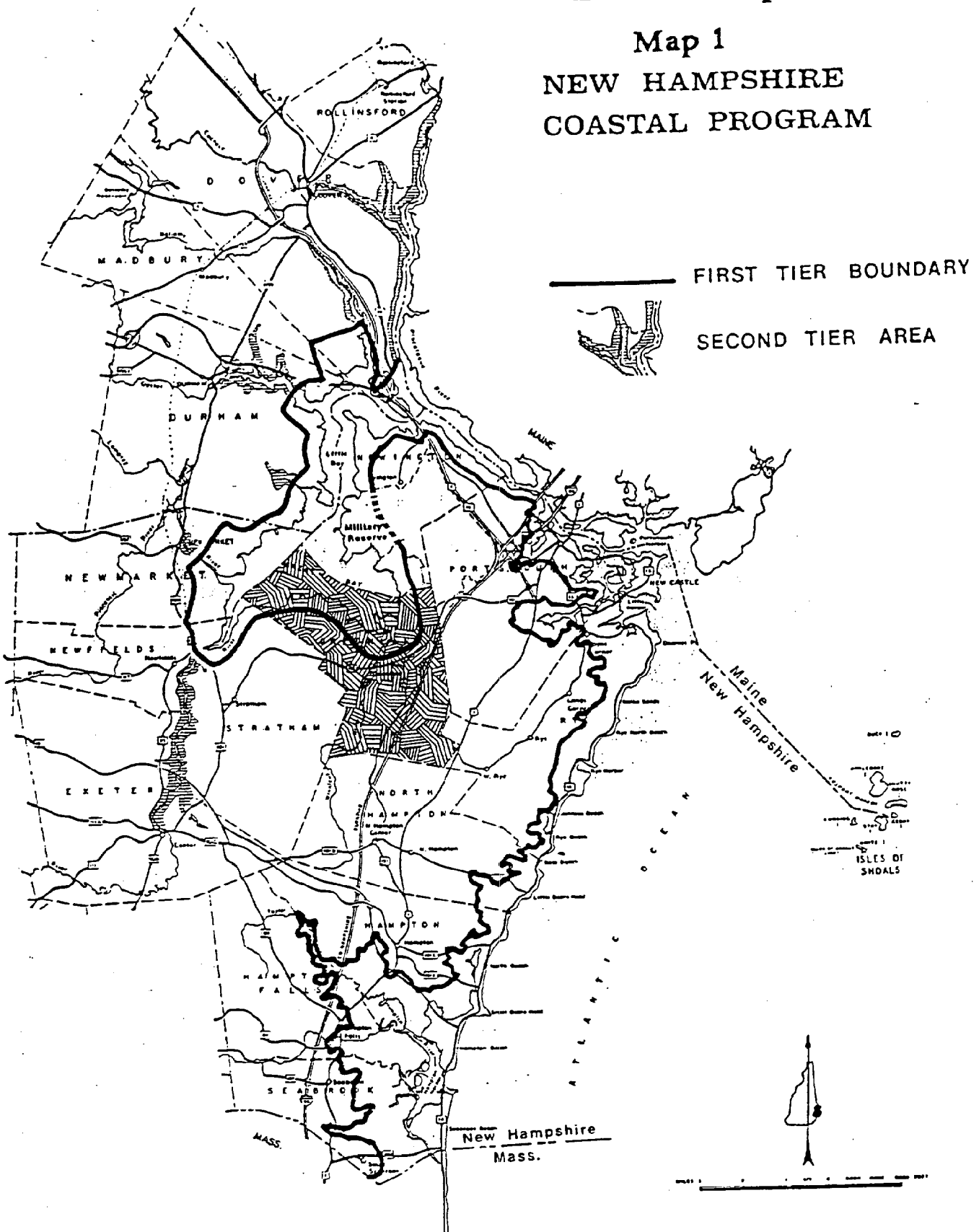
2. Surficial Geology

Surficial deposits overlie bedrock and are comprised of glacially deposited unconsolidated clay, silt, sand, and gravel. Permeabilities vary for this material depending on the size and shape of the particles, the heterogeneity of the mixture, and the degree to which the material has been sorted. In southeastern New Hampshire, these materials were deposited more than 10,000 years ago. There are five types of surficial materials in Greenland (described below).

Till originated as debris either frozen within or pushed beneath the glacial ice sheet. When the ice melted, this material was plastered onto the surface of the bedrock. As a result, till is a mixture of rock fragments ranging in size from boulders to minute clay particles

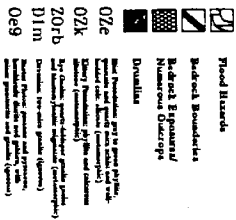
Location Map

Map 1 NEW HAMPSHIRE COASTAL PROGRAM



NEW HAMPSHIRE OFFICE OF STATE PLANNING 1966

Map 2



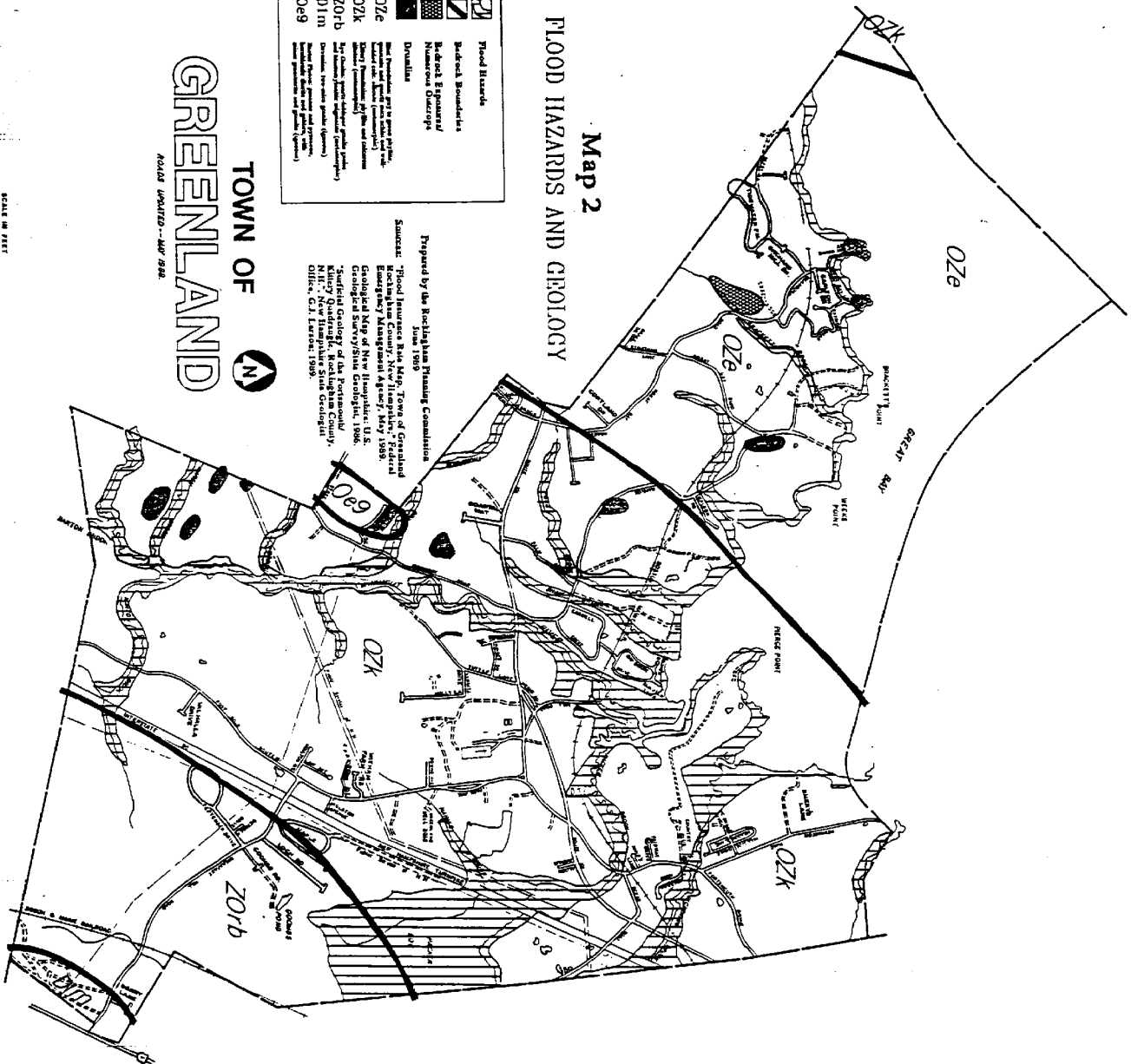
Prepared by the Rockingham Planning Commission
June 1989

"Flood Insurance Rate Map, Town of Greenland, Washington County, New Hampshire," Federal Emergency Management Agency, May 1989.

Geological Survey of New Hampshire: U.S. Geological Survey/State Geologist, 1986.

"Sacred Ground of the Portsmouth Military Quadrangle, Rockingham County, N.H.," New Hampshire State Geologist Office, G.J. Larson, 1989.

ROADS UPDATED -- MAY 1988.



A horizontal scale bar with markings at 0, 1000, 2000, and 3000 feet. The text "SCALE IN FEET" is written vertically above the scale.

which fill the smallest voids between material. Thus, till deposits are usually of low porosity and are relatively impermeable. Little groundwater can be stored in or flow through such small spaces. Till deposits are relatively thin compared to those of stratified drift, and wells drilled in till yield only small volumes of groundwater.

Roughly one-quarter of Greenland's surficial geology is characterized by till. Till formations are located primarily along the Town's western, southern, and eastern borders.

Stratified drift was formed by glacial material that was transported and deposited by meltwater streams. Its materials, ranging in size from sands to cobble gravels, were worked and reworked by flowing water and as a result, are well sorted. They are also loose and coarse in texture. These characteristics result in a porous and permeable material through which groundwater can flow quite readily. Stratified drift aquifers have potential to yield large volumes of water to a well and are therefore prime sources of water for municipalities and other large-volume water users.

A relatively large stratified drift formation has been identified by the N.H. State Geologist Office. This formation may contain large quantities of water which would be suitable for a municipal water supply. (See Map 8 - "Aquifers" and Section IV.C for further discussion.)

Stream alluvium is comprised of sand, silt, and some gravel in floodplains and along rivers and streams. Alluvial deposits indicate areas subject to flooding. Greenland's greatest concentration of these deposits are along the Winnicut River valley.

Marine deposits are comprised of sand, silt, and clay. These surficial deposits were formed as follows: the melting glacier caused a rise in sea level and the inundation of most of southeastern New Hampshire; marine sediments were formed along the bottom of the ancient sea and its bays and estuaries; the land elevation gradually rose, as the weight of the glacier decreased, and the sea level retreated to its present position leaving the marine deposits on what is now upland. The land north of Route 101 toward Great Bay is predominantly marine deposits.

Swamp deposits are comprised of muck, peat, silt, and sand. These formations are generally five to ten feet thick, but may be as thick as 20 feet. Swamp deposits can be found along Great Bay and within Packer Bog.

C. TOPOGRAPHY

Greenland's terrain is predominantly rolling with gentle slopes of 0-8 percent. The topography ranges from a low of slightly above mean sea level at the shores of Great Bay to a high of about 100 feet at Breakfast Hill.

The valleys between the uplands consist of pockets of wetlands and small ponds and brooks. The Winnicut River, Greenland's most significant river, flows northerly through Town to Great Bay. The tidal portion of the River,

as well as the shores of Great Bay, are characterized by alluvial plains and tidal marshes. In addition, Great Bog - a wetland of regional significance - is located at the Portsmouth border.

A group of eight drumlins, from 60 to 80 feet in elevation, are located along Greenland's western border. Drumlins are hills with smooth, rounded surfaces, consisting almost entirely of glacial till deposits. These interesting landforms are depicted on Map 2 - "Flood Hazards and Geology."

D. SOILS

Knowledge about soils is critical in making sound land use decisions. With information regarding soil characteristics and their limitations for development, development can be directed to those areas most suitable and away from those areas least suitable. For example, residential development should be located away from areas with unstable soil conditions, high water tables and slow percolation rates because of the constraints for foundations and septic systems. Other soils are better suited for agricultural use because of level topography, good drainage and lack of stoniness -- important considerations in defining and establishing agricultural districts.

1. Development Suitability

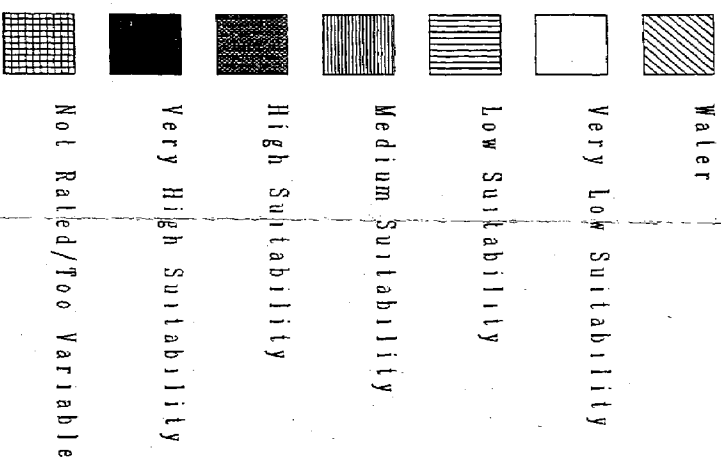
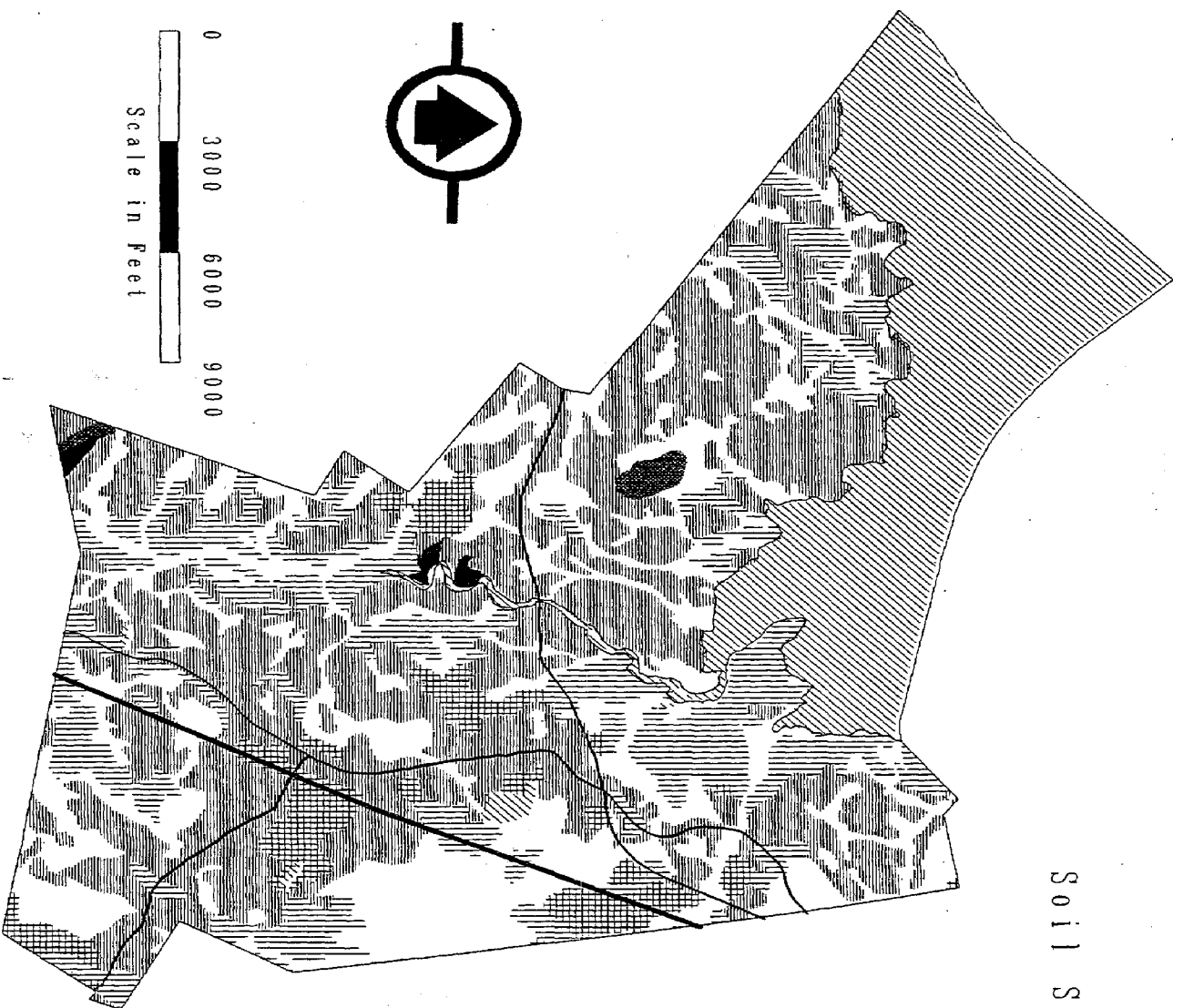
The lack of a centralized sewer in Greenland has heightened the importance of soil-based information in the land use planning process. The dependence on on-site wastewater disposal requires careful evaluation of soil conditions to ensure adequate wastewater disposal and protection of public health and the environment. Poor soils and steep slopes cause severe limitations for on-site sewage disposal systems, hence restricting development. Map 3 - "Soil Suitability for Septic Systems" - depicts the general areas of Greenland which have different soil potentials for septic system development. Five categories were used based on assorted soil characteristics. For example, soils with low and very low suitability typically have limitations due to steep slopes or high water tables (as well as high shrink-swell properties, short depths to bedrock and stoniness).

2. Agriculture and Forestry

Soils information has not only proven to be an excellent indicator of general development suitability, but also of critical resource areas such as wetlands, prime agricultural land, forest land, and wildlife habitat.

Important agricultural soils include "prime farmland" and "farmland of Statewide importance". As defined by the U.S.D.A. Soil Conservation Service, prime agricultural soils include those that are best suited for producing food, feed, forage, fiber, and outseed crops. Prime farmland has the soil quality, growing season and moisture content needed to produce sustained high yields when managed according to modern farming methods. It can be farmed continuously or nearly continuously without degrading the environment and will produce the most for the least amount of energy used; it requires the least investment to remain productive and is not susceptible to the leaching

Town of Greenland Soil Suitability for Septic Systems Map 3



Sources: "Soils Potential for Development - Rockingham County", U.S.D.A.-Soil Conservation Service and Rockingham County Conservation Dist., May 1987.
Rockingham County, N.H. Soils Map: U.S.D.A.-Soil Conservation Service, July 1983.
Preliminary Data - Subject to Change
Prepared by the Rockingham Planning Commission, May 1988. SRC

of fertilizer or pesticide applications (source: Soils of New Hampshire; S.A.L. Pilgrim and N.K. Peterson; N.H. Agricultural Experiment Station, UNH and U.S.D.A. SCS; December 1979). "Farmland of Statewide importance" has many of the same attributes as "prime farmland" but is generally of lesser quality.

As depicted on Map 4 - "Farmland Soils," Greenland contains an extensive amount of agricultural soils. In fact, Greenland has one of the highest percentages of agricultural soil (49%) in Rockingham County (Newington has 64%, Stratham has 60%).

The U.S.D.A. Soil Conservation Service has also evaluated soils according to their suitability as woodland soils. In general, soils which are suitable for growing crops are suitable for growing trees as well.

The soils information mapped in this section was taken from a soil survey map for the Town of Greenland, which was prepared by the Soil Conservation Service in July 1983, and digitized by the Complex Systems Research Center (UNH). Soil maps are an important tool for making generalized land use determinations. However, these maps are not intended for site-specific evaluations due to their scale, accuracy, and the likelihood of other soil types being found within the broader classifications. For specific assessments, on-site field investigation is necessary.

E. LAND USE AND ZONING

1. Land Use

The previous sections focused on the natural, pre-developed conditions of land in Greenland and various open space land uses. These conditions, however, are modified by man-made changes in land use. For example, soils may be classified as suitable for agricultural use, but once the land is used for a commercial site or a "grid" subdivision, these soils are no longer suitable for farming.

Approximately one-third of Greenland is forested, and about 15% is in farmland. During 1953 to 1974, 18% of the Town's farmlands and 43% of the Town's forested lands were lost to development. Between 1974 and 1982, Greenland lost an additional 19% of forest land and 26% of farmland to development. Overall, about 90 acres per year were converted to urban uses between 1953 and 1982. This trend toward urbanization, consisting primarily of residential development has led to a corresponding reduction in open space. Table 1 shows the acreage estimates of different land use categories for those years.

Table 1

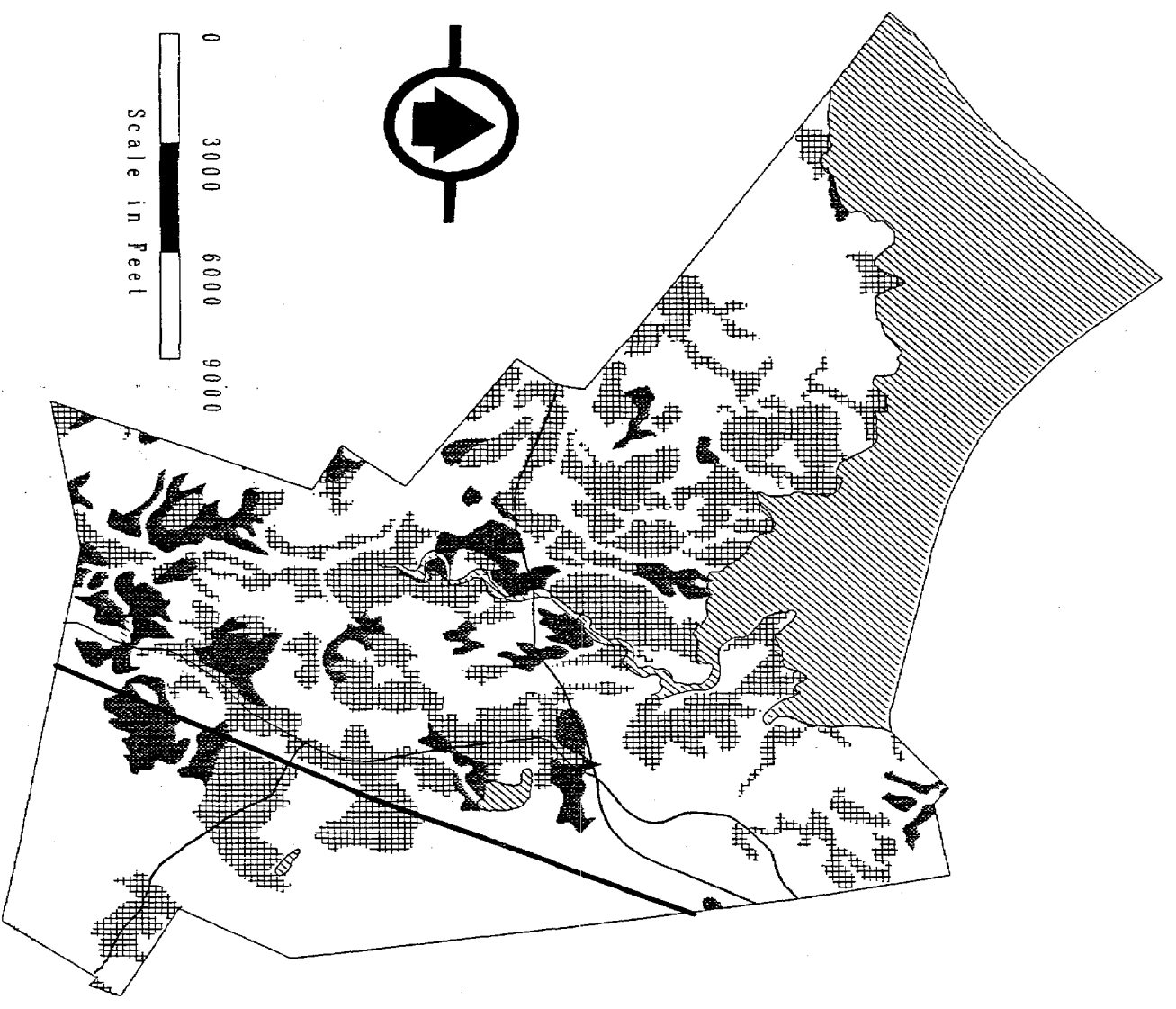
EXISTING LAND USE: 1953, 1974, 1982

Town of Greenland, New Hampshire

<u>Land Use</u>	<u>1953</u>	<u>1974</u>	<u>1982</u>	<u>% Change 1953-1982</u>
Agriculture	2,540	1,245	1,040	-59.0
Developed	670	2,645	3,370	503.0
Forest	3,065	2,720	2,150	-29.8
Idle	130	145	75	-42.3
Other (marshland, etc.)	190	100	40	-78.9
Water	1,965	1,885	1,885	- 4.1
Total Acreage:	8,560			

Source: Land Use Change: Rockingham County, New Hampshire, 1953-1982; Wm. Befort, A.E. Luloff, M. Morrone; NH Agricultural Experiment Station, UNH, Durham, NH; 1987.

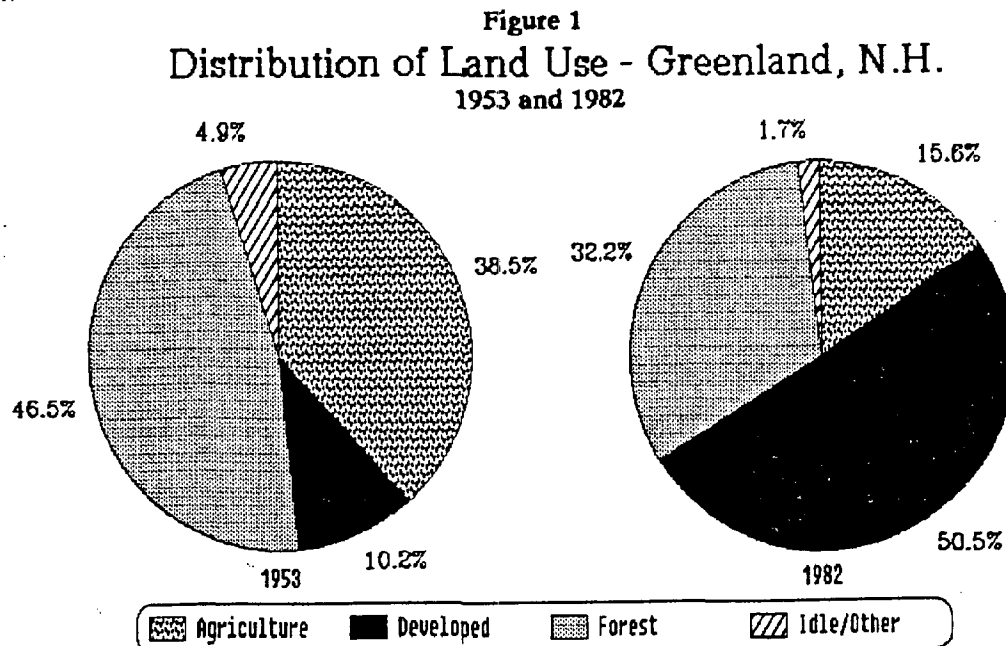
Town of Greenland Farmland Soils Map 4



-  Water
-  Prime Farmland
-  Farmland of Statewide Importance

Sources: "Important Farmlands in Rockingham County, New Hampshire", U.S.D.A.-Soil Conservation Service and Rockingham County Conservation Dist., Feb. 1986.
 Rockingham County, N.H. Soils Map: U.S.D.A.-Soil Conservation Service July 1983
 Preliminary Data - Subject to Change.
 Prepared by the Rockingham Planning Commission, June 1989. SRC

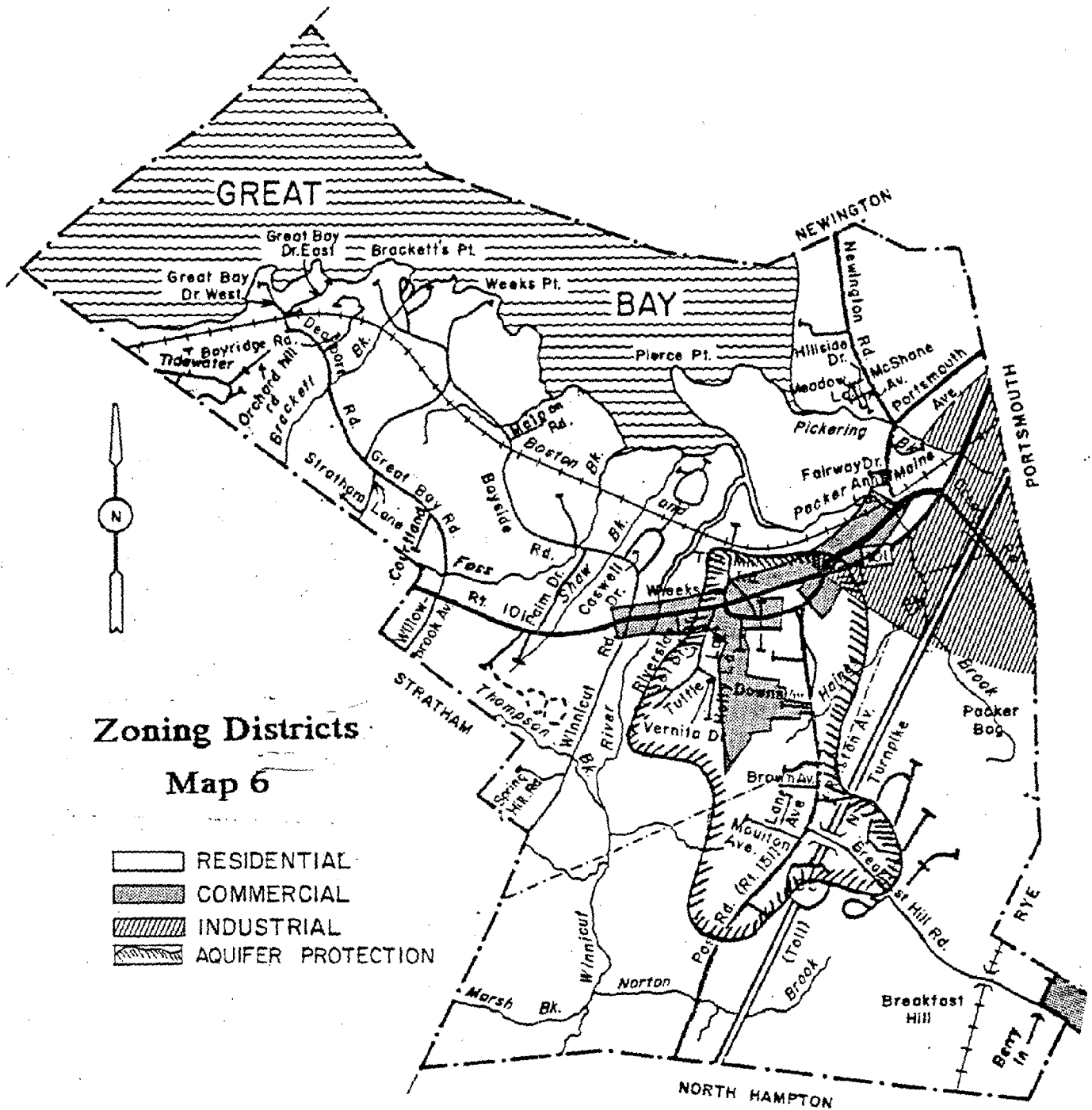
Figure 1 - "Distribution of Land Use" - provides a graphic illustration of the land use changes between 1953 and 1982.



Map 5 - "Existing Land Use" - provides information on the location and type of land uses in Greenland and provides an overall look at the pattern and configuration of land uses. The Town has continued to develop primarily along its existing roads. Commercial development, while expanding, has been restricted to N.H. Route 101 and Portsmouth Avenue. The amount of land used for industrial purposes has increased, with this growth taking place primarily in conjunction with older industrial uses. All of Greenland's industrial uses are located at the east end of Town on Route 101 or Ocean Road.

2. Zoning

Another consideration for open space planning is the Town's zoning districts. Greenland presently has four zoning districts: Residential, Commercial, Industrial, and Aquifer Protection. The Aquifer Protection District is an overlay district superimposed on all other districts and is intended to "protect, preserve and maintain potential groundwater supplies and related groundwater recharge areas within a known aquifer..." These zoning districts are depicted on Map 6 - "Zoning Districts".



0 1/4 1/2 3/4
Scale in Miles

GREENLAND

IV. OPEN SPACE VALUES, INVENTORY, AND ANALYSIS

IV. OPEN SPACE VALUES, INVENTORY, AND ANALYSIS

As was mentioned in Section II, open space lands have many resource values. For the purposes of this plan, the resource values of open space are:

A) recreation; B) forestry and agriculture; C) environmental protection; D) habitat; E) aesthetics; F) education/research; and G) historic/archeological sites.

Section IV describes each of the seven open space values, and provides a descriptive inventory. For analysis, the Town's needs are evaluated, and recommendations given.

A. RECREATION

1. Values

The importance of outdoor recreation is widely accepted. It is one of the best ways to understand and appreciate the environment. For many residents, the decision to live in Greenland is strongly influenced by the diversity of opportunities to interact with the environment through outdoor recreation. Overall, recreational opportunities are of value for individual enjoyment, building of community through group activities, and educating both children and adults about open spaces and natural resources.

2. Inventory

Greenland has many locations for outdoor recreation. Activities which take place on general open spaces throughout Town include boating, fishing, hunting, hiking, jogging, picnicking, bird watching, horseback riding, bicycling, cross-country skiing, and snowmobiling. Some of these activities also take place at the Town's designated public recreation facilities. Golfing, camping, and shooting are types of recreation which take place at Greenland's private recreation facilities.

Greenland's public recreation facilities include the following: Sunset Field, Caswell Park, Central Elementary School, Ralston Park, the Winnicut River Dam access, Town Landing, Depot Road Landing, and Breakfast Hill Park. In addition, six private recreational facilities are located in Greenland: the Portsmouth Country Club, the Portsmouth YMCA, the Piscataqua Fish and Game Club, Liberty Tree Campground, and Emery's Landing. These recreation areas are marked on Map 10 - "Open Space Values" - and are further described below.

a. Public

- (1) **Sunset Field.** This field, located behind the Town Offices along Portsmouth Avenue, is a regulation-sized baseball field, and has bleachers and lights for night-time play. It is used for Babe Ruth baseball, Junior High School baseball, and two Men's softball leagues.
- (2) **Caswell Park.** Located at the corner of Caswell Drive and Bayside Road, the Park contains one regulation-sized baseball field (with dug-outs), two tennis courts, and a basketball court. The site

is 2 1/2 acres in area. The baseball field is used by three Little League teams and two Minor League teams.

- (3) **Central Elementary School.** The site is 3 1/2 acres and is located in the center of Town along Post Road. Behind the school there is a playground with swings, slides, and a jungle-gym made of tires. A small baseball field, used by six Girl's softball teams, is situated next to the playground.
- (4) **Ralston Park.** This Town park abuts the Winnicut River, and is at the corner of N.H. Route 101 and Riverside Drive. The park is about 1/4 acre and has no facilities.
- (5) **Winnicut River Access.** This 1/2 acre parcel is owned by the State of New Hampshire, and managed by the N.H. Fish and Game Department. The site has an un-paved boat access point, and is a popular area for fishing. Parking is very limited.
- (6) **Town Landing.** The Town Landing, located at the end of Tide Mill Road where it meets the Winnicut River, is suitable only for launching un-trailerred boats. The Town owns no land outside of the right-of-way.
- (7) **Depot Road Landing.** This site is located at the end of a path which starts at the end of Depot Road. The area has no parking, and access is limited to foot travel. Like the Town Landing, Greenland owns no land outside of the right-of-way.
- (8) **Breakfast Hill Park.** The Park is situated in the southeastern tip of Greenland, on the northern side of Breakfast Hill Road, and is used for picnicking. This 3/4 acre park contains no facilities but is of historical significance, as described in Section IV.G.

b. Private

- (1) **Portsmouth Country Club.** This facility is accessed by Portsmouth Avenue, and contains an 18-hole golf course with a club house and a few out-buildings. This impressive site is situated on 253 acres abutting Great Bay. Within the parcel is a scenic outlook of the Bay, known as Pierce Point, which is also the first landing site of the Colonial people, on what was to be incorporated as the Town of Greenland.
- (2) **Camp Gundalow.** This 13-acre site is owned by the Portsmouth YMCA and is located at the end of Tuttle Lane. It is a summer camp for children. It includes a basketball court, swimming pool, playing area, and cabins. The facility is listed for sale as of June 1989.
- (3) **Piscataqua Fish and Game Club.** Located at the end of Tuttle Lane, the main activity at the Club is target-shooting. The site is 18 acres and contains a small shed.
- (4) **Liberty Hill Campground.** This 8-acre facility is located off of N.H. Route 101 and is used primarily by recreational (camping) vehicles.

(5) **Spruce Meadow.** The entrance to this site is located in Portsmouth along Ocean Road, just beyond the Town line. The site contains a "Par 3" golf course, one tennis court, and an out-building; and totals about nine acres in area within Greenland.

(6) **Emery's Landing.** Located at the end of Emery's Lane, this site is used primarily as an access area for ice-fishing shanties.

3. Analysis

The New Hampshire Office of State Planning has established guidelines to assist communities in recreation planning. Table 2 - "Selected Standards for Outdoor Recreation Facilities and Present Needs" - lists certain standards from OSP's 1989 State Comprehensive Outdoor Recreation Plan. Standards for recreational facilities are helpful in evaluating town needs for playfields, ball courts, and playgrounds, and can be used for preliminary planning. However, standards can be unresponsive to any special needs a town may have.

Table 2

Selected Standards for Outdoor Recreation Facilities and Present Needs

Town of Greenland, New Hampshire

<u>Facility</u>	<u>Standard Per^a 1000 Persons</u>	<u>Greenland^b Standard</u>	<u>Existing Facilities</u>	<u>Facility Needs</u>
Baseball Diamond	1.1	2-3	3	0
Basketball Courts	0.8	1-2	1	0-1
Boat/Fishing Access	1.8	4	3	1
Ice Skating Area	0.14	0-1	0	0-1
Open Space/Natural Areas (acres)	51.0	114	209 ^c	0
Parks, Community (acres)	6.0	13-14	1	12-13
Playgrounds (town and school)	0.5	1-2	1	0-1
Soccer Fields	0.16	0-1	0	0-1
Tennis Courts	0.95	2-3	3	0
Trails, Hiking (miles)	2.2	4-5	0	4-5

^a Source: New Hampshire Outdoors 1988-1993; N.H. State Comprehensive Outdoor Recreation Plan; Office of State Planning and Department of Resources and Economic Development; 1989.

^b Based on a Town population of 2,231 (Source: "1987 Population Estimates of New Hampshire Cities and Towns;" August 1988).

^c Sum total of accessible land consisting of: Town-owned "Vickery" land (24 acres), Packer Bog land (140 acres), land adjacent to Moulton Avenue (5 acres) and State-owned land by Great Bay (40 acres).

The recreational activities which take place in Greenland have been grouped into five categories: a) organized sports; b) family-related recreation; c) water-related recreation; d) trail-related recreation; and e) hunting.

- a. **Organized Sports.** This category includes activities such as baseball, softball, basketball, tennis, and golf. Even though Table 2 indicates that the Town has three baseball diamonds, the field behind the Central School is under-sized. According to the Greenland Recreation Commission, the Town needs another baseball field as well as a soccer field. Table 2 also shows a potential need for a soccer field and a basketball court.
- b. **Family-Related Recreation.** This category involves facilities such as playgrounds, skating areas, campgrounds, and picnic tables. Although a few of these facilities do exist, the Town is deficient in some areas. Greenland has no sizeable community park and virtually no picnicking facilities. Table 2 suggests that the Town needs a 12 to 13 acre community park. There is also a potential need for a playground and an ice skating area.

In order to meet its recreation needs, the Town should seriously consider purchasing Camp Gundalow (previously described). This is a 13-acre site which could be developed into a fine community park.

- c. **Water-Related Recreation.** Relative to other towns within Rockingham County, Greenland has many streams and rivers. The Town also contains an extensive shoreline along the Great Bay. Water-related recreational activities include shell and fin fishing, boating, swimming, and skating.

The Winnicut River and Great Bay are the most commonly fished water bodies in Greenland. (The Winnicut River is used for skating as well.) Another popular fishing area is at an unnamed pond, located along Post Road, where the pond is stocked and a fishing derby is held every summer.

The Winnicut River and Great Bay are currently being stocked with anadromous fish by the N.H. Fish and Game Department as part of a Statewide restoration program. This program involves stocking the River with game fish such as rainbow smelt, river herring, American shad, Pacific salmon, steelhead, brown trout, and Atlantic salmon. Great Bay also supports recreational and commercial shellfishing for oysters and, to a lesser extent, clams.

The Winnicut River and Great Bay are also the most suitable waters for boating. Canoeing is particularly popular along the Winnicut River. As previously described, Greenland has three public access areas: the Town Landing, Depot Road Landing, and the N.H. Fish and Game access at the Winnicut River Dam. Since the Town-owned landings have such a limited area, the Town should investigate acquiring additional land at these sites. Moreover, Table 2 indicates that the Town is in need of one more boating/fishing access area.

Aside from some swimming at the Winnicut River Dam, there are no waters within Greenland that have sufficient volume and/or access to be suitable for swimming.

All water-related recreation requires high water quality for an ideal experience. Poor quality affects the safe enjoyment of water recreation and impairs its aesthetic appeal. Greenland must safeguard its surface water quality, particularly that of the Winnicut River and Great Bay, in order to provide the opportunity of sports fishing and swimming for present and future townspeople.

- d. **Trail-Related Recreation.** There are many examples of small communities creating trail systems accessible to the public. These trails can be used for hiking, walking, jogging, bicycling, cross-country skiing, and horseback riding. Trails can also be segregated for recreational vehicles such as snowmobiles.

In the Seacoast Region, the Town of Hampstead provides the best example of a multi-purpose trail system, developed and managed by the community. This system consists of a public trail network which offers a variety of recreational, environmental, and educational opportunities within reasonable reach of every resident's home.

An interpretive guide, which describes points of interest throughout the trail system, is available. For more information on developing a public trail system, see the Feasibility Study Report - A Town-wide, Multi-purpose Trail System for Hampstead, New Hampshire (by E.B. Shore, in collaboration with the Hampstead Trails Committee, and the Hampstead Recreation Commission; May 1988).

Much of Hampstead's efforts involved contacting private landowners to gain access across their land to expand the trail system. Landowners have opted to donate their land, sell or donate ten-foot strips across their land (outright or by easement), or sign an agreement which "permits passage". Under the latter agreement, landowners have the option to revoke that permission if the trail is ever misused or the land is vandalized. In terms of liability, there are N.H. statutes which legally protect landowners who allow the public to use their land for recreational purposes. These landowners cannot be sued for injuries if they do not charge a fee and are not willfully negligent.

At present, Greenland has no public land designated for trail-related recreation. Table 2 indicates that the Town should have four to five miles of hiking trails.

Even with the substantial population growth of the 80's, the Town of Greenland still has numerous locations on which to create a green-belt/trail network. The Town should focus its attentions in the following areas: 1) along the Winnicut River and Great Bay; 2) along areas that would link publicly-owned open space parcels throughout Town, especially along Great Bay; and 3) within the area of Packer's Bog. A trail system through Packer's Bog could consist of an elevated boardwalk with botanical labels and interpretive markers along its length. (See Map 11 -

"Protected Open Spaces and Public Lands" - for parcel identification.)

- e. **Hunting.** The Great Bay estuary is an important way-station on the Atlantic waterfowl "fly way" which has resulted, for generations, in excellent bird-hunting opportunities. Other types of game that are hunted in Town include deer, coyotes, raccoons, rabbits, and pheasant. The best hunting areas in Greenland are Packer Bog, the large undeveloped tracts in the southern part of Town, and in the area between Bayside Road and Week's Point.

The Piscataqua Fish and Game Club provides recreational opportunities for hunters in the Region.

It can be stated generally that, as Greenland grows, the Town needs to maintain and expand its recreational opportunities. The Town should consider its projected population growth and, in turn, plan for and protect its critical open space lands. Otherwise, existing open space areas and facilities will become overused, to the detriment of all users and to the environment.

B. AGRICULTURE/FORESTRY

1. Agriculture

a. Values

Aside from its obvious agricultural importance, farmland has value as a scenic and recreational resource, as wildlife habitat, and as an area for aquifer recharge. Farming also has economic and social importance, especially to the local and regional economy.

1) Recreation and Scenic Quality

Farmlands are typically wide open areas of rolling fields and pastures. They provide pleasant scenery and act to maintain a town's rural character. In addition, farmlands are well-suited for many types of recreation, including hunting, cross-country skiing, and birdwatching. But cropland and open fields are frequently the most imperiled areas in a community because these lands are the easiest to develop. It is ironic that the attractiveness of a town's rural character threatens its existence, as farmlands are developed into residential neighborhoods.

2) Wildlife

The habitat requirements of many wildlife species, e.g., pheasant, grouse, songbirds, mice, rabbits, woodchucks, foxes, and deer, include open fields and the edges between fields and woodland. The loss of farmland thereby restricts the habitat and range of resident wildlife.

3) Aquifer Recharge

Groundwater supplies are replenished by the infiltration of water through the ground. Infiltration cannot occur if the ground surface is overlain with impervious material such as roofs and pavement. Agriculture is a desirable land use in an aquifer recharge zone, as it permits the unimpeded flow of water into the ground. Moreover, the soils which are most suitable for agriculture - those which retain moisture for plants - function also as water filters, and thus provide ideal recharge conditions. The loss of farmland to development means both the loss of critical recharge surface area and the loss of water volume, as runoff is artificially directed away from the development.

However, some agriculture practices, particularly the use and storage of highly concentrated fertilizers and pesticides, can have serious negative impacts on groundwater resources. Proper agricultural management will prevent nutrient, bacterial, or chemical contamination to the groundwater.

4) Economic and Social

Farming as an industry and as a land use have direct and indirect economic values. The local production of foodstuffs reduces the costs of transporting the goods to the markets, while delivering fresher products to the consumer. With local businesses as the marketplace, the retail trade income is enhanced, while consumer prices are kept low. Finally, the operation of a farm requires support industries such as farm equipment sales and service, and the sale of feed, fertilizer, and other supplies.

As discussed in Section II.B, the indirect economic benefits of farming relate to the value of the farmland itself compared to the cost of providing public services to residents. When a residential subdivision consumes farmland, the cost to the Town to provide services to additional families is typically greater than the increased property tax revenue.

b. Inventory

Many areas throughout Greenland are currently being used for agriculture. These areas are depicted on Map 10 - "Open Space Values". In Town, agricultural lands are used to grow the following: hay, feed corn (for silage), and forage crops (for grazing). To a lesser degree, other agricultural products are grown, such as fruits and vegetables for direct wholesale or retail sale.

Table 3 - "Principal Commercial Farms" - lists Greenland's significant commercial farms, including their general classification and contiguous land area. The farm locations are depicted on Map 10.

Table 3

PRINCIPAL COMMERCIAL FARMS

Town of Greenland, New Hampshire

<u>Farm Name</u>	<u>Type</u>	<u>Estimated Contiguous Acreage</u>
Weeks Farm	Dairy	160
Ye Olde Allen Farm	Fruit (apples, strawberries)	25
Hodgdon's Turkey Farm	Poultry (turkey)	20
Parker Tree Farm	Fruit (apples)	15

c. Analysis

As in other parts of Rockingham County, the contribution of agriculture to the Town's economy and work force has been steadily declining. This trend was discussed in Section III.E. If agricultural land conversion continues at past rates, then the future of farming in Greenland looks bleak.

However, there are currently several mechanisms designed to aid the farmer and save farmland. These include the current use assessment program; the Trust for New Hampshire Lands program; and the Development Rights Program of the N.H. Department of Agriculture. (These mechanisms, and others, are described in Section VII.C - "Methods for Open Space Protection.")

Acquisition of development rights is one of the most effective means of preserving farmland. After conveying these rights, the farmer still retains ownership and has full farming rights to his land. Additionally, by receiving the cash value of the land's development rights, the farmer realizes the full market value of his land over time. The farmer can eventually sell his land to another farmer at an affordable price. Hence, the land and the industry are both preserved.

Obviously, purchasing development rights is costly and cannot be applied to every situation. In the absence of unlimited financial resources there are several land use controls which provide varying degrees of protection: a) cluster development, b) agricultural zoning, and c) floodplain conservation zoning.

- a) A cluster development ordinance promotes the preservation of agricultural land by allowing all buildings to be clustered on a specified minimum acreage of the development, while keeping the rest of the site open. This approach to farmland preservation does not require either large public expenditures (to purchase development rights to farmland) or large private sacrifices. With a cluster ordinance, farmers who view their land as their "pension" need not destroy their farms in order to retire with a guaranteed income. In fact, they can pass on the farm house, barns, silos, and a large portion of the agriculturally productive land to the next generation. The majority of original fields could continue to be farmed on a lease-back system from

the community association which controls the open space as a permanent conservation area.

- b) An agricultural district is intended for working farms which have demonstrated a long range commitment to agricultural use. Commitments may include the selling of development rights, the placement of property in current use, and the ongoing use of the land in crops, pasture, or tree farms. An agricultural district serves to protect agricultural areas.

Keeping agriculture in Greenland is important to the residents. But residential development next to farms can create conflicts in use. For example, many of the "side effects" of farming - the odors of fertilizers and manure, and the noises of machinery - can be offensive to nearby homeowners. By defining agricultural areas and addressing the needs of farmers, future conflicts may be avoided.

- c) Floodplain areas typically contain high quality farmland soils. Floodplain conservation zoning would prohibit building but would allow agricultural uses on floodplains. Protecting floodplains from development can be justified on the basis of protecting public health and safety.

In Greenland, and throughout the Seacoast Region, there is a lack of public knowledge regarding the need for farmland protection, as well as the laws and programs available for protection. There is also a lack of public support (including support from farmers) for farmland preservation efforts. Clearly, Greenland has many opportunities to protect its agricultural land resources and to encourage the farming industry. Without a concerted and coordinated effort to preserve farmland by the Town, landowners, and developers, farmland resources will continue to dwindle until active farms become more like museums than integral parts of the Town's economy and landscape.

2. Forestry

a. Values

Forestland is a major renewable resource, providing both commodities (e.g., wood products and maple syrup), and non-commodity benefits (e.g., watershed protection, air quality and energy conservation, wildlife habitat, recreation and scenic quality). In general, forested lands have values similar to those of agricultural lands.

1) Economic

Most woodlots in the Region are privately-owned, and many are managed for financial gain from the sale of timber products. There are examples of publicly-owned woodlots as well. The sale of timber from public lands can provide a town with money to cover the cost of managing the timber stand, while helping to increase the future yield of forest products.

2) Watershed Protection

The broad category of watershed protection includes water conservation, flood control, erosion control, and water quality protection. Forests have a significant effect on the rate at which water will reach the ground, run off into surface waters, and infiltrate the ground surface. By slowing the rate of runoff, forests serve to reduce flood levels, prevent the erosion of soils, and filter pollutants from runoff.

3) Air Quality and Energy Conservation

Forests act to moderate temperatures in their immediate vicinity and can provide nearby houses with cooling shade in the summer and can slow the cold winds of winter. Hence, forests can reduce home heating and cooling costs. In addition, forests act as filters by removing particulates and absorbing carbon-dioxide from the air.

4) Wildlife

A rich forest wildlife habitat has a variety of vegetative cover types for browsing, resting, nesting, and hiding. Most animals inhabit several different landscape types, including meadows, dense underbrush, and open woods, from which it obtains food and shelter. The greater the number of interfaces between landscape types, the greater abundance of wildlife habitat. Conversely, in a densely canopied forest, where deep shade inhibits the growth of understory plants, the variety of animal species is reduced. Thus, a forest management program to improve the wildlife habitat increases the number of vegetative types and landscape types.

5) Recreation and Scenic Quality

Throughout Greenland, the pattern of forested land alternating with farmland and developed land gives the Town its rural character. The complexity and diversity which determine the wildlife value of a forest also determine the scenic and recreational value (e.g., for birdwatching and hunting). The scenic quality of a forest can be improved by increasing the diversity of plant species and cover types, which will in turn enhance the wildlife value.

b. Inventory

According to the Rockingham County Extension Service, there are three significant "managed woodlands" in Greenland. These areas are shown on Map 10 - "Open Space Values". The predominant tree species are Spruce, Douglas Fir, and Scotch Pine. Each forested area is managed for multiple-use purposes, i.e., woodland wildlife and wood products.

c. Analysis

Much of Greenland is currently forested with mature trees (over 40 feet tall and harvestable). As discussed in Section III.E,

the acreage of forest land in Town has decreased over the years. Even though forestry is not as important to the Town's economy as farming, forested lands provide important saleable wood products such as saw logs and cordwood. As with farmland, there are currently methods which help to preserve forest land. These include tax incentives (e.g., current use assessment program) and the Trust for New Hampshire Lands program.

As stated in the previous section regarding farmland, the Town could promote natural resource protection by adopting a cluster ordinance. With buildings being clustered in a certain area of the development, forest management practices could be implemented on the remaining open space.

In regard to public land, the Town should consider creating an official "town forest," which would provide many benefits to the townspeople. Proper management would allow multiple forest uses.

As is true for farmland, development pressure on Greenland's forested areas will continue to intensify. The Town should seek to have forest lands of manageable size (greater than ten acres) preserved through sound, long-term forest management programs which provide for all forest benefits, including watershed protection, wildlife habitat, recreation, and aesthetics.

C. ENVIRONMENTAL PROTECTION

1. Surface Water

a. Values

As with all natural resources, surface waters have multiple, interrelated values. Surface water is a key resource for fish, wildlife habitat, recreation, aesthetics, and groundwater recharge.

1) Fisheries and Wildlife

Water is an essential element in any wildlife habitat. Ponds, streams, and rivers (and Great Bay) provide food, water, and protection for waterfowl, songbirds, and birds of prey (e.g., the Great Blue Heron and the Double-crested Cormorant), and for many small animals and game species. Obviously, clean surface water is important for a healthy and diverse fish population.

2) Recreation and Aesthetics

Areas that have good fisheries or wildlife habitat also have a high recreational value for fishermen and hunters. Other recreational pursuits include swimming and boating, which require sufficient area, clean water, and adequate access. Moreover, water bodies provide some of the highest

quality scenic views. Examples of scenic waters range from the meandering stream on up to the expanse of Great Bay.

3) Groundwater Recharge

The quantity and quality of surface water and groundwater are closely related. When there is little rain, groundwater is released to maintain streamflow. When flooding occurs, excess water soaks back into wetlands, woodlands, and grasslands to recharge groundwater. Pumping of wells lowers the groundwater locally and can draw water to the wells from nearby ponds and streams through the process of induced infiltration. Since the quality of surface water has a bearing on that of groundwater, actions to protect one will provide some degree of protection to the other.

b. Inventory

Greenland has approximately 1,885 acres of surface water, which is equivalent to 22% of its total acreage (see Table 1). The Town contains two regional watersheds - the drainage areas for Great Bay and the New Hampshire Coast. These watersheds were identified on the "New Hampshire Hydrologic Unit Map" (source: U.S. Department of Agriculture, Soil Conservation Service, May 1982). The watershed boundaries shown on Map 7 - "Perennial Surface Waters" - were delineated by the Rockingham Planning Commission using topographic maps (source: Newmarket and Portsmouth, 7.5 minute topographic maps; U. S. Geological Survey).

As discussed in Section IV.A, Greenland is fortunate to have many streams and rivers. The Town also contains a large portion of Great Bay. In addition, ponds make up part of Greenland's surface water system. These water bodies are described below, and depicted on Map 7.

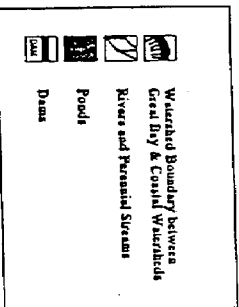
1) Great Bay

Greenland's northwestern border is within Great Bay. The Town's coastline runs approximately 5.8 miles along the Bay. The total water surface of Great Bay covers 5,696 acres (8.9 sq.mi.) at mean high water and 2,688 acres (4.2 sq.mi.) at mean low water (source: Great Bay National Estuarine Research Reserve Management Plan - Draft, N.H. Office of State Planning; January, 1989). Approximately 50% of the aerial surface of Great Bay is exposed as mudflat at low tide. The high water surface area of the Bay contained within Greenland is about 1,800 acres (2.8 sq.mi.), and the total length of shoreline within Town remains at 5.8 miles.

Great Bay is an outstanding resource for the citizens of Greenland. The Bay supports recreational and commercial shellfishing for oysters and, to a lesser extent, clams. Great Bay is also a prime area for recreational boating.

PERENNIAL SURFACE WATERS

Map 7



Prepared by the Rockingham Planning Commission
June 1989

Sources: Newmarket and Portsmouth,
7.5 Minute Topographic Maps,
U.S. Geological Survey.

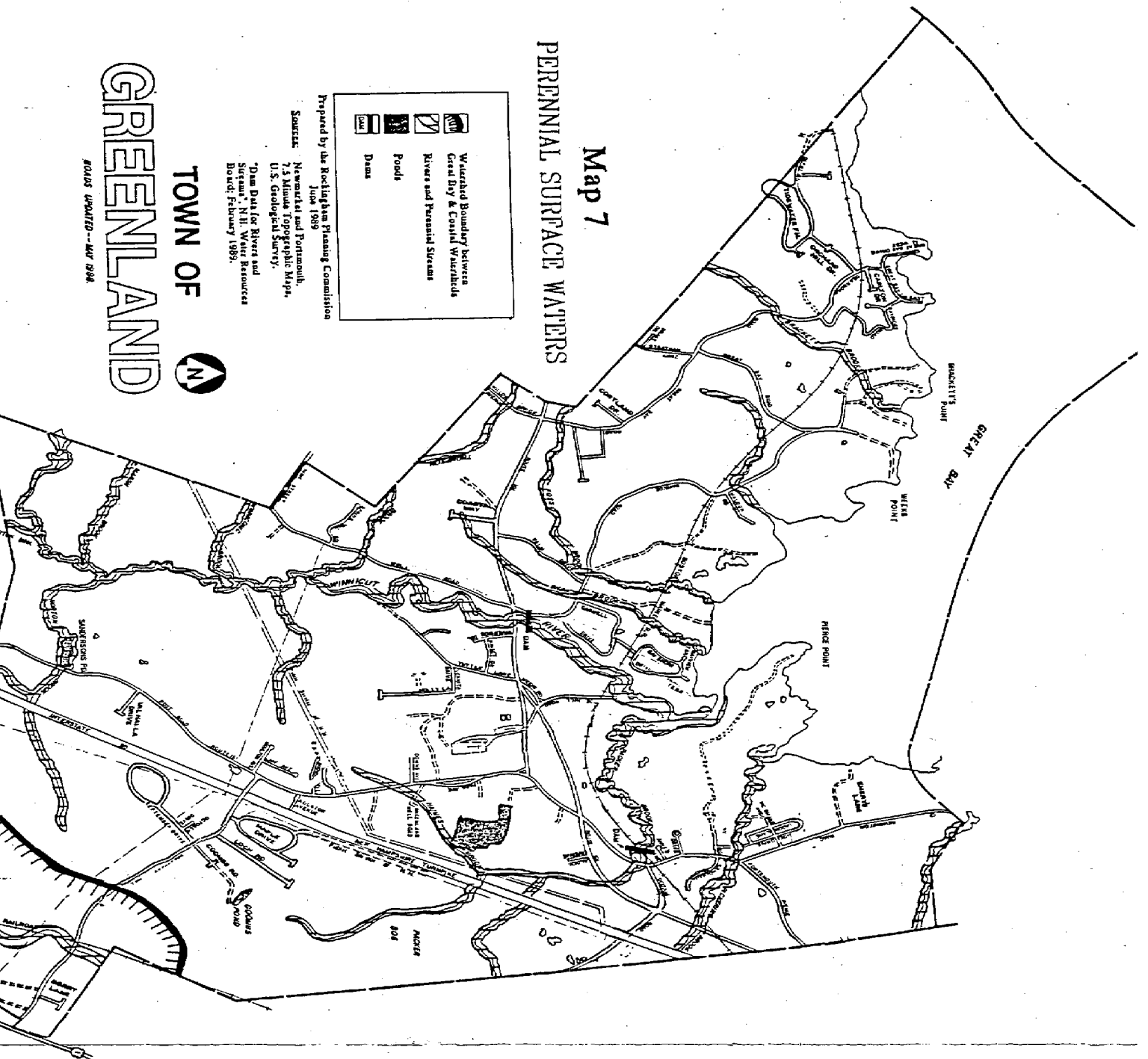
"Dan Duff for Rivers and
Streams", N.H. Water Resources
Board, February 1988.

TOWN OF



GREENLAND

ROADS UPDATED--MAY 1984



2) Rivers and Streams

Greenland has a total of 18 flowing water bodies: The Winnicut River, which is the largest river in Town, is fed by seven perennial tributaries: Barton Brook, Norton Brook, Marsh Brook, Winniconic Brook, Thompson Brook, and two unnamed streams. The remaining perennial streams throughout Town include: Brackett Brook, Foss Brook, Shaw Brook, Packer Brook, Haines Brook, Pickering Brook, Berrys Brook, and three unnamed streams.

3) Ponds

Greenland contains three sizeable ponds: Coombs Pond, Sanderson Pond, and an unnamed man-made pond. The latter pond was created through gravel excavation by the State during the construction of Interstate 95. This pond is 15 acres in size.

4) Water Quality

According to the New Hampshire Water Quality Report to Congress 305(b), all of the water bodies within Greenland meet their legislative classification of "B" for water quality; which means that the water is swimmable and fishable, but would not be potable without treatment (source: N.H. Department of Environmental Services, Water Supply and Pollution Control Division; April 1988).

However, according to a recent State report, there have been clams taken from Pierce Point along the Bay with lead levels exceeding 5 parts per million, which is the alert level of the National Shellfish Sanitation Program (source: Preliminary Metals and Organics Survey of Shellfish from the Great Bay Estuarine System, New Hampshire; N.H. Division of Public Health and the Fish and Game Department, 1989). But the report also adds that "the findings are not considered sufficient to support a consumption advisory at this time." The report recommends that areas with elevated contaminant levels, such as Pierce Point, be monitored for the next two to four years to determine the extent of contamination.

b. Analysis

The Great Bay estuarine system, covering approximately 17 square miles is one of the largest and most pristine estuaries along the east coast of the United States. This system is formed by the convergence of seven rivers: the Salmon Falls, Cocheco, Bellamy, Oyster, Lamprey, Squamscott, and Winnicut.

This estuarine system will soon (expected in late 1989) be designated as the Great Bay National Estuarine Research Reserve by the National Oceanic and Atmospheric Administration (NOAA). The Great Bay reserve will be one of 17 throughout the country. The research reserve system is a non-regulatory federal program

that emphasizes research, education, and land protection. The Office of State Planning has provided the initiative in establishing the program in New Hampshire, although once under full implementation, the State Fish and Game Department will assume program responsibility.

Another organization committed to conserving the land and water resources of Great Bay is the Great Bay Estuarine System Conservation Trust (GBESCT). The GBESCT is a private, non-profit citizen's group whose membership is drawn largely from the Seacoast area. Although originally organized as a local land trust, the GBESCT also has worked to protect water quality, as well as air quality and critical marine habitat.

All of Great Bay's tributaries are now closed to shellfish harvesting because of improperly treated or untreated sewage. Another threat to the Bay comes from development and unwise construction of buildings. In order to promote the protection of the Great Bay Estuary, the Town should work with the abutting landowners, the Office of State Planning, the GBESCT, the Water Supply and Pollution Control Division, the Fish and Game Department, the Rockingham County Conservation District, and the Rockingham Planning Commission on wise land stewardship of the watershed.

Surface waters are important because they provide ecological, scenic, and recreational value to the Town and are often hydrologically related to groundwater. In general, there is a direct relationship between land use and water quality. Uses in areas with poor suitability can degrade and contaminate both surface and groundwater, increase flood hazards, destroy water-based wildlife, and interfere with scenic and recreational values. It is the responsibility of the Town to take precautions to protect all water resources from incompatible uses and, in so doing, protect the health and general welfare of the community.

2. Wetlands

a. Values

Wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and indigenous plant and animal communities. Marshes, swamps, and bogs have been well known features of the landscape for centuries, but only relatively recently have attempts been made to group these landscape units under the single term of "wetlands."

Historically, wetlands have been considered to be wastelands of little value to society and have been subject to dumping, filling, and draining with little thought given to the consequences. But the role of wetlands in maintaining and improving environmental quality has recently become more fully understood. And, as more land gets developed, the benefits that wetlands provide become more significant. With increased development, the demand for clean water supplies, flood protection, wildlife habitat, and recreation also increases.

Wetlands pose considerable development constraints. They severely restrict all types of building development because of high water table conditions, poor drainage, slow percolation rates for septic systems, highly unstable conditions for foundations, and susceptibility to flooding. Costs to overcome these limitations and the potential environmental damage can be prohibitive.

Wetlands are important, valuable natural resources and are worthy of protection from inappropriate use. They have been found, in general, to provide critical ecological and socially valuable functions, including:

- 1) act as flood water storage areas;
- 2) absorb and filter pollutants and sediments;
- 3) help maintain groundwater and surface water levels;
- 4) provide habitat and reproduction areas for plants, fish, and wildlife;
- 5) provide opportunities for recreation and education; and
- 6) contribute to scenic value.

These values are described further below. (Also see diagrams in Appendix I - "Function of Wetlands".)

1) Flood Control

Wetlands are natural flood storage areas which reduce peak flood levels and the likelihood of flash flooding by storing and slowly releasing flood waters. For example, when a stream overflows its banks, flood waters spread horizontally into the surrounding wetlands where the vegetation acts to temporarily detain the water. The protection of all wetlands in a predominantly rural community wisely anticipates future development which causes increased runoff, higher flood levels, and greater likelihood of flooding.

2) Water Quality

Along with controlling flood waters, wetlands also serve to maintain water quality. They have a "self-cleaning" ability which, if not overtaxed, can filter or absorb pollutants from runoff before they enter an adjoining watercourse. In many respects, wetlands function much like sophisticated sewage treatment plants by removing nutrients and other pollutants prior to discharge to a waterway. This is done at virtually no cost to the taxpaying public. In addition, a wetland acts as a buffer zone to trap sediments resulting from natural and man-induced erosion.

3) Water Supply

The flood storage function of wetlands also serves to collect surface runoff and route it into the ground, thereby recharging the groundwater. During low-flow periods this stored groundwater can then replenish nearby surface water.

4) Habitat

Wetlands represent a critical link in the life cycles and food webs of fish and wildlife. Wetlands are nutrient rich habitats which supply food, shelter, and spawning grounds for many fish and wildlife. Coastal wetlands also provide critical habitat for shellfish and wading birds (e.g., herons and sandpipers).

5) Recreation and Education

Wetlands offer unspoiled, open space for the aesthetic enjoyment of nature as well as activities such as bird watching, hiking, fishing, hunting, photography, and environmental education. High quality wetlands can also be used for biological research or as outdoor classrooms for students of all ages.

6) Aesthetics

Wetlands add to the Town's scenic landscape. The relatively flat landform and diversified vegetation of wetlands create a distinctive visual character. Wetland vegetation provides unusual seasonal variations in color. Visible wildlife also contributes to wetlands' character.

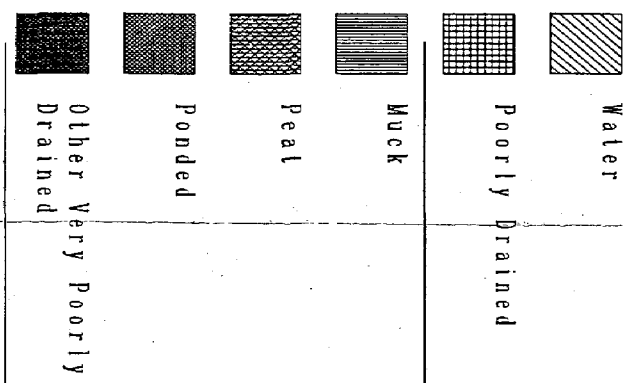
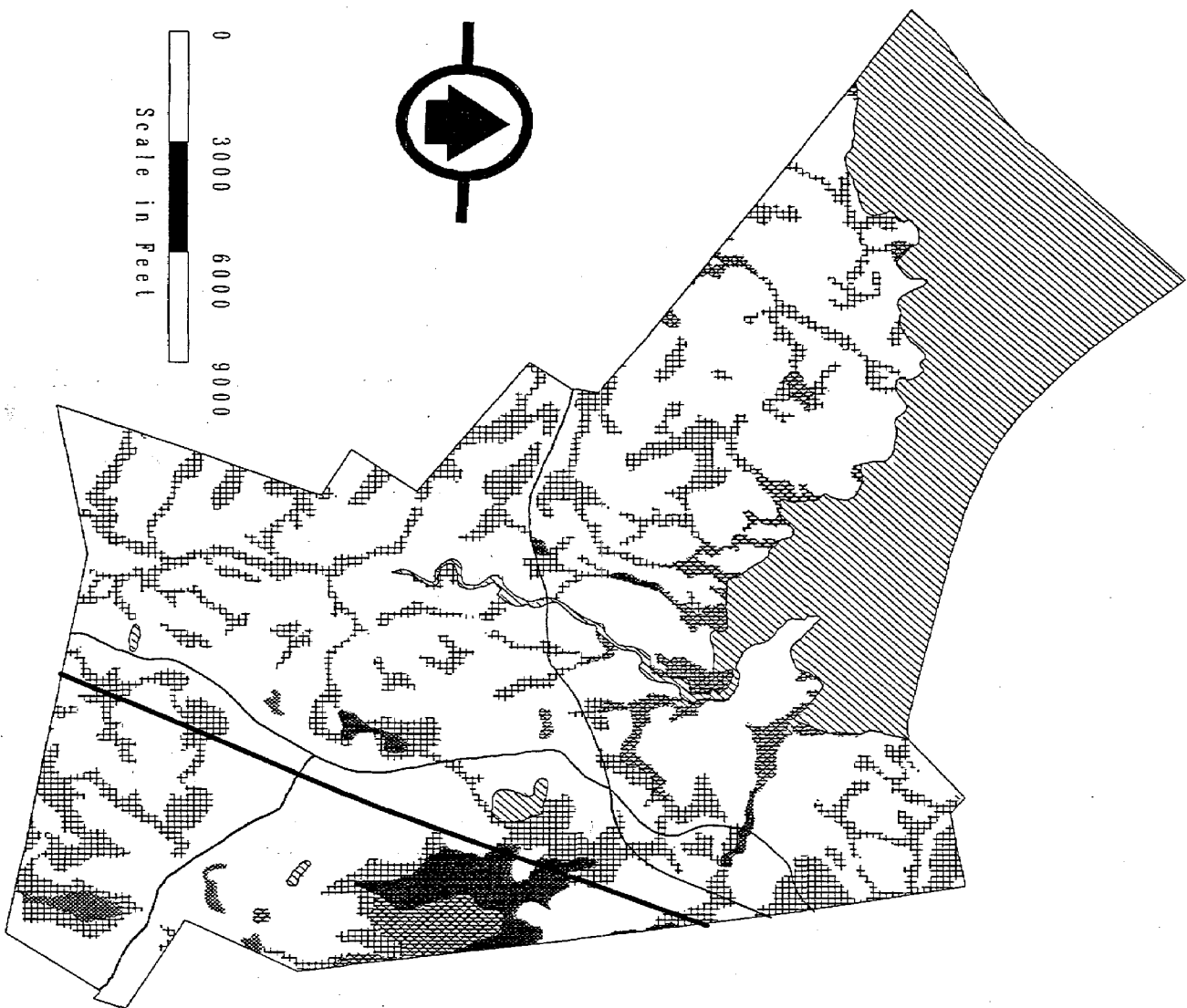
b. Inventory

Wetland types found in Greenland include shrub swamps, shallow and deep marshes, meadows, and forested swamps. Lands with soil having a seasonally high water table, and classified as poorly or very poorly drained soils by the U.S.D.A. Soil Conservation Service, are also considered to be wetlands.

Greenland's area of wetland soils is approximately 1,900 acres, which is 25.8 percent of the Town's total land area. Map 8 - "Wetlands" - depicts these areas as poorly drained and very poorly drained soils. Very poorly drained soils can be categorized as muck, peat, ponded, or "other". Many of the wetland areas in Greenland are adjacent to rivers and streams. This is especially true along the Bay at the mouths of Foss Brook, Shaw Brook, Pickering Brook, Packer Brook, and the Winnicut River. This area contains approximately 150 acres of tidal wetlands (source: Municipal Coastal Inventory and Assessment Report, Town of Greenland. Southeastern New Hampshire Regional Planning Commission; April 1979).

Packer Bog, located in the eastern part of Town, is Greenland's most expansive and magnificent wetland. The cattails, sedge, and other wetland vegetation, make it an excellent habitat for migrating waterfowl. The Bog is also considered to be the Town's best habitat for deer, woodcock, pheasant, raccoon, mink, muskrat, rabbit, and other species (source: Open Space Plan; Portsmouth, N.H.; by J.M. Carlock and the Portsmouth Planning Department; 1972). In addition, the N.H. Natural Heritage Inventory has indicated that the area contains several rare and endangered species of plants (see Section IV.D for further discussion).

Town of Greenland Wetlands Map 8



Very Poorly
Drained

Sources: "Soils Potential for Development-
Rockingham County", U.S.D.A.-Soil
Conservation Service and Rockingham
County Conservation Dist., May 1987.
Rockingham County, N.H. Soils Map:
U.S.D.A.-Soil Conservation Service
July 1983
Preliminary Data - Subject to Change.
Prepared by the Rockingham Planning
Commission, May 1989. SRC

Greenland also contains the western periphery of the Great Bog, located in Portsmouth. Geologically, Great Bog is part of the same swamp complex which includes Packer Bog. This entire area contains examples of the stages of vegetational succession. These range from plants living in small pools and "dry-season" mud flats to trees characteristic of the Region's mature forests.

c. Analysis

According to the N.H. Wetlands Board, Packer Bog is of regional importance because of its size, rarity, wildlife, and bogland values. This wetland has excellent potential to be designated as a "prime wetland" by the Town. This designation would require the Wetlands Board to give the Bog special consideration for any "dredge and fill" permit applications. This wetlands protection program is briefly described in the Section VII.C.

The filling of and use of wetlands for building construction not only destroys wetlands and their benefits, but may lead to groundwater contamination as well. Leaching fields constructed in filled areas are likely to be placed too near the seasonal high water table below and to have an inadequate receiving layer for proper treatment of the septic system's effluent.

There is an ongoing need to protect wetlands in Greenland. Statewide, wetlands are under increasing development pressure due to the depletion of the most developable land. Although the U.S. Army Corps of Engineers and the State of New Hampshire have laws and regulations governing wetlands, they do not always provide the degree of protection needed. Existing regulations look at each dredge and fill request as a separate application, resulting in a piecemeal approach. In addition, the inadequate number of federal and State inspectors means that some wetlands are not sufficiently protected. A local wetlands ordinance enables the community to protect wetlands in a Town-wide context. Unlike State and federal rules, local regulations can give the Town control over the location of structures and septic systems in relation to wetlands.

For these reasons, Greenland should adopt a Wetlands Protection Ordinance. This ordinance would effectively guide development to areas that are most suited for development, which is an important and practical consideration when planning for future growth.

3. Floodplains

a. Values

Flooding is a natural feature of the riverine system and adjacent wetland network. Periodic flooding fertilizes the floodplain soils, maintains their productivity and that of the river corridor, and provides habitat for the animals and plants that have adapted to live there.

During flooding, enormous quantities of water are stored temporarily on and in floodplain soils, and within tributary wetlands. At these times, the groundwater reservoirs are recharged. As the flood levels decline, the stored water is slowly released back into the river. Natural vegetation slows the flow of water during the flood and helps prevent erosion. In this way, the wetlands and floodplains naturally moderate the extremes of the flooding river.

In fact, floodplains are often closely linked to wetlands. Both function to reduce peak flood levels by storing and slowly releasing floodwaters. The most significant difference between floodplains and wetlands is that floodplains are associated with a river or stream, whereas wetlands can be more isolated.

b. Inventory

In 1988, the Federal Emergency Management Agency mapped the flood hazard areas in Greenland for use in the National Flood Insurance Program. This flood zone was designated for the 100-year storm based on topography and previous flooding history.

As is true for the Town's wetlands, the 100-year flood zone surrounds the major water courses flowing through Greenland. These areas are depicted on Map 2 - "Flood Hazards and Geology". The State has identified approximately 600 acres of floodplain in Greenland. The largest zone lies within Packer Bog. A relatively narrow floodplain runs along the shores of Great Bay from one end of Town to the other. The floodplain also juts inland along Brackett Brook, Foss Brook, Shaw Brook, Packer Brook, and Pickering Brook. The Winnicut River, and its tributaries, are surrounded by flood hazard areas as well.

c. Analysis

At the 1989 Town Meeting, the Greenland voters adopted a Floodplain Management District ordinance, which establishes land use control measures for Greenland's flood prone areas. This ordinance was necessary to keep the Town in good standing with the National Flood Insurance Program, and remain eligible for flood insurance.

Even with a floodplain management ordinance in place, the Town should encourage landowners and State and private agencies to negotiate the purchase or donation of lands, or conservation easements, for floodplain areas; especially those which are part of the estuarine areas along Great Bay. This action would help to preserve the ecological and scenic integrity of Greenland's portion of the Great Bay estuary.

Floodplains are not suited for development. Buildings should be located away from these low-lying areas because of the potential for flooding and the unstable soil conditions. Development encroaching on a floodplain may also lead to surface water contamination caused by flooding damage to septic systems,

and the general flushing-out of materials around a house or parking lot, such as trash, paint, gasoline, oil, etc.

Areas prone to flooding need to be protected in order to maintain their capacity to absorb, store, and transmit runoff and floodwater. Floodplains are part of a river or stream, and should be respected as such.

4. Shorelands

Shorelands are herein defined as those lands located along the water's edge of a stream, river, or Great Bay. Much of the discussion below pertains to the riparian corridors of rivers and major streams. For ease of discussion, the term "river" will also include major streams (such as those which flow year-round and are depicted on a U.S.G.S. topography map).

a. Values

A river corridor serves many functions and has significant ecological and aesthetic values, as described below.

1) Wildlife

In general, river corridors provide one of the richest habitats for fish, wildlife, and plants. Many fish and wildlife populations cannot survive within limited habitat areas. Wildlife must have travel lanes within their range, and waterfowl and other birds need ground-level nesting habitat. Protection of these linear river corridors is essential to the stability of wildlife populations. (See Section IV.D for further discussion.) This concept is in contrast with what have been called "habitat islands" where wildlife refuge areas are separated by development, with no way for animals to travel from one area to another.

2) Floodwater Storage

The flood absorption function of shorelands and floodplains was discussed in the previous section (IV.C.3 - "Floodplains").

3) Pollution Abatement and Filtration

Natural corridors along a river have been termed as "filter strips" because the shoreland vegetation acts to filter out sediment and pollutants from surface water runoff. Many scientific studies have repeatedly confirmed the need to retain a naturally vegetated buffer strip adjacent to the water line, to filter out pollutants from lawn fertilizers, and agricultural pesticides. An absolute minimum of 50 ft. (preferably 75 ft. or more) is needed to protect rivers and marshes from these substances, according to research results from North Carolina, recently published by the Smithsonian Environmental Research Center (source: Planning for the Changing Rural Landscape of New

England: Blending Theory and Practice; New England Center, UNH; November 1987).

River corridors can be environmentally sensitive as well. In many instances, these areas consist of coarse-grained soils which have a limited ability to trap and hold contaminants. This can lead to water quality problems especially when septic systems are constructed too close to a riverbank. During low-flow periods, the contaminated groundwater can then seep into the river.

4) Riverbank Stabilization

Riverbanks denuded of vegetation can be vulnerable to erosion. The roots of trees and other plants along a natural shoreline stabilizes the banks from the erosive forces of wave action, flood flows, and overland runoff.

5) Recreation

River corridors can provide some of the best recreational opportunities in the Region. Examples include canoeing, hiking, fishing, birding, picnicking, horse trails, and cross-country skiing.

6) Aesthetics

The changes in flow, the diversity of vegetation, and the associated variety of wildlife, all contribute to the scenic qualities of a river corridor. River corridors are prime areas for interacting with the natural environment.

7) Unique Natural Features

Examples of unique natural features along a River include waterfalls, rapids, meanders, and oxbows. In addition, rare and endangered plant species are often located along river corridors.

b. Inventory

As previously stated, shorelands are found along surface water bodies. Greenland's water bodies are shown on Map 7.

There is no set width for "shoreland." As a general rule, the shoreland values described above diminish as the distance between development and the water's edge decreases. Literature on this subject indicates that shoreland widths range from 50 to 200 feet.

Certain shoreland areas in Greenland have been developed. They include Meadow Lane along Pickering Brook, Bayside Drive along the Winnicut River, and various developments fronting on Great Bay, west of Weeks Point. However, the Town continues to maintain many miles of natural shoreland.

c. Analysis

As real estate values increase, the shorelands of Greenland are becoming ripe for new residential subdivision proposals. Without adequate controls, waterfront land is highly vulnerable to development in which new homes line the banks and in which all natural vegetation is removed to create broad open views extending down to the water, across a succession of back yards.

This scenario can be avoided through the adoption of a Shoreland Protection ordinance to insure the proper protection of shorelands and associated water bodies. This ordinance would establish a shoreland overlay district with construction setbacks from the seasonal high water mark and restrictions on the removal of natural vegetation (i.e., no clearcutting) within a buffer zone adjacent to the water.

The establishment of a Shoreland Protection District will promote the following objectives:

- 1) Discourage development in flood hazard areas;
- 2) Protect public waters from pollution;
- 3) Prevent erosion;
- 4) Conserve and protect aquatic and terrestrial habitat associated with riparian areas; and
- 5) Preserve and enhance those recreational and aesthetic values associated with natural shorelines and river environment.

What follows is a brief discussion of some issues which arise regarding shoreland protection.

- 1) Is shoreland protection "confiscatory"? One of the major obstacles for instituting laws which protect river and stream corridors is that many people consider this type of regulation as a "taking of land" without compensation. However, river corridor protection is a "valid public purpose" which prevents the deterioration of public resources from erosion, pollution, flood damage, wildlife disruption, etc..
- 2) Private benefit versus public benefit. When a development is built next to a water body, the buildings gain value by having an "exclusive" waterfront view. Is it equitable for a private development to gain value from a river (a public resource) and at the same time exclude the public from using the river by blocking physical and/or visual access, in addition to diminishing the river's natural resource values?
- 3) Piecemeal development. Another issue is the gradual and piecemeal development of a river corridor and with it the gradual and incremental loss of the corridor's resource values. The sooner the Town acts, the less shoreland will be lost to development.

In conclusion, shoreland corridors are valuable in terms of water quality, wildlife habitat, recreational opportunities, and scenic beauty. In order to maintain these benefits for present and future generations, the Town should act to protect its shorelands.

5. Groundwater

a. Values

Groundwater provides the primary supply of potable water for the Region. Favorable groundwater potential is typically found in areas of unconsolidated sediment and, to a lesser extent, bedrock fractures. Because of its high porosity, transmissivity, and hydraulic conductivity, areas of "stratified drift" (as defined in Section III.B) can yield the greatest volumes of water when pumped. The term "aquifer" is herein defined as earth material containing sufficient quantities of groundwater for pumping.

The primary value of groundwater is as a source of water supply for individuals and for community water systems. Because of the great difference in treatment costs, municipalities more frequently choose to develop public water supplies from groundwater. Groundwater supplies are less costly to develop than man-made surface water supplies, in terms of land-taking, engineering, and maintenance.

Groundwater has an additional environmental value, in the recharge of surface water bodies and wetlands. A seasonally high water table may rise close to or above the ground surface, creating a wetland during the wet months of the year, and providing moisture to the wetland vegetation.

b. Inventory

The groundwater resources of Greenland have been investigated by two federal agencies: the U.S. Army Corps of Engineers (USACE) and the U.S. Geological Survey (USGS). Both of these agencies based their findings on the surficial geology of the Town. They assumed that areas in Town which contained stratified drift formations would also yield the greatest amount of groundwater.

The USACE classified eastern Greenland as having an aquifer, which was defined as "an unconsolidated geologic formation containing a minimum of 20 feet of saturated permeable material, which will yield significant quantities of water to wells for public usage. Generally, this range is in the order of 150 gpm per well" (source: Groundwater Assessment Study for 50 Communities in Southeastern New Hampshire, USACE; September, 1980).

Three years previous to the USACE report, the USGS also identified the eastern part of Greenland as having high potential to yield water. Wells located "within these areas should yield sufficient quantities of water to meet or augment supplies for municipal and/or industrial purposes" (Source: Availability of Groundwater in the Lower Merrimack River Basin, Southern New Hampshire, J.E. Cotton, USGS; 1977).

The latest and most reliable source of information concerning stratified drift aquifers is from the N.H. State Geologist Office.- In early 1989, the surficial geology map for the Portsmouth, N.H. quadrangle was finalized. This map identified stratified drift formations as "glacial and post-glacial water-laid deposits."

The stratified drift formations, as identified from the sources described above, have been depicted on Map 9 - "Aquifers." All three of these zones are located in the eastern part of Town. The favorability of this area to yield groundwater has been proven by the Portsmouth Water Department, which currently extracts an average of 480,000 gallons per day from this aquifer (source: Public Water Supplies, Facilities and Policy Summary; N.H. Water Supply and Pollution Control Division; updated November 1987).

c. Analysis

Groundwater is a very valuable resource for the Town of Greenland. It has the potential to provide the Town with drinking water for many generations to come. However, the resource is vulnerable to contamination or depletion if not properly managed and protected.

Groundwater quality can be impaired by a variety of materials. Sources of groundwater contaminants include landfills, commercial and industrial wastes, agricultural fertilizers, human sewage, road salting, etc. Groundwater quantity is reduced by contamination of available groundwater supplies, over-pumping in the aquifer zone, and increasing impervious surfaces such as roof tops and parking lots, thereby preventing recharge of the aquifer.

Fortunately the Town of Greenland has recognized the importance of protecting its aquifer, and has established an Aquifer Protection District. The ordinance establishes an aquifer overlay district with certain use regulations, in order to protect the Town's present and future water supply.

D. HABITAT

This section describes the natural habitat for wildlife and for rare and endangered plants.

1. Values

All wildlife have three basic requirements for survival: food, cover, and water. Fish, amphibians, and waterfowl require the presence of water for spawning and egg laying. Vegetation provides the necessary cover to serve as nursery habitat. Water also serves as spawning grounds for insects, which, in addition to vegetation, provide food for various animals. Furbearers such as muskrat, otter, mink, and beaver utilize wetlands as habitat. Coastal and inland marshes serve not only as breeding grounds for waterfowl but also are critical resting and feeding areas during spring and fall migration.

Map 9 Aquifers

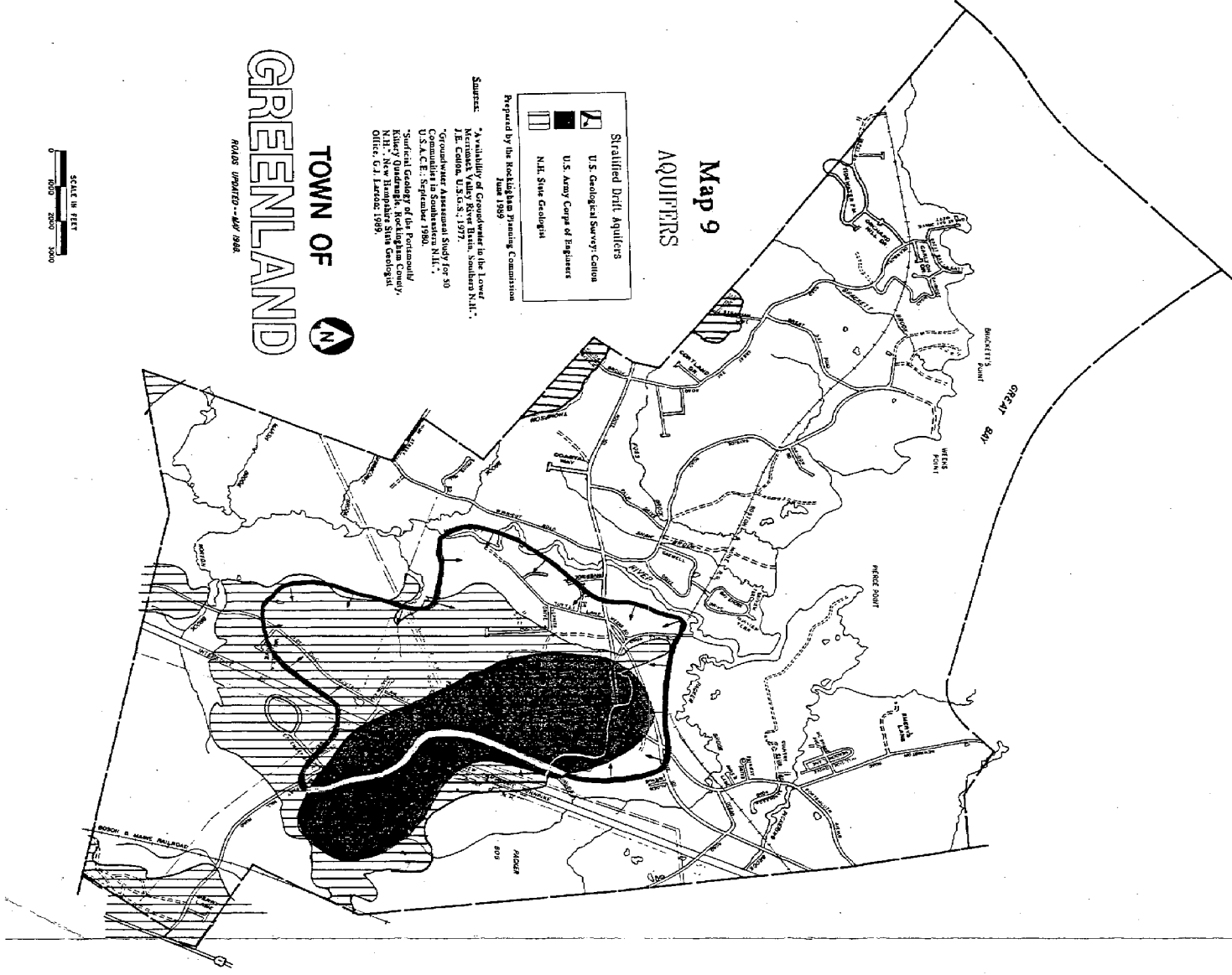
Stratified Drift Aquifers	
	U.S. Geological Survey, Condon
	U.S. Army Corps of Engineers
	N.H. State Geologist

Prepared by the Koolhaas Planning Commission
June 1989

Sources:
 "Availability of Groundwater in the Lower Merrimack Valley River Basin, Southern N.H.", J.E. Condon, U.S.G.S., 1977.
 "Groundwater Assessment Study for 50 Communities in Southern N.H.", U.S.A.C.E., September 1986.
 "Stratigraphic Geology of the Merrimack Valley, New Hampshire State Geologist, N.H.", New Hampshire State Geologist, Office, C.J. Landon, 1989.

TOWN OF
GREENLAND

ROADS UPDATED--MAY 1988



The value of an area as habitat depends on a number of factors including size, contiguity with similar areas, and amount of edge. Edge is the transitional area between habitat types and consists of understory plants and early successional types of vegetation which provide both forage and cover for numerous species of birds and mammals. Edge can be created by utility transmission rights-of-way, crop and pasture land practices, regrowth of old fields, and similar types of clearings. The habitat value and edge effect of an area may be significantly reduced if adjacent land uses and encroachments by man create barriers or threaten the integrity of that area.

Plants also require certain environmental conditions for survival. Wetland vegetation provides a good example of plants requiring a specific set of conditions, i.e., soil type and water table elevation.

2. Inventory

a. Wildlife

As discussed in Section IV.C.1, the Great Bay Estuary provides prime habitat for many wildlife species. According to a N.H. Fish and Game study, more than 90,000 birds reside in the estuary (source: Inventory of the Natural Resources of Great Bay Estuarine System; N.H. Fish and Game Department; December 1981). Thousands of Canada geese and black ducks rest and feed in the fall. Osprey are common in the spring and fall migration. Three rare and endangered animal species which live within in the estuary include the bald eagle, common tern, and the common loon.

Terrestrial mammals which utilize Great Bay include raccoons, whitetail deer, red fox, woodchuck, muskrats, chipmunks, grey squirrels, cottontail rabbits, mink, otter, and beaver.

A complete inventory of all animals (and plants) which live in the Great Bay is contained in the Fish and Game study cited above, as well as in the Great Bay National Estuarine Research Reserve Management Plan (previously cited in Section IV.C.1).

In addition to excellent coastal habitat, Greenland also has important inland habitat areas. Examples include: wetlands; river and stream corridors; forests such as coniferous, hardwood, and mixed woodlands; and open lands comprised of meadows and fields. These habitat types support a wide range of animals including game species such as deer, coyotes, raccoons, rabbits, and pheasant.

Greenland's prime wildlife habitat areas include those along the undeveloped portions of Great Bay and the Winnicut River corridor, as well as Packer Bog.

b. Vegetation

Natural plant communities in Greenland are typical of coastal New Hampshire, with vegetative patterns reflecting soils and moisture conditions. However, the N.H. Natural Heritage Inventory has identified four rare and endangered plant species which grow

in the Town. The common names of these plants are: Small Spike-rush, Marsh Elder, Exserted Knotweed, and Stout Bulrush. All of these species, except for Small Spike-rush, are "imperiled in the State because of rarity". Small Spike-rush is critically imperiled because of "extreme rarity." These terms are explained more fully in Appendix II - "Rare and Endangered Plants." The areas in which these plants grow are shown on Map 10 - "Open Space Values."

3. Analysis

a. Wildlife

As contiguous tracts of open space become splintered with development, wildlife can no longer move easily from one natural area to another, and some must move away from the area's boundaries into the more protected center. This can be harmful to wildlife if the size of the habitat is related to food supply or to the amount of genetic diversity necessary for a healthy population. It is well known that some species of wildlife require fairly large areas of habitat to survive. (The ranges for pine marten and white tail deer are roughly 640 acres.) Plant species also require contiguous areas to proliferate.

In addition, small, isolated habitats have less diversity of plant and animal species than those that are large and contiguous. Each species has its own mix of habitat needs for water, food, nesting or resting, breeding, and cover. A species may require low wetland areas for one use and upland areas for another. If both types of areas are not accessible because land is developed between them, the species can no longer flourish.

Overall, large contiguous tracts of conservation land are necessary to protect the Town's current diversity of plant and animal species from the impact of habitat isolation and fragmentation. It is thus important to consider conservation lands not only as individual parcels, but also in relation to other protected lands. For these reasons, the Town should endeavor to acquire lands which are contiguous to publicly-owned or otherwise protected parcels. Therefore, the Town should seek to preserve corridors that link large tracts of open space in order to maintain habitat integrity. (The Town's large contiguous tracts are shown on Map 11 - "Protected Open Space and Public Lands.")

b. Vegetation

Four rare and endangered plants have been identified in Greenland. There are important biological and ecological reasons for protecting these plants. By preserving different types of vegetation, the diversity of ecosystems are maintained. If a species is lost, the overall biological complexity of the habitat is reduced. Hence, the Town should seek to protect these areas in order to preserve this piece of Greenland's natural heritage.

E. AESTHETICS

1. Values

Open space maintains a Town's rural character by providing pleasant scenery and visual relief from developed lands. It provides natural buffers against noise and reduces "overcrowding of land." In general, scenic resources contribute to the quality of life for townspeople and is a key element of the Region's tourist economy.

Visual-cultural values of such areas consist of an array of inter-related, intangible values which benefit the public. Wetlands, for example, contribute directly to the scenic value of landscapes and add to landscape diversity. This value of aesthetics is achieved through direct recreational usage and from distance viewing. The recreational values vary greatly according to user and landform type. Recreational activities may range from bird watching and picnicking to walking, canoeing, hunting, and fishing.

In general, aesthetic values are difficult to measure. Researchers have attempted to measure the values of scenic views through preference studies. Most of these studies have indicated that natural landscapes are preferred over landscapes which contain obtrusive structures (source: A Proposed Method for Coastal Scenic Landscape Assessment; H. Dominie and M. Droege; Maine State Planning Office; October 1987).

2. Inventory

Greenland's visual character is one of its most priceless assets. The diversity of landforms of farmland, rolling hills, forested areas, marsh, river corridors, and Great Bay add to the uniqueness and richness of Greenland's character. The Town has many significant scenic views. Many of the scenic landscapes throughout Greenland can be viewed readily from Town and State roads.

A "scenic road" is typically a rural Town road, which has a relatively low volume of traffic. (The term "scenic road" as used in this plan is not to be confused with Scenic Road Designation, RSA 231:157.) A scenic road can derive its aesthetic qualities from the contrast of open fields and woodland, architectural features, stone walls, and occasional vistas.

The Town's scenic roads and most outstanding scenic views have been identified on Map 10 - "Open Space Values". A brief description of each is provided below.

a. Scenic Views

- Farmland/Great Bay. Located along Newington Road, these farm fields are part of what was the Emery Farm. (They are now used for hay production by the Weeks Farm.) Looking west toward Great Bay, the site has scenic views of rolling farmland (with impressive sunset views as well). This area serves as a "gateway" from Newington.

- Tidewater Farm Road. Along this road, looking north, there are two panoramic views of Great Bay.

- Pasture Land. Along N.H. Route 101, just outside of the Town of Stratham, there are scenic views of farmland looking in both directions. On the north side is a rolling hay field, and on the south, a pastoral scene with pasture land and a variety of vegetation (often with cows grazing). This area serves as an important "gateway" from Stratham, and is seen by thousands of people each day (the average daily traffic along this part of N.H. Route 101 is in the vicinity of 20,000 cars, as of December 1988).

b. Scenic Roads

- Newington Road. From the northern section of this road there are expansive views of farm fields on both sides, as well as the scenic view of Great Bay (described above).

- Dearborn Road. From the intersection of Great Bay Road to Great Bay Drive (East and West), Dearborn Road is a rural, winding road with adjacent forest land of both deciduous and coniferous trees.

3. Analysis

One of the Town's most valuable resources is the scenic quality of its landscapes. These scenic resources provide a unique visual experience for residents, and help to attract tourists - who in turn contribute to the Town's economy. For the most part, Greenland's scenic landscapes are privately owned. Nevertheless, the public "uses" the visual landscape, and therefore a tangible public benefit is derived from these private properties. Outstanding scenic views, therefore, deserve protection whenever possible.

In general, agricultural land is the primary contributor to the high landscape quality of Greenland and the Region. However, farmland is particularly vulnerable to development. It is common for development to be proposed in open areas, which were once farm fields, due to good soils, lack of clearing costs, and extensive panoramic views from the subdivided parcels. This type of development is highly visible and severely detracts from the aesthetics of the original farmland.

There is a great need to protect the scenic views which serve as "gateways" to the Town. As people enter into Greenland, the scenic quality of the immediate surroundings greatly influences the observer's impression of the Town. This open space also acts as a visual buffer between towns by interrupting what may one day be a road lined with buildings.

Greenland should protect its prominent scenic views from obtrusive development. Scenic resource protection measures include encouraging cluster development as well as the purchase of visually important land, or scenic easements to those lands. The Town should also consider selectively clearing roadside vegetation in order to open views of scenic fields and river corridors.

F. EDUCATION/RESEARCH

1. Values

By using open space lands as outdoor classrooms, people of all ages can learn about the natural world. Many areas (e.g., wetlands, forest land) can serve as areas of scientific research and as outdoor educational exhibits which demonstrate the dynamics of ecological relationships. Interpretive hiking trails also provide an excellent means of teaching cultural and environmental lessons to the general public. As environmental education and the natural sciences become more common in primary and secondary schools, natural areas will become even more valuable for education.

2. Inventory

The most significant area in Greenland that is used for education and/or research is that part of Town within the Great Bay estuary. The unique qualities of the estuary have attracted many different organizations and government agencies which have conducted scientific and educational activities. The University of New Hampshire, at the Jackson Estuarine Laboratory, has been the primary agency to conduct research and education on the Great Bay estuary. Other such agencies and organizations include: the N.H. Department of Fish and Game; the Piscataqua Gundalow Project; the Great Bay Estuarine System Conservation Trust; the Audubon Society of New Hampshire; the Institute for the Study of Earth, Oceans, and Space; the N.H. Office of State Planning; and the N.H. Department of Environmental Services, Water Supply and Pollution Control Division, and the Rockingham Planning Commission. (For a more complete description of these programs, see the Great Bay National Estuarine Research Reserve Management Plan, previously cited.)

As discussed throughout this plan, there are many open space lands in Greenland with educational potential. The primary site which is actively being used for educational purposes is Ye Olde Allen Farm. The Central Elementary School uses the Farm for educational field trips, where the students learn about apple farming, cider-making, and so on.

3. Analysis

Environmental education is the study of contemporary conservation issues, ecology, biology, and the overall study, enjoyment, and understanding of the natural environment. Programs have been successfully implemented throughout the country for groups of all ages.

The Town should promote increased conservation awareness and education at the primary and secondary school levels. The Conservation Commission could work with the School Department in arranging for conservation-related field trips, workshops, and lectures. Potential sites for educational field trips include: Great Bay, the Winnicut River, a farm, a managed forest, or a prime wetland area. Geology, weather,

soils, biology, forestry, wetlands, wildlife, chemistry, and environmental issues could be studied at these areas.

Moreover, the Town should work with the N.H. Fish and Game Department toward developing opportunities for education and research within the Great Bay estuary. The Town can thereby play an active role in this important function of the Great Bay Estuarine Research Reserve program.

G. HISTORIC/ARCHEOLOGICAL SITES

1. Historic Sites

Since this plan focuses on open space lands, this section will discuss only historic sites, rather than historic structures.

a. Values

Although historic sites enhance town character the ultimate value of preserving them is educational. Historic sites are an important part of the Town's historic and cultural heritage. It is important for the townspeople to be aware of the events in history which have shaped the Town's present condition, and society in general. If development occurs on these sites, their value is lost and cannot be replaced elsewhere.

b. Inventory

This plan identifies four historic sites (see Map 10):

1. Pierce Point: The landing site of the first Colonial people, on what was to be incorporated as the Town of Greenland.
2. Breakfast Hill: This is the site of a battle between Colonists and Native Americans.
3. Town Park: This site contains a turn-of-the-century gazebo, which was built for passengers using the electric street cars which travelled to Exeter, Hampton, and Portsmouth.
4. Veteran's Memorial Park (The Parade): This site was used during the 18th century as a practice ground for the local militia. The Park contains two monuments (for veterans of both World Wars).

c. Analysis

The sites described above contribute to Greenland's unique history and cultural heritage. It is therefore, in the public interest to protect them. For privately-owned sites (e.g., Pierce Point), negotiations for easements may be the best means of protection.

2. Archeological Sites

a. Values

New Hampshire contains a wide array of archeological sites worthy of protection. Such sites represent nonrenewable resources which contain the unique record of human achievements spanning at least 10,000 years of prehistory. This period spans the age from first occupation after the retreat of the glaciers (at the end of the Ice Age) through the displacement of Native American Indian culture by European explorers and colonists. For most of this period, archeological sites are the only sources of information about the Native American cultural tradition. For the historical period of the Euro-American cultural tradition, archeological sites provide an important dimension for the understanding of history. Archeological sites may balance, expand, corroborate, or contradict the written and oral record of history and, together with our architectural heritage, provide physical reminders of the past.

Generally, prehistoric sites are most likely to be found in areas with the following characteristics: **proximity to water** (both potable water, and waterways for travel); **sandy and gravelly well-drained soils**; **level ground**; **exposure** (either to sunlight and/or prevailing winds); **proximity to raw material sources** (especially suitable rock for the making of tools); and **proximity to food sources** (such as estuarine environments for shellfish beds, falls and rapids for restricting the passage of anadromous fish, freshwater marshes and thickets for other shellfish and small game, and pockets of farmable soils, important to late prehistoric horticulturalists).

b. Inventory

One prehistoric site has been recorded in Greenland by the N.H. Division of Historical Resources (DHR). Known as the Great Bay Site, and located in the vicinity of Brackett's Point, this site has the potential to be among the most significant in the entire coastal zone (see Map 10). According to the State Archeologist, the site was used as a semi-permanent village or seasonal camp by Native Americans for thousands of years. Testing performed by the University of New Hampshire indicates that it is an extensive site and dates back as much as 5,000 years.

Within the Coastal Region, the distribution of recorded prehistoric archeological sites is as follows: 52% in the Upper Riverine System; 6% in the Lower Riverine System; 9% in the Riverine Tidal System; 20% in the Estuarine System; 5% in the Marine System; 5% in the Lacustrine System (lakes); and 3% within the Palustrine System (marsh, bog, swamp). The site in Greenland has been recorded in the Estuarine System.

The DHR has identified another major historic/archeological site in Greenland: the 17th century estate of Captain Francis Champerowne, a wealthy Seacoast pioneer, located on Pickering Brook on the south side of Great Bay (see Map 10). Although part of the estate was

disturbed by construction of the Portsmouth Country Club golf course, the core of the estate is believed to remain intact and to contain significant information about colonial life in New Hampshire.

c. Analysis

The following is a paraphrased excerpt from a memo written by Gary Hume, State Archeologist, regarding archeological sites in the Seacoast Region.

Most recorded sites in the Coastal Region are located on flat, dry areas within 125 meters of various water bodies. Because of the recreational and residential development which has taken place on waterfront areas in the Region, many potential archeological areas have been disturbed and destroyed. However, a number of small, undisturbed pockets may remain in the midst of developed areas. Large tracts of undisturbed land have high archeological potential.

The DHR recommends that before development takes place along the Region's waterfront areas, builders and/or planning boards check with them to see if the developments may be disturbing potential archeological sites. Early consultation is preferred, so as to allow time for archeological studies and/or redevelopment of proposed projects. According to RSA 290, it is illegal under most circumstances to disturb human remains without a permit. According to RSA 227-C:8, when unmarked human remains are discovered, excavation must be discontinued. The discovery should be reported to the local police who will, in turn, notify a medical examiner and the State Archeologist when it is appropriate.

The Coastal Region is an area rich in archeological sites. Due to ideal conditions, the Native American Indians located their settlements on the shores of our various water bodies. They left behind them many sites which can yield information about their culture. Archeologists have just begun this study. Unfortunately, the rapid development which has taken place in the Coastal Region has destroyed many sites. Based upon a field check in 1986 of recorded sites, the attrition rate from development in the past ten years has been a staggering 25%! By making people more aware of the fact that archeological sites do exist in the Coastal Region, it may be possible to prevent destruction of these valuable nonrenewable resources.

As with its historic sites, Greenland should work toward protecting the only two known archeological sites in Town.



Map 10
Open Space Values

PORTS
 1 Walls From
 2 Ye Olde Alder Farm
 3 Shallop & Tolly Farm
 4 Tolly Farm

- | | |
|--|-------------------------|
| | Recreation Area |
| | Public |
| | Recreation Area |
| | Active Farmland |
| | Managed Forest |
| | Historical low Rise |
| | Public |
| | Scenic View |
| | Scenic Road |
| | Education/Research Site |
| | Historic Site |
| | Archaeological Site |

Prepared by the Rockingham Planning Commission
 June 1993



TOWN OF

GREENLAND

ROADS UPDATED--MAY 1984



SCALE IN FEET
 0 500 1000 2000

V. OWNERSHIP OF OPEN SPACE LAND

V. OWNERSHIP OF OPEN SPACE LAND

This section briefly describes the sizeable publicly-owned and protected lands in Greenland. These parcels, as well as other incidental parcels, are depicted on Map 11 - "Protected Open Space and Public Lands." It should be noted that even though a parcel is publicly-owned, it is not necessarily protected forever. The Conservation Commission should encourage the Board of Selectmen to put covenants on critical Town-owned open spaces. This concept applies to State-owned lands as well. If the State is not interested in any permanent means of protection, the Commission should pursue an option or right of first refusal for the land. The following is an inventory and description of public and protected lands in Greenland (shown on Map 11).

A. PUBLIC

1. Town

The Town of Greenland owns a significant amount of open space, most of which is located in the vicinity of Packer Bog. The Town's major land holdings include: Packer Bog (140 acres); "Vickery" land, adjacent to Interstate 95 (24 acres); Town Office land (21 acres); land adjacent to Moulton Avenue (5 acres); marsh land adjacent to Foss Brook (9.5 acres); and Caswell Park (2.5 acres).

2. State

The State of New Hampshire owns several parcels in Town, the most notable being the 40-acre tract which runs from Bayside Road to Great Bay. The N.H. Fish and Game Department manages this land, as well as others including the Winnicut River Access and the site of their regional office across the River on Riverside Drive. The State's major holdings include: N.H. Fish and Game parcels described above (40, 0.6, and 1.5 acres); a tract adjacent to a former State-owned gravel pit, used during construction of I-95 (10 acres); and a parcel adjacent to I-95, within Packer Bog (8 acres).

3. Federal

Pease Air Force Base owns two parcels in the northeastern tip of Town, totalling approximately 12 acres.

B. QUASI-PUBLIC

In Greenland, quasi-public lands include those which are owned by the Boston and Maine Railroad; and power-line easements owned by the Public Service Company of New Hampshire. These corridors can provide important links to open space lands.

C. PRIVATE PROTECTED LAND

There are two parcels in Town which are protected through conservation easements:

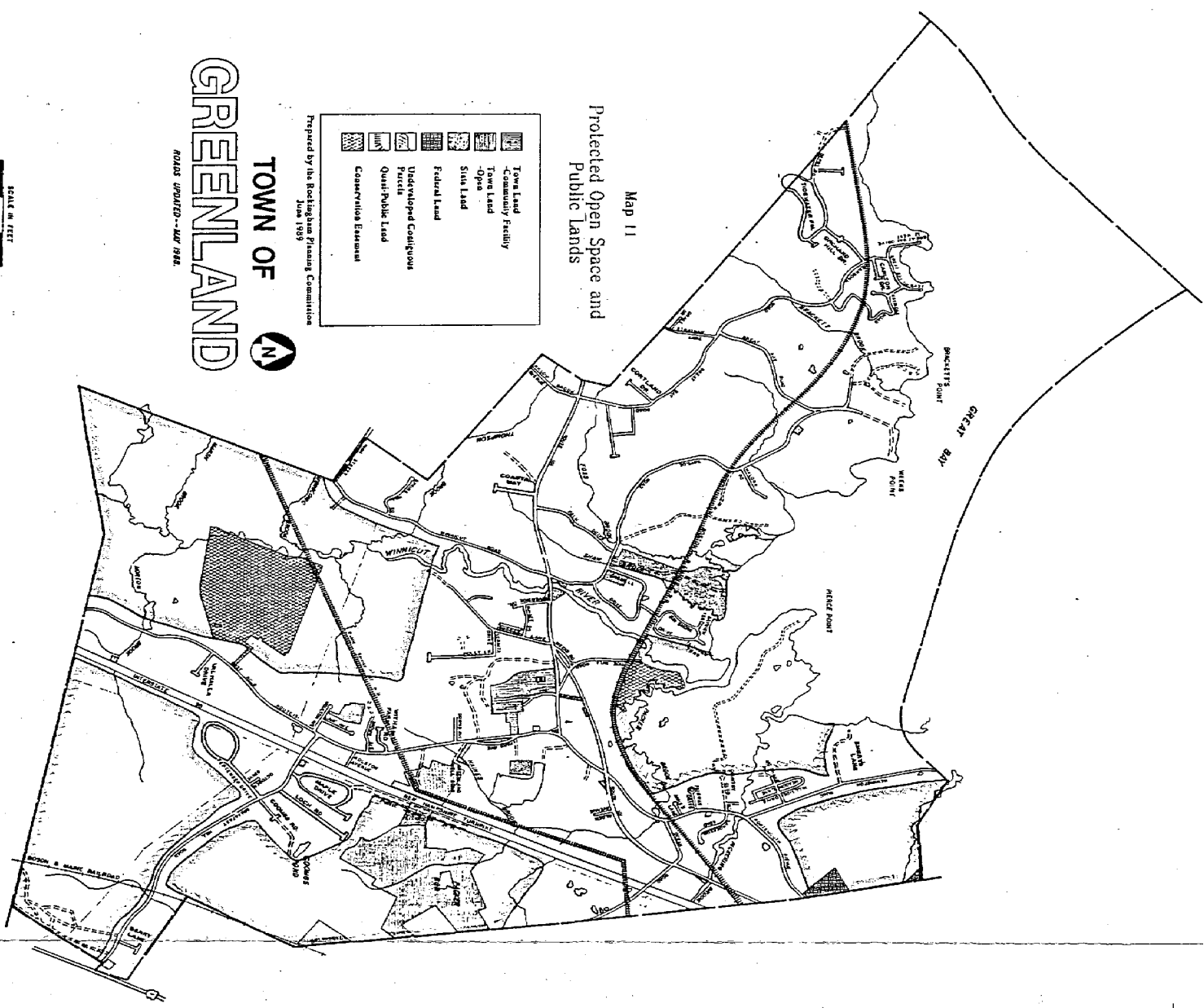


Map 11
Protected Open Space and
Public Lands

	Town Land - Community Facility
	Town Land - Open
	Town Land - Site Land
	Federal Land
	Undeveloped Contiguous Parcel
	Quasi-Public Land
	Conservation Easement

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- 1) Parker Tree Farm. This parcel is located in southern Greenland. At 153 acres, this is the Town's largest tract of protected land. The conservation easement is held by the Rockingham County Conservation District. Public access is allowed by permission only.
- 2) Hughes Conservation Land. This 20-acre parcel is located between the Winnicut River and Packer Brook. The area is ecologically important - containing rare and endangered plants, and comprising a significant portion of the Winnicut River estuary. Public access is allowed by permission only.

D. LARGE TRACTS

Map 11 depicts the locations of Greenland's remaining tracts of contiguous open space (labeled as "undeveloped contiguous parcels"). Significant concentrations of open space are located in the northwest, northeast, and south parts of Town.

Large tracts of open space are important to consider when planning for the Town's future open space needs. In general, the larger tracts of open space land are of greater value in terms of open space benefits, e.g., farming, forestry, recreation, wildlife habitat, aesthetics, etc. For this reason, the Town should endeavor to acquire and/or protect those large lots which are contiguous to publicly-owned or otherwise protected parcels.

VI. GOALS AND RECOMMENDATIONS

VI. GOALS AND RECOMMENDATIONS

The following goals create a framework within which to operate and prioritize areas on which to focus energies. Objectives have been set forth as actions to be taken in order to incrementally achieve long range goals. Goals are established and described below - ordered according to Section IV of this plan.

IV. OPEN SPACE VALUES, INVENTORY, AND ANALYSIS

A. RECREATION

Goal: To maintain and enhance present recreation lands and facilities; to expand recreation opportunities by securing additional lands and by adding or expanding facilities.

Recommendations:

-- Seek funding sources for additional facilities in order to meet State standards for outdoor recreation facilities.

-- Designate funds for recreational facility improvements through capital improvement programming.

-- Conduct an inventory of possible recreation land sites that may become available for donation/acquisition and target those that are most desirable for public acquisition.

-- Encourage developers of large subdivisions to donate a portion of their parcels for use by the residents of the Town.

-- Seek to establish a public hiking trail (see Map 12) by inter-connecting, through easements and other agreements with landowners, a network of trails linking public conservation and recreation lands.

B. AGRICULTURE/FORESTRY

Goal: To preserve significant farm and forest land for resource production and preservation of rural character.

Recommendations:

1. Agriculture

-- Conduct an inventory of possible agricultural lands that may become available for donation/protection.

-- Contact landowners regarding possible preservation techniques (e.g., LCIP, donation of conservation easements, purchase of development rights).

-- Provide Current Use Assessment information to farmland owners who qualify, to make retention of agricultural lands more economically feasible.

-- Educate farmland owners about creative development techniques so that, if necessary, financial needs may be met while preserving important farmland.

-- Promote the adoption of land use controls (e.g., cluster development zoning and agricultural zoning) designed to preserve remaining farmlands.

2. Forestry

-- Monitor lands surrounding large publicly-owned parcels as to their availability for Town purchase; work toward creating a Town forest.

-- Seek to have forested lands of manageable size (greater than ten acres) preserved through sound, long-term forest management programs which provide for all forest benefits, including watershed protection, wildlife habitat, recreation, and aesthetics.

-- Promote the adoption of a cluster development ordinance in order to preserve remaining forest lands.

C. ENVIRONMENTAL PROTECTION

Goal: To protect all environmentally sensitive areas by preventing detrimental alteration, development, or pollution.

Recommendations:

1. Surface Water

-- Work with other municipalities abutting the Great Bay to develop a regional protection plan for coordinated shoreline protection and wise land stewardship.

-- Seek funding sources (e.g., Trust for New Hampshire Lands) to acquire/protect lands abutting the Great Bay according to priority.

2. Wetlands

-- Promote the adoption of a Wetlands Protection District to prevent further detrimental alteration of the Town's wetlands.

-- Perform a wetlands evaluation and adopt Prime Wetlands designation for the municipality's most important wetlands.

-- Encourage the enforcement of current subdivision regulations, as well as state and federal rules/laws pertaining to wetlands.

-- Continue to review Dredge and Fill applications.

-- Protect the most important wetlands by easement and/or acquisition.

3. Floodplains

-- See that the Town, as a participant in the National Flood Insurance Program, keeps its floodplain ordinance up to date and consistent with the program's requirements.

-- Attempt to acquire lands or interest in lands in floodplain areas - especially those along the Winnicut River and Great Bay.

-- Review proposed developments or alterations in floodplains for compliance with local, state, and federal requirements - especially with respect to waste water disposal and erosion.

4. Shorelands

-- Improve public access to the water bodies in Town by acquiring more shorefront land or easements.

-- Promote the adoption of a Shoreland Protection District to prevent detrimental alteration of sensitive lands along water bodies and to limit development in the immediate shoreland area.

5. Groundwater

-- Perform an inventory of well water quality and continue to monitor.

-- Conduct an inventory of all underground storage tanks.

-- Maintain Aquifer Protection District to prevent potential contamination of the Town aquifer.

D. HABITAT

Goal: To preserve and protect populations, or habitats, of rare or endangered plant and animal species, natural habitats of high productivity, and migration corridors for wildlife.

Recommendations:

-- Hire a consultant to identify and inventory habitats for game and non-game wildlife populations that are valued but not rare; these may include deer yards, freshwater riparian habitats, and saltwater wetlands associated with estuarine systems. In addition, important migration corridors for wildlife should be identified.

-- Seek to protect habitat areas for rare and/or endangered species through conservation easements or fee-simple acquisition.

-- Attempt to preserve corridors that link large tracts of open space in order to maintain habitat integrity.

E. AESTHETICS

Goal: To retain scenic vistas and natural areas to enhance the aesthetic quality and character of the Town.

Recommendations:

-- Protect high quality scenic views along public roads through easements (or acquisition).

F. EDUCATION/RESEARCH

Goal: To provide adequate opportunities for education and research by protecting existing unique sites and acquiring areas which will offer expanded opportunities.

Recommendations:

-- Work with the N.H. Fish and Game Department toward developing opportunities for education and research within the Great Bay estuary.

-- Promote increased conservation awareness and education at the primary and secondary school levels. The Conservation Commission should work with the School Board in arranging for conservation-related field trips, workshops, and lectures.

G. HISTORIC/ARCHEOLOGICAL SITES

Goal: To preserve historical archeological sites of significance and provide public education about them as they are an important and irreplaceable part of Greenland's cultural heritage.

Recommendations:

-- Work with the N.H. Department of Historic Resources to inventory archeological sites of significance.

-- Pursue permanent protection of the identified significant historic/archeological sites in Town.

VII. OPEN SPACE PLAN

VII. OPEN SPACE PLAN

A. GENERAL

Greenland is fortunate to have many high-quality natural resources and open spaces. Section IV evaluated the Town's land according to the seven identified resource values of open space. These types of open space were then depicted on a series of maps. Through this process, specific areas have been designated which possess multiple resource values and warrant protection. These areas include wetlands, floodplains, shorelands, aquifer recharge areas, unique scenic views, prime farmland, rare habitat, and sites of recreational, educational, historical, or archeological significance.

What this process has proven is that even with extensive protection of the identified environmentally sensitive areas and high quality open space lands, there is ample land available throughout Town for future development.

Map 11 shows the publicly-owned federal, State, and Town lands, power line and railroad rights-of-way, and parcels protected by easements or covenants. Benefits from these open spaces can be maximized through green-belt linkages and trail systems.

For this reason, Map 12 - "Open Space Protection Plan" - proposes a trail network which links important open space areas throughout Greenland using some sections of the railroad right-of-way and the powerline easement. This trail system would provide superb recreational and educational opportunities to the townspeople. It should be noted that utility easements do not necessarily give the public a right of passage. Therefore, in creating a trail network, agreements must be made with landowners for such use.

It would be unrealistic to expect to preserve all of the identified areas in their natural state; therefore some decisions were made regarding recommendations for parcel protection. The process of prioritizing areas for conservation/protection was carried out by evaluating the findings of this plan (e.g., type of resource value, location, Town's specific open space needs).

The Conservation Commission, the Planning Board, the Board of Selectmen, and Town Meeting can use this plan to make strategic decisions regarding recommended parcels. The plan will also be useful to the Recreation Commission in their efforts to expand and improve recreational facilities. For example, if land is proposed for development, the Planning Board can use this plan to evaluate the design of the development. The Town, by using this plan, can target areas for protection. Once targetted the Conservation Commission and Selectmen should actively pursue their protection, either through conservation easements or outright acquisition.

It would be very useful to inventory all open space areas in Town. A property study - including such information as tax map lot number, name and address of owner, acreage, appraised value, and a map showing property boundaries - would be a valuable tool as a starting point for landowner contact and parcel protection. In 1988, the Rockingham Planning Commission performed an inventory of sizeable properties along the Squamscott River

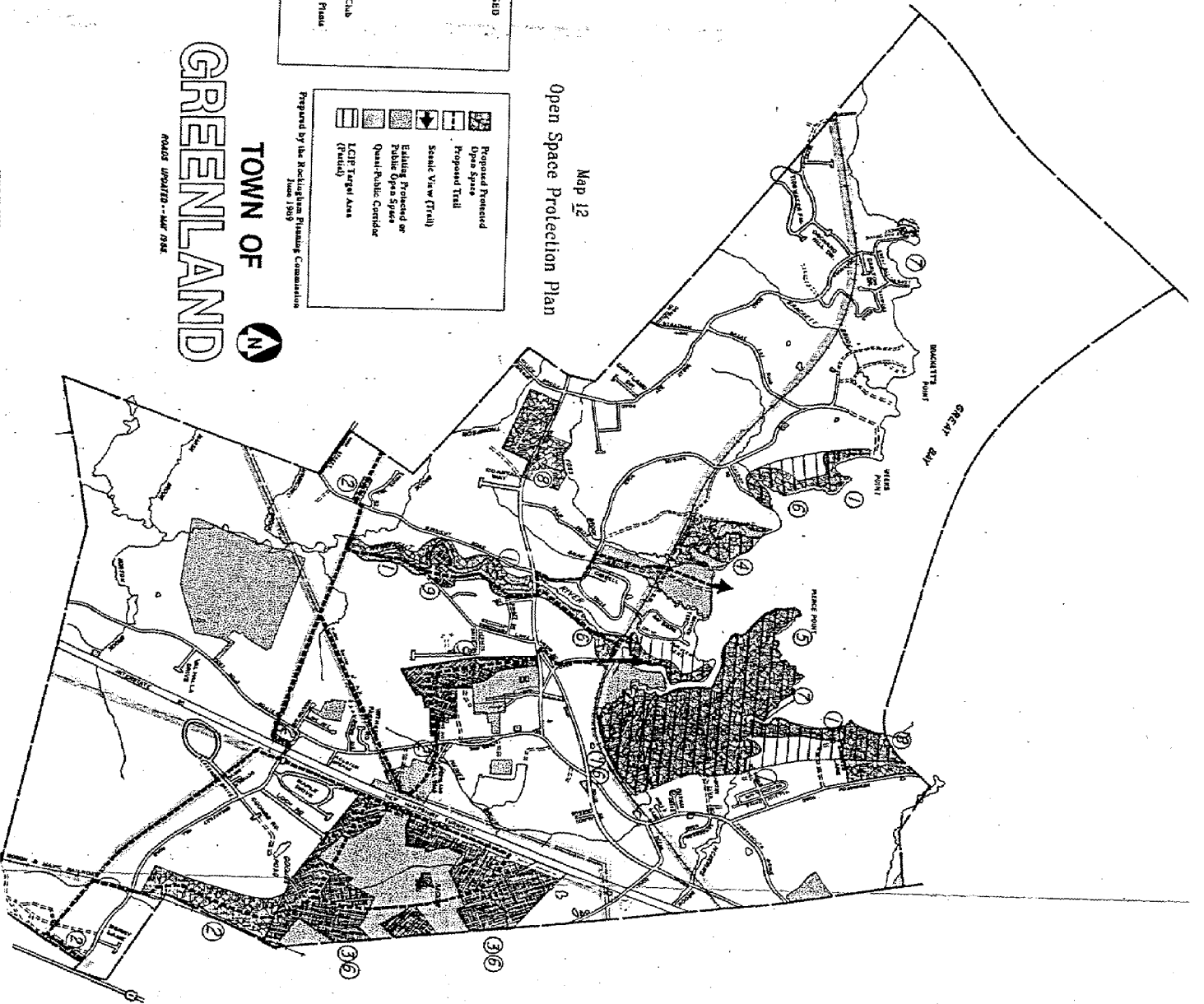
Map 12
Open Space Protection Plan

- INDEX FOR PROPOSED
OPEN SPACES
- ① Shoreland Easement
 - ② Trail Link
 - ③ Public Dog
 - ④ Public Land Liability
 - ⑤ Portsmouth Country Club
 - ⑥ Race and Endangered Plant

- Proposed Protected Open Space
- Proposed Trail
- Scenic View (Trail)
- Existing Protected or Public Open Space
- Quasi Public Corridor
- LCR Target Area (Trail)

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SCALE IN FEET
0 100 200

in Stratham, Exeter, and Newfields (see Squamscott River Property Study, Rockingham Planning Commission, 1988). It is recommended that Greenland, with assistance from the Rockingham Planning Commission, conduct such an inventory of all valuable natural resource areas in Town.

B. THE PLAN

The areas shown on Map 12 consist of parcels already protected and areas designated to become part of Greenland's open space system. They are categorized as follows.

Existing Protected or Public Open Space. As discussed in Section V, these areas include publicly-owned Town, State, and federal lands, and lands protected by conservation easements. These areas are depicted on Map 11 as well.

Quasi-Public Lands. Also discussed in Section V, these lands include the Boston and Maine Railroad right-of-way and the power line easements owned by the Public Service Company of N.H. (depicted on Map 11).

Proposed Protected Open Space. This category was further broken down into "Fee Simple Acquisition" and "Conservation Easement". Fee simple acquisition is recommended for two types of land: 1) parcels that are under imminent development pressure; and 2) parcels contiguous to Packer Bog. Since Packer Bog is not suitable for development, yet has so many open space values, this recommendation is made to keep the area in its pristine condition.

Proposed Trail. The concept of a public trail system was described in Section IV.A.3. As stated earlier, community trails would provide a variety of recreational and educational opportunities. If developed, a trail system would be an incredible asset to the Town.

LCIP Target Area (Partial). This information was obtained from an overlay map drafted by the N.H. Office of State Planning and the UNH Complex Systems Research Center in 1988. This map is used in conjunction with the Land Conservation Investment Program (LCIP), funded through the Trust for New Hampshire Lands (see Section VII.C, for further discussion). This overlay was based on information contained in the U.S. Geological Survey topography maps (photorevised 1973). Map 12 does not show all of the areas on the LCIP map due to the following reasons:

- 1) The map was prepared using the 1973 USGS maps. Some areas on the USGS map, where development was not shown, were included on the LCIP map, but some parcels have been developed since 1973, and are no longer suitable for conservation purposes; or
- 2) some parcels have already been protected through full acquisition, or through conservation easements, by the Town or State (see Section V for a discussion of protected parcels).

Open Space Areas Proposed for Protection

The following is a brief description of the areas designated on Map 12 as "proposed protected open space". The numbered paragraphs below correspond to the numbers shown on the map.

1. Shoreland Easement (75-150 feet). Shoreland protection has been recommended for certain portions of Great Bay, Pickering Brook, Packer Brook, and the Winnicut River. These are environmentally sensitive areas and provide valuable wildlife habitat. This protection would preserve the amenities of pristine shoreland, as discussed in Section IV.C.4. There are three additional reasons for protecting these shorelands: 1) the area where Packer Brook meets the Winnicut River contains rare and endangered plants; 2) there is an important archeological site located near the mouth of Pickering Brook (see Section IV.G); and 3) these areas contain floodplains and wetlands.
2. Trail Links. These areas are located in various locations along "proposed trails," and would be needed to link important open space areas throughout Town. The trail widths shown on Map 12 are not necessarily drawn to scale. The optimal width will vary on a case-by-case basis. For example, the corridor leading to Packer Bog should be relatively wide because of the importance of this area to wildlife. In general, a wide trail corridor is more effectively buffered from surrounding uses than a narrow one. Nevertheless, easements for public trails through private lands typically range from 10 to 30 feet in width.

Scenic outlooks along these trails would be from the Town Landing and at the end of the Fish and Game parcel (as depicted on Map 12).

3. Packer Bog. The Town should seek to acquire parcels within and surrounding Packer Bog. The Bog is a unique and regionally significant wetland. Moreover, this entire area contains several rare and endangered plant species (as described in Section IV.D), and is the Town's largest floodplain area (see Section IV.C.3).
4. Public Land Linkage. This tract of land fronts on the Bay, and has significant areas of Town-owned wetlands on two sides (east and west). The Boston and Maine Railroad is located on the remaining side (south). This entire site is contiguous to the 40-acre State-owned parcel. It would be beneficial to preserve this area as a large tract of open space. This site also contains floodplain.
5. Portsmouth Country Club. This land has high open space value. The area is replete with scenic views of Great Bay and the surrounding salt marsh. It contains Pierce Point, the landing site of Greenland's first settlers and considerable floodplain area. In addition, the parcel has approximately one mile of frontage on the Bay, 3/4 mile on Packer Brook and over 1,000 feet on Pickering Brook. This is an exemplary natural resource worthy of protection - especially in light of the increasing development activities in the Region. It is conceivable that,

like so many golf courses in New Hampshire and New England, the Portsmouth Country Club could be driven by intense development pressure to build residential units on the course. This would destroy forever the wildlife, aesthetic, and recreational values of this magnificent parcel. A conservation easement on the parcel would protect the natural resource values of the land while also assuring Club members and the general public that the aesthetic qualities of the course will not be harmed. In addition, an easement would provide a decrease in assessed value and could lead to tax savings by the Club. The Town should approach the Portsmouth Country Club and seek a conservation easement on the parcel either by sale or donation as soon as practical.

6. Rare and Endangered Plants. These areas should be protected in order to preserve the rare and endangered plant species described in Section IV.D. These sites are located in the following areas: where Packer Brook and the Winnicut River meet; near Maloon Road where an unnamed stream empties into the Bay; and throughout Packer Bog (all floodplain and wetland areas). The N.H. Natural Heritage Inventory should be consulted for assistance toward protecting these sites.
7. Archeological Site. Important archeological sites are located on the shore the Great Bay and near the mouth of Pickering Brook. These sites warrant protection for their educational and cultural significance (see Section IV.G).
8. Scenic Views. Lands in this category provide outstanding scenic views from public roadways for both residents and visitors, and should be protected from development to the greatest extent possible. These views include Great Bay from Newington Road and the expansive pasture land and hay land along N.H. Route 101. These areas serve as the "gateway" to Greenland and are an important asset to the Town's character.
9. Potential Recreation Land. These areas are recommended for acquisition because they are under immediate development pressure. Both parcels have excellent potential to be used as recreation facilities. These parcels include "Camp Gundalow" and "Vickery's Pit." Both parcels have excellent recreation potential.
 - Camp Gundalow. As discussed in Section IV.A, Camp Gundalow is on 13 acres and is presently for sale. The Town should act to purchase this site for use as a community park. The parcel also has important shore frontage (and floodplains) along the Winnicut River.
 - Vickery's Pit. This is a 52-acre parcel located adjacent to the Town Office. It has access to both Portsmouth Avenue and Post Road. As of June 1989, this site is being considered for purchase by the Town. If acquired, this land could provide a general recreational area with a hiking trail and playing fields. The site is important for two more reasons: it overlays the Town's primary aquifer recharge area; and it is centrally located, abutting the Town Office

land and is in close proximity to Greenland's historic center.

If acquisition costs for these parcels exceed the Town's capabilities, Town officials should investigate other funding mechanisms as described in the following Section VII.C. A final option would be "limited development". This land protection technique would involve partial development of these parcels (possibly using a "cluster" design), so as to offset any acquisition costs. This method is also described in the following section.

10. LCIP Target Area (Partial). Because of their outstanding natural resource values, the Town should work with the Land Conservation Investment Program toward protecting these area.

C. METHODS FOR OPEN SPACE PROTECTION

The previous section described the open space lands which are recommended for protection. The next step is to present the various methods available to protect open space for plan implementation.

1. Voluntary Land Protection Techniques

- a. Land Purchase (fee-simple interest): Purchase of land will give the Town ultimate control over its use, but may also be the most expensive means of land acquisition. However, federal and State matching grants (discussed in Section 3 below) can greatly reduce purchase costs. The Town should establish a Land Conservation fund which could be used as capital to purchase critical open space lands or to provide matching funds required by various grant sources.
- b. Option: In some cases where landowners are not interested in any permanent protect method, they may be willing to grant or sell an option to the Town for purchase of the property. The two parties would then agree on a purchase price and a specified amount of time during which the Town could purchase the land at that price. Sometimes an option will require a percentage of the purchase price up front, which can be used toward the price if the parcel is bought. This mechanism is useful in situations where a landowner wants to sell, but the Town needs time to secure funding. If the parcel is not purchased within the specified time frame, the option expires and the land can go on the market.
- c. Right of First Refusal: This method is similar to an option except that it simply guarantees the Town the opportunity to purchase the land for a price equal to a bona fide offer from another party. Once the Town acquires rights of first refusal on the high priority parcels, they will then have a means to become aware of potential sales and the opportunity to respond.
- d. Purchase and Resale (also known as "limited development"): An increasingly necessary option is the purchase of a property and

its subsequent resale, of all or part, with restrictions or limited development opportunities. In this way, the Town may be able to recoup more than its purchase cost through some creative planning and tasteful development on that part of the land not critical to open space benefits.

- e. Bargain Sale/Purchase: Buying the land for less than its fair market value reduces the purchase price for the Town and offers tax deductions to the seller. The difference between the fair market value and the bargain sale price may be used as a charitable donation by the landowner. Used in concert with the Trust for New Hampshire Lands, Land and Water Conservation Funds, or Pitman-Robertson funds (administered through the Department of Resource and Economic Development), a bargain sale of 50% could eliminate any expense for the Town.

f. Easements (less-than-fee interests):

- Conservation easement: Sometimes called a conservation restriction, this mechanism is a practical way for private landowners to protect environmentally significant land while retaining their ownership. Easements provide permanent protection from uses of land that could damage or destroy its scenic, ecological, and natural resource values. Generally, easements are donated (but they may be sold) to a non-profit conservation organization or public agency which enforces the restrictions in perpetuity. The terms of the easement run with the land and apply to all future owners. Each easement is 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 is a less expensive method of protection than fee-simple purchase.
- Purchase of Development Rights: If a conservation organization or government body is interested in purchasing it, a landowner may sell his easement. See Section 3.b below.

Both of these methods provide tax benefits to the landowner by decreasing the assessed value. In addition, donation of a conservation easement usually qualifies as a charitable donation and allows for a deduction for federal income taxes (see the following Section "Tax Incentives").

g. Tax Incentives:

- Donation: Landowners who donate their land, or easement restrictions, can receive tax benefits in the form of federal income tax deductions, potential estate tax benefits, and relief from property taxes.
- Current Use Assessment Program: Authorized by NH RSA 79-A, this property tax abatement program generally provides for reduced property assessments on parcels of field, farm,

forest and wetland of 10 acres or more or on "natural preserves" of any size, recreational land of any size, or farmland generating more than \$2,500 annually. Once in the program, a landowner cannot develop his parcel without paying a penalty. The current use status remains with the land even if it is sold. If the land is ever developed, the current owner is assessed a land use change tax equal to 10% of the fair market value of the property at the time the land use change occurs. While this mechanism provides an incentive for landowners to avoid developing their land, it does not protect or preserve parcels because current use is an optional designation.

Landowners who have active farmland in current use may qualify for a further reduction in their tax assessment under the 1988 changes in RSA 79-A:5. These changes allowed the soil potential index (SPI) to be used in computing property taxes. The Rockingham County Conservation District has further information on this program.

2. Regulation and Zoning:

Through land use regulation, Greenland can conserve open space areas in the interest of environmental quality and public health and welfare. Zoning helps the Town keep one person's development from putting a tax burden on others. For example, the Aquifer Protection District ordinance requires that development above known aquifers comply with certain standards to avoid large public expenditures on water systems and/or clean up.

Another regulatory technique for protecting open space is to allow cluster development in certain areas, so that a portion of the property will be restricted by deed and remain undeveloped (cluster development was previously discussed in Section IV.B). In a cluster development, houses can be grouped or clustered on that portion of a parcel best suited for development, while maintaining the Town's overall housing density requirements. In turn, the parts of the land that are poorly suited for development or which have high natural resource values are kept as open space in perpetuity. This allows the developer to save valuable groups of trees, wetlands, shorelands, etc., while building the same number of housing units allowed by conventional subdivisions. The resulting open space amenities of cluster developments can lead to significant increases in property values. At the same time, service and development costs are lower than for conventional, sprawling developments because utility lines and roads are not as extensive and site preparation costs are reduced by cutting fewer trees, less site grading, and so on.

3. Public Programs:

- a. Designation of Prime Wetlands: This program would permit the Town to designate some wetlands within its borders as "prime wetlands" because of their size, unspoiled character, fragility or uniqueness. Once prime wetlands are designated, the NH Wetlands Board is required to give special consideration to these areas. The Wetlands Board will not issue a dredge and fill

permit: 1) without a public hearing; and 2) if the proposed project impairs the value of the wetland.

- b. Acquisition of Agricultural Land Development Rights: This program is administered by the Agricultural Land Preservation Committee (ALPC) within the NH Department of Agriculture and is designed to save important farmland throughout New Hampshire.

If the ALPC designates a farmland parcel as an "agricultural preservation restriction area," the state will purchase the land's development rights in order to limit the land's use to agricultural production. Criteria used to make this designation include:

- 1) soils potential and suitability;
- 2) threat of development;
- 3) cost of development rights;
- 4) present status of land.

The State of New Hampshire appropriated \$3 million in 1979 and \$2 million in 1985 to purchase development rights on important agricultural land in the state.

- c. Trust for New Hampshire Lands: This is a private non-profit corporation formed in October, 1986 by representatives from the business, conservation, and government sectors. Funded by grants and private donations, the Trust has two primary goals: 1) to protect up to 100,000 acres of prime natural land throughout the state for conservation and recreation purposes; and 2) to enable towns to identify and retain important natural landscapes that enhance the community's character. The Trust is accomplishing its land preservation goals through voluntary negotiation with landowners, and relies on land protection methods such as fee-simple acquisition, bargain sales, conservation easements, and purchase of development rights.

In May, 1987, the Legislature created the Land Conservation Investment Program (LCIP), a state program within the Office of State Planning. As the public arm of the Trust, it receives all monies appropriated by the Legislature and uses them for the land acquisition. In 1987, \$20 million was appropriated; and in 1989, \$18 million. The program provides funding which must be matched by towns in the form of cash, land, or interest in land. All administrative costs (e.g., salaries) are paid by the Trust. There are six land agents throughout the State to assist municipalities with landowner contact and the application process.

- d. Federal Grants: There are two federal grant programs for the purchase of conservation land: 1) The Land and Water Conservation Fund offers grants of up to 50% of the fair market value of lands acquired by governmental units or public recreation (funding maximum is \$25,000). Conservation lands could qualify; 2) The N.H. Department of Fish & Game receives Pitman-Robertson Funds which cover 75% of the fair market value of lands acquired by the Department for wildlife protection.

4. **Conservation Commission:**

The Conservation Commission, as well as the Selectmen, play a critical role in the conservation and preservation of open space in Greenland.

Conservation Commissions typically provide information and instruction to other town officials regarding the open space protection methods described above. In addition, they are the people most often implementing them.

Chapter 36-A of the RSA's establishes the right of a municipality to create a conservation commission for the purpose of "proper utilization and protection of the natural resources and for the protection of watershed resources of said town". The commissions also inventory open space; natural, aesthetic, and ecological areas; marshlands; swamps; and other wetlands and make recommendations to the selectmen for the use of such lands. In addition, RSA 36-A:4 allows the conservation commissions to receive gifts of property or money that are intended for conservation purposes, subject to the approval of the selectmen. The commission is then responsible for managing the acquired land.

It is also recommended that the Conservation Commission petition the Selectmen (signed by at least ten registered voters) to insert into the Town Meeting warrant the following articles:

1. Establish a conservation fund and place all "current use" program penalties in it. This fund would be used for conservation purposes i.e., land acquisition, purchase of development rights, etc.
2. Make annual appropriations to the fund.

RSA 36-A:5, I was amended in July, 1987 to allow Conservation Commissions by majority vote, to expend monies from the conservation fund without further approval of Town Meeting.

VIII. CONCLUSION

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The open space resources of Greenland constitute an important component of the Town's landscape. Open space provides the basic visual identity of the community and provides recreational and ecological values as well. Without adequate openspace, the quality of life of the community would be reduced.

The open space plan has been prepared in order to guide the community in protecting its open space and recreational resources. The Plan is not a regulatory document. Rather it contains recommendations that, if acted upon in a timely manner, can help ensure that important open space lands are protected and preserved in the future as the Town continues to develop. The Plan should be adopted as part of the Greenland Master Plan so that the Planning Board can use it when making development decisions.

In addition to presenting a natural resources inventory for Greenland, the plan establishes a logical network of protected open space. The Plan of protected open space (as depicted on Map 12 and described in Section VII) is based on four objectives: to protect critical natural resources, to create an interconnected trail system for recreational use, to link important habitat areas through wildlife corridors, and to build on the existing base of protected open space land.

In order to carry forth the recommendations of this Plan, the Town should carefully consider the methods of protecting open space lands, contained in Section VII.C.

The conservation of valuable and unique natural resources and the preservation of open space is important to Greenland. It is one way to maintain the community's character in spite of its continued growth. All the Town boards, but especially the Conservation Commission and Planning Board, should play an active and ongoing role in this endeavor.

APPENDICES

APPENDIX I - Functions of Wetlands

APPENDIX II - Rare and Endangered Plants

FUNCTIONS OF WETLANDS

surface waters, including physical controls, which filter from the wetland and help to purify the water.



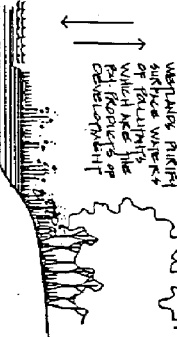
WETLANDS AS SURFACE WATER FILTERS

Wetlands serve as a natural flood plain which helps to absorb excess water and prevent flooding of adjacent areas.



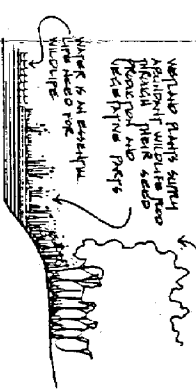
WETLANDS AS NATURAL FLOOD PLAINS

Wetlands provide a natural habitat for many types of plants and animals, including birds, fish, and insects.



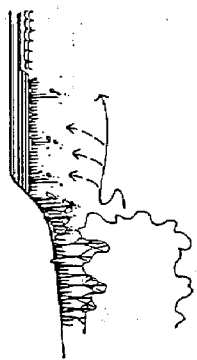
WETLANDS AS NATURAL HABITAT

Wetlands provide a natural habitat for many types of plants and animals, including birds, fish, and insects.



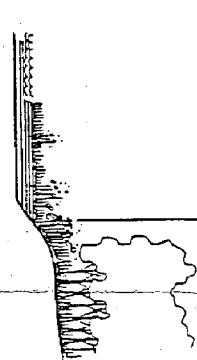
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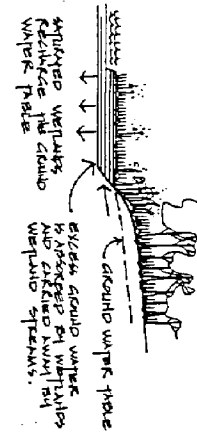
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WETLANDS AS NATURAL HABITAT

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Source: Open Space and Recreation Plan Bedford, prepared by Environmental Collaborative, Cambridge, Mass.

Rare and Endangered Plants

Town of Greenland

SRank	GRank	Federal	State	Scientific Name	Common Name
S1	G5		ST	ELEOCHARIS PARVULA	SMALL SPIKE-RUSH
S2	G5T5		ST	IVA FRUTESCENS VAR. ORARIA	MARSH ELDER
S2	G5			POLYGONUM EXSERTUM	EXSERTED KNOTWEED
S2	G5		ST	SCIRPUS ROBUSTUS	STOUT BULRUSH
S2	G5		ST	SCIRPUS ROBUSTUS	STOUT BULRUSH
				SNE ACIDIC SEEPAGE SWAMP	

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.

Key to Status

NH Native Plant Protection Act: RSA 217-A:3,III (endangered plants) and RSA 217-A:3,XII (threatened plants). State protected animals: Fish & Game Rules Chapt. Fis 1000 Conservation of Endangered Species. Part Fis 1001.01 (endangered animals) and 1001.02 (threatened animals).

SE = State Endangered
ST = State Threatened

Federal Endangered Species Act, 1973. Public Law 93-205, as amended.

LE = Federally Endangered
LT = Federally Threatened
FC = Federal Candidate Species (includes C1, C2, 3C, etc.)
PE = Proposed Endangered
PT = Proposed Threatened

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